Murrumbidgee Irrigation

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24 December 2021

Mr Lloyd Eley-Smith
Team Leader, Water Assessments, Planning and Assessment
Department of Planning, Industry & Environment
12 Darcy Street
Parramatta NSW 2150
Submitted via DPIE Major Projects Portal

Attn Mark Wisely, Senior Planning Officer

Dear Messrs. Eley-Smith and Wisely

Response to request for additional information – Environmental Audit Reporting for DA-101-4-2004-I, Major Portal Ref: DA101-4-2004-I-Mod-1

We refer to the letter from Department of Planning Industry & Environment (the Department) dated 5 November 2021 and provide the requested reports and an outline of details relating to these documents below. We advise that some records could not be found, given the time period since the original approval, however we have provided some information which may assist to address the Department's request.

Environmental audit report – condition 4.3

Attachment A: Final Environmental Audits of Barren Box Swamp and Brays Dam Project – Final report, Ecowise Environmental, July 2007.

This report was provided to the Department following its completion. While we cannot provide a copy of the transmission documentation, we note the Department's letters dated 27 May and 14 November 2008 indicate this report has been read and comments provided back to Murrumbidgee Irrigation (MI).

We have no record of any correspondence from the Department requesting additional audits be undertaken under this condition.

In 2019-2020 MI commenced an internal legal compliance review process. The Barren Box project approval was identified for detailed review and NGH was engaged to audit the compliance against the approval conditions. This work provided the basis for MI's modification application. We attach this audit report for your information:

Attachment A: NGH audit of operational compliance against the conditions of consent for DIPNR DA-101-4-2004-i 2005. Letter reported dated September 2020.

Annual Environmental Management Report – condition 7.5

Attachment B: Annual reports from 2006 to 2021

MI issues annual reports to meet compliance reporting each year for the prior financial year. Upon completion of the report, it is then made publicly available via our website for approximately four years. Recent reports can be found here: Annual Compliance Report | Murrumbidgee Irrigation (mirrigation.com.au).

Community complaints register – condition 5.3

MI provides the community with contact details through our website. Contact methods include a webform, phone number, email and postal address. Customers can also lodge queries through the MI App.

MI records enquiries and complaints in two ways:

- TechOne – a database which records all interactions with MI customers
- Beakon – our incident database which records customer enquiries or complaints with the need for further investigation and potential corrective action response. Beakon is also used to record complaints or issues raised by non-customers and/or regulatory bodies.

A summary of environmental complaints, i.e. numbers against environmental aspects, is included in MI's EPL4651 Annual Return each year.

We have provided below a summary of the number of enquiries and complaints relating to the scope of the project approval for the Barren Box Swamp Project. Enquiries range from requests for access to Barren Box to customer enquiries in the area. This information is for the last four full financial years. Due to the private information contained in this register, we have not attached to this submission, however MI can make the details available to DPIE upon request to ensure confidentiality and privacy.

Financial Year	Complaints	Enquiries
2017-2018	3	5
2018-2019	2	6
2019-2020	0	1
2020-2021	4	3

We hope this information satisfies the Department's queries regarding our modification report.

Should you wish to discuss this information further, please feel free to contact Fern Dorricott, Environmental Planning Manager, on 02 6962 0200 or the undersigned.

Yours sincerely

Jody Rudd
General Manager – Asset Delivery

Encl:

Attachment A: Audit reports

A-1: Final Environmental Audits of Barren Box Swamp and Brays Dam Project – Final report, Ecowise Environmental, July 2007.

A-2: NGH audit of operational compliance against the conditions of consent for DIPNR DA-101-4-2004-i 2005. Letter reported dated September 2020.

Attachment B: Annual reports from 2006 to 2021

B1: Licence compliance report FY 2005-2006

B2: Licence compliance report FY 2006-2007

B3: Licence compliance report FY 2007-2008

B4: Licence compliance report FY 2008-2009

B5: Licence compliance report FY 2009-2010

B6: Licence compliance report FY 2010-2011

B7: Licence compliance report FY 2011-2012

B8: Licence compliance report FY 2012-2013

B9: Licence compliance report FY 2013-2014

B10: Annual compliance report FY 2014-2015

B11: Annual compliance report FY 2015-2016

B12: Annual compliance report FY 2016-2017

B13: Annual compliance report FY 2017-2018

B14: Annual compliance report FY 2018-2019

B15: Annual compliance report FY 2019-2020

B16: Annual compliance report FY 2020-2021

Attachment A: Audit reports

A-1: Final Environmental Audits of Barren Box Swamp and Brays Dam Project – Final report, Ecowise Environmental, July 2007.

MURRUMBIDGEE IRRIGATION LTD

FINAL REPORT ON FINAL ENVIRONMENTAL AUDITS OF BARREN BOX SWAMP AND BRAYS DAM PROJECT

Prepared By

Ecowise Environmental (Victoria) Pty Ltd

July 2007

DOCUMENT REVIEW SHEET

CLIENT:	Murrumbidgee Irrigation Ltd	
PROJECT:	Environmental Audits – Barren Box Swamp and Brays Dam Project	
TITLE:	Report of Final Audit	
DOCUMENT REFERENCE NO:	1054-2007-014	
LEAD AUDITOR:	P. Chier	FILE NO: 1054-2007-014

ISSUE NO.: 1

Control Details		**Preparation & Self Check**	**Review By**	**Corrective Action**	**Approved for Issue By**
REVISION	Name: Date Signature:	P. Chier 4.07.2007	S. Longmuir 10.07.2007		
	Name: Date: Signature:				
	Name: Date: Signature:				
	Name: Date: Signature:				
Reviewers Comments:					

Revision List

Revision Number	Revision Date	Description of Revision	Approved By	Date Revision Effected
0	13.06.2007	Draft Report Issued to MI	SL	
1	11.07.2007	Final Report Issued to MI	SL	

Distribution Record

Copy No	Position	Name

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ACKNOWLEDGEMENTS

The valuable assistance of Murrumbidgee Irrigation staff in the conduct of site inspections and the provision of documentation for review is gratefully acknowledged.

ABBREVIATIONS

AEMR	Annual Environmental Management Report
AS	Australian Standards
BBS	Barren Box Swamp
CEMP	Construction Environmental Management Plan
dB(A)	Decibel (A-weighted)
DEC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources (currently divided into two departments – Department of Planning and Department of Natural Resources)
DNR	Department of Natural Resources
EIS	Environmental Impact Statement
EM	Electro Magnetic
EPA	Environmental Protection Authority (incorporated into the DEC)
GL	Gigalitres
ha	hectare
ISO	International Organisation for Standardization
km	kilometre
LAeq	A-weighted equivalent continuous noise level
MI	Murrumbidgee Irrigation
ML	Megalitres
NSW	New South Wales
OEMP	Operation Environmental Management Plans
POEO	Protection of the Environment Operations Act 1997
RTA	Roads and Traffic Authority
SISD	Safe Intersection Sight Distance

E EXECUTIVE SUMMARY

Ecowise Environmental (Victoria) Pty Ltd (Ecowise) was engaged by Murrumbidgee Irrigation Ltd to conduct a final environmental audit of the Barren Box Swamp and Brays Dam as the works were completed in August 2006.

The audit was conducted on the 5th of June, 2007. The audit team consisted of Patty Chier (Associate Environmental Auditor) and Stuart Longmuir (Principal Consultant - Infrastructure). Patty is certified by RAB-QSA in accordance with ISO 19011:2003.

E.1 OBJECTIVES

The objectives of this Final Environmental Audit were:

- to review the compliance issues raised during the mid-term audit;
- to assess compliance with the requirements of the development consent and other licences and approvals that apply to the development;
- to assess the environmental performance of the development against the predictions made and conclusions drawn in the documents referred to under condition 1.1 of the development consent; and,
- to review the effectiveness of the environmental management of the development including any environmental impact mitigation works.

E.2 CONCLUSION AND RECOMMENDATIONS

The Barren Box Swamp and Brays Dam projects are generally in compliance with the development consent. Murrumbidgee Irrigation has endeavoured to implement best practice measures to ensure construction does not adversely impact the environment.

The principal audit recommendations are to:

- obtain formal approval from the relevant authorities with respect to the Operation Environmental Management Plans (OEMP), Property Vegetation Plan, adequacy of compaction tests and removal of conditions 6.5e(v) and (vi);
- obtain a reply from the Director-General or delegate to amend the Consent Conditions with respect to the conditions related to:
    - water saving agreement;
    - annual water savings;
    - Mirrool Creek water management; and
    - Wetlands Rehabilitation and Management Plan.

1 INTRODUCTION

1.1 Background

Ecowise Environmental (Victoria) Pty Ltd (Ecowise) was engaged by Murrumbidgee Irrigation Ltd (MI) to conduct a final environmental audit of the Barren Box Swamp, the Wah Wah enlargement and Brays Dam once works were completed in August 2006.

The audit was conducted on the 5th of June, 2007. The audit team consisted of Patty Chier (Associate Environmental Auditor) and Stuart Longmuir (Principal Consultant – Infrastructure). Patty is certified by RAB-QSA.

1.2 Objectives

The objectives of this Final Environmental Audit were:

- to review the compliance issues raised during the mid-term audit;
- to assess compliance with the requirements of the development consent and other licences and approvals that apply to the development;
- to assess the environmental performance of the development against the predictions made and conclusions drawn in the documents referred to under condition 1.1 of the development consent; and,
- to review the effectiveness of the environmental management of the development including any environmental impact mitigation works.

1.3 Scope

The audit was restricted to the following sites:

- Brays Dam En-route storage;
- Barren Box Swamp; and,
- Wah Wah Enlargement.

The scope of the audit included the following tasks:

- review and collection of documentation;
- preparation of consent conditions checklist and audit plan;
- site visit and audit of sites;
- preparation of draft report of final audit for review; and,
- preparation of final report.

2 SITES

2.1 Barren Box Swamp and Wah Wah Enlargement

Barren Box Swamp, used for water storage and flood mitigation since the 1920's, has been divided into three sections:

- an active water storage cell of 24,000 ML;
- an intermediate storage cell of 4,000 ML; and,

- an ephemeral wetland cell (approximately 1,500 ha).

The structural works required for this project were the construction of:

- a 5.8 km long embankment to create the main active cell;
- a 2.8 km long embankment to create the intermediate cell;
- a 800 m long inlet channel from the Wah Wah Main to the active cell;
- an inlet structure to regulate flow from the Wah Wah Main to the active cell;
- three low level cross structures through the embankments; and,
- two breach sections within the new embankments.

Modifications to the Wah Wah Main were also required and include:

- widening of the Wah Wah Main from Willow Dam to the proposed Active Cell inlet structure to a capacity of 2,000 ML/day; and,
- widening of the Wah Wah Main from the proposed Active Cell inlet to the Barren Box Swamp outfall channel to a capacity of 1,500ML/day.

Wilde Earthmoving Pty Ltd (Wilde) was the contractor for the construction of the Barren Box Swamp embankments and Wah Wah Main enlargements. The works were completed in July 2006.

2.2 Brays Dam En-route Storage

Brays Dam is an en-route water storage with a total capacity of 2,500 ML. It captures water from Mirrool Creek and Benerembah Channel that is in excess of downstream irrigation demand.

The work required for Brays Dam included:

- construction of storage embankment with a perimeter length of 4.1km;
- construction of a combined inlet and outlet channel to and from Mirrool Creek;
- installation of an inlet channel pump station for Mirrool Creek;
- construction of an outlet structure for Mirrool Creek;
- construction of inlet and outlet structures for Benerembah Channel; and,
- construction of a regulator upstream of the storage outlet to Benerembah Channel.

Three contractors were selected for the construction of the en-route storage: inlet/outlet channels - Murrumbidgee Irrigation Ltd (MI), earthworks - R Collie Earthmoving Pty Ltd and pump station - Goodwood Services Pty Ltd.

3 DEVELOPMENT CONSENT

This section presents the result of the mid-term audit, as well as the final audit, against the development consent conditions. Reassessment of the non-conformances from the mid-term audit is highlighted in blue text. Development consent conditions audited in the final audit are presented in **bold text**. All of the other conditions have not been altered. Further audit observations and recommendations are presented in Section 4.

3.1 General

			Compliant?	Evidence	Comments	Recommendations
Scope of Development						
1.1		The Applicant shall carry out the development generally in accordance with:				
	a)	Development Application No. DA-101-4-2004-i, lodged with the Department of Infrastructure, Planning and Natural Resources on 30 April 2004.	Yes	Interview with Murrumbidgee Irrigation (MI) Environment Manager	The development application was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	b)	Amendment Development Application lodged with the Department of Infrastructure, Planning and Natural Resources on 8 December 2004.	Yes	DA-101-4-2004-i	The amended development application has been reviewed and the development is generally in accordance with this document.	
	c)	Environmental Impact Statement: Barren Box Swamp Project, Volumes One, Two and Three prepared by URS Australia Pty Ltd and dated April 2004.	Yes	Interview with MI Environment Manager	The original EIS was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	d)	Amended Environmental Impact Statement: Barren Box Swamp Project, NSW, Volumes One, Two and Three prepared by URS Australia Pty Ltd and dated December 2004.	Yes	EIS	The amended EIS has been reviewed and the development is generally in accordance with this document.	

			Compliant?	Evidence	Comments	Recommendations
	e)	Submission Response Report - Barren Box Swamp Project, prepared by URS Australia Pty Ltd and dated March 2005.	Yes	Interview with MI Environment Manager	The submission response report was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	f)	Additional information supplied to the Department from the applicant dated 3 June 2004 in response to issues raised by the Department.	Yes	Interview with MI Environment Manager	The additional information was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	g)	Additional information supplied to the Department from the applicant dated 22 June 2004 in response to issues raised by the Department.	Yes	Interview with MI Environment Manager	The additional information was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	h)	Additional information supplied to the Department from the applicant dated 12 July 2004 in response to issues raised in submissions received by the Department.	Yes	Interview with MI Environment Manager	The additional information was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	i)	Additional information supplied to the Department from the applicant dated 7 October 2004 in response to a request for clarification on the proposal by the Department.	Yes	Interview with MI Environment Manager	The additional information was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	j)	Additional information supplied to the Department from URS Australia Pty Ltd dated 8 October 2004 in response to issues raised by the Department; and	Yes	Interview with MI Environment Manager	The additional information was not reviewed. However, interview with the MI Environment Manager indicated that the development is generally in accordance with this document.	
	k)	the conditions of this consent	No	Determination of a Development Application for State Significant, Designated and Integrated Development Under Section 80 of the Environmental Planning and Assessment Act, 1979.	See the following conditions for areas of areas of non-compliance and audit report.	Implement the recommendations from the audit report.

			Compliant?	Evidence	Comments	Recommendations
1.2		In the event of an inconsistency between:				
	a)	the conditions of this consent and any documents listed from condition 1.1 a) to j) inclusive, the conditions of consent shall prevail to the extent of the inconsistency; and	Yes			
	b)	any document listed from condition 1.1 a) to j) inclusive, the most recent document shall prevail to the extent of the inconsistency.	Yes			
Statutory Requirements						
1.3		The Applicant shall ensure that all licences, permits and approvals are obtained and maintained as required throughout the life of the development. No condition of this consent removes the obligation for the Applicant to obtain, renew or comply with such licences, permits or approvals. The Applicant shall ensure that a copy of this consent and all relevant environmental approvals are available on the site at all times during the development.	Yes	Development Consent (DIPNR), Section 87 & Section 90 Consent (DEC), Variation to EPA Licence (DEC)		
Dispute Resolution						
1.4		In the event that a dispute arises between the Applicant and Council or a public authority other than the Department, in relation to a specification or requirement applicable under this consent, the matter shall be referred by either party to the Director-General, or if not resolved, to the Minister, whose determination of the dispute shall be final and binding on all parties. For the purpose of this condition, "public authority" has the same meaning as provided under section 4 of the Act.	Yes	Interview with MI Environment Manager	Interview with MI Environment Manager indicated that there has been no dispute between the Applicant or public authority other than the department.	

			Compliant?	Evidence	Comments	Recommendations
Provision of Documents						
1.5		Where practicable, the Applicant shall provide all documents and reports required to be submitted to the Director-General under this consent in an electronic format. Provision of documents and reports to other parties, as required under this consent, shall be in a format acceptable to those parties and shall aim to minimise resource consumption.	Yes	EIS and other documentation have been provided in electronic format.		
1.6		Nothing in this consent prevents the Applicant from combining reporting requirements under this consent with identical or similar reporting requirements for submission to another relevant party. Reporting requirements shall only be combined with the prior agreement of the Director-General of the Department of Infrastructure, Planning and Natural Resources and the Director-General (or equivalent) of the other relevant party.	Yes			
Water Savings Agreement						
1.7		Prior to the commencement of any construction works, the Applicant shall provide suitable evidence, to the satisfaction of the Director-General, that Murrumbidgee Irrigation and a suitable partner have commenced negotiations for entering into an agreement concerning the arrangements for funding the development and the process for providing water savings generated by the development to be transferred to the suitable partner.	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.**	**Funding for the project was from MI funds. Therefore, references to funding in conditions 1.7 and 1.8 are no longer relevant.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied**

			Compliant?	Evidence	Comments	Recommendations
1.8		**Prior to the commencement of operations, the Applicant shall provide suitable evidence that the agreement with the suitable partner referred to in Condition 1.7 above has been finalised and is in place, to the satisfaction of the Director-General.**	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.**	**see comments for 1.7**	**see recommendation for 1.7**
Annual Water Savings						
1.9		**Every 12 months following the commencement of operations of the development, the Applicant shall demonstrate and provide documentary evidence that a minimum average of 20,000 Megalitres of water savings have been made, including evidence that the water savings have been returned to the suitable partner referred to in conditions 1.7 and 1.8 above, to the satisfaction of the Director-General.**	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.** **NSW Certificate of Title (XZR7-QR-AAA6)**	**20 GL has been permanently transferred to the Water Administration Ministerial Corporation. Therefore, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied**
		Should a minimum average of 20,000 Megalitres of water savings not be achieved for a 12 month period, the Applicant shall provide detailed justification to the satisfaction of the Director-General, as to why the level of savings was not made.	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.** **NSW Certificate of Title (XZR7-QR-AAA6)**	**see comment above**	**see recommendation above**
Heads of Agreement						
1.10		Prior to the issue of a construction certificate or the commencement of any construction activities the subject of the consent, whichever is earlier, the Applicant shall as agreed:	Yes	Letter from Department of Planning to MI dated 5/12/2005.		

			Compliant?	Evidence	Comments	Recommendations
	(i)	purchase that part of Mr and Mrs Michael and Julieanne Keenan's (referred to in the DA and EIS as HR3) land in Barren Box Swamp up to the high water level zoned 7(W) Environment Protection - Wetlands under the Griffith Local Environment Plan 2002; and	Yes	as above		
	(ii)	convert Mr Michael and Julieanne Keenan's Licence 40SL046108 to a members contract with Murrumbidgee Irrigation.	Yes	as above		
		This condition will be satisfied by the provision of appropriate evidence demonstrating the above has occurred to the satisfaction of the Director-General.	Yes	as above		
Demolition						
1.11		The Applicant shall undertake all demolition work strictly in accordance with AS 2601-1991 The Demolition of Structures.	Yes	MI Environment Manager said that no demolition work has been undertaken by MI.	Former owner of Bray's Dam land removed house and demolished sheering shed.	

3.2 Compliance

			Compliant?	Evidence	Comments	Recommendations
2.1		The Applicant must put in place a management system, and take reasonable steps, to ensure that employees, contractors and sub-contractors are aware of, and comply with, the conditions of this consent relevant to their respective activities.	Yes	Induction procedures, contract documentation, tender documentation, meeting minutes, interview with MI and contractor staff. Department of Planning letter to MI, dated 7 August 2006.	Although management of Alligator Weed is discussed during inductions in practice, it is not included in the site induction program. Reply from the Director-General's delegate indicating that the CEMP is satisfactory.	
2.2		The Applicant shall be responsible for the works the subject of this consent and the environmental impacts that may result from those works, and shall put in place an environmental management system governing the conduct of all persons on the site, including contractors, subcontractors and visitors.	Yes	Induction procedures, contract documentation, tender documentation, meeting minutes, interview with MI and contractor staff.		
2.3		Prior to each of the events listed from a) to b) below, or within such period otherwise agreed by the Director-General, the Applicant shall certify in writing to the satisfaction of the Director-General, that it has complied with all conditions of this consent applicable prior to that event. Where an event is to be undertaken in stages, the Applicant may, subject to the agreement of the Director-General, stage the submission of compliance certification consistent with the staging of activities relating to that event.				
	a)	commencement of construction; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	

			Compliant?	Evidence	Comments	Recommendations
	b)	**commencement of operation.**	**No**	**Interview with MI Environment Manager**	**The Operational Environmental Management Plan (OEMP) was submitted to the Department of Planning but no reply to indicate that the OEMP was satisfactory.**	**Director-General or delegate to provide written evidence that the OEMP is satisfactory**
2.4		Notwithstanding condition 2.3 of this consent, the Director-General may require an update report on compliance with all, or any part, of the conditions of this consent. Any such update shall meet the requirements of the Director-General and be submitted within such period as the Director-General may agree.	Yes	Email from Environmental Review Coordinator, DNR to MI Environment Manager dated 14 February 2006, and subsequent meeting to discuss project progress.		
2.5		The Applicant must meet the requirements of the Director-General in respect of the implementation of any measure necessary to ensure compliance with the conditions of this consent, and general consistency with the documents listed under condition 1.1 of this consent. The Director-General may direct that such a measure be implemented in response to the information contained within any report, plan, correspondence or other document submitted in accordance with the conditions of this consent, within such time as the Director-General may agree.	Yes	Interview with MI Environment Manager indicated that there had been no request from Department of Planning.		

3.3 Environmental Performance

			Compliant?	Evidence	Comments	Recommendations
Air Quality Impacts						
Odour Emissions						
3.1		The Applicant must not cause or permit the emission of offensive odour beyond the boundary of the premises	Yes	Interview with MI Environment Manager indicated that there is no offensive odours generated at either site; confirmed by site visit.		
Air Quality Impacts						
3.2		The Applicant shall ensure that all activities occurring at the premises are carried out in a manner that will minimise emissions of dust from the Barren Box Swamp (BBS) construction impact zone, the En-route storage construction impact zone and the Wah Wah Enlargement construction impact zone.	Yes	Dust Management and Traffic Management Plans prepared for BBS and en-route storage sites. Interview and inspection verified that dust emissions are minimised to the satisfaction of the community.		
3.3		The Applicant must ensure that all trucks entering and leaving the Barren Box construction impact zone, the En-route storage construction impact zone or the Wah Wah Enlargement construction impact zone that are carrying loads are covered at all times, except during loading and unloading.	Yes	Interview with MI Environment Manager and Site Supervisor indicated that loads were covered when leaving and entering the BBS and en-route storage sites.		

			Compliant?	Evidence	Comments	Recommendations
3.4		All trafficable areas and vehicle maneuvering areas on the site must be maintained in a condition that will minimise the generation or emission of wind blown or traffic generated air pollution from the site at all times.	Yes	Interview with MI Environment Manager and Site Supervisor and contractor indicated that trafficable areas maintained in condition to minimise generation or emission of air pollution. Contractor also indicated that work flow was managed according to weather conditions to minimise dust emission. This was verified by inspection.		
3.5		The Applicant shall ensure that there is no incineration or open burning of any material(s) within the Barren Box Swamp construction impact zone, the En-route storage construction impact zone, or the Wah Wah Enlargement construction impact zone.	Yes	Interview with MI Environment Manager and Site Supervisor indicated that MI has not burned any materials on the BBS or en-route storage sites.		
Surface Water Management						
3.6		The Applicant must carry out the development in a manner that prevents and/ or minimises potential water pollution generated by the development from impacting on nearby watercourses.	Yes	Erosion and Sediment Management Plans and CEMPs indicated that various mitigation measures to be used to comply with this condition. Inspection verified that these measures have been implemented.		
3.7		Except as may be expressly provided by a licence under the Protection of the Environment Operations Act 1997 (POEO) in relation of the development, section 120 POEO Act must be complied with in and in connection with the carrying out of the development.	Yes	Water quality monitoring and compliance procedures are documented in EPA licence.		

			Compliant?	Evidence	Comments	Recommendations
3.8		The Applicant shall ensure that prior to commencing any works a 'works approval' is obtained in accordance with the Water Management Act 2000 from the Department for the works associated with Barren Box Swamp, the En-route storage facility and the Wah Wah main	Yes	Letter from DIPNR to MI dated 25 August 2005 with attached works approval.		
3.9		**Within two months of completing construction work permitted by the works approval, the Applicant shall provide the Department's Murray Murrumbidgee Office with the following:**				
		- The location of the authorised works on the lot and Deposited Plan preferably using GPS references; and	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.**	**Condition 3.9 relates to works requiring approval under the Water Management Act 2000. As Mirrool Creek has now been de-proclaimed as a regulated water source, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied.**
		- Details and design of the work (including size, dimensions and capacity of the works).	**NA**	**see above**	**see comments above**	**see recommendations above**
		This design shall not be altered except with the agreement of the Department's Murray Murrumbidgee Office. Any proposal to alter the location or design of the works shall be accompanied by sufficient information for the department to determine the effects of the alteration.	**NA**	**see above**	**see comments above**	**see recommendations above**

			Compliant?	Evidence	Comments	Recommendations
3.10		If in the reasonable opinion of a Department officer, any work is being carried out in such a manner as it may damage or detrimentally affect the flow of water or the bed or bank stability of Mirrool Creek or Barren Box Swamp outside the scope of works detailed in the DA and Environmental Impact Statement, work shall cease immediately upon oral or written direction of the officer.	Yes	Interview with MI Environment Manager and site supervisor indicated that Department officer(s) had not asked for work to cease.		
3.11		**If required by the Department, the extraction of water from the works in Mirrool Creek associated with Brays Dam must be recorded and reported as specified by the Department. For instance, the Department may require an annual return of information on hours pumped, extraction rate and volume, and water levels in Mirrool Creek prior to and during the pumping period.**	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.**	**Condition 3.11 relates to works requiring approval under the Water Management Act 2000. As Mirrool Creek has now been de-proclaimed as a regulated water source, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied.**

			Compliant?	Evidence	Comments	Recommendations
3.12		**Prior to the commencement of operation, the Applicant shall consult the Department's Murray Murrumbidgee Office of the operating protocols of the proposed works, such as trigger and cease to pumps levels in Mirrool Creek, maximum daily extraction and of any potential impacts on Mirrool Creek and consider any suggestions to modify the protocol to minimise potential impacts to the satisfaction of the Director-General. If during the operation of the development the Director-General considers that unforseen impacts on water users, land holders or the environment has occurred as a direct result of the Applicant's operational protocol, the Director-General in consultation with the Applicant, may direct the Applicant to modify the works or their operation as considered necessary to alleviate or mitigate the impact to the satisfaction of the Director-General.**	**NA**	**Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.**	**Condition 3.12 relates to works requiring approval under the Water Management Act 2000. As Mirrool Creek has now been de-proclaimed as a regulated water source, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied.**
3.13		**The Applicant shall ensure that reasonable access to off-allocation / environmental surplus flow in Mirrool Creek remains available to those irrigators who have a history of access, including the Wah Wah Irrigators.**	**NA**	**Interview with MI Environment Manager**	**Due to the drought, provision of off-allocation was not possible.**	
Groundwater Management						

			Compliant?	Evidence	Comments	Recommendations
3.14		**Prior to the commencement of operation of the Barren Box Swamp and En-route Storage facility, the Applicant shall prepare a Groundwater Monitoring Program to the satisfaction of the EPA. The Program shall meet the requirements of the EPA and include, but not necessarily be limited to:**				
	a)	**details of the procedures to identify any changes or adverse trends as a result of the proposed development;**	**Yes**	**OEMP**		
	b)	**parameters / pollutants to be monitored, including procedures and protocols for sampling and testing; and**	**Yes**	**OEMP and Water Management Works Licence – Environmental Management Conditions 1997**		
	c)	**A contingency plan to mitigate any groundwater level rises or salinity increases that arise from the development.**	**Yes**	**OEMP and Water Management Works Licence – Environmental Management Conditions 1997**		
3.15		The Applicant shall ensure that the enlargement of the Wah Wah main channel and construction of the en-route storage (Brays Dam) are undertaken in such a manner to ensure that the floor and walls of the water storages are appropriately constructed to minimise the potential for leakage and salinisation of adjacent properties.	Yes	Interview with MI Environment Manager indicated that the construction quality is being regularly monitored by MI and URS and will be verified in a works as executed report produced by URS.		

			Compliant?	Evidence	Comments	Recommendations
3.16		Prior to the commencement of construction, the Applicant shall undertake an EM-31 survey of the entire area of the Wah Wah main channel enlargement and Brays Dam (en-route storage) in order to identify potential areas of high permeability such as "prior stream beds". The Geotechnical Study submitted in the EIS indicated the presence of higher permeability sub-surface strata (such as sandy clays, sandy silts and silty sands) beneath the proposed storage area. The permeability variation at a finer scale will be more appropriately assessed through an EM-31 survey rather than the bore hole analysis undertaken and detailed in the EIS using a limited number of samples. The EM-31 survey will provide the applicant with defined target areas of high permeability that may require compaction and/or lining. This survey must include appropriate "ground truthing" to validate results obtained. The existing boreholes may be used for validation purposes.	Yes	EM-31 surveys undertaken by Lloyd Angov Soil Surveying and Drilling Pty Ltd dated 25 May 2005 (en-route storage) and 19 August 2004 (Wah Wah) Preconstruction Activity Requirements documents		
		The EM-31 survey and report interpreting the survey results and, if required, outlining proposed mitigative works, must be submitted to the satisfaction of the Department's Murray Murrumbidgee Regional Office as soon as possible after the survey has been completed to be reviewed.	Yes	EM-31 surveys undertaken by Lloyd Angov Soil Surveying and Drilling Pty Ltd dated 25 May 2005 (en-route storage) and 19 August 2004 (Wah Wah) Preconstruction Activity Requirements documents Department of Planning letter to MI, dated 7 August 2006	Reply obtained from the Director-General's delegate indicating that the Department is satisfied that the issues relating to the construction of the development have been adequately addressed. Accordingly, the Director-General has approved the CEMP for Stage 2 – 3.	

			Compliant?	Evidence	Comments	Recommendations
3.17		The Applicant is to achieve a minimum compaction standard of 95% or greater standard density compaction for the floor and walls of the enlargement to the Wah Wah Main Channel and en-route storage facility. The storage integrity analysis must be undertaken and results submitted to Department's Murray Murrumbidgee Regional Office, as soon as possible after the completion of the channel. If the applicant has concluded that the floor and walls of the Wah Wah works and en-route storage comply with the 95% or greater standard density compaction, the storages may be inundated prior to the results being submitted to Department's Murray Murrumbidgee Regional Office.	No	Final Draft Operational Environmental Management Plan (Appendix B, Sect. B1.9)	MI Environment Manager and Site Supervisor indicated that clay compaction is proceeding satisfactorily and will be certified by URS at completion of construction. Compaction test results are available in the OEMP. However, compactions tests were only done on floors of the Wah Wah Main Channel and en-route storage facility and not the walls. Given that the floor compaction tests complied with a minimum compaction standard of 95%, it is reasonable to assume that the construction of the walls would have been undertaken using similar equipment and that the walls have been compacted to the same standard. It is impractical to undertake additional compaction testing on the walls as it is only the upper layer that is accessible.	Director-General or delegate to provide written acknowledgement that the compaction tests conducted are adequate.
3.18		**Upon completion of Wah Wah Main enlargement and en-route storage at Bray's Dam, the Applicant shall validate the integrity of the artificial water storages through a series of compaction tests. The location and frequency of testing will be determined by Department's Murray Murrumbidgee Regional Office once it has reviewed the EM-31 survey and associated report.**	**Yes**	**Final Draft Operational Environmental Management Plan (Appendix B, Sect. B1.9)**	**No evidence was sighted of the compaction testing on the artificial water storage (except for the floors of the Wah Wah Main enlargement and Bray's Dam). It is presumed that no such testing was required on BBS following the Department's review of the EM-31 surveys.**	
Erosion and Sediment Control						
3.19		Prior to the commencement of construction (including earthworks), the Applicant shall provide documentary evidence to, and to the satisfaction of, the Director-General confirming that all erosion and sedimentation controls are in place.	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	

			Compliant?	Evidence	Comments	Recommendations
3.20		The Applicant shall ensure that soil must be removed from the wheels and undercarriage of any vehicles that leave the Barren Box Swamp construction impact zone, the En-route storage construction impact zone, or the Wah Wah Enlargement construction impact zone.	Yes	Dust & Traffic Management Plan and site visit to BBS, En-route storage and Wah Wah Enlargement sites.	Dust & Traffic Management Plan indicates that a wheel wash or similar device will be used to remove soil from wheels and undercarriage of any vehicles leaving the sites. This procedure is complied with at BBS. The road to the En-route storage site is tarred and therefore does not require wheel wash or similar device.	
3.21		The Applicant shall ensure that all works involving soil or vegetation disturbance shall be undertaken with adequate measures to prevent soil erosion and the entry of contaminants into any river, lake, waterbody, wetland or groundwater system.	Yes	Erosion and Sediment Management plans provide procedures. Inspections and interviews indicated that procedures as implemented were adequate to prevent soil erosion and the entry of contaminants into any river, lake, waterbody, wetland or groundwater system.		
3.22		The Applicant may use excess soil to reinforce embankments or line channel floors and walls along the sections of Mirrool Creek and Barren Box Swamp that are included in DA-101-4-2004-i. If excess soil is used for embankment reinforcement it must be stockpiled on embankments at a grade no steeper than 3:1 (V:H) and revegetated as soon as practically possible to minimise erosion into said streams.	NA		MI Environment Manager indicated that there were embankments or line channel floors and walls would not be reinforced as part of this project.	
3.23		**On completion of construction works, the Applicant shall ensure that the development site, is rehabilitated and stabilised. Temporary structures (other than silt fences and other erosion control devices) installed during the course of the works are to be removed.**	**Yes**	**Site visit to BBS, En-route storage and Wah Wah Enlargement sites.**	**Fences from the construction period are retained at BBS for future containment of equipment.**	

			Compliant?	Evidence	Comments	Recommendations
3.24		**All erosion and sedimentation controls required as part of this consent shall remain in place until such time as all ground disturbed by the works has been stabilised and rehabilitated so that it no longer acts as a source of sediment.**	**Yes**	**Site visit to BBS, En-route storage and Wah Wah Enlargement sites.**		
Waste Management Impacts						
3.25		The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by a licence under the POEO Act 1997.	Yes	MI Environment Manager and Site Supervisor indicated that no waste is received at site. Contractors waste removed by licensed waste contractor.		
Noise Impacts						
Construction						
3.26		Prior to the commencement of Construction, the Applicant shall enter into an agreement(s) with the landowners referred to in the EIS and development as F1079 and HR60 or provide such other forms of benefit or amelioration as may be agreed between the parties as providing acceptable compensation for the predicted noise levels experienced. A copy of the agreement(s) shall be forwarded to the satisfaction of the Director-General prior to the commencement of construction works.	Yes	Letter from Department of Planning to MI dated 5 December 2005.		

			Compliant?	Evidence	Comments	Recommendations
3.27		The Applicant must ensure that noise from construction works associated with Barren Box Swamp, the En-route Storage and the Wah Wah Enlargement does not exceed a LAeq (15 minute) noise emission criterion of 35 dB(A) at any residence at any time.	Yes	Letter from Barry Johnstone (resident near BBS) to MI. Interview with MI Environment Manager	MI Environment Manager indicated that any residents potentially affected by the noise at any of the construction sites have been consulted with and any sound proofing work has been performed. Interviews with contractors also indicate that wind direction has been monitored and construction activities moved to ensure noise is minimised. Construction of the embankments closest to residents at the BBS was constructed first so that the embankments can act as noise barriers. Although noise monitoring is not conducted and therefore the 35 dB(A) criterion cannot be verified, noise is monitored effectively through the complaints management procedure and constant community consultations.	
3.28		Noise from either the Barren Box Swamp, the En-Route storage or the Wah Wah Enlargement construction works is to be measured at the most affected point or within the residential boundary or at the most affected point within 30 metres of the dwelling (rural situations) where the dwelling is more than 30 metres from the boundary to determine compliance with the LAeq (15 minute) noise limit in Condition 3.27.	Yes	Interview with MI Environment Manager	Noise is effectively monitored through the complaints management procedure and constant community consultations.	
		Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance (refer to Chapter 11 of the NSW Industrial Noise Policy (INP). The modification factors presented in Section 4 of the NSW INP must also be applied to the measured noise levels where applicable.	Yes	Interview with MI Environment Manager	Noise is effectively monitored through the complaints management procedure and constant community consultations.	

			Compliant?	Evidence	Comments	Recommendations
3.29		Prior to the commencement of Construction, the Applicant shall prepare a Construction Noise Management Protocol. The Protocol shall include but not be limited to:				
		- Compliance standards;	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	
		- Community consultation;	Yes	Noise Management Plan		
		- Complaints handling and monitoring systems;	Yes	Noise Management Plan		
		- Site contact person to follow up complaints;	Yes	Noise Management Plan		
		- Mitigation measures;	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	
		- The design/orientation of the proposed mitigation methods demonstrating best practice;	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	
		- Construction times;	Yes	Noise Management Plan		
		- Contingency measures where noise complaints are received; and	Yes	Noise Management Plan		
		- Monitoring methods program.	Yes	Noise Management Plan	No monitoring methods program was found in the plan. However, noise is monitored effectively through the complaints management procedure and constant community consultation.	
Hours of Construction Activities						
3.30		The Applicant shall ensure that except as specified below, construction work may only be carried out within the construction impact zone as follows:-				
	a)	Wah Wah Main Enlargement 7am to 6pm Monday to Friday 8am to 1pm Saturday; and	 Yes Yes	Interview with MI Environment Manager		

			Compliant?	Evidence	Comments	Recommendations
		at no times on Sundays and Public holidays	Yes			
	b)	BBS - within 1500 m radius of Residence F2373 7am to 6pm Monday to Friday 8am to 1pm Saturday; and at no times on Sundays and Public holidays	 Yes Yes Yes	Interview with MI Environment Manager		
	c)	BBS - outside a 1500 m radius of Residence F2373 24 hours a day Monday to Friday* Midnight to 1pm Saturday*; and at no times on Sundays or Public holidays Note: *Night time activities may only be conducted within Barren Box Swamp construction impact zone outside an exclusion zone of 1500 metre radius from Residence F2373. Night time is defined as 10pm to 7am Monday to Saturday	 NA NA NA	Interview with MI Environment Manager	Hours of construction are from 6am to 6pm, Monday to Sunday. MI Environment Manager indicated that the site will be shut down if a complaint was received. As no complaints were received and the works have been completed, this condition is no longer considered to be relevant.	
	d)	En-route storage - within a 1200 m radius of Residence F1078 7am to 6pm Monday to Friday 8am to 1pm Saturday; and at no times on Sundays and Public holidays	 Yes Yes Yes	Interview with MI Environment Manager	Hours of construction were complied with.	
	e)	En-route storage - outside a 1200 m radius of Residence F1078 24 hours a day Monday to Friday* Midnight to 1pm Saturday*; and at no times on Sundays or Public holidays	 Yes Yes Yes	Interview with MI Environment Manager		

			Compliant?	Evidence	Comments	Recommendations
		Note: *Night time activities within the En-route storage construction impact zone are not to be conducted until the En-route storage southern embankment is sufficiently completed to act as a noise barrier, and then activities must only be undertaken outside an off set of 1200 metres from Residence F1078. Night time is defined as 10pm to 7am Monday to Saturday				
3.31		All heavy vehicle movements to and from the Barren Box Swamp construction impact zone, the En-route storage construction impact zone, and the Wah Wah Enlargement construction impact zone must only occur as follows:				
	a)	7am to 6pm Monday to Friday	Yes	Interview with MI Environment Manager	Heavy vehicle movements are not allowed during before and after school hours as children along the haul routes are being picked up by the school bus.	Include the control measure to halt deliveries during the period before and after school hours in the Traffic Management Plan
	b)	8am to 1pm Saturday; and	Yes			
	c)	at no times on Sundays and Public holidays	Yes			
3.32		The Applicant shall note that Condition 3.31 above does not apply to the delivery of material outside the hours of operation permitted by condition 3.30, if that delivery is required by Police or other authorities for safety reasons; and/or the operation or personnel or equipment are endangered. In such circumstances, prior notification is provided to the EPA and affected residents as soon as possible, or within a reasonable period in the case of an emergency.	Yes	Interview with MI Environment Manager	There has not been any requirement for delivery of material outside the hours of operation permitted by condition 3.30.	
Traffic and Transport Impacts						

			Compliant?	Evidence	Comments	Recommendations
3.33		If any public road (ie Shaws Road or the like) is to be used to remove or import material, then prior approval of Griffith City Council is required. In such cases the upgrading of public roads will be conditioned as per Griffith City Council requirements.	Yes	Letter from Griffith City Council to MI dated 15/7/05.		
3.34		Extracted material used for the construction of embankments at the BBS, En-route Storage and Wah Wah Main, must be from quarries approved by Griffith City Council under the EP&A Act and Regulations.	Yes	Interview with MI Environment Manager indicated that Milbrae Quarries currently holds a licence for the quarry.		
3.35		All vehicles that transport any material to and from the Barren Box Swamp construction impact zone, the En-route storage construction impact zone, or the Wah Wah Enlargement construction impact zone must be maintained so as to prevent the leakage of water or other fine materials.	Yes	Sightings of delivery trucks and interview with MI Environment Manager.	Sand delivery trucks sighted were covered. However, no vehicles transporting liquid were seen.	
3.36		Prior to the commencement of construction works on the en-route storage facility, the Applicant shall appropriately seal Pellizzer Road to the satisfaction of Griffith City Council.	Yes	Letter from Griffith City Council to MI dated 15/7/05 and 25/11/05.		
3.37		Prior to the commencement of construction, the Applicant shall demonstrate, to the satisfaction of the RTA and Director-General, that the Safe Intersection Sight Distance (SISD) from the proposed egress locations at the intersection with Kidman Way are in accordance with the RTA's Road Design guide for the prevailing speed limit.	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	

			Compliant?	Evidence	Comments	Recommendations
3.38		Any road works or road maintenance required to be undertaken as a result of the development shall be at no cost to the RTA or Griffith City Council. Any road maintenance shall be undertaken to the satisfaction of Griffith City Council.	Yes	Letter from Griffith City Council to MI dated 15/7/05 and 25/11/05.		
Visual Amenity Impacts						
3.39		**The Applicant shall ensure that the landscape works surrounding the En-route storage facility is undertaken to the satisfaction of Griffith City Council.**	**NA**	**Interview with MI Environment Manager**	**No landscaping has occurred on the site surrounding the En-route storage facility. Griffith City Council will be contacted and comments invited when landscaping does occur.**	
3.40		The Applicant must ensure that all external lighting associated with the development does not create a nuisance to surrounding properties or roadways. The lighting shall be the minimum level of illumination necessary and shall comply with AS 4282(INT) 1995 - Control of Obtrusive Effects of Outdoor Lighting.	Yes	Site visit to BBS, the En-route storage facility and the Wah Wah main.	No external lighting at any of the sites.	
Heritage Impacts						
3.41		The Applicant must obtain a section 90 approval under the National Parks and Wildlife Act 1974 to 'destroy' the eleven (11) hearth sites recorded as BB 16, 18, 20, 21, 22, 23, 24, 25, 26, 27, and 28.	Yes	Letter from DEC to MI dated 8/9/05 and consent #2295.		

			Compliant?	Evidence	Comments	Recommendations
3.42		That the Section 90 consent be issued in conjunction with a Section 87 Permit to excavate the hearths with the intention of obtaining a radio-carbon (C14) sample for dating purposes and salvage of a representative sample of artefacts for relocation or educational purposes. The collection of artefacts being subject to the issue of a conditional Care and Control permit to the Griffith Local Aboriginal Land Council.	Yes	Letter from DEC to MI dated 8/9/05 and consent #2296.		
3.43		That the Section 90 consent also cover any sites within the construction zones not currently known but which may be incidentally discovered during earth disturbance works provided always that:				
	-	any excavation works up to one metre in depth or ground surface clearance works (ie initial grading of access tracks) are monitored for the presence of cultural heritage sites and if found;	Yes	Wilde CEMP.		
	-	the site shall be inspected for the presence of datable material, a sample of which may be taken and in any event have its position recorded by means of a GPS reference. Any sites so discovered shall be formally recorded and submitted to the Aboriginal Heritage Information Management System (AHIMS) registrar for inclusion on the AHIMS database; and	Yes	Wilde CEMP.		
	-	construction work is not to proceed in areas where sites have been uncovered until the consultant archaeologist or his delegate has certified in writing that the permit works have been completed.	Yes	Wilde CEMP.	Wilde Earthmoving's CEMP states that a sign-off letter was produced dated 18/1/06. However, it was not sighted by the auditors.	

			Compliant?	Evidence	Comments	Recommendations
3.44		Prior to the commencement of construction works, the Applicant shall prepare a Research and Study design appropriate for the above work referred to in conditions 3.42 and 3.43, including an analysis of the stone tools and the spatial considerations of sites around the swamp subject to approval the DEC Aboriginal Heritage Unit.	Yes	Barren Box Swamp: Archaeological Research and Study Design for Section 87(1) Research Permit and Section 90 Consent to Destroy with Salvage by Biosis Research.		
3.45		Prior to the commencement of construction, the Applicant shall ensure that the archaeological sites identified as numbers 17, 18, 19, 29 and 56 within the development area shall be clearly identified and provided with a highly visible temporary protective buffer of star pickets and flagging or similar for a minimum 10 metres around the sites to avoid disturbance.	Yes	BBS site visit	Sites were clearly marked and fenced. Vehicular movement is controlled by clear signage on site.	
3.46		To reduce the risk of disturbance to any potential cultural heritage deposits, the Applicant shall ensure that the Borrow Pits at the ends of the active cell embankment of the Barren Box Swamp are not extended onto the shoreline area.	Yes	BBS site visit		
3.47		To reduce the risk of disturbance to any potential cultural heritage deposits, the Applicant shall ensure that the termination point of the intermediate cell embankment of Barren Box Swamp does not extend to the natural shoreline. This termination point shall be determined following on the ground inspection and consultation between the developer and the relevant local Aboriginal Community.	Yes	BBS site visit		

			Compliant?	Evidence	Comments	Recommendations
3.48		In the event that any other previously unidentified relic of indigenous significance is uncovered during the construction of the development, all construction work in the vicinity of the relic must cease and the Applicant shall contact the DEC as soon as practicable. The Applicant shall meet the requirements of the DEC with respect to the treatment, management and/or preservation of any such relic.	Yes	Wilde Earth Moving CEMP.		
Hazards and Risk Impacts						
3.49		The Applicant must ensure that all liquid chemicals, fuels and oils within the Barren Box construction impact zone, the En-route storage construction impact zone or the Wah Wah Enlargement construction impact zone are stored in containers inside a suitable bund(s).	Yes	Site visits to the BBS, the En-route storage and the Wah Wah Enlargement sites Interview with MI Environment Manager	MI Environment Manager indicated that the bunding was in place. No visible spill marks or evidence of chemical spillage could be discerned at BBS and Brays Dam pump station.	
3.50		The Applicant must ensure that the bund(s) referred to in condition 3.49 above are designed, constructed and maintained in accordance with the EPA's Technical Guidelines "Bunding and Spill Management".	Yes	Site visits to the BBS construction impact zone, the En-route storage construction impact zone or the Wah Wah Enlargement construction impact zone		
3.51		The Applicant shall store and handle all dangerous goods (as defined by the Australian Dangerous Goods Code, including pesticides, fertilisers, and LPG) and combustible liquids, strictly in accordance with:				
	a)	all relevant Australian Standards;	Yes	Site visits to the BBS, the En-route storage and the Wah Wah Enlargement sites Interview with MI Environment Manager	MI Environment Manager indicated that the bunding was in place. No visible spill marks or evidence of chemical spillage could be discerned at BBS and Brays Dam pump station.	

			Compliant?	Evidence	Comments	Recommendations
	b)	a minimum bund volume requirement of 110% of the volume of the largest single stored volume within the bund; and	Yes	Site visits to the BBS, the En-route storage and the Wah Wah Enlargement sites Interview with MI Environment Manager	see comments for 3.51a	
	c)	the EPA's Environment Protection Manual Technical Bulletin Bunding and Spill Management.	Yes	Site visits to the BBS construction impact zone, the En-route storage construction impact zone or the Wah Wah Enlargement construction impact zone		
		In the event of an inconsistency between the requirements listed from a) to c) above, the most stringent requirement shall prevail to the extent of the inconsistency.	Yes			
Wetland Concept						
3.52		Six months after the commencement of construction, the Applicant shall must prepare and implement a Wetland Concept Design for the Barren Box Swamp area to describe the proposed wetland design parameters. The Concept Design must be prepared by an appropriately qualified person/s, in consultation with the Department's Murray Murrumbidgee Office, the Murrumbidgee Wetlands Working Group, Department of Primary Industries (former NSW Fisheries), Griffith City Council, Department of Environment and Conservation and the previously established Wetland Reference Group. The Concept Plan shall include, but not necessarily be limited to:	Yes	EIS - Appendix F: Wetland Concept Design		

			Compliant?	Evidence	Comments	Recommendations
	i)	details of the proposed water monitoring that would be undertaken, including duration, to ascertain the potential changes to the hydrological regime;	No	OEMP and letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	The OEMP makes reference to monitoring but a detailed monitoring program will be in the Wetland Rehabilitation and Management Plan. A request for an extension to the deadline for having this plan completed has been submitted to the Department of Planning but no reply has been received.	Director-General or delegate to provide written evidence that the variations requested are granted or denied
	ii)	expected vegetation communities and plant species to be utilised in the rehabilitation;	Yes	EIS - Appendix F: Wetland Concept Design		
	iii)	consideration of potential aquatic habitats that would be created;	Yes	EIS - Appendix F: Wetland Concept Design		
	iv)	specific mitigation measures that would be implemented during construction activities;	No	OEMP and letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	The OEMP makes no reference to mitigation measures but it will be included in the Wetland Rehabilitation and Management Plan. A request for an extension to the deadline for having this plan completed has been submitted to the Department of Planning but no reply has been received	Director-General or delegate to provide written evidence that the variations requested are granted or denied
	v)	details of the anticipated outcomes/targets that would be achieved for the wetland area;	Yes	EIS - Appendix F: Wetland Concept Design		
	vi)	outcomes of consultation with landowners adjoining the proposed wetland area.	No	OEMP and letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	The OEMP makes no reference to outcomes of consultation with landowners but it will be included in the Wetland Rehabilitation and Management Plan. A request for an extension to the deadline for having this plan completed has been submitted to the Department of Planning but no reply has been received	Director-General or delegate to provide written evidence that the variations requested are granted or denied

3.4 Environmental Monitoring and Auditing

			Compliant?	Evidence	Comments	Recommendations
General Monitoring Requirements						
4.1		The results of all monitoring required under this consent shall be:				
	a)	in a legible form, or in a form that can readily reduced to a legible form;	Yes	Murrumbidgee Irrigation daily site logs Site/hazard/inspection calendar Inspection and test plan/checklist for site weather conditions Inspection and test plan/checklist daily plant log Wilde Earth Moving daily log		
	b)	kept for at least 4 years after the monitoring or event to which the results relate took place; and	NA	NA	NA	NA
	c)	produced in a legible form to any authorised officer of the EPA, DIPNR or the Director-General, upon request;	Yes	see 4.1a		
	d)	kept with the following details for each sample required to be collected:				
	i)	the date(s) on which the sample was collected;	Yes	Dust samples at Brays Dam		
	ii)	the time(s) at which the sample was collected;	Yes	Interview with MI Environment Manager	MI Environment Manager indicated that the time samples were collected was noted down on the container. As construction works has been completed, this condition is no longer relevant.	
	iii)	the point at which the sample was collected; and	Yes	Dust samples at Brays Dam		
	iv)	the name of the person who collected the sample.	Yes	Dust samples at Brays Dam	Although not on the container, only one person, Barry MacKay, takes the sample.	

			Compliant?	Evidence	Comments	Recommendations
4.2		The Applicant must undertake all water quality monitoring required under this development consent in accordance with the NSW EPA's Approved Methods for the Sampling and Analysis of Water Pollution in NSW.	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	
Independent Environmental Auditing						
4.3		Within two years of the commencement of construction of the development, and then as may be directed by the Director-General, the Applicant shall commission an independent person or team to undertake an Environmental Audit of the development. The independent person or team shall be approved by the Director-General prior to the commencement of the Audit. The Audit shall:	Yes	Acceptance email from Rob Kelly to Ecowise dated 23/2/06.	MI has commissioned Ecowise to perform a mid-term and final audit of the development.	
	a)	be carried out in accordance with ISO 19011:2002 - Guidelines for Quality and/ or Environmental Management Systems Auditing;	Yes			
	b)	assess compliance with the requirements of this consent, and other licences and approvals that apply to the development;	Yes			
	c)	assess the environmental performance of the development against the predictions made and conclusions drawn in the documents referred to under condition 1.1 of this consent; and	Yes			
	d)	review the effectiveness of the environmental management of the development, including any environmental impact mitigation works.	Yes			

			Compliant?	Evidence	Comments	Recommendations
		An Environmental Audit Report shall be submitted for comment to the Director-General, Griffith City Council, Department of Primary Industries, the EPA and the DIPNR (Natural Resources) within two months of the completion of the Audit, detailing the findings and recommendations of the Audit and including a detailed response from the Applicant to any of the recommendations contained in the Report.	**Yes**	**Report of final audit by Eowise Environmental**		
		The Director-General may having considered any submissions made by Griffith City Council, Department of Primary Industries, the EPA and the DIPNR (Natural Resources) in response to the Report, require the Applicant to undertake works to address the findings or recommendations presented in the Report. Any such works shall be completed within such time as the Director-General may require.	**NA**	**Report of the final audit has not yet been submitted**		

3.5 Community Information and Involvement

			Compliant?	Evidence	Comments	Recommendations
5.1		Subject to confidentiality, the Applicant shall make all documents required under this consent available for public inspection upon request. This shall include provision of all documents at the site for inspection by visitors as well as being made available in an electronic format.	Yes	MI website and site visit.	Although documents are not available directly on line, there is a phone number to the MI Environment Manager to obtain further information on the EIS. Documents were available on site.	
Complaints Procedure						
5.2		Prior to the commencement of construction of the development, the Applicant must implement a system for community complaints. Such a complaints system must include:				
	a)	a 24-hour telephone number on which complaints about operations on the site may be registered;	Yes	Complaints Management Plan and sign near the entrance of each site.		
	b)	a postal address to which written complaints may be sent; and	Yes	Complaints Management Plan and sign near the entrance of each site.		
	c)	an email address to which electronic complaints may be transmitted, should the Applicant have email capabilities.	Yes	Complaints Management Plan and sign near the entrance of each site.		

			Compliant?	Evidence	Comments	Recommendations
		The telephone number, the postal address and the email address shall be advertised in a newspaper circulating within the locality on at least one occasion prior to the commencement of construction of each stage of the development. These details must also be displayed on a sign near the entrance to the site, in a position that is clearly visible to the public and on the Applicant's internet site, should one exist. The telephone number, postal address and email address must be maintained throughout the life of the development.	Yes	The Area News advertisement dated 16/3/06.		
5.3		The Applicant must record details of all complaints received through the means listed under condition 5.2 of this consent in an up-to-date Complaints Register. The Register must record, but not necessarily be limited to:				
	a)	the date and time, where relevant, of the complaint;	Yes	Complaints/Enquiry record		
	b)	the means by which the complaint was made (telephone, mail or email);	NA	Interview with MI Environment Manager	The addition of a field for the means by which the complaint was not necessary as no further complaints were registered after the mid-term audit.	
	c)	any personal details of the complainant that were provided, or if no details were provided, a note to that effect;	Yes	Complaints/Enquiry record		
	d)	the nature of the complaint;	Yes	Complaints/Enquiry record		
	e)	any action(s) taken by the Applicant in relation to the complaint, including any follow-up contact with the complainant; and	Yes	Complaints/Enquiry record		
	f)	if no action was taken by the Applicant in relation to the complaint, the reason(s) why no action was taken.	Yes	Complaints/Enquiry record		

			Compliant?	Evidence	Comments	Recommendations
		The Complaints Register must be made available for inspection by the Director-General upon request.	Yes		MI Environment Manager has all of the complaints on file.	
Community Communication Strategy						
5.4		**Prior to the commencement of operations of the development, the Applicant shall prepare and implement a Community Communication Strategy for the development. This strategy shall be designed to enable the Applicant to respond to any community / licence holder enquiries and to provide mechanisms to inform the local community, particularly from Murrumbidgee Irrigation licence holders, as to the nature and operational environmental performance of the facility. The Strategy shall include, but does not necessarily be limited to:**	**Yes**	**OEMP**		
	a)	**mechanisms through which the Applicant can report to the licence holders on the operations of the development and its environmental performance;**	**Yes**	**OEMP**		
	b)	**process by which the Applicant can advise licence holders of availability of off-allocation water;**	**Yes**	**OEMP**		
	c)	**mechanism for providing licence holders with updates on any activities that may potentially disrupt water supplies;**	**Yes**	**OEMP**		
	d)	**mechanisms through which the licence holders can provide feedback to the Applicant in relation to the environmental management of the development; and**	**Yes**	**OEMP**		

			Compliant?	Evidence	Comments	Recommendations
	e)	**mechanisms through which the Applicant can respond to any enquires or feedback from the licence holders in relation to the environmental performance and the nature of operations at the development.**	**Yes**	**OEMP**		
		The Strategy shall be approved by the Director-General prior to the commencement of any operations at the site.	**No**	**OEMP**	**The OEMP was submitted to the Department of Planning but no reply to indicate that the OEMP was satisfactory.**	**Director-General or delegate to provide written evidence that the OEMP is satisfactory.**

3.6 Environmental Management

			Compliant?	Evidence	Comments	Recommendations
Environmental Representative						
6.1		Prior to the commencement of construction of the development, the Applicant must nominate a suitably qualified and experienced Environmental Representative(s) whose appointment is to receive prior approval of the Director-General. The Applicant shall employ the Environmental Representative(s) throughout the life of the development. The Environmental Representative shall be:	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.	The MI Environmental Representative is Rob Kelly (MI Environment Manager).	
	a)	the primary contact point in relation to the environmental performance of the development;	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.		
	b)	responsible for all Management Plans, mitigation measures and Monitoring Programs required under this consent;	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.		
	c)	responsible for considering and advising on matters specified in the conditions of this consent, and all other licences and approvals related to the environmental performance and impacts of the development;	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.		
	d)	responsible for receiving and responding to complaints in accordance with condition 5.2 of this consent; and	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.	MI Environment Manager has indicated that all complaints and their responses are addressed by him.	

			Compliant?	Evidence	Comments	Recommendations
	e)	given the authority and independence to require reasonable steps be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment be likely to occur.	Yes	Preconstruction Activity Requirements documents sent 28/10/05 from MI to Department of Planning.		
		The Applicant shall notify the Director-General of any changes to that appointment that may occur from time to time.	NA		There have been no changes to the representative appointed.	

3.7 Construction Environmental Management Plan

			Compliant?	Evidence	Comments	Recommendations
Construction Environmental Management Plan						
6.2		The Applicant must prepare and implement a Construction Environmental Management Plan (CEMP) to outline environmental management practices and procedures to be followed during the construction of each stage of the development. The Plan must include, but not necessarily be limited to:	Yes	Department of Planning letter to MI, dated 7 August 2006.	Reply obtained from the Director-General's delegate indicating that the CEMP is satisfactory.	
	a)	a description of all activities to be undertaken on the site during construction of the development, including an indication of stages of construction, where relevant;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	b)	statutory and other obligations that the Applicant is required to fulfil during construction, including all approvals, consultations and agreements required from authorities and other stakeholders, and key legislation and policies;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	c)	specific consideration of measures to address any requirements of the Department, the EPA and Council during construction;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	d)	details of the proposed construction of dry phase refuges in Barren Box Swamp (including the Intermediate, Active and Wetland cells) in consultation with the Department of Primary Industries;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	e)	details of how the environmental performance of the construction works will be monitored, and what actions will be taken to address identified adverse environmental impacts;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	f)	a description of the roles and responsibilities for all relevant employees involved in the construction of the development;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	g)	complaints handling procedures during construction and site preparation;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	h)	the relevant environmental monitoring requirements outlined under section 4 of the consent; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	i)	the Management Plans listed under condition 6.3 of this consent. The following environmental performance issues must also be addressed in the Plan:				
	i)	measures to monitor and manage traffic impacts resulting from road works and general construction activities; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	ii)	measures to monitor and manage dust emissions, including contingency measures in the event relevant criteria are not being met.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
		The CEMP shall be submitted for the approval of the Director-General no later than one month prior to the commencement of any site preparation and construction works associated with the development, or within such period as otherwise agreed by the Director-General. Where the construction work is to be undertaken in stages, the Applicant may, subject to the agreement of the Director-General, stage the submission of the CEMP consistent with the staging of activities relating to that work.	Yes	Preconstruction Activities Requirements documents sent to the Department of Planning on the 28/10/05.		

			Compliant?	Evidence	Comments	Recommendations
		Site preparation and construction works associated with any stage of the development shall not commence until written approval has been received from the Director-General for that stage. Upon receipt of the Director-General's approval, the Applicant shall supply a copy of the CEMP to the DEC and Council as soon as practicable.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
6.3		As part of the CEMP for the development, required under condition 6.2 of this consent, the Applicant shall prepare and implement the following Management Plans:				
	a)	an Erosion and Sedimentation Management Plan to detail measures to minimise erosion during construction of the development. The Plan must be prepared in consultation with the DEC, Council and the Department. The Plan must include, but not necessarily be limited to:	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	i)	results of investigations into soils associated with the site, in particular the stability of the soil and its susceptibility to erosion;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	ii)	demonstration of best practice methods to be applied for the on-site control of run-off, sediments and other pollutants;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet		

			Compliant?	Evidence	Comments	Recommendations
	iii)	details of the measures that will be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction activities;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Details were found in the CEMP for BBS and some of the contractors' CEMPs at the En-route storage.	
	iv)	demonstration that erosion and sediment control measures will conform with, or exceed, the relevant requirements and guidelines provided in the most recent versions of the Department's publication Urban Erosion and Sedimentation Handbook, the EPA's publication Pollution Control Manual for Urban Stormwater, the Department of Housing's publications Soil and Water Management for Urban Development and the Managing Urban Stormwater - Soils and Construction;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet		
	v)	design specifications for diversionary works, banks and any sediment basins;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	vi)	details of steps to be implemented to minimise soil erosion and the discharge of sediments and/ or other pollutants from the site including how they will be monitored during those works, clearly indicating who will conduct the monitoring, how the results will be recorded; and, if any non-compliance is detected, what corrective action will be taken;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	vii)	description of procedures to ensure that the measures implemented to control sedimentation and erosion on site, are maintained at all times; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	viii)	measures to address erosion, should it occur, and to rehabilitate/ stabilise disturbed areas of the site.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	b)	a Noise Management Plan to detail measures to minimise noise emissions associated with the development, including road transport noise. The Plan shall include, but not necessarily be limited to:	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Noise management plan was found in the CEMP for BBS and the contractors' CEMPs at the En-route storage.	
	i)	identification of all major sources of noise that may be emitted as a result of the carrying out of the development;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	ii)	specification of the noise criteria as it applies to the particular activity;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iii)	identification and implementation of best practice management techniques for minimisation of noise emissions;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet		
	iv)	procedure for notifying potentially affected local residents of construction program and of a contact person to contact should they have concerns with any construction noise generated;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	v)	measures to manage impacts from noisy construction work activities on residents, particularly during sensitive time periods (eg 6pm to 7am) and from road traffic noise;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet		

			Compliant?	Evidence	Comments	Recommendations
	vi)	procedures for the monitoring of noise emissions; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	vii)	description of procedures to be undertaken if any non-compliance is detected or complaints are made.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	c)	a Dust Management Plan to detail measures to minimise the generation of dust on the development site during construction, and the impacts of dust on surrounding land owners. The Plan shall include, but not necessarily be limited to:	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	i)	identification of the potential sources of dust during construction;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	ii)	specification of appropriate dust control criteria for the works;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iii)	a description of what actions and measures would be implemented to minimise dust generation during the proposed works;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iv)	details of how the effectiveness of these measures would be monitored during the proposed works; and, if any non-compliance is detected;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	v)	a description of what procedures would be followed to ensure compliance.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	d)	a Vegetation Clearing Protocol to detail measures to manage and minimise the impact of vegetation clearing and is to be prepared in consultation with Griffith City Council. The Protocol must include, but not necessarily be limited to:	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Vegetation clearing protocol found in the CEMP for BBS but not in the contractors' CEMPs for the En-route storage as no vegetation clearing was required.	
	i)	a detailed plan showing the area and type of vegetation that is to be cleared;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	ii)	requirements for the protection of vegetation not to be cleared (such as fencing);	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iii)	details of proposed pre-clearance surveys;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iv)	re-use of cleared vegetation and leaf mulch including for weed eradication;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	v)	strategies to minimise impacts on fauna (such as checking hollows for any fauna and relocation of the fauna away from the impacted areas, prior to felling of any trees), such as strategies for the Brown Treecreeper;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Strategies found in the CEMP for BBS.	
	vi)	details of salvage and reuse of material from the site, particularly large woody debris (eg tree trunks and large limbs) as refuges during dry periods in all of Barren Box Swamp;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Details found in the CEMP for BBS.	
	vii)	water quality controls;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	viii)	control of weeds during clearance activities; and	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Control of Alligator Weed found in the CEMP for BBS and some general weed management in some of the contractors' CEMPs for the En-route storage.	
	ix)	measures to ensure stockpiles are located on cleared areas.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	e)	an Alligator Weed Management Plan to detail measures to manage and monitor the potential occurrence of Alligator Weed in the development area. The Plan shall be developed in consultation with Griffith City Council, the Department of Primary Industries and the Alligator Weed Task Force, include, but not necessarily be limited to:	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Alligator weed management plan found in the CEMP for BBS but not in the contractors' CEMPs for the En-route storage as there is no alligator weed present at that site.	
	i)	measures for the management of Alligator Weed;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	Measures were found in the CEMP for BBS.	
	ii)	process for the on-going monitoring for Alligator Weed, including ensuring the wash down of vehicles leaving the site;	Yes	CEMP Splitting of Barren Box Swamp Stage 1 Works - Site Establishment & Temporary Bunds CEMP Brays Dam En-route Storage Structures, Separable Portions 2 & 3 CEMP for Construction of Brays Dam En-route Storage CEMP Brays Dam Pump Station and Inlet	General monitoring process was found in the CEMP for BBS. Wash down of vehicles prior to leaving the site was mentioned in the BBS CEMP.	
	iii)	details of proposed mitigation measures to manage any potential occurrences of Alligator Weed; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iv)	procedures for the notification of Council, the Department of Primary Industries, and the Alligator Weed Task Force should an outbreak occur.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	f)	a Traffic Management Plan to outline measures for the management and coordination of road works required under this consent and to minimise potential conflicts between different user groups. The Plan must be prepared in consultation with the RTA and Griffith City Council and must include, but not necessarily be limited to:	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	i)	details of measures to minimise interactions between the development and other users of the roads such as through the use of fencing, lights, barriers, traffic diversions etc;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	ii)	measures to monitor and manage traffic impacts and also road maintenance resulting from road works and general construction activities;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iii)	procedures for informing the residents along the selected transport routes of the proposed vehicle movements (eg media, newsletter or radio), duration and times of vehicle movements, the contact details of a Company representative for residents to raise any concerns with during the construction period for and details of any restrictions to road uses as a result of the development;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	iv)	details of traffic routes to be used by heavy vehicles associated with the development;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	v)	minimum requirements for vehicle maintenance to address noise and exhaust emissions, particularly along roads in close proximity to residences;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	vi)	speed limits to be observed along routes to and from the site and within the site;	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	

			Compliant?	Evidence	Comments	Recommendations
	vii)	details of the expected behavioural requirements for vehicle drivers travelling to and from the site and within the site, such as through a driver code of conduct; and	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
	viii)	outlining mitigation measures to be employed to reduce noise emissions and ensure the relevant criteria as outlined in the EPA's publication Environmental Criteria for Road Traffic Noise are being met.	Yes	Department of Planning letter to MI, dated 7 August 2006.	see comments for 6.2	
Operation Environmental Management Plan						
6.4		**The Applicant must prepare and implement an Operation Environmental Management Plan (OEMP) to detail an environmental management framework, practices and procedures to be followed during operation of the development. The Plan shall include, but not necessarily be limited to:**				
	a)	**identification of all statutory and other obligations that the Applicant is required to fulfil in relation to operation of the development, including all consents, licences, approvals and consultations;**	**Yes**	**OEMP**		
	b)	**a description of the roles and responsibilities for all relevant employees involved in the operation of the development;**	**Yes**	**OEMP**		
	c)	**overall environmental policies and principles that will be/ are applied to the operation of the development;**	**Yes**	**OEMP**	**The objectives of each section are clearly expressed in each section of the OEMP.**	

			Compliant?	Evidence	Comments	Recommendations
	d)	standards and performance measures that will be applied/ are to the development, and a means by which environmental performance can be periodically reviewed and improved;	Yes	OEMP		
	e)	details of contingency measures should seepages occur from the development;	Yes	OEMP		
	f)	measures for the management and control of weeds in pests in the proposed development area;	Yes	OEMP and MI Weeds & Draingage – Leeton & Griffith 2004-2007 Review and Strategic Plan		
	g)	management policies to ensure that environmental performance goals are met and to comply with the conditions of this consent;	Yes	OEMP		
	h)	details of all landscaping to be undertaken on the site;	No	OEMP Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006 Interview with MI Environment Manager	Details of landscaping for BBS will be in the Wetland Rehabilitation and Management Plan to be completed in the near future. Details of landscaping for the En-route storage facility will be in the Property Vegetation Plan to be completed in the near future.	Director-General or delegate to provide written evidence that the variations requested are granted or denied. MI to seek approval from Director-General or delegate that the details of landscaping for the En-route storage facility in the Property Vegetation Plan will be sufficient to comply with this condition.
	i)	the Management Plans listed under condition 6.5 of this consent;	Yes	OEMP		
	j)	the environmental monitoring requirements outlined under condition 3 and 4.1 of this consent, inclusive; and	Yes	OEMP		

			Compliant?	Evidence	Comments	Recommendations
	k)	contingency measures should monitoring of environmental issues under this consent indicate that the development has had, or is having an adverse environmental impact.	Yes	OEMP		
		The OEMP must be submitted for the approval of the Director-General no later than one month prior to the commencement of operation of the development, or within such period as otherwise agreed by the Director-General. Operation shall not commence until written approval has been received from the Director-General. Upon receipt of the Director-General's approval, the Applicant shall supply a copy of the OEMP to the EPA and Council as soon as practicable.	No	OEMP and email	The OEMP was submitted to the Department of Planning but no reply to indicate that the OEMP was satisfactory.	Director-General or delegate to provide written evidence that the OEMP is satisfactory
6.5		As part of the OEMP for the development, required under condition 6.4 of this consent, the Applicant shall prepare and implement the following Management Plans:				
	a)	an Exotic Flora and Fauna Management Plan to detail measures to manage and monitor the occurrence of any exotic flora and fauna in the development area. The Plan shall be developed in consultation with Griffith City Council, the Department of Primary Industries, the Alligator Weed Task Force and adjacent landowners, and include, but not necessarily be limited to:	Yes	OEMP		
	i)	Details of long term management measures for the European Carp;	Yes	OEMP		

			Compliant?	Evidence	Comments	Recommendations
	ii)	Detailed management options and monitoring for weed management following any clearing of vegetation and the change in the hydrologic regime of the wetland cell;	Yes	OEMP		
	iii)	Procedures for the notification of Council, the Department of Primary Industries, and the Alligator Weed Task Force (in the event of an outbreak of Alligator Weed) of any outbreak of exotic flora or fauna;	Yes	OEMP		
	iv)	Measures for the management and monitoring for Alligator Weed; and	Yes	OEMP		
	v)	Measures for the management and monitoring for feral animals ie pigs and foxes.	Yes	OEMP		
	b)	a Groundwater Management Plan to detail measures to manage and minimise the impact of the proposal on groundwater. The Plan must include, but not necessarily be limited				
	(i)	details of baseline groundwater quality, as present prior to the commencement of construction of the development;	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		
	(ii)	identification of materials and activities associated with the development that have the potential to impact on groundwater quality, and how these materials and activities are to be managed to prevent those impacts;	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		
	(iii)	monitoring of groundwater quality, including parameters to be monitored and frequency of monitoring;	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		

			Compliant?	Evidence	Comments	Recommendations
	(iv)	details of how any groundwater level rises or salinity increases in nearby properties will be monitored and managed;	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		
	(v)	details of contingency measures and management options should monitoring of groundwater quality indicate that the development has had, or is having, an adverse effect on groundwater quality;	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		
	(vi)	details on the location of monitoring piezometers around the Wah Wah main channel, en-route storage (Brays Dam) and Barren Box Swamp to monitor standing water levels and electrical conductivities on neighbouring properties. The construction and positioning of the piezometers shall be determined in consultation with the Department's Murray Murrumbidgee Office.	Yes	OEMP and Water Management Works Licence – Environmental Management Conditions 1997		
	c)	a Cultural Heritage Management Plan shall be developed for the area following completion of the works with particular emphasis on establishing the extent and ongoing management of the resource in the wetland cell. This shall be developed in conjunction with the local Aboriginal Community.	Yes	Cultural Heritage Management Plan		

			Compliant?	Evidence	Comments	Recommendations
	d)	a Wetland Rehabilitation and Management Plan for Barren Box Swamp to outline the proposed measures that will be undertaken as part of establishing an ephemeral wetland system in Swamp area. The Plan must be prepared by an appropriately qualified person/s, in consultation with the Department of Primary Industries (former NSW Fisheries), Griffith Local Aboriginal Land Council, adjoining landowners, Griffith City Council, Department's Murray Murrumbidgee Office, Murrumbidgee Wetlands Working Group, Department of Environment and Conservation and the previously established Wetland Reference Group. The Plan shall include, but not necessarily be limited to:	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	The OEMP contains a section on the Wetland Rehabilitation and Management Plan. However, a more detailed plan is under preparation and a request for an extension to the deadline for having this plan completed has been submitted to the Department of Planning but no reply has been received.	Director-General or delegate to provide written evidence that the variations requested are granted or denied
	i)	details of the anticipated timeframe for implementing the Plan;	Yes	OEMP		
	ii)	results and adopted recommendations from the Wetland Concept Plan;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	iii)	details of the proposed financial commitment to undertake the works required by this Plan and for the ongoing management of the Wetland area;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	iv)	details of the proposed measures to protect and manage Aboriginal objects and cultural values;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	v)	determination of the rate of filling and drying (as near as possible to natural rates);	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d

			Compliant?	Evidence	Comments	Recommendations
	vi)	measures for controlling stock grazing to retain dead standing material;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	vii)	procedures for the management of salt and nutrient accretion;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	viii)	details of proposed planting programs, including species to be used;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	ix)	description of the hydrological requirements and ecological responses for threatened species and their habitat;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	x)	details of the water requirements of the Lower Mirrool Creek floodway to ensure that the Barren Box Swamp Project does not have a negative impact on this wetland system;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	xi)	details of an ecological monitoring regime. The monitoring regime shall include aquatic ecology and cover the entire Barren Box Swamp;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	xii)	details of the proposed establishment of aquatic and arboreal habitats, and monitoring of the success of these habitats;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	xiii)	performance indicators and monitoring in accordance with the Department of Environment and Heritage endorsed framework for development environmental water regimes in wetlands;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	xiv)	details of an ongoing monitoring program of the Lower Mirrool Creek Floodway wetland system;	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d

			Compliant?	Evidence	Comments	Recommendations
	xv)	details on how water will be transferred for a deliberate release into the Lower Mirrool Creek Wetland System of sufficient quantity, including procedures for determining this quantity, should monitoring of the Lower Mirrool Creek Floodway Wetland System [refer to subclause xiv) above] identifies that the condition of the vegetation has deteriorated as a direct result of the operation of the proposed development. This is required to avoid degradation of the wetland system and comply with the principles of the NSW Wetland Management Policy.	No	Letter from MI to Department of Planning for variations to Conditions of Consent dated 14/8/2006.	see comments for 6.5d	see recommendation for 6.5d
	Note:	The Applicant may be required to submit an application in accordance with the requirements of the Environmental Planning and Assessment Act,1979 (the Act) for the undertaking of any development works as part of the Wetland Rehabilitation and Management Plan should those works require development consent under the Act.				
	e)	a Flood Management Plan to outline the proposed management of flood waters in the development area. The Plan shall be prepared in consultation with Griffith City Council and the Department's Murray-Murrumbidgee Office, and is to include, but not necessarily limited to:	Yes	OEMP		

			Compliant?	Evidence	Comments	Recommendations
	i)	measures to monitor the flood behaviour in the development area following the completion of construction activities. This information is to be used to update water balance models;	Yes	OEMP		
	ii)	a program for the assessment of the water requirements of the Lower Mirrool Creek floodway to ensure that the Barren Box Swamp Project does not have a negative impact on this wetland system;	Yes	OEMP		
	iii)	procedures for the release of flood waters from Barren Box Swamp to the floodway;	Yes	OEMP		
	iv)	revised operational levels for flood mitigation in Barren Box Swamp;	Yes	OEMP		
	v)	details of contingency measures should impacts be identified; and	No	Interview with MI Environment Manager	Flood management procedures are dictated by the NSW Government and therefore, any impacts are beyond MI's control.	Seek written confirmation from the Director-General or delegate that this clause be removed.
	vi)	evidence of consultations with relevant landowners.	No	Interview with MI Environment Manager	Frequent meetings and communication with landowners. A level of trust has been established between MI and landowners where landowners are happy for MI to disseminated information on an as required basis.	Seek written confirmation from the Director-General or delegate that this clause be removed as consultation with landowners are numerous and on-going.

			Compliant?	Evidence	Comments	Recommendations
6.6		**Within three years of the commencement of this consent, and at least every three years thereafter, the Applicant shall undertake a formal review of the Operation Environmental Management Plan (OEMP) required under condition 6.4 of this consent. The review shall ensure that the OEMP is up-to-date and all changes to procedures and practices since the previous review have been fully incorporated into the OEMP. The Applicant shall notify the Director-General, Council and the EPA of the completion of each review, and shall supply a copy of the updated OEMP to those parties on request. The Applicant shall, subject to confidentiality, also make any revised OEMP available for public inspection on request.**	**Yes**	**OEMP**		

3.8 Environmental Reporting

			Compliant?	Evidence	Comments	Recommendations
Incident Reporting						
7.1		The Applicant shall notify the EPA and the Director-General of any incident with actual or potential significant off-site impacts on people or the biophysical environment as soon as practicable after the occurrence of the incident. The Applicant shall provide written details of the incident to the EPA and the Director-General within seven days of the date on which the incident occurred.	Yes	MI incident reporting systems are in place and apply to this project but have not been required.		
7.2		The Applicant shall meet the requirements of the Director-General to address the cause or impact of any incident, as it relates to this consent, reported in accordance with condition 7.1, within such period as the Director-General may agree.	Yes	MI incident reporting systems are in place and apply to this project but have not been required.		
	Note:	Condition 7.2 of this consent does not limit or preclude the EPA from requiring any action to address the cause or impact of any incident, in the context of the EPA's statutory role in relation to the development.				
7.3		The Applicant shall submit an Annual Return to the EPA in relation to the development, as required by any licence issued under the Protection of the Environment Operations Act 1997. In the Return, the Applicant shall:	Yes	MI submits an annual return to the EPA in relation to its EPA licence. The annual return will include the points listed in condition 7.3		
	a)	report on the annual monitoring undertaken (where the activity has resulted in pollutant discharges);	Yes	As above		

			Compliant?	Evidence	Comments	Recommendations
	b)	provide a summary of complaints relating to the development;	Yes	As above		
	c)	report on compliance with licence conditions; and	Yes	As above		
	d)	provide a calculation of licence fees (administrative fees and, where relevant, load-based fees) that are payable. If load-based fees apply, the Applicant shall be required to submit load-based fee calculation worksheets with the Return.	Yes	As above		
Annual Performance Reporting						
7.4		**The Applicant must, throughout the life of the development, prepare and submit for the approval of the Director-General, an Annual Environmental Management Report (AEMR). The AEMR shall review the performance of the development against the Operation Environmental Management Plan (refer to condition 6.4 of this consent), the conditions of this consent and other licences and approvals relating to the development. The AEMR shall include, but not necessarily be limited to:**	**Yes**	**OEMP**	**The OEMP details the requirement to submit an AEMR. As the BBS, En-route storage and Wah Wah Main have not been operating for a year at the time of the audit, the subclauses of condition 7.4 are not relevant.**	
	a)	**details of compliance with the conditions of this consent;**	**NA**		**see comments for 7.4**	
	b)	**a copy of the Complaints Register (refer to condition 5.3 of this consent) for the preceding twelve month period (exclusive of personal details), and details of how these complaints were addressed and resolved. This must include details of any environmental surplus flow related complaints;**	**NA**		**see comments for 7.4**	

			Compliant?	Evidence	Comments	Recommendations
	c)	**a comparison of the environmental impacts and performance of the development against the environmental impacts and performance predicted in the EIS and the additional information listed under condition 1.1;**	**NA**		**see comments for 7.4**	
	d)	**results of all environmental monitoring required under this consent and other approvals, including interpretations and discussion by a suitably qualified person;**	**NA**		**see comments for 7.4**	
	e)	**a list of all occasions in the preceding twelve-month period when environmental performance goals for the development have not been achieved, indicating the reason for failure to meet the goals and the action taken to prevent recurrence of that type of incident;**	**NA**		**see comments for 7.4**	
	f)	**demonstration and documentary evidence that a minimum average of 20,000 Megalitres of water savings have been made for the twelve month period, including evidence that the water savings have been returned to Water for Rivers. Should a minimum average of 20,000 Megalitres of water savings not be achieved for the reporting period, the Applicant shall provide detailed justification as to why the level of savings was not made;**	**NA**		**20 GL has been permanently transferred to the Water Administration Ministerial Corporation. Therefore, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied**
	g)	**details of the total volume of water savings that have been made for the reporting period;**	**NA**		**20 GL has been permanently transferred to the Water Administration Ministerial Corporation. Therefore, this condition is no longer applicable.**	**Director-General or delegate to provide written evidence that the variations requested are granted or denied**

			Compliant?	Evidence	Comments	Recommendations
	h)	**details of the health of the Lower Mirrool Creek Floodway Wetland System. This is to include details of the condition of vegetation, duration and extent of inundation and quality of the water discharged through the system;**	**NA**		**see comments for 7.4**	
	i)	**details of any deliberate releases (refer to Condition 6.5d) xv);**	**NA**		**see comments for 7.4**	
	j)	**outline the number of occasions and estimate of water volume that was made available as off-allocation / environmental surplus flow water to licence holders in Barren Box, Mirrool Creek and the Wah Wah District for the 12 month period;**	**NA**		**see comments for 7.4**	
	k)	**identification of trends in monitoring data over the life of the development to date;**	**NA**		**see comments for 7.4**	
	l)	**a list of variations obtained to approvals applicable to the development and to the site during the preceding twelve-month period; and**	**NA**		**see comments for 7.4**	
	m)	**environmental management targets and strategies for the following twelve-month period, taking into account identified trends in monitoring results.**	**NA**		**see comments for 7.4**	

			Compliant?	Evidence	Comments	Recommendations
7.5		**The Applicant must submit a copy of the AEMR to the Director-General, Council and the DEC every year, with the first AEMR to be submitted no later than twelve months after the commencement of operation of the development. The second and subsequent AEMRs are to be submitted every 12 months from the first AEMR or concurrently with the EPA's annual reporting period established for the site under its Environment Protection Licence for the site.**	**NA**	**OEMP**	**see comments for 7.4**	
7.6		**The Director-General may require the Applicant to address certain matters in relation to the environmental performance of the development, in response to review of the Annual Environmental Report and any comments received from the EPA and Council. Any action required to be undertaken shall be completed within such period as the Director-General may agree.**	**NA**			

4 SUMMARY OF NON-CONFORMANCE

This section presents a summary of the non-conformances and recommended actions.

4.1 Formal Confirmation/Acknowledgement from Government Departments

Although efforts have been made by Murrumbidgee Irrigation to submit documents to the relevant governmental departments, formal written acceptances of documents and actions are still required.

The Director-General or delegate needs to provide written acknowledgement that the following are approved:

- the Operation Environmental Management Plans (OEMP) for Barren Box Swamp (BBS), En-route storage and Wah Wah Main;
- the adequacy of compaction tests conducted on the floors of Wah Wah Main enlargement and Brays Dam;
- the Property Vegetation Plan that details the landscaping to be performed at the En-route storage facility;
- the removal of condition 6.5e(v) of the Consent Conditions as flood procedures are dictated by the NSW Government and therefore any impact of flood management procedures are beyond MI's control; and
- the removal of condition 6.5e(vi) of the Consent Conditions as consultation with landowners is ongoing and does not need to be contained in a Flood Management Plan.

4.2 Variation to Conditions of Consent

On the 14th of August, 2006, MI submitted a letter formally requesting several conditions in the Consent Conditions (DA-101-4-2004-I) be amended, details of which are presented in this section.

Written approval is required from the Director-General or delegate to:

- exclude conditions 1.7 and 1.8 from the Consent Conditions – Water Saving Agreement as funding for the project was from MI funds and therefore, references to funding are no longer relevant;
- exclude condition 1.9 from the Consent Conditions – Annual Water Savings as 20 GL has been permanently transferred to the Water Administration Ministerial Corporation and therefore, references to water savings are no longer relevant;
- exclude conditions 3.9, 3.11 and 3.12 from the Consent Conditions – Surface Water Management as condition 3.9 relates to works requiring approval under the Water Management Act 2000 and as Mirrool Creek has now been de-proclaimed as a regulated water source, this condition is no longer relevant;
- amend conditions 3.52 and 6.5(d) from the Consent Conditions – Wetland Concept as more time is required to complete a comprehensive Wetlands Rehabilitation and Management Plan for Barren Box Swamp; and
- exclude conditions 7.4(f) and (g) from the Consent Conditions – Annual Performance Reporting as 20 GL has been permanently transferred to the Water Administration Ministerial Corporation and therefore, references to water savings are no longer relevant.

5 CONCLUSION AND RECOMMENDATIONS

The Barren Box Swamp and Brays Dam projects are generally in compliance with the development consent. Murrumbidgee Irrigation has endeavoured to implement best practice measures to ensure construction does not adversely impact the environment.

The principal audit recommendations are to:

- obtain formal approval from the relevant authorities with respect to the OEMP, Property Vegetation Plan, adequacy of compaction tests and removal of conditions 6.5e(v) and (vi);
- obtain a reply from the Director-General or delegate to amend the Consent Conditions with respect to the conditions related to:
    - water saving agreement;
    - annual water savings;
    - Mirrool Creek water management; and
    - Wetlands Rehabilitation and Management Plan.

A-2: NGH audit of operational compliance against the conditions of consent for DIPNR DA-101-4-2004-i 2005. Letter reported dated September 2020.

29 September 2020

Fern Dorricott
Environmental Planning Manager
Murrumbidgee Irrigation
86 Research Station Road,
Hanwood NSW 2680

Fern.Dorricott@mirrigation.com.au

Dear Fern Dorricott

Re: Barren Box Swamp Modification - #19-148

NGH completed an initial investigation into Murrumbidgee Irrigation (MI) operational compliance with the NSW Department of Planning, Industry and Environment's (DPIE), formerly Department of Infrastructure, Planning and Natural Resources (DIPNR) project approval for Barren Box Swamp Project DA-101-4-2004-i June 2005 (Approval). A summary of the investigations and advice on the next step was outlined in correspondence on the 7 June 2019.

Subsequently MI requested an audit of operational compliance against the conditions of consent for DIPNR DA-101-4-2004-i 2005. NGH and MI conducted a preliminary audit and site inspection in July 2019. Document exchange and review occurred over the subsequent months. MI have over the last twelve months updated various plans and documents. NGH have subsequently updated the audit results based on amended documents.

AUDIT SCOPE AND PLAN

This audit is a preliminary independent environmental audit. The audit has examined compliance against the DIPNR consent for DA-101-4-2004-i 2005 (Appendix A). This audit has not been prepared in consultation with external departments or agencies.

COMPLIANCE STATUS DESCRIPTORS

The compliance descriptors used in this report are:

- **Compliant** Requirement has been met
- **Non-Compliant** Requirement has not been met
- **Not Triggered** Requirement not triggered

SITE INSPECTION

NGH attended site on the 9th July 2020 and completed a site inspection of the offline storage between Benerembah Channel and Mirrool Creek off west of Kidman Way 13 km south of Griffith CBD. During the site inspection it was noted that vegetation planted for screening occupied about 6.5 ha along the eastern edge of the storage. The landscaping provided effective screening of views from the east and north east. It was also noted that nested piezometers were located around the site and were in

reasonable condition. The Facilities on site had modest lighting at best in the form or a sensor activated fluorescent light. The site was mostly stable with some minor erosion adjacent to the gates at Mirrool Creek.

DOCUMENT REVIEW

Documents were requested during the audit and were provided by MI. Management Plans and Records were viewed electronically and in hard copy format. Records (photographs, notes, digital files) were made of the documents examined. Notes were made about the documents against and regarding the CoA and license requirements. Documents viewed included:

- Barren Box Swamp Project DA-101-4-2004-i
- Griffith LEP 2014 and Land Zoning
- BBS Mid-term Audit (Ecowise 2006)
- BBSW O&M Guidelines_2018
- BBSW OEMP 2018 - final draft
- BBSW OEMP September 2020
- MI Limited Environmental Policy 2018
- Environment Protection Licence 4651
- Flood risk management study 2017
- Barren Box Wetland CH MP (Biosis 2005)
- BBSW OEMP (URS 2006), Modified (MI 2018)
- BBSW OEMP conditions review (MI 2018)
- BBSW Flood Risk Management Study, (BMT WBM 2017)
- Surplus Water Rules (MI 2016)
- Barren Box Wetland Cultural and Heritage Management Plan, Biosis (2008)
- OEMP App3: Wetland Revegetation Species List (2008)
- Barren Box Swamp Rehabilitation Plan 2009 – 2014 (2008)
- Monitoring and Reporting Plan, Water Holder Approval 40CA403245 (2018)
- MI Environmental Policy 2018
- Murrumbidgee Irrigation ACR 2009
- Murrumbidgee Irrigation ACR 2012
- Murrumbidgee Irrigation ACR 2014-15
- Murrumbidgee Irrigation ACR 2017-18
- Minutes BBS& Wetland Rehab Project - Landholder Meeting Two, 22 Sept 2008
- NRAR Water Supply Works and Water Use Approval 2005 – 2025
- OEMP Barren Box Swamp and En-route Storage final 2006
- Google Earth Images of sites: 2018, 2015, 2013, 2012, 2011, 2009, 2003
- Six Maps, Images and topography of sites
- Correspondence from MI to DOP Oct 2006, RE permanent transfer of 20,000 ML
- Correspondence from DoP to MI Jan 2008, re CoA 1.7-1.9 satisfied
- Correspondence from DoP to MI Nov 2008, re pro-operational compliance
- Position Description: MI Environmental Planning Manager (May 2020)
- Correspondence from DoP to MI Jan 2009

SUMMARIES OF FINDINGS

NGH have completed the audit of compliance against the conditions of consent. The results of the audit are presented in the audit protocol (Appendix B). The audit found 20 Non compliances.

CoA	Condition Summary	Finding	Recommendation
1.3	Obtain all licences, permits and approvals for the life of the project.	Fisheries permits not obtained	Complete EIA prior to work, identify legislative needs.
3.39	Landscaping of En-route storage to be to the satisfaction of GCC.	Evidence of GCC satisfaction not found.	Obtain statement of satisfaction from GCC.
6.1	Nominated ERs to be approved by Dept. Planning	Post construction ER's not approved	Modify / remove consent condition.
6.1 (e)	ERs be given authority to minimise impacts (stop works).	No evidence of authority.	Modify / remove consent condition.
6.1 (note)	Notify Dept. Planning of changed ERs appointment.	No evidence of notification.	Modify / remove consent condition.
6.4(a)	OEMP to identify all likely statutory obligations.	Obligations not completely listed	OEMP to provide a full list of obligations
6.5 (d)iii	Detail financial commitment to Wetland Rehabilitation Man. Plan.	Commitment not included in plan.	Modify / remove consent condition.
6.5 (d)vii	Wetland Rehabilitation Man. Plan to describe measures to manage salt & nutrient accretion	Not addressed in the OEMP.	Include measures in the OEMP.
6.5 (e)ii	Flood Management Plan to have measures to ensure water for Mirrool Creek wetland system.	Not addressed in the OEMP.	Remove consent condition.
6.6	OEMP to be reviewed every three years following approval	No evidence of review every three years.	Modify / remove consent condition.
7.4 (a)	AEMR to include details of compliance with the conditions of this consent	Compliance summary not provided.	Include summary in AEMR.
7.4 (b)	AEMR to include details of complaints and resolutions (excl personal details).	Complaint list not provided.	Include complaint list in AEMR.
7.4 (c)	AEMR to have comparison of actual impacts & performance against those predicted in EIS.	Comparison not presented.	Modify / remove consent condition.
7.4 (d)	AEMR to include results of monitoring required for consent and other approvals	Some results presented but not all.	Modify / remove consent condition.
7.4 (e)	AEMR to include list of performance goals for last 12 months not met and reasons.	Unmet goals not presented.	Include summary of goal not met.
7.4 (h)	AEMR to include details of the health of the Lower Mirrool Creek Floodway Wetland	Mirrool Creek health not assessed.	Modify / remove consent condition.
7.4 (k)	AEMR to include data trends over the life of the development	Trend analysis of MIA done but not BBS impact.	Modify / remove consent condition.
7.4 (m)	AEMR to include identified targets and strategies based on monitoring trends.	No evidence observed.	Identify targets from trends and include in OEMP.

The audit found 18 non-compliance with the CoAs. Of the 18 non-compliances with the CoAs identified it is recommended that ten be the subject of a modification to the consent to remove or reword. To rectify the remaining 8 non-compliances will require changes to management plans, actions, or reporting. Most were minor in nature and may be achieved with a reasonable plan of action over a period of 12 to 18 months.

MODIFYING CONSENT CONDITIONS

When MI choses to seek a modification to the existing consent an established process will be followed (Appendix D). In general, the follow in steps are required for a modification including:

1. Register on DPIE planning portal and request a meeting to discuss modifying the project.
2. Submit preliminary information requesting and supporting the modification.
3. Determine modification pathway (Appendix E) S 4.55 or S 4.56 of the EP&A Act*1979.*
4. Take the departments requirements (if issued) and prepare modification report.
5. Submit modification report to DPIE.
6. DPIE checks modification report.
7. DPIE place on modification report on display (if required).
8. Submissions on modification report received and submissions report prepared (if required).
9. Submission report submitted to DPIE.
10. Pending assessment outcomes conditional approval issued.

A summarised potential justification and recommendation for consent change is provided below.

CoA	Condition Summary	Justification	Recommendation
6.1	Nominated ERs to be approved by Dept. Planning.	ER's are generally used for construction only.	Modify consent condition to require ER for construction.
6.1 (e)	ERs be given authority to minimise impacts (stop works).	ER's are generally used for construction only.	Modify consent condition to require ER for construction.
6.1 (note)	Notify Dept. Planning of changed ERs appointment.	ER's are generally used for construction only.	Modify consent condition to require ER for construction.
6.5 (d)iii	Detail financial commitment to Wetland Rehabilitation Man. Plan.	Commitment not included in plan.	Modify consent condition to be outcomes focused.
6.5 (e)ii	Flood Management Plan to have measures to ensure water for Mirrool Creek wetland.	Existing flow regime is minimal.	Remove consent condition.
6.6	OEMP to be reviewed every three years following approval.	MIA managed without external oversight. BBS is part of MIA, should be same.	Remove consent condition.
7.4 (c)	AEMR to have comparison of actual impacts & performance against those predicted in EIS.	Altered climate/water use negate previous assumptions.	Remove consent condition.
7.4 (d)	AEMR to include results of monitoring required for consent and other approvals.	Reference EPL and NRAR reporting	Modify consent condition.
7.4 (h)	AEMR to include details of the health of the Lower Mirrool Creek Floodway Wetland.	Mirrool Creek health not assessed.	Remove consent condition.
7.4 (k)	AEMR to include data trends over the life of the development.	Trend analysis for whole of MIA done.	Modify consent condition.

NGH can provide a detailed pathway for the modification of the existing consent and a staged proposal for that modification on request.

If you have any questions, please contact myself on 69231532. I would be pleased to discuss this project with you further.

Yours sincerely,



Michial Sutherland
Manager Riverina and Western NSW
0427953053
NGH Pty Ltd
ABN: 31 124 444 622
ACN: 124 444 622

APPENDIX A AUDIT SCOPE AND PLAN

AUDITED ORGANISATION	PROJECT
Murrumbidgee Irrigation Limited	Barren Box Swamp Project
LOCATION OF AUDIT	**DATE OF AUDIT**
MI Administration Office NGH Office Wagga Wagga	9th July 2019 to 23 September 2020
DEPTH OF AUDIT	**SCOPE OF AUDIT**
Environmental	Compliance with: • Development Consent Conditions DA-101-4-2004-i
AUDIT CRITERIA	**AUDIT DETAILS**
• Development Consent Conditions • Audit Period 2006 to July 2019	On Site Opening Meeting – 9/07/2019, 8:00am On Site Closing Meeting – 10/07/2019, 16:30pm
PROJECT REPRESENTATIVES PRESENT	**AUDIT TEAM**
Lindsay Golsby-Smith, Coordinator – Water Resources and Initiatives Fern Dorricott, Environmental Planning Manager	Mike Sutherland, **NGH** Environmental – Lead Auditor
AUDIT REPORT	
A final Audit Report is provided to MI at the completion of the audit process.	
PREVIOUS AUDIT DATE	**PREVIOUS AUDIT REFERENCE**
March 2006	MID-TERM REPORT ON ENVIRONMENTAL AUDITS OF BARREN BOX SWAMP AND BRAYS DAM PROJECT (April 2006): Ecowise Environmental (Victoria) Pty Ltd

APPENDIX B AUDIT PROTOCOL

Reference	Required Audit Action, and Terms of Approval	Evidence collected Jun 2019	Comments	Finding	Proposed Action
	Barren Box Swamp Project DA-101-4-2004-I Applicant: Murrumbidgee Irrigation Limited				
	Part of Lot 2 DP 788532, Lot 1 DP 433132, Lot 53 DP 756062 and Lot 90 DP 751686, and map reference numbers 2896-3060, 2086-3060, Griffith, NSW				
GENERAL					
1.3	The Applicant shall ensure that all licences, permits and approvals are obtained and maintained as required throughout the life of the development. No condition of this consent removes the obligation for the Applicant to obtain, renew or comply with such licences, permits or approvals. The Applicant shall ensure that a copy of this consent and all relevant environmental approvals are available on the site at all times during the development.	EPA licence 2/10/18 Water supply works and Water use approval 40CA403245.	EPL is for the whole MI area ops and relates to five discharge points of which 1 is relevant to BBS and may not always be used. The water use approval is relevant to BBS although no direct mention is made of BBS, in the same way as all channels are not listed. MI is currently in negotiations with NRAR regarding flood work approvals for flood Works, the department is formulating a position with respect to MI and irrigators in NSW. Permits and approvals are held electronically. Key fish habitat Permit not obtained for channel desilting, channel is to move water from the intermediate cell to riser pumps to Mirrool Ck	Non-compliant	Ensure fisheries permits are obtained or the area is delisted prior to future work.
1.8	Prior to the commencement of operations, the Applicant shall provide suitable evidence that the agreement with the suitable partner referred to in Condition 1.7 above has been finalised and in place, to the satisfaction of the Director-General.	Previous Ecowise 2006 Audit Sect. 3	Letter from Department of Planning sites evidence of agreement with a suitable partner. Funding of the completed project by the Commonwealth also provides evidence the past identification of a suitable partner	Compliant	
1.9	Every 12 months following the commencement of operations of the development, the Applicant shall demonstrate and provide documentary evidence that a minimum average of 20,000 Megalitres of water savings have been made, including evidence that the water savings have been returned to the suitable partner referred to in conditions 1.7 and 1.8 above, to the satisfaction of the Director General. Should a minimum average of 20,000 Megalitres of water savings not be achieved for a 12 month period, the Applicant shall provide detailed justification to the satisfaction of the Director-General, as to why the level of savings was not made.	MI letter to DoP Oct 2006, including certificates of title demonstrates permanent transfer of 20, 000ML. DoP letter to MI confirming CoA 1.7-1.9 are satisfied and do not need modification.	MI has permanently transferred 20,000ML from their allocation. The permanent transferee is evidence of savings and is potential evidence of compliance . Annual assessment not required based on DoP letter dated 31/1/2008.	Compliant	
COMPLIANCE			Annual assessment may not be possible.		
2.1	The Applicant must put in place a management system, and take reasonable steps to ensure that employees, contractors and sub-contractors are aware of, and comply with, the conditions of this consent relevant to their respective activities.	OEMP Sect 1.5, 2.1-2.3 and 8. Operating and Maintenance Guidelines Sep 2018. Ecowise Audit 2006 Sect. 3	BBSW induction includes description of consent and main aspects. Induction provides link to Consent. OEMP (sect 1.5, 2 & 8) refence induction and consent. Barren Box Swamp induction is a computer based video presentation. Training records will be collated and managed through MI HR. Renewal of inductions occur on a regular basis.	Compliant	
2.3	Prior to each events listed from a) to b) below, or within such period otherwise agreed by the Director-General, the applicant shall certify in writing to the satisfaction of the Director General, that it has complied with all relevant conditions of this consent applicable to that event. Where an event is to be undertaken in stages, the applicant may, subject to the agreement of the Director -General, stage the submission of compliance certification consistent with the staging of activities relating to that event. a) commencement of construction b) commencement of operation	Ecowise Audit 2006, Section 1 and Section 5 DoP Letter to MI 14/11/08 conditionally supporting commissioning of the project.	Letter from DoP to MI 14/11/08 stating pre-operational compliance with relevant conditions. Additional information requested at that time also. The Ecowise Audit was conducted mid-term during the construction of BBS and Brays Dam enlargement.	Compliant	
ENVIRONMENTAL PERFORMANCE					
3.1	The Applicant must not cause or permit the emission of offensive odour beyond the boundary of the premises. Note: No conditions in this consent identifies a potentially offensive odour for the purposes of section 129 of the POEO 1997.	Complaint management System Print out.	No recorded observations of odour by staff or the public. No complaints of odour recorded from the public from BBS.	Compliant	Suggest removal of the condition, this matter is covered by the EPL.
3.6	The Applicant must carry out the development in a manner that prevents and/ or minimises potential water pollution generated by the development from impacting on nearby watercourses	Water Qual results last three years. WRMP	Water quality in BBS is monitored weekly in summer and every two weeks in winter as required by the WRMP. BBS discharges are the predominant source of flows in Mirrool Ck downstream of BBS except in major flood events. WRMP reviewed annually.	Compliant	
3.11	If required by the Department, the extraction of water from the works in Mirrool Creek associated with Brays Dam must be recorded and reported as specified by the Department. For instance, the Department may require an annual return of information on hours pumped, extraction rate and volume, and water levels in Mirrool Creek prior to and during the pumping period.	Data records for Scada sited DoP Letter to MI 14/11/08 conditionally supporting commissioning of the project.	Records of extraction from Mirrool Ck to Brays Dam collected via Scada. This information is available on request. DoP letter (14/11/08) indicates CoA met, and that D. Water and Energy supports this view	Compliant	

3.12	Prior to the commencement of operation, the Applicant shall consult the Department's Murray Murrumbidgee Office of the operating protocols of the proposed works, such as trigger and cease to pumps levels in Mirrool Creek, maximum daily extraction and of any potential impacts on Mirrool Creek and consider any suggestions to modify the protocol to minimise potential impacts to the satisfaction of the Director-General. If during the operation of the development the Director-General considers that unforeseen impacts on water users, land holders or the environment has occurred as a direct result of the Applicant's operational protocol, the Director-General in consultation the Applicant, may direct the Applicant to modify the works or their operation as considered necessary to alleviate or mitigate the impact to the satisfaction of the Director-General.	Surplus water rules. DoP Letter to MI 14/11/08 conditionally supporting commissioning of the project.	The CoA is not definable, does it relate to BBS or Brays Dam or customers or all three? Cease to pump relates to Mirrool Ck when it was a "River" it is now defined as a water management works, "Channel". Consultation with DIPNR not evidenced. Pumping trigger levels for extraction from Mirrool Ck defined in customer licenses. DoP letter (14/11/08) indicates CoA met, and that D. Water and Energy supports this view.	Compliant	
3.13	The Applicant shall ensure that reasonable access to off-allocation/environmental surplus flow in Mirrool Creek remains available to those irrigators who have a history of access, including the Wah Wah irrigators.	Surplus water rules	The development and use of Surplus Water Rules are taken as evidence of compliance.	Compliant	
3.14	Prior to the commencement of operation of the Barren Box Swamp and En-route Storage facility, the Applicant shall prepare a Groundwater Monitoring Program to the satisfaction of the EPA. The Program shall meet the requirements of the EPA and include, but not necessarily be limited to:	Groundwater monitoring Program. DoP Letter to MI 27/05/08 accepts GW monitoring plan as	GWMP is included in OEMP. Evidence of consultation with the EPA regarding the development of the GWMP was not available at the time of the Audit	Compliant	
	a) details of the procedures to identify any changes or adverse trends as a result of the proposed development.	Discussions with Monitoring Staff. Review of OEMP Review of ACR.	Piezos in area of swamp monitored on an annual basis. Ground water data analysis presented as part of the ACR and the larger MIA. Overall decrease in water levels and pressures observed.	Compliant	
	b) parameters/pollutants to be monitored, including procedures and protocols for sampling and testing; and	Groundwater monitoring Program. DoP Letter to MI 27/05/08	Not included in OEMP and is not occurring. DoP letter 27/05/2008 accepts OEMP and GW Man Plan as satisfying requirements.	Compliant	
	c) A contingency plan to mitigate any groundwater level rises or salinity increases that arise from the development.	OEMP	contains strategy for responding to increases in water level.	Compliant	
3.39	The Applicant shall ensure that landscape works surrounding the En-route storage facility is undertaken to the satisfaction of Griffith City Council.	No evidence of Council satisfaction re. landscaping available at the time of the audit.	Evidence of consultation with GCC re landscaping not available. Observations at the time of the audit indicate landscaping well established and mature, 70m long and up to 120m wide.	Non-compliant	Seek satisfaction of Council to landscaping,
3.4	The Applicant must ensure that all external lighting associated with the development does not create a nuisance to surrounding properties or roadways. The lighting shall be the minimum level of illumination necessary and shall comply with AS4282(INT)1995 - Control of Obtrusive Effects of Outdoor Lighting.	Previous audit 2006 found compliance. On site observations.	No dwellings with in 900m of pump infrastructure or lighting. No floodlighting was observed at the time of the audit. Limited low level florescent lighting for access.	Compliant	
3.52	Six months after the commencement of construction, the Applicant must prepare and implement a Wetland Concept Design for the Barren Box Swamp area to describe the proposed wetland design parameters. The Concept Design must be prepared by an appropriately qualified person/s, in consultation with the Department's Murray Murrumbidgee Office, the Murrumbidgee Wetlands Working Group, Department of Primary Industries (former NSW Fisheries), Griffith City Council, Department of Environment and Conservation and the previously established Wetland Reference Group. The Concept Plan shall include, but not necessarily be limited to:	Previous audit 2006 found partial compliance. Original OEMP 2006 updated Appendix C.	Plan prepared, described in Section 8 and appended to the OEMP 2006. Not all groups specified were part of the working group. Consultation with DEC, MCMA, GCC, Fisheries, DIPNR, MDFRC, Aboriginal Community and specialists Noted. A grazing plan is in place for fuel suppression.	Compliant	
	i) details of the proposed water monitoring that would be undertaken, including duration, to ascertain the potential changes to the hydrological regime;	Section 3 of the OEMP 2006	OEMP nominates monitoring	Compliant	
	ii) expected vegetation communities and plant species to be utilised in the rehabilitation;	Section 7 of the OEMP 2006	OEMP nominates 9 species and their requirements	Compliant	
	iii) consideration of potential aquatic habitats that would be created;	URS drawing App of OEMP	Channel, seasonal, intermittent and permanent aquatic habitats identified.	Compliant	
	iv) specific mitigation measures that would be implemented during construction activities;	Section 8 of the OEMP	While minimal by todays standards mitigations were identified.	Compliant	
	v) details of the anticipated outcomes/targets that would be achieved for the wetland area;	Section 5 and 8 OEMP	Targets and objectives are well defined and given operational description in sect 8.	Compliant	
	vi) outcomes of consultation with landowners adjoining the proposed wetland area.	OEMP	Adjacent owners identified for consultation, although limited. No documented evidence of consultation. But assumed they met as part of the working group.	Compliant	
ENVIRONMENTAL MONITORING AND AUDITING					
4.1	The results of all monitoring required under this consent shall be:				
	a) in a legible form, or in a form that can readily reduced to a legible form;	Previous Audit 2006 Chain of custody forms Lab results. Sampling procedure, conversation with Environmental Officer for Sampling Paul Blumer	MI are keeping records in a legible form as an EPL requirement	Compliant	
	b) kept for at least 4 years after the monitoring or event to relate took place; and	As above	Records were retrieved as far back as 2009	Compliant	
	c) produced in a legible form to any authorised officer of the EPA, DIPNR or the Director-General, upon request;	As above	Legible notes able to be reproduced	Compliant	
	d) kept with the following details for each sample required to be collected:	As above		Compliant	
	i) the date(s) on which the sample was collected; ii) the time(s) at which the sample was collected; iii) the point at which the sample was collected; and iv) the name of the person who collected the sample.	As above	These sample details are recorded.	Compliant	
4.2	The Applicant must undertake all water quality monitoring required under this development consent in accordance with the NSW EPA's Approved Methods for the Sampling and Analysis of Water Pollution in NSW.	Lab results EPL 4651 Licence Summary of non compliances	Review of non compliance for 10 years indicate that non use of the Approved Methods for the Sampling and Analysis has not been reported as a non compliance. Limited review of lab results indicates that NATA accredited labs and Approved methods used.	Compliant	

4.3	Within two years of the commencement of construction of the development, and then as may be directed by the Director-General, the Applicant shall commission an independent person or team to undertake an Environmental Audit of the development. The independent person or team shall be approved by the Director-General prior to the commencement of the Audit. The Audit shall:	Letter accepting initial audit report	Audit conducted 24/3/2006 No indication of any subsequent direction to further audit the project.	Compliant	
	a) be carried out in accordance with ISO 19011:2002 - Guidelines for Quality and/or Environmental Management Systems Auditing;	Letter accepting initial audit report	Audit conducted 24/3/2006	Compliant	
	b) assess compliance with the requirements of this consent, and other licences and approvals that apply to the development;	Audit Report 2006	Audit conducted 24/3/2006	Compliant	
	c) assess the environmental performance of the development against the predictions made and conclusions drawn in the documents referred to under condition 1.1 of this consent; and	Audit Report 2006	Audit conducted 24/3/2006	Compliant	
	d) revise the effectiveness of the environmental management of the development, including any environmental impact mitigation works.	Audit Report 2006	Audit conducted 24/3/2006	Compliant	
	An Environmental Audit Report shall be submitted for comment to the Director-General, Griffith City Council, Department of Primary Industries, the EPA and the DIPNR (Natural Resources) within two months of the completion of the Audit, detailing the findings and recommendations of the Audit and including a detailed response from the Applicant to any of the recommendations contained in the Report.	Audit Report 2006	No evidence of submission.	Compliant	
COMMUNITY INFORMATION AND INVOLVEMENT					
5.1	Subject to confidentiality , the applicant shall make all documents required under this consent available for public inspection upon request. This shall include provision of all documents at the site for inspection by visitors as well as being made available in an electronic format.	Website: https://www.mirrigation.com.au/Home	Documents not fully available on line but information available on request from the service counter. Some documents required by the consent are not available.	Compliant	Add required documents to website and have copies available on request.
5.2	Prior to the commencement of construction of the development, the construction of the development, the Applicant must implement a system for community complaints. Such a complaints system must include:	OEMP section 1.7 Customer service procedure Complaints log. - Enviro	Complaints Procedure in the OEMP.	Compliant	
	a) a 24-hour telephone number on which complaints about operations on the site may be registered;	OEMP section 1.7 Website: https://www.mirrigation.com.au/Home	24 hour number and website complaint system available	Compliant	
	b) a postal address to which written complaints may be sent; and	OEMP section 1.7 Website: https://www.mirrigation.com.au/Home	Available on the website	Compliant	
	c) an email address to which electronic complaints may be transmitted, should the Applicant have email capabilities.	info@mirrigation.com.au	Available on the website	Compliant	
	The telephone number, the postal address and the email address shall be advertised in a newspaper circulating within the locality on at least one occasion prior to the commencement of construction of each stage of the development. These details must also be displayed on a sign near the entrance to the site, in a position that is clearly visible to the public and on the Applicant's internet site, should one exist. The telephone number, postal address and email address must be maintained throughout the life of the development.	Previous Audit 2006.	Advertising in the Area News sited.	Compliant	
5.4	Prior to the commencement of operations of the development, the Applicant shall prepare and implement a Community Communication Strategy for the development. This strategy shall be designed to enable the Applicant to respond to any community/licence holder inquiries and to provide mechanisms to inform the local community, particularly from Murrumbidgee Irrigation licence holders, as to the nature and operational environmental performance of the facility. The Strategy shall include, but does not necessarily be limited to:	Invoices for advertising in print and electronic media. Website notices. Off allocation notices. Newsletter vis website, email, TXT SMS, and hardcopy. The "Easy Water" electronic water ordering interface.	Community Communications Strategy is included in the OEMP. Complaint recording system in place, Blow grass causing issues.. Water ordering process in place. Multiple orders sited.	Compliant	
	a) mechanisms through which the Applicant can report to the licence holders on the operations of the development and its environmental performance;	As above	Community Communications Strategy is included in the OEMP. No evidence of implementation.	Compliant	
	b) process by which the Applicant can advise licence holders of availability of off-allocation water;	As above	Community Communications Strategy is included in the OEMP. No evidence of implementation.	Compliant	
	c) mechanism for providing licence holders with updates on any activities that may potentially disrupt water supplies;	As above	Community Communications Strategy is included in the OEMP. No evidence of implementation.	Compliant	
	d) mechanisms through which the licence holders can provide feedback to the Applicant in relation to the environmental management of the development; and	Complaint system	Community Communications Strategy is included in the OEMP. No evidence of implementation.	Compliant	
	e) mechanisms through which the Applicant can respond to any enquiries or feedback from the licence holders in relation to the environmental performance and the nature of operations at the development.	TXT and website, direct contact by MI engagement team Algae coms procedure.	Community Communications Strategy is included in the OEMP. No evidence of implementation.	Compliant	
	The Strategy shall be approved by the Director-General prior to the commencement of any operations at the site.		No evidence could be found	Compliant	
ENVIRONMENTAL MANAGEMENT - Environmental Representative					
6.1	Prior to the commencement of construction of the development, the Applicant must nominate a suitably qualified and experienced Environmental Representative(s) whose appointment is to receive prior approval of the Director-General. The Applicant shall employ the Environmental Representative(s) throughout the life of the development. The Environmental Representative shall be:	Environmental Representative was Rob Kelly (MI Environment Manager). Karen McCann (MI employee)	ER appointed prior to and during construction. No evidence could be found of Dept Planning approving subsequent ERs.	Non-compliant	Recommend retiring ER requirement from the approval.
	a) the primary contact point in relation to the environmental performance of the development;	Previous Audit 2006 OEMP	Evidence from the previous audit 2006 supports compliance at that time. Limited evidence exists that MI EM is routinely appointed as the ER.	Compliant	Recommend retiring ER requirement from the approval.
	b) responsible for all Management Plans, mitigation measures and Monitoring Programs required under this consent;	MI Environmental Manager Role description	OEMP nominates MI environment manager to for fill these tasks.	Compliant	Recommend retiring ER requirement from the approval.

	c) responsible for considering and advising on matters specified in the conditions of this consent, and all other licences and approvals related to the environmental performance and impacts of the development;	Previous Audit 2006 OEMP MI Environmental Planning Manager PD (May 2020)	Evidence from the previous audit 2006 supports compliance at that time. PD for MI Environmental Planning Manager indicates the position is responsible for compliance with CoAs.	Compliant	Recommend retiring ER requirement from the approval.
	d) responsible for receiving and responding to complaints in accordance with condition 5.2 of this consent; and	Previous Audit 2006 OEMP	Evidence from the previous audit 2006 supports compliance at that time. Limited evidence exists that MI EM is routinely appointed as the ER.	Compliant	Recommend retiring ER requirement from the approval.
	e) given the authority and independence to require reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment be likely to occur.	Previous Audit 2006 OEMP	Evidence from the previous audit 2006 supports compliance at that time. No evidence found that current MI EM has this responsibility.	Non-compliant	Recommend retiring ER requirement from the approval.
	The Applicant shall notify the Director-General of any changes to that appointment that may occur from time to time.	Previous Audit 2006 OEMP	No evidence could be found notifying the department of changes to the ER role.	Non-compliant	Recommend retiring ER requirement from the approval.
6.4	The Applicant must prepare and implement an Operation Environmental Management Plan (OEMP) to detail an environmental management framework, practices and procedures to be followed during operation of the development. The Plan shall include, but not necessarily be limited to:	Draft OEMP 2006, Updated OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Final draft dated June 2006 was submitted to the DP&E. Evidence of final approval from DoP for OEMP dated 14/11/2008.	Compliant	Update and submit for approval in accordance with current DPIE Post Approval Requirements.
	a) identification of all statutory and other obligations that the Applicant is required to fulfil in relation to operation of the development, including all consents, licences, approvals and consultations;	Draft OEMP 2006, Updated OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving	OEMP 2006 had a list of relevant legislation, consent conditions but little relating to licence conditions. OEMP 2018 has some relevant legislation but requires a fuller account of licenses and CoC.	Non-compliant	Update OEMP to provide a full list of obligations and commensurate tasks.
	b) a description of the roles and responsibilities for all relevant employees involved in the operation of the development;	Draft OEMP 2006, Updated OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	OEMP 2006 lists staff implementing the OEMP and operating the BBS. Responsibilities not defined. Oomph 2016 list staff and some but not all responsibilities required by the consent.	Compliant	Update OEMP with all responsibilities in the consent.
	c) overall environmental policies and principles that will be/are applied to the operation of the development;	Draft OEMP 2006, Updated OEMP 2018	Policy and principles poorly described in OEMP 2006. Policy and principles (objectives) listed in the OEMP 2016	Compliant	
	d) standards and performance measures that will be/are applied to the development, and a means by which environmental performance can be periodically reviewed and improved;	Draft OEMP 2006, Updated OEMP 2018	Standards well described in OEMP 2006.	Compliant	
	e) details of contingency measures should seepages occur from the development;	Draft OEMP 2006, Updated OEMP 2018	Process describing action on seepage in OEMP 2006 and 2018.	Compliant	
	f) measures for the management and control of weeds and pests in the proposed development area;	Draft OEMP 2006, Updated OEMP 2018	OEMP 2006 and 2018 have an Exotic Flora and Fauna Management plan with measures for pest control included.	Compliant	
	g) management policies to ensure that environmental performance goals are met and to comply with the conditions of this consent;	Draft OEMP 2006, Updated OEMP 2018	OEMP 2006 lacks reference to policy and its implementation. OEMP 2018 refences MI Environment Policy and provides sufficient detail on implementation.	Compliant	
	h) details of all landscaping to be undertaken on the site;	Draft OEMP 2006, Updated OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Landscape Plans Approved as part of the OEMP.	Compliant	
	i) the Management Plans listed under condition 6.5 of this consent;	Draft OEMP 2006, Updated OEMP 2018	The OEMP 2006 and 2018 include the management plans listed in CoA 6.5	Compliant	
	j) the environmental monitoring requirements outlined under condition 3 and 4.1 of this consent, inclusive; and	Draft OEMP 2006, Updated OEMP 2018	The OEMP 2006 and 2018 include the monitoring requirements listed in CoA 3 and 4.1	Compliant	
	k) contingency measures should monitoring of environmental issues under this consent indicate that the development has had, or is having, an adverse environmental impacts.	Draft OEMP 2006, Updated OEMP 2018	Response included in OEMP 2006 and 2018.	Compliant	
	The OEMP must be submitted for the approval of the Director-General no later than one month prior to the commencement of operation of the development or within such period as otherwise agreed by the Director-General. Operation shall not commence until written approval has been received from the Director-General. Upon receipt of the Director-General's approval, the Applicant shall supply a copy of the OEMP to the EPA and Council as soon as practicable.	Draft OEMP 2006, Updated OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Evidence found of approval to OEMP. DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Compliant	
6.5	As part of the OEMP for the development, required under condition 6.4 of this consent, the Applicant shall prepare and implement the following Management Plans:			Compliant	
	a) an Exotic Flora and Fauna Management Plan to detail measures to manage and monitor the occurrence of any exotic flora and fauna in the development area. The Plan shall be developed in consultation with Griffith City Council, the Department of Primary Industries, the Alligator Weed Task Force and adjacent landowners, and include, but not necessarily be limited to:	OEMP 2006 Section Five OEMP 2018 Section Six	Included in OEMP. In the OEMP it states that MI consulted with Griffith City Council and the DPI through the Alligator Weed Task Force. No other evidence found.	Compliant	
	i) Details of long term management measures for the European Carp;	OEMP 2006, S5 and 2018 s6.4	Included in OEMP. The OEMP states "Implement recommendations of the Wetland Rehabilitation and Management Plan (when final) . . ." No WRMP found.	Compliant	
	ii) Detailed management options and monitoring for weed management following any clearing of vegetation and the change in the hydrologic regime of the wetland cell;	OEMP 2006 Section Five OEMP 2018 Section Six	Included in OEMP. No evidence of implementation.	Compliant	
	iii) Procedures for the notification of Council, the Department of Primary Industries, and the Alligator Weed Task Force (in the event of an outbreak of Alligator Weed) of any outbreak of exotic flora or fauna;	OEMP 2006 Section Five OEMP 2018 Section Six	Included in OEMP. No evidence of implementation.	Compliant	
	iv) Measures for the management and monitoring for Alligator Weed; and	OEMP	Included in OEMP. Evidence of implementation from working group meetings.	Compliant	

	v) Measures for the management and monitoring for feral animals, i.e. pigs and foxes.	OEMP LLS records	Included in OEMP. Records from LLS evidence of implementation.	Compliant	
	b) A Groundwater Management Plan to detail measures to manage and minimise the impact of the proposal on groundwater. The Plan must include, but not necessarily be limited to:	DoP letters dated 14/11/2008 accepting OEMP and GW Man Plan and also approving commencement of operations.		Compliant	
	i) details of baseline groundwater quality, as present prior to the commencement of construction of the development;	Groundwater results	Included in OEMP 2006. ACMR includes ground water monitoring for MIA.	Compliant	
	ii) identification of materials and activities associated with the development that have the potential to impact on groundwater quality, and how these materials and activities are to be managed to prevent those impacts;	OEMP 2006 GWMP and Seepage works program OEMP 2018 DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations..	Compliant	
	iii) monitoring of groundwater quality, including parameters to be monitored and frequency of monitoring;	Ground water monitoring program	Ground water monitoring program includes frequency and parameters.	Compliant	
	iv) details of how any groundwater level rises or salinity increases in nearby properties will be monitored and managed;	OEMP 2006 and 2018 Ground water monitoring program. DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Not directly included in OEMP. Indirectly managed by targeting seepage as a causal agent.	Compliant	
	v) details of contingency measures and management options should monitoring of groundwater quality indicate that the development has had, or is having, an adverse effect on groundwater quality;	OEMP 2006 and 2018 Ground water monitoring program. DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Not directly included in OEMP. Indirectly managed by targeting seepage as a causal agent.	Compliant	
	vi) details on the location of monitoring piezometers around the Wah Wah main channel, en-route storage (Brays Dam) and Barren Box Swamp to monitor standing water levels and electrical conductivities on neighbouring properties. The construction and positioning of the piezometers shall be determined in consultation with the Department's Murray Murrumbidgee office.	OEMP 2006 Section Five OEMP 2018 Section Six DoP letters dated 14/11/2008 accepting OEMP and approving commencement of operations.	Brays Dam and Barren Box Swamp piezometers included in OEMP. Electromagnetic survey of Wah Wah Main Channel also included. No direct evidence of consultation with Murray Murrumbidgee office. Inferred input from working group involvement.	Compliant	
	c) A Cultural Heritage Management Plan shall be developed for the area following completion of the works with particular emphasis on establishing the extent and ongoing management of the resource in the wetland cell. This shall be developed in conjunction with the local Aboriginal Community.	OEMP 2006 Section Seven OEMP 2018 Section Eight Cultural Heritage MP 2008	Included in OEMP 2006. Cultural plan developed by MI available.	Compliant	
	d) A Wetland Rehabilitation and Management Plan for Barren Box Swamp to outline the proposed measures that will be undertaken as part of establishing an ephemeral wetland system in Swamp areas. The Plan must be prepared by an appropriately qualified person/s, in consultation with the Department of Primary Industries (former NSW Fisheries), Griffith Local Aboriginal Land Council, adjoining landowners, Griffith City Council, Department's Murray Murrumbidgee Office, Murrumbidgee Wetlands Working Group, Department of Environment and Conservation and the previously established Wetland Reference Group. The Plan shall include, but not necessarily be limited to:	OEMP 2006 Section Eight OEMP 2018 Section Nine Minutes BBS& Wetland Rehab Project - Landholder Meeting 22 Sept 2008 Barren Box Wetland Rehabilitation Plan Draft 2008 (BBWRP 2008).	Included in OEMP. Griffith LALC, adjoining landowners and Griffith City Council were included as part of the Wetland Reference Group formed to guide the project. Stakeholder meeting minutes cited.	Compliant	
	i) details of the anticipated timeframe for implementing the Plan;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008	The OEMP states "The detailed "how" this will be achieved and managed and the precise "when specific tasks and actions will occur will be addressed in the next phase of the process, the Wetland Construction and Management Plan." The BBWRP 2008 in section 6.1 outlines a program for works	Compliant	
	ii) results and adopted recommendations from the Wetland Concept Plan;	OEMP 2006 Section Eight OEMP 2018 Section Nine BBWRP 2008	Recommendations are included in the Wetland Concept Design document in the OEMP. No direct statement of adoption but the rehab plan does adopt the broad principles.	Compliant	
	iii) details of the proposed financial commitment to undertake the works required by this Plan and for the ongoing management of the Wetland area;	OEMP 2006 OEMP 2018 Barren Box Wetland Rehabilitation Plan Draft 2008	No financial details included.	Non-compliant	Request condition to be removed
	iv) details of the proposed measures to protect and manage Aboriginal objects and cultural values;	OEMP 2006 OEMP 2018 Barren Box Wetland Rehabilitation Plan Draft 2008	Specific measures are not included in OEMPs or Rehabilitation Plan. The Barren Box Storage and Wetland Cultural and Heritage management plan is cross referenced at 11	Compliant	
	v) determination of the rate of filling and drying (as near as possible to natural rates);	OEMP 2006 Section OEMP 2018 Section Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 3.4.4	Not included in OEMP. Comprehensive description of past and future filling, drying, flooding and volumes.	Compliant	
	vi) measures for controlling stock grazing to retain dead standing material;	OEMP 2006 Section Eight OEMP 2018 Section Nine OEMP Sept 2020 P18 Barren Box Wetland Rehabilitation Plan Draft 2008	Not included in original OEMP or rehab plan. OEMP 2020 includes fencing and locked gates to control stock movement included.	Compliant	
	vii) procedures for the management of salt and nutrient accretion;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008	Not included in OEMP or rehab plan	Non-compliant	Request condition to be removed

	viii) details of proposed planting programs, including species to be used;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 6	Not included in OEMP. Rehab plan list the species to be used in Sect 6.	Compliant	
	ix) description of the hydrological requirements and ecological responses for threatened species and their habitat;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 6	Not included in OEMP. Rehab plan list the species to be used in Sect 6.	Compliant	
	x) details of the water requirements of the Lower Mirrool Creek floodway to ensure that the Barren Box Swamp Project does not have a negative impact on this wetland system;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 3.2, 3.4 and 7	Not included in OEMP. Rehab plan acknowledges need for flows in Mirrool Creek and describes the logic rules for flows and monitoring requirements.	Compliant	
	xi) details of an ecological monitoring regime. The monitoring regime shall include aquatic ecology and cover the entire Barren Box Swamp;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 7	Not included in OEMP. Rehab plan requires monitoring of wetland/aquatic ecology in Sect 7	Compliant	
	xii) details of the proposed establishment of aquatic and arboreal habitats, and monitoring of the success of these habitats;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008 Sect 7	Not included in OEMP. Rehab plan requires monitoring of habitat ecology over the long term in Sect 7	Compliant	
	xiii) performance indicators and monitoring in accordance with the Department of Environment and Heritage endorsed framework for development of environmental water regimes in wetlands;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008	Observed in section 7 of the OEMP or Rehab plan.	Compliant	
	xiv) details of an ongoing monitoring program of the Lower Mirrool Creek Floodway wetland system;	OEMP 2006 Section Eight OEMP 2018 Section Nine Barren Box Wetland Rehabilitation Plan Draft 2008	Observed in section 7 of the OEMP or Rehab plan.	Compliant	
	xv) details of how water will be transferred for a deliberate release into the Lower Mirrool Creek Wetland System of sufficient quantity, including procedures for determining this quantity, should monitoring of the Lower Mirrool Creek Floodway Wetland System (refer to subclause xiv) above) identifies that the condition of the vegetation has deteriorated as a direct result of the operation of the proposed development. This is required to avoid degradation of the wetland system and comply with the principles of the NSW Wetland Management Policy.	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Included in OEMP 2006 as part of section 9 Flood Management Plan.	Compliant	
	e) a Flood Management Plan to outline the proposed management of flood waters in the development area. The Plan shall be prepared in consultation with Griffith City Council and the Department's Murray-Murrumbidgee Office, and is to include, but not necessarily limited to:	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Included in OEMP. No evidence of consultation could be found.	Compliant	
	i) measures to monitor the flood behaviour in the development area following the completion of construction activities. This information is to be used to update water balance models;	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Included in OEMP.	Compliant	
	ii) a program for the assessment of the water requirements of the Lower Mirrool Creek floodway to ensure that the Barren Box Swamp Project does not have a negative impact on this wetland system;	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016 OEMP Sept 2020 Sect 10.4	Not included in OEMP. Advice from Dr Jane Roberts and SKM indicated that insufficient data was available to determine flows in the LMCF. Flood flows not requested by C'wealth, NSW or	Compliant	Surplus water rules now in place, negative impacts not identified to date.
	iii) procedures for the release of flood waters from Barren Box Swamp to the floodway;	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Included in OEMP.	Compliant	
	iv) revised operational levels for flood mitigation in Barren Box Swamp;	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Included in OEMP.	Compliant	
	v) details of contingency measures should impacts be identified; and	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016	Not included in OEMP. As negative impacts have not been raised at this point it would seem premature to identify contingency measures. However seepage contingency measures are in place for system operations.	Compliant	
	vi) evidence of consultations with relevant landowners.	OEMP 2006 Section Nine OEMP 2018 Section Ten Surplus Water Rules 2016 Minutes BBS& Wetland Rehab Project - Landholder Meeting 22 Sept 2008 DoP letter Nov 2008	Evidence of consultation provided in the form of meeting minutes. Letter from DoP accepting evidence supplied by MI of consultation with landowners.	Compliant	
6.6	Within three years of the commencement of this consent, and at least every three years thereafter, the Applicant shall undertake a formal review of the Operation Environmental Management Plan (OEMP) required under condition 6.4 of this consent. The review shall ensure that the OEMP is up to date and all changes to procedures and practices since the previous review have been fully incorporated into the OEMP. The Applicant shall notify the Director-General, Council and the EPA of the completion of each review, and shall supply a copy of the updated OEMP to those parties on request. The Applicant shall, subject to confidentiality, also make any revised OEMP available for public inspection on request.	Previous plans have been reviewed and new versions produced.	No evidence of the review at specified intervals could be found. Three versions of the OEMP have been cited. Those version do not meet the 3 year review interval requirement.	Non-compliant	Finalise reviewed plan. Provide latest versions of OEMP to DPIE and EPA. Recommend modifying consent condition.
ENVIRONMENTAL REPORTING					

7.1	The Applicant shall notify the EPA and the Director-General of any incident with actual or potential significant off-site impacts on people or the biophysical environment as soon as practicable after the occurrence of the incident. The Applicant shall provide written details of the incident to the EPA and the Director-General within seven days of the date on which the incident occurred.	Incident response procedure BEAKON PIRMP	BEAKON-incident reporting and management system (internal). PIRMP available Level 4 incidents triggers comprehensive notification to down stream customers No evidence of any incidents or notification	Compliant	
7.3	The Applicant shall submit an Annual Return to the EPA in relation to the development, as required by any licence issued under the *Protection of the Environment Operations Act 1997*. In the Return, the Applicant shall:	EPL public register	Previous Annual returns cited.	Compliant	
	a) report on the annual monitoring undertaken (where the activity has resulted in pollutant discharges);	EPL Register, annual returns summary AEMR's 2009 to present Previous Audit 2006	Evidence of an Annual Return found.	Compliant	
	b) provide a summary of complaints relating to the development;	EPL Register, annual returns summary AEMR's 2009 to present Previous Audit 2006	Evidence of an Annual Return could be found. Complaint system queried.	Compliant	
	c) report on compliance with licence conditions; and	EPL Register, annual returns summary AEMR's 2009 to present Previous Audit 2006	Evidence of an Annual Return found.	Compliant	
	d) provide a calculation of licence fees (administrative fees and, where relevant, load-based fees) that are payable. If load-based fees apply, the Applicant shall be required to submit load-based fee calculation worksheets with the Return.	EPL Register, annual returns summary AEMR's 2009 to present Previous Audit 2006	Evidence of an Annual Return found.	Compliant	
7.4	The Applicant must, throughout the life of the development, prepare and submit for the approval of the Director-General, an Annual Environmental Management Report (AEMR). The AEMR shall review the performance of the development against the Operation Environmental Management Plan (refer to condition 6.4 of this consent), the conditions of this consent and other licences and approvals relating to the development. The AEMR shall include, but not necessarily be limited to:	AEMRs 2009 -2018	AEMR produced annually and submitted to EPA, Council and NSW Planning (for a few years?)	Compliant	
	a) details of compliance with the conditions of this consent;	AEMRs 2009 -2018	No summary of compliance with consent conditions supplied in AEMR could be found.	Non-compliant	Present a summary of compliance in AEMR.
	b) a copy of the Complaints Register (refer to condition 5.3 of this consent) for the preceding twelve month period (exclusive of personal details), and details of how these complaints were addressed and resolved. This must include details of any environmental surplus flow related complaints;	AEMRs 2009 -2018	Evidence of complaint summary in the AEMR found. Complaint reporting in terms of the EPL only.	Non-compliant	Present a summary of compliance in AEMR.
	c) a comparison of the environmental impacts and performance of the development against the environmental impacts and performance predicted in the EIS and the additional information listed under condition 1.1;	AEMRs 2009 -2018	No evidence of a comparison could be found in the AEMR.	Non-compliant	Delete or modify condition.
	d) results of all environmental monitoring required under this consent and other approvals, including interpretations and discussion by a suitably qualified person;	AEMRs 2009 -2018	Evidence of some monitoring results presented and analysed in AEMR. Not all monitoring completed.	Non-compliant	Rationalise monitoring between EPL and Management Plans.
	e) a list of all occasions in the preceding twelve-month period when environmental performance goals for the development have not been achieved, indicating the reason for failure to meet the goals and the action taken to prevent recurrence of that type of incident;	AEMRs 2009 -2018	No evidence could be found.	Non-compliant	Include summary of goal non-compliance.
	f) demonstration and documentary evidence that a minimum average of 20,000 Megalitres of water savings have been made for the twelve month period, including evidence that the water savings have been returned to Water for Rivers. Should a minimum average of 20,000 Megalitres of water savings not be achieved for the reporting period, the applicant shall provide detailed justification as to why the level of savings was not made;	AEMRs 2009 -2018 MI letter to DoP Oct 2006, including certificates of title demonstrates permanent transfer of 20, 000ML. DoP letter to MI confirming CoA 1.7-1.9 are satisfied and do not	20,000 Megalitres of water has been permanently transferred out of the scheme.	Compliant	Change consent condition
	g) details of the total volume of water savings that have been made for the reporting period;	AEMRs 2009 -2018 MI letter to DoP Oct 2006, including certificates of title demonstrates permanent transfer of 20, 000ML. DoP letter to MI confirming CoA 1.7-1.9 are satisfied and do not need modification	20,000 Megalitres of water has been permanently transferred out of the scheme.	Compliant	Change consent condition
	h) details of the health of the Lower Mirrool Creek Floodway Wetland System. This is to include details of the condition of vegetation, duration and extent of inundation and quality of the water discharged through the system;	AEMRs 2009 -2018	No evidence of an AEMR could be found	Non-compliant	Delete condition or change consent condition to be in line with EPL and measurable parameters
	i) details of any deliberate releases (refer to Condition 6.5d) xv);	AEMRs 2009 -2018	Release documented in the AEMR.	Compliant	
	j) outline the number of occasions and estimate of water volume that was made available as off-allocation/environmental surplus flow water to licence holders in Barren Box, Mirrool Creek and the Wah Wah District for the 12 month period;	Surplus waster supply rules and AEMRs. DoP letter to MI 31/1/2008 indicating that 7.4(j) no longer relevant	No direct and specific evidence in the AEMR found. Broader reporting across the MIA system. DoP letter to MI 31/1/2008 indicates that 7.4(j) no longer relevant due to change in Mirrool Creek status.	Compliant	
	k) identification of trends in monitoring data over the life of the development to date;	AEMRs 2009 -2018	Trends for ground water and water use across the MIA are well represented. The direct impacts of BBS are not identified in detail.	Non-compliant	Report or alter consent condition.
	l) a list of variations obtained to approvals applicable to the development and to the site during the preceding twelve-month period; and	AEMRs 2009 -2018	Non applied for outside water permits.	Compliant	
	m) environmental management targets and strategies for the following twelve-month period, taking into account identified trends in monitoring results.	AEMRs 2009 -2018	No evidence of an AEMR could be found	Non-compliant	Identify and report on targets
7.6	The Applicant must submit a copy of the AEMR to the Director-General, Council and the DEC every year, with the first AEMR to be submitted no later than twelve months after the commencement of operation of the development. The second and subsequent AEMRs are to be submitted every 12 months from the first AEMR or concurrently with the EPA's annual reporting period established for the site under its Environment Protection Licence for the site.	AEMRs 2009 -2018	AEMR produced annually and submitted to EPA, Council and NSW Planning (for a few years?)	Compliant	

APPENDIX C INDEPENDENT AUDIT DECLARATION

Project Name	Barren Box Swamp Project
Consent No.	DA-101-4-2004-i
Description of Project	Alteration to water storage at Barren Box Swamp
Project Address	Griffith NSW
Proponent	Murrumbidgee Irrigation Limited
Operator Address	86 Research Station Road, Hanwood NSW 2680
Title of Audit	Independent Initial Compliance Audit
Date	July 2019 – July 2020

I declare that I have undertaken the Independent Audit and prepared the contents of the attached Independent Audit Report and to the best of my knowledge:

- the audit has been undertaken in accordance with relevant condition(s) of consent and the *Independent Audit Post Approval Requirements (Department 2018)*;
- the findings of the audit are reported truthfully, accurately and completely;
- I have exercised due diligence and professional judgement in conducting the audit;
- I have acted professionally, objectively and in an unbiased manner;
- I am not related to any proponent, owner or operator of the project neither as an employer, business partner, employee, or by sharing a common employer, having a contractual arrangement outside the audit, or by relationship as spouse, partner, sibling, parent, or child;
- I do not have any pecuniary interest in the audited project, including where there is a reasonable likelihood or expectation of financial gain or loss to me or spouse, partner, sibling, parent, or child;
- neither I nor my employer have provided consultancy services for the audited project that were subject to this audit except as otherwise declared to the Department prior to the audit; and
- I have not accepted, nor intend to accept any inducement, commission, gift or any other benefit (apart from payment for auditing services) from any proponent, owner or operator of the project, their employees or any interested party. I have not knowingly allowed, nor intend to allow my colleagues to do so.

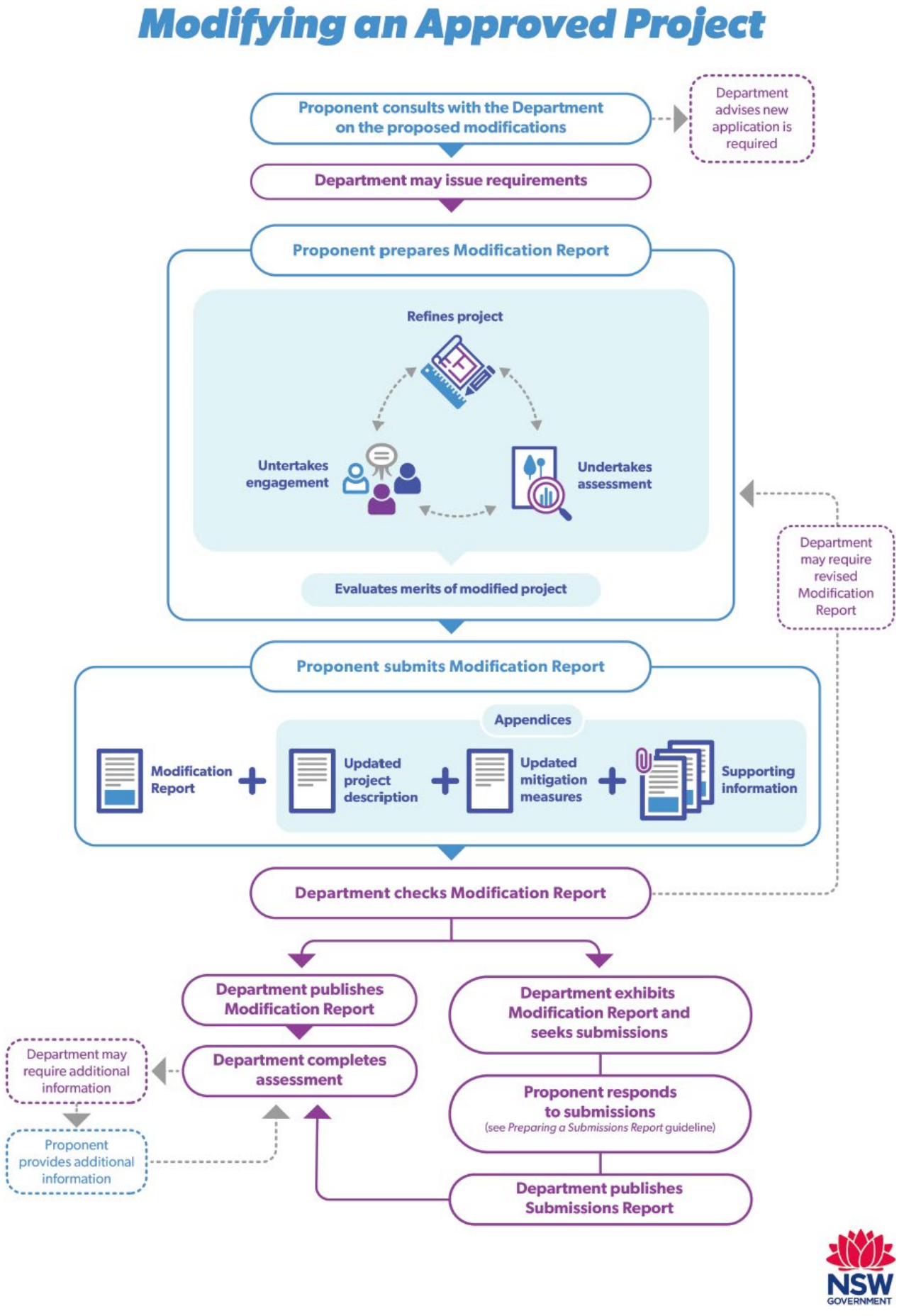
Notes:

a) Under section 10.6 of the *Environmental Planning and Assessment Act 1979* a person must not include false or misleading information (or provide information for inclusion in) in a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows that the information is false or misleading in a material respect. The proponent of an approved project must not fail to include information in (or provide information for inclusion in) a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows that the information is materially relevant to the monitoring or audit. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000; and

b) The *Crimes Act 1900* contains other offences relating to false and misleading information: section 307B (giving false or misleading information – maximum penalty 2 years imprisonment or 200 penalty units, or both)

Name of Auditor	Michial Sutherland
Signature	 29/9/2020
Qualification	Ba.Edu Sci., Environmental Audit, Centre for Professional Development Melb.1997, Environmental Auditing (22 years) including manufacturing, waste, SSI / SSD.
Email Address	Michial.s@nghenvironmental.com.au
Company	NGH Environmental
Company Address	35 Kincaid Street, Wagga Wagga, NSW

APPENDIX D MODIFYING AN APPROVED PROJECT



APPENDIX E MODIFICATION PATHWAY

Type of Modification	Statutory provisions	Scope of modification	Community participation	Public exhibition
State significant development: • State significant development consent • State significant concept development consent	• An applicant can apply for one of the following modifications: o Modification involving minor error, misdescription or miscalculation – section 4.55(1) of the Act	The modification must be to correct a minor error, misdescription or miscalculation	No mandatory requirements	None
	o Modification involving minimal environmental impact – section 4.55(1A);	• The proposed modification must be of minimal environmental impact • The development as modified must be *substantially the same* as the development for which consent was originally granted and before that consent as originally granted was modified at all	No mandatory requirements	14 days (if exhibited)
	o Other modifications – section 4.55(2); and o Modifications of consents granted by the Court – section 4.56.	• The development as modified must be *substantially the same* as the development for which consent was originally granted and before that consent as originally granted was modified at all	The application must be publicly exhibited and each person who made a submission to the original development application must be notified	14-28 days
Part 3A project approval - transitioned to SSD	The same as applies for a State significant development consent (see above)	The development as modified must be *substantially the same development* as the development authorised by the consent as last modified under the former section 75W (if applicable) – see clause 3BA (6) of schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*	The same as applies for a State significant development consent (see above)	• The same as applies for a State significant development consent (see above)

NSW GOVERNMENT

Department of Planning and Environment

Attachment B: Annual reports from 2006 to 2021

B1: Licence compliance report FY 2005-2006

MURRUMBIDGEE IRRIGATION



06

LICENCE COMPLIANCE REPORT

ENVIRONMENTAL CARE

FOR FUTURE GENERATIONS

Introduction

Welcome to Murrumbidgee Irrigation's second Licence Compliance Report. After positive feedback on the format change last year, Murrumbidgee Irrigation decided to make only minor changes to further enhance the quality of the report this year.

The aim of this report is to address Murrumbidgee Irrigation's obligations under its licences with the Department of Environment and Conservation and the Department of Natural Resources. More information on Murrumbidgee Irrigation's social, environmental and economic performance can be found in the Annual Report for 2005/06.

This report provides information on how Murrumbidgee Irrigation manages MIA EnviroWise (the MIA & Districts Community Land and Water Management Plan), Water Supply and Drainage, Groundwater, Floods and Floodplain, Aquatic Environment, General Environment, Salinity and Water Quality.

Apart from a few exceptions which have been explained and justified in the Annual Return, Murrumbidgee Irrigation has complied with all licence requirements. It is proposed that the licence review process, scheduled for late 2006, will address issues to ensure that the licences remain current and focused as the major planning framework to meet targeted environmental objectives. Further that they remain relevant to the Murrumbidgee Irrigation Area and continue to balance the interests of the community and Murrumbidgee Irrigation's customers and their businesses with the natural environment.



Dick Thompson
Chairman
Murrumbidgee Irrigation



Leith Boully
Chair
Environment Sustainability Committee





Cover: Greg Harrison, Stanbridge shareholder, with Kate Lightfoot, Incentives Officer, and Anthony Kidman, IHS Project Leader.

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Note:
Murrumbidgee Irrigation Limited owns the information provided in this document. This document must not be copied, reproduced or used for any purpose other than a purpose approved by Murrumbidgee Irrigation Limited. Written authorisation may be obtained by making a formal request in writing to the Company Secretary.

A.1 Land and Water Management Plan

MIA EnviroWise (otherwise known as the MIA and Districts' Community Land and Water Management Plan)

A.1.1 Annual Environment Management Report

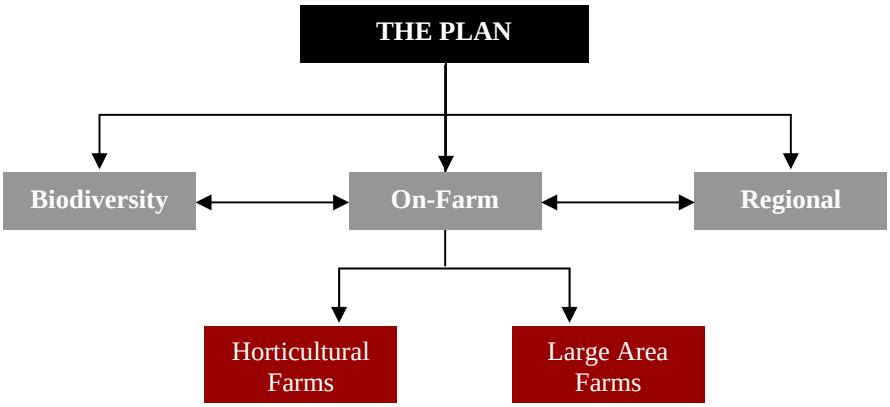
The goal of MIA EnviroWise is to maintain and enhance the sustainability and profitability of agriculture in the MIA and Districts.

The main objectives are:

- To maintain or increase irrigated agriculture productivity
- To reduce seepage to the groundwater system
- To keep drainage water quality within agreed standards
- To reduce surface drainage volumes to acceptable levels
- To protect our natural resources
- To minimise or prevent downstream effects

MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

MIA EnviroWise structure



The cost of implementing MIA EnviroWise is shared between the NSW and Australian governments and the MIA and Districts community. MIA EnviroWise is scheduled to be implemented over a 30-year period. It commenced in 2000/01 with government funding available for the first 15 years of implementation. To date government funding has been provided by the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality and irrigator and community funds.

The total cost of implementing MIA EnviroWise has been calculated at $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

Table 1.1.a: Funding sources, receipts and expenditure for MIA EnviroWise

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2006 ($ million)	Expenditure to 30 June 2006 ($ million)
Government	50.1	15	11.4	10.1
Landholders-in-kind	214.2	30	n/a	38.0
Landholders/urban levy	19.6	30	5.2	2.0
Total expenditure				**49.3**

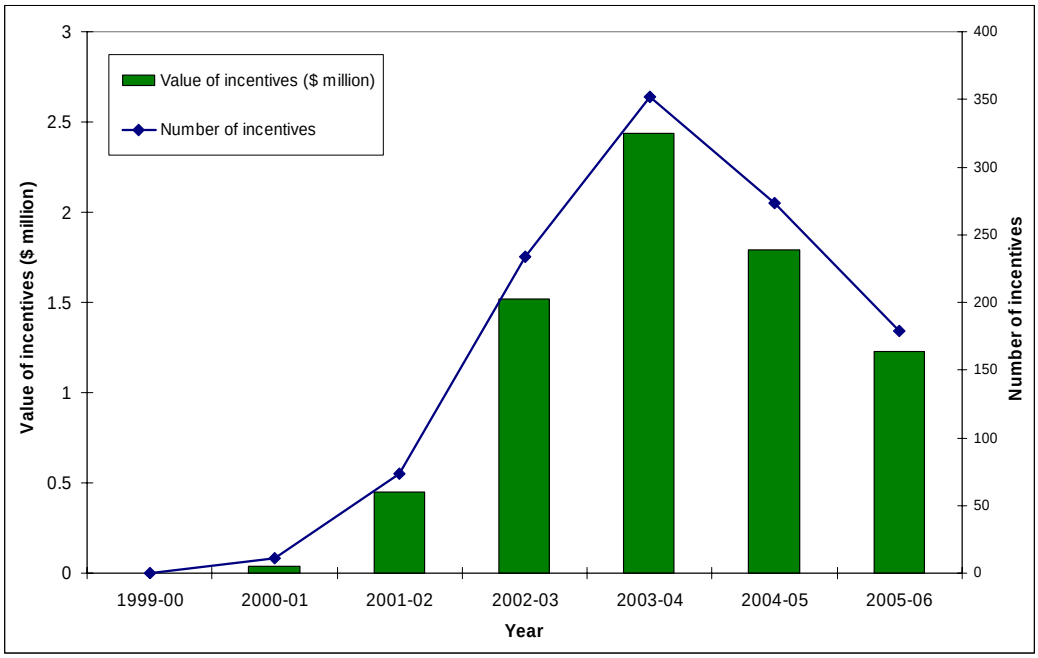
* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (unsigned).

The financial administration of MIA EnviroWise is the responsibility of Murrumbidgee Irrigation Limited.

The expenditure of MIA EnviroWise funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Figure 1.1.a The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding



Overview of the On Farm Program line items

Outlined in Table 1.1.b is an overview of the On Farm Program line items, targets and timelines for achievement of the line items, and achievement of the line items to 30 June 2006.

Table 1.1.b: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2006

Line item	Target	Time frame	Incentive available	Achieved to 30 June 2006
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program Horticulture Large Area				1127 farms 660 farms 467 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	330 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	240 farms
* Vegetation Management Planning	450 farms	1-15 years	Yes	312 farms 167 landholders
Irrigation efficiency systems	(270 farms)	1-15 years	Yes	70 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	252 farms
Conversion to perennial pasture	(2000 ha)	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	(40 farms)	10 years	No	0 ha
On-farm channel seepage control			No	0 ha
Rice soil amelioration & reclassification	(72 farms)	1-10 years	No	TBD
Drainage recycling	(450 farms)	1-15 years	Yes	180 farms
Sub-surface drainage and disposal	(65 farms)	1-13 years	Yes	6 farms
Mole drainage and on-farm recirculation	(7 farms)	1-10 years	No	0 farms
Laser forming	(7500 ha)	1-10 years	No	TBD
Rice target water use #	(619 ha)	1-10 years	No	Inconclusive
* EM31 Surveys	900 farms		Yes	42 farms
* Structural adjustment			Yes	4 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Line item included in structural adjustment

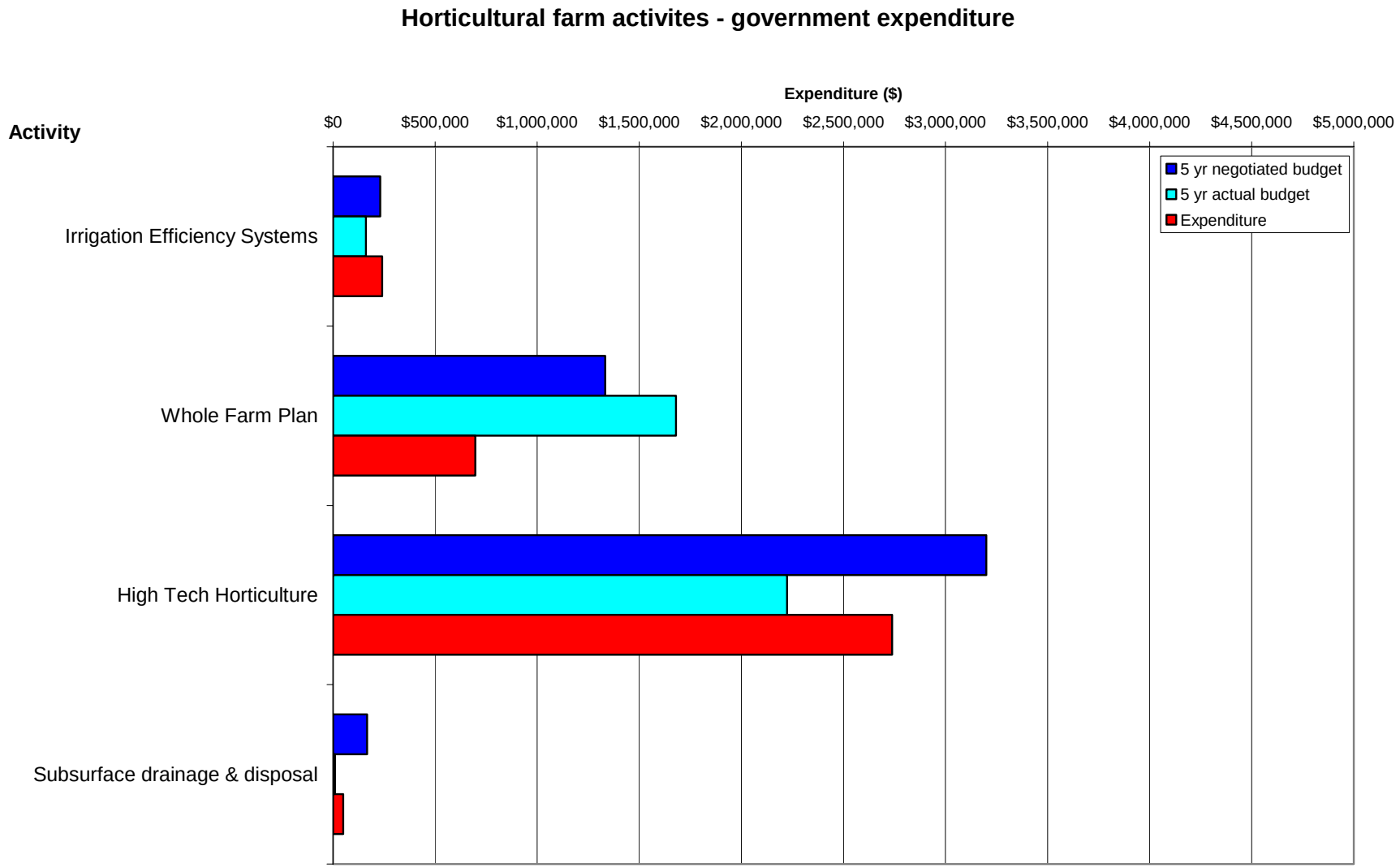
Program Expenditure and Targets

The program expenditure for component programs of MIA EnviroWise for the review period is presented in Figures 1.1.b to 1.1.f (pages 5, 7, 9 and 10).

Horticulture Farm Activities (Figure 1.1.b – page 5)

- Irrigation Efficiency Systems Implementation incentive is tracking well against both the 5 year negotiated and 5 year actual budgets. Irrigation Efficiency incentive is ahead of target due to the large expansion of horticulture over the past 5 years. These farms do not fit the current criteria for High Tech horticulture. The expansion in large area farms converting to horticulture is on the decline recently due to the drop in commodity prices.
- Farm planning activities expenditure has fallen well behind both the actual and negotiated budgets during the 5 year review period. This can be attributed to the generally lower costs associated with preparing a horticultural farm plan compared to the estimated costs during the LWMP development. On average a farm plan is costing between $2,000–3,000 to prepare. Whole Farm Planning is below target. This can be accounted to the decrease in commodity prices, dry conditions and the anticipation of the company's Integrated Horticulture Supply (IHS) system.
- The High Tech horticulture incentive is tracking well. This is due to the prioritisation of this incentive over the first 5 years. The early demand and backlog of applicants has now been absorbed to the point that over the last two years there has been a tailing off in landholders applying for this incentive. This has been further exacerbated by the downturn in commodity prices resulting in cash flow problems for landholders. Further to this the linking of the IHS program to the on-farm conversion of pressurised irrigation systems has also slowed down implementation of on-farm activities until the off-farm system has been upgraded. The linking of the on and off farm system is a more holistic and beneficial approach particularly when considering the outcomes that will be achieved. Additionally, there are limited suppliers available to install systems on farm. Compounding this is the window to install the systems is confined to the winter months. The advice provided by all local designers and installers is that the maximum possible systems to install annually is 60-70 which is well below the negotiated level of 112. Therefore, the total expenditure in any one year is limited to the number of systems that can be installed. To a certain extent the number may be increased by linking with the IHS project as less on-farm works are required, however, it has not been determined to what level this is possible.
- Subsurface drainage & disposal expenditure and target are in excess of the five year actual budget and target set. All of the incentives were paid for systems installed between July 1998 and 2001. Hence these incentives were paid retrospectively. While the ongoing dry conditions and lower watertables may have influenced the uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive.

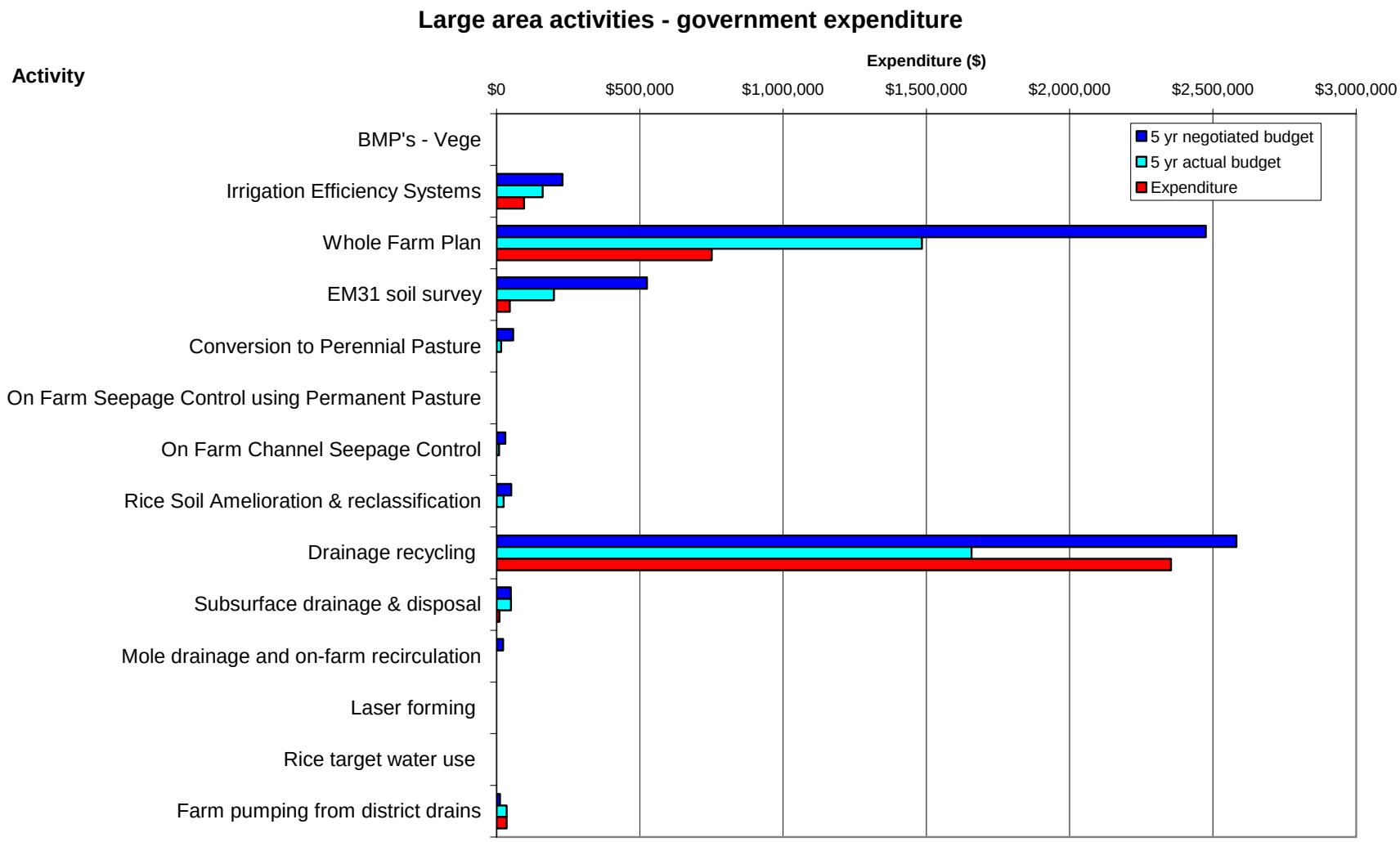
Figure 1.1.b: Horticultural Farm Activities



Large Area Farm Activities (Figure 1.1.c – page 7)

- Irrigation Efficiency Systems activity while not in line with the negotiated outcomes was not offered as a high priority due to 40% of negotiated funds received in 2001/02, no funding received in 2002/03 and 2004/05. If promoted greater uptake of this incentive would be achieved.
- Farm planning activities expenditure and target have fallen well behind both the budget and targets set. This can be attributed to the generally lower costs associated with preparing the farm plan based on the receipts provided by applicants. The average cost is approximately $6,000 resulting in an incentive payment of $3,000. However, this figure may be misleading when determining the true cost of preparing a large area Whole Farm Plan. Many of the participants to date have only required their plans to be consolidated and have their paddocks tied together meaning very little field survey work is required. This is due to the fact their farms are fully developed and laser levelled. All that is required is to consolidate previous survey work to allow the design of a drainage recycling system. Additionally, there are limited suppliers available locally to prepare plans and this can at times result in delays in completing plans and achieving the targets set.
- Uptake of EM31 soil survey incentive has been slow and well below what was predicted and budgeted for. There has been an apparent reluctance to apply for this incentive due the conditions imposed relating to a potential reduction in areas approved to grow rice based on the finding of the survey.
- Conversion to Perennial Pasture incentive has not been offered as it is not a priority and further it is unlikely there will be any uptake of this incentive.
- There has been no uptake of On-farm Channel Seepage Control (WWID only) incentive despite promotion.
- Rice Soil Amelioration & reclassification incentive has not been offered at this stage and it is uncertain if there will be ongoing interest in it.
- Drainage recycling has been tracking well against both the budget and targets. There has been a prioritisation of this activity. During the dry conditions farmers have seen a real need to maximise their water on-farm. Drainage recycling allows them to do this and make every drop count.
- The expenditure and target for Subsurface drainage & disposal activity is lower than the figures set. The single incentive paid was for a system installed between July 1998 and 2001. While the ongoing dry conditions and lower watertables may have influenced the uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive.

Figure 1.1.c: Large Area Farm Activities



Biodiversity Activities (Figure 1.1.d – page 9)

- There has been a slow uptake in the incentive for 'Irrigated Woodlots and Harvesting' and 'Plant perennial vegetation' due to the ongoing drought, requirements restricting harvesting, and limited time available by landholders to implement despite relatively high number of VMP's (Vegetation Management Plans) completed. A vegetation implementation officer has been employed to increase conversion rate from VMP to on-ground action. Implementing this incentive in its current form may meet the target expenditure and area planted may not meet the desired biodiversity outcome without the development of a landscape plan identifying areas of high conservation value.
- Low priority was assigned to 'Channel seepage control by tree planting' and 'Plant corridors of trees on crown land' due to 40% of negotiated funds received in 2001/02, no funding received in 2002/03 and 2004/05 and ongoing drought conditions.
- Considerable work has been undertaken in establishing baseline biodiversity data. The projects undertaken provide an extremely comprehensive set of data that will act as a building block for the establishment of a biodiversity strategy for the MIA. They are stored in a custom-designed Geodatabase allowing for easy data retrieval, linkages to other statewide datasets and spatial analysis. While expenditure of both government and community funds is in excess of the forecast budget, the level of expenditure and hence the quality of work should result in the strategy being developed at low cost as no additional data sets will be required. The datasets provide a perfect baseline for the transition to and development of the next stage and will assist in establishing clear outcomes for biodiversity activities.

Figure 1.1.d: Biodiversity Activities

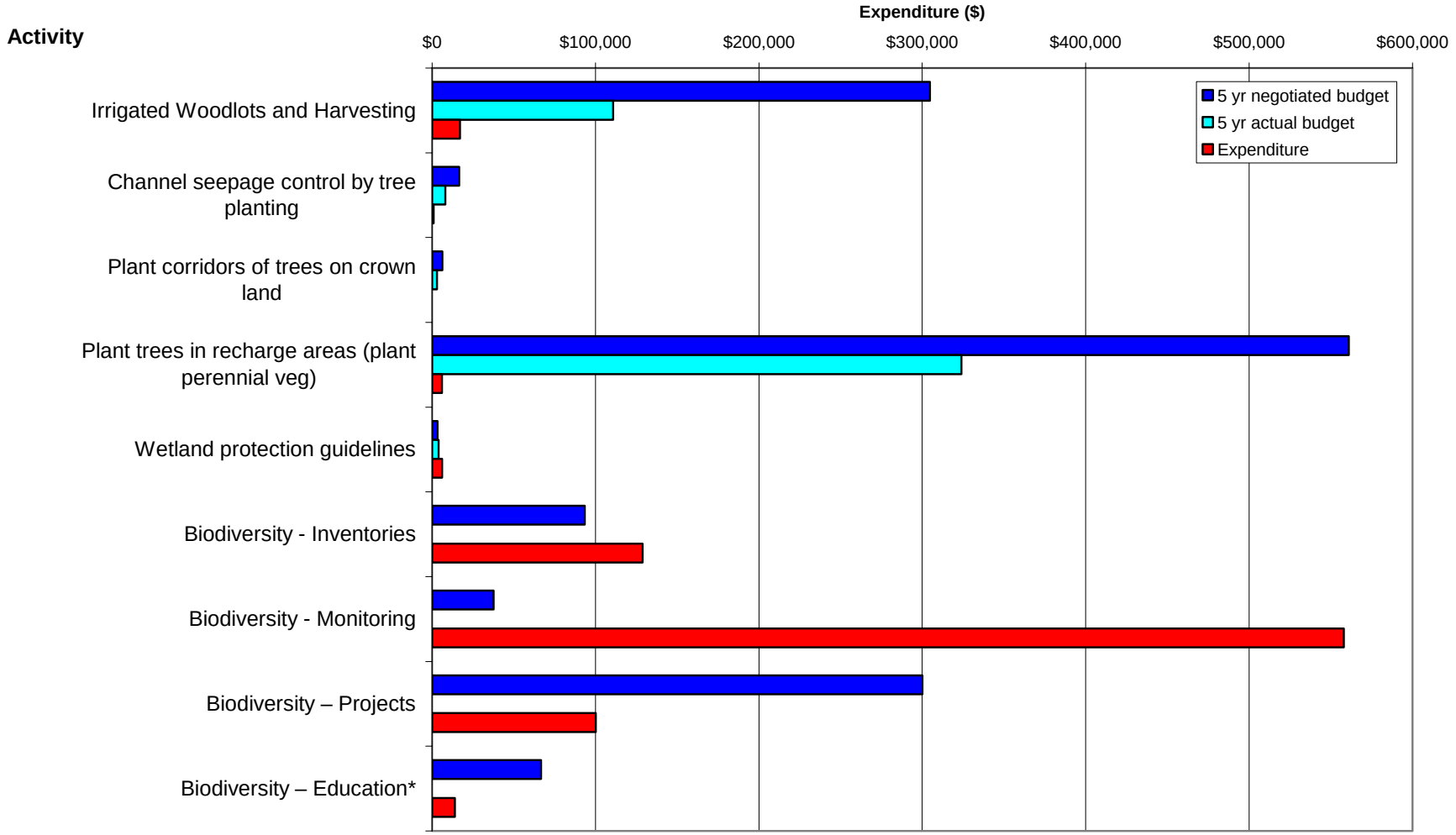


Figure 1.1.e: Implementation Activities – government expenditure

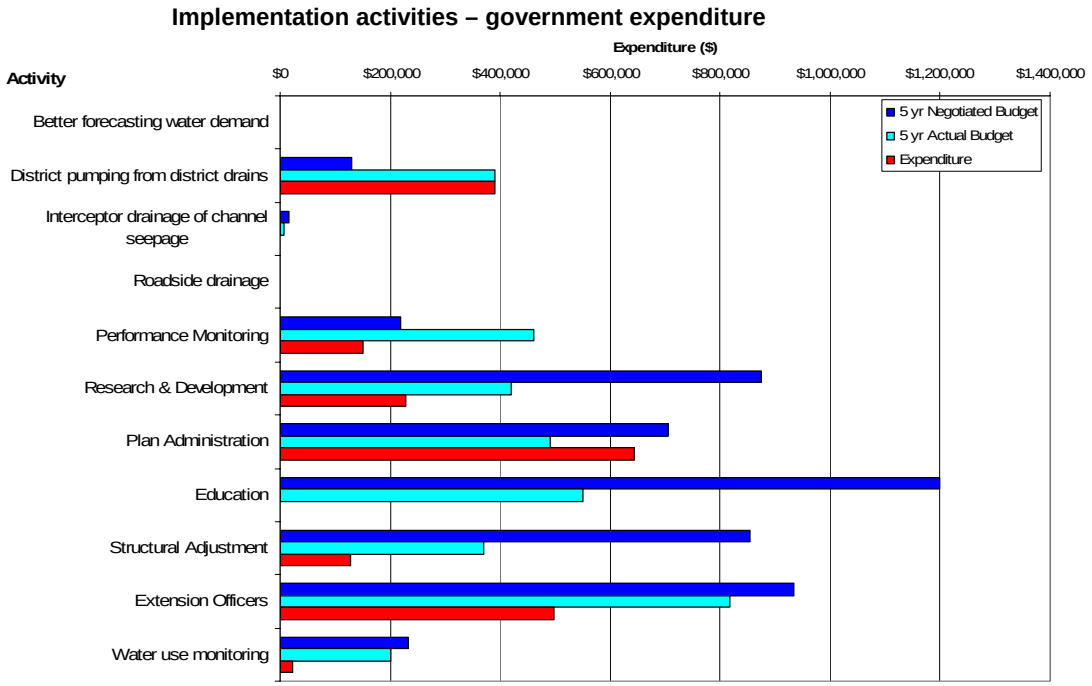
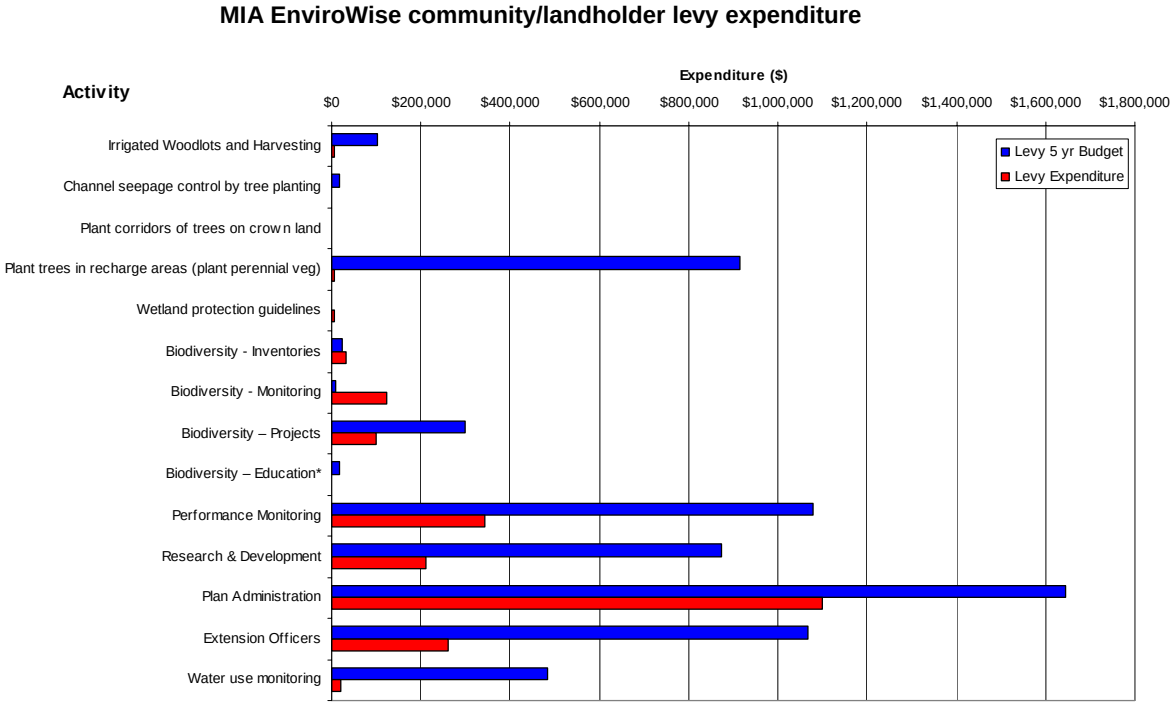


Figure 1.1.f: MIA EnviroWise community/landholder levy expenditure



A.1.2 Documentation relevant to background and/or implementation of the LWMP

Table 1.2.c includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

Table 1.2.c: Key reference documents relevant to the LWMP (MIA EnviroWise)

Document	O/R	Submitted to DNR	Endorsed by DNR
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, Charles Sturt University, Wagga Wagga. Report prepared for Murrumbidgee Irrigation. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.	R	October 2006 Electronic (on disc)	*

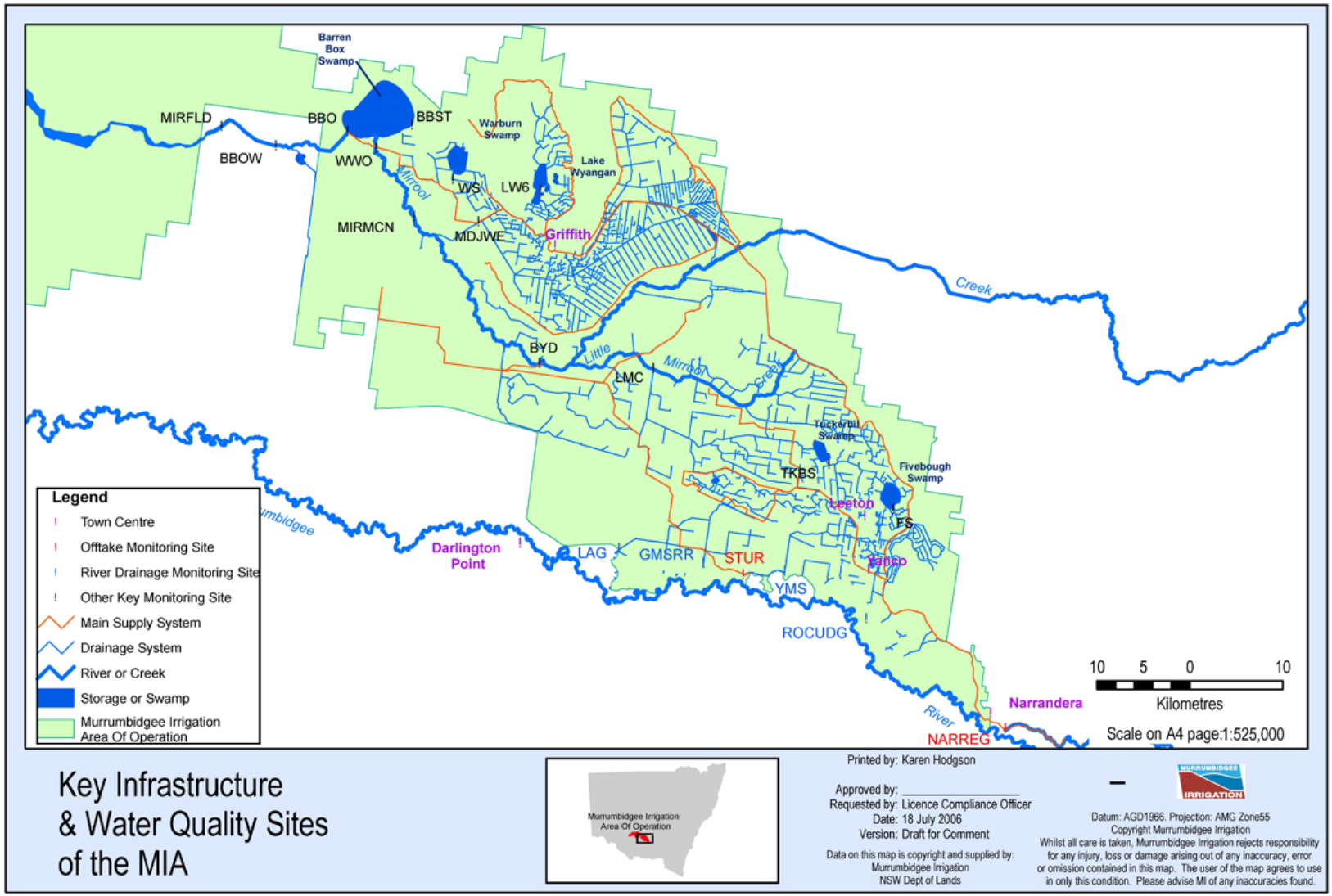
A.1 Land and Water Management Plan

Document	O/R	Submitted to DNR	Endorsed by DNR
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants.* Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	*

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DNR, waiting on endorsement

A.2. Water Supply and Drainage Management

Figure 2.a: Key irrigation infrastructure in the MIA



A.2.2 Reporting requirements

Climatic conditions

2005/06 was a year which showed significant variation to the long term average weather patterns. The distribution of rainfall was not regularly spaced throughout the year. There was increased monthly rainfall in the June to December period with a significant monthly decrease over January to May. Total rainfall was below the long term average and licence benchmark figures but was significantly higher than that in 2004/05.

Table 2.2.a: Summary of climatic data

Month	Eto 2005/06 (mm)	Rainfall 2005/06 (mm)	Net Eto (ET-Rainfall) (mm)	LTA ETo (1962-2004) (mm)	LTA Rainfall (1962-2004) (mm)
July	43.6	34.2	9.4	49.9	34.0
August	86.6	52.2	34.4	76.1	37.0
September	99.8	49.4	50.4	114.4	37.8
October	156.0	58.6	97.4	172.8	42.4
November	237.0	55.8	181.2	227.1	28.4
December	297.4	29.6	267.8	273.3	29.5
January	318.5	6.4	312.1	279.5	33.9
February	245.9	6.6	239.3	230.4	29.5
March	218.8	15.0	203.8	189.8	34.2
April	113.7	15.0	98.7	114.1	31.7
May	73.0	0.8	72.2	65.8	38.1
June	44.6	43.0	1.6	44.0	35.6
Total	**1934.9**	**366.6**	**1568.3**	**1837.2**	**412.1**

Source: CSIRO Griffith
Notes
LTA = Long term average (1962-2004), weather data from CSIRO Griffith
ETo = reference evapotranspiration

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2006

Year	Announced allocation (general/high %)	Total diversions (ML)	Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2005/06	57/95	1,036,519*	829,990	1568	1935	367
2004/05	43/95	826,207	648,417	1,713	1,983	270
2003/04	41/95	861,499	651,806	1,645	1,998	353
2002/03	38/95	960,119	754,112	1,938	2,191	253
2001/02	72/95	1,141,607	916,611	1,744	2,032	288
2000/01	90/95	1,048,053	857,455	1,471	1,887	416
1999/00	78/100	818,496	646,402	1,242	1,832	590
1998/99	85/100	1,036,169	825,390	1,331	1,868	537
1997/98	90/100	1,225,805	976,972	1,563	1,931	368
1996/97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995/96	105/100	1,107,225	882,766	1,439	1,862	423
LTA					1,837	412

Sources: MI Irrigation Services and Corporate Office, CSIRO Griffith
Notes: LTA = Long term average (1962-2004), weather data from CSIRO Griffith
* = Does not include 2,146ML environmental waterway diversions for DNR

A.2.2(1) Diversions, volume

Table 2.2.c: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2005/06

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	5,970	12,829	1,210
September	20,838	34,990	6,085
October	31,502	72,523	10,630
November	22,958	78,544	13,220
December	40,142	130,276	19,165
January	43,469	158,213	20,845
February	27,925	107,600	10,975
March	16,454	76,023	11,520
April	9,277	49,813	12,450
May	10,530	54,173	9,060
June	0	1,872	510
Total 2005/06	**229,065**	**776,856**	**115,670**
Total 2004/05	145,728	680,479	100,155
Total 2003/04	174,150	687,349	94,027
Total 2002/03	176,488	783,631	98,915
Total 2001/02	229,155	912,452	145,490
Total 2000/01	223,518	824,535	167,255
Total 1999/00	165,440	653,056	151,020
Total 1998/99	200,260	835,909	165,385
Total 1997/98	212,875	977,720	161,130
Total 1996/97	261,955	1,016,135	151,960
Total 1995/96	218,888	868,968	200,990

Notes:
Diversions shown in Table 2.2.c for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK - deliberate downstream diversion to Gum Creek escape
Diversions for the Main Canal include diversions from at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and Yenda storage reservoir diversions
Diversions for the Wah Wah Supply System includes Mirrool Creek Diversions + Barren Box Diversions

Table 2.2.d: Summary of Gross Diversions Main and Sturt Canal 2005/06

	Sturt	Main
Aug	5,970	12,899
Sept	20,838	35,351
Oct	32,202	74,553
Nov	22,393	83,609
Dec	42,180	136,801
Jan	45,744	161,983
Feb	27,925	108,900
Mar	16,324	77,118
Apr	9,137	52,203
May	10,675	57,998
Jun	0	3,862
TOTAL	**233,388**	**805,277**

Note: 233,388 + 805,277 ML = 1,038,665 ML
less DNR approved diversions to wetlands (environmental flows) 2,146 ML
net irrigation diversions = 1,036,519 ML

A.2.2(2) Supply efficiency, storage levels

Supply efficiency

The table below shows the simple efficiency of the system to be 80.1%. This calculation shows the apparent loss to be about 207GL. The water balance in Section A.2.2(5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

Table 2.2.e: Simple efficiency of the system —1999 to 2006

Parameter	2005/06	2004/05	2003/04	2002/03	2001/02	2000/01	1999/00	1998/99
Diversions (ML)								
Sturt Canal	233,388	145,728	174,150	176,488	229,155	223,518	165,440	200,260
Main Canal	805,277	680,479	687,349	783,631	912,452	824,535	653,056	835,909
Less DNR Environmental Diversions	2,146							
NET TOTAL irrigation diversions	**1,036,519**	**826,207**	**861,499**	**960,119**	**1,141,607**	**1,048,053**	**818,496**	**1,036,169**
Sales (ML) - metered and unmetered*	829,990	648,417	651,806	754,112	916,611	857,455	646,402	825,390
Conveyance (ML)	206,529	177,790	209,693	206,007	224,996	190,598	172,094	210,779
Simple Efficiency(%)	**80.1**	**78.5**	**75.7**	**78.5**	**80.3**	**81.8**	**79.0**	**79.7**

Source: MI Irrigation Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100

Storage levels

Barren Box

Barren Box receives water from Mirrool Creek and forms an important site for the storage and diversion of drainage (reused as supply water) to the Wah Wah district. Construction commenced on the splitting of Barren Box in November to create a smaller, more responsive water storage that meets the requirements of the company for the supply of irrigation water to the Wah Wah Irrigation and Stock and Domestic District, while enhancing the site's ability to mitigate flood flows. Other major outcomes expected from the redevelopment are improved water quality for downstream users and the restoration of more than 1,600 hectares to an ecologically alive and diverse ephemeral wetland.

Due to the continuing dry conditions and the commencement of construction works, no surplus flows entered the site until June. This resulted in the site being dry for the majority of the 2005/06 season.

Lake Wyangan

The Lake Wyangan catchment is essentially a closed drainage basin. North Lake Wyangan and South Lake Wyangan capture surface runoff and subsurface drainage from within the Lake Wyangan sub-catchment. The North Lake (at its northerly perimeter) receives water from various drains including the *Lake Drain* which feed into the North Lake bringing drainage from the north west of the sub catchment. The South Lake (at its southerly perimeter) receives drainage water from farms east and south of the Lake Wyangan catchment.

The North Lake, a man-made reservoir- previously a gypsum mine, is used for recreational purposes. It is Crown Land with Griffith City Council as Trustee of the land. The South Lake is or includes a nature reserve, and again Griffith City Council is the reserve trustee.

The works comprised in the storage facilities at Lake Wyangan are designated as a drainage area and as a result Murrumbidgee Irrigation's irrigation and drainage interests in both the North and South Lakes remain a priority use right for Murrumbidgee Irrigation.

LW6, a long-term water quality monitoring site, is located at South Lake Wyangan.

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. Murrumbidgee Irrigation attempts to regulate the Lakes' levels to satisfy the various demands to meet commercial irrigation, environmental and community objectives.

An underground pipe between the two lakes allows the North Lake to be kept at a desirable level and drainage from there discharged to the South Lake.

Additional deliberate diversions into the Lake are achieved by directing channel escape flows into the drainage system (for example escapes from the Ballingal Branch Canal).

The South Lake is used as a drainage recycling system. Up to approximately 40ML/day can be pumped from the South Lake via the Lake View Branch Canal pumps (Pumps No 1) located to the east of the South Lake near Jones Road. This drainage water augments the Lake View Branch Canal system. Water quality is regularly monitored to ensure that the EC is at an acceptable level. This season 675 ML was discharged via the Lake View Branch pumps to the Lake View Branch Canal system. Another set of pumps called the Lake Wyangan drainage pumps (Pumps No 2) are located to the south west of the South Lake. In the past, these were used to assist evacuation of surplus water from the lakes. More recently but very infrequently, during peak demand periods drainage water has been pumped from the South Lake westwards to the south of the Main Canal at Tharbogang where it has discharged into Main Drain J for potential reuse at Wah Wah. These pumps are old and are not used very often.

The monthly figures relating to the volumes pumped by Murrumbidgee Irrigation from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.j in A.2.2(4), Drainage reuse. Table 2.2.f provides 2005/06 monthly gauge heights (water depth) for the lakes.

Table 2.2.f: Gauge heights for South and North Lake Wyangan 2005/06

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.44	1,440	1.05	2,100
Aug				
Sep	1.15	1,150	1.32	2,640
Oct	1.18	1,180	1.42	2,840
Nov	1.25	1,250	1.52	3,040
Dec	1.04	1,040	1.45	2,900
Jan	1.13	1,130	1.36	2,720
Feb	1.12	1,120	1.16	2,320
Mar	0.98	980	1.02	2,040
Apr	1.09	1,090	0.95	1,900
May	1.26	1,260	0.96	1,920
Jun	1.39	1,390	0.98	1,960

Source: MI Irrigation Services
Gross Resources = Gauge height converted into megalitres.

A.2.2(3) Drainage volumes and salt loads

Table 2.2.g: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description
	NARREG	Narrandera Regulator
	STUR	Sturt Canal
410167	BBOW	Barren Box Outfall Canal Wyvern
410174	MDJWE	Main Drain J Upstream of Warburn Escape
410085	LMC	Little Mirrool Creek
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon
41010921	GMSRR	Gogeldrie Main Southern Drain
410083	YMS	Yanco Main Southern Drain
41010005	ROCUDG	Cudgel Creek Roaches Escape
41010162	WS	Warburn Swamp
41010955	MIRMCN	Mirrool Creek at McNamara Road
41010908	BYD	Bray's Dam Diversions and Bywash
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage & Wetlands*
41010896	LW6	Lake Wyangan Causeway
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)
41010157	TKBS	Tuckerbil Swamp By-pass drain
41010163	MIRFLD	Mirrool Creek Floodway (when being used)
Other Sites Required for DNR Licence		
41010903	BBO	Barren Box Outfall
41010978	WWO	Willow Dam

A.2 Water Supply and Drainage Management

Table 2.2.h shows the monthly total flow volumes from the Murrumbidgee River entering the Murrumbidgee Irrigation Area measured at two of the three main area regulated sites. At Narrandera (NARREG), after diversion at Berembed Weir and also at the Sturt Canal (STUR) after diversion at Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- Little Mirrool Creek (LMC) - which accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- Bray's Dam (BYD) - Drainage diversion from LMC to the Benerembah Irrigation District.
- Mirrool Creek at McNamara Road (MIRMCN) - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and / Wah Wah
- Main Drain J (MDJWE) - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- Barren Box Outfall Wyvern (BBOW) - Drainage flow from Barren Box at Wyvern Station discharging to Wah Wah Irrigation District.

Additionally, the 4 river channel wetland sites which potentially discharge to the Murrumbidgee River

- Yanco Main Southern (YMS) - partial Leeton/Yanco drainage
- Gogeldrie Main Southern (GMSRR) - partial Gogeldrie drainage
- Gooragool Lagoon (LAG) - partial Gogeldrie drainage
- Cudgel Creek downstream from Cudgel Creek (ROCUDG) - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings as well as those decisions dealing with asset design, purpose and function.

Table 2.2.h: Drainage Volumes (ML) – July 2005 to June 2006

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	[ ]	12899	35351	74553	83609	136801	161983	108900	77118	52203	57998	3862	**805277**
STUR**	**Monthly Total**	[ ]	5970	20838	32202	22393	42180	45744	27925	16324	9137	10675	0	**233388**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	17.4	10.7	67.2	86.2	92.0	91.2	108.0	110.0	109.0	73.0	67.0	35.9	72
	Median	12.4	7.5	62.5	81.3	76.1	85.4	114.0	110.0	112.0	68.6	66.1	21.5	72
	Inst.Max	76.4	53.3	150.0	199.0	296.0	265.0	131.0	134.0	149.0	102.0	93.4	126.0	296
	Inst.Min	4.0	3.3	24.2	31.4	47.3	52.2	78.3	84.3	80.7	52.7	49.2	4.1	3
	Monthly Total	538.0	333.0	2010.0	2670.0	2760.0	2830.0	3350.0	3080.0	3390.0	2190.0	2080.0	1080.0	**26300**
MIRROOL AREA - MIRROOL CREEK														
BYD (Diversions)**	**Monthly Total**	[ ]	0.0	1440.0	765.0	1385.0	600.0	550.0	1360.0	2775.0	1020.0	840.0	0.0	**10735**
BYD (Bywash)**	**Monthly Total**	1018.0	456.0	1080.0	2625.0	3496.0	8144.0	6662.0	2948.0	1639.0	1830.0	3363.0	2108.0	**35369**
MIRMCN (41010955)	**Mean**	111.0	68.7	226.0	355.0	501.0	654.0	569.0	472.0	432.0	389.0	546.0	222.0	379
	Median	95.7	32.0	236.0	361.0	512.0	624.0	561.0	477.0	426.0	385.0	514.0	207.0	406
	Inst.Max	245.0	282.0	368.0	689.0	1150.0	939.0	735.0	667.0	578.0	528.0	807.0	514.0	1150
	Inst.Min	26.9	9.5	110.0	114.0	278.0	511.0	357.0	320.0	266.0	215.0	292.0	81.5	10
	Monthly Total	3440	2130	6770	11000	15000	20300	17600	13200	13400	11700	16900	6650	**138000**
DRAINS														
MDJWE (410174)	**Mean**	[59.8]	[29.2]	105.0	252.0	309.0	365.0	419.0	392.0	338.0	338.0	340.0	91.7	295
13.9 days missing data	**Median**	[53.3]	[16.7]	106.0	246.0	305.0	335.0	418.0	399.0	307.0	332.0	361.0	67.8	320
	Inst.Max	[142]	[123]	211.0	1010.0	1560.0	914.0	564.0	612.0	626.0	512.0	499.0	461.0	1560
	Inst.Min	[31.0]	[9.8]	32.9	48.8	96.6	166.0	306.0	252.0	212.0	225.0	160.0	35.0	33
	Monthly Total	[1260]	[759]	3160	7830	9260	11300	13000	11000	10500	10100	10500	2750	**91400**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	[67.7]	[0.0]	176.0	281.0	[270]	376.0	424.0	398.0	[317]	[ ]	[299]	55.4	285
56.8 days missing data	**Median**	[76.2]	[0.0]	244.0	260.0	[229]	388.0	395.0	403.0	[321]	[ ]	[320]	37.9	324
	Inst.Max	[141]	[0.0]	366.0	508.0	[510]	546.0	689.0	577.0	[576]	[ ]	[419]	358.0	689
	Inst.Min	[0.0]	[0.0]	0.0	142.0	[157]	236.0	279.0	201.0	[190]	[ ]	[151]	0.0	0
	Monthly Total	[1220]	[0]	5290	8730	[7020]	11700	13100	11100	[8570]	[ ]	[7780]	1660	**76200**
														***
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	6.9	5.2	12.6	14.0	10.1	0.6	0.6	0.6	0.6	0.7	0.8	0.7	4
	Median	5.9	5.1	11.5	13.9	10.7	0.7	0.6	0.6	0.6	0.7	0.8	0.7	1
	Inst.Max	16.6	14.1	22.9	22.9	34.0	0.9	0.9	0.9	0.8	0.8	1.0	0.9	34
	Inst.Min	4.5	0.0	6.0	4.3	0.0	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0
	Monthly Total	213.0	162.0	377.0	434.0	303.0	20.0	19.0	17.0	19.0	21.0	24.0	22.0	**1630**
GMSRR (41010921)	**Mean**	1.4	4.3	3.2	4.6	3.0	4.5	2.5	4.6	4.0	3.4	5.7	9.5	4
	Median	0.5	3.1	2.1	2.2	2.1	2.7	3.0	4.5	4.0	2.4	2.1	2.4	2
	Inst.Max	5.0	20.3	19.9	38.9	36.1	49.7	8.4	11.2	6.9	24.5	63.2	44.6	63
	Inst.Min	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0
	Monthly Total	42.0	135.0	95.0	144.0	91.0	141.0	77.0	129.0	124.0	103.0	177.0	285.0	**1540**
LAG (41010940)	**Mean**	2.6	1.0	19.6	6.6	11.1	2.7	3.6	4.8	9.3	4.4	0.6	35.3	8
	Median	0.7	0.4	13.0	4.3	4.5	2.1	2.6	4.0	9.1	0.6	0.4	30.7	3
	Inst.Max	27.7	7.9	87.3	56.3	105.0	16.1	10.4	16.1	27.1	59.3	5.2	80.5	105
	Inst.Min	0.0	0.0	0.7	0.5	1.1	0.6	1.3	0.8	0.4	0.3	0.0	1.0	0
	Monthly Total	82.0	30.0	589.0	204.0	332.0	82.0	112.0	135.0	287.0	131.0	19.0	1060.0	**3060**
ROCUDG (41010005)	**Mean**	11.9	3.2	26.8	6.4	1.4	8.9	2.0	3.1	1.0	2.1	8.5	1.3	6
	Median	10.7	2.1	9.2	2.1	0.8	3.1	1.8	0.9	0.9	1.3	3.9	1.1	2
	Inst.Max	22.2	15.4	186.0	39.9	8.5	71.8	8.5	24.7	3.9	7.4	28.9	3.2	186
	Inst.Min	6.1	0.2	0.8	0.7	0.1	0.2	0.0	0.3	0.4	0.7	1.2	0.6	0
	Monthly Total	370.0	98.0	804.0	199.0	42.0	276.0	61.0	87.0	31.0	62.0	265.0	40.0	**2340**
TOTAL														**8570**
SWAMPS														
WS*	**Monthly Total**	0.0	0.0	0.0	0.5	1.0	2.0	2.0	2.0	3.0	2.0	0.0	0.0	**13**
FLOODWAY														
**MIRFLD	**Monthly Total**	[ ]	150	0	0	1770	0	0	30	0	0	0	0	**1950**
EXTRA SITES FOR DNR														
WWO**t		[ ]	0	0	60	10	40	300	60	0	10	4375	4111	8966
BBO**#		0.0	0	0	0	0	0	0	0	0	0	0	0	0
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	2.0	3.0	18.4	17.4	14.7	[14.0]	[ ]	[19.2]	20.2	[7.6]	13.8	0.9	11
66.8 Days missing data	**Median**	0.1	0.0	15.9	13.6	9.5	[14.8]	[ ]	[18.0]	18.8	[0.0]	15.9	0.0	12
	Inst.Max	17.1	24.0	45.1	39.1	38.1	[28.3]	[ ]	[32.5]	41.4	[21.7]	22.8	10.5	45
	Inst.Min	0.0	0.0	3.2	6.4	1.1	[4.0]	[ ]	[7.7]	0.0	[0.0]	0.0	0.0	0
	Monthly Total	63.0	94.0	552.0	540.0	442.0	[239]	[ ]	[517]	626.0	[61]	427.0	27.0	**3590**
														***

A.2 Water Supply and Drainage Management

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	[0.1]@	[ ]@	2.9	1.2	[1.5]@	[0.7]@	0.2	0.2	1.3	[0.1]@	0.4	[0.1]@	1
	Median	[0.1]@	[ ]@	1.9	0.5	[0.1]@	[0.4]@	0.1	0.1	0.4	[0.1]@	0.2	[0.0]@	0
	Inst.Max	[0.6]@	[ ]@	9.4	7.2	[12.7] @	[2.3]@	0.7	1.7	7.6	[1.0]@	2.3	[0.6]@	9
	Inst.Min	[0.0]@	[ ]@	0.4	0.1	[0.0]@	[0.0]@	0.0	0.0	0.1	[0.0]@	0.0	[0.0]@	0
	Monthly Total	[3]@	[ ]@	86.0	38.0	[42]@	[19]@	6.0	7.0	42.0	[2]@	14.0	[3]@	**261**
														***
DCWIDG (41017001)	**Mean**	0.3	0.0	0.6	0.2	1.6	2.6	2.4	1.1	1.7	2.0	0.7	0.5	1
	Median	0.2	0.0	0.1	0.1	0.3	0.2	1.7	0.8	1.2	1.7	0.4	0.1	0
	Inst.Max	2.6	0.4	5.6	3.1	28.8	47.1	16.5	6.4	6.5	6.9	4.4	6.2	47
	Inst.Min	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.4	0.1	0.1	0
	Monthly Total	11.0	1.0	18.0	6.0	48.0	80.0	76.0	31.0	53.0	61.0	21.0	15.0	**421**
														***
DCCENT (410172)	**Mean**	0.0	0.2	1.5	4.0	5.0	6.6	0.5	3.8	3.2	3.4	3.7	1.3	3
	Median	0.0	0.0	0.5	3.2	3.6	7.5	0.0	3.9	2.1	2.6	2.1	1.0	2
	Inst.Max	0.0	1.1	13.3	14.7	24.1	22.1	6.0	16.9	53.9	34.9	17.0	6.8	54
	Inst.Min	0.0	0.0	0.0	0.7	0.8	0.0	0.0	0.1	0.0	0.7	0.4	0.3	0
	Monthly Total	0.0	5.0	47.0	125.0	151.0	206.0	15.0	106.0	99.0	104.0	114.0	40.0	**1010**
BID2 (41010717)	**Mean**	0.0	26.4	138.0	146.0	168.0	185.0	184.0	111.0	76.2	41.2	40.6	0.0	93
	Median	0.0	0.0	143.0	144.0	185.0	175.0	184.0	127.0	75.3	42.4	41.1	0.0	101
	Inst.Max	0.0	160.0	222.0	190.0	240.0	228.0	251.0	159.0	109.0	74.2	79.1	0.0	251
	Inst.Min	0.0	0.0	58.7	123.0	96.5	151.0	133.0	33.0	31.4	15.0	0.0	0.0	0
	Monthly Total	0.0	818.0	4140.0	4530.0	5040.0	5730.0	5720.0	3110.0	2360.0	1240.0	1260.0	0.0	**33900**

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by ECOWISE except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. Salt loads have been calculated from EC readings using a Minolta EC sensor 1500, which is designed for long term EC monitoring between 0 and 10,000 u/cm. This equipment is accurate to 0.2% of full scale at 25°Celsius.
3. [ ] Data not recorded 0 = No flow
4. [ ]@ Water Level below sensor (no flow)
5. [n] Incomplete data set due to missing data
6. Some flow data has been extrapolated from rating table based on gauge height
7. MI has called for tenders for the upgrade of the monitoring stations as data losses have been unsatisfactory.
8. BBST no longer used for monitoring
9. t Flows into BBS from Willow Dam
10. # Flows at BBS to the Outfall
11. STUR = The Sturt supply system first use water
12. NARREG = The Main Canal supply system first use water
13. ND At the time of releases to the Mirrool Creek floodway no salinity data was collected
14. No Flow or flow less than 5ML
15. Salt loads could not be calculated because of no flow or no EC available at time of flow.
16. *** Total of available days
17. Salt loads from Ecowise unless ** where we have calculated them using the formula below

Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000

Drainage Volumes to the Murrumbidgee River (ML)

Site	**2003/04**	**2004/05**	**2005/06**
TOTAL	**7,434**	**5,663**	**8,570**

Sites highlighted in blue are sites that drain to the Murrumbidgee River.

During the 2005/06 year Murrumbidgee Irrigation diverted almost 1,039 GL containing approximately 72,623 tonnes of salt from the Murrumbidgee River.

Of this substantial salt load, approximately 1,887 tonnes of salt was discharged back to the river at Yanco in 8.5 GL of drainage water (0.8% of diversions).

The 2005/06 season drainage back to the river was 0.8% of diversions, carrying 2.6% of the imported salt load.

At two of the four river drainage points, works have been completed, which have the potential to minimise river drainage from those sites. This should see a further reduction in overall river drainage in the near future.

The licence authorises discharge to the Mirrool Creek Floodway on the basis that average salinity loads do not increase to that identified in the benchmark.

Table 2.2.i shows that for the year, 19,748 tonnes of salt was estimated at the drainage reach of Mirrool Creek at McNamara Road.

A.2 Water Supply and Drainage Management

Considering that salt is contained naturally in soils, geological formations and groundwater this means that through natural processes like weathering, erosion and runoff and the system process of supply and drainage to the MIA, a substantial amount of salt is being deposited in the MIA landscape, either concentrated on the soil surface, leached through the soil profile, or contained within storages. In a healthy environment salt is slowly leached downwards where it is stored beyond the root zone of plants.

Murrumbidgee Irrigation has strategies in place to improve its ability to manage salt in the landscape. These include programs on Rice Environmental Monitoring and channel seepage control, soil suitability and hydraulic loading. Murrumbidgee Irrigation's MIA EnviroWise program also contributes to these management objectives.

We are still building on our knowledge regarding groundwater levels and salinity. A proposed Research and Development program in collaboration with the CSIRO will assist us to improve our strategies on salinity control. We will be able to report on the nature of the programs and their progress next year.

In some areas the rates of salinisation can possibly be stopped or reversed with careful management. In other areas only engineering solutions can mitigate against impacts and prevent unsustainable situations resulting.

Figures 2.2.b and 2.2.c show that at most monitoring sites within the drainage system there has been a reduction of salt loadings since the 1999/00 reference year. A significant reason for this is the reduced drainage volumes.

The water and salt balances give us a very general picture of how efficient the supply and drainage system is and what happens to supply and drainage flows and resultant salt loads moving through the MIA system. Detailed figures are provided in Tables 2.2.h and 2.2.i.

Figure 2.2.b: Historical Salt Loads to the Murrumbidgee River

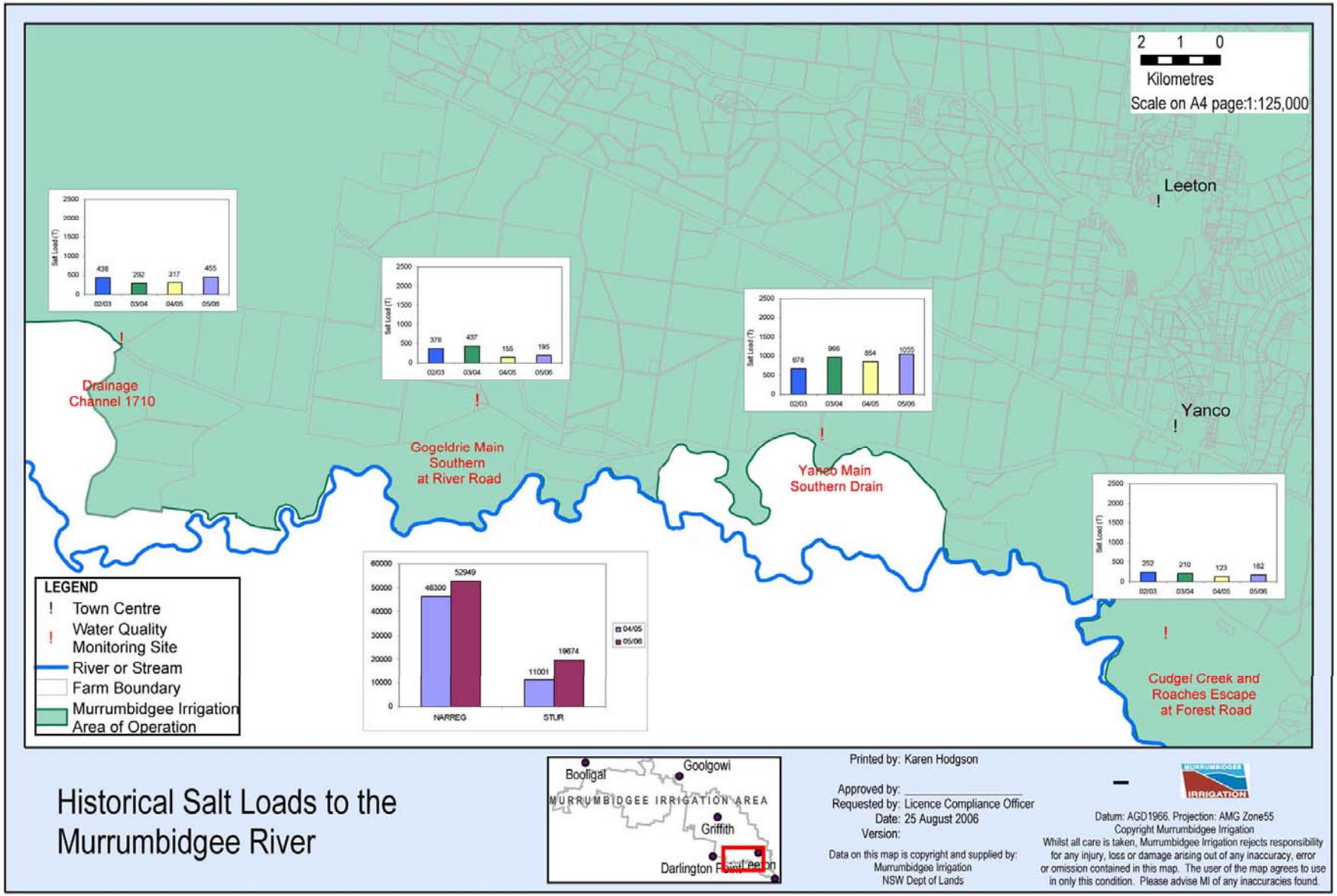


Figure 2.2.c: Historical Salt Loads to the Mirrool Creek System

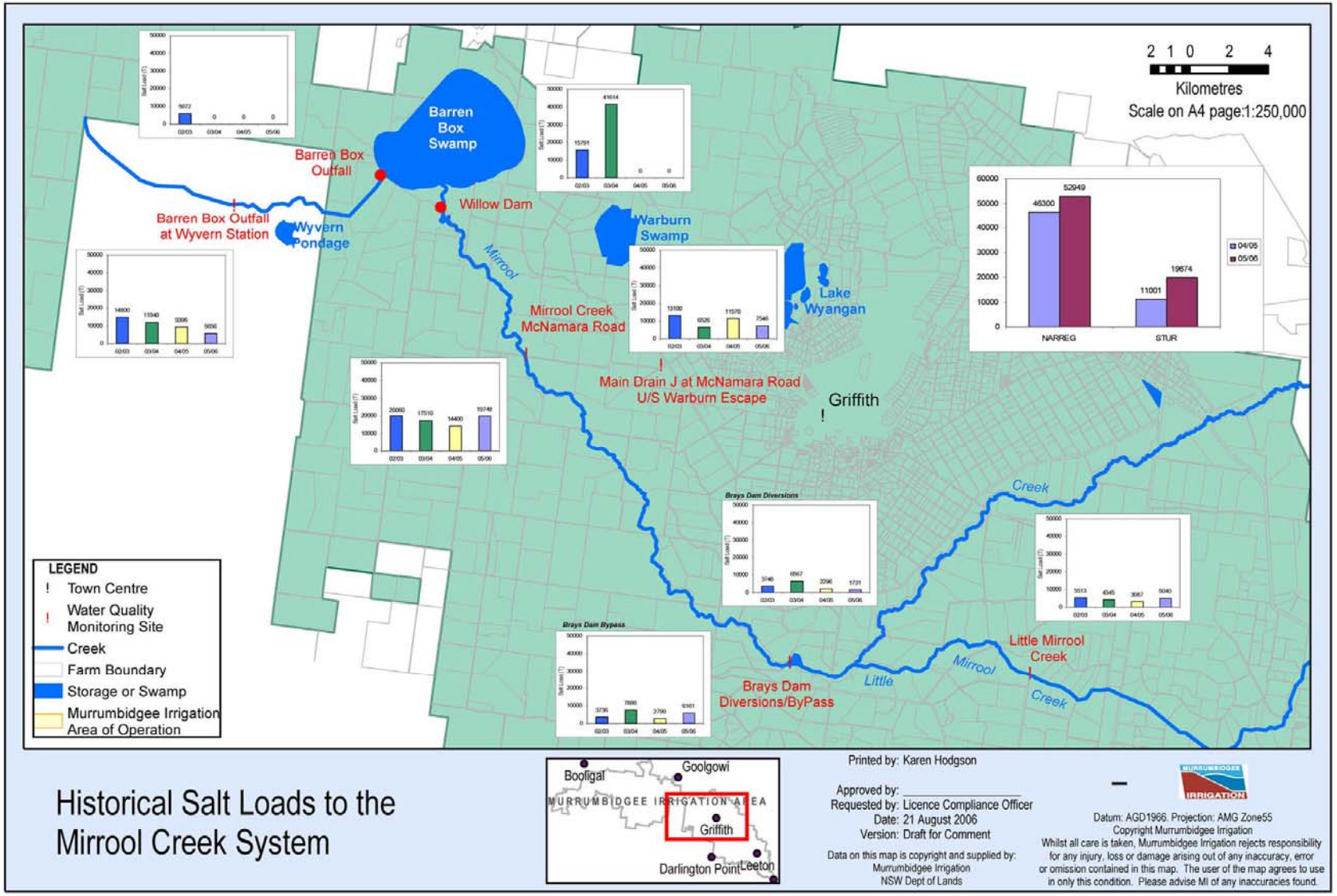


Table 2.2.i: Salt Loads (Tonnes) – July 2005 to June 2006

Monthly Salt Load Data (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**		826	3597	9018	7545	7179	11611	6133	2418	2038	2450	133	**52949**
STUR**	**Monthly Total**			2147	5235	3024	3023	3220	1644	512	363	506		**19674**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	7.8	8.6	14.9	18.3	18.5	15.6	18.3	16.6	18.2	11.5	10.5	7.1	13.8
	Median	5.7	6.0	14.4	17.2	16.2	14.6	18.8	16.4	18.1	10.9	10.2	6.0	14.5
	Inst.Max	22.9	29.1	25.8	31.3	46.9	33.4	21.0	19.8	22.0	15.5	13.3	13.3	47
	Inst.Min	4.0	3.7	8.1	9.9	11.5	10.0	13.7	13.2	13.6	7.9	8.3	3.1	3
	Monthly Total	243.0	266.0	446.0	568.0	554.0	482.0	566.0	466.0	565.0	345.0	327.0	212.0	**5040**
MIRROOL AREA - MIRROOL CREEK														
BYD (Diversions)**	**Monthly Total**			334.5	176.3	242.9	79.1	87.6	208.9	406.7	121.4	73.7	0.0	**1731**
BYD (Bywash)**	**Monthly Total**	576.6	386.1	250.9	604.8	613.1	1073.7	1061.7	452.8	240.2	217.8	294.9	388.5	**6161**
MIRMCN (41010955)	**Mean**	56.7	32.0	32.8	73.4	96.0	76.7	73.0	53.9	45.4	30.8	45.2	32.6	54
	Median	50.3	29.1	29.7	74.7	90.7	73.6	73.0	53.0	43.7	30.1	41.5	32.5	47
	Inst.Max	90.8	58.7	51.1	129.0	186.0	132.0	86.0	72.3	65.6	39.0	66.7	50.5	186
	Inst.Min	29.3	13.9	16.8	29.0	65.5	58.6	56.9	40.2	28.3	21.5	28.8	19.0	14
	Monthly Total	1760.0	990.0	985.0	2270.0	2880.0	2380.0	2260.0	1510.0	1410.0	925.0	1400.0	978.0	**19748**
DRAINS														
MDJWE (410174)	**Mean**	[47.6]	[ ]	[31.6]X	62.8X	72.7X	53.9	57.7	39.8	32.8	31.5	32.5	[18.3]	41
13.9 days missing data	**Median**	[46.4]	[ ]	[30.1]X	60.5X	72.3X	47.3	56.8	38.9	33.0	31.6	30.7	[13.9]	36
	Inst.Max	[71.9]	[ ]	[43.0]X	152X	244X	146.0	71.1	58.5	63.6	43.6	48.1	[41.6]	146
	Inst.Min	[21.8]	[ ]	[25.3]X	19.2X	30.9X	33.5	47.7	29.7	24.5	19.9	21.2	[12.0]	20
	Monthly Total	[999]	[ ]	[505]X	1950X	2180X	1670.0	1790.0	1110.0	1020.0	946.0	1010.0	[385]	**7546**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	[23.9]	[0.0]	32.5	42.0	[52.5]	[53.4]	65.0	48.8	[37.1]	[ ]	[30.5]	4.7	39
56.8 days missing data	**Median**	[21.4]	[0.0]	43.3	43.3	[53.8]	[53.4]	61.6	48.5	[37.3]	[ ]	[33.4]	2.9	43
	Inst.Max	[45.7]	[0.0]	64.9	71.4	[58.8]	[61.7]	93.7	65.5	[58.5]	[ ]	[46.8]	28.7	94
	Inst.Min	[2.5]	[0.0]	0.0	25.3	[40.7]	[46.1]	40.7	31.3	[24.3]	[ ]	[13.6]	0.0	0
	Monthly Total	[430]	[0]	976.0	1300.0	[315]	[694]	2010.0	1370.0	[1000]	[ ]	[793]	142.0	**5656**
														***
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	7.5	6.3	8.7	7.1	2.5	0.1	0.2	0.2	0.3	0.3	0.5	0.7	3
	Median	7.2	7.1	7.4	6.4	2.3	0.1	0.2	0.2	0.3	0.4	0.4	0.7	1
	Inst.Max	14.3	10.5	14.2	12.2	7.6	0.2	0.3	0.4	0.4	0.4	0.7	1.0	14
	Inst.Min	5.4	0.0	5.3	3.3	0.0	0.0	0.2	0.2	0.2	0.3	0.3	0.4	0
	Monthly Total	231.0	194.0	261.0	222.0	75.0	3.0	7.0	7.0	10.0	10.0	15.0	20.0	**1055**
GMSRR (41010921)	**Mean**	0.6	1.4	[0.6]X	[1.1]X	[0.7]X	0.6	0.4	0.7	0.7	0.5	0.5	1.0	1
	Median	0.1	1.3	[0.5]X	[0.4]X	[0.6]X	0.3	0.5	0.8	0.7	0.3	0.2	0.2	0
	Inst.Max	1.6	2.7	[2.1]X	[5.0]X	[2.0]X	4.5	1.0	1.2	1.2	3.0	2.4	4.0	5
	Inst.Min	0.0	0.6	[0.0]X	[0.1]X	[0.0]X	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Monthly Total	18.0	43.0	[12]X	[24]X	[11]X	19.0	14.0	20.0	22.0	15.0	15.0	29.0	**195**
LAG (41010940)	**Mean**	1.0	0.1	2.6	1.0	1.2	0.3	0.6	0.7	1.4	0.6	0.1	5.5	1
	Median	0.3	0.1	1.9	0.8	0.5	0.2	0.4	0.6	1.4	0.1	0.0	5.3	0
	Inst.Max	6.1	0.8	9.4	3.9	8.5	2.0	1.3	1.6	3.8	3.8	0.3	12.5	13
	Inst.Min	0.0	0.0	0.3	0.2	0.1	0.0	0.2	0.2	0.1	0.0	0.0	2.1	0
	Monthly Total	30.0	5.0	77.0	31.0	35.0	10.0	18.0	20.0	45.0	18.0	2.0	164.0	**455**
ROCUDG (41010005)	**Mean**	0.5	0.1	2.7	0.6	0.1	0.7	0.2	0.3	0.1	0.2	0.5	0.1	1
	Median	0.4	0.1	0.7	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0
	Inst.Max	1.2	0.5	20.9	3.4	0.7	3.5	1.1	2.3	0.2	0.5	1.4	0.2	21
	Inst.Min	0.3	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0
	Monthly Total	15.0	4.0	81.0	17.0	4.0	21.0	7.0	8.0	3.0	5.0	15.0	2.0	**182**
TOTAL														**1887**
SWAMPS														
WS*	**Monthly Total**				0.7	1.9	1.1	2.9	2.0	4.5	3.3			16
FLOODWAY														
**MIRFLD	**Monthly Total**	0.0	ND			ND								
EXTRA SITES FOR DNR														
WWO**t		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	457.0	782.3	
BBO**#														
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.6	0.9	1.8	1.9	1.7	[1.5]	[ ]	[1.7]	2.9	[0.5]	1.1	0.1	1
66.8 Days missing data	**Median**	0.0	0.0	1.5	1.6	1.3	[1.5]	[ ]	[1.8]	2.4	[0.0]	1.3	0.0	1
	Inst.Max	4.3	7.5	3.9	4.4	3.8	[2.7]	[ ]	[3.0]	5.8	[1.5]	1.9	0.7	8
	Inst.Min	0.0	0.0	0.4	0.8	0.4	[0.6]	[ ]	[0.7]	0.0	[0.0]	0.0	0.0	0
	Monthly Total	19.0	27.0	53.0	59.0	52.0	[25]	[ ]	[47]	89.0	[4]	34.0	2.0	**335**

A.2 Water Supply and Drainage Management

Monthly Salt Load Data (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
														***
DCCUD (41010713)	**Mean**	0.1	0.0	0.9	0.4	0.3	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0
	Median	0.0	0.0	0.7	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0
	Inst.Max	0.5	0.0	3.3	2.2	1.7	0.7	0.2	0.1	0.7	0.0	0.2	0.1	3
	Inst.Min	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	Monthly Total	4.0	0.0	27.0	11.0	10.0	4.0	1.0	1.0	6.0	0.0	1.0	1.0	**66**
														***
DCWIDG (41017001)	**Mean**	0.1	0.0	0.1	0.1	0.3	0.5	0.6	0.2	0.4	0.3	0.1	0.1	0
	Median	0.1	0.0	0.0	0.0	0.1	0.1	0.4	0.1	0.3	0.3	0.1	0.0	0
	Inst.Max	0.4	0.0	0.8	0.5	2.9	7.4	3.7	0.7	1.1	1.0	0.6	0.5	7
	Inst.Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0
	Monthly Total	2.0	0.0	4.0	2.0	9.0	17.0	18.0	5.0	12.0	10.0	4.0	2.0	**85**
														***
DCCENT (410172)	**Mean**	0.0	0.2	0.5	1.1	1.3	1.8	0.2	1.1	0.6	0.5	0.6	0.2	1
	Median	0.0	0.0	0.3	0.8	1.0	1.0	0.0	1.1	0.5	0.3	0.3	0.2	0
	Inst.Max	0.0	1.2	2.8	3.5	4.8	6.7	2.5	3.4	2.4	3.4	2.9	0.8	7
	Inst.Min	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0
	Monthly Total	0.0	6.0	15.0	34.0	38.0	56.0	5.0	32.0	20.0	15.0	19.0	7.0	**247**
BID2 (41010717)	**Mean**	0.0	3.9	19.7	17.0	14.5	10.6	13.1	8.5	6.5	3.4	3.2	0.0	8
	Median	0.0	0.0	20.7	16.9	15.1	10.6	13.3	8.5	6.5	3.4	3.0	0.0	8
	Inst.Max	0.0	22.2	37.1	32.5	23.8	14.4	17.5	10.9	9.0	5.0	6.2	0.0	37
	Inst.Min	0.0	0.0	8.3	5.2	5.1	7.6	9.1	4.7	3.9	1.7	0.0	0.0	0
	Monthly Total	0.0	122.0	592.0	526.0	436.0	330.0	407.0	238.0	200.0	102.0	100.0	0.0	**3053**

Sources: Thiess Services and MI Irrigation Services
Notes: See Table 2.2.h.

A.2.2(4) Drainage reuse

Murrumbidgee Irrigation endeavours to recover and to reuse water within its system. Table 2.2.j shows that the total amount of water captured for reuse during the 2005/06 season was almost 104GL. This is made up of escape flows, off-farm drainage and rainfall run off in the MIA.

Reuse occurs extensively throughout the MIA supply and drainage system. South, the Sturt Canal system (which also supplies Benerembah) is augmented by Yanco and Gogeldrie Main Southern Drains and in the north, Lake Wyangan augments the Lake View Branch Canal system. The Benerembah Irrigation District and the Wah Wah Irrigation Districts are to a large extent supplied by Mirrool Creek Flows which are diverted at Bray's Dam and Willow Dam.

Table 2.2.j: Reuse quantities (ML) for the MIA and Districts 2005/06

Site	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Bray's Dam Diversion to Benerembah	0	1,440	765	1,385	600	550	1,360	2,775	1,020	840	0	**10,735**
Mirrool Creek Licensed Diverters (DNR)	0	615	891	877	662	1,017	697	754	258	891	0	**6,662**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	225	150	20	50	310	655	115	95	420	0	**2,040**
Mirrool Creek to Wah Wah Main	1,210	6,055	10,540	13,090	19,165	20,500	10,945	11,460	12,400	8,985	510	**114,860**
Barren Box Storage to Wah Wah Main @ BBS Pumps	0	30	90	130	0	345	30	60	50	75	0	**810**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage Licensed Diverters (DNR)	0	0	0	0	0	0	0	0	0	0	0	**0**
Losses in Barren Box Storage	0	-30	-30	-120	40	-45	30	-60	-40	-75	-14	**-344**
YMSD Reuse												**7,609**
GMSD Reuse												**4,743**
Sub Total	1,210	8,335	12,406	15,382	20,517	22,677	13,717	15,104	13,783	11,136	496	**134,763**
Less: First Use Water Diversions	70	205	2,730	4,785	8,368	5,560	1,075	985	2,280	4,115	1,430	**31,603**
Plus: Lake Wyangan Pumps to Lake View Canal	0	60	195	225	45	0	35	15	60	40	0	**675**
TOTAL WATER CAPTURED	**1,140**	**8,190**	**9,871**	**10,822**	**12,194**	**17,117**	**12,677**	**14,134**	**11,563**	**7,061**	**-934**	**103,835**

Source: MI Irrigation Services
Note: 1 No July figures due to winter system close.
2 Figures for YMSD and GMSD provided by John Brennick, MI Customer Services, from drainage reuse meter readings

A.2.2(5) Water balance loss and gain

Table 2.2.k: Annual Water Balance Assessment MIA system (Gigalitres) 2005/06

Factor		1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Bench-mark	Median	Comment
Climatic												
Rainfall		537	590	416	288	253	353	270	367	400	386	CSIRO, BM data
Evaporation		1868	1750	1896	2032	2191	1998	1983	1935	1869	1947	CSIRO, BM data
Type of Year (% dry)		33	25	48	78	90	68	75	60	50	58	Look up table
Main Gross Data												
Gross Diversions	(1)	1036	819	1048	1142	960	862	826	1037	1154	987	MI data (11 year medians)
Total Deliveries	(2)	823	646	857	917	754	652	648	830	952	787	MI data (11 year medians)
Apparent Loss	(3)	213	173	191	225	206	210	178	207	202	201	(3)=(1)-(2)
Apparent Efficiency %		79	79	82	80	79	76	78	80	82	79	= (2)/(1)*100
Inevitable Real Losses												
Seepage from Channels		21	20	21	21	22	21	21	21	31	22	Based on % dry year
Evaporation from Channels		19	18	21	24	26	23	24	23	18	22	Based on % dry year
BBS + LW evaporation		31	29	34	39	21	11	4	15	35	24	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)		29	34	19	31	28	28	26	29	29	28	No benchmark in License
Leaks, Theft, misc.		10	10	10	10	10	10	10	10	5	9	Estimated
Subtotal		110	110	104	125	107	93	85	98	118	106	Inevitable Losses
System Flow Losses												
Yanco drainage to River	(4)	18	20	23	18	8	7	1	9	33	15	Old Bristol Rec. data
Floodway Releases		25	26	0	0	0	0	3	2	48	12	MI data
Subtotal		43	46	23	18	8	7	4	10	81	27	Flow Losses
Total True Losses	(5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**199**	132	Inevitable + Flow Losses
Unexplained Losses		115	90	120	128	106	91	91	116	133	110	Est (14% of deliveries)
Total System Losses	(6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**332**	242	True Losses + Errors
Assessed System Gains	(7)	55	74	56	47	15	-19	2	18	130	42	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows												
Willow Dam Flows		174	148	161	135	90	98	100	124	160	132	MI data
Bray's Dam Diversions		26	25	21	28	25	15	17	11		21	MI data
Benerembah pumps		9	4	7	7	3	4	2	2		5	MI data
Landholders pumping (incl 22C)		7	8	7	8	4	5	5	7	67	13	MI data
Total Drainage Mirrool Creek	(8)	216	186	196	178	122	122	124	144	227	168	Sum
Total Drainage	(9)	234	206	219	196	130	129	125	152	260	183	(9)=(4)+(8)
Reconciliation												
Special Diversions WWID	(10)	0	0	0	0	0	0	4	2	0	1	MI data
Reduction in BBS	(11)	-17	-4	-15	-15	-24	-4	0	0	-20	-11	MI data
Corrected Drainage To MC	(12)	216	186	196	178	122	122	120	142	227	168	(12)=(8)-(10)
Corrected Total System Supply	(13)	1074	889	1089	1174	951	839	828	1055	1264	1018	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC	(14)	25	40	28	26	12	-16	2	13	57	21	(14)=(7)/(12)*100
System Efficiency	(15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**84**	87	(15)=((13)-(5))/(13)*100
BBS Fill Factor		1.00	1.00	1.00	1.00	0.45	0.20	0.00			0.66	
Lake Wyangan Fill Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Combined Fill Factor		1.00	1.00	1.00	1.00	0.51	0.28	0.10			0.70	

A.2 Water Supply and Drainage Management

In 2005/06 irrigation diversions from the Murrumbidgee River was 1037 GL with 830 GL being recorded deliveries (sales). This left an apparent loss of 207 GL which meant that Murrumbidgee Irrigation's *apparent* operational [1]efficiency was approximately 80%.

Of that loss, the *true loss* was estimated at about 109 GL. This included losses due to channel seepage, evaporation during storage and conveyance as well as diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 116 GL. This means that the likely calculated assessed gains were 18 GL (real total system loss).[2]

In order to assess Murrumbidgee Irrigation's operational efficiency previous reporting has subtracted the true losses from the corrected total system supply (taking into account diversions plus water already in BBS storage[3] plus the assessed system gains) to give an estimate of operational efficiency. The limitation to this approach is that substantial unaccounted losses due to the presumed underestimation of flow by dethridge wheels has not been included in the calculations. Despite this, significant improvements in measuring flow and preventing water loss have been provided and will continue to be provided by Murrumbidgee Irrigation in implementing the rollout of more efficient metering and the IHS project.

Despite this limitation, the approach has been continued this year to ensure consistency between annual reporting protocols.

The drainage component identifies flow discharged to Mirrool Creek as well as that flow which was reused at Benerembah, diverted to Willow Dam for downstream irrigation or to the Lake View Branch Canal. The reconciliation is carried out to deduct that flow which was deliberately diverted to the floodway or which entered the system up stream from Mirrool Creek. It provides a more accurate picture of what the drainage component actually is.

A comparison of the benchmark year and the current year show an improvement to system efficiency from 84% to 90%.

Limitations:
The limitations, assumptions and issues associated with the water balance are currently being addressed by Murrumbidgee Irrigation.

[1] 'Operational' in this sense means the capacity to effectively sell (receive, hold and deliver to the farm gate) 100% of water which is taken from the Murrumbidgee River and diverted to the MIA.
[2] Although rainfall has not been included specifically as a system gain it has been apparently accounted for in estimating true losses attributed to the 'type of year' (ie % wet year, % dry year or deviation from average).
[3] That is water already in the storage from the previous year 2004/05.

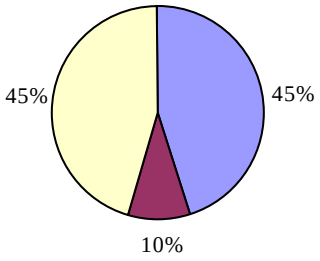
A.2.2(6) Crop statistics

Irrigated Crop Statistics

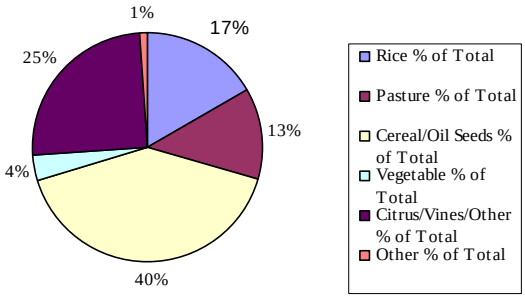
The following charts show the distribution of crops grown this year in comparison to last year (2004/05) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries to rice with a similar distribution to that of the baseline year. A significant change to baseline is that the deliveries to permanent plantings has increased from a 10% to 18% of total deliveries.

Figure 2.2.d: Distribution of irrigated crops – 1995/96, 2004/05 and 2005/06

Comparison of Crop Type by % ML delivered Baseline year 1995/96



Comparison of Crop Type by % ML delivered 2004/05



Comparison of Crop Type by % ML delivered 2005/06

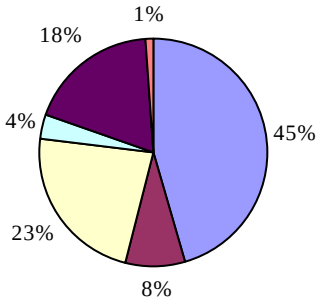


Table 2.2.l: Historical Deliveries to Major Crop Types

Year	Rice		Pasture		Cereal and Oil Seeds	
	Total (ML)	Rice % of Total	Total (ML)	Pasture % of Total	Total (ML)	Cereal/Oil Seeds % of Total
2005/06	355,254	45.4	65,878	8.4	181,641	23.2
2004/05	101,494	16.7	77,364	12.8	247,267	40.8
2003/04	221,732	34.6	63,960	10.0	182,940	28.6
2002/03	251,424	34.3	64,093	8.8	237,612	32.5
2001/02	469,513	52.0	85,556	9.5	184,253	20.4
2000/01	479,757	56.0	112,668	13.1	108,690	12.7
1999/00	394,224	61.2	54,159	8.4	68,366	10.6
1998/99	477,563	58.1	101,791	12.4	65,231	7.9
1997/98	489,363	50.1	179,246	18.3	126,247	12.9
1996/97	519,053	51.0	187,441	18.4	143,746	14.1
1995/96	446,917	51.4	185,931	21.4	87,725	10.1

Year	Vegetables		Citrus + Vines+ Other Fruits		Other Crops + Plantations	
	Total (ML)	Vegetable % of Total	Total (ML)	Citrus/Vines/Other % of Total	Total (ML)	Other % of Total
2005/06	27,588	3.5	142,025	18.2	9,481	1.2
2004/05	22,736	3.7	150,601	24.8	7,078	1.2
2003/04	16,504	2.6	132,866	20.7	22,519	3.5
2002/03	14,970	2.0	138,929	19.0	24,983	3.4
2001/02	17,989	2.0	122,884	13.6	23,403	2.6
2000/01	18,794	2.2	98,285	11.5	39,262	4.6
1999/00	12,013	1.9	75,108	11.7	40,060	6.2
1998/99	24,967	3.0	105,522	12.8	47,504	5.8
1997/98	19,714	2.0	115,200	11.8	47,176	4.8
1996/97	23,464	2.3	104,561	10.3	40,461	4.0
1995/96	32,348	3.7	87,983	10.1	28,905	3.3

Table 2.2.m: Summary of deliveries and areas for the major crop groupings during 2005/06

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)	Net Crop Evapotranspiration (ML/ha)
Rice	27,437	355,254	12.9	11.3
Winter Cereal	48,506	117,116	2.4	n/a
Summer Cereal	4,997	36,908	7.4	n/a
Winter Pasture	10,321	35,282	3.4	n/a
Summer Pasture	5,458	30,596	5.6	n/a
Winter Oilseed	8,417	13,066	1.6	n/a
Summer Oilseed	2,426	14,551	6.0	n/a
Other Crops	756	30,434	n/a	n/a
Vegetable	3,862	27,588	n/a	n/a
Citrus	8,423	46,400	5.5	n/a
Vines	17,151	88,093	5.1	n/a
Other Fruits	1,953	7,532	n/a	n/a
Bulk Town Supply	n/a	12,821	n/a	n/a
Industrial	n/a	5,161	n/a	n/a
Stock & Domestic	n/a	8,779	n/a	n/a
Plantation	520	409	0.8	n/a
TOTAL		**829,990**		

Source: All figures provided by MI Irrigation Services and Corporate Office, except for rice figures, which are derived from Rice Environmental Monitoring database.

Notes: N/A = Not available due to data collection method.

- These figures do not include water for stock and domestic, industry, town supply and BBS surplus flows.
- The rice figure is potentially misleading as many farmers sow a winter cereal into rice stubble after harvest and make use of the sub soil moisture. When this sub soil moisture is not readily available for example on paddocks not sown to rice, crops are required to be irrigated and therefore this can result in more water use.

A.2.3 Chemical contingency

Murrumbidgee Irrigation works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

Murrumbidgee Irrigation undertakes an extensive water quality monitoring program for pesticides and other contaminates and incorporates immunoassay techniques like the ELISA field sampling program to detect molinate which is used as an indicator chemical to gauge the likelihood of chemicals in drainage water.

Apart from chemical sampling, Murrumbidgee Irrigation also undertakes nutrient sampling at sensitive locations like floodways, wetlands and designated river discharge sites. This occurs after certain storm events and at other times and places when the flow rate is greater than 5ML/day.

Murrumbidgee Irrigation does this because nutrient levels are related to flow conditions. During low flow conditions fine sediment, organic matter and nutrients accumulate in waterways and bind to sediments. The flow regime is important in how nutrients are managed in our network by impacting on the level of nutrient concentrations.

Additionally, Murrumbidgee Irrigation has been and will continue to be involved in research projects which provide new information and insights including recommending new techniques to improve and evaluate how water quality is impacted upon by what we do in our community.

One possibility for the future is to consider the possibility of developing a Stream Flow Management Plan (SFMP) for the Murrumbidgee Irrigation Area to examine how we holistically manage the drainage and

supply network. Although such plans are relevant for natural catchments they also have a place in an artificial catchment like an irrigation environment because objectives and issues are similar.

This process would clarify our objectives with stakeholders and examine issues and policies relating to drainage and supply such as managing flows (including environmental flows), managing water quality, fostering biodiversity etc.

Scheduled chemicals

Table 2.3.n shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the Department of Environment and Conservation.

Table 2.3.n: Scheduled chemicals in Murrumbidgee Irrigation's screening program

Chemical	Environmental Guidelines (µg/L)	OLD Notification Level (µg/L)	NEW Notification Level (µg/L)	OLD Action Level (µg/L)	NEW Action Level (µg/L)
Atrazine	2	2	**13**	10	**45**
Chlorpyrifos	0.001	0.001	**0.01**	0.005	**0.11**
Diazinon	0.0006	0.0006	**0.01**	0.003	**0.2**
Diuron	8	8	**1 ***	40	**5 ***
Endosulfan	0.01	0.05	**0.03**	0.1	**0.2**
Malathion	0.07	0.07	**0.05**	0.35	**0.2**
Metolachlor	8	8	**0.02 #**	40	**0.1 #**
Molinate	2.5	12.5	**3.4**	25	**14**
Simazine	10	10	**3.2**	50	**11**
Thiobencarb	1	1	**2.8**	5	**4.6**
Trifluralin	0.1	0.1	**2.6**	0.5	**4.4**

Source: Department of Environment and Conservation

Notes: * Notification and action levels for diuron were set at 1.0µg/l and 5.0µg/l respectively. These interim levels were negotiated with Murrumbidgee Irrigation Limited to allow a phased introduction of the new levels and for industry to develop and refine management options for future use and management of diuron.

\# Please note that notification and action levels for metolachlor were reduced by 400%.

Chemical Contingency Plan for MIA

MI is required to have in place a Chemical Contingency plan to identify the processes that occurs when a chemical is detected above notification or action level.

The limiting factor with monthly pesticide sampling is the time elapse between when a sample is taken and when the results are made available to MI. In some cases where significant time periods have elapsed, no follow up of action level detection is possible.

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the Department of Environment and Conservation (DEC) by telephone within twenty-four (24) hours once the sampling results have been received by Murrumbidgee Irrigation.

2. Notify DNR within 24 hours of the results affecting the river sites once the sampling results have been received by Murrumbidgee Irrigation.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if Action Levels are exceeded at sites identified by Murrumbidgee Irrigation as resupply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

Response to DEC direction:

In the event that a DEC direction is received to restrict the discharge by an irrigator of irrigation waste water to the company drainage works, the company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.
2. Refuse to or discontinue the supply of water to the irrigator.
3. Undertake works to prevent the continuance of the problem.
4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 Groundwater Management

A.3.2 Reporting requirements

The following groundwater information was derived from Ary Van der Lely's report "*Shallow Groundwater Behaviour (Causes and Effects) in the MIA.* Report to 2006".

A.3.2(1) Groundwater monitoring and analysis

The groundwater conditions for September 2005 and the changes since baseline year 1996 and September 2004 are summarised in Table 3.2.a.

Table 3.2.a: Average depth to the watertable at September 2005 compared to 2004 and baseline year 1996 *

Area	1996 Deep Aquifer	2004 Deep Aquifer	2005 Deep Aquifer	1996 Shallow Aquifer	2004 Shallow Aquifer	2005 Shallow Aquifer
Yanco	2.69	4.53	4.74	2.11	3.43	3.76
Mirrool	2.24	4.40	4.91	1.52	3.05	3.48
Benerembah	7.76	10.79	11.46	2.21	3.56	3.87
Wah Wah	13.12	13.47	13.95	N/A	N/A	N/A
MIA u/s BBS	4.4	6.79	7.24	1.88	3.21	3.53

Note: * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable.

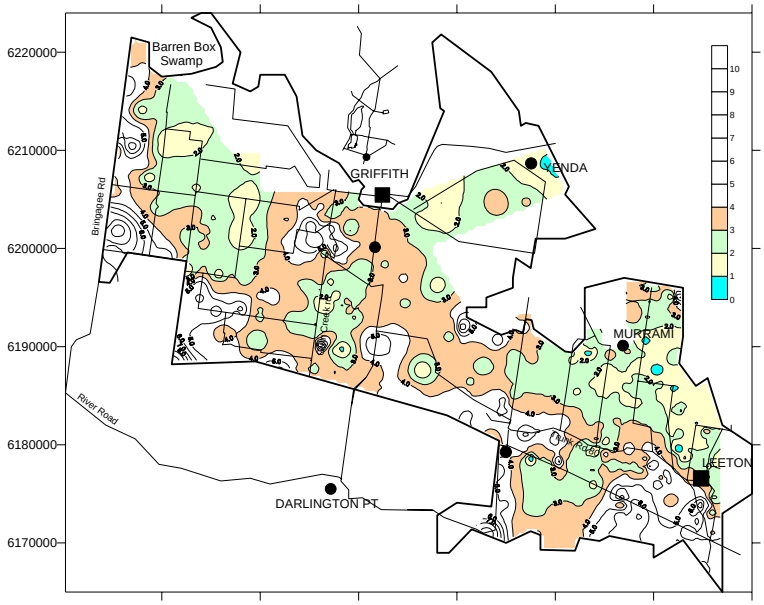
The shallow and deeper piezometers have been re-categorised based on a recommendation in the 2004 Annual Groundwater Report, which considered that the most important aquifer affecting sustainability issues is the most shallow (watertable) aquifer, but that this zone contained too few piezometers in the official piezometer list to produce an optimal analysis. About 160 piezometers were transferred from the "deep" to the "shallow" category.

The average depth to the water table fell to their lowest values during September 2005, to an average depth of 3.53 metres, a drop of 0.32 metres since September 2004. The deeper Shepparton aquifers showed similar behaviour. The average for the MIA declined from 6.79 metres during September 2004 to 7.24 metres during September 2005. A drop of pressure level in the Calivil Formation was also recorded, to an average of 16.24 metres beneath the MIA.

Currently, an optimisation model is used to determine the main contributing factors to groundwater behaviour. As this method is based on statistical principals, the reliable of the number produced by the model are not fully accurate. We are investigating different methods of analysis and also seek to develop a more robust model through research and development in partnership with CSIRO. Based on the current model, rice recharge, groundwater evaporation, deep leakage, rainfall recharge, autumn irrigation recharge and channel seepage are the largest factors influencing groundwater change.

The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. Small areas where the groundwater was within 2 metres from the surface stand out. These areas presently are confined mostly to the Murrami/Koonadan area, near Gum Creek Road and several other pockets in Mirrool and Benerembah.

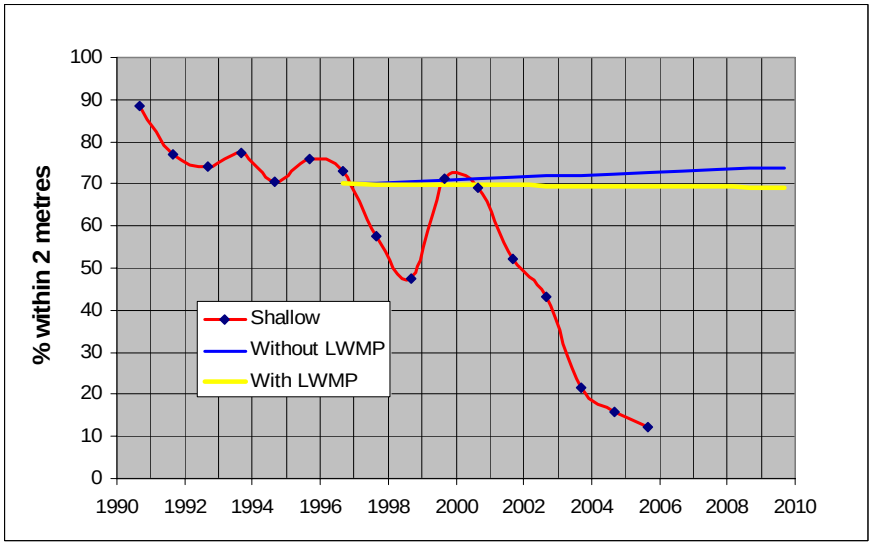
Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable)



The area with groundwater within 2 metres from the surface dropped from 16% at September 2004 to 12% at September 2005. An upswing to 23% however was noted for March 2006. Due to the redistribution of shallow piezometers, the figures reported in the previous LCR have now been adjusted. The September 2005 figures are the lowest recorded in recent times.

The performance of areas within 2 metres for the last few years relative to the early 1990's and the Land and Water Management Plan 'Without Plan' and 'With Plan' scenarios are shown at Figure 3.2.b.

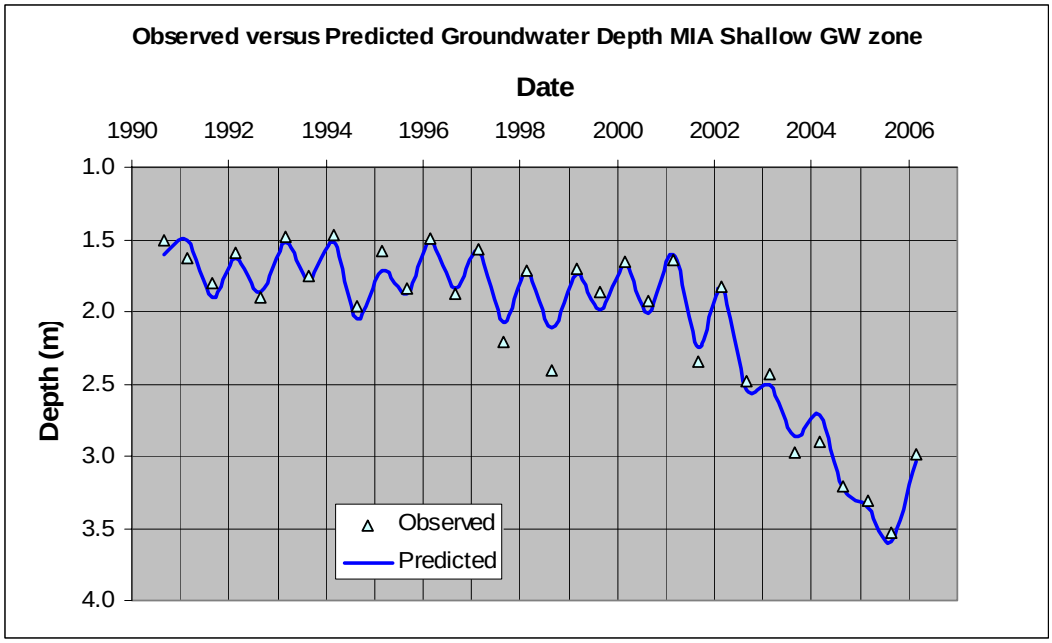
Figure 3.2.b: Area with watertable within 2 metres, September 1990 to 2005 relative to LWMP assessment benchmarks (which commenced 1997)



The seasonal variation in groundwater behaviour was assessed by calculating groundwater depth averages for the MIA and seven sub-districts for every March and September, from 1990 to 2006. The point values of Figure 3.2.c show the pattern of behaviour. The variation in levels between March and September and vice versa represents the volume of net recharge every six months to the groundwater system. Recharge occurs when water is added to the groundwater system and discharge occurs when water leaves the groundwater system. Net recharge represents all contributing recharge and discharge

factors. Most of these factors vary between seasons and annually, for instance weather, irrigation volumes, rice areas, and deep leakage.

Figure 3.2.c: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



Optimisation techniques were used to analyse the variation of each factor contributing to the groundwater balance. The aim was to discover which recharge and discharge factors have the most impact on the groundwater balance.

In recent years recharge from irrigation has declined more than the factors contributing to groundwater discharge, resulting in the drop in groundwater levels.

Other findings of the groundwater report are:

- The data capture of piezometers has been satisfactory and better than that required by the Water Management and Works License IC-5, Environmental Management Conditions.
- At present there are no issues with groundwater levels adjacent to the MIA, in the floodway of downstream Mirrool Creek, the Lake Wyangan area and the Wah Wah district.
- There has not been any noted or observed event of groundwater contamination over the 2005/06 period.

A.3.2(2) Wah Wah groundwater and Mirrool Creek flooding

In respect to the Lower Mirrool Creek Floodway, Table 3.2.b shows that most piezometers have changed very little since 1996. Bores 3345 and 3388 show the largest drops. There have been no flood events in the Lower Mirrool Creek since the early 1990's.

Table 3.2.b: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway

Bore-ID	X-cma	Y-cma	Depth	1/3/96	1/9/96	1/3/00	1/9/02	1/9/03	1/9/04	1/3/05	1/9/05	1/3/06
G3388	344820	6225460	14.5	8.85	7.07	10.35	10.71	11.12	11.33	11.44	11.82	11.75
G3389	322800	6231850	18.6	17.40	N/A	17.02	17.16	16.25	17.31	17.37	17.52	17.42
G3391	360100	6204100	16.0	13.77	13.70	13.90	13.89	14.03	14.12	14.15	14.47	13.41
G3392	326300	6231250	26.0	17.90	17.81	17.85	17.94	17.95	18.08	18.18	18.23	18.14
G3345	343633	6224050	25.0	14.08	14.00	14.45	14.65	14.97	15.28	15.46	15.63	15.37
G3337	346300	6227100	22.0	16.32	16.16	16.45	16.40	16.82	17.08	17.17	17.52	17.24

Note: All figures indicate depth to watertable.

It is noted that some shallow piezometers in the western part of the Floodway zone have been destroyed.

A.3.2(3) Groundwater volumes and salt loads extracted from tile drains and pump sites

Tubewells

There are a number of tubewells installed by previous government departments and now operated in the MIA to provide drainage to horticultural areas, principally in the Yanco area.

Table 3.2.c shows a steady decrease in the salt load from year to year since the 1997/98 season. During the 2005/06 season, the discharge increased slightly while the salt load decreased, indicating a drop in salt concentration of the discharge.

Table 3.2.c: Groundwater volumes and salt loads extracted from tubewells

Name	2005/06 Discharge (ML/year)	2005/06 Salt Load (T/year)	2004/05 Discharge (ML/year)	2004/05 Salt Load (T/year)	1997/98 Discharge (ML/year)	1997/98 Salt Load (T/year)
Five Bridges	758	330	737	617	1,059	1,016
Gil Gil	330	454	457	796	631	1,231
Yanco West	297	373	221	220	821	1,232
South Leeton	881	1,497	802	1,370	1,325	2,067
Baulch's	308	134	238	143	694	541
Wamoon	440	250	380	273	945	681
East Wamoon	887	557	552	368	-	-
TOTAL	**3,902**	**3,595**	**3,387**	**3,787**	**5,475**	**6,768**

Source: MI Electrical Services, MI Environmental Services

Tile Drains

Of the 20 flow meters permanently attached to tile drainage outlets reported for the 2004/05 season, five have been decommissioned or regularly unused due to removal of pumps or installation of drip systems. Of the 15 farms with flow meters, 13 with tile drainage outlets discharged a total drainage volume of 202 ML with an estimated total salt load of 230 tonnes.

A.3.2(4) Groundwater accession control targets and rice environmental monitoring

Groundwater accession control target

The rice water use target is a seasonally adjusted figure, calculated from weather in Hanwood and Hay. The target is calculated by summing the evapotranspiration from 1 October through to 28/29 February and subtracting the rainfall over the same period. The resulting figure is an estimate of the irrigation requirement. We further allow for 4 ML/ha for filling up the profile, absorb the system losses from the farm outlet to the field and some percolation. During the 2005/06 season, the target has been recalculated using true sowing and physiological maturity date in some cases. This was done because many rice growers sowed late, which means crops were still growing in March. March 2006 was a higher water use month than October 2005.

The Rice Water Use Target for 2005/06 was 15.3 ML/ha with the target set at 15.9 ML/ha for the Wah Wah Irrigation District, due to higher evapotranspiration rates.

Rice water use and rice growing practices

The simple rice water consumption figures, as presented in Table 3.2.d, shows the effects of the drop in groundwater levels and the extremely dry soil profiles since the commencement of the drought during the 2002/03 season. Relatively, more crops exceeded the seasonal target than before the drought. In order to take into account these severe conditions, one extra megalitre per hectare was allowed on rice paddocks that had no previous history of high usage. All rice growers whose crop exceeded the target were sent a notification with a survey form to explain their water use. Some growers were asked for further explanation of their water use. As a result of this interview process, 400 hectares of rice ground will require EM31 surveys to check suitability for rice growing.

Table 3.2.d: Summary of rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)								
Irrigation Area or District	**Total Rice Area (ha) 2005/06**	**Total Water to Rice (ML) 2005/06**	**2005/06**	**2004/05**	**2003/04**	**2002/03**	**2001/02**	**2000/01**	**1999/00**	**1998/99**	**1997/98**
Yanco	9,102	114,579	12.6	13.1	13.3	14.1	12.0	11.2	11.3	11.3	11.8
Mirrool	7,962	100,875	12.7	12.9	13.2	14.0	12.3	11.2	10.6	12.6	12.5
Benerembah	7,993	103,151	12.9	12.8	13.3	14.0	13.1	11.1	10.4	15.3	15.8
Tabbita	320	4,252	13.3	14.1	14.6	15.5	12.3	13.3	10.7	15.9	11.5
Wah Wah	1,874	25,248	14.0	11.9	12.4	14.4	14.3	13.7	11.8	14.6	13.9
Kooba *	295	3,836	13.5	15.2	14.8	16.2	*	*	*	*	*
Total/average	27,546	351,941	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**	**10.9**	**12.9**	**13.0**
Target			15.3	15.0	15.0	17.3	15.3	14.2	13.2	15.4	16.0
Simple WUE			88%	**85%**	**83%**	**94%**	**90%**	**89%**	**84%**	**88%**	**92%**

Sources: REM database, water use table as at 12 October
MI Environmental Services
Note: * Kooba's rice water use was previously calculated as part of Mirrool

Rice hydraulic loading

There were no rice hydraulic loading limit exceedences last year, as shown in Table 3.2.e below. Murrumbidgee Irrigation has a system in place using rice farm plans which allows rice growers to vary their rice entitlement between years as long as the average over 3 to 5 years is not exceeded. This system is being updated for the 2006/07 season.

Table 3.2.e: Summary of rice area exceedences

Area	2005/06 No. of breaches	2005/06 Area (hectares)	2004/05 No. of breaches	2004/05 Area (hectares)	2003/04 No. of breaches	2003/04 Area (hectares)
Yanco	0	0	0	0	1	1.3
Mirrool	0	0	0	0	1	3.1
Benerembah	0	0	0	0	3	6.3
Tabbita	0	0	0	0	0	0.0
Wah Wah	0	0	0	0	0	0.0
Total	**0**	**0**	**0**	**0**	**5**	**10.7**

Source: MI Environmental Services

Estimated Groundwater Accessions

CSIRO Land and Water researchers (Dr Shahbaz Khan, Senior Research Scientist, Groundwater Hydrologist, Tariq Mahmood Rana, Hydrologist and Jason Carroll, Research Technician) have provided the following process and estimates for groundwater accessions. The following steps were used to estimate recharge under rice for different areas within the MIA.

1. Groundwater condition maps were developed at the start of Year 2005/06 using SURFER software. This was necessary to understand spatial minimum, median and maximum groundwater depths in each of the zones.
2. Actual rainfall and ET for 2005/06 season were entered into SWAGMAN Farm on a monthly basis. This was necessary to determine the net crop water requirements.
3. Using a water balance of the soil profile, crop water uptake and groundwater conditions an estimation of total recharge to groundwater was made for minimum, median and maximum groundwater depths. This step was accomplished using estimates of average irrigation levels of rice.

Table 3.2.f: Rice Recharge for 2005/06

Irrigation Area/District	Total Rice Area (ha)	Total Water Applied to Rice (ML)	Minimum Recharge (ML/ha)* based on 75%	Median Recharge (ML/ha)* based on 50%	Maximum Recharge (ML/ha)* based on 25%	Average Rice Water Use (ML/ha) **
Yanco	9,100	116,480	0	0.45	0.91	12.8
Mirrool	7,949	101,747	0	0.26	0.78	12.8
Benerembah	7,963	108,297	0	0.85	1.52	13.6
Tabbita	320	4,352	0	0.04	0.35	13.6
Wah Wah	1,874	26,236	0.57	1.31	1.71	14.0
Kooba	295	4,042	0.38	0.81	1.18	13.7
Total	**27,502**	**361,164**				**13.1**

* Minimum recharge is based on the level whereby 75% of the piezometers read at that level or lower, average and maximum recharge is based on the level whereby 25% of the piezometers read at that level or lower and median recharge is based on the level where 50% of piezometers read at that level or lower. Minimum, median and maximum groundwater depths in these regions for 2005/06.

** Based on preliminary figures made available to CSIRO on 12 Sept 2006. Minor alteration occurred as reported in Table 3.2.d.

Table 3.2.g: Net Recharge based on all irrigation landhuse

Irrigation Area/District	Net Recharge (ML/ha) 2005/06	Net Recharge (ML/ha) 2004/05
Yanco	0.24	0.02
Mirrool	0.09	0.07
Benerembah	0.50	-0.09
Tabbita	0.02	0.86
Wah Wah*	N/C	N/C
Kooba	0.84	0.60
Average	**0.34**	**0.25**

Source: CSIRO Griffith
Notes: * Net recharge not calculated for Wah Wah as insufficient groundwater data exists. Rice groundwater accessions calculated on the basis of rice water use and groundwater depths extracted from limited data.

Rice growing policy

The Interim Rice Growing Rules were submitted in October 2005. Murrumbidgee Irrigation is waiting on endorsement.

A.3.2(5) Groundwater data format

A copy of "*Shallow Groundwater Behaviour (Causes and Effects) in the MIA. Report to 2006"* has been forwarded in electronic format.

A.3.2(6) Groundwater data reliably captured

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by staff of Murrumbidgee Irrigation at Leeton and at Griffith during March and September each year. The statistics for piezometers read during March 2005, September 2005, and March 2006, and three earlier dates are summarised in Table 3.2.h.

Table 3.2.h: Availability of piezometer readings for various dates and categories of piezometers.

Type of Piezometer	Listed in Database	Read Sep96	Read Sep00	Read Sep04	Read Mar05	Read Sep05	Read Mar06
Shallow (*1)	273	302	295	283	282	285	280
Shallow (*2)	144	163	164	161	161	162	161
Shallow (WW)	30	22	23	20	20	15	15
Total Shallow	**447**	**487**	**482**	**464**	**463**	**462**	**456**
Deep (*3)	359	363	362	332	330	330	325
Deep >35m	19	28	28	27	26	26	26
Deep (WW)	35	44	43	44	44	42	41
Total Deep	**413**	**435**	**433**	**403**	**400**	**396**	**393**

*1. Aquifer within 12 metres piezometers
*2. Piezometers of aquifers 12-18 metres which behave as if in the shallow zone
*3. Aquifers 12 – 35 metres, all piezometers not categorised as "shallow".

The shallow and deeper piezometers have been re-categorised based on a recommendation in the 2004 Annual Groundwater Report, which considered that the most important aquifer affecting sustainability issues is the most shallow (watertable) aquifer, but that this zone contained too few piezometers in the official piezometer list to produce an optimal analysis. About 160 piezometers were transferred from the 'deep' to the 'shallow' category (Table 3.2.h).

Despite a number of piezometers becoming lost over time, especially in the 2000 to 2004 period, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

The Yanco area contributes the most to the excess number of piezometer readings above licence requirements, hence if a rationalisation was to be considered, this is where the most culling is likely to take place.

In the Wah Wah District quite a few shallow piezometers have become lost. The lost piezometers have not yet been replaced. Most deep piezometers in Wah Wah have not been levelled, with the consequence that it is not possible to determine an AHD groundwater contour map ([4]) for that area.

The bi-monthly reading list used since 1995 has 108 piezometers, of which about 100 have been visited and read during the 2005/06 year. This is well in excess of the license requirement (60). The company has maintained this higher than necessary degree of monitoring to assist the calibration and development of an integrated groundwater model for the MIA.

Groundwater was last sampled for salinity during 2002 and this has been reported (Murrumbidgee Irrigation report by van der Lely, January 2003).

A.3.2(7) Groundwater data analysis

The Department of Planning and Natural Resources did not make a request for information this year.

A.3.2(8) Groundwater contamination

There were no known, or reported, groundwater pollution events during 2005/06.

[4] AHD = metres above sea level.

A.3.2(9) Groundwater — annual monitoring schedule

Table 3.2.i: Groundwater monitoring schedule – as required by DNR

No	Type	Description	Depth (metres)	Frequency	Location	
					Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.d	44
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.e	44
3	Map	Depth to pressure level	70-125	annual	Figure 3.2.f	45
4	Map	AHD of pressure level	12-35	annual	Figure 3.2.g	45
5	Map	Change in pressure level	5-12	annual	Figure 3.2.h	46
6	Map	Change in pressure level	12-35	annual	Figure 3.2.i	46
7	Map	Change in pressure level	70-125	annual	Figure 3.2.j	47
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.k	48-49
11	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.k	48-49
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.j	50-51
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.j	50-51
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.l	52
16	Map	Groundwater sub-districts	-	annual	Figure 3.2.m	53

Notes * *"It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable."* Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ West Hanwood and Wah Wah information is not available at the time of printing.

The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

Figure 3.2.d: MIA September 2005 – Depth to pressure level 5-12 metres

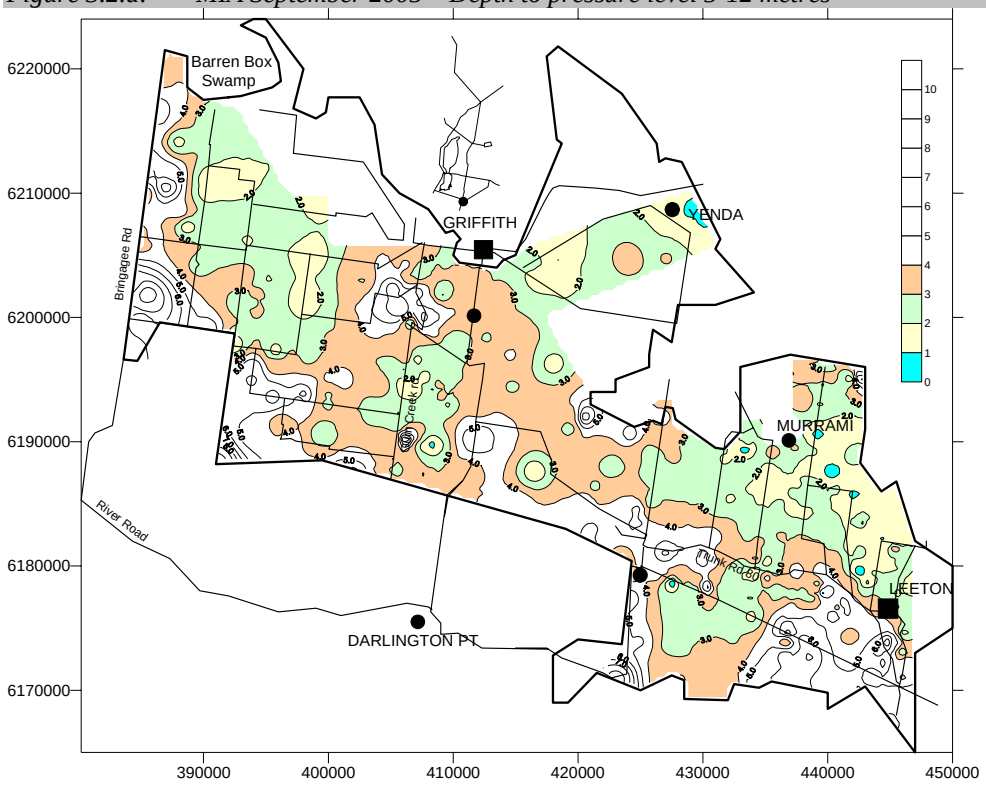


Figure 3.2.e: MIA September 2005 – Depth to pressure level 12-35 metres



Figure 3.2.f: MIA September 2005 – Depth to pressure level 70-120 metres

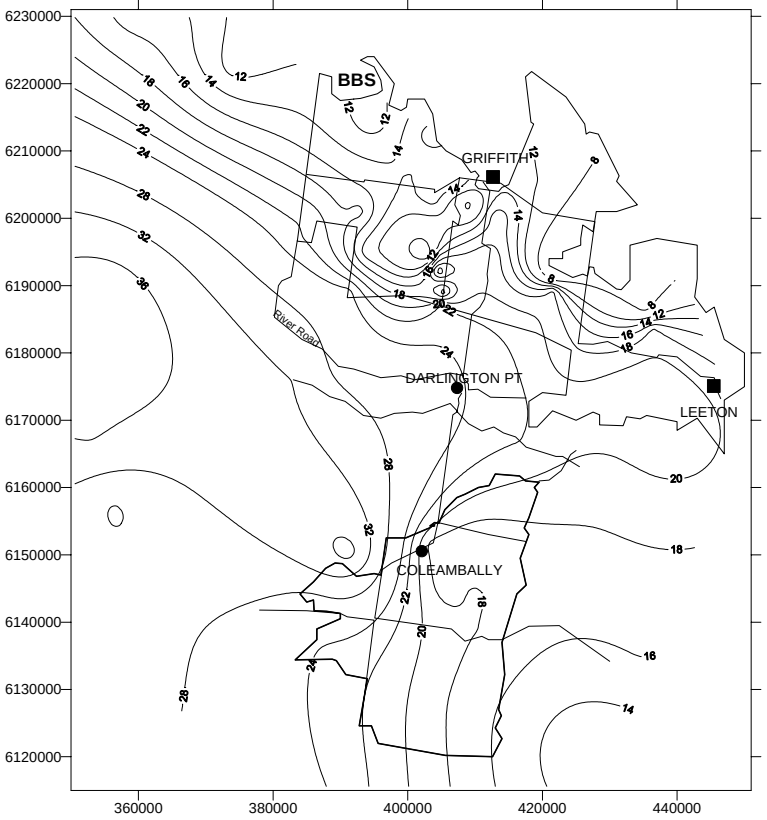


Figure 3.2.g: MIA September 2005 – AHD of pressure level 12-35 metres

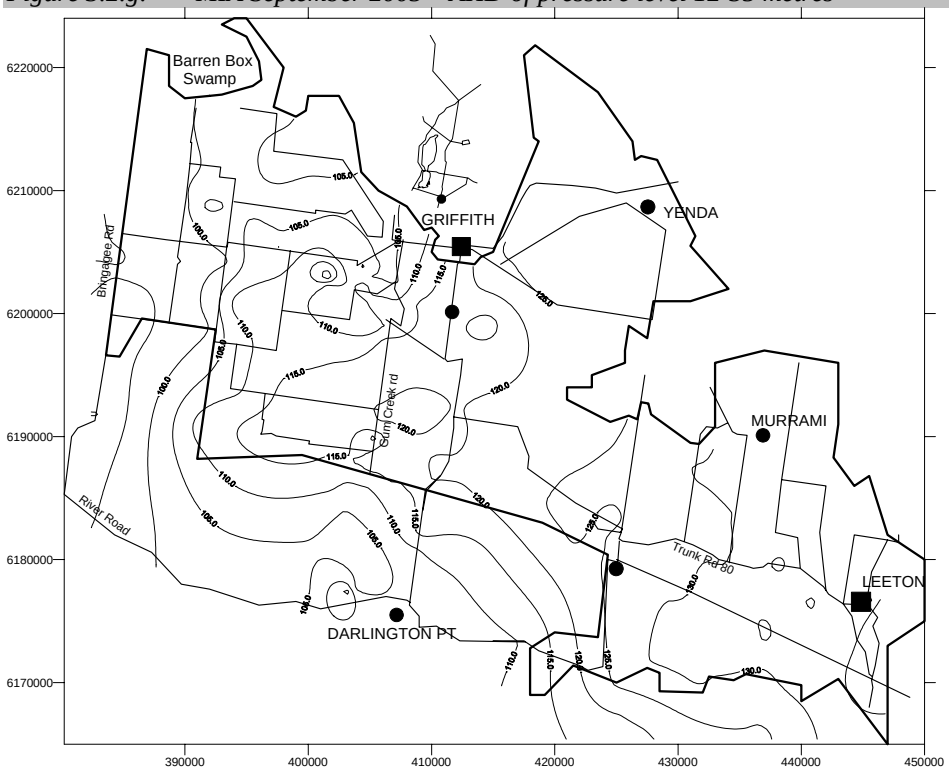


Figure 3.2.h: MIA 2000-2005 – change in pressure level 5-12 metres

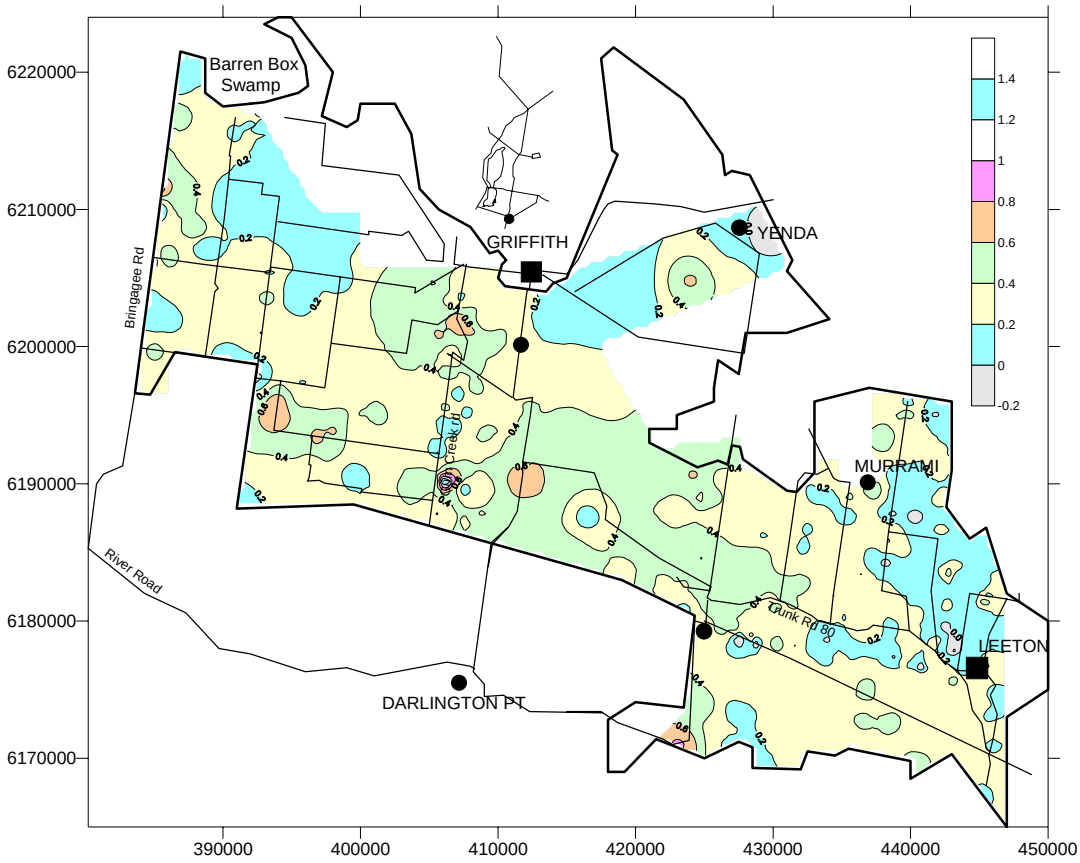


Figure 3.2.i: MIA 2000-2005 – change in pressure level 12-35 metres

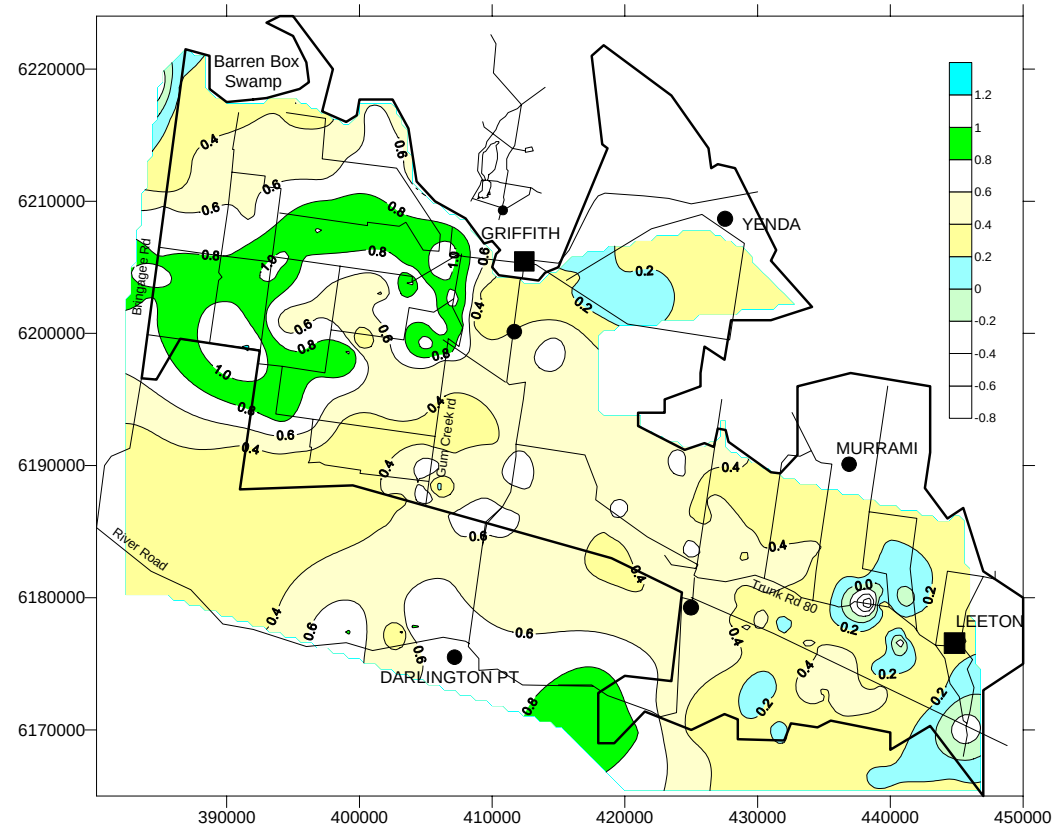


Figure 3.2.j: MIA 2000-2005 – change in pressure level 70-125 metres

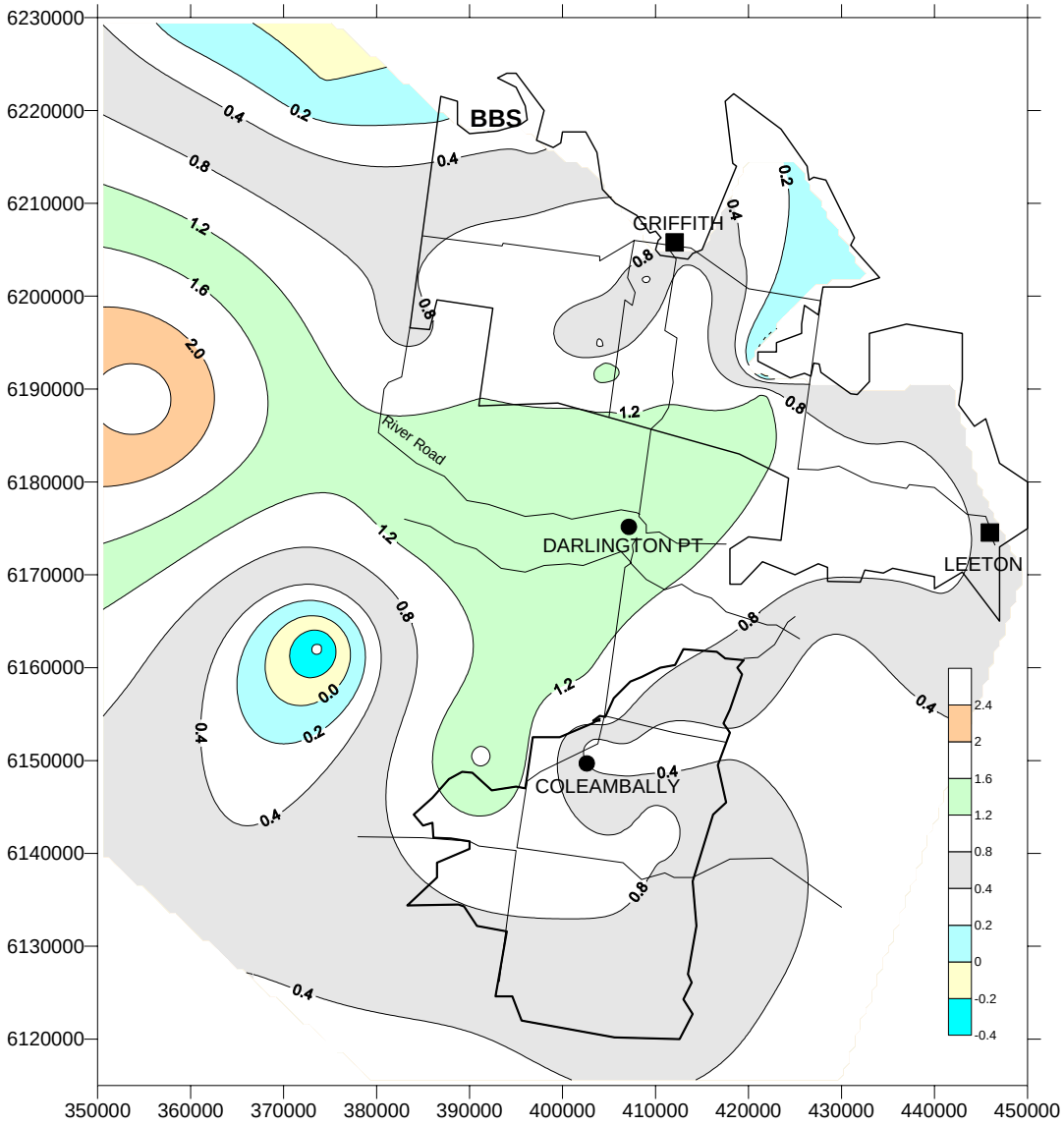
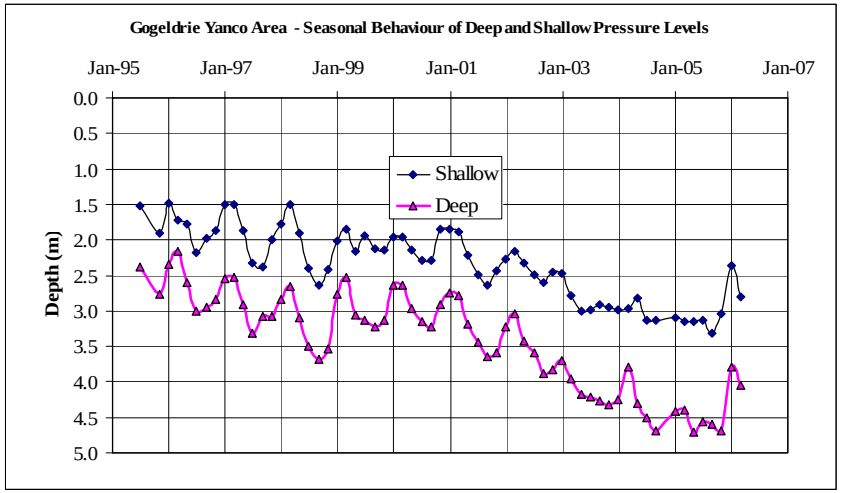
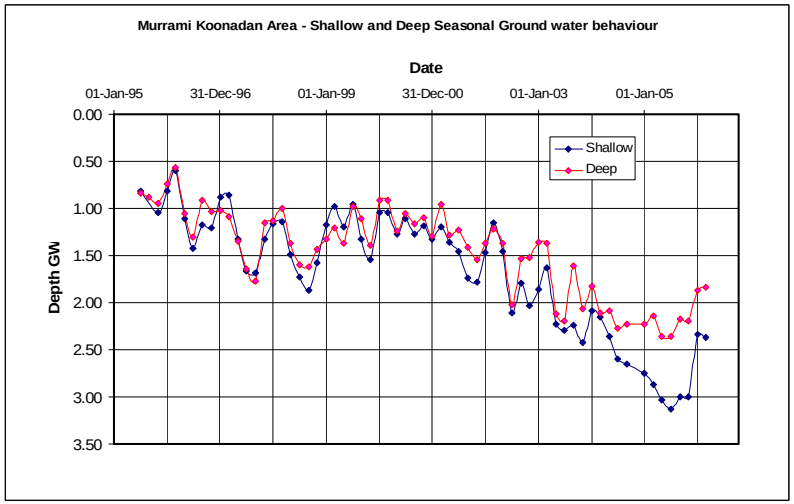
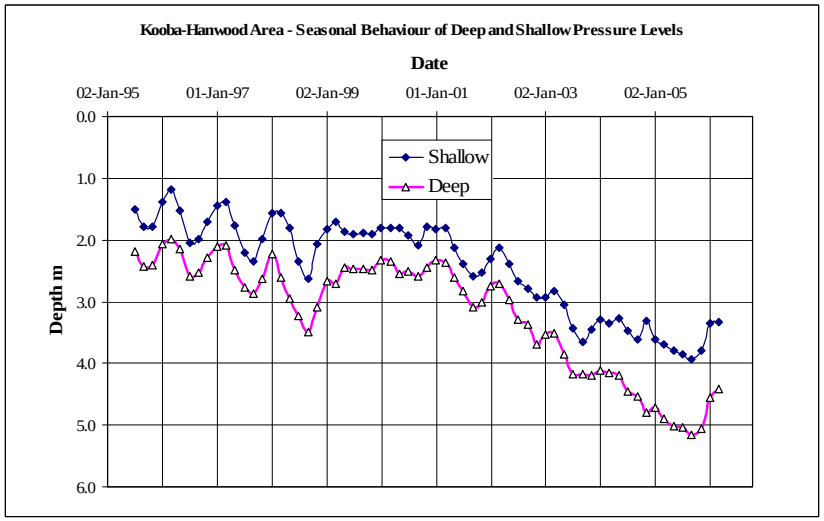


Figure 3.2.k: MIA September 2005 - Average seasonal behaviour of 8 sub-districts 5-12 metres and 12-35 metres ++







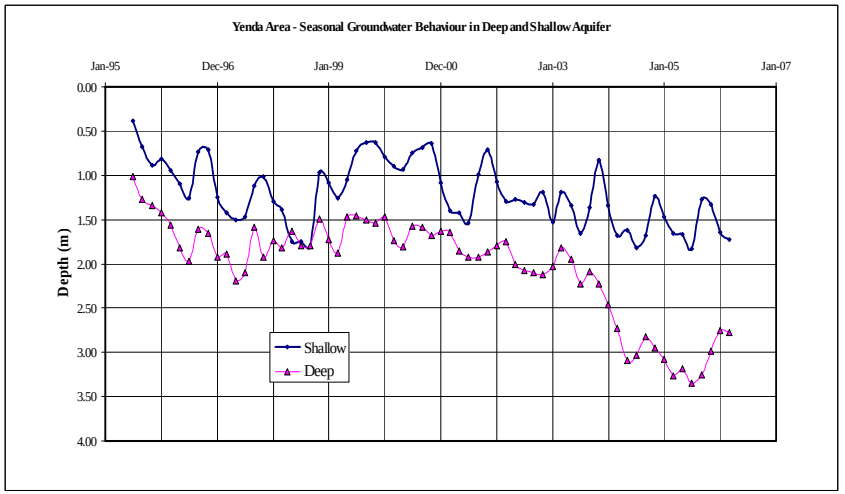
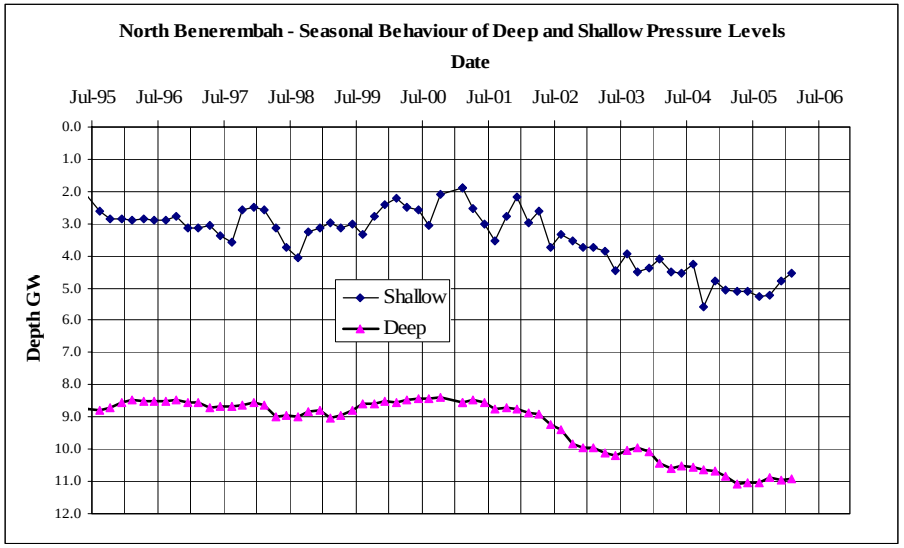
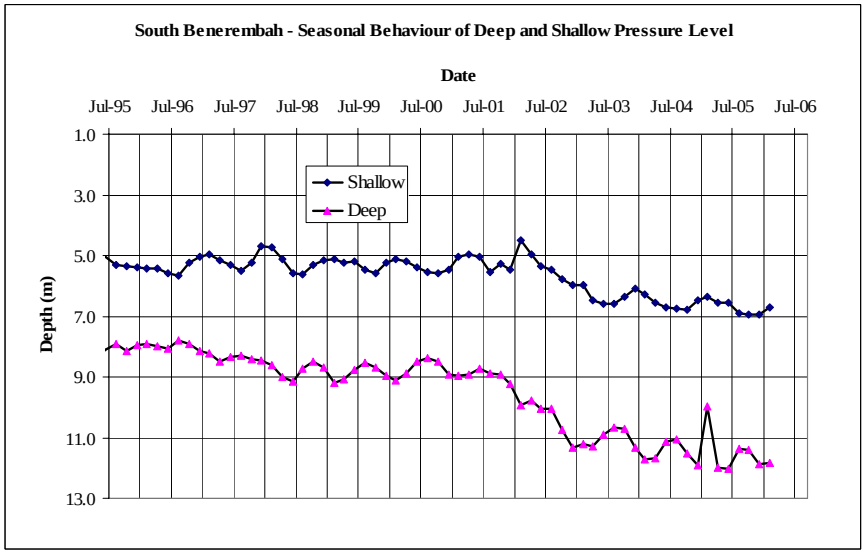


Figure 3.2.k: MIA September 2005 - Average seasonal behaviour of 8 sub-districts 5-12 metres and 12-35 metres++ - continued





Note: ++ West Hanwood and Wah Wah information is not available at the time of printing.

Figure 3.2.k shows the average seasonal behaviour of subdistricts in the MIA. There is a linear relationship shown between shallow (watertable) and deep aquifers for the Gogeldrie Yanco Area and the Kooba Hanwood area. The graphs here show that recharge to the shallow aquifer appears to be related to recharge in the deeper aquifer. This means that there is reasonable transmissivity or deep leakage between the 2 aquifers. On the other hand the Murrami-Koonadan graph and the Yenda graph show that there is no well-defined linear relationship between the shallow and deeper aquifer. This suggests that the hydraulic conductivity between aquifers is low and that an aquitard of low permeability may be present inhibiting percolation between aquifers. The graph for Murrami appears to show the influence of other factors affecting the hydraulic pressure. However, the relationship between the two aquifers cannot be commented upon with certainty in view of the variability of information available due to the absence of a reasonable number of peizometers to illustrate what is actually happening in the subdistrict.

All graphs show a general reduction in the watertable since 1995.

Table 3.2.j: ***Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35metres) aquifers, September 2005, and historic trend in areas within 2 metres ++***

North Benerembah							
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**
within 1 metre	12	10	1	0	1	0	1
within 2 metre	76	74	69	28	28	19	29
within 3 metre	94	93	90	75	71	68	76
within 4 metre	99	100	97	91	86	84	99
Deep							
within 2 metre	0	0	0	0	0	0	0
within 4 metre	0	0	0	0	0	0	0
within 6 metre	17	13	7	0	0	0	0
within 8 metre	47	46	28	4	3	4	4
South Benerembah							
Shallow							
within 1 metre	37	12	1	0	1	0	1
within 2 metre	68	56	39	3	10	5	9
within 3 metre	83	78	71	42	49	29	56
within 4 metre	89	88	87	69	69	63	76
Deep							
within 2 metre	13	12	8	0	1	0	1
within 4 metre	34	32	23	15	14	8	16
within 6 metre	61	57	42	31	28	27	29
within 8 metre	75	71	62	49	44	43	47
Kooba							
Shallow							
within 1 metre	17	24	2	0	0	0	2
within 2 metre	87	84	44	10	4	3	16
within 3 metre	99	98	86	57	37	23	67
within 4 metre	100	100	98	87	79	68	87
Deep							
within 1 metre	3	1	0	0	0	0	0
within 2 metre	53	53	11	1	0	0	1
within 3 metre	86	83	64	8	3	1	25
within 4 metre	97	93	85	49	38	18	60
Yenda/Bilbul							
Shallow							
within 1 metre	33	24	0	0	0	2	0
within 2 metre	97	98	39	19	28	36	29
within 3 metre	100	100	100	89	90	88	93
within 4 metre	100	100	100	100	99	99	99

Yenda/Bilbul							
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**
within 1 metre	16	22	1	0	0	0	0
within 2 metre	74	73	60	23	14	19	23
within 3 metre	86	84	77	69	62	61	65
within 4 metre	93	90	85	80	79	78	78
Murrami/Koonadan							
Shallow							
within 1 metre	40	44	46	2	1	1	6
within 2 metre	91	90	78	50	24	32	58
within 3 metre	99	100	96	85	82	78	90
within 4 metre	100	100	100	97	95	96	99
Deep							
within 1 metre	14	18	1	0	0	0	0
within 2 metre	76	72	53	12	7	6	30
within 3 metre	99	97	82	59	52	50	74
within 4 metre	100	100	99	89	79	77	94
Gogeldrie/Yanco							
Shallow							
within 1 metre	0	1	0	1	0	0	0
within 2 metre	31	27	12	4	2	1	11
within 3 metre	62	56	44	31	30	20	39
within 4 metre	95	82	68	50	49	43	57
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**
within 1 metre	1	2	0	0	0	0	0
within 2 metre	27	23	5	1	1	0	7
within 3 metre	58	48	37	13	16	9	33
within 4 metre	87	73	61	36	42	37	53

Note: ++ West Hanwood and Wah Wah information is not available at the time of printing.

Figure 3.2.l: Bi-monthly Groundwater Piezometers

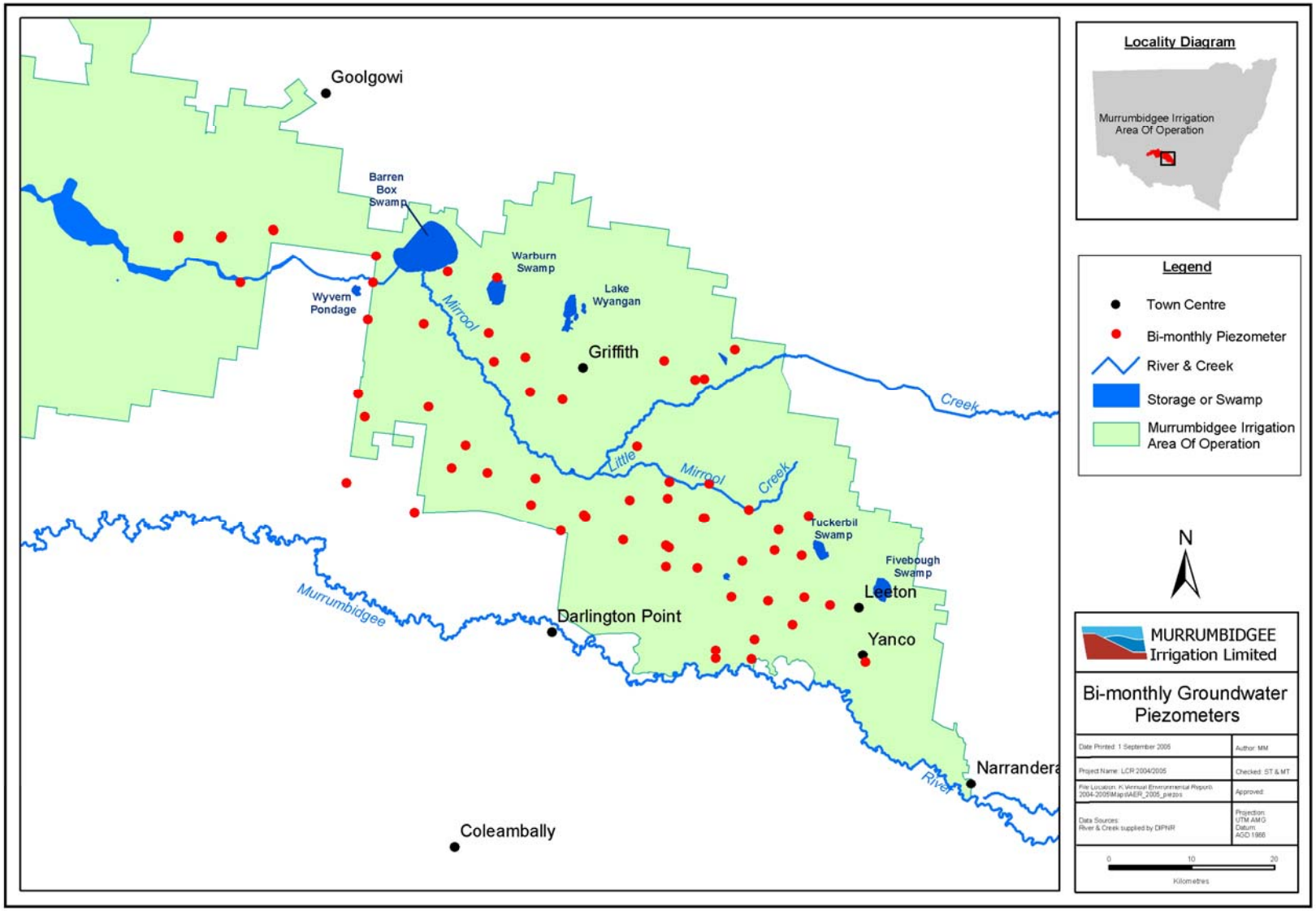
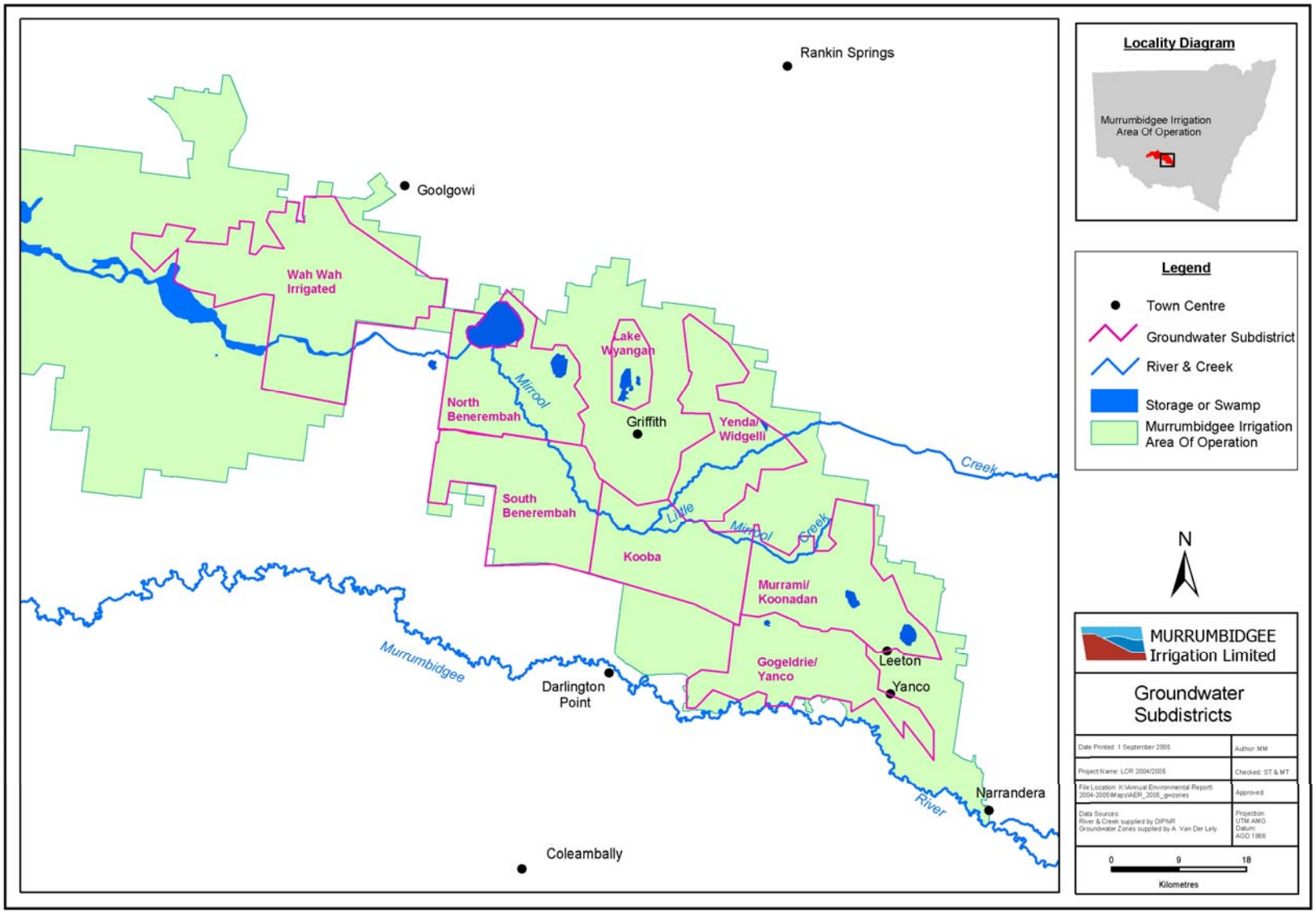


Figure 3.2.m: Groundwater sub-districts



A.4 Floods and Floodplain Management

A.4.2 Reporting requirements

A.4.2 (1 & 2) Flood levels, floodplain structures, flood releases

Approximately 1,950 ML of water was diverted into the floodway during the season.

Works undertaken on the floodway are commented on below.

A.4.2 (3 & 4) Flood reporting – Lower Mirrool Creek Floodway

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

During the 2005/06 irrigation season, releases were lower than in the previous year.

However, a number of factors resulted in discharges to the floodway during the reporting period including construction activities at Barren Box and works to upgrade the floodway off-take structures.

With civil construction works at the Barren Box underway, a decision had been made to not permit surplus flows to enter the site.

When all other reasonable opportunities were exhausted, flows were diverted to the floodway. This option did not permit water use or financial returns. Environmental gains were achieved by supplying water to trees and other vegetation in the vicinity, which had tolerated four years of drought.

The renewal of the offtake structure to the floodway also resulted in flows that would otherwise have been used for irrigation being released to the floodway. Weather delayed the installation of new doors at the structure by two weeks resulting in water being discharged to the floodway. However, with the upgrade now complete it is expected that there will be improved control over floodway releases and hence an improvement in environmental conditions.

A.5 Aquatic Environment Management

A.5.2 Reporting requirements

A.5.2(1) Significant change (Activities & D4 Major Wetlands)

The following table shows the condition of wetlands which were assessed approximately 18 months ago. Roberts in her *Wetland Audit* suggests that monitoring wetlands should occur periodically, perhaps every 5 years.

Table 5.2.a: D4 Wetlands – area, tenure, type, current use and condition

Wetland Name	Approx. Area (ha)	Land Tenure	Wetland Type	Current Use	Wetland Condition Score (%) *
Coonancoocabil Lagoon	103	Crown	Former river channel	Irrigation drainage easement	53.89
Euwarderry Lagoon	21	Crown	Former river channel	Irrigation drainage easement	52.22
Gooragool Lagoon	92	Crown	Former river channel	Water storage	60.00
Turkey Flats	33	Crown	Former river channel	Grazing	42.78
Horseshoe Lagoon	3	Crown	Cut-off meander	Grazing	
Fivebough Swamp	285	Crown	Deflation basin	Sewerage treatment, conservation	67.78
Tuckerbil Swamp	103	Crown	Deflation basin	Conservation, grazing	50.00
Stanbridge Swamp	38	Private	Depression	Irrigation drainage easement	56.11
Almond Road Swamp	3	Private	Depression	Grazing	56.11
Campbell's Swamp	33	Crown	Depression	Irrigation drainage easement, conservation	61.67
Nericon Swamp	34	Crown	Deflation basin	Conservation	45.56
Tharbogang Swamp	93	Crown	Depression	Grazing	40.00
Lake Wyangan	287	Crown	Deflation basin	Irrigation drainage easement, recreation, flora and fauna reserve	66.11
Gum Creek Lagoon	284	Private	Depression	Grazing	dry
Kooba Swamp	24	Private	Depression	Irrigation drainage	dry
Warburn Swamp	378	Crown	Depression	Irrigation drainage easement	58.33
Barren Box	3019	M'gee Irrigation	Deflation basin	Irrigation drainage easement	68.89
The Pondage	97	Private	Depression	Irrigation drainage easement	dry

Source: MI Environmental Services

Notes: * Method developed by Spencer et al (1998) and modified by Wassens et al (2004)

Spencer, C., Robertson, A.I. & Curtis, A. (1998). *Development and testing of a rapid appraisal wetland condition index in south-eastern Australia*. Journal of Environmental Management, 54, pp.143-159.

Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity in the Murrumbidgee Irrigation Area: a baseline survey*. Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.

A.5.2(2) Management practice or work impact upon the aquatic environment (EP&A Act)

The Barren Box Water Conservation Project (BBS Project) commenced work at Barren Box in November 2005 and January 2006 at the Bray's Dam storage site. All work was undertaken in accordance with the Department of Planning's approved Construction Environmental Management Plans and the Development Approval. Throughout the reporting period there was no impact on the aquatic environment.

A.5.2(3) Noxious weeds

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Two inspections have been carried out at Barren Box, downstream channel systems and the floodway.

Barren Box

The first inspection and treatment took place in February 2006. With the continuing dry conditions, low numbers of plants have been found once again at Barren Box. However location of terrestrial plants on the surrounding shoreline has been assisted with Alligator Weed continuing to grow and other vegetative cover being limited. There were 29 plants found and most plants were small in size.

The second inspection and treatment of Alligator Weed around Barren Box took place in May 2006 and located 2 plants. All plants were chemically treated.

Channel System

The first inspection of the Wah Wah Main and Outfall channel systems took place in December 2005. Five plants were located within the system.

A follow up inspection took place in May 2006. This inspection located 4 plants in total. All plants located were small in size and were physically removed and treated.

Floodway

An inspection of the floodway between the Outfall channel offtake and Cameron Lane took place in February 2006. Eleven plants were found.

A follow up inspection took place in May 2006. One plant was found. All plants found on the floodway were chemically treated.

A.6 General Environment Management

A.6.3 Reporting requirements

A.6.3(1) Register of activities

A *register of activities* is ordinarily required by a determining authority, generally being a government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning & Assessment Act. However, as this remains a licence requirement, despite the privatisation of Murrumbidgee Irrigation, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2005/06. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2006

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	Murrumbidgee Irrigation	February 2005

Source: MI Environmental Services

A.6.3(2) Significant change to and condition of environment assets

Monitoring and Management of Wetlands in the MIA

Murrumbidgee Irrigation is required to monitor the condition of aquatic environments which are or may be impacted by its operations or the practices of irrigators. Murrumbidgee Irrigation is also required to implement strategies to protect and enhance biodiversity within the MIA.

An *Inventory of Wetlands in the Eastern MIA*, prepared in 2005[5], reports on the condition of wetlands impacted or potentially affected by the operations of Murrumbidgee Irrigation or its account holders.

Since then Murrumbidgee Irrigation has commissioned an audit[6] to identify which wetlands should be monitored and on what basis. The audit has recommended 18 wetlands for monitoring. The wetlands have been recommended based on their structural formation and because as a group they are regionally representative and appropriate for monitoring according to a range of indicators including size, condition, hydrological regime and ecological value.

[5] Harrison, L & Roberts J; Inventory of Wetlands in the Eastern MIA, May 2005.
[6] Roberts, J. *An Audit of Wetlands in the Eastern MIA*, 2005

Table 6.3.b: Target Wetlands (18) for monitoring wetland condition

Wetland type	Wetland
Depression Wetlands	Gum Creek Lagoon Kooba Swamp Stanbridge Swamp The Pondage Warburn Swamp Whitton Common
Former Floodplain Channels	Coonancoocabil Lagoon Euwarderry Lagoon Gooragool Lagoon McKays Lagoon Yanco Ag Lagoon
Wyangan Basin wetlands	Campbell's Swamp Lake Wyangan Nericon Swamp
Deflation Basins	Barren Box Fivebough Swamp Tuckerbil Swamp
Impounded Meander	Willow Dam

The audit recommends that Murrumbidgee Irrigation should consider the guidelines and protocols in Recommended Methods for Monitoring Floodplains and Wetlands[7] in devising a future monitoring, assessment and reporting regime.

The audit also recommends that Murrumbidgee Irrigation adopt a landscape or macro approach in considering wetlands as a group and not just as isolated ecosystems.

The initial requirement is to define the reference condition for wetlands based on historical research and local knowledge and prepare a vegetative snapshot for each wetland.

Barren Box Water Conservation Project

During the 2005/06 reporting year significant structural works were undertaken at both Barren Box and Bray's Dam en-route storage. The work undertaken during the reporting period involved the construction of earth embankments, construction of water regulating structures, and the placement of rock rip rap for wave protection and prevention of erosion. At the time of reporting the work was 90% complete.

All work was undertaken in accordance with the conditions of consent and the Department of Planning approved Construction Environmental Management Plans (CEMP's). In addition, regular internal audits were undertaken at both sites as well as an independent audit. The aims of the audits were to ensure compliance with the CEMP's and conditions of consent. The audit results did not find any major non-conformances with either CEMP's or conditions of consent.

Further, Murrumbidgee Irrigation was required to record and address any complaints from the public in relation to the project. During the reporting period there were three complaints received; two relating to traffic and transportation (dust generation and road condition) and one to road side rubbish. All complaints were addressed with the complainant notified of the outcome within 24 hours of receipt.

[7] Baldwin et al 2005

A.6.3(3) Soil salinity survey (every 3 years)

Due to the continuing drought, the soil salinity survey due to be completed this year was postponed until conditions improve. Murrumbidgee Irrigation considers regional salinity surveys less effective and desires a system with key sites for salinity monitoring. This has not yet been implemented. (A van der Lely, 2004).

A.7 Salinity Management and Accounting

A.7.4 Reporting requirements

A.7.4(1) Flow, salt load and salinity data

Refer to Drainage Volumes, Table 2.2.h, page 20, for flow data.

Refer to Salt Loads, Table 2.2.i, page 25, for salt load data.

Refer to refer to Table M.4, page 67, for salinity data.

A.7.4(2) Notice for compliance with Salinity and Drainage Strategy

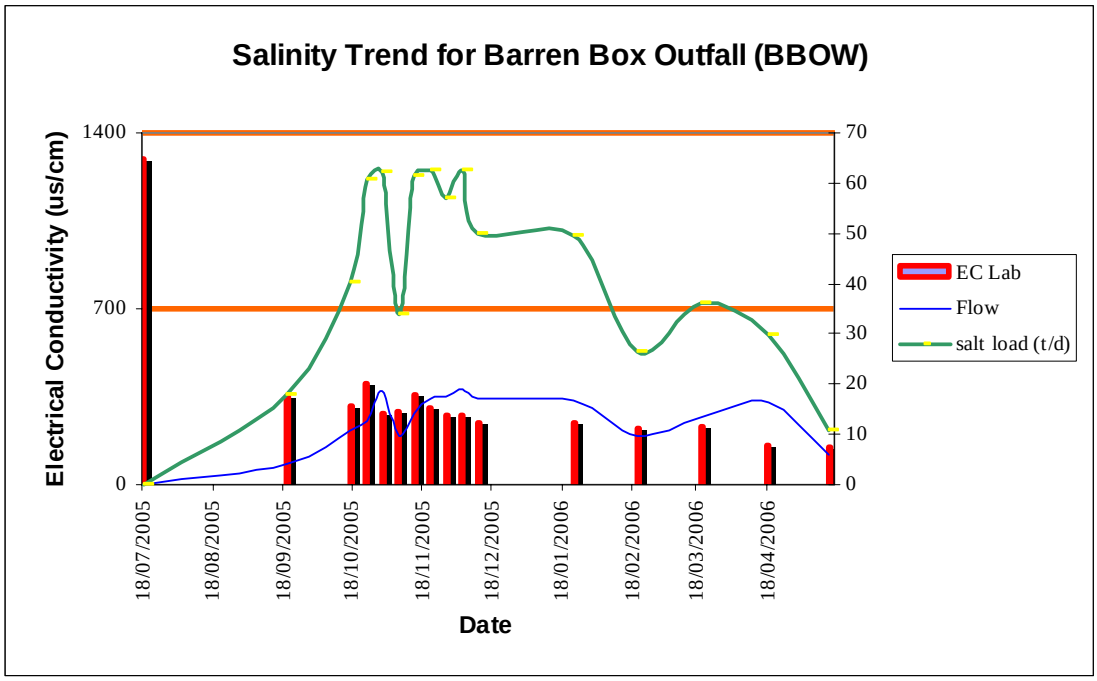
No written notice was received for the period.

A.7.4(3) Salt load discharges

Refer to Salt Loads, Table 2.2.i, page 25.

A.7.4(4) Salinity in Barren Box Outfall Drain against benchmark

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark



Note: Water from BBOW has not come from Barren Box.

Figure 7.4.a shows that water salinity is related to flow conditions. It is evident that for the 2005/06 irrigation season the quality of water discharged from BBOW to the Wah Wah main for supply to the Wah Wah Irrigation District has been satisfactory with EC levels below the identified 700 EC benchmark limit.

Water Quality Management

Murrumbidgee Irrigation has an elaborate system of monitoring in place to ensure compliance with its licences as well as using data for the efficient management of the irrigation area. Murrumbidgee Irrigation continuously monitors flow and electrical conductivity at key sites throughout the area as well as nutrients and pesticides on a monthly basis. Pesticide detections are compared to notification and action levels, set by the Department of Environment and Conservation (DEC).

Murrumbidgee Irrigation works together with various industry groups in order to prevent pollution incidents. This is achieved, for example, through regular attendance at the Rice Discussion Group meetings and through media opportunities. Murrumbidgee Irrigation continuously works on improving its systems for measuring and recording data as well as reporting. Murrumbidgee Irrigation is one of the case studies for a CRCIF project called 'The Sustainability Challenge'. The hypothesis tested in this project is whether improved reporting will lead to improved outcomes.

The 2005/06 pesticides monitoring program has revealed a total of 12 detections with 905 samples analysed for pesticides. Of this 8 detections were notification level with 4 action level. In total just 1.3% of samples tested were at notification level or higher. The chemical most often detected was metolachlor and the major issue of concern is possible contamination of surface waters and groundwaters. Metolachlor is a herbicide to control the emergence of annual grasses on maize and sorghum and is compatible and often mixed with other chemicals like atrazine. Because metolachlor has a long half life it takes a long time to degrade.

The area which needs to be targeted is the Murrumbidgee River wetlands and floodplains near Yanco. It is expected that the proposed drainage recycling systems for this area will mitigate to improve this situation in the future.

The weekly ELISA molinate sampling program has also revealed several chemical detections in Murrumbidgee Irrigation's surface water drainage system however these were largely due to poor on-site farm management practices.

In comparison to previous years the overall chemical detections at or above notification level were reduced. This is particularly so for diuron which is a herbicide used on vines which has had a recent history of high detections.

Murrumbidgee Irrigation's involvement in monitoring nutrients was in accordance with licence requirements. One issue to consider is that TSS (total suspended solids) is the benchmark indicator for water quality of the Murrumbidgee River. However research has identified that in the MIA the correlation between turbidity and TSS is not that great probably due to the presence of dispersible (slaking) clays which are turbid but don't have great TSS volumes.

For this year, the Department of Environment and Conservation agreed to the following temporary variations to Murrumbidgee Irrigation's Environment Protection Licence:

1. Weeks 1, 11, 12 and 13 to be deleted from the October – December 2005 weekly molinate monitoring program. Weekly sampling and analysis will be required for the 9 weeks commencing 10/10/05 and ceasing 9/12/05;
2. If a rainfall event of >20mm within a 48 hour period is experienced in weeks 1, 11, 12 or 13, samples are to be collected and submitted for laboratory analysis (or ELISA analysis done if sufficient kits were available); and
3. If it can be verified through water ordering and delivery data or satellite imagery, that no rice is grown in the catchment of a designated environmental monitoring or discharge points, then the DEC accepts that the weekly monitoring for rice chemicals is not necessary in the 12 weeks, October to December 2005.

There was no rainfall event higher than 20 mm within a 48 hour period during week 1, 11, 12 or 13 so no ELISA molinate testing was carried out during those weeks.

Table M.1: Department of Environment and Conservation compliance requirements

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Location of monitoring sites	Table M.2	64
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3	65
	Chlorpyrifos (Monthly)	Table M.3	65
	Conductivity (>5Mg)	Table M.4	67
	Diazinon (November)	Table M.5	68
	Diuron (Monthly)	Table M.3	65
	Endosulfan (Monthly) (alpha & beta)	Table M.3	66
	Flow (Monthly) LW6	Table 2.2.h Table 2.2.f	20 18
	Malathion (Oct/Nov)	Table M.5	68
	Metolachlor (Oct/Nov/Dec)	Table M.5	68
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.5	69
	Nitrogen (>5Mg)	Table M.6	70
	Phosphorus (>5Mg)	Table M.6	70
	Simazine (Monthly)	Table M.3	66
	Thiobencarb (Nov)	Table M.5	69
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	69
	Turbidity (>5Mg)	Table M.6	70
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.h	20
M3	**Testing Methods – concentration limits**		
	Approved by DEC	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11&12		
	Atrazine (Monthly)	Table M.3	65
	Chlorpyrifos (Monthly)	Table M.3	65
	Conductivity (Monthly)	Table M.4	67
	Diazinon (Nov)	Table M.5	68
	Diuron (Monthly)	Table M.3	65
	Endosulfan (Monthly) (alpha & beta)	Table M.3	66
	Flow (Monthly)	Table 2.2.h	20
	Malathion (Oct/Nov)	Table M.5	68
	Metolachlor (Oct/Nov/Dec)	Table M.5	68
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	69
	Simazine (Monthly)	Table M.3	66
	Thiobencarb (Nov)	Table M.5	69
	Nitrogen (>5Mg/day)	Table M.6	70
	Phosphorus (>5Mg/day)	Table M.6	70
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	69
	Turbidity (>5Mg/day)	Table M.6	70

Table M.1: Department of Environment and Conservation compliance requirements (cont.)

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Monitoring Sites 13 &14		
	Atrazine (Monthly)	Table M.3	65
	Chlorpyrifos (Monthly)	Table M.3	65
	Conductivity (Monthly)	Table M.4	67
	Diazinon (Nov)	Table M.5	68
	Diuron (Monthly)	Table M.3	65
	Endosulfan (Monthly) (alpha & beta)	Table M.3	66
	Malathion (Oct/Nov)	Table M.5	68
	Metolachlor (Oct/Nov/Dec)	Table M.5	68
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	69
	Simazine (Monthly)	Table M.3	66
	Thiobencarb (Nov)	Table M.5	69
	Nitrogen (Monthly)	Table M.6	70
	Phosphorus (Monthly)	Table M.6	70
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	69
	Turbidity (Monthly)	Table M.6	70
	M7.2 Conductivity (Continuously) Sites 1 & 9	Table M.4	67
	M7.3 Molinate Elisa Testing (Oct/Nov/Dec) one week intervals for sites 1-12	Table M.7	71
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Records stored on computer, Page 56	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	DEC contacted Table R.1, Page 73	
R3	**Written report**		
	R3.1 Send reports to DEC at their request, regarding environmental harm	DEC sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	DEC contacted, Table R.1, Page 73	
R5	**Annual report**		
	R5.1 Submit annual report to DEC	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.h A.3.2(4) Figure R.1 Table R.1	14 20 39 72 73
	R5.4 Send copies of DEC, DNR, DPI, MDBC	Submitted	

Table M.2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR	Gogeldrie Main Southern Drain	5	*
410083	YMS	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

Table M.3: Monthly monitoring of Atrazine, Chlorpyrifos, Diuron, Alpha Endosulfan, Beta Endosulfan and Simazine

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Atrazine (DL = 0.05ug/L)												
BBOW	BDL	NF	BDL	0.27	0.05	BDL	BDL	BDL	BDL	BDL	BDL	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	0.12	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF
LAG	NF	NF	BDL	0.22	0.22	0.16	BDL	BDL	BDL	BDL	NF	BDL
LMC	BDL	BDL	BDL	0.25	0.09	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LW6	BDL	BDL	BDL	BDL	0.22	0.18	0.14	0.11	0.08	0.05	BDL	BDL
MDJWE	BDL	BDL	BDL	0.21	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MIRMCN	BDL	BDL	BDL	0.23	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ROCUDG	NF	BDL	0.05	0.05	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.13	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF
YMS	BDL	BDL	BDL	0.09	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chlorpyrifos (DL = 0.05 g/L)												
BBOW	BDL	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LAG	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL
LMC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL	BDL	BDL
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ROCUDG	NF	BDL	BDL	BDL	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	**0.06**	BDL	NF	BDL	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Diuron (DL = 0.1 ug/L)												
BBOW	0.3	NF	BDL	BDL	BDL	BDL	0.6	BDL	BDL	BDL	0.1	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.5	0.9	0.1	BDL	0.1	BDL	BDL	BDL	BDL	**2.5**	0.9	0.2
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.2	BDL	BDL	BDL	0.3	0.3	BDL	BDL	NF	NF	NF
LAG	NF	NF	BDL	0.1	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL
LMC	0.6	0.7	0.2	BDL	0.1	BDL	0.3	BDL	BDL	0.3	**2.4**	0.8
LW6	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	NF	0.2	0.3	0.4
MDJWE	0.1	BDL	BDL	BDL	0.1	BDL	BDL	BDL	BDL	BDL	0.3	BDL
MIRMCN	0.2	0.1	BDL	BDL	BDL	BDL	0.1	BDL	BDL	0.3	0.3	0.2
ROCUDG	NF	BDL	BDL	BDL	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.6	0.2	BDL	0.1	BDL	NF	BDL	NF	NF
YMS	0.1	BDL	BDL	BDL	0.3	0.1	BDL	BDL	BDL	BDL	**2.1**	0.2

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Alpha Endosulfan (DL = 0.01 ug/L)												
BBOW	BDL	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LAG	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL
LMC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL	BDL	BDL
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ROCUDG	NF	BDL	BDL	BDL	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	BDL	BDL	NF	BDL	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beta Endosulfan (DL = 0.01 ug/L)												
BBOW	BDL	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LAG	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL
LMC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL	BDL	BDL
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ROCUDG	NF	BDL	BDL	BDL	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	BDL	BDL	NF	BDL	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Simazine (DL = 0.05 ug/L)												
BBOW	0.26	NF	0.16	0.07	BDL	BDL	BDL	BDL	BDL	BDL	0.09	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.18	0.32	0.15	0.07	BDL	BDL	BDL	0.05	BDL	0.83	0.56	0.09
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.1	0.12	0.09	0.07	0.14	0.05	BDL	BDL	NF	NF	NF
LAG	NF	NF	0.75	0.66	0.05	BDL	0.08	BDL	BDL	BDL	NF	0.11
LMC	0.14	0.21	0.15	0.05	BDL	BDL	BDL	BDL	BDL	0.11	1.20	0.35
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	BDL	BDL	BDL
MDJWE	BDL	BDL	BDL	0.12	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
MIRMCN	0.25	0.06	0.06	0.13	BDL	BDL	BDL	0.05	BDL	0.13	BDL	0.09
ROCUDG	NF	BDL	0.23	0.06	BDL	BDL	NF	NF	BDL	BDL	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.13	BDL	BDL	BDL	BDL	NF	BDL	NF	NF
YMS	0.23	0.17	0.17	0.05	0.11	0.06	0.07	0.07	BDL	BDL	2.30	0.16

Notes: Refer to Summary of Events (Table R.1, Page 73) for further details.
Action level detection Notification level detection NF = No flow BDL = Below detectable level

Table M.4: Monthly conductivity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results > 5ML/day												
BBOW*	1296	NF	350	312	303	245	247	226	228	153	151	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD*	885	1323	363	360	274	206	249	240	229	186	137	288
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR*	NF	1033	292	410	403	323	434	381	209	197	NF	NF
LAG*	NF	NF	310	347	233	155	394	236	248	185	NF	374
LMC*	915	1780	430	427	341	456	301	269	259	292	333	1326
LW6	548	611	671	694	749	772	763	686	637	596	548	547
MDJWE*	1830	1630	342	351	375	275	241	187	170	169	108	373
MIRFLD	431	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
MIRMCN*	1320	1720	343	336	333	225	241	206	199	146	119	344
NARREG*	55	100	159	189	141	82	112	88	49	61	66	54
ROCUDG*	NF	75	158	183	227	161	NF	NF	148	126	76	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
STUR*	NF	NF	161	254	211	112	110	92	49	62	74	NF
WS	NF	NF	NF	2340	2970	869	2300	1580	2320	2550	NF	NF
YMS*	1920	2620	1216	665	664	481	1144	838	74	1289	413	1810

Source: MI Environmental Services. Mean monthly field data. If no field data available, mean monthly MI lab data is used.

Notes: * continuous monitoring sites

NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

MIRFLD data – at the time of releases to the Mirrool Creek floodway no salinity data was collected.

In some situations the EC result has been shown even though flow rate is less than 5ML/day. Apart from three instances in August, all other high levels occurred when the flow rate was null or less than 5ML/day.

Table M.5: Monitoring of Diazinon, Malathion, Metolachlor, Thiobencarb and Trifluralin

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Diazinon (November monitoring required)												
BBOW					BDL							
BBST					NF							
BYD					BDL							
FS					NF							
GMSRR					BDL							
LAG					BDL							
LMC					BDL							
LW6					BDL							
MDJWE					BDL							
MIRMCN					BDL							
ROCUDG					BDL							
TKBS					NF							
WS					BDL							
YMS					BDL							
Malathion (October and November monitoring required)												
BBOW				BDL	BDL							
BBST				NF	NF							
BYD				BDL	BDL							
FS				NF	NF							
GMSRR				BDL	BDL							
LAG				BDL	BDL							
LMC				BDL	BDL							
LW6				BDL	BDL							
MDJWE				BDL	BDL							
MIRMCN				BDL	BDL							
ROCUDG				BDL	BDL							
TKBS				NF	NF							
WS				BDL	BDL							
YMS				BDL	BDL							
Metolachlor (October to December monitoring required)												
BBOW				BDL	BDL	BDL						
BBST				NF	NF	NF						
BYD				BDL	BDL	BDL						
FS				NF	NF	NF						
GMSRR				BDL	**0.05**	BDL						
LAG				**0.17**	**0.16**	**0.31**						
LMC				BDL	**0.09**	BDL						
LW6				BDL	**0.06**	**0.05**						
MDJWE				BDL	BDL	BDL						
MIRMCN				BDL	BDL	BDL						
ROCUDG				BDL	BDL	BDL						
TKBS				NF	NF	NF						
WS				BDL	BDL	BDL						
YMS				BDL	BDL	BDL						

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Thiobencarb (November monitoring required)												
BBOW					0.05							
BBST					NF							
BYD					0.06							
FS					NF							
GMSRR					BDL							
LAG					BDL							
LMC					0.13							
LW6					BDL							
MDJWE					BDL							
MIRMCN					0.05							
ROCUDG					BDL							
TKBS					NF							
WS					0.05							
YMS					BDL							
Trifluralin (September-December and March-May monitoring required) (DL = 0.05 g/L)												
BBOW			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
BBST			NF	NF	NF	NF			NF	NF	NF	
BYD			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
FS			NF	NF	NF	NF			NF	NF	NF	
GMSRR			BDL	BDL	BDL	BDL			BDL	NF	NF	
LAG			BDL	BDL	BDL	BDL			BDL	BDL	NF	
LMC			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
LW6			BDL	BDL	BDL	BDL			NF	BDL	BDL	
MDJWE			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
MIRMCN			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
ROCUDG			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
TKBS			NF	NF	NF	NF			NF	NF	NF	
WS			NF	BDL	BDL	BDL			NF	BDL	NF	
YMS			BDL	BDL	BDL	BDL			BDL	BDL	BDL	
Molinate (September - February monitoring required)												
BBOW			BDL	0.18	0.12	0.1	BDL	BDL				
BBST			NF	NF	NF	NF	NF	NF				
BYD			BDL	0.08	0.26	0.09	BDL	BDL				
FS			NF	NF	NF	NF	NF	NF				
GMSRR			BDL	BDL	0.81	**24.6**	BDL	BDL				
LAG			BDL	0.19	BDL	BDL	BDL	BDL				
LMC			BDL	BDL	3.2	0.14	BDL	BDL				
LW6			BDL	BDL	BDL	BDL	BDL	BDL				
MDJWE			BDL	0.31	BDL	0.06	BDL	BDL				
MIRMCN			BDL	0.27	0.13	0.07	BDL	BDL				
ROCUDG			BDL	BDL	BDL	BDL	NF	NF				
TKBS			NF	NF	NF	NF	NF	NF				
WS			NF	0.11	BDL	BDL	BDL	BDL				
YMS			BDL	BDL	0.67	BDL	BDL	BDL				

Notes: Refer to Summary of Events (Table R.1, Page 73) for further details.
Action level detection Notification level detection NF = No flow, no sample taken BDL = Below detectable level

Table M.6: Monitoring of Nitrogen, Phosphorus and Turbidity

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
TKN (mg/L)												
BBOW	1.2	NF	0.6	1.3	1	0.9	0.7	1.1	0.5	0.2	0.5	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.6	0.7	0.4	1	1.1	0.8	1.2	0.9	0.6	0.3	0.3	0.2
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.9	1.2	2	1.8	0.3	1.6	0.8	0.7	0.6	NF	NF
LAG	NF	NF	1	0.1	1.2	0.4	1	1.4	0.6	0.8	NF	0.5
LMC	0.6	0.6	0.8	1.6	1.4	1.1	1	0.8	0.7	0.3	0.3	0.5
LW6	1	1.1	0.8	1.2	1.2	1.4	1.1	0.8	0.6	0.6	0.8	1.3
MDJWE	2.7	6.9	1.3	1.1	1.2	0.9	0.8	0.5	0.4	0.4	0.3	2
MIRMCN	0.9	2.9	0.8	0.8	1.4	0.8	1.1	0.8	0.5	0.6	0.3	0.7
ROCUDG	NF	0.6	1.1	0.4	1	0.2	NF	NF	0.7	0.3	0.5	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	1.1	1.6	1.6	2	1.1	0.9	0.5	NF	NF
YMS	0.8	0.7	1.3	1.8	1.8	0.4	0.8	0.7	0.7	0.4	0.4	1
Total Phosphorus (mg/L)												
BBOW	0.06	NF	0.05	0.1	0.1	0.15	0.08	0.06	0.19	0.04	0.01	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.03	BDL	0.04	0.11	0.05	0.21	0.07	0.04	0.13	0.09	0.01	BDL
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.07	0.05	0.15	0.08	0.02	0.06	0.13	0.03	0.01	NF	NF
LAG	NF	NF	0.14	0.15	1.43	0.39	0.08	0.41	0.07	0.16	NF	0.08
LMC	0.04	BDL	0.12	0.18	0.21	0.27	0.08	0.04	0.08	0.08	0.02	BDL
LW6	0.1	0.1	0.08	0.09	0.09	0.21	0.03	0.03	0.18	0.1	0.01	0.03
MDJWE	0.08	0.45	0.21	0.08	0.05	0.09	0.07	0.02	0.13	0.1	0.01	0.01
MIRMCN	0.03	0.2	0.16	0.09	0.07	0.11	0.06	0.05	0.3	0.05	0.01	0.01
ROCUDG	NF	0.06	0.08	0.04	0.03	0.02	NF	NF	BDL	0.06	BDL	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.05	0.09	0.11	0.07	0.08	BDL	0.01	NF	NF
YMS	0.03	BDL	0.04	0.16	0.12	0.02	BDL	0.02	BDL	BDL	BDL	0.04
Turbidity (NTU)												
BBOW	55	NF	92	132	176	104	105	126	121	103	92.2	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	70	37	125	215	170	57	139	201	245	184	95.8	40.8
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	98	137	291	208	219	223	204	251	156	NF	NF
LAG	NF	NF	153	295	244	213	119	399	387	498	NF	84.2
LMC	97	22	243	402	315	178	246	256	294	182	142	42.3
LW6	67	72	79	156	91	87	48	35	42	108	21.4	47.5
MDJWE	21	25	74	96	78	67	77	88	128	75	45.8	24
MIRMCN	50	24	85	117	89	46	87	116	150	88.8	65.9	45.1
ROCUDG	NF	112	165	84	65	71	NF	NF	52	53.7	65.7	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	35	129	232	84	52	47	52	NF	NF
YMS	84	24	149	305	182	46	36	55	61	24.3	184	28.9

Notes: NF = No flow
BDL = Below detectable level

Table M.7: Molinate ELISA testing

Weekly molinate sampling												
		11/10	17/10	24/10	31/10	7/11	14/11	28/11	28/11	5/12		
	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk9	Wk 10	Wk 11	Wk 12
BBOW		BDL	BDL	BDL	BDL	2.22	BDL	BDL	BDL	1.459		
BBST		NF	NF	NF	NF	NF	NF	NF	NF	NF		
BYD		BDL	BDL	**12.39**	BDL	2.55	BDL	BDL	BDL	BDL		
FS		NF	NF	NF	NF	NF	NF	NF	NF	NF		
GMSRR		BDL	1.53	BDL	BDL	BDL	2.35	BDL	BDL	3.188		
LAG				BDL	BDL	BDL	1.30	BDL	BDL	1.834		
LMC		BDL	2.85	BDL	**10.18**	BDL	**3.50**	BDL	BDL	BDL		
LW6		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.203		
MDJWE		BDL	BDL	**4.12**	BDL	BDL	1.07	BDL	BDL	0.58		
MIRMCN		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.95		
ROCUDG				BDL	BDL	BDL	BDL	BDL	BDL	BDL		
TKBS		NF	NF	NF	NF	NF	NF	NF	NF	NF		
WS		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.249		
YMS		BDL	2.10	1.21	**>30**	BDL	BDL	BDL	BDL	0.5		

Refer to Summary of Events (Table R.1, Page 73) for further details.

Notes: DEC approval was obtained to exclude weeks 1, 10, 11 and 12 from the weekly molinate sampling program. During weeks 2 and 3 several catchments were known not to contain rice, approval was granted to exclude these catchments from the sampling program during that time.

= Notification level detection

= Action level detection

NF = No flow

BDL = Below detectable level

Table M.7 shows one action level and several notification level detections for ELISA Molinate during the rice irrigation season.

The incident shown on 31/10/05 was due to a rice bay washout after a period of heavy rain. After advice by the farmer, Murrumbidgee Irrigation notified the authorities accordingly and a later inspection showed that the rice banks had been repaired to a satisfactory standard.

The notification level detections were all reported to the DEC and DNR as required by the licence.

Discussion of chemical monitoring results

Figure R1 shows that there has been a dramatic reduction in the incidence of pesticide detections above notification level since the 1995/96 baseline year.

Figure R.1: Irrigation waste water trends

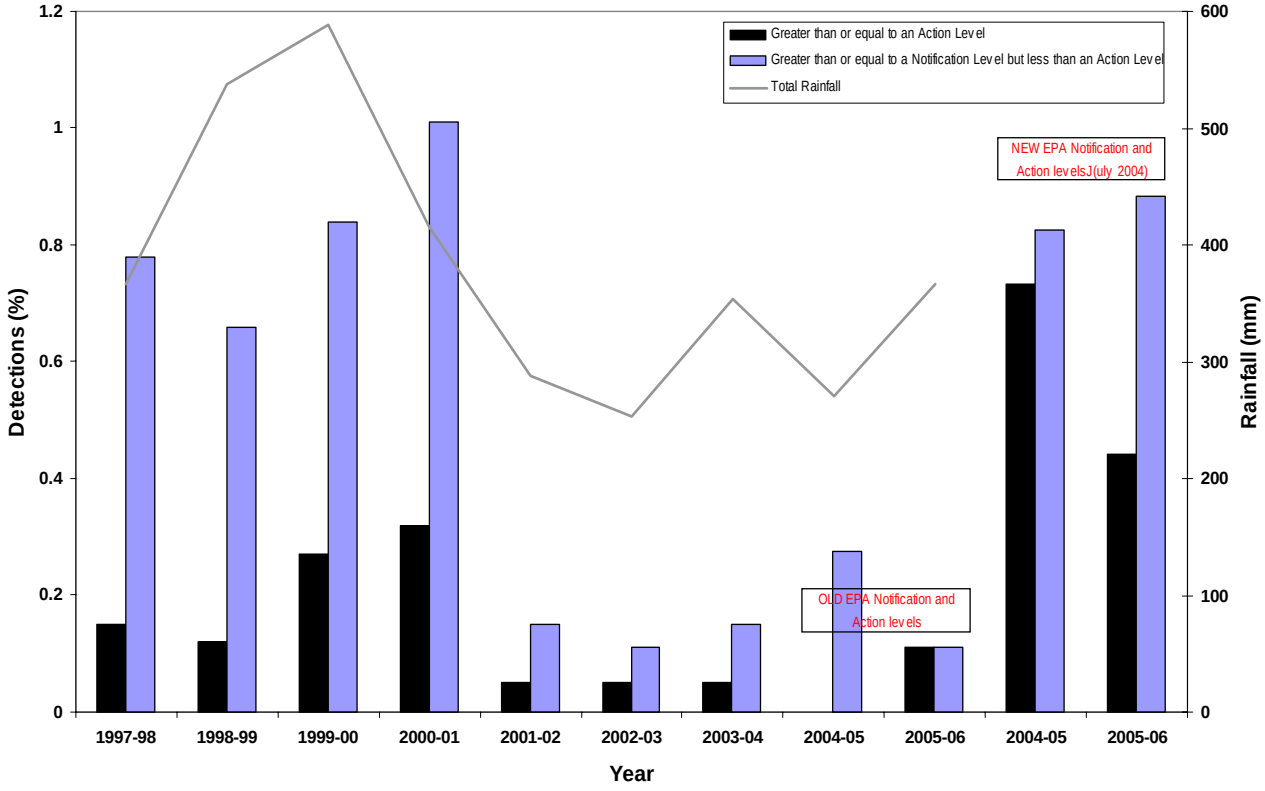


Table R.1 (overleaf) shows reporting of pollution events as required by the licence. It is important to note that the definition of *pollution* is not clear and is linked to the potential of events to result in adverse environmental impact. Without prescriptive indicators this definition appears to be subjective. This is why the table includes machinery or vehicles in channels as there remains the potential for these events to result in adverse environmental impact through potentially impacting on bank erosion, turbidity, fish kills due to direct hits or presence of oil and fuel despite the fact that such impact is considered unlikely.

Table R.1: Summary of all Events Reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide DEC Action Level				
LAG	18/10/2005	An action level of Metolachlor (0.17ug/L) was detected	DEC and DNR were notified	
LAG	21/11/2005	An action level of Metolachlor (0.16ug/L) was detected	DEC and DNR were notified	
LAG	13/12/2005	An action level of Metolachlor (0.31ug/L) was detected	DEC and DNR were notified.	Industry body was approached to discuss the use of Metolachlor.
GMSRR	13/12/2005	An action level of Molinate (24.6ug/L) was detected	The results were received after 3pm on Friday 23/12/2005. Staffing levels did not allow for a field investigation at that time.	DEC and DNR were notified in January 2006.
Pesticide DEC Notification Level				
GMSRR	21/11/2005	An notification level of Metolachlor (0.05ug/L) was detected	DEC and DNR were notified. An assessment of the drainage catchment above the sample sites did not identify the source	
LMC	21/11/2005	An notification level of Metolachlor (0.09ug/L) was detected	See above Comments	
LW6	21/11/2005	An notification level of Metolachlor (0.06ug/L) was detected	See above Comments	
LW6	13/12/2005	An notification level of Metolachlor (0.05ug/L) was detected	DEC and DNR were notified	Industry body was approached to discuss the use of Metolachlor.

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Molinate (ELISA) Action Levels				
YMS	31/10/2005	An action level of Molinate (>30ug/L) was detected.	DEC and DNR were notified. Field investigations within the sub-catchment proved inconclusive. Afterwards a landholder phoned to advise that a day after applying chemicals one of his rice bays had been washed out resulting in about two-thirds of the volume escaping. A site inspection by staff along with the landholder revealed that the bay banks had been soundly reconstructed.	
Molinate (ELISA) Notification Levels				
BYD	25/10/2005	A notification level of Molinate (12ug/L) was detected. Evidence of a substantial rice bay breach was found on a farm which borders Mirrool Creek. It appears that heavy rainfall 3 and 4 days before sampling has caused the water levels in higher bays to spill over into lower bays until the lowest bay on the slope breached into a farm drain which leads into the creek.	DEC and DNR were notified. The breach was located in the same day that the sample was taken. The landholder was asked about the breach and explained that he had been out of the area at the time and that the farm had been left to someone else to supervise.	A letter was drafted to the landholder asking that the bay design of his farm be reviewed and the he take steps to ensure that a mechanism to seal his drain be put in place in the event of a bay breach.
MDJWE	25/10/2005	A notification level of Molinate (4.12ug/L) was detected.	DEC and DNR were notified.	
LMC	31/10/2005	A notification level of Molinate (10.18ug/L) was detected.	DEC and DNR were notified.	
LMC	14/11/2005	A notification level of Molinate (3.50ug/L) was detected.	DEC and DNR were notified.	

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Other Pollution Events				
Channel Bank – adjacent to a farm	27/10/2005	After an anonymous phone call, staff observed buckets, pump and mixing equipment on the supply bank.	Staff spoke to the owner of the farm who agreed to remove the equipment and use an alternative site and water source.	
Main Canal – downstream Murrumbidgee Avenue	16/08/2005	After an anonymous telephone call, staff identified a foamy puddle (approx. 8m x 4m) on the supply road reserve approx. 2m from the bank. There appeared to be no evidence of spillage into the supply system.	Police, DEC and GCC were notified and a media release advising of events circulated. Samples were collected for testing. Irrigation Services were directed to halt supply from the Supply downstream of Murrumbidgee Avenue.	The Rural Fire Brigade later advised Murrumbidgee Irrigation that they caused the spill during a training exercise.
Lateral 6 – Sara Road	19/10/2005	After being alerted by phone, staff observed a machine dumped in the Supply Canal off Sara Road. Irrigation supply was contaminated by a small leakage of diesel fuel.	The Field Operator advised that the spillage would be discharged via the Escape and the supply water was not scheduled for use during the day.	
Casella Wines – Intersection of McDonough and Simpson Roads Yenda	25/10/2005	After being alerted by the DEC staff went to the site and observed that there was a break in the pipeline conveying liquid wastes from the winery processing area to the winery disposal area. The liquid wastes were being discharged into MI drains DC 1498 and DC 1484TJ.	Workers were advised by Murrumbidgee Irrigation on the remedial action necessary. The drain was blocked and liquid wastes were pumped to tankers for separate disposal.	
Farm 393	25/10/2005	A small steady stream of water was found to be leaking from the southern corner of Farm 393 near the junction of Swales and Condon road. The water leaving the bay was entering drain D-2-380J-010E	A sample was collected for analysis and the owner asked to rectify the breached bank.	A later site visit confirmed that the bank was repaired.
Condon Road Bilbul	25/10/2005	Drainage inlet leaking rice tail water to Main Drain J.	The owners of the farm were advised to rectify the situation.	The breach was rectified.

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Lateral 56 – McDonald Road Bilbul	09/11/2005	After receiving the complaint, staff located nine large deceased carp against check boards. The channel reach had ponded water with little flow.	The channel was drained.	
Northern Branch Canal	02/12/2005	Brown discoloured water was overflowing from the sump into the supply channel as the door on the farm side was not shut down and surface drainage had overspilled the dam after recent rains.	Samples from two farms were collected and analysed which showed the presence of Diuron and Malathion. Levels found on one farm: Diuron (31.3 ug/L) and Diuron (11.8ug/L) Levels found on another farm Diuron (0.8 ug/L) and Diuron (0.34ug/L)	
DC 128A	06/12/2005	MI Staff noticed that drainage water had an odour. Site inspection revealed that wastewater from an orange package shed builds up in the drain and cannot escape due to the presence of weeds and silt.	Request for MI maintenance to clear drain. Advised the packing plant manager to prevent pollution to the drain.	
Erskine Road – near G3 sewer pump well.	24/03/2006	Fax advice from GCC that ferrous chloride (approx. 300L) leaked into the stormwater system.	The area was cleaned up with magnesium hydroxide and water. Approx. 2,000L of magnesium hydroxide was added to dilute the spillage and the area was bunded with sand and soil to absorb contaminates. The stormwater system was flushed with water for dilution and reduction of toxic concentration levels. Council staff opened a bund valve to drain the ferrous back into Councils sewer pump station.	

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Supply Canal – at rear of Brisbane Street Wamoon	30/05/2006	A neighbour telephoned Murrumbidgee Irrigation complaining about a septic being pumped out into the supply reserve. A site visit by staff found that a pipe from the rear of the residence at Brisbane Street appeared to have discharged grey water from a sump on the canal reserve where a large puddle had formed. There appeared to be no direct contamination of the supply system.	Leeton Shire Council's Health/Compliance Officer was contacted to initiate action under the Local Government Act.	A follow-up site inspection revealed that the sump pipe had been removed from the supply reserve.
Channel 54D	05/01/2006	A telephone complaint was received regarding algal growth in channel 54D, Bilbul. A site visit by staff found some algae. Photos were taken and the situation was discussed with the complainant.	The complainant was asked to telephone Murrumbidgee Irrigation again if the problem persisted. No further complaints were received.	

Events Reported under R.2 & R.3 of the Environment Protection Licence 4651

References

1. Murrumbidgee Irrigation (2006). *'Shallow Groundwater Behaviour, causes and effects, in the MIA. Report to 2006.'*, prepared by van der Lely, A, NSW.

Glossary

APHA	American Public Health Association	**m**	Metre
CSIRO	Commonwealth Scientific Investigation and Research Organisation	**MI**	Murrumbidgee Irrigation Limited
CSU	Charles Sturt University	**MIA**	Murrumbidgee Irrigation Area
DEC	Department of Environment and Conservation	**MIA&Ds**	Murrumbidgee Irrigation Area and Districts
DIPNR	Department of Infrastructure, Planning and Natural Resources	**ML**	Megalitre
DNR	Department of Natural Resources	**mm**	Millimetre
DPI	Department of Primary Industries	**NRM**	Natural Resource Management
EC	Electrical Conductivity	**NTU**	Nephloteric Turbidity Units
EIS	Environmental impact statement	**SEE**	Statement of Environmental Effect
ELISA	Field testing Molinate kit	**SFU**	Single farming unit
EM31	Electromagnetic Induction Survey (31)	**T**	Tonnes
EPA	Environment Protection Authority	**TN**	Total nitrogen
ET	Evapotranspiration	**TP**	Total phosphorus
ETo	Reference Evapotranspiration	**TSS**	Total suspended solids
GL	Gigalitre	**URS**	Consulting company
ha	Hectare(s)	**USEPA**	United States EPA
IHS	Integrated Horticulture Supply	**VMP**	Vegetation Management Plan
L	Litre	**WFP**	Whole farm plan
LTA	Long term average	**WUE**	Water use efficiency
LWMP	Land and Water Management Plan	**Note:**	See Table 2.2.g (page 18) and Table M.2 (page 64) for complete listings of monitoring sites

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MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

B2: Licence compliance report FY 2006-2007



Murrumbidgee Irrigation

MURRUMBIDGEE IRRIGATION

Licence compliance report 07

Executive Summary

Murrumbidgee Irrigation's licenses with the Department of Water & Energy (formerly Department of Natural Resources) and the Department of Environment and Climate Change (formerly Department of Environment and Conservation) set the minimum standard for environmental management. The Company's programs are aimed at operating beyond compliance.

The DWE licence requirements focus on data recording and reporting, without set limits or targets. The DECC licence requirements for water quality and drainage flows are about recording and reporting against targets.

DWE LICENCE REQUIREMENTS

The DWE license comprises of seven broad categories (A1 – A7) which are summarised below:

A1. Land and Water Management Plan

The Land and Water Management Plan (MIA EnviroWise) continued to enhance the sustainability and profitability of the MIA and Districts over the last year through a combination of education, on-farm incentives and regional projects. The 2006/07 year saw $3.14 million of government money invested in the MIA and Districts through MIA EnviroWise, of which less than 10% was used in plan administration. Due to the reduction in landholders completing on-farm works as a result of continued low allocations, MIA EnviroWise increased the emphasis on the Biodiversity Activities. This resulted in approximately 360 ha of native vegetation planted and protected, an increase of 350ha compared to the previous year. In relation to the on-farm incentives, an Education incentive has been offered for the first time with 31 farming business undertaking training. In addition, during the past year the mid-term (5 year) review was completed and endorsed by the Murrumbidgee Catchment Management Authority and the recommendations included a review of the on-farm incentive program which will be completed in the next three months.

A2. Water Supply and Drainage Management

The much higher than average evapotranspiration combined with the much lower than average rainfall made for a difficult season for Murrumbidgee Irrigation and its shareholders. General security allocations and therefore total deliveries were the lowest on record, leading to a lower simple system efficiency than previous years.

As a result all available drainage water was re-used, in order to increase the system efficiency.

Due to the low general security allocation, there was a shift in deliveries for specific crop types. Horticultural crops received about one third of deliveries, as did winter cereals and oilseeds, while the last third was delivered to all other crop categories.

The license specifies continuous measurement of flow and salinity, which is done using flow gauging stations at key sites across the area. Continuous monitoring implies that 100% of the data is expected to be measured and recorded. While Murrumbidgee Irrigation complies with this requirement, except on a small number of occasions when data is lost due to equipment failure. During the renegotiation of the Water Management Works License, it will be requested to vary this requirement to more realistic levels of accuracy, eg 95% of data is recorded.

A3. Groundwater Management

As per the license requirements, all bi-monthly and six-monthly bores were read. The shallow and deep water tables have continued to drop due to improved on-farm management and the on-going drought. The MIA is now well below the predicted levels of the LWMP raising concerns as to the appropriateness of such benchmarks. Less than 10% of the MIA has water table levels within 2 m of the surface, as compared to 70% before the commencement of the drought.

Executive Summary

A4. Floods and flood plain management
There were no deliberate diversions to the floodway.

A5. Aquatic Environment Management
Work has continued on the rehabilitation of a number of wetlands in the MIA including Barren Box and wetlands along Mirrool Creek with the aim of improving the quality and the extent of habitat.

The control of alligator weed in the aquatic environment has continued over the past year with two inspections carried out. Inspections were carried out at Barren Box, the channel system and the floodway with six alligator weeds found in low numbers. All sites identified with alligator weed were chemically treated. This was an extremely low number of plants and demonstrates the commitment of the Company to eradicate this nationally significant weed.

A6. General Environmental Management
The protection and enhancement of local native species, remnant revegetation and other environmental assets are managed through the Property Vegetation Plans under the MIA EnviroWise program. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Section A1.

In relation to soil salinity it was concluded after the last survey that the current survey method does not provide an effective way to monitor the changes to soils salinity from irrigated agriculture and/or improve soil salinity. Therefore, this program is suspended, pending the review of the license and the outcomes of the three year research project with CSIRO.

A7. Salinity Management and Accounting
The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

DECC LICENCE REQUIREMENTS
The DECC license has detailed requirements for monitoring and recording of drainage flows. The results are:

Water Quality Management
Temporary variations were obtained for:

- Molinate monitoring which was reduced from 13 weeks to 5 weeks.
- Chemical monitoring which was changed to only being required once the flow is over 5 ML/day from 1 April 2007 to 30 June 2007.

The Company was unable to take monthly samples for water quality at all sites all months. This was due to the reduced allocation leading to significantly reduced drainage flows.

Of the samples collected and analysed there were six notification level detections found during the season, equating to 0.7% of samples taken. No adverse impacts resulting from the notification level detections were reported.

The analysis of water quality results indicates there is a declining trend in detections of notification and action levels in the Company's drainage system. This trend has been observed over the last six years.

In addition to regular monitoring of water quality the Company is also required to investigate miscellaneous pollution incidents. In 2006/2007 there were seven miscellaneous complaints received from the public and Company staff. Each of these were followed up and resolved to the satisfaction of the Company and in accordance with licence and other legislative conditions.

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Introduction

Murrumbidgee Irrigation has complied with the requirements under its licenses with the Department of Water & Energy (formerly Department of Natural Resources) and the Department of Environment and Climate Change (formerly Department of Environment and Conservation).

Due to the continuing drought, resulting in low allocations for general security shareholders and therefore greatly reduced drainage flows, the Company was able to take about 50% of the samples.

Relevant variations to the existing licences were obtained and are referred to in the text.

The Company is currently going through a review of both the licenses. Pending the outcome of these reviews as well as a three-year research project with the CSIRO, the soil salinity monitoring program and groundwater salinity monitoring programs have been suspended.

Dick Thompson
Chairman
Murrumbidgee Irrigation



Leith Boully
Chair
Environment Sustainability Committee



A.1 Land and Water Management Plan

MIA EnviroWise (otherwise known as the MIA and Districts' Community Land and Water Management Plan)

A.1.1 Annual Environment Management Report

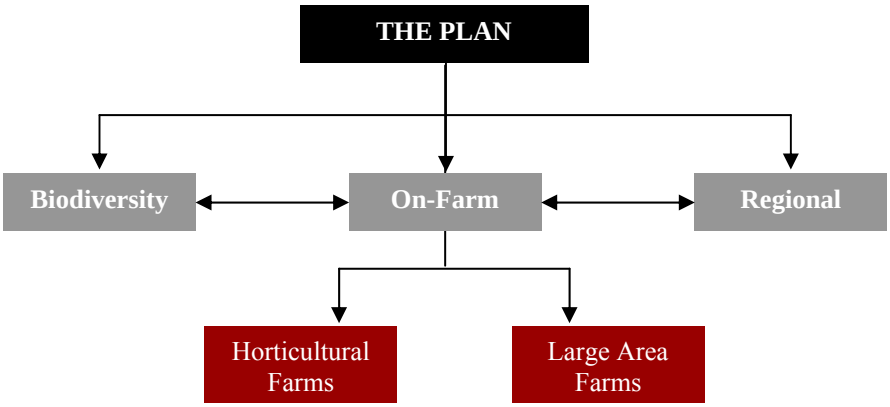
The goal of MIA EnviroWise is to maintain and enhance the sustainability and profitability of agriculture in the MIA and Districts.

The main objectives are:

- To maintain or increase irrigated agriculture productivity
- To reduce seepage to the groundwater system
- To keep drainage water quality within agreed standards
- To reduce surface drainage volumes to acceptable levels
- To protect our natural resources
- To minimise or prevent downstream effects

MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

MIA EnviroWise structure



The cost of implementing MIA EnviroWise is shared between the NSW and Australian governments and the MIA and Districts community. MIA EnviroWise is scheduled to be implemented over a 30-year period. It commenced in 2000/01 with government funding available for the first 15 years of implementation. To date government funding has been provided by the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality and irrigator and community funds.

The total cost of implementing MIA EnviroWise has been calculated at $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

Table 1: Funding sources, receipts and expenditure for MIA EnviroWise

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2007 ($ million)	Expenditure to 30 June 2007 ($ million)
Government	50.1	15	20.5^	13.4
Landholders-in-kind	214.2	30	n/a	48.0#
Landholders/urban levy	19.6	30	6.4	2.0
Total expenditure				**63.4**

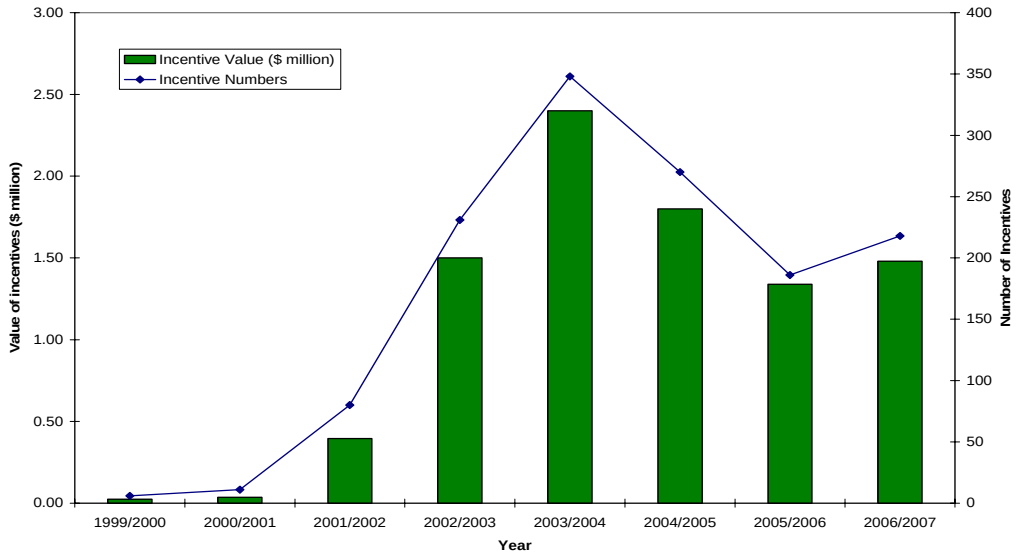
* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (agreed to but as yet unsigned).
^ This includes funds received that extend beyond the 2006/2007 reporting year.
# Calculated from invoices received from landholders and is an underestimate of total in-kind contribution

The financial administration of MIA EnviroWise is the responsibility of Murrumbidgee Irrigation Limited.

The expenditure of MIA EnviroWise funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Figure 1 The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding



Overview of the On Farm Program line items

Outlined in Table 1.1.b is an overview of the On Farm Program line items, targets and timelines for line items to 30 June 2007.

Table 2: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2007

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2007
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program Horticulture Large Area				1210 farms 700 farms 510 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	396 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	278 farms
* Vegetation Management Planning and Property Vegetation Planning	450 farms	1-15 years	Yes	315 farms 170 landholders
Irrigation efficiency systems	(270 farms)	1-15 years	Yes	91 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	303 farms
Conversion to perennial pasture	(2000 ha)	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	(40 farms)	10 years	No	0 ha
On-farm channel seepage control			No	0 ha
Rice soil amelioration & reclassification	(72 farms)	1-10 years	No	7 farms[+]
Drainage recycling	(450 farms)	1-15 years	Yes	214 farms
Sub-surface drainage and disposal	(65 farms)	1-13 years	Yes	6 farms
Mole drainage and on-farm recirculation	(7 farms)	1-10 years	No	0 farms
Laser forming	(7500 ha)	1-10 years	No	65,000ha▪
Rice target water use #	(619 ha)	1-10 years	No	443[^]
* EM31 Surveys	900 farms		Yes	50 farms
* Structural adjustment			Yes	5 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Line item included in structural adjustment
+ Farms now classified as unsuitable for rice production. There are an additional 48 farms classed as unsuitable pending investigation
^ Based on rice soil areas reclassified as unsuitable as per the Rice Environmental Monitoring Policy
▪ Based on number of whole farm plans completed

Program Expenditure and Targets

The program expenditure and the actual number of incentives paid against targets for line items of MIA EnviroWise for the last five years are presented in Figures 2 to 4. The highlights for the past year were the success of the biodiversity program with in excess of 360 ha of native vegetation planted and protected. In addition, the implementation costs have fallen below 10% of the program expenditure. In the past year the mid-term (5 year) review was completed and endorsed by the Murrumbidgee Catchment Management Authority. The review recommended a redevelopment of the on-farm incentives to ensure the program remains adaptive and keeps pace with advances in technology. The review of incentives will be completed in the next 6 months with the revised incentives being available over the remaining years of government funding.

On-Farm Activities (Figures 2 & 3 - pages 7 & 8)

Over the life of the program the payment of the government funding has been sporadic with no funding being received in some years. In 2006/2007 funding year the Murrumbidgee Catchment Management Authority (MCMA) has provided catch up funding. The aim of this was to bring the MIA EnviroWise program funding into line with the Heads of Agreement. The catch up funding equated to spending three years funding in two and resulted in the outputs being well below the identified targets. Outlined below is a summary of the on-farm incentives program for 2006/2007 including a discussion on progress:

- Irrigation Efficiency Systems Implementation incentive is close to budget and target levels. This is mainly due to the number of large area farms converting to horticulture over the past 5 years. Currently these farms are not eligible for the High Tech Horticulture incentive. Large area farms also use this incentive where they do not meet the criteria for the Drainage recycling incentive.
- Whole Farm Planning activities expenditure has fallen well behind budget during the past 5 years. This can be attributed to the generally lower costs of preparing a horticultural farm plan compared to the estimated costs during the LWMP development. On average a farm plan is costing between $2,000–3,000 to prepare for both large area and horticulture farmers. However, this figure may be misleading when determining the true cost of preparing a large area Whole Farm Plan. To date many of the large area participants have only needed their plans to be consolidated meaning very little field survey work is required. This is due to the fact their farms are fully developed and laser levelled. In relation to horticulture Whole Farm Plans, the cost of drip irrigation design was incorporated into the system costs and not billed separately which has meant that MIA EnviroWise has not been able to include the design costs in the Whole Farm Plan. Whole Farm Planning incentive numbers are also below target for both large area and horticulture. In relation to horticulture, this can be attributed to the reduction in commodity prices, dry conditions and the anticipation of the company's Integrated Horticulture Supply (IHS) system. The limited suppliers available locally to prepare plans at times results in delays in completing plans and achieving the targets set for large area farmers.
- As was indicated in the 2005/06 report there has been a widening of the gap between the budgeted target number and the actual implemented number of incentive for High Tech Horticulture. The High Tech horticulture incentive has not been close to either the budget or target number for the past 5 years (see figures 2 and 3). In 2006/2007 numbers have increased in relation to previous years however due to the catch up funding being provided the numbers were well below the target. The limited availability of installers with a narrow window for installation (confined to winter months) has also contributed to the lower than expected uptake rates. The advice provided by all local installers is that a maximum of 60-70 systems could be installed annually, which is well below the negotiated level of 157 for the past year. It is anticipated that as Murrumbidgee Irrigation's IHS program continues there will be an increase in the number of landholders converting to drip irrigation as their supply channels are converted to pressurised pipelines. In light of this and based on the recommendations of the MIA EnviroWise review the annual target number of High Tech Horticulture systems will be reviewed to extend it over the remaining years of the plan and to bring it in line with the ability of the installers to implement systems as well as the HIS timeframe

- Subsurface drainage & disposal expenditure and incentives paid are in below the target for the past five years. All of the incentives were paid for systems installed between July 1998 and 2001. Hence these incentives were paid retrospectively. While the ongoing dry conditions and lower watertables may have influenced the uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive.
- Uptake of EM31 soil survey incentive has been slow and well below both target and budget. This has been the result of to two factors. The first is due to the conditions imposed relating to a potential reduction in areas approved to grow rice. Secondly there has been a dramatic reduction in the area sown to rice due to the low allocation levels, meaning the farmers are using soils more suited to rice growing resulting in lower water use. This in turn leads to fewer landholders exceeding the rice target water use and therefore no requirement to undertake a EM31 surveys.
- Conversion to Perennial Pasture incentive has not been offered as it is not a priority and further it is unlikely there will be any uptake of this incentive.
- There has been no uptake of On-farm Channel Seepage Control (WWID only) incentive despite being promoted in previous years. In the past year there has been no promotion of this incentive.
- Rice Soil Amelioration & reclassification incentive has not been offered and it is uncertain if there will be ongoing interest with this incentive. Despite there being no incentive there has been 443ha (7 farms) reclassified as unsuitable for rice production and a further 3,471ha (48 farms) reclassified as "unsuitable, awaiting investigation". There has also been 3,190ha in 46 farms converted to horticulture production since the inception of MIA EnviroWise, unofficially taking unsuitable land out of rice production
- Drainage recycling continues to track well against both the budget and targets in figures 2 and 3. For the 2006/2007 year both expenditure and incentive numbers have fallen below the overall targets. This is due to the catch up funding provided by the CMA. Additionally, while farmers believe that recycling will maximise their water use efficiency there has been minimal on-farm expenditure in the past year as farm income is reduced due to the ongoing drought.
- There has been no expenditure on Mole Drainage and Recirculation since the inception of the program despite being promoted. While the ongoing dry conditions and lower watertables may have influenced the uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive.

Figure 2: On-Farm Activities - Expenditure

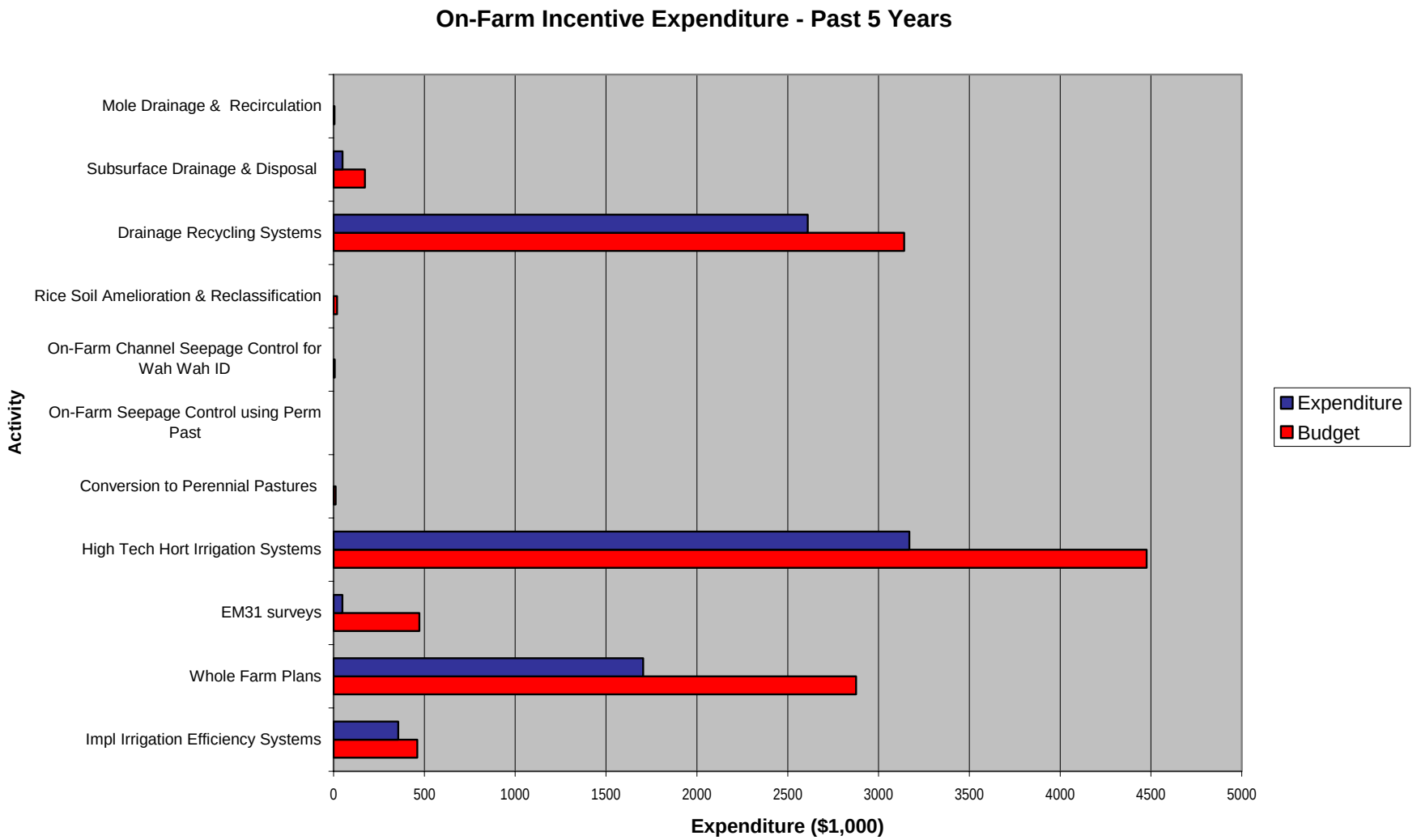
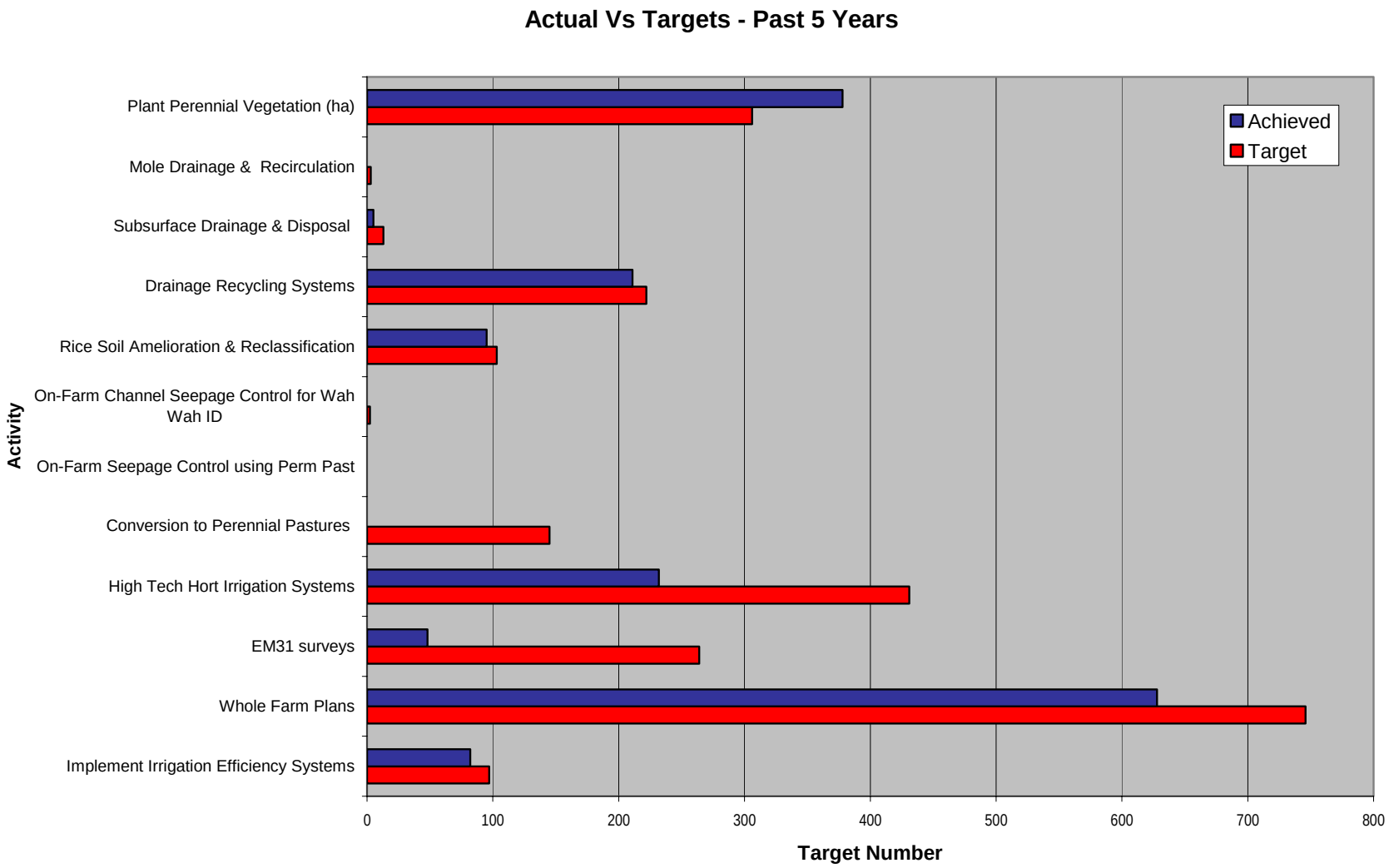


Figure 3: On-Farm Activities – Targets Achieved

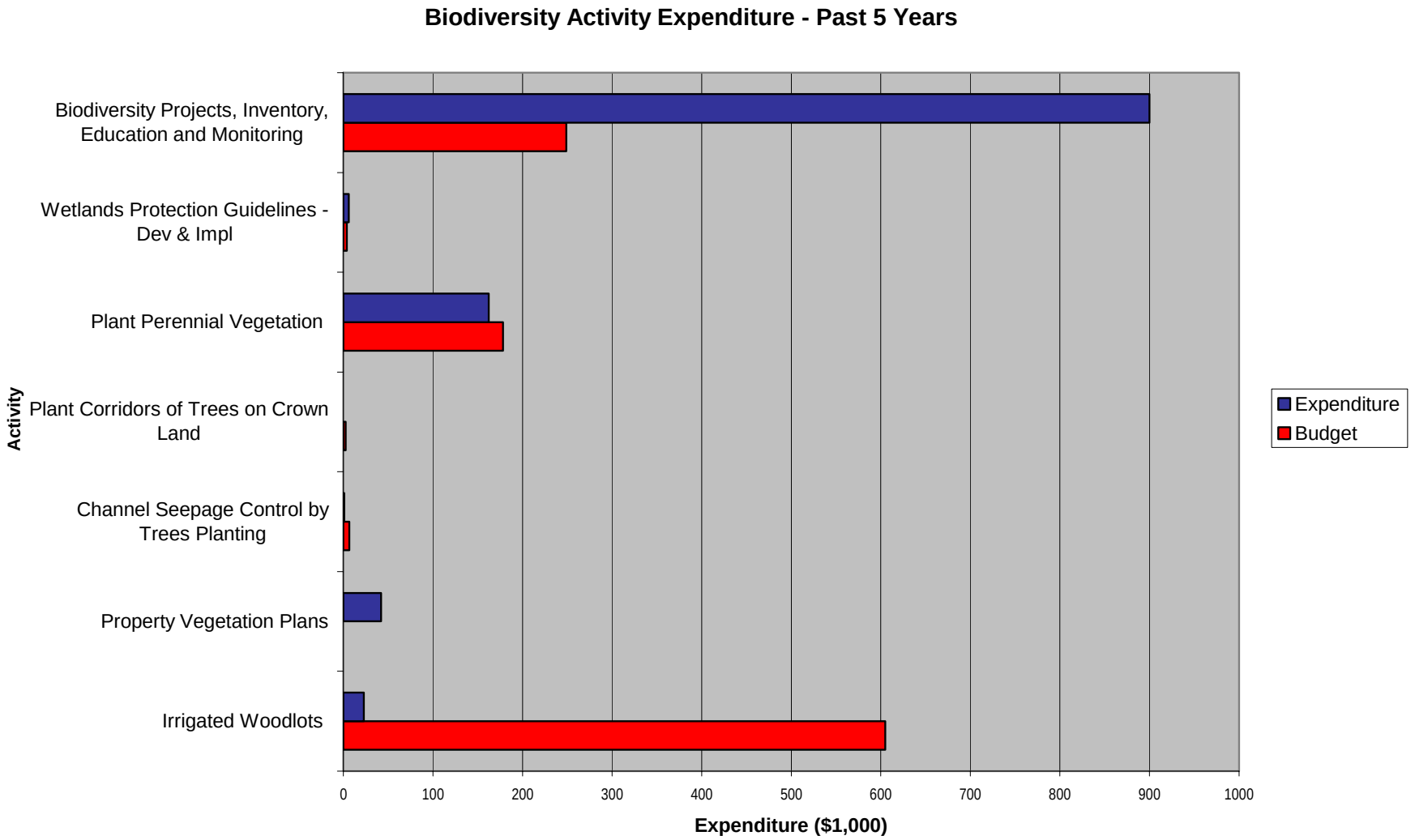


Biodiversity Activities (Figure 4 – page 10)

Due to the reduction in landholders completing on-farm works as a result of continued low allocations, MIA EnviroWise has increased the emphasis on the Biodiversity Activities.

- The focus on the biodiversity component of the program has seen many of the relatively large number of vegetation management plans being implemented over the past 12 months which has greatly exceeded the target as shown in figure 3. It is also worth noting that while achieving in excess of the target, expenditure was well below budget (see figure 4).
- Low priority was assigned to 'Channel seepage control by tree planting' and 'Plant corridors of trees on crown land' due ongoing drought conditions. There are plans to increase the priority of these line items in the coming year if the season improves.
- A new item (Property Vegetation Plans) has been added which is consistent with the *Native Vegetation Act, 2000*.
- In the past considerable work has been undertaken in establishing baseline biodiversity data. The projects undertaken have provided an extremely comprehensive set of data that will act as a building block for the establishment of a biodiversity strategy for the MIA. Over the past year there has been very little in the way of biodiversity monitoring with the focus now on on-ground biodiversity project such as Mirrool Creek. While expenditure of both government and community funds is in excess of the forecast budget, the quality of work achieved will result in the strategy being developed at low cost as no additional data sets will be required. The datasets provide a perfect baseline for the transition to and development of the next stage and will assist in establishing clear outcomes for biodiversity activities.

Figure 4: Biodiversity Activities

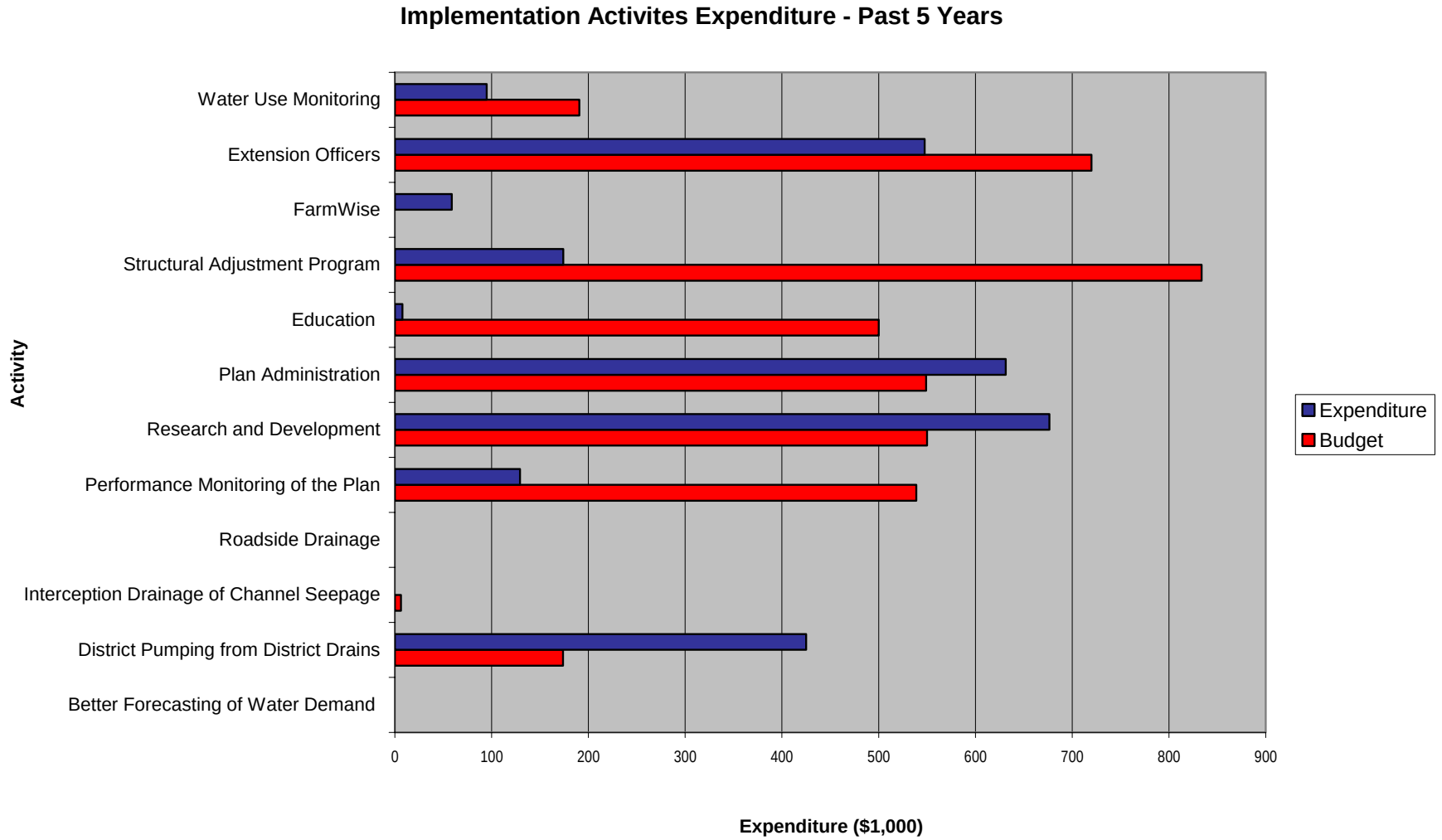


Implementation Activities (Figure 5 – page 12)

Implementation activities are programs carried out by the Company on behalf of the whole community. The highlights on the implementation activities for the 2006/2007 year have been:

- the installation of six weather stations to improve the water use monitoring across the MIA
- the development and implementation of an Education incentive with 31 farming business undertaking training involving improving water use efficiency, biodiversity management and best management practices for farming.
- Plan Administration being managed below 10% of total expenditure.
- The development of a Research and Development program with a joint venture an initial project with CSIRO.
- The mid-term review has been completed as and formally endorsed by the Murrumbidgee Catchment Management Authority.
- The development and implementation of an urban Smart Watering Program which was aimed at improving the efficiency of urban garden water use.

Figure 5: Implementation Activities – Expenditure



A.1.2 Documentation relevant to background and/or implementation of the LWMP

Table 3 includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

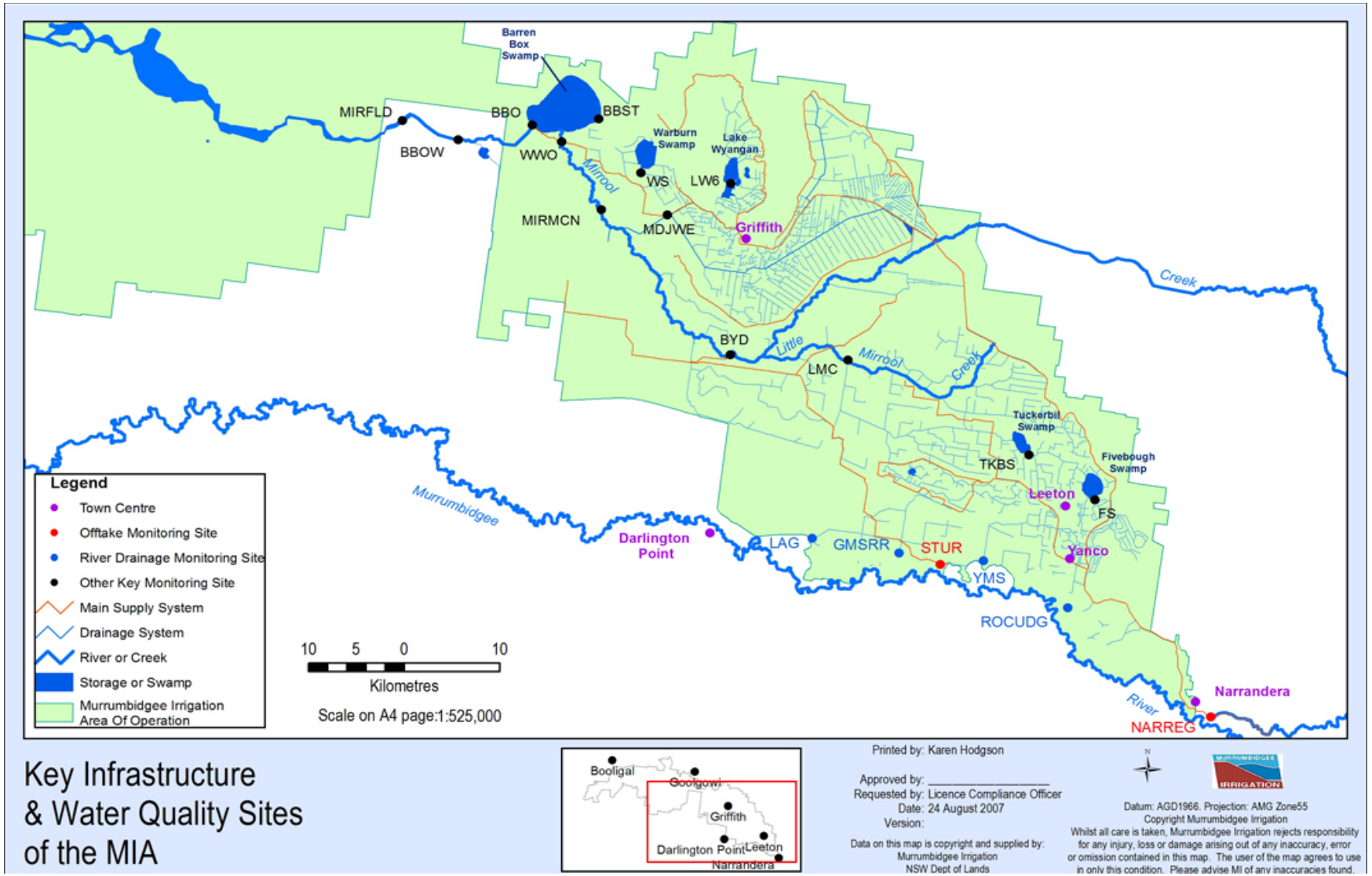
Table 3: Key reference documents relevant to the LWMP (MIA EnviroWise)

Document	O/R	Submitted to DNR	Endorsed by DNR
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey.* Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, Charles Sturt University, Wagga Wagga. Report prepared for Murrumbidgee Irrigation. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for	R	October	*

	O/R	Submitted to DNR	Endorsed by DNR
Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.		2006 Electronic (on disc)	
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants*. Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	
Van der Lely, A. (2006). *Groundwater Conditions In The MIA and Districts: Annual Report 2006*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
MIA EnviroWise (2007) Five Year Review	R	February 2007	*

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DNR, waiting on endorsement

A.2. Water Supply and Drainage Management



A.2.2 Reporting requirements

Climatic conditions

The 2006/07 season showed significant variation to the long term average weather patterns. Rainfall was minimal throughout the year. There was little to no rainfall from August to May. Total rainfall was less than half the long term average, lower than licence benchmark figures and significantly lower than that in 2005/06. ETo was higher which combined with low rainfall made for a difficult season for irrigators.

Table 2.2.a: Summary of climatic data

Month	ETo 2006/07 (mm)	Rainfall 2006/07 (mm)	Net ETo (ET-Rainfall) (mm)	LTA ETo (1962-2006) (mm)	LTA Rainfall (1962-2006) (mm)
July	50	44.2	5.8	44.2	35.7
August	88.8	2.6	86.2	49.8	34.2
September	154.6	10.2	144.4	76.6	36.6
October	239.6	0	239.6	115.0	37.4
November	262.4	18.4	244	174.0	41.9
December	309.2	3.4	305.8	228.1	28.8
January	317.3	11.2	306.1	274.7	28.9
February	267.5	1.2	266.3	280.9	33.3
March	224.8	19.8	205	230.1	29.0
April	143.6	21.8	121.8	191.0	33.8
May	80.8	45.6	35.2	114.8	31.3
June	43.6	16.6	27	66.3	37.3
Total	**2182.2**	**195**	**1987.2**	**1845**	**408.2**

Source: CSIRO Griffith
Notes
LTA = Long term average (1962-2006), weather data from CSIRO Griffith
ETo = reference evapotranspiration

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2007

Year	Announced allocation (general/high %)	Total diversions (ML)	Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2006/07	**10/90**	**559,952***	**411,898**	**1987**	**2182**	**195**
2005/06	57/95	1,036,519*	829,990	1568	1935	367
2004/05	43/95	826,207	648,417	1,713	1,983	270
2003/04	41/95	861,499	651,806	1,645	1,998	353
2002/03	38/95	960,119	754,112	1,938	2,191	253
2001/02	72/95	1,141,607	916,611	1,744	2,032	288
2000/01	90/95	1,048,053	857,455	1,471	1,887	416
1999/00	78/100	818,496	646,402	1,242	1,832	590
1998/99	85/100	1,036,169	825,390	1,331	1,868	537
1997/98	90/100	1,225,805	976,972	1,563	1,931	368
1996/97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995/96	105/100	1,107,225	882,766	1,439	1,862	423
LTA					1,845	408

Sources: Corporate Office, CSIRO Griffith
Notes: * = Does not include 3,256ML State Water environmental flows through Roaches Escape.

A.2.2(1) Diversions, volume

Table 2.2.c: Summary of Gross Diversions Main and Sturt Canal 2006/07

	Sturt (ML)	Main(ML)
July	0	1477
Aug	6611	37430
Sept	18812	69343
Oct	23551	92189
Nov	4054	52437
Dec	3868	55855
Jan	3024	61521
Feb	0	51139
Mar	360	53343
Apr	0	16087
May	0	8607
Jun	0	3500
TOTAL	**60280**	**502928**

Note: 60,280 + 502,928 ML = 563,208 ML
less State Water diversions through Roaches Escape (environmental flows) 3,256 ML
net irrigation diversions = 559,952 ML

Table 2.2.d: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2006/07

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
July	0	1,477	0
August	8,576	36,695	3,410
September	23,907	68,888	9,275
October	27,528	91,059	10,320
November	5,881	51,361	7,655
December	5,410	55,182	5,075
January	5,187	60,322	4,005
February	3,906	50,103	2,615
March	4,807	51,298	7,780
April	-33	16,102	2,530
May	-387	4,608	30
June	-725	3,777	0
Total 2006/07	**84,057**	**490,872**	**52,695**
Total 2005/06	229,065	776,856	115,670
Total 2004/05	145,728	680,479	100,155
Total 2003/04	174,150	687,349	94,027
Total 2002/03	176,488	783,631	98,915
Total 2001/02	229,155	912,452	145,490
Total 2000/01	223,518	824,535	167,255
Total 1999/00	165,440	653,056	151,020
Total 1998/99	200,260	835,909	165,385
Total 1997/98	212,875	977,720	161,130
Total 1996/97	261,955	1,016,135	151,960

Notes:
Diversions shown in Table 2.2.d for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System includes Mirrool Creek Diversions + Barren Box Diversions

A.2.2(2) Supply efficiency, storage levels

Supply efficiency

The table below shows the simple efficiency of the system to be 73.6%. This calculation shows the apparent loss to be about 148GL. The water balance in Section A.2.2 (5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

The deterioration in simple efficiency reflects the real efficiency loss as diversions reduce to lower than optimal levels. Allocation cuts were made mid- year. This left many systems with insufficient demand to make diversions in any way comparatively efficient. Many management and operational changes were implemented to minimise conveyance losses and improve efficiency. Without those initiatives, the simple efficiency would have been much lower.

Table 2.2.e: Simple efficiency of the system —1999 to 2006

Parameter	2006/07	2005/06	2004/05	2003/04	2002/03	2001/02	2000/01	1999/00
Diversions (ML)								
Sturt Canal	60,280	233,388	145,728	174,150	176,488	229,155	223,518	165,440
Main Canal	502,928	805,277	680,479	687,349	783,631	912,452	824,535	653,056
Less DNR Environmental Diversions	3,256	2,146						
NET TOTAL irrigation diversions	**559,952**	**1,036,519**	**826,207**	**861,499**	**960,119**	**1,141,607**	**1,048,053**	**818,496**
Sales (ML) - metered and un-metered*	411,898	829,990	648,417	651,806	754,112	916,611	857,455	646,402
Conveyance (ML)	148,054	206,529	177,790	209,693	206,007	224,996	190,598	172,094
Simple Efficiency(%)	**73.6**	**80.1**	**78.5**	**75.7**	**78.5**	**80.3**	**81.8**	**79.0**

Source: MI Irrigation Services and Corporate Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100

Storage levels

Barren Box

The Barren Box Storage and Wetland facility was commissioned on the 11th of August 2006. About 7365 ML of water was evacuated from the Storage in the Spring of 2006. Approval was sought and obtained from State Water to evacuate all water stored in the intermediate and active cells. This was an exceptional situation, due to the drought. The water was used to help supply growers in the Wah Wah Irrigation District.

Lake Wyangan

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. Murrumbidgee Irrigation attempts to regulate the Lakes' levels to satisfy the various demands to meet commercial irrigation, environmental and community objectives.

As a result of the allocation cut-back announced in November 2006, Murrumbidgee Irrigation's conveyance licence was cut as well. In order to meet supply requirements, temporary pumps were used in

April 2007 to pump approximately 800 ML from the North Lake up into the South Lake for reuse on citrus crops on the Lakeview Branch Canal.

Due to the low water levels in the Lakes and continued warm weather into autumn, there were some algal blooms in the Lakes. This led to the Lakes being closed for a brief period. The situation was monitored by Griffith City Council with assistance from Murrumbidgee Irrigation.

The monthly figures relating to the volumes pumped by Murrumbidgee Irrigation from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.j in A.2.2(4), Drainage reuse. Table 2.2.f (below) provides 2006/07 monthly gauge heights (water depth) for the lakes.

Table 2.2.f: Gauge heights for South and North Lake Wyangan 2006/07

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.34	1336	1.12	1119
Aug	1.20	1195	1.17	1165
Sep	1.21	1208	1.20	1203
Oct	1.13	1125	1.11	1105
Nov	1.31	1310	1.05	1053
Dec	1.20	1204	0.91	908
Jan	1.09	1090	0.74	738
Feb	0.97	970	0.58	583
Mar	1.02	1023	0.50	500
Apr	1.12	1124	0.30	300
May	1.19	1190	0.20	200
Jun	1.35	1345	0.36	356

Source: MI Irrigation Services
Gross Resources = Gauge height converted into megalitres.

A.2.2 (3) Drainage volumes and salt loads

Table 2.2.g: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description
410127	NARREG	Narrandera Regulator
410129	STUR	Sturt Canal
410167	BBOW	Barren Box Outfall Canal Wyvern
410174	MDJWE	Main Drain J Upstream of Warburn Escape
410085	LMC	Little Mirrool Creek
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon
41010921	GMSRR	Gogeldrie Main Southern Drain
410083	YMS	Yanco Main Southern Drain
41010005	ROCUDG	Cudgel Creek Roaches Escape
41010162	WS	Warburn Swamp
41010955	MIRMCN	Mirrool Creek at McNamara Road
41010908	BYD	Bray's Dam Diversions and Bywash
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage & Wetlands*
41010896	LW6	Lake Wyangan Causeway
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)
41010157	TKBS	Tuckerbil Swamp By-pass drain
41010163	MIRFLD	Mirrool Creek Floodway (when being used)
Other Sites Required for DNR Licence		
41010903	BBO	Barren Box Outfall
41010978	WWO	Willow Dam

Table 2.2.h shows the monthly total flow volumes from the Murrumbidgee River entering the Murrumbidgee Irrigation Area measured at two of the three main regulated sites; at Narrandera (NARREG) after diversion at Berembed Weir and also at the Sturt Canal (STUR) after diversion at Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- Little Mirrool Creek (LMC) - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- Bray's Dam (BYD) - Drainage diversion from LMC to the Benerembah Irrigation District.
- Mirrool Creek at McNamara Road (MIRMCN) - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- Main Drain J (MDJWE) - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- Barren Box Outfall Wyvern (BBOW) - Drainage flow from Barren Box at Wyvern Station discharging to Wah Wah Irrigation District.

Additionally, the four river channel wetland sites which potentially discharge to the Murrumbidgee River

- Yanco Main Southern (YMS) - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- Gogeldrie Main Southern (GMSRR) - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water is pumped into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- Gooragool Lagoon (LAG) - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by customers as drainage reuse water.
- Cudgel Creek downstream from Cudgel Creek (ROCUDG) - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings as well as those decisions dealing with asset design, purpose and function.

A.2 Water Supply and Drainage Management

Table 2.2.h: Drainage Volumes (ML) – July 2005 to June 2006

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	[ ]	38907	69343	92189	52437	55855	61521	51139	53343	16087	8607	3500	**502928**
STUR**	**Monthly Total**	[ ]	6611	18812	23551	4054	3868	3024	0	360	0	0	0	**60280**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	13.5	29.1	90.2	80.9	43.8	33.9	30.1	26.9	28.3	10.0R	5.6R	5.2R	33
	Median	10.6	7.2	88.3	79.8	40.5	34.9	28.2	27.4	27.5	6.6R	4.0R	3.8R	27
	Inst.Max	53.1	116	188	123	80.8	51	52.2	40	42.6	38.1R	22.0R	17.0R	188
	Inst.Min	3.7	4.5	42.8	56.5	18.7	18.8	17.9	16.6	16.1	1.5R	0.8R	1.1R	1
	Monthly Total	419	902	2705	2508	1315	1051	932	753	876	299R	173R	156R	**12090**
MIRROOL AREA - MIRROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	1370	3080	2365	1570	1105	875	940	1195	15	0	0	12515
BYD (Bywash)**	**Monthly Total**	3168	973	878	1226	918	1090	186	60	548	1103	83	0	10233
MIRMCN (41010955)	**Mean**	137 R	103 R	239	282	226	156 R	139	118 R	149	94.3R	44.2R	27.9R	143
	Median	125 R	29.4R	240	276	226	145 R	128	120 R	142	89.7R	22.1R	17.1R	127
	Inst.Max	317 R	313 R	327	436	350	254 R	236	182 R	223	237 R	192 R	236 R	436
	Inst.Min	18.9R	6.3R	149	200	132	60.6R	77.1	62.1R	95.5	14.6R	4.9R	5.0R	5
	Monthly Total	4260R	3201R	7181	8729	6784	4821R	4307	3317R	4628	2829R	1369R	838R	**52260**
DRAINS														
MDJWE (410174)	**Mean**	63.3R	122 R	255	263	[237]	[130]	127	111	225	62.1R	33.5R	27.4R	138
	Median	19.7R	30.4R	244	259	[230]	[120]	122	104	253	39.2R	21.3R	18.1R	112
	Inst.Max	765 R	414 R	595	355	[466]	[235]	222	186	403	299 R	146 R	238 R	765
	Inst.Min	4.9R	5.3R	94.4	181	[104]	[53.2]	72.6	63.8	83.9	13.4R	13.5R	12.5R	5
	Monthly Total	1962R	3786R	7655	8164	[2841]	[3117]	3933	3099	6960	1863R	1038R	823R	**45240**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	0.0R	112 R	406	329	270 R	141 R	55.8R	240 R	231 R	272 R	19.0R	0.0R	173
	Median	0.0R	0.0R	387	318	261 R	127 R	46.4R	272 R	246 R	269 R	0.0R	0.0R	187
	Inst.Max	0.0R	617 R	606	511	489 R	316 R	187 R	474 R	468 R	370 R	174 R	0.0R	617
	Inst.Min	0.0R	0.0R	247	166	97.0R	0.0R	0.0R	7.9R	0.0R	151 R	0.0R	0.0R	0
	Monthly Total	0R	3457R	12190	10190	8115R	4372R	1729R	6730R	7155R	8154R	589R	0R	**62690**
YANCO AREA-RIVER DRAINS														
YMS∞ (410083)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	0
GMSRR (41010921)	**Mean**	2.3	0.8	0.7	0.7	1.2R	1.4	1.2R	1.6R	1.5R	0.4R	0.8R	0.9	1
Flows measured at this	**Median**	0.3	0.3	0.7	0.6	1.1R	1.1	1.2R	1.4R	1.5R	0.3R	0.2R	0.4	1
site are re-used and there-	**Inst.Max**	20.1	9.2	3.3	2.7	6.2R	5.4	3.7R	11.9R	7.2R	5.6R	5.2R	5	20
fore not included in total	**Inst.Min**	0.1	0.1	0.1	0.3	0.5R	0.7	0.0R	0.0R	0.0R	0.0R	0.0R	0.1	0
river drainage	**Monthly Total**	70	26	22	22	37R	43	39R	45R	48R	12R	24R	26	414
LAG ≈ (41010940)	**Mean**	4.4	0.5	2.5	5.8	1.0	[0.8]	[3.0]	1.1R	1.1R	1.3R	1.3R	0.8	2
	Median	2.8	0.5	2.1	3.8	0.3	[0.8]	[2.9]	1.1R	1.0R	1.5R	1.3R	0.8	1
	Inst.Max	20.8	3.3	14.6	37.7	7.1	[1.5]	[8.0]	4.9R	1.7R	2.2R	2.2R	1.1	38
	Inst.Min	0.3	0.1	0.0	0.1	0.2	[0.2]	[0.3]	0.2R	0.8R	0.6R	0.9R	0.4	0
	Monthly Total	138	16	76	180	29	[9]	[67]	32R	33R	40R	40R	23	683
ROCUDG^ (41010005)	**Mean**	0.6R	0.5R	0.6R	1.8R	0.4R	0.9R	1.7R	0.4R	1.6R	0.1R	57.0R	12.2R	6
	Median	0.6R	0.5R	0.6R	1.6R	0.4R	0.6R	0.6R	0.0R	0.9R	0.0R	5.4R	1.6R	1
	Inst.Max	0.8R	0.8R	1.4R	6.2R	1.5R	4.2R	9.8R	3.1R	8.1R	0.6R	197 R	188 R	197
	Inst.Min	0.4R	0.3R	0.1R	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.7R	0
	Monthly Total	19R	15R	18R	56R	13R	27R	52R	11R	49R	2R	1768R	366R	2396[&]
TOTAL		[&] May & June figures for ROCUDG are State Water Diversions and have been excluded from the total												**945**
SWAMPS														
WS**	**Monthly Total**	0	0	0	4	2	2	0	0	2	0	0	0	10
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	0
EXTRA SITES FOR DNR														
WWO**t		0	3900	350	55	160	0	0	15	245	295	808	600	1427
BBO**>		0	50	0	0	0	0	0	0	0	0	0	0	50
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Monthly Total	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	**0**

A.2 Water Supply and Drainage Management

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0.0	0.4	1.2	0.6	0.1	0	0	0	0	0	0	0	0
	Median	0.0	0.0	0.7	0.3	0.0	0	0	0	0	0	0	0	0
	Inst.Max	0.0	2.4	7.1	3.6	2.0	0	0	0	0	0	0	0	7
	Inst.Min	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0
	Monthly Total	0	11	35	18	3	0	0	0	0	0	0	0	67
DCWIDG (41017001)	Mean	0.6	0.1	0.4	0.4	[1.6]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0B	0.0B	0
	Median	0.2	0.1	0.2	0.2	[0.6]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0B	0.0B	0
	Inst.Max	10.2	0.6	2.5	2.3	[16.2]	[0.6]	0.0=	0.0=	0.0=	0.0=	0.0B	0.0B	16
	Inst.Min	0.0	0.1	0.1	0.1	[0.1]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0B	0.0B	0
	Monthly Total	18	4	12	13	[33]	[0]	0=	0=	0=	0=	0B	0B	80
DCCENT (410172)	Mean	0.3	0.1	0.5	0.7	0.5	0	0	0	0	0	0	0	0
	Median	0.2	0.0	0.4	0.0	0.1	0	0	0	0	0	0	0	0
	Inst.Max	1.4	2.4	2.4	7.5	6.6	0.1	0	0	0	0	0	0	8
	Inst.Min	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0
	Monthly Total	9	2	15	23	14	0	0	0	0	0	0	0	62
BID2 (41010717)	Mean	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
Rating confirmation not	Median	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
received at time of	Inst.Max	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
printing	Inst.Min	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
	Monthly Total	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by ECOWISE (July to November) and THIESS SERVICES (December to June) except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. [ ] Data not recorded 0 = No flow
3. [n] Incomplete data set due to missing data
4. R Rating table extrapolated
5. S Rating table suspended
6. t Flows into BBS from Willow Dam
7. # Other Authorities data
8. Salt loads could not be calculated because of no flow or no EC available at time of flow.
9. Salt loads from Ecowise & Thiess Services unless** where we have calculated them using the formula below
   Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000
10. = Pool reading only, no flow condition
11. □ Suspect/bad data
12. B Backed-up stage
13. ^ The following comments from Thiess Services indicate that the measurements at this site are not always accurate: "Large amounts of debris have built up below the control. This will cause the control to become ineffective at high flows. The Rating Table being used is 2-3 years old and changes have occurred in creek."
14. ≈ Of the total flow of 683 ML, 409 ML was re-used by growers who pump out of the drainage channel.
15. ∞ Zero flow and therefore zero salt load, to be confirmed by Thiess.
16. TBC To Be Confirmed
17. " No data exists
18. T Probe out of water
19. * debris affecting sensor
20. > Flows at BBS to the Outfall

Drainage volumes to the Murrumbidgee River (ML)

Year	2003/04	2004/05	2005/06	2006/07
TOTAL	7,434	5,663	8,570	945

Sites highlighted in blue are sites that may drain back to the Murrumbidgee River

During the 2006/07 year Murrumbidgee Irrigation diverted 563,208 ML of water from the Murrumbidgee River, of which 3,256 ML were environmental flows taken in on behalf of DWE. This water contained approximately 19,185 tonnes of salt.

Of this salt load, approximately 189 tonnes (less than 1% of the imported salt load) were discharged into wetlands which are connected to the Murrumbidgee River in about 1 GL of drainage water (0.2% of diversions).

The significant reduction in drainage back to the wetlands associated with the Murrumbidgee River is due to the low allocations which have led to reduced on-farm drainage as well as innovative solutions for drainage re-use.

Murrumbidgee Irrigation has strategies in place to improve its ability to manage salt in the landscape. These include programs on Rice Environmental Monitoring and channel seepage control, soil suitability and hydraulic loading. Murrumbidgee Irrigation's MIA EnviroWise program also contributes to these management objectives.

Figures 2.2.b and 2.2.c show that at most monitoring sites within the drainage system there has been a reduction of salt loadings since the 1999/00 reference year. A significant reason for this is the reduced

drainage volumes, which is the result of improved on-farm water management as well as innovative solutions for drainage re-use by Murrumbidgee Irrigation.

The water and salt balances give us a very general picture of what happens to supply and drainage flows and resultant salt loads moving through the MIA system. Detailed figures are provided in Tables 2.2.h and 2.2.i.

Figure 2.2.b: Historical Salt Loads to the Murrumbidgee River

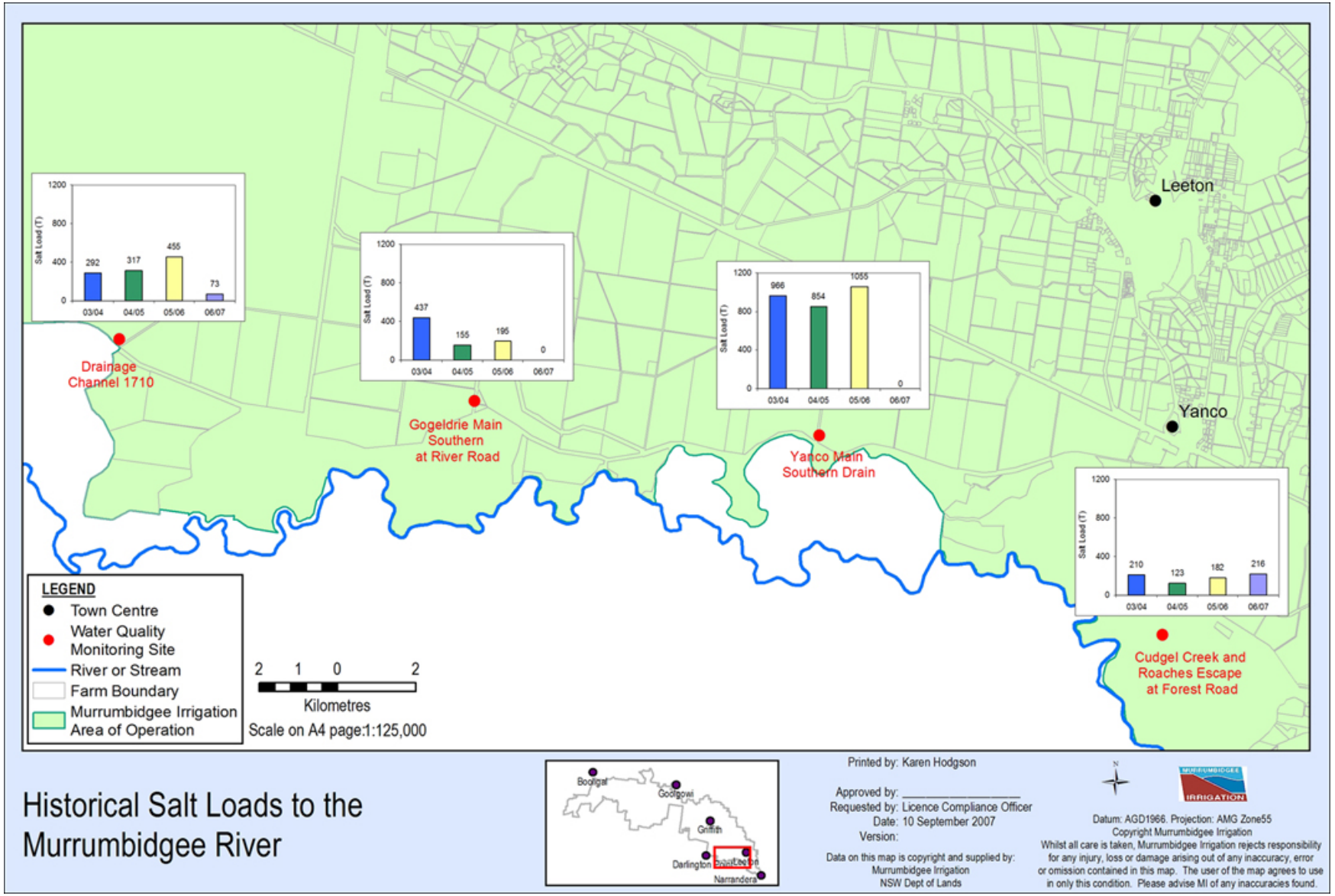


Figure 2.2.c: Historical Salt Loads to the Mirrool Creek System

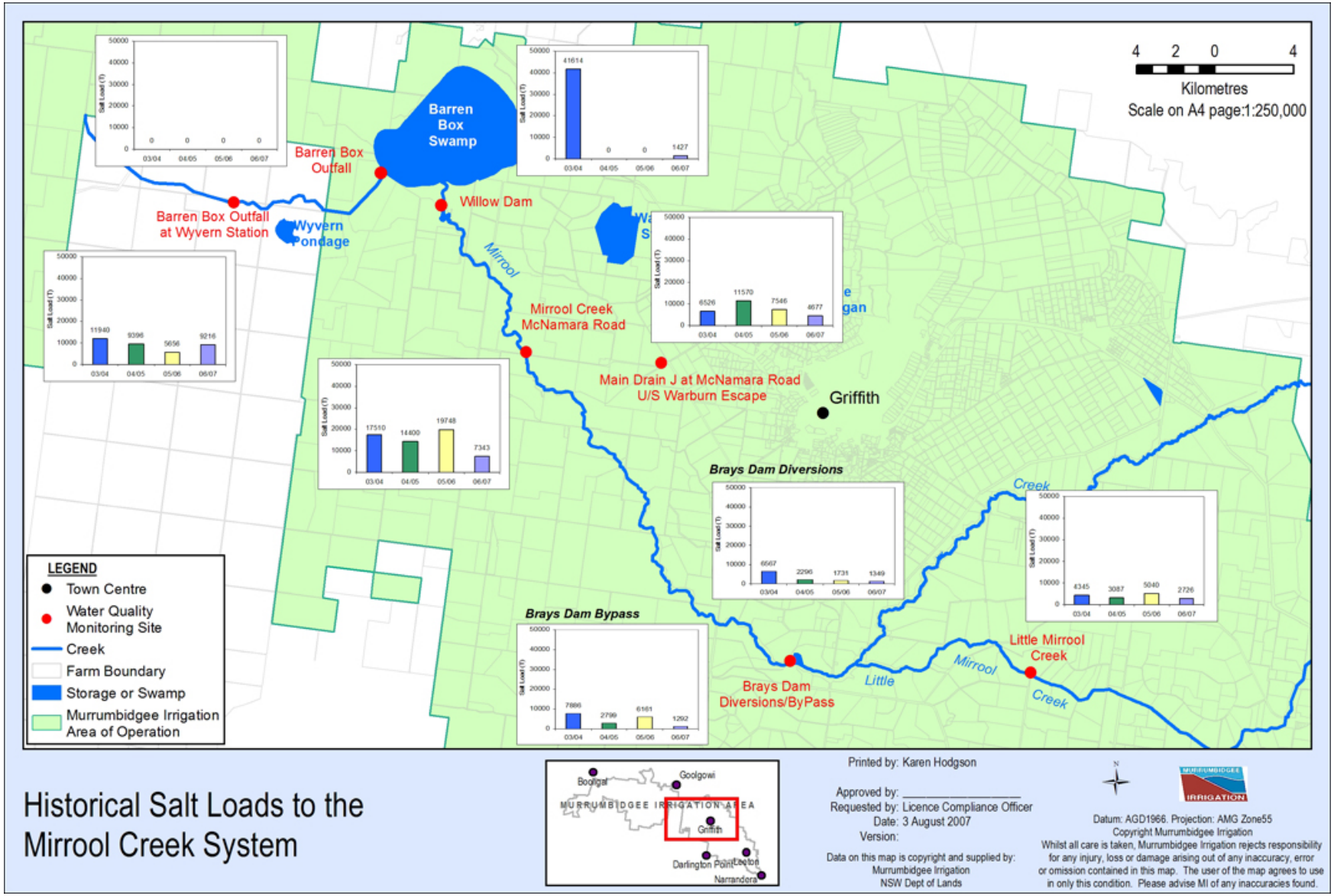


Table 2.2.i: Salt Loads (Tonnes) – July 2005 to June 2006

Monthly Salt Load Data (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0	41	3240	2714	1644	1895	2284	2324	2868	0	0	0	**17008**
STUR**	**Monthly Total**	0	905	927	799	135	187	108	0	21	0	0	0	**2177**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	8.5#	13.3#	14.6#	13.1#	9.7#	5.9	4.9	5.4	5.2	2.8R	3.1R	2.9R	7
	Median	6.6#	12.4#	13.9#	12.9#	9.5#	5.4	5	5.2	5	2.3R	2.2R	2.4R	5
	Inst.Max	44.8#	38.7#	24.8#	19.5#	17.0#	15.8	12.4	13	11.8	8.5R	14.2R	10.6R	45
	Inst.Min	2.4#	7.5#	9.2#	8.3#	4.8#	3	2.5	2.9	3.3	0.9R	0.8R	0.7R	1
	Monthly Total	264#	413#	438#	405#	291#	184	153	151	161	85R	95R	88R	**2726**
MIRROOL AREA - MIRROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	214	481	303	215	0	136	0	0	0	0	0	1349
BYD (Bywash)**	**Monthly Total**	691	152	137	157	126	0	29	0	0	0	0	0	1292
MIRMCN (41010955)	**Mean**	27.2R	21.9R	34.1#	40.6#	27.5#	17.5R	13.4	12.3R	14.7	14.2R	10.4R	7.0R	20
	Median	21.0R	18.7R	36.7#	41.8#	26.9#	17.5R	13	12.1R	14.7	13.0R	7.5R	5.9R	16
	Inst.Max	93.2R	68.0R	48.6#	58.8#	44.3#	31.6R	24.3	19.2R	22.2	34.2R	35.4R	31.9R	93
	Inst.Min	9.0R	5.5R	20.8#	24.4#	17.9#	8.4R	8.4	6.4R	8.8	4.8R	1.8R	2.3R	2
	Monthly Total	844R	679R	1022#	1258#	825#	542R	416	343R	456	425R	323R	210R	**7343**
DRAINS														
MDJWE (410174)	**Mean**	5.5R	5.4R	16.0#	28.8#	[37.0]	[16.2]	12.5	11.9	20.1	9.7R	8.9R	7.4R	15
13.9 days missing data	**Median**	4.4R	6.3R	0.0#	42.0#	[35.0]	[15.6]	12.5	11.8	19.8	7.9R	7.4R	6.4R	10
	Inst.Max	23.4R	22.2R	57.1#	68.7#	[79.6]	[38.3]	28.3	20.1	33.1	30.7R	26.4R	31.3R	80
	Inst.Min	0.0R	0.0R	0.0#	0.0#	[16.1]	[7.6]	8.2	8	10.2	3.1R	4.5R	4.6R	0
	Monthly Total	172R	169R	481#	894#	[444]	[388]	386	333	622	290R	277R	221R	**4677**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	0.0R	22.6R	69.5#	59.6#	41.5R	17.2R	5.5R	26.0R	26.9R	33.0R	2.7R	0.0R	25
56.8 days missing data	**Median**	0.0R	0.0R	63.7#	53.7#	41.2R	15.1R	4.9R	30.5R	23.7R	31.4R	0.0R	0.0R	19
	Inst.Max	0.0R	121 R	131 #	119 #	81.8R	41.0R	18.9R	61.2R	66.1R	49.5R	23.4R	0.0R	131
	Inst.Min	0.0R	0.0R	36.8#	29.8#	9.7R	0.0R	0.0R	0.8R	0.0R	15.2R	0.0R	0.0R	0
	Monthly Total	0R	700R	2084#	1849#	1244 R	534R	170R	729R	832R	990R	84R	0R	**9216.0**
YANCO AREA-RIVER DRAINS														
YMS∞ (410083)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0.003	0	0	0	0	0.003
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**
GMSRR (41010921)	**Mean**	1.0#	0.3#	0.2#	0.2#	[0.2]	[0.1]	0.1R	0.2R	0.1R	0.0R	0.1*	0.1	0
Salt loads measured at this	**Median**	0.1#	0.1#	0.2#	0.2#	[0.2]	[0.1]	0.1R	0.1R	0.1R	0.0R	0.0*	0	0
site are not included in	**Inst.Max**	9.6#	4.4#	0.5#	1.3#	[0.6]	[0.3]	0.3R	3.0R	0.6R	0.3R	0.4*	0.5	10
total river drainage	**Inst.Min**	0.0#	0.0#	0.0#	0.1#	[0.1]	[0.1]	0.0R	0.0R	0.0R	0.0R	0.0*	0	0
	Monthly Total	30#	8#	5#	7#	[4]	[2]	3R	5R	3R	1R	2*	2	**73**
LAG (41010940)	**Mean**	3.0#	0.3#	0.2#	0.3#	0.1#	[0.1]	[0.7]	0.2R	0.2R	0.3R	0.3R	[0.2]	0
	Median	1.8#	0.2#	0.1#	0.3#	0.0#	[0.1]	[0.6]	0.2R	0.2R	0.3R	0.3R	[0.2]	0
	Inst.Max	10.1#	0.8#	1.2#	1.4#	0.8#	[0.2]	[2.1]	0.8R	0.3R	0.6R	0.6R	[0.3]	10
	Inst.Min	0.2#	0.0#	0.0#	0.0#	0.0#	[0.0]	[0.0]	0.0R	0.1R	0.1R	0.2R	[0.1]	0
	Monthly Total	92#	8#	7#	10#	2#	[1]	[16]	6R	5R	10R	10R	[4]	**170**
ROCUDG (41010005)	**Mean**	0.0R	0.0R	0.0R	0.1R	0.0R	0.1R	[0.2]	0.0R	0.1R	0.0R	5.2R	1.2R	1
	Median	0.0R	0.0R	0.0R	0.1R	0.0R	0.1R	[0.1]	0.0R	0.1R	0.0R	0.6R	0.2R	0
	Inst.Max	0.1R	0.1R	0.1R	0.4R	0.1R	0.3R	[0.8]	0.3R	0.6R	0.0R	20.0R	19.6R	20
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.1R	0
	Monthly Total	1R	1R	1R	4R	1R	2R	[4]	1R	3R	0R	160R	37R	**216**
TOTAL		[&] May & June figures for ROCUDG are State Water Diversions and have been excluded from the total												**189**
SWAMPS														
WS**	**Monthly Total**				3	1	2			0				
FLOODWAY														
MIRFLD**	**Monthly Total**													
EXTRA SITES FOR DNR														
WWO**t	**Monthly Total**	0	1308	57	8	24	0	0	2	28	0	0	0	1427
BBO**>	**Monthly Total**													
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Salt Load Data (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DCCUD (41010713)	**Mean**	0.0#	0.1#	0.3#	0.1#	0.0#	0	0	0	0	0	0	0	0
	Median	0.0#	0.0#	0.2#	0.1#	0.0#	0	0	0	0	0	0	0	0
	Inst.Max	0.0#	1.0#	1.8#	1.4#	0.3#	0	0	0	0	0	0	0	2
	Inst.Min	0.0#	0.0#	0.0#	0.0#	0.0#	0	0	0	0	0	0	0	0
	Monthly Total	0#	3#	9#	5#	0#	0	0	0	0	0	0	0	**17**
DCWIDG (41017001)	**Mean**	0.1#	0.0#	0.1#	0.1#	[0.2]	[0.0]	0.0T	0.0T	0.0T	0.0T	0.0B	0.0B	0
	Median	0.1#	0.0#	0.1#	0.0#	[0.1]	[0.0]	0.0T	0.0T	0.0T	0.0T	0.0B	0.0B	0
	Inst.Max	3.3#	0.2#	0.8#	0.3#	[0.7]	[0.0]	0.0T	0.0T	0.0T	0.0T	0.0B	0.0B	3
	Inst.Min	0.0#	0.0#	0.0#	0.0#	[0.0]	[0.0]	0.0T	0.0T	0.0T	0.0T	0.0B	0.0B	0
	Monthly Total	4#	1#	3#	2#	[3]	[0]	0T	0T	0T	0T	0B	0B	**13**
DCCENT (410172)	**Mean**	[ ]"	[ ]"	[0.0]	0.1#	[0.1]	0	0	0	0	0	0	0	0
	Median	[ ]"	[ ]"	[0.0]	0.0#	[0.0]	0	0	0	0	0	0	0	0
	Inst.Max	[ ]"	[ ]"	[0.0]	2.1#	[2.2]	0	0	0	0	0	0	0	2
	Inst.Min	[ ]"	[ ]"	[0.0]	0.0#	[0.0]	0	0	0	0	0	0	0	0
	Monthly Total	[ ]"	[ ]"	[0]	4#	[4]	0	0	0	0	0	0	0	**8**
BID2 (41010717)	Mean	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
Rating confirmation not	Median	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
received at time of	Inst.Max	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
printing	Inst.Min	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
	Monthly Total	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Sources: Thiess Services and MI Irrigation Services
Notes: See Table 2.2.h. page 22

A.2.2 (4) Drainage reuse

Murrumbidgee Irrigation has continued to actively pursue recovery and use of water from its drainage systems. Table 2.2j responds to A.2.2, however, it is clear that much of the historically reported quantities at this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites.

Due to the pending review of the water balance and its supporting tables, especially considering the emerging reporting requirements under the National Water Initiative, it has been agreed to continue to include this table (mostly unaltered) for this reporting year. That should not be taken to mean that its continued presentation is meaningful or adds value to the water balance.

Table 2.2.j: Reuse quantities (ML) for the MIA and Districts 2005/06

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Bray's Dam Diversion to Benerembah	0	1370	3080	2365	1570	1105	875	940	1195	15	-	-	**12,515**
Mirrool Creek Licensed Diverters (DNR)	0	392	746	1086	43	87	98	68	243	30	12	0	**2,805**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	490	1090	1040	110	0	0	0	0	0	0	0	**2,730**
Mirrool Creek to Wah Wah Main	0	1840	6400	8200	7105	4925	4005	2615	7680	2530	30	0	**45,330**
Barren Box Storage to Wah Wah Main @ BBS Pumps	0	1570	2875	2120	550	150	0	0	100	0	0	0	**7,365**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	50	0	0	0	0	0	0	0	0	0	0	**50**
Barren Box Storage Licensed Diverters (DNR)	0	70	0	0	0	0	0	0	0	0	0	0	**70**
Sub Total	**0**	**5782**	**14191**	**14811**	**9378**	**6267**	**4978**	**3623**	**9218**	**2575**	**42**	**0**	**70,865**
Less: First Use Water Diversions	0	1085	505	732	802	243	663	441	2591	191	83	63	**7,399**
Plus: Lake Wyangan Pumps to Lake View Canal	0	0	335	10	130	101	177	89	121	193	0	145	**1,301**
TOTAL WATER CAPTURED	**0**	**4697**	**14021**	**14089**	**8706**	**6125**	**4492**	**3271**	**6748**	**2577**	**-41**	**82**	**64,767**

Source: Corporate Services

A.2.2 (5) Water balance loss and gain

Table 2.2.k: Annual Water Balance Assessment MIA system (Gigalitres) 2006/07

Factor	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	Bench-mark	Median	Comment
Climatic												
Rainfall	537	590	416	288	253	353	270	367	195	400	367	CSIRO, BM data
Evaporation	1868	1750	1896	2032	2191	1998	1983	1935	2182	1869	1970	CSIRO, BM data
Type of Year (% dry)	33	25	48	78	90	68	75	60	93	50	62	Look up table
Main Gross Data												
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	1154	944	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	952	750	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	202	195	(3)=(1)-(2)
Apparent Efficiency %	79	79	82	80	79	76	78	80	74	82	79	= (2)/(1)*100
Inevitable Real Losses												
Seepage from Channels	21	20	21	21	22	21	21	21	22	31	22	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	18	22	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	35	23	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	29	27	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	118	104	Inevitable Losses
System Flow Losses												
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	33	14	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	48	10	MI data
Subtotal	43	46	23	18	8	7	4	10	1	81	24	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**199**	128	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	133	105	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**332**	233	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	130	38	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows												
Willow Dam Flows	174	148	161	135	90	98	100	124	52	160	124	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13		20	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3		5	MI data
Landholders pumping (incl 22C)	7	8	7	8	4	5	5	7	2	67	12	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	227	158	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	260	172	(9)=(4)+(8)
Reconciliation												
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	1	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-20	-9	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	227	158	(12)=(8)-(10)
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	1264	973	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	57	19	(14)=(7)/(12)*100
System Efficiency (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**84**	87	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15		0.60	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24		0.64	

A.2 Water Supply and Drainage Management

In 2006/07 irrigation diversions from the Murrumbidgee River were 560 GL with 418 GL being recorded deliveries (sales). This left an apparent loss of 142 GL which meant that Murrumbidgee Irrigation's *apparent* operational[1] efficiency was approximately 75%.

Of that loss, the *true loss* was estimated at about 87 GL. This included losses due to channel seepage, evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 59 GL, using the standard formula of 14% of deliveries. This means the total losses are estimated at 145 GL, while the apparent loss was 142 GL. This means that the likely calculated assessed gains were 3 GL.[2]

In order to assess Murrumbidgee Irrigation's operational efficiency previous reporting has subtracted the true losses from the corrected total system supply (taking into account diversions plus water already in BBS[3] plus the assessed system gains) to give an estimate of operational efficiency. The limitation to this approach is that substantial unaccounted losses due to the presumed underestimation of flow by dethridge wheels has not been included in the calculations. Despite this, significant improvements in measuring flow and preventing water loss have been provided and will continue to be provided by Murrumbidgee Irrigation in implementing the rollout of more efficient metering and the IHS project.

Despite this limitation, the approach has been continued this year to ensure consistency between annual reporting protocols. It is expected that a review of the water balance method will be completed during the 2007/08 season, which will result in a more realistic water balance which will meet the NWI expectations.

A comparison of the benchmark year and the current year show that the system efficiency is 85%, similar to that in the baseline year. This is a good performance for Murrumbidgee Irrigation when taking into account that diversions into our system were at a record low.

[1] 'Operational' in this sense means the capacity to effectively sell (receive, hold and deliver to the farm gate) 100% of water which is taken from the Murrumbidgee River and diverted to the MIA.
[2] Although rainfall has not been included specifically as a system gain it has been apparently accounted for in estimating true losses attributed to the 'type of year' (ie % wet year, % dry year or deviation from average).
[3] That is water already in the storage from the previous year 2005/06.

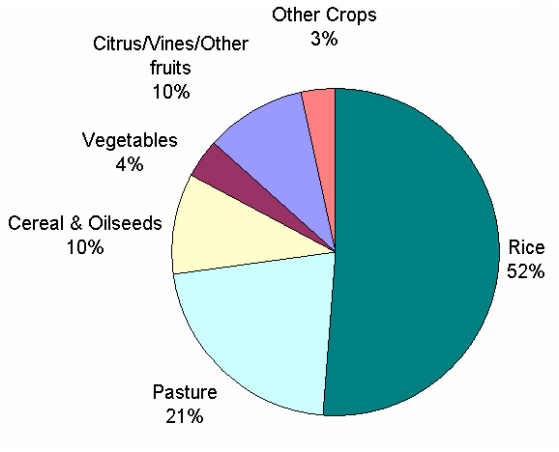
A.2.2 (6) Crop statistics

Irrigated Crop Statistics

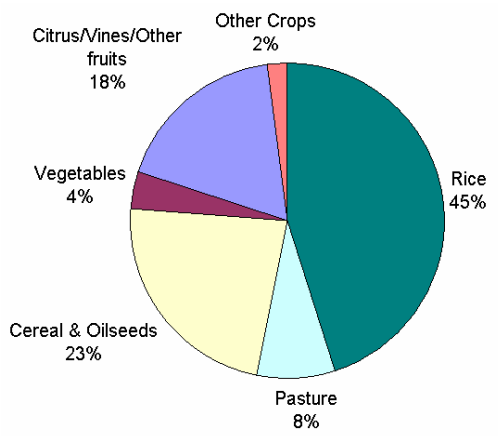
The following charts show the distribution of crops grown this year in comparison to last year (2005/06) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries for both citrus, vines and other fruits, and cereal and oilseeds greater than that of the baseline year. The graphs also indicate a significant reduction in deliveries to rice. This shift in water distribution is due to the very low general security allocation which prohibited many of our irrigators from growing a summer crop. Other crops such as plantations have again increased from last season.

Figure 2.2.d: Distribution of irrigated crops – 1995/96, 2005/06 and 2006/07
Comparison of crop type by percentage of megalitres delivered.

Baseline year 1995/96



2005/06



2006/07

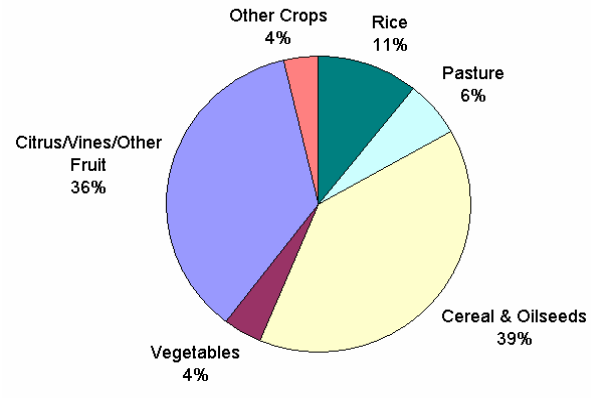


Table 2.2.l: Historical Deliveries to Major Crop Types

Year	Rice		Pasture		Cereal and Oil Seeds	
	Total (ML)	Rice % of Total	Total (ML)	Pasture % of Total	Total (ML)	Cereal/Oil Seeds % of Total
2006/07	41,296	10.8	23,419	6.1	149,441	39.1
2005/06	355,254	45.4	65,878	8.4	181,641	23.2
2004/05	101,494	16.7	77,364	12.8	247,267	40.8
2003/04	221,732	34.6	63,960	10.0	182,940	28.6
2002/03	251,424	34.3	64,093	8.8	237,612	32.5
2001/02	469,513	52.0	85,556	9.5	184,253	20.4
2000/01	479,757	56.0	112,668	13.1	108,690	12.7
1999/00	394,224	61.2	54,159	8.4	68,366	10.6
1998/99	477,563	58.1	101,791	12.4	65,231	7.9
1997/98	489,363	50.1	179,246	18.3	126,247	12.9
1996/97	519,053	51.0	187,441	18.4	143,746	14.1
1995/96	446,917	51.4	185,931	21.4	87,725	10.1

Year	Vegetables		Citrus + Vines+ Other Fruits		Other Crops + Plantations	
	Total (ML)	Vegetable % of Total	Total (ML)	Citrus/Vines/Other % of Total	Total (ML)	Other % of Total
2006/07	15,577	4.1	138,234	36.2	13,834	3.6
2005/06	27,588	3.5	142,025	18.2	9,481	1.2
2004/05	22,736	3.7	150,601	24.8	7,078	1.2
2003/04	16,504	2.6	132,866	20.7	22,519	3.5
2002/03	14,970	2.0	138,929	19.0	24,983	3.4
2001/02	17,989	2.0	122,884	13.6	23,403	2.6
2000/01	18,794	2.2	98,285	11.5	39,262	4.6
1999/00	12,013	1.9	75,108	11.7	40,060	6.2
1998/99	24,967	3.0	105,522	12.8	47,504	5.8
1997/98	19,714	2.0	115,200	11.8	47,176	4.8
1996/97	23,464	2.3	104,561	10.3	40,461	4.0
1995/96	32,348	3.7	87,983	10.1	28,905	3.3

Source: Rice ML from REM database, all other figures from Irrigation Services, Griffith.

Table 2.2.m: Summary of deliveries and areas for the major crop groupings during 2006/07

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)	Net Crop Evapotranspiration (ML/ha)
WINTER CEREALS	52606.2	124906.0	2.4	n/a
VINES	18159.8	81039.0	4.5	n/a
CITRUS	8433.6	48135.0	5.7	n/a
WINTER OILSEEDS	5927.0	8029.0	1.4	n/a
WINTER PASTURES	6196.5	7955.0	1.3	n/a
RICE	2342.7	41296.0	13.4	13.6
VEGETABLES	2421.3	15577.0	6.4	n/a
OTHER FRUITS	2196.8	9060.0	n/a	n/a
SUMMER PASTURES	3348.0	15464.0	4.6	n/a
OTHER CROPS	1126.6	13447.0	n/a	n/a
SUMMER CEREALS	1987.1	15422.0	7.8	n/a
STOCK & DOMESTIC	917.3	13129.0	n/a	n/a
PLANTATION	478.8	387.0	0.8	n/a
SUMMER OILSEEDS	355.2	1084.0	3.1	n/a
INDUSTRIAL	34.0	4432.0	n/a	n/a
BULK TOWN SUPPLY	603.0	12536.0	n/a	n/a
TOTAL		**411,898**		

Source: All figures provided by MI Irrigation Services, except for rice ha, water use and crop evapotranspiration figures, which are derived from Rice Environmental Monitoring database.

Notes: N/A = Not available due to data collection method.

- These figures do not include water for stock and domestic, industry, town supply and BBS surplus flows.
- The rice figure is potentially misleading as many farmers sow a winter cereal into rice stubble after harvest and make use of the sub soil moisture. When this sub soil moisture is not readily available for example on paddocks not sown to rice, crops are required to be irrigated and therefore this can result in more water use.

A.2.3 Chemical contingency

Murrumbidgee Irrigation works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

Murrumbidgee Irrigation undertakes an extensive water quality monitoring program for pesticides and other contaminants and incorporates immunoassay techniques like the ELISA field sampling program to detect molinate which is used as an indicator chemical to gauge the likelihood of chemicals in drainage water.

Apart from chemical sampling, Murrumbidgee Irrigation also undertakes nutrient sampling at sensitive locations like floodway's, wetlands and designated river discharge sites. This occurs after certain storm events and at other times and places when the flow rate is greater than 5ML/day.

Murrumbidgee Irrigation does this because nutrient levels are related to flow conditions. During low flow conditions fine sediment, organic matter and nutrients accumulate in waterways and bind to sediments. The flow regime is important in how nutrients are managed in our network by impacting on the level of nutrient concentrations.

Additionally, Murrumbidgee Irrigation has been and will continue to be involved in research projects which provide new information and insights including recommending new techniques to improve and evaluate how water quality is impacted upon by what we do in our community.

Scheduled chemicals

Table 2.3.n shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the Department of Environment and Climate Change.

Table 2.3.n: Scheduled chemicals in Murrumbidgee Irrigation's screening program

Chemical	Environmental Guidelines (µg/L)	Pre- July 04 Notification Level (µg/L)	Post July 04 Notification Level (µg/L)	Pre- July 04 Action Level (µg/L)	Post July 04 Action Level (µg/L)
Atrazine	2	2	**13**	10	**45**
Chlorpyrifos	0.001	0.001	**0.01**	0.005	**0.11**
Diazinon	0.0006	0.0006	**0.01**	0.003	**0.2**
Diuron	8	8	**1 ***	40	**5 ***
Endosulfan	0.01	0.05	**0.03**	0.1	**0.2**
Malathion	0.07	0.07	**0.05**	0.35	**0.2**
Metolachlor	8	8	**0.02 #**	40	**0.1 #**
Molinate	2.5	12.5	**3.4**	25	**14**
Simazine	10	10	**3.2**	50	**11**
Thiobencarb	1	1	**2.8**	5	**4.6**
Trifluralin	0.1	0.1	**2.6**	0.5	**4.4**

Source: Department of Environment and Climate Change

Notes: * Notification and action levels for diuron were set at 1.0µg/l and 5.0µg/l respectively. These interim levels were negotiated with Murrumbidgee Irrigation Limited to allow a phased introduction of the new levels and for industry to develop and refine management options for future use and management of diuron.

\# Please note that notification and action levels for metolachlor were reduced by 400%.

Chemical Contingency Plan for MIA

MI is required to have in place a Chemical Contingency plan to identify the processes that occurs when a chemical is detected above notification or action level.

The limiting factor with monthly pesticide sampling is the time elapse between when a sample is taken and when the results are made available to MI. In some cases where significant time periods have elapsed, no follow up of action level detection is possible.

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the Department of Environment and Climate Change (DECC) by telephone within twenty-four (24) hours once the sampling results have been received by Murrumbidgee Irrigation.

2. Notify DNR within 24 hours of the results affecting the river sites once the sampling results have been received by Murrumbidgee Irrigation.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if Action Levels are exceeded at sites identified by Murrumbidgee Irrigation as re-supply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

Response to DECC direction:

In the event that a DECC direction is received to restrict the discharge by an irrigator of irrigation waste water to the company drainage works, the company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.
2. Refuse to or discontinue the supply of water to the irrigator.
3. Undertake works to prevent the continuance of the problem.
4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 Groundwater Management

A.3.2 Reporting requirements

The following groundwater information was derived from Ary Van der Lely's report "*Shallow Groundwater Behaviour in the MIA*. Annual Report 2007".

A.3.2(1) Groundwater monitoring and analysis

The groundwater conditions for September 2006 and the changes since baseline year 1996 and September 2005 are summarised in Table 3.2.a.

Table 3.2.a: Average depth to the watertable at September 2006 compared to 2005 and baseline year 1996 *

Area	1996 Deep Aquifer	2005 Deep Aquifer	2006 Deep Aquifer	1996 Shallow Aquifer	2005 Shallow Aquifer	2006 Shallow Aquifer
Yanco	2.69	4.74	4.61	2.11	3.76	3.69
Mirrool	2.24	4.91	5.17	1.52	3.48	3.43
Benerembah	7.76	11.46	11.23	2.21	3.87	3.57
Wah Wah	13.12	12.83	12.58	N/A	N/A	N/A
MIA u/s BBS	4.4	7.24	7.28	1.88	3.53	3.52

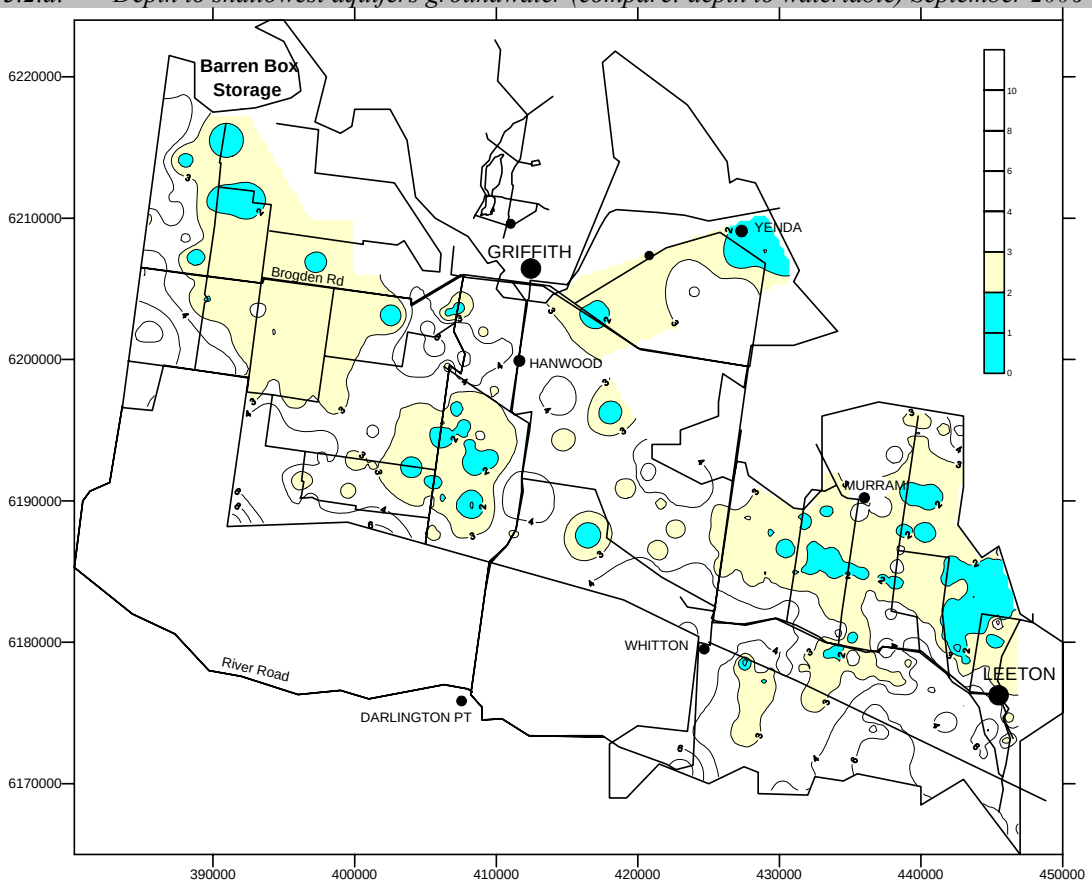
Note: * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable.

Last year, all values in this table were recalculated due to the redistribution of the piezometers. Some piezometers from the deep category, which were behaving as shallow piezometers, were put in the shallow category.

Table 3.2.a shows a marked drop in water table levels since the baseline year of 1996, to the extent that the proportion of land with groundwater within 2 metres has dropped from over 70% before 2000 to about 8% by September 2006 and continued to drop to about 3% by March 2007. This drop is expected to be due to the continued lower than average general security allocation levels as well as reduced rainfall of the past five years. The average depth to the water table is now at a record low. The implementation of MIA EnviroWise programs will also have had an impact on the lowering of watertables.

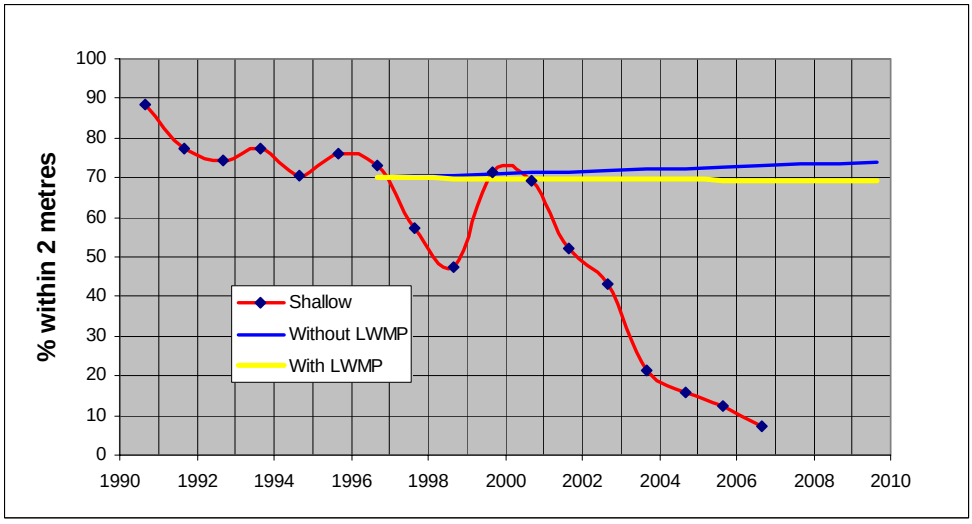
The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. The area with groundwater within 2 metres from the surface is restricted to parts of the Koonadan/Murrami area near Leeton, and pockets of land near Gum Creek Road, Northern Benerembah and near Yenda.

Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable) September 2006



The percentage of areas within 2 metres from the surface compared to the Land and Water Management Plan 'Without Plan' and 'With Plan' scenarios are shown at Figure 3.2.b.

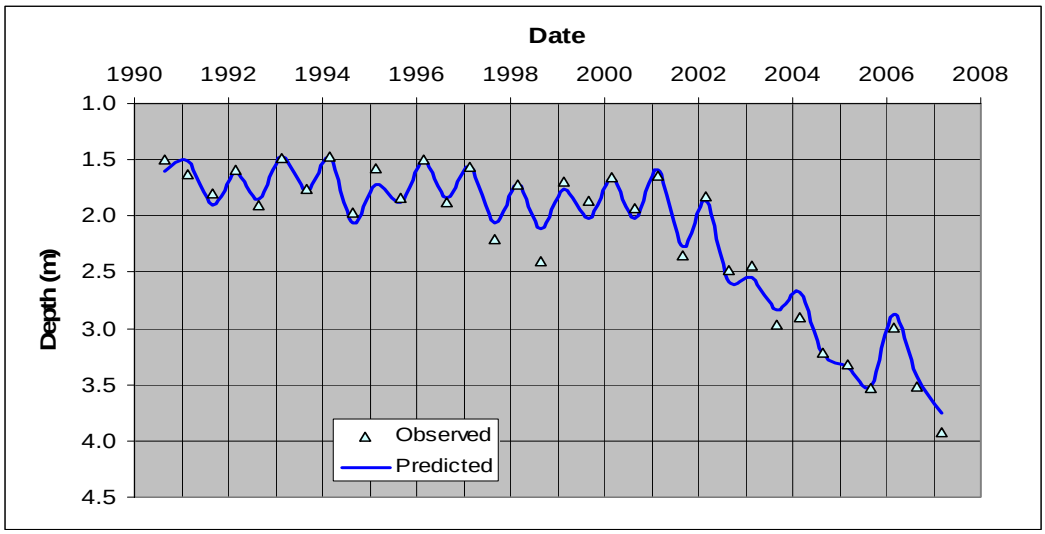
Figure 3.2.b: Area with watertable within 2 metres, September 1990 to 2005 relative to LWMP assessment benchmarks (which commenced 1997)



There has been a huge reduction in the percentage of areas with groundwater within two metres from the surface, from over 70% in the early 1990's to 7.6% September 2006. It is clear from Figure 3.2.b that the groundwater predictions developed as part of the Land and Water Management Plan are no longer relevant given the changes to groundwater levels due to reduced allocations and the on-going drought. As a result a clearer understanding of the impacts on groundwater from irrigation and climate is required and this is the subject of research being undertaken by CSIRO Land and Water in conjunction with Murrumbidgee Irrigation. The results of which will provide a more realistic benchmark.

Figure 3.2.c shows the observed data of average groundwater depths in the MIA versus the predicted values based on the model coefficients.

Figure 3.2.c: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



The model used to produce these predictions, can also be used to analyse various scenarios likely to occur in the future. More work is being undertaken, in conjunction with CSIRO Land & Water, to refine these predictions and ultimately to assist in the management of the MIA & D.

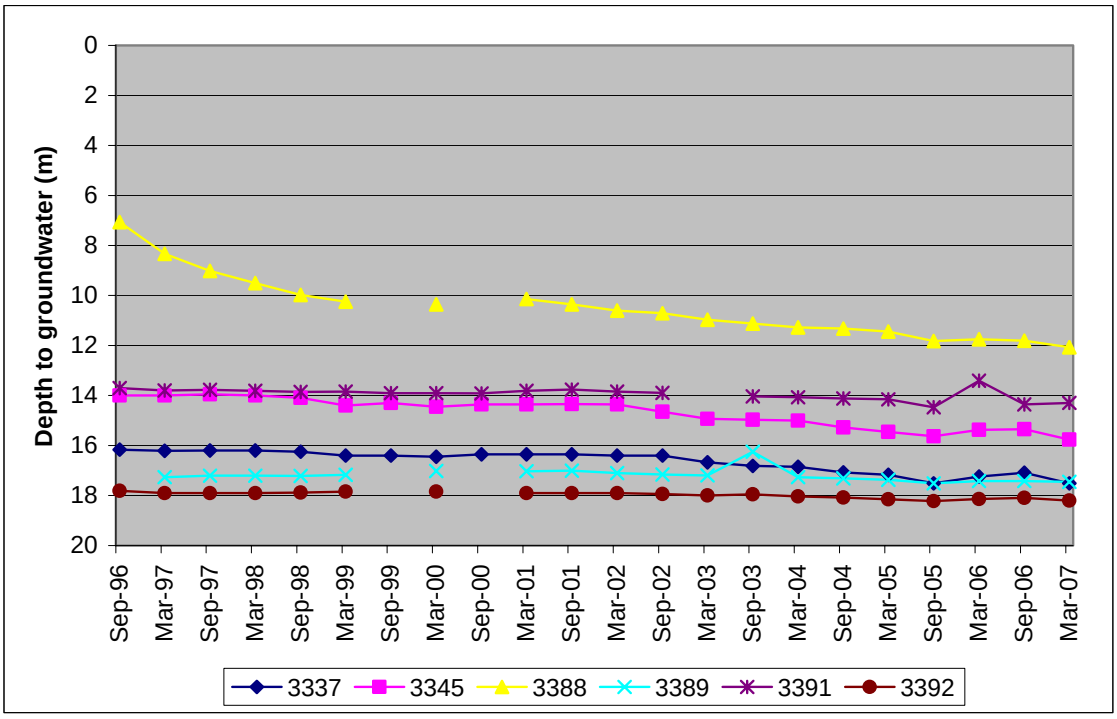
Other findings and conclusions of the groundwater report are:

- Analysis of bi-monthly monitoring data has not resulted in an improved understanding of the groundwater system or irrigation practices, similar to that found in previous years reports.
- LWMP targets have been met, although the impact of the targets are not entirely clear.
- Accessions to the groundwater system have been significantly less.
- The proportions of area and distribution for watertable levels within 2 metres from the surface are at an all-time low.
- The pressure levels in the deep aquifer are at an all-time low.
- It was concluded there are no groundwater management issues resulting from the 2006/07 data set.

A.3.2(2) Wah Wah groundwater and Mirrool Creek flooding

In respect to the Lower Mirrool Creek Floodway, Figure 3.2.d shows that most piezometers have changed very little since 1996. Bores 3345 and 3388 show the largest drops. There have been no flood events in the Lower Mirrool Creek since the early 1990's.

Figure 3.2.d: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway



A.3.2(3) Groundwater volumes and salt loads extracted from tile drains and pump sites

Tubewells

There are 15 tubewells installed in the MIA by previous government departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a steady decrease in the salt load since the 1997-98 season. During the 2006-07 season the discharge volumes and therefore salt loads were slightly higher for some sites compared with last year.

Table 3.2.b: Groundwater volumes and salt loads extracted from tubewells

Name	2006-07 Discharge ML/year	2006-07 salt load T/year	2005-06 Discharge (ML/year)	2005-06 Salt Load (T/year)	1997-98 Discharge (ML/year)	1997-98 Salt Load (T/year)
Five Bridges	644	471	758	568*	1,059	1,016
Gil Gil	421	590	330	454	631	1,231
Yanco West	316	420	297	373	821	1,232
South Leeton	1,128	1,857	881	1,497	1,325	2,067
Baulch's	275	104	308	134	694	541
Wamoon	423	245	440	250	945	681
East Wamoon	781	469	887	557	-	-
TOTAL	**3,989**	**4,156**	**3,902**	**3,833**	**5,475**	**6,768**

Source: MI Electrical Services, MI Environmental Services
* This figure was erroneously reported as 330 T/year in the previous report

Tile Drains

At present there are 20 flow meters attached to tile drainage outlet pipes in the MIA these sites are assessed every month for volume of flow and annually a sample of the discharge is measured for electric conductivity. During 2006-2007 the total volume pumped from 11 sites was 97.2 ML and 127.3 tonnes of salt was discharged. At the remaining nine sites there was no discharge recorded.

A.3.2(4) Groundwater accession control targets and rice environmental monitoring

Groundwater accession control target

The rice water use target is a seasonally adjusted figure, calculated from weather data collected at CSIRO Land and Water in Hanwood. During the 2006/07 season, Murrumbidgee Irrigation installed a network of seven additional automatic weather stations in the MIA & D. The stations are located at Yenda, Wamoon, Kooba, Benerembah, Bringagee, Barren Box Storage and Carrathool.

The target is normally calculated by summing the evapotranspiration from 1 October through to 28/29 February and subtracting the rainfall over the same period. However, this year the target was calculated using the same method, but from 15 October to 15 March. This was done to coincide with the installation of the new stations in October 2006. The resulting figure is an estimate of the irrigation requirement for rice. There is a further allowance made for 4 ML/ha for filling up the profile, absorption of system losses from the farm outlet to the field and some percolation. During the 2006/07 season, the target has been used only as an indicative figure to allow farmers to assess their own water use. Due to the continuing severe seasonal conditions and the low rice acreage in the MIA & D, a licence variation was submitted to and approved by the Department of Natural Resources (now Department of Water & Energy) which exempted Murrumbidgee Irrigation from implementing the Rice Policy. "Given the current circumstances, I have no concerns with you implementing the proposed amendments to the REM program for the 2006/07 season," (email from Scott Lawson, Manager Access and Compliance, DNR Murray- Murrumbidgee).

The proposed amendments for the 2006/2007 rice season were as follows*;*

- Crop water use statistics will be assessed using records provided by landholders and the information contained in the Company's irrigation management system.
- All landholders growing rice will automatically be allowed a tolerance of 10% or 10 hectares, whichever is the greater, in accordance with the Rice Growing Rules.
- No implementation of area penalty breaches or water use penalty breaches.

The Rice Water Use Target for 2006/07 was calculated at 17.8 ML/ha, based on the CSIRO weather station at Hanwood. The target for Wah Wah is 19.6 ML/ha based on the Carrathool AWS (as shown in Table 3.2.c). The table below shows the target figures for all AWSs across the MIA & D. A seventh station at Bringagee was installed in early 2007 and therefore could not be included in this seasons target figures.

Table 3.2.c Target Rice Water Use figures for various AWSs across the MIA

Station	Net ETo (ETo – rainfall)	Target for 2006/07 incl additional 4ML/ha
CSIRO	13.8	17.8
Carrathool	15.6	19.6
Benerembah	13.6	17.6
Yenda	13.7	17.7
Kooba	14.6	18.6
Wamoon	13.5	17.5

This season's water use was high due to the continuing drought, which resulted in above average evapotranspiration and below average rainfall.

Rice water use and rice growing practices

The allocation cuts in November led to large areas of rice being cut off. This in turn has made it impossible to make an accurate estimate of rice water use for 2006/07. Therefore, the figures in Table 3.2.d have not been updated for 2006/07.

In order to take into account the severe climatic conditions and many farmers cutting off all their rice crops completely, after the allocation cut back announcement in November 2006, no breaches will be issued for this year under permission from DWE. Instead all rice growers will be sent a letter notifying them of their water use for the season, with a request for a possible explanation of any high figures.

Table 3.2.d: Summary of rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)								
Irrigation Area or District	**Total Rice Area (ha) 2006/07**	**Total Water to Rice (ML) 2006/07**	**2006/07**	**2005/06**	**2004/05**	**2003/04**	**2002/03**	**2001/02**	**2000/01**	**1999/00**	**1998/99**
Yanco	N/A	N/A	N/A	12.6	13.1	13.3	14.1	12.0	11.2	11.3	11.3
Mirrool	N/A	N/A	N/A	12.7	12.9	13.2	14.0	12.3	11.2	10.6	12.6
Benerembah	N/A	N/A	N/A	12.9	12.8	13.3	14.0	13.1	11.1	10.4	15.3
Tabbita	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3	10.7	15.9
Wah Wah	N/A	N/A	N/A	14.0	11.9	12.4	14.4	14.3	13.7	11.8	14.6
Kooba *	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*	*	*
Total/average	N/A	N/A	N/A	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**	**10.9**	**12.9**
Target			N/A	15.3	15.0	15.0	17.3	15.3	14.2	13.2	15.4
Simple WUE			N/A	**88%**	**85%**	**83%**	**94%**	**90%**	**89%**	**84%**	**88%**

Sources: REM database, water use table as at 16 July.
MI Environmental Services
Note: * Kooba's rice water use was previously calculated as part of Mirrool.

No aerial rice photographs have been flown this year, with DWE (formerly DNR) approval. Therefore rice areas were estimated from field inspections carried out in March 2007. Rice areas cut back or cut off from initial plantings have not been incorporated in these figures. Water use figures provided in this report are an estimate and include only those farms that harvested rice.

Table 3.2.e Adjusted rice water consumption figures for 2006/07*

District	Total rice area (ha)	Total Water to rice (ml)	Average
Yanco	626.6	9609.2	15.6
Mirrool	1284.4	17576.6	14.0
Benerembah	64.1	958	14.1
Tabbita	0	0	0
Wah Wah	0	0	0
Kooba	0	0	0
Total/average	1975.1	28143.8	14.2

Note: * Adjusted figures only include those farms that harvested rice and whose rice usage was >8ML/ha and <25ML/ha

Rice hydraulic loading

There were no rice hydraulic loading limit exceedances for the 2006/07 season due to the small allocation, which did not allow farmers to plant their full rice area entitlements.

Table 3.2.f: Summary of rice area exceedences

Area	2006/07 No. of breaches	2006/07 Area (hectares)	2005/06 No. of breaches	2005/06 Area (hectares)	2004/05 No. of breaches	2004/05 Area (hectares)
Yanco	0	0	0	0	0	0
Mirrool	0	0	0	0	0	0
Benerembah	0	0	0	0	0	0
Tabbita	0	0	0	0	0	0
Wah Wah	0	0	0	0	0	0
Total	**0**	0	**0**	**0**	**0**	**0**

Source: MI Environmental Services

Estimated Groundwater Accessions

This section was not carried out this year in accordance with the Licence variation.

In future, Murrumbidgee Irrigation will be looking at monitoring water use across a range of crops.

Rice growing policy

The Interim Rice Growing Rules were updated and renamed "Rice Policy 2006" through consultation with members of the Rice Review Group and endorsed by the Rice Growers' Association of Australia. This was prepared before the start of the rice season, however the low allocation announcement and subsequent temporary variation to the Water Management Works Licence which exempts Murrumbidgee Irrigation from implementing the Rice Policy lead to the Rice Policy not being submitted to DNR for endorsement. The previous Interim Rice Growing Rules were submitted in October 2005. Murrumbidgee Irrigation is still waiting on endorsement.

A.3.2(5) Groundwater data format

A copy of "*Shallow Groundwater Behaviour in the MIA. Annual Report 2007"* has been forwarded to the Department of Water & Energy (formerly DNR) in electronic format.

A.3.2(6) Groundwater data reliably captured

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by Murrumbidgee Irrigation staff during March and September each year. The statistics for piezometers read during September 2006, March 2007, and three earlier dates are summarised in Table 3.2.g.

Table 3.2.g: Availability of piezometer readings for various dates and categories of piezometers.

Type of Piezometer	Listed in Database	Read Sep96	Read Sep00	Read Sep05	Read Sep06	Read Mar07
Shallow (*1)	417	465	459	447	440	437
Shallow (WW)	30	22	23	15	14	13
Total Shallow	**447**	**487**	**482**	**462**	***454***	***450***
Deep (*2)	359	363	362	330	330	329
Deep >35m	19	28	28	26	27	27
Deep (WW)	35	44	43	42	41	41
Total Deep	**413**	**435**	**433**	**396**	***396***	***495***

*1. Piezometers in aquifers within 12 metres and in aquifers 12-18m which behave as if in the shallow zone
*2. Aquifers 12 – 35 metres, all piezometers not categorised as "shallow".

Despite a number of piezometers becoming lost over time, especially in the 2000 to 2004 period, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

Figure 3.2.l shows that there is a considerable variation in coverage across the area. In the Wah Wah District there is a lack of piezometer sites. The same applies for the Lake Wyangan area. Piezometers are also lacking in areas of the MIA where there are no underlying sands, such as in parts of the Yenda area. This situation varies for the deep and shallow piezometer sets.

Most deep piezometers in Wah Wah have not been levelled, with the consequence that it is not possible to determine an AHD groundwater contour map ([4]) for that area.

The bi-monthly reading list used since 1995 has 108 piezometers, of which about 100 have been visited and read during the 2005/06 year. This is well in excess of the license requirement (60). Murrumbidgee Irrigation has maintained this higher than necessary degree of monitoring to assist the calibration and development of an integrated groundwater model for the MIA.

Groundwater was last sampled for salinity during 2002 and this has been reported (Murrumbidgee Irrigation report by van der Lely, January 2003).

A.3.2(7) Groundwater data analysis

The Department of Natural Resources (now DWE) did not make a request for information this year.

A.3.2(8) Groundwater contamination

There were no known, or reported, groundwater pollution events during 2006/07.

[4] AHD = metres above sea level.

A.3.2(9) Groundwater — annual monitoring schedule

Table 3.2.h: Groundwater monitoring schedule – as required by DNR

No	Type	Description	Depth (metres)	Frequency	Location	
					Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.d	44
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.e	44
3	Map	Depth to pressure level	70-125	annual	Figure 3.2.f	45
4	Map	AHD of pressure level	12-35	annual	Figure 3.2.g	45
5	Map	Change in pressure level	5-12	annual	Figure 3.2.h	46
6	Map	Change in pressure level	12-35	annual	Figure 3.2.i	46
7	Map	Change in pressure level	70-125	annual	Figure 3.2.j	47
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.k	48-49
11	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.k	48-49
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.j	50-51
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.j	50-51
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.l	52
16	Map	Groundwater sub-districts	-	annual	Figure 3.2.m	53

Notes * "*It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable*." Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ There are not enough piezometers in the West Hanwood and Wah Wah areas to produce reliable hydrographs.

\# The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

Figure 3.2.e: MIA September 2006 – Depth to pressure level 5-12 metres

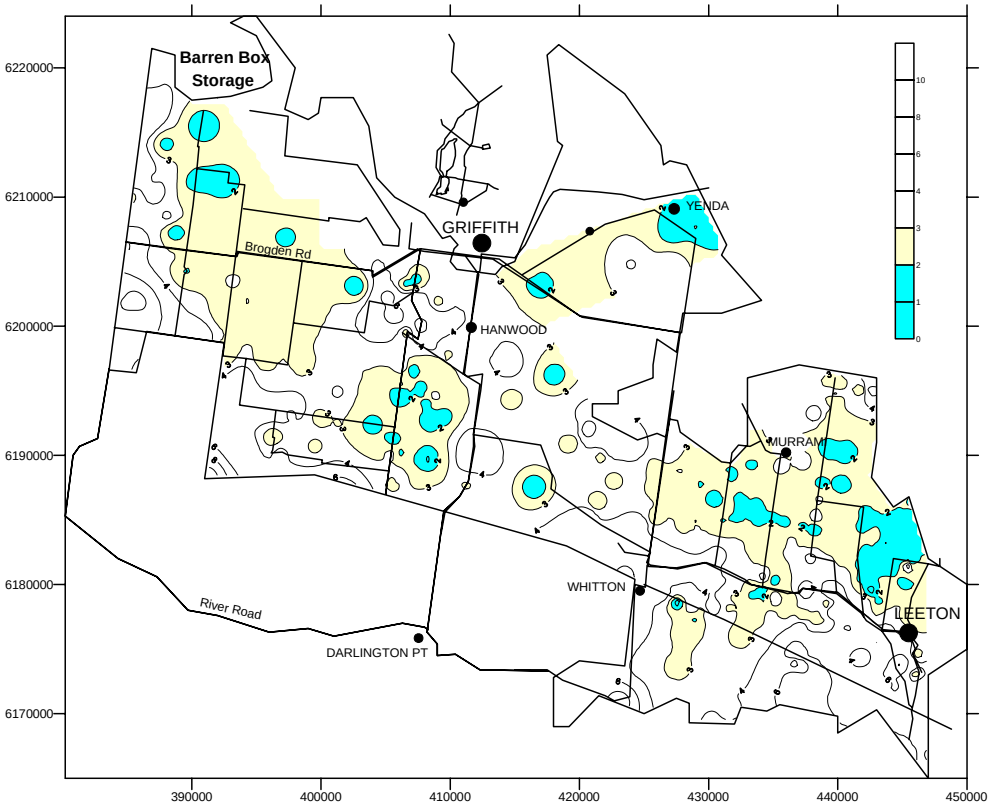


Figure 3.2.f: MIA September 2006 – Depth to pressure level 12-35 metres

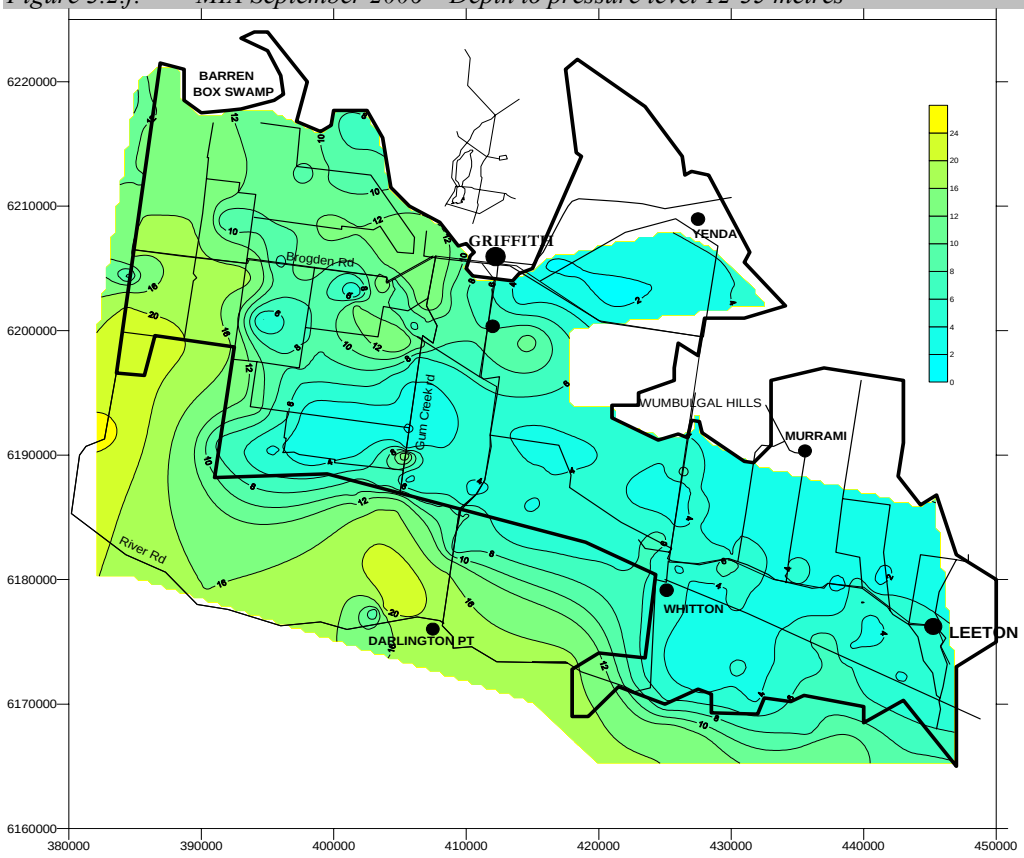


Figure 3.2.g: MIA September 2006 – Depth to pressure level 70-120 metres

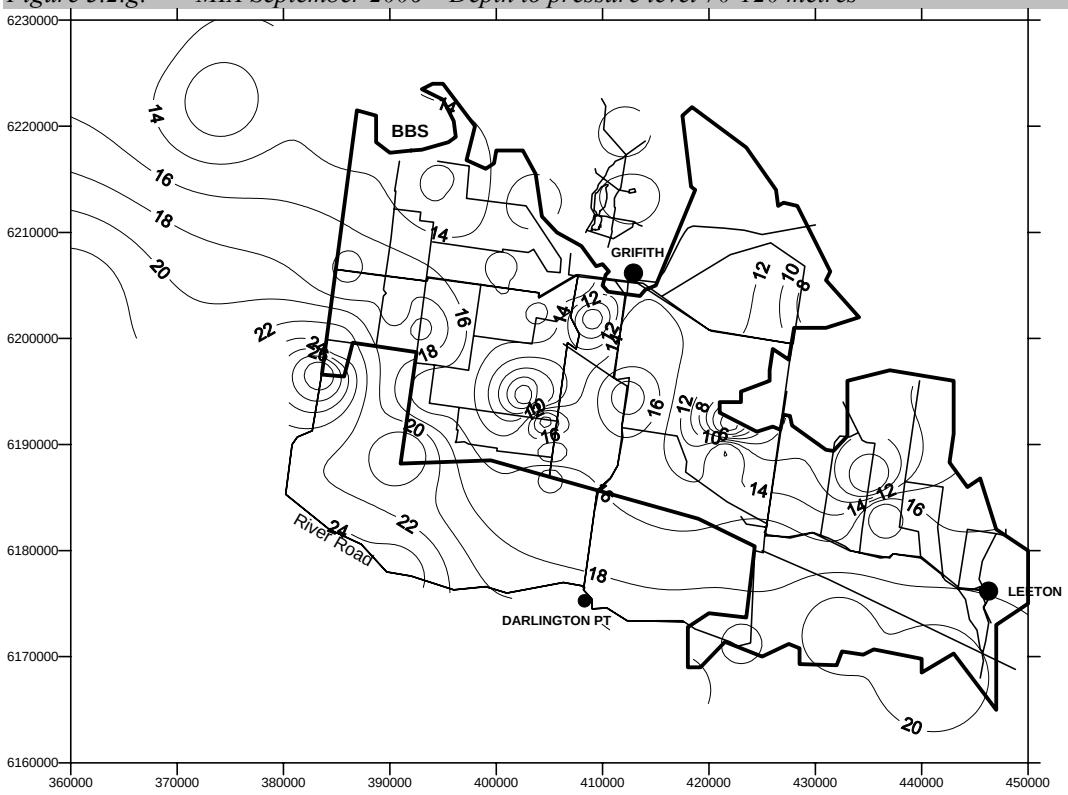


Figure 3.2.h: MIA September 2006 – AHD of pressure level 12-35 metres



Figure 3.2.i: MIA 2000-2006 – change in pressure level 5-12 metres

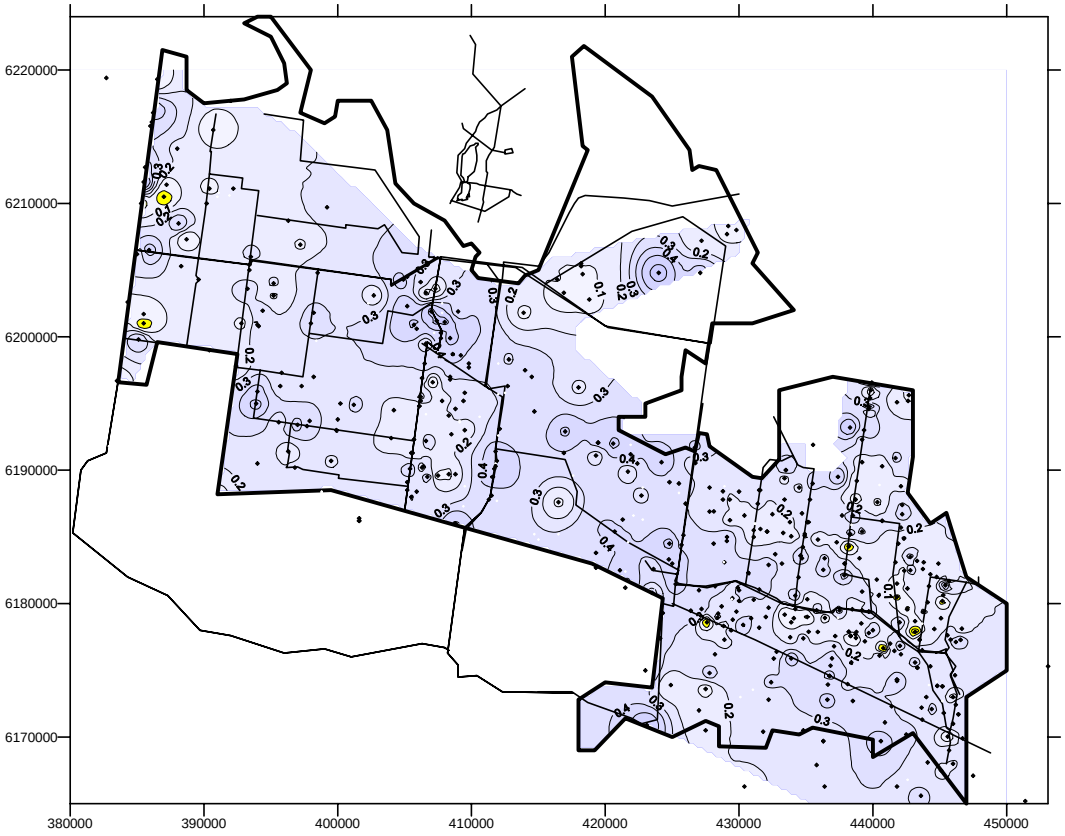
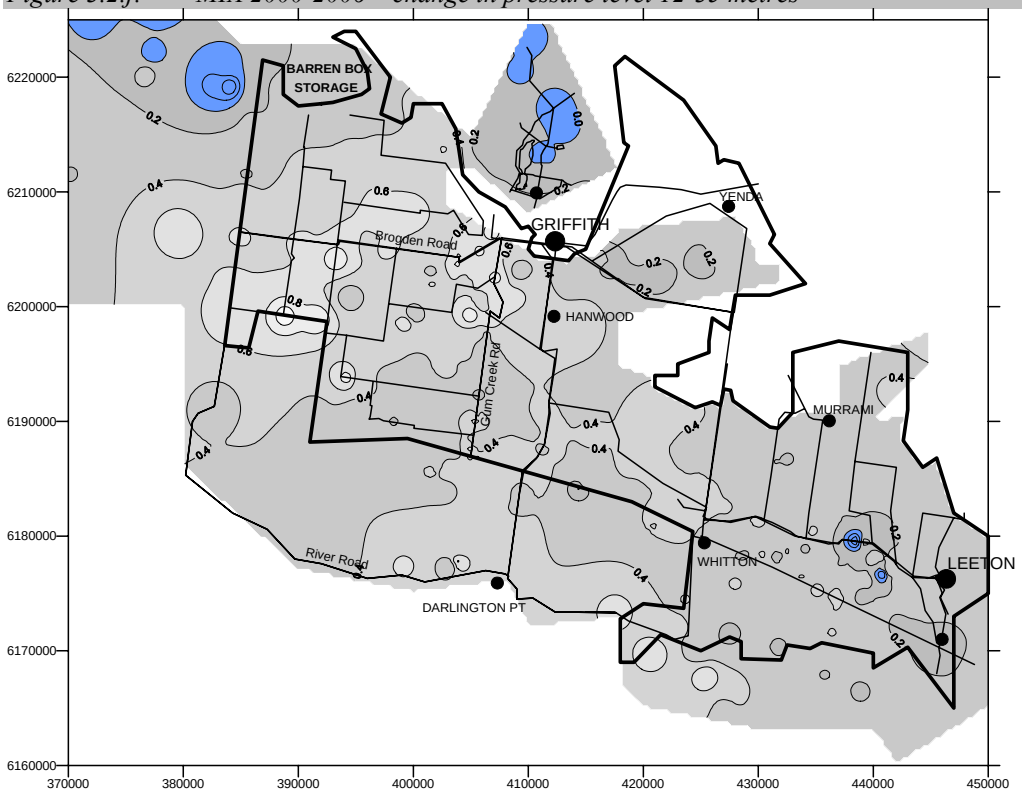


Figure 3.2.j: MIA 2000-2006 – change in pressure level 12-35 metres



3.2.k: MIA 2001-2006 – change in pressure level 70-125 metres

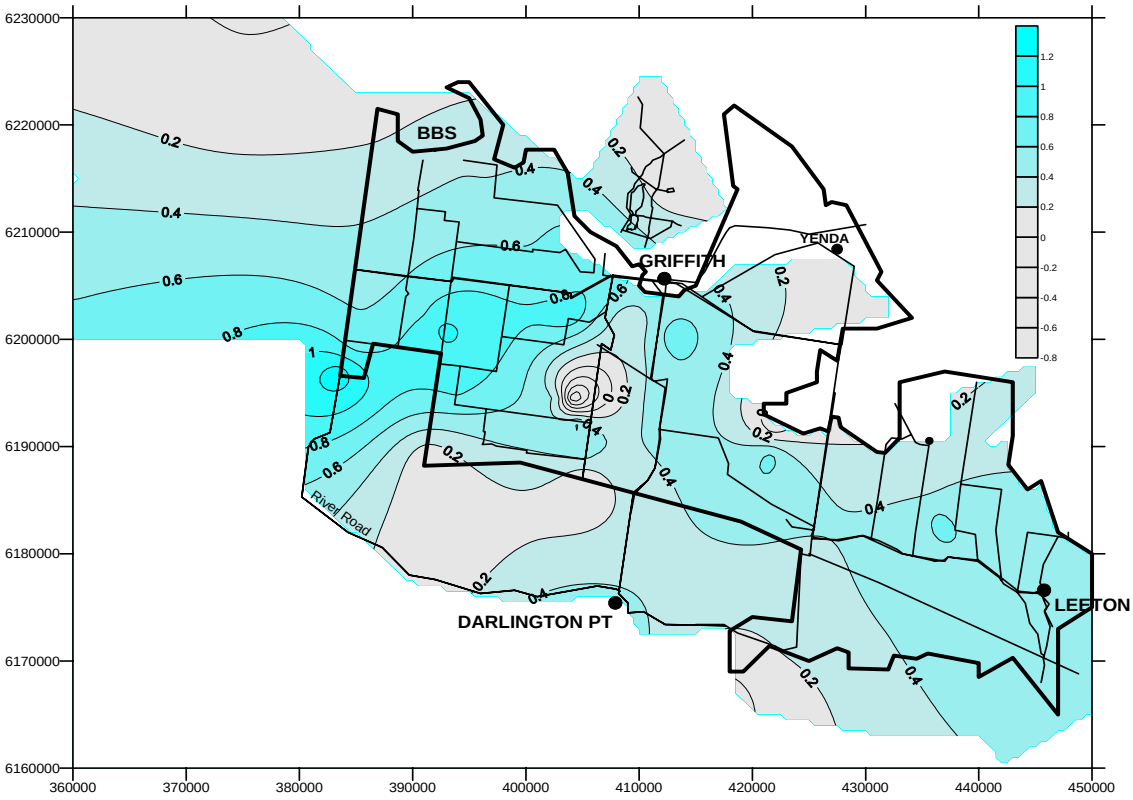
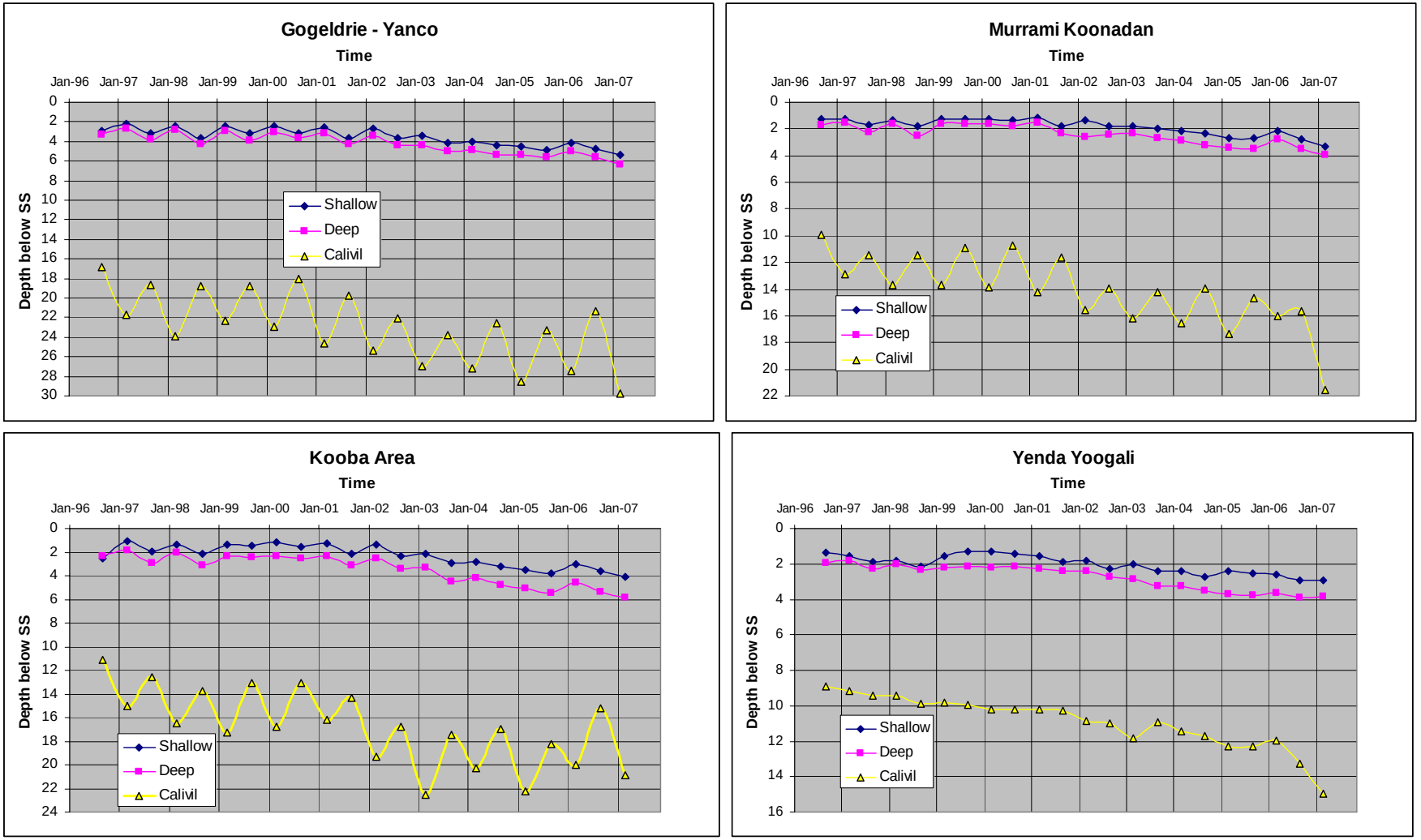
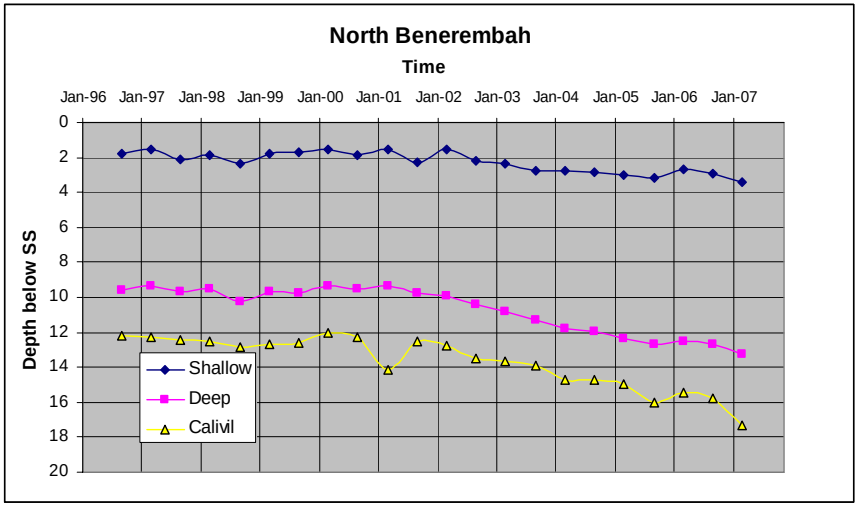
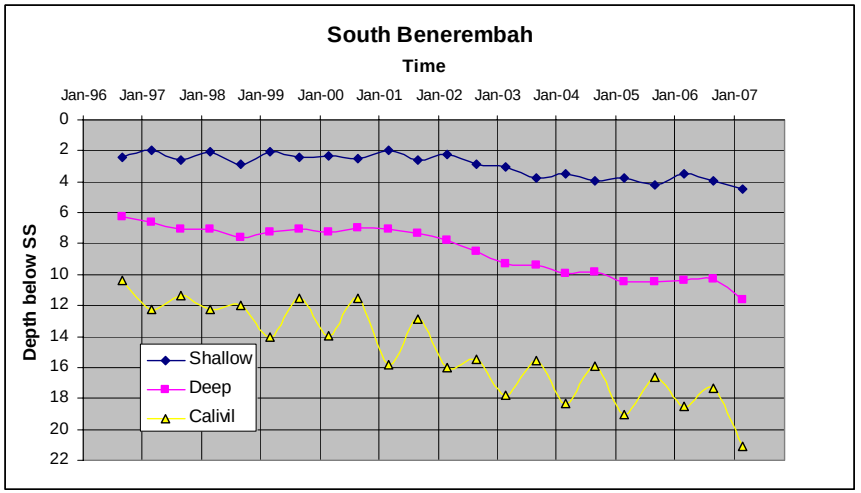


Figure 3.2.1: MIA September 2005 - Average seasonal behaviour of 8 sub-districts 5-12 metres and 12-35 metres



gure 3.2.l: MIA September 2005 - Average seasonal behaviour of 8 sub-districts 5-12 metres and 12-35 metres - continued





In previous Licence Compliance and Annual Environmental Reports, the bi-monthly groundwater monitoring data was used to produce the graphs showing average seasonal behaviour. These graphs were compiled as an average hydrograph of the few piezometers (usually 3 to 8) in each sub-district. These average hydrographs therefore did not represent the individual sites, nor were they a true sub-district average. However, they did show seasonal trends. It was concluded that sub-district seasonal groundwater behaviour is better represented by averages as calculated from gridding and contouring, and that has been used in this report. There are not enough piezometers in place to provide graphs for the Hanwood and Wah Wah districts.

All graphs show a steady decline in water table levels and pressure levels in all three aquifers, with seasonal variation most clearly shown in the Calivil formation.

Table 3.2.i: ***Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35metres) aquifers, September 2005, and historic trend in areas within 2 metres ++***

North Benerembah									
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	12	10	1	0	1	0	1	0	0
within 2 metre	76	74	69	28	28	19	29	12	1
within 3 metre	94	93	90	75	71	68	76	72	63
within 4 metre	99	100	97	91	86	84	99	89	79
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 2 metre	0	0	0	0	0	0	0	0	0
within 4 metre	0	0	0	0	0	0	0	0	0
within 6 metre	17	13	7	0	0	0	0	0	0
within 8 metre	47	46	28	4	3	4	4	3	0
South Benerembah									
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	37	12	1	0	1	0	1	0	0
within 2 metre	68	56	39	3	10	5	9	2	0
within 3 metre	83	78	71	42	49	29	56	39	13
within 4 metre	89	88	87	69	69	63	76	68	55
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 2 metre	13	12	8	0	1	0	1	0	0
within 4 metre	34	32	23	15	14	8	16	13	10
within 6 metre	61	57	42	31	28	27	29	27	23
within 8 metre	75	71	62	49	44	43	47	45	35
Kooba									
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	17	24	2	0	0	0	2	0	0
within 2 metre	87	84	44	10	4	3	16	6	1
within 3 metre	99	98	86	57	37	23	67	27	18
within 4 metre	100	100	98	87	79	68	87	75	64
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	3	1	0	0	0	0	0	0	0
within 2 metre	53	53	11	1	0	0	1	0	0
within 3 metre	86	83	64	8	3	1	25	3	0
within 4 metre	97	93	85	49	38	18	60	18	10
Yenda/Bilbul									
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	33	24	0	0	0	2	0	0	0
within 2 metre	97	98	39	19	28	36	29	17	16
within 3 metre	100	100	100	89	90	88	93	70	69
within 4 metre	100	100	100	100	99	99	99	99	97

Note: ++ There is not enough information to create reliable figures for West Hanwood and Wah Wah.

Yenda/Bilbul									
	Sep 96	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	16	22	1	0	0	0	0	0	0
within 2 metre	74	73	60	23	14	19	23	11	16
within 3 metre	86	84	77	69	62	61	65	59	61
within 4 metre	93	90	85	80	79	78	78	75	75
Murrami/Koonadan									
	Sep 96	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	40	44	46	2	1	1	6	0	0
within 2 metre	91	90	78	50	24	32	58	19	6
within 3 metre	99	100	96	85	82	78	90	76	78
within 4 metre	100	100	100	97	95	96	99	95	90
	Sep 96	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	14	18	1	0	0	0	0	0	0
within 2 metre	76	72	53	12	7	6	30	1	5
within 3 metre	99	97	82	59	52	50	74	47	26
within 4 metre	100	100	99	89	79	77	94	81	63
Gogeldrie/Yanco									
	Sep 96	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	0	1	0	1	0	0	0	0	0
within 2 metre	31	27	12	4	2	1	11	1	1
within 3 metre	62	56	44	31	30	20	39	13	9
within 4 metre	95	82	68	50	49	43	57	44	37
	Sep 96	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Mar 06**	**Sep 06**	**Mar 07**
within 1 metre	1	2	0	0	0	0	0	0	0
within 2 metre	27	23	5	1	1	0	7	0	0
within 3 metre	58	48	37	13	16	9	33	7	2
within 4 metre	87	73	61	36	42	37	53	36	20

Figure 3.2.k: Groundwater piezometers currently being read

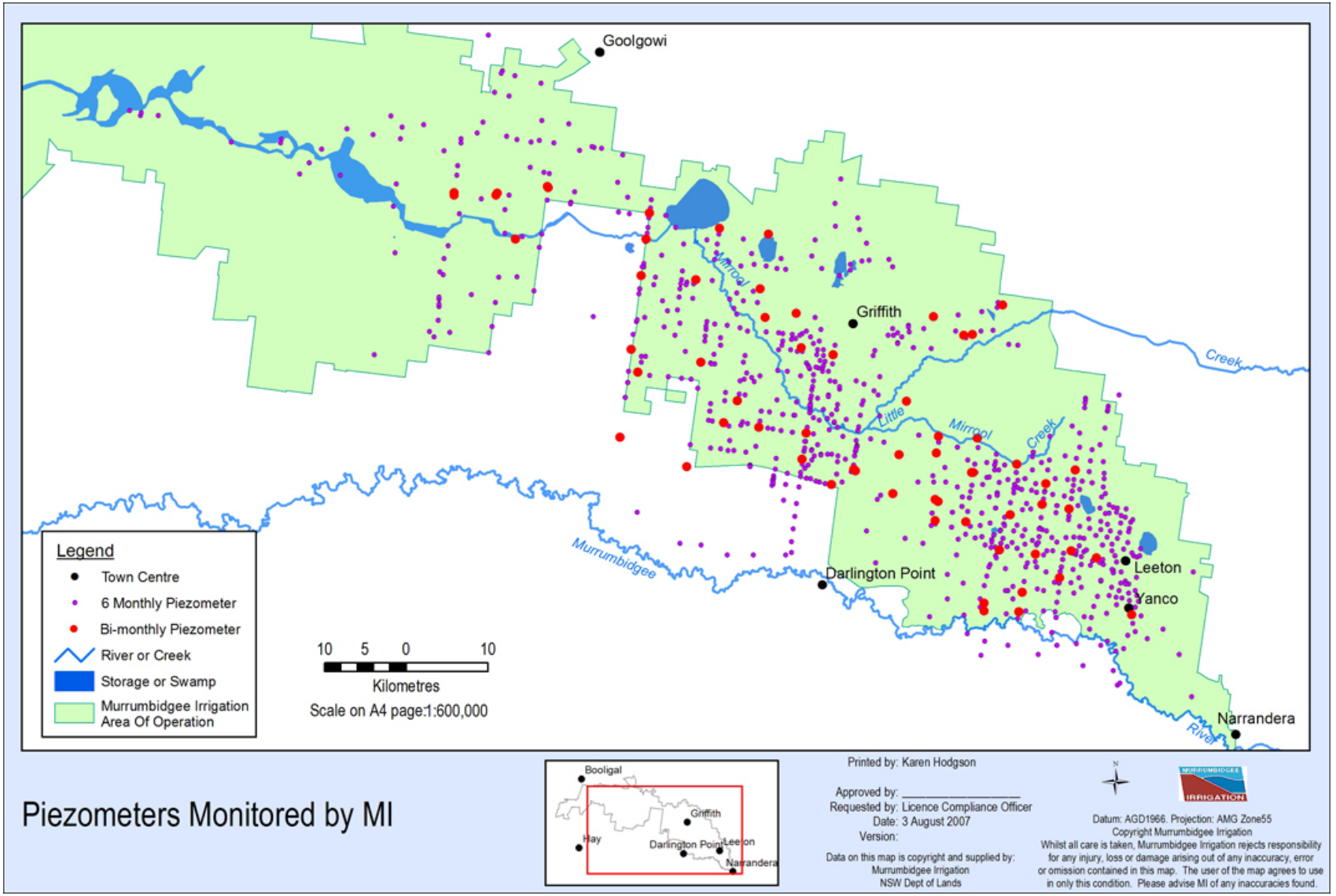
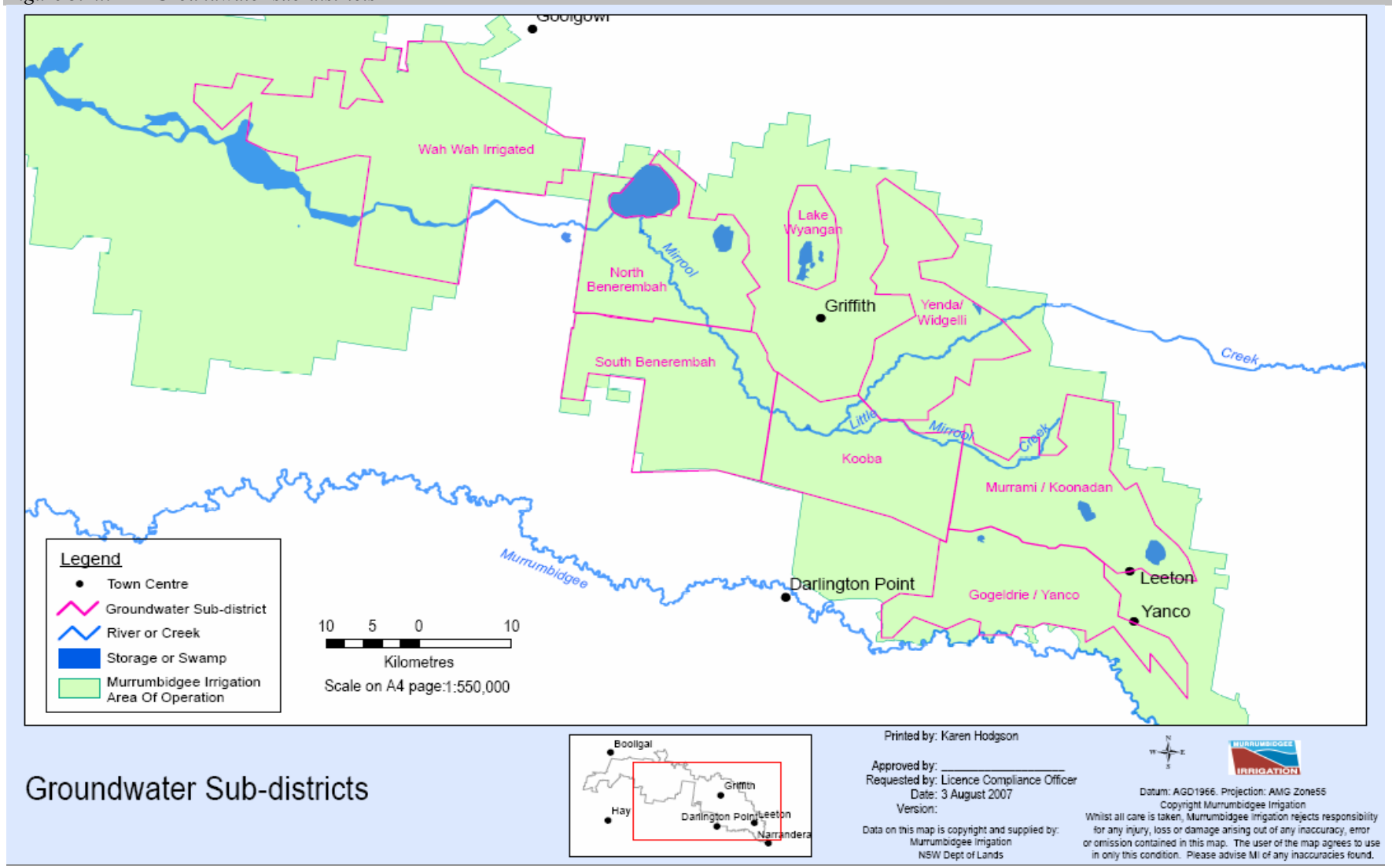


Figure 3.2.1: Groundwater sub-districts



A.4 Floods and Floodplain Management

A.4.2 Reporting requirements

A.4.2 (1 & 2) Flood levels, floodplain structures, flood releases

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

There were no deliberate releases into the floodway during the 2006/07 season. We realised some of our efficiency gains due to the Barren Box Storage and Wetlands development, consistent with our operational philosophy.

There were a number of cuts in Channel 13 which runs through Wyvern Station. These cuts were put in place to provide water to the wetland in Wyvern, known as The Pondage. However, due to excessive amounts of water flowing into the wetland causing degradation of the habitat, the cuts in the bank were re-instated to provide better control over the Benerembah Irrigation District's drainage water through Wyvern. These works resulted in improved conditions at the wetland.

A.4.2 (3 & 4) Flood reporting – Lower Mirrool Creek Floodway

There were no major works undertaken other than assisting Wyvern Station with their noxious weed control.

A.5 Aquatic Environment Management

A.5.2 Reporting requirements

A.5.2(1) Significant change to Major Wetlands

During 2006/2007 a number of projects have been developed aimed at improving the quality and extent of wetlands. The projects which are in various stages of completion include the following:

Whitton Common Wetland

This joint project with Leeton Shire Council and the Whitton community is aimed at enhancing and managing via revegetation and fencing 30 hectares of wetland located within the Whitton Common. The Whitton community has also applied for an environmental water allocation to assist in the rehabilitation process.

Barren Box Swamp, Brays Dam, and Mirrool Creek

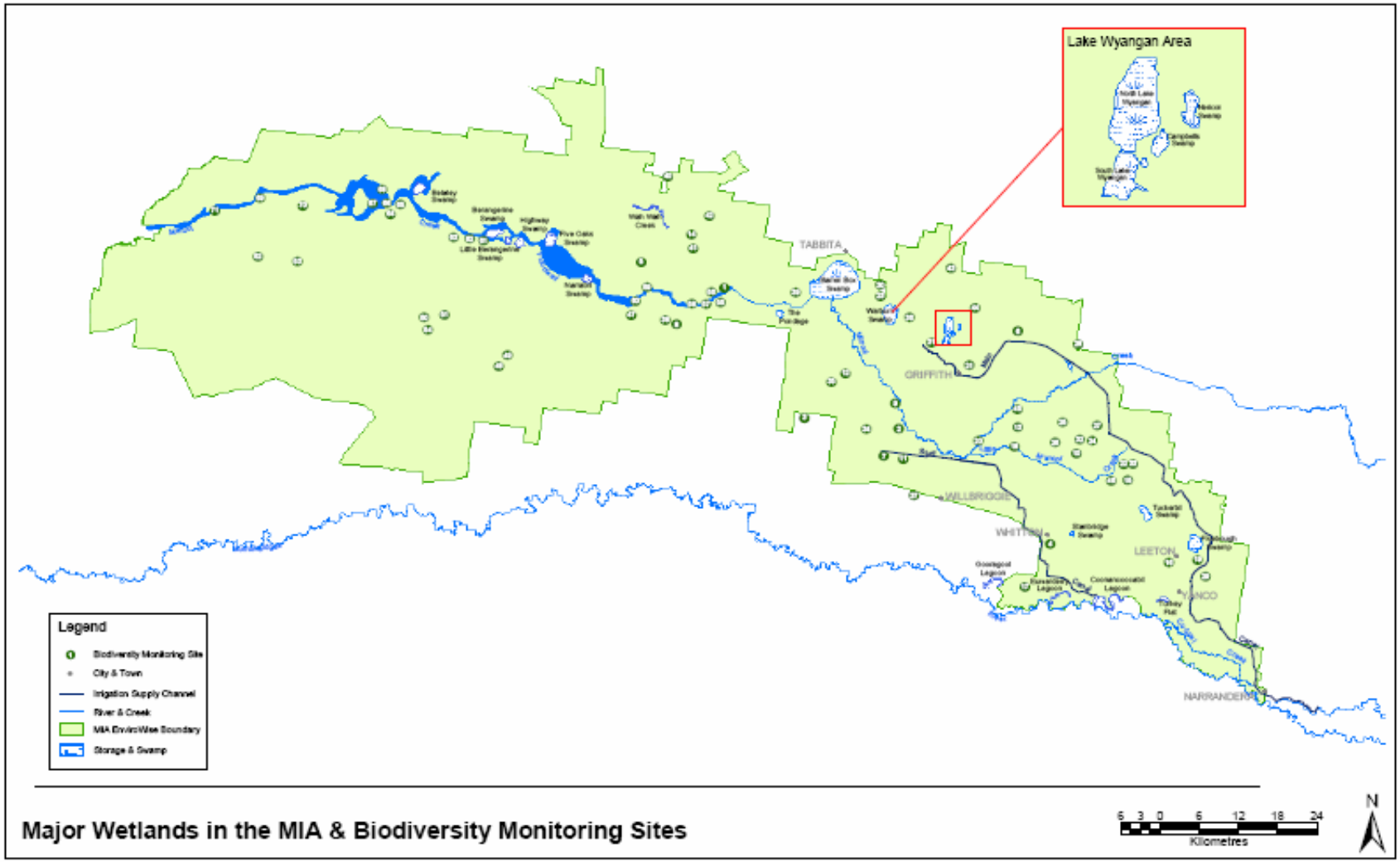
Detailed planning works for the aerial sowing of 500 hectares at Barren Box have been completed with implementation planned for early in the 2007/2008 year. The aim of this work is to assist with the re-establishment of a seed bank allowing natural regeneration to occur when favourable conditions return.

In addition, a number of smaller areas in the order of 50 hectares around the perimeter of Barren Box will undergo a combination of direct seeding and tube stock planting.

At Brays Dam planning and ground preparation of 6.5 hectares has been completed with planting of indigenous species to take place in July 2007. The proposed plantings will form a corridor with other proposed plantings along the entire length of Mirrool Creek which will improve the ecological functioning of the creek and surrounding landscape with future linkages to the rehabilitated Barren Box Wetland. It is anticipated that further Mirrool Creek works will be undertaken over the next 2 years with planning underway.

Nericon Swamp, Campbell Swamp, South Lake Wyangan
Griffith City Council has undertaken direct seeding with local indigenous species at 3 important wetland sites in the MIA in June 2007. At Nericon Swamp and Campbells swamp 8ha was sowed with 2ha sowed at South Lake Wyangan. Once established these works will enhance the wetland ecology to provide additional habitat to the many populations of birds that use these wetlands for breeding.

Figure 5.2.a: Habitat Quality in the MIA



Monitoring and Management of Wetlands in the MIA

Murrumbidgee Irrigation is required to monitor the condition of aquatic environments which are or may be impacted by its operations or the practices of irrigators. Murrumbidgee Irrigation is also required to implement strategies to protect and enhance biodiversity within the MIA.

An *Inventory of Wetlands in the Eastern MIA*, prepared in 2005[1], reports on the condition of wetlands impacted or potentially affected by the operations of Murrumbidgee Irrigation or its account holders. Since then Murrumbidgee Irrigation has commissioned an audit[2] to identify which wetlands should be monitored and on what basis. The audit has recommended 18 wetlands for monitoring. The wetlands have been recommended based on their structural formation and because as a group they are regionally representative and appropriate for monitoring according to a range of indicators including size, condition, hydrological regime and ecological value.

1 Harrison, L & Roberts J; Inventory of Wetlands in the Eastern MIA, May 2005.
2 Roberts, J. *An Audit of Wetlands in the Eastern MIA,* 2005

Table5.2.a: Target Wetlands (18) for monitoring wetland condition

Wetland type	Wetland
Depression Wetlands	Gum Creek Lagoon Kooba Swamp Stanbridge Swamp The Pondage Warburn Swamp Whitton Common
Former Floodplain Channels	Coonancoocabil Lagoon Euwarderry Lagoon Garoogal Lagoon McKays Lagoon Yanco Ag Lagoon
Wyangan Basin Wetlands	Campbell's Swamp Lake Wyangan Nericon Swamp
Deflation Basins	Barren Box Fivebough Swamp Tuckerbil Swamp
Impounded Meander	Willow Dam

The audit recommends that Murrumbidgee Irrigation should consider the guidelines and protocols in Recommended Methods for Monitoring Floodplains and Wetlands[7] in devising a future monitoring, assessment and reporting regime. The audit also recommends that Murrumbidgee Irrigation adopt a landscape or macro approach in considering wetlands as a group and not just as isolated ecosystems.

A.5.2(2) Management practice or work impact upon the aquatic environment (EP&A Act)

The Barren Box Water Conservation Project (BBS Project) commenced work at Barren Box in November 2005 and January 2006 at the Bray's Dam storage site. Both the Barren Box and Brays Dam sites were completed in June 2006. All work was undertaken in accordance with the Department of Planning's approved Construction Environmental Management Plans and the Development Approval. An Operational Environment Management Plan (OEMP) was developed and submitted to the Department of Planning in July 2006 for approval. The Company is still waiting for an official response from the Department in relation to the OEMP. Throughout the reporting period there was no impact on the aquatic environment.

However, throughout 2006/2007 work has continued to progress on the wetland rehabilitation and management plan with the formation of a Steering Committee, Technical Panel and the appointment of a Project Officer. Activities undertaken to date include:

- Development of draft goals and objectives
- Identification of knowledge gaps and the development of strategies to address them.
- A literature review of similar wetlands to Barren Box to gain an understanding of issues that may affect the rehabilitation
- Community engagement through landholder meetings and conducted tours.
- Indigenous engagement through community meetings and tours
- Invasive species control (plant and animal)
- Development of trials for aerial seeding of 500 hectares of the wetland cell. Aerial seeding is planned for July/August 2007 or when conditions are favourable.

Development of a vegetation planting plan for the direct seeding of 50 hectares of the active storage cell. It is planned for the direct seeding to take place in July 2007.

A.5.2(3) Noxious weeds

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Two inspections have been carried out at Barren Box Swamp and downstream channel systems and one inspection of the floodway.

Barren Box Swamp

The first inspection and treatment took place in February 2007. With the continuing dry conditions, low numbers of plants have been found once again at Barren Box. However the location of terrestrial plants on the surrounding shoreline has been assisted with Alligator Weed continuing to grow and other vegetative cover limited. There were 4 plants found and all plants were small in size.

The second inspection and treatment of Alligator Weed around Barren Box Swamp took place in May 2007 and located 2 plants. All plants were chemically treated.

Channel System

The first inspection of the Wah Wah Main and Outfall channel systems took place in December 2006. 3 plants were located within the system. All plants located in the channel system were small in size and were physically removed and treated.

A follow up inspection took place in May 2007. This inspection located no plants.

Floodway

An inspection of the floodway between the Outfall channel off take and Cameron Lane took place in May 2007. 3 plants were found. All plants found on the floodway were chemically treated. Owing to the extreme dry conditions and number of stock in the floodway, the early inspection was not carried out.

A.6 General Environment Management

A.6.3 Reporting requirements

A.6.3(1) Register of activities

A *register of activities* is ordinarily required by a determining authority, generally being a government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning & Assessment Act. However, as this remains a licence requirement, despite the privatisation of Murrumbidgee Irrigation, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2006/07. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2006

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	Murrumbidgee Irrigation	February 2005

Source: MI Environmental Services

A.6.3(2) Significant change to and condition of environment assets

Monitoring and Management of environmental assets in the MIA

Remnant Protection and Local Native Species Revegetation

Since 1st July 2006 til 30th June 2007 under the Vegetation Management Plan Implementation scheme MIA EnviroWise has completed 92ha of direct seeding, 30ha of new plantings, 240ha enhanced remnants.

Murrumbidgee Irrigation managing Environmental Assets

MIA EnviroWise is required through the MCMA to complete Property Vegetation Plans (PVP's) for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder. In 2006/07 two PVP's were completed and approved by the MCMA.

Biodiversity Incentives are available to MI account holders to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant protection and enhancement through fencing and direct seeding, new plantings along drainage lines, or plantings with the intention of linking remnant vegetation creating corridors for the movement of fauna within the MIA. Vegetation Implementation Officers assist landholders in the planning and implementation of their Vegetation Management Plans.

7 Baldwin et al 2005

Figure 6.3.a: Threatened, vulnerable or endangered ecological communities or species.

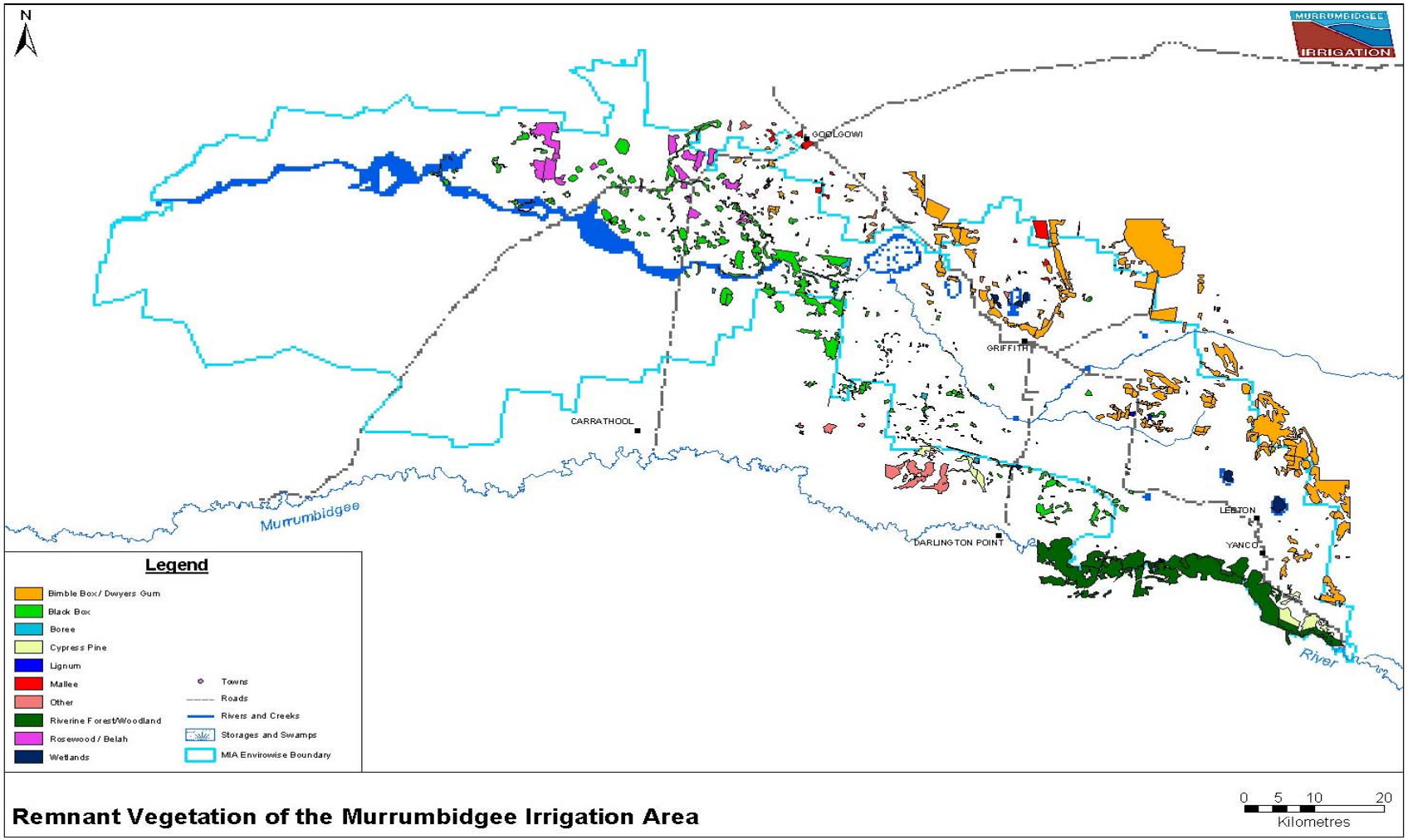
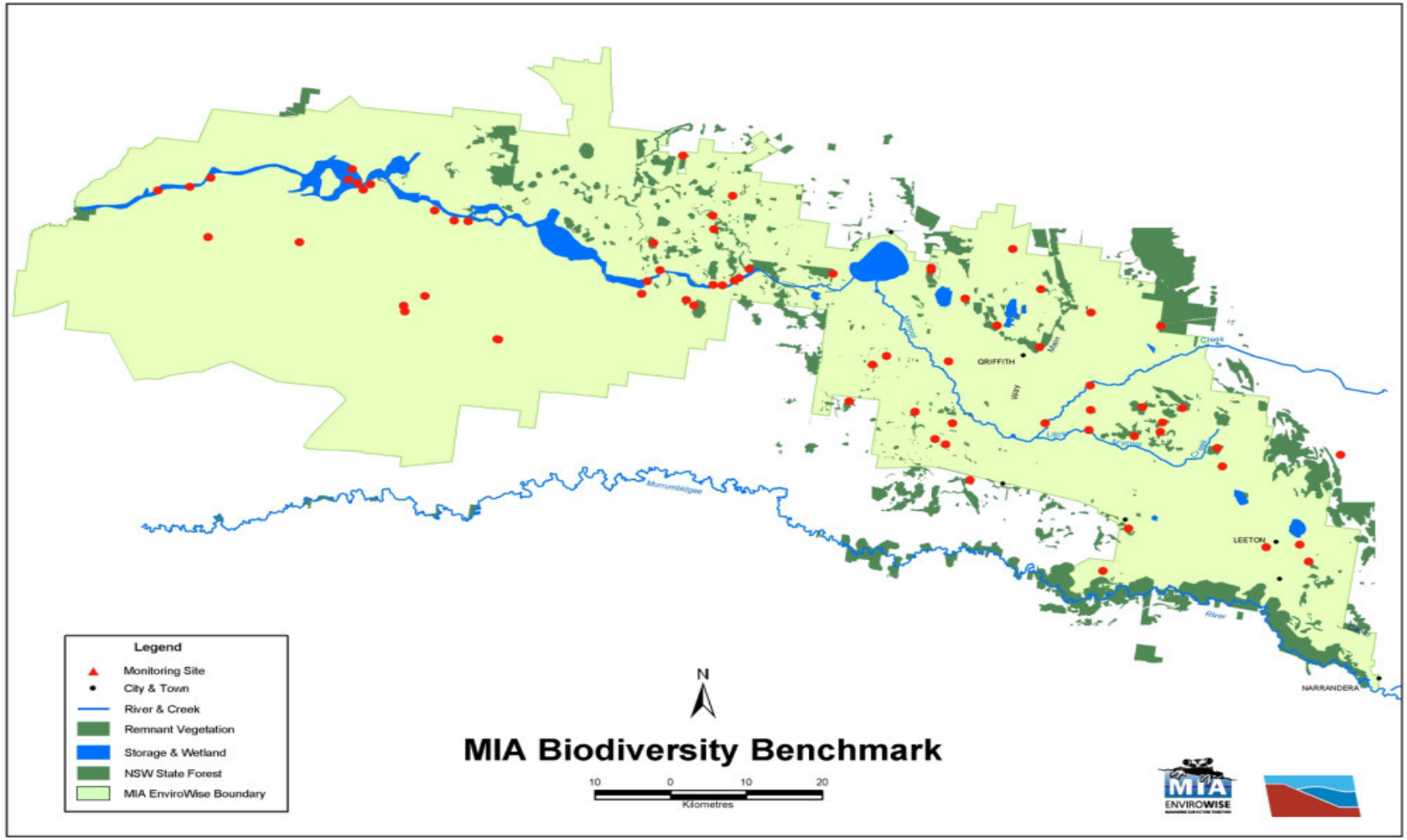


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



A.6.3(3) Soil salinity survey (every 3 years)

Due to the continuing drought, the soil salinity survey due to be completed last year was postponed until conditions improve. Murrumbidgee Irrigation considers regional salinity surveys less effective and desires a system with key sites for salinity monitoring. This has not yet been implemented. (A van der Lely, 2004).

DNR has stated in their reply to the 2006 Compliance Report: "MI have indicated preference for key sites monitoring. This needs to be discussed in detail with DNR, and the condition amended accordingly if appropriate."

Murrumbidgee Irrigation is committed to work with the DWE (formerly DNR) to develop a more effective way to monitor and improve soil salinity. Further it is expected that the outcomes from the CSIRO research will guide the development of a more appropriate regional soil salinity assessment method.

A.7 Salinity Management and Accounting

A.7.4 Reporting requirements

A.7.4(1) Flow, salt load and salinity data

Refer to Drainage Volumes, Table 2.2.h, page 22, for flow data.

Refer to Salt Loads, Table 2.2.i, page 27, for salt load data.

Refer to refer to Table M.4, page 73, for salinity data.

A.7.4(2) Notice for compliance with Salinity and Drainage Strategy

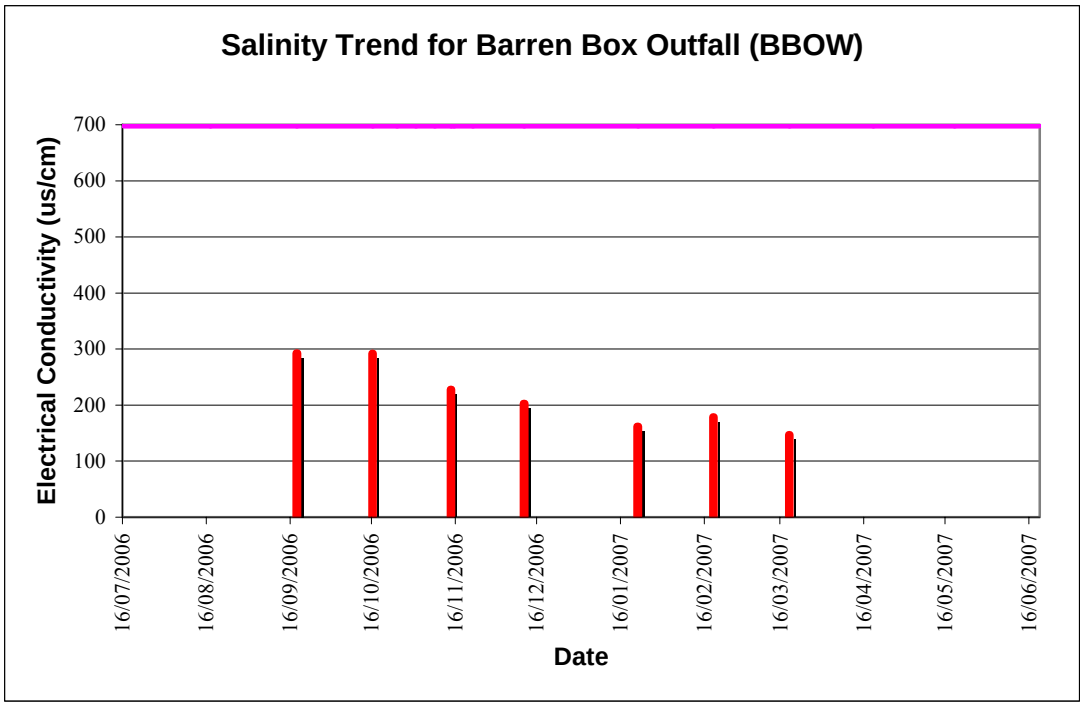
No written notice was received for the period.

A.7.4(3) Salt load discharges

Refer to Salt Loads, Table 2.2.i, page 27.

A.7.4(4) Salinity in Barren Box Outfall Drain against benchmark

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark



Note: Water from BBOW has not come from Barren Box.

Due to the low allocations during the 2006/07 season, there was a reduction in salinity readings taken at Barren Box Outfall Channel. During low flow or no flow conditions, the salinity levels can rise due to evaporation of water, leaving the salts behind. This in turn would lead to a false indication of the amount of salt transported into the Wah Wah area. It is for this reason, that salinity readings are only taken when there is a reasonable flow (>5ML/day). It is evident that for the 2006/07 irrigation season the quality of water discharged from the Barren Box Outfall at Wyvern to the Wah Wah Main Canal for supply to the Wah Wah Irrigation District has been satisfactory with EC levels below the identified 700 EC benchmark limit.

Water Quality Management

Murrumbidgee Irrigation has an elaborate monitoring system in place to ensure we comply with our licences as well as have data for the efficient management of our Irrigation Area. We continuously monitor flow and electrical conductivity at key sites throughout our area as well as nutrients and pesticides on a monthly basis. Our pesticide detections are compared to notification and action levels, set by the Department of Environment and Climate Change (DECC), formerly the Department of Environment and Conservation.

Due to the continued drought, Murrumbidgee Irrigation requested and gained approval from the Department of Environment and Conservation for temporary variations to our Environment Protection Licence 4651. These are:

1. *Weekly sampling and analysis [for molinate] will be required for the five (5) weeks commencing 23 October 2006 and ceasing 20 November 2006;*
2. *If a rainfall event of ≥ 20 millimetres within a 48 hour period is experienced in weeks commencing 2 October 2006 to 22 October 2006, or 20 November to 31 December 2006, samples are to be collected and submitted for laboratory analysis using the HPLC/DAD method;*
3. *If it can be verified through water ordering and delivery data or aerial imagery, that no rice is grown in the catchment of a designated environmental monitoring or discharge point, then the DEC accepts that the weekly monitoring for rice chemicals is not necessary in the period October 2006 to December 2006; and*
4. *Please note unless otherwise varied by this letter all samples are to be taken in accordance with the requirements of environmental protection licence 4651.*
5. *Monthly chemical sampling will only be required when flows at the specified sites are in excess of 5 ML/day for the period of 1 April 2007 to the start of the next irrigation season. This is already the case for nutrient sampling.*

The 2006-2007 pesticides monitoring program has revealed no detections above action level for any of the chemicals tested. There were six notification detections (out of 824 analyses), of which three were diuron, one chlorpyrifos, one simazine and one metolachlor.

The weekly ELISA Molinate sampling program, which was cut back to five weeks, revealed no notification or action level detections. In fact, molinate was only found on two occasions at low levels. This is due to a combination of improved management, low rice areas and low rainfall.

There was no rainfall event larger than 20 mm within a 48 hour period during the whole of the rice growing season, so variation condition 2 was not activated.

No monthly sampling occurred in April and May, while only two sites had flows larger than 5 ML/day in June. Samples were taken at these two sites and sent away for analysis, which revealed no detections. Due to a change over of laboratories, the incorrect tests were carried out on the samples. Only chlorpyrifos and endosulphan were tested for. The incident has been discussed with the laboratory and measures have been put in place to ensure the correct tests will be carried out next time.

Murrumbidgee Irrigation has commenced a replacement program for the flow gauging stations during the 2006/07 season. Sites earmarked for upgrade by 31 August 2007 are: LMC, MDJWE, MIRMCN and BBOW. The upgrade will ensure more reliable measurement of flow and electrical conductivity.

Overall, the 2006/07 season has seen a reduced number of detections (as a % of the total number of analyses) compared to previous seasons, which is shown in Figure R1 (page 78). Due to the drought and therefore limiting resources, the on-going pollution prevention program has been suspended, pending an improvement in allocations. The pollution prevention program was set up to work with farmers to promote best management practices in order to minimise pollution in our drains. This included, for example, participation in farmer shed meetings and using local media to create awareness.

Table M.1: Department of Environment and Climate Change compliance requirements

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Location of monitoring sites	Table M.2	69
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (>5Mg)	Table M.4	72
	Diazinon (November)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	71
	Flow (Monthly) LW6	Table 2.2.h Table 2.2.f	21 18
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	75
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.5	74
	Nitrogen (>5Mg)	Table M.6	75
	Phosphorus (>5Mg)	Table M.6	75
	Simazine (Monthly)	Table M.3	71
	Thiobencarb (Nov)	Table M.5	74
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	74
	Turbidity (>5Mg)	Table M.6	75
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.h	21
M3	**Testing Methods – concentration limits**		
	Approved by DECC	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11&12		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (Monthly)	Table M.4	72
	Diazinon (Nov)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	71
	Flow (Monthly)	Table 2.2.h	21
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	75
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	74
	Simazine (Monthly)	Table M.3	75
	Thiobencarb (Nov)	Table M.5	75
	Nitrogen (>5Mg/day)	Table M.6	71
	Phosphorus (>5Mg/day)	Table M.6	74
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	74
	Turbidity (>5Mg/day)	Table M.6	75

*Table M.1: Department of Environment and Conservation compliance requirements (*cont.)

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Monitoring Sites 13 &14		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (Monthly)	Table M.4	72
	Diazinon (Nov)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	71
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	75
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	74
	Simazine (Monthly)	Table M.3	75
	Thiobencarb (Nov)	Table M.5	75
	Nitrogen (Monthly)	Table M.6	71
	Phosphorus (Monthly)	Table M.6	74
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	74
	Turbidity (Monthly)	Table M.6	75
	M7.2 Conductivity (Continuously) Sites 1 & 9	Table M.4	72
	M7.3 Molinate Elisa Testing (Oct/Nov/Dec) one week intervals for sites 1-12	Table M.7	76
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Records stored on computer, Page 59	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	DEC contacted Table R.1, Page 78	
R3	**Written report**		
	R3.1 Send reports to DEC at their request, regarding environmental harm	DEC sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	DEC contacted, Table R.1, Page 79	
R5	**Annual report**		
	R5.1 Submit annual report to DEC	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.h A.3.2(4) Figure R.1 Table R.1	15 21 40 77 78
	R5.4 Send copies of DEC, DNR, DPI, MDBC	Submitted	

Table M.2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR	Gogeldrie Main Southern Drain	5	*
410083	YMS	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

Table M.3: Monthly monitoring of Atrazine, Chlorpyrifos, Diuron, Alpha Endosulfan, Beta Endosulfan and Simazine

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Atrazine (DL = 0.05ug/L)												
BBOW	NF	NF	0.05	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LAG	BDL	NF	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LMC	0.60	0.36	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LW6	0.05	0.13	0.14	0.11	0.29	1.06	0.33	0.29	0.24	NF	NF	NF
MDJWE	BDL	0.15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NT
MIRMCN	BDL	0.16	0.05	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NT
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	NF	NF	BDL	NF	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
Chlorpyrifos (DL = 0.05 g/L)												
BBOW	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LAG	BDL	NF	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LMC	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	NF	NF	BDL	NF	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
Diuron (DL = 0.1 ug/L)												
BBOW	NF	NF	0.1	0.4	BDL	0.3	BDL	BDL	0.2	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	0.1	BDL	BDL	BDL	0.2	BDL	0.1	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	0.1	0.9	0.5	NF	BDL	NF	BDL	NF	NF	NF
LAG	BDL	NF	BDL	BDL	0.2	NF	BDL	NF	BDL	NF	NF	NF
LMC	4.50	BDL	0.1	BDL	BDL	BDL	0.2	0.1	0.1	NF	NF	NF
LW6	0.30	0.2	0.3	0.3	0.2	0.1	0.1	0.1	0.1	NF	NF	NF
MDJWE	2.00	BDL	BDL	BDL	0.1	BDL	BDL	BDL	BDL	NF	NF	NT
MIRMCN	1.30	BDL	0.1	BDL	0.2	BDL	BDL	BDL	BDL	NF	NF	NT
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	0.2	BDL	NF	NF	BDL	NF	NF	NF
YMS	0.9	BDL	0.1	0.3	0.2	0.2	BDL	BDL	BDL	NF	NF	NF

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Alpha Endosulfan (DL = 0.01 ug/L)												
BBOW	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LAG	BDL	NF	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LMC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	NF	NF	BDL	NF	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
Beta Endosulfan (DL = 0.01 ug/L)												
BBOW	NF	NF	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LAG	BDL	NF	BDL	BDL	BDL	NF	BDL	NF	BDL	NF	NF	NF
LMC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
MIRMCN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	<0.5*
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	NF	NF	BDL	NF	NF	NF
YMS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
Simazine (DL = 0.05 ug/L)												
BBOW	NF	NF	0.12	0.05	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	BDL	BDL	0.06	0.07	BDL	BDL	0.08	BDL	0.06	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	BDL	0.08	0.55	0.30	NF	BDL	NF	BDL	NF	NF	NF
LAG	0.18	NF	BDL	0.09	BDL	NF	0.06	NF	BDL	NF	NF	NF
LMC	3.8	0.06	0.08	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
LW6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NF
MDJWE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NT*
MIRMCN	BDL	BDL	0.12	BDL	BDL	BDL	BDL	BDL	BDL	NF	NF	NT*
ROCUDG	NF	BDL	BDL	BDL	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	BDL	BDL	BDL	NF	NF	BDL	NF	NF	NF
YMS	0.5	BDL	0.30	0.42	0.60	0.08	BDL	0.06	BDL	NF	NF	NF

Notes: Refer to Summary of Events (Table R.1, Page78) for further details.
Action level detection Notification level detection NF = No flow BDL = Below detectable level
NT = Not tested * Incorrect test requested from lab, therefore some chemicals not tested, others at higher detection limits.

Table M.4: Monthly conductivity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results > 5ML/day												
BBOW*	NF	NF	293	292	228	203	162	179	147	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD*	341	244	244	200	214	293	243	237	388	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR*	NF	311	478	115	108	NF	68	NF	410	NF	NF	NF
LAG*	1710	NF	157	77	105	NF	410	NF	264	NF	NF	NF
LMC*	853	604	450	309	334	437	493	625	NF	NF	NF	NF
LW6	NF	NF	654	NF	NF	NF	NF	NF	NF	NF	NF	NF
MDJWE*	726	288	288	222	211	163	112	164	NF	NF	NF	242
MIRFLD	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
MIRMCN*	484	430	321	225	225	161	144	151	139	NF	NF	431
NARREG*	156	163	73	46	49	53	58	71	84	NF	NF	NF
ROCUDG*	NF	98	102	100	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
STUR*	NF	214	77	53	52	75	56	68	89	NF	NF	NF
WS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
YMS*	1029	1660	2130	NF	1162	812	1400	1520	1077	NF	NF	NF

Source: MI Environmental Services. Mean monthly field data. If no field data available, mean monthly MI lab data is used.

Notes: * continuous monitoring sites

NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

NT = Not tested due to miscommunication with laboratory during change over. Samples were taken but incorrect test conducted.

MIRFLD data – No releases were made to the Mirrool Creek floodway.

Table M.5: Monitoring of Diazinon, Malathion, Metolachlor, Thiobencarb and Trifluralin

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Diazinon (November monitoring required)												
BBOW					BDL							
BBST					NF							
BYD					BDL							
FS					NF							
GMSRR					BDL							
LAG					BDL							
LMC					BDL							
LW6					BDL							
MDJWE					BDL							
MIRMCN					BDL							
ROCUDG					NF							
TKBS					NF							
WS					BDL							
YMS					BDL							
Malathion (October and November monitoring required)												
BBOW				BDL	BDL							
BBST				NF	NF							
BYD				BDL	BDL							
FS				NF	NF							
GMSRR				BDL	BDL							
LAG				BDL	BDL							
LMC				BDL	BDL							
LW6				BDL	BDL							
MDJWE				BDL	BDL							
MIRMCN				BDL	BDL							
ROCUDG				BDL	NF							
TKBS				NF	NF							
WS				BDL	BDL							
YMS				BDL	BDL							
Metolachlor (October to December monitoring required)												
BBOW				BDL	BDL	BDL						
BBST				NF	NF	NF						
BYD				BDL	BDL	BDL						
FS				NF	NF	NF						
GMSRR				BDL	0.07	NF						
LAG				BDL	BDL	NF						
LMC				BDL	BDL	BDL						
LW6				BDL	BDL	BDL						
MDJWE				BDL	BDL	BDL						
MIRMCN				BDL	BDL	BDL						
ROCUDG				BDL	NF	NF						
TKBS				NF	NF	NF						
WS				BDL	BDL	BDL						
YMS				BDL	BDL	BDL						

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Thiobencarb (November monitoring required)												
BBOW					BDL							
BBST					NF							
BYD					BDL							
FS					NF							
GMSRR					BDL							
LAG					BDL							
LMC					BDL							
LW6					BDL							
MDJWE					BDL							
MIRMCN					BDL							
ROCUDG					NF							
TKBS					NF							
WS					BDL							
YMS					BDL							
Trifluralin (September-December and March-May monitoring required) (DL = 0.05 g/L)												
BBOW			BDL	BDL	BDL	BDL			BDL	NF	NF	
BBST			NF	NF	NF	NF			NF	NF	NF	
BYD			BDL	BDL	BDL	BDL			BDL	NF	NF	
FS			NF	NF	NF	NF			NF	NF	NF	
GMSRR			BDL	BDL	BDL	NF			BDL	NF	NF	
LAG			BDL	BDL	BDL	NF			BDL	NF	NF	
LMC			BDL	BDL	BDL	BDL			BDL	NF	NF	
LW6			BDL	BDL	BDL	BDL			BDL	NF	NF	
MDJWE			BDL	BDL	BDL	BDL			BDL	NF	NF	
MIRMCN			BDL	BDL	BDL	BDL			BDL	NF	NF	
ROCUDG			BDL	BDL	NF	NF			NF	NF	NF	
TKBS			NF	NF	NF	NF			NF	NF	NF	
WS			NF	BDL	BDL	BDL			BDL	NF	NF	
YMS			BDL	BDL	BDL	BDL			BDL	NF	NF	
Molinate (September - February monitoring required)												
BBOW			BDL	BDL	BDL	BDL	BDL	BDL				
BBST			NF	NF	NF	NF	NF	NF				
BYD			BDL	BDL	BDL	BDL	BDL	BDL				
FS			NF	NF	NF	NF	NF	NF				
GMSRR			BDL	BDL	BDL	NF	BDL	NF				
LAG			BDL	BDL	BDL	NF	BDL	NF				
LMC			BDL	BDL	BDL	BDL	BDL	BDL				
LW6			BDL	BDL	BDL	BDL	BDL	BDL				
MDJWE			BDL	BDL	BDL	BDL	BDL	BDL				
MIRMCN			BDL	BDL	BDL	BDL	BDL	BDL				
ROCUDG			BDL	BDL	NF	NF	NF	NF				
TKBS			NF	NF	NF	NF	NF	NF				
WS			NF	BDL	BDL	BDL	NF	NF				
YMS			BDL	BDL	0.11	BDL	BDL	BDL				

Notes: Refer to Summary of Events (Table R.1, Page78) for further details.
Action level detection Notification level detection NF = No flow, no sample taken BDL = Below detectable level

Table M.6: Monitoring of Nitrogen, Phosphorus and Turbidity

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
TKN (mg/L)												
BBOW	NF	NF	1.3	1.4	0.7	0.3	0.7	NF	0.7	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.8	0.7	0.9	0.7	0.6	0.9	0.4	0.6	0.6	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.8	1.5	1.7	0.4	NF	0.8	NF	0.3	NF	NF	NF
LAG	1	NF	1.4	1	0.3	NF	2.1	NF	0.7	NF	NF	NF
LMC	0.8	0.9	1	0.6	0.6	0.8	0.3	0.9	0.9	NF	NF	NF
LW6	1.6	1	1.7	0.8	1.7	1.1	0.3	1.2	0.6	NF	NF	NF
MDJWE	3.6	1.3	1.4	0.5	0.9	0.5	1	0.8	0.3	NF	NF	NF
MIRMCN	3.9	1.2	1.4	0.6	0.8	0.6	0.7	1	0.5	NF	NF	NF
ROCUDG	NF	0.7	1.4	1	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.6	1.5	1.1	NF	NF	0.6	NF	NF	NF
YMS	0.9	0.8	1.3	2.1	0.3	0.9	0.7	6	0.4	NF	NF	NF
Total Phosphorus (mg/L)												
BBOW	NF	NF	0.09	0.23	0.09	0.43	0.04	NF	0.06	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	0.05	0.09	0.06	0.08	0.05	0.28	0.04	0.07	0.09	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	0.09	0.15	0.2	0.22	NF	0.07	NF	0.08	NF	NF	NF
LAG	0.12	NF	0.2	0.08	0.23	NF	1.13	NF	0.07	NF	NF	NF
LMC	0.12	0.16	0.07	0.07	0.12	0.25	1.16	0.05	0.2	NF	NF	NF
LW6	0.07	0.14	0.11	0.06	0.08	0.29	0.05	0.05	0.04	NF	NF	NF
MDJWE	0.2	0.24	0.13	0.07	0.13	0.16	0.09	0.12	0.04	NF	NF	NF
MIRMCN	0.16	0.19	0.11	0.07	0.23	0.16	0.1	0.11	0.1	NF	NF	NF
ROCUDG	NF	0.07	0.15	0.05	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	0.05	0.03	0.03	NF	NF	0.04	NF	NF	NF
YMS	0.06	0.05	0.08	0.19	0.05	0.33	2.49	0.02	0.02	NF	NF	NF
Turbidity (NTU)												
BBOW	NF	NF	133	183	146	176	165	119	129	NF	NF	NF
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	181	62.3	97	276	234	190	145	186	211	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR	NF	78.2	148	443	259	NF	104	NF	209	NF	NF	NF
LAG	109	NF	145	188	392	NF	35.5	NF	53.4	NF	NF	NF
LMC	418	127	NF	NF	NF	262	230	243	420	NF	NF	NF
LW6	58.2	59.3	91.4	78.1	89.9	32.9	45	19.4	24.5	NF	NF	NF
MDJWE	115	96.6	87.6	140	99.4	119	122	95	73.2	NF	NF	NT
MIRMCN	161	77	87	176	133	122	154	114	105	NF	NF	NT
ROCUDG	NF	113	110	91.5	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	72.4	119	11.4	NF	NF	93.1	NF	NF	NF
YMS	173	67	92.7	236	72.3	151	145	45.7	114	NF	NF	NF

Notes: NF = No flow
BDL = Below detectable level
NT = Not tested

Table M.7: Molinate ELISA testing

Weekly molinate sampling												
	25/10	1/11	8/11	15/11	22/11	29/11	6/12	13/12	20/12	27/12	3/01	10/01
	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk9	Wk 10	Wk 11	Wk 12
BBOW	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
BBST	NR	NR	NR	NR	NR	E	E	E	E	E	E	E
BYD	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
FS	NR	NR	NR	NR	NR	E	E	E	E	E	E	E
GMSRR	<0.2	<0.2	1.51	<0.2	<0.2	E	E	E	E	E	E	E
LAG	NR	NR	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
LMC	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
LW6	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
MDJWE	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
MIRMCN	<0.2	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
ROCUDG	NR	<0.2	<0.2	<0.2	<0.2	E	E	E	E	E	E	E
TKBS	NR	NR	NR	NR	NR	E	E	E	E	E	E	E
WS	NR	NR	NR	NR	NR	E	E	E	E	E	E	E
YMS	<0.2	<0.2	0.32	<0.2	<0.2	E	E	E	E	E	E	E

Refer to Summary of Events (Table R.1, Page 78) for further details.

Notes: E DECC approval was obtained to exclude weeks 1, 10, 11 and 12 from the weekly molinate sampling program. During weeks 2 and 3 several catchments were known not to contain rice, approval was granted to exclude these catchments from the sampling program during that time.

= Notification level detection

= Action level detection

NF = No flow

BDL = Below detectable level

NR = Not required due to no rice grown in sub-catchment.

Table M.7 shows that molinate was detected on only two occasions, both below notification level.

Discussion of chemical monitoring results

Figure R1 shows that there continues to be a reduction in the incidence of pesticide detections above notification and action level since the 1995/96 baseline year.

Due to the reduced number of analyses undertaken, a single detection will show up as a higher percentage. There were no Action Level detections and six Notification Level detections from the licenced monitoring program during the 2006/07 season. However, there were two additional detections from out of season monitoring (See Table R1). Compared to the pre July 2004 guidelines, there would have been one Action Level detection and no Notification Level detections; however the size of the black bar suggests an increase in Action Level detections since the early 2000s.

Figure R.1: Results from DECC licenced monitoring program

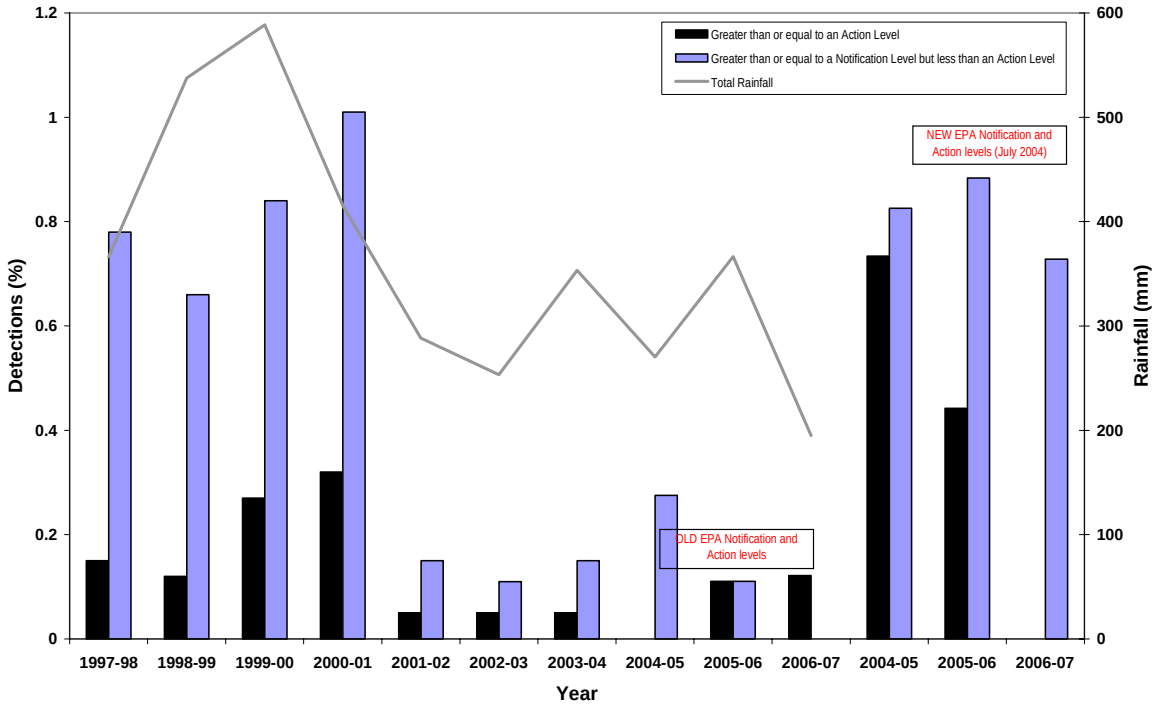


Table R.1 (overleaf) shows reporting of pollution events as required by the licence. It is important to note that the definition of *pollution* is not clear and is linked to the potential of events to result in adverse environmental impact. Without prescriptive indicators this definition appears to be subjective. This is why the table includes machinery or vehicles in channels as there remains the potential for these events to result in adverse environmental impact through potentially impacting on bank erosion, turbidity, fish kills due to direct hits or presence of oil and fuel despite the fact that such impact is considered unlikely.

Table R.1: Summary of all Events Reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide DEC Action Level				
LAG	18/07/2006	An action level of Metolachlor (0.11ug/L) was detected	DEC and DNR were notified	None due to delay in detection required outside monitoring
Pesticide DEC Notification Level				
LMC	17/07/2006	A notification level of Chlorpyrifos (0.1ug/L) was detected	DEC and DNR were notified	N/A
MIRMCN	17/07/2006	A notification level of Diuron (1.3ug/L) was detected	DEC and DNR were notified	N/A
MDJWE	17/07/2006	A notification level of Diuron (2ug/L) was detected	DEC and DNR were notified	N/A
LMC	17/07/2006	A notification level of Diuron (4.5ug/L) was detected	DEC and DNR were notified	N/A
LMC	18/07/2006	A notification level of Simazine (3.8ug/L) was detected	DEC and DNR were notified	N/A
GMSRR	16/11/2006	A notification level of Metolachlor (0.07ug/L) was detected	DEC and DNR were notified	N/A

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
LAG	22/01/2007	A notification level of Metolachlor (0.08ug/L) was detected	DEC and DNR were notified	Outside required monitoring program
Other Pollution Events				
Wamoon township	10/10/2006	A report of sewerage discharge was received from a Field Operator. An inspection by Kelly Tyson and John Sutherland at Wamoon found what appeared to be sewerage water laying on the supply reserve.	A letter was sent to the General Manager of the Leeton Shire on the 20th October requesting their cooperation in this matter.	
Road reserve - Hillston Road adjacent to Summertime Fruit Juices	09/01/2007	Kelly Tyson investigated the site and the drainage inlet was discharging liquid waste on the road reserve immediately in front of the property and a neighbouring business. The liquid waste was brown-black and had a strong offensive odour.	Both EPA and Council were advised with Council requested to take action. The company was advised to cease activity immediately.	
Murray Road	16/02/2007	Algal scum (possibly Euglenoids) present in high concentrations in Murray Road Drain. A drainage pump was seen discharging into the drain.	Notified GCC and awaiting response	
GCC	06/03/2007	Sewage discharged into stormwater system drain near the reservoir site.	Council was contacted and they advised they had immediately flushed and disinfected the area. And the overflow was caused from a pump station was turned off to conduct pipe repair.	

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Supply reserve Yenda	30/03/2007	Chemical drums, pump and spray cart was seen on channel reserve. Appears supply channel used for chemical mixing.	Letter dated 3rd April to adjacent owner asking to cease the practice. Owner rang the next day and committed not to do this again.	
LMC,LAG & YMS	22/01/2007	Non routine Blue- green algae monitoring conducted after amber alert at Whitton offtake.	Took samples at Whitton offtake, South Lake,3 ways & Yenda Bridge (YENDBN) on 31/1/07 and visually inspected EMR, LMC, Yenda Storage & LAG. Decided not to test at LAG (lots of decaying veg due to recent spraying as no real risk as pump not operating and nothing likely to irrigate from the farmer).	
North& South lake Wyangan Lake View Channel	13/04/2007	Notification by GCC of BG algae in LW	Samples taken after the Griffith Shire took samples on the11th April from the Lakes after a report of a green slime. Some algae found but no toxic BGA	

Events Reported under R.2 & R.3 of the Environment Protection Licence 4651

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Glossary

APHA	American Public Health Association
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&Ds	Murrumbidgee Irrigation Area and Districts
ML	Megalitre
mm	Millimetre
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
SEE	Statement of Environmental Effect
SFU	Single farming unit
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Table 2.2.g (page 20) and Table M.2 (page 70) for complete listings of monitoring sites

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MIA EnviroWise program has been made possible thanks to funding from the Australian and NSW Government's *National Action Plan for Salinity and Water Quality.*

B3: Licence compliance report FY 2007-2008

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Murrumbidgee Irrigation on 02 6962 0200

Licence Compliance Report 08

MURRUMBIDGEE IRRIGATION



ENVIRONMENTAL CARE
for future generations

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Executive Summary

Murrumbidgee Irrigation's licences with the NSW Department of Water & Energy and the NSW Department of Environment and Climate Change set the minimum standard for environmental management. The Company's programs are aimed at operating beyond compliance.

DWE LICENCE REQUIREMENTS

The DWE licence comprises of seven broad categories (A1 – A7) which are summarised below:

A1. Land and Water Management Plan

The Land and Water Management Plan (MIA EnviroWise) continued to enhance the sustainability and profitability of the MIA and Districts over the last year through a combination of education, on-farm incentives and regional projects. The 2007/08 year saw $8.223 million of government money invested in the MIA and Districts through MIA EnviroWise, of which less than 5% was devoted to plan administration.

The 2007/08 season saw a record number of incentives processed which resulted in the record expenditure of $8.223 million of government funding. Of this, $5 million was spent on on-farm works and education while the majority of the remaining funds were spent on biodiversity activities, including the BioTender (a 15-year program – protecting in excess of 1,000ha of high quality remnant vegetation on long term contracts), the Mirrool Creek restoration project and biodiversity plantings.

A2. Water Supply and Drainage Management

The drought conditions that have impacted on water availability in the MIA&D since the 2002/03 season remain. While rainfall was only just below the long term average, the majority of that fell during the November to January period where evaporation rates are typically higher than the traditional pattern of winter/spring rainfall. Very low general security allocations leading to a reduced summer cropping program meant that most crops were not able to benefit from the rainfall. This, combined with evapotranspiration still well above average made for another difficult season for Murrumbidgee Irrigation and its customers. While general security allocations were only just below those of the previous season, the total deliveries were much lower than the previous season due to various pay-back obligations from general security customers. The very low deliveries led to a lower simple system efficiency than previous years, although it should be noted that total system efficiency losses were reduced to an all-time low due to the vigilance of MI staff.

As a result all available drainage water was re-used, in order to increase the system efficiency.

Due to the low general security allocation, there was a shift in deliveries for specific crop types. Horticultural crops received about two third of deliveries, while winter cereals and oilseeds received just over 20%. Notably the summer cropping program was virtually non-existent.

Executive Summary

The licence specifies continuous measurement of flow and salinity, which is done using flow gauging stations at key sites across the area. Continuous monitoring implies that 100% of the data is expected to be measured and recorded. While Murrumbidgee Irrigation takes all reasonable action to ensure compliance with this requirement, there were a small number of occasions when data was lost due to equipment failure. During the renegotiation of the Water Management Works Licence, it will be requested to vary this requirement to more realistic levels of accuracy, eg 95% of data is recorded.

A3. Groundwater Management

As per the licence requirements, all bi-monthly and six-monthly bores were read. The shallow and deep water tables have continued to drop due to improved on-farm management and the on-going drought. The MIA is now well below the predicted groundwater levels of the LWMP raising concerns as to the appropriateness of such benchmarks in the current context. The LWMP was born of a wet period and has been implemented in a very dry one. Less than 1% of the MIA has water table levels within 2 m of the surface, as compared to 70% before the commencement of the drought.

A4. Floods and flood plain management

There were no deliberate diversions to the floodway.

A5. Aquatic Environment Management

Work has continued on the rehabilitation of a number of wetlands in the MIA including Barren Box and wetlands along Mirrool Creek with the aim of improving the quality and the extent of habitat.

The control of alligator weed in the aquatic environment has continued over the past year with two inspections carried out. Inspections were carried out at Barren Box, the channel system and the floodway with 18 small alligator weed plants found during the first inspection. All sites identified with alligator weed were chemically treated. The follow up inspection found only one plant with no sign of re-growth on the chemically treated plants. This extremely low number of plants demonstrates the commitment of the Company to eradicate this nationally significant weed.

A6. General Environmental Management

The protection and enhancement of local native species, remnant revegetation and other environmental assets are managed through the Property Vegetation Plans under the MIA EnviroWise program. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Section A1.

In relation to soil salinity it was concluded after the last survey that the current survey method does not provide an effective way to monitor the changes to soil salinity from irrigated agriculture and/or improve soil salinity. Therefore, this program is suspended, pending the review of the licence and the outcomes of the three year research project with CSIRO.

A7. Salinity Management and Accounting

The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

Executive Summary

DECC LICENCE REQUIREMENTS

The DECC licence has detailed requirements for monitoring and recording of drainage water quality.

Due to the continued drought, Murrumbidgee Irrigation requested and gained approval from the Department of Environment and Climate Change (DECC) for temporary variations to our Environment Protection Licence 4651.

It was agreed that the monthly water quality monitoring program would not be carried out if general security allocation stayed below 20%. As reported, the general security allocation was only 13% and therefore no monthly monitoring occurred.

In addition to regular monitoring of water quality the Company is also required to investigate miscellaneous pollution incidents. In 2007/2008 four miscellaneous complaints were received from the public and Company staff. Each of these were followed up and resolved in accordance with licence and other legislative requirements.

As part of the Company's commitment to act beyond compliance, a new risk-based monitoring and benchmarking program will be trialled during the 2008/09 season, which has been approved by the DECC. If successful, this risk-based approach will form the basis of the Company's new DECC licence which will be aimed at improving our performance by reducing risks as opposed to measuring our performance through monitoring.

Introduction

Murrumbidgee Irrigation has complied with the requirements under its licences with the Department of Water & Energy and the Department of Environment and Climate Change.

Due to the continuing drought, resulting in low allocations for general security shareholders and therefore greatly reduced drainage flows, the Company obtained relevant variations to the existing licences and these are referred to in the text.

The Company is currently going through a review of both the licences. Pending the outcome of these reviews as well as a three-year research project with the CSIRO, the soil salinity monitoring program and groundwater salinity monitoring programs have been suspended.



Dick Thompson
Chairman
Murrumbidgee Irrigation



Leith Boully
Chair
Environment Sustainability Committee





A.1 Land and Water Management Plan

MIA EnviroWise (otherwise known as the MIA and Districts' Community Land and Water Management Plan)

A.1.1 Annual Environment Management Report

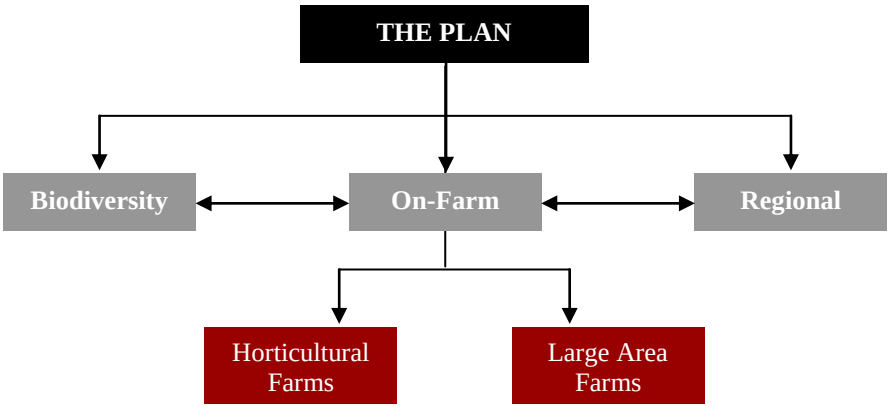
The goal of MIA EnviroWise is to maintain and enhance the sustainability and profitability of agriculture in the MIA and Districts.

The main objectives are:

- To maintain or increase irrigated agriculture productivity
- To reduce seepage to the groundwater system
- To keep drainage water quality within agreed standards
- To reduce surface drainage volumes to acceptable levels
- To protect our natural resources
- To minimise or prevent downstream effects

MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

MIA EnviroWise structure



A.1 Land and Water Management Plan

The cost of implementing MIA EnviroWise is shared between the NSW and Australian governments and the MIA and Districts community. MIA EnviroWise is scheduled to be implemented over a 30-year period. It commenced in 2000/01 with government funding available for the first 15 years of implementation. To date government funding has been provided by the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality and irrigator and community funds.

The total cost of implementing MIA EnviroWise has been calculated at $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

Table 1.1.a: Funding sources, receipts and expenditure for MIA EnviroWise

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2008 ($ million)	Expenditure to 30 June 2008 ($ million)
Government	50.1	15	21.9^	21.9
Landholders-in-kind	214.2	30	n/a	63.6#
Landholders/urban levy	19.6	30	6.4	2.5
Total expenditure				**88.0**

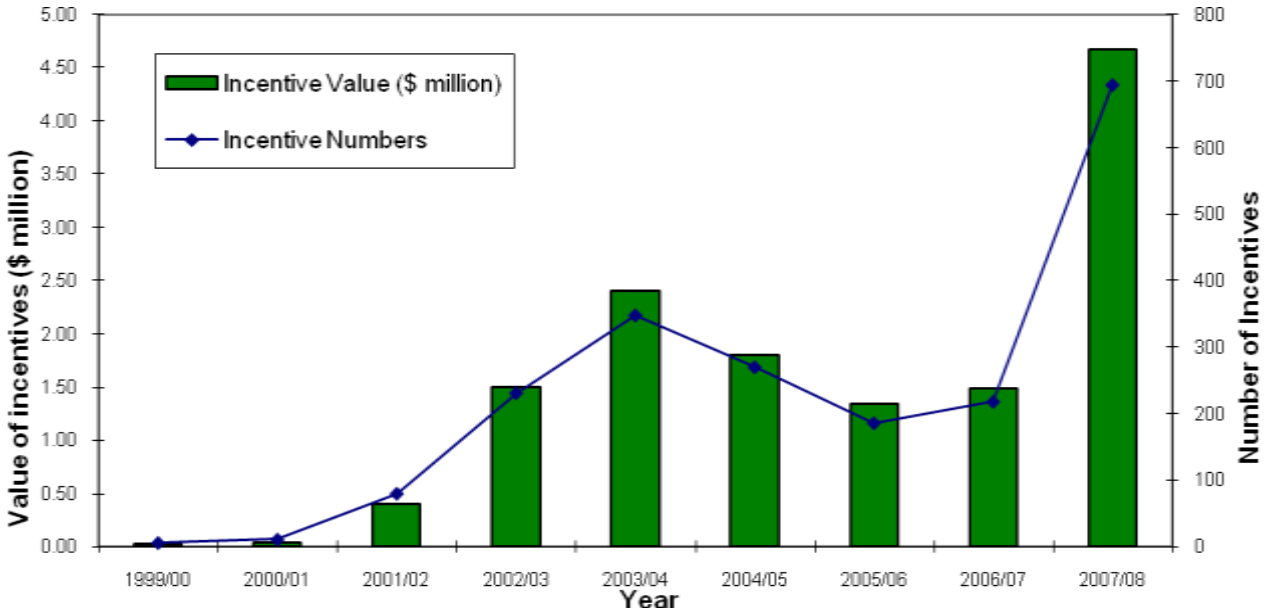
* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (unsigned).
^ This does not include funds for expenditure beyond 2007/2008
# Calculated from invoices received from landholders and is an underestimate of total in-kind contribution

The financial administration of MIA EnviroWise is the responsibility of Murrumbidgee Irrigation Limited.

The expenditure of MIA EnviroWise funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP in 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Figure 1.1.a The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding



Overview of the On Farm Program line items

Outlined in Table 1.1.b is an overview of the On Farm Program line items, targets and timelines for achievement of the line items, and achievement of the line items to 30 June 2008.

Table 1.1.b: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2008

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2008
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program (Total) Horticulture Large Area				1356 farms 820 farms 536 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	483 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	354 farms
* Vegetation Management Planning and Property Vegetation Planning	450 farms	1-15 years	Yes	333 farms 185 landholders
Irrigation efficiency systems	270 farms	1-15 years	Yes	137 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	387 farms
Conversion to perennial pasture	2000 ha	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	40 farms	10 years	No	0 ha
On-farm channel seepage control			No	0 ha
Rice soil amelioration & reclassification	72 farms	1-10 years	No	7 farms[#]
Drainage recycling	450 farms	1-15 years	Yes	274 farms
Sub-surface drainage and disposal	65 farms	1-13 years	Yes	6 farms
Mole drainage and on-farm recirculation	7 farms	1-10 years	No	0 farms
Laser forming	7500 ha	1-10 years	No	70,000 ha[+]
Rice target water use #	619 ha	1-10 years	No	443[^]
* EM31 Surveys	900 farms		Yes	63 farms
* Structural adjustment			Yes	7 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Farms now classified as unsuitable for rice production. There are an additional 48 farms classed as unsuitable pending investigation.
[+] Estimate based on the number of Whole Farm Plans implemented
^ Based on rice soil areas reclassified as unsuitable as per the Rice Environmental Monitoring Policy

Program Expenditure and Targets

The program expenditure and the actual number of incentives paid against targets for line items of MIA EnviroWise for the last five years are presented in Figures 1.1.b to 1.1.d. The highlights for the past year were again the success of the biodiversity program, including the new BioTender protecting in excess of 1,000ha of high quality remnant vegetation on long term contracts. In addition, the administration costs have fallen below 5% of the program expenditure, and the number of incentives paid (676) was the highest since the beginning of the program and exceeded the annual target for the first time, and also the highest value of money ($8,222,561) invested in on-farm water efficiency projects and natural resource management projects.

On-Farm Activities (Figures 1.1.b & 1.1.c - pages 7 & 8)

Over the life of the program the payment of the government funding has not occurred in accordance with the original program budget forecasts with no funding being received in some years. In 2007/2008 funding year the Murrumbidgee Catchment Management Authority (MCMA) has provided catch up funding. The aim of this was to bring the MIA EnviroWise program funding into line with the Heads of Agreement. The catch up funding equated to spending three years funding in two, which in previous years has resulted the outputs being well below the identified targets, however in 2007/2008 the majority of the line items achieved or bettered the target. Outlined below is a summary of the on-farm incentives program for 2007/2008 including a discussion on progress:

- Irrigation Efficiency Systems Implementation incentive has exceeded budget and target levels. This is mainly due to the number of large area farms converting to horticulture over the past 5 years. Currently these farms are not eligible for the High Tech horticulture incentive. Large area farms also use this incentive where they do not meet the criteria for the Drainage recycling incentive.
- Whole Farm Planning activities expenditure continues to be under budget, however for the first time the numbers of Whole Farm Plans implemented has risen above the target, this can be attributed to large number of horticultural farmers converting to drip irrigation due to the reduction in water allocations and the dramatic increase in the value of water on the temporary market. An explanation as to why the Whole Farm Plan incentive is over target but below budget is the generally lower costs of preparing a whole farm plan compared to the estimated costs during the LWMP development. On average a farm plan costs between $3,000–4,000 to prepare for both large area and horticulture farmers. However, this figure may be misleading when determining the true cost of preparing a large area Whole Farm Plan. To date many of the large area participants have only needed their plans to be consolidated meaning very little field survey work is required. This is due to the fact that their farms are fully developed and laser levelled. In relation to horticulture Whole Farm Plans, the cost of drip irrigation design was incorporated into the system costs and not billed separately which has meant that MIA EnviroWise has not been able to include the design costs in the Whole Farm Plan.
- In the last two reports there has been a widening of the gap between the budgeted target number and the actual implemented number of incentive for High Tech Horticulture, however this year the gap has started to close although the actual number of systems implemented is still below target (see figures 1.1.b and 1.1.c). In 2007/2008 numbers have increased in relation to previous years, this increase can be attributed to new service providers opening in the district combined with the reduction in water allocations and the dramatic increase in the value of water on the temporary market. There have also been more customers connecting to Murrumbidgee Irrigation's IHS (high pressure pipeline supply system) resulting in an increase in the number of landholders converting to drip irrigation as their supply channels are converted to pressurised pipelines.
- Subsurface drainage & disposal expenditure and the number of incentives paid continue to be below the target for the past five years. All of the incentives were paid for systems installed between July 1998 and 2001. While the ongoing dry conditions and lower watertables may have influenced the uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive as more landholders will have converted to drip irrigation system. As recommended in the five year review this incentive will not be offered in the future and therefore this is the last year that it will be reported.

- Uptake of EM31 soil survey incentive has been slow and well below both target and budget. This has been put down to two factors. The first is due to the conditions imposed relating to a potential reduction in areas approved to grow rice, this may also result in EM31being done without an incentive being claimed. Secondly there has been a dramatic reduction in the area sown to rice due to the low allocation levels, meaning the farmers are using soils more suited to rice growing resulting in lower water use. This in turn leads to fewer landholders exceeding the rice target water use and therefore no requirement to undertake EM31 surveys.
- Conversion to Perennial Pasture incentive has not been offered as it is not a priority and further it is unlikely there will be any uptake of this incentive. As recommended in the five year review this incentive will not be offered in the future and therefore this is the last year that it will be reported.
- There has been no uptake of On-farm Channel Seepage Control (WWID only) incentive despite being promoted in previous years. In the past year there has been no promotion of this incentive. As recommended in the five year review this incentive will not be offered in the future and therefore this is the last year that it will be reported.
- Rice Soil Amelioration & reclassification incentive has not been offered and it is uncertain if there will be ongoing interest in it. As recommended in the five year review this incentive will not be offered in the future and therefore this is the last year that it will be reported.
- Drainage recycling continues to track well against both the budget and targets in figures 1.1.b and 1.1.c. For the 2007/2008 year both expenditure and incentive numbers have again risen above the overall targets. This is due to the targets getting smaller as this incentive gets closer to the end of its lifespan.
- There has been no expenditure in Mole Drainage and Recirculation since the inception of the program despite being promoted. While the ongoing dry conditions and lower watertables may have influenced the lack of uptake of this incentive it is believed that a return to more average rainfall patterns will not see a significant increase in uptake of this incentive. As recommended in the five year review this incentive will not be offered in the future and therefore this is the last year that it will be reported.

Figure 1.1.b: On-Farm Activities - Expenditure

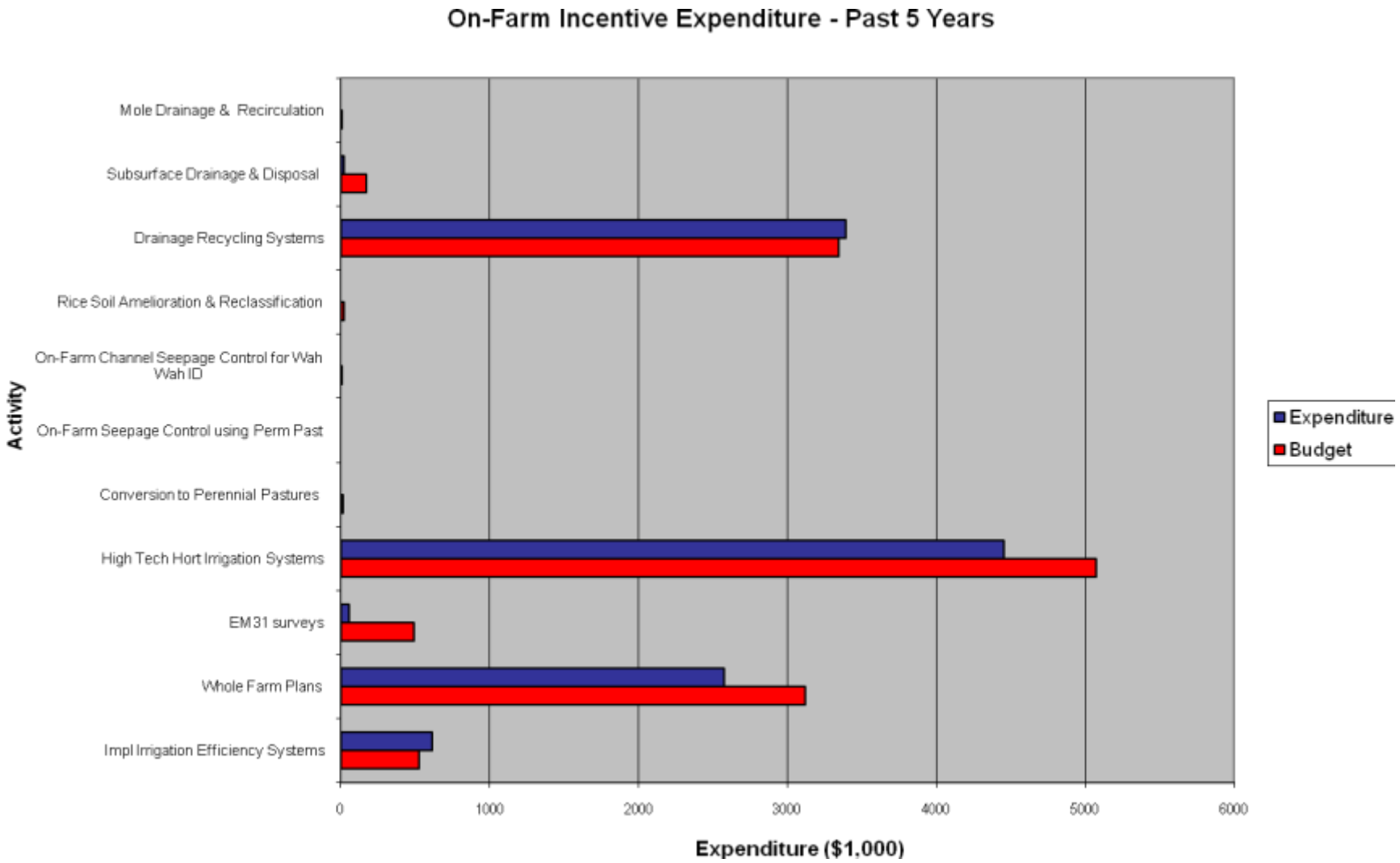
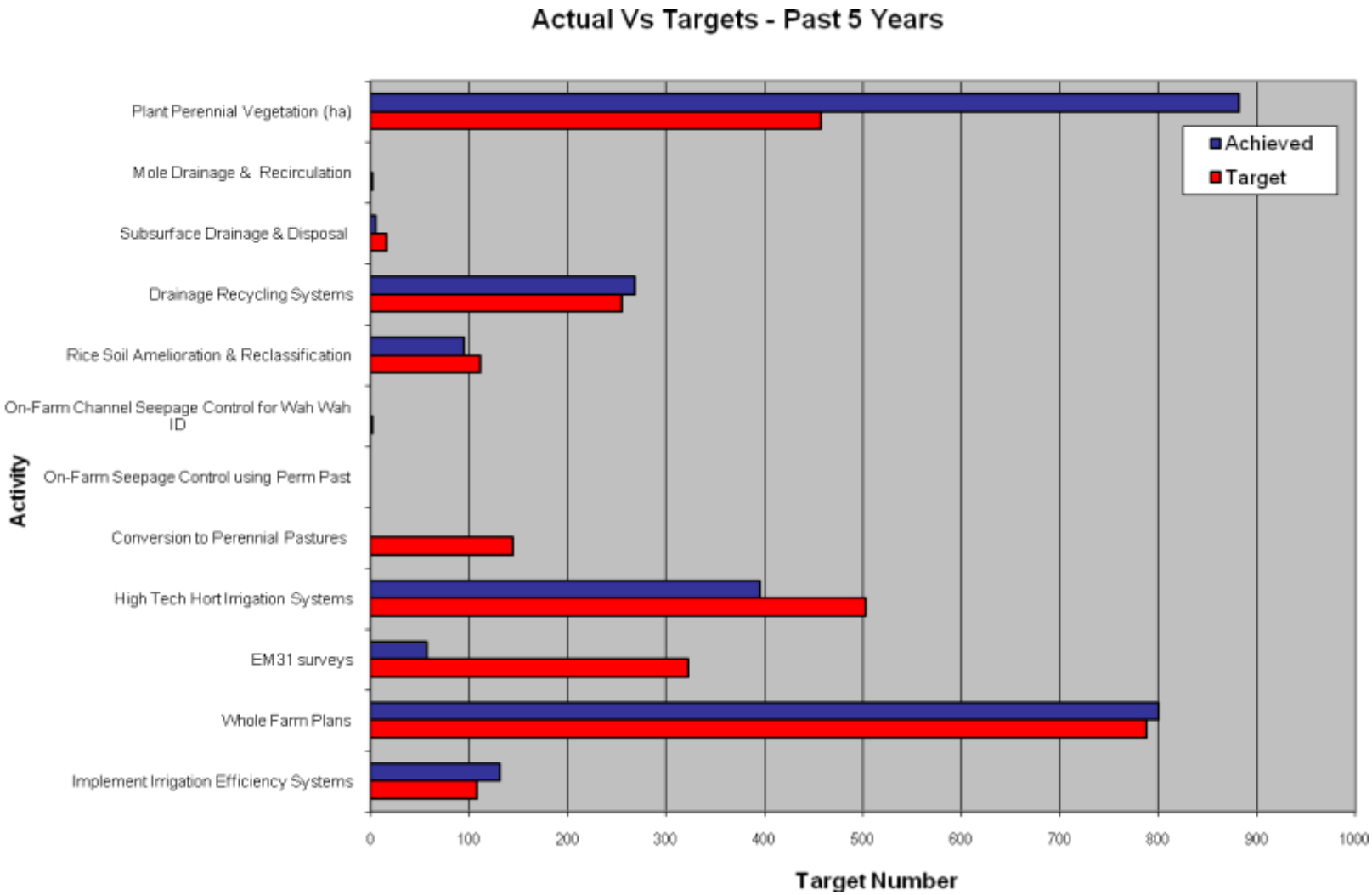


Figure 1.1.c: On-Farm Activities – Targets Achieved

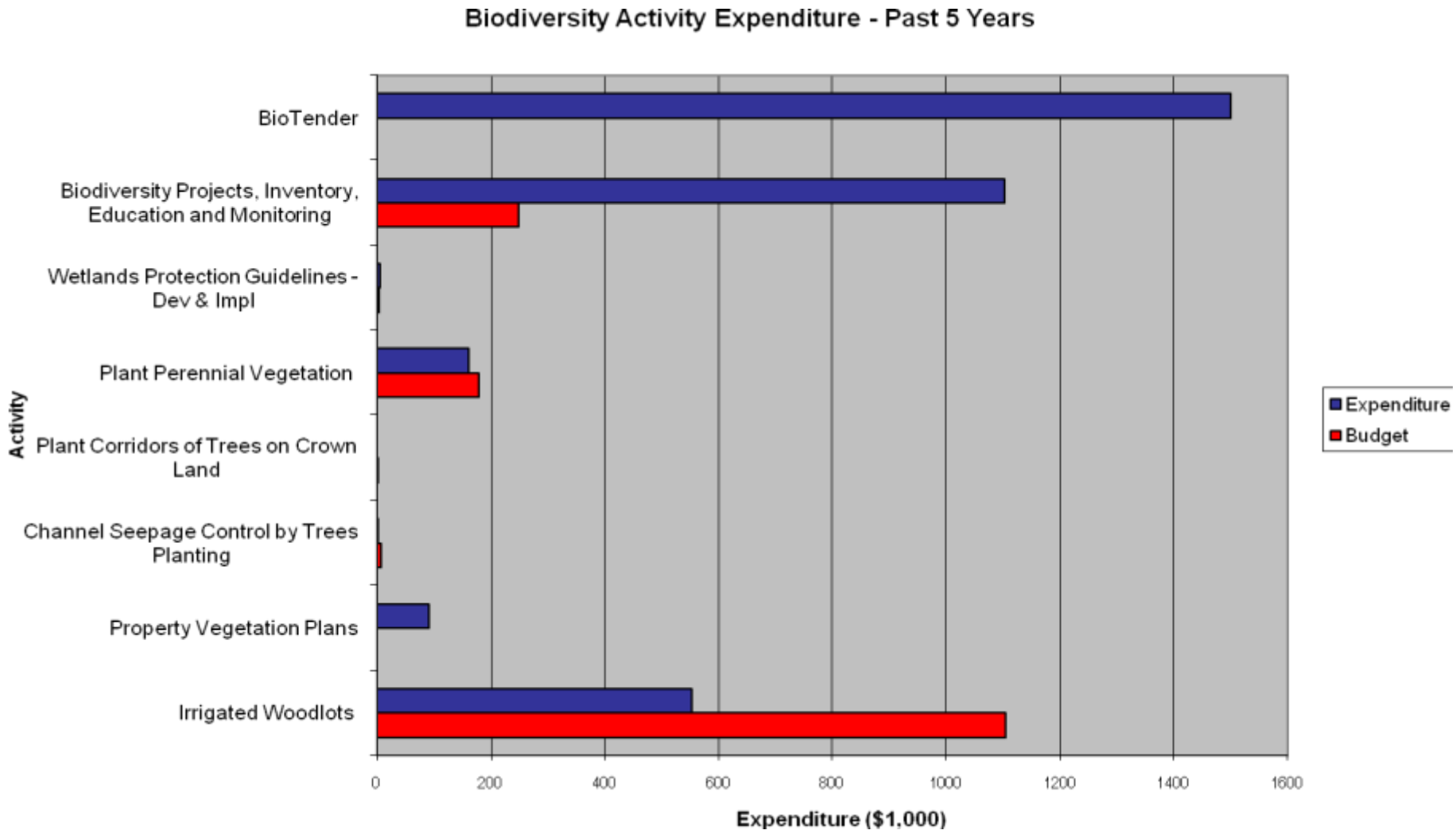


Biodiversity Activities (Figure 1.1.d – page 10)

Due to the reduction in landholders completing on-farm works as a result of continued low allocations, MIA EnviroWise has increased the emphasis on the Biodiversity Activities. This has been highlighted by developing and implementing the BioTender program.

- A new initiative has commenced this year with the establishments of BioTender, MIA EnviroWise's new stewardship program. BioTender will see in excess of 1,000ha of high quality remnant vegetation managed for conservation purposes under contract. The contracts will run for 15 years and specify the specific management requirements of each site that the landholder will be responsible for undertaking. The first call for tenders resulted in close to 2,000ha of remnant vegetation being offered, and a total of $1,500,000 under contract to secure as much of this as possible. A second round of nominations will be called for in the next 12 months.
- Despite the continued drought conditions the focus on the biodiversity component of the program has seen many of the old vegetation management plans and newer property vegetation plans being implemented over the past 12 months, as a result the program has greatly exceeded the MIA EnviroWise target as shown in figure 1.1.c.
- Low priority was assigned to 'Channel seepage control by tree planting' and 'Plant corridors of trees on crown land' due to ongoing drought conditions. There are plans to increase the priority of these line items in the coming year if the season improves.
- In the past, considerable work has been undertaken in establishing baseline biodiversity data. The projects undertaken have provided an extremely comprehensive set of data that will act as a building block for the establishment of a biodiversity strategy for the MIA. Over the past year there has been very little in the way of biodiversity monitoring with the focus now on on-ground biodiversity project such as Mirrool Creek. While expenditure of both government and community funds is in excess of the forecast budget, the level of expenditure and hence the quality of work will result in the strategy being developed at low cost as no additional data sets will be required. The datasets provide a perfect baseline for the transition to and development of the next stage and will assist in establishing clear outcomes for biodiversity activities. There is however, still the need to continue with a monitoring program in the future in order to understand the variance from the baseline and what can be attributed to the activities undertaken as a result of the biodiversity strategy.

Figure 1.1.d: Biodiversity Activities

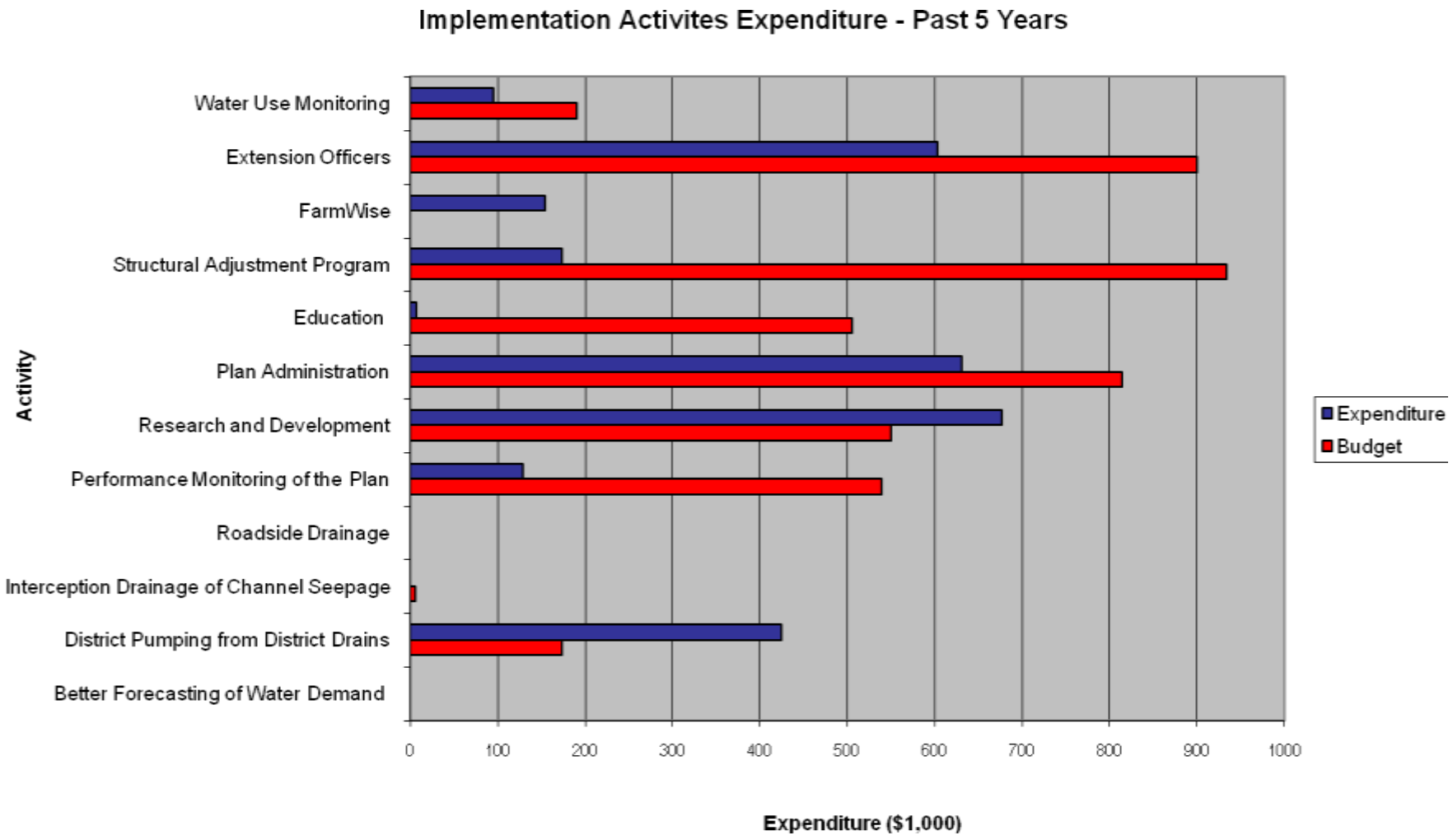


Implementation Activities (Figure 1.1.e – page 12)

Implementation activities are programs carried out by the Company on behalf of the whole community. The highlights of the implementation activities for the 2007/2008 year have been:

- Plan Administration costs being less than 5% of total expenditure, which is the lowest ratio since the commencement of MIA EnviroWise.
- There has been a focus on community and school education in the last year with several 'Smart Watering' workshops held for the urban community to assist them to improve their water use efficiency in the garden. These have been a great success with 226 people from Griffith and Leeton attending. In addition to the Smart Watering, MIA EnviroWise Staff have worked with approximately 600 primary school children at various days to promote environmental awareness and highlight the benefits of better water use efficiency, both on-farm and around the home.
- Following on from the successful redevelopment of Barren Box Storage and Wetland (BBSW) in 2006, members of the local Aboriginal community have been working in collaboration with Murrumbidgee Irrigation through MIA EnviroWise to develop the Barren Box Cultural Heritage Management Plan. The plan addresses cultural, social and educational issues of this culturally significant site for the Wiradjuri people.
- Murrumbidgee Irrigation has been the driving force along with the local Indigenous Community to work with Griffith City Council to develop a plan for a cultural and recreation park at the 3-Ways which will be constructed as soon as the relevant approvals are obtained from the Council. The park will incorporate Indigenous culture into NRM as well as transition biodiversity from a rural to urban landscape.
- The development of a 'digital elevation model' of the entire Murrumbidgee Irrigation Area that will provide information about the various wetlands and other areas of environmental significance in the MIA. It will also be an invaluable resource as Murrumbidgee Irrigation undertakes new water saving projects such as the piping of the Wah Wah stock and domestic supply system.

Figure 1.1.e: Implementation Activities – Expenditure



A.1.2 Documentation relevant to background and/or Implementation of the LWMP

Table 1.2.a includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

Table 1.2.a: Key reference documents relevant to the LWMP (MIA EnviroWise)

Document	O/R	Submitted to DNR	Endorsed by DNR
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey.* Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, Charles Sturt University, Wagga Wagga. Report prepared for Murrumbidgee Irrigation. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.	R	October 2006 Electronic	*

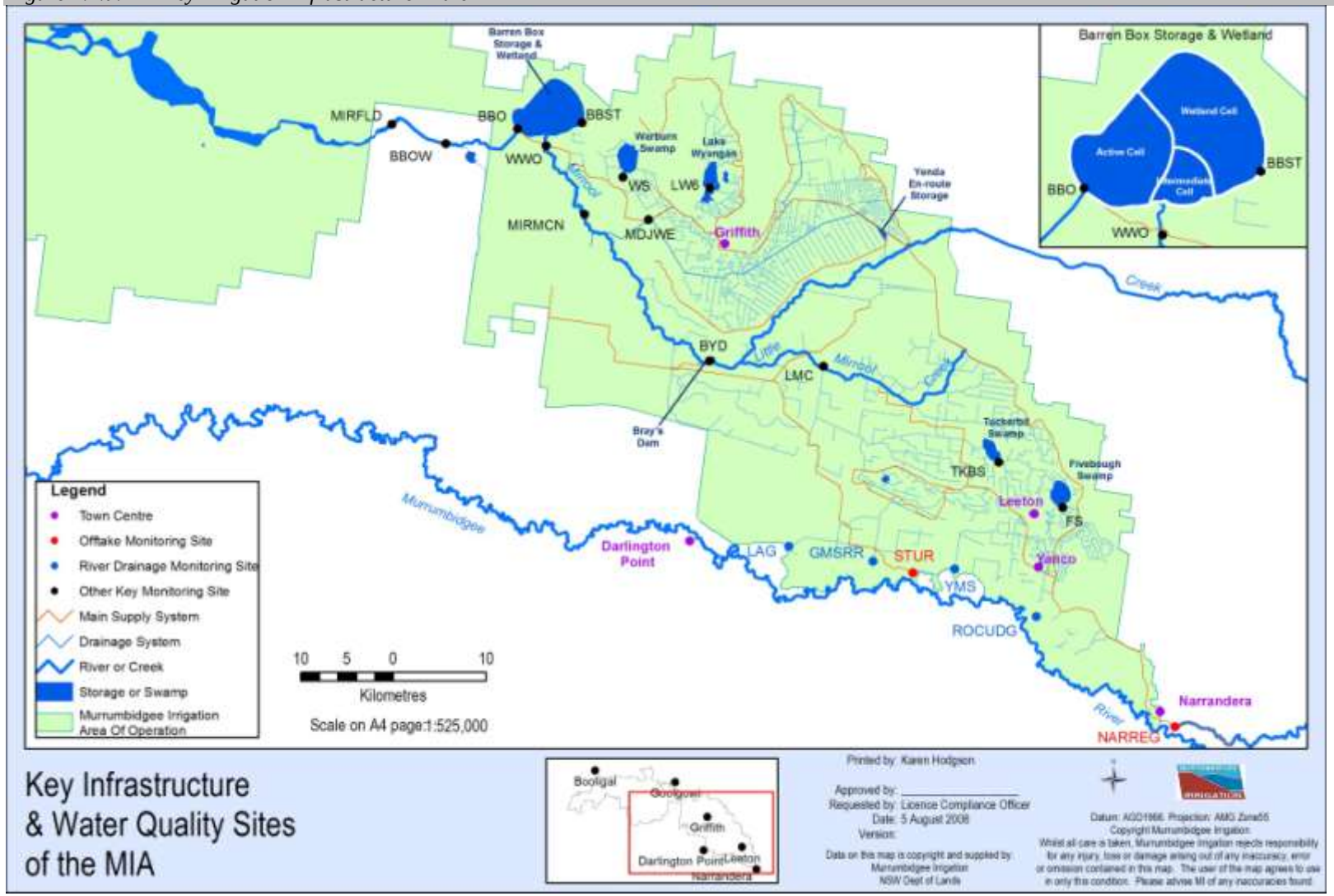
A.1 Land and Water Management Plan

Document	O/R	Submitted to DNR	Endorsed by DNR
		(on disc)	
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants*. Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	*
Van der Lely, A. (2006). *Groundwater Conditions In The MIA and Districts: Annual Report 2006*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
MIA EnviroWise (2007) Five Year Review	R	February 2007	*
Smith, W, D. (2007). *The effects of a fire on wetland plant seeds and zooplankton eggs in Barren Box Swamp, NSW*. Thesis prepared for Murrumbidgee Irrigation, in partial fulfilment of the requirements for the Degree of Bachelor of Science with Honours. Department of Environmental Management and Technology, La Trobe University.	R	Hard copy may be provided on request	

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DNR, waiting on endorsement

A.2. Water Supply and Drainage Management

Figure 2.2.a: Key irrigation infrastructure in the MIA



A.2.2 Reporting requirements

Climatic conditions

The 2007/08 season showed significant variation to the long term average weather patterns. Rainfall was minimal throughout the year. There was little to no rainfall from August to May. Total rainfall was higher than in 2006/2007, slightly lower than the long term average. ETo was slightly lower than in 2006/2007.

Table 2.2.a: Summary of climatic data

Month	ETo 2007-08 (mm)	Rainfall 2007-08 (mm)	Net ETo (ETo-Rainfall) (mm)	LTA ETo (1962-2007) (mm)	LTA Rainfall (1962-2007) (mm)
July	50.9	29.8	21.1	49.7	34.2
August	115	6.4	108.6	77.3	35.9
September	174.6	2.2	172.4	116.3	36.7
October	239.7	13.6	226.1	175.0	41.3
November	235	79.8	155.2	227.0	29.9
December	285.6	84.2	201.4	274.9	30.1
January	315.1	51.6	263.5	282.4	33.2
February	230.4	18.2	212.2	230.9	28.2
March	223.7	8.4	215.3	192.7	32.9
April	131.6	24.2	107.4	115.6	30.9
May	72.5	9	63.5	66.8	36.9
June	53.3	34	19.3	44.3	35.3
Total	**2127.4**	**361.4**	**1766**	**1852.9**	**405.4**

Source: CSIRO Griffith

Notes

LTA = Long term average (1962-2007), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.

ETo = reference evapotranspiration

Table 2.2.b shows that even though the general security announcement was only 2% lower this season compared to the previous season, the total deliveries were only 60% of the previous season. This is because during the 2007/08 season the 2002/03 Snowy Hydro borrows were due for pay-back as was the overuse of water by general security customers which occurred as a result of the allocation cut-backs in November 2006. The record low total diversions have lead to a record low simple efficiency of our system as discussed in section A.2.2(2).

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2008

Year	Announced Allocation (general/high%)	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2007-08	**13/95**	**335,687** [a]	**210,297** [a]	**1,766**	**2,127**	**361.4**
2006-07	15/90	559,952[+]	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423
LTA (1962-2007)					**1,853**	**405**

Sources: Corporate Office, CSIRO Griffith

Notes: * = Does not include 2,146ML environmental waterway diversions for DNR.

[+] = Does not include 3,256ML State Water environmental flows through Roaches Escape.

a = Subject to AFFRA (offtake meter) correction.

A.2.2 (1) Diversions, volume

Table 2.2.c: Summary of Gross Diversions Main and Sturt Canal 2007/08

	Sturt (ML)	Main (ML)
August	1988	16817
September	4060	37132
October	1832	32020
November	790	23208
December	995	27783
January	2165	42747
February	1998	34930
March	3123	41683
April	4165	40089
May	150	12009
June	0	6003
TOTAL	**21,266**	**314,421**

Note: 21,266 + 314,421 ML = 335,687 ML

The above diversion figures are subject to the AFFRA (offtake meter) correction.

Table 2.2.d: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2007/08

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	3,048	17,099	1,985
September	4,276	37,005	1,015
October	2,406	31,892	2,275
November	1,008	23,005	4,115
December	1,119	27,516	2,956
January	2,791	42,453	1,884
February	2,952	35,070	2,135
March	2,950	40,926	3,322
April	3,986	37,678	8,810
May	788	12,081	3,025
June	113	5,096	1,810
Total 2007-08	**25,437**	**304,601**	**33,332**
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130
Total 1996-97	261,955	1,016,135	151,960
Total 1995-96	218,888	868,968	200,990

Notes:
Diversions shown in Table 2.2.d for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via North Kooba channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via North Kooba Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

It needs to be noted that the figures presented in the table above are adjusted diversions, ie this is the "available resource" that was specifically delivered to each of these systems for sales.

The above diversion figures are subject to the AFFRA (offtake meter) correction.

A.2.2 (2) Supply efficiency, storage levels

Supply efficiency

The table below shows the simple efficiency of the system to be 62.6%. This calculation shows the apparent loss to be about 125 GL. The water balance in Section A.2.2 (5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

The deterioration in simple efficiency reflects the real efficiency loss as diversions reduce to lower than optimal levels. It should be noted that the total system losses were reduced to an all time low due to the vigilance of MI staff. Many management and operational changes were implemented to minimise conveyance losses and improve efficiency. Without those initiatives, the simple efficiency would have been much lower.

Table 2.2.e: Simple efficiency of the system — 1999 to 2008

Parameter	2007/08	2006/07	2005/06	2004/05	2003/04	2002/03	2001/02	2000/01
Diversions (ML)								
Sturt Canal	21,266	60,280	233,388	145,728	174,150	176,488	229,155	223,518
Main Canal	314,421	502,928	805,277	680,479	687,349	783,631	912,452	824,535
Less DNR Environmental Diversions	0	3,256	2,146					
NET TOTAL irrigation diversions	**335,687**	**559,952**	**1,036,519**	**826,207**	**861,499**	**960,119**	**1,141,607**	**1,048,053**
Sales (ML) - metered and unmetered	210,297	411,898	829,990	648,417	651,806	754,112	916,611	857,455
Conveyance (ML)	125,390	148,054	206,529	177,790	209,693	206,007	224,996	190,598
Simple Efficiency(%)	**62.6**	**73.6**	**80.1**	**78.5**	**75.7**	**78.5**	**80.3**	**81.8**

Source: MI Irrigation Services and Corporate Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100
The above diversion figures are subject to the AFFRA (offtake meter) correction

Storage levels

Barren Box

The Barren Box Storage and Wetland facility was commissioned on the 11th of August 2006. 7365 ML of water was evacuated from the Storage in the Spring of 2006. Approval was sought and obtained from State Water to evacuate all water stored in the intermediate and active cells. This was an exceptional situation, due to the drought. The water was used to help supply growers in the Wah Wah Irrigation District.

As an ongoing consequence of limited water resource, the Company continued to minimise wetted surface area within the facility. In July 2007, the total volume in intermediate cell storage equated to 2,215 ML. In June 2008, an equivalent storage of 3,250 ML was held. No water was diverted into the active and wetland cells during the reporting period. The Company continues to optimise the facilities use in balancing losses and augmenting downstream customer demand.
In early March 2008, Barren Box Storage and Wetlands were placed under a red alert as per the "New Interim Guidelines for Cyanobacteria in New South Wales". Weekly sampling was carried out to monitor the situation until the algal bloom subsided in the middle of May 2008. The cause of the bloom is thought to have been a combination of limited downstream demand, limited movement of water and extraordinarily high temperatures. Customers with access to water in the Storage were contacted and the water was contained within the Barren Box system until the bloom subsided.

The Company's risk assessment process was updated to include measures for early identification of conditions which favour algal blooms. The operating conditions of the Storage have also been reviewed and where able, decreased water retention times have been projected, thus limiting the chances of algal blooms reoccurring.

Lake Wyangan

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. Murrumbidgee Irrigation attempts to regulate the Lakes' levels to satisfy the various demands to meet commercial irrigation, environmental and community objectives.

At a conclusion of the 2006/2007 irrigation year, the North Lake was evacuated to enable augmentation of irrigation supplies. This condition continued for the reporting period. There was no additional deliberate pumping from the North to the South Lakes during this time as levels remained so low. Opportunistic water was pulsed into the South Lake during the reporting period. Volumes at the commencement and at the end of the reporting period were effectively the same.

Due to the low water levels in the Lakes and continued warm weather, there were some algal blooms in the Lakes. This led to the Lakes being closed. The situation was monitored by Griffith City Council with assistance from Murrumbidgee Irrigation.

The monthly figures relating to the volumes pumped by Murrumbidgee Irrigation from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.j in A.2.2(4), Drainage reuse. Table 2.2.f (below) provides 2007/08 monthly gauge heights (water depth) for the lakes.

Table 2.2.f: Gauge heights for South and North Lake Wyangan 2007/08

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.31	1,049	0.40	1,670
Aug	1.32	1,058	0.37	1,619
Sep	1.23	984	0.29	1,483
Oct	1.21	968	0.13	1,211
Nov	0.98	786	0.13	1,211
Dec	0.90	730	0.20	1,330
Jan	0.85	695	0.12	1,194
Feb	0.84	688	0.07	1,109
Mar	0.79	653	0.03	1,041
Apr	0.85	695	0.01	1,007
May	0.90	730	0.01	1,007
Jun	1.08	864	0.03	1,041

Source: MI Irrigation Services
Gross Resources = Gauge height converted into megalitres.

A.2.2 (3) Drainage volumes and salt loads

Table 2.2.g: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Monitoring Frequency	Type of measurement & recording
410167	BBOW	Barren Box Outfall Canal Wyvern	1	Continuous	EC Flow
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	Continuous	EC Flow
410085	LMC	Little Mirrool Creek	3	Continuous	EC Flow
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	Continuous	EC Flow
41010921	GMSRR	Gogeldrie Main Southern Drain river road	5	Continuous	EC Flow
410083	YMS	Yanco Main Southern Drain	6	Continuous	EC Flow
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	Continuous	EC Flow
41010162	WS	Warburn Swamp	8	monthly	EC,PH,NTU
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	Continuous	EC Flow
41010908	BYD	Bray's Dam Diversions and Bywash	10	monthly	EC,PH,NTU
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	N/A	N/A
41010896	LW6	Lake Wyangan Causeway	12	monthly	EC,PH,NTU
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	After10mm rain	Pesticide
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	After10mm rain	Pesticide
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	15	When flowing	Pesticide EC
Other Sites Required for DNR Licence					
41010903	BBO	Barren Box Storage		monthly	EC,PH NTU
41010978	WWO	Willow Dam		monthly	EC,PH,NTU
410164	BOD1	CH 13 escape at the outfall channel Wyvern		Continuous	EC Flow
41010713	DCCUD	DC Cudmore at Outfall channel		Continuous	EC Flow
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek		Continuous	EC Flow
410172	DCCENT	DC Central at BID pumps Brogden Road		Continuous	EC Flow

All continuous sites are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated at least four times a year. All sites are visited monthly for routine maintenance by Thiess staff. Monthly field data is collected by MI staff using a Hydro-lab, collecting temperature, EC and pH.

A.2 Water Supply and Drainage Management

Table 2.2.h shows the monthly total flow volumes from the Murrumbidgee River entering the Murrumbidgee Irrigation Area measured at the two main regulated sites; at Narrandera (NARREG) after diversion at Berembed Weir and also at the Sturt Canal (STUR) after diversion at Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- Little Mirrool Creek (LMC) - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- Bray's Dam (BYD) - Drainage diversion from LMC to the Benerembah Irrigation District.
- Mirrool Creek at McNamara Road (MIRMCN) - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- Main Drain J (MDJWE) - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- Barren Box Outfall Wyvern (BBOW) - Drainage flow from Barren Box at Wyvern Station discharging to Wah Wah Irrigation District.

Additionally, the four river channel wetland sites which potentially discharge to the Murrumbidgee River

- Yanco Main Southern (YMS) - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- Gogeldrie Main Southern (GMSRR) - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water is pumped into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- Gooragool Lagoon (LAG) - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by customers as drainage reuse water.
- Cudgel Creek downstream from Cudgel Creek (ROCUDG) - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings as well as those decisions dealing with asset design, purpose and function.

Table 2.2.h: Drainage Volumes (ML) – July 2007 to June 2008

Monthly Flow Data (ML/d)														
Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	TOTAL
RIVER SUPPLY														
NAREG**	Monthly Total	0	16817	37132	32020	23208	27783	42747	34930	41683	40089	12009	6003	**314421**
STUR**	Monthly Total	0	1988	4060	1832	790	995	2165	1998	3123	4165	150	0	**21266**
WEST FLOWING DRAINS														
LMC (410085)	Mean	3.8R	10.0R	19.4	19.5	17.1R	24.0R	11.8	11.1	16.6	17.6K	8.0R	10.3R	14
	Median	2.7R	5.0R	18.2	19.3	17.5R	11.8R	10.4	9.8	15.5	17.9K	6.4R	6.1R	11
	Inst.Max	14.3R	26.6R	35.8	32.5	53.8R	182 R	30.2	24.3	43.3	31.5K	24.3R	68.0R	182
	Inst.Min	0.9R	0.4R	7.2	8.3	1.6R	1.2R	2.4	5	6.4	8.2K	0.9R	0.6R	0
	Monthly Total	11.8R	309R	582	603	514R	743R	366	322	514	527K	247R	310R	**5156R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	Monthly Total		1195.0	230.0	550.0	130.0	355.0	485.0	885.0	845.0	480.0	490.0	0.0	5645
BYD (Bywash)**	Monthly Total		1177.0	210.0	455.0	25.0	710.0	375.0	515.0	335.0	1000.0	230.0	0.0	5032
MIRMCN (41010955)	Mean	17.8R	49.4R	[125]	97.8	121	196	184	138	156	[249]	62.4R	85.8R	124
	Median	15.3R	30.5R	[118]	90.8	105	123	181	124	149	[240]	42.7R	79.7R	112
	Inst.Max	38.2R	166 R	[194]	206	289	1190	431	260	239	[341]	186 R	206 R	1190
	Inst.Min	3.4R	0.9R	[42.0]	59.6	36.7	63.6	56	56	91.3	[172]	8.6R	15.9R	1
	Monthly Total	553R	1533R	[3494]	3030	3621	6070	5708	4000	4838	[5724]	1936R	2574R	**[43080]**
DRAINS														
MDJWE (410174)	Mean	20.0R	44.5R	113	102	117	152 R	133	122	142	239	52.3	45.1	107
	Median	18.0R	29.7R	118	96.8	99.5	83.5R	133	117	130	231	33.9	36.8	98
	Inst.Max	34.1R	138 R	172	252	370	1830 R	487	292	262	417	185	138	1830
	Inst.Min	13.2R	9.4R	34.4	68.1	41.7	44.6R	42.2	55.2	86	103	16.3	16.1	9
	Monthly Total	619R	1378R	3386	3155	3504	4702R	4130	3549	4390	7174	1620	1352	**38960R**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	Mean	0.0R	55.1R	47.2R	[129]	[200]	63.2R	60.6R	0.3R	179 R	252 R	25.6R	5.5R	85
	Median	0.0R	7.3R	51.4R	[147]	[202]	54.5R	60.3R	0.0R	243 R	296 R	13.2R	6.9R	53
	Inst.Max	0.0R	205 R	131 R	[260]	[300]	201 R	206 R	6.1R	426 R	490 R	136 R	18.4R	490
	Inst.Min	0.0R	0.0R	0.1R	[0.0]	[114]	0.7R	0.0R	0.0R	0.0R	37.9R	0.0R	0.0R	0
	Monthly Total	0R	170.9R	1415R	[3232]	[3993]	1959R	1878R	9R	5541R	7563R	792R	164R	**[28250]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	Mean	0.0=	0.0=	0.0=	0.0=	1.0R	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0R	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	44.0R	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	44
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0R	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Monthly Total	0=	0=	0=	0=	29R	0=	0=	0=	0=	0=	0=	0=	29R
GMSRR (41010921)	Mean	0.0R	0.4R	0.1R	0.2R	[0.0]	0.9R	2.1R	1.6	1.6R	1.2R	0.3R	0.0R	1
	Median	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.2R	1.3	1.1R	0.7R	0.0R	0.0R	0
	Inst.Max	0.1R	4.0R	1.7R	1.4R	[0.0]	10.3R	7.6R	4	12.1R	8.3R	6.5R	0.0R	12
	Inst.Min	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.5	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	13R	2R	5R	[0]	29R	66R	46	49R	37R	8R	0R	[255]
LAG (41010940)	Mean	0.6	0.3R	0.1R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.5	0.2R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	1.5	0.9R	0.5R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	2
	Inst.Min	0.2	0.1R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	19	8R	2R	[0]	[0]	0R	0R	0R	0R	0R	0R	0R	[29]
ROCUDG^ (41010005	Mean	0.7R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.7R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	1.3R	0.5R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	1
	Inst.Min	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	2.1R	3R	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	24R
TOTAL														**337**
SWAMPS														
WS**	Monthly Total	LF	LF	LF	LF	LF	LF	0.3	0.2	LF	0.5	LF	0.5	**1.5**
FLOODWAY														
MIRFLD**	Monthly Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
EXTRA SITES FOR DNR														
WWO**t		0.0	1485	3332	3070	3231	3916	3732	3747	4138	8890	2003	2235	39779.0
BBO**#		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENEREMBAH SITES														
BOD1(410164)	Mean	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	[0.0]	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	[0.0]	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	[0.0]	0
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	[0.0]	0
	Monthly Total	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0V	[0]	**[0]**

Monthly Flow Data (ML/d)														
Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	TOTAL
DCCUD (41010713)	Mean	0	0	0	0	0	0.2	0	0	0	0	0	0.1	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0.1	4.3	0	0	0	0	0	2.2	4
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	5	0	0	0	0	0	4	**9**
DCWIDG (41017001)	Mean	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.3]	[ ]B	[57.0]	6
	Median	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.3]	[ ]B	[67.9]	0
	Inst.Max	[0.0]	0.0=	[0.0]	0.1=	0	[0.5]	[0.0]	[ ]B	[ ]B	[0.5]	[ ]B	[79.7]	80
	Inst.Min	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.2]	[ ]B	[0.0]	0
	Monthly Total	[0]	0=	[0]	0=	0	[0]	[0]	[ ]B	[ ]B	[1]	[ ]B	[171]	**[173]**
DCCENT (410172)	Mean	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Median	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Inst.Min	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	[0]	[0]	0	0	0	0	**[0]**
BID2 (41010717)**	Monthly Total	0.0	240.0	228.0	135.0	410	65.0	42.0	63.0	154.0	198.0	8.0	10.0	**1184**

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by THIESS SERVICES except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. [ ] Data not recorded 0 = No flow
3. [n] Incomplete data set due to missing data
4. R Rating table extrapolated
5. S Rating table suspended
6. t Flows into BBS from Willow Dam
7. # Flows at BBS to the Outfall
8. Salt loads could not be calculated because of no flow or no EC available at time of flow.
9. Salt loads from Thiess Services unless ** where we have calculated them using the formula below
   Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000
10. = Pool reading only, no flow condition
11. Z Medium editing >Q=15 or HYMAN data import (Thiess Services quality code)
12. B Backed-up stage
13. K Minor editing.
14. ~ Reliable interpolation.
15. ∞ Zero flow and therefore zero salt load, to be confirmed by Thiess.
16. TBC To Be Confirmed.
17. V Operational data/abnormal data from operational or natural extremes.

Drainage volumes to the Murrumbidgee River (ML)

Year	2003/04	2004/05	2005/06	2006/07	2007/08
TOTAL	7,434	5,663	8,570	945	337

Sites highlighted in blue are sites that may drain back to the Murrumbidgee River

During the 2007/08 year Murrumbidgee Irrigation diverted 335,687 ML (subject to AFFRA – offtake meter – correction) of water from the Murrumbidgee River. This water contained approximately 28,594 tonnes of salt. The tonnage is higher than the previous season, even though the diversions were about 60% of last year's. This is due to the increased salinity of the diverted water, which was about 2.5 times higher this season compared to last.

Of this salt load, approximately 68 tonnes (about 0.24% of the imported salt load) were discharged into wetlands which are connected to the Murrumbidgee River in about 337 ML of drainage water (0.1% of diversions), which is a record low.

The significant reduction in drainage back to the wetlands associated with the Murrumbidgee River is due to the low allocations which have led to reduced off-farm drainage as well as innovative solutions for drainage re-use.

As the Murrumbidgee Irrigation Area is essentially a closed system, most of the salt that is imported into the area via supply water, makes its way into our soils during irrigation activities. Due to the unprecedented drop in groundwater levels over the past seven years, our soils are no longer under the immediate threat of salinisation due to shallow water table levels. However, with irrigation and rainfall levels at record low we need to understand the impact of the lack of leaching of salts out of the soil profile.

Murrumbidgee Irrigation currently funds a three-year CSIRO research project called "Hydro-ecological assessment of the MIA". The aims of this project are to increase the understanding of our surface and groundwater systems, their connectivity and their connection to the regional ecology. An expected outcome of this study is a better understanding of salinity issues in each zone which will allow us to better and more specifically monitor and manage soil salinity. Detailed salt and water balances will also be compiled.

Table 2.2.i: Salt Loads (Tonnes) – July 2007 to June 2008

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NAREG**	**Monthly Total**	0	2608	3929	4036	3146	2785	3057	2078	1636	1864	1044	635	**26816**
STUR**	**Monthly Total**	0	308	430	231	107	100	155	119	123	194	13	0	**1778**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	2.4R	4.7R	6.1	6.4	5.8R	7.2R	4.3	3.9	4.5	3.8K	2.9R	4.0R	5
	Median	1.9R	4.1R	6.3	6.6	5.2R	3.9R	4.4	3.4	4.0	3.5K	2.7R	2.5R	4
	Inst.Max	11.7R	27.0R	11.1	34.5	18.7R	45.5R	11.6	10.1	13.2	9.0K	10.0R	28.3R	46
	Inst.Min	0.7R	0.3R	1.9	2.0	0.8R	0.7R	0.9	2.0	1.7	1.1K	0.4R	0.6R	0
	Monthly Total	75R	146R	182.0	199.0	175R	225R	134.0	112.0	141.0	114K	91R	120R	**1715R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0.0	599.6	46.6	132.3	42.1	90.2	108.6	193.7	108.1	81.1	105.3	0.0	**1508**
BYD (Bywash)**	**Monthly Total**	0.0	590.5	42.6	109.5	8.1	188.4	84.0	112.7	42.8	168.9	49.4	0.0	**1397**
MIRMCN (41010955)	**Mean**	5.8R	12.4R	[22.6]	23.3	30.6	55.8	37.8	21.9	[17.5]	[21.5]	9.1R	12.7R	23
	Median	4.7R	9.6R	[20.9]	20.8	27.2	34.4	37.2	19.1	[17.2]	[21.7]	8.4R	11.2R	20
	Inst.Max	16.0R	43.0R	[42.5]	57.3	68.2	261	106	47.4	[26.7]	[37.7]	28.8R	49.5R	261
	Inst.Min	1.3R	0.4R	[12.7]	9.8	11.1	22	16.2	10.9	[11.8]	[14.3]	2.5R	3.8R	0
	Monthly Total	181R	384R	[589]	721	919	1730	1173	636	[315]	[322]	283R	381R	**[7634]**
DRAINS														
MDJWE (410174)	**Mean**	6.8R	12.3R	21.0~	24.4	29.6	41.0R	28.1	20	18.7	25.6	12.6V	10.1V	21
	Median	6.4R	12.2R	19.6~	21.4	27.2	27.7R	25.1	17.5	17.9	24.7	11.2V	9.9V	19
	Inst.Max	12.8R	28.7R	37.7~	63.1	79.5	415 R	123	45.7	30.5	48.4	51.8V	33.5V	415
	Inst.Min	5.1R	4.5R	11.0~	13	11.3	11.9R	12.8	10.9	12.8	13.4	2.1V	4.9V	2
	Monthly Total	210R	381R	629~	757	887	1272R	872	580	581	769	389V	304V	**7633R**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	0.0R	13.5R	12.9R	[26.9]	[51.5]	17.7R	11.3R	0.1R	20.4R	21.3R	4.8R	1.4R	15
	Median	0.0R	2.3R	13.4R	[29.7]	[50.8]	17.6R	10.3R	0.0R	27.2R	25.4R	3.3R	1.8R	12
	Inst.Max	0.0R	46.9R	34.0R	[53.0]	[77.2]	49.3R	37.6R	1.3R	54.5R	44.4R	16.0R	4.7R	77
	Inst.Min	0.0R	0.0R	0.0R	[0.0]	[30.5]	0.2R	0.0R	0.0R	0.0R	4.0R	0.0R	0.0R	0
	Monthly Total	0R	418R	388R	[671]	[927]	547R	350R	2R	632R	639R	148R	42R	**[4764]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0K	0.0=	0.0=	[0.0]	[1.9]	0.0K	0.0K	0.0Z	0.0Z	0.0=	0.0=	0.0=	0
	Median	0.0K	0.0=	0.0=	[0.0]	[0.0]	0.0K	0.0K	0.0Z	0.0Z	0.0=	0.0=	0.0=	0
	Inst.Max	0.0K	0.0=	0.0=	[0.0]	[41.0]	0.0K	0.0K	0.0Z	0.0Z	0.0=	0.0=	0.0=	41
	Inst.Min	0.0K	0.0=	0.0=	[0.0]	[0.0]	0.0K	0.0K	0.0Z	0.0Z	0.0=	0.0=	0.0=	0
	Monthly Total	0K	0=	0=	[0]	[27]	0K	0K	0Z	0Z	0=	0=	0=	[27]
GMSRR (41010921)	**Mean**	0.0R	0.1R	0.0R	0.0R	[0.0]	0.2R	0.2R	0.1	0.2R	0.1R	0.1R	0.0R	0
	Median	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.1	0.1R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.6R	0.2R	0.1R	[0.0]	3.1R	0.8R	0.3	3.2R	1.6R	1.9R	0.0R	3
	Inst.Min	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	2R	0R	1R	[0]	5R	6R	3	7R	2R	2R	0R	[28]
LAG (41010940)	**Mean**	0.2	0.1R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.1	0.1R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.5	0.4R	0.2R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	1
	Inst.Min	0.1	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	6	4R	1R	[0]	[0]	0R	0R	0R	0R	0R	0R	0R	[11]
ROCUDG (41010005)	**Mean**	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.1R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	2R	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	2R
TOTAL														**68**
SWAMPS														
WS*	**Monthly Total**							0.4	0.1		0.5		1.5	**2**
FLOODWAY														
MIRFLD**	**Monthly Total**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
EXTRA SITES FOR DNR														
WWO**t	**Monthly Total**	0.0	537.9	641.8	772.1	1087.7	1175.1	874.0	877.7	553.0	1240.3	816.5	440.5	**9017**
BBO**#	**Monthly Total**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	0.0V	0
	Median	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	0.0V	0
	Inst.Max	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	0.0V	0
	Inst.Min	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0V	0.0V	0
	Monthly Total	0	0	0=	0=	0=	0=	0=	0=	0=	0=	0V	0V	**0V**

Monthly Salt Loads (Tonnes/day)														
Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	TOTAL
DCCUD (4101071 3)	Mean	0	0	0	0	0	0	0	0	0	0	0	0.1	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0.5	0	0	0	0	0	1	1
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	1	0	0	0	0	0	2	**3**
DCWIDG (4101700 1)	Mean	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.0]	[ ]B	[9.8]	1
	Median	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.0]	[ ]B	[11.5]	0
	Inst.Max	[0.0]	0.0=	[0.0]	0.0=	0	[0.1]	[0.0]	[ ]B	[ ]B	[0.0]	[ ]B	[14.2]	14
	Inst.Min	[0.0]	0.0=	[0.0]	0.0=	0	[0.0]	[0.0]	[ ]B	[ ]B	[0.0]	[ ]B	[0.0]	0
	Monthly Total	[0]	0=	[0]	0=	0	[0]	[0]	[ ]B	[ ]B	[0]	[ ]B	[29]	**[29]**
DCCENT (410172)	Mean	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Median	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Inst.Min	0	0	0	0	0	0	[0.0]	[0.0]	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	[0]	[0]	0	0	0	0	**[0]**
BID2 (4101071 7)**	Monthly Total	0.0	62.2	45.5	31.4	10.0	17.8	12.8	17.3	35.2	26.6	14	2.0	**262**

Sources: Thiess Services and MI Irrigation Services
Notes: See Table 2.2.h. page 23

A.2.2 (4) Drainage reuse

Murrumbidgee Irrigation has continued to actively pursue recovery and use of water from its drainage systems. Table 2.2j provides information on reuse quantities (section A.2.2 of the DWE licence); it needs to be noted that much of the historically reported quantities in this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites.

Due to the pending review of the water balance and its supporting tables, especially considering the emerging reporting requirements under the National Water Initiative, it has been agreed to continue to include this table (mostly unaltered) for this reporting year. That should not be taken to mean that its continued presentation is meaningful or adds value to the water balance.

Table 2.2.j: Reuse quantities (ML) for the MIA and Districts 2007/08

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Bray's Dam Diversion to Benerembah	0	1195	230	550	130	355	485	885	845	480	490	0	**5,645**
Mirrool Creek Licensed Diverters (DNR)	0	67	106	153	0	0	98	97	61	239	52	0	**873**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek to Wah Wah Main	0	1045	935	1835	2525	2196	1884	2095	3322	8810	945	1080	**26,672**
Barren Box Storage to Wah Wah Main @ BBS Pumps	0	940	80	440	1590	760	0	40	0	0	1058	730	**5,638**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage Licensed Diverters (DNR)	0	8	3	0	0	0	16	2	0	0	167	0	**196**
Losses in Barren Box Storage	0	352	339	1060	361	55	292	1075	886	190	181	35	**4,826**
Sub Total	**0**	**3607**	**1693**	**4038**	**4606**	**3366**	**2775**	**4194**	**5114**	**9719**	**2893**	**1845**	**43,850**
Less: First Use Water Diversions	0	121	241	163	196	61	204	215	379	2438	188	492	**4,698**
Plus: Lake Wyangan Pumps to Lake View Canal	0	43	142	145	268	119	115	103	25	5	0	0	**965**
TOTAL WATER CAPTURED	**0**	**3529**	**1594**	**4020**	**4678**	**3424**	**2686**	**4082**	**4760**	**7286**	**2705**	**1353**	**40,117**

Source: Corporate Services

A.2.2 (5) Water balance loss and gain

Table 2.2.k: Annual Water Balance Assessment MIA system (Gigalitres) 2007/08

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	Bench-mark	Median	Comment
Climatic													
Rainfall	537	590	416	288	253	353	270	367	195	361	400	363	CSIRO, BM data
Evaporation	1868	1750	1896	2032	2191	1998	1983	1935	2182	2127	1869	1982	CSIRO, BM data
Type of Year (% dry)	33	25	48	78	90	68	75	60	93	73	50	63	Look up table
Main Gross Data													
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	336	1154	921	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	952	727	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	202	195	(3)=(1)-(2)
Apparent Efficiency %	79	79	82	80	79	76	78	80	74	63	82	78	= (2)/(1)*100
Inevitable Real Losses													
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	35	21	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	29	27	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	118	102	Inevitable Losses
System Flow Losses													
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	33	12	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	48	6	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	81	18	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**199**	120	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	133	102	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**332**	222	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	130	27	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows													
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	160	120	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6		20	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0		5	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	67	6	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	227	151	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	260	162	(9)=(4)+(8)
Reconciliation													
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	1	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	-20	-8	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	227	150	(12)=(8)-(10)
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	318	1264	940	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	57	14	(14)=(7)/(12)*100
System Efficiency (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**84**	87	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10		0.60	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19		0.64	

A.2 Water Supply and Drainage Management

In 2007/08 irrigation diversions from the Murrumbidgee River were 336 GL with 210 GL being recorded deliveries (sales). This left an apparent loss of 125 GL which meant that Murrumbidgee Irrigation's *apparent* operational[1] efficiency was approximately 63%.

Of that loss, the *true loss* was estimated at about 79 GL. This included losses due to channel seepage, evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 29 GL, using the standard formula of 14% of deliveries. This means the total losses are estimated at 109 GL, while the apparent loss was 125 GL. This means that 17 GL of water has not been accounted for. This is most likely due to the very low general security allocations this season which are unprecedented and therefore are not properly accounted for in this water balance exercise.

It was expected that through the NWI, a more realistic water balance method be introduced. However, this has not happened and in order to maintain consistency between reporting years, it was decided to once again use the method of previous years.

A comparison of the benchmark year and the current year show that the system efficiency is 75%, which is 12% lower than the benchmark of 87%. As explained before, this is still a good performance for Murrumbidgee Irrigation when taking into account that diversions into our system were at a record low as were the total system losses.

[1] 'Operational' in this sense means the capacity to effectively sell (receive, hold and deliver to the farm gate) 100% of water which is taken from the Murrumbidgee River and diverted to the MIA.

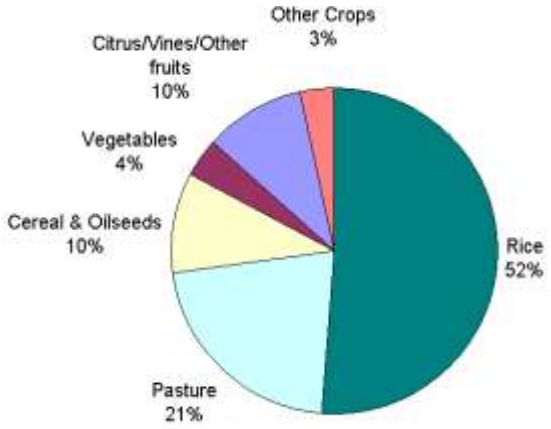
A.2.2 (6) Crop statistics

Irrigated Crop Statistics

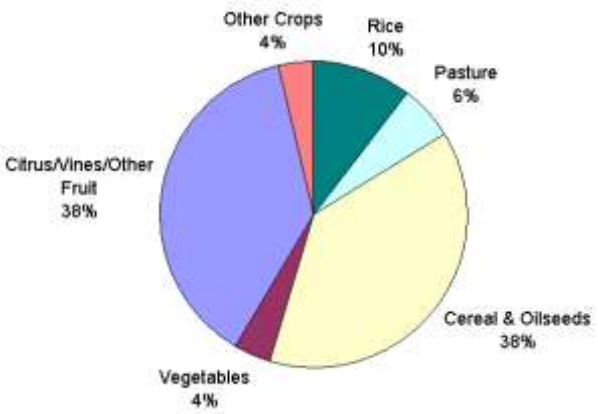
The following charts show the distribution of crops grown this year in comparison to last year (2006/07) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries for citrus, vines and other fruits and a further reduction in deliveries to rice. Water deliveries to cereal and oilseed were lower than the previous year and greater than that of the baseline year. This shift in water distribution is due to the very low general security allocation which prohibited many of our irrigators from growing a summer crop. Comparison of the baseline year and the 2007/08 season shows a completely different picture due to the continuing drought conditions.

Figure 2.2.d: Distribution of irrigated crops – 1995/96, 2006/07 and 2007/08
Comparison of crop type by percentage of megalitres delivered.

Baseline year 1995/96



2006/07



2007/08

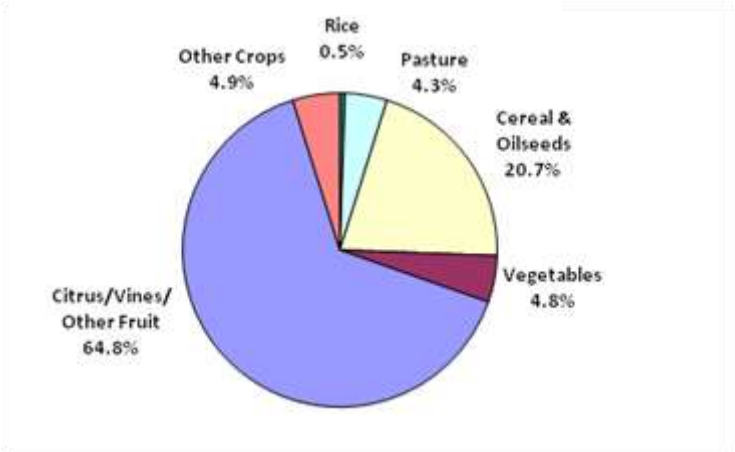


Table 2.2.l: Historical Deliveries to Major Crop Types

Year	Rice		Pasture		Cereal and Oil Seeds	
	Total (ML)	Rice % of Total	Total (ML)	Pasture % of Total	Total (ML)	Cereal/Oil Seeds % of Total
2007/08	1,006.3	0.5	8,217.5	4.3	39,537.7	20.7
2006/07	41,296.0	10.8	23,419.0	6.1	149,441.0	39.1
2005/06	355,254	45.4	65,878	8.4	181,641	23.2
2004/05	101,494	16.7	77,364	12.8	247,267	40.8
2003/04	221,732	34.6	63,960	10.0	182,940	28.6
2002/03	251,424	34.3	64,093	8.8	237,612	32.5
2001/02	469,513	52.0	85,556	9.5	184,253	20.4
2000/01	479,757	56.0	112,668	13.1	108,690	12.7
1999/00	394,224	61.2	54,159	8.4	68,366	10.6
1998/99	477,563	58.1	101,791	12.4	65,231	7.9
1997/98	489,363	50.1	179,246	18.3	126,247	12.9
1996/97	519,053	51.0	187,441	18.4	143,746	14.1
1995/96	446,917	51.4	185,931	21.4	87,725	10.1

Year	Vegetables		Citrus + Vines+ Other Fruits		Other Crops + Plantations	
	Total (ML)	Vegetable % of Total	Total (ML)	Citrus/Vines/Other % of Total	Total (ML)	Other % of Total
2007/08	9,190.7	4.8	123,510.2	64.8	9,273.8	4.9
2006/07	15,577.0	4.1	138,234.0	36.2	13,834.0	3.6
2005/06	27,588	3.5	142,025	18.2	9,481	1.2
2004/05	22,736	3.7	150,601	24.8	7,078	1.2
2003/04	16,504	2.6	132,866	20.7	22,519	3.5
2002/03	14,970	2.0	138,929	19.0	24,983	3.4
2001/02	17,989	2.0	122,884	13.6	23,403	2.6
2000/01	18,794	2.2	98,285	11.5	39,262	4.6
1999/00	12,013	1.9	75,108	11.7	40,060	6.2
1998/99	24,967	3.0	105,522	12.8	47,504	5.8
1997/98	19,714	2.0	115,200	11.8	47,176	4.8
1996/97	23,464	2.3	104,561	10.3	40,461	4.0
1995/96	32,348	3.7	87,983	10.1	28,905	3.3

Source: All figures from Irrigation Services, Griffith.

Table 2.2.m: Summary of deliveries and areas for the major crop groupings during 2007/08

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)	Net Crop Evapotranspiration (ML/ha)
VINES	18,866	72,781.6	3.9	n/a
WINTER CEREALS	18,139	32,417.9	1.8	n/a
CITRUS	8,357	41,945.8	5.0	n/a
WINTER OILSEEDS	3,846	4,349.7	1.1	n/a
WINTER PASTURES	3,145	4,099.7	1.3	n/a
OTHER FRUITS	2,546	8,782.8	n/a	n/a
OTHER CROPS	1,518	9,008.3	n/a	n/a
VEGETABLES	1,422	9,190.7	6.5	n/a
STOCK & DOMESTIC	1,173	6,393.0	n/a	n/a
SUMMER PASTURES	1,143	4,117.8	3.6	n/a
BULK TOWN SUPPLY	603	9,799.6	n/a	n/a
SUMMER CEREALS	495	2,548.2	5.1	n/a
PLANTATION	489	265.5	0.5	n/a
RICE	76	1,006.3	13.3	10.6
INDUSTRIAL	39	3,368.2	n/a	n/a
SUMMER OILSEEDS	32	221.9	6.9	n/a
TOTAL		**210,297.0**		

Source: All figures provided by MI Irrigation Services, except for crop evapotranspiration figures, The rice net crop evapotranspiration was calculated using monthly weather data. In previous years, rice ha and water use figures have been derived from Rice Environmental Monitoring database. This year, due to the drought, DWE has allowed MI to amend the Rice Environmental Monitoring (REM) program and irrigation services has provided rice acreages.

Notes: N/A = Not available due to data collection method.

- These figures do not include water for stock and domestic, industry, town supply and BBS surplus flows.
- The rice figure is potentially misleading as many farmers sow a winter cereal into rice stubble after harvest and make use of the sub soil moisture. When this sub soil moisture is not readily available for example on paddocks not sown to rice, crops are required to be irrigated and therefore this can result in more water use.

A.2.3 Chemical contingency

It needs to be noted here that approval was given to Murrumbidgee Irrigation to suspend the Water Quality Monitoring Program during the 2007/08 season due to the very low general security allocations. The information provided below is what would happen in a "normal" year.

Murrumbidgee Irrigation works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

Murrumbidgee Irrigation undertakes an extensive water quality monitoring program for pesticides and other contaminants and incorporates immunoassay techniques like the ELISA field sampling program to detect molinate which is used as an indicator chemical to gauge the likelihood of chemicals in drainage water.

Apart from chemical sampling, Murrumbidgee Irrigation also undertakes nutrient sampling at sensitive locations like floodways, wetlands and designated river discharge sites. This occurs after certain storm events and at other times and places when the flow rate is greater than 5ML/day.

Murrumbidgee Irrigation does this because nutrient levels are related to flow conditions. During low flow conditions fine sediment, organic matter and nutrients accumulate in waterways and bind to sediments. The flow regime is important in how nutrients are managed in our network as low flow increases nutrient concentrations.

Additionally, Murrumbidgee Irrigation has been and will continue to be involved in research projects which provide new information and insights including recommending new techniques to improve and evaluate how water quality is impacted upon by what we do in our community.

Scheduled chemicals

Table 2.3.n shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the Department of Environment and Climate Change.

Table 2.3.n: Scheduled chemicals in Murrumbidgee Irrigation's screening program

Chemical	Environmental Guidelines (μg/L)	Pre- July 04 Notification Level (μg/L)	Post July 04 Notification Level (μg/L)	Pre- July 04 Action Level (μg/L)	Post July 04 Action Level (μg/L)
Atrazine	2	2	**13**	10	**45**
Chlorpyrifos	0.001	0.001	**0.01**	0.005	**0.11**
Diazinon	0.0006	0.0006	**0.01**	0.003	**0.2**
Diuron	8	8	**1 ***	40	**5 ***
Endosulfan	0.01	0.05	**0.03**	0.1	**0.2**
Malathion	0.07	0.07	**0.05**	0.35	**0.2**
Metolachlor	8	8	**0.02 #**	40	**0.1 #**
Molinate	2.5	12.5	**3.4**	25	**14**
Simazine	10	10	**3.2**	50	**11**
Thiobencarb	1	1	**2.8**	5	**4.6**
Trifluralin	0.1	0.1	**2.6**	0.5	**4.4**

Source: Department of Environment and Climate Change

Notes: * Notification and action levels for diuron were set at 1.0μg/l and 5.0μg/l respectively. These interim levels were negotiated with Murrumbidgee Irrigation Limited to allow a phased introduction of the new levels and for industry to develop and refine management options for future use and management of diuron.

\# Please note that notification and action levels for metolachlor were reduced by 400%.

Chemical Contingency Plan for MIA

While the information provided below is accurate, Murrumbidgee Irrigation has developed a risk management framework. DECC has given approval to Murrumbidgee Irrigation to trial this framework during the 2008/09 season. The aim of this framework is to minimise the risk and manage the system accordingly, as opposed to the old monitoring program which aimed to react when an incident occurs, rather than manage to prevent risks from occurring.

MI is required to have in place a Chemical Contingency plan to identify the processes that occurs when a chemical is detected above notification or action level.

The limiting factor with monthly pesticide sampling is the time elapse between when a sample is taken and when the results are made available to MI. In some cases where significant time periods have elapsed, no follow up of action level detection is possible.

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the Department of Environment and Climate Change (DECC) by telephone within twenty-four (24) hours once the sampling results have been received by Murrumbidgee Irrigation.

2. Notify DWE within 24 hours of the results affecting the river sites once the sampling results have been received by Murrumbidgee Irrigation.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if Action Levels are exceeded at sites identified by Murrumbidgee Irrigation as re-supply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

Response to DECC direction:

In the event that a DECC direction is received to restrict the discharge by an irrigator of irrigation waste water to the Company drainage works, the Company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.
2. Refuse to or discontinue the supply of water to the irrigator.
3. Undertake works to prevent the continuance of the problem.
4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 Groundwater Management

A.3.2 Reporting requirements

The following groundwater information was derived from Ary Van der Lely's report "*Groundwater Conditions and Behaviour in the MIA*. Annual Report 2008".

It needs to be noted that in order to comment on "Groundwater Management", information about pumped volumes and use of groundwater should be included. This information is kept by the DWE and at the time of preparation of this report, that information was not available.

A.3.2 (1) Groundwater monitoring and analysis

The groundwater conditions for September 2007 and the changes since baseline year 1996 and September 2006 are summarised in Table 3.2.a.

Table 3.2.a: Average depth to the watertable at September 2007 compared to 2006 and baseline year 1996 *

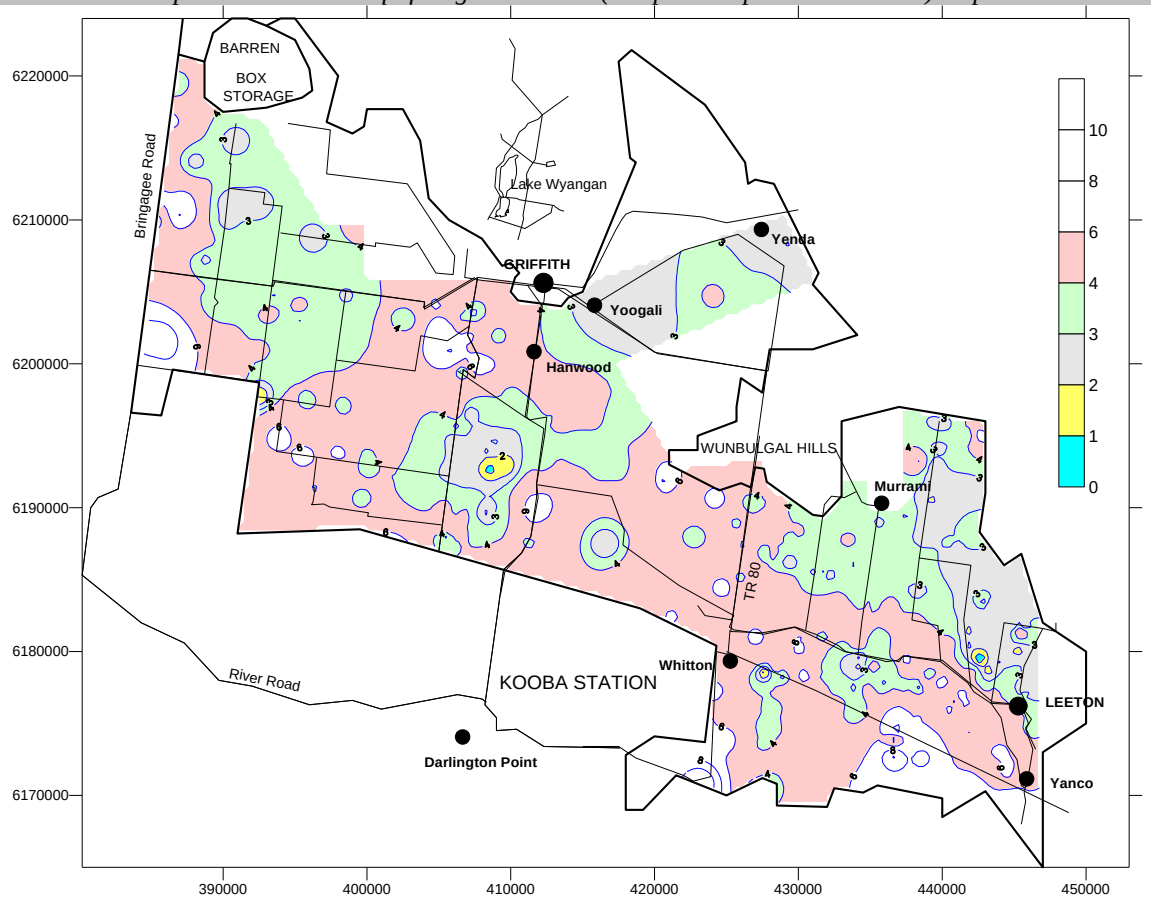
Area	2007 Deep Aquifer	2006 Deep Aquifer	1996 Deep Aquifer	2007 Shallow Aquifer	2006 Shallow Aquifer	1996 Shallow Aquifer
Yanco	5.66	4.61	2.69	4.62	3.69	2.11
Mirrool	6.24	5.17	2.24	4.26	3.43	1.52
Benerembah	12.61	11.23	7.76	4.67	3.57	2.21
Wah Wah	13.49	12.58	13.12	N/A	N/A	N/A
MIA u/s BBS	8.43	7.28	4.4	4.53	3.52	1.88

Note: * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable in metres.

Table 3.2.a shows continued drop in water table levels since the baseline year of 1996, to the extent that the proportion of land with groundwater within 2 metres has dropped from over 70% before 2000 to less than 1% by September 2007. This drop is expected to be due to the continued lower than average general security allocation levels as well as reduced rainfall of the past six years. The average depth to the water table is now at a record low. The implementation of MIA EnviroWise programs has also had an impact on the lowering of watertables.

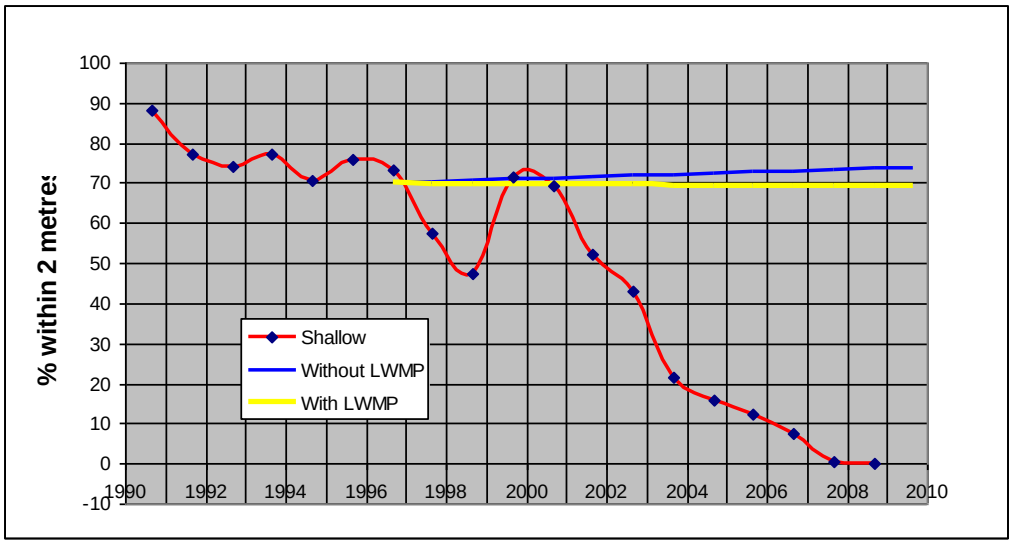
The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. High groundwater levels within two metres were almost non-existent and confined to small areas near Mirrool Creek in Mirrool and in the Yanco district, possibly related to channel seepage locations. The highest groundwater areas generally are in the Koonadan area north-west of Leeton, and around Yoogali and Yenda. Even in these areas they have retreated to between 2 and 3 metres depth.

Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable). September 2007



The percentage of areas within 2 metres from the surface compared to the Land and Water Management Plan 'Without Plan' and 'With Plan' scenarios are shown at Figure 3.2.b.

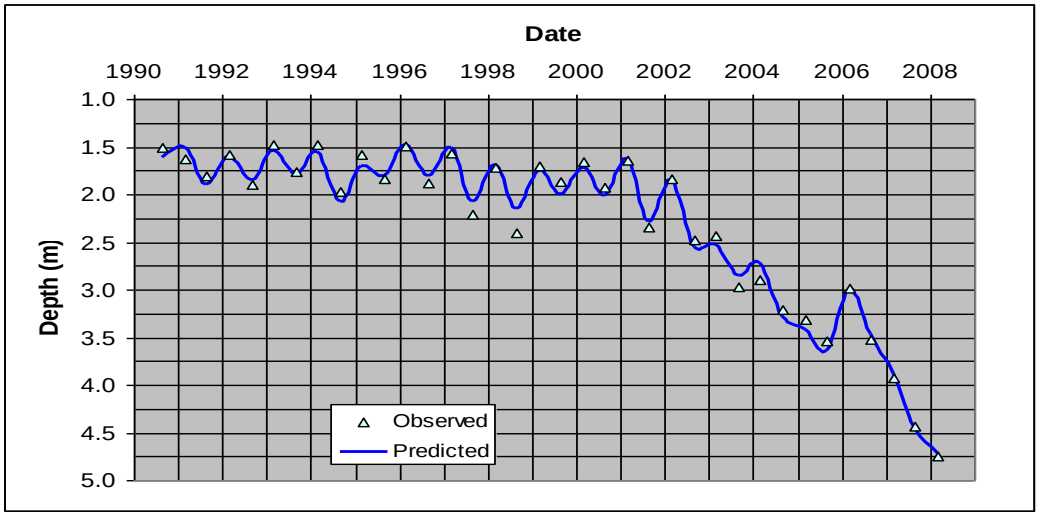
Figure 3.2.b: Area with watertable within 2 metres, September 1990 to 2008 relative to LWMP assessment benchmarks (which commenced 1997)



There has been a significant reduction in the percentage of areas with groundwater within two metres from the surface, from over 70% in the early 1990's to 7.6% September 2006 and less than 1% in 2007 and 2008. It is clear from Figure 3.2.b that the groundwater predictions developed as part of the Land and Water Management Plan are no longer relevant given the changes to groundwater levels due to reduced allocations and the on-going drought. As a result, a clearer understanding of the impacts of irrigation and climate on groundwater is required and this is the subject of research being undertaken by CSIRO Land and Water in conjunction with Murrumbidgee Irrigation. The results of which will provide a more realistic benchmark.

Figure 3.2.c shows the observed data of average groundwater depths in the MIA versus the predicted values based on the model coefficients.

Figure 3.2.c: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



The model used to produce these predictions, can also be used to analyse various scenarios likely to occur in the future. More work is being undertaken, in conjunction with CSIRO Land & Water, to refine these predictions and ultimately to assist in the management of the MIA & D.

The conclusions of the groundwater report are:

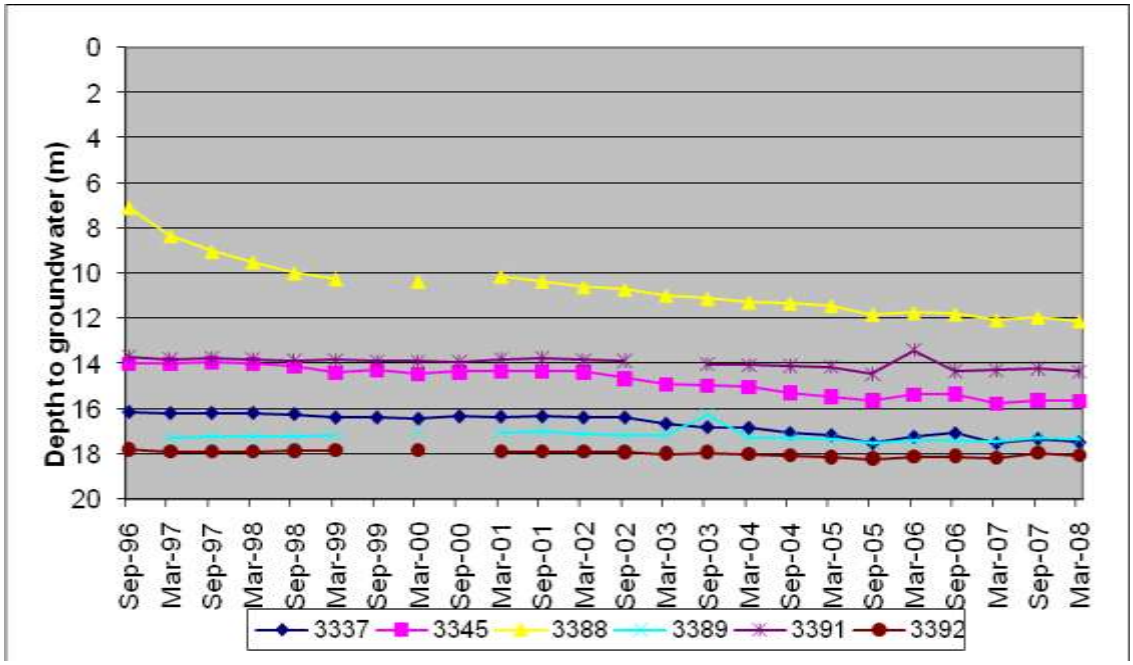
- LWMP targets have been met.
- Net groundwater accessions have been significantly less than average during 2007/08.
- The area and distribution figures for watertable levels within 2 metres from the surface are at an all-time low.
- The pressure levels in the deep aquifer are at an all-time low, and questions regarding sustainability of current groundwater pumping rates exist.

It was concluded there are no groundwater management issues coming forth from the 2007/08 data set.

A.3.2 (2) Wah Wah groundwater and Mirrool Creek flooding

In respect to the Lower Mirrool Creek Floodway, Figure 3.2.d shows that most piezometer levels have changed very little since 1996, apart from bore 3388 showing a total drop of five metres over the past 12 years. There have been no flood events in the Lower Mirrool Creek since the early 1990's.

Figure 3.2.d: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway



A.3.2 (3) Groundwater volumes and salt loads extracted from tile drains and pump sites

Tubewells

There are 15 tubewells installed in the MIA by previous government departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a steady decrease in the salt load since the 1997-98 season. During the 2007-08 season the discharge volumes were lower for most sites compared with last year, resulting in less than half the salt load of last season. This means that the salinity levels of the discharge has been reduced.

Table 3.2.b: Groundwater volumes and salt loads extracted from tubewells

Name	2007/08 Discharge (ML/year)	2007/08 Salt Load (T/year)	2006/07 Discharge (ML/year)	2006/07 Salt Load (T/year)	1997/98 Discharge (ML/year)	1997/98 Salt Load (T/year)
Five Bridges	707	489	644	471	1,059	1,016
Gil Gil	266	353	421	590	631	1,231
Yanco West	305	404	317*	420	821	1,232
South Leeton	76	118	1,128	1,857	1,325	2,067
Baulch's	137	52	275	104	694	541
Wamoon	384	200	423	245	945	681
East Wamoon	778	454	781	469	-	-
TOTAL	**2,653**	**2,071**	**3,989**	**4,156**	**5,475**	**6,768**

Source: MI Electrical Services, MI Environmental Services
* This figure was erroneously reported as 316 T/year in the 2006/07 report

Tile Drains

At present there are 19 flow meters attached to tile drainage outlet pipes in the MIA, this is one less than last year as one of the metered tile drainage pumps was removed. The sites are assessed every six months for volume of flow and annually a sample of the discharge is measured for electric conductivity. During the 2007-2008 season, the total volume pumped from 13 sites was 119 ML, which is slightly higher than last year. In total 151.4 tonnes of salt was discharged, this is the same proportional increase as the volume which indicates that the salinity of the tile drainage water has remained unchanged compared to last season. At the remaining six sites there was no discharge recorded.

A.3.2 (4) Groundwater accession control targets and rice environmental monitoring

Groundwater accession control target

Due to the continuing severe seasonal conditions and the record low rice acreage in the MIA & D, a licence variation was submitted to and approved by the Department of Water & Energy.

The agreed amendments for the 2007/2008 season were as follows:

In case the announced allocation remains below 40% on the 1st of October 2007:

- *Crop water use statistics will be assessed using records provided by landholders and the information contained in the Company's irrigation management system.*
- *All landholders growing rice will be automatically allowed a tolerance of 10% or 10 hectares whichever is the greater in accordance with the Rice Growing Policy.*
- *No implementation of area penalty breaches or water use penalty breaches.*

The reduced summer cropping activity in conjunction with low winter rainfall has meant that the observed groundwater level has continued to drop during the 2007/08 season, as shown in figure 3.2.c.

Rice water use and rice growing practices

The only two commercial rice crops grown in the MIA&D recorded unprecedentedly low water use figures. So much so, that the NSW Department of Primary Industries plans to run trials involving delaying the application of permanent water to rice in the Murrumbidgee Irrigation Area, to save on water use but still obtain reasonable yields.

Table 3.2.d: Summary of historic rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)									
Irrigation Area or District	**Total Rice Area (ha) 2007/08**	**Total Water to Rice (ML) 2007/08**	**'07/08**	**'06/07**	**'05/06**	**'04/05**	**'03/04**	**'02/03**	**'01/02**	**'00/01**	**'99/00**	**'98/99**
Yanco	N/A	N/A	N/A	N/A	12.6	13.1	13.3	14.1	12.0	11.2	11.3	11.3
Mirrool	N/A	N/A	N/A	N/A	12.7	12.9	13.2	14.0	12.3	11.2	10.6	12.6
Benerembah	N/A	N/A	N/A	N/A	12.9	12.8	13.3	14.0	13.1	11.1	10.4	15.3
Tabbita	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3	10.7	15.9
Wah Wah	N/A	N/A	N/A	N/A	14.0	11.9	12.4	14.4	14.3	13.7	11.8	14.6
Kooba *	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*	*	*
Total/average	N/A	N/A	N/A	N/A	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**	**10.9**	**12.9**
Target			N/A	N/A	15.3	15.0	15.0	17.3	15.3	14.2	13.2	15.4
Simple WUE			N/A	N/A	**88%**	**85%**	**83%**	**94%**	**90%**	**89%**	**84%**	**88%**

Sources: MI Irrigation and Environmental Services
Note: * Kooba's rice water use was previously calculated as part of Mirrool.

Due to the low summer cropping activity in the MIA & D, no aerial photos were taken. Assessments of areas and water use were based on information provided by growers during the placement of water orders. See table 2.2.m (page 36) for cropping area and water use details.

Estimated Groundwater Accessions

During 2007/08 the irrigation volumes were even less than for 2006/07. Rainfall in 2007 up to the end of October was 160 mm. This combined with groundwater pumping to the south and west caused groundwater levels to continue to drop for September 2007. With minimum irrigation during summer 2007/08 the higher summer rainfall did not result in higher groundwater levels for March 2008. This has now been an ongoing trend since about December 2001. (Van der Lely, 2008)

Rice growing policy

The "Rice Growing Policy 2006/2007", was adopted with one small amendment for the 2007/08 season. This document has been forwarded to the Department of Water & Energy in electronic format.

A.3.2 (5) Groundwater data format

A copy of "*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas. Annual Report 2008"* has been forwarded to the Department of Water & Energy in electronic format.

A.3.2 (6) Groundwater data reliably captured

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by Murrumbidgee Irrigation staff during March and September each year. The statistics for piezometers read during September 2007, March 2008, and three earlier dates are summarised in Table 3.2.g.

Table 3.2.g: Availability of piezometer readings for various dates and categories of piezometers.

Type of Piezometer	Listed in Database	Read Sep96	Read Sep00	Read Sep06	Read Sep07	Read Mar08
Shallow (*1)	417	465	459	440	437	438
Shallow (WW)	30	22	23	14	12	12
Total Shallow	***447***	***487***	***482***	***454***	***449***	***450***
Deep (*2)	359	363	362	330	331	330
Deep >35m	19	28	28	27	26	25
Deep (WW)	35	44	43	41	39	39
Total Deep	***413***	***435***	***433***	***396***	***396***	***394***

*1. Piezometers in aquifers within 12 metres and in aquifers 12-18m which behave as if in the shallow zone
*2. Aquifers 12 – 35 metres, all piezometers not categorised as "shallow".
WW= Wah Wah Irrigation District

The piezometer network has been set up over a long period of time with the last piezometers installed more than ten years ago. Over 3,800 piezometers were installed, some of which have become lost over time. The aim of the network has always been to monitor the deep, shallow and perched groundwater levels in the MIA & D. Results from the biannual monitoring program are used to assess groundwater movement and predict changes into the future. The valuable dataset that has resulted from this monitoring program is now being used in the CSIRO research project, as described on page 10.

Despite a number of piezometers becoming lost over time, especially in the 2000 to 2004 period, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

Figure 3.2.l shows that there is a considerable variation in coverage across the area. In both the Wah Wah and Lake Wyangan Districts there is a lack of piezometer sites and therefore hydrographs for those district cannot be created. Piezometers are also lacking in areas of the MIA where there are no underlying sands, such as in parts of the Yenda area. This situation varies for the deep and shallow piezometer sets.

Most deep piezometers in Wah Wah have not been levelled, with the consequence that it is not possible to determine an AHD groundwater contour map ([2]) for that area.

The bi-monthly reading list used since 1995 has 108 piezometers, of which about 100 have been visited and read during the 2007/08 year. This is well in excess of the licence requirement (60). Murrumbidgee Irrigation has maintained this higher than necessary degree of monitoring to assist the calibration and development of an integrated groundwater model for the MIA.

Groundwater was last sampled for salinity during 2002 and this has been reported (Murrumbidgee Irrigation report by van der Lely, January 2003).

A.3.2 (7) Groundwater data analysis

The Department of Water & Energy did not make a request for information this year.

A.3.2 (8) Groundwater contamination

There were no known, or reported, groundwater pollution events during 2007/08.

[2] AHD = metres above sea level.

A.3.2 (9) Groundwater — annual monitoring schedule

Table 3.2.h: Groundwater monitoring schedule – as required by DNR

No	Type	Description	Depth (metres)	Frequency	Location	
					Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.a	36
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.e	43
3	Map	Depth to pressure level	70-125	annual	Figure 3.2.f	44
4	Map	AHD of pressure level	12-35	annual	Figure 3.2.g	44
5	Map	Change in pressure level	5-12	annual	Figure 3.2.h	45
6	Map	Change in pressure level	12-35	annual	Figure 3.2.i	45
7	Map	Change in pressure level	70-125	annual	Figure 3.2.j	46
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12	annual	Figure 3.2.k	47-48
11	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	12-35	annual	Figure 3.2.k	47-48
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.i	49-50
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.i	49-50
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.l	51
16	Map	Groundwater sub-districts	-	annual	Figure 3.2.m	52

Notes * "*It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable*." Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ There are not enough piezometers in the West Hanwood and Wah Wah areas to produce reliable hydrographs.

The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

Figure 3.2.e: MIA September 2007 – Depth to pressure level 12-35 metres

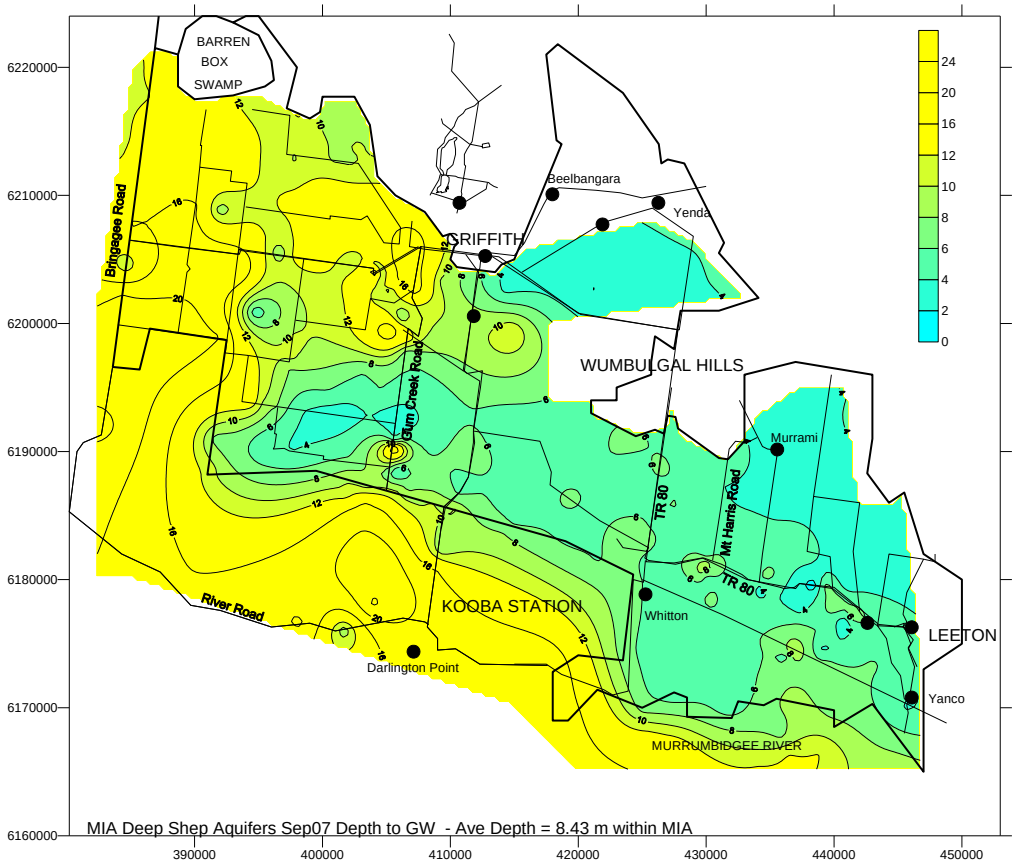


Figure 3.2.f: MIA August / September 2007 – Depth to pressure level 70-120 metres

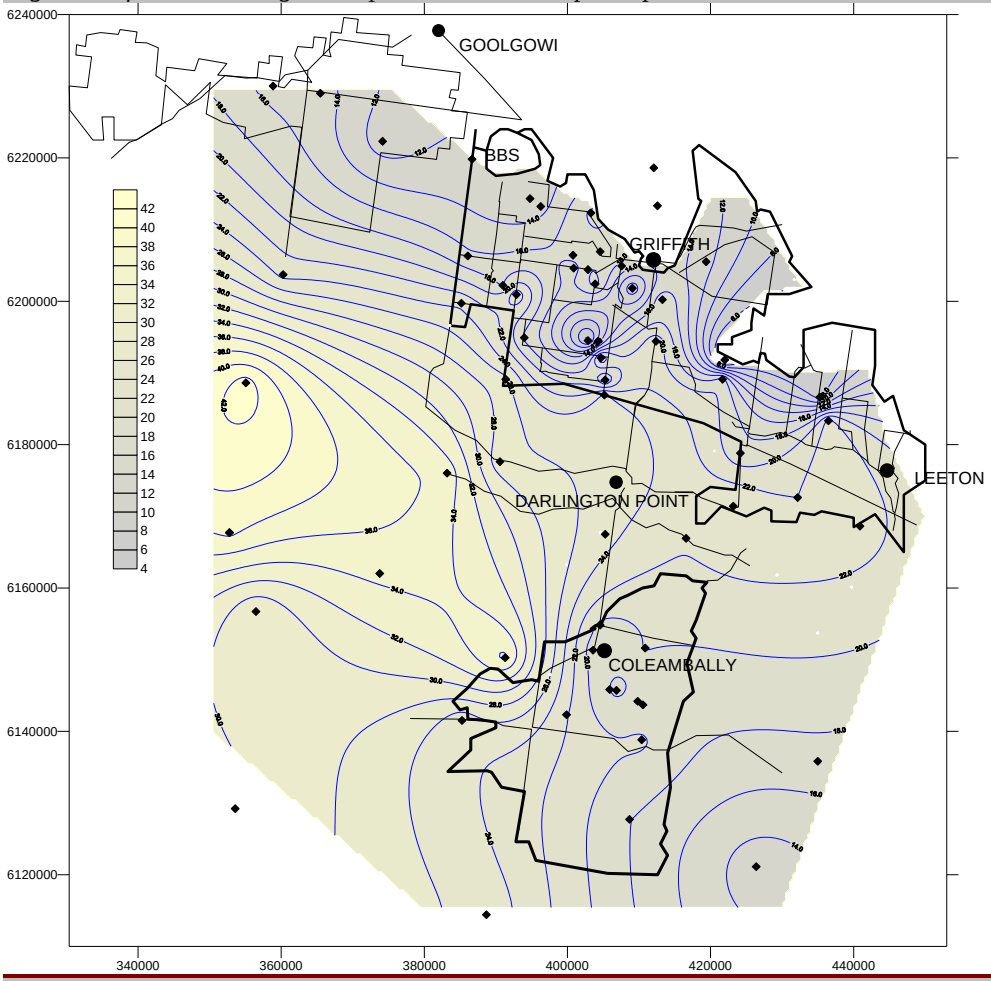


Figure 3.2.g: MIA September 2007 – AHD of pressure level 12-35 metres

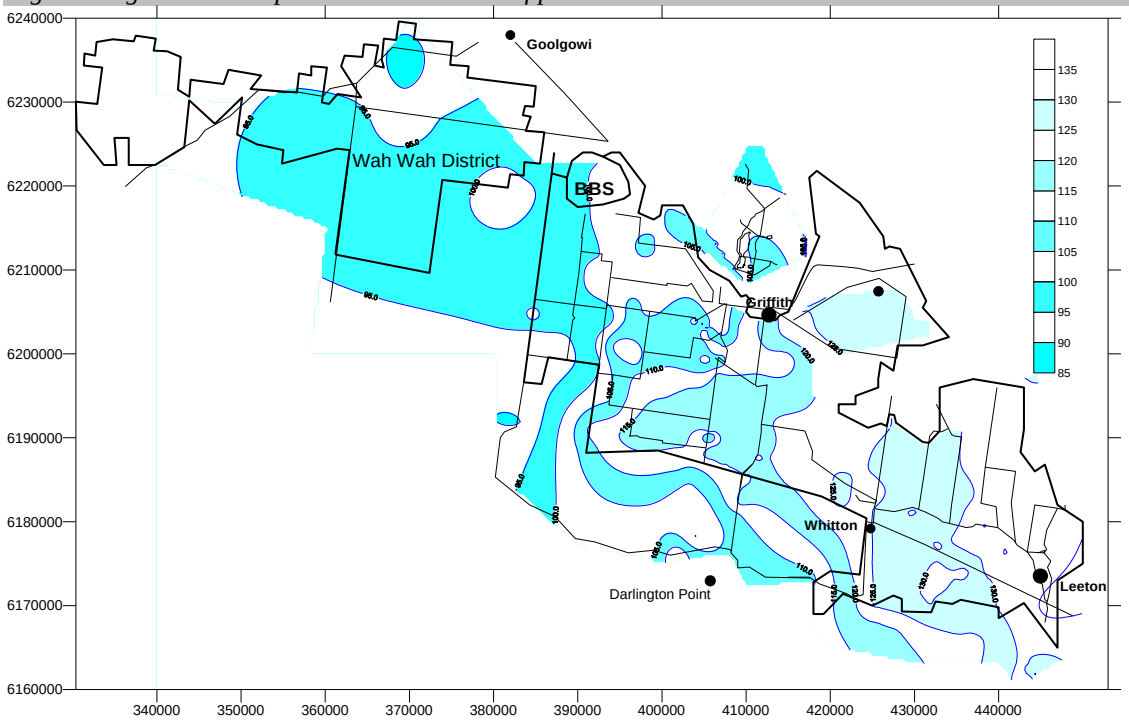


Figure 3.2.h: MIA 2000-2007 – change in pressure level 5-12 metres

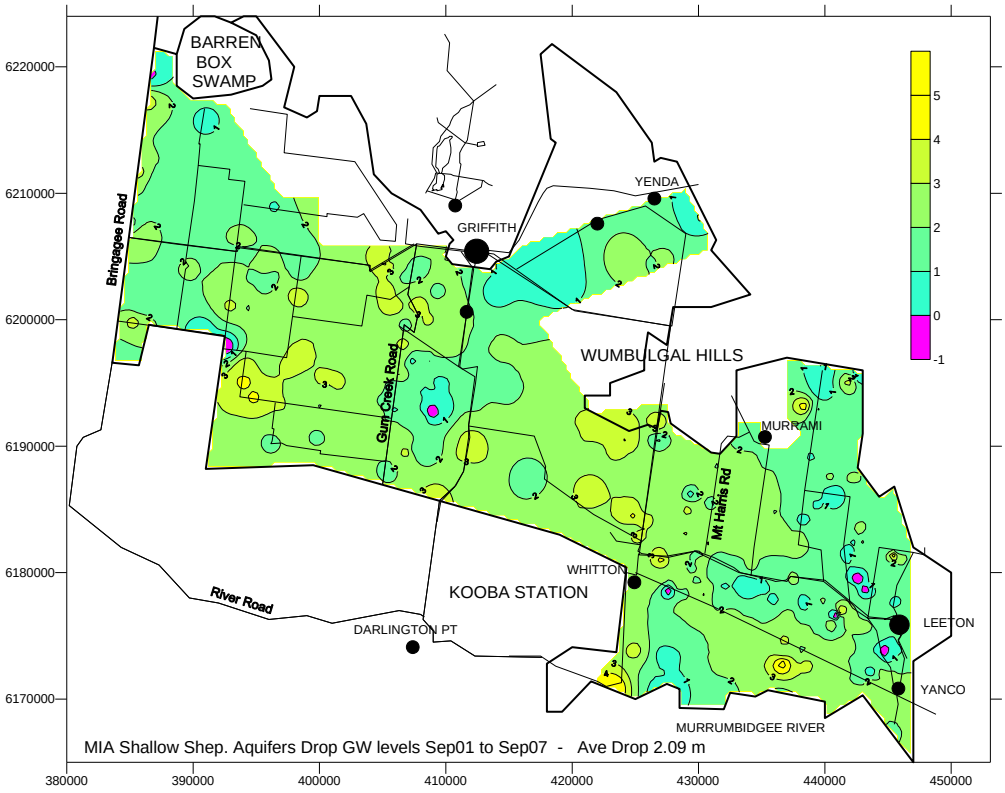


Figure 3.2.i: MIA 2000-2007 – change in pressure level 12-35 metres

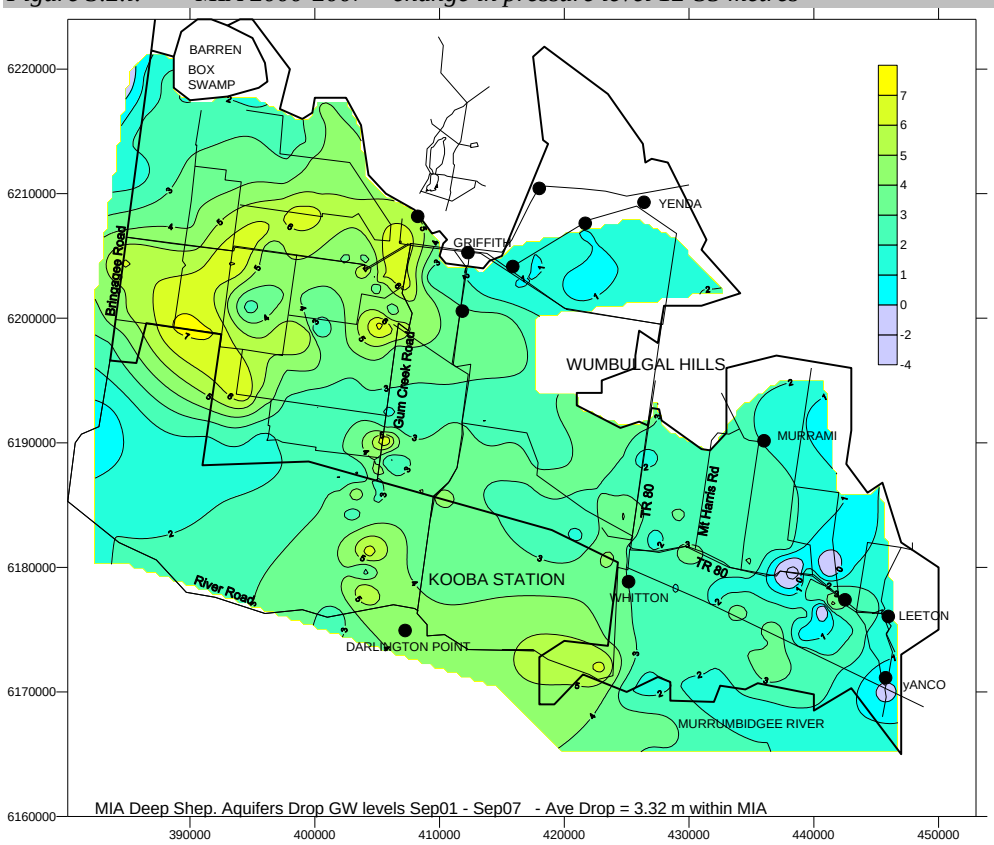


Figure 3.2.j: MIA 2001-2007 – change in pressure level 70-125 metres

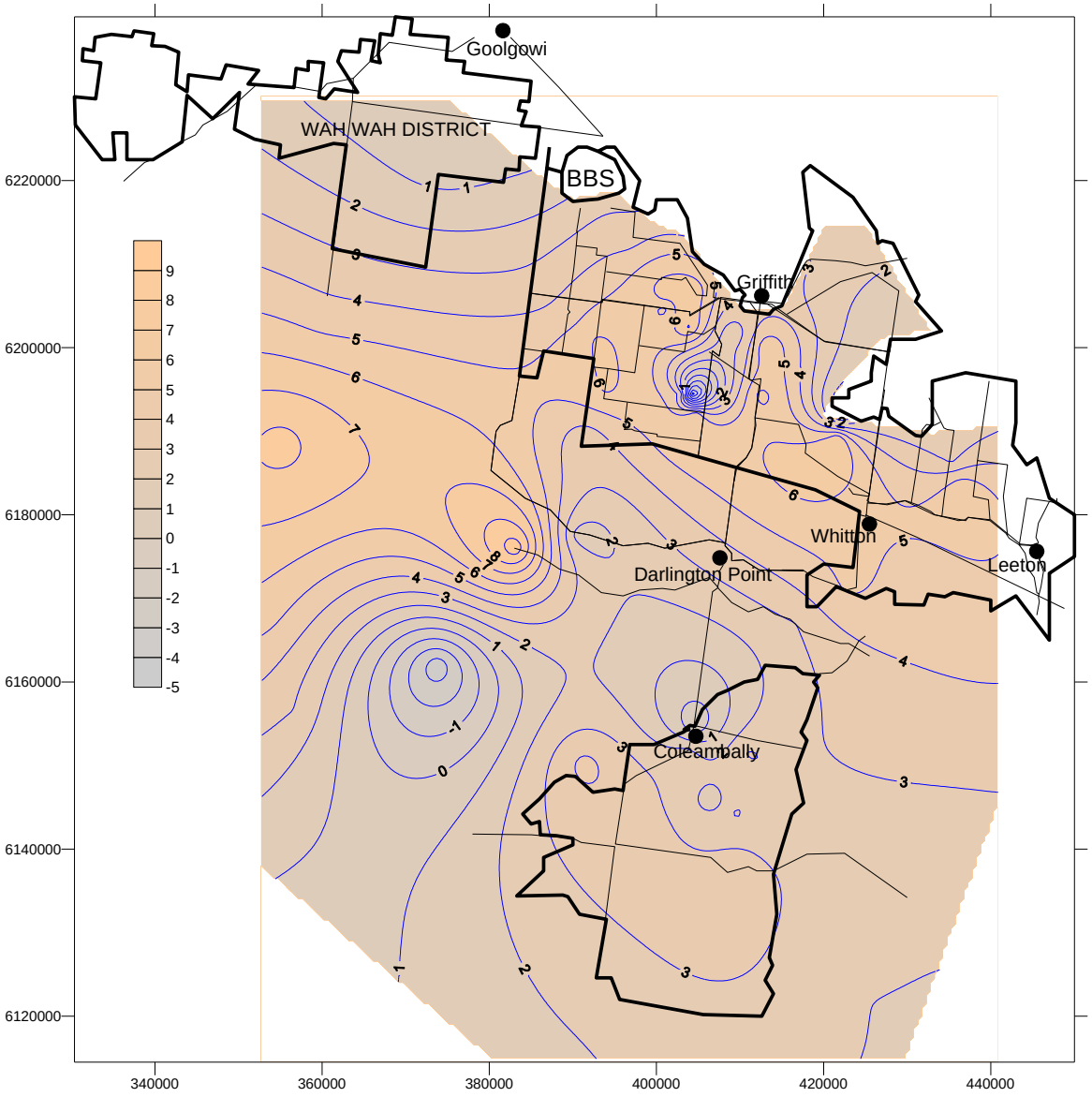
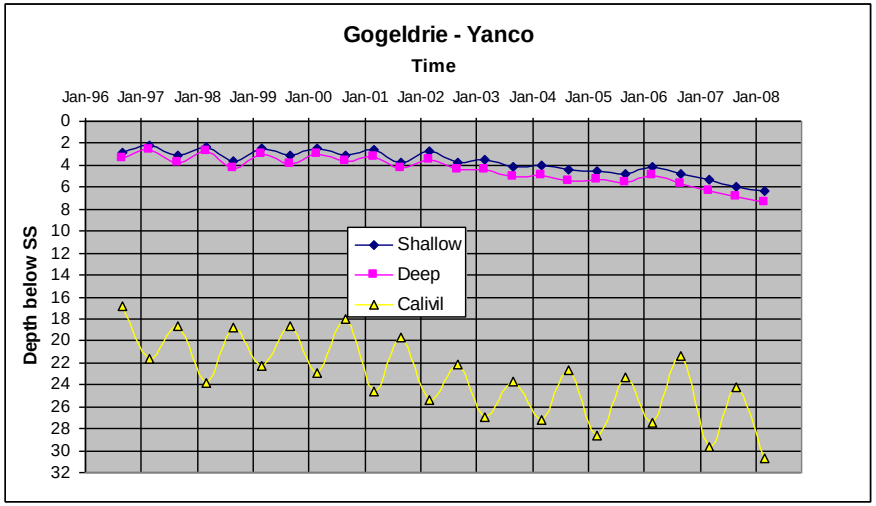
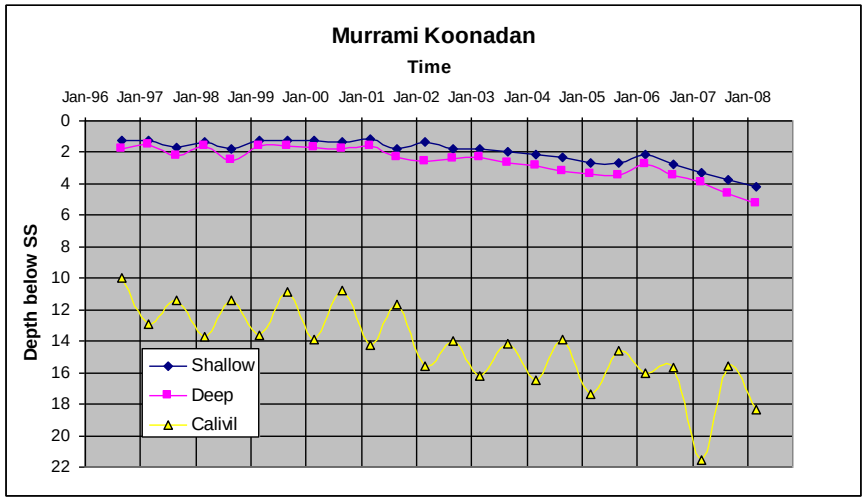
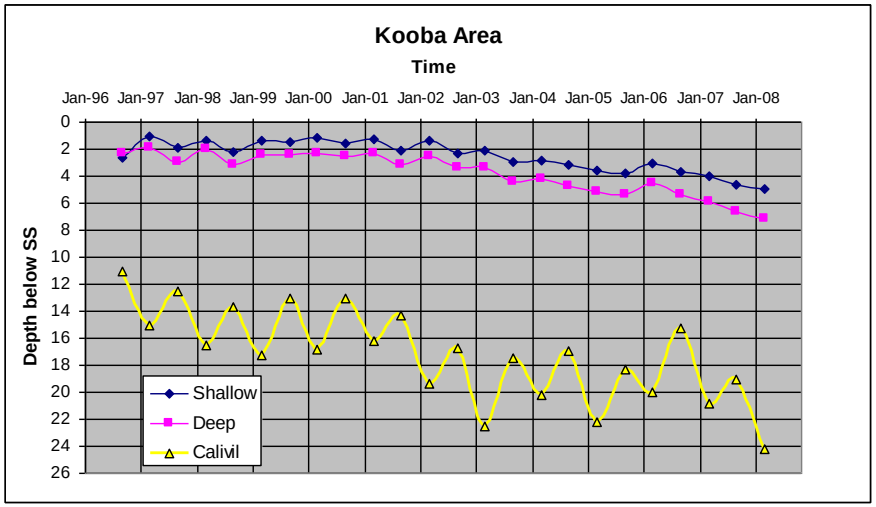


Figure 3.2.k: MIA March and September 1996 to 2008 - Average seasonal behaviour of 6 of 8 sub-districts 5-12 metres and 12-35 metres







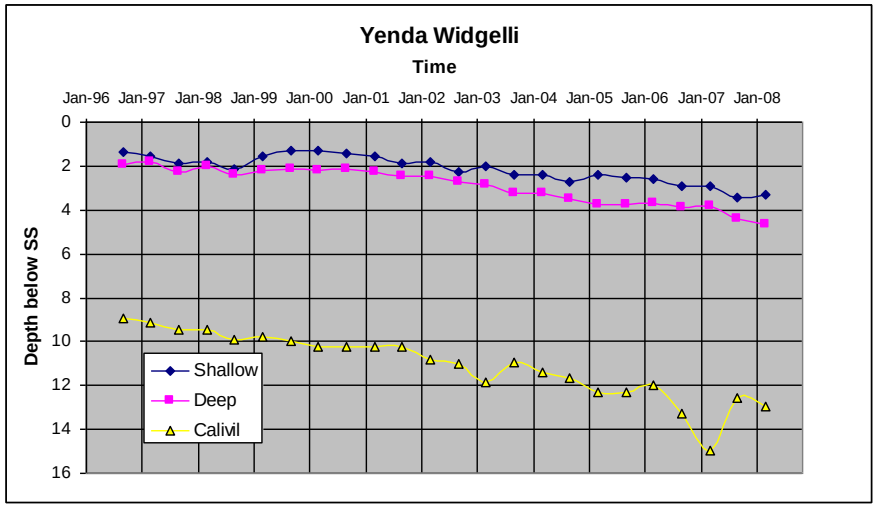
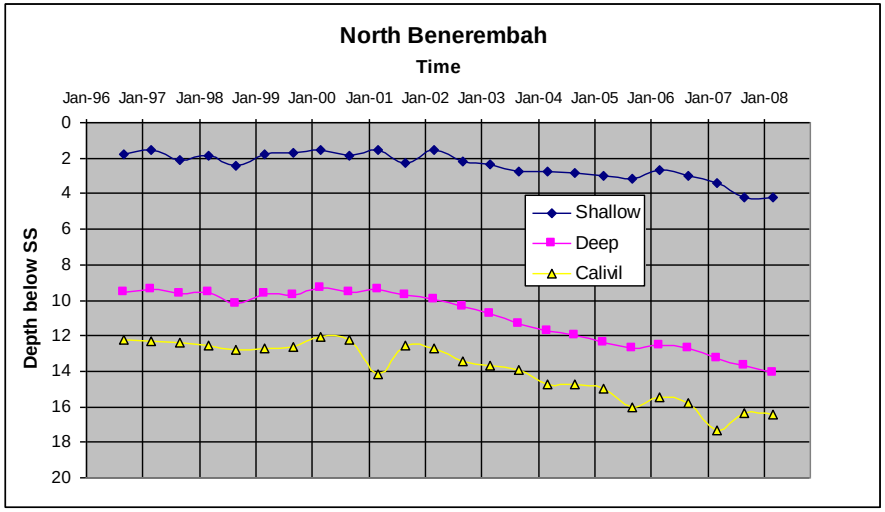
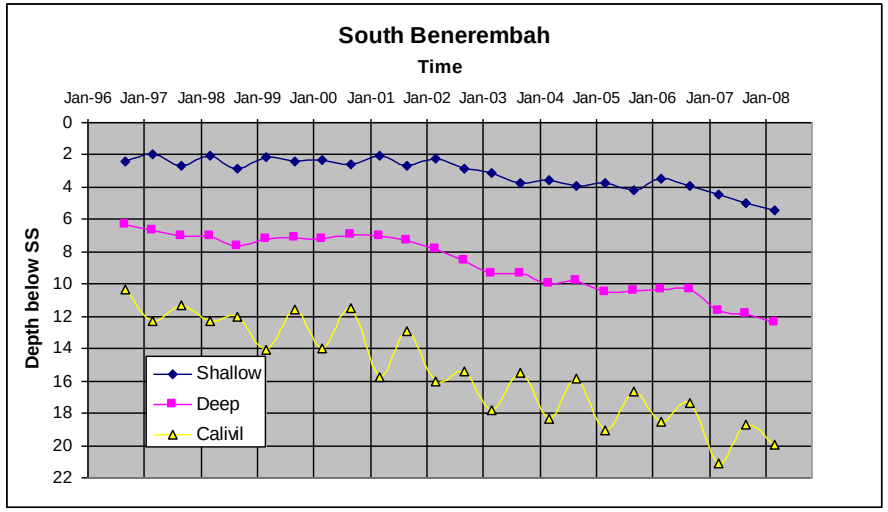


Figure 3.2.k: MIA March and September 1996 to 2008 - Average seasonal behaviour of 6 of 8 sub-districts 5-12 metres and 12-35 metres - continued





In previous Licence Compliance and Annual Environmental Reports, the bi-monthly groundwater monitoring data was used to produce the graphs showing average seasonal behaviour, see Figure 3.2.k. These graphs were compiled as an average hydrograph of the few piezometers (usually 3 to 8) in each sub-district. These average hydrographs therefore did not represent the individual sites, nor were they a true sub-district average. However, they did show seasonal trends. It was concluded that sub-district seasonal groundwater behaviour is better represented by averages as calculated from gridding and contouring, and as last year, that has again been used in this report. There are not enough piezometers in place to provide meaningful graphs for the Hanwood and Wah Wah districts.

All graphs show a steady decline in water table levels and pressure levels in all three aquifers, with seasonal variation most clearly shown in the Calivil formation.

Table 3.2.i: ***Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35metres) aquifers, September 2007, and historic trend in areas within 2 metres.*** *Figures taken from 'Groundwater Conditions and Behaviour in the MIA, Ary van der Lely, 2008'.* ++

North Benerembah										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	12	10	1	0	1	0	0	0	0	0
within 2 metre	76	74	69	28	28	19	12	1	0	1
within 3 metre	94	93	90	75	71	68	72	63	12	16
within 4 metre	99	100	97	91	86	84	89	79	69	69
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 2 metre	0	0	0	0	0	0	0	0	0	0
within 4 metre	0	0	0	0	0	0	0	0	0	0
within 6 metre	17	13	7	0	0	0	0	0	0	0
within 8 metre	47	46	28	4	3	4	3	0	0	0
South Benerembah										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	37	12	1	0	1	0	0	0	0	0
within 2 metre	68	56	39	3	10	5	2	0	0	0
within 3 metre	83	78	71	42	49	29	39	13	1	0
within 4 metre	89	88	87	69	69	63	68	55	31	18
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 2 metre	13	12	8	0	1	0	0	0	0	0
within 4 metre	34	32	23	15	14	8	13	10	6	2
within 6 metre	61	57	42	31	28	27	27	23	19	16
within 8 metre	75	71	62	49	44	43	45	35	33	28
Kooba										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	17	24	2	0	0	0	0	0	0	0
within 2 metre	87	84	44	10	4	3	6	1	1	1
within 3 metre	99	98	86	57	37	23	27	18	10	7
within 4 metre	100	100	98	87	79	68	75	64	34	29
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	3	1	0	0	0	0	0	0	0	0
within 2 metre	53	53	11	1	0	0	0	0	0	0
within 3 metre	86	83	64	8	3	1	3	0	0	0
within 4 metre	97	93	85	49	38	18	18	10	1	0
Yenda/Bilbul										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	33	24	0	0	0	2	0	0	0	0
within 2 metre	97	98	39	19	28	36	17	16	0	2
within 3 metre	100	100	100	89	90	88	70	69	51	53
within 4 metre	100	100	100	100	99	99	99	97	94	88

Note: ++ There is not enough information to create reliable figures for West Hanwood and Wah Wah.

Yenda/Bilbul										
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	16	22	1	0	0	0	0	0	0	0
within 2 metre	74	73	60	23	14	19	11	16	0	1
within 3 metre	86	84	77	69	62	61	59	61	38	27
within 4 metre	93	90	85	80	79	78	75	75	70	67
Murrami/Koonadan										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	40	44	46	2	1	1	0	0	0	0
within 2 metre	91	90	78	50	24	32	19	6	1	1
within 3 metre	99	100	96	85	82	78	76	78	27	17
within 4 metre	100	100	100	97	95	96	95	90	71	59
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	14	18	1	0	0	0	0	0	0	0
within 2 metre	76	72	53	12	7	6	1	5	0	0
within 3 metre	99	97	82	59	52	50	47	26	10	4
within 4 metre	100	100	99	89	79	77	81	63	39	21
Gogeldrie/Yanco										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	0	1	0	1	0	0	0	0	0	0
within 2 metre	31	27	12	4	2	1	1	1	0	0
within 3 metre	62	56	44	31	30	20	13	9	2	1
within 4 metre	95	82	68	50	49	43	44	37	12	7
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Mar 05**	**Sep 05**	**Sep 06**	**Mar 07**	**Sep 07**	**Mar 08**
within 1 metre	1	2	0	0	0	0	0	0	0	0
within 2 metre	27	23	5	1	1	0	0	0	0	0
within 3 metre	58	48	37	13	16	9	7	2	1	1
within 4 metre	87	73	61	36	42	37	36	20	3	3

Figure 3.2.l: Groundwater piezometers currently being read

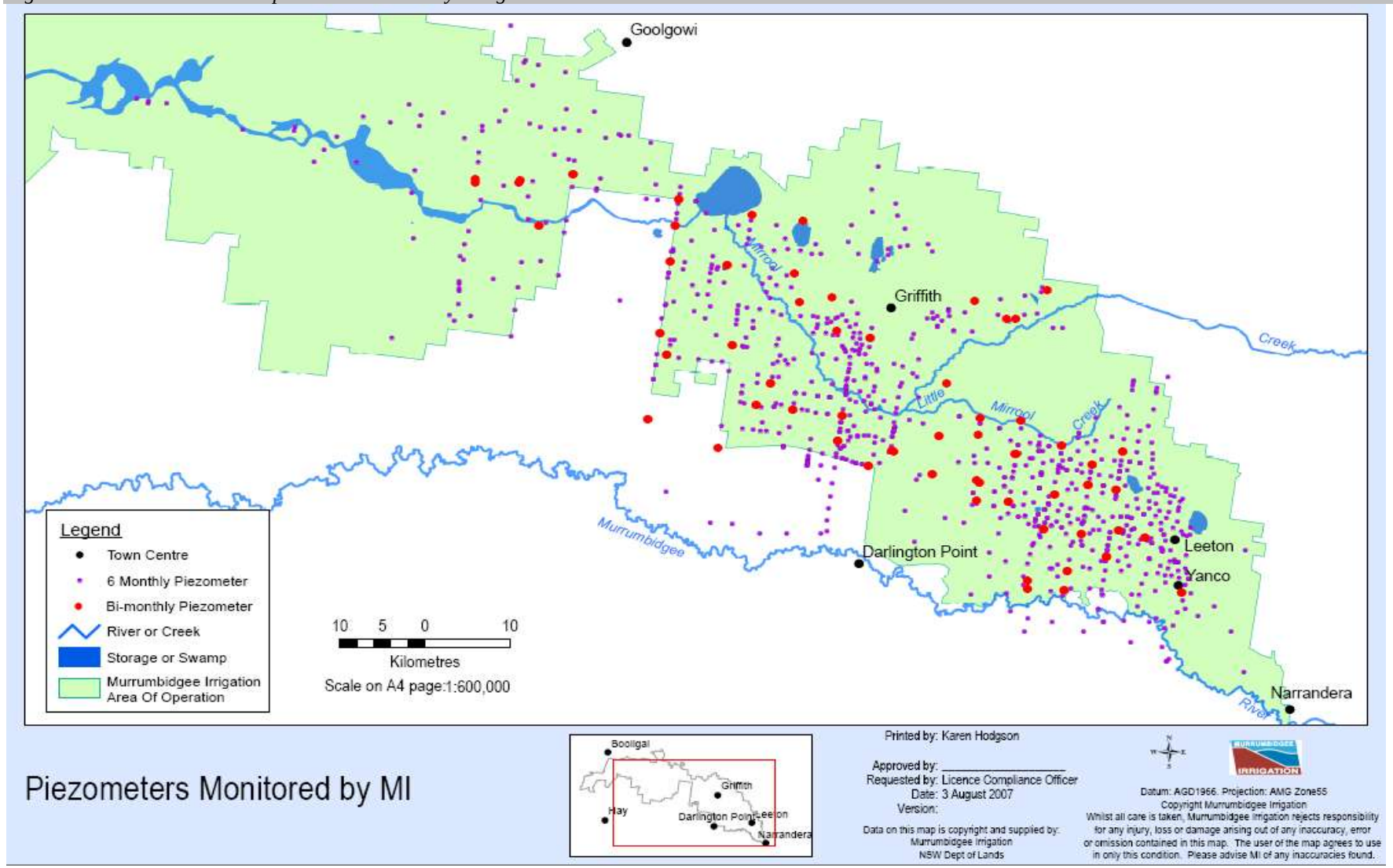
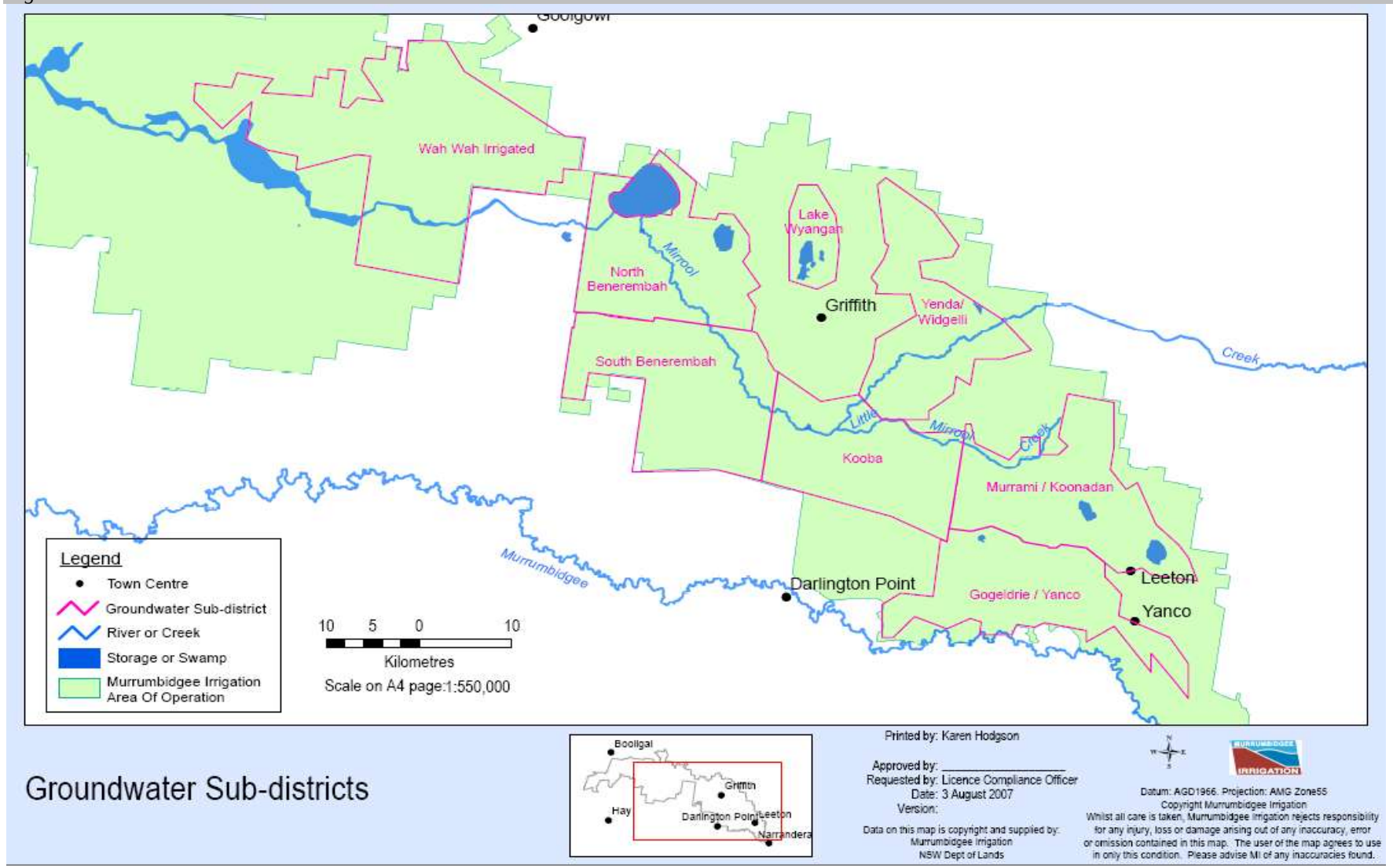


Figure 3.2.m: Groundwater sub-districts



A.4 Floods and Floodplain Management

A.4.2 Reporting requirements

A.4.2 (1 & 2) Flood levels, floodplain structures, flood releases

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

There were no deliberate releases into the floodway during the 2007/08 season due to the on-going drought conditions and the ability to better manage drainage flows arriving at Barren Box Swamp as a result of the improved operating efficiency from the reconfiguration works.

A.4.2 (3 & 4) Flood reporting – Lower Mirrool Creek Floodway

There were no major works undertaken other than assisting Wyvern Station with their noxious weed control.

The company is working closely with appropriate councils, who have recently obtained funding for undertaking flood studies.

A.5 Aquatic Environment Management

A.5.2 Reporting requirements

A.5.2 (1) Significant change to Major Wetlands

During 2007/2008 a number of projects have been developed aimed at improving the quality and extent of wetlands. The projects which are in various stages of completion include the following:

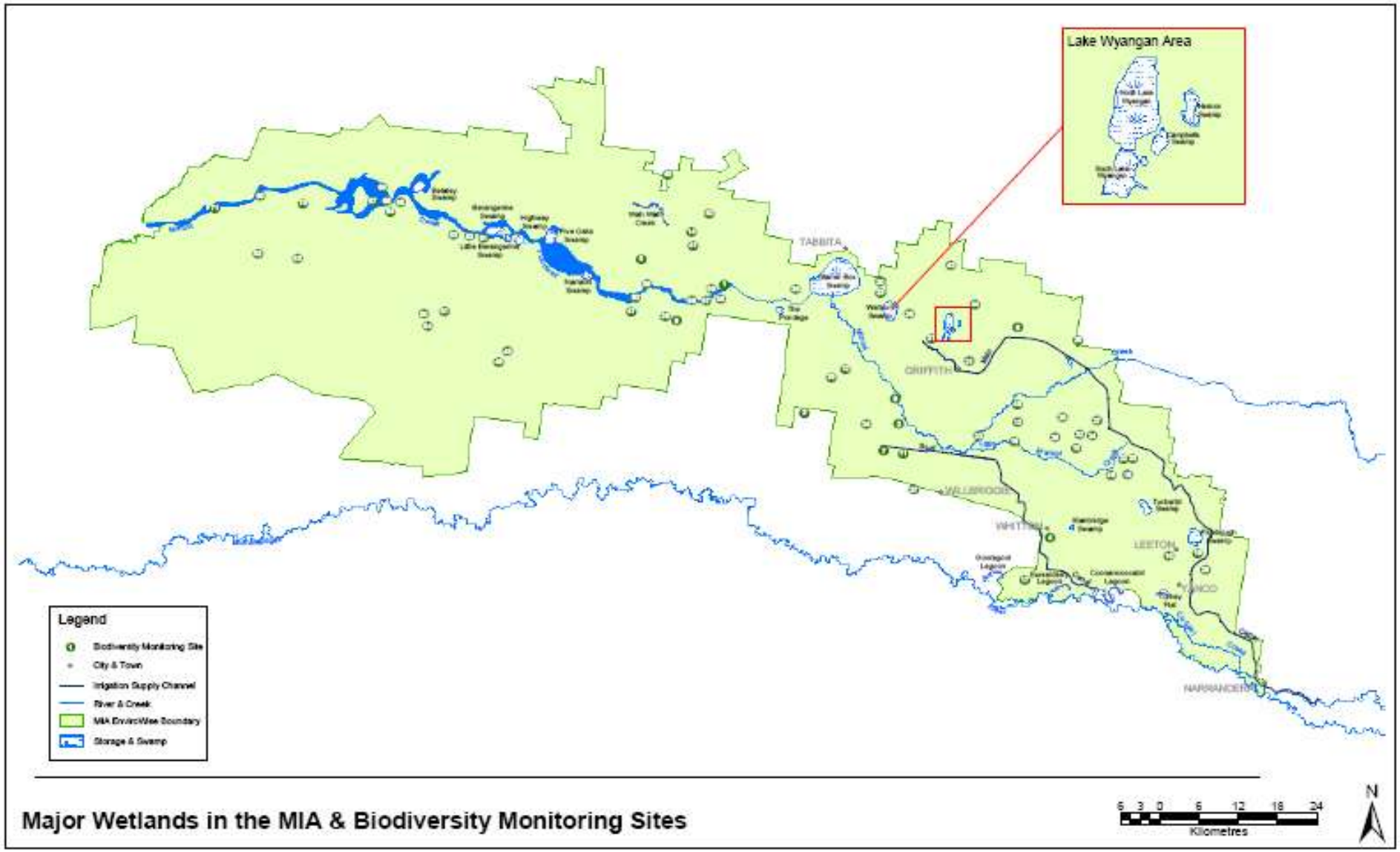
Barren Box Swamp, Brays Dam, and Mirrool Creek

Detailed planning works for the aerial sowing of 500 hectares at Barren Box have been completed with implementation planned for August 2008. The aim of this work is to assist with the re-establishment of a seed bank allowing natural regeneration to occur when favourable conditions return.

In addition, a number of smaller areas in the order of 50 hectares around the perimeter of Barren Box will undergo a combination of direct seeding and tube stock planting. Direct seeding was completed in Aug 2007 with successful recruitment of native species. Tubestock planting is planned for August 2008.

At Brays Dam 2300 native species were planted in July 2007. This planting will form a corridor with other proposed plantings along the entire length of Mirrool Creek which will improve the ecological functioning of the creek and surrounding landscape with future linkages to the rehabilitated Barren Box Wetland. It is anticipated that further Mirrool Creek works will be undertaken over the next 2 years with planning underway.

Figure 5.2.a: Habitat Quality in the MIA



Monitoring and Management of Wetlands in the MIA

Murrumbidgee Irrigation is required to monitor the condition of aquatic environments which are or may be impacted by its operations or the practices of irrigators. Murrumbidgee Irrigation is also required to implement strategies to protect and enhance biodiversity within the MIA.

The Mirrool Creek project is being implemented as an "icon" project for the MIA. The project will form an integral part of the transition from the current MIA EnviroWise Program. The project seeks to:

1. Better engage landholders and the community in seeking shared outcomes for Mirrool Creek
2. Improve water quality in Mirrool Creek
3. Improve biodiversity within the Mirrool Creek system including increasing the area of native vegetation and its associated habitat.
4. Reduce the risk of flooding to Mirrool Creek landholders
5. Control the impact of plant and animal pests and diseases
6. Provide a more efficient operating system for the Company
7. Increase the level of service Mirrool Creek landholders

In order to achieve the above outcomes the following scope of works was proposed:

1. Analysis of the current biophysical status of the creek including gaps in knowledge.
2. Understanding Community aspirations and social perceptions for the Creek.
3. Development of a detailed project description and implementation plan.
4. Planning and re-engagement of the community with better information.
5. Implementation, monitoring and review.
6. Development of operational protocols for Mirrool Creek.

The Project commenced last year and in the past 12 months there has been a focus on the water flow in the creek. There have been earthworks along approximately 65km of Mirrool Creek in the MIA which have resulted in improved flow and preventing water pooling in the low lying areas adjoining the creek. The project team this year will focus on protecting and enhancing the areas of remnant vegetation along Mirrool Creek and revegetating previously cleared areas.

To describe the current and future condition and in determining the impact of intervention on the long-term management of Mirrool Creek, a comprehensive monitoring program is required. The objectives of the monitoring program include:

- Establish a comprehensive baseline inventory of key indicators and riparian condition along Mirrool Creek for ongoing monitoring;
- Develop methods to determine changes to biodiversity within the Mirrool Creek riparian zone;
- Identify opportunities for improved management of fauna habitat and aquatic environments; and
- Develop a monitoring program that can be used to measure the effects of altered environment condition.

A monitoring program will be undertaken to address the objectives and it is expected that this will be completed by November 2008.

Barren Box Storage & Wetland Rehabilitation is an “Icon” Project for the Company and the Murrumbidgee Irrigation Area. Following intensive planning and construction the project moves into the next Phase: Wetland Rehabilitation and Management Planning. The interim aim of the project is “*to create an ecologically alive and diverse wetland that also respects, preserves and enhances the cultural significance of the area.”*

In order to understand the ecological outcomes of the wetland rehabilitation it is important to understand what species are currently using the wetland. For this purpose a detailed waterbird monitoring program of the intermediate cell was initiated in April 2007 and will continue with fortnightly surveys over a

period of 24 months. The objective of these surveys is to establish baseline data on waterbird species and abundance in the MIA.

A.5.2 (2) Management practice or work impact upon the aquatic environment (EP&A Act)

Barren Box Swamp

The Barren Box Water Conservation Project (BBS Project) commenced work at Barren Box in November 2005 and January 2006 at the Bray's Dam storage site. Both the Barren Box and Brays Dam sites were completed in June 2006. All work was undertaken in accordance with the Department of Planning's approved Construction Environmental Management Plans and the Development Approval. An Operational Environment Management Plan (OEMP) was developed and submitted to the Department of Planning in July 2006 for approval. The Company is currently finalising departmental requirements following its review of the OEMP in early 2008. Throughout the reporting period there was no impact on the aquatic environment.

However, throughout 2007/2008 work has continued to progress on the wetland rehabilitation and management plan. Activities undertaken to date include:

- Finalisation of goals and objectives
- Modelling the hydrology of the wetland cell to better define ecological zones for the determination of ecological targets.
- Community engagement through landholder meetings and conducted tours.
- Indigenous engagement through community meetings and tours and the development of a draft cultural and heritage management plan.
- Invasive species control (plant and animal)
- Planting of 50 hectares of the active cell with native vegetation.

Lake Talbot

The company aided the Narrandera Shire in a Willow Tree removal project in June through December of 2007. This necessitated lowering the main canal operating level and evacuating Lake Talbot. The company funded the construction of inlet and outlet regulating structures for this project and incorporated Department of Fisheries requirements for fish passage in both these structures. Additionally, the Company has now incorporated operating protocols designed to minimise level changes and thus impacts on stakeholders. Fisheries also participated in adopting these protocols.

A.5.2 (3) Noxious weeds

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Two inspections have been carried out at Barren Box Swamp and downstream channel systems and one inspection at the floodway.

Barren Box Swamp

The first inspection and treatment took place in February 2008. With the continuing dry conditions, low numbers of plants have been found once again at Barren Box. However the location of terrestrial plants on the surrounding shoreline has been assisted with Alligator Weed continuing to grow and other vegetative cover limited. There were 18 plants found and all plants were small in size. 15 of the plants were located in an area of Barren Box known Crumps lease with the remaining 3 plants located adjacent to the boundary of Farm 2373.

The second inspection and treatment of Alligator Weed around Barren Box Swamp took place in May 2008 and located 1 plant (adjacent to Farm 2373). All plants were chemically treated. All plants chemically treated during the February inspection showed no signs of re-growth.

Channel System

The first inspection of the Wah Wah Main and Outfall channel systems took place in December 2007. 6 plants were located within the system. All plants located in the channel system were small in size and were physically removed and treated.

A follow up inspection took place in May 2008. This inspection located 2 plants. All plants found were chemically treated.

Floodway

An inspection of the floodway between the Outfall channel off take and Cameron Lane took place in May 2008. One plant was found and was chemically treated. Owing to the extreme dry conditions and number of stock in the floodway, the early inspection was not carried out.

A.6 General Environment Management

A.6.3 Reporting requirements

A.6.3 (1) Register of activities

A *register of activities* is ordinarily required by a determining authority, generally being a government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning & Assessment Act. However, as this remains a licence requirement, despite the privatisation of Murrumbidgee Irrigation, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2007/08. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2006

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	Murrumbidgee Irrigation	February 2005

Source: MI Environmental Services

A.6.3 (2) Significant change to and condition of environment assets

Monitoring and Management of environmental assets in the MIA

Remnant Protection and Local Native Species Revegetation

For the reporting period 1 July 2007 to 30 June 2008 70 ha new plantings, 499ha of enhanced remnants, and 119 ha of direct seeding took place to increase the area of remnant native vegetation within the MIA. The enhancement of remnant vegetation was done under a combination of Property Vegetation Plans (PVP's) and Vegetation Management Plans (VMP's) with funding provided by MIA EnviroWise.

MIA EnviroWise is required through the MCMA to complete Property Vegetation Plans (PVP's) for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder. In 2007/08 18 PVP's were completed and approved by the MCMA.

Biodiversity Incentives are available to MI account holders to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant protection and enhancement through fencing and direct seeding, new plantings along drainage lines, or plantings with the intention of linking remnant vegetation creating corridors for the movement of fauna within the MIA. Vegetation Implementation Officers assist landholders in the planning and implementation of their Vegetation Management Plans.

Barren Box waterbird monitoring program

Murrumbidgee Irrigation has initiated a waterbird monitoring program in the intermediate cell at Barren Box Storage and Wetland. In order to understand the ecological outcomes of the wetland rehabilitation it is important to understand what species are currently using the wetland.

A.6 General Environment Management

The project aims to establish baseline data on waterbird species and abundance in the MIA.
The overall aim of the monitoring program is to determine species richness and abundance of waterbirds that utilise Barren Box, to determine species that are breeding and to gather information that will lead to better management to enhance waterbird populations within the MIA.

Surveys began in March 2008 and will be conducted on a fortnightly basis for a period of 24 months.
To date 12 visits have been conducted with results indicating a total of 55 bird species; 35 waterbird species and 20 woodland species. In addition, 3 threatened species recorded include blue billed duck, freckled duck, and Australasian Bittern.

Figure 6.3.a: Remnant vegetation of the Murrumbidgee Irrigation Area

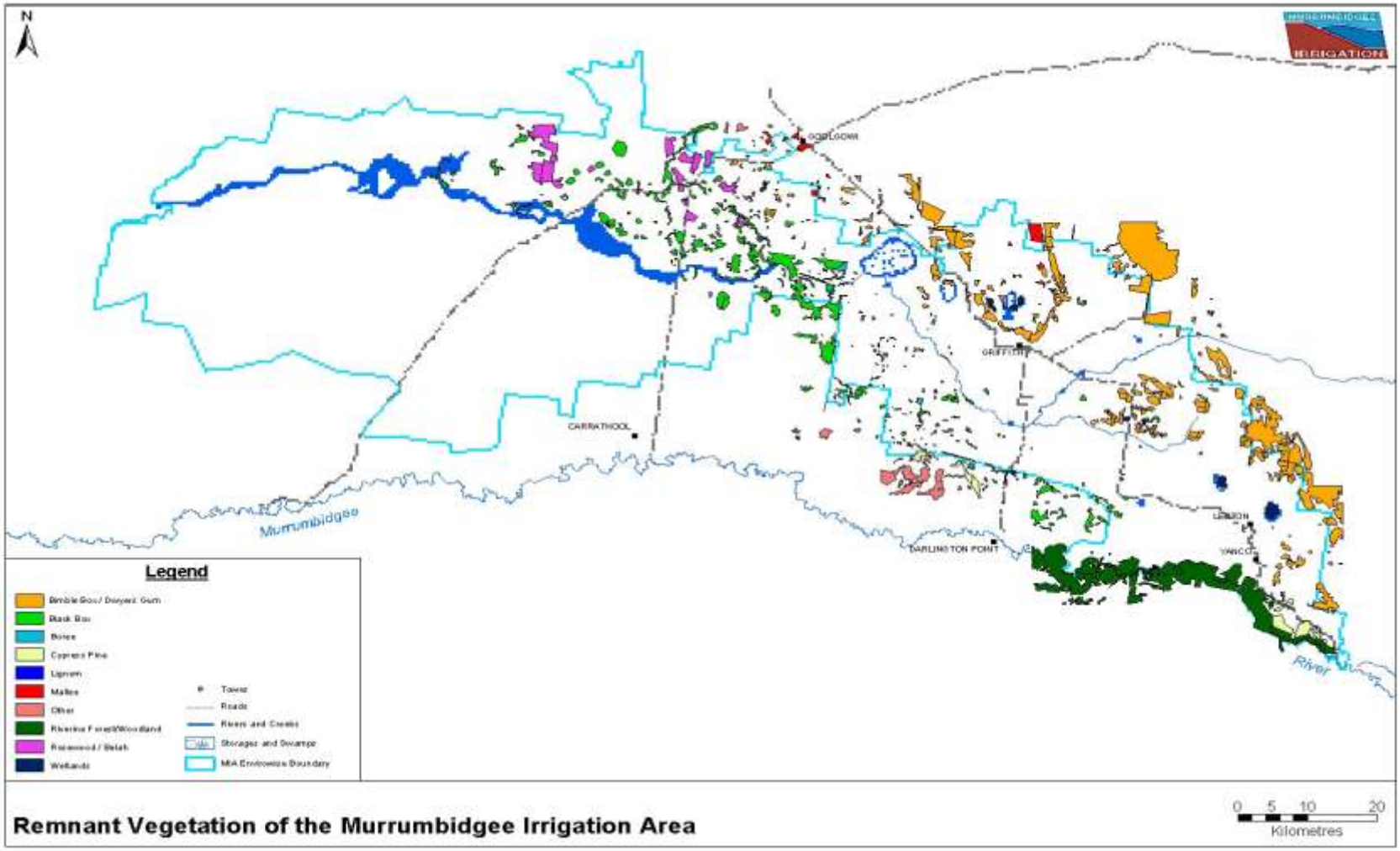
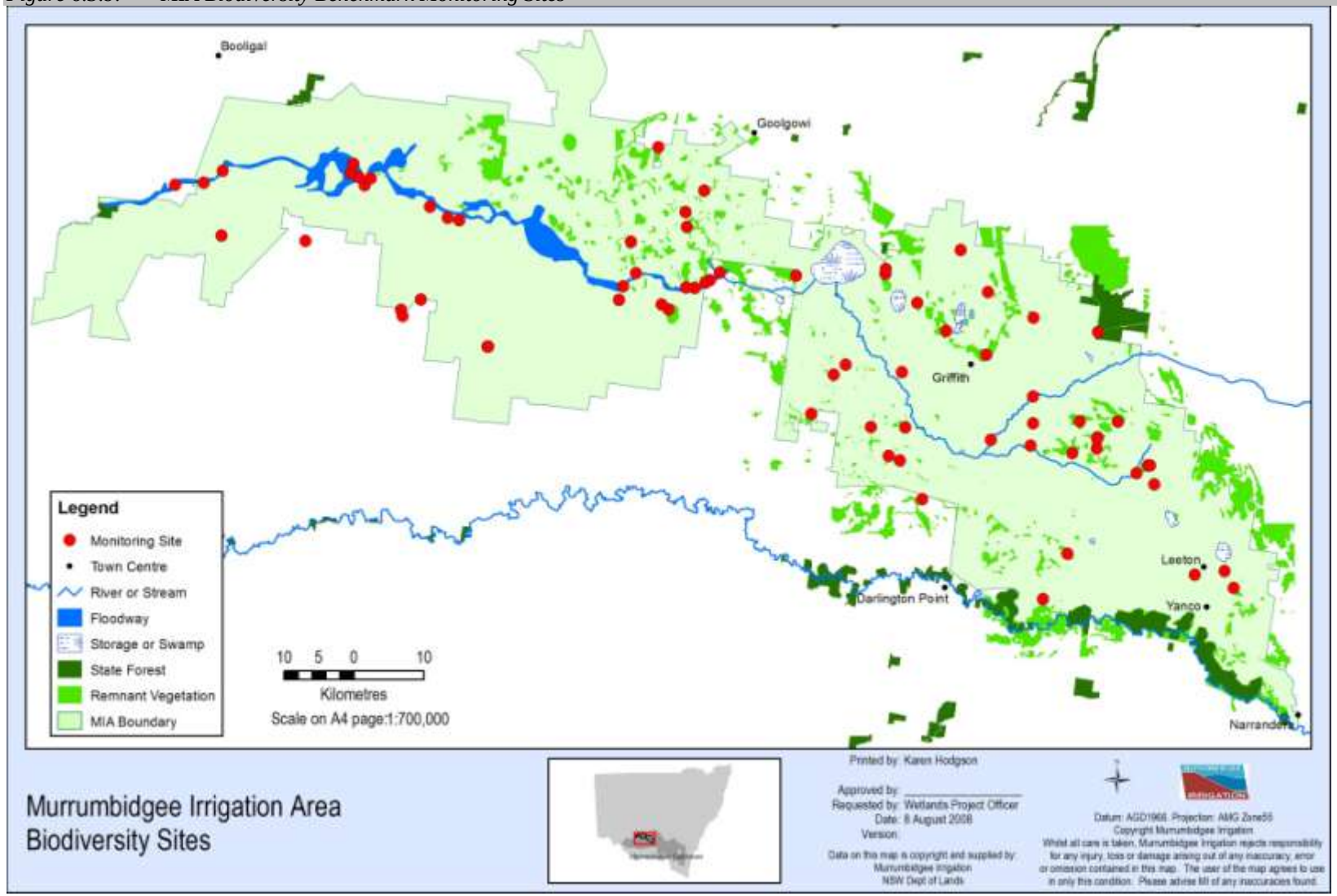


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



A.6.3 (3) Soil salinity survey (every 3 years)

Pending the outcome of the review of the Company's licences with DECC and DWE and the outcome of the CSIRO hydro-ecological assessment project, the soil salinity survey has been suspended.

DWE stated in their reply to the 2007 Compliance Report: "MI advises that survey was postponed due to drought and that methodology is under review. DWE will await outcome of the CSIRO research project but will also consider which agency will take accountability for conditioning for soil salinity survey."

Murrumbidgee Irrigation is committed to develop a more effective way to monitor and improve soil salinity. Further it is expected that the outcomes from the CSIRO research will guide the development of a more appropriate regional soil salinity assessment method.

A.7 Salinity Management and Accounting

A.7.4 Reporting requirements

A.7.4 (1) Flow, salt load and salinity data

Refer to Drainage Volumes, Table 2.2.h, page 23, for flow data.

Refer to Salt Loads, Table 2.2.i, page 25, for salt load data.

Refer to refer to Table M.4, page 72, for salinity data.

A.7.4 (2) Notice for compliance with Salinity and Drainage Strategy

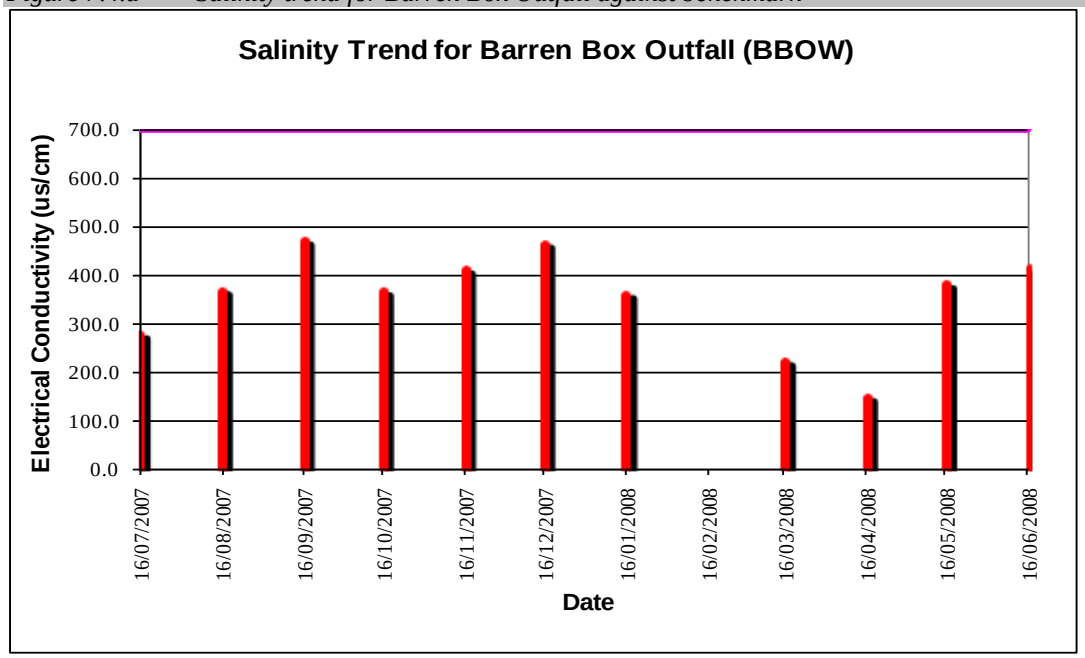
No written notice was received for the period.

A.7.4 (3) Salt load discharges

Refer to Salt Loads, Table 2.2.i, page 25.

A.7.4 (4) Salinity in Barren Box Outfall Drain against benchmark

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark



Note: Water from BBOW has not come from Barren Box.
Source: Thiess flow gauging station.

Figures 7.4.a shows the salinity trend for Barren Box Outfall against the benchmark of 700 EC. The figures presented are monthly averages. During low flow or no flow conditions, the salinity levels can rise due to evaporation of water, leaving the salts behind. This in turn would lead to a false indication of the amount of salt transported into the Wah Wah area. It is for this reason, that salinity readings are only reported when there is a reasonable flow (>5ML/day). It is evident that for the 2007/08 irrigation season the quality of water discharged from the Barren Box Outfall at Wyvern to the Wah Wah Main Canal for supply to the Wah Wah Irrigation District has been satisfactory with EC levels below the identified 700 EC benchmark limit.

Water Quality Management

For many years, Murrumbidgee Irrigation has had an elaborate monitoring system in place to ensure that licence compliance was achieved and that data was available for the efficient management of our Irrigation Area. We continuously monitored flow and electrical conductivity at key sites throughout our area as well as nutrients and pesticides on a monthly basis.

Due to the continued drought, Murrumbidgee Irrigation requested and gained approval from the Department of Environment and Climate Change (DECC) for temporary variations to our Environment Protection Licence 4651.

It was agreed that no monthly monitoring program would be carried out if general security allocation stayed below 20%. As reported in Table 2.2.b, the general security allocation was only 13% and therefore, no monthly monitoring occurred.

Murrumbidgee Irrigation has completed Stage I of the replacement program for the flow gauging stations. The upgraded sites are: LMC, MDJWE, MIRMCN and BBOW. The upgrade will ensure more reliable measurements of flow and electrical conductivity. All continuous monitoring sites were maintained during the 2007/08 season.

Due to the drought and therefore limiting resources, the on-going pollution prevention program has been suspended, pending an improvement in allocations. The pollution prevention program was set up to work with farmers to promote best management practices in order to minimise pollution in our drains. This included, for example, participation in farmer shed meetings and using local media to create awareness.

As part of the Company's commitment to act beyond compliance, a new risk-based monitoring and benchmarking program is being trialled, which has been approved by the DECC. If successful, this risk-based approach will form the basis of the Company's new DECC licence which will be aimed at improving our performance by reducing risks as opposed to measuring our performance through monitoring.

For completeness sake and to ensure that this report still follows the structure of our licence, the water quality monitoring tables are included to show that no testing occurred. Similarly, Figure R. 1 has been updated to show no testing for 2007/08.

Table M.1: Department of Environment and Climate Change compliance requirements

DECC Licence	Issue/requirement	Compliance /reference	Page No.
	Location of monitoring sites	Table M.2	69
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (>5Mg)	Table M.4	72
	Diazinon (November)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	71
	Flow (Monthly) LW6	Table 2.2.h Table 2.2.f	23 20
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	73
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.5	73
	Nitrogen (>5Mg)	Table M.6	75
	Phosphorus (>5Mg)	Table M.6	75
	Simazine (Monthly)	Table M.3	71
	Thiobencarb (Nov)	Table M.5	73
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	73
	Turbidity (>5Mg)	Table M.6	75
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.h	23
M3	**Testing Methods – concentration limits**		
	Approved by DECC	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11&12		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (Monthly)	Table M.4	72
	Diazinon (Nov)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	70
	Flow (Monthly)	Table 2.2.h	23
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	73
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	73
	Simazine (Monthly)	Table M.3	70
	Thiobencarb (Nov)	Table M.5	73
	Nitrogen (>5Mg/day)	Table M.6	75
	Phosphorus (>5Mg/day)	Table M.6	75
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	73
	Turbidity (>5Mg/day)	Table M.6	75

Table M.1: Department of Environment and Climate Change compliance requirements (cont.)

DECC Licence	Issue/requirement	Compliance /reference	Page No.
	Monitoring Sites 13 &14		
	Atrazine (Monthly)	Table M.3	70
	Chlorpyrifos (Monthly)	Table M.3	70
	Conductivity (Monthly)	Table M.4	72
	Diazinon (Nov)	Table M.5	73
	Diuron (Monthly)	Table M.3	70
	Endosulfan (Monthly) (alpha & beta)	Table M.3	71
	Malathion (Oct/Nov)	Table M.5	73
	Metolachlor (Oct/Nov/Dec)	Table M.5	73
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.5	74
	Simazine (Monthly)	Table M.3	71
	Thiobencarb (Nov)	Table M.5	74
	Nitrogen (Monthly)	Table M.6	75
	Phosphorus (Monthly)	Table M.6	75
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.5	74
	Turbidity (Monthly)	Table M.6	75
	M7.2 Conductivity (Continuously) Sites 1 & 9	Table M.4	72
	M7.3 Molinate Elisa Testing (Oct/Nov/Dec) one week intervals for sites 1-12	Table M.7	76
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Records stored on computer	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	DECC contacted Table R.1, Page 78	
R3	**Written report**		
	R3.1 Send reports to DECC at their request, regarding environmental harm	DECC sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	DECC contacted, Table R.1, Page 78	
R5	**Annual report**		
	R5.1 Submit annual report to DECC	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.h A.3.2(4) Figure R.1 Table R.1	17 23 39 77 78
	R5.4 Send copies of DECC, DNR, DPI, MDBC	Submitted	

Table M. 2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR[#]	Gogeldrie Main Southern Drain	5	*
410083	YMS[#]	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

[#] **Note :** There was very little flow at these sites. Flow ceased draining to river and is now diverted (Pumped or gravity-fed) to the supply system.

Table M. 3: Monthly monitoring of Atrazine, Chlorpyrifos, Diuron, Alpha Endosulfan, Beta Endosulfan and Simazine

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Atrazine (DL = 0.05ug/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Chlorpyrifos (DL = 0.05 g/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Diuron (DL = 0.1 ug/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Alpha Endosulfan (DL = 0.01 ug/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Beta Endosulfan (DL = 0.01 ug/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Simazine (DL = 0.05 ug/L)												
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes: Refer to Summary of Events (Table R. 1, Page 95) for further details.
Action level detection Notification level detection NF = No flow BDL = Below detectable level
NT = Not tested * Incorrect test requested from lab, therefore some chemicals not tested, others at higher detection limits.

Table M. 4: Monthly conductivity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results > 5ML/day												
BBOW *	NF	368	471	366	411	464	361	NF	223	150	381	414
BBST	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
BYD	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
FS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
GMSRR *	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
LAG *	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
LMC *	NF	1029	549	538	634	618	631	607	490	360	814	973
LW6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
MDJWE*	568	587	463	402	435	501	372	264	226	182	570	NF
MIRMCN*	588	566	301	393	434	492	364	266	217	140	310	574
ROCUDG*	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
TKBS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
WS	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
YMS *	NF	NF	NF	NF	1811	NF	NF	NF	NF	NF	NF	NF
MIRFLD	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
NARREG	NF	NF	NF	NF	NF	NF	124	140	NF	75	165	NF
STUR	NF	NF	NF	NF	NF	NF	121	226	NF	105	135	NF

Source: Thiess Services.continuous sites. Mean monthly field data. If no field data available, mean monthly MI lab data is used.
Notes: * continuous monitoring sites
NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples
MIRFLD data – No releases were made to the Mirrool Creek floodway.

Table M. 5: Monitoring of Diazon, Malathion, Metolachlor, Thiobencarb, Trifluralin and Molinate

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Diazinon (November monitoring required)												
BBOW					NT							
BBST					NT							
BYD					NT							
FS					NT							
GMSRR					NT							
LAG					NT							
LMC					NT							
LW6					NT							
MDJWE					NT							
MIRMCN					NT							
ROCUDG					NT							
TKBS					NT							
WS					NT							
YMS					NT							
Malathion (October and November monitoring required)												
BBOW				NT	NT							
BBST				NT	NT							
BYD				NT	NT							
FS				NT	NT							
GMSRR				NT	NT							
LAG				NT	NT							
LMC				NT	NT							
LW6				NT	NT							
MDJWE				NT	NT							
MIRMCN				NT	NT							
ROCUDG				NT	NT							
TKBS				NT	NT							
WS				NT	NT							
YMS				NT	NT							
Metolachlor (October to December monitoring required)												
BBOW				NT	NT	NT						
BBST				NT	NT	NT						
BYD				NT	NT	NT						
FS				NT	NT	NT						
GMSRR				NT	NT	NT						
LAG				NT	NT	NT						
LMC				NT	NT	NT						
LW6				NT	NT	NT						
MDJWE				NT	NT	NT						
MIRMCN				NT	NT	NT						
ROCUDG				NT	NT	NT						
TKBS				NT	NT	NT						
WS				NT	NT	NT						
YMS				NT	NT	NT						

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Thiobencarb (November monitoring required)												
BBOW					NT							
BBST					NT							
BYD					NT							
FS					NT							
GMSRR					NT							
LAG					NT							
LMC					NT							
LW6					NT							
MDJWE					NT							
MIRMCN					NT							
ROCUDG					NT							
TKBS					NT							
WS					NT							
YMS					NT							
Trifluralin (September-December and March-May monitoring required) (DL = 0.05 g/L)												
BBOW			NT	NT	NT	NT			NT	NT	NT	
BBST			NT	NT	NT	NT			NT	NT	NT	
BYD			NT	NT	NT	NT			NT	NT	NT	
FS			NT	NT	NT	NT			NT	NT	NT	
GMSRR			NT	NT	NT	NT			NT	NT	NT	
LAG			NT	NT	NT	NT			NT	NT	NT	
LMC			NT	NT	NT	NT			NT	NT	NT	
LW6			NT	NT	NT	NT			NT	NT	NT	
MDJWE			NT	NT	NT	NT			NT	NT	NT	
MIRMCN			NT	NT	NT	NT			NT	NT	NT	
ROCUDG			NT	NT	NT	NT			NT	NT	NT	
TKBS			NT	NT	NT	NT			NT	NT	NT	
WS			NT	NT	NT	NT			NT	NT	NT	
YMS			NT	NT	NT	NT			NT	NT	NT	
Molinate (September - February monitoring required)												
BBOW			NT	NT	NT	NT	NT	NT				
BBST			NT	NT	NT	NT	NT	NT				
BYD			NT	NT	NT	NT	NT	NT				
FS			NT	NT	NT	NT	NT	NT				
GMSRR			NT	NT	NT	NT	NT	NT				
LAG			NT	NT	NT	NT	NT	NT				
LMC			NT	NT	NT	NT	NT	NT				
LW6			NT	NT	NT	NT	NT	NT				
MDJWE			NT	NT	NT	NT	NT	NT				
MIRMCN			NT	NT	NT	NT	NT	NT				
ROCUDG			NT	NT	NT	NT	NT	NT				
TKBS			NT	NT	NT	NT	NT	NT				
WS			NT	NT	NT	NT	NT	NT				
YMS			NT	NT	NT	NT	NT	NT				

Notes: Refer to Summary of Events (Table R. 1, Page 95) for further details.
Action level detection Notification level detection NF = No flow, no sample taken BDL = Below detectable level

Table M. 6: Monitoring of Nitrogen, Phosphorus and Turbidity

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
TKN (mg/L)												
BBOW*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Total Phosphorus (mg/L)												
BBOW*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Turbidity (NTU)												
BBOW*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	118
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	41.5
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	85.8
MDJWE*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	38.3
MIRMCN*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	70.8
ROCUDG*	NT	NT	NT	NF	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	14.4
YMS*	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes: NF = No flow
BDL = Below detectable level
NT = Not tested

Table M. 7: Molinate ELISA testing

Weekly molinate sampling												
	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk9	Wk 10	Wk 11	Wk 12
BBOW	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BBST	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
FS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LW6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
TKBS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
WS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Refer to Summary of Events (Table R. 1, Page 95) for further details.

Notes: DEC approval was obtained to exclude weeks 1, 10, 11 and 12 from the weekly molinate sampling program. During weeks 2 and 3 several catchments were known not to contain rice, approval was granted to exclude these catchments from the sampling program during that time.

= Notification level detection

= Action level detection

NT = Not taken.

NF = No flow.

BDL = Below detectable level

Discussion of chemical monitoring results

Pesticide figures are not provided due to cancellation of the program, see page **94** for more details.

Figure R. 1: Irrigation waste water trends

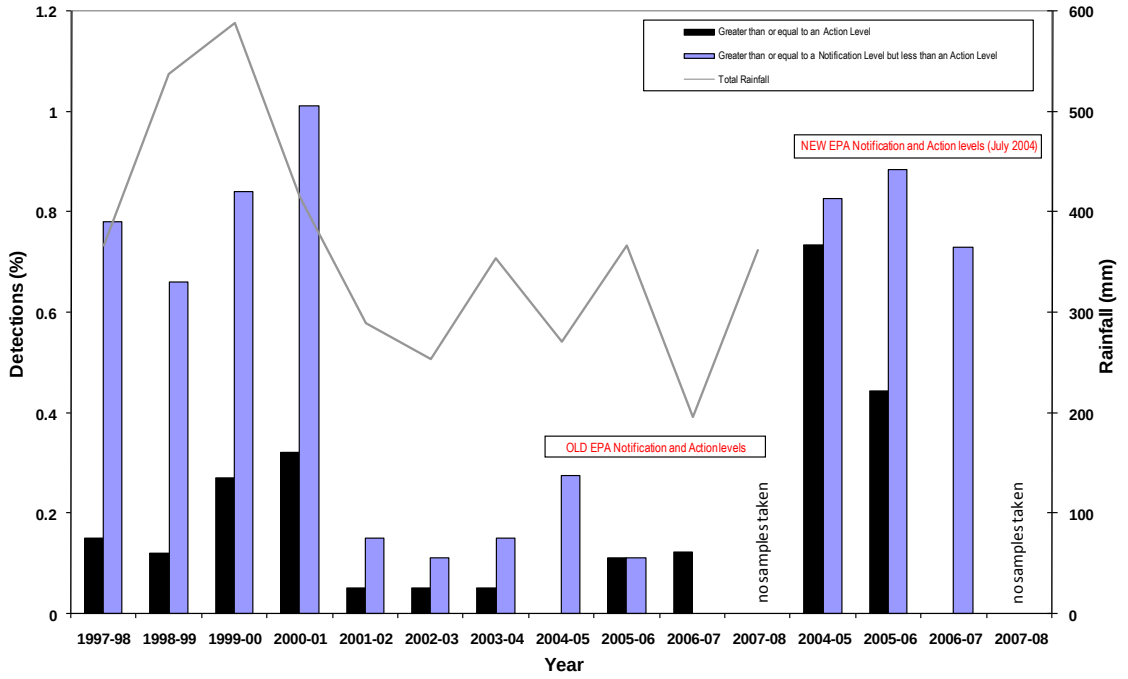


Table R. 1 (overleaf) shows a record of pollution events that were reported to the Company by members of the public, staff or government departments. It is important to note that the definition of *pollution* is not clear and is linked to the potential of events to result in adverse environmental impact. Only four pollution incidents were recorded during the season.

Table R. 1: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide DECC Action Level				
		N/A		
Pesticide DECC Notification Level				
		N/A		
Other Pollution Events				
Lake View Branch canal	16/10/2007	A 4WD vehicle containing a spray vat half full with chemical was located in a canal. The vat was not compromised upon inspection and vehicle was removed. Some fuel was observed to be on water surface, but did not pose hazard.	The owner was notified.	Not required.
Lake Wyangan	16/11/2007	An algal slick was observed to be present on the Eastern side of the North lake.	A sample was taken but no BGA noticed. Council will take samples week starting 19th Nov.	Council issue. Results potentially high levels of BGA and irrigators to be notified if using water.
Lake Wyangan	3/12/2007	After results received from GCC, samples of the south Lake Wyangan were taken to test for BGA.		Council issue. Results not clear.
Collina pumps	5/12/2007	Report by council of high metal traces and ecoli in water going to WTP.		TBA

References

Van der Lely, A (2008). '*Groundwater Conditions and Behaviour in the MIA. Annual Report 2008.*'. Murrumbidgee Irrigation. NSW.

Harrison, L & Roberts J (2005). "*Inventory of Wetlands in the Eastern MIA.".* Murrumbidgee Irrigation. NSW.

Roberts, J (2005). "*An Audit of Wetlands in the Eastern MIA, 2005*." Murrumbidgee Irrigation, NSW.

A van der Lely, A (2004) "*Groundwater Conditions in the MIA and Districts. Annual Report 2004*." Murrumbidgee Irrigation. NSW.

Glossary

APHA	American Public Health Association
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&Ds	Murrumbidgee Irrigation Area and Districts
ML	Megalitre
mm	Millimetre
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
SEE	Statement of Environmental Effect
SFU	Single farming unit
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Table 2.2.g (page 18) and Table M.2 (page 64) for complete listings of monitoring sites



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MURRUMBIDGEE IRRIGATION

MIA ENVIROWISE
MANAGING OUR FUTURE TOGETHER

Murrumbidgee CATCHMENT MANAGEMENT AUTHORITY

Australian Government

New South Wales Government

MIA EnviroWise program has been made possible thanks to funding from the Australian and NSW Government's National Action Plan for Salinity and Water Quality.

B4: Licence compliance report FY 2008-2009

Murrumbidgee Irrigation

2009 LICENCE COMPLIANCE REPORT



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Executive Summary

Murrumbidgee Irrigation's licences with the NSW Department of Water & Energy and the NSW Department of Environment and Climate Change set the minimum standard for environmental management. The Company's programs are aimed at operating beyond compliance.

DWE LICENCE REQUIREMENTS

The DWE licence comprises of seven broad categories (A1 – A7) which are summarised below:

A1. Land and Water Management Plan

The Land and Water Management Plan (MIA EnviroWise) continued to enhance the sustainability and profitability of the MIA and Districts over the last year through a combination of education, on-farm incentives and regional projects. The 2008/09 year saw $7.632 million of government funding invested in the MIA and Districts through MIA EnviroWise, of which less than 5% was devoted to plan administration.

The 2008/09 season saw a record number of incentives processed which resulted in the record expenditure of $6.2 million of government funding. Of this, $4 million was spent on on-farm works while the majority of the remaining funds were spent on biodiversity activities, including the BioTender, the Barren Box Wetland, Cultural and Heritage project, Mirrool Creek project and education.

A2. Water Supply and Drainage Management

The drought conditions that have impacted on water availability in the MIA&D since the 2002/03 season remain. Rainfall was again below the long term average and fell inconsistently throughout the season. Rainfall during the critical period for finishing winter crops, August to October was also well below average, requiring irrigation for those who had available allocations. General security allocation increased by 8% compared to the previous season allowing an increase in rice cropping compared with the previous season totalling 2779 ha, which is well below average. Continued low general security allocations combined with evapotranspiration still well above average made for another difficult season for Murrumbidgee Irrigation and its customers. Total deliveries were higher this season, a reflection of the higher allocations that were available to irrigators who had completed various pay-back obligations in 2007/08. Simple system efficiency increased in line with higher deliveries combined with continued vigilance of MI staff.

All available drainage water was re-used, in order to increase the system efficiency.

Due to the low general security allocation, there was a shift in deliveries for specific crop types. Horticultural crops received about half of total deliveries, while winter cereals and oilseeds received just under 20%. Rice totalled 14% of total deliveries.

Executive Summary

The licence specifies continuous measurement of flow and salinity, which is done using flow gauging stations at key sites across the area. Continuous monitoring implies that 100% of the data is expected to be measured and recorded. While Murrumbidgee Irrigation takes all reasonable action to ensure compliance with this requirement, there were a small number of occasions when data was lost due to equipment failure.

A3. Groundwater Management

As per the licence requirements, all bi-monthly and six-monthly bores were read. The shallow and deep water tables have continued to drop due to improved on-farm management and the on-going drought. The MIA is now well below the predicted groundwater levels of the LWMP raising concerns as to the appropriateness of such benchmarks in the current context. The LWMP was born of a wet period and has been implemented in a very dry one. Less than 1% of the MIA has water table levels within 2 m of the surface, as compared to 70% before the commencement of the drought.

A4. Floods and flood plain management

There were no deliberate diversions to the floodway.

A5. Aquatic Environment Management

Work has continued on the rehabilitation of a number of wetlands in the MIA including Barren Box and wetlands along Mirrool Creek with the aim of improving the quality and the extent of habitat.

The control of alligator weed in the aquatic environment has continued over the past year with two inspections carried out. Inspections were carried out at Barren Box, the channel system and the floodway with 15 small alligator weed plants found during the first inspection. All sites identified with alligator weed were chemically treated. The follow up inspection found only two plants with no sign of re-growth on the chemically treated plants. This extremely low number of plants demonstrates the commitment of the Company to eradicate this nationally significant weed.

A6. General Environmental Management

The protection and enhancement of local native species, remnant revegetation and other environmental assets are managed through the Property Vegetation Plans under the MIA EnviroWise program. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Section A1.

In relation to soil salinity it was concluded after the last survey that the current survey method does not provide an effective way to monitor the changes to soil salinity from irrigated agriculture and/or improve soil salinity. DWE has agreed to await outcome of the CSIRO research project and will consider the relevance of a soil salinity survey to its legislative requirements and understanding of the salt balance within the Area of Operation.

A7. Salinity Management and Accounting

The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

Executive Summary

DECC LICENCE REQUIREMENTS

The DECC licence has detailed requirements for monitoring and recording of drainage water quality.

Murrumbidgee Irrigation requested and gained approval from the DECC to trial the draft Water Quality Monitoring Program for the 2008/09 irrigation season. The DECC acknowledged that this meant that Murrumbidgee Irrigation would not be monitoring water quality in accordance with the current requirements of the Environment Protection Licence 4651 for the 2008/09 season.

The new Water Quality Monitoring Program was successfully trialled during the 2008/09 season and the DECC has given Murrumbidgee Irrigation in principle support to adopt the risk-based approach to water quality monitoring and management as part of the DECC licence.

In addition to the Water Quality Monitoring Program, the Company is also required to investigate miscellaneous pollution incidents. In 2008/2009 five miscellaneous complaints were received from the public and Company staff. Each of these were followed up and resolved in accordance with licence and other legislative requirements.

Introduction

Murrumbidgee Irrigation has complied with the requirements under its licences with the Department of Water & Energy and the Department of Environment and Climate Change.

Due to the continuing drought, resulting in low allocations for general security shareholders and therefore greatly reduced drainage flows, the Company obtained relevant variations to the existing licences and these are referred to in the text.

The Company is currently going through a review of both the licences. Pending the outcome of these reviews as well as a three-year research project with the CSIRO, the soil salinity monitoring program and groundwater salinity monitoring programs have been suspended.



Dick Thompson
Chairman
Murrumbidgee Irrigation



Leith Boully
Director
Murrumbidgee Irrigation





A.1 Land and Water Management Plan

MIA EnviroWise (otherwise known as the MIA and Districts' Community Land and Water Management Plan)

A.1.1 Annual Environment Management Report

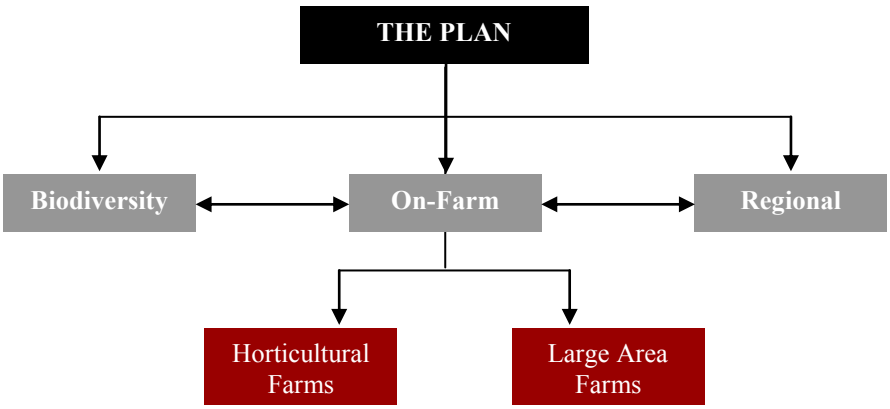
The goal of MIA EnviroWise is to maintain and enhance the sustainability and profitability of agriculture in the MIA and Districts.

The main objectives are:

- To maintain or increase irrigated agriculture productivity
- To reduce seepage to the groundwater system
- To keep drainage water quality within agreed standards
- To reduce surface drainage volumes to acceptable levels
- To protect our natural resources
- To minimise or prevent downstream effects

MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

MIA EnviroWise structure



In 1989 the Murrumbidgee Irrigation Area (MIA) community initiated the Murrumbidgee Irrigation Area & Districts Land and Water Management Plan (MIA&D LWMP) in response to threats to the area's future sustainability as a result of widespread flooding. It was agreed that the cost of implementation would be shared between the NSW and Australian governments and the MIA & Districts community. MIA EnviroWise covers more than 480,000 hectares with a gross value of approximately $7 billion in value added agricultural production.

The total cost of implementing MIA EnviroWise has been calculated at $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

Table 1.1.a: Funding sources, receipts and expenditure for MIA EnviroWise

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2008 ($ million)	Expenditure to 30 June 2008 ($ million)
Government	50.1	15	26.0^	25.3
Landholders-in-kind	214.2	30	n/a	78.2#
Landholders/urban levy	19.6	30	7.4	3.8
Total expenditure				**107.3**

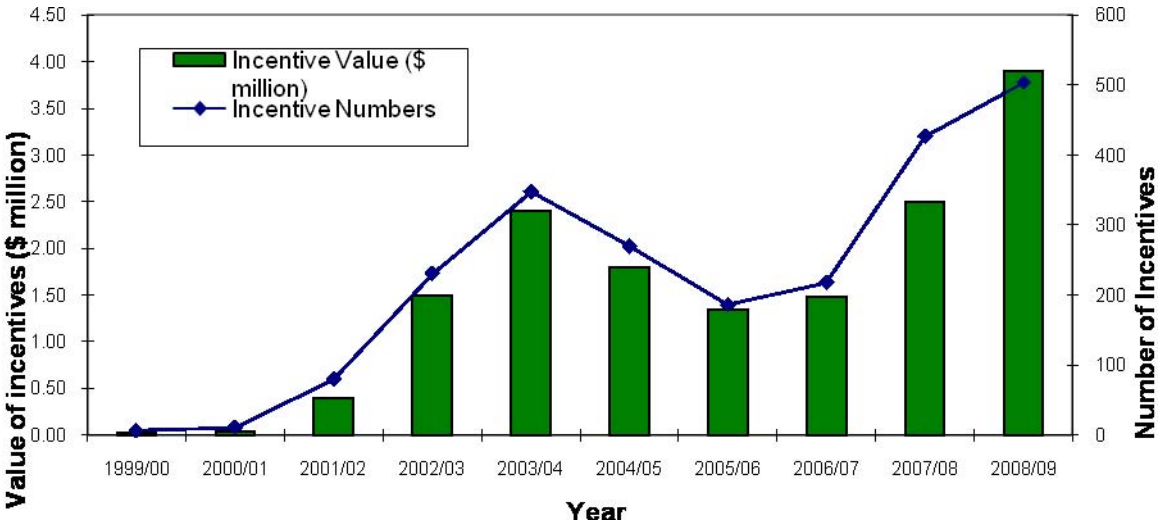
* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (unsigned).
^ This does not include funds for expenditure beyond 2009
# Calculated from invoices received from landholders and is an underestimate of total in-kind contribution

The financial administration of MIA EnviroWise is the responsibility of Murrumbidgee Irrigation Limited.

The expenditure of MIA EnviroWise funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP in 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Figure 1.1.a The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding



Overview of the On Farm Program line items

Outlined in Table 1.1.b is an overview of the On Farm Program line items, targets and timelines for achievement of the line items, and achievement of the line items to 30 June 2009.

Table 1.1.b: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2009

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2009
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program (Total) Horticulture Large Area				1422 farms 865 farms 557 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	639 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	399 farms
* Vegetation Management Planning and Property Vegetation Planning	450 farms	1-15 years	Yes	365 farms 213 landholders
Irrigation efficiency systems	270 farms	1-15 years	Yes	193 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	519 farms
Conversion to perennial pasture	2000 ha	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	40 farms	10 years	No	0 ha
On-farm channel seepage control			No	0 ha
Rice soil amelioration & reclassification	72 farms	1-10 years	No	TBD#
Drainage recycling	450 farms	1-15 years	Yes	315 farms
Sub-surface drainage and disposal	65 farms	1-13 years	Yes	6 farms

Mole drainage and on-farm recirculation	7 farms	1-10 years	No	0 farms
Laser forming	7500 ha	1-10 years	No	75,000 ha[+]
Rice target water use #	619 ha	1-10 years	No	443[^]
* EM31 Surveys	900 farms		Yes	66 farms
* Structural adjustment			Yes	7 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Line item included in structural adjustment
[+] Estimate based on the number of Whole Farm Plans implemented
^ Based on rice soil areas reclassified as unsuitable as per the Rice Environmental Monitoring Policy

Program Highlights

The program expenditure and the actual number of incentives paid against targets for line items of MIA EnviroWise for the 2008/09 reporting year are presented in Figures 1.1.b to 1.1.e. The highlights for the past year were again the success of the biodiversity program, especially the new BioTender program permanently protecting close to 1,500ha of high quality remnant vegetation. The expansion of the community education program has seen more than 500 school students and community members participate in Environmental Education activities.

In addition, the administration costs have remained below 5% of the program expenditure, and the number of incentives paid (504) was the highest since the beginning of the program and again exceeded the annual target. The year also saw largest investment in on-farm water efficiency projects with close to $3,900,000 in government incentives paid to landholders in the MIA.

Activities

The implementation of MIA EnviroWise has been broken into three sections being On-Farm, Biodiversity and Regional. The On-Farm program is focused on improving the water use efficiency of farms in the MIA through education, extension and the provision of financial incentives to the farmers. The Biodiversity program also works with farmers as well and the general community and regional organisations to protect and enhance the amount and diversity of native vegetation to improve habitat for native fauna. The program also works to incorporate local Wiradjuri culture into natural resource management in the MIA. The Regional program is the coordination of the plan and the regional activities such as school and community education. The progress of the various projects against their targets for the 2008/09 reporting year is shown in figure 1.1b on page 6.

On-Farm Program

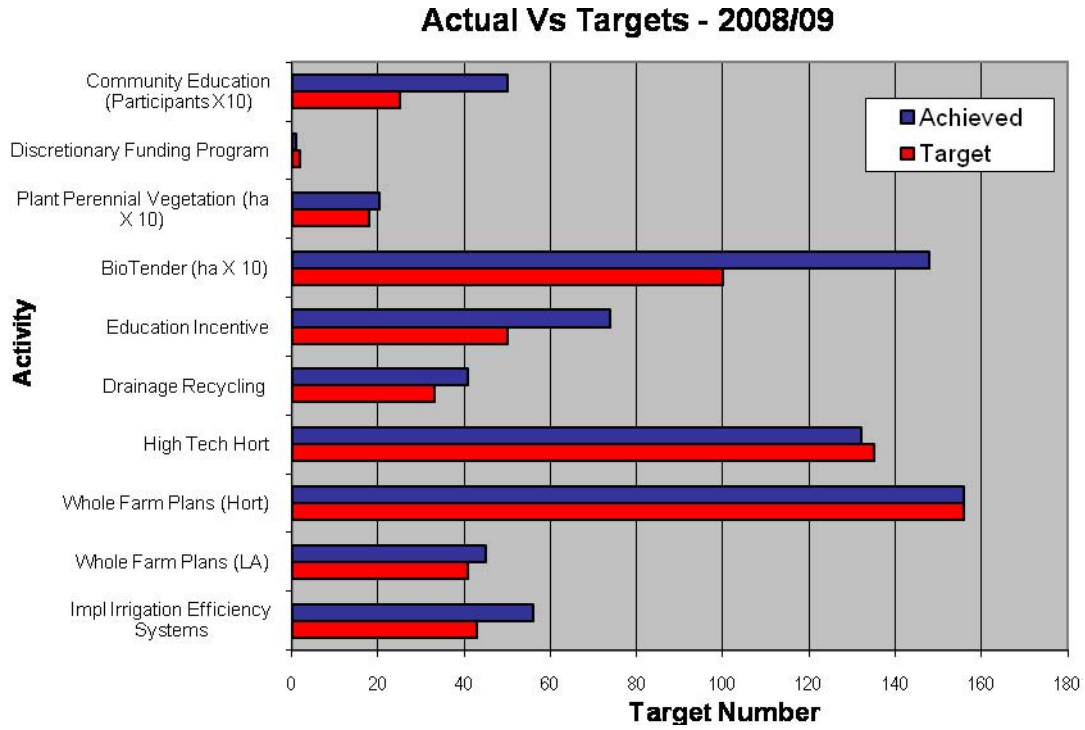
Outlined below is a summary of the on-farm incentives program for 2008/2009 including a discussion on progress:

- Irrigation Efficiency Systems Implementation incentive has again exceeded target levels. This is mainly due to the number of large area farms converting to horticulture over past years. Currently these farms are not eligible for the High Tech Horticulture incentive. Large

area farms also use this incentive where they do not meet the criteria for the Drainage recycling incentive.

- The Whole Farm Planning incentive has been combined with both the Drainage Recycling Incentive and the High Tech Horticulture incentive for the different farming systems as recommended in the Mid-Term review. However for consistency of reporting all new Drainage Recycling and High Tech Horticulture incentives have been counted as also having a Whole Farm Plan incentive. The 2008/09 year saw the target for horticulture Whole Farm Plans (156) met exactly and the target for Large Are Whole Farm Plans (41) exceeded with 45 paid.
- Again the target numbers for the High Tech Horticulture Incentive has not met the target however it was extremely close with 132 incentives paid against a target of 135. It is anticipated that next year the target will be exceeded in the final year that the On-Farm program will be offered in the current form.
- Drainage recycling continues to track well against the target and once again exceeded target levels for the year, which given the lack of general security allocation over the past 5 seasons is a great result.
- Once again the education incentive has proved to be very popular with the landholders of the MIA with in excess of 75 farming families taking the opportunity to undertake further education with the assistance of MIA EnviroWise

Figure 1.1.b: MIA EnviroWise Targets Achieved



Biodiversity Program

Outlined below is a summary of the biodiversity program for 2008/2009 including both the on-farm plantings and BioTender:

- The vast majority of Biodiversity plantings this year have been in the form of directly sown seed rather than the traditional planting of seedlings. Close to 210 hectares of native vegetation has been planted and over the past 12 months across 25 individual properties. This consisted of 50 hectares of newly planted seedlings and 160 hectares of direct seed.
- In addition to the new plantings there was, 8 hectares of remnant vegetation enhanced though the PVP process. These sites have been fenced off to protect from constant grazing pressure and stock are now better managed to ensure natural regeneration of the sites.
- The MIA EnviroWise BioTender program has been a huge success with 1,480ha of high quality remnant vegetation protected in perpetuity, with a target of 1,000ha this program has been a huge success.

Regional Program

Outlined below is a summary of the regional program for 2008/2009 including a project administration and education:

- In the 2008/09 year there was again an increased focus on school and community education in the MIA EnviroWise program. This year there were in excess of 490 school children from within and outside the MIA attend education sessions run by MIA EnviroWise staff.

- The FarmWise irrigation management course was run again, however as the on-farm incentive program draws to an end the numbers of participants is falling with 66 this year. There has been a change in focus to running the next level of course providing more detailed information and a specific range of topics suited to specific farming groups.
- The Discretionary Funding for School and Small Community Groups program was not as successful as the past with only the one school taking the opportunity to secure funding to improve the biodiversity of their school area. This will be offered again but it is expected interest will continue to slow.
- The MIA EnviroWise program employed 10 staff in a combination of full and part time employment to implement the various projects for the past year. The staff specialised in Biodiversity planning and implementation, project management and education.

Expenditure

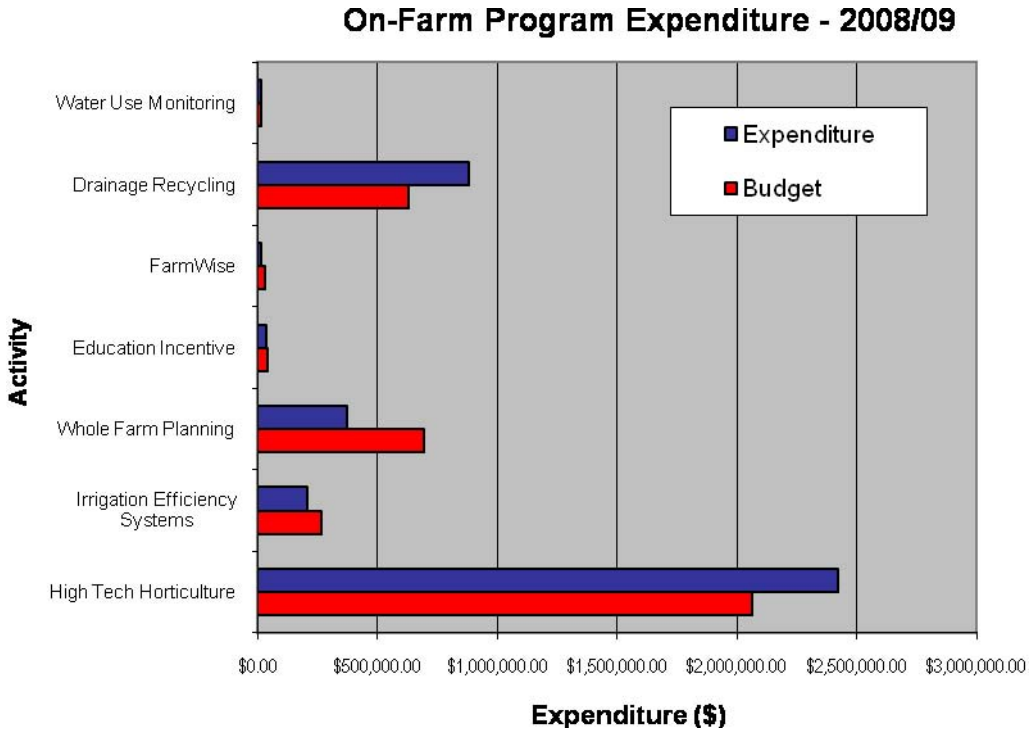
For the first time MIA EnviroWise expenditure was over budget. The budget for the year was $7,530,000 and the cost of implementing the program for the year was $7,632,000 (1.35% over budget). Of the money invested in the MIA $6,190,000 was government funding while the remaining $1,442,000 came from the landholders of the MIA through their levy. That ratio of Landholder to Government contribution is expected to even out in the future as less On-Farm Incentives (100% funded by Government) are offered in the future.

On-Farm Program

Figure 1.1b shows of the expenditure for the on-farm incentives program for 2008/2009 against budget, with an explanation detailed in the points below:

- Despite that fact that Irrigation Efficiency Systems Implementation incentive paid was in excess of the target the levels the expenditure fell below budget. For the past year the average amount paid for each incentive was $3,600 compared to the $5,000 maximum payment.
- In the last two reports there has been a widening of the gap between the budgeted target number and the actual implemented number of incentive for High Tech Horticulture, however this year the gap has started to close although the actual number of systems implemented is still below target (see figure 1.1.b. In 2008/2009 numbers have increased in relation to previous years, this increase can be attributed to new service providers opening in the district combined with the reduction in water allocations and the dramatic increase in the value of water on the temporary market. There have also been more customers connecting to Murrumbidgee Irrigation's IHS (high pressure pipeline supply system) resulting in an increase in the number of landholders converting to drip irrigation as their supply channels are converted to pressurised pipelines.
- Drainage recycling once again exceeded that budget levels. This was due to again exceeding the target numbers along with the fact that the Whole Farm Plan incentive was combined with the Drainage Recycling incentive creating an underspend in whole farm planning.
- As detailed in the last two points Whole Farm Planning is well below budget, this can mostly be explained by the fact the incentive was combined with others and funding reported against those incentives.

Figure 1.1.c: On-Farm Activities - Expenditure

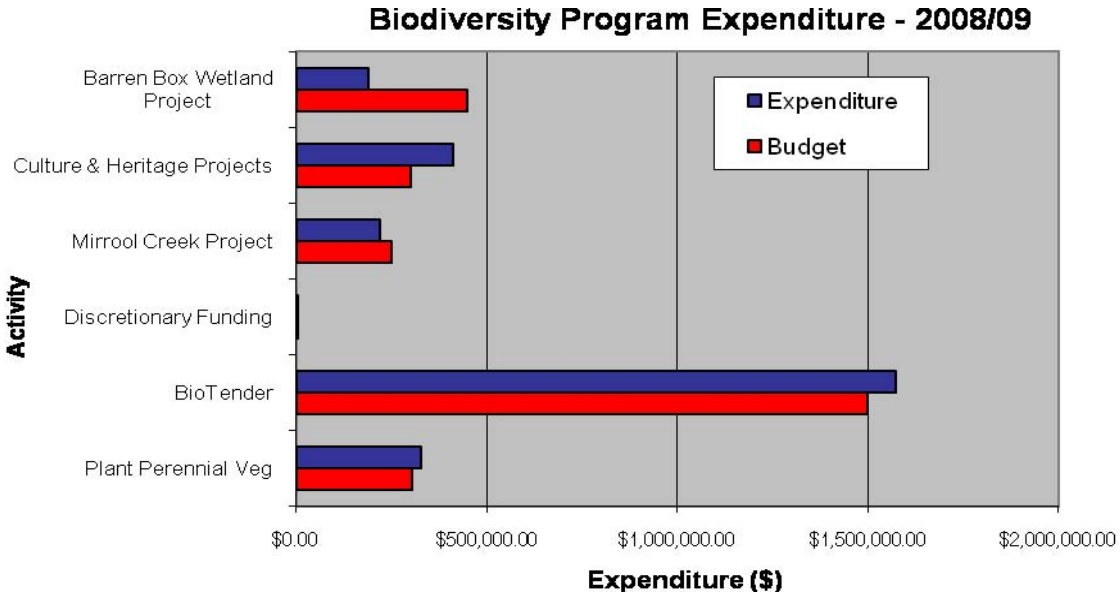


Biodiversity Program

Figure 1.1d below, shows of the expenditure for the biodiversity program for 2008/2009 against budget, with explanations for on-farm plantings, BioTender and various biodiversity related projects detailed in the points below:

- The Barren Box Storage and Wetland Project expenditure was less than half of budget while still achieving the desired outcomes (see section A5) this is mostly due to the fact that a planned boardwalk will not be installed as it is not required.
- The major focus of the Culture & Heritage Program to date has been the establishment of a cultural park at the 3-Ways in Griffith. This whole program is over budget, however that has been more than covered by the under-expenditure at Barren Box Storage and Wetland.
- The Mirrool Creek Project has also run slightly over budget, however this can partially be explained by additional investigation and planning work that was not budgeted for and again the excess expenditure is covered by the under-expenditure at Barren Box Storage and Wetland.
- Both the BioTender and the on farm planting incentives were over budget, for the BioTender there were a number of good sites and the decision was made to spend the extra money to secure the protection of the highest value sites. The other plantings have experienced a sharp increase in the price of fencing materials which has seen expenditure exceed the budget slightly.

Figure 1.1.d: Biodiversity Program Expenditure

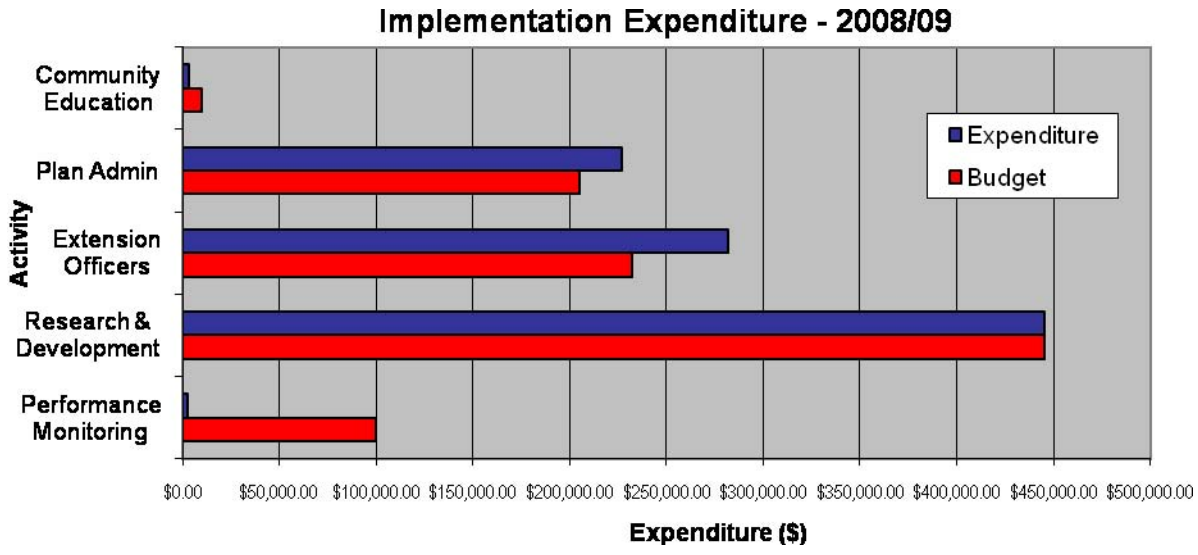


Regional Program

Outlined below is a summary of the regional program for 2008/2009 including a project administration and education:

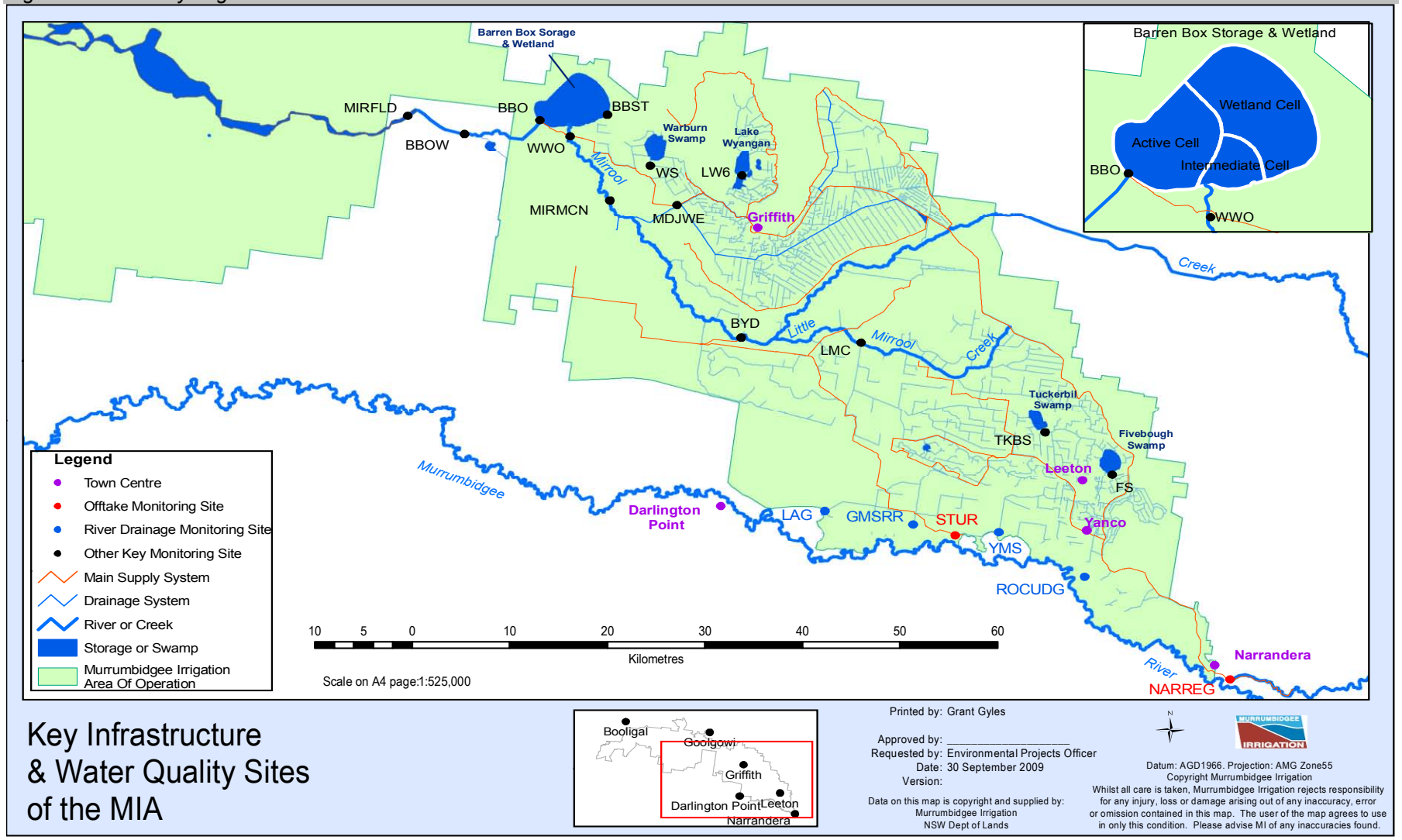
- There was very little spent to date on Performance monitoring of the plan, however those funds will be carried over to the 2009/10 year for the development of MIA EnviroWise Mark II.
- Plan Administration continues to be well below the target range of 10% of costs with 97% of expenditure going to on-ground work for the last year.
- Again the education program is one that falls well below budget yet more than exceeds the target numbers for participants.

Figure 1.1.e: Implementation Activities – Expenditure



A.2 Water Supply and Drainage Management

Figure 2.2.a: Key irrigation infrastructure in the MIA



A.2.2 Reporting requirements

Climatic conditions

The 2008/09 season showed significant variation to the long term average weather patterns. Rainfall fell inconsistently and although the total rainfall was higher than in 2007/2008, it was again lower than the long term average. ETo was slightly higher than in 2007/2008 and well above the long term average. The region experienced an extreme heatwave late December to early January evident in the above average ETo figures listed.

Table 2.2.a: Summary of climatic data

Month	ETo 2008-09 (mm)	Rainfall 2008-09 (mm)	Net ETo (ETo-Rainfall) (mm)	LTA ETO (1962-2008) (mm)	LTA Rainfall (1962-2008) (mm)
July	59.5	29.8	29.7	49.9	34.1
August	90.9	20.8	70.1	77.6	35.6
September	163.8	22	141.8	117.3	36.4
October	242.1	20.2	221.9	176.5	40.8
November	225.2	67	158.2	227.0	30.7
December	275.9	45.8	230.1	268.0	30.4
January	353.7	7	346.7	283.8	32.7
February	282.8	17.4	265.4	232.0	28.0
March	204.6	3.6	201	192.9	32.3
April	136.9	30.2	106.7	116.1	30.9
May	91.4	4.6	86.8	67.3	36.2
June	39.1	77.2	-38.1	44.2	35.3
Total	**2165.9**	**345.6**	**1820.3**	**1852.5**	**403.3**

Source: CSIRO Griffith

Notes

LTA = Long term average (1962-2008), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.

ETo = reference evapotranspiration

Table 2.2.b shows an increase of 8% in general security allocation compared to the previous season, total deliveries increased by 31%. Many general security customers have repaid outstanding Snowy Hydro borrows in 2006/07 making their allocations available for use this season. The 2008/09 season included a substantial increase in deliveries to rice cropping as detailed in table 2.2o.

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2009

Year	Announced Allocation (general/high%)	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2008-09	**21/95**	**393,973**	**276,233**	**1,820**	**2165.9**	**345.6**
2007-08	13/95	335,687	210,297	1,766	2,127	361.4
2006-07	15/90	559,952+	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423
LTA (1962-2008)					**1,853**	**405**

Sources: MI Corporate Office & CSIRO Griffith

Notes: * = Does not include 2,146ML environmental waterway diversions for DNR.

+ = Does not include 3,256ML State Water environmental flows through Roaches Escape.

A.2.2 (1) Diversions, volume

Table 2.2.c: Summary of Gross Diversions Main and Sturt Canal 2008/09

	Sturt (ML)	Main (ML)
August	2451	16810
September	1091	19939
October	3573	41874
November	1904	32358
December	5372	44466
January	6042	71112
February	4144	52810
March	3088	39751
April	2973	32223
May	305	10507
June	0	1180
TOTAL	**30,943**	**363,030**

Note: 30,943 + 363,030 ML = 393,973 ML

Table 2.2.d: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2008/09

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	4,215	16,714	2,435
September	2,008	19,440	3,780
October	4,357	40,176	4,529
November	2,251	29,213	6,768
December	5,560	42,607	5,310
January	7,444	69,207	5,029
February	5,410	51,256	3,690
March	3,845	38,988	3,335
April	4,708	29,133	7,560
May	839	9,954	1,480
June	-393	-406	84
Total 2008-09	40,244	346,282	44,000
Total 2007-08	25,437	304,601	33,332
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130
Total 1996-97	261,955	1,016,135	151,960

Notes:
Diversions shown in Table 2.2.d for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

Table 2.2.c shows the summary of gross diversion coming into our system at the two regulated sites at Narrandera and the Sturt Canal. The sum of these diversions are the Net Total Irrigation Diversions as shown in Table 2.2.e

Table 2.2.d shows the actual amounts of water going through each of the three main systems which make up the MIA&D:

1. the Main Canal System, which is primarily fed through the Narrandera Regulator
2. the Sturt Canal System, which is primarily fed through the Sturt Offtake
3. the Wah Wah System, which was primarily fed through Barren Box Storage & Wetland before the drought but now consist of mostly fresh water which entered the system through the Narrandera and Sturt regulators.

The total amount of water going through these three systems combined is greater than the Net Total Irrigation Diversions because of Murrumbidgee Irrigation's innovative re-use program. For details on which water is included in each of the systems, please refer to Table 2.2.d notes.

A.2.2 (2) Supply efficiency, storage levels

Supply efficiency

The table below shows the simple efficiency of the system to be 70.1%. This calculation shows the apparent loss to be 118 GL. The water balance in Section A.2.2 (5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

The improvement in simple efficiency is in line with increased diversions combined with management and operational changes implemented to minimise conveyance losses and improve efficiency. Without those initiatives, the simple efficiency would have been much lower.

Table 2.2.e: Simple efficiency of the system — 2001 to 2009

Parameter	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04	2002/03	2001/02
Diversions (ML)								
Sturt Canal	30943	21,266	60,280	233,388	145,728	174,150	176,488	229,155
Main Canal	363030	314,421	502,928	805,277	680,479	687,349	783,631	912,452
Less DNR Environmental Diversions	0	0	3,256	2,146				
NET TOTAL irrigation diversions	**393,973**	**335,687**	**559,952**	**1,036,519**	**826,207**	**861,499**	**960,119**	**1,141,607**
Sales (ML) - metered and unmetered	276,233	210,297	411,898	829,990	648,417	651,806	754,112	916,611
Conveyance (ML)	117,740	125,390	148,054	206,529	177,790	209,693	206,007	224,996
Simple Efficiency(%)	**70.1**	**62.6**	**73.6**	**80.1**	**78.5**	**75.7**	**78.5**	**80.3**

Source: MI Irrigation Services and Corporate Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100

Storage levels

Barren Box Storage

The Barren Box Storage and Wetland has transformed a degraded swampland into an efficient water storage facility which returns around 20,000ML of water per annum to the Snowy River. The storage comprises of three cells:
Active cell – storage capacity 24,500ML
Intermediate cell – storage capacity 4,500ML
Wetland cell covering 1650ha
All flows during the 2008/09 season were diverted to the Intermediate cell only and reuse downstream resulted in a reduced volume of 645ML over this period.

Table 2.2.f: Barren Box Storage Intermediate Cell 2008/09

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	1270	0	180	363	90	105	31	568	423	0	595	2215	5840
Outflow	0	1200	1450	1750	150	550	285	0	350	750	0	0	6485
Variation	1270	-1200	-1270	-1387	-60	-445	-254	568	73	-750	595	2215	-645

Note: Licensed Pumpers on BBS (DIPNR) = 71 ML 2008/09

Lake Wyangan

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. Murrumbidgee Irrigation attempts to regulate the Lakes' levels to satisfy the various demands to meet commercial irrigation, environmental and community objectives.

On the 19th November 2008, at the request of Griffith City Council, a deliberate diversion began flowing into the North Lake. The flows ceased on the 11th January 2009 with a total of 2000ML being recorded. A further 500ML was diverted in the month of March with no further flows being recorded for the season. Water for lake filling was underwritten by Griffith City Council's town entitlement following consultation with DWE staff as to whether this was appropriate. These flows were used for both environmental and recreational needs of the community. Opportunistic water was pulsed into the South Lake during the reporting period and utilised for irrigation purposes where possible. The volumes of both Lakes increased over the reporting period with the North Lake closing significantly higher than the same time last year.

The monthly figures relating to the volumes pumped by Murrumbidgee Irrigation from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.m in A.2.2(4), Drainage reuse. Table 2.2.g (below) provides 2008/09 monthly gauge heights (water depth) for the lakes.

Table 2.2.g: Gauge heights for South and North Lake Wyangan 2008/09

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.21	968	0.01	1007
Aug	1.19	952	0.02	1024
Sep	1.23	984	0.02	1024
Oct	1.24	992	0.02	1024
Nov	1.17	936	0.05	1075
Dec	1.19	952	0.56	1942
Jan	1.09	872	0.60	2010
Feb	1.19	952	0.53	1891
Mar	1.06	848	0.68	2146
Apr	1.10	880	0.61	2027
May	1.15	920	0.55	1925
Jun	1.28	1024	0.60	2010

Source: MI Irrigation Services
Gross Resources = Gauge height converted into estimated megalitres.

Yenda Storage

The figures in table 2.2.h. show the inflows and outflows at the Yenda En-route Storage. This storage is primarily used to compensate for differences between orders and diversions from the river. The yearly balance shows an increased storage volume of 234 ML over the 2008/09 season.

Table 2.2.h: Inflow and Outflow Yenda En-route Storage 2008-09

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow (ML)	160	335	290	342	584	503	952	431	535	647	272	773	5824
Outflow (ML)	120	120	305	475	488	580	861	478	353	782	750	278	5590
Variation (ML)	40	215	-15	-133	96	-77	91	-47	182	-135	-478	495	234

Bray's Dam Storage

The Bray's storage has the operational ability to capture and redistribute irrigation water that has been rejected after rainfall. Water can also be pumped from Mirrool Creek and reused in the irrigation network. Table 2.2i shows an increased volume of 2111ML over the 2008/09 season.

Table 2.2.i: Inflow and Outflow Brays Dam Storage 2008/09

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	705	45	394	329	1309	1169	790	735	1034	350	143	1498	8501
Outflow	0	1280	150	565	902	680	565	627	383	1037	201	0	6390
Variation	705	-1235	244	-236	407	489	225	108	651	-687	-58	1498	2111

A.2.2 (3) Drainage volumes and salt loads

Table 2.2.j: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	Site No.	Frequency	Type	X-Coordi-nates	Y-Coordi-nates
410167	BBOW	Barren Box Outfall Canal Wyvern	1	Continuous	EC, Flow	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	Continuous	EC, Flow	403257	6208333
410085	LMC	Little Mirrool Creek	3	Continuous	EC, Flow	422126	6192597
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	Continuous	EC, Flow	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	5	Continuous	EC, Flow	427479	6171449
410083	YMS	Yanco Main Southern Drain	6	Continuous	EC, Flow	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	Continuous	EC, Flow	444891	6165663
41010162	WS	Warburn Swamp	8	After trigger	EC, pH, NTU	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	Continuous	EC, Flow	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	10	After trigger	EC, pH, NTU	409886	6193089
41010990	BBST	*This site no longer exists, due to the construction of BBSW*					
41010896	LW6	Lake Wyangan Causeway	12	After trigger	EC, pH, NTU	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	After trigger	Pesticide	440983	6182501
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	15	When flowing	Pesticide EC	375673	6218725
	Other Sites Required for DWE Licence						
41010903	BBO	Barren Box Storage		After trigger	EC, pH, NTU	389236	6218183
41010978	WWO	Willow Dam		After trigger	EC, pH, NTU	392197	6216283
410164	BOD1	Channel 13 escape at the outfall channel Wyvern		Continuous	EC, Flow	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel		Continuous	EC, Flow	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek		Continuous	EC, Flow	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road		Continuous	EC, Flow	396994	6205386

All continuous sites are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated at least four times a year. All sites are visited monthly for routine maintenance by Thiess staff. Monthly field data is collected by MI staff using a Hydro-lab, collecting temperature, EC and pH.

This list is currently under review and is expected to change when the DECC and DWE licence have been renegotiated.

Table 2.2.k: Drainage Volumes (ML) – July 2008 to June 2009

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0	16810	19939	41874	32358	44466	71112	52810	39751	32223	10507	1180	**363030**
STUR**	**Monthly Total**	0	2451	1091	3573	1904	5372	6042	4144	3088	2973	305	0	**30943**
TOTAL														**393973**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	5.0R	4.9R	10	10.2R	14.9R	15.5R	19.6	22.4	19.9	14.8	7.2R	10.5R	13
	Median	2.5R	0.3R	8	9.0R	14.0R	13.5R	18.5	21.2	18	13.5	5.6R	4.9R	11
	Inst.Max	44.6R	28.7R	23.2	24.5R	56.4R	49.1R	39.8	39.4	40.1	36.5	27.4R	53.6R	56
	Inst.Min	0.4R	0.0R	4	1.9R	2.1R	2.1R	9.6	12.6	12.9	5.7	0.5R	2.0R	0
	Monthly Total	155R	153R	300	317R	447R	479R	607	626	618	444	223R	314R	**4683R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	240	525	740	545	580	1813	1453	1344	1356	604	0	9200
BYD (Bywash)**	**Monthly Total**	0.0	125	55	425	902	680	565	526	383	987	201	0	4849
MIRMCN (41010955)	**Mean**	63	53.8R	96.7	138	222	202	213	194	148	195	82.8	80.5	141
	Median	46.4	24.2R	86.3	101	234	207	207	191	143	206	43.5	61.1	122
	Inst.Max	258	241 R	315	361	449	433	315	396	226	320	213	229	449
	Inst.Min	23.3	0.3R	32.4	30.4	86.4	80.8	138	116	78.1	78.4	26.7	32.6	0
	Monthly Total	1954	1668R	2902	4270	6650	6254	6598	5446	4600	5840	2568	2416	**51170R**
DRAINS														
MDJWE (410174)	**Mean**	22.5	39	73.3	128	166 K	145 K	214	186	134 E	193	[71.5]	51.5	119
	Median	19.2	15.1	62.7	86.1	176 K	153 K	197	172	130 E	182	[38.3]	43.4	108
	Inst.Max	54.5	167	330	365	507 K	477 K	383	513	231 E	427	[243]	189	513
	Inst.Min	10.7	10.4	23.1	23.6	49.1K	37.3K	115	84	59.8E	57.1	[16.5]	19.8	10
	Monthly Total	699	1209	2200	3972	4968K	4506K	6637	5221	4152E	5792	[2003]	1546	**[42910]**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	[5.9]	[34.4]	[94.4]	53.2	152	95.8	61.9K	54.5K	43.7	195	53.4	9.1V	71
	Median	[4.8]	[7.9]	[55.6]	14.1	154	84.2	62.7K	46.8K	33.6	202	17.6	6.7V	40
	Inst.Max	[11.9]	[172]	[309]	172	175	152	89.2K	117 K	126	227	176	34.2V	309
	Inst.Min	[2.1]	[3.0]	[4.8]	0.8	96.7	55.6	30.3K	22.5K	0	152	0	0V	0
	Monthly Total	[176]	[860]	[2455]	1650	4549	2971	1919K	1526K	1354	5843	1654	272V	**[25230]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Monthly Total	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=	0=
GMSRR (41010921)	**Mean**	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.3R	0.7	0.2R	0.0R	0.0R	0.7R	0
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R	0.7	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	4.8R	0.5R	0.0R	2.1R	0.0R	14.5R	5.8	3.6R	0.0R	0.1R	37.1R	37
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	2R	0R	0R	1R	0R	9R	21	6R	0R	0R	20R	58R
LAG (41010940)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0]
ROCUDG (41010005)	**Mean**	5.5R	0.8R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	1
	Median	1.8R	0.9R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	71.2R	1.4R	0.7R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	71
	Inst.Min	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	170R	26R	1R	0R	0R	0R	0R	0R	0R	0R	0R	0R	197R
TOTAL														**197R**
SWAMPS														
WS**	**Monthly Total**	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	**0**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES FOR DNR														
WWO**t		0	70	180	363	90	75	31	568	423	0	595	2215	4610
BBpumps**#		0	1200	1450	1750	150	550	285	0	350	750	0	0	6485
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0=	0.1=	5.2=	0.0=	0	0	0	0	0	0	0	0	0
	Median	0.0=	0.0=	7.3=	0.0=	0	0	0	0	0	0	0	0	0
	Inst.Max	0.0=	3.3=	9.9=	0.0=	0	0	0	0	0	0	0	0	10
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0	0
	Monthly Total	0=	3=	155=	0=	0	0	0	0	0	0	0	0	**158=**

Monthly Flow Data (ML/d)														
Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	TOTAL
DCCUD (41010713)	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0.6	1
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	1	**1**
DCWIDG (41017001)	Mean	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Median	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Inst.Max	[0.1]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Inst.Min	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Monthly Total	[0]	0=	0=	0=	0=	0	0	0	0	0	0	0	**[1]**
DCCENT (410172)	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by THIESS SERVICES except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. 0 No flow recorded
3. [n] Incomplete data set due to missing data
4. R Rating table extrapolated
5. K Minor editing
6. ? Irregular data, use with caution
7. V Operational data (no field readings were obtained to confirm the data)
8. Z Medium editing
9. = Pool reading only, no flow condition
10. t Flows into BBS from Willow Dam
11. # Flows at BBS to the Outfall
12. Salt loads Thiess Services unless * where we have calculated them using the formula below
    Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000
    NARREG and STUR saltloads were calculated using the above formula, with the average EC calculated from mean monthly EC from the Murrumbidgee River at Wagga (http://waterinfo.nsw.gov.au/index.epl?site=410001)
13. ND Not Determined (due to a farm accident at this site the gauging station was completely destroyed)
14. LF Low flow conditions, not able to provide a reliable estimate

Drainage volumes to the Murrumbidgee River (ML)

Year	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
TOTAL	7,434	5,663	8,570	945	337	197

Sites highlighted in blue are sites that may drain back to the Murrumbidgee River. During the 2008/09 season, only the discharge from ROCUDG left the area.

Table 2.2.k shows the monthly total flow volumes from the Murrumbidgee River entering the Murrumbidgee Irrigation Area measured at our two regulated sites; Narrandera (NARREG) after diversion at the Berembed Weir and the Sturt Canal (STUR) after diversion at the Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- Little Mirrool Creek (LMC) - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- Bray's Dam (BYD) - Drainage diversion from LMC to the Benerembah Irrigation District.
- Mirrool Creek at McNamara Road (MIRMCN) - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- Main Drain J (MDJWE) - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- Barren Box Outfall Wyvern (BBOW) - Flows from Willow Dam, Barren Box and channel 13 escape discharging to Wah Wah Irrigation District.

There are four river channel wetland sites which potentially discharge to the Murrumbidgee River

- Yanco Main Southern (YMS) - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- Gogeldrie Main Southern (GMSRR) - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water gravitates into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- Gooragool Lagoon (LAG) - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by licensed customers.
- Cudgel Creek downstream from Cudgel Creek (ROCUDG) - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings, drainage re-use options as well as those decisions dealing with asset design, purpose and function.

During the 2008/09 year Murrumbidgee Irrigation diverted 393,973 ML of water from the Murrumbidgee River. This water contained approximately 26,053 tonnes of salt.

Of this salt load, approximately 2 tonnes (less than 0.01% of the imported salt load) were discharged into wetlands which are connected to the Murrumbidgee River in about 197 ML of drainage water (0.05% of diversions), which is again a record low.

The significant reduction in drainage back to the wetlands associated with the Murrumbidgee River is due to the low allocations which have led to reduced on-farm drainage as well as innovative solutions for drainage re-use.

As the Murrumbidgee Irrigation Area is essentially a closed system most of the salt that is imported into the area via supply water makes its way into our soils during irrigation activities. The equivalent of about one quarter of the imported salt is exported to the Wah Wah Irrigation District, which leaves about 20,000 tonnes in the area east of Barren Box. Due to the unprecedented drop in groundwater levels over the past seven years, our soils are no longer under the immediate threat of salinisation. Through irrigation and rainfall, salts are now able to leach out of the rootzone into the groundwater system and ultimately out of our area.

Murrumbidgee Irrigation currently funds a three-year CSIRO research project called “Hydro-ecological assessment of the MIA”. The aims of that project are to increase the understanding of our surface and groundwater systems, their connectivity and their connection to the regional ecology. As part of that study, the MIA will be divided into hydrologic zones which will each have a unique set of characteristics. Each zone will be managed and monitored accordingly. Another expected outcome of this study is a better understanding of salinity issues in each zone which will allow us to better and more specifically monitor and manage soil salinity. Detailed salt and water balances will also be compiled.

Table 2.2.I: Salt Loads (Tonnes) – July 2008 to June 2009

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0	1914	1416	3561	1301	2265	3433	1895	2692	4045	1319	138	**23982**
STUR**	**Monthly Total**	0	279	77	304	77	274	292	149	209	373	38	0	**2072**
TOTAL														**26053**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	1.8R	[2.0]	3.7	3.4R	5.1R	4.8R	5.4	3.4	[2.2]	1.7	3.2R	3.5R	3
	Median	1.2R	[0.3]	3.5	3.1R	5.1R	3.8R	4.9	2.7	[1.9]	1.5	2.3R	1.9R	3
	Inst.Max	18.6R	[12.1]	9.5	8.9R	14.6R	18.5R	14.2	8.8	[5.9]	4.9	10.6R	28.1R	28
	Inst.Min	0.3R	[0.0]	1.0	1.2R	1.0R	0.6R	2.5	1.3	[1.1]	0.6	0.4R	0.7R	0
	Monthly Total	57R	[49]	112.0	107R	153R	150R	169.0	95.0	[67]	52.0	99R	104R	**[1214]**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	36	169	238	175	110	367	136	136	217	97	0	**1679**
BYD (Bywash)**	**Monthly Total**	0	19	18	136	290	129	114	49	39	158	32	0	**983**
MIRMCN(41010955)	**Mean**	12.6	11.2R	18.5	[25.0]	32.8K	25.0K	22.6	18.7	12.7	24.9	14.5	19.6	20
	Median	11.5	7.1R	14.9	[21.9]	32.5K	25.2K	21.6	19.0	12.9	26.5	9.2	15.8	17
	Inst.Max	27.9	40.2R	77.9	[61.2]	73.2K	56.1K	33.2	39.3	17.1	42.3	36.3	48.2	78
	Inst.Min	6.0	0.1R	6.7	[6.8]	16.7K	11.6K	15.7	11.3	7.2	11.9	5.6	8.7	0
	Monthly Total	389.0	348R	556.0	[701]	983K	775K	700.0	523.0	392.0	748.0	450.0	587.0	**[7151]**
DRAINS														
MDJWE (410174)	**Mean**	9.7?	11.2?	15.3?	22.6	25.7K	15.7K	24.2	25.8	14.5E	31.9	[9.7]	15.9Z	19
	Median	9.2?	7.3?	13.2?	16.7	22.4K	13.8K	23.1	22.8	14.6E	32.7	[8.2]	15.2Z	15
	Inst.Max	29.8?	34.6?	67.6?	62.7	87.2K	77.0K	55.8	80.5	41.4E	73.5	[29.6]	41.4Z	87
	Inst.Min	4.3?	2.9?	6.4?	5.8	10.2K	2.6K	4.1	9.8	2.2E	2	[1.9]	7.4Z	2
	Monthly Total	302?	346?	460?	701	771K	487K	749	724	449E	956	[223]	478Z	**[6648]**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	[1.5]	[8.6]	[22.1]	10.6	[23.5]	[12.0]	6.8K	6.2K	4.5	26.2	8.0K	[2.4]	11
	Median	[1.3]	[1.9]	[11.3]	3.9	[22.0]	[11.5]	6.8K	5.5K	3.7	27.5	3.1K	[1.9]	5
	Inst.Max	[8.4]	[53.8]	[88.1]	44.8	[43.3]	[26.9]	18.0K	24.2K	15.5	38.8	35.0K	[15.4]	88
	Inst.Min	[0.0]	[0.0]	[0]	0	[14.6]	[2.2]	0K	0K	0	0	0K	[0]	0
	Monthly Total	[45]	[216]	[575]	330	[376]	[313]	211K	175K	138	786	249K	[66]	**[3481]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0=	0.0=	[0.0]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Median	0.0=	0.0=	[0.0]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Max	0.0=	0.0=	[0.0]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Inst.Min	0.0=	0.0=	[0.0]	[0.0]	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0
	Monthly Total	0=	0=	[0]	[0]	0=	0=	0=	0=	0=	0=	0=	0=	[0]
GMSRR (41010921)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0	0.0R	0.0R	0.0R	0.1R	0
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	2.0R	0.1R	0.0R	0.2R	0.0R	3.6R	0.4	0.3R	0.0R	0.0R	12.5R	13
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	1R	0R	0R	0R	0R	1R	1	0R	0R	0R	4R	7R
LAG (41010940)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	0R	0R	0R	0R	[0]	[0]	0R	0R	0R	0R	0R	[0]
ROCUDG (41010005)	**Mean**	0.5R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Median	0.2R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	6.7R	0.1R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	7
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	16R	3R	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	19R
TOTAL														**19R**
SWAMPS														
WS**	**Monthly Total**	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	**0**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES FOR DNR														
WWO**t	**Monthly Total**	0	22	56	113	16	1	6	56	42	0	59	218	**588**
BBO**#	**Monthly Total**	0	366	442	533	46	69	35	0	37	144	0	0	**1670**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0=	0.0K	1.2=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0K	0.0K	0.0=	0.0=	0
	Median	0.0=	0.0K	1.7=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0K	0.0K	0.0=	0.0=	0
	Inst.Max	0.0=	2.6K	3.1=	0.1=	0.0=	0.0=	0.0=	0.0=	0.0K	0.0K	0.0=	0.0=	3
	Inst.Min	0.0=	0.0K	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0K	0.0K	0.0=	0.0=	0
	Monthly Total	0=	1K	38=	0=	0=	0=	0=	0=	0K	0K	0=	0=	**38K**

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0.2	0
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**
DCWIDG (41017001)	**Mean**	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Median	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Inst.Max	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Inst.Min	[0.0]	0.0=	0.0=	0.0=	0.0=	0	0	0	0	0	0	0	0
	Monthly Total	[0]	0=	0=	0=	0=	0	0	0	0	0	0	0	**[0]**
DCCENT (410172)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	0	**0**
BID2 (41010717)**	**Monthly Total**	0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	**0**

Sources: *Thiess Services and MI Irrigation Services*
Notes: See Table 2.2.k. pages 18-19.

A.2.2 (4) Drainage reuse

Murrumbidgee Irrigation has continued to actively pursue recovery and use of water from its drainage systems. Table 2.2m provides information on reuse quantities. It needs to be noted that much of the historically reported quantities in this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites.

Due to the pending review of the water balance and its supporting tables, especially considering the emerging reporting requirements under the National Water Initiative, it has been agreed to continue to include this table (mostly unaltered) for this reporting year.

Table 2.2.m: Reuse quantities (ML) for the MIA and Districts 2008/09

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Bray's Dam Diversion to Benerembah	0	240	525	740	545	580	1813	1453	1344	1356	604	0	**9,200**
Mirrool Creek Licensed Diverters (DNR)	0	216	108	685	319	626	841	511	133	29	5	0	**3,473**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek to Wah Wah Main	0	1235	2330	2779	6618	4760	4744	3690	2985	6810	1480	50	**37,481**
Barren Box Storage to Wah Wah Main @ BBS Pumps	0	1200	1450	1750	150	550	285	0	350	750	0	0	**6,485**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage Licensed Diverters (DNR)	0	0	71	0	0	0	0	0	0	0	0	0	**71**
Losses in Barren Box Storage	0	-1683	1056	68	-6	-381	-214	-52	-433	376	49	-333	**-1,553**
Sub Total	**0**	**1208**	**5540**	**6022**	**7626**	**6135**	**7469**	**5602**	**4379**	**9321**	**2138**	**-283**	**55,157**
Less: First Use Water Diversions	0	310	499	1903	2965	1977	1830	1473	659	2933	1031	1106	**16,686**
Plus: Lake Wyangan Pumps to Lake View Canal	0	64	15	112	0	41	71	42	150	29	0	0	**524**
TOTAL WATER CAPTURED	**0**	**962**	**5056**	**4231**	**4661**	**4199**	**5710**	**4171**	**3870**	**6417**	**1107**	**-1389**	**38,995**

Source: Irrigation Services

A.2.2 (5) Water balance loss and gain

Table 2.2.n: Annual Water Balance Assessment MIA system (Gigalitres) 2008/09

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	Bench-mark	Median	Comment
Climatic														
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	400	361	CSIRO data
Evaporation **(mm)**	1868	1750	1896	2032	2191	1998	1983	1935	2182	2127	2166	1869	2012	CSIRO data
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	50	65	Look up table
Main Gross Data														
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	336	394	1154	820	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	276	952	639	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	118	202	181	(3)=(1)-(2)
Apparent Efficiency **(%)**	79	79	82	80	79	76	78	80	74	63	70	82	76	= (2)/(1)*100
Inevitable Real Losses														
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	35	19	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	29	25	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	81	118	98	Inevitable Losses
System Flow Losses														
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	33	10	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	48	5	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	0	81	15	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**199**	113	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	133	89	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**332**	202	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	130	21	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows														
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	160	104	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9		18	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0		4	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	67	5	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	227	130	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	260	140	(9)=(4)+(8)
Reconciliation														
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	1	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-20	-7	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	227	130	(12)=(8)-(10)
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	318	396	1264	834	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	57	9	(14)=(7)/(12)*100
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**84**	85	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10		0.50	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19		0.55	

Comments provided by the Department of Water & Energy suggested a simplification of Table 2.2.n. Storage volume changes are included for Barren Box and Lake Wyangan. The variation in en-route storages at Yenda and Bray's dam are minimal in comparison to the figures quoted in the table (gigalitres), Mirrool Creek Floodway releases are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions. As explained later in this chapter, Murrumbidgee Irrigation has chosen not to amend the Water Balance format until a national format is decided upon.

In 2008/09 irrigation diversions from the Murrumbidgee River were 394 GL with 276 GL being recorded deliveries (sales). This left an apparent loss of 118 GL which meant that Murrumbidgee Irrigation's *apparent* operational efficiency was approximately 70%.

Of that loss, the *true loss* was estimated at about 81 GL. This included losses due to channel seepage and evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 39 GL, using the standard formula of 14% of deliveries. The total losses are estimated at 120 GL, while the apparent loss was 118 GL. This means that 2 GL of water has not been accounted for. This is most likely due to the very low general security allocations this season which are unprecedented and therefore are not properly accounted for in this water balance exercise.

A comparison of the benchmark year and the current year show that the system efficiency is 80%, which is 4% lower than the benchmark of 84%. This is a good performance for Murrumbidgee Irrigation when taking into account the very low diversions into our system.

It was expected that through the NWI, a more realistic water balance method would be introduced. However, this has not happened and in order to maintain consistency between reporting years, it was decided to once again use the method of previous years.

The Bureau of Meteorology has now been charged with the preparation of a Pilot National Water Account. Murrumbidgee Irrigation is working with the Bureau by providing data under the Water Information program. The Murrumbidgee Irrigation Area has been chosen as a pilot region, which means that additional data has been requested.

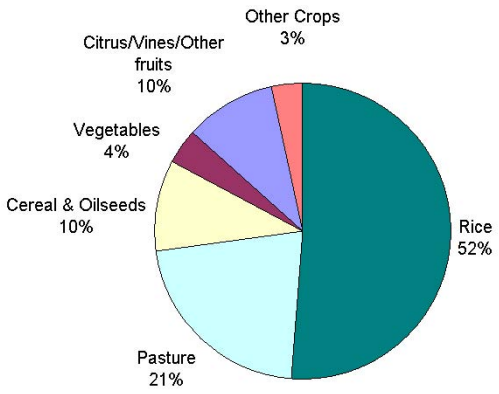
A.2.2 (6) Crop statistics

Irrigated Crop Statistics

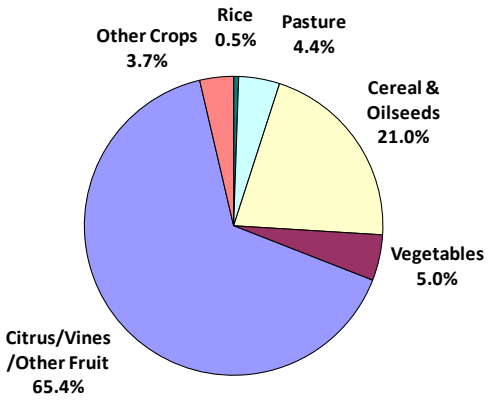
The following charts show the distribution of crops grown this year in comparison to last year (2007/08) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries to rice cropping, a reflection of the 8% increase in general security allocation and guaranteed higher prices per tonne on offer. Water deliveries to cereal and oilseed were similar to the previous year and greater than that of the baseline year. The shift in water distribution with the majority of deliveries supplied to Citrus, Vines and Other Crops is again due to the continuance of low general security allocation which prohibited many of our irrigators from growing a summer crop. Other crops such as plantations have decreased slightly from last season.

Figure 2.2.b: Distribution of irrigated crops – 1995/96, 2007/08 and 2008/09 Comparison of crop type by percentage of megalitres delivered.

Baseline year 1995/96



2007/08



2008/09

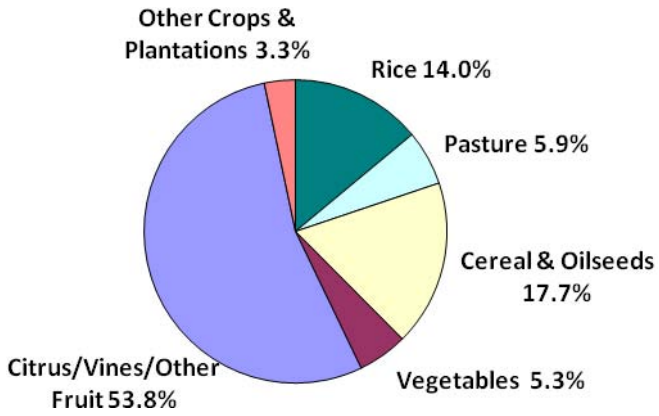


Table 2.2.o: Historical Deliveries to Major Crop Types

Year	Rice		Pasture		Cereal and Oil Seeds	
	Total (ML)	Rice % of Total	Total (ML)	Pasture % of Total	Total (ML)	Cereal/Oil Seeds % of Total
2008/09	**34,450**	**14.0**	**14,447**	**5.9**	**43,688**	**17.7**
2007/08	1,006	0.5	8,218	4.3	39,538	20.7
2006/07	41,296	10.8	23,419	6.1	149,441	39.1
2005/06	355,254	45.4	65,878	8.4	181,641	23.2
2004/05	101,494	16.7	77,364	12.8	247,267	40.8
2003/04	221,732	34.6	63,960	10.0	182,940	28.6
2002/03	251,424	34.3	64,093	8.8	237,612	32.5
2001/02	469,513	52.0	85,556	9.5	184,253	20.4
2000/01	479,757	56.0	112,668	13.1	108,690	12.7
1999/00	394,224	61.2	54,159	8.4	68,366	10.6
1998/99	477,563	58.1	101,791	12.4	65,231	7.9
1997/98	489,363	50.1	179,246	18.3	126,247	12.9
1996/97	519,053	51.0	187,441	18.4	143,746	14.1
1995/96	446,917	51.4	185,931	21.4	87,725	10.1

Year	Vegetables		Citrus + Vines+ Other Fruits		Other Crops + Plantations	
	Total (ML)	Vegetable % of Total	Total (ML)	Citrus/Vines/Other % of Total	Total (ML)	Other % of Total
2008/09	**13,108**	**5.3**	**132,721**	**53.8**	**8,168**	**3.3**
2007/08	9,191	4.8	123,510	64.8	9,274	4.9
2006/07	15,577	4.1	138,234	36.2	13,834	3.6
2005/06	27,588	3.5	142,025	18.2	9,481	1.2
2004/05	22,736	3.7	150,601	24.8	7,078	1.2
2003/04	16,504	2.6	132,866	20.7	22,519	3.5
2002/03	14,970	2.0	138,929	19.0	24,983	3.4
2001/02	17,989	2.0	122,884	13.6	23,403	2.6
2000/01	18,794	2.2	98,285	11.5	39,262	4.6
1999/00	12,013	1.9	75,108	11.7	40,060	6.2
1998/99	24,967	3.0	105,522	12.8	47,504	5.8
1997/98	19,714	2.0	115,200	11.8	47,176	4.8
1996/97	23,464	2.3	104,561	10.3	40,461	4.0
1995/96	32,348	3.7	87,983	10.1	28,905	3.3

Source: Irrigation Services, Griffith.

Table 2.2.p: Summary of deliveries and areas for the major crop groupings during 2007/08

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)	Net Crop Evapotranspiration (ML/ha)
VINES	19,243	76,811	4.0	n/a
WINTER CEREALS	16,794	30,130	1.8	n/a
CITRUS	8,216	44,186	5.4	n/a
WINTER OILSEEDS	3,700	5,654	1.5	n/a
WINTER PASTURES	2,478	6,414	2.6	n/a
OTHER FRUITS	2,538	11,724	n/a	n/a
OTHER CROPS	1,176	7,875	n/a	n/a
VEGETABLES	2,453	13,108	5.3	n/a
STOCK & DOMESTIC	1,024	12,005	n/a	n/a
SUMMER PASTURES	2,000	8,033	4.0	n/a
BULK TOWN SUPPLY	5	14,009	n/a	n/a
SUMMER CEREALS	833	6,404	7.7	n/a
PLANTATION	481	293	0.6	n/a
RICE	2,779	34,450	12.4	12.2
INDUSTRIAL	40	3,637	n/a	n/a
SUMMER OILSEEDS	455	1,500	3.3	n/a
TOTAL		**276,233**		

Source: All figures provided by MI Irrigation Services, except for crop evapotranspiration figures, the rice net crop evapotranspiration was calculated using monthly weather data. In previous years, rice area (ha) and water use figures have been derived from Rice Environmental Monitoring database. This year, due to the drought, DWE has allowed MI to amend the Rice Environmental monitoring (REM) program and irrigation services has provided rice area (ha).

Notes: N/A = Not available due to data collection method.

- These figures do not include water for stock and domestic, industry, town supply and BBS surplus flows.
- Note: The rice figure provided does not consider soil moisture utilised by subsequent cereal crops planted into rice stubble. Cereal crops that do not follow a rice crop often require more irrigations, resulting in higher water use for these crops.

A.2.3 Chemical contingency

Murrumbidgee Irrigation works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

During the 2008/09 season the DECC gave approval to Murrumbidgee Irrigation to continue trialing a new risk-based water quality program.

As part of this new program, the MIA has been divided into sub-catchments. Each sub-catchment went through a risk assessment process. Based on the perceived risk of each sub-catchment and certain predefined triggers (discharge at licensed sites, blue-green algae levels at storages, rainfall and reported pollution incidents) water quality monitoring is carried out.

The program consists of two components.

Benchmark sampling

Benchmark sampling is used to assess the quality of water within the system at specified times throughout the season. Benchmarking occurs at the start, middle and end of season creating an overall quality trend. Benchmarking samples are analysed for physical parameters, pesticides

and EC. Results are used to internally benchmark water quality throughout the season and identify quality trends within our supply and drainage system under the varying range of operating conditions. The benchmark sampling also provides additional information for further sampling that takes place throughout the season.

Routine Site Inspections

Routine site inspections are be conducted to assist in managing risks. Conducting routine inspections assists in identifying high risk areas prior to a trigger or reported event (e.g. algal blooms, illegal discharge etc). It allows flexibility in monitoring operations throughout the season and will assist in streamlining compliance related activities. As a minimum routine site inspections will occur on a monthly basis. Any pollution incidences arising from such inspections will follow the Reported Pollution Incident format of assessment.

Scheduled chemicals

Table 2.3.q shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the Department of Environment and Climate Change.

Table 2.3.q: Scheduled chemicals in Murrumbidgee Irrigation's screening program

Chemical	Environmental Guidelines (ug/L)	Notification Level (ug/L)	Action Level (ug/L)
Atrazine	2	**13**	**45**
Chlorpyrifos	0.001	**0.01**	**0.11**
Diazinon	0.0006	**0.01**	**0.2**
Diuron	8	**1**	**5**
Endosulfan	0.01	**0.03**	**0.2**
Malathion	0.07	**0.05**	**0.2**
Metolachlor	8	**0.02**	**0.1**
Molinate	2.5	**3.4**	**14**
Simazine	10	**3.2**	**11**
Thiobencarb	1	**2.8**	**4.6**
Trifluralin	0.1	**2.6**	**4.4**

Source: Department of Environment and Climate Change

Chemical Contingency Plan for MIA

As part of the new water quality monitoring program, Murrumbidgee Irrigation has developed a Water Quality Risk Management Framework. The framework is developed so that potential threats to the MIA & D can be identified and managed before they develop into a problem. This reduced the reliability on slow laboratory tests which was the main concern with the previous program. A summary of the new framework is provided below.

Framework	Description
Drainage Catchments within MIA	Drainage sub-catchments across the system identified to allow MI to identify, monitor, and manage risks to WQ.
↓	
Drainage Catchment Risk Profiling	Provide an overall risk profile for the MIA and identify key areas of higher risk.
↓	
Trigger	Triggers include; rainfall >25mm in 24hr, Reported Pollution Incident (RPI), farm drainage, discharge out of MIA, prolonged dry weather, other.
↓	
Risk assessment	Risk assessment conducted on site to determine course of action
↓	
Action	Appropriate action taken eg sampling, further investigations, and/or follow up.
↓	
Report/analysis/corrective action	Data analysis, internal reporting and corrective action

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the Department of Environment and Climate Change (DECC) within twenty-four (24) hours once the sampling results have been received by Murrumbidgee Irrigation.

2. Notify DNR within 24 hours of the results affecting the river sites once the sampling results have been received by Murrumbidgee Irrigation.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be

issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if Action Levels are exceeded at sites identified by Murrumbidgee Irrigation as re-supply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

Response to DECC direction:

In the event that a DECC direction is received to restrict the discharge by an irrigator of irrigation waste water to the company drainage works, the company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.
2. Refuse to or discontinue the supply of water to the irrigator.
3. Undertake works to prevent the continuance of the problem.
4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 Groundwater Management

A.3.2 Reporting requirements

The following groundwater information was derived from Ary Van der Lely's report "*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas*. Annual Report 2009".

A.3.2 (1) Groundwater monitoring and analysis

The groundwater conditions for September 2008 and the changes since baseline year 1996 and September 2007 are summarised in Table 3.2.a.

*Table 3.2.a: Average depth to the watertable at September 2008 compared to 2007 and baseline year 1996 **

Area	2008 Deep Aquifer	2007 Deep Aquifer	1996 Deep Aquifer	2008 Shallow Aquifer	2007 Shallow Aquifer	1996 Shallow Aquifer
MIA u/s BBS	9.23	8.43	4.4	5.18	4.53	1.88

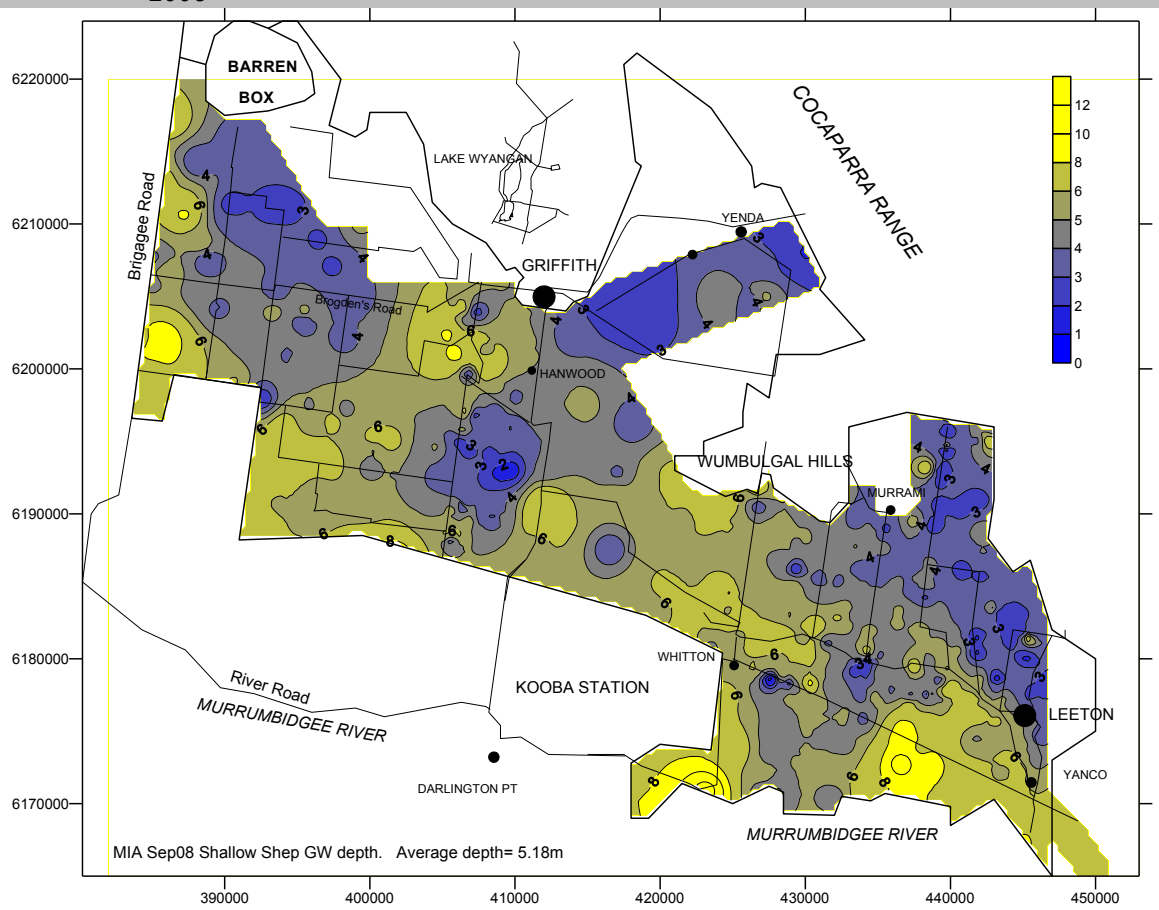
Note: * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable in metres.

Table 3.2.a shows a continuing drop in water table levels since the baseline year of 1996, to the extent that the proportion of land with groundwater within 2 metres has dropped from over 70% before 2000 to less than 1% by September 2008. This drop is expected to be due to the continued lower than average general security allocation levels as well as reduced rainfall of the past seven years. The average depth to the water table is now at a record low. The implementation of MIA EnviroWise programs will also have had an impact on the lowering of watertables.

The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. High groundwater levels within two metres were almost non-existent and confined to small areas near Mirrool Creek in Mirrool and in the Yanco district, possibly related to channel seepage locations. The highest groundwater areas generally are in the Koonadan area north-west of Leeton, and around Yoogali and Yenda. Even in these areas they have retreated to between 2 and 3 metres depth.

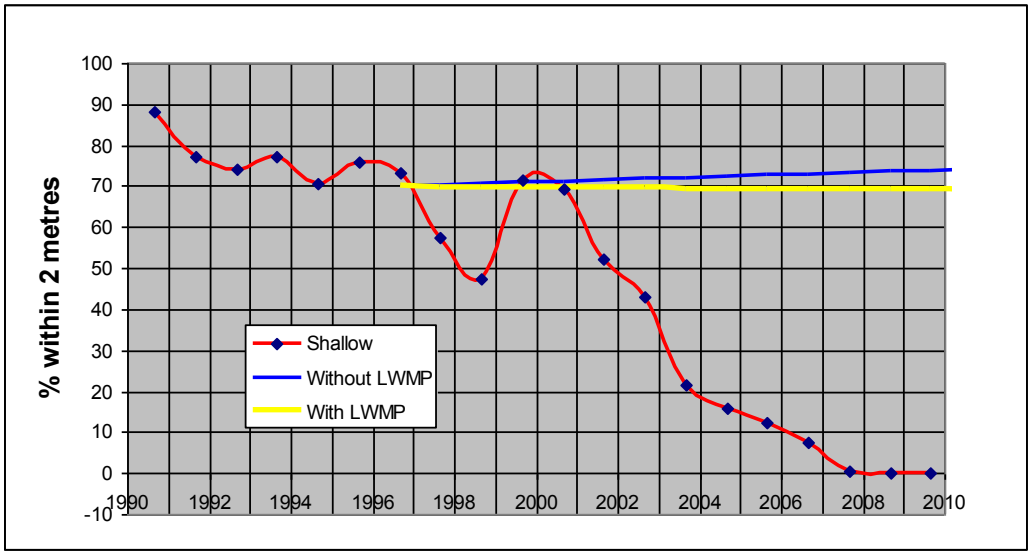
The small pockets of high groundwater in Northern Benerembah are related to a depressed prior stream site, a soil ridge formation with down slope seepage and probably some channel seepage spots.

Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable). September 2008



The percentage of areas within 2 metres from the surface compared to the Land and Water Management Plan 'Without Plan' and 'With Plan' scenarios are shown at Figure 3.2.b.

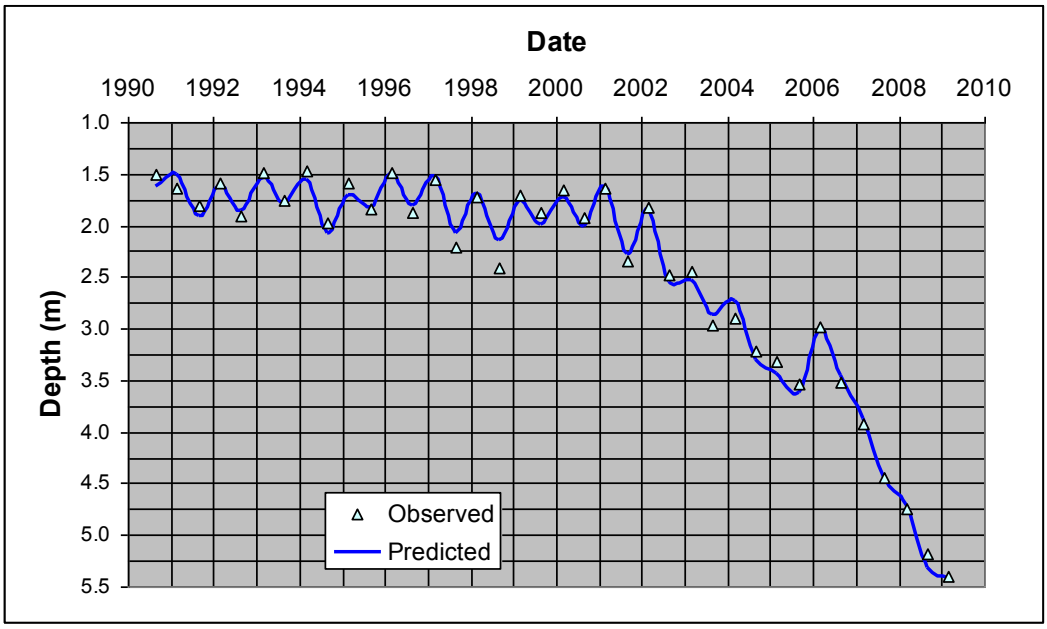
Figure 3.2.b: Area with watertable within 2 metres, September 1990 to 2008 relative to LWMP assessment benchmarks (which commenced 1997)



There has been a significant reduction in the percentage of areas with groundwater within two metres from the surface, from over 70% in the early 1990's to 7.6% September 2006 and less than 1% in 2007, 2008 and 2009. It is clear from Figure 3.2.b that the groundwater predictions developed as part of the Land and Water Management Plan are no longer relevant given the changes to groundwater levels due to reduced allocations and the on-going drought. As a result a clearer understanding of the impacts on groundwater from irrigation and climate is required and this is the subject of research being undertaken by CSIRO Land and Water in conjunction with Murrumbidgee Irrigation. The results of which will provide a more realistic benchmark.

Figure 3.2.c shows the observed data of average groundwater depths in the MIA versus the predicted values based on the model coefficients.

Figure 3.2.c: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



The model used to produce these predictions, can also be used to analyse various scenarios likely to occur in the future. More work is being undertaken, in conjunction with CSIRO Land & Water, to refine these predictions and ultimately to assist in the management of the MIA & D.

The conclusions of the groundwater report are:

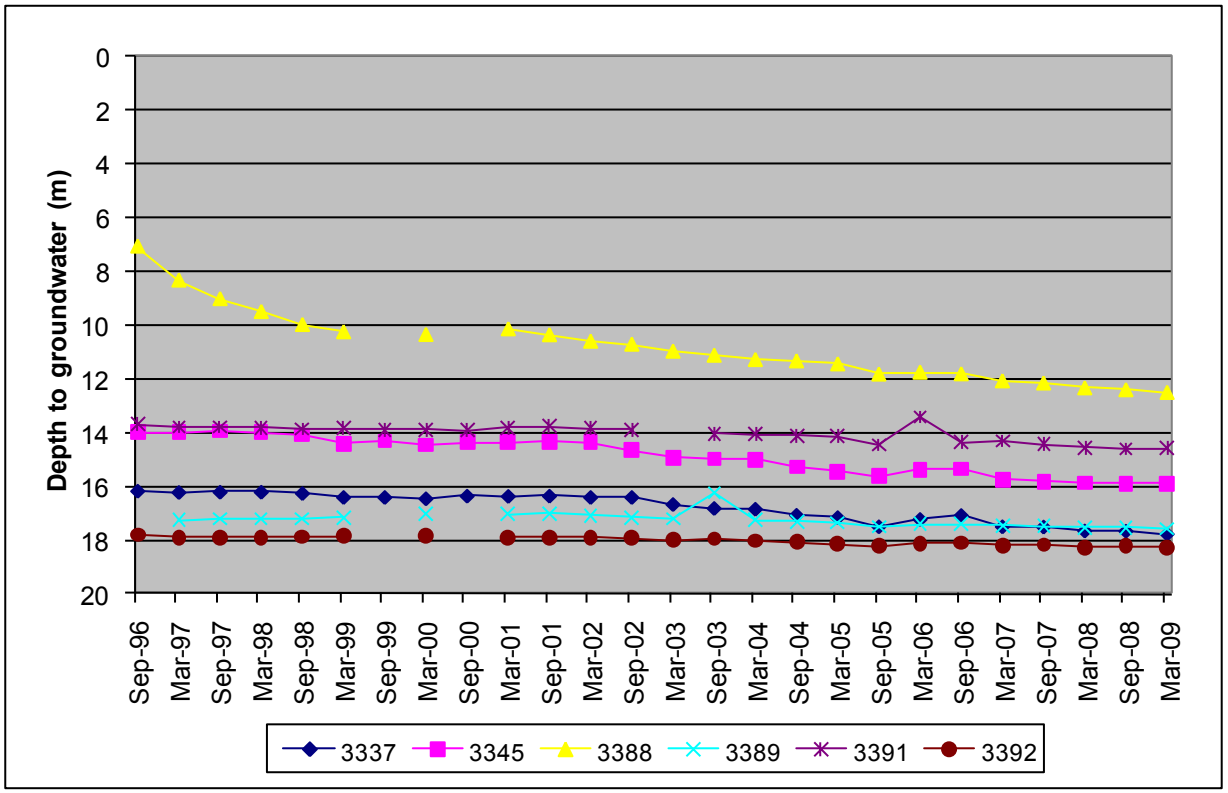
- LWMP targets have been met but they need to be reviewed.
- Net groundwater accessions have been significantly less than average during 2008/09.
- The area and distribution figures for watertable levels within 2 metres from the surface are at an all-time low.
- The pressure levels in the deep aquifer are at an all-time low, and questions regarding sustainability of current groundwater pumping rates remain.

It was concluded there are no groundwater management issues coming forth from the 2008/09 data set.

A.3.2 (2) Wah Wah groundwater and Mirrool Creek flooding

In respect to the Lower Mirrool Creek Floodway, Figure 3.2.d shows that most piezometers have shown small declines in groundwater levels since 1996 apart from Bore 3345 which shows a drop of over five metres since 1996. There have been no flood events in the Lower Mirrool Creek since the early 1990's.

Figure 3.2.d: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway



A.3.2 (3) Groundwater volumes and salt loads extracted from tile drains and pump sites

Tubewells

There are 15 tubewells installed in the MIA by previous Government Departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a steady decrease in discharge volume and salt load since the 1997-98 season. The total discharge volume during the 2008/09 season was about 73% of the previous season, while the salt load was about 76% which means that the salinity levels of the discharge have remained at similar levels.

Table 3.2.b: Groundwater volumes and salt loads extracted from tubewells

Name	2008/09 Discharge (ML/year)	2008/09 Salt Load (T/year)	2007/08 Discharge (ML/year)	2007/08 Salt Load (T/year)	1997/98 Discharge (ML/year)	1997/98 Salt Load (T/year)
Five Bridges	659	423	707	489	1,059	1,016
Gil Gil	276	366	266	353	631	1,231
Yanco West	309	408	305	404	821	1,232
South Leeton	0	0	76	118	1,325	2,067
Baulch's	16	7	137	52	694	541
Wamoon	4	2	384	200	945	681
East Wamoon	668	361	778	454	-	-
TOTAL	**1,933**	**1,568**	**2,653**	**2,071**	**5,475**	**6,768**

Source: MI Electrical Services, MI Environmental Services

Tile Drains

At present there are 19 flow meters attached to tile drainage outlet pipes in the MIA, this is one less than last year as one of the metered tile drainage pumps was taken out. The sites are assessed every six months for volume of flow and annually a sample of the discharge is measured for electric conductivity. During the 2008-2009 season, the total volume pumped from nine sites was 76 ML, which is lower than last year. In total 101 tonnes of salt was discharged, this is the same proportional decrease as the volume which indicates that the salinity of the tile drainage water has remained unchanged compared to last season. At the remaining ten sites there was no discharge recorded.

The discharge from both the tubewells and the tile drains enters MI's drainage system and is therefore accounted for in the drainage volumes and salt load tables in section A2.

A.3.2 (4) Groundwater accession control targets and rice environmental monitoring

Groundwater accession control target

The continuing severe seasonal conditions lead to another year of low rice acreage in the MIA & D. A licence variation was submitted to and approved by the Department of Water & Energy.

The agreed amendments for the 2008/2009 season were the same as for 2007/08 and are as follows:

When the water allocation on the 1st of October 2008 is below 40%:

- Crop water use statistics will be assessed using records provided by landholders and the information contained in the Company's irrigation management system.
- All landholders growing rice will be automatically allowed a tolerance of 10% or 10 hectares whichever is the greater in accordance with the Rice Growing Policy.
- No area penalty breaches or water use penalty breaches will be implemented.

The reduced summer cropping activity in conjunction with low winter rainfall has meant that the observed groundwater level has continued to drop during the 2008/09 season, as shown in figure 3.2.c.

Rice water use and rice growing practices

Due to the low summer cropping activity in the MIA & D, no aerial photos were taken. Assessments of areas and water use were based on information provided by growers during the placement of water orders as well as field observations by MI staff. See table 2.2.p (page 28) for cropping area and water use details.

Murrumbidgee Irrigation supported a NSW Department of Primary Industries initiated project to run trials involving delaying the application of permanent water to rice in the Murrumbidgee Irrigation Area, to save on water use while maintaining reasonable yields.

Table 3.2.c: Summary of historic rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)										
Irrigation Area or District	**Total Rice Area (ha) 2008/09**	**Total Water to Rice (ML) 2008/09**	**'08/09**	**'07/08**	**'06/07**	**'05/06**	**'04/05**	**'03/04**	**'02/03**	**'01/02**	**'00/01**	**'99/00**	**'98/99**
Yanco	536	7450.30	13.9	N/A	N/A	12.6	13.1	13.3	14.1	12	11.2	11.3	11.3
Mirrool	1236	15453.40	12.5	N/A	N/A	12.7	12.9	13.2	14	12.3	11.2	10.6	12.6
Benerembah	902	10855.00	12.0	N/A	N/A	12.9	12.8	13.3	14	13.1	11.1	10.4	15.3
Tabbita	N/A	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3	10.7	15.9
Wah Wah	20	401.50	20.6	N/A	N/A	14	11.9	12.4	14.4	14.3	13.7	11.8	14.6
Kooba *	N/A	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*	*	*
Total/average	2694	34160	12.7	N/A	N/A	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**	**10.9**	**12.9**
Target			**16.3**	N/A	N/A	15.3	15	15	17.3	15.3	14.2	13.2	15.4

Sources: MI Irrigation and Environmental Services
Note: * Kooba's rice water use was previously calculated as part of Mirrool.

Estimated Groundwater Accessions

During 2008/09 the irrigation volumes were more than the previous season, but less than for 2006/07. Rainfall from July to October 2008 was 92.8mm (63% of the long term average). This, combined with groundwater pumping caused groundwater levels to continue to drop for September 2008. The minimal irrigation during the 2007/08 summer and lower than average summer rainfall resulted in a further drop in groundwater levels for March 2009.

Rice growing policy

The "Rice Growing Policy 2007/2008", was adopted without amendments for the 2008/09 season. This document has been forwarded to the Department of Water & Energy in electronic format.

A.3.2 (5) Groundwater data format

A copy of "*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas. Annual Report 2009"* has been forwarded to the Department of Water & Energy in electronic format.

A.3.2 (6) Groundwater data reliably captured

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by Murrumbidgee Irrigation staff during March and September each year. The statistics for piezometers read during September 2008, March 2009, and three earlier dates are summarised in Table 3.2.g.

Table 3.2.d: Availability of piezometer readings for various dates and categories of piezometers.

Type of Piezometer	***Listed in Database***	***Read Sep96***	***Read Sep00***	***Read Sep08***	***Read Mar09***
Shallow (*1)	417	465	459	449	441
Shallow (WW)	30	22	23	11	11
Total Shallow	***447***	***487***	***482***	***460***	***452***
Deep (*2)	359	363	362	355	352
Deep >35m	19	28	28	24	24
Deep (WW)(*3)	35	44	43	37	36
Total Deep	***413***	***391***	***390***	***379***	***376***

*1. Piezometers in aquifers within 12 metres and in aquifers 12-18m which behave as if in the shallow zone
*2. Aquifers 12 – 35 metres, all piezometers not categorised as "shallow"
*3 . Wah Wah piezometers are part of the totals for "shallow" or "deep", not to be double counted.

Despite a number of piezometers becoming lost over time, especially in the 2000 to 2004 period, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

Figure 3.2.I shows that there is a considerable variation in coverage across the area. In the Wah Wah District there is a lack of piezometer sites. The same applies for the Lake Wyangan area. Piezometers are also lacking in areas of the MIA where there are no underlying sands, such as in parts of the Yenda area. This situation varies for the deep and shallow piezometer sets.

Most deep piezometers in Wah Wah have not been levelled, with the consequence that it is not possible to determine an AHD ([1]) groundwater contour map for that area.

The bi-monthly reading list used since 1995 has 108 piezometers, of which about 101 have been visited and read during the 2008/09 year. This is well in excess of the license requirement (60). Murrumbidgee Irrigation has maintained this higher than necessary degree of monitoring to assist the calibration and development of an integrated groundwater model for the MIA.

[1] AHD = metres above sea level.

A.3 Groundwater Management

Groundwater was last sampled for salinity during 2002 and this has been reported (Murrumbidgee Irrigation report by van der Lely, January 2003).

A.3.2 (7) Groundwater data analysis

The Department of Water & Energy did not make a request for information this year.

A.3.2 (8) Groundwater contamination

There were no known, or reported, groundwater pollution events during 2008/09.

A.3.2 (9) Groundwater — annual monitoring schedule

Table 3.2.h: Groundwater monitoring schedule – as required by DNR

No	Type	Description	Depth (metres)	Frequency	Location	
					Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.a	33
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.b	41
3	Map	Depth to pressure level	70-125	annual	Figure 3.2.c	42
4	Map	AHD of pressure level	12-35	annual	Figure 3.2.d	42
5	Map	Change in pressure level	5-12	annual	Figure 3.2.e	43
6	Map	Change in pressure level	12-35	annual	Figure 3.2.f	43
7	Map	Change in pressure level	70-125	annual	Figure 3.2.g	44
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.h	45-46
11	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.h	45-46
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.e	47-48
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.e	47-48
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.i	49
16	Map	Groundwater sub-districts	-	annual	Figure 3.2.j	50

Notes * "*It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable*." Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ There are not enough piezometers in the West Hanwood and Wah Wah areas to produce reliable hydrographs.

The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

Figure 3.2.b: MIA September 2008 – Depth to pressure level 12-35 metres

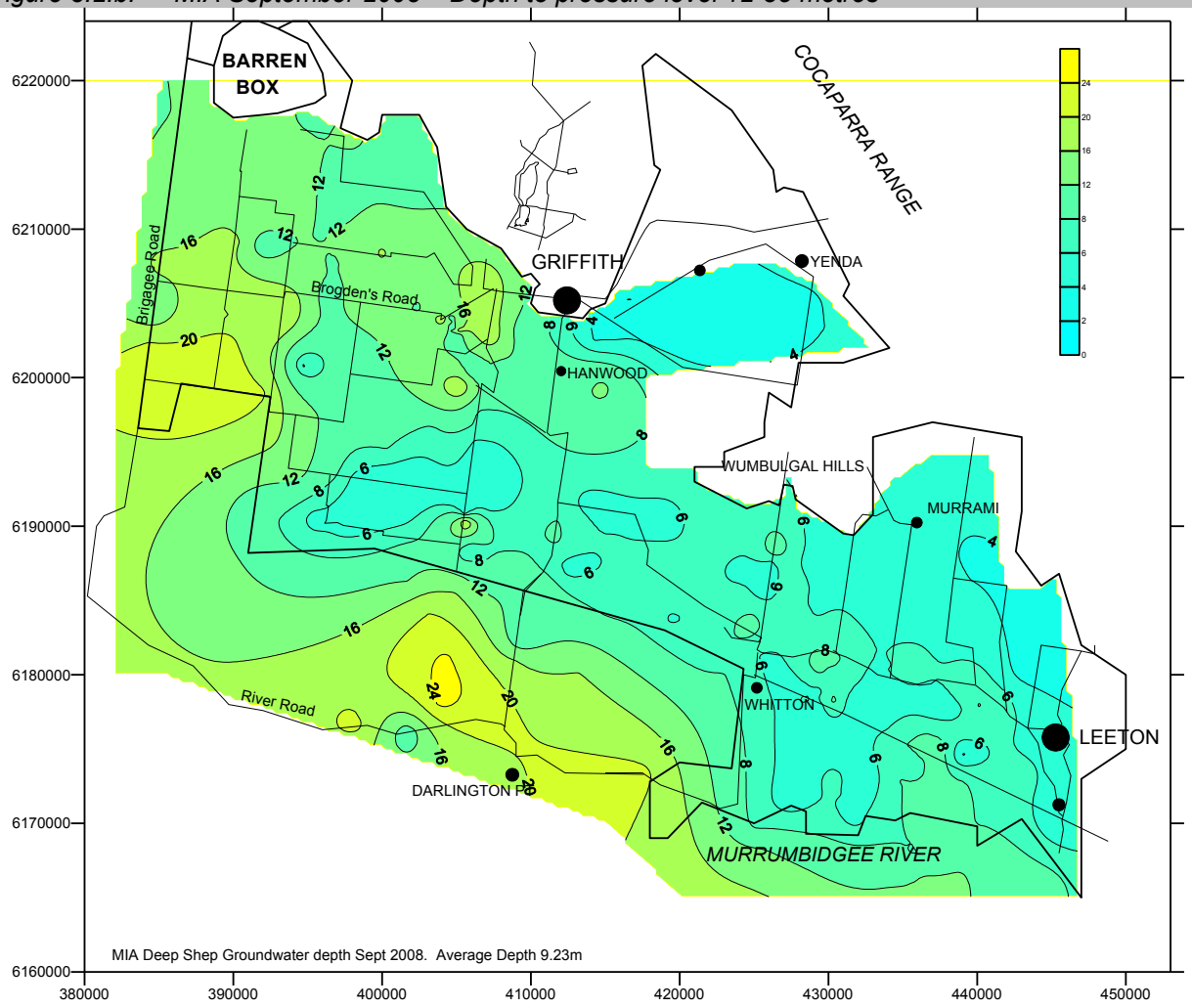


Figure 3.2.c: MIA September 2008 – Depth to pressure level 70-125 metres

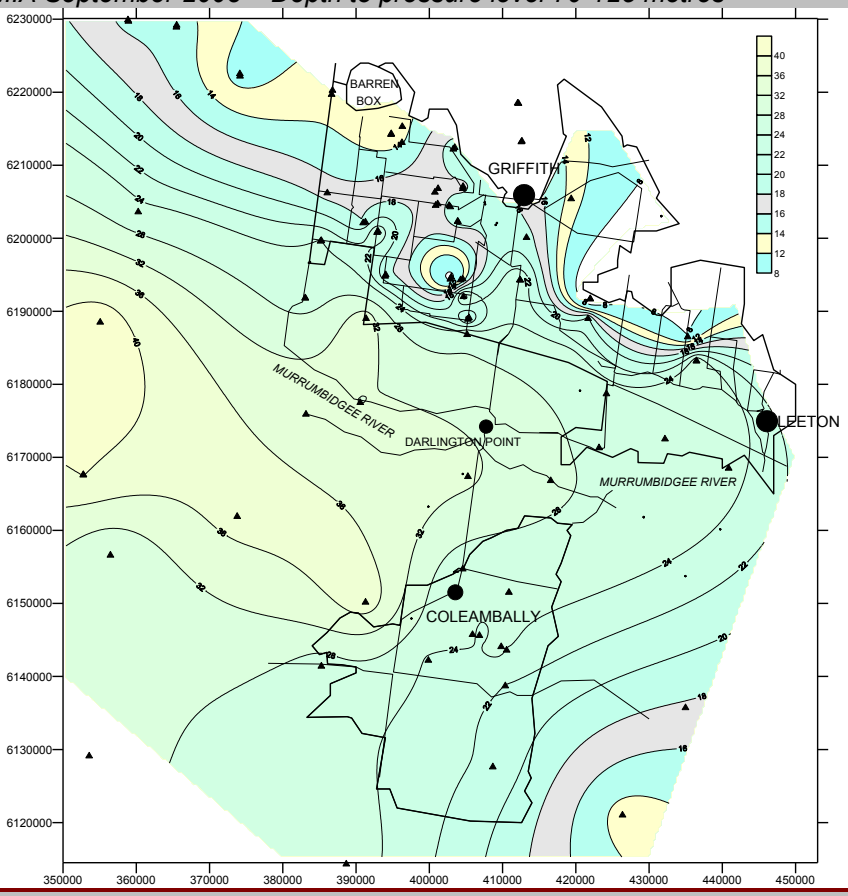


Figure 3.2.d: MIA September 2008 – AHD of pressure level 12-35 metres

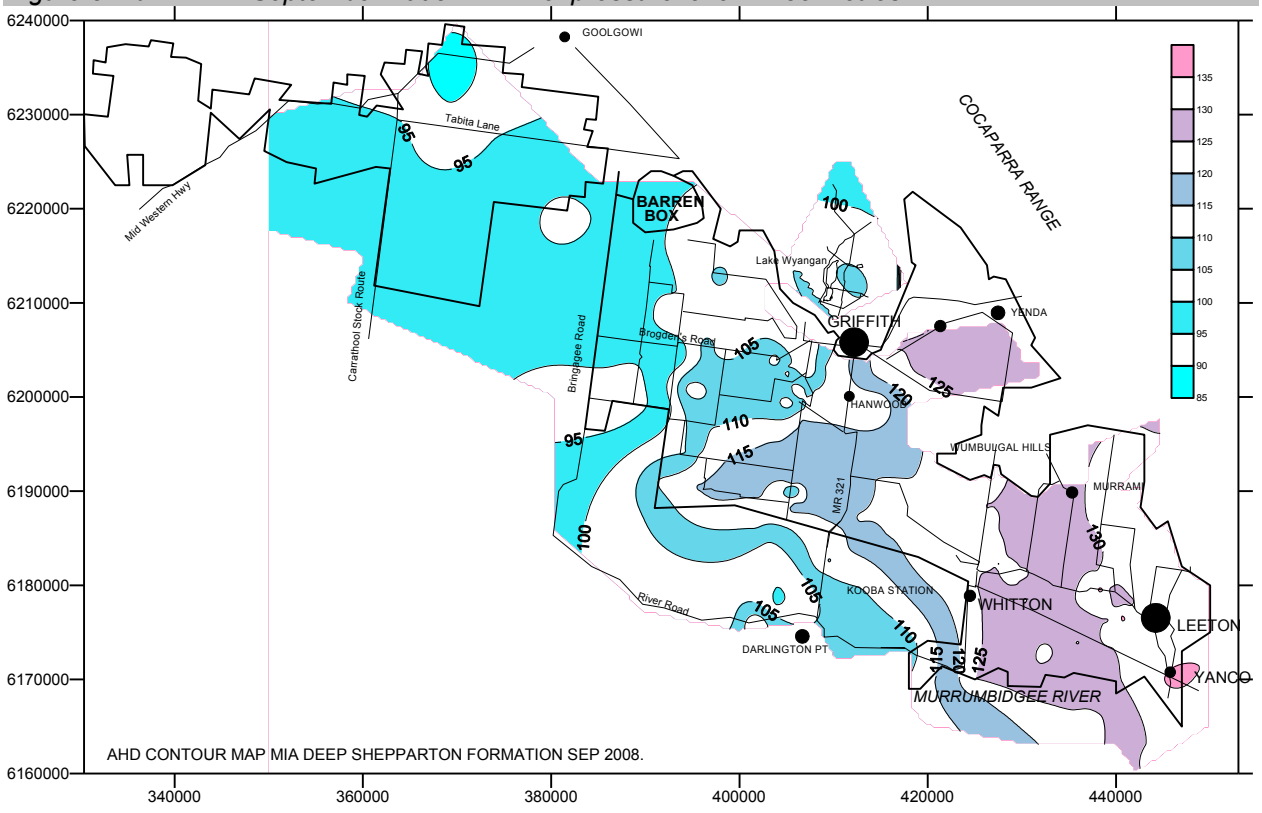


Figure 3.2.e: MIA 2001-2008 – change in pressure level 5-12 metres

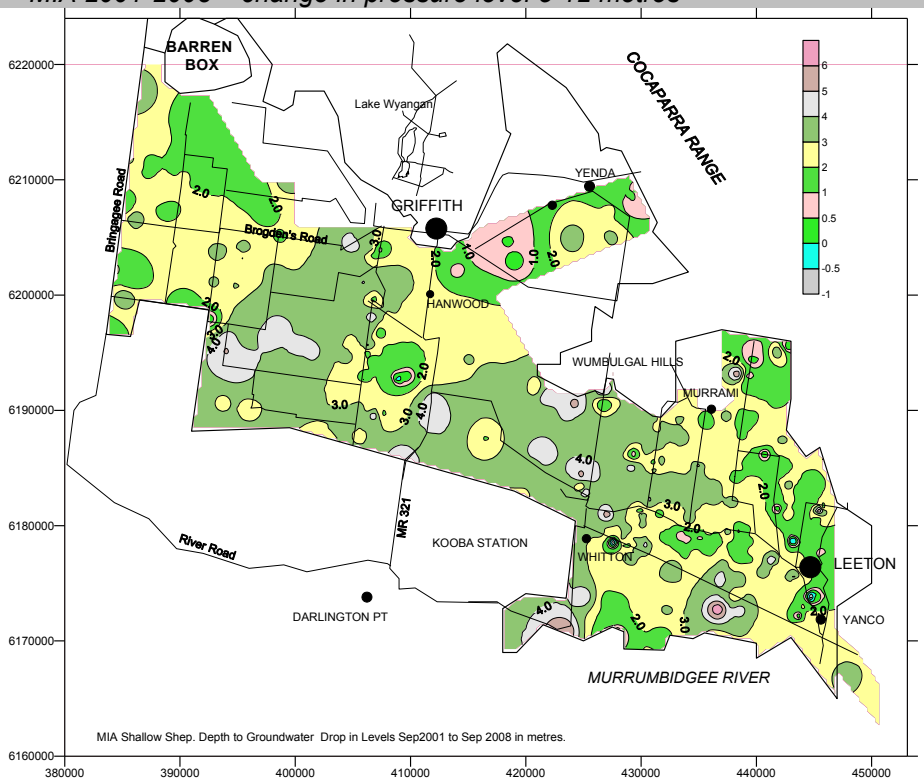


Figure 3.2.f: MIA 2001-2008 – change in pressure level 12-35 metres

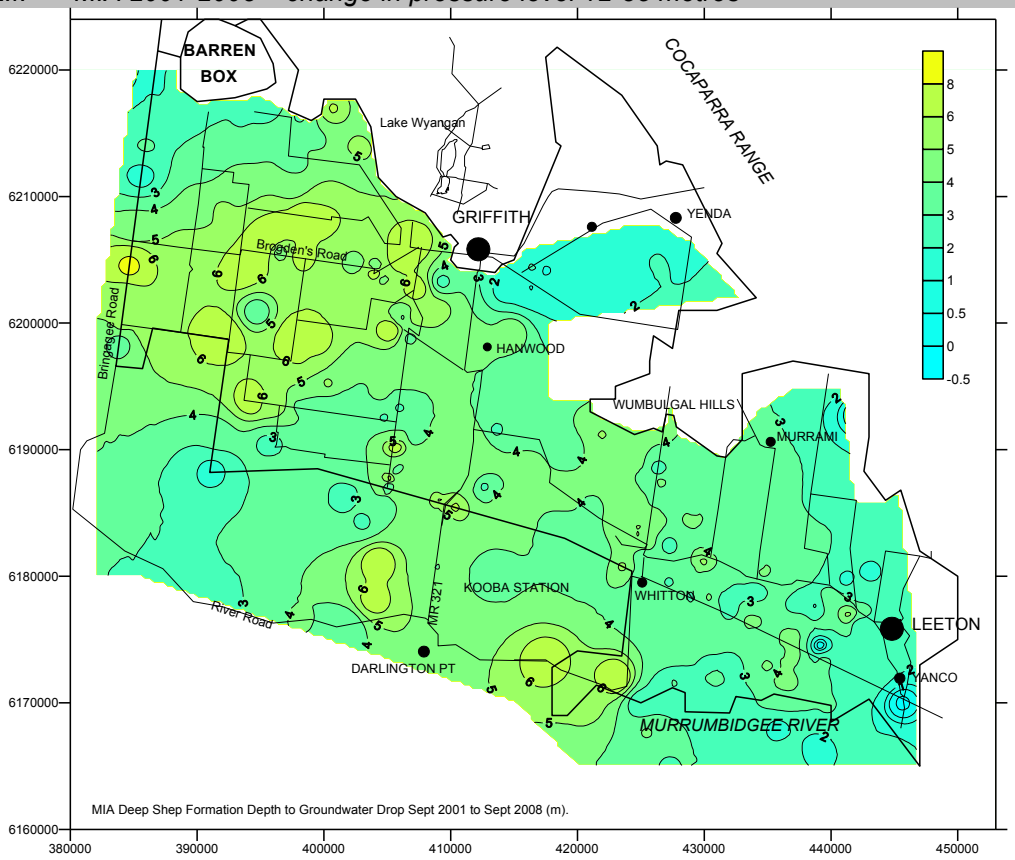


Figure 3.2.g: MIA 2001-2008 – change in pressure level 70-125 metres

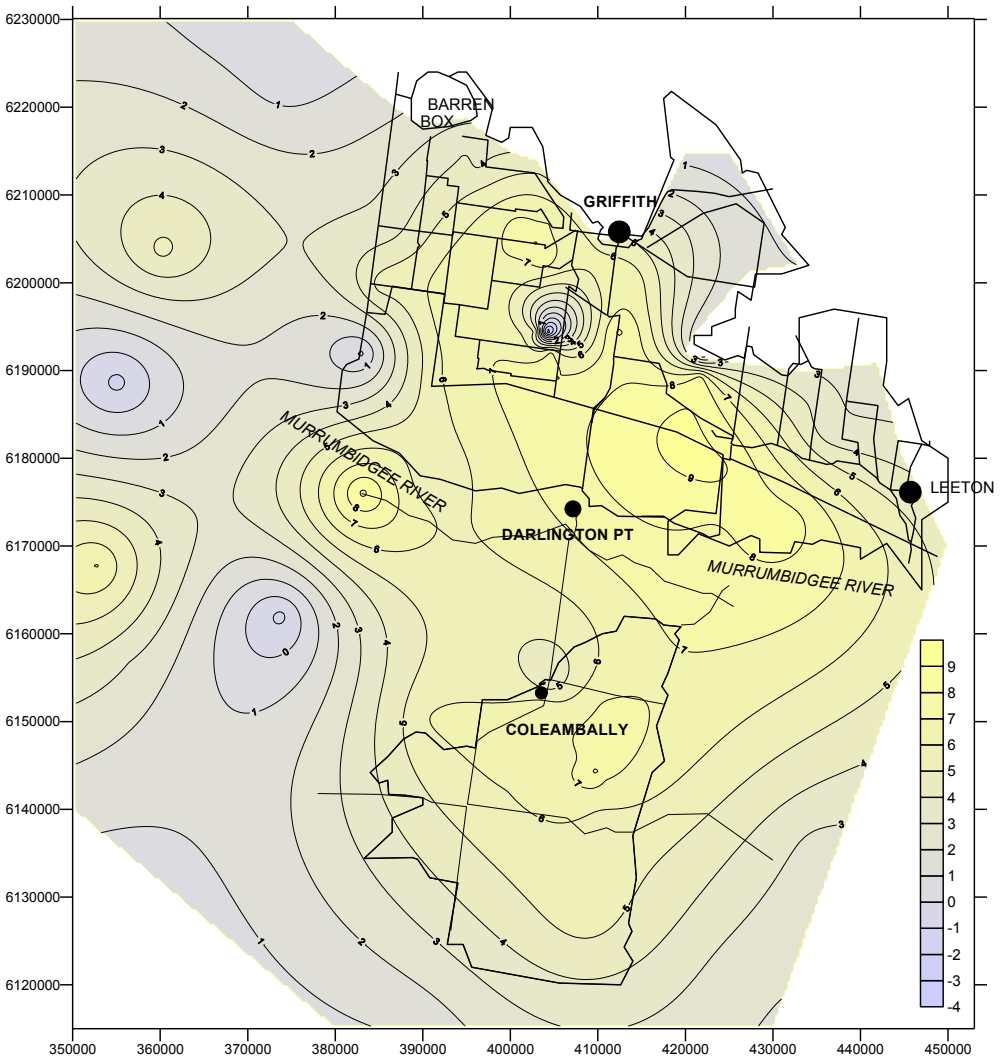


Figure 3.2.h: MIA March and September 1996 to 2009 - Average seasonal behaviour of 6 of 8 sub-districts

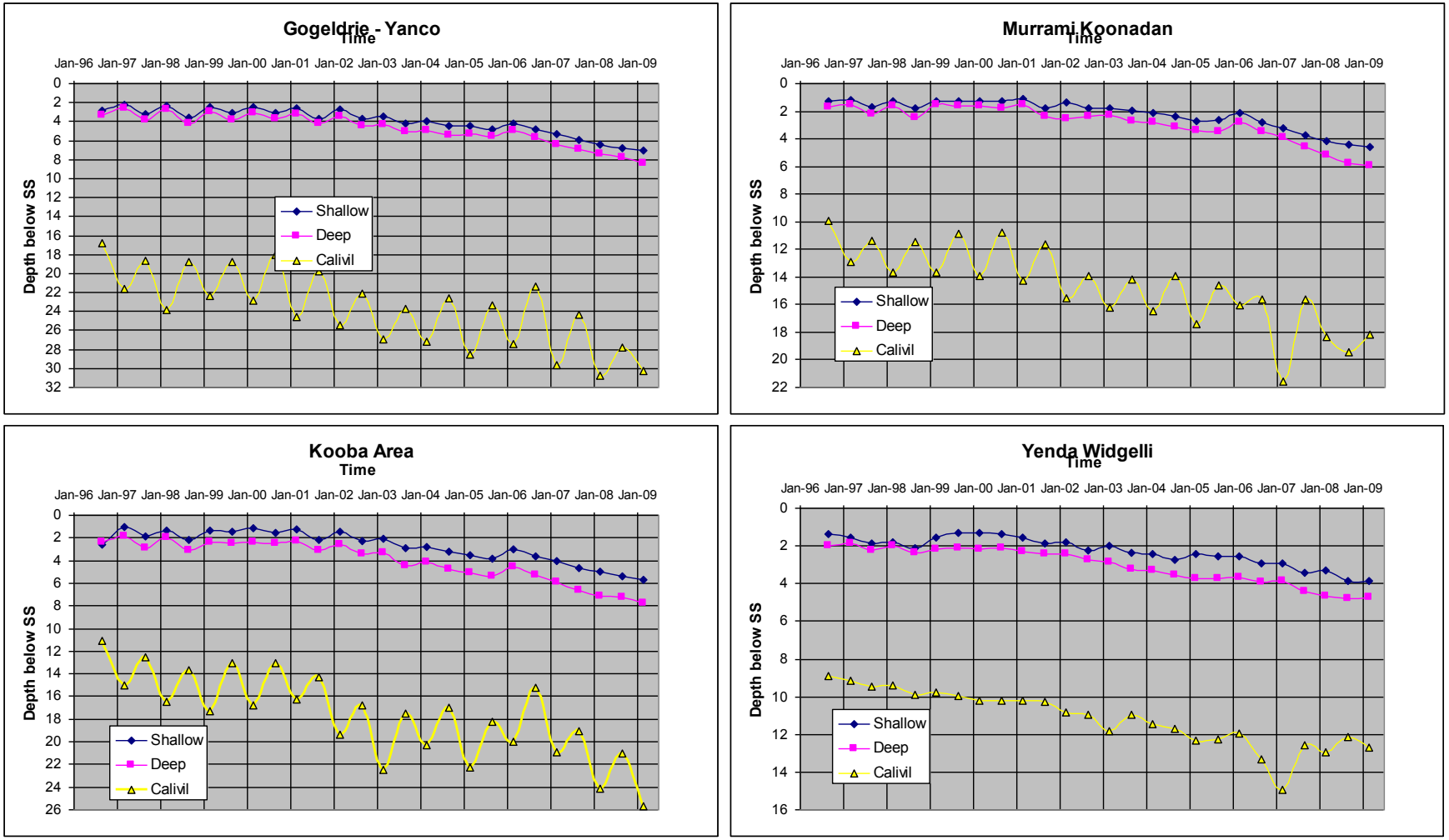
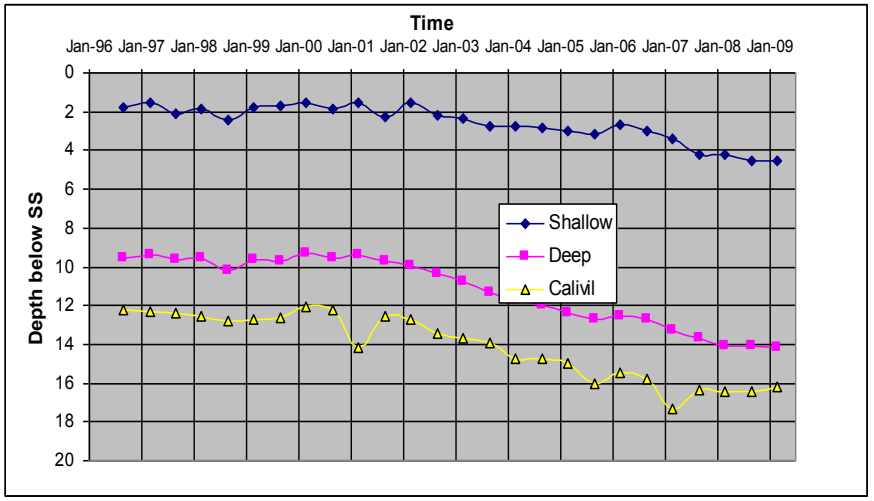
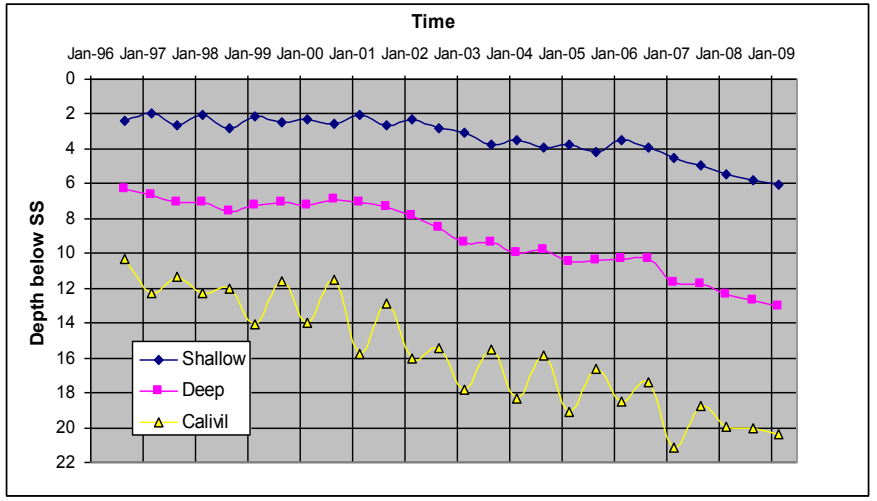


Figure 3.2.h: MIA March and September 1996 to 2009 - Average seasonal behaviour of 6 of 8 sub-districts - continued

North Benerembah



South Benerembah



In previous Licence Compliance and Annual Environmental Reports, the bi-monthly groundwater monitoring data was used to produce the graphs showing average seasonal behaviour, see Figure 3.2.i. These graphs were compiled as an average hydrograph of the few piezometers (usually 3 to 8) in each sub-district. These average hydrographs therefore did not represent the individual sites, nor were they a true sub-district average. However, they did show seasonal trends. It was concluded that sub-district seasonal groundwater behaviour is better represented by averages as calculated from gridding and contouring, and as last year, that has again been used in this report. There are not enough piezometers in place to provide meaningful graphs for the Hanwood and Wah Wah districts.

All graphs show a steady decline in water table levels and pressure levels in the two shallowest aquifers. Seasonal variation is most clearly shown in the Calivil formation.

Table 3.2.e: Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35 metres) aquifers, September 1996 - 2008, and historic trend in areas within 2 metres. Figures taken from 'Groundwater Conditions and Behaviour in the MIA, Ary van der Lely, 2009'.

North Benerembah										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	12	10	1	0	0	0	0	0	0	0
within 2 metre	76	74	69	28	19	12	0	1	0	0
within 3 metre	94	93	90	75	68	72	12	16	10	6
within 4 metre	99	100	97	91	84	89	69	69	59	46
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 2 metre	0	0	0	0	0	0	0	0	0	0
within 4 metre	0	0	0	0	0	0	0	0	0	0
within 6 metre	17	13	7	0	0	0	0	0	0	0
within 8 metre	47	46	28	4	4	3	0	0	0	0
South Benerembah										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	37	12	1	0	0	0	0	0	0	0
within 2 metre	68	56	39	3	5	2	0	0	0	0
within 3 metre	83	78	71	42	29	39	1	0	0	0
within 4 metre	89	88	87	69	63	68	31	18	7	3
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 2 metre	13	12	8	0	0	0	0	0	0	0
within 4 metre	34	32	23	15	8	13	6	2	0	0
within 6 metre	61	57	42	31	27	27	19	16	13	10
within 8 metre	75	71	62	49	43	45	33	28	26	24
Kooba										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	17	24	2	0	0	0	0	0	0	0
within 2 metre	87	84	44	10	3	6	1	1	1	1
within 3 metre	99	98	86	57	23	27	10	7	4	2
within 4 metre	100	100	98	87	68	75	34	29	17	14
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	3	1	0	0	0	0	0	0	0	0
within 2 metre	53	53	11	1	0	0	0	0	0	0
within 3 metre	86	83	64	8	1	3	0	0	0	0
within 4 metre	97	93	85	49	18	18	1	0	0	0

Note: There is not enough information to create reliable figures for West Hanwood and Wah Wah.

Yenda/Bilbul										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	33	24	0	0	2	0	0	0	0	0
within 2 metre	97	98	39	19	36	17	0	2	0	0
within 3 metre	100	100	100	89	88	70	51	53	25	3
within 4 metre	100	100	100	100	99	99	94	88	70	65
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	16	22	1	0	0	0	0	0	0	0
within 2 metre	74	73	60	23	19	11	0	1	0	2
within 3 metre	86	84	77	69	61	59	38	27	18	28*
within 4 metre	93	90	85	80	78	75	70	67	67	67*
Murrami/Koonadan										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	40	44	46	2	1	0	0	0	0	0
within 2 metre	91	90	78	50	32	19	1	1	0	1
within 3 metre	99	100	96	85	78	76	27	17	10	10
within 4 metre	100	100	100	97	96	95	71	59	49	40
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	14	18	1	0	0	0	0	0	0	0
within 2 metre	76	72	53	12	6	1	0	0	0	0
within 3 metre	99	97	82	59	50	47	10	4	0	0
within 4 metre	100	100	99	89	77	81	39	21	8	17
Gogeldrie/Yanco										
Shallow	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	0	1	0	1	0	0	0	0	0	0
within 2 metre	31	27	12	4	1	1	0	0	0	0
within 3 metre	62	56	44	31	20	13	2	1	1	0
within 4 metre	95	82	68	50	43	44	12	7	3	2
Deep	**Sep 96**	**Sep 00**	**Sep 02**	**Sep 04**	**Sep 05**	**Sep 06**	**Sep 07**	**Mar 08**	**Sep 08**	**Mar 09**
within 1 metre	1	2	0	0	0	0	0	0	0	0
within 2 metre	27	23	5	1	0	0	0	0	0	0
within 3 metre	58	48	37	13	9	7	1	1	0	0
within 4 metre	87	73	61	36	37	36	3	3	0	0

*The data for this area is not accurate because of the small number of piezometers available for monitoring. During drilling operations (decades ago) sands were found within 20-30 metres from the surface at only a small number of locations, hence the small number of piezometers.

Figure 3.2.i: Groundwater piezometers currently being read

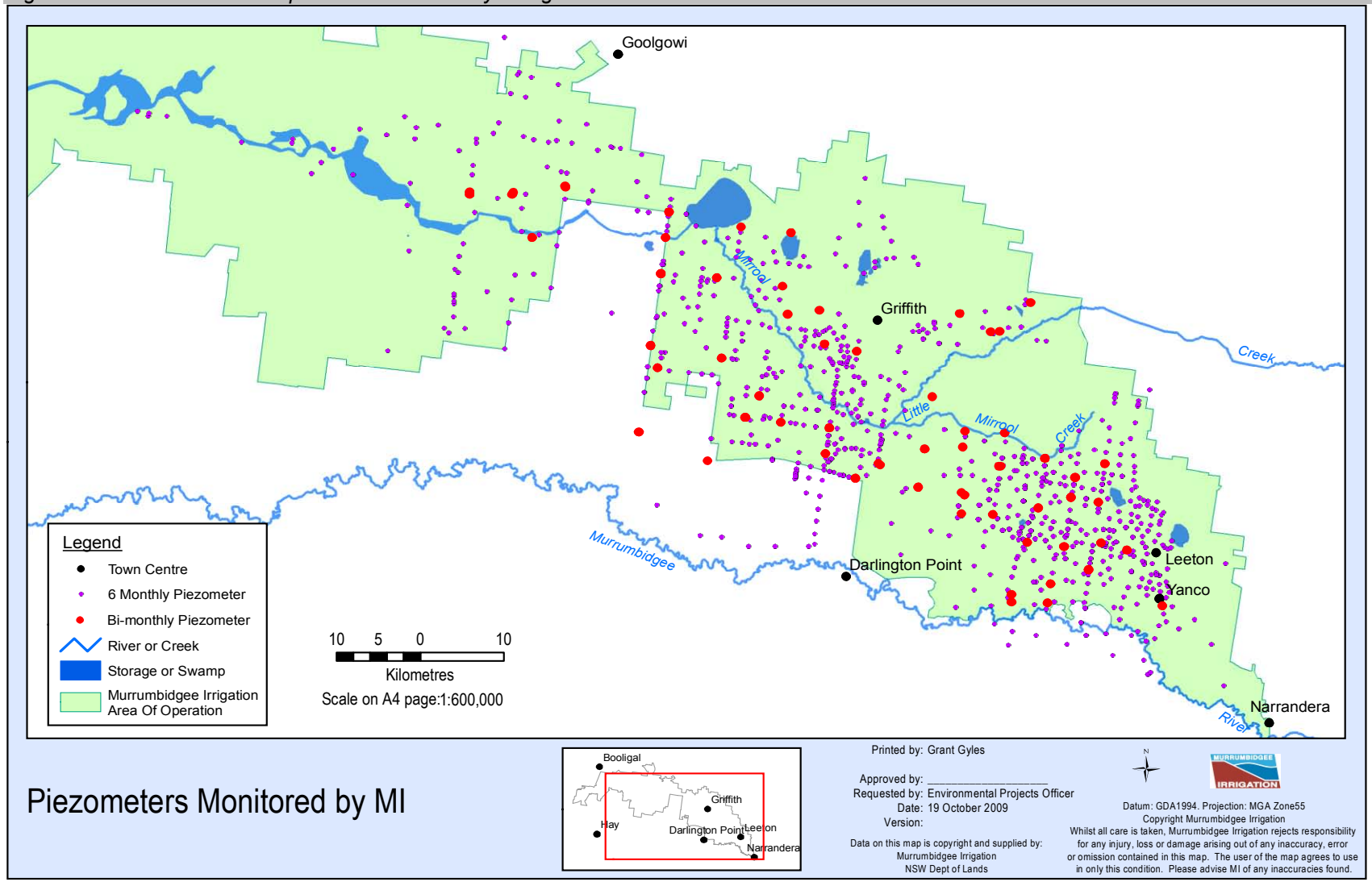
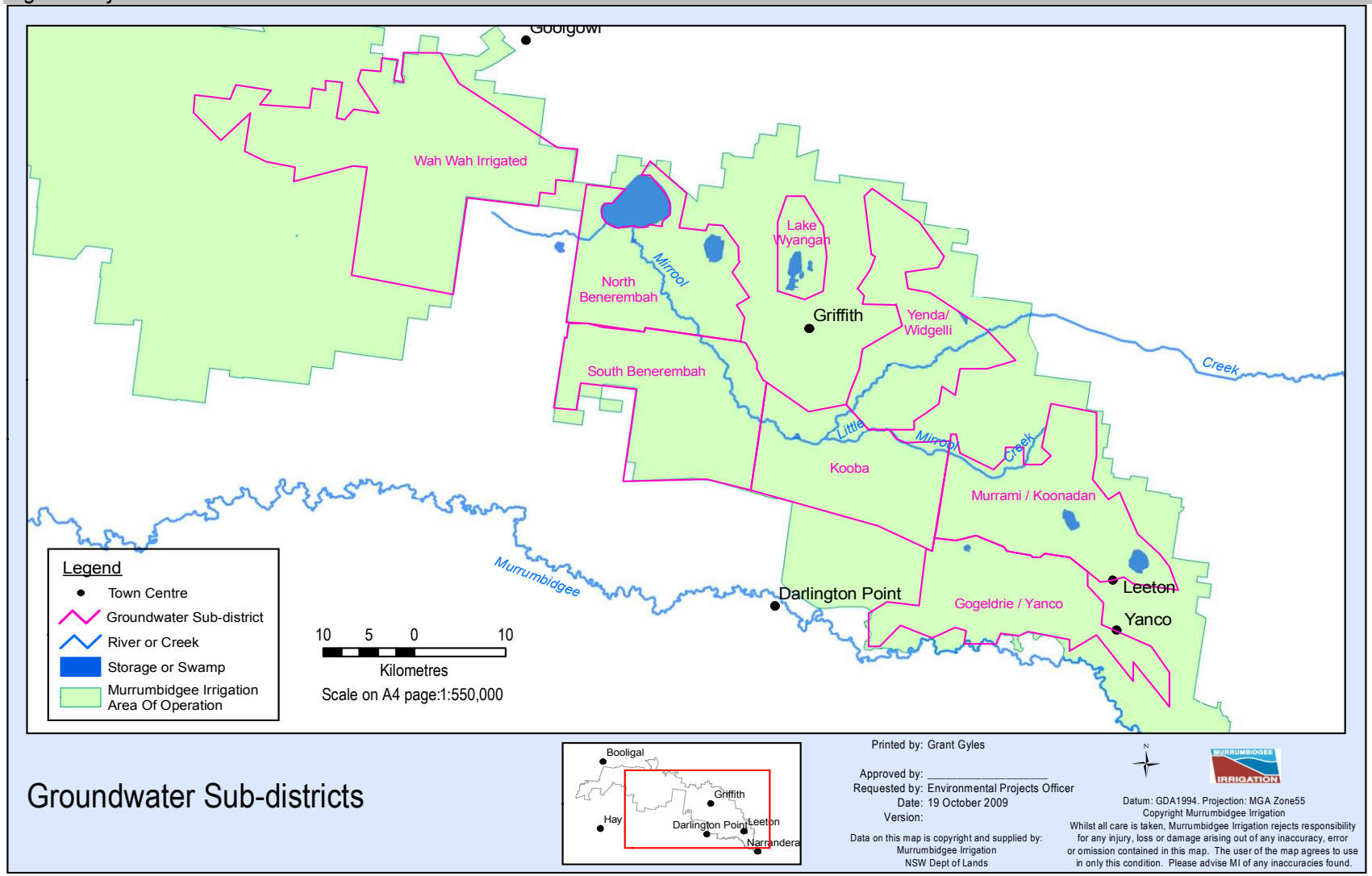


Figure 3.2.j: Groundwater sub-districts



A.4 Floods and Floodplain Management

A.4.2 Reporting requirements

A.4.2 (1 & 2) Flood levels, floodplain structures, flood releases

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

There were no deliberate releases into the floodway during the 2008/09 season due to the on-going drought conditions and the ability to better manage drainage flows arriving at Barren Box Storage and wetland as a result of the improved operating efficiency from the reconfiguration works.

There were no modifications or new works relevant to these conditions during the year

A.4.2 (3 & 4) Flood reporting – Lower Mirrool Creek Floodway

There were no major works undertaken other than assisting Wyvern Station with their noxious weed control.

The company is working closely with appropriate councils, who have recently obtained funding for undertaking flood studies.

There were no modifications or new works relevant to these conditions during the year

A.5 Aquatic Environment Management

A.5.2 Reporting requirements

A.5.2 (1) Significant change to Major Wetlands

During 2008/2009 ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of wetlands continued. The projects which are in various stages of completion include the following:

Barren Box Storage and Wetland and Mirrool Creek

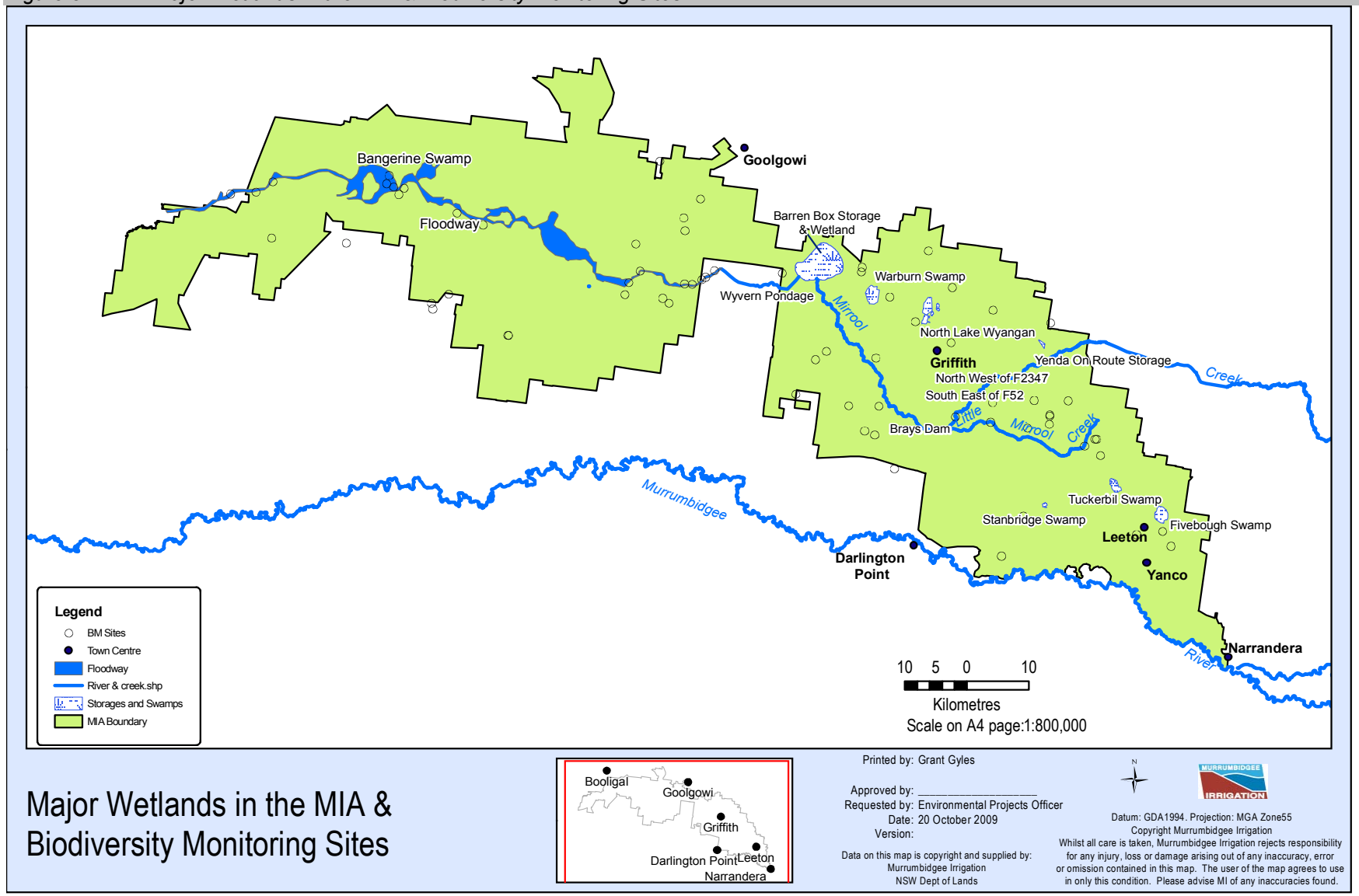
The Barren Box Storage and Wetland (BBSW) Rehabilitation Plan is in the final stages of completion. The plan aims to "*create an ecologically diverse and functioning Black Box wetland and surrounding grassy woodland/chenopod shrubland that also respects, preserves and enhances the cultural significance of the area, by example to promote stewardship of regional natural resources."*

In July 2008, 690ha within the wetland cell was aerial sown with locally collected Black Box seed *Eucalyptus largiflorens*. Direct seeding within the terrestrial zone of the wetland cell continued in June 2009 with 300ha direct seeded with a combination of Boree, *Acacia pendula,* and chenopod shrubland native species. The aim of this work is to assist with the re-establishment of a seed bank allowing natural regeneration to occur when favourable conditions return.

In addition, 50 hectares around the perimeter of Barren Box Storage were planted with native tree species in June 2009.

On July 4 2008, The Honourable Tony Kelly, Minister for Lands, Minister for Rural Affairs, and Minister for Regional Development gazetted all crown lands of Mirrool Creek between the main canal and BBSW (including Little Mirrool Creek), a Crown reserve for rural purposes with MI appointed as trustee for the reserved land.
With this change, MI will now manage the ongoing care of the Reserve including integrated maintenance, water management, management of leases, and environmental restoration and management. This means all Crown lands within the Reserve will come under one management arrangement allowing for more effective water management and environmental restoration.

Figure 3.2.k: Major Wetlands in the MIA & Biodiversity Monitoring Sites



Monitoring and Management of Wetlands in the MIA

Murrumbidgee Irrigation is required to monitor the condition of aquatic environments which are or may be impacted by its operations or the practices of irrigators. Murrumbidgee Irrigation is also required to implement strategies to protect and enhance biodiversity within the MIA.

Following the gazettal of Mirrool Creek Crown lands and the appointment of Murrumbidgee Irrigation as trustee of the reserved land, Murrrumbidgee Irrigation have developed a Mirrool and Little Mirrool Creek Crown Reserve Plan of Management. The purpose of the PoM is to provide a clear direction regarding future use and management of Mirrool Creek and Little Mirrool Creek to which the PoM applies. The effective management and resolution of conflicts over the use of the Reserve is essential if its values are to be protected and enhanced. The PoM has been prepared in accordance with the *Crown Lands Act* 1989 and the *Local Government Act* 1993 ultimately for adoption by the Minister of Lands and MI.
MI's vision is 'to improve the ability of Mirrool Creek to provide long term ecological, social and economic services to the Murrumbidgee Irrigation Area' (MIA 2008a). To achieve MI's vision, this PoM is being developed with four main objectives:

1. Develop a PoM for the Mirrool and Little Mirrool Creek Reserve in accordance with Department of Lands Trust Handbook
2. Identify and address issues associated with Mirrool and Little Mirrool Creek Crown Reserve
3. Prepare a concept plan showing Mirrool and Little Mirrool Creek Crown Reserve
4. Incorporate the Mirrool Creek Rehabilitation project and the monitoring, review, and evaluation program into the Mirrool and Little Mirrool Creek Crown Reserve PoM.

Mirrool Creek Rehabilitation Project – Property Vegetation Plan (PVP)

Mirrool and Little Mirrool Creek rehabilitation works will be facilitated through a Property Vegetation Plan (PVP) contract, a standardised revegetation management contract that is an agreement between the landholder and the local Catchment Management Authority. Development of the PVP is in process with site and landholder visits being conducted to identify areas for revegetation and potential timelines for works.

Mirrool Creek Monitoring

To describe the current and future condition and in determining the impact of intervention on the long-term management of Mirrool Creek, a comprehensive monitoring program is required. The objectives of the monitoring program include:
• Establish a comprehensive baseline inventory of key indicators and riparian condition along Mirrool Creek for ongoing monitoring;
• Develop methods to determine changes to biodiversity within the Mirrool Creek riparian zone;
• Identify opportunities for improved management of fauna habitat and aquatic environments; and
• Develop a monitoring program that can be used to measure the effects of altered environment condition.

In May 2009 the Mirrool Creek Restoration and Monitoring Program report was completed. This report comprises three sections. The monitoring method development is contained in the main

body of the report and the recommended monitoring procedure and field sheets are contained in the Methods Manuals in Appendix A Landholder guide and Appendix B Biodiversity Monitoring manual.

Barren Box Storage & Wetland Rehabilitation is an "Icon" Project for the Company and the Murrumbidgee Irrigation Area. Following intensive planning and construction the project moves into the next Phase: Wetland Rehabilitation and Management Planning. The aim of the project is "*to create an ecologically diverse and functioning Black Box wetland and surrounding grassy woodland/chenopod shrubland that also respects, preserves and enhances the cultural significance of the area, by example to promote stewardship of regional natural resources."*

Section 7 of the Barren Box Wetland Rehabilitation Plan 2009-2014 details the essential components of monitoring, evaluation and review on the status and condition of the ecosystem. Monitoring for the rehabilitation of the Wetland Cell at Barren Box Storage and Wetland will be undertaken in two parts:

- Short term monitoring of revegetation success to inform ongoing management; and
- Long term monitoring against ecological targets.

A comparison of these against targets allows evaluation of project progress and success.
This plan has a life of 5 years (2009-2014). At the end of this period, a formal review that assesses not only the achievements and progress towards ecological targets, but also a review of the vision and objectives to ensure that they are still relevant and feasible. This review will include an assessment of monitoring data by an expert technical panel to determine whether additional actions are required to meet long-term ecological targets.

In order to understand the ecological outcomes of the wetland rehabilitation it is important to understand what species are currently using the wetland. For this purpose a detailed waterbird monitoring program of the intermediate cell was initiated in April 2007 and will continue with fortnightly surveys over a period of 24 months. The objective of these surveys is to establish baseline data on waterbird species and abundance in the MIA.

To date a six monthly interim report has been completed, a 12 monthly report is currently being composed and a full report outlining the results from the two year study will be completed by September 30, 2010.
The six month report covered the period of autumn and winter, from March to August 2008. One of the most notable features during the study period was the significant breeding event of four species of cormorants and darters. The maximum number of active nests at any one time was 354 for the Great Cormorant and 61 for the Pied Cormorant.
Forty eight species were recorded in total with a maximum per visit of 35 species. The number of species declined slightly as the season progressed. Two threatened species, the Blue-billed duck and the Freckled duck were recorded and eight species were recorded breeding. In general terms the most numerous species were wildfowl (ducks and swans), grebes and cormorants.

A.5.2 (2) Management practice or work impact upon the aquatic environment (EP&A Act)

There were no major works undertaken that affect this section.

A.5.2 (3) Noxious weeds

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Two inspections have been carried out at Barren Box Storage and wetland and downstream channel systems and one inspection at the floodway.

Barren Box

The first inspection and treatment took place in February 2009. With the continuing dry conditions, low numbers of plants have been found once again at Barren Box. However the location of terrestrial plants on the surrounding shoreline has been assisted with Alligator Weed continuing to grow and other vegetative cover limited. There were six plants found and all plants were small in size. Four of the plants were located in an area of Barren Box known as "Crumps lease", one at the end of DC2370 and the remaining plant located adjacent to the boundary of Farm 2373. All plants were chemically treated.

The second inspection and treatment of Alligator Weed around Barren Box Storage and wetland took place in May 2009, there were no plants located. All plants chemically treated during the February inspection showed no signs of re-growth.

Channel System

The first inspection of the Wah Wah Main and Outfall channel systems took place in December 2008. 5 plants were located within the system. All plants located in the channel system were small in size and were physically removed and treated.

A follow up inspection took place in May 2009. This inspection located 2 plants. All plants found were chemically treated.

Floodway

An inspection of the floodway between the Outfall channel off take and Cameron Lane took place in May 2009. Four plants were found and chemically treated. Owing to the extreme dry conditions and number of stock in the floodway, the early inspection was not carried out.

A.6 General Environment Management

A.6.3 Reporting requirements

A.6.3 (1) Register of activities

A *register of activities* is ordinarily required by a determining authority, generally being a Government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning & Assessment Act. However, as this remains a licence requirement, despite the privatisation of Murrumbidgee Irrigation, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2008/09. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2009

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	Murrumbidgee Irrigation	February 2005

Source: MI Environmental Services

A.6.3 (2) Significant changes and condition of environment assets

Monitoring and Management of environmental assets in the MIA

Remnant Protection and Local Native Species Revegetation

For the reporting period 1 July 2008 to 30 June 2009 50 ha new plantings, 1,488 ha of enhanced remnants, and 160 ha of direct seeding took place to increase the area of remnant native vegetation within the MIA. The enhancement of remnant vegetation was done under a combination of Property Vegetation Plans (PVP's) and the new BioTender program with funding provided by MIA EnviroWise.

MIA EnviroWise is required through the Murrumbidgee Catchment Management Authority to complete Property Vegetation Plans (PVP's) for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder. In 2008/09 PVP's were completed and approved by the MCMA on 32 MIA farms.

Biodiversity Incentives are available to MI account holders to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant protection and enhancement through fencing and direct seeding, new plantings along drainage lines, or plantings with the intention of linking remnant vegetation creating corridors for the movement of fauna within the MIA.

Vegetation Implementation Officers assist landholders in the planning and implementation of their Vegetation Management Plans.

MIA EnviroWise implemented the new biodiversity stewardship program 'BioTender'. The aim of the program is to capture remnant native vegetation sites of high ecological value within the MIA, and through a ten to fifteen year stewardship payment encourage landholders to maintain and enhance these sites. Landholders are encouraged to submit an application during a tender period for the cost of protecting and enhancing their remnant native vegetation. The program aimed to protect 2,000 hectares of remnant vegetation over two tender rounds, which will be well and truly exceeded this almost 1,500 hectares of remnant native vegetation successfully tendered by landholders in round one alone and a further 1,300 hectares in the final stages of round two to be finalised in the 2009/10 reporting year.

Figure 6.3.a: Remnant Vegetation of the Murrumbidgee Irrigation Area

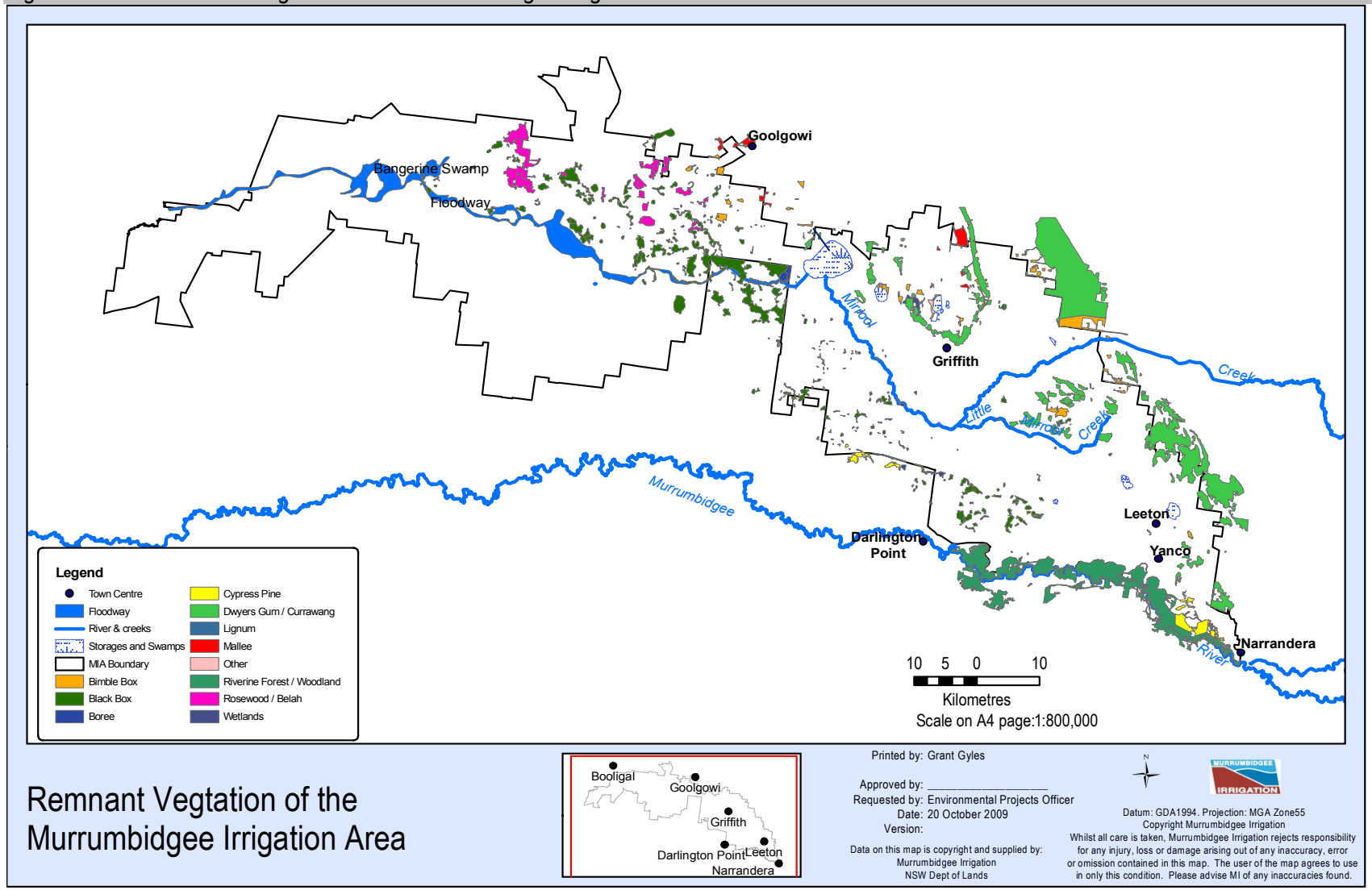
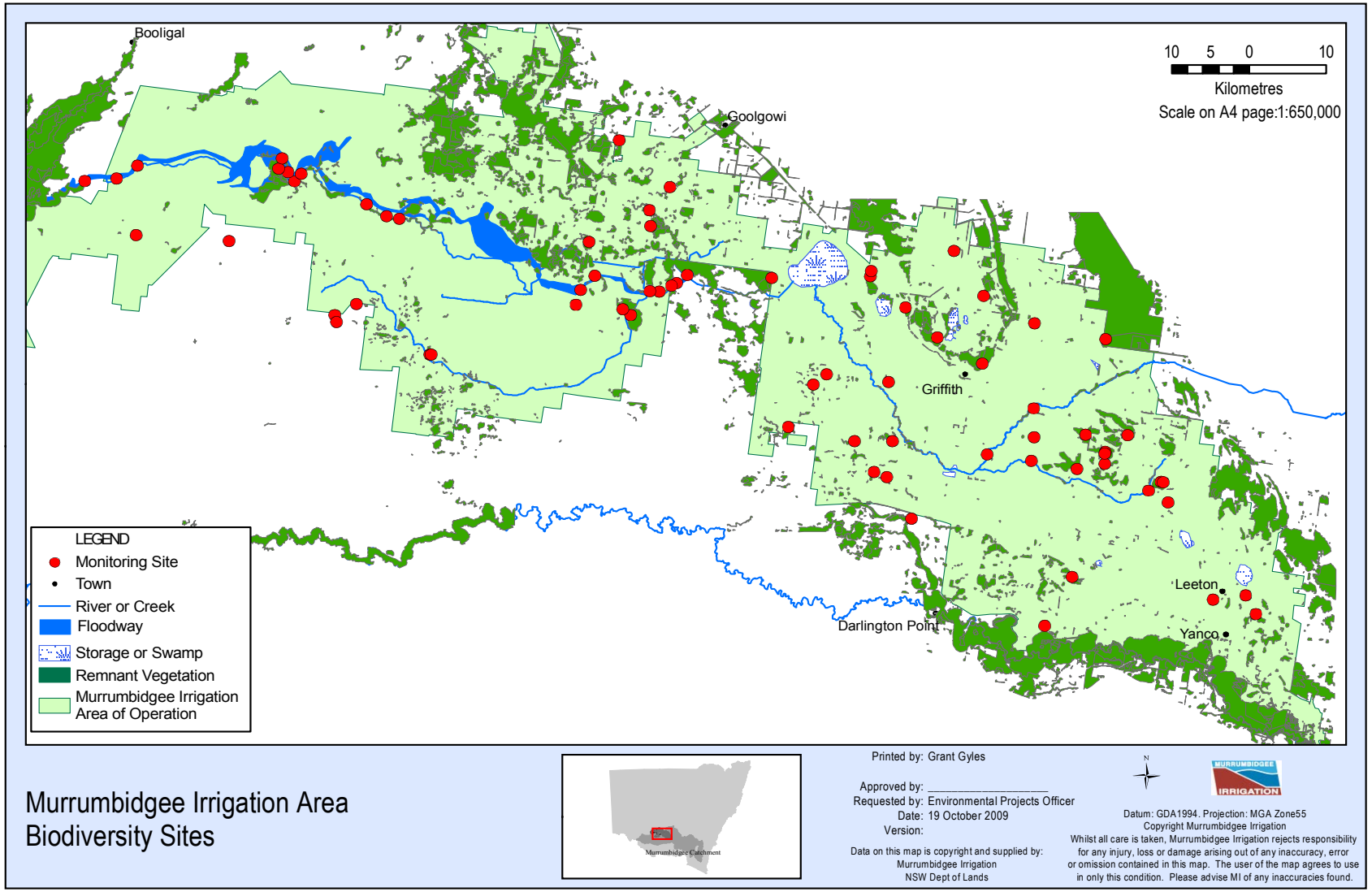


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



A.6.3 (3) Soil salinity survey (every 3 years)

Pending the outcome of the review of the Company's licences with DECC and DWE and the outcome of the CSIRO hydro-ecological assessment project, the soil salinity survey has been suspended.

Murrumbidgee Irrigation is committed to develop a more effective way to monitor and improve soil salinity. Further it is expected that the outcomes from the CSIRO research will guide the development of a more appropriate regional soil salinity assessment method.

DWE stated in their reply to the 2008 Compliance Report: "MI advised that survey was postponed due to drought and that methodology is under review. DWE will await outcome of the CSIRO research project and will consider the relevance of such surveys to its legislative requirements and understanding of the salt balance within the Area of Operation."

A.7 Salinity Management and Accounting

A.7.4 Reporting requirements

A.7.4 (1) Flow, salt load and salinity data

Refer to Drainage Volumes, Table 2.2.k, page 18-19, for flow data.

Refer to Salt Loads, Table 2.2.l, page 21-22, for salt load data.

Refer to refer to Table M.5, page 74, for salinity data.

A.7.4 (2) Notice for compliance with Salinity and Drainage Strategy

No written notice was received for the period.

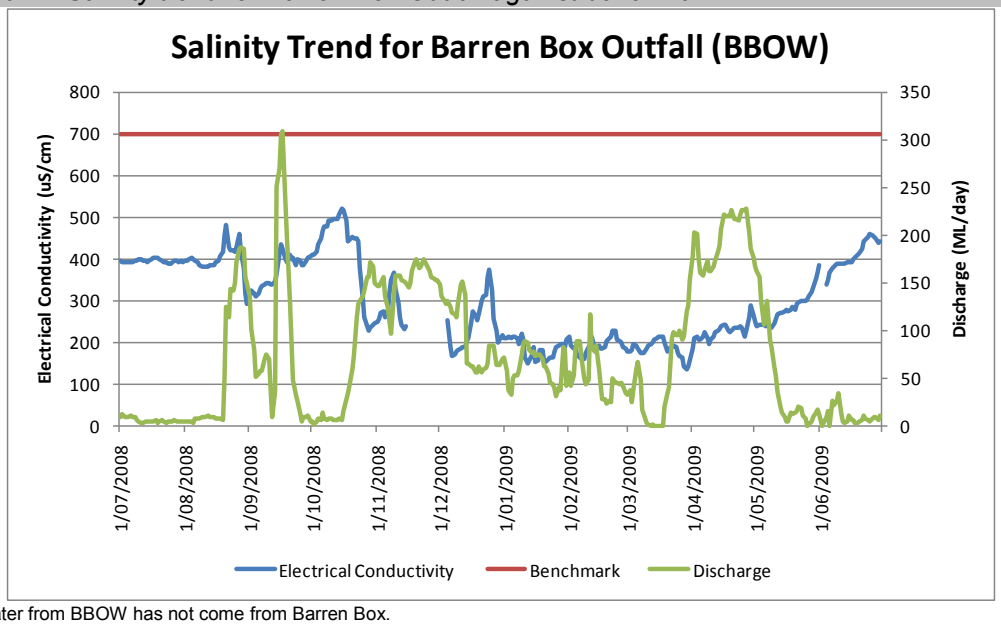
There were no changes in operations and practices that could change the long-term salt discharges from the Area of Operation. For more detail see commentary on Table 2.2.h.

A.7.4 (3) Salt load discharges

Refer to Salt Loads, Table 2.2.l, page 21-22.

A.7.4 (4) Salinity in Barren Box Outfall Drain against benchmark

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark



Note: Water from BBOW has not come from Barren Box.
Source: Thiess flow gauging station.

A.7 Salinity Management and Accounting

Figure 7.4.a shows the salinity trend for Barren Box Outfall against the benchmark of 700 EC. The figures presented are daily averages. The figure shows that during low flow or no flow conditions, the salinity levels are generally higher. It is evident that for the 2008/09 irrigation season the quality of water discharged from the Barren Box Outfall Channel for supply to the Wah Wah Irrigation District has been satisfactory with EC levels well below the identified 700 EC benchmark limit.

Water Quality Management

Murrumbidgee Irrigation requested and gained approval from the DECC to trial the draft Water Quality Monitoring Program for the 2008/09 irrigation season. The DECC acknowledged that this meant that Murrumbidgee Irrigation would not be monitoring water quality in accordance with the current requirements of the Environment Protection Licence 4651 for the 2008/09 season.

The details of the new Monitoring Program are explained in Section A.2.3 of this report.

As part of the new water quality program, supply water quality was measured three times during the season and trace levels of some chemicals were found and this was reported to the relevant authorities. It is important that this information is available in case of detections of those same chemicals in the drainage channels. As expected, the number of detections of chemicals in our drainage water increased compared to previous years. The reason for this increase is the more targeted approach of the new program. An example of how well the program works is the fact that malathion was detected on a number of occasions and due to the targeted approach the source of the pollution was easily detected and action was undertaken to stop the contamination. It is expected that this increase in detections will happen for a number of years until we have gained a better understanding of where and when pollutions occurs. This will then allow us to develop strategies and education programs to reduce the detections and therefore increase the quality of our drainage water. All notification and action level detections have been reported in Table M3 and a brief explanation of each has been provided in Table M4.

The successful trial of the new water quality monitoring framework means that Murrumbidgee Irrigation expects to update its licence with the DECC and include the new program.

As part of the new program, Murrumbidgee Irrigation will review and update its pollution prevention program, which was set up to work with farmers to promote best management practices in order to minimise pollution in our drains. This includes, for example, participation in farmer shed meetings and using local media to create awareness. Based on the risks associated with each of the sub-catchments, as well as the results from the targeted monitoring program, new pollution prevention programs will be developed.

Table M.1: Department of Environment and Climate change compliance requirements

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Location of monitoring sites	Table M.2	67
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3 & M.4	68-73
	Chlorpyrifos (Monthly)	Table M.3 & M.4	68-73
	Conductivity	Table M.5	74
	Diazinon (November)	Table M.3 & M.4	68-73
	Diuron (Monthly)	Table M.3 & M.4	68-73
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	68-73
	Flow (Monthly) LW6	Table 2.2.k Table 2.2.g	18-19 15
	Malathion (Oct/Nov)	Table M.3 & M.4	68-73
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Nitrogen (>5Mg)	Table M.3 & M.4	68-73
	Phosphorus (>5Mg)	Table M.3 & M.4	68-73
	Simazine (Monthly)	Table M.3 & M.4	68-73
	Thiobencarb (Nov)	Table M.3 & M.4	68-73
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Turbidity	Table M.5	74
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.k	18-19
M3	**Testing Methods – concentration limits**		
	Approved by DEC	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11&12		
	Atrazine (Monthly)	Table M.3 & M.4	68-73
	Chlorpyrifos (Monthly)	Table M.3 & M.4	68-73
	Conductivity (Monthly)	Table M.5	74
	Diazinon (Nov)	Table M.3 & M.4	68-73
	Diuron (Monthly)	Table M.3 & M.4	68-73
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	68-73
	Flow (Monthly)	Table 2.2.k	18-19
	Malathion (Oct/Nov)	Table M.3 & M.4	68-73
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Simazine (Monthly)	Table M.3 & M.4	68-73
	Thiobencarb (Nov)	Table M.3 & M.4	68-73
	Nitrogen (>5Mg/day)	Table M.3 & M.4	68-73
	Phosphorus (>5Mg/day)	Table M.3 & M.4	68-73
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Turbidity	Table M.5	74

*Table M.1: Department of Environment and Conservation compliance requirements (*cont.)

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Monitoring Sites 13 &14		
	Atrazine (Monthly)	Table M.3 & M.4	68-73
	Chlorpyrifos (Monthly)	Table M.3 & M.4	68-73
	Conductivity (Monthly)	Table M.5	74
	Diazinon (Nov)	Table M.3 & M.4	68-73
	Diuron (Monthly)	Table M.3 & M.4	68-73
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	68-73
	Malathion (Oct/Nov)	Table M.3 & M.4	68-73
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Simazine (Monthly)	Table M.3 & M.4	68-73
	Thiobencarb (Nov)	Table M.3 & M.4	68-73
	Nitrogen (Monthly)	Table M.3 & M.4	68-73
	Phosphorus (Monthly)	Table M.3 & M.4	68-73
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	68-73
	Turbidity (Monthly)	Table M.5	74
	M7.2 Conductivity Sites 1 & 9	Table M.5	74
	M7.3 Molinate	Table M.3 & M.4	68-73
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Records stored on computer, Page 56	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	DEC contacted Table R.1, Page 76	
R3	**Written report**		
	R3.1 Send reports to DEC at their request, regarding environmental harm	DEC sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	DEC contacted, Table R.1, Page 76	
R5	**Annual report**		
	R5.1 Submit annual report to DEC	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.k A.3.2(4) Table R.1 Table R.1	12 18-19 36 75-76 75-76
	R5.4 Send copies of DEC, DNR, DPI, MDBC	Submitted	

Table M. 2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR[#]	Gogeldrie Main Southern Drain	5	*
410083	YMS[#]	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

[#] **Note :** There was very little flow at these sites. Flow ceased draining to river and is now diverted (Pumped or gravity-fed) to the supply system.

Table M. 3: Benchmark sampling monitoring

Site	EMR	NARREG	STUR	BYD	BARDENS	3WAYS	PENFOLDS
Nitrite + Nitrate as N (LOR 0.01mg/L)							
Sep	<0.01	<0.01	<0.01	<0.01	0.2	<0.01	<0.01
Jan	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
May	1.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)							
Sep	0.4	0.3	<0.1	0.6	0.8	0.3	0.7
Jan	0.4	0.3	0.9	0.7	0.7	0.3	0.6
May	0.5	0.8	0.7	1.4	0.7	0.5	0.4
Total Nitrogen as N (LOR 0.1mg/L)							
Sep	0.4	0.3	<0.1	0.6	1	0.3	0.7
Jan	0.4	0.3	0.9	0.7	0.7	0.3	0.6
May	1.6	0.8	0.7	1.4	0.7	0.5	0.4
Total Phosphorus as P (LOR 0.01mg/L)							
Sep	<0.01	<0.01	0.04	0.02	0.21	<0.01	<0.01
Jan	0.02	0.05	0.01	0.01	0.05	<0.01	<0.01
May	0.02	0.05	<0.01	0.13	0.07	0.01	0.03
Biochemical Oxygen Demand							
Sep	2	2	2	4	4	3	3
Jan	<2	4	2	<2	<2	<2	<2
May	<2	<2	<2	<2	<2	<2	<2
alpha-Endosulfan							
Sep	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Jan	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT
beta-Endosulfan							
Sep	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Jan	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT
Simazine (LOR = 0.005 ug/L)							
Sep	0.106	0.06	0.038	2.63	0.544	0.059	0.058
Jan	<0.005	0.08	<0.005	0.09	0.192	<0.005	<0.005
May	0.074	0.01	0.071	0.175	0.06	0.093	0.065
Diuron (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	1.39	0.45	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	0.043	0.045	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Atrazine (LOR = 0.005 ug/L)							
Sep	0.013	0.021	<0.005	0.025	0.006	0.011	0.009
Jan	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005
May	0.012	<0.005	0.011	<0.005	0.007	0.015	0.01

Table M. 3: Benchmark sampling monitoring cont

Site	EMR	NARREG	STUR	BYD	BARDENS	3WAYS	PENFOLDS
Molinate (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Metolachlor (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	0.01	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	<0.005
Malathion (LOR = 0.002 ug/L)							
Sep	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Jan	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
May	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diazinon (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thiobencarb (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	0.011	<0.005	<0.005	0.012	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorpyrifos (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trifluralin (LOR = 0.005 ug/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Blue Green Algae Count							
Sep	11900	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT

Notes:

Action level detection

Notification level detection

NT Not tested

Table M. 4: Trigger based sampling

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	BBOW	WWO	GRI
Nitrite + Nitrate as N (LOR 0.01mg/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	0.3	0.48	0.52	0.03	0.01	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.15	0.31	0.02	NT	NT	NT	<0.01	NT
Dec	NT	0.58	0.73	1.61	0.73	0.04	0.14	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.67	1.03	NT	0.06	<0.01	NT	NT	NT
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	1.1	0.6	0.9	0.4	0.8	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.8	0.7	1.1	NT	NT	NT	0.4	NT
Dec	NT	0.6	1.1	0.5	0.5	1	0.5	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.7	1.3	NT	0.2	0.8	NT	NT	NT
Total Nitrogen as N (LOR 0.1mg/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	1.4	1.1	1.4	0.4	0.8	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	1	1	1.1	NT	NT	NT	0.4	NT
Dec	NT	1.1	1.8	2.2	1.2	1	0.7	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	1.3	2.4	NT	0.3	0.8	NT	NT	NT
Total Phosphorus as P (LOR 0.01mg/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	0.06	0.06	0.12	0.08	0.09	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.01	0.07	0.03	NT	NT	NT	0.12	NT
Dec	NT	0.25	0.3	0.07	0.37	0.08	0.29	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.15	0.25	NT	0.1	0.11	NT	NT	NT

Table M. 4: Trigger based sampling cont

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	BBOW	WWO	GRI
alpha-Endosulfan									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.010	<0.010	<0.010	<0.010	<0.010	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.010	<0.010	<0.010	NT	NT	NT	<0.010	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT
beta-Endosulfan									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.010	<0.010	<0.010	<0.010	<0.010	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.010	<0.010	<0.010	NT	NT	NT	<0.010	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT
Simazine (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	0.755	0.817	3.21	1.62	2.11	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.252	0.598	0.394	NT	NT	NT	0.117	NT
Dec	NT	0.106	0.087	0.141	0.159	0.05	0.168	NT	<0.020
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0.061	0.06	0.009	0.023	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.695	0.323	NT	0.464	0.07	NT	NT	NT
Diuron (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	0.322	0.293	2.46	0.793	0.686	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.133	0.189	0.395	NT	NT	NT	0.24	NT
Dec	NT	0.097	0.175	0.975	1.41	0.098	0.099	NT	0.213
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	0.014	0.048	0.016	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.857	0.581	NT	0.706	0.661	NT	NT	NT

Table M. 4: Trigger based sampling cont

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	BBOW	WWO	GRI
Atrazine (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	0.008	0.005	0.056	0.013	0.019	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.083	0.079	0.038	NT	NT	NT	0.115	NT
Dec	NT	0.038	0.061	0.013	0.014	0.023	0.139	NT	0.486
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.055	0.037	NT	0.031	0.132	NT	NT	NT
Molinate (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.013	0.026	0.006	NT	NT	NT	<0.005	NT
Dec	NT	0.111	0.038	<0.005	<0.005	<0.005	1.23	NT	<0.005
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	NT	NT	NT
Metolachlor (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	0.019	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NT	0.017
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	<0.020	0.032	NT	NT	NT
Malathion (LOR = 0.002 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.002	<0.002	0.406	<0.002	<0.002	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.028	0.224	<0.002	NT	NT	NT	<0.002	NT
Dec	NT	<0.002	<0.002	<0.002	<0.002	<0.002	0.158	NT	1.39
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.002	0.082	<0.002	<0.002	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	NT	NT	NT

Table M. 4: Trigger based sampling cont

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	BBOW	WWO	GRI
Diazinon (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	0.024	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.011	<0.005	<0.005	NT	NT	NT	0.007	NT
Dec	NT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NT	<0.005
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	NT	NT	NT
Thiobencarb (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NT	<0.005
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	0.02	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	NT	NT	NT
Chlorpyrifos (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	0.036	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	<0.005	0.016	<0.005	0.025	<0.005	<0.005	NT	<0.005
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	<0.020	<0.020	NT	0.021	<0.020	NT	NT	NT
Trifluralin (LOR = 0.005 ug/L)									
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	<0.005	0.006	0.006	<0.005	<0.005	<0.005	NT	<0.005
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jun	NT	0.114	0.063	NT	0.05	0.046	NT	NT	NT

xxx	Action level detection
	Notification level detection
NT	Not tested
LOL	Limit of reporting

Table M. 5: Monthly Conductivity and Turbidity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results (µs/cm)												
YMS	NF	NF	NF	NF	NF	NF	NF	318	521	NF	NF	NF
GMSRR	NF	NF	NF	NF	NF	329	281	71.5	185	NF	NF	NF
LAG	NF	NF	NF	NF	NF	NF	NF	115	NF	NF	NF	NF
ROCUDG	160	NF	171	NF	NF	NF	NF	NF	NF	NF	NF	NF
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Turbidity results (NTU)												
YMS	NF	NF	NF	NF	NF	NF	NF	676	659	NF	NF	NF
GMSRR	NF	NF	NF	NF	NF	563	380	65.2	443	NF	NF	NF
LAG	NF	NF	NF	NF	NF	NF	NF	65.2	NF	NF	NF	NF
ROCUDG	48.5	NF	7.57	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: Murrumbidgee Irrigation field data
NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

Table R. 1: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide DECC Action Level				
Drainage sites: MIRMCN, MDJWE, LMC. Drainage re-use sites: BARDENS & BYD	23/09/2008	Trace levels of simazine, diuron & atrazine at all drainage points sampled.Trace level of metalochlor at MDJWE. Notification level of Simazine, Diuron, Diazinon and Chlorpyrifos at MDJWE. Action level of Malathion at MDJWE.	DECC notified via email on 09/10/08. Follow-up email sent to DECC on 27/10/08	Negotiation between MI, DPI & DECC resulting in Malathion replaced with organic fruit fly chemicals.
Drainage sites: MIRMCN, MDJWE, LMC & WWO (Willow dam)	3/11/2008	Notification level of Diazinon at MIRMCN and Action level of Malathion at MDJWE.	DECC notified via email on 25/11/08. Follow-up email sent to DECC on 03/12/08.	Negotiation between MI, DPI & DECC resulting in Malathion replaced with organic fruit fly chemicals.
GRI, LW6, BBOW, MIRMCN, MDJWE, LMC & BYD	15/12/2008	Notification level of Diuron (1.41µg/L) at BYD. Notification level of Chlorpyrifos (0.016µg/L) at MDJWE and (0.025µg/L) at BYD. Notification level of Malathion (0.158µg/L) at BBOW. Action Level of Malathion (1.39µg/L) at GRI.	DECC notified via email on 20/01/09.	Negotiation between MI, DPI & DECC resulting in Malathion replaced with organic fruit fly chemicals.
Pesticide DECC Notification Level				
NARREG, EMR, Penfold's Bridge, 3 WAYS, STUR, BYD & Barden's Check	2/09/2008	Trace levels for atrazine & simazine in supply & notification level of diuron (@BYD & Barden's Check).	Notified DECC & DWE via email. Emailed GCC & LSC.	
Drainage sites: MIRMCN, MDJWE, LMC. Drainage re-use sites: BARDENS & BYD	23/09/2008	Trace levels of simazine, diuron & atrazine at all drainage points sampled.Trace level of metalochlor at MDJWE. Notification level of Simazine, Diuron, Diazinon and Chlorpyrifos at MDJWE. Action level of Malathion at MDJWE.	DECC notified via email on 09/10/08.	Negotiation between MI, DPI & DECC result in Malathion replaced with organic chemicals.
Drainage sites: MIRMCN, MDJWE, LMC & WWO (Willow dam)	3/11/2008	Notification level of Diazinon at MIRMCN and Action level of Malathion at MDJWE.	DECC notified via email on 25/11/08.	Negotiation between MI, DPI & DECC result in Malathion replaced with organic chemicals.

Pesticide DECC Notification Level continued				
GRI, LW6, BBOW, MIRMCN, MDJWE, LMC & BYD	15/12/2008	Notification level of Diuron (1.41µg/L) at BYD. Notification level of Chlorpyrifos (0.016µg/L) at MDJWE and (0.025µg/L) at BYD. Action Level of Malathion (1.39µg/L) at GRI and (0.158µg/L) at BBOW.	DECC notified via email on 20/01/09.	
Other Pollution Events				
Bundidgerry Storage	10/07/2008	Tyres dumped into Storage and started to be covered with dirt and tree limbs.	Photos taken and referred to Environmental.	Narrandera Shire Council contacted, tyres were removed by the offender
Drainage pipe outlet from Winery, DC144, Kidman way	15/08/2009	A written complaint was made to MI by a concerned resident living in the area. An odour of sulphur from grapes and fermented product coming from DC144 was reported. An MI channel attendant observed the drain on the 14th August 2008, and reported odour and black water (waste water) coming out of the drainage piped in-let which services the winery.	Reported to Griffith City Council	
Benerembah, Access Bridge on Channel 2, near HR-36-2 outlet	9/09/2008	Tractor ran off access bridge and into Goldberg door regulator. Divisional operator reported the incident (by telephone) to Glen Henderson. The owner of the tractor also rang MI to advise of the incident. No injury occurred.	Photos, referred to Environmental Services. Divisional operator forwarded details of the incident to field operator, so that repair costs could be added to rectify the situation.	Letter (and invoice of repair costs) to be sent to offender.
Drainage pipe outlet from Winery, DC144, Kidman way	10/02/2009	A MI channel attendant reported black water freely flowing from the drainage pipe in-let which services a winery into (DC144) to Environmental Services on the 10/02/09.	MI informed the EPA. The EPA advised MI to contact Griffith City Council.	Reported to Griffith City Council
Drainage channel from Winery on Laurence Rd, Bilbul	26/02/2009	A MI channel attendant reported black water in the drainage channel flowing from a winery to MI on the 26/02/09.	MI contacted the EPA / DECC.	DECC informed MI that they would follow up the pollution incident with the winery.

Events Reported under R.2 & R.3 of the Environment Protection Licence 4651

References

Van der Lely, A. (2009). '*Groundwater Conditions and Behaviour in the MIA. Annual Report 2009.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2003). '*Salinity survey 2002-MIA: methods, data, analysis, results, findings.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2002). '*Groundwater Conditions in the MIA - Annual Report 2001.*'. Murrumbidgee Irrigation. NSW.

Glossary

APHA	American Public Health Association
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&Ds	Murrumbidgee Irrigation Area and Districts
ML	Megalitre
mm	Millimetre
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
SEE	Statement of Environmental Effect
SFU	Single farming unit
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Table 2.2.g (page 18) and Table M.2 (page 64) for complete listings of monitoring sites

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MIA EnviroWise program has been made possible thanks to funding from the Australian and NSW Government's *National Action Plan for Salinity and Water Quality*.

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for future generations

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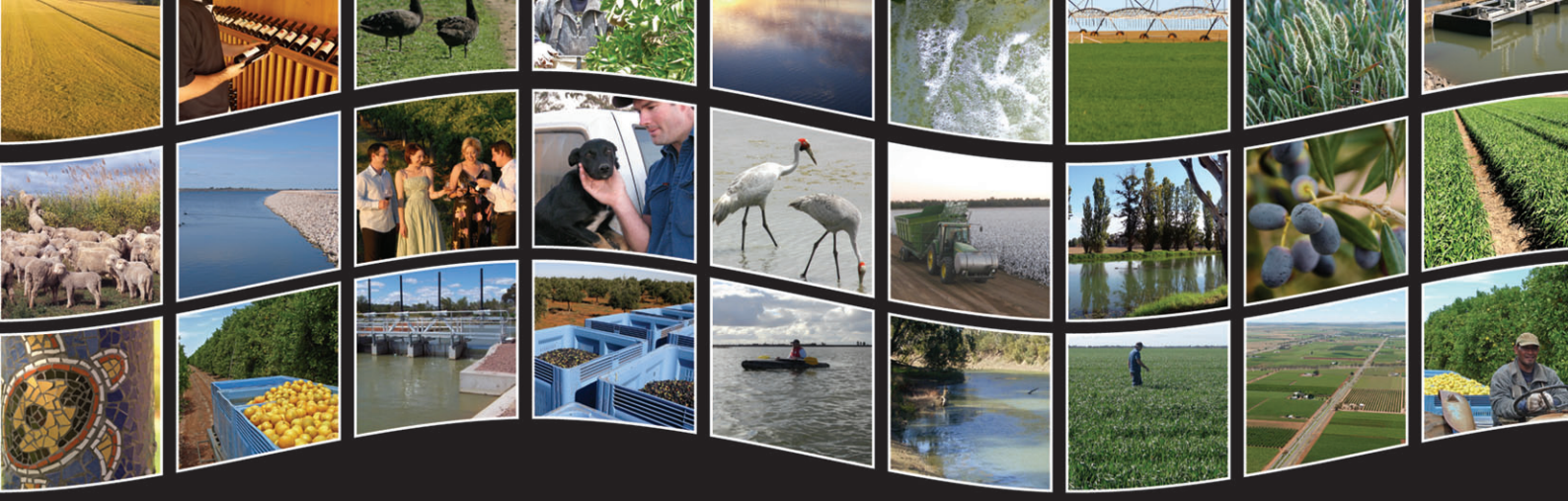
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Australian Government
New South Wales Government

B5: Licence compliance report FY 2009-2010



Murrumbidgee Irrigation Ltd

2010

LICENCE COMPLIANCE REPORT

The information in this document should be read as a whole document. The data contained in this LCR is for meeting Murrumbidgee Irrigation's Licence Compliance only. Murrumbidgee Irrigation does not guarantee the accuracy, reliability or suitability of excerpts of this data for any other purpose. Please contact Environmental Services, Murrumbidgee Irrigation on 02 6962 0200 for further information.



Directors Statement

MI has complied with the requirements under its licences with the NSW Department of Environment, Climate Change and Water.

Due to the continuing drought, resulting in low allocations for general security shareholders and therefore greatly reduced drainage flows, the company obtained relevant variations to the existing licences and these are referred to in the text.

The company is currently going through a review of both the licences. Pending the outcome of these reviews as well as a three-year research project with the CSIRO, the soil salinity monitoring program and groundwater salinity monitoring programs have been suspended.



Gillian Kirkup
Chairman
Murrumbidgee Irrigation



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EXECUTIVE SUMMARY

Murrumbidgee Irrigation's (MI) licences with the NSW Department of Environment, Climate Change and Water (DECCW) set the minimum standard for environmental management. The Company's programs are aimed at operating beyond compliance.

DECCW LICENCE REQUIREMENTS

The DECCW licence comprises of seven broad categories (A1 – A7) which are summarised below:

A1. LAND AND WATER MANAGEMENT PLAN

The Land and Water Management Plan (LWMP), otherwise known as MIA EnviroWise, continued to enhance the sustainability and profitability of the MIA and districts over the last year through a combination of education, on-farm incentives and regional projects. The 2009/10 year saw $3.02 million of government funding invested in the Murrumbidgee Irrigation Area (MIA) and districts through MIA EnviroWise, of which less than 5% was devoted to plan administration.

The 2009/10 season saw the conclusion of the On-Farm Incentive Program which has resulted in a total government investment in improving on-farm water use efficency expenditure of $19.2 million since the inception of the plan. In the 2009/10 year, the remaining funds were spent on biodiversity activities, including MIA EnviroWise BioTender (a biodiversity Stewardship Scheme), Barren Box Wetland Cultural and Heritage project, Mirrool Creek project and landholder, community and school education activities.

A2. WATER SUPPLY AND DRAINAGE MANAGEMENT

The drought conditions that have impacted on water availability in the MIA and Districts since the 2002/03 season remain. Rainfall was again below the long term average and fell inconsistently throughout the season. Rainfall during the critical period for finishing winter crops, August to October, was also well below average, requiring irrigation for those who had available allocations. General security allocation increased by 8% compared to the previous season allowing an increase in rice cropping totalling 7,622 hectares, which is still well below average. Continued low general security allocations combined with evapotranspiration still well above average made for another difficult season for MI and its customers. Simple system efficiency increased in line with higher deliveries combined with continued vigilance of MI staff.

All available drainage water was re-used, in order to increase the system efficiency.
Due to low general security allocation, there was a shift in deliveries for specific crop types. Horticultural crops received about one third of total deliveries, while winter cereals and oilseeds received just under 20%. Rice totalled 31% of total deliveries.

EXECUTIVE SUMMARY

The licence specifies continuous measurement of flow and salinity, which is done using flow gauging stations at key sites across the area. Continuous monitoring implies that 100% of the data is expected to be measured and recorded. MI was successful in obtaining funding from the Bureau of Meteorology to upgrade the flow gauging stations at the three of our four river drain sites. No data was lost at any of the river drain sites during the season.

A3. GROUNDWATER MANAGEMENT

As per the licence requirements, all bi-monthly and six-monthly bores were read. The shallow and deep water tables have continued to drop to September 2009, while a slight increase was observed in the March 2010 readings. The MIA is now well below the predicted groundwater levels of the LWMP raising concerns as to the appropriateness of such benchmarks in the current context. The LWMP was created in a wet period and has been implemented in a very dry one. Less than 1% of the MIA has water table levels within two metres of the surface, as compared to 70% before the commencement of the drought.

A4. FLOODS AND FLOOD PLAIN MANAGEMENT

There were no deliberate diversions to the floodway.

A5. AQUATIC ENVIRONMENT MANAGEMENT

Work has continued on the rehabilitation of a number of wetlands in the MIA including Barren Box and Wetlands (BBSW) along Mirrool Creek with the aim of improving the quality and the extent of habitat.

The control of alligator weed in the aquatic environment has continued over the past year. Inspections were carried out at BBSW, the channel system and the floodway with 13 small alligator weed plants found. All sites identified with alligator weed were chemically treated and GPS locations recorded. This extremely low number of plants demonstrates MI's commitment to eradicate this significant weed.

Inspections and treatments of *Sagittaria graminea* during 2009-10 were carried out monthly from September through to the end of June.

A6. GENERAL ENVIRONMENTAL MANAGEMENT

The protection and enhancement of local native species, remnant revegetation and other environmental assets are managed through the Property Vegetation Plans under the MIA EnviroWise program. MIA EnviroWise implemented the new biodiversity stewardship program 'MIA EnviroWise BioTender' in the 2008/09 financial year. The aim of this program is to capture remnant native vegetation sites of high ecological value within the MIA, and through a 10 to 15 year stewardship payment encourage landholders to maintain and enhance these sites. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Section A1.

Measuring soil salinity and the drivers that impact across regional scale continues to be difficult. It was concluded after the last survey that the current survey method does not provide an effective way to monitor the changes to soil salinity from irrigated agriculture and/or improve soil salinity. MI is committed to developing a more effective way to monitor and improve soil salinity.

EXECUTIVE SUMMARY

Further it is expected that the outcomes from the CSIRO research will assist in the development of a more appropriate regional soil salinity assessment method. While the CSIRO project will not develop a methodology, the outcomes will be used to guide the development of a new risk based approach to monitoring soil salinity.

A7. SALINITY MANAGEMENT AND ACCOUNTING

The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

DECCW LICENCE REQUIREMENTS

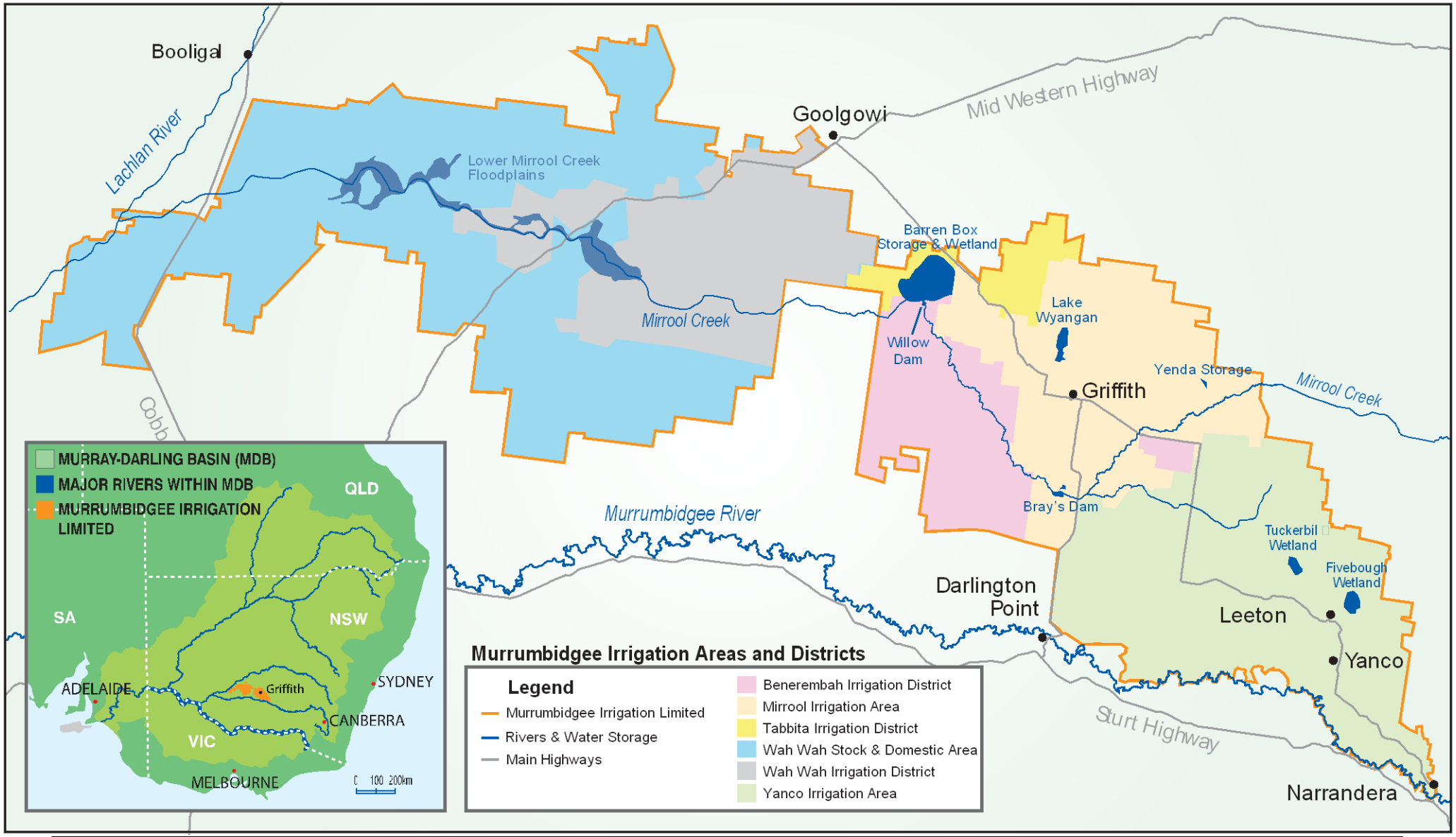
The DECCW licence has detailed requirements for monitoring and recording of drainage water quality.

MI and DECCW continued discussions regarding the detail of the new licence agreement. During these negotiations, the arrangements made for the 2008/09 season remained in place. The DECCW acknowledged that this meant that MI would not be monitoring water quality in accordance with the current requirements of the Environment Protection Licence 4651 for the 2009/10 season.

The new Water Quality Monitoring Program was successfully trialled during the 2008/09 and 2009/10 seasons and the DECCW has given MI in principle support to adopt the risk-based approach to water quality monitoring and management as part of the DECCW licence.

In addition to the Water Quality Monitoring Program, MI is also required to investigate miscellaneous pollution incidents. In 2009/10 six miscellaneous complaints were received from the public and company staff. Each of these were followed up and resolved in accordance with licence and other legislative requirements.

Murrumbidgee Irrigation Areas and Districts



A.1 LAND AND WATER MANAGEMENT PLAN

The MIA and Districts' Community Land and Water Management Plan is otherwise known as MIA EnviroWise.

A.1.1 ANNUAL ENVIRONMENT MANAGEMENT REPORT

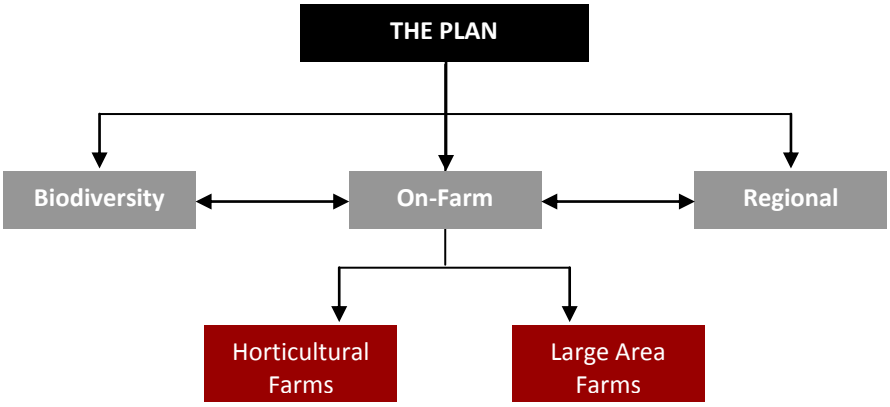
The goal of MIA EnviroWise is to maintain and enhance the sustainability and profitability of agriculture in the MIA and Districts.

The main objectives are:

- To maintain or increase irrigated agriculture productivity.
- To reduce seepage to the groundwater system.
- To keep drainage water quality within agreed standards.
- To reduce surface drainage volumes to acceptable levels.
- To protect our natural resources.
- To minimise or prevent downstream effects.

MIA EnviroWise program has been made possible thanks to funding from the National Action Plan for Salinity and Water Quality (NAP)

MIA EnviroWise Structure



A.1 LAND AND WATER MANAGEMENT PLAN

In 1989 the Murrumbidgee Irrigation Area (MIA) community initiated the Murrumbidgee Irrigation Area and Districts Land and Water Management Plan (MIA&D LWMP) in response to threats to the area's future sustainability as a result of widespread flooding. It was agreed that the cost of implementation would be shared between the NSW and Australian Governments and the MIA and Districts community. MIA EnviroWise covers more than 480,000 hectares with a gross value of approximately $7 billion in value added agricultural production.

The total cost of implementing MIA EnviroWise is $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

Table 1.1.a: Funding sources, receipts and expenditure for MIA EnviroWise

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2010 ($ million)	Expenditure to 30 June 2010 ($ million)
Government	50.1	15	28.3^	28.3
Landholders-in-kind	214.2	30	n/a	102.9#
Landholders/urban levy	19.6	30	8.6	4.9
Total expenditure				**136.1**

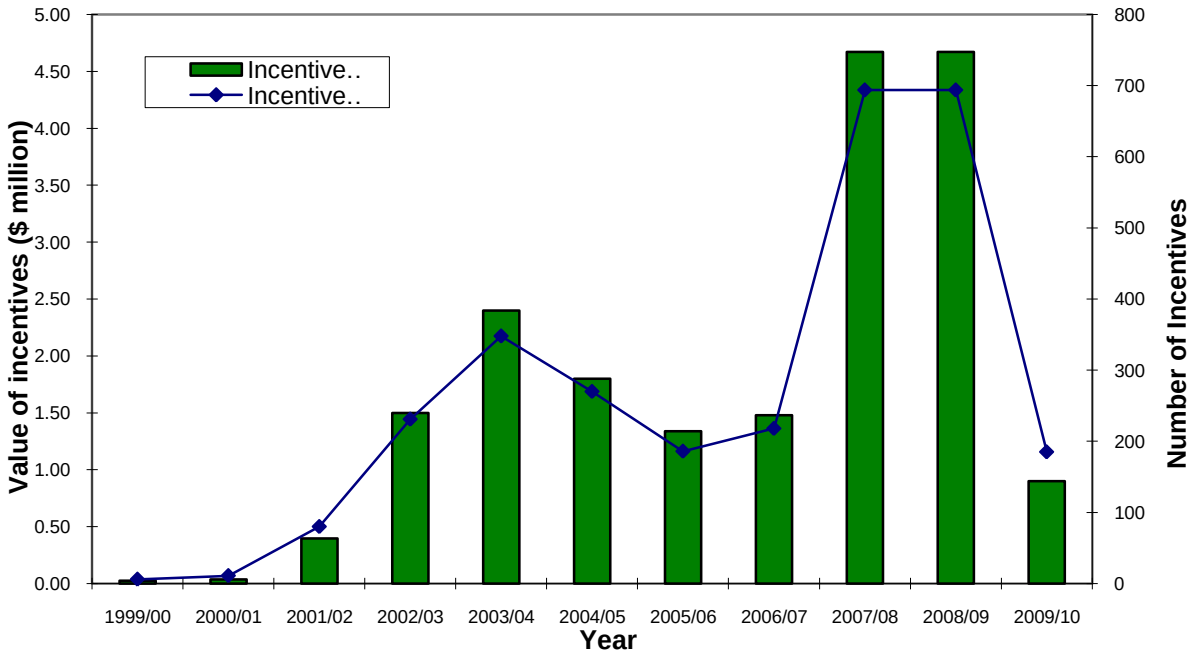
* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (unsigned).
^ This does not include funds for expenditure beyond 2010
# Calculated from invoices received from landholders and is an underestimate of total in-kind contribution

The financial administration of MIA EnviroWise is the responsibility of Murrumbidgee Irrigation Limited.

The expenditure of MIA EnviroWise funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP in 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Figure 1.1.a *The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding*



OVERVIEW OF THE ON FARM PROGRAM LINE ITEMS

Outlined in Table 1.1.b is an overview of the On-Farm Program line items, targets and timelines for achievement of the line items, and achievement of the line items to 30 June 2010.

Table 1.1.b: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2010

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2010
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program (Total) Horticulture Large Area				1432 farms 872 farms 560 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	690 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	407 farms
* Vegetation Management Planning and Property Vegetation Planning	450 farms	1-15 years	Yes	409 farms 252 landholders
Irrigation efficiency systems	270 farms	1-15 years	Yes	197 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	569 farms
Conversion to perennial pasture	2000 ha	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	40 farms	10 years	No	0 ha
On-farm channel seepage control			No	0 ha

Rice soil amelioration & reclassification	72 farms	1-10 years	No	TBD#
Drainage recycling	450 farms	1-15 years	Yes	320 farms
Sub-surface drainage and disposal	65 farms	1-13 years	Yes	6 farms
Mole drainage and on-farm recirculation	7 farms	1-10 years	No	0 farms
Laser forming	7500 ha	1-10 years	No	78,000 ha[+]
Rice target water use #	619 ha	1-10 years	No	443[^]
* EM31 Surveys	900 farms		Yes	66 farms
* Structural adjustment			Yes	7 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Line item included in structural adjustment
[+] Estimate based on the number of Whole Farm Plans implemented
^ Based on rice soil areas reclassified as unsuitable as per the Rice Environmental Monitoring Policy

Program highlights

The program expenditure and the actual number of incentives paid against targets for line items of MIA EnviroWise for the 2009/2010 reporting year are presented in Figures 1.1.b to 1.1.d. The highlights for the past year were again the success of the biodiversity program, especially BioTender which has permanently protected close to another 2,000 hectares of high quality remnant vegetation. The continued expansion of the community education program has seen more than 1,900 school students and community members participate in environmental education activities.

The On-Farm Incentive Program drew to a close this year with a large reduction in both the number of incentives paid and funding invested in on-farm water efficiency projects. In addition, the administration costs have remained below 5% of the program expenditure.

Activities

The implementation of MIA EnviroWise has been broken into three sections - on-farm, biodiversity and regional. The On-Farm Program is focused on improving the water use efficiency of farms in the MIA through education, extension and the provision of financial incentives to the farmers. The biodiversity program also works with farmers as well the general community and regional organisations to protect and enhance the amount and diversity of native vegetation to improve habitat for native fauna. The program also works to incorporate the local Wiradjuri culture into natural resource management in the MIA. The regional program is the coordination of the plan and the regional activities such as school and community education. The progress of the various projects against their targets for the 2009/10 reporting year is shown in Figure 1.1a on page 5.

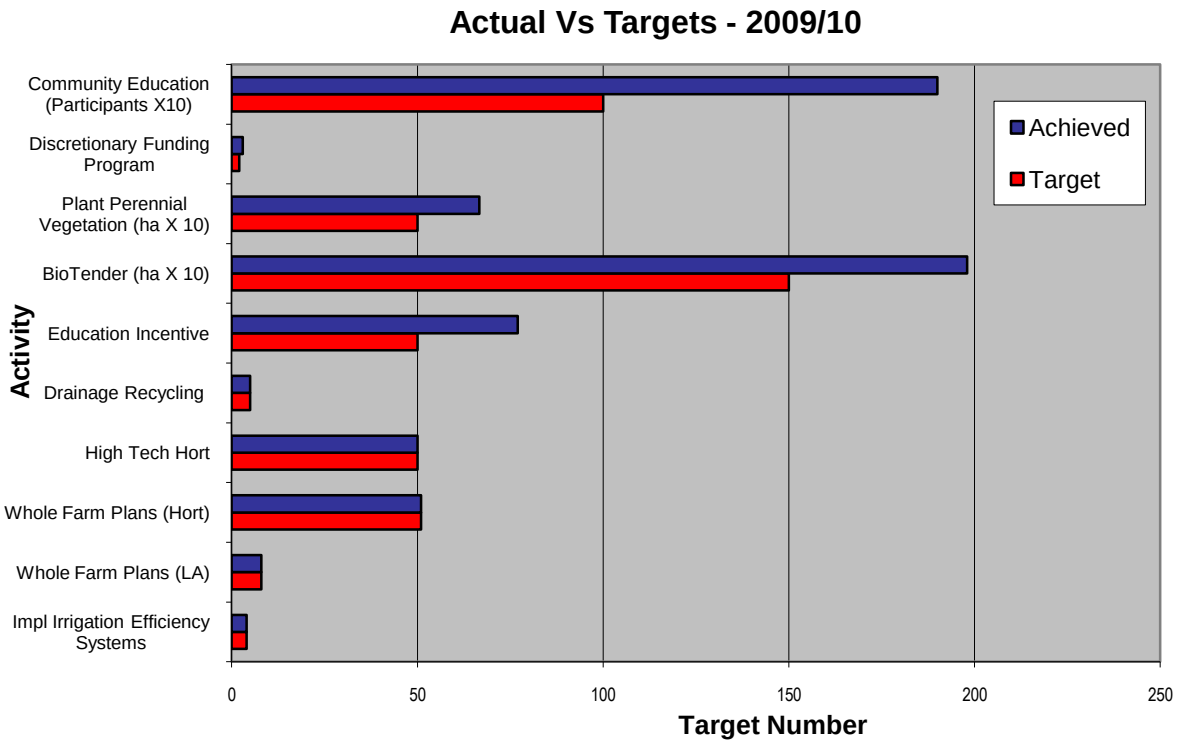
On-Farm Program

Outlined below is a summary of the On-Farm Incentives Program for 2009/2010 including a discussion on progress:

- This is the final year of funding for the MIA EnviroWise On-Farm Incentives Program, and as such all applications for funding were due by 30 June 2009. The applications formed the target numbers for the year and therefore targets for all types of incentives were met but not exceeded. The only incentive that will be offered in the future through MIA EnviroWise will be the Education Incentive and therefore that will be the only one reported against.

- Once again the Education Incentive has proved to be very popular with the landholders of the MIA with over 75 farming families taking the opportunity to undertake further education with the assistance of MIA EnviroWise.

Figure 1.1.a: MIA EnviroWise Targets Achieved



Biodiversity Program

Outlined below is a summary of the Biodiversity Program for 2009/10 including both the on-farm plantings and BioTender:

- The vast majority of biodiversity plantings this year have been in the form of directly sown seed rather than the traditional planting of seedlings. There was in excess of 650 hectares of native vegetation planted and over the past 12 months across 31 individual properties and Murrumbidgee Irrigation land. This consisted of 107 hectares of newly planted seedlings and 550 hectares of direct seed.
- The MIA EnviroWise BioTender program was again a huge success with 1,980 hectares of high quality remnant vegetation protected in perpetuity. With a target of 1,500 hectares this program has exceeded target for the second year. Unfortunately budgetary constraints have seen the program suspended until more substantial funding can be found.

Regional Program

Outlined below is a summary of the regional program for 2009/10 including a project administration and education:

- In the 2009/2010 year there was again an increased focus on school and community education in the MIA EnviroWise program. This year in excess of 1,900 school children from within and outside the MIA attended education sessions run by MIA EnviroWise staff.

- There was only one FarmWise irrigation management course run this year, due to the conclusion of the On-Farm Incentive Program. This course was held for those who had not completed parts of the FarmWise course to be eligible for their on-farm incentives.
- There has been a change in focus to running the next level of course providing more detailed information and a specific range of topics, courses included Micro Irrigation Management, Pasture Cropping, Centre Pivot & Lateral-Move Systems, Fertiliser Applications and Native Grass Identification.
- The Discretionary Funding for School and Small Community Groups program was more successful than last year with two school and one community group taking the opportunity to secure funding to improve the biodiversity of their areas of operations.
- The MIA EnviroWise program employed 12 staff (including five Wiradjuri Cultural and Heritage Project Officers) in a combination of full and part time employment to implement the various projects over the past year. The staff specialised in biodiversity planning and implementation, project management and education.

EXPENDITURE

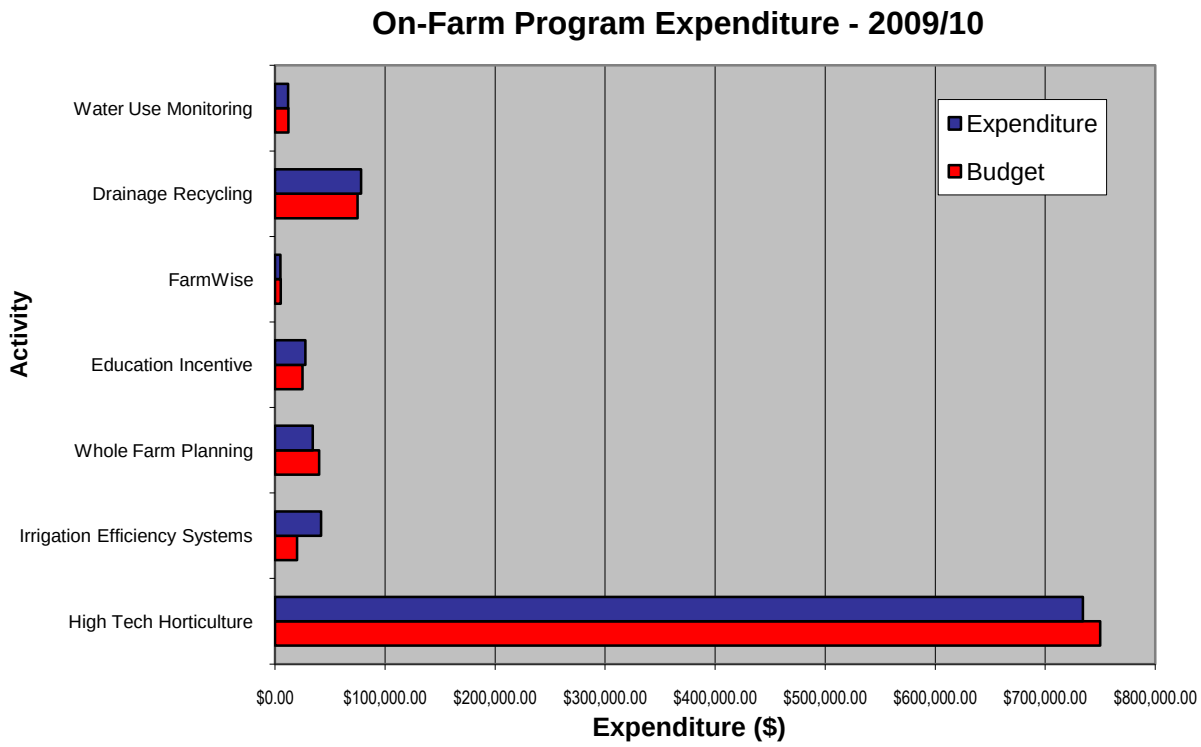
MIA EnviroWise expenditure was over budget for the second year running, however only very slightly. The budget for the year was $4,112,000 and the cost of implementing the program for the year was $4,116,734 (0.2% over budget). Of the money invested in the MIA, a total of $3,022,207 was government funding while the remaining $1,094,527 came from the landholders of the MIA through their levy. That ratio of Landholder to Government contribution is expected to even out in the future as less On-Farm Incentives (100% funded by Government) are offered in the future.

On-Farm Program

Figure 1.1b shows of the expenditure for the On-Farm Program for the 2009/2009 year. As the targets were set based on the applications received there is very little variation from budget across the range of program line items.

As this program has concluded there will be no future reporting.

Figure 1.1.b: On-Farm Activities - Expenditure

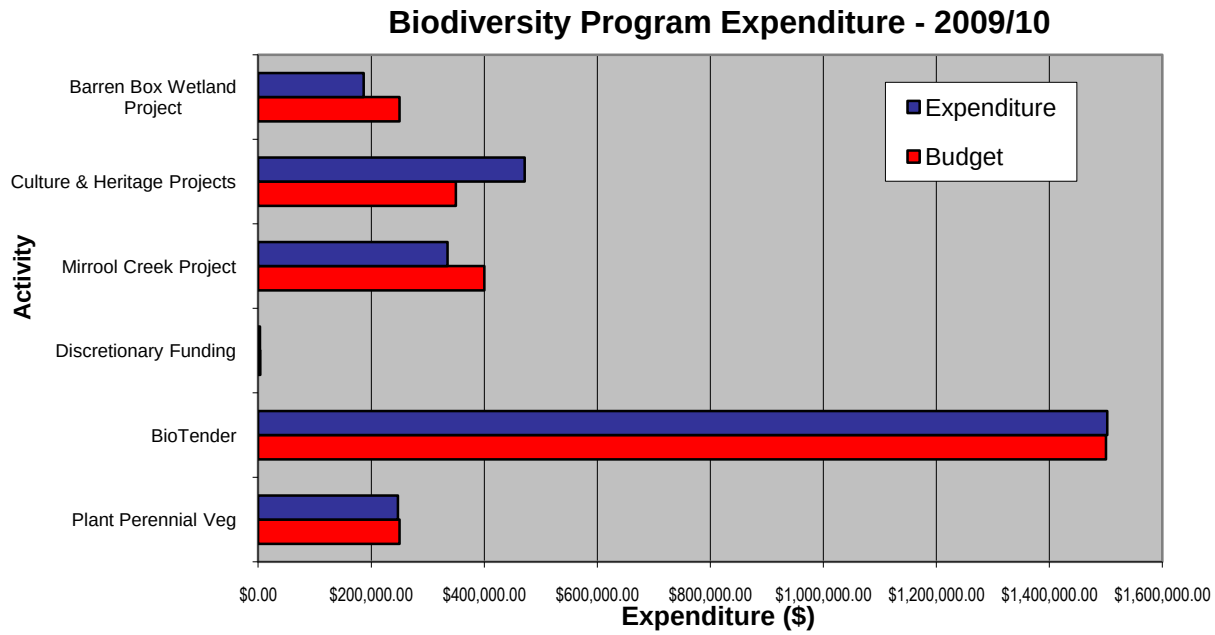


Biodiversity Program

Figure 1.1c below, shows the expenditure for the biodiversity program for 2009/10 against budget, with explanations for on-farm plantings, BioTender and various biodiversity related projects detailed in the points below:

- BBSW Project expenditure was again under budget while still achieving the desired outcomes (see section A5).
- The major focus of the Culture and Heritage Program to date has been the establishment of a cultural park at Three Ways in Griffith. This whole program is over budget, however that has been more than covered by the under-expenditure in the other biodiversity projects.
- The Mirrool Creek Project was under budget, this is primarily due to delays in construction due additional investigation and planning work, and the delay caused by MI becoming the 'Reserve Trust Manager' for the Crown Land along the Creek, which required detailed negotiations with adjoining landholders that is still ongoing.
- BioTender was slightly over budget as there were a number of good sites and the decision was made to spend the extra money to secure the protection of the highest value sites. This was offset by the on-farm plantings coming in slightly under budget.

Figure 1.1.c: Biodiversity Program Expenditure

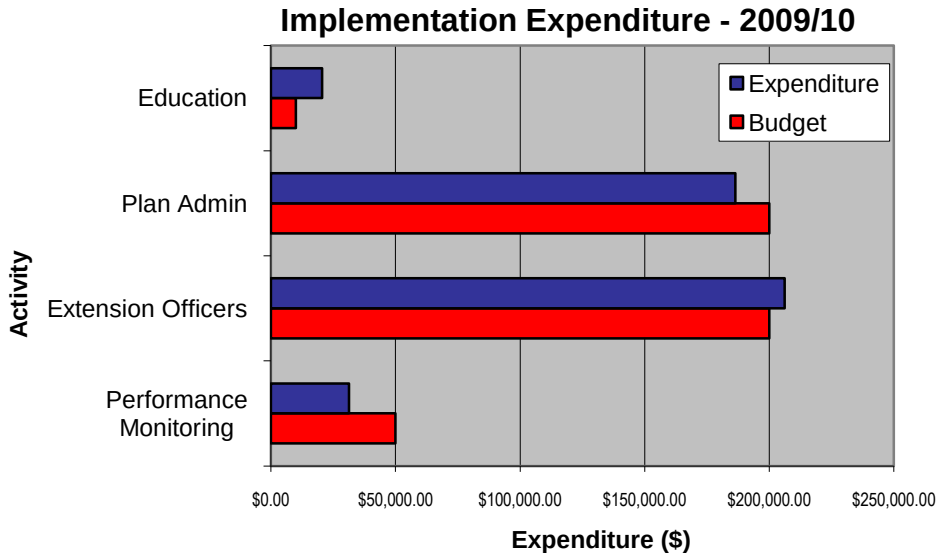


Regional Program

Outlined below is a summary of the regional program expenditure for 2009/10 including project administration and education:

- Performance monitoring of the plan was well under budget while delivering the MIA EnviroWise Strategy for the next five years.
- Plan administration continues to be well below the target range of 10% of costs with 95% of expenditure going to on-ground work for the last year.
- Although the education program exceeded budget, it was extremely successful with close to 2,000 individuals attending events run by the MIA EnviroWise education team.

Figure 1.1.d: Implementation Activities – Expenditure



A.1.2 MIA ENVIROWISE 2

One of our key challenges is to integrate the management of water, energy and carbon. Water remains pre-eminent, and the challenges of improving water productivity and water quality in a more difficult and variable climate are formidable. Meeting these challenges is fundamental to the long-term viability of the MIA. We recognise that those challenges need to be tackled in a manner that is extremely conscious of our energy and carbon footprints.

In 2010, we completed the development of our new environmental strategy, MIA EnviroWise 2 which goes beyond water, to look holistically at climate, carbon, energy, water and biodiversity - and the interactions between them - in a social, cultural and economic context. The strategy was developed by a steering committee comprising Leith Boully, Gillian Kirkup, Doug McWilliam, Helen Dalton, Scott Vaessen, Eric Burton, Greg Budgden, Judy Johnson, Rob Kelly and Karen Hutchinson.

A.1.3 NEW DOCUMENTATION RELEVANT TO BACKGROUND AND/OR IMPLEMENTATION OF THE LWMP

Table 3 includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

Table 3: Key reference documents relevant to the LWMP (MIA EnviroWise)

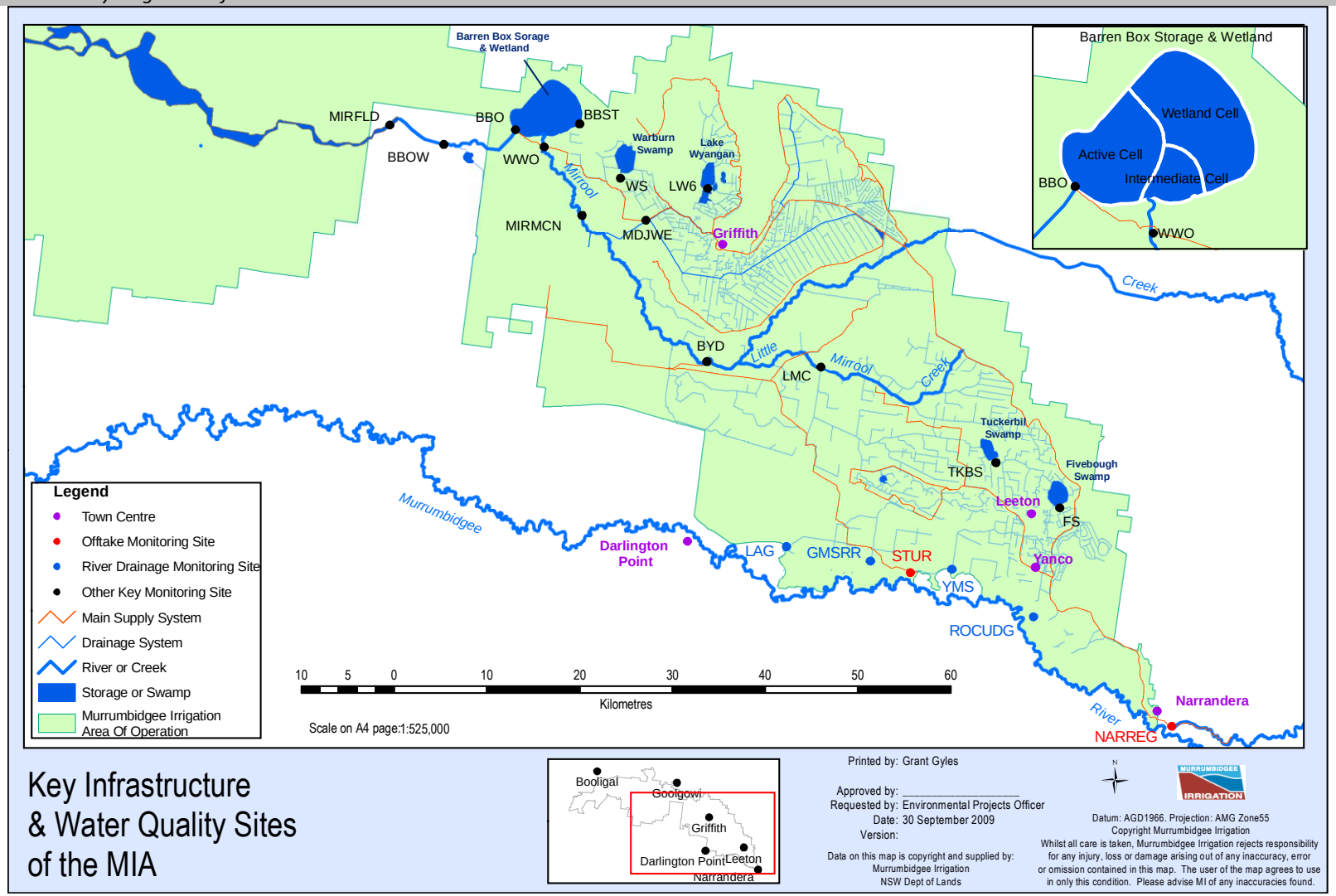
Document	O/R	Submitted to DECCW	Endorsed by DECCW
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation.	R	Oct 2005 Electronic	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey.* Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, CSU, Wagga Wagga. Report prepared for MI. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.	R	October 2006 Electronic (on disc)	*

Document	O/R	Submitted to DECCW	Endorsed by DECCW
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants*. Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	
Van der Lely, A. (2006). *Groundwater Conditions In The MIA and Districts: Annual Report 2006*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Van der Lely, A. (2007). *Groundwater Conditions In The MIA and Districts: Annual Report 2007*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
MIA EnviroWise (2007) Five Year Review	R	February 2007	*
Hale, J (2008) Barren Box Wetland Rehabilitation Plan 2009-2014	R	December 2008	
Taylor, I R. (2008) Barren Box Intermediate Cell Waterbird Study	R	August 2008	
Van der Lely, A. (2008). *Groundwater Conditions In The MIA and Districts: Annual Report 2008*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Campbell, A. (2009). *MIA EnviroWise 2 Strategy.* Prepared for Murrumbidgee Irrigation by Triple Helix Consulting.	R	December 2009	
Lewis, B (2010). *Biodiversity Benchmarking Survey of the Murrumbidgee Irrigation Area: Birds.* Prepared for Murrumbidgee Irrigation by Lewis Ecological Surveys	R	March 2010	
Taylor, I R. & Schultz, M.C. (2010) *Barren Box Intermediate Cell Waterbird Study.* Prepared for Murrumbidgee Irrigation by CSU	R	June 2010	
Van der Lely, A. (2010). *Groundwater Conditions In The MIA and Districts: Annual Report 20010*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DECCW

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Figure 2.2.a: Key irrigation infrastructure in the MIA



A.2.2 REPORTING REQUIREMENTS

Climatic conditions

The 2009/10 season showed significant variation to the long term average weather patterns. Rain fell inconsistently and was recorded below both the previous season totals and the long term average. Total ETo was slightly lower than in 2008/09 and well above the long term average.

Table 2.2.a: Summary of climatic data

Month	ETo 2009-10 (mm)	Rainfall 2009-10 (mm)	Net ETo (ETo-Rainfall) (mm)	LTA ETO (1962-2009) (mm)	LTA Rainfall (1962-2009) (mm)
July	59.30	15.40	43.90	50.10	36.30
August	110.70	8.80	101.90	78.30	32.70
September	167.20	20.40	146.80	118.30	37.20
October	212.20	13.20	199.00	177.20	41.20
November	270.70	30.80	239.90	227.90	29.40
December	295.40	50.20	245.20	275.40	32.70
January	345.20	8.60	336.60	285.10	34.40
February	224.00	51.40	172.60	231.80	28.40
March	190.20	48.00	142.20	192.90	30.50
April	115.80	23.80	92.00	116.10	28.10
May	52.00	50.40	1.60	67.00	35.60
June	42.40	14.60	27.80	44.20	36.10
Total	**2,085.00**	**336.00**	**1,750.00**	**1,864.00**	**403.00**

Source: CSIRO Griffith

Notes

LTA = Long term average (1962-2009), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.
ETo = reference evapotranspiration

Table 2.2.b shows the general security announcement 6% higher than the previous season with total deliveries increasing by 31%. The remainder of the 2002/03 Snowy Hydro Borrow was repaid this season, making general security allocations available for use. The 2009/10 season included another substantial increase in deliveries to rice cropping as detailed in table 2.2o.

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2010

Year	Announced Allocation (general/high%)	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2009-10	**27/95**	**505,176****	**368,269**	**1,750**	**2,085**	**336**
2008-09	21/95	393,973	276,233	1,820	2,166	346
2007-08	13/95	335,687	210,297	1,766	2,127	361
2006-07	15/90	559,952+	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423

Sources: MI Corporate Office & CSIRO Griffith

Notes: * = Does not include 2,146ML environmental waterway diversions for DNR.

+ = Does not include 3,256ML State Water environmental flows through Roaches Escape.

** = Does not include 1,468ML Environmental diversions for NOW.

A.2.2 (1) DIVERSIONS, VOLUME

Table 2.2.c: Summary of Gross Diversions Main and Sturt Canal 2009/10

	Sturt (ML)	Main (ML)
August	2,607	17,627
September	3,724	25,340
October	8,028	42,611
November	14,510	66,894
December	10,100	54,587
January	17,061	82,350
February	8,238	39,369
March	10,507	38,008
April	4,326	31,403
May	2,239	22,638
June	91	4,386
Less Environmental Diversions	0	1,468
TOTAL	**81,431**	**423,745**

Note: 81,431 + 423,745 = 505,176 ML

Table 2.2.d: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2009/10

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	3,948	17,204	1,769
September	4,910	24,859	1,920
October	8,748	41,735	4,320
November	13,817	61,968	9,153
December	11,409	51,634	7,355
January	17,687	80,147	7,218
February	8,976	38,786	3,441
March	12,435	35,395	5,952
April	5,553	28,555	6,220
May	4196	21,386	3,508
June	-412	2162	243
Total 2009-10	91,267	403,831	51,099
Total 2008-09	40,244	346,282	44,000
Total 2007-08	25,437	304,601	33,332
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130
Total 1996-97	261,955	1,016,135	151,960

Notes:

Diversions shown in Table 2.2.d for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

Table 2.2.c shows the summary of gross diversion coming into our system at the two regulated sites at Narrandera and the Sturt Canal. The sum of these diversions are the Total Diversions as shown in Table 2.2.b. Water to environmental flows are excluded.

Table 2.2.d shows the actual amounts of water going through each of the three main systems which make up the MIA andDistricts:

1. The Main Canal System, which is primarily fed through the Narrandera Regulator.
2. The Sturt Canal System, which is primarily fed through the Sturt offtake.
3. The Wah Wah System, which was primarily fed through BBSW before the drought but now consist of mostly fresh water which entered the system through the Narrandera and Sturt regulators.

The total amount of water going through these three systems combined is greater than the Net Total Irrigation Diversions because of MI's innovative re-use program. For details on which water is included in each of the systems, please refer to Table 2.2.d notes.

A.2.2 (2) SUPPLY EFFICIENCY, STORAGE LEVELS

Supply efficiency

The table below shows the simple efficiency of the system to be 73%. This calculation shows the apparent loss to be 135 GL. The water balance in Section A.2.2 (5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

The improvement in simple efficiency is in line with increased diversions combined with management and operational changes implemented to minimise conveyance losses and improve efficiency. Without those initiatives, the simple efficiency would have been much lower.

Table 2.2.e: Simple efficiency of the system —2002 to 2010

Parameter	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04	2002/03
Diversions (ML)								
Sturt Canal	81,431	30,943	21,266	60,280	233,388	145,728	174,150	176,488
Main Canal	425,213	363,030	314,421	502,928	805,277	680,479	687,349	783,631
Less DNR Environmental Diversions	1,468	0	0	3,256	2,146			
NET TOTAL irrigation diversions	**505,176**	**393,973**	**335,687**	**559,952**	**1,036,519**	**826,207**	**861,499**	**960,119**
Sales (ML) - metered and unmetered	368,269	276,233	210,297	411,898	829,990	648,417	651,806	754,112
Conveyance (ML)	136,907	117,740	125,390	148,054	206,529	177,790	209,693	206,007
Simple Efficiency(%)	**73**	**70**	**63**	**74**	**80**	**79**	**76**	**79**

Source: MI Irrigation Services and Corporate Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100

Storage levels

Barren Box Storage Storage and Wetland (BBSW)
BBSW has transformed a degraded swampland into an efficient water storage facility which returns around 20,000ML of water per annum to the Snowy River. The storage comprises of three cells:

- Active cell – storage capacity 24,500ML
- Intermediate cell – storage capacity 4,500ML
- Wetland cell covering 1,650 hectares

All flows during the 2009/10 season were diverted to the intermediate cell only. The last two months of the season experienced significant inflows into the intermediate cell due to reduced demand downstream and good rainfall in the last week of May. These additional inflows contributed to increased volume of 3,008ML for the period.
The outflows of 7,090 from the Intermediate cell, are also dispayed in Table 2.2.m as Barren Box Storage to Wah Wah Main @ B.B.S. Pumps.

Table 2.2.f: Barren Box Storage Intermediate Cell 2009/10

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	875	85	518	404	416	1,301	395	1,099	1,558	334	705	2,408	10,098
Outflow	0	700	0	2,000	790	250	850	0	850	1,400	200	50	7,090
Variation	875	-615	518	-1,596	-374	1,051	-455	1,099	708	-1,066	505	2,358	3,008

Note: Licensed Pumpers on BBS (DIPNR) = 242ML for 2009/10

Lake Wyangan

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. MI attempts to regulate the lakes' levels to satisfy the various demands to meet commercial irrigation, environmental and community objectives.

At the request of Griffith City Council, a deliberate diversion flowed into the North Lake during the months of November, December and March, with a total figure of 2,168ML being recorded. Water for lake filling was underwritten by Griffith City Council's town entitlement. These flows were used for both environmental and recreational needs of the community. Opportunistic water was pulsed into the South Lake during the reporting period and utilised for irrigation purposes where possible. A total of 903 ML was also diverted from the South Lake into the North lake during the reporting period. 595ML of this was part of Griffith City Councils underwritten portion, with the remaining 308ML being diverted to maintain a safe operating level in the South Lake.The volume of the North Lake closed significantly higher than the same time last year, with the South Lake closing slightly lower.

The monthly figures relating to the volumes pumped by MI from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.m in A.2.2(4), Drainage reuse. Table 2.2.g (below) provides 2009/10 monthly gauge heights (water depth) for the lakes.

Table 2.2.g: Gauge heights for South and North Lake Wyangan 2009/10

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.29	1,032	0.47	1,789
Aug	1.25	1,000	0.44	1,738
Sep	1.29	1,032	0.39	1,653
Oct	1.30	1,040	0.30	1,500
Nov	1.32	1,058	0.20	1,330
Dec	1.05	840	0.62	2,044
Jan	0.88	716	0.40	1,670
Feb	0.94	758	0.35	1,585
Mar	1.10	880	0.82	2,384
Apr	1.18	944	0.84	2,418
May	1.39	1,121	0.97	2,639
Jun	1.15	920	1.14	2,970

Source: MI Irrigation Services

Gross Resources = Gauge height converted into estimated megalitres.

Yenda Storage

The figures in table 2.2.h. show the inflows and outflows at the Yenda en-route storage. This storage is primarily used to compensate for differences between orders and diversions from the river.

Table 2.2.h: Inflow and Outflow Yenda En-route Storage 2009/10

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	0	683	556	813	1,201	864	721	474	686	604	684	738	8,024
Outflow	65	410	488	616	789	971	685	485	578	514	794	581	6,976
Variation	-65	273	68	197	412	-107	36	-11	108	90	-110	157	1,048

Bray's Dam Storage

Bray's Dam storage has the operational ability to capture and redistribute irrigation water that has been rejected after rainfall. Water can also be pumped from Mirrool Creek and reused in the irrigation network.

Table 2.2.i: Inflow and Outflow Brays Dam Storage 2009/10

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	461	0	104	224	762	368	661	1,015	1,285	1,154	682	1,501	8,217
Outflow	0	812	827	827	87	560	553	867	624	560	638	0	6,355
Variation	461	-812	-723	-603	675	-192	108	148	661	594	44	1,501	1,862

A.2.2 (3) DRAINAGE VOLUMES AND SALT LOADS

Table 2.2.j: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	Site No.	Frequency	Type	X-Coordinates	Y-Coordinates
410167	BBOW	Barren Box Outfall Canal Wyvern	1	Continuous	EC, Flow	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	Continuous	EC, Flow	403257	6208333
410085	LMC	Little Mirrool Creek	3	Continuous	EC, Flow	422126	6192597
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	Continuous	EC, Flow	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	5	Continuous	EC, Flow	427479	6171449
410083	YMS	Yanco Main Southern Drain	6	Continuous	EC, Flow	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	Continuous	EC, Flow	444891	6165663
41010162	WS	Warburn Swamp	8	After trigger	EC, pH, NTU	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	Continuous	EC, Flow	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	10	After trigger	EC, pH, NTU	409886	6193089
41010990	BBST	*This site no longer exists, due to the construction of BBSW*					
41010896	LW6	Lake Wyangan Causeway	12	After trigger	EC, pH, NTU	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	After trigger	Pesticide	440983	6182501
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	15	When flowing	Pesticide EC	375673	6218725
Other Sites Required for NOW Licence							
41010903	BBO	Barren Box Storage		After trigger	EC, pH, NTU	389236	6218183
41010978	WWO	Willow Dam		After trigger	EC, pH, NTU	392197	6216283
410164	BOD1	Channel 13 escape at the outfall channel Wyvern		Continuous	EC, Flow	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel		Continuous	EC, Flow	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek		Continuous	EC, Flow	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road		Continuous	EC, Flow	396994	6205386

All continuous sites are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated at least four times a year. All sites are visited monthly for routine maintenance by Thiess staff. Monthly field data is collected by MI staff using a Hydro-lab, collecting temperature, EC and pH.

This list is currently under review and is expected to change when the DECCW licence has been renegotiated.

Table 2.2.k: Drainage Volumes (ML) – July 2009 to June 2010

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0	17627	25340	42611	66894	54587	82350	39369	38008	31403	22638	4386	**425213**
STUR**	**Monthly Total**	0	2607	3742	8028	14510	10100	17061	8238	10507	4326	2239	91	**81431**
TOTAL														**506644**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	2.5R	3.7R	10.2R	13.4R	28.7	27.9	23.6R	22.7R	27.9	24.4	21.9R	16.0R	19
	Median	2.3R	1.9R	10.1R	12.0R	25.6	25.7	21.4R	22.7R	16.7	22.6	13.4R	6.4R	15
	Inst.Max	7.3R	17.9R	25.8R	31.5R	81.1	64.4	50.9R	70.2R	146	56.8	121 R	89.1R	146
	Inst.Min	0.7R	0.0R	0.6R	2.6R	5	10.5	2.2R	3.0R	6.4	6.5	2.6R	1.5R	0
	Monthly Total	79R	114 R	306 R	415R	859.8	864.4	731R	636 R	863.7	730.6	677 R	479.8 R	**6755 R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	1075	1172	872	1030	1759	1418	1543	2078	1277	1724	0	13948
BYD (Bywash)**	**Monthly Total**	0.0	672	827	234	87	560	553	867	624	497	638	0	5559
MIRMCN (41010955)	**Mean**	41.3R	59.9R	112R	142	298	251	224	184	247	210	156	121	171
	Median	29.2R	58.8R	121R	141	302	263	214	174	236	193	140	107	158
	Inst.Max	208 R	143R	257R	209	500	435	337	368	809	489	380	353	809
	Inst.Min	12.7R	10.7R	17.3R	89.4	142	135	133	96.9	139	133	94.1	56.9	11
	Monthly Total	1280R	1857R	3370R	4401	8935	7769	6940	5150	7662	6310	4840	3632	**62150R**
DRAINS														
MDJWE (410174)	**Mean**	14.6R	44.3R	79.8R	113	284	254	231	165	182 R	160	103	49.3K	140
	Median	10.4R	43.9R	79.7R	115	301	275	222	134	179 R	122	87.4	32.1K	119
	Inst.Max	50.6R	129R	280R	194	575	537	420	471	1080 R	649	434	350 K	1080
	Inst.Min	5.0R	4.1R	6.6R	56	105	84.5	91.4	57.8	59.2R	72.1	54.6	14.2K	4
	Monthly Total	452R	1372R	2395R	3490	8524	7878	7161	4634	5635R	4811	3178	1479K	**51010**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	5.7	13.9?	2.2?	[55.5]	[120]	[87.0]	[62.2]	31.2	89	200	74.4	14.9	63
	Median	2.2	2.9?	2.3?	[43.2]	[147]	[80.5]	[51.6]	19.9	82.1	211	69.2	15.5	47
	Inst.Max	21.8	81.4?	7.7?	[155]	[192]	[117]	[133]	106	298	294	145	24.9	298
	Inst.Min	0	0.3?	0.0?	[0.9]	[0.0]	[53.3]	[21.8]	0.7	0	85.7	4.4	2.4	0
	Monthly Total	178	431?	67?	[555]	[2398]	[1479]	[1617]	874	2760	6001	2307	446	**[19110]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.1=	0.0=	[0.0]	[ ]S	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	8.2=	0.0=	[0.0]	[ ]S	8
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	0
	Monthly Total	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.000=	2.9=	0.000=	[0.000]	[ ]S	[2.9]
GMSRR (41010921)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3R	0.0R	0.0R	0
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	6.5R	0.0R	0.0R	7
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	7.8R	0.0R	0.0R	8
LAG (41010940)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	2.3R	0.0R	0.2R	0.6R	0
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	24.1R	0.0R	5.4R	4.9R	24
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	71R	0.0R	5.8R	17.1R	94 R
ROCUDG(41010005)	**Mean**	0.0R	0.0R	[0.4]	0.0R	0.0R	0.0R	0.0R	0.0R	[1.3]	[17.6]	[3.0]	[6.2]	2
	Median	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[16.6]	[0.4]	[2.1]	0
	Inst.Max	0.0R	0.0R	[6.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[110]	[78.4]	[48]	[41]	110
	Inst.Min	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	[0.0]	[0.6]	0
	Monthly Total	0.0R	0.0R	[9.5]	0.0R	0.0R	0.0R	0.0R	0.0R	[33]	[247	[33]	[179]	[501]
TOTAL														**598**
SWAMPS														
WS**	**Monthly Total**	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	**0**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES FOR DNR														
WWO**t		0	960	518	404	416	1301	395	1099	1558	334	705	2443	10133
BBpumps**#		0	700	0	2000	790	250	850	0	850	1400	200	50	7090
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0	0	0	0.0R	1.5@	0.8@	0.5@	1.7@	8.8@	1.5@	1.5@	3.5@	2
	Median	0	0	0	0.0R	1.3@	0.3@	0.0@	0.4@	7.7@	1.4@	0.1@	0.1@	0
	Inst.Max	0	0	0	1.3R	4.8@	5.1@	2.6@	4.9@	33.7@	3.2@	7.0@	23.0@	34
	Inst.Min	0	0	0	0.0R	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0
	Monthly Total	0	0	0	1R	46@	25@	15@	46@	273@	45@	46@	104@	**601R**

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0.2	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	4.3	4
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0.007	7.325	**7**
DCWIDG (41017001)	**Mean**	0	0	[0.0]	[ ]M	[0.0]	0	0	0	1.5?	0.0?	0.1?	0	0
	Median	0	0	[0.0]	[ ]M	[0.0]	0	0	0	0.3?	0.0?	0.0?	0	0
	Inst.Max	0	0	[0.0]	[ ]M	[0.0]	0	0	0	19.1?	0.0?	2.3?	0	19
	Inst.Min	0	0	[0.0]	[ ]M	[0.0]	0	0	0	0.0?	0.0?	0.0?	0	0
	Monthly Total	0	0	[0.0]	[ ]M	[0.0]	0	0	0	46 ?	0.0?	2.3?	0.568	**49**
DCCENT (410172)	**Mean**	0	0	0	0	0	0.2	0	0.1	0.4R	0.2	0.2R	0.1	0
	Median	0	0	0	0	0	0	0	0	0.0R	0	0.0R	0	0
	Inst.Max	0	0	0	0	0	0.2	0	0.1	0.4R	0.2	0.2R	0.1	0
	Inst.Min	0	0	0	0	0	0	0	0	0.0R	0	0.0R	0	0
	Monthly Total	0	0	0.41	1.11	0.042	5.684	0.26	2.881	12.2R	7.032	4.8R	2.068	**36**

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by THIESS SERVICES except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. S Rating table suspended
3. = Pool reading only, no flow condition
4. R Rating table extrapolated
5. M Equipment malfunction
6. [] Some missing record during the period
7. K Minor editing
8. ? Irregular data, use with caution
9. @ ... Theoretical rating table applied
10. t Flows into BBS from Willow Dam
11. # Flows at BBS to the Outfall
12. Salt loads Thiess Services unless * where we have calculated them using the formula below
    Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000
    NARREG and STUR saltloads were calculated using the above formula, with the average EC calculated from mean monthly EC from the Murrumbidgee River at Wagga (http://waterinfo.nsw.gov.au/index.epl?site=410001)
13. ND Not Determined (due to a farm accident at this site the gauging station was completely destroyed)
14. LF Low flow conditions, not able to provide a reliable estimate

Drainage volumes to the Murrumbidgee River (ML)

Year	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
TOTAL	7,434	5,663	8,570	945	337	197	598

Sites highlighted in blue are sites that may drain back to the Murrumbidgee River.

Table 2.2.k shows the monthly total flow volumes from the Murrumbidgee River entering the MIA measured at our two regulated sites; **Narrandera (NARREG)** after diversion at the Berembed Weir and the **Sturt Canal (STUR)** after diversion at the Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- **Little Mirrool Creek (LMC)** - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- **Bray's Dam (BYD)** - Drainage diversion from LMC to the Benerembah Irrigation District.
- **Mirrool Creek at McNamara Road (MIRMCN)** - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- **Main Drain J (MDJWE)** - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- **Barren Box Outfall Wyvern (BBOW)** - Flows from Willow Dam, Barren Box and channel 13 escape discharging to Wah Wah Irrigation District.

There are four river channel wetland sites which potentially discharge to the Murrumbidgee River.

- **Gogeldrie Main Southern (GMSRR)** - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- **Yanco Main Southern (YMS)** - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water gravitates into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- **Gooragool Lagoon (LAG)** - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by licensed customers.
- **Cudgel Creek downstream from Cudgel Creek (ROCUDG)** - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings, drainage re-use options as well as those decisions dealing with asset design, purpose and function.

During the 2009/10 year, MI diverted 506,644 ML of water from the Murrumbidgee River including 1,468ML for environmental flows. This water contained approximately 41,792 tonnes of salt.

Of this salt load, approximately 78 tonnes (less than 0.2% of the imported salt load) were discharged into wetlands which are connected to the Murrumbidgee River in about 598 ML of drainage water (0.1% of diversions).

The significant reduction in drainage on historical levels, to the wetlands associated with the Murrumbidgee River is due to the low allocations which have led to reduced on-farm drainage as well as innovative solutions for drainage re-use.

As the MIA is essentially a closed system, most of the salt that is imported into the area via supply water makes its way into our soils during irrigation activities. The equivalent of about one quarter of the imported salt is exported to the Wah Wah Irrigation District, which leaves about 20,000 tonnes in the area east of BBSW. Due to the unprecedented drop in groundwater levels over the past seven years, our soils are no longer under the immediate threat of salinisation. Through irrigation and rainfall, salts are now able to leach out of the rootzone into the groundwater system and ultimately out of our area.

MI currently funds a three-year CSIRO research project “Hydro-ecological assessment of the MIA”. The aims of that project are to increase the understanding of our surface and groundwater systems, their connectivity and their connection to the regional ecology. As part of that study, the MIA will be divided into hydrologic zones which will each have a unique set of characteristics. Each zone will be managed and monitored accordingly. Another expected outcome of this study is a better understanding of salinity issues in each zone which will allow us to better and more specifically monitor and manage soil salinity. Detailed salt and water balances will also be compiled.

Table 2.2.I: Salt Loads (Tonnes) – July 2009 to June 2010

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	**0**	**2459**	**3016**	**4309**	**3939**	**2480**	**3162**	**3427**	**5595**	**3417**	**2898**	**522**	**35244**
STUR**	**Monthly Total**	**0**	**345**	**467**	**832**	**910**	**410**	**723**	**633**	**1486**	**476**	**385**	**0**	**6568**
TOTAL														**41792**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	1.2R	[2.6]	[3.8]	4.6R	6.8	5.5	5.7R	6.2R	7.1	6.6	3.8R	3.6R	5
	Median	1.0R	[2.5]	[3.9]	3.9R	6.5	4.9	5.6R	5.9R	5.3	6.3	2.7R	2.4R	4
	Inst.Max	8.6R	[21.7]	[11.7]	16.9R	25.6	16.5	13.7R	19.5R	33.4	15.7	25.4R	15.0R	33
	Inst.Min	0.2R	[0.1]	[0.4]	1.2R	1.9	1.9	0.7R	0.6R	2.1	1.9	0.7R	0.8R	0
	Monthly Total	38R	[41]	[111]	142R	205.0	170.0	176R	174R	219.0	199.0	119R	109R	**[1704]**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0	239	366	206	199	216	196	163	297	244	249	0	**2376**
BYD (Bywash)**	**Monthly Total**	0	150	258	55	17	69	76	92	89	95	92	0	**993**
MIRMCN (41010955)	**Mean**	11.7R	14.2R	21.4R	21.7	27.4	21.0	22.3	20.2	37.2	36.1	26.6	27.7	24
	Median	8.3R	15.3R	22.5R	21.8	27.8	20.3	20.9	19.3	35.8	34.1	23.0	26.6	22
	Inst.Max	49.5R	29.8R	46.1R	31.6	51.6	44.7	35.1	41.0	99.8	89.0	65.3	69.5	100
	Inst.Min	4.9R	4.1R	4.5R	13.3	17.3	10.6	11.6	11.8	17.3	24.7	14.4	15.3	4
	Monthly Total	363R	439R	642R	674.0	823.0	651.0	690.0	567.0	1154.0	1082.0	826.0	830.0	**8741R**
DRAINS														
MDJWE (410174)	**Mean**	7.3R	10.3R	15.9R	16.3	29.3	30.9	24.9K	19.6K	32.8R	30.1	14	10.2K	20
	Median	6.1R	11.9R	15.3R	16	30.3	32.1	23.5K	18.2K	23.8R	25	11	8.6K	17
	Inst.Max	19.8R	25.7R	51.1R	28.1	62.4	64.3	44.6K	54.8K	173 R	125	52.1	33.6K	173
	Inst.Min	1.6R	0.6R	2.0R	8.2	13.3	13.7	11.2K	8.1K	9.4R	15.9	6.2	4.8K	1
	Monthly Total	227R	320R	477R	506	879	956	770K	550K	1018R	904	434	305K	**7347R**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	1.4	4.1?	0.5?	[10.2]	[10.8]	[8.6]	[6.6]	3.5	14	35.1	12.7	2.7	11
	Median	0.5	0.8?	0.5?	[6.2]	[13.1]	[8.0]	[6.3]	2.1	11.7	38.4	11.6	2.8	7
	Inst.Max	16.8	44.7?	18.4?	[44.8]	[37.4]	[17.7]	[20.6]	18.1	66.9	60.6	34.8	7.4	67
	Inst.Min	0	0.0?	0.0?	[0.0]	[0.0]	[0.5]	[0.0]	0	0	6.7	0	0	0
	Monthly Total	44	128?	14?	[102]	[217]	[146]	[171]	98	433	1054	393	80	**[2880]**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	0
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	0
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	2.9=	0.0=	[0.0]	[ ]S	3
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	0
	Monthly Total	0=	0=	0=	0=	0=	0=	0=	0=	1=	0=	[0]	[ ]S	[1]
GMSRR (41010921)	**Mean**	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	0
(all water re-used)	**Median**	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	1.5R	0.0R	0.0R	2
	Inst.Min	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	[0]	0R	0R	0R	0R	0R	0R	0R	2R	0R	0R	[2]
LAG (41010940)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3R	0.0R	0.0R	0.1R	0
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Inst.Max	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	5.2R	0.0R	1.3R	1.1R	5
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0
	Monthly Total	0R	0R	0R	0R	0R	0R	0R	0R	10R	0R	1R	4R	15R
ROCUDG (41010005)	**Mean**	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0.1]	[2.2]	[0.4]	[0.7]	0
	Median	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[2.2]	[0.1]	[0.3]	0
	Inst.Max	0.0R	0.0R	[0.6]	0.0R	0.0R	0.0R	0.0R	0.0R	[9.4]	[9.4]	[6.8]	[4.6]	0
	Inst.Min	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	[0.0]	[0.1]	0
	Monthly Total	0R	0R	[1]	0R	0R	0R	0R	0R	[3]	[31]	[5]	[21]	[62]
TOTAL														**[78]**
SWAMPS														
WS**	**Monthly Total**	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	**0**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES FOR DNR														
WWO**t	**Monthly Total**	0	208	97	62	54	111	32	139	247	54	94	488	**1587**
BBO**#	**Monthly Total**	0	154	0	429	198	29	94	0	131	242	37	9	**1322**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0=	0.0=	0.0=	0.0R	0.4@	0.1@	0.1@	0.3@	1.4@	0.3@	0.3@	0.6@	0
	Median	0.0=	0.0=	0.0=	0.0R	0.4@	0.0@	0.0@	0.1@	1.3@	0.3@	0.0@	0.0@	0
	Inst.Max	0.0=	0.0=	0.0=	0.7R	1.2@	1.1@	0.5@	1.0@	6.0@	0.8@	2.3@	4.8@	6
	Inst.Min	0.0=	0.0=	0.0=	0.0R	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0.0@	0
	Monthly Total	0=	0=	0=	1R	11@	4@	2@	7@	43@	9@	11@	19@	**107R**

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0	0	0	0	0	0	0	0	0	0	0	0	0
	Median	0	0	0	0	0	0	0	0	0	0	0	0	0
	Inst.Max	0	0	0	0	0	0	0	0	0	0	0	0.8	1
	Inst.Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Monthly Total	0	0	0	0	0	0	0	0	0	0	0	1	**1**
DCWIDG (41017001)	**Mean**	0	0	[0.0]	[ ]M	[0.0]	0	0	0	0.2?	0.0?	0.0?	0	0
	Median	0	0	[0.0]	[ ]M	[0.0]	0	0	0	0.0?	0.0?	0.0?	0	0
	Inst.Max	0	0	[0.0]	[ ]M	[0.0]	0	0	0	4.4?	0.0?	0.5?	0	4
	Inst.Min	0	0	[0.0]	[ ]M	[0.0]	0	0	0	0.0?	0.0?	0.0?	0	0
	Monthly Total	0	0	[0]	[ ]M	[0]	0	0	0	7?	0?	1?	0	**[8]**
DCCENT (410172)	**Mean**	0	0	0	0	0	0	0	0	[0.4]	0	0.0R	0	0
	Median	0	0	0	0	0	0	0	0	[0.0]	0	0.0R	0	0
	Inst.Max	0	0	0.1	0.5	0	0.7	0	0.8	[20.0]	2	2.2R	0.9	20
	Inst.Min	0	0	0	0	0	0	0	0	[0.0]	0	0.0R	0	0
	Monthly Total	0	0	0	0	0	1	0	0	[11]	1	1R	0	**[15]**

Sources: Thiess Services and MI Irrigation Services

Notes: See Table 2.2.k. pages 18-19.

A.2.2 (4) DRAINAGE REUSE

MI has continued to actively pursue recovery and use of water from its drainage systems. Table 2.2m provides information on reuse quantities. It needs to be noted that much of the historically reported quantities in this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites.

Due to the pending review of the water balance and its supporting tables, especially considering the emerging reporting requirements under the National Water Initiative, it has been agreed to continue to include this table (mostly unaltered) for this reporting year.

Table 2.2.m: Reuse quantities (ML) for the MIA and Districts 2009/10

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
GMSD Pumps (Yanco esc + Stormwater)	-	191	68	105	192	141	149	132	147	270	236	140	**1771**
Collina Pump (N.B.C. Drainage + Stormwater)	-	32	0	140	30	0	0	224	310	300	230	25	**1291**
Lake Wyangan Pumps to L.V.B.C.	-	94	80	121	108	34	168	0	10	3	0	0	**618**
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	-	112	182	140	0	0	0	63	0	0	0	0	**497**
Mirrool Creek Diversion to Benerembah (@ Brays)	-	1075	1172	872	1030	1759	1418	1543	2078	1277	1724	0	**13948**
Mirrool Creek Licensed Diverters (Creek Pumps)	-	0	117	547	451	534	796	387	601	83	51	0	**3567**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	-	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek to Wah Wah Main	-	1069	1920	2320	8363	7105	6368	3441	5102	4820	3308	193	**44009**
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	-	700	0	2000	790	250	850	0	850	1400	200	50	**7090**
Barren Box Storage to Wah Wah Main @ Pipes	-	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	-	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage Licensed Diverters	-	0	148	82	0	0	0	0	0	0	12	0	**242**
Losses in Barren Box Storage	-	228	370	252	23	389	647	96	142	1	-231	-234	**1683**
Sub Total	-	**3501**	**4057**	**6579**	**10987**	**10212**	**10396**	**5886**	**9240**	**8154**	**5530**	**174**	**74716**
Less: First Use Water Diversions	-	518	493	1270	6017	3389	2668	918	2405	2118	693	1657	**22146**
TOTAL WATER CAPTURED (Re-Used)	**-**	**2983**	**3564**	**5309**	**4970**	**6823**	**7728**	**4968**	**6835**	**6036**	**4837**	**-1483**	**52570**

Source: Irrigation Services

A.2.2 (5) WATER BALANCE LOSS AND GAIN

Table 2.2.n: Annual Water Balance Assessment MIA system (Gigalitres) 2009/10

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	Bench-mark	Median	Comment
Climatic															
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	336	400	361	CSIRO data
Evaporation **(mm)**	1868	1750	1896	2032	2191	1998	1983	1935	2182	2127	2166	2085	1869	2012	CSIRO data
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	75	50	65	Look up table
Main Gross Data															
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	336	394	505	1154	794	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	276	368	952	616	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	118	137	202	178	(3)=(1)-(2)
Apparent Efficiency **(%)**	79	79	82	80	79	76	78	80	74	63	70	73	82	76	= (2)/(1)*100
Inevitable Real Losses															
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	21	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	24	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	8	35	19	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	19	29	25	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	81	82	118	98	Inevitable Losses
System Flow Losses															
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	1	33	10	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	0	48	5	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	0		81	15	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**82**	**199**	113	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	51	133	89	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**132**	**332**	202	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	-11	130	21	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows															
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	54	160	104	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9	14		18	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0	0		4	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	4	67	5	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	72	227	130	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	72	260	140	(9)=(4)+(8)
Reconciliation															
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	0	1	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-1	-20	-7	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	72	227	130	(12)=(8)-(10)
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	318	396	494	1264	834	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	-16	57	9	(14)=(7)/(12)*100
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**83**	**84**	85	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10	0.10		0.50	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19	0.19		0.55	

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

The Bureau of Meteorology has been charged with the preparation of a Pilot National Water Account. MI is working with the Bureau by providing data under the Water Information program. The MIA has been chosen as a pilot region, which means that additional data has been requested. However, we have not been made aware of any pilot method for water balance accounting being made available and for that reason we have decided to maintain consistency in our reporting method and use the method that is currently recommended in our licence.

In 2009/10 irrigation diversions from the Murrumbidgee River were 505 GL with 368 GL being recorded deliveries (sales). This left an apparent loss of 137 GL which meant that MI's *apparent* operational efficiency was approximately 73%.

Of that loss, the *true loss* was estimated at about 82 GL. This included losses due to channel seepage and evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 51 GL, using the standard formula of 14% of deliveries. The total losses are estimated at 132 GL, while the apparent loss was 137 GL. This means that 5 GL of water has gained throughout the system. This is most likely due to the our improved operating efficiency and increase potential for water to be reused within our system. The current accounting method does not adequately take into account the water that is reused which is a significant amount as is shown in Table 2.2.m.

Storage volume changes are included for BBSW and Lake Wyangan. The variation in en-route storages at Yenda and Bray's Dam are minimal in comparison to the figures quoted in the table (gigalitres). Mirrool Creek Floodway releases are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

A comparison of the benchmark year and the current year shows that the system efficiency is 83%, which is very close to the benchmark of 84%. This is a good performance for MI when taking into account the very low diversions into our system.

A.2.2 (6) CROP STATISTICS

Irrigated crop statistics

The following charts show the distribution of crops grown this year in comparison to last year (2008/09) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries to rice cropping, a reflection of the general security announcement that increased by 6% on the previous year, another contributing factor was considerably lower prices available on the tempory trade market. Water deliveries to cereal and oilseeds; pasture; vegetables; and other crops also icreased accordingly. The notable distribution percentage change to citrus, vines and other fruits is largely due to increased deliveries to broad acre cropping enterprises.

Figure 2.2.b: Distribution of irrigated crops – 1995/96, 2008/09 and 2009/10
Comparison of crop type by percentage of megalitres delivered.

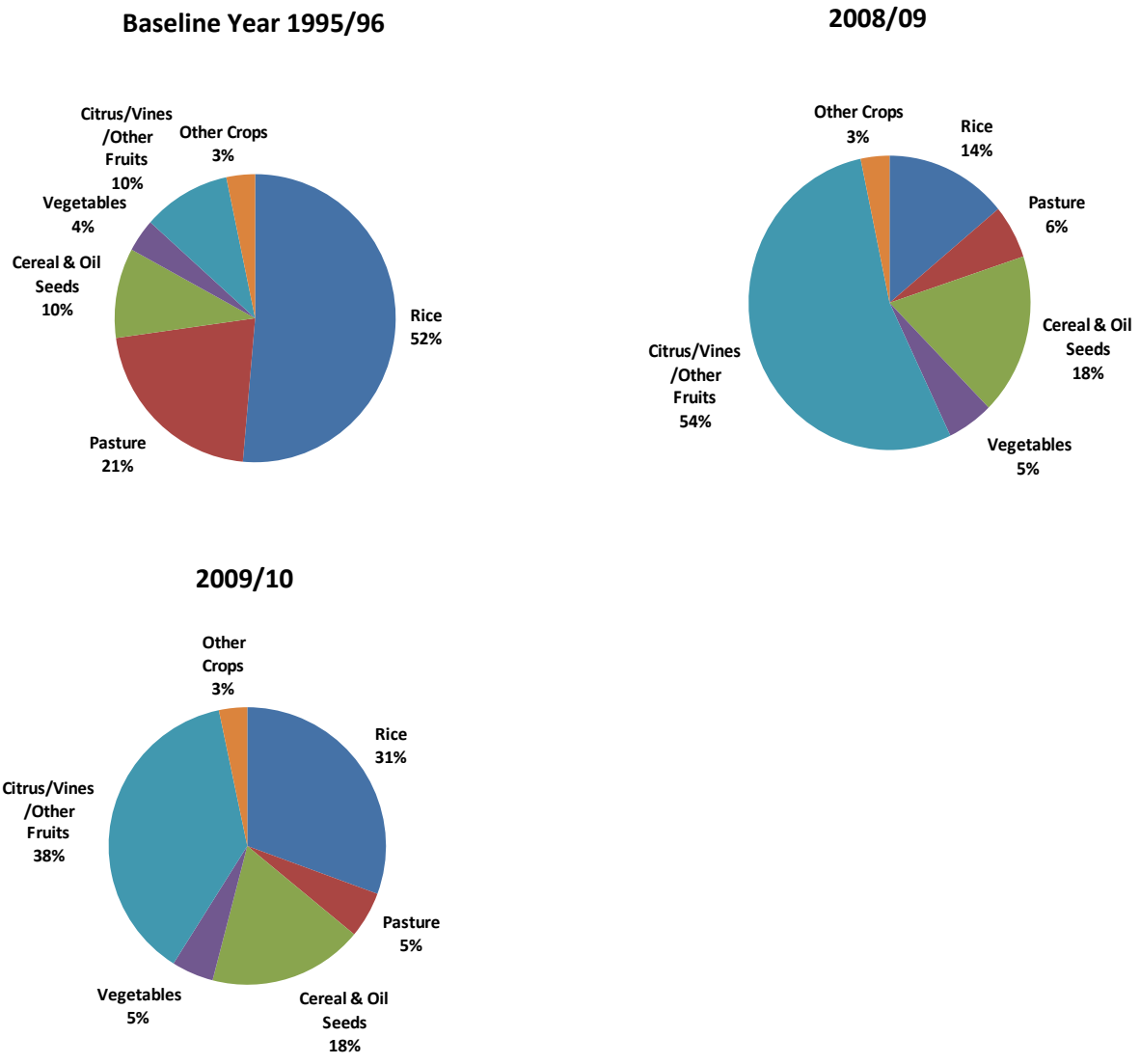


Table 2.2.o: Historical deliveries to major crop types

Year	Rice		Pasture		Cereal and Oil Seeds	
	Total (ML)	Rice % of Total	Total (ML)	Pasture % of Total	Total (ML)	Cereal/Oil Seeds % of Total
2009/10	**103,208**	**30.60**	**18,161**	**5.39**	**60,850**	**18.04**
2008/09	34,450	14.00	14,447	5.90	43,688	17.7
2007/08	1,006	0.50	8,218	4.30	39,538	20.7
2006/07	41,296	10.80	23,419	6.10	149,441	39.1
2005/06	355,254	45.40	65,878	8.40	181,641	23.2
2004/05	101,494	16.70	77,364	12.80	247,267	40.8
2003/04	221,732	34.60	63,960	10.00	182,940	28.6
2002/03	251,424	34.30	64,093	8.80	237,612	32.5
2001/02	469,513	52.00	85,556	9.50	184,253	20.4
2000/01	479,757	56.00	112,668	13.10	108,690	12.7
1999/00	394,224	61.20	54,159	8.40	68,366	10.6
1998/99	477,563	58.10	101,791	12.40	65,231	7.9
1997/98	489,363	50.10	179,246	18.30	126,247	12.9
1996/97	519,053	51.00	187,441	18.40	143,746	14.1
1995/96	446,917	51.40	185,931	21.40	87,725	10.1
Year	**Vegetables**		**Citrus + Vines+ Other Fruits**		**Other Crops + Plantations**	
	Total (ML)	Vegetable % of Total	Total (ML)	Citrus/Vines/Other % of Total	Total (ML)	Other % of Total
2009/10	**16,519**	**4.90**	**127,381**	**37.77**	**11,109**	**3.29**
2008/09	13,108	5.30	132,721	53.80	8,168	3.30
2007/08	9,191	4.80	123,510	64.80	9,274	4.90
2006/07	15,577	4.10	138,234	36.20	13,834	3.60
2005/06	27,588	3.50	142,025	18.20	9,481	1.20
2004/05	22,736	3.70	150,601	24.80	7,078	1.20
2003/04	16,504	2.60	132,866	20.70	22,519	3.50
2002/03	14,970	2.00	138,929	19.00	24,983	3.40
2001/02	17,989	2.00	122,884	13.60	23,403	2.60
2000/01	18,794	2.20	98,285	11.50	39,262	4.60
1999/00	12,013	1.90	75,108	11.70	40,060	6.20
1998/99	24,967	3.00	105,522	12.80	47,504	5.80
1997/98	19,714	2.00	115,200	11.80	47,176	4.80
1996/97	23,464	2.30	104,561	10.30	40,461	4.00
1995/96	32,348	3.70	87,983	10.10	28,905	3.30

Source: MI Irrigation Services, Griffith.

Table 2.2.p: Summary of deliveries and areas for the major crop groupings during 2009/10

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)	Net Crop Evapotranspiration (ML/ha)
RICE	7,622	103,208	13.5	11.9
VINES	18,709	71,086	3.8	n/a
CITRUS	8,117	42,267	5.2	n/a
WINTER CEREALS	24,569	41,054	1.7	n/a
VEGETABLES	3,031	16,519	5.5	n/a
OTHER FRUITS	2,411	14,028	n/a	n/a
TOWN SUPPLY	5	14,167	n/a	n/a
SUMMER PASTURE	2,862	10,609	3.7	n/a
SUMMER CEREALS	1,603	9,385	5.9	n/a
WINTER PASTURE	3,403	7,552	2.2	n/a
OTHER CROPS	1,475	9,306	n/a	n/a
SUMMER OILSEEDS	949.5	5,468	5.8	n/a
STOCK & DOMESTIC	476.6	12,764	n/a	n/a
WINTER OILSEEDS	3,567	4,943	1.4	n/a
INDUSTRIAL	26	4,110	n/a	n/a
PLANTATION	217	1,803	8.3	n/a
TOTAL		**368,269**		

Source: All figures provided by MI Irrigation Services, except for crop evapotranspiration figures, the rice net crop evapotranspiration was calculated using monthly weather data. In previous years, rice area (ha) and water use figures have been derived from Rice Environmental Monitoring database. This year, due to the drought and low general security allocations, the DECCW has allowed MI to amend the Rice Environmental monitoring (REM) program and irrigation services has provided rice area (ha).

Notes: N/A = Not available due to data collection method.
Note: The rice figure provided does not consider soil moisture utilised by subsequent cereal crops planted into rice stubble. Cereal crops that do not follow a rice crop often require more irrigations, resulting in higher water use for these crops.

A.2.3 CHEMICAL CONTINGENCY

MI works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

During the 2007/08 season, the DECCW gave approval to MI to trial a new risk-based water quality program. This trial has been on-going and will replace the previous sampling program permanently from 2010/11.

As part of the new program, the MIA has been divided into sub-catchments. Each sub-catchment has a risk assessment undertaken. Based on the assessed risk of each sub-catchment and certain predefined triggers (discharge at licensed sites, blue-green algae levels at storages, rainfall and reported pollution incidents) water quality monitoring is undertaken.

The program consists of two components as described below.

Benchmark sampling

Benchmark sampling is used to assess the quality of water within the system at specified times throughout the irrigation season. Benchmark sampling takes place at the start, middle and end of season creating an overall quality trend. Benchmarking samples are analysed for physical parameters, pesticides and EC. Results are used to internally benchmark overtime water quality throughout the season and identify quality trends within our supply and drainage system under the varying range of operating conditions. The benchmark sampling also provides additional information if further sampling should take place throughout the season.

Routine site inspections

Routine site inspections are conducted to assist in managing risks. Conducting routine inspections assist in identifying high risk areas prior to a trigger or reported event (e.g. algal blooms, illegal discharge etc). It allows flexibility in monitoring operations throughout the season and will assist in streamlining compliance related activities. As a minimum routine site inspections will occur on a monthly basis. Any pollution incidences arising from such inspections will follow the Reported Pollution Incident format of assessment.

SCHEDULED CHEMICALS

Table 2.3.n shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the NSW Department of Environment, Climate Change and Water.

Table 2.3.n: Scheduled chemicals in Murrumbidgee Irrigation's screening program

Chemical	Environmental Guidelines (μg/L)	Notification Level (μg/L)	Action Level (μg/L)
Atrazine	2	**13**	**45**
Chlorpyrifos	0.001	**0.01**	**0.11**
Diazinon	0.0006	**0.01**	**0.2**
Diuron	8	**1***	**5***
Endosulfan	0.01	**0.03**	**0.2**
Malathion	0.07	**0.05**	**0.2**
Metolachlor	8	**0.02**	**0.1**
Molinate	2.5	**3.4**	**14**
Simazine	10	**3.2**	**11**
Thiobencarb	1	**2.8**	**4.6**
Trifluralin	0.1	**2.6**	**4.4**

Source: Department of Environment and Climate Change

Notes: ***** Notification and action levels for diuron were set at 1.0μg/l and 5.0μg/l respectively. These interim levels were negotiated with Murrumbidgee Irrigation Limited to allow a phased introduction of the new levels and for industry to develop and refine management options for future use and management of diuron.

CHEMICAL CONTINGENCY PLAN FOR MIA

As part of the water quality monitoring program, MI has developed a Water Quality Risk Management Framework. The framework is developed so that potential threats to the MIA & D can be identified and managed before they develop into a problem. This reduced the reliability on slow laboratory tests which was the main concern with the previous program. A summary of the new framework is provided below.

Framework	Description
Drainage Catchments within MIA	Drainage sub-catchments across the system identified to allow MI to identify, monitor, and manage risks to WQ.
↓	
Drainage Catchment Risk Profiling	Provide an overall risk profile for the MIA and identify key areas of higher risk.
↓	
Trigger	Triggers include; rainfall >10*mm in 24hr, Reported Pollution Incident (RPI), farm drainage, discharge out of MIA, prolonged dry weather, other.
↓	
Risk assessment	Risk assessment conducted on site to determine course of action
↓	
Action	Appropriate action taken e.g. sampling, further investigations, and/or follow up.
↓	
Report/analysis/corrective action	Data analysis, internal reporting and corrective action

* Due to the low rainfall during the drought, the trigger for rainfall based sampling was lowered to 10mm in a 24 hour period. The program agreed to by the DECCW and commencing in the 2010/11 season has the rainfall trigger set at 15mm in a 24 hour period.

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the DECCW by telephone within twenty-four (24) hours once the sampling results have been received by MI.

2. Notify NOW within 24 hours of the results affecting the river sites once the sampling results have been received by MI.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if action levels are exceeded at sites identified by MI as re-supply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

RESPONSE TO DECCW DIRECTION:

In the event that a DECCW direction is received to restrict the discharge by an irrigator of irrigation waste water to the company drainage works, the company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.

2. Refuse to or discontinue the supply of water to the irrigator.

3. Undertake works to prevent the continuance of the problem.

4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 GROUNDWATER MANAGEMENT

A.3.2 REPORTING REQUIREMENTS

The following groundwater information was derived from Ary Van der Lely's report "*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas*. Annual Report 2010".

A.3.2 (1) GROUNDWATER MONITORING AND ANALYSIS

The groundwater conditions for September 2009 and the changes since baseline year 1996 and September 2008 are summarised in Table 3.2.a.

Table 3.2.a: Average depth to the watertable at September 2008 compared to 2007 and baseline year 1996 *

Area	2009 Deep Aquifer	2008 Deep Aquifer	1996 Deep Aquifer	2009 Shallow Aquifer	2008 Shallow Aquifer	1996 Shallow Aquifer
MIA u/s BBS	9.73	9.23	4.4	5.66	5.18	1.88

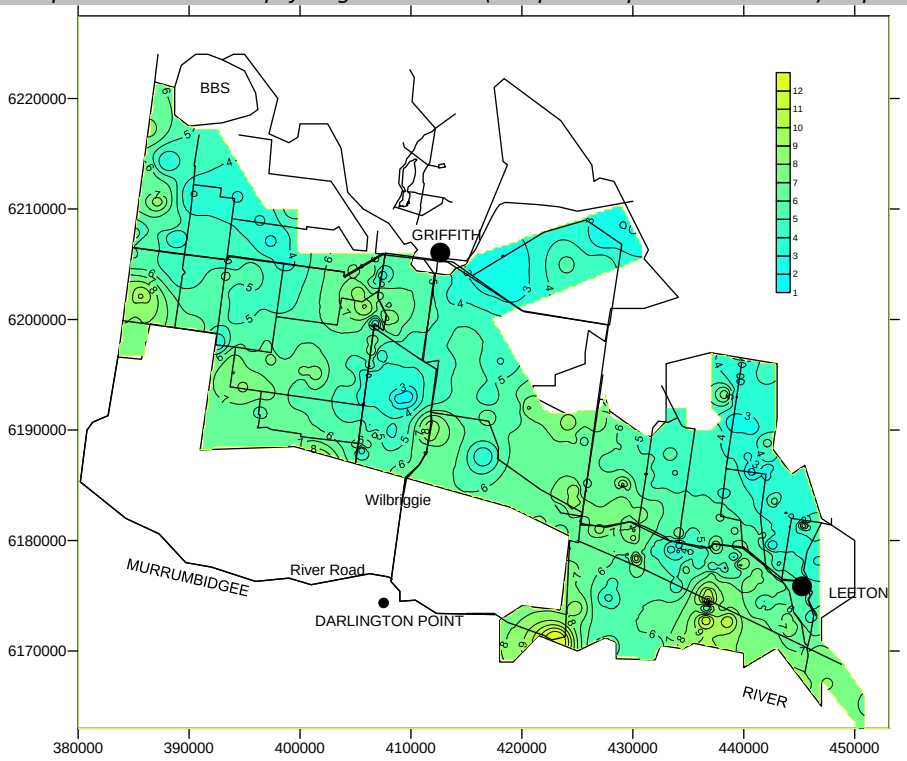
Note: * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable in metres.

Table 3.2.a shows a continuing drop in water table levels since the baseline year of 1996, to the extent that the proportion of land with groundwater within 2 metres has dropped from over 70% before 2000 to less than 1% by September 2007. This has been maintained during the past two years. This drop is due to the continued lower than average general security allocation levels as well as reduced rainfall from July to October 2009 (39% of the long term average). The average depth to the water table is now at a record low. The implementation of MIA EnviroWise programs has also had an impact on the lowering of water tables. There was a slight rise groundwater level between September 2009 and March 2010 in some parts of the MIA and Districts. It is believed that this was due to the increased summer irrigation activity, combined with a 20% higher than average summer rainfall (November 2009 to March 2010).

The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. High groundwater levels within two metres were almost non-existent and confined to small areas near Mirrool Creek in Mirrool and in the Yanco district, possibly related to channel seepage locations. The highest groundwater areas generally are in the Koonadan area north-west of Leeton, and around Yoogali and Yenda. Even in these areas they have retreated to between two and three metres depth.

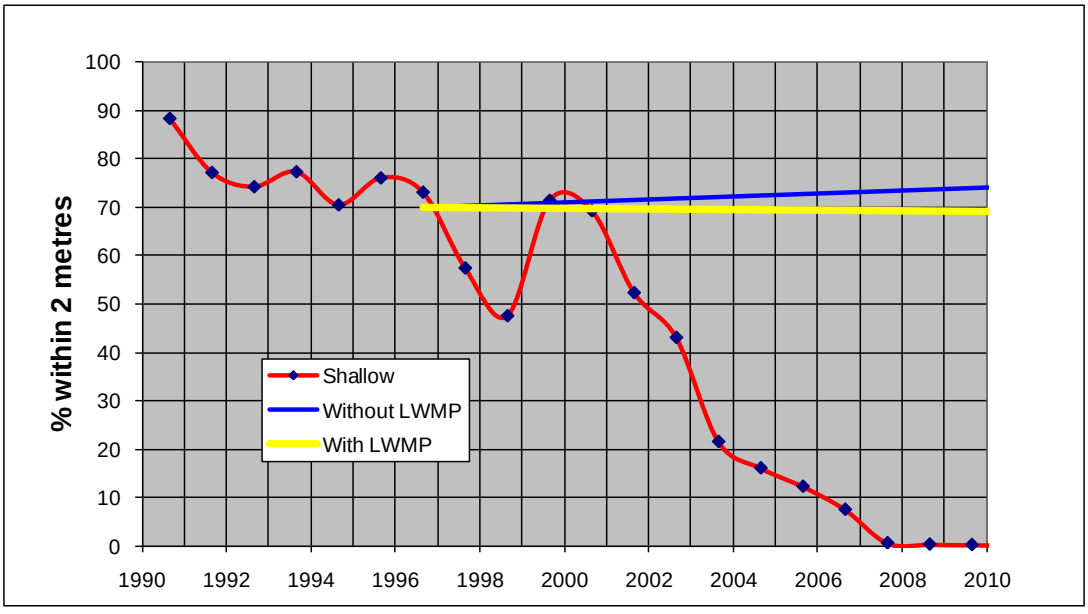
The small pockets of high groundwater in Northern Benerembah are related to a depressed prior stream site, a soil ridge formation with down slope seepage and probably some channel seepage spots.

Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable). September 2009



The percentage of areas within 2 metres from the surface compared to the Land and Water Management Plan 'Without Plan' and 'With Plan' scenarios are shown at Chart 3.2.1.

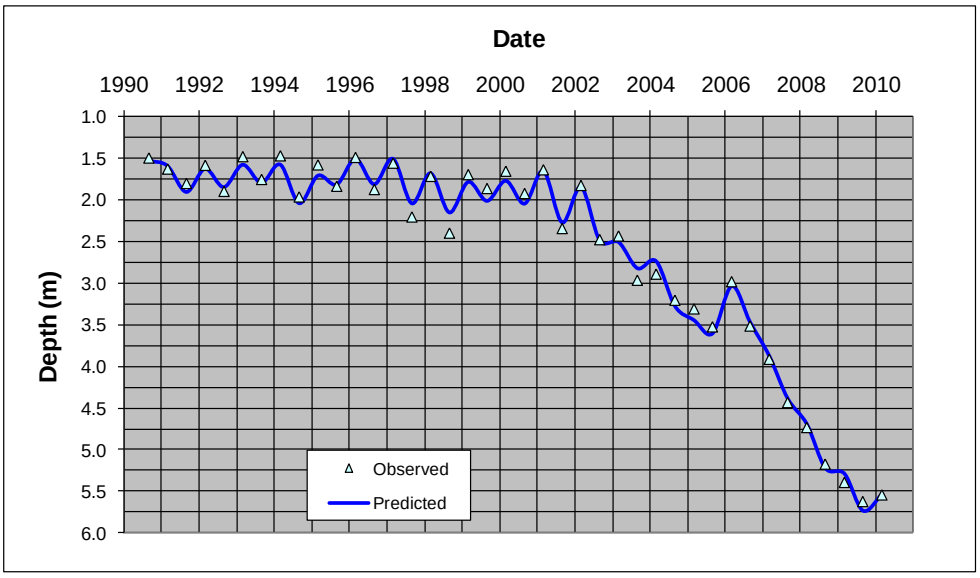
Chart 3.2.1: Area with watertable within 2 metres, September 1990 to 2009 relative to LWMP assessment benchmarks (which commenced 1997)



There has been a significant reduction in the percentage of areas with groundwater within two metres from the surface, from over 70% in the early 1990's to 7.6% September 2006 and less than 1% in 2007, 2008 and 2009. It is clear from Figure 3.2.b that the groundwater predictions developed as part of the LWMP are no longer relevant given the changes to groundwater levels due to reduced allocations and the on-going drought. As a result a clearer understanding of the impacts on groundwater from irrigation and climate is required and this is the subject of research being undertaken by CSIRO Land and Water in conjunction with MI. The results of which will provide a more realistic benchmark.

Chart 3.2.2 shows the observed data of average groundwater depths in the MIA versus the predicted values based on the model coefficients.

Chart 3.2.2: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



The model used to produce these predictions, can also be used to analyse various scenarios likely to occur in the future. More work is being undertaken, in conjunction with CSIRO Land and Water, to refine these predictions and ultimately to assist in the management of the MIA and Districts.

The conclusions of the groundwater report are:

- LWMP targets have been met but they need to be reviewed to determine their continued relevance.
- Target for accessions to and extractions from the groundwater system (net accessions): A small increase in irrigation activity and rice growing resulted in a small 0.08m water table rise and a net recharge to groundwater of about 5,500 ML during 2009/10.
- Area and distribution targets for watertable levels within two metres from the surface: The proportions are still at an all-time low.
- Pressure level in deep aquifer target: The pressure levels are still dropping and at an all-time low. Questions regarding sustainability of current groundwater pumping rates south of the MIA persist.

It was concluded there are no groundwater management issues coming forth from the 2009/10 data set.

A.3.2 (2) WAH WAH GROUNDWATER AND MIRROOL CREEK FLOODING

In respect to the Lower Mirrool Creek Floodway, Chart 3.2.3 shows that all piezometers have shown small declines in groundwater levels since 1996 apart from Bore 3388 which shows a drop of over five metres since 1996. There have been no flood events in the Lower Mirrool Creek since the early 1990's.

Chart 3.2.3: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway

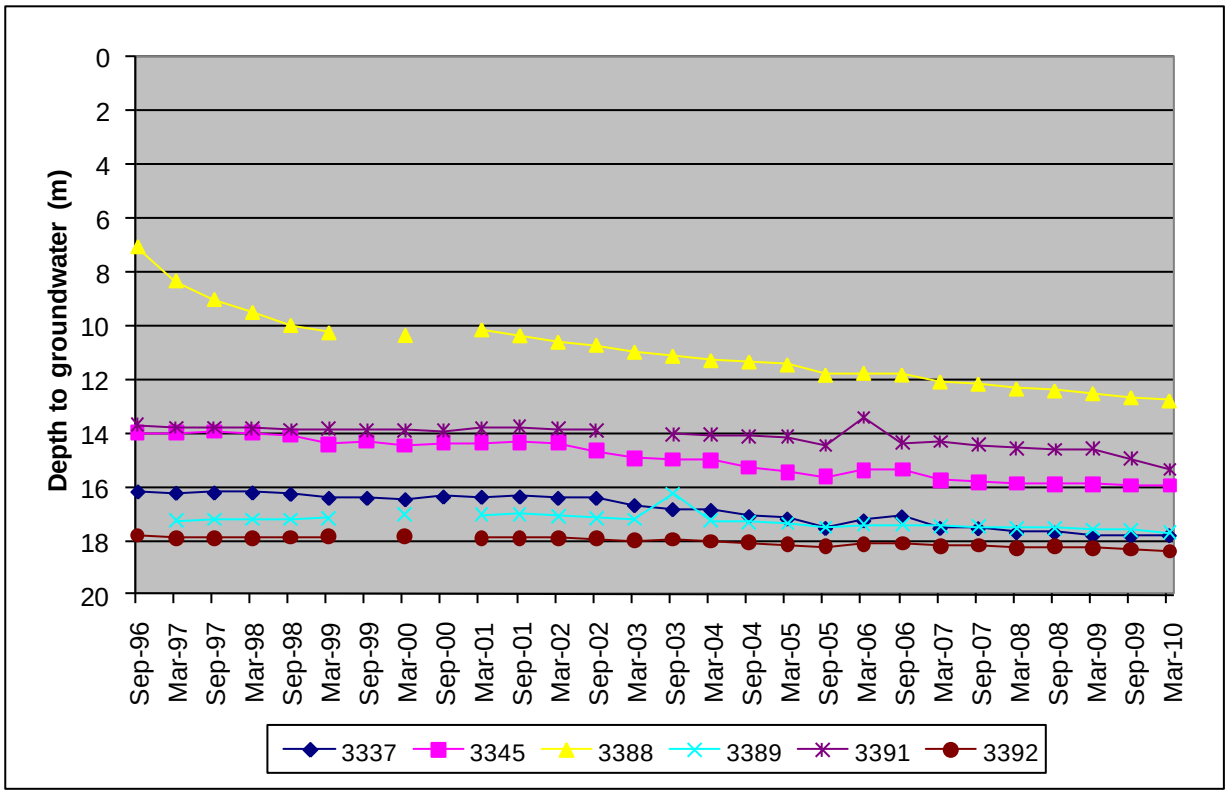
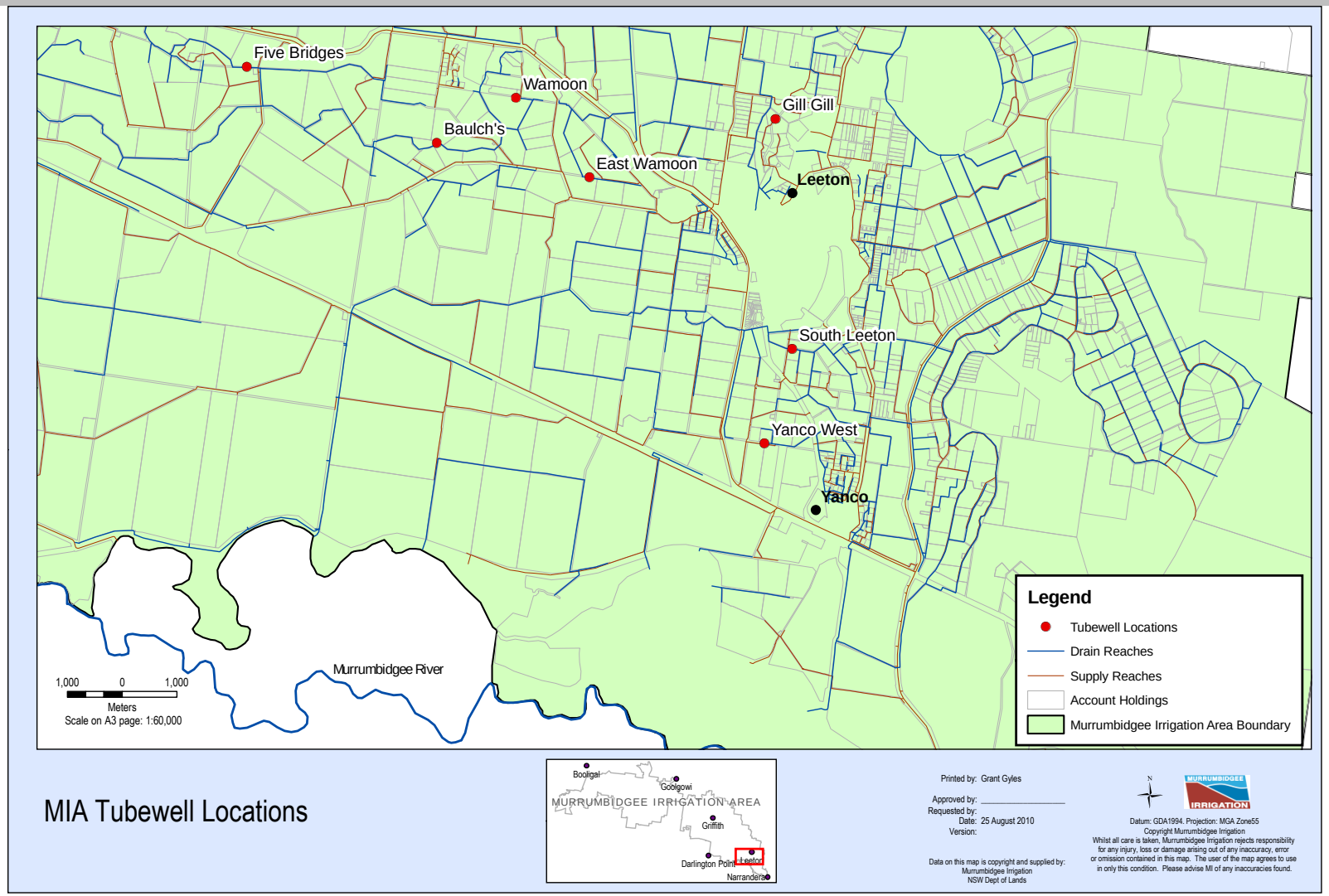


Chart 3.2.4: MIA Tubewell Locations



A.3.2 (3) GROUNDWATER VOLUMES AND SALT LOADS EXTRACTED FROM TILE DRAINS AND PUMP SITES

Tubewells

There are 15 tubewells installed in the MIA by previous government departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a steady decrease in discharge volume and salt load since the 1997/98 season, although the salt load slightly increased in 2009/10. The total discharge volume during the 2009/10 season was about 94% of the previous season, while the salt load was about 114% which means that the salinity levels of the discharge have increased. This can be explained by a continued drop in groundwater levels which allows salts stored in the soil to leach into the groundwater.

Table 3.2.b: Groundwater volumes and salt loads extracted from tubewells

Name	2009/10 Discharge (ML/year)	2009/10 Salt Load (T/year)	2008/09 Discharge (ML/year)	2008/09 Salt Load (T/year)	1997/98 Discharge (ML/year)	1997/98 Salt Load (T/year)
Five Bridges	268	181	659	423	1,059	1,016
Gil Gil	493	790	276	366	631	1,231
Yanco West	304	420	309	408	821	1,232
South Leeton	30	47	0	0	1,325	2,067
Baulch's	-	-	16	7	694	541
Wamoon	407	250	4	2	945	681
East Wamoon	176	105	668	361	-	-
TOTAL	1,678	1,793	1,933	1,568	5,475	6,768

Source: MI Electrical Services, MI Environmental Services

Tile drains

At present there are 19 flow meters attached to tile drainage outlet pipes in the MIA. The sites are assessed annually for volume of flow and a sample of the discharge is measured for electric conductivity. During the 2009/10 season, nine of the 19 systems were operational and the total volume pumped from the nine sites was 97 ML, which is 28% higher than last year. In total 205 tonnes of salt was discharged, this is more than a proportional increase compared to the volume and indicates that the salinity of the tile drainage water has increased compared to last season. At the remaining ten sites there was no discharge recorded.

The discharge from both the tubewells and the tile drains enters MI's drainage system and is therefore accounted for in the drainage volumes and salt load tables in section A2.

A.3.2 (4) GROUNDWATER ACCESSION CONTROL TARGETS AND RICE ENVIRONMENTAL MONITORING

Groundwater accession control target

The continuing drought conditions lead to another year of low rice acreage in the MIA and Districts and consequently, a licence variation was submitted to and approved by the NSW Office of Water (NOW), which is part of the NSW Department of Environment, Climate Change and Water.

A letter, dated the 23 October 2009, from the NOW stated that: "Therefore, the Office agrees that condition A.1.2.2 (1) will not apply in the 2009/2010 season." It further stated that the Office recommends that the Rice Environmental Monitoring Policy be amended to clearly establish the conditions under which monitoring and reporting may be suspended or reduced. This would negate the need to obtain temporary variations.

The watertable level showed a slight average increase of 0.08m throughout the MIA, with the exception of the Yanco area. However, the deeper aquifers are continuing to drop. Compared with the previous season, there was more summer cropping activity in conjunction with higher rainfall levels.

Rice water use and rice growing practices

Due to the relatively low summer cropping activity in the MIA and Districts no aerial photos were taken. Assessments of areas and water use were based on information provided by growers during the placement of water orders as well as field observations by MI staff. A total of 7,622 ha of rice were grown in the MIA during the 2009/10 season. It needs to be noted that the figures in Table 3.2.c are based on surface water irrigation only. The NOW is responsible for the management and recording of groundwater use. We have been made aware that groundwater has been used to grow rice, but information on how much was used or what crop it was used on has not been made available to MI.

Table 3.2.c: Summary of historic rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)											
Irrigation Area or District	**Total Rice Area (ha) 2009/10**	**Total Water to Rice (ML) 2009/10**	**'09/10**	**'08/09**	**'07/08**	**'06/07**	**'05/06**	**'04/05**	**'03/04**	**'02/03**	**'01/02**	**'00/01**	**'99/00**	**'98/99**
Yanco	N/A	N/A	13.5	13.9	N/A	N/A	12.6	13.1	13.3	14.1	12	11.2	11.3	11.3
Mirrool	N/A	N/A	13.7	12.5	N/A	N/A	12.7	12.9	13.2	14	12.3	11.2	10.6	12.6
Benerembah	N/A	N/A	14.2	12.0	N/A	N/A	12.9	12.8	13.3	14	13.1	11.1	10.4	15.3
Tabbita	N/A	N/A	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3	10.7	15.9
Wah Wah	N/A	N/A	15.7	20.6	N/A	N/A	14	11.9	12.4	14.4	14.3	13.7	11.8	14.6
Kooba [1]	N/A	N/A	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*	*	*
Total/average [2]	7,622	103,208	**13.8**	**12.7**	N/A	N/A	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**	**10.9**	**12.9**
Target			15.9	16.3	N/A	N/A	15.3	15	15	17.3	15.3	14.2	13.2	15.4

Sources: MI Irrigation and Environmental Services

Note: [1] Kooba's rice water use was previously calculated as part of Mirrool.

[2] Area or district totals are not available this season, due to low general security allocation, MI gained an exemption to implementing the Rice Environmental Monitoring program and accurate rice water use data is unavailable. 2009/10 Total/average figures provided by MI Irrigation Services.

Estimated groundwater accessions

During 2009/10 the net total irrigation diversions were higher than that of the previous two seasons, but about 10% less than of 2006/07. Rainfall from July to October 2009 was 57.8mm (39% of the long term average). This, combined with groundwater pumping caused groundwater levels to continue to drop for September 2009. Compared to the previous season, irrigation activity during the 2009/10 summer increased but remained well below pre-drought levels. This, combined with a 20% higher than average summer rainfall (November 2009 to March 2010) resulted in a marginal increase of 0.08 metre on average in watertable levels but a further drop in deep aquifer levels for March 2010.

Rice growing policy

The "Rice Growing Policy 2007/2008", was adopted without amendments for the 2008/09 season and again for the 2009/10 season. This document has been forwarded to the DECCW in electronic format in 2009.

Due to the temporary variation to our licence, the rice growing policy has not been fully implemented. Rice area were measured by GPS and entered into our GIS system while water use figures were collected based on water orders. All rice growers were sent a letter showing their rice area and water use and were given the opportunity to provide feedback on our data.

A.3.2 (5) GROUNDWATER DATA FORMAT

A copy of "*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas. Annual Report 2010"* has been forwarded to the DECCW in electronic format.

A.3.2 (6) GROUNDWATER DATA RELIABLY CAPTURED

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by MI staff during March and September each year. The statistics for piezometers read during 2007/08, 2008/09 and 2009/10 are summarised in Table 3.2.d.

Table 3.2.d: Availability of piezometer readings for various dates and categories of piezometers.

Piezometers	Read Sep 07	Read Mar 08	Read Sep 08	Read Mar 09	Read Sep 09	Read Mar 10
Positive readings	835	826	822	810	796	778
Read but "dry"	61	60	69	74	84	97
Available	**896**	**886**	**891**	**884**	**880**	**875**
Unavailable	63	86	83	94	102	107

Despite a number of piezometers becoming lost over time, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

Figure 3.2.d shows that there is a considerable variation in coverage across the area. In the Wah Wah District there is a lack of piezometer sites. The same applies for the Lake Wyangan area. Piezometers are also lacking in areas of the MIA where there are no underlying sands, such as in parts of the Yenda area. This situation varies for the deep and shallow piezometer sets.

There are some issues with the maintenance of the piezometer set. The loss of piezometers in some areas such as Wah Wah may or may not be a serious issue as the number of piezometers needed

depends on many factors, including the perception that the collection of groundwater data is essential for salinity management. If the risk of salinity developing is low, the need for having piezometers is low. A lesser intensively irrigated district may have less risk. Soil, hydro-geological factors and irrigation management also affect the optimal number. This is matter to be considered by licence reviewers.

For most piezometers, the height of the pipe above ground has been re-measured and the coordinates have been checked for accuracy by GPS.

Groundwater was last sampled for salinity during 2002 and this has been reported (Murrumbidgee Irrigation report by van der Lely, January 2003).

A.3.2 (7) GROUNDWATER DATA ANALYSIS

The DECCW did not make a request for information this year.

A.3.2 (8) GROUNDWATER CONTAMINATION

There were no known, or reported, groundwater pollution events during 2009/10.

A.3.2 (9) GROUNDWATER – ANNUAL MONITORING SCHEDULE

Table 3.2.f: Groundwater monitoring schedule – as required by DECCW

No	Type	Description	Depth	Frequency	Location	
			(metres)		Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.a	35
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.b	44
3	Map	AHD of pressure level	70-125	annual	Figure 3.2.c	44
4	Map	Depth to pressure level	12-35	annual	Figure 3.2.d	45
5	Map	Change in pressure level	5-12	annual	Figure 3.2.e	45
6	Map	Change in pressure level	12-35	annual	Figure 3.2.f	46
7	Map	Change in pressure level	70-125	annual	Figure 3.2.g	46
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.h	47-48
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.e	49-51
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.e	49-51
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.i	52
16	Map	Groundwater sub-districts	-	-l	Figure 3.2.j	53

Notes * "*It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable*." Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ There are not enough piezometers in the West Hanwood and Wah Wah areas to produce reliable hydrographs.

The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

Figure 3.2.b: MIA September 2009 – Depth to pressure level 12-35 metres

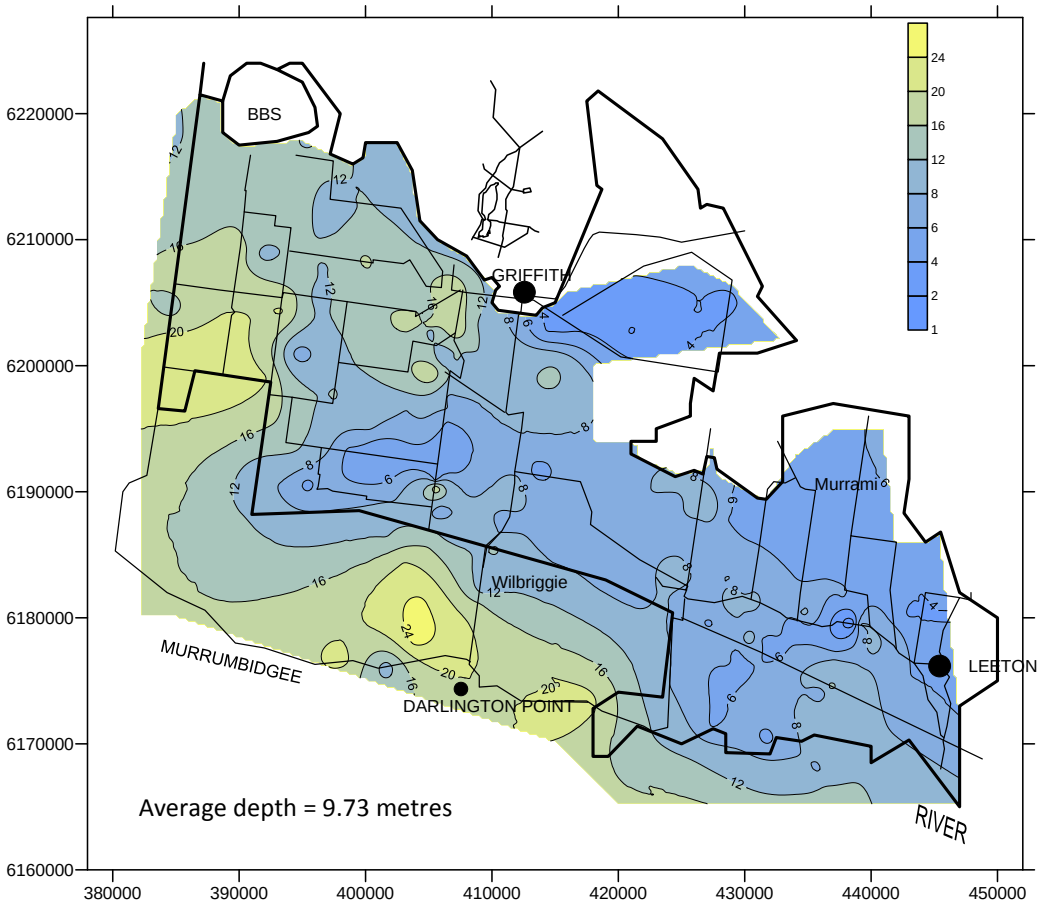


Figure 3.2.c: MIA September 2009 – AHD of pressure level 12-35 metres

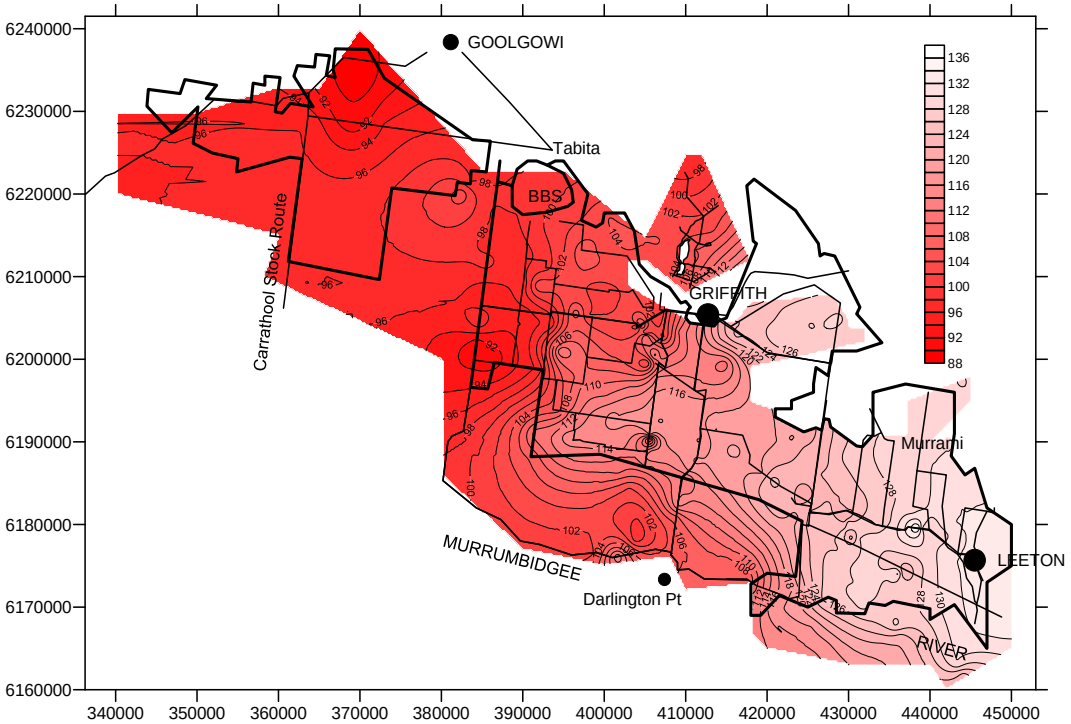


Figure 3.2.d: MIA 2008-2009 – depth to pressure level 70-125 metres

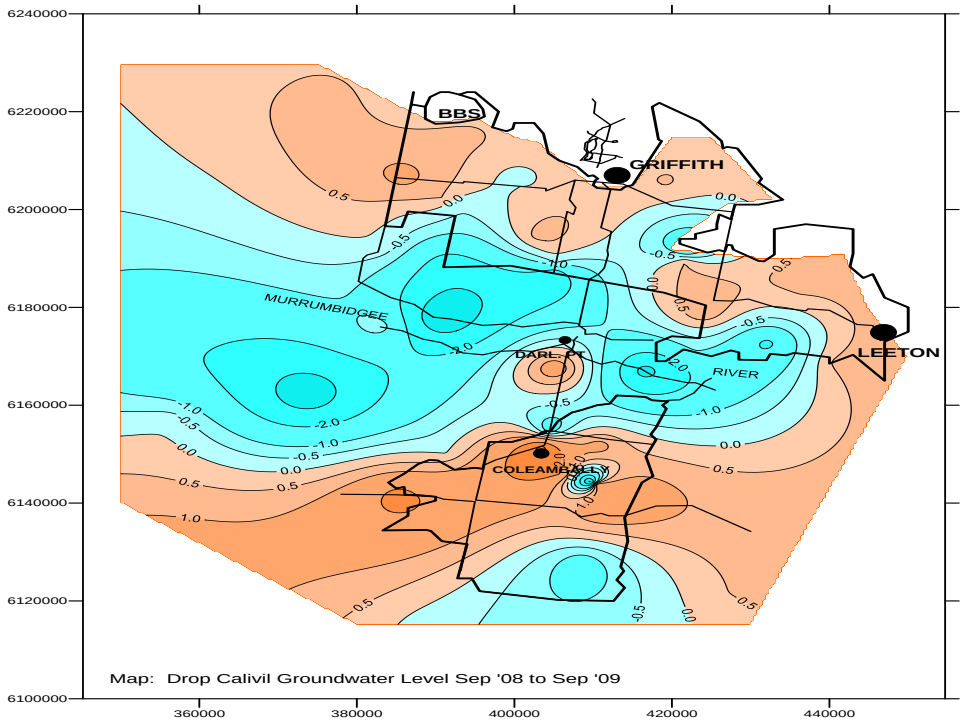


Figure 3.2.e: MIA 2008-2009 – change in pressure level 5-12 metres

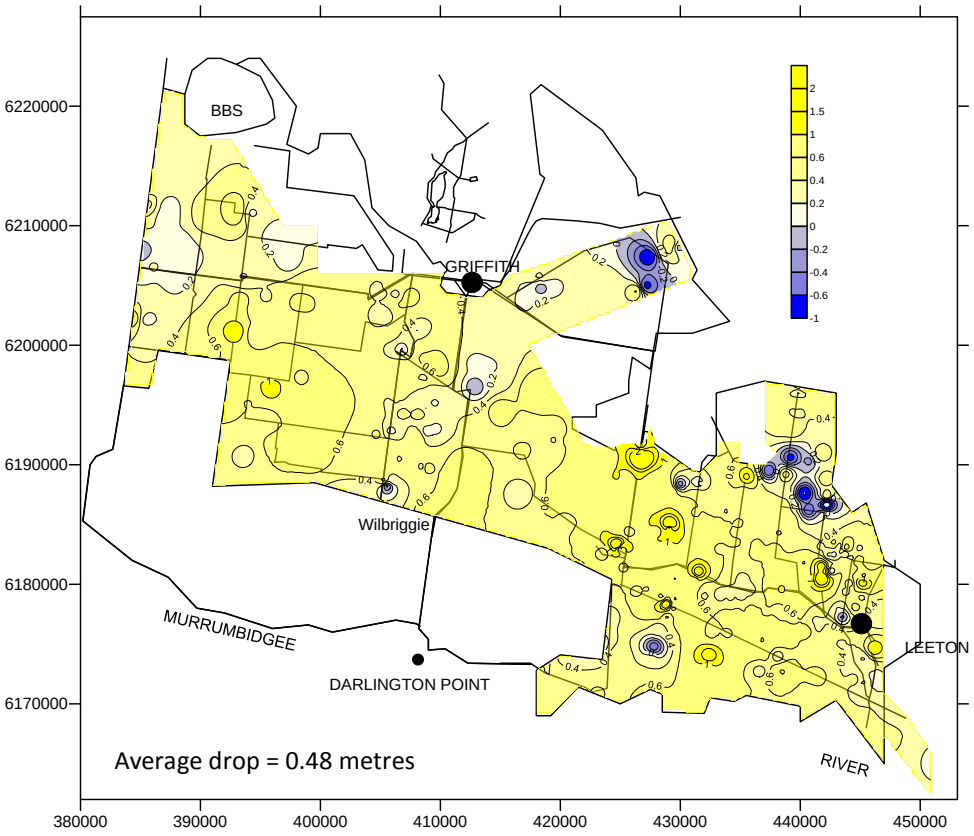


Figure 3.2.f: MIA 2008-2009 – change in pressure level 12-35 metres

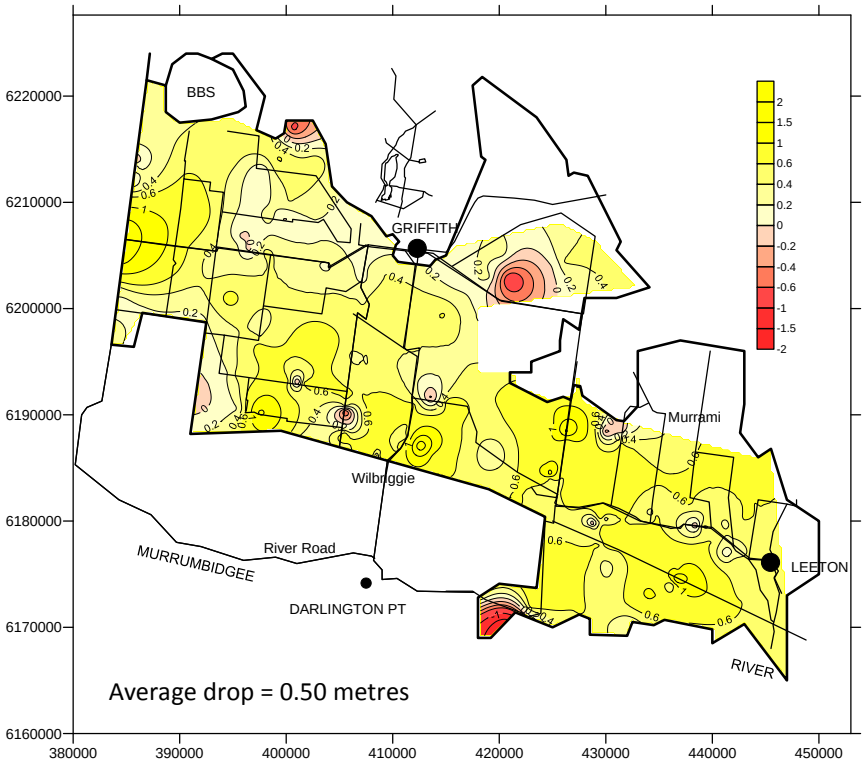


Figure 3.2.g: MIA 2008-2009 – change in pressure level 70-125 metres

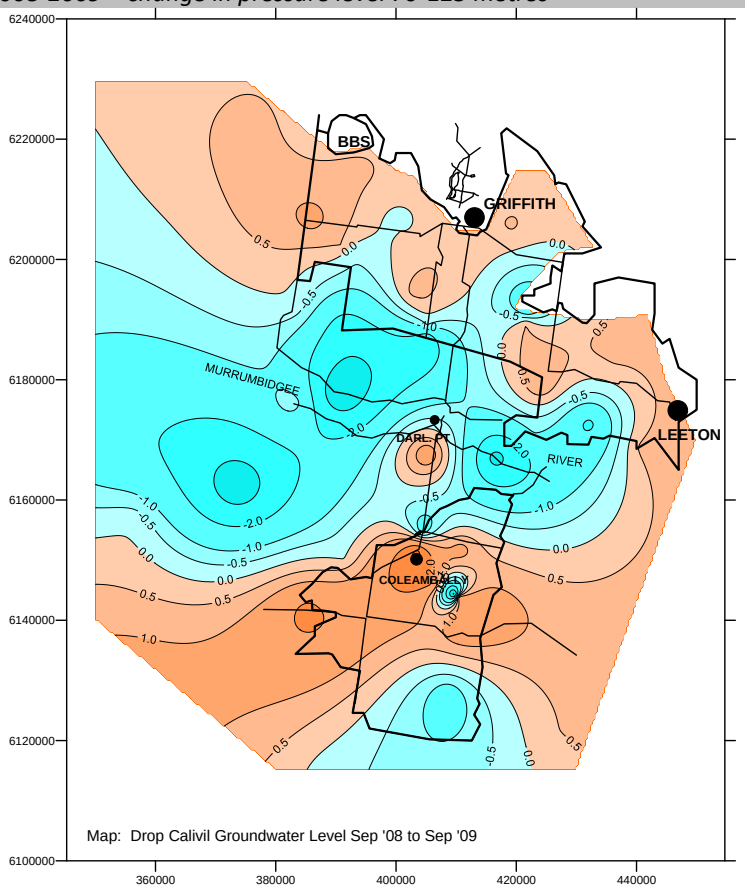
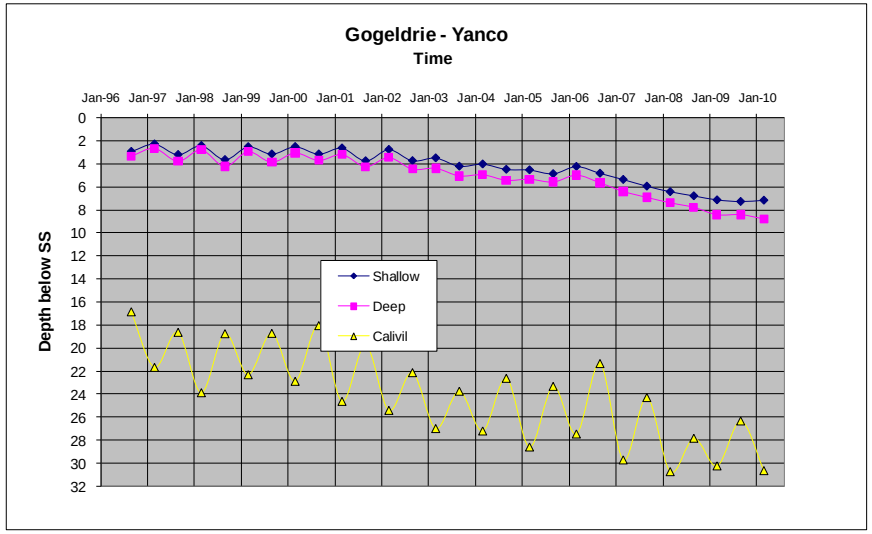
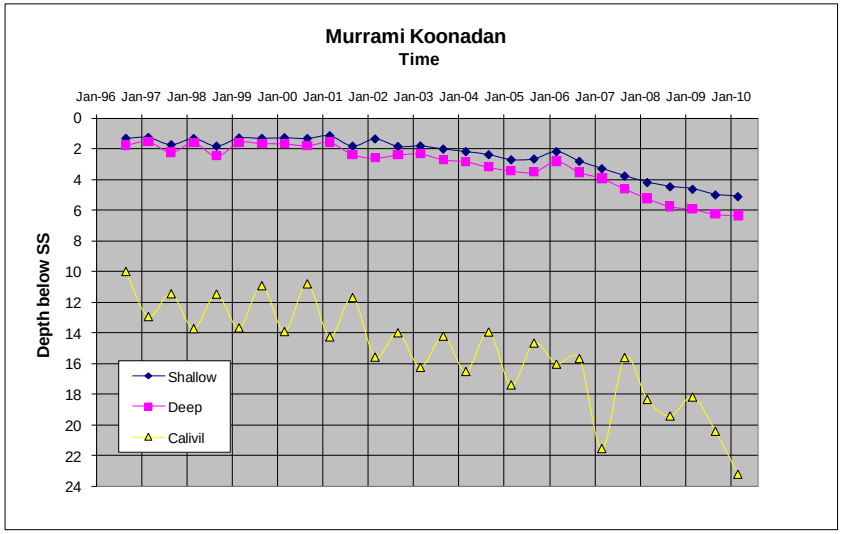
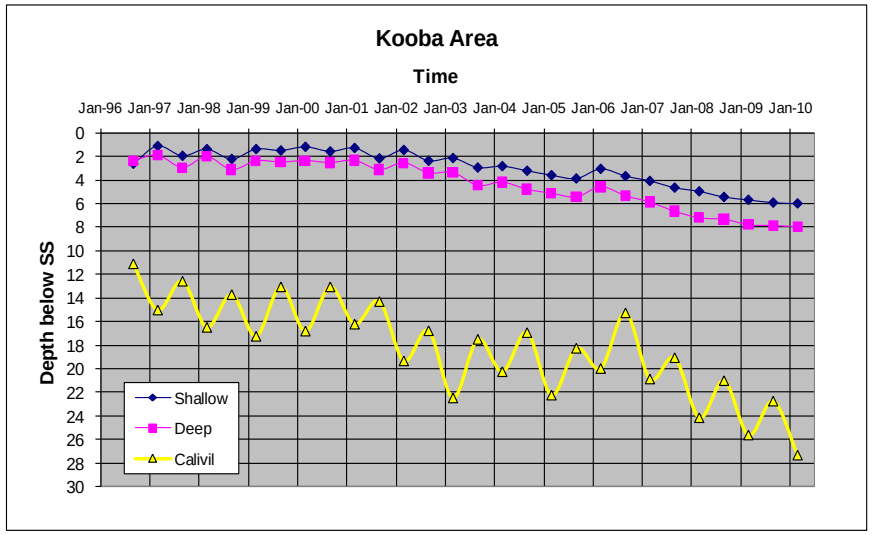


Figure 3.2.h: MIA March and September 1996 to 2010 - Average seasonal behaviour groundwater sub-districts







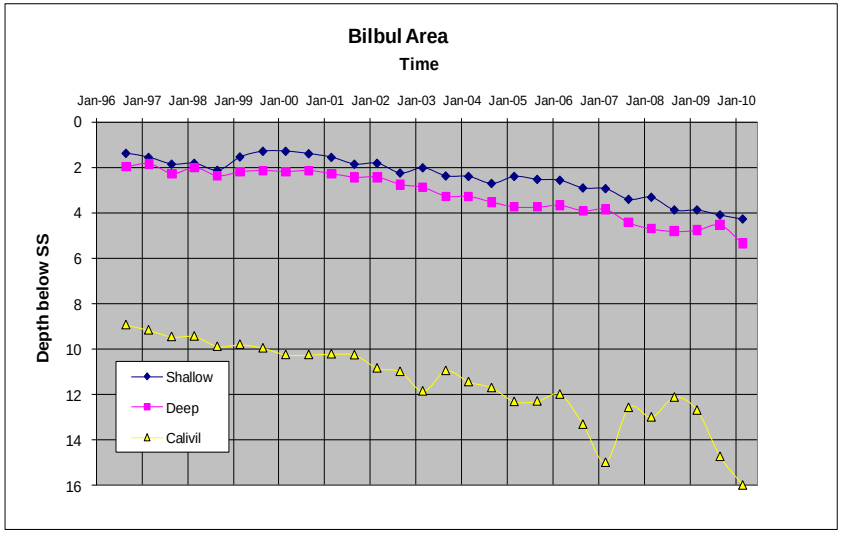
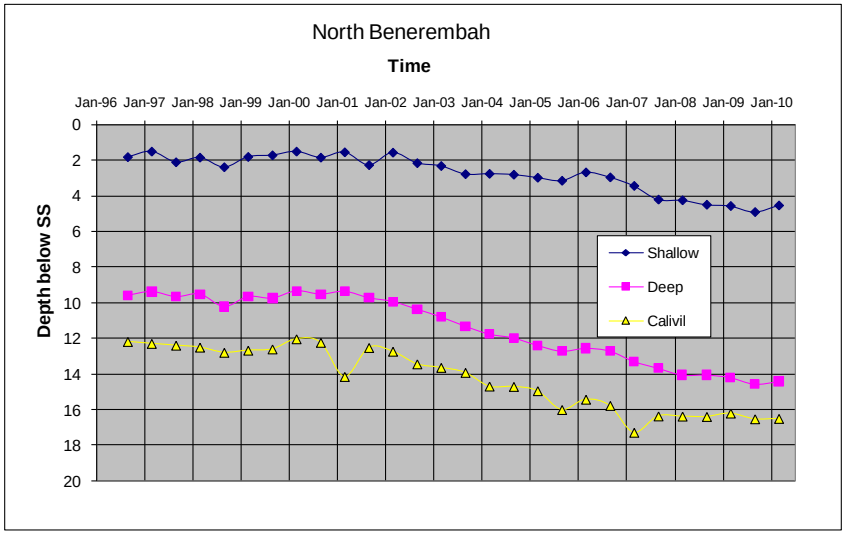
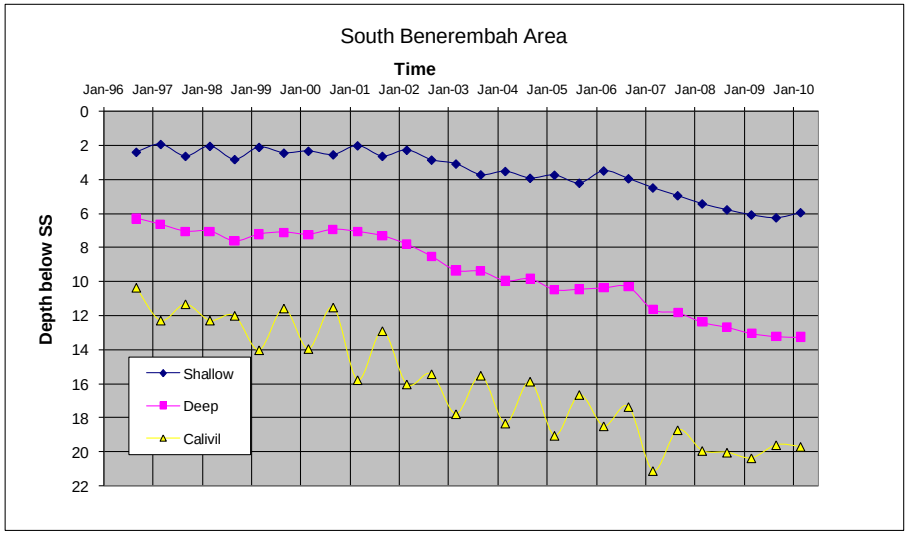
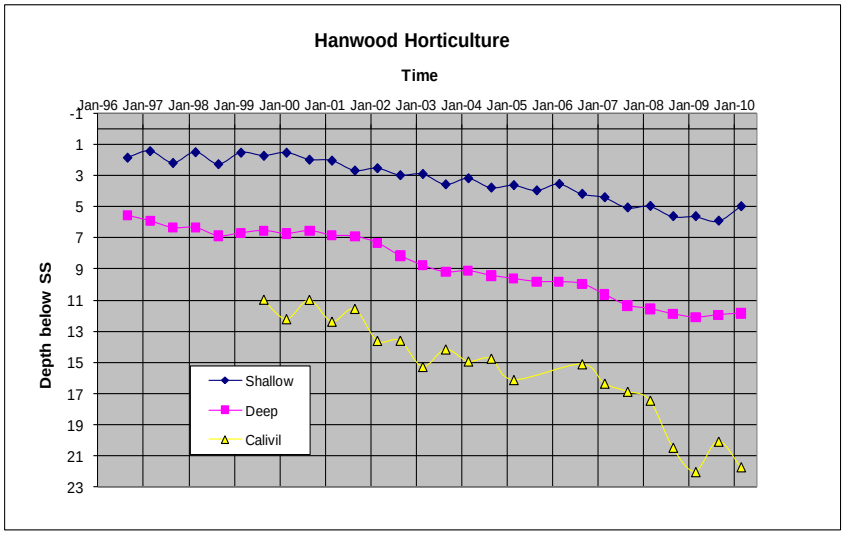


Figure 3.2.h: MIA March and September 1996 to 2010 - Average seasonal behaviour groundwater sub-districts cont.







In previous Licence Compliance and Annual Environmental Reports, the bi-monthly groundwater monitoring data was used to produce graphs showing average seasonal behaviour, see Chart 3.2.2. These graphs were compiled as an average hydrograph of the few piezometers (usually 3 to 8) in each sub-district. These average hydrographs therefore did not represent the individual sites, nor were they a true sub-district average. However, they did show seasonal trends. It was concluded that sub-district seasonal groundwater behaviour is better represented by averages as calculated from gridding and contouring, and as last year, that has again been used in this report. There are not enough piezometers in place to provide meaningful graphs for all the groundwater districts.

All graphs show a steady decline in water table levels to September 2009 with a slight increase in some from September 2009 to March 2010 as discussed in section A.3.2 (1) and A.3.2 (4). The deeper aquifers continue to show an overall declining trend. Seasonal variation is most clearly shown in the Calivil formation.

In previous reports only the Kooba sub-district, and the Bilbul/Yenda area and the Lake Wyangan area have been used for reporting. To this the Hanwood West area including horticulture was added for the 2009 report. The north Yenda area and the Widgelli area have no piezometers with groundwater level readings, and the Yoogali and Hanwood horticultural areas are less relevant for groundwater analysis since groundwater levels are controlled by tile drainage.

Table 3.2.e: ***Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35metres) aquifers, September 1996 - 2009, and historic trend in areas within 2 metres.*** *Figures taken from 'Groundwater Conditions and Behaviour in the MIA, Ary van der Lely, 2010'.*

North Benerembah											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	12	10	1	0	0	0	0	0	0	0	0
within 2 metre	76	74	69	28	12	0	1	0	0	0	0
within 3 metre	94	93	90	75	72	12	16	10	6	1	5
within 4 metre	99	100	97	91	89	69	69	59	46	26	37
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 2 metre	0	0	0	0	0	0	0	0	0	0	0
within 4 metre	0	0	0	0	0	0	0	0	0	0	0
within 6 metre	17	13	7	0	0	0	0	0	0	0	0
within 8 metre	47	46	28	4	3	0	0	0	0	0	1
South Benerembah											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	37	12	1	0	0	0	0	0	0	0	0
within 2 metre	68	56	39	3	2	0	0	0	0	0	0
within 3 metre	83	78	71	42	39	1	0	0	0	0	0
within 4 metre	89	88	87	69	68	31	18	7	3	1	3
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 2 metre	13	12	8	0	0	0	0	0	0	0	0
within 4 metre	34	32	23	15	13	6	2	0	0	0	0
within 6 metre	61	57	42	31	27	19	16	13	10	8	8
within 8 metre	75	71	62	49	45	33	28	26	24	23	23

Kooba											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	17	24	2	0	0	0	0	0	0	0	0
within 2 metre	87	84	44	10	6	1	1	1	1	1	1
within 3 metre	99	98	86	57	27	10	7	4	2	2	2
within 4 metre	100	100	98	87	75	34	29	17	14	10	13
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	3	1	0	0	0	0	0	0	0	0	0
within 2 metre	53	53	11	1	0	0	0	0	0	0	0
within 3 metre	86	83	64	8	3	0	0	0	0	0	0
within 4 metre	97	93	85	49	18	1	0	0	0	0	0
Yenda/Bilbul											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	33	24	0	0	0	0	0	0	0	0	0
within 2 metre	97	98	39	19	17	0	2	0	0	0	0
within 3 metre	100	100	100	89	70	51	53	25	3	17	15
within 4 metre	100	100	100	100	99	94	88	70	65	58	50
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	16	22	1	0	0	0	0	0	0	0	0
within 2 metre	74	73	60	23	11	0	1	0	2	0	0
within 3 metre	86	84	77	69	59	38	27	18	28*	22	11
within 4 metre	93	90	85	80	75	70	67	67	67*	58	51
Murrami/Koonadan											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	40	44	46	2	0	0	0	0	0	0	0
within 2 metre	91	90	78	50	19	1	1	0	1	0	0
within 3 metre	99	100	96	85	76	27	17	10	10	4	3
within 4 metre	100	100	100	97	95	71	59	49	40	30	27
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	14	18	1	0	0	0	0	0	0	0	0
within 2 metre	76	72	53	12	1	0	0	0	0	0	0
within 3 metre	99	97	82	59	47	10	4	0	0	na	na
within 4 metre	100	100	99	89	81	39	21	8	17	2	6
Gogeldrie/Yanco											
Shallow	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	0	1	0	1	0	0	0	0	0	0	0
within 2 metre	31	27	12	4	1	0	0	0	0	0	0
within 3 metre	62	56	44	31	13	2	1	1	0	0	0
within 4 metre	95	82	68	50	44	12	7	3	2	3	1
Deep	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	1	2	0	0	0	0	0	0	0	0	0
within 2 metre	27	23	5	1	0	0	0	0	0	0	0
within 3 metre	58	48	37	13	7	1	1	0	0	0	0
within 4 metre	87	73	61	36	36	3	3	0	0	0	0
Hanwood and West Area											
Shallow	**Sep-96**	**Sep-01**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	4	0	na	0	na	0	na	0	0	0	0
within 2 metre	81	8	na	0	na	0	na	0	0	0	3
within 3 metre	97	90	na	18	na	2	na	1	3	1	12
within 4 metre	100	98	na	84	na	23	na	13	15	8	28
Deep	**Sep-96**	**Sep-01**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
within 1 metre	na	na	na	na	na	na	na	0	0	0	0
within 2 metre	na	na	na	na	na	na	na	0	0	0	0
within 3 metre	na	na	na	na	na	na	na	0	0	0	0
within 4 metre	na	na	na	na	na	na	na	3	3	3	0

Wah Wah											
	Sep-96	Sep-01	Sep-02	Sep-04	Sep-06	Sep-07	Mar-08	Sep-08	Mar-09	Sep-09	Mar-10
within 4 metre	1	0	na	na	0	0	0	0	0	0	0
within 6 metre	6	4	na	na	0	0	0	0	0	0	0
within 8 metre	13	12	na	na	5	0	0	0	2	3	2
within 4 metre	34	37	na	na	14	2	5	2	10	12	11
Wah Wah	**Sep-96**	**Sep-01**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**
Ave Shep M	12.21	11.84	na	12.36	12.61	13.49	13.64	13.27	13.1	12.87	13.12
Ave Calivil M	15.02	14.44	na	14.65	16.35	15.78	16.04	15.44	15.51	15.8	15.87

Figure 3.2.i: Groundwater piezometers currently being read

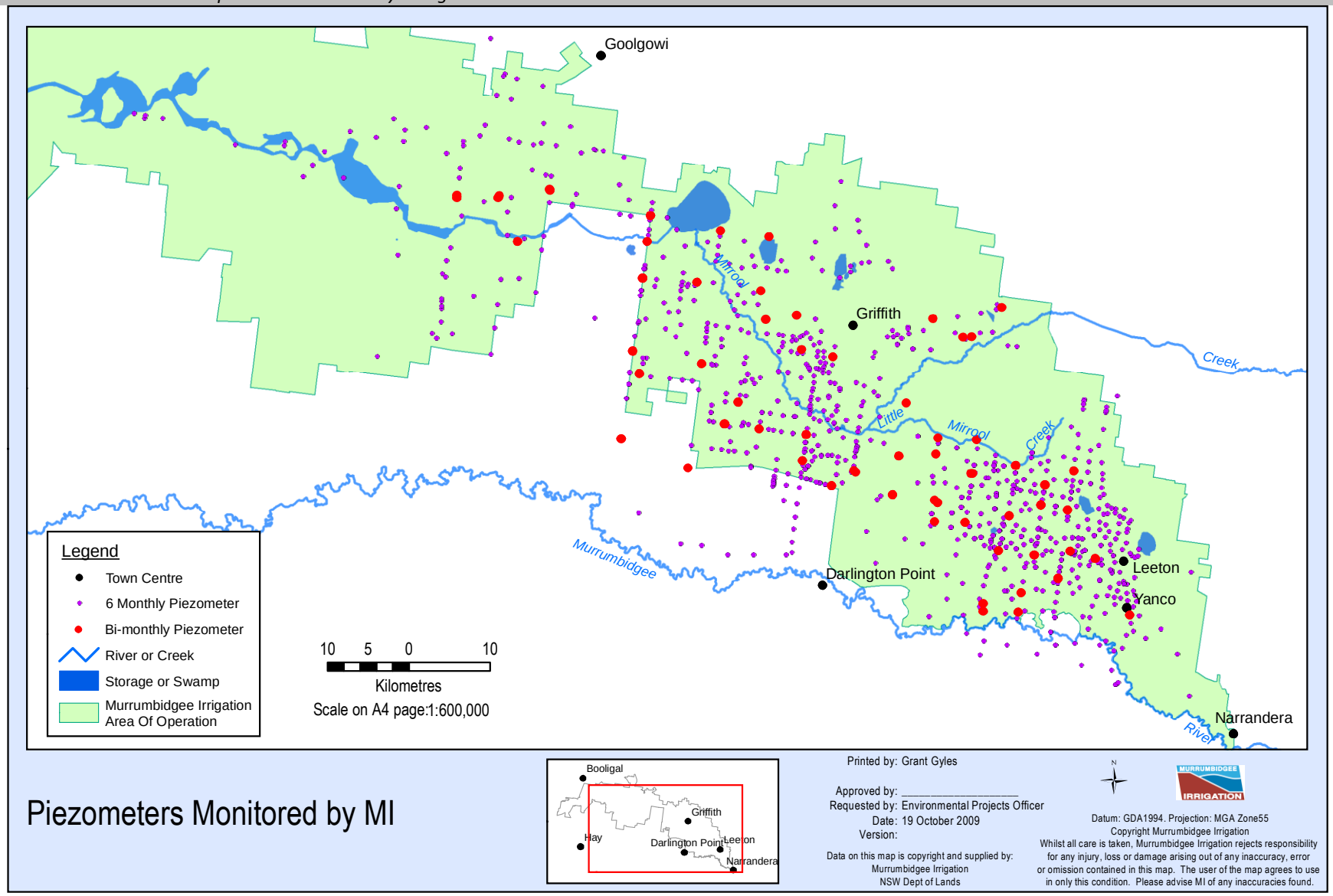
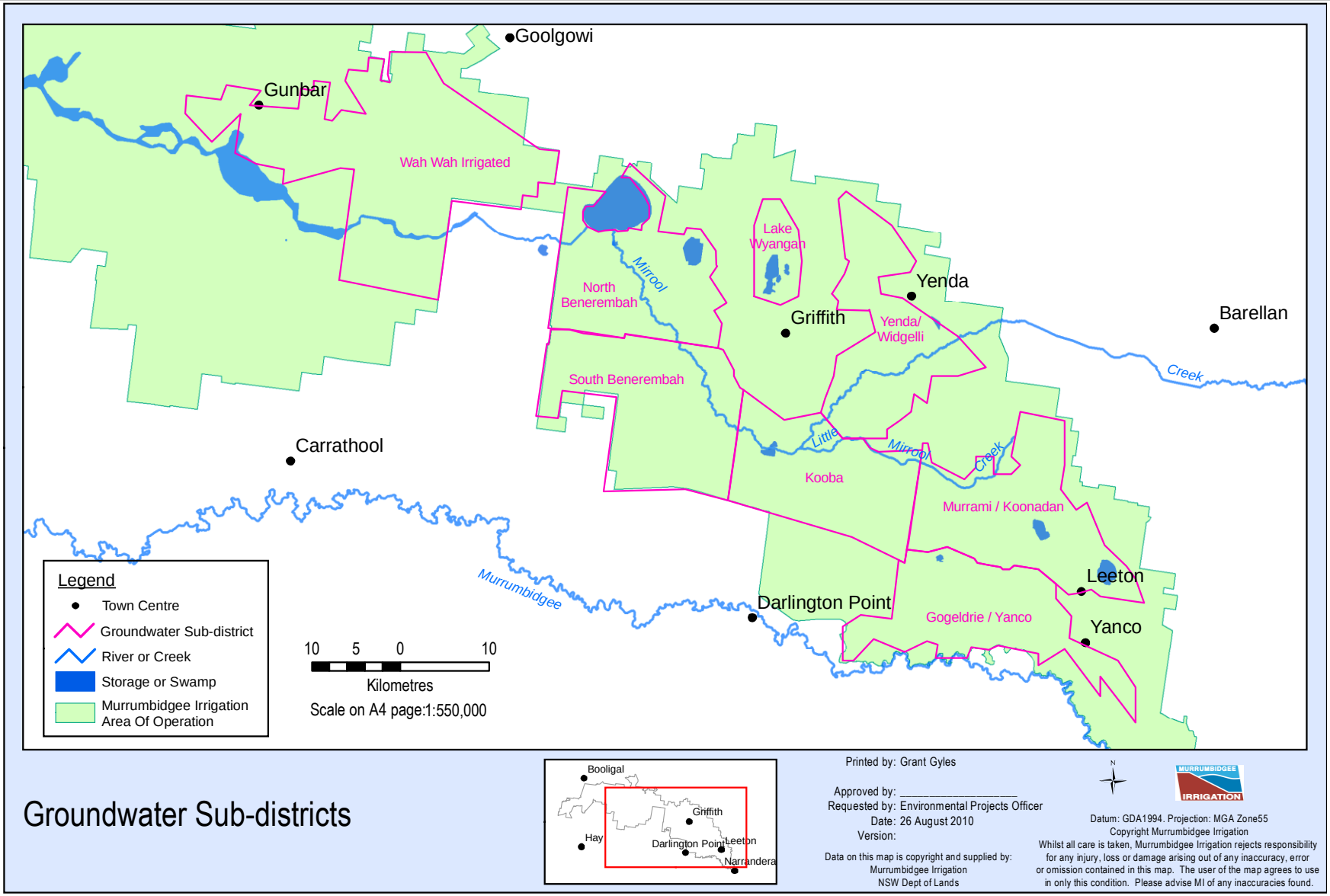


Figure 3.2.j: Groundwater sub-districts



A.4 FLOODS AND FLOODPLAIN MANAGEMENT

A.4.2 REPORTING REQUIREMENTS

A.4.2 (1 & 2) FLOOD LEVELS, FLOODPLAIN STRUCTURES, FLOOD RELEASES

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

There were no deliberate releases into the floodway during the 2008/09 season due to the on-going drought conditions and the ability to better manage drainage flows arriving at Barren Box Storage and wetland as a result of the improved operating efficiency from the reconfiguration works.

There were no modifications or new works relevant to these conditions during the year

A.4.2 (3 & 4) FLOOD REPORTING – LOWER MIRROOL CREEK FLOODWAY

There were no major works undertaken other than assisting Wyvern Station with their noxious weed control as part of a negaotiated agreement with Wyvern Station.

The company is working closely with appropriate councils, who have recently obtained funding for undertaking flood studies.

There were no modifications or new works relevant to these conditions during the year.

A.5 AQUATIC ENVIRONMENT MANAGEMENT

A.5.2 REPORTING REQUIREMENTS

A.5.2 (1) SIGNIFICANT CHANGE TO MAJOR WETLANDS

During 2009/2010 ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of wetlands continued. The projects which are in various stages of completion include the following:

Barren Box Storage and Wetland (BBSW)
BBSW Rehabilitation Plan moves into the implementation stage with major works being completed by 2014 and ongoing management continuing on an annual basis.
Implementation activities conducted at BBSW during the 2009/10 season include 60 ha within zone 7 of the wetland cell direct seeded with native grass species. Direct seeding within the terrestrial zone of the wetland cell continued in May 2010 with 190 ha direct seeded with a combination of Boree, *Acacia pendula,* and chenopod shrubland native species.
The aim of this work is to assist with the re-establishment of a seed bank allowing natural regeneration to occur when favourable conditions return.

BBSW waterbird monitoring
In order to understand the ecological outcomes of the wetland rehabilitation it is important to understand what species are currently using the wetland. For this purpose a detailed waterbird monitoring program of the intermediate cell was initiated in April 2007 and will continue with fortnightly surveys over a period of 24 months and monthly surveys for a further 24 months. The objective of these surveys is to establish baseline data on waterbird species and abundance in the MIA.

The Barren Box Intermediate Cell Waterbird Study Final Report 2008-2010 was completed in June 2010. The diversity, numbers and distribution of waterbirds within the intermediate cell covering 320 hectares were quantified from mid March 2008 to the end of March 2010 and relationships were tested with seasons and variations in water volume in the cell.

Fifty six water dependant species were recorded in total with a maximum number of species per survey of 35. Two threatened species, the Blue-billed duck and the Freckled duck were recorded and the total number of individual waterbirds of all species combined varied greatly from survey to survey, ranging from 104 to 6510.

Mirrool Creek Crown Reserve
As part of MI's commitment to the environment, MI is undertaking the Mirrool Creek Rehabilitation Project (the Project) with a vision to protect and enhance remnant native vegetation and revegetate bare degraded land adjacent to the Mirrool and Little Mirrool Creeks (the Creek) to create a 'green corridor' through the MIA. The project will also undertake works to improve water drainage efficiency and reduce flooding.

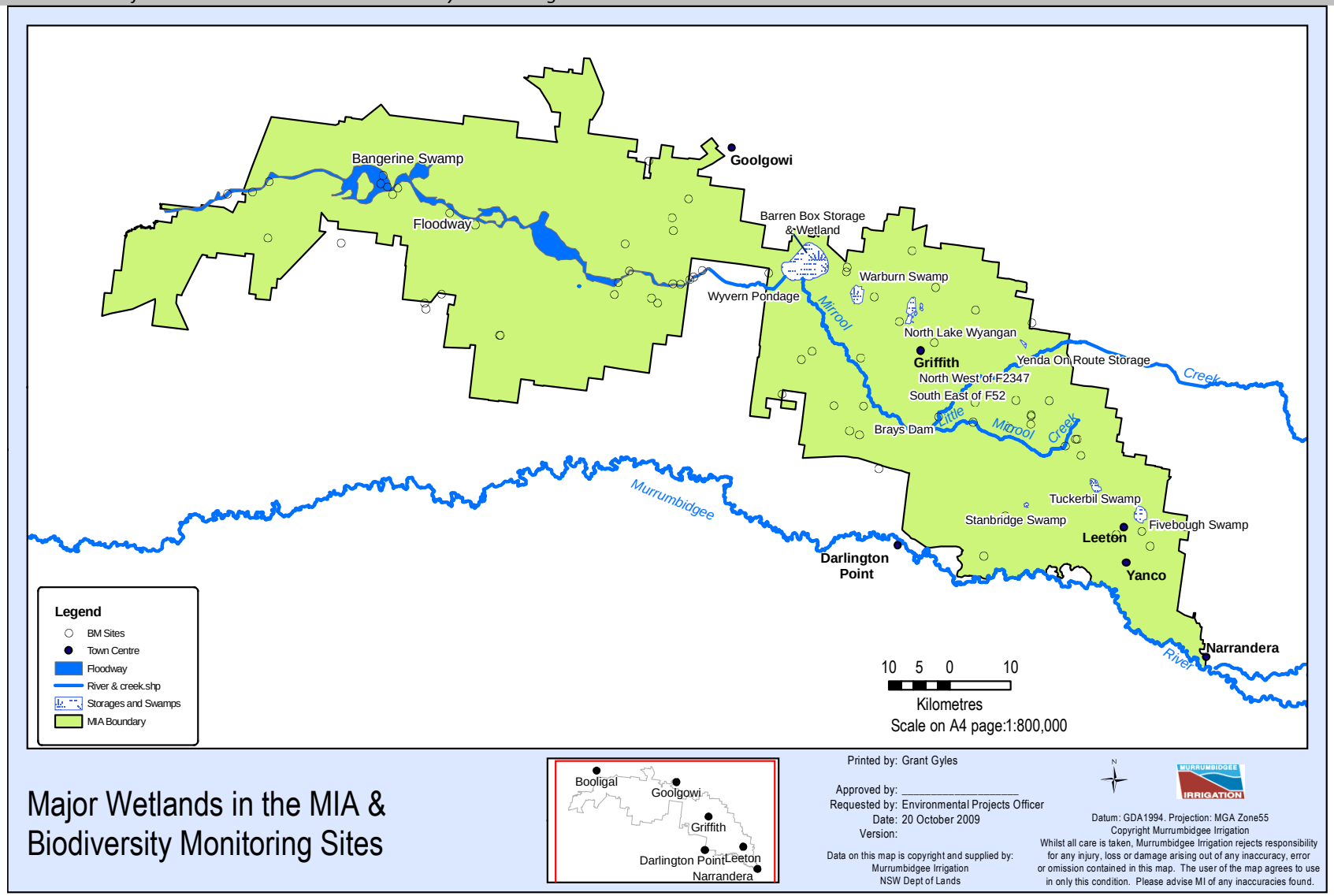
In 2009/10 a woody weed control program saw the removal of all African boxthorn and briar rose along the length of the Crown Reserve sections of the creek line. A combination of spraying and mechanical removal was used. A follow up program in spring 2010 will eliminate regrowth.

A.5 AQUATIC ENVIRONMENT MANAGEMENT

In 2009/10 a Mirrool Creek and Little Mirrool Creek Crown reserve usage audit identified several lease holdings were used for uses other than those agreed in the Department of Lands leases. This included the development of infrastructure or the application of irrigation water. Following the usage audit a boundary survey was undertaken providing on-ground markers of boundaries for negotiation with landholders.

Leases will now be negotiated with landholders that will reflect the findings of the boundary survey and will have usage conditions based on the *Crown Lands Act 1989* and achieving biodiversity outcomes for the project.

Figure 5.2.a: Major Wetlands in the MIA & Biodiversity Monitoring Sites



A.5.2 (2) NOXIOUS WEEDS

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Inspections have been carried out at BBSW and downstream channel systems and at the floodway.

Barren Box Storage and Wetland

Inspections and treatment took place in February 2010. With the continuing dry conditions, low numbers of plants have been found once again at BBSW. There were eleven plants found and all plants were small in size.

Channel System

Only one plant was found, in the Wah Wah Extention downstream of Merrrondale Lane.

Floodway

An inspection of the floodway between the Outfall channel Offtake and Cameron Lane took place in February 2010. One plant was found.

Outfall Channel

No plants were found.

Treatment

All Alligator Weed found has been treated with Brushoff. GPS co-ordinates have been taken and recorded.

Sagittaria - Griffith Area

Inspections of Sagittaria during 2009/10 were carried out monthly from September through to the end of June; plants are treated with Roundup Biactive in accordance with an APVMA off label permit for use to the rate of up to 10L per 100L or 40L per hectare. Permit: 11856.

A.6 GENERAL ENVIRONMENT MANAGEMENT

A.6.3 REPORTING REQUIREMENTS

A.6.3 (1) REGISTER OF ACTIVITIES

A *register of activities* is ordinarily required by a determining authority, generally being a Government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning & Assessment Act. However, as this remains a licence requirement, despite the privatisation of Murrumbidgee Irrigation, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2009/10. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2010

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	Murrumbidgee Irrigation	February 2005

Source: MI Environmental Services

A.6.3 (2) SIGNIFICANT CHANGES AND CONDITION OF ENVIRONMENT ASSETS

Monitoring and management of environmental assets in the MIA

Remnant protection and local native species revegetation

For the reporting period 1 July 2009 to 30 June 2010, 107 hectares new plantings, 1,980 hectares of enhanced remnants, and 550 hectares of direct seeding took place to increase the area of remnant native vegetation within the MIA. The enhancement of remnant vegetation was done under a combination of Property Vegetation Plans (PVP's) and the new BioTender program with funding provided by MIA EnviroWise.

MIA EnviroWise is required through the Murrumbidgee Catchment Management Authority (MCMA) to complete PVP's for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder. In 2009/10, 39 PVP's were completed and approved by the MCMA on 44 MIA farms.

Biodiversity incentives are available to MI customers to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant protection and enhancement through fencing and direct seeding, new plantings along

drainage lines, or plantings with the intention of linking remnant vegetation creating corridors for the movement of fauna within the MIA.

Vegetation Implementation Officers assist landholders in the planning and implementation of their PVP's.

MIA EnviroWise implemented the new biodiversity stewardship program 'BioTender' in the 2008/09 financial year. The aim of the program is to capture remnant native vegetation sites of high ecological value within the MIA, and through a ten to fifteen year stewardship payment encourage landholders to maintain and enhance these sites. Landholders were encouraged to submit an application during a tender period for the cost of protecting and enhancing their remnant native vegetation. The program aimed to protect 2,000 hectares of remnant vegetation over two tender rounds, and well and truly exceeded this with around 3350 hectares of remnant native vegetation successfully tendered by landholders over the two rounds, comprising 1,500 hectares in round one in the 2008/09 reporting year and a further 1,850 hectares in round two, finalised in the 2009/10 reporting year.

Figure 6.3.a: Remnant Vegetation of the Murrumbidgee Irrigation Area

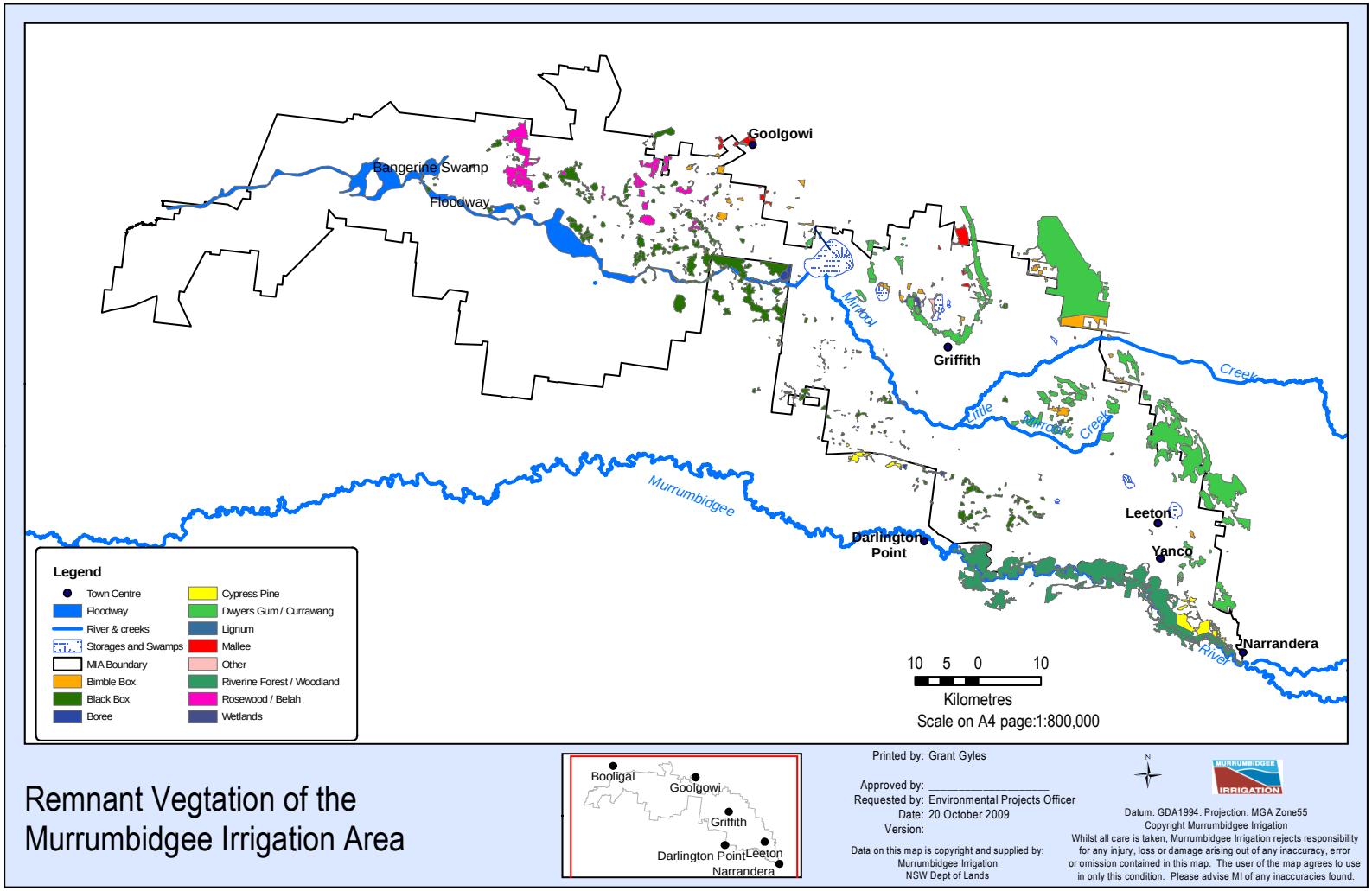
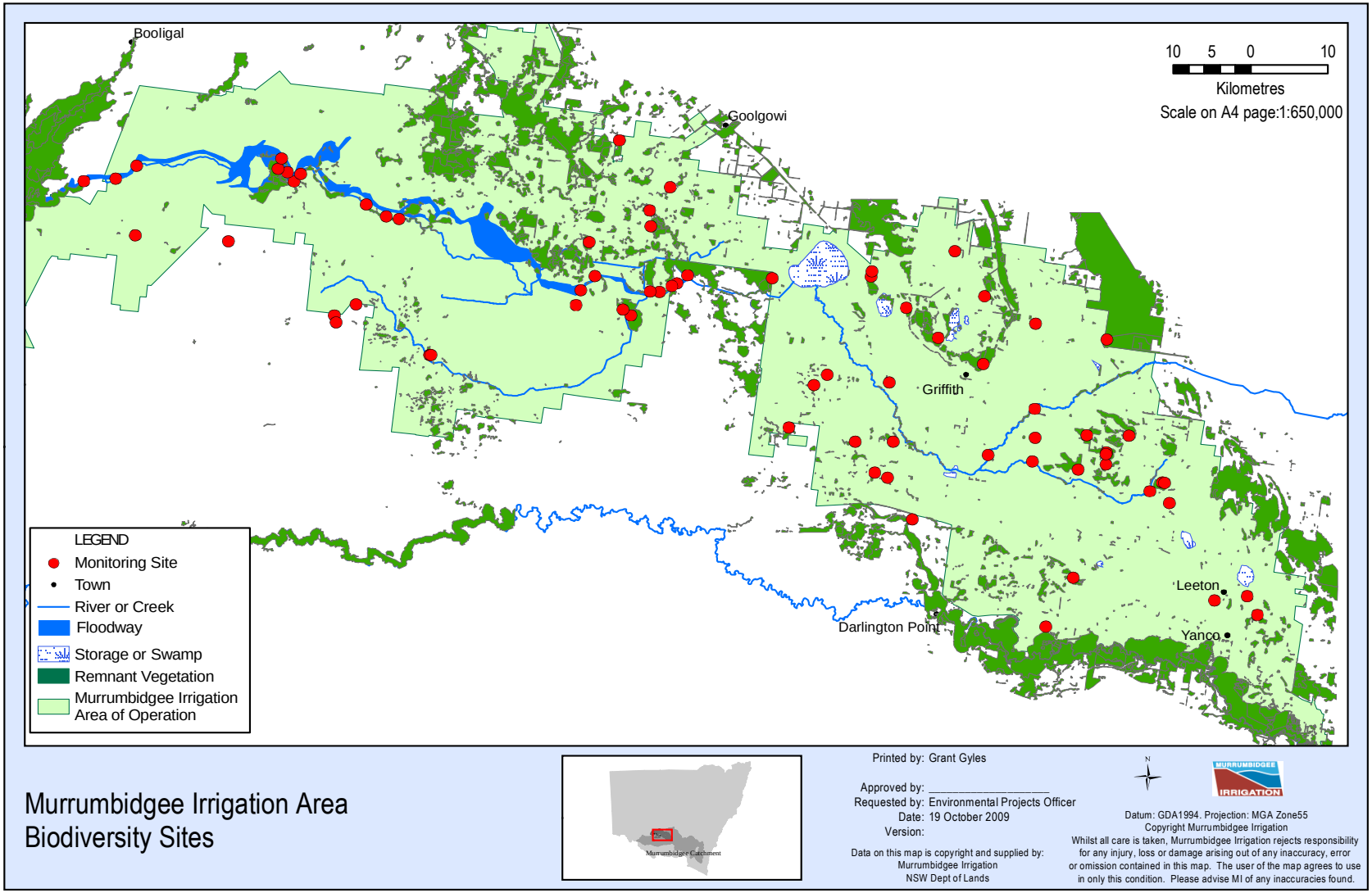


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



A.6.3 (3) SOIL SALINITY SURVEY (EVERY THREE YEARS)

Pending the outcome of the review of the company's licence with the DECCW and the outcome of the CSIRO hydro-ecological assessment project, the soil salinity survey has been suspended.

MI is committed to develop a more effective way to monitor and improve soil salinity. Further it is expected that the outcomes from the CSIRO research will assist in the development of a more appropriate regional soil salinity assessment method. While the CSIRO project will not develop a methodology the outcomes will be used to guide the development of a new risk based approach to monitoring soil salinity.

The risk based approach will involve identifying an area where change is likely to occur or has recently occurred (such as the replacement of an open channel system with pressurised piping) and monitoring that area more in-depth for a predetermined period of time to establish if the change will have or has had an effect on soil salinity. The information collected will then be used in developing future programs. This approach will provide a more effective and targeted way to use our resources and will assist in identifying the salinity risk for future developments and planning in the MIA and Districts.

A.7 SALINITY MANAGEMENT AND ACCOUNTING

A.7.4 REPORTING REQUIREMENTS

A.7.4 (1) FLOW, SALT LOAD AND SALINITY DATA

Refer to Drainage Volumes, Table 2.2.k, page 20-21, for flow data.

Refer to Salt Loads, Table 2.2.l, page 23-24, for salt load data.

Refer to refer to Table M.5, page 75, for salinity data.

A.7.4 (2) NOTICE FOR COMPLIANCE WITH SALINITY AND DRAINAGE STRATEGY

No written notice was received for the period.

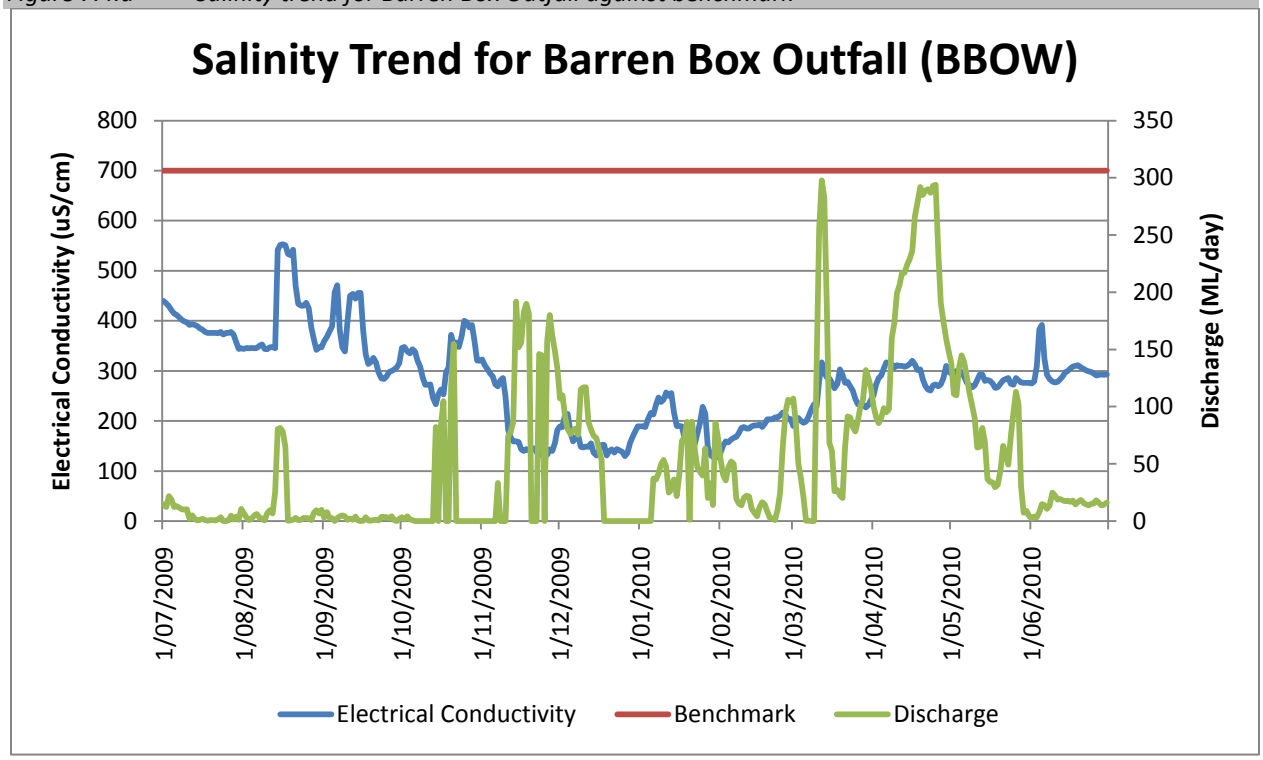
There were no changes in operations and practices that could change the long-term salt discharges from the Area of Operation. For more detail see commentary on Table 2.2.h.

A.7.4 (3) SALT LOAD DISCHARGES

Refer to Salt Loads, Table 2.2.l, page 23-24.

A.7.4 (4) SALINITY IN BARREN BOX OUTFALL DRAIN AGAINST BENCHMARK

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark



Source: Thiess flow gauging station.

Figure 7.4.a shows the salinity trend for Barren Box Outfall against the benchmark of 700 EC. The figures presented are daily averages. The figure shows that during low flow or no flow conditions, the salinity levels are generally higher. It is evident that for the 2009/10 irrigation season the quality of water discharged from the Barren Box Outfall Channel for supply to the Wah Wah Irrigation District has been satisfactory with EC levels well below the identified 700 EC benchmark limit.

WATER QUALITY MANAGEMENT

MI requested and gained approval from the DECCW to continue trial the draft Water Quality Monitoring Program for the 2009/10 irrigation season. The DECCW acknowledged that this meant that MI would not be monitoring water quality in accordance with the current requirements of the Environment Protection Licence 4651 for the 2009/10 season.

New licence provisions have been negotiated with the DECCW and the Water Quality Program that has been trialled over the past two seasons will be in place under licence from July 1 2010. The details of the new Monitoring Program are explained in Section A.2.3 of this report.

As part of the new water quality program, supply water quality was measured three times during the season and trace levels of some chemicals were found and this was reported to the relevant authorities. It is important that this information is available in case of detections of those same chemicals in the drainage channels. As expected, the number of detections of chemicals in our drainage water increased compared to previous years. The reason for this increase is the more targeted approach of the new program and heavy rain fall events. It is expected that this increase in detections will happen for a number of years until we have gained a better understanding of where and when pollutions occurs. This will then allow us to develop strategies and education programs to reduce the detections and therefore increase the quality of our drainage water. All notification and action level detections have been reported in Tables M3 and M4.

The successful trial of the new water quality monitoring framework means that MI expects to update its licence with the DECCW and include the new program.

As part of the new program, MI will review and update its pollution prevention program, which was set up to work with farmers to promote best management practices in order to minimise pollution in our drains. This includes, for example, participation in farmer shed meetings and using local media to create awareness. Based on the risks associated with each of the sub-catchments, as well as the results from the targeted monitoring program, new pollution prevention programs will be developed.

Table M.1: Department of Environment and Climate change compliance requirements

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Location of monitoring sites	Table M.2	69
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3 & M.4	70-75
	Chlorpyrifos (Monthly)	Table M.3 & M.4	70-75
	Conductivity	Table M.5	75
	Diazinon (November)	Table M.3 & M.4	70-75
	Diuron (Monthly)	Table M.3 & M.4	70-75
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	70-75
	Flow (Monthly) LW6	Table 2.2.k Table 2.2.g	20-21 18
	Malathion (Oct/Nov)	Table M.3 & M.4	70-75
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Nitrogen (>5Mg)	Table M.3 & M.4	70-75
	Phosphorus (>5Mg)	Table M.3 & M.4	70-75
	Simazine (Monthly)	Table M.3 & M.4	70-75
	Thiobencarb (Nov)	Table M.3 & M.4	70-75
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Turbidity	Table M.5	75
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.k	20-21
M3	**Testing Methods – concentration limits**		
	Approved by DEC	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11&12		
	Atrazine (Monthly)	Table M.3 & M.4	70-75
	Chlorpyrifos (Monthly)	Table M.3 & M.4	70-75
	Conductivity (Monthly)	Table M.5	75
	Diazinon (Nov)	Table M.3 & M.4	70-75
	Diuron (Monthly)	Table M.3 & M.4	70-75
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	70-75
	Flow (Monthly)	Table 2.2.k	20-21
	Malathion (Oct/Nov)	Table M.3 & M.4	70-75
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Simazine (Monthly)	Table M.3 & M.4	70-75
	Thiobencarb (Nov)	Table M.3 & M.4	70-75
	Nitrogen (>5Mg/day)	Table M.3 & M.4	70-75
	Phosphorus (>5Mg/day)	Table M.3 & M.4	70-75
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Turbidity	Table M.5	75

*Table M.1: Department of Environment and Conservation compliance requirements (***cont.**)

DEC Licence	Issue/requirement	Compliance /reference	Page No.
	Monitoring Sites 13 &14		
	Atrazine (Monthly)	Table M.3 & M.4	70-75
	Chlorpyrifos (Monthly)	Table M.3 & M.4	70-75
	Conductivity (Monthly)	Table M.5	75
	Diazinon (Nov)	Table M.3 & M.4	70-75
	Diuron (Monthly)	Table M.3 & M.4	70-75
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	70-75
	Malathion (Oct/Nov)	Table M.3 & M.4	70-75
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Simazine (Monthly)	Table M.3 & M.4	70-75
	Thiobencarb (Nov)	Table M.3 & M.4	70-75
	Nitrogen (Monthly)	Table M.3 & M.4	70-75
	Phosphorus (Monthly)	Table M.3 & M.4	70-75
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	70-75
	Turbidity (Monthly)	Table M.5	75
	M7.2 Conductivity Sites 1 & 9	Table M.5	75
	M7.3 Molinate	Table M.3 & M.4	70-75
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Records stored on computer, Page 58	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	DECCW contacted Table R.1, Page 76	
R3	**Written report**		
	R3.1 Send reports to DEC at their request, regarding environmental harm	DECCW sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	DECCW contacted, Table R.1, Page 76	
R5	**Annual report**		
	R5.1 Submit annual report to DEC	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.k A.3.2(4) Table R.1 Table R.1	14 20-21 39 76-77 76-77
	R5.4 Send copies to DECCW, DII and MDBC	Submitted	

Table M. 2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR[#]	Gogeldrie Main Southern Drain	5	*
410083	YMS[#]	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

[#] **Note :** There was very little flow at these sites. Flow ceased draining to river and is now diverted (Pumped or gravity-fed) to the supply system.

Table M. 3: Benchmark sampling monitoring

Site	EMR	NARREG	STUR	BYD	BARDENS	3WAYS	PENFOLDS
Nitrite + Nitrate as N (LOR 0.01mg/L)							
Sep	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Jan	<0.01	<0.01	0.04	0.02	<0.01	<0.01	<0.01
May	<0.01	0.31	0.37	<0.01	<0.01	0.01	<0.01
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)							
Sep	0.4	0.4	0.3	0.6	0.8	0.3	0.6
Jan	0.4	0.3	0.3	1.1	1	0.6	0.4
May	0.3	0.4	0.5	0.5	0.5	0.4	0.6
Total Nitrogen as N (LOR 0.1mg/L)							
Sep	0.4	0.4	0.3	0.6	0.8	0.3	0.6
Jan	0.4	0.3	0.4	1.1	1	0.6	0.4
May	0.3	0.7	0.9	0.5	0.5	0.4	0.6
Total Phosphorus as P (LOR 0.01mg/L)							
Sep	0.04	0.03	0.02	0.05	0.06	0.03	0.05
Jan	0.03	0.04	0.01	0.08	0.13	0.03	0.02
May	0.06	0.04	0.02	0.05	0.14	0.11	0.05
Biochemical Oxygen Demand							
Sep	NT	NT	NT	NT	NT	NT	NT
Jan	2	<2	<2	3	3	3	3
May	3	2	3	3	3	2	3
Simazine (LOR = 0.005 µg/L)							
Sep	0.022	0.029	0.022	0.313	0.204	0.022	0.025
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	0.077	0.116	0.091	0.149	0.113	0.066	0.066
Diuron (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	0.074	0.059	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Atrazine (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	0.008	0.053	0.015	<0.005	0.006
Jan	0.006	0.006	0.006	0.012	0.01	0.008	0.006
May	0.03	0.03	0.032	0.017	0.016	0.018	0.019
Molinate (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Metolachlor (LOL = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Malathion (LOR = 0.002 µg/L)							
Sep	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Jan	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
May	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diazinon (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thiobencarb (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorpyrifos (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	0.007	<0.005	<0.005	<0.005	0.023	<0.005	0.011
Trifluralin (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:

Action level detection

Notification level detection

Table M. 4: Trigger based sampling

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	EMR	WWO	FS	YMS	MDJY	LAG	GRI
Nitrite + Nitrate as N (LOR 0.01mg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.49	1.17	1.13	0.62	0.12	NT	NT	NT	4.79	NT	NT	0.95	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.46	0.46	0.39	0.17	NT	NT	0.05	NT	NT	NT	NT	0.64
Jun	NT	0.67	1.03	NT	0.06	<0.01	<0.01	NT	NT	NT	NT	NT	NT
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	1.2	1.7	2	2.2	1.2	NT	NT	NT	3	NT	NT	4.7	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.4	0.3	0.4	0.2	NT	NT	0.2	NT	NT	NT	NT	NT
Jun	NT	0.7	1.3	NT	0.2	0.8	0.4	NT	NT	NT	NT	NT	0.4
Total Nitrogen as N (LOR 0.1mg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	1.7	2.9	3.1	2.8	1.3	NT	NT	NT	7.8	NT	NT	5.6	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.9	0.8	0.8	0.4	NT	NT	0.2	NT	NT	NT	NT	1
Jun	NT	1.3	2.4	NT	0.3	0.8	0.4	NT	NT	NT	NT	NT	NT
Total Phosphorus as P (LOR 0.01mg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.24	0.36	0.5	0.36	0.19	NT	NT	NT	1.09	NT	NT	1.91	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.15	0.18	0.17	0.17	NT	NT	0.08	NT	NT	NT	NT	0.24
Jun	NT	0.15	0.25	NT	0.1	0.11	<0.01	NT	NT	NT	NT	NT	NT
Simazine (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.397	0.431	0.07	0.055	NT	NT	NT	14.5	0.862	NT	NT	NT

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	EMR	WWO	FS	YMS	MDJY	LAG	GRI
Dec	0.115	0.195	0.146	NT	NT	NT	NT	NT	NT	NT	0.051	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.033	0.037	0.031	0.025	0.029	NT	NT	NT	3.58	0.062	NT	0.251	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.519	0.335	0.432	0.978	NT	NT	0.231	NT	NT	NT	NT	5.08
Jun	NT	0.695	0.323	NT	0.464	0.07	0.065	NT	NT	NT	NT	NT	NT
Diuron (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.28	1.41	0.073	0.036	NT	NT	NT	14.2	3.4	NT	NT	NT
Dec	0.237	0.074	0.117	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.401	0.359	0.353	<0.005	<0.005	NT	NT	NT	3.59	0.053	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.965	1.1	0.937	1.7	NT	NT	0.58	NT	NT	NT	NT	6.27
Jun	NT	0.857	1.3	NT	0.706	0.661	<0.020	NT	NT	NT	NT	NT	NT
Atrazine (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.01	0.038	0.009	0.01	NT	NT	NT	0.017	0.008	NT	NT	NT
Dec	0.024	0.012	0.014	NT	NT	NT	NT	NT	NT	NT	0.009	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.007	0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	<0.100	<0.005	NT	<0.005	NT
May	NT	0.013	0.011	0.012	0.015	NT	NT	0.01	NT	NT	NT	NT	0.045
Jun	NT	0.055	0.037	NT	0.031	0.132	<0.020	NT	NT	NT	NT	NT	NT
Molinate (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.038	0.03	0.877	0.286	NT	NT	NT	0.036	0.057	NT	NT	NT
Dec	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	0.01	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.100	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	NT	NT	NT	<0.005
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	<0.020	NT	NT	NT	NT	NT	NT
Metolachlor (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Dec	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	NT	NT	NT	<0.005
Jun	NT	<0.020	<0.020	NT	<0.020	0.032	<0.020	NT	NT	NT	NT	NT	NT

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	EMR	WWO	FS	YMS	MDJY	LAG	GRI
Malathion (LOR = 0.002 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.002	<0.002	<0.002	<0.002	NT	NT	NT	<0.002	<0.002	NT	NT	NT
Dec	<0.002	<0.002	<0.002	NT	NT	NT	NT	NT	NT	NT	<0.002	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.002	<0.002	<0.002	<0.002	<0.002	NT	NT	NT	<0.002	<0.002	NT	<0.002	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.804	0.283	<0.002	<0.002	NT	NT	<0.002	NT	NT	NT	NT	0.49
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	<0.020	NT	NT	NT	NT	NT	NT
Diazinon (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Dec	0.015	0.011	0.031	NT	NT	NT	NT	NT	NT	NT	0.038	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	NT	NT	NT	<0.005
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	<0.020	NT	NT	NT	NT	NT	NT
Thiobencarb (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Dec	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	NT	NT	NT	<0.005
Jun	NT	<0.020	<0.020	NT	<0.020	<0.020	<0.020	NT	NT	NT	NT	NT	NT
Chlorpyrifos (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	0.023	NT	NT	NT
Dec	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	<0.005	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.035	0.024	0.018	0.033	NT	NT	0.036	NT	NT	NT	NT	0.02
Jun	NT	<0.020	<0.020	NT	0.021	<0.020	<0.020	NT	NT	NT	NT	NT	NT
Trifluralin (LOR = 0.005 µg/L)													
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	0.006	<0.005	0.006	NT	NT	NT	0.006	<0.005	NT	NT	NT
Dec	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	NT

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	LW6	EMR	WWO	FS	YMS	MDJY	LAG	GRI
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	0	0	0	0	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	0.014	<0.005	<0.005	NT	NT	NT	0.186	<0.005	NT	<0.005	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	NT	NT	NT	<0.005
Jun	NT	0.114	0.063	NT	0.05	0.046	<0.020	NT	NT	NT	NT	NT	NT
Notes:													
xxx	Action level detection												
	Notification level detection												
NT	Not tested												
LOR	Limit of reporting												

Table M. 5: Monthly Conductivity and Turbidity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results (us/cm)												
YMS	NT	708	628	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	242	NT	636	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	81	NT	NT	NT
ROCUDG	NT	NT	171	NT	NT	NT	NT	NT	NT	211	241	NT
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Turbidity results (NTU)												
YMS	NT	475	488	NT	NT	NT	NT	NT	NT	NT	NT	NT
GMSRR	NT	139	NT	159	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
ROCUDG	NT	NT	7.57	NT	NT	NT	NT	NT	NT	9.86	14.8	NT

Source: Murrumbidgee Irrigation field data

NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

Table R. 1: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide DECC Action Level				
Drainage site at Fivebough Swamp (FS)	7/03/2010	Fivebough Swamp - Action levels of Simazine & Diuron	DECCW notified via email 9/12/2009	Investigations revealed low flow at time of sampling affected sample quality.
Drainage sites MIRMCN, MDJWE and MDJY	26/05/2010	MIRMCN - Action level of Malathion, MDJWE - Action level of Malathion MDJY - Action levels of Malathion and Diuron	DECCW notified via email 30/06/20010	Investigations pending
Pesticide Notification level				
Drainage sites : BARDENS, MIRMCN, MDJWE & MDJY	28/12/2009	Notification levels of Diazinon at BARDENS, MIRMCN, MDJWE & MDJY	DECCW notified via email	Risk based approach - continue to monitor for trends
Channel S-1-5-060E Lilly Pilly Road Leeton	22/02/2010	Notification level of Chlorpyrifos	DECCW notified via email 19/03/2010	Samples were taken and channel was flushed out and refilled
Drainage sites:MDJWE & YMS	7/03/2010	MDJWE - Notification level of Diuron, FS - Notification levels of Diuron and Chlorpyrifos	DECCW notified via email 9/12/2009	Risk based approach - continue to monitor for trends
Drainage site at Fivebough Swamp (FS)	7/03/2010	Notification levels of Simazine & Diuron	DECCW notified via email 19/03/2010	Risk based approach - continue to monitor for trends
Drainage sites MIRMCN, MDJWE and MDJY, BYD, WWO, LMC	26/05/2010	Notification levels of Chlorpyrifos at WWO, MIRMCN, MDJWE, LMC, BYD and MDJY. Diuron at BYD and MDJWE and Simazine at MDJY	DECCW notified via email 19/03/2010	Risk based approach - continue to monitor for trends

Other Pollution Events				
Winery storm water inlet into DC 808J Yenda	22/07/2009	Complaint made by resident relating to winery effluent ponding in DC 808J. Inspection revealed a red /grey strong odorous discharge in DC 808J, consultation with the winery staff confirmed effluent had entered MI system through a contamination of storm water system.	Field inspection & photos taken. Reported to GCC Environmental & Health Coordinator, request made for clean up order.	On inspection of site, agreement was reached for winery to organise effluent removal (pumped out) and disposal. Site inspection 24/07/2009 confirmed clean up as appropriate, photos on file. Winery investigated storm water system and capped off a pipe leading into wineries effluent system to ensure no further contamination
Mirrool Creek/Brays Dam	24/11/2009	Algal bloom noticed in Mirrool Ck from Kidman Way	Samples taken	Lab analysis identified total Cyanobacteria 7600 & 4450 cells/ml, no known toxic species present and algal biovolume within safe guidelines.
Algae reported in Cudgel creek	24/02/2010	Site was inspected and algae was found to be a green slime.	Channel flushed and refilled.	No further issue
Winery reported sewerage spill into MI drain	11/03/2010	Winery notified MI of a sewerage spill from a ruptured main line entering MI drain DC 1479J. The line was isolated soon after the spill was identified with only a small amount of sewerage entering the MI drain.	Site inspection 15/3/2010, photos on file. Casella Wines notified DECCW	Winery arranged a truck to pump out and remove the contaminant. An inspection of the point of entry and downstream MI drainage network showed no evidence of contamination. Winery sample analysis results on file.
Report of odour coming from DC 242 Leeton	30/03/2010	Site visit revealed contamination of industrial waste entered DC 242 directly off the Griffith Road, material included carrots and corn decomposing in the drain causing the odour	Site inspection 30/03/2010, LSC contacted 31/03/2010	Request made to LSC to inspect & issue a cleanup order, channel cleaned up.
3 Mile pool	30/05/2010	Car reported in channel by police, no pollution evident	Channel drained to allow removal	Car removed

REFERENCES

Van der Lely, A. (2010). '*Groundwater Conditions and Behaviour in the MIA. Annual Report 2010.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2003). '*Salinity survey 2002-MIA: methods, data, analysis, results, findings.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2002). '*Groundwater Conditions in the MIA - Annual Report 2001.*'. Murrumbidgee Irrigation. NSW.

GLOSSARY

APHA	American Public Health Association
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&D	Murrumbidgee Irrigation Area and Districts
ML	Megalitre
mm	Millimetre
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
SEE	Statement of Environmental Effect
SFU	Single farming unit
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Table 2.2.j (page 17) and Table M.2 (page 67) for complete listings of monitoring sites

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MIA EnviroWise program has been made possible thanks to funding from the NSW Government's *National Action Plan for Salinity and Water Quality*.



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MURRUMBIDGEE IRRIGATION

MIA ENVIROWISE
MANAGING OUR FUTURE TOGETHER

Murrumbidgee CATCHMENT MANAGEMENT AUTHORITY

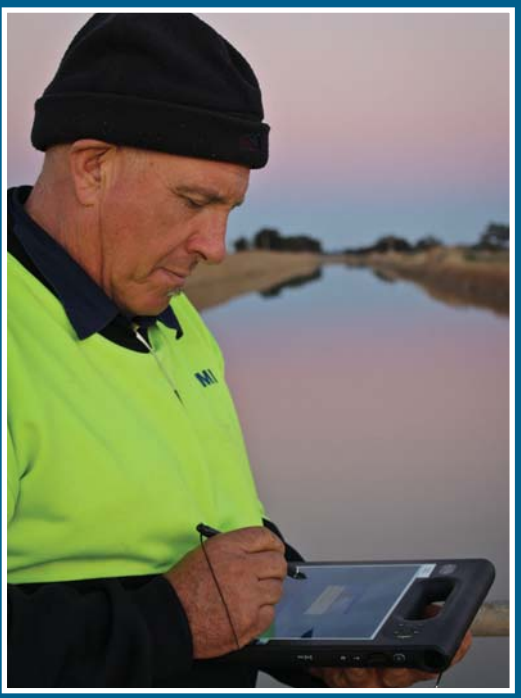
New South Wales Government



B6: Licence compliance report FY 2010-2011

Murrumbidgee Irrigation Ltd

Licence Compliance Report 2011











Growing opportunity - water and beyond.

The information in this document should be read as a whole document. The data contained in this LCR is for meeting MI's Licence Compliance only. MI does not guarantee the accuracy, reliability or suitability of excerpts of this date for any other purpose. Please contact Environmental Services, Murrumbidgee Irrigation on 02-6962 0200 for further information.

INTRODUCTION

Murrumbidgee Irrigation (MI) has complied with the requirements under its licences with the NSW Office of Water (NOW) and views environmental sustainability as core business.

After many years of below average allocations and rainfall the 2010/2011 season saw significantly above average rainfall and full allocations. This resulted in a significant increase in monitoring activities associated with licence compliance.

Our environmental programs, which aim to exceed our environmental obligations, demonstrate our commitment to ensuring that our operations do not impact on the environment.

Our environmental monitoring programs, the results of which are contained in this report, demonstrate that our programs are having an impact in ensuring the sustainability of the MIA.



Gillian Kirkup
Chairman
Murrumbidgee Irrigation



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EXECUTIVE SUMMARY

Murrumbidgee Irrigation (MI) operates under the Works Management Licence IC5 with the NSW Office of Water (NOW) and Environmental Protection Licence in accordance with the Protection of the Environment Operations Act, 1997. These licences set the minimum standard for environmental management. The Company has a corporate objective to operate beyond compliance and its environmental programs have been developed to meet this objective.

NOW WATER MANAGEMENT WORKS LICENCE IC5 REQUIREMENTS

The NOW licence comprises of seven broad categories (A1 – A7) which are summarised below:

A.1 LAND AND WATER MANAGEMENT PLAN

The Land and Water Management Plan (LWMP) is now incorporated in the Murrumbidgee Irrigation Sustainable Business Strategy (MI SBS). The MI SBS continued to enhance the sustainability and profitability of the MIA and districts over the last year through a combination of education, incentives and regional projects. The 2010/11 year saw $873,860 of government funding and $746,182 in direct Landholder funding invested in the Murrumbidgee Irrigation Area (MIA) and districts through the MI SBS, of which less than 10% was devoted to plan administration.

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

In contrast to the drought conditions that have impacted on water availability since 2002/03, well above average rainfall in the catchment and MIA & Districts throughout the 2010/11 season resulted in full irrigation allocations. Heavy rainfall particularly from October to March saw high flow levels in the Murrumbidgee River with associated lagoon flooding causing MI river drains to back up in some instances. The heavy rainfall resulted in a significant increase in drainage to wetlands associated with the Murrumbidgee River.

General security allocation increased markedly throughout the season from the initial announcement to reach 100%. The trigger for the Rice Environmental Monitoring Program (40% General security allocation by 1st October) was reached and the program was implemented in line with the Rice Environmental Monitoring Policy. Shareholders increased their rice cropping programs significantly with over 25,000 ha planted compared to 7,622 ha in the previous season.

With full irrigation allocations there was a shift in deliveries for specific crop types. Deliveries to rice increased to 52% of the total, while supply requirements for Horticultural crops were much lower at 15% of the total, a reflection of high summer rainfall combined with lower temperatures.

Simple system efficiency increased in line with higher deliveries combined with continued vigilance of MI staff.

The licence specifies continuous measurement of flow and salinity, which is done using flow gauging stations at key sites across the area. Continuous monitoring implies that 100% of the data is expected to be measured and recorded. Recent upgrades to flow gauging stations at the three of our four river drain sites (ROCUDG, GMSRR and LAG) have ensured data integrity. No data was lost at any of the river drain sites during the season.

EXECUTIVE SUMMARY

A.3 GROUNDWATER MANAGEMENT

As per the licence requirements, all bi-monthly and six-monthly bores were read. The shallow and deep water tables have levelled off to September 2010, while a significant increase was observed in the March 2011 readings due to more intensive irrigation and higher rainfall. The MIA is still well below the predicted groundwater levels of the LWMP raising concerns as to the appropriateness of such benchmarks in the current context. Less than 9% of the MIA has water table levels within two metres of the surface, compared to 70% before the commencement of the drought.

A.4 FLOODS AND FLOOD PLAIN MANAGEMENT

There were no deliberate diversions to the Lower Mirrool Creek (LMC) floodway.

A.5 AQUATIC ENVIRONMENT MANAGEMENT

During 2010/2011, ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of wetlands continued. The projects which are in various stages of completion include the Barren Box Storage and Wetland (BBSW), Mirrool Creek Crown Reserve Rehabilitation and BBSW waterbird monitoring.

Control of alligator weed in the aquatic environment has continued over the past year. Inspections were carried out at BBSW, the channel system and the LMC floodway with 8 alligator weed plants found. All sites identified were chemically treated, weed removed where possible and GPS locations recorded. This extremely low number of plants demonstrates MI's commitment to eradicate this significant weed.

Inspections and treatments of *Sagittaria graminea* during 2010/11 were carried out monthly from September through to the end of June. Chemical treatments are carried out in accordance with APVMA permits. In addition MI has approved two research projects aimed at controlling aquatic weeds including Sagittaria. One project involves a biological control agent, while the other aims to collect data relating to rates and efficacy for the registration of an alternate chemical with the APVMA.

A.6 GENERAL ENVIRONMENTAL MANAGEMENT

Protection and enhancement of local native species, remnant revegetation and other environmental assets is managed through the Property Vegetation Plans (PVP's). Biodiversity incentives are offered to landholders to undertake a PVP through the MI SBS. The aim of these incentives is to encourage landholders to protect remnant native vegetation sites of high ecological value within the MIA and/or set aside areas of their farm to return to native vegetation and manage these areas to achieve biodiversity targets, through a legally binding 10 to 15 year contract. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Sections A.1 and A.6.

Measuring and assessing the drivers that impact soil salinity at a regional scale continues to be difficult. It was concluded after the last survey that the current survey method does not provide an effective way to monitor the changes to soil salinity from irrigated agriculture and/or improve soil salinity. MI is committed to developing a more effective way to monitor and improve soil salinity.

It is expected that the outcomes from the CSIRO research will assist in the development of a more appropriate regional soil salinity assessment method. While the CSIRO project will not develop a methodology, the outcomes will be used to guide the development of a new risk based approach to monitoring soil salinity.

A.7 SALINITY MANAGEMENT AND ACCOUNTING

The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

OEH ENVIRONMENTAL PROTECTION LICENCE

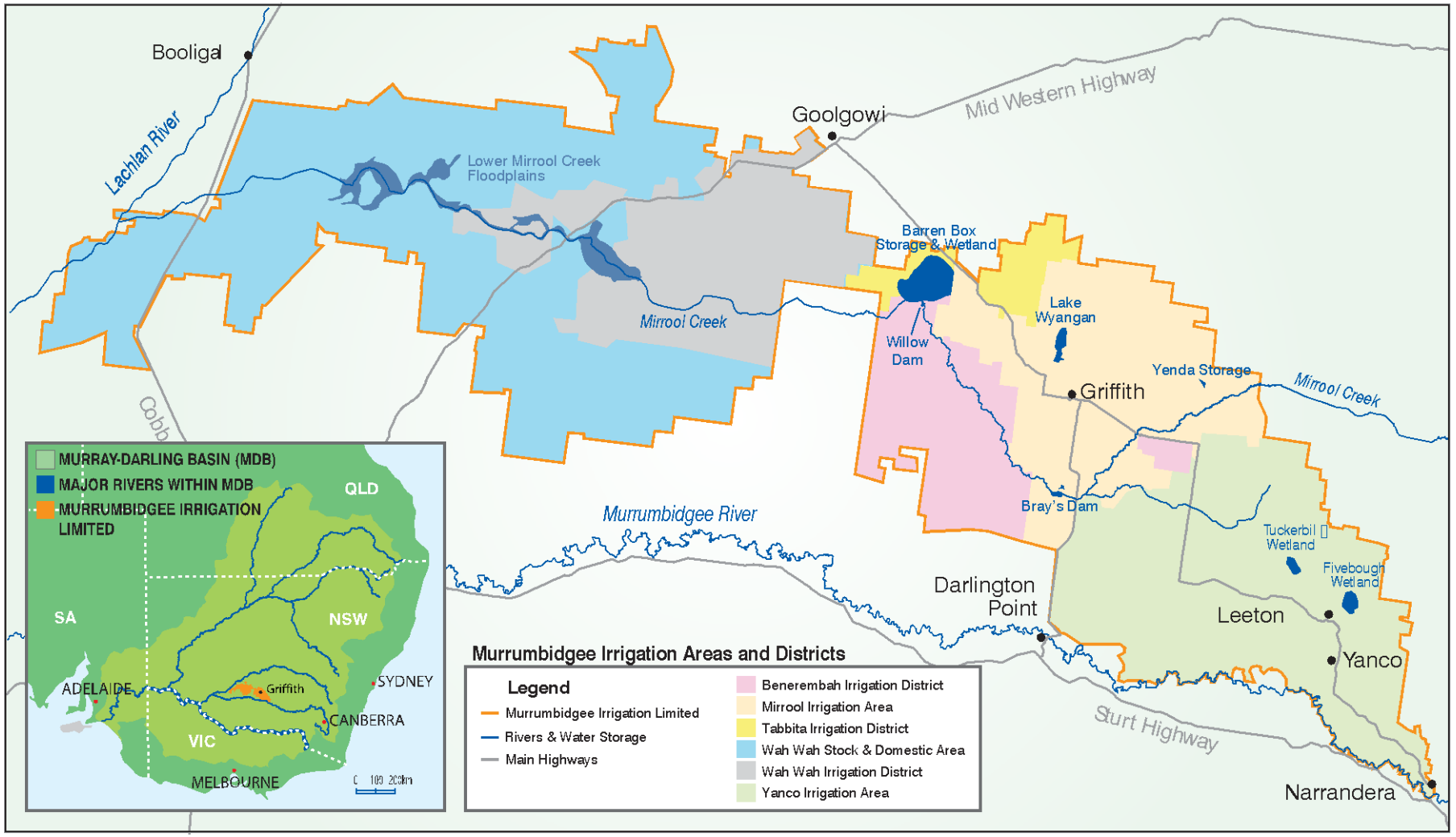
The OEH licence has detailed requirements for monitoring and recording of drainage water quality.

The quality of drainage water is monitored within sub catchments using a risk based approach endorsed by OEH. Trigger monitoring is used to test water quality when predefined conditions occur. The supply water quality is monitored using benchmarking samples collected at three times throughout the irrigation season.

In addition to the Water Quality Monitoring Program, MI is also required to investigate miscellaneous pollution incidents. In 20010/11 seventeen miscellaneous complaints were received from the public and company staff. Each of these were followed up and resolved in accordance with licence and other legislative requirements.

Murrumbidgee Irrigation Ltd

Murrumbidgee Irrigation Areas and Districts



A.1 Land and Water Management Plan

MI Sustainable Business Strategy (incorporating the MIA and Districts' Community Land and Water Management Plan)

A.1.1 ANNUAL ENVIRONMENT MANAGEMENT REPORT

In 1989, the Murrumbidgee Irrigation Area (MIA) community initiated the Murrumbidgee Irrigation Area and Districts Land and Water Management Plan (MIA&D LWMP) in response to threats to the area's future sustainability as a result of widespread flooding. It was agreed that the cost of implementation would be shared between the NSW and Australian governments and the MIA and Districts community. The MIA&D LWMP was implemented as MIA EnviroWise until 2010 when it was absorbed into the Murrumbidgee Irrigation Sustainable Business Strategy (MI SBS) to further integrate environmental management into MI operations. The MIA covers more than 660,000 hectares with a gross value of approximately $7 billion in value added agricultural production.

The total cost of implementing MIA&D LWMP has been calculated at $285.4 million over 30 years. The breakdown of funding, and a summary of funds received and expended to date are presented in Table 1.1.a.

MIA EnviroWise (Mark II) began development in 2009 with the aim of providing strategic framework for continued and innovative environmental management in the MIA. The strategic plan has been approved by the board of MI and now stands as the MI SBS. The vision underpinning and informing the MI SBS is that:

Murrumbidgee Irrigation is recognised as the best irrigation company in Australia in measuring and managing its water, energy, carbon and landscape footprint; preparing its business, its customers and its region to operate effectively in a more variable and difficult climate with less secure water resource availability; making extremely efficient and profitable use of irrigation water; differentiating its services based on environmental performance; and developing new sustainable business opportunities

The objectives of the MI SBS are to provide a strategic framework that will guide and support MI, its customers and the region, in order to:

1. Facilitate adaptation to a more variable and difficult climate incorporating improved land management techniques;
2. Improve the management of irrigation water, the efficiency of the delivery system and the productivity of water use;
3. Maintain drainage water quality to be better than agreed standards and improve the environmental health of aquatic ecosystems;
4. Mitigate net greenhouse gas emissions, with a target of carbon neutrality for MI operations by 2015, and to demonstrate the capacity of the MIA to be carbon neutral by 2020;
5. Reduce energy use, improve energy efficiency and increase the proportion of renewable energy consumed, to the point where MI is a net producer of renewable energy by 2020;
6. Minimise MI's waste streams, and pursue opportunities to re-use or sell waste;

7. Ensure that areas of remnant vegetation and wetlands of high conservation value are managed under long-term stewardship arrangements, and enhanced by ongoing biodiversity and carbon plantings, to improve ecosystem function by 2020;
8. Recognise and reinforce the social and cultural dimensions of landscape, enterprise and natural resource management, and build community pride in the environmental performance of the MIA, through active community engagement;
9. Develop new sustainable business opportunities; and
10. Position the MIA to differentiate and promote its produce in more demanding and discerning markets on the basis of its environmental performance.

Environmental sustainability is core business for Murrumbidgee Irrigation Limited.

Table 1.1.a: Funding sources, receipts and expenditure for MIA&D LWMP

Funding source	Total funds committed at 2000/01* ($ million)	Term (years)	Funds received to 30 June 2011 ($ million)	Expenditure to 30 June 2011 ($ million)
Government	50.1	15	29.2^	29.2
Landholders-in-kind	214.2	30	n/a	102.9#
Landholders/urban levy	19.6	30	9.5	5.7
Total expenditure				**137.8**

* Funds as negotiated between Murrumbidgee Irrigation and NSW Government as detailed in the Heads of Agreement (unsigned).
^ This does not include funds for expenditure beyond 2010
# Calculated from invoices received from landholders and is an underestimate of total in-kind contribution

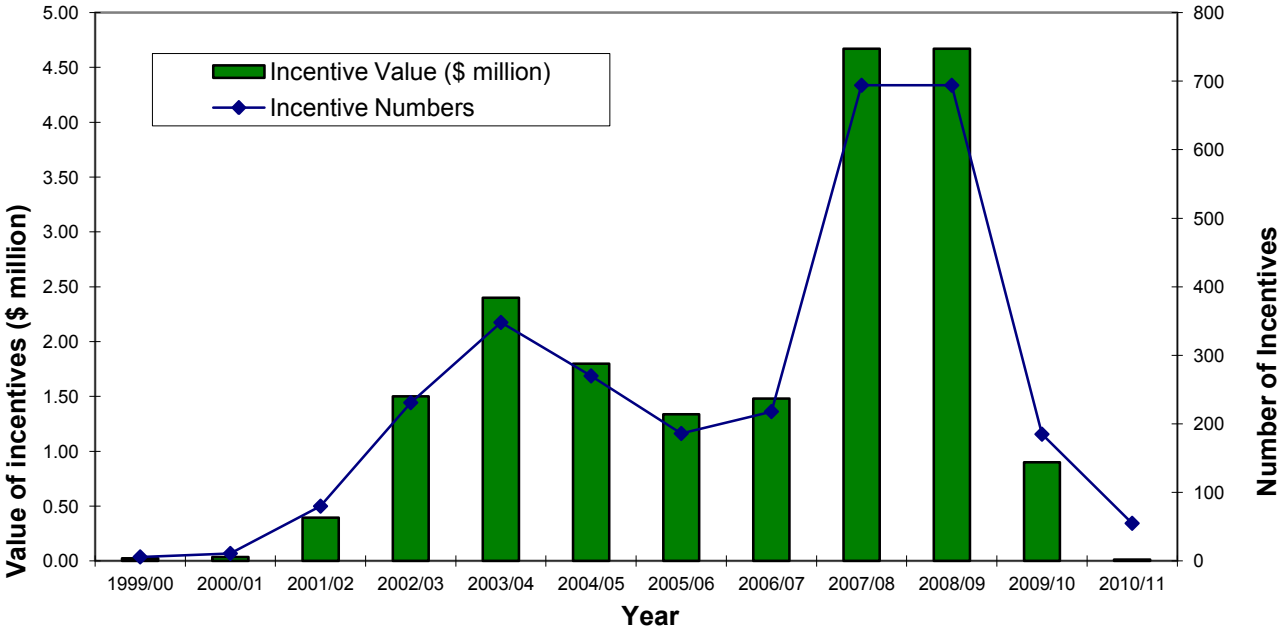
The financial administration of government funds for the MI SBS is the responsibility of Murrumbidgee Irrigation Limited. The expenditure of these funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP in 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001.

The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

OVERVIEW OF THE ON FARM PROGRAM LINE ITEMS

Figure 1.1.a. shows how the funding received for on-farm infrastructure incentives has been distributed over the years and as the on-farm infrastructure incentive program has concluded the funding has ceased.

Figure 1.1.a: The number and the dollar value of incentives for on farm works, since 1999 when seed funding was received for the LWMP, and then from 2001 when MIA EnviroWise received funding



Outlined in Table 1.1.b is an overview of the On Farm Program line items, targets and timelines for achievement of the line items, and achievement of the line items to 30 June 2011.

Table 1.1.b: On Farm Program line items (specified in LWMP 1998) – targets and achievements to 30 June 2011

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2010
Best Management Practices – Horticulture	n/a	n/a	n/a	Fact Sheets
Best Management Practices – Large Area	n/a	n/a	n/a	Fact Sheets
FarmWise Education Program (Total) Horticulture Large Area				1432 farms 872 farms 560 farms
Irrigation/drainage survey & design (Whole Farm Planning – Horticulture)	800 farms	1-15 years	Yes	690 farms
Irrigation/drainage survey & design (Whole Farm Planning – Large Area)	450 farms	1-15 years	Yes	407 farms
* Vegetation Management Planning and Property Vegetation Planning	450 farms	1-15 years	Yes	440 farms 273 landholders
Irrigation efficiency systems	270 farms	1-15 years	Yes	197 farms
High Tech horticultural irrigation systems	800 farms	1-15 years	Yes	569 farms
Conversion to perennial pasture	2000 ha	1-10 years	No	0 ha
On-farm seepage control using permanent pastures	40 farms	10 years	No	0 ha
On-farm channel seepage control			No	0 ha

Line item	Target	Time frame	Incentive available	Achieved from 2001 to 30 June 2010
Rice soil amelioration & reclassification	72 farms	1-10 years	No	TBD#
Drainage recycling	450 farms	1-15 years	Yes	320 farms
Sub-surface drainage and disposal	65 farms	1-13 years	Yes	6 farms
Mole drainage and on-farm recirculation	7 farms	1-10 years	No	0 farms
Laser forming	7500 ha	1-10 years	No	78,000 ha[+]
Rice target water use #	619 ha	1-10 years	No	443[^]
* EM31 Surveys	900 farms		Yes	66 farms
* Structural adjustment			Yes	7 farms
* Water use monitoring			n/a	

Note: * Line items included since 1998
Line item included in structural adjustment
[+] Estimate based on the number of Whole Farm Plans implemented
^ Based on rice soil areas reclassified as unsuitable as per the Rice Environmental Monitoring Policy

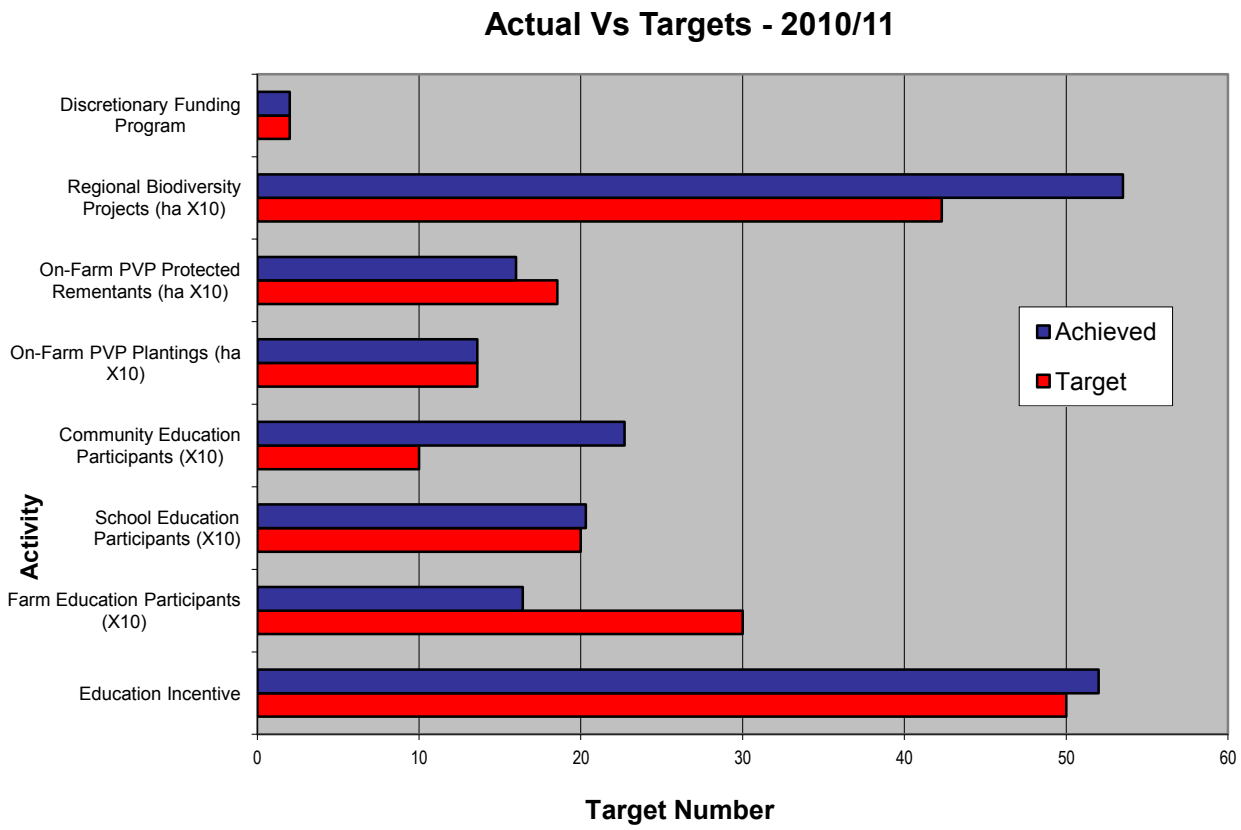
Program Highlights

The program expenditure and targets achieved for line items of the MI SBS for the reporting year are presented in Figures 1.1.c and 1.1.d. The highlights for the past year were again the success of the biodiversity program, especially at Barren Box Wetland where 3,000 ML of environmental water was used to flood the wetland which was also aerial sown with Black Box seed. The continued expansion of the community education program has seen more than 2,250 school students and community members participate in Environmental Education activities.

Implementation Activities

Implementation of the MI SBS is currently focused on improving the water use efficiency of farms in the MIA through education and extension programs with farmers, while still working with individual landholders as well as the wider community and regional organisations to protect and enhance the amount and diversity of native vegetation to improve habitat for native fauna. The program also works to incorporate the local Wiradjuri culture into natural resource management in the MIA again through on-ground implementation and work to educate school and community groups. The progress of the various projects against their targets for the 2010/11 reporting year is shown in figure 1.2.

Figure 1.1.c: MI SBS Targets Achieved



Outlined below is a summary of the achievements of the MI SBS against targets for 2010/2011:

- Once again the education incentive has proved to be very popular with the landholders of the MIA with in excess of 50 farming families taking the opportunity to undertake further education with the assistance of the MI SBS.
- For the regional biodiversity projects undertaken by MI, the majority of biodiversity plantings this year have been in the form of directly sown seed rather than the traditional planting of seedlings. There was 535 hectares of native vegetation planted over the past 12 months across MI land (mostly Barren Box Storage and Wetland and Mirrool Creek).
- On farm in the MIA, 136 hectares of new biodiversity plantings were completed in 2010/2011 - all of these were protected under legally binding Property Vegetation Plan (PVP) agreements. These new planting consisted of a mixture of sites sown with seeds (86 hectares) and sites where seedlings (50 hectares) were used.
- There was also 160 hectares of remnant vegetation protected under long term PVP agreements on farms across the MIA in 2010/2011.
- In the 2010/2011 year there was again an increased focus on school education through the MI SBS program. This year there were in excess of 2,000 school children from within and outside the MIA attend education sessions run by MI environmental staff.

- In addition to the schools, the MI SBS renewed a focus on wider community education with in excess of 225 community members attending workshops coordinated and run by the MI education team. The primary focus of these workshops was related to waste minimisation and recycling. These workshops were very popular with more than double the target number attending.
- There were eight farm courses run by the MI Education team applicable to both broad acre and horticulture farms. The courses covered a range of topics including management of drip irrigation systems, soil and fertiliser management, farm office management, understanding weather and water policy. In total in excess of 150 farmers attended these courses.
- The Discretionary Funding for School and Small Community Groups program was again utilised with one school and one community group taking the opportunity to secure funding to improve the biodiversity of their areas of operations.

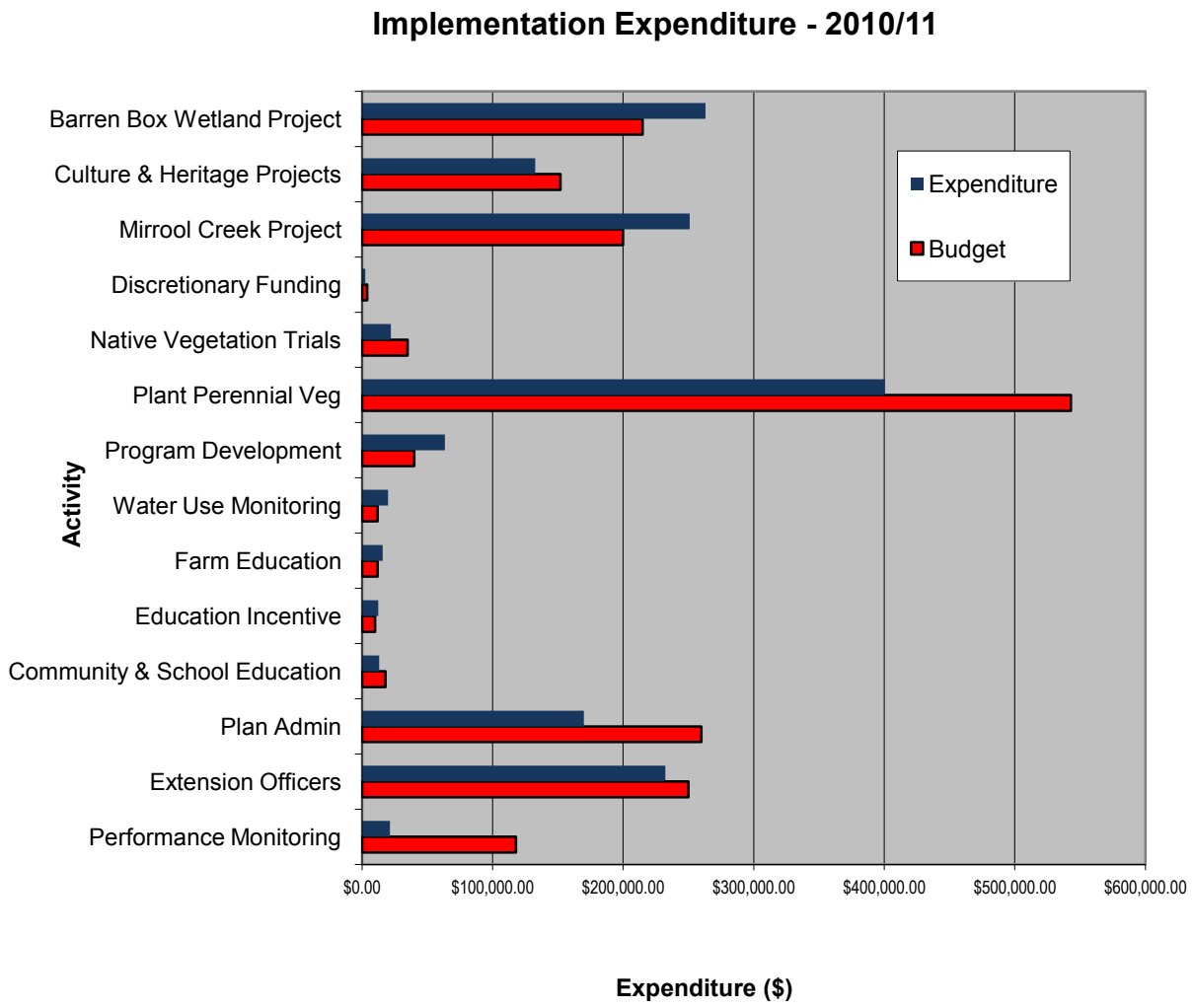
EXPENDITURE

The budget for the year was $1,869,000 and expenditure totalled $1,620,042 (13% under budget). Of the money invested in the MIA $873,860 was government funding while the remaining $746,182 came from the landholders of the MIA through their levy. The ratio of Landholder to Government contributions has evened out, as less On-Farm Incentives (100% funded by Government) have been offered, as expected.

Figure 1.1.c. below, shows how the expenditure for the various programs in the MI SBS fared against budget with explanations various projects detailed in the points below:

- The Barren Box Storage and Wetland Project expenditure was over budget along with the Mirrool Creek Project. This over expenditure was compensated for by under expenditure in the plant perennial vegetation program. The additional expenditure on these two projects went to achieving specific project targets (see section A5).
- Plan administration costs rose as a percentage of all costs but still met target at 10% meaning 90% of expenditure went to on-ground work for the last year. The rise as a percentage can be attributed to the reduced budget for the year - total expenditure for plan administration dropped from $186,417 to $169,926.
- The education program slightly exceeded budget ($1,375 over budget), however it was once again extremely successful, with close to 2,500 individuals attending events run by the MI Education Team.
- Program development was $23,000 over budget, but the result of the new MI SBS is outstanding and very much worth the additional expenditure (recovered from extension officers and plan administration)

Figure 1.1.d: MI SBS Implementation Expenditure



A.1.2 NEW DOCUMENTATION RELEVANT TO BACKGROUND AND/OR IMPLEMENTATION OF THE LWMP

Table 1.2.a. includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

Table 1.2.a: Key reference documents relevant to the LWMP

Document	O/R	Submitted to DECCW	Endorsed by DECCW
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation.	R	Oct 2005 Electronic	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, CSU, Wagga Wagga. Report prepared for MI. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.	R	October 2006 Electronic (on disc)	*

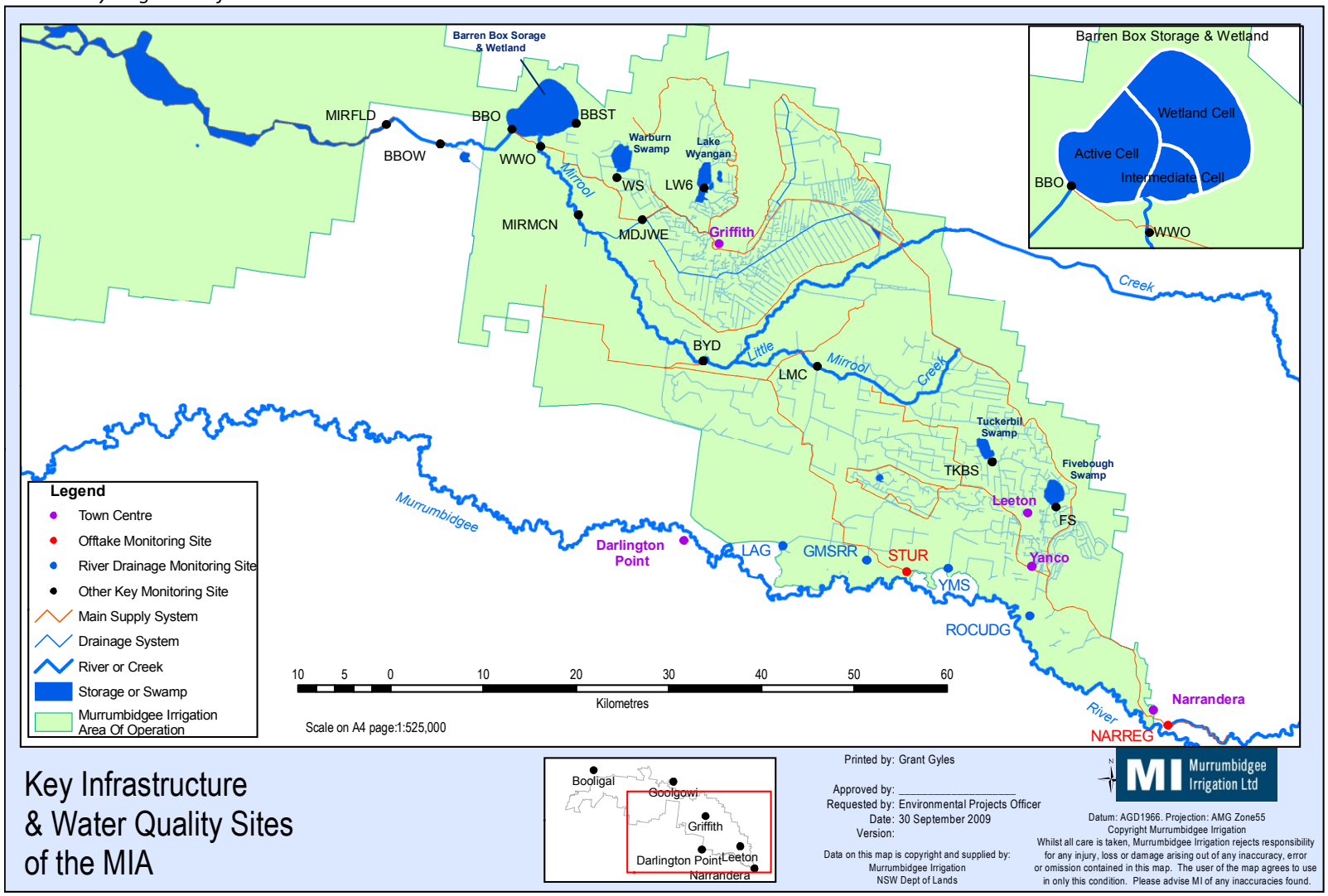
A.1 LAND AND WATER MANAGEMENT PLAN

Document	O/R	Submitted to DECCW	Endorsed by DECCW
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants*. Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	
Van der Lely, A. (2006). *Groundwater Conditions In The MIA and Districts: Annual Report 2006*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Van der Lely, A. (2007). *Groundwater Conditions In The MIA and Districts: Annual Report 2007*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
MIA EnviroWise (2007) Five Year Review	R	February 2007	*
Hale, J (2008) Barren Box Wetland Rehabilitation Plan 2009-2014	R	December 2008	
Taylor, I R. (2008) Barren Box Intermediate Cell Waterbird Study	R	August 2008	
Van der Lely, A. (2008). *Groundwater Conditions In The MIA and Districts: Annual Report 2008*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Campbell, A. (2009). *MIA EnviroWise 2 Strategy.* Prepared for Murrumbidgee Irrigation by Triple Helix Consulting.	R	December 2009	
Lewis, B (2010). *Biodiversity Benchmarking Survey of the Murrumbidgee Irrigation Area: Birds.* Prepared for Murrumbidgee Irrigation by Lewis Ecological Surveys	R	March 2010	
Taylor, I R. & Schultz, M.C. (2010) *Barren Box Intermediate Cell Waterbird Study.* Prepared for Murrumbidgee Irrigation by CSU	R	June 2010	
Van der Lely, A. (2010). *Groundwater Conditions In The MIA and Districts: Annual Report 20010*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Taylor, I R. & Schultz, M.C. (2011) *Barren Box Intermediate Cell Waterbird Study.* Prepared for Murrumbidgee Irrigation by CSU	R	June 2011	
Van der Lely, A. (2011). *Groundwater Conditions In The MIA and Districts: Annual Report 20011*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DECCW

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Figure 2.2.a: Key irrigation infrastructure in the MIA



A.2.2 REPORTING REQUIREMENTS

Climatic conditions

Well above average rainfall was the predominant feature of the 2010/11 season and heralded the break of long term drought. Very low ETo figures recorded below both long term average and the previous season are a reflection of increased rainfall combined with milder temperatures.

Table 2.2.a: Summary of climatic data

Month	ETT 2010-11 (mm)	Rainfall 2010-11 (mm)	Net ETT (ETT-Rainfall) (mm)	LTA ETO (1962-2010) (mm)	LTA Rainfall (1962-2010) (mm)
July	32.6	35.2	-2.6	49.8	36.2
August	56.3	68.5	-12.2	77.8	33.7
September	77	43	34	117.5	37.4
October	122.5	106.8	15.7	176.1	42.9
November	150.5	65	85.5	226.3	30.4
December	199.3	80.2	119.1	273.8	34.0
January	262.1	51	211.1	285.5	34.9
February	172.2	160.4	11.8	231.1	31.8
March	134	60.2	73.8	192.1	31.3
April	89	24.6	64.4	115.8	28.0
May	51.7	28	23.7	66.8	35.4
June	44.1	15.8	28.3	44.3	35.6
Total	**1391**	**739**	**653**	**1857**	**412**

The ET_{ref_t} (tall crop) is the FAO56 equation modified to represent tall crops (taller than 0.5m) and is to be used in semi arid or arid climates. The Griffith, Finley, Hay and Tullakool weather stations have traditionally used a Penman-Meyer equation (ETo) which is very similar to the ET_{ref_t} (ASCE tall crop) equation.

Source: CSIRO Griffith

Notes: LTA = Long term average (1962-20010), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.

Table 2.2.b shows 95% announced allocation for both general and high security. General security allocations increased by 73% from the previous year with total diversions only increasing by 12%. The significant increase in the annual rainfall was the major contributing factor in lower than expected diversions. There was another substantial increase in deliveries to rice cropping as detailed in table 2.2o, while horticulture deliveries show a notable decline also reflecting high summer rainfall.

Table 2.2.b: Summary of climatic data, diversions and deliveries for 1995 to 2011

Year	Announced Allocation % General / High	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2010-11	100/95	567,223^	490,329	653	1391	739
2009-10	27/95	505,176	368,269	1,750	2,085	336
2008-09	21/95	393,973	276,233	1,820	2165.9	345.6
2007-08	13/95	335,687	210,297	1,766	2,127	361.4
2006-07	15/90	559,952^{+}	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423

Sources: MI Corporate Office & CSIRO Griffith

Notes: 2010-11 ^ = Does not include 2,724 ML environmental allocation water diverted for DECCW

2005-06 * = Does not include 2,146 ML environmental waterway diversions for DNR.

2006-07 $^{+}$ = Does not include 3,256 ML State Water environmental flows through Roaches Escape.

A.2.2 (1) DIVERSIONS, VOLUME

Table 2.2.c: Summary of Gross Diversions Main and Sturt Canal 2010/11

	Sturt (ML)	Main (ML)
August	17,233	26,360
September	8,501	10,433
October	23,216	46,617
November	19,743	52,890
December	28,099	74,030
January	35,407	108,870
February	8,550	30,324
March	5,673	25,544
April	2,015	17,810
May	7,416	17,117
June	6	4,093
TOTAL	155,859	414,088

Note: 155,859 +414,088 = 569,947 ML (includes environmental allocation)

Table 2.2.d: Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2010/11

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	18,052	20,173	5,528
September	8,919	10,036	2,743
October	25,145	42,116	4,426
November	22,033	50,874	4,851
December	33,611	74,159	7,607
January	40,043	106,871	12,225
February	12,286	28,713	4,962
March	9,077	25,031	2,828
April	3,669	17,566	4,455
May	9706	17,629	6,172
June	-268	4079	2,135
Total 2010-11	182,273	397,247	57,932
Total 2009-10	91,267	403,831	51,099
Total 2008-09	40,244	346,282	44,000
Total 2007-08	25,437	304,601	33,332
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130

Notes:
Diversions shown in Table 2.2.d for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

Table 2.2.c shows the summary of gross diversion coming into our system at the two regulated river sites at Narrandera and the Sturt Canal. The sum of these diversions with noted exclusions is the Total Diversions as shown in Table 2.2.b.

Table 2.2.d shows the actual amounts of water going through each of the three main systems which make up the MIA and Districts:

1. The Main Canal System, which is primarily fed through the Narrandera Regulator.
2. The Sturt Canal System, which is primarily fed through the Sturt regulator.
3. The Wah Wah System, which was primarily fed through BBSW before the drought but now consist of mostly fresh water which entered the system through the Narrandera and Sturt regulators.

The total amount of water going through these three systems combined is greater than the Net Total Irrigation Diversions because of MI's innovative re-use program. For details on which water is included in each of the systems, please refer to Table 2.2.d notes.

A.2.2 (2) SUPPLY EFFICIENCY, STORAGE LEVELS

Supply efficiency

The table below shows the simple efficiency of the system to be 86%. This calculation shows the apparent loss to be 77 GL. The water balance in Section A.2.2 (5) more clearly reconciles the losses and gains of the system and takes into account drainage reuse.

The improvement in simple efficiency is partly attributed to increased diversions combined with management and operational changes implemented to minimise conveyance losses and improve efficiency. Without those initiatives, the simple efficiency would have been much lower.

Table 2.2.e: Simple efficiency of the system —2003 to 2011

Parameter	2010/11	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04
Diversions (ML)								
Sturt Canal	155859	81431	30943	21,266	60,280	233,388	145,728	174,150
Main Canal	414088	425213	363030	314,421	502,928	805,277	680,479	687,349
Less OEH Environmental Diversions	2,724	1,468	0	0	3,256	2,146		
NET TOTAL irrigation diversions	**567,223**	**505,176**	**393,973**	**335,687**	**559,952**	**1,036,519**	**826,207**	**861,499**
Sales (ML) - metered and unmetered	490,329	368,269	276,233	210,297	411,898	829,990	648,417	651,806
Conveyance (ML)	76,894	136,907	117,740	125,390	148,054	206,529	177,790	209,693
Simple Efficiency (%)	**86.4**	**72.8**	**70.1**	**62.6**	**73.6**	**80.1**	**78.5**	**75.7**

Source: MI Irrigation Services and Corporate Services
Note: Simple efficiency = Total Sales/Total Gross Diversions x 100

Storage levels

Barren Box Storage and Wetland (BBSW)
BBSW has transformed a degraded swampland into an efficient water storage facility which returns around 20,000ML of water per annum to the Snowy River. The storage and wetland comprises of three cells:

- Active cell – storage capacity 24,500ML
- Intermediate cell – storage capacity 4,500ML
- Wetland cell covering 1,650 hectares

During the 2010/11 season, regular inflows were experienced in both the Active and Intermediate cells, due to the significant rainfall experienced throughout the summer months. These additional inflows contributed to increased volume of 27,473 for the period, displayed in Table 2.2.f.
The combined outflows of 18,073 from the Intermediate cell and Active cells are also displayed in Table 2.2.m as:

- Barren Box Storage to Wah Wah Main @ B.B.S. Pumps.
- Barren Box Storage to Outfall (include flood releases)
- Barren Box Storage Licenced Diverters

Table 2.2.f: Barren Box Storage 2010/1

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	6468	1753	2635	8039	2426	2754	2550	9352	6112	1038	815	1604	45546
Outflow	0	2139	850	1179	1180	2705	6920	200	0	450	2050	400	18073
Variation	6468	-386	1785	6860	1246	49	-4370	9152	6112	588	-1235	1204	27473

Note: Outflows include Licensed Pumpers on BBS = 98ML for 2010/111

Lake Wyangan

Water depths within the lakes are regulated for various operational purposes including maintenance and management and flow supplementation for the adjacent supply channels in times of shortage. MI attempts to regulate the lake levels to satisfy the various demands to meet commercial irrigation contracts, environmental and community objectives.

A total of 90 ML was also diverted from the North Lake into the South Lake during the reporting period. Water was released intermittently from the South Lake during the reporting period and utilised for irrigation purposes where possible. The volume of the both lakes closed slightly lower than the same time last year.

The monthly figures relating to the volumes pumped by MI from Lake Wyangan into Lake View Branch Canal can be found in Table 2.2.m in A.2.2(4), Drainage reuse. Table 2.2.g (below) provides 2010/11 monthly gauge heights (water depth) for the lakes.

Table 2.2.g: Gauge heights for South and North Lake Wyangan 2010/11

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
July	1.04	832	1.36	3410
Aug	1.13	904	1.38	3450
Sep	0.94	758	1.36	3410
Oct	1.14	912	1.39	3470
Nov	1.09	872	1.29	3270
Dec	1.04	832	1.27	3230
Jan	1.06	848	1.19	3070
Feb	1.26	1008	1.23	3150
Mar	1.12	896	1.20	3090
Apr	1.16	928	1.16	3010
May	1.03	824	1.18	3050
Jun	0.90	730	1.23	3150

Source: MI Irrigation Services

Gross Resources = Gauge height converted into estimated megalitres.

Yenda Storage

The figures in table 2.2.h. show the inflows and outflows at the Yenda en-route storage. This storage is primarily used to compensate for differences between orders and diversions from the river.

Table 2.2.h: Inflow and Outflow Yenda En-route Storage 2010/11

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	25	622	468	1123	917	1129	1382	1168	1169	941	932	554	10430
Outflow	639	474	780	828	1244	1557	1105	1191	1257	1086	1773	551	12485
Variation	-614	148	-312	295	-327	-428	277	-23	-88	-145	-841	3	-2055

Bray's Dam Storage

Bray's Dam storage has the operational ability to capture and redistribute irrigation water that has been rejected after rainfall.

Table 2.2.i: Inflow and Outflow Brays Dam Storage 2010/11

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	152	2386	882	0	1978	1578	1430	2255	1969	202	326	1308	14466
Outflow	0	1963	100	109	2555	1293	2003	1022	736	794	924	58	11557
Variation	152	423	782	-109	-577	285	-573	1233	1233	-592	-598	1250	2909

A.2.2 (3) DRAINAGE VOLUMES AND SALT LOADS

Table 2.2.j: Description of monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	Site No.	Frequency	Type	X-Coordi-nates	Y-Coordi-nates
410167	BBOW	Barren Box Outfall Canal Wyvern	1	Continuous	EC, Flow	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	Continuous	EC, Flow	403257	6208333
410085	LMC	Little Mirrool Creek	3	Continuous	EC, Flow	422126	6192597
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	Continuous	EC, Flow	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	5	Continuous	EC, Flow	427479	6171449
410083	YMS	Yanco Main Southern Drain	6	Continuous	EC, Flow	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	Continuous	EC, Flow	444891	6165663
41010162	WS	Warburn Swamp	8	After trigger	EC, pH, NTU	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	Continuous	EC, Flow	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	10	After trigger	EC, pH, NTU	409886	6193089
41010990	BBST	*This site no longer exists, due to the construction of BBSW*					
41010896	LW6	Lake Wyangan Causeway	12	After trigger	EC, pH, NTU	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	After trigger	Pesticide	440983	6182501
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	15	When flowing	Pesticide EC	375673	6218725
	Other Sites Required for NOW Licence						
41010903	BBO	Barren Box Storage		After trigger	EC, pH, NTU	389236	6218183
41010978	WWO	Willow Dam		After trigger	EC, pH, NTU	392197	6216283
410164	BOD1	Channel 13 escape at the outfall channel Wyvern		Continuous	EC, Flow	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel		Continuous	EC, Flow	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek		Continuous	EC, Flow	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road		Continuous	EC, Flow	396994	6205386

All continuous sites are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated at least four times a year. All sites are visited monthly for routine maintenance by Thiess staff. Monthly field data is collected by MI staff using a Hydro-lab, collecting temperature, EC and pH.

This list is currently under review and is expected to change when the NOW licence has been renegotiated.

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Table 2.2.k: Drainage Volumes (ML) – July 2010 to June 2011

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0.0	26360	10433	46617	52890	74030	108870	30324	25544	17810	17117	4093	**414088**
STUR**	**Monthly Total**	0.0	17233	8501	23216	19743	28099	35407	8550	5673	2015	7416	6	**155859**
TOTAL														**569947**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	22.2R	6.4R	14.6R	104 R	42.5	37.3	76.4K	129 R	73.6Z	15.8Z	17.5	28.0R	
	Median	3.8R	1.5R	11.3R	42.0R	36.5	34.2	57.9K	77.6R	69.3Z	14.0Z	13.9	17.3R	
	Inst.Max	94.1R	28.4R	86.2R	1030R	92.7	81.2	236 K	885 R	130 Z	41.6Z	96.4	131R	
	Inst.Min	0.0R	0.0R	1.0R	5.4R	14.6	16.3	29.3K	23.6R	24.4Z	5.3Z	4.2	2.7R	
	Monthly Total	688.9R	198.1R	439.4R	3224R	1276	1158	2369K	3624R	2282Z	473.2 Z	541.2	840.9R	**17110 R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	**0.0**	2219	247	1255	3277	5242	5347	3327	3045	1265	2179	0.0	27403
BYD (Bywash)**	**Monthly Total**	**0.0**	1348	89	109	2475	1183	1963	1022	736	729	924	0.0	10578
MIRMCN (41010955)	**Mean**	**229**	177	167	390	212 Z	211Z	297Z	488	288K	164K	157	100	
	Median	**173**	156	144	251	176 Z	198Z	271Z	374	292K	154K	149	104	
	Inst.Max	**537**	385	335	1500	714 Z	547Z	649Z	1550	543K	307K	354	238	
	Inst.Min	**57.9**	47.3	74.8	112	102Z	102Z	155Z	189	110K	115K	101	11.8	
	Monthly Total	**7109**	5476	5022	12080	6348Z	6542Z	9222Z	13670	8923K	4912K	4862	3015	**87180Z**
DRAINS														
MDJWE (410174)	**Mean**	57.9R	87.5R	52.4K	[213	149 R	169	264	367R	185	102	90.2	44.6R	
	Median	26.2R	50.2R	48.0K	[151	125 R	161	275	217R	174	97.9	82.9	41.3R	
	Inst.Max	333 R	319 R	222 K	[2010	1030 R	805	503	2090R	655	255	361	165 R	
	Inst.Min	9.4R	7.5R	22.6K	[44.0	69.0R	62.2	113	125 R	45.9	59.4	42.5	5.3R	
	Monthly Total	1795 R	2714 R	1573K	6392	4480R	5249	8196	10270R	5739	3046	2798	1339R	**53590**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	7.8	72.3	38.8	78.3	78.9	101	210	83.6	61.8	59.2	78.0K	38.6K	
	Median	9.1	22.9	41.1	60.1	80.1	133	210	66.3	39.7	55.8	74.6K	21.5K	
	Inst.Max	26.2	195	72.2	208	132	256	299	226	189	115	132 K	119 K	
	Inst.Min	-1	0	4.5	5.5	-23.9	-39.6	104	7	11.6	26.9	41.6K	-2.6K	
	Monthly Total	242	2242	1165	2428	2368	3136	6511	2342	1917	1777	2418K	1157K	**27700K**
YANCO AREA-RIVER DRAINS														
YMS (410083)**	**Mean**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0	0.0	0.0	
	Inst.Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14	0.0	0.0	0.0	0.0	
	Inst.Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Monthly Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1
GMSRR (41010921)	**Mean**	0.1R	0.0R	[0.1	[7.2	[0.7	[0.9	1.6R	6.2R	4.2R	0.4R	0.0R	8.5R	
(all water re-used)	**Median**	0.0R	0.0R	[0.0	[0.5	[0.7	[0.9	0.8R	0.7R	0.8R	0.0R	0.0R	0.0R	
	Inst.Max	4.9R	0.0R	[7.0	[67.8	[0.9	[1.4	13.7R	36.5R	41.7R	12.2R	0.0R	120 R	
	Inst.Min	0.0R	0.0R	[0.0	[0.1	[0.4	[0.6	0.4R	0.4R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	3.370R	0.000R	[2.649	[137.3	[11.90	[3.686	48.47 R	173.1 R	130.3 R	12.89 R	0.000R	255.7 R	[779.2
LAG (41010940)	**Mean**	0.0R	0.7R	1.1V	[37.8	[0.0	[B	4.4R	9.3R	1.7R	0.2R	0.0R	0.0R	
	Median	0.0R	0.2R	1.1V	[3.3	[0.0	[B	2.0R	0.4R	0.1R	0.0R	0.0R	0.0R	
	Inst.Max	0.0R	2.8R	3.7V	[208	[0.1	[B	27.6R	115 R	35.6R	1.7R	0.6R	0.1R	
	Inst.Min	0.0R	0.0R	0.2V	[0.1	[0.0	[B	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	0.011R	21.61 R	32.29V	[945.7	[0.093	[B	137.7 R	260.2 R	54.26 R	5.509R	0.577R	0.089R	1458
ROCUDG(41010005)	**Mean**	0.0=	5.7=	[1.6	[7.3	[61.5	[B	[4.5	23.1	4.5	2.3	1.3	[21.9	
	Median	0.0=	0.8=	[1.6	[0.0	[55.2	[B	[2.3	12.2	4.5	2	1.3	[0.7	
	Inst.Max	0.3=	69.8=	[2.1	[53.1	[158	[B	[22.4	106	10.4	10.8	3.4	[150	
	Inst.Min	0.0=	0.0=	[0.9	[0.0	[8.7	[B	[0.0	0	1.8	0.6	0.3	[0.0	
	Monthly Total	0.371=	176.3 =	[11.22	[80.00	1782	[B	[129.8	645.5	138.5	68.85	41.43	[592.5	3667
TOTAL to river														**5126**
FLOODWAY														
MIRFLD**	**Monthly Total**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
EXTRA SITES FOR DNR														
WWO**t		0.0	8221	2635	8039	2426	2754	2550	9352	6112	1038	815	1604	45546
BBO**		0.0	2139	850	1100	1180	2686	6920	200	0	450	2050	400	17975
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0R	3.0R	8.0@	22.5@	8.5@	[8.4]	7.5@	18.4@	[17.0]	[4.5]	[4.9]	8.8@	
	Median	0.0R	0.0R	6.8@	8.0@	6.3@	[6.7]	5.0@	14.1@	[16.4]	[2.1]	[5.4]	0.0@	
	Inst.Max	0.0R	15.3R	14.3@	84.8@	25.6@	[38.5]	30.8@	52.4@	[31.8]	[12.2]	[13.2]	49.7@	
	Inst.Min	0.0R	0.0R	3.9@	3.0@	0.1@	[0.0]	0.0@	3.4@	[7.6]	[1.3]	[0.3]	0.0@	
	Monthly Total	0R	94R	240@	698@	255@	[243]	234@	515@	[390]	[76]	[142]	263@	**[3151]**

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0	0.1	0.4=	1.6=	0.7=	0.5=	0.6=	0.9=	2.6	1.1=	0.6=	0.9=	
	Median	0	0	0.2=	0.8=	0.3=	0.0=	0.6=	0.5=	1.6	0.1=	0.3=	0.1=	
	Inst.Max	0	1.7	2.1=	7.8=	8.6=	3.1=	1.9=	4.6=	11.5	8.0=	6.1=	10.5=	
	Inst.Min	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.1	0.0=	0.0=	0.0=	
	Monthly Total	0	2.481	11.94 =	48.85 =	22.26 =	14.04 =	18.10 =	24.25 =	81.92	32.64 =	19.82 =	27.15 =	**304**
DCWIDG (41017001)	**Mean**	0.2=	0.1?	0.0?	12.9?	0.3Z	0.8=	[2.0]	15.1	[7.5]	[0.4]	0.1	0.0=	
	Median	0.0=	0.0?	0.0?	0.4?	0.2Z	0.3=	[0.1]	1.5	[7.6]	[0.1]	0.1	0.0=	
	Inst.Max	1.4=	0.7?	0.1?	184?	3.3Z	5.4=	[65.4]	181	[15.5]	[2.6]	0.7	0.1=	
	Inst.Min	0.0=	0.0?	0.0?	0.0?	0.0Z	0.0=	[0.0]	0.1	[1.4]	[0.0]	0	0.0=	
	Monthly Total	6.047=	2.188?	0.804?	400.6?	10.32 Z	26.16 =	[59.36]	422.6	[166.1]	[9.674]	3.812	0.302=	**1108]**
DCCENT (410172)	**Mean**	0	0.3V	0.6Z	1.1R	0.4V	0.0V	0.1V	0.4V	0.3V	0.8V	0.1V	0.4V	
	Median	0	0.0V	0.5Z	0.2R	0.1V	0.0V	0.0V	0.0V	0.2V	0.8V	0.0V	0.5V	
	Inst.Max	0	8.7V	2.6Z	24.1R	6.2V	1.9V	4.6V	5.2V	1.8V	1.6V	0.3V	0.6V	
	Inst.Min	0	0.0V	0.0Z	0.0R	0.0V	0.0V	0.0V	0.0V	0.0V	0.0V	0.0V	0.0V	
	Monthly Total	0	7.932V	17.03 Z	35.61 R	10.61 V	1.525V	3.461V	11.49 V	8.518V	22.79 V	1.939V	12.41 V	**133.3 R**

Sources: Thiess Services and MI Irrigation Services

Notes:

1. All data supplied by THIESS SERVICES except when shown ** supplied in-house by Murrumbidgee Irrigation.
2. # ... Other authorities data
3. S ... Rating table suspended
4. = ... Pool reading only, no flow condition
5. R ... Rating table extrapolated
6. B ... Backed-up stage
7. M ... Equipment malfunction
8. []... Some missing record during the period
9. K . . . Minor editing
10. V . . . Data used for operational purposes
11. ~ ... Reliable Interpolation
12. ? .... Irregular data, use with caution
13. @ ... Theoretical rating table applied
14. Z ... Med. edit >Q=15 (inc MW) or HYMAN imp.
15. T ... Probe out of water/below instrument threshold
16. " ... No Data Exists
17. t Flows into BBS from Willow Dam
18. Salt loads Thiess Services unless * where we have calculated them using the formula below

Salt Load (Tonnes/day) = Drainage Volumes (ML) x mean monthly EC x 0.64/1000

NARREG and STUR saltloads were calculated using the above formula, with the average EC calculated from mean monthly EC from the Murrumbidgee River at Wagga (http://waterinfo.nsw.gov.au/index.epl?site=410001)

Drainage volumes to the Murrumbidgee River (ML)

Year	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
TOTAL	8,570	945	337	197	598	5905

Sites highlighted in blue are sites that may drain back to the Murrumbidgee River. During the 2010/11 season, discharge from sites ROCUDG, LAG and YMS left the area.

Table 2.2.h shows the monthly total flow volumes from the Murrumbidgee River entering the MIA measured at our two regulated sites; **Narrandera (NARREG)** after diversion at the Berembed Weir and the **Sturt Canal (STUR)** after diversion at the Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system.

- **Little Mirrool Creek (LMC)** - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- **Bray's Dam (BYD)** - Drainage diversion from LMC to the Benerembah Irrigation District.
- **Mirrool Creek at McNamara Road (MIRMCN)** - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- **Main Drain J (MDJWE)** - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- **Barren Box Outfall Wyvern (BBOW)** - Flows from Willow Dam, Barren Box and channel 13 escape discharging to Wah Wah Irrigation District.

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

There are four river channel wetland sites which potentially discharge to the Murrumbidgee River:

- **Yanco Main Southern (YMS)** - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- **Gogeldrie Main Southern (GMSRR)** - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water is pumped into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- **Gooragool Lagoon (LAG)** - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by customers as drainage reuse water.
- **Cudgel Creek downstream from Cudgel Creek (ROCUDG)** - Cudgel Creek area

The purpose of collecting this data is to identify the drainage and supply volumes as well as daily and seasonal variations which need to be managed. The flow regimes are important in making management decisions including those associated with contamination issues such as pesticide concentrations and salt loadings, drainage re-use options as well as those decisions dealing with asset design, purpose and function.

During the 2010/11 year, MI diverted 569,947 ML of water from the Murrumbidgee River. This water contained approximately 58,864 tonnes of salt.

Of this salt load, approximately 578 tonnes (0.98% of the imported salt load) were discharged into wetlands which are connected to the Murrumbidgee River in 5905 ML of drainage water (0.9% of diversions).

Well above average rainfall including several heavy summer storms resulted in a significant increase in drainage to wetlands associated with the Murrumbidgee River.

As the Murrumbidgee Irrigation Area is essentially a closed system, most of the salt that is imported into the area via supply water makes its way into our soils during irrigation activities. The equivalent of about one quarter of the imported salt is exported to the Wah Wah Irrigation District, which leaves about 44,000 tonnes in the area east of Barren Box. Above average rainfall and full irrigation allocations have resulted in a rise in water tables, however groundwater levels remain considerably lower than they were prior to drought. Through irrigation and rainfall, salts are currently able to leach out of the rootzone into the groundwater system and ultimately out of our area.

MI currently funds a CSIRO research project called 'Hydro-ecological assessment of the MIA'. The aim of this project is to increase the understanding of our surface and groundwater systems, their connectivity and their connection to the regional ecology. As part of that study, the MIA will be divided into hydrologic zones which will each have a unique set of characteristics. Each zone will be managed and monitored accordingly. Another expected outcome of this study is a better understanding of salinity issues in each zone which will allow us to better and more specifically monitor and manage soil salinity. Detailed salt and water balances will also be compiled.

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Table 2.2.l: Salt Loads (Tonnes) – July 2010 to June 2011

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	**0.0**	**3329**	**1290**	**4055**	**3798**	**7195**	**11169**	**4195**	**3256**	**2309**	**1864**	**402**	**42861**
STUR**	**Monthly Total**	**0.0**	**2176**	**1051**	**2020**	**1418**	**2731**	**3632**	**1183**	**723**	**261**	**808**	**1**	**16003**
TOTAL														**58864**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	4.2R	2.2R	4.5R	14.9R	9.5	8.8	15.4K	27.7R	14.7Z	4.1Z	4.1	4.8R	
	Median	1.5R	0.8R	4.0R	8.2R	8.8	8.5	13.0K	20.7R	15.2Z	3.9Z	3.6	3.8R	
	Inst.Max	29.5R	11.0R	25.3R	113 R	27.8	19.8	58.7K	141 R	28.5Z	14.4Z	29.7	28.2R	
	Inst.Min	0.0R	0.0R	0.3R	1.3R	3.8	3.3	7.4K	10.0R	5.1Z	1.2Z	1.2	1.0R	
	Monthly Total	129R	70R	136R	463R	286.0	274.0	478K	776R	456Z	123Z	127.0	144R	**3464R**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0.0	1037	1	280	621	1144	537	396	362	151	219	0.0	**4747**
BYD (Bywash)**	**Monthly Total**	0.0	630	0	24	469	258	197	122	88	87	93	0.0	**1968**
MIRMCN (41010955)	**Mean**	39.3	32.6	40.8K	90.5K	49.4Z	48.6Z	57.5Z	126 K	60.3K	36.7K	34.1	22.9	
	Median	37.1	31.8	39.8K	64.8K	45.0Z	47.6Z	50.7Z	101 K	60.0K	34.7K	33.1	22.0	
	Inst.Max	105.0	77.0	89.0K	321 K	154 Z	108 Z	140 Z	381 K	113 K	73.1K	77.9	61.3	
	Inst.Min	15.6	14.6	19.6K	26.0K	26.3Z	25.8Z	30.1Z	44.7K	25.3K	24.2K	19.4	5.3	
	Monthly Total	1220.0	1010.0	1223K	2806K	1481Z	1507Z	1782Z	3515K	1870K	1101K	1056.0	687.0	**19260Z**
DRAINS														
MDJWE (410174)	**Mean**	10.3R	17.4R	23.2K	[35.4]	[38.9]	42.8	50.1	[61.4]	[36.9]	25.9	25.3	[14.5]	
	Median	8.1R	15.5R	21.1K	[31.9]	[31.8]	42.3	50.1	[61.4]	[35.6]	24	24.2	[13.2]	
	Inst.Max	94.5R	77.4R	76.1K	[110]	[213]	147	121	[134]	[118]	64.3	80.4	[40.4]	
	Inst.Min	3.6R	4.1R	9.6K	[14.5]	[17.8]	19	21.7	[43.8]	[13.2]	16.3	13.6	[3.5]	
	Monthly Total	320R	538R	697K	[495]	[1051]	1327	1554	[123]	[811]	778	785	[364]	**[8842]**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	1.4	13.6	6.6K	16.9K	19.2K	24.4K	50.1K	19.2K	13.6K	13.3	19.0K	8.8K	
	Median	1.8	4.6	6.6K	13.3K	17.8K	35.1K	50.9K	15.0K	9.8K	13	18.7K	6.3K	
	Inst.Max	15.5	71.6	57.4K	55.5K	43.9K	56.5K	88.3K	64.1K	43.7K	27.9	43.1K	33.3K	
	Inst.Min	-8.8	-7.4	-7.5K	-9.6K	-9.2K	-12.6K	17.7K	-1.0K	-1.5K	3.4	0.0K	-1.4K	
	Monthly Total	44	422	198K	523K	576K	758K	1554K	538K	421K	399	590K	265K	**6289K**
YANCO AREA-RIVER DRAINS														
YMS (410083)**	**Mean**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0	0.0	0.0	
	Inst.Max	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	
	Inst.Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Monthly Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3
GMSRR (41010921)	**Mean**	0.0R	0.0R	[0.0]	[0.5]	[0.1]	[0.1]	0.2R	0.6R	0.6R	0.0R	0.0R	0.5R	
(all water re-used)	**Median**	0.0R	0.0R	[0.0]	[0.1]	[0.1]	[0.1]	0.1R	0.1R	0.1R	0.0R	0.0R	0.0R	
	Inst.Max	0.8R	0.0R	[1.3]	[6.2]	[0.1]	[0.2]	2.0R	3.6R	5.8R	1.0R	0.0R	8.8R	
	Inst.Min	0.0R	0.0R	[0.0]	[0.0]	[0.0]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	1R	0R	[0]	[10]	[1]	[0]	6R	16R	18R	1R	0R	16R	[70]
LAG (41010940)	**Mean**	0.0R	0.2R	0.3V	[3.2]	[0.0]	[ ]B	0.6R	0.8R	0.3R	0.1R	0.0R	[0.0]	
	Median	0.0R	0.0R	0.2V	[0.6]	[0.0]	[ ]B	0.3R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Inst.Max	0.0R	1.2R	0.9V	[16.0]	[0.0]	[ ]B	5.2R	11.2R	5.4R	1.0R	0.1R	[0.0]	
	Inst.Min	0.0R	0.0R	0.0V	[0.0]	[0.0]	[ ]B	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Monthly Total	0R	6R	8V	[81]	[0]	[ ]B	19R	22R	9R	2R	0R	[0]	[147]
ROCUDG (41010005)	**Mean**	0.0=	0.8=	[0.2]	[0.7]	[5.8]	[ ]B	[0.7]	2.3	0.5	0.3	0.2	[1.7]	
	Median	0.0=	0.1=	[0.2]	[0.0]	[5.2]	[ ]B	[0.3]	1.3	0.5	0.2	0.2	[0.1]	
	Inst.Max	0.0=	10.3=	[0.2]	[5.1]	[15.6]	[ ]B	[3.8]	10.1	1.1	1.3	0.4	[15.7]	
	Inst.Min	0.0=	0.0=	[0.1]	[0.0]	[0.8]	[ ]B	[0.0]	0	0.2	0.1	0	[0.0]	
	Monthly Total	0=	24=	[1]	[8]	[169]	[ ]B	[19]	65	15	9	5	[46]	[361]
TOTAL														**508**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES FOR DNR														
WWO**t	**Monthly Total**	0	1977	708	2003	623	695	527	2625	1381	249	189	453	**11431**
BBQ**	**Monthly Total**	0	399	149	240	296	598	1745	47	0	108	530	99	**4212**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0R	0.5R	1.2@	3.0@	1.1@	[1.1]	1.3@	3.1@	[3.5]	[0.9]	[1.0]	1.3@	
	Median	0.0R	0.0R	1.1@	1.6@	0.8@	[1.0]	0.9@	2.8@	[3.4]	[0.4]	[0.9]	0.0@	
	Inst.Max	0.0R	2.6R	2.6@	16.8@	4.7@	[4.5]	7.1@	7.8@	[6.8]	[2.7]	[4.0]	7.9@	
	Inst.Min	0.0R	0.0R	0.5@	0.5@	0.0@	[0.0]	0.0@	0.5@	[1.5]	[0.2]	[0.0]	0.0@	
	Monthly Total	0R	15R	37@	92@	34@	[33]	42@	88@	[81]	[16]	[28]	39@	**[506]**

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0	0	0.1=	0.3=	0.1=	0.1=	0.1=	0.2=	0.9	0.6=	0.4=	0.2K	
	Median	0	0	0.0=	0.1=	0.1=	0.0=	0.1=	0.2=	0.4	0.0=	0.3=	0.0K	
	Inst.Max	0	0.4	0.4=	1.4=	1.1=	0.3=	0.5=	1.2=	4.2	5.3=	10.0=	4.1K	
	Inst.Min	0	0	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0	0.0=	0.0=	0.0K	
	Monthly Total	0	1	2=	8=	4=	2=	4=	7=	27	19=	12=	6K	**92K**
DCWIDG (41017001)	**Mean**	0.0=	0.0?	0.0?	2.9E	0.1Z	0.2=	[0.3]	3.2Z	[1.8]	[0.1]	0	0.0K	
	Median	0.0=	0.0?	0.0?	0.1E	0.0Z	0.1=	[0.0]	0.6Z	[1.9]	[0.0]	0	0.0K	
	Inst.Max	0.2=	0.2?	0.0?	40.9E	0.8Z	1.4=	[6.2]	35.2Z	[4.6]	[0.6]	0.3	0.0K	
	Inst.Min	0.0=	0.0?	0.0?	0.0E	0.0Z	0.0=	[0.0]	0.0Z	[0.4]	[0.0]	0	0.0K	
	Monthly Total	1=	1?	0?	91E	2Z	7=	[8]	91Z	[39]	[2]	1	0K	**[243]**
DCCENT (410172)	**Mean**	0	0.1V	[0.2]	[0.4]	0.1V	0.0V	0.0V	0.1Z	0.1Z	0.2K	0.0V	0.1V	
	Median	0	0.0V	[0.2]	[0.0]	0.0V	0.0V	0.0V	0.0Z	0.0Z	0.2K	0.0V	0.2V	
	Inst.Max	0	3.8V	[1.9]	[7.8]	1.7V	0.5V	0.5V	1.2Z	0.4Z	0.5K	0.1V	0.2V	
	Inst.Min	0	0.0V	[0.0]	[0.0]	0.0V	0.0V	0.0V	0.0Z	0.0Z	0.0K	0.0V	0.0V	
	Monthly Total	0	3V	[6]	[7]	3V	0V	0V	2Z	2Z	6K	0V	4V	**[34]**

Sources: Thiess Services and MI Irrigation Services

Notes: See Table 2.2.k. pages 18-19.

A.2.2 (4) DRAINAGE REUSE

MI has continued to actively pursue recovery and use of water from its drainage systems. Table 2.2m provides information on reuse quantities. It needs to be noted that much of the historically reported quantities in this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites.

Due to the pending review of the water balance and its supporting tables, especially considering the emerging reporting requirements under the National Water Initiative, it has been agreed to continue to include this table (mostly unaltered) for this reporting year.

Table 2.2.m: Reuse quantities (ML) for the MIA and Districts 2010/11

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
GMSD Pumps (Yanco esc + Stormwater)	0	382	175	320	263	184	85	583	583	241	267	100	**3183**
YMSD	0	0	0	292	33	95	117	179	153	76	55	27	**1027**
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lake Wyangan Pumps to L.V.B.C.	0	61	333	189	222	332	196	110	284	101	165	168	**2161**
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek Diversion to Benerembah (@ Brays)	0	2219	247	1255	3277	5242	5347	3327	3045	1265	2179	0	**27403**
Mirrool Creek Licensed Diverters (Creek Pumps)	0	245	385	1171	300	712	769	150	6	0	143	0	**3881**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	0	0	0	7	0	0	0	0	0	**7**
Mirrool Creek to Wah Wah Main	0	3339	1759	2623	3434	4649	5070	4287	2486	3825	4027	1560	**37059**
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	0	2139	850	1100	1180	1786	5300	200	0	450	2050	400	**15455**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	0	0	0	0	900	1620	0	0	0	0	0	**2520**
Barren Box Storage Licensed Diverters	0	0	0	79	0	19	0	0	0	0	0	0	**98**
Losses in Barren Box Storage	0	3893	90	513	2876	1510	1569	85	1204	148	1006	510	**13404**
Channel 13 Escape (Benerembah Drainage)	0	50	134	703	237	272	235	475	342	180	95	175	**2898**
Sub Total	**0**	**12328**	**3973**	**8245**	**11822**	**15701**	**20315**	**9396**	**8103**	**6286**	**9987**	**2940**	**109096**
Less: First Use Water Diversions	0	6845	1018	3063	679	477	1673	1338	576	407	384	152	**16612**
TOTAL WATER CAPTURED (Re-Used)	**0**	**5483**	**2955**	**5182**	**11143**	**15224**	**18642**	**8058**	**7527**	**5879**	**9603**	**2788**	**92484**

Source: Irrigation Services

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

A.2.2 (5) WATER BALANCE LOSS AND GAIN

Table 2.2.n: Annual Water Balance Assessment MIA system (Gigalitres) 2010/11

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10 *	10/11	Bench-mark	Median	Comment
Climatic																
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	336	739	400	359	CSIRO data
Evaporation **(mm)**	1868	1750	1896	2032	2191	1998	1983	1935	2182	2127	2166	2085	1391	1869	2018	CSIRO data
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	75	0	50	66	Look up table
Main Gross Data																
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	336	394	505	567	1154	794	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	276	368	490	952	616	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	118	137	77	202	178	(3)=(1)-(2)
Apparent Efficiency **(%)**	79	79	82	80	79	76	78	80	74	63	70	73	86	82	76	= (2)/(1)*100
Inevitable Real Losses																
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	21	20	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	24	14	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	8	4	35	18	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	19	13	29	25	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	81	82	61	118	97	Inevitable Losses
System Flow Losses																
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	1	6	33	9	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	0	0	48	5	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	0	1	6	81	13	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**82**	**67**	**199**	110	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	52	69	133	86	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**134**	**136**	**332**	196	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	-3	59	130	19	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows																
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	54	83	160	99	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9	14	27		18	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0	0	0		3	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	4	4	67	5	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	72	114	227	126	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	72	120	260	134	(9)=(4)+(8)
Reconciliation																
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-1	-14	-20	-6	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	72	114	227	125	(12)=(8)-(10)
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	318	396	501	612	1264	806	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	-4	52	57	8	(14)=(7)/(12)*100
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**84**	**89**	**84**	85	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10	0.10	0.10		0.5	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.0	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19	0.19	0.19		0.52	

**Although the raw data in the table was correct there was some errors in the formulas used for 2009/10 which have since been corrected for the this years document*

A.2 WATER SUPPLY AND DRAINAGE MANAGEMENT

In 2010/11, irrigation diversions from the Murrumbidgee River were 567 GL with 490 GL being recorded deliveries (sales). This left an apparent loss of 77 GL which meant that MI's *apparent* operational efficiency was approximately 86%. This is the highest recorded operational efficiency by the Company.

Of that loss, the *true loss* was estimated at about 67 GL, the lowest losses recorded by the Company in a season. This included losses due to channel seepage and evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 69 GL, using the standard formula of 14% of deliveries. The total losses are estimated at 136 GL, while the apparent loss was 77 GL. This means that 59 GL of water has been gained throughout the system.

Storage volume changes are included for BBSW and Lake Wyangan. The variation in en-route storages at Yenda and Bray's Dam are minimal in comparison to the figures quoted in the table (gigalitres). Mirrool Creek Floodway releases are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

A comparison of the benchmark year and the current year shows that the system efficiency is 89%, which exceeds the benchmark of 84%. This is the best performance for MI since the 2005/06 season where 90% efficiency was achieved.

A.2.2 (6) CROP STATISTICS

Irrigated crop statistics

The following charts show the distribution of crops grown this year in comparison to last year (2009/10) and the baseline year (1995/96). The comparison shows a marked increase in the water deliveries to rice cropping, a reflection of the general security announcement that increased by 73% on the previous year. The notable distribution percentage change to citrus, vines and other fruits is largely due to increased rainfall for the reporting period along with a significant increase in rice deliveries.

Figure 2.2.b: Distribution of irrigated crops – 1995/96, 2009/10 and 2010/11
Comparison of crop type by percentage of megalitres delivered.

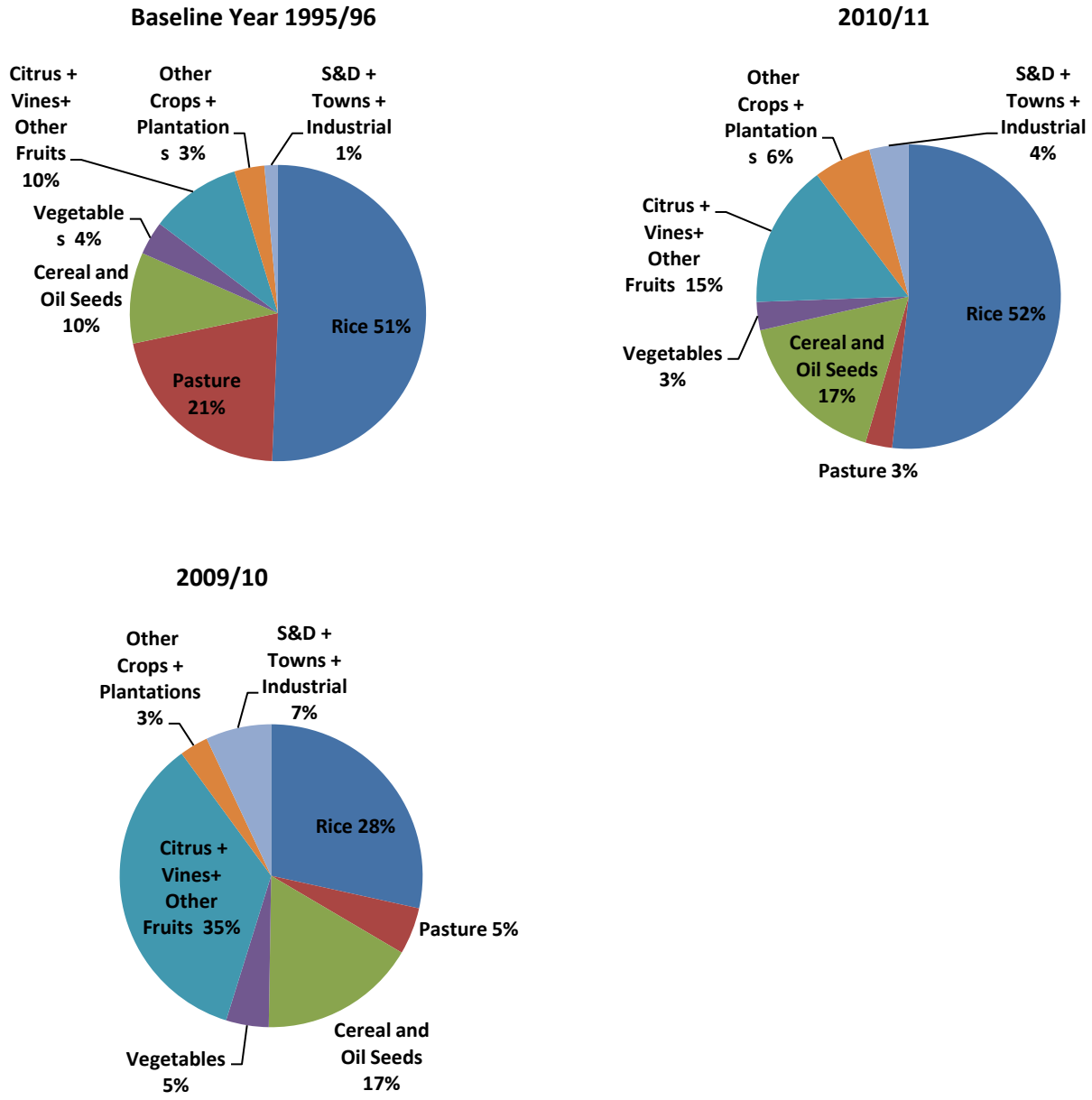


Table 2.2.o: Historical deliveries to major crop types* and *% of Total ML Delivered

Year	Rice*	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2010/11	**253,699**	**13,924**	**82,696**	**14,717**	**74,912**	**29,927**	**20,455**
2009/10	103,208	18,162	60,851	16,519	127,386	11,110	25,386
2008/09	34,450	14,447	43,688	13,108	132,721	8,168	29,651
2007/08	1,006	8,218	39,538	9,191	123,510	9,274	19,560
2006/07	41,296	23,419	149,441	15,577	138,234	13,834	30,097
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123
2004/05	101,494	77,364	247,267	22,736	150,601	7,078	41,877
2003/04	221,732	63,960	182,940	16,504	132,866	22,519	11,285
2002/03	251,424	64,093	237,612	14,970	138,929	24,983	22,101
2001/02	469,513	85,556	184,253	17,989	122,884	23,403	13,013
2000/01	479,757	112,668	108,690	18,794	98,285	39,262	0
1999/00	394,224	54,159	68,366	12,013	75,108	40,060	0
1998/99	477,563	101,791	65,231	24,967	105,522	47,504	0
1997/98	489,363	179,246	126,247	19,714	115,200	47,176	0
1996/97	519,053	187,441	143,746	23,464	104,561	40,461	66,379
1995/96	446,917	185,931	87,725	32,348	87,983	28,905	12,957

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2010/11	**51.7%**	**2.8%**	**16.9%**	**3.0%**	**15.3%**	**6.1%**	**4.2%**
2009/10	28.5%	5.0%	16.8%	4.6%	35.1%	3.1%	7.0%
2008/09	12.5%	5.2%	15.8%	4.7%	48.0%	3.0%	10.7%
2007/08	0.5%	3.9%	18.8%	4.4%	58.7%	4.4%	9.3%
2006/07	10.0%	5.7%	36.3%	3.8%	33.6%	3.4%	7.3%
2005/06	42.8%	7.9%	21.9%	3.3%	17.1%	1.1%	5.8%
2004/05	15.7%	11.9%	38.1%	3.5%	23.2%	1.1%	6.5%
2003/04	34.0%	9.8%	28.1%	2.5%	20.4%	3.5%	1.7%
2002/03	33.3%	8.5%	31.5%	2.0%	18.4%	3.3%	2.9%
2001/02	51.2%	9.3%	20.1%	2.0%	13.4%	2.6%	1.4%
2000/01	56.0%	13.1%	12.7%	2.2%	11.5%	4.6%	0%*
1999/00	61.0%	8.4%	10.6%	1.9%	11.6%	6.2%	0%*
1998/99	57.9%	12.3%	7.9%	3.0%	12.8%	5.8%	0%*
1997/98	50.1%	18.3%	12.9%	2.0%	11.8%	4.8%	0%*
1996/97	47.8%	17.3%	13.2%	2.2%	9.6%	3.7%	6.1%
1995/96	50.6%	21.1%	9.9%	3.7%	10.0%	3.3%	1.5%

Source: MI Irrigation Services, Griffith.

*Rice data in tables 2.2o and 2.2p are calculated from customer water orders, amended data including measured area (ha) located in table 3.2c

Table 2.2.p: Summary of deliveries and areas for the major crop groupings during 2010/11

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)
CITRUS	7,978	25,914	3.2
INDUSTRIAL	26	3,656	n/a
OTHER CROPS	4,945	28,330	n/a
OTHER FRUITS	2,468	9,631	n/a
PLANTATION	228	1,597	7.0
RICE*	25,767	253,699	9.8
STOCK & DOMESTIC	448	9,056	n/a
SUMMER CEREALS	2,928	13,301	4.5
SUMMER OILSEEDS	1,472	6,606	4.5
SUMMER PASTURE	2,098	4,490	2.1
TOWN SUPPLY	6	7,743	n/a
VEGETABLES	3322.3	14,717	4.4
VINES	18512.6	39367	2.1
WINTER CEREALS	39,750	56,866	1.4
WINTER OILSEEDS	4288	5,923	1.4
WINTER PASTURE	5947	9,434	1.6
TOTAL		**490,329**	

Source: All figures provided by MI Irrigation Services, except for crop evapotranspiration figures, the rice net crop evapotranspiration was calculated using monthly weather data.

Notes: N/A = Not available due to data collection method.
Note: The rice figure provided does not consider soil moisture utilised by subsequent cereal crops planted into rice stubble. Cereal crops that do not follow a rice crop often require more irrigation, resulting in higher water use for these crops.

A.2.3 CHEMICAL CONTINGENCY

MI works closely with its shareholders as well as other stakeholders including customers, grower organisations and government agencies to guard against unsatisfactory water quality in the supply and drainage network.

MI's water quality monitoring involves dividing the MIA into sub-catchments. Each sub-catchment has a risk assessment undertaken. Based on the assessed risk of each sub-catchment and certain predefined triggers (discharge at licensed sites, blue-green algae levels at storages, rainfall and reported pollution incidents) water quality monitoring is undertaken.
The program consists of two components as described below.

Benchmark sampling

Benchmark sampling is used to assess the quality of water within the system at specified times throughout the irrigation season. Benchmark sampling takes place at the start, middle and end of season creating an overall quality trend. Benchmarking samples are analysed for physical parameters, pesticides and EC. Results are used to internally benchmark overtime water quality throughout the season and identify quality trends within our supply and drainage system under the varying range of operating conditions. The benchmark sampling also provides additional information if further sampling should take place throughout the season.

Routine site inspections

Routine site inspections are conducted to assist in managing risks. Conducting routine inspections assist in identifying high risk areas prior to a trigger or reported event (e.g. algal blooms, illegal discharge etc). It allows flexibility in monitoring operations throughout the season and will assist in streamlining compliance related activities. As a minimum routine site inspections will occur on a monthly basis. Any pollution incidences arising from such inspections will follow the Reported Pollution Incident format of assessment.

SCHEDULED CHEMICALS

Table 2.3.n shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the Office of Environment and Heritage.

Table 2.3.n: Scheduled chemicals in MI's screening program

Chemical	Environmental Guidelines (μg/L)	Notification Level (μg/L)	Action Level (μg/L)
Atrazine	2	**13**	**45**
Chlorpyrifos	0.001	**0.01**	**0.11**
Diazinon	0.0006	**0.01**	**0.2**
Diuron	8	**1***	**5***
Endosulfan	0.01	**0.03**	**0.2**
Malathion	0.07	**0.05**	**0.2**
Metolachlor	8	**0.02**	**0.1**
Molinate	2.5	**3.4**	**14**
Simazine	10	**3.2**	**11**
Thiobencarb	1	**2.8**	**4.6**
Trifluralin	0.1	**2.6**	**4.4**

Source: Department of Environment and Climate Change

Notes: ***** Notification and action levels for diuron were set at 1.0μg/l and 5.0μg/l respectively. These interim levels were negotiated with Murrumbidgee Irrigation Limited to allow a phased introduction of the new levels and for industry to develop and refine management options for future use and management of diuron.

CHEMICAL CONTINGENCY PLAN FOR MIA

As part of the water quality monitoring program, MI has developed a Water Quality Risk Management Framework. The framework is developed so that potential threats to the MIA&D can be identified and managed before they develop into a problem. This reduced the reliability on lag indicators such as laboratory tests to determine if there was a problem with water quality. A summary of the risk framework is provided below.

Framework	Description
Drainage Catchments within MIA	Drainage sub-catchments across the system identified to allow MI to identify, monitor, and manage risks to WQ.
↓	
Drainage Catchment Risk Profiling	Provide an overall risk profile for the MIA and identify key areas of higher risk.
↓	
Trigger	Triggers include; rainfall >15*mm in 24hr, Reported Pollution Incident (RPI), farm drainage, discharge out of MIA, prolonged dry weather, other.
↓	
Risk assessment	Risk assessment conducted on site to determine course of action
↓	
Action	Appropriate action taken e.g. sampling, further investigations, and/or follow up.
↓	
Report/analysis/corrective action	Data analysis, internal reporting and corrective action

* Due to the low rainfall during the drought, the trigger for rainfall based sampling was lowered to 10mm in a 24 hour period. The program agreed to by the OEH and commencing in the 2010/11 season has the rainfall trigger set at 15mm in a 24 hour period.

The following steps are a summary of the general actions that the company takes if a pesticide is detected above a Notification or Action Level.

1. Notify the OEH by telephone within 24 hours once the sampling results have been received by MI.

2. Notify OEH within 24 hours of the results affecting the river sites once the sampling results have been received by MI.

3. Investigate the drainage sub-catchment to determine the source (which may involve taking more water samples). Once a source is identified, assess the situation and take appropriate remedial action. In some situations immediate on-farm works may be necessary or preventing further drainage discharge, or even withholding water supply to the farm until the contamination or contamination risk is mitigated.

4. Inform farmers by a recorded message placed on the automated Water Ordering system when widespread problems with excessive drainage can be identified. Warnings may be issued that continued detection could result in prosecution and/or supply being withdrawn from farmers who are found deliberately draining.

5. Advise downstream water users if action levels are exceeded at sites identified by MI as re-supply sites. Although the knowledge of the effects of pesticide levels on livestock and crops is incomplete they can be made aware of the situation and take precautions to protect their livestock and crops.

6. Program dilution flows from some parts of the system, when possible.

RESPONSE TO OEH DIRECTION:

In the event that an OEH direction is received to restrict the discharge by an irrigator of irrigation waste water to the company drainage works, the Company is committed to ensuring such direction is complied with. One or more of the following actions may be undertaken:

1. Send a letter to the relevant irrigator containing a warning that supply of water will be discontinued if the relevant problem is not rectified.

2. Refuse to or discontinue the supply of water to the irrigator.

3. Undertake works to prevent the continuance of the problem.

4. Notify the irrigator in writing that consent to discharge any substances into the drainage works is withdrawn.

A.3 GROUNDWATER MANAGEMENT

A.3.2 REPORTING REQUIREMENTS

The following groundwater information was derived from Ary Van der Lely's report '*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas*. Annual Report 2011'.

A.3.2 (1) GROUNDWATER MONITORING AND ANALYSIS

The groundwater conditions for September 2010 and the changes since baseline year 1996 and September 2009 are summarised in Table 3.2.a.

Table 3.2.a: Average depth to the watertable at September 2010 compared to 2009 and baseline year 1996 *

Area	2010 Deep Aquifer	2009 Deep Aquifer	1996 Deep Aquifer	2010 Shallow Aquifer	2009 Shallow Aquifer	1996 Shallow Aquifer
MIA u/s BBS	9.72	9.73	4.4	5.68	5.66	1.88

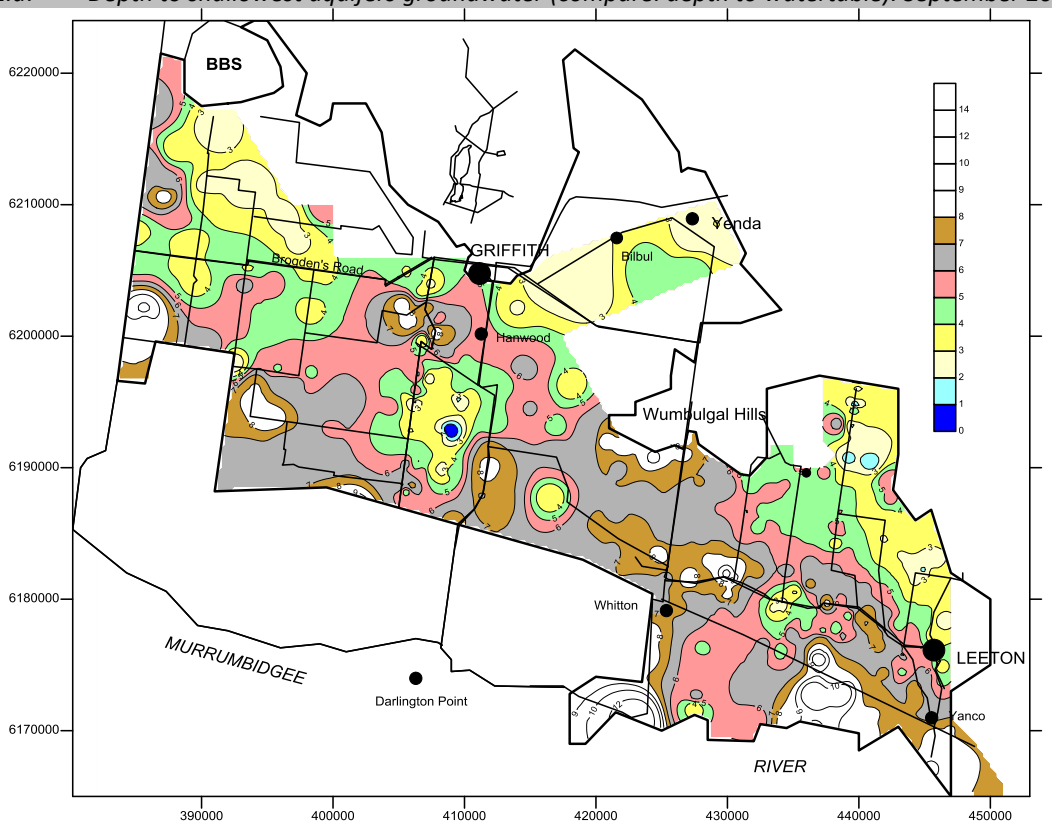
Note**:** * The shallow Shepparton is defined as being the aquifer systems less than 12 metres from the surface. The deeper Shepparton is defined as the aquifer systems from 12-35 metres from the surface. All figures indicate depth to watertable in metres.

Table 3.2.a shows groundwater levels plateau compared to the same period in the previous season. The proportion of land with groundwater within two metres has dropped from over 70% before 2000 to less than 1% by September 2007. This has been maintained during the past two years although in stark contrast groundwater levels have raised to March 2011. This rise is a reflection of a full irrigation season and well above average rainfall (179% of the long term average), particularly through the spring to summer seasons. The implementation of MI environmental programs and associated on farm irrigation system improvement has assisted with managing water tables.

The groundwater contours for the shallowest aquifers of the MIA are shown in Figure 3.2.a. High groundwater levels within two metres that were almost non-existent in the previous season are now evident in 9% of the MIA. The highest groundwater areas generally are in the Koonadan area north-west of Leeton, Murrami and in the Bilbul/Yenda area.

The small pockets of high groundwater in Northern Benerembah are related to a depressed prior stream site, a soil ridge formation with down slope seepage and probably some channel seepage spots.

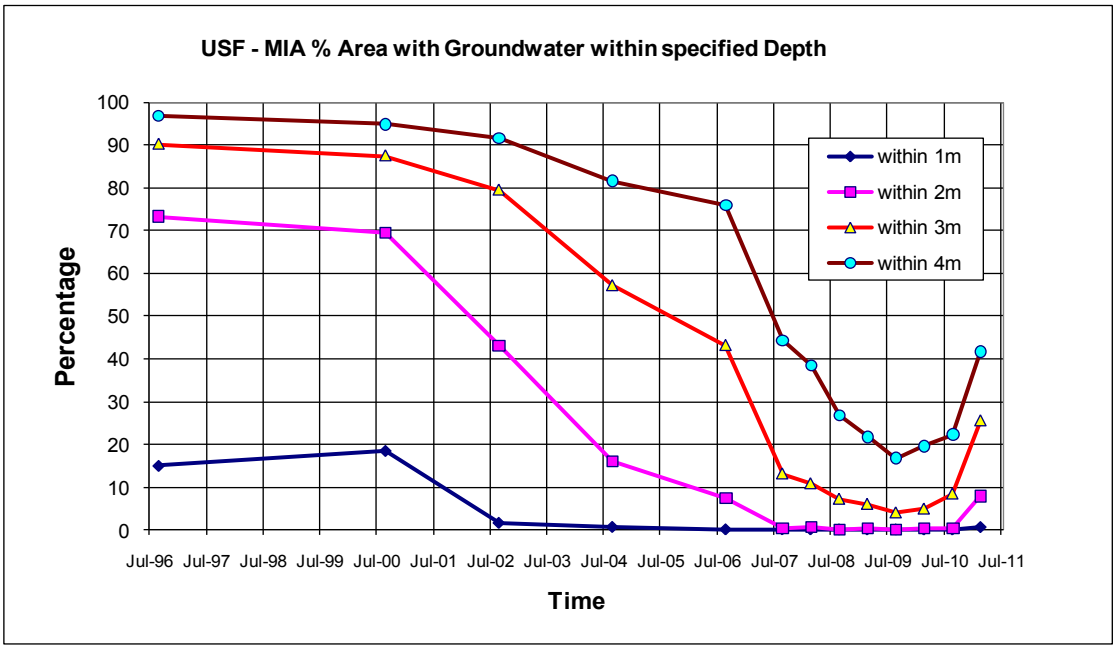
Figure 3.2.a: Depth to shallowest aquifers groundwater (compare: depth to watertable). September 2010



MAP 1: UPPER SHEPPARTON DEPTH TO GROUNDWATER SEPT. 2010
Average = 5.68m

The percentage of areas with groundwater levels within depth specified for water table aquifers (USF) in the MIA (excluding Wah Wah) are shown in Chart 3.2.1.

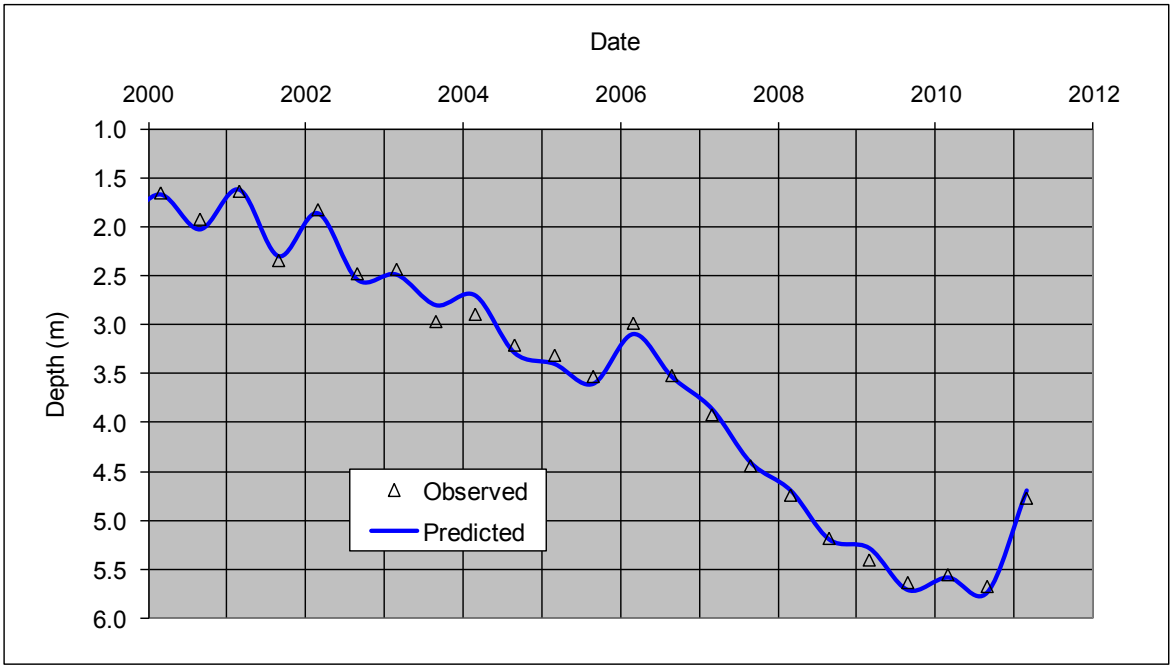
Chart 3.2.1: Trend of average groundwater depths in three aquifer formations of the MIA



A.3 GROUNDWATER MANAGEMENT

Chart 3.2.2 shows the observed data of average groundwater depths in the MIA versus the predicted values based on the model coefficients.

Chart 3.2.2: Observed average groundwater depths in the MIA and calculated trend line based on optimisation of the groundwater balance each time step



The model used to produce these predictions, can also be used to analyse various scenarios likely to occur in the future. More work is being undertaken, in conjunction with CSIRO Land and Water, to refine these predictions and ultimately to assist in the management of the MIA and Districts.

The conclusions of the groundwater report are:

- LWMP targets have been met but they need to be reviewed to determine their continued relevance.
- Target for accessions to and extractions from the groundwater system (net accessions). The groundwater level increase is concerning and further consideration should be given to the rice growing and target water use policies within the MIA.
- Area and distribution targets for watertable levels within two metres from the surface. The proportions are low but have started to increase. The water table will be close to the surface again within a few years unless overall irrigation management is changed.
- Pressure level in deep aquifer target. The pressure levels have also increased significantly, probably due to a (temporary) cessation of groundwater pumping just south of the MIA. If volumes of pumping are being controlled it is possible that the practice of groundwater pumping practices south of the MIA are sustainable. This is beyond the management responsibility of MI.

The conclusion is that there are some groundwater management issues forthcoming from the 2010/11 data set. These should be considered in conjunction with sustainability issues but also other considerations, such as possible changes in the overall irrigation infra-structure review.

A.3.2 (2) WAH WAH GROUNDWATER AND MIRROOL CREEK FLOODING

In respect to the Lower Mirrool Creek Floodway, Chart 3.2.3 shows small declines in groundwater levels for piezometers 3388 and 3391 with slight increases for 3345 and 3337. Readings for the remaining two bores were unavailable due to localised flooding. There have been no recorded flood events in the Lower Mirrool Creek since the early 1990's.

Chart 3.2.3: Behaviour of piezometers in the Lower Mirrool Creek Floodway area west of the Mid Western Highway

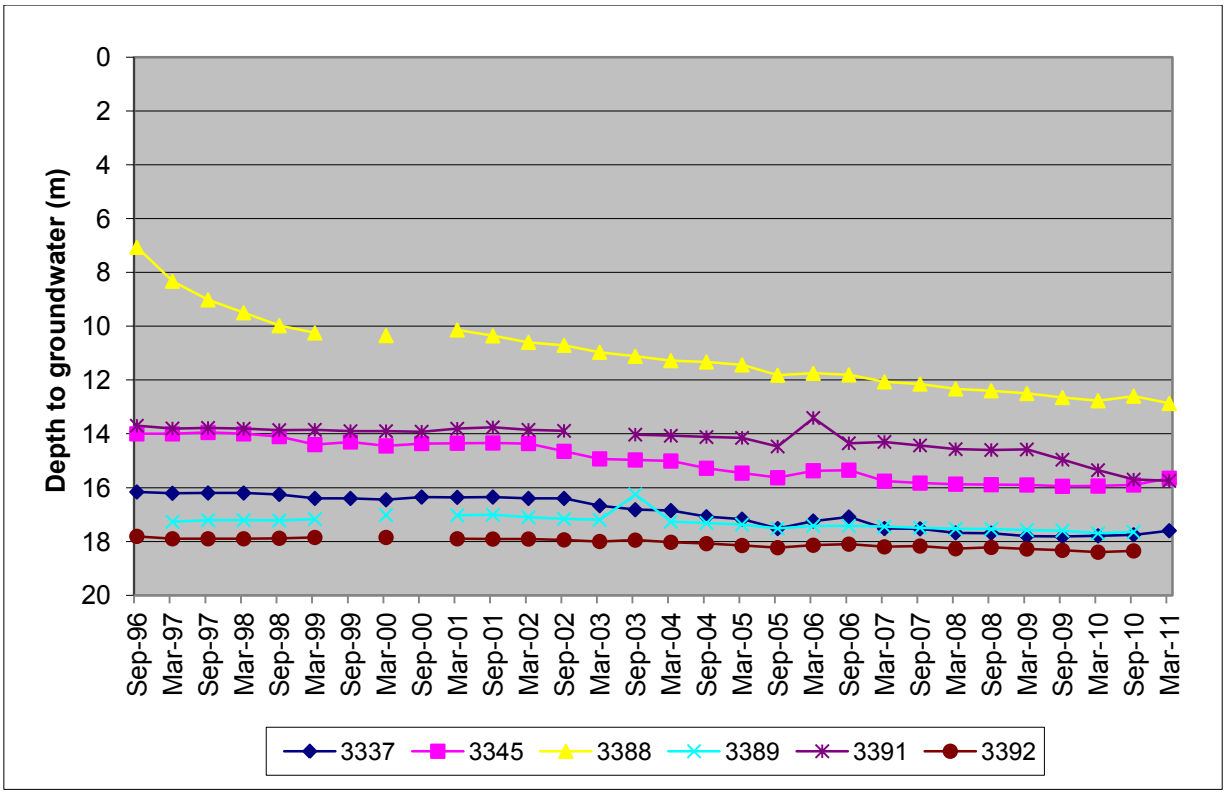
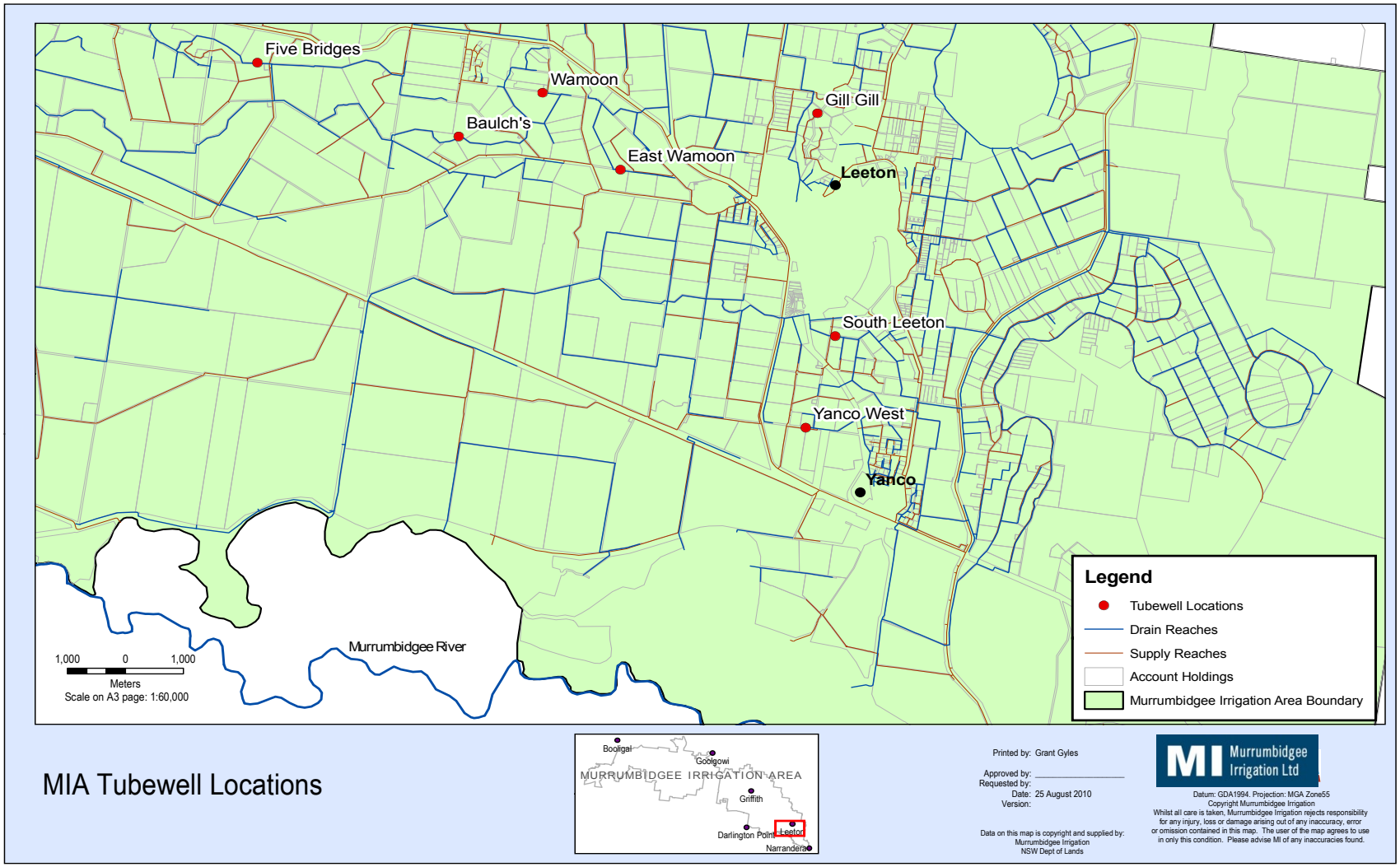


Chart 3.2.4: MIA Tubewell Locations



A.3.2 (3) GROUNDWATER VOLUMES AND SALT LOADS EXTRACTED FROM TILE DRAINS AND PUMP SITES

Tubewells

There are 15 tubewells installed in the MIA by previous government departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a steady decrease in discharge volume since the 2008/09 season, the total salt load was also slightly lower in 20010/11. The total discharge volume during the 2010/11 season was about 69% of the previous season, while the salt load was similar at 99%, which means that the salinity levels of the discharge have increased. This can be explained by a continued drop in groundwater levels which allows salts stored in the soil to leach into the groundwater.

Table 3.2.b: Groundwater volumes and salt loads extracted from tubewells

Name	2010/11 Discharge (ML/year)	2010/11 Salt Load (T/year)	2009/10 Discharge (ML/year)	2009/10 Salt Load (T/year)	2008/09 Discharge (ML/year)	2008/09 Salt Load (T/year)
Five Bridges	27	33	268	181	659	423
Gil Gil	482	907	493	790	276	366
Yanco West	154	306	304	420	309	408
South Leeton	193	347	30	47	0	0
Baulch's	-	-	-	-	16	7
Wamoon	275	169	407	250	4	2
East Wamoon	28	18	176	105	668	361
TOTAL	1159	1780	1,678	1,793	1,933	1,568

Source: MI Electrical Services, MI Environmental Services

Tile drains

At present there are 19 flow meters attached to tile drainage outlet pipes in the MIA. The sites are assessed annually for volume of flow and a sample of the discharge is measured for electric conductivity. During the 2010/11 season, nine of the 19 systems were operational and the total volume pumped from the nine sites was 126 ML, which is 29% higher than last year. In total 192 tonnes of salt was discharged and this is similar to the previous season's total of 205. At the remaining ten sites there was no discharge recorded.

The discharge from both the tubewells and the tile drains enters MI's drainage system and is therefore accounted for in the drainage volumes and salt load tables in section A2.

A.3.2 (4) GROUNDWATER ACCESSION CONTROL TARGETS AND RICE ENVIRONMENTAL MONITORING

Groundwater accession control target

Drought breaking rainfall throughout the catchment and MIA resulted in general security allocations reaching 100% for the first time since the 1996/97 season, shareholders utilised the water availability to increase their rice cropping programs substantially. MI was required to implement its Rice Environmental Monitoring program (REM) when the trigger point of general security allocations reached 40% by October 1 in line with licence conditions with the NSW Office of Water (NOW).

Groundwater levels in the Upper Shepparton Formation (USF) and the Lower Shepparton Formation (LSF) in all sub-districts stayed about the same from March 2010 to September 2010 despite some significant rainfall resulting in recharge. The groundwater levels in all areas except Wah Wah and Lake Wyangan from September 2010 to March 2011 increased by about a metre as irrigation, including a full season of rice growing, recommenced after a long period of below average water availability. The Calivil Formation showed much larger increases in the southern parts of the MIA, up to seven metres, and these changes mostly occurred during the March 2010 to September 2010 period, rather than in the September 2010 to March 2011 period.

Rice water use and rice growing practices

With the reintroduction of the REM program, aerial photos of the MIA were captured in January 2011 and rice areas measured using GIS. This data was provided to all shareholders in post season surveys and used to verify rice water usage figures obtained from customer water orders. A total of 251,214 ML supplied 25,376 hectares of rice grown in the MIA in the 2010/11 season with an average of 9.9ML/hectares recorded. It needs to be noted that the figures in Table 3.2.c are based on surface water irrigation only. The NOW is responsible for the management and recording of groundwater use. We have been made aware that groundwater has been used to grow rice, but information on how much was used or what crop it was used on has not been made available to MI.

Table 3.2.c: Summary of historic rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)										
Irrigation Area or District	**Total Rice Area (ha) 2010/11**	**Total Water to Rice (ML) 2010/11**	**'10/11**	**'09/10**	**'08/09**	**'07/08**	**'06/07**	**'05/06**	**'04/05**	**'03/04**	**'02/03**	**'01/02**	**'00/01**
Yanco	7,226	75,068	10.4	13.5	13.9	N/A	N/A	12.6	13.1	13.3	14.1	12	11.2
Mirrool	8,972	82,246	9.2	13.7	12.5	N/A	N/A	12.7	12.9	13.2	14	12.3	11.2
Benerembah	7,894	80,735	10.2	14.2	12	N/A	N/A	12.9	12.8	13.3	14	13.1	11.1
Tabbita	259	2,126	8.2	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3
Wah Wah	799	8,452	10.6	15.7	20.6	N/A	N/A	14	11.9	12.4	14.4	14.3	13.7
Kooba [1]	227	2,587	11.4	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*
Total/average	25,377	251,214	9.9	**13.8**	**12.7**	N/A	N/A	**12.8**	**12.9**	**13.3**	**14.1**	**12.5**	**11.5**
Target			11.5	15.9	16.3	N/A	N/A	15.3	15	15	17.3	15.3	14.2

Sources: MI Irrigation and Environmental Services

Note: [1] Kooba's rice water use was previously calculated as part of Mirrool.

Estimated groundwater accessions

During 2010/11 the net total diversions were higher than that of the previous two seasons, 112% of 2009/10. Rainfall from July to October 2009 was 254mm (169% of the long term average). This, combined with a reduction in groundwater pumping, caused groundwater levels to plateau to September 2010. Compared to the previous season, irrigation activity during the 20010/11 summer increased. This, combined with a 39% higher than average summer rainfall (November 2010 to March 2011) resulted in a substantial increase close to one metre on average in watertable levels to March 2011. Deep Calivil Formation showed much larger increases in the southern parts of the MIA, up to seven metres, and these changes mostly occurred during the March 2010 to September 2010 period, rather than in the September 2010 to March 2011 period.

Rice growing policy

An updated MI Rice Growing Policy 2010/11 was implemented in line with the reintroduction of the REM program. This document has been forwarded to the NOW in electronic format.

With the reintroduction of the REM program, aerial photos of the MIA were captured in January 2011 and rice areas measured using GIS. This data was provided to all shareholders in post season surveys and used to verify rice water usage figures obtained from customer water orders.

A.3.2 (5) GROUNDWATER DATA FORMAT

A copy of '*Groundwater Conditions and Behaviour in the Murrumbidgee Irrigation Areas. Annual Report 2010*' has been forwarded to the DECCW in electronic format.

A.3.2 (6) GROUNDWATER DATA RELIABLY CAPTURED

The Environmental Management Conditions (EMC), Part 2 of IC5, identifies that 850 piezometers are to be used for six-monthly monitoring. A minimum subset of 60 piezometers is to be used for two-monthly monitoring to determine seasonal trends.

Piezometer readings are being taken by MI staff during March and September each year. The statistics for piezometers read during 2008/09, 2009/10 and 2010/11 are summarised in Table 3.2.d.

Table 3.2.d: Availability of piezometer readings for various dates and categories of piezometers.

Piezometers	Read Sep 08	Read Mar 09	Read Sep 09	Read Mar 10	Read Sep 10	Read Mar 11
Positive readings	822	810	796	778	790	788
Read but 'dry'	69	74	84	97	93	81
Available	**891**	**884**	**880**	**875**	**883**	**869**
Unavailable	83	94	102	107	106	11

A.3 GROUNDWATER MANAGEMENT

Despite a number of piezometers becoming lost over time, the number of piezometers read is still above the 90% (of 850) requirement specified in the licence. However, in some cases a piezometer of the original list has been lost and alternative piezometers available in the field have been used to make up for this loss of data. This substitution has a small effect on accuracy by which groundwater statistics between years may be compared.

Figure 3.2.i shows that there is a considerable variation in coverage across the area. In the Wah Wah District there is a lack of piezometer sites. The same applies for the Lake Wyangan area. Piezometers are also lacking in areas of the MIA where there are no underlying sands, such as in parts of the Yenda area. This situation varies for the deep and shallow piezometer sets.

There are some issues with the maintenance of the piezometer set. The loss of piezometers in some areas such as Wah Wah may or may not be a serious issue as the number of piezometers needed depends on many factors, including the perception that the collection of groundwater data is essential for salinity management. If the risk of salinity developing is low, the need for having piezometers is low. A lesser intensively irrigated district may have less risk. Soil, hydro-geological factors and irrigation management also affect the optimal number. This is matter to be considered by licence reviewers.

For most piezometers, the height of the pipe above ground has been re-measured and the coordinates have been checked for accuracy by GPS.

Groundwater was last sampled for salinity during 2002 and this has been reported (MI report by van der Lely, January 2003).

A.3.2 (7) GROUNDWATER DATA ANALYSIS

The NOW did not make a request for information this year.

A.3.2 (8) GROUNDWATER CONTAMINATION

There were no known, or reported, groundwater pollution events during 2010/11.

A.3.2 (9) GROUNDWATER – ANNUAL MONITORING SCHEDULE

Table 3.2.e: Groundwater monitoring schedule – as required by DECCW

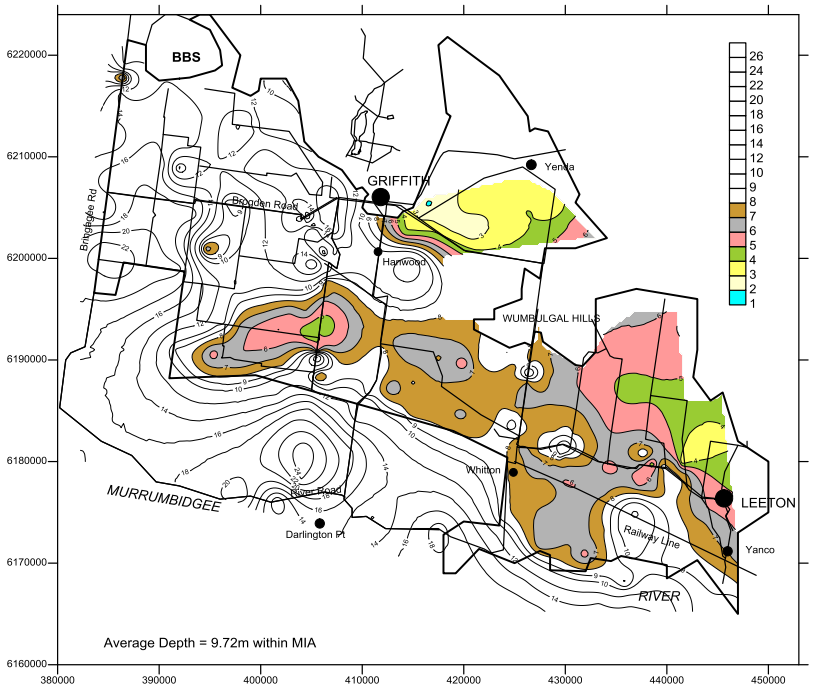
No	Type	Description	Depth	Frequency	Location	
			(metres)		Name	Page
1	Map	Depth to pressure level	5-12	annual	Figure 3.2.a	37
2	Map	Depth to pressure level	12-35	annual	Figure 3.2.b	46
3	Map	Depth to pressure level	70-125	annual	Figure 3.2.c	46
4	Map	AHD of pressure level	12-35	annual	Figure 3.2.d	47
5	Map	Change in pressure level	5-12	annual	Figure 3.2.e	47
6	Map	Change in pressure level	12-35	annual	Figure 3.2.f	48
7	Map	Change in pressure level	70-125	annual	Figure 3.2.g	48
8	Map	Salinity of groundwater	5-12	3 yearly	*	
9	Map	Salinity of groundwater	12-35	3 yearly	*	
10	Hydrograph	Average seasonal behaviour of 8 sub-districts ++	5-12, 12-35	annual	Figure 3.2.h	49-50
12	Freq Table #	Groundwater depth in the 8 sub-districts ++	5-12	annual	Table 3.2.e	51-52
13	Freq Table #	Groundwater depth in the 8 sub-districts ++	12-35	annual	Table 3.2.e	51-52
14	Freq Table #	Groundwater salinity	12-35	3 yearly	*	
15	Map	Piezometer sites	-	annual	Figure 3.2.i	53
16	Map	Groundwater sub-districts	-	-l	Figure 3.2.j	54

Notes: *"*It appears that the MIA is a mature region as far as groundwater conditions are concerned. Future changes will be slow, as they have been for most sub-districts (except WWID). This raises the question whether it is necessary to sample every three years. A five or ten year frequency may be quite reasonable*." Van der Lely (2002). As a result of the above view, MI did not undertake any sampling this year.

++ There are not enough piezometers in the West Hanwood and Wah Wah areas to produce reliable hydrographs.

The 2003 Annual Groundwater report states it is impossible to produce frequency statistics in the Yenda/Widgelli area because there just aren't enough (shallow and deep) piezometers to base such information on. The same applies for Lake Wyangan, where there are no shallow piezometers at all, and just a few deep piezometers.

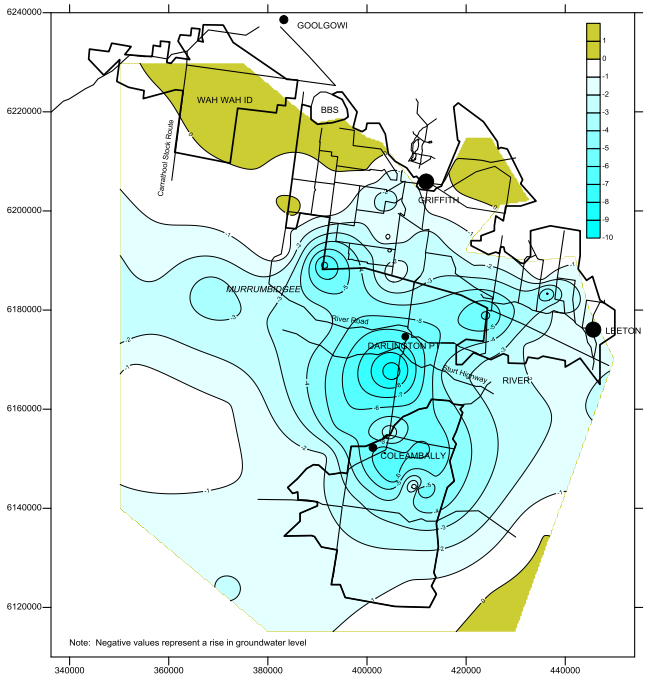
Figure 3.2.b: MIA September 2010 – Depth to pressure level 12-35 metres



MAP 3: Lower Shepparton Formation Depth to Groundwater Sep 2010.

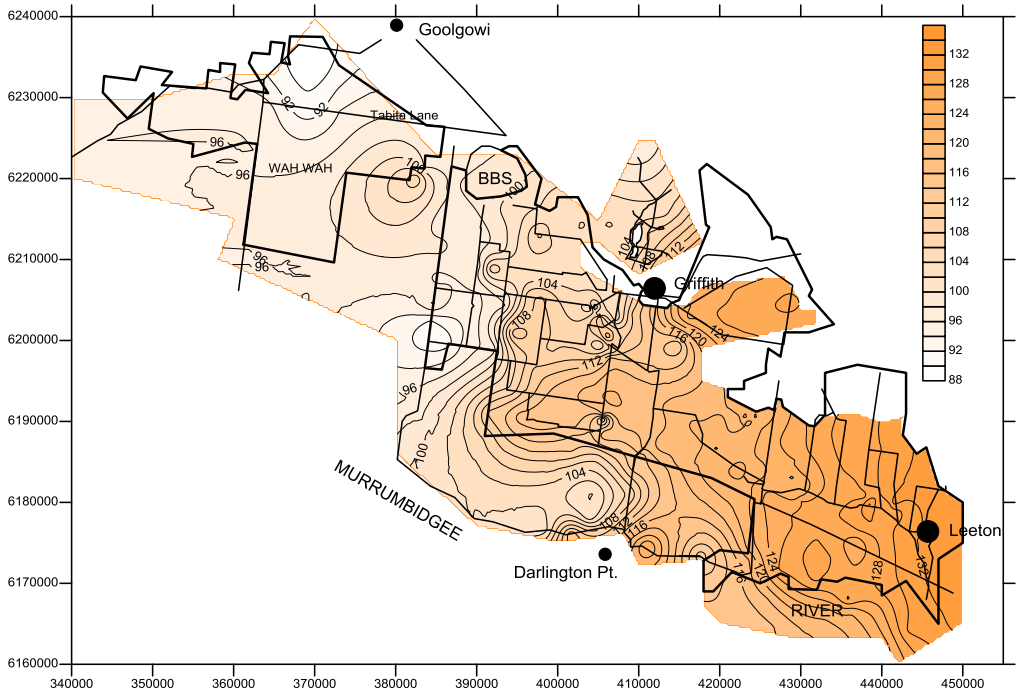
Average depth = 9.73 metres

Figure 3.2.c: MIA September 2010 –Depth to pressure level 70-125 metres



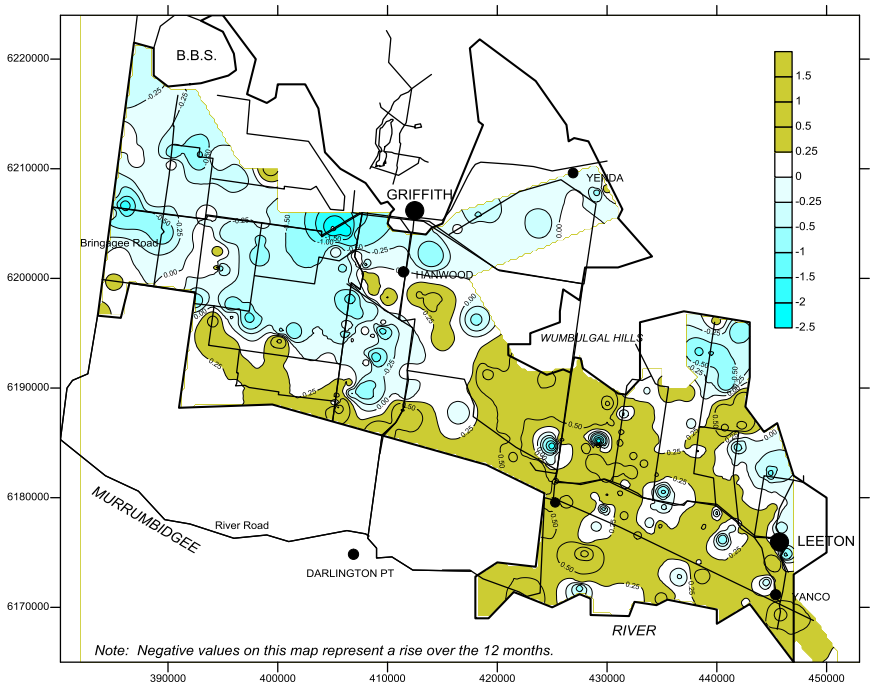
MAP 10a: Calivil Formation - Change Depth to Groundwater Sep'09 to Sep'10

Figure 3.2.d: MIA September 2010 – AHD of pressure level 12-35 meters



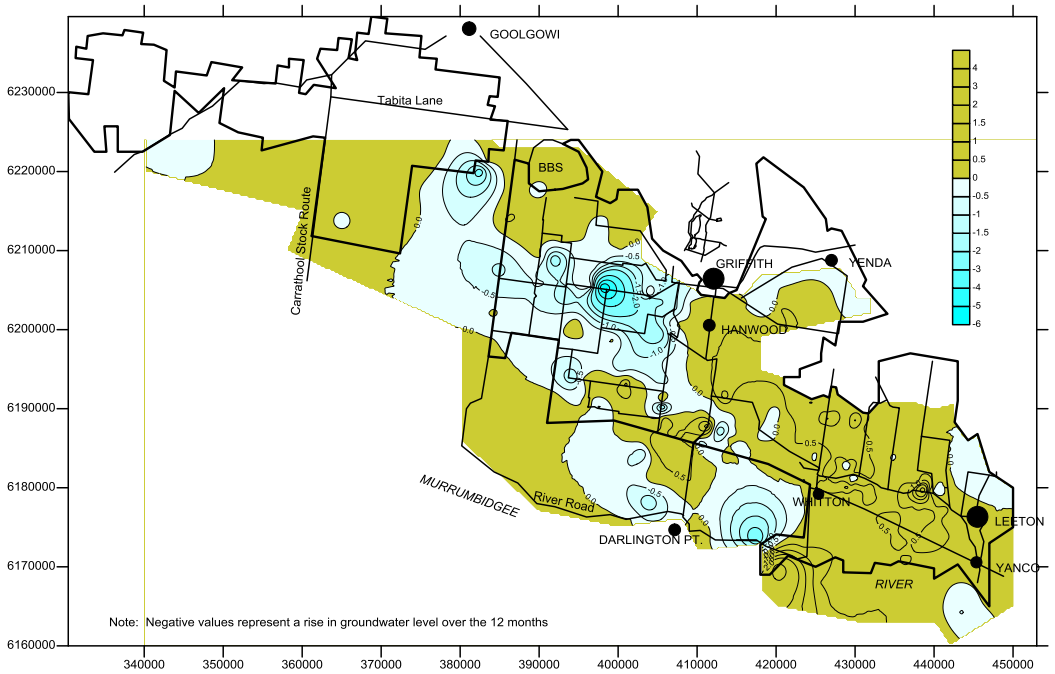
Map 12: AHD contours within Lower Shepparton Formation, September 2010

Figure 3.2.e: MIA 2009-2010 – change in pressure level 5-12 metres



MAP 6a: Upper Shepparton Formation - Change Groundwatre levels Sep '09 to Sep '10

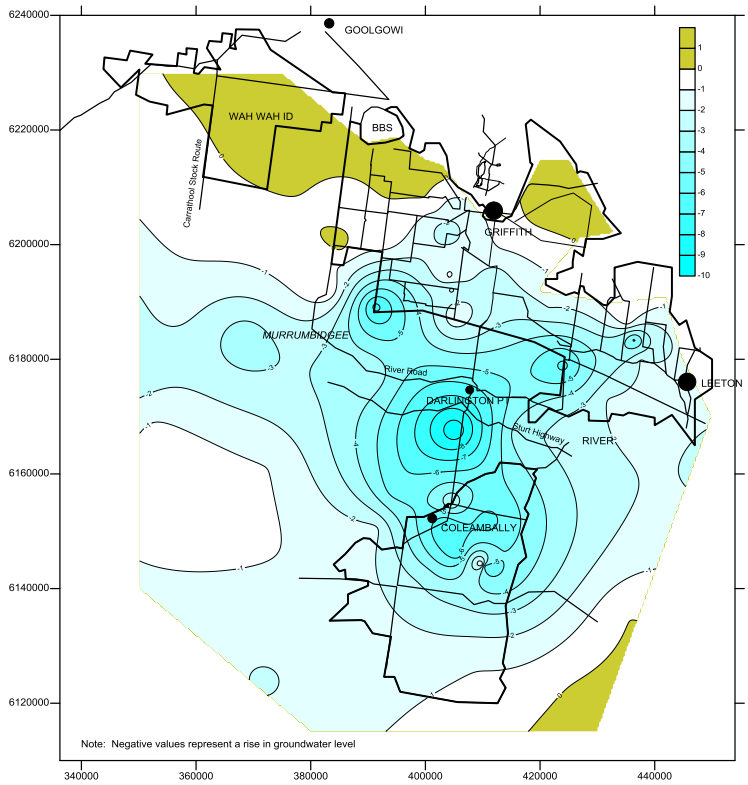
Figure 3.2.f: MIA 2009-2010 – change in pressure level 12-35 metres



MAP 7a: Lower Shepparton Formation - Change Depth to Groundwater Sep '09 to Sep '10

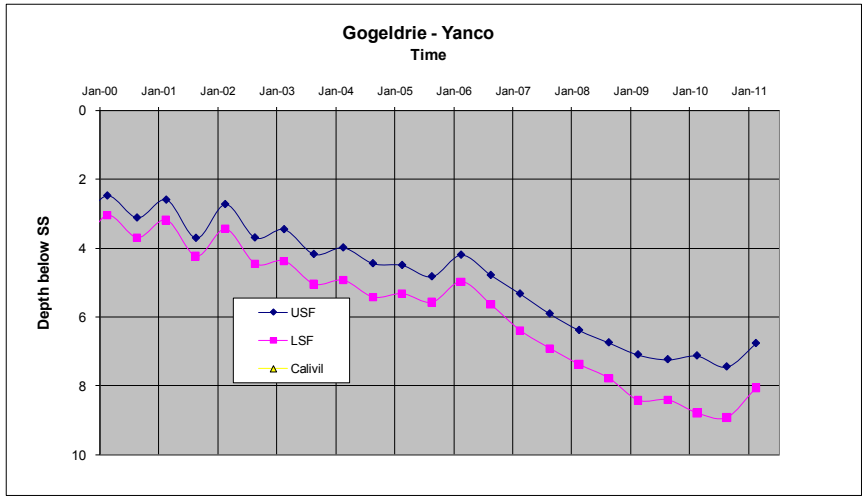
Average drop = 0.50 metres

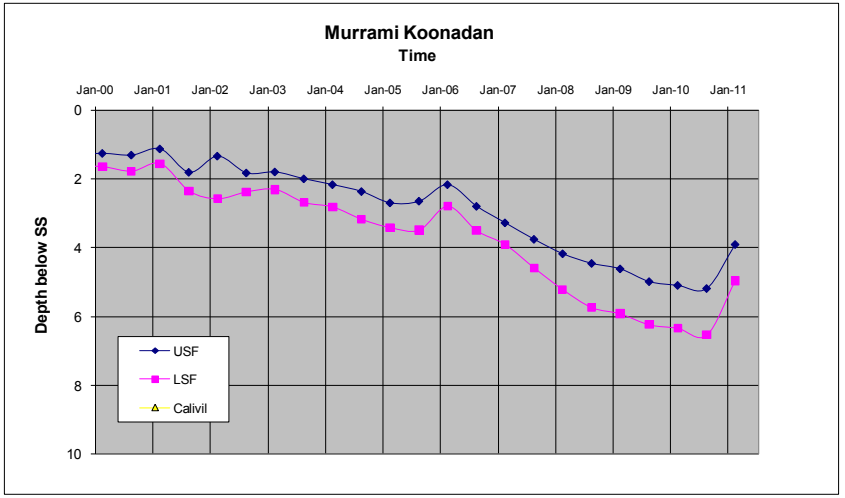
Figure 3.2.g: MIA 2009-2010 – change in pressure level 70-125 metres

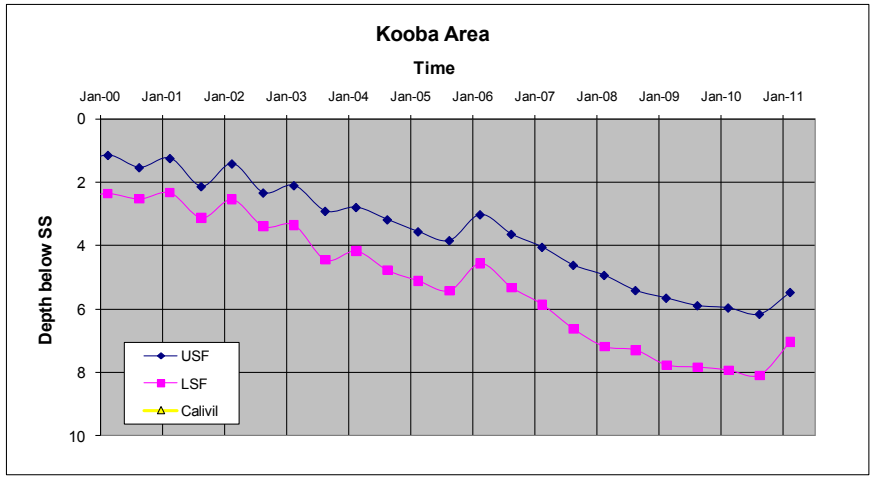


MAP 10a: Calivil Formation - Change Depth to Groundwater Sep'09 to Sep'10

Figure 3.2.h: MIA March and September 1996 to 2010 - Average seasonal behaviour groundwater sub-districts







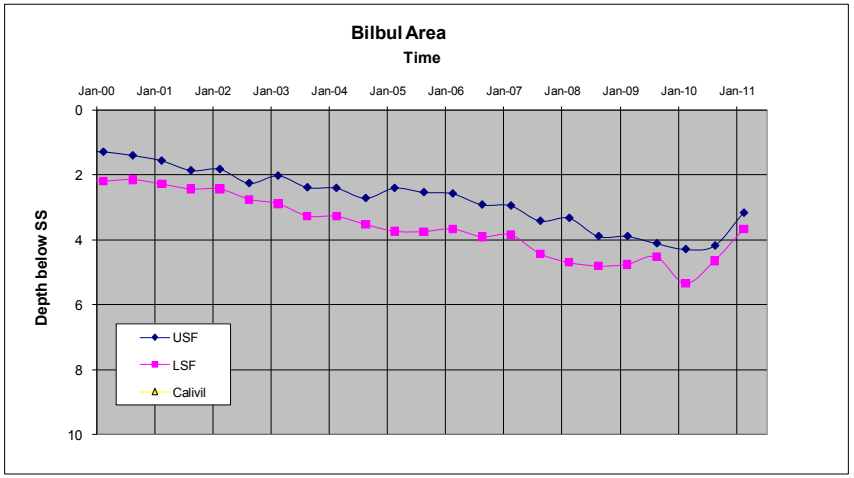
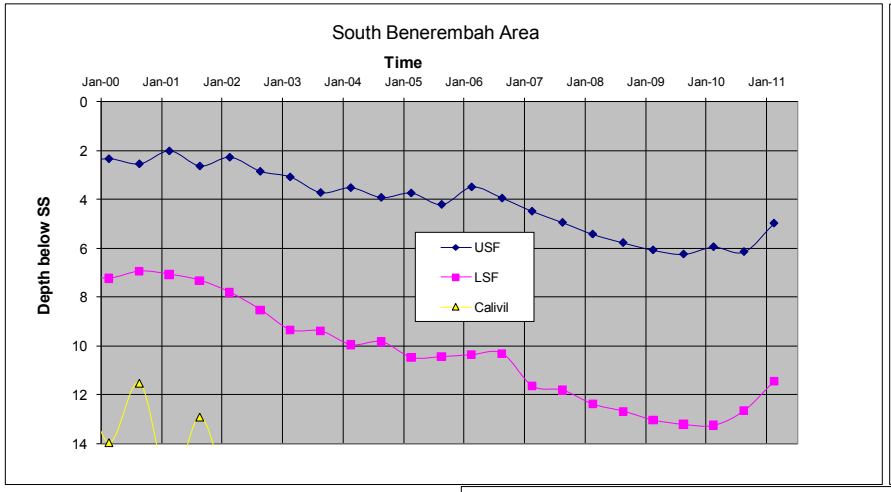
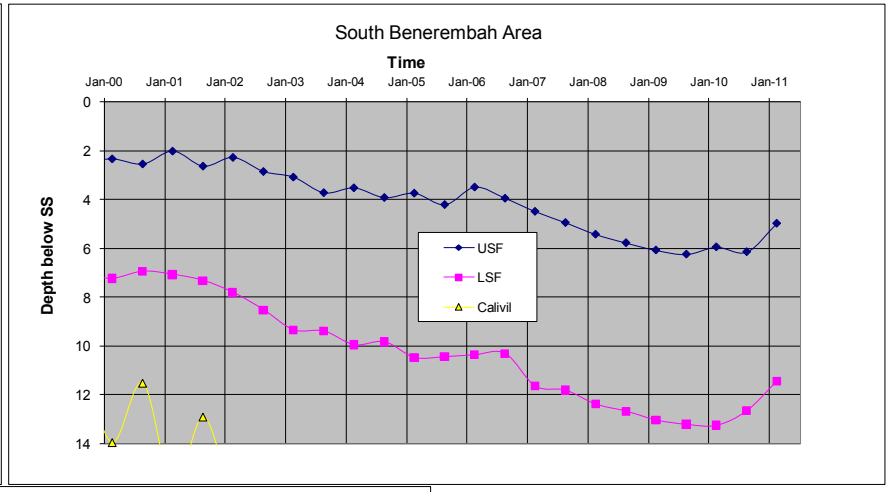
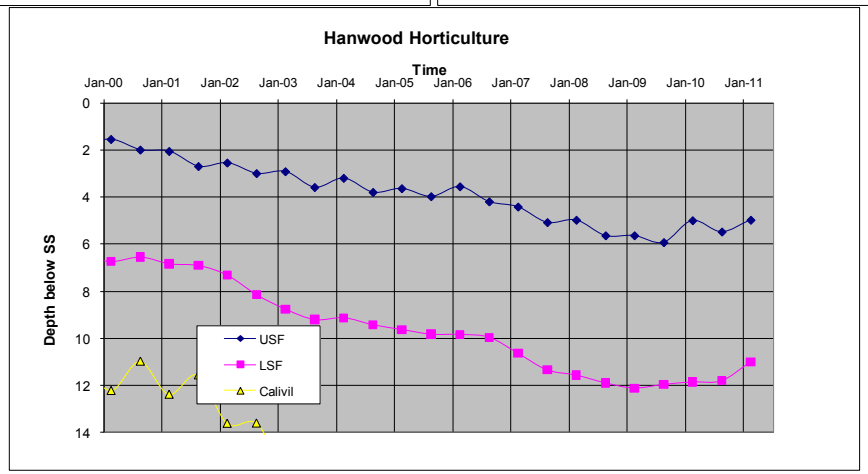


Figure 3.2.h: MIA March and September 1996 to 2010 - Average seasonal behaviour groundwater sub-districts cont.







A.3 GROUNDWATER MANAGEMENT

In previous Licence Compliance and Annual Environmental Reports, the bi-monthly groundwater monitoring data was used to produce graphs showing average seasonal behaviour, see Chart 3.2.2. These graphs were compiled as an average hydrograph of the few piezometers (usually 3 to 8) in each sub-district. These average hydrographs therefore did not represent the individual sites, nor were they a true sub-district average. However, they did show seasonal trends. It was concluded that sub-district seasonal groundwater behaviour is better represented by averages as calculated from gridding and contouring and this method has again been used this year. It should also be noted that there are not enough piezometers in place to provide meaningful graphs for all the groundwater districts.

All graphs show various rates of increased groundwater levels to September with most increases evident from September 2010 to March 2011 as discussed in section A.3.2 (1) and A.3.2 (4). The deeper Calivil Formation showed much larger increases in the southern parts of the MIA, up to seven metres, and these changes mostly occurred during the March 2010 to September 2010 period, rather than in the September 2010 to March 2011 period.

In previous reports only the Kooba sub-district, and the Bilbul/Yenda area and the Lake Wyangan area have been used for reporting. The Hanwood West area including horticulture was added for the 2009 report. The north Yenda area and the Widgelli area have no piezometers with groundwater level readings, and the Yoogali and Hanwood horticultural areas are less relevant for groundwater analysis since groundwater levels are controlled by tile drainage.

Table 3.2.e: ***Frequency statistics (as percentage of area) for sub-districts for shallow (<12metres) aquifers and deeper (12-35metres) aquifers, September 1996 - 2011, and historic trend in areas within 2 metres.***

North Benerembah area: % of Land with groundwater within specified depth													
USF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1m	12	10	1	0	0	0	0	0	0	0	0	0	1
within 2m	76	74	69	28	12	0	1	0	0	0	0	0	18
within 3m	94	93	90	75	72	12	16	10	6	1	5	24	60
within 4m	99	102	97	91	89	69	69	59	46	26	37	56	73
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 2m	0	0	0	0	0	0	0	0	0	0	0	0	0
within 4m	0	0	0	0	0	0	0	0	0	0	0	0	0
within 6m	17	13	7	0	0	0	0	0	0	0	0	0	1
within 8m	47	46	28	4	3	0	0	0	0	0	1	0	2
South Benerembah area: % of Land with groundwater within specified depth													
USF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1m	37	12	1	0	0	0	0	0	0	0	0	0	0
within 2m	68	56	39	3	2	0	0	0	0	0	0	0	3
within 3m	83	78	71	42	39	1	0	0	0	0	0	0	14
within 4m	89	88	87	69	68	31	18	7	3	1	3	6	39
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 2m	13	12	8	0	0	0	0	0	0	0	0	0	0
within 4m	34	32	23	15	13	6	2	0	0	0	0	0	8
within 6m	61	57	42	31	27	19	16	13	10	8	8	7	21
within 8m	75	71	62	49	45	33	28	26	24	23	23	23	35

A.3 GROUNDWATER MANAGEMENT

Kooba area: % of Land with groundwater within specified depth

USF	Sep-96	Sep-00	Sep-02	Sep-04	Sep-06	Sep-07	Mar-08	Sep-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-11
within 1m	17	24	2	0	0	0	0	0	0	0	0	0	1
within 2m	87	84	44	10	6	1	1	1	1	1	1	1	3
within 3m	99	98	86	57	27	10	7	4	2	2	2	3	10
within 4m	100	100	98	87	75	34	29	17	14	10	13	14	23
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1 m	3	1	0	0	0	0	0	0	0	0	0	0	0
within 2m	53	53	11	1	0	0	0	0	0	0	0	0	0
within 3m	86	83	64	8	3	0	0	0	0	0	0	0	0
within 4m	97	93	85	49	18	1	0	0	0	0	0	0	1

Bilbul Yenda area: % of Land with groundwater within specified depth

USF	Sep-96	Sep-00	Sep-02	Sep-04	Sep-06	Sep-07	Mar-08	Sep-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-11
within 1m	33	24	0	0	0	0	0	0	0	0	0	0	0
within 2m	97	98	39	19	17	0	2	0	0	0	0	0	8
within 3m	100	100	100	89	70	51	53	25	3	17	15	24	65
within 4m	100	100	100	100	99	94	88	70	65	58	50	56	92
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1 m	16	22	1	0	0	0	0	0	0	0	0	0	0
within 2m	74	73	60	23	11	0	1	0	2	0	0	0	7
within 3m	86	84	77	69	59	38	27	18	28	22	11	12	65
within 4m	93	90	85	80	75	70	67	67	67	58	51	73	82

Hanwood Area: % of Land with groundwater within specified depth

USF	Sep-96	Sep-01	Sep-04	Sep-07	Sep-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-11
within 1m	4	0	0	0	0	0	0	0	0	0
within 2m	81	8	0	0	0	0	0	3	0	1
within 3m	97	90	18	2	1	3	1	12	4	12
within 4m	100	98	84	23	13	15	8	28	19	28
LSF	**Sep-96**	**Sep-01**	**Sep-04**	**Sep-07**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1 m					0	0	0	0	0	0
within 2m					0	0	0	0	0	0
within 3m					0	0	0	0	0	1
within 4m					3	3	3	0	3	4

Murrami / Koonadan ooba area: % of Land with groundwater within specified depth

USF	Sep-96	Sep-00	Sep-02	Sep-04	Sep-06	Sep-07	Mar-08	Sep-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-11
within 1m	39.8	44.2	46.2	2.4	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.6
within 2m	91.3	90.1	78.1	49.9	18.7	1.0	0.9	0.1	0.8	0.1	0.2	0.9	13.4
within 3m	99.4	99.7	96.0	85.1	76.4	27.3	16.8	10.3	10.1	3.8	2.9	8.7	39.6
within 4m	100.0	100.0	100.0	96.5	95.4	70.8	58.7	48.8	40.2	30.5	27.4	31.7	66.3
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1 m	13.8	17.7	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
within 2m	75.7	71.9	52.7	11.8	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
within 3m	98.6	97.4	81.8	58.8	46.8	10.3	4.1	0.0	0.5	0.4	0.0	0.0	13.0
within 4m	99.8	100.3	98.7	88.6	80.8	38.8	20.7	8.4	17.4	1.8	6.5	4.0	45.9

Gogeldrie / Yanco area: % of Land with groundwater within specified depth

USF	Sep-96	Sep-00	Sep-02	Sep-04	Sep-06	Sep-07	Mar-08	Sep-08	Mar-09	Sep-09	Mar-10	Sep-10	Mar-11
within 1m	0.4	1.5	0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
within 2m	31.2	26.7	12.4	4.0	0.7	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.7
within 3m	62.4	56.4	44.0	30.7	12.8	1.6	1.2	0.9	0.5	0.3	0.2	0.3	2.4
within 4m	95.3	82.4	67.7	49.9	44.1	12.1	6.9	3.4	1.5	3.4	1.1	1.4	5.8
LSF	**Sep-96**	**Sep-00**	**Sep-02**	**Sep-04**	**Sep-06**	**Sep-07**	**Mar-08**	**Sep-08**	**Mar-09**	**Sep-09**	**Mar-10**	**Sep-10**	**Mar-11**
within 1 m	1.0	1.8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
within 2m	27.1	23.1	4.6	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
within 3m	58.1	48.3	37.1	13.5	7.3	0.6	0.8	0.0	0.0	0.0	0.0	0.0	0.0
within 4m	87.1	73.4	60.8	36.1	35.5	2.9	3.1	0.0	0.0	0.0	0.0	2.1	25.4

Figures taken from 'Groundwater Conditions and Behaviour in the MIA, Ary van der Lely, 2011'.

Figure 3.2.i: Groundwater piezometers currently being read

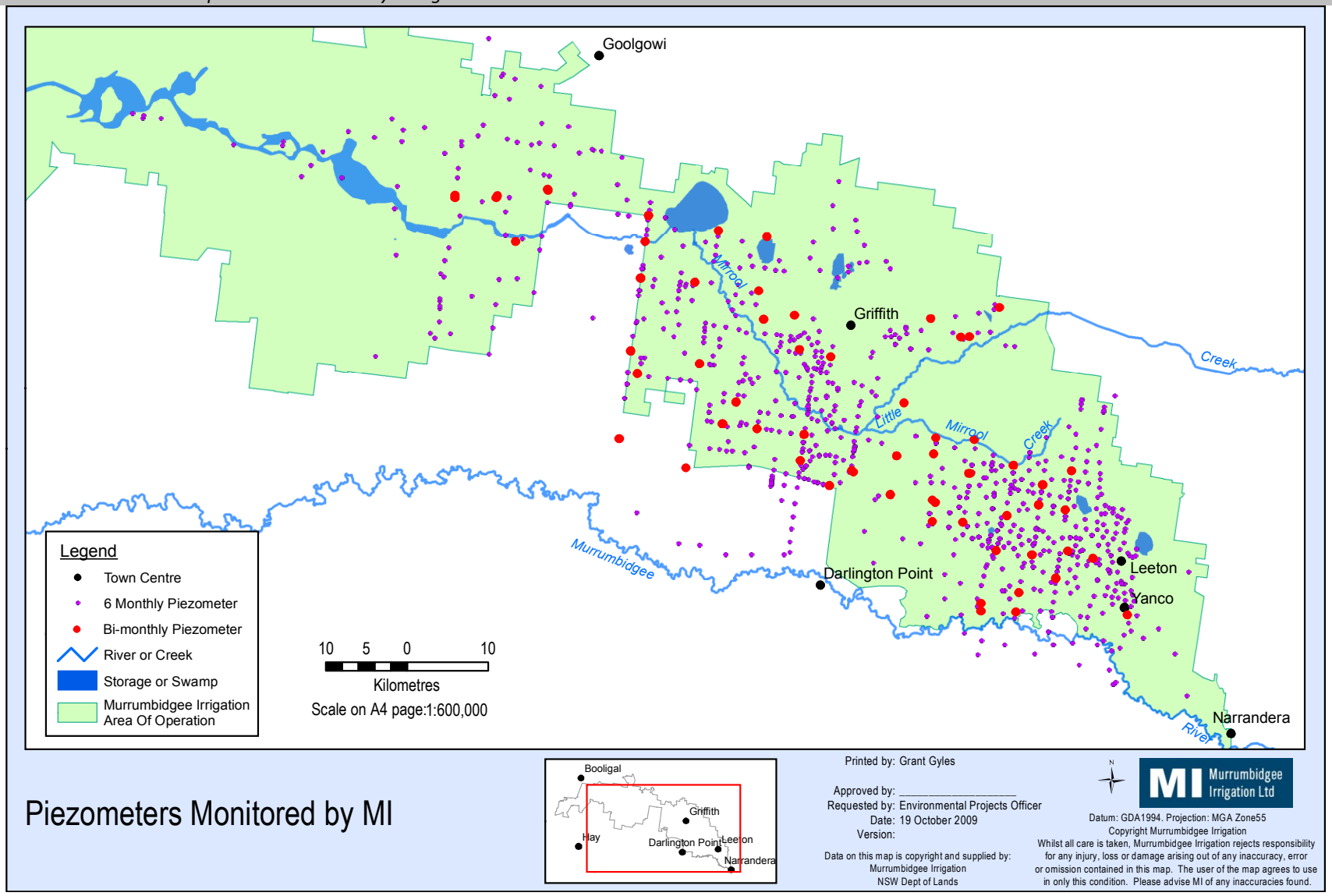
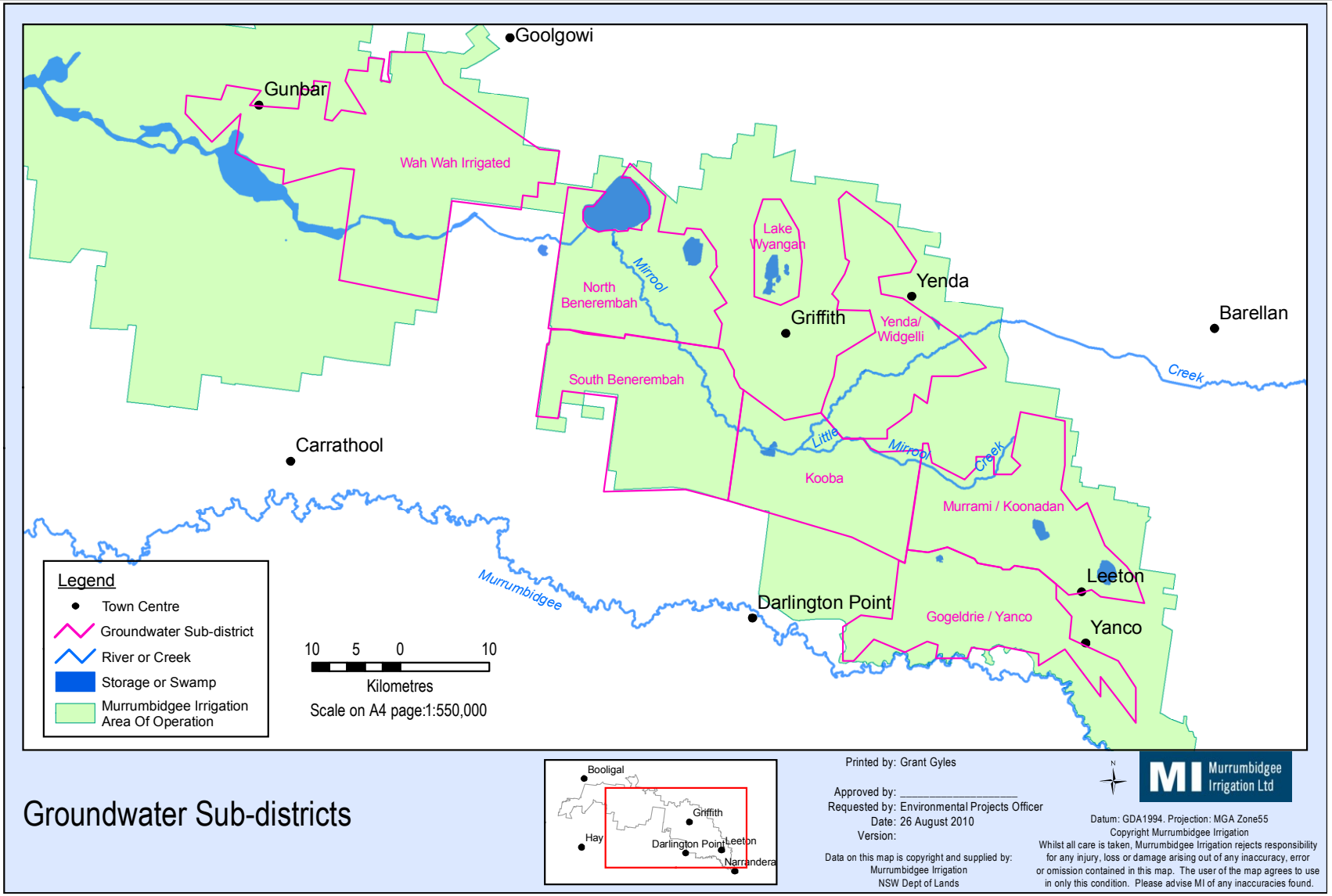


Figure 3.2.j: Groundwater sub-districts



A.4 FLOODS AND FLOODPLAIN MANAGEMENT

A.4.2 REPORTING REQUIREMENTS

A.4.2 (1 & 2) FLOOD LEVELS, FLOODPLAIN STRUCTURES, FLOOD RELEASES

Floodway releases are the last resort effect of flows arriving at Willow Dam, which are surplus to the Wah Wah irrigation and stock and domestic requirements and cannot be stored for future supply.

There were no deliberate releases into the floodway during the 20010/11 season due to the ability to better manage drainage flows arriving at Barren Box Storage and wetland as a result of the improved operating efficiency from the reconfiguration works.

There were no modifications or new works relevant to these conditions during the year

A.4.2 (3 & 4) FLOOD REPORTING – LOWER MIRROOL CREEK FLOODWAY

There were no major works undertaken other than assisting Wyvern Station with their noxious weed control as part of a negotiated agreement with Wyvern Station.

The company is working closely with appropriate councils, who have recently obtained funding for undertaking flood studies.

There were no modifications or new works relevant to these conditions during the year.

A.5 AQUATIC ENVIRONMENT MANAGEMENT

A.5.2 REPORTING REQUIREMENTS

A.5.2(1) SIGNIFICANT CHANGE TO MAJOR WETLANDS

During 2010/2011, ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of wetlands continued. The projects which are in various stages of completion include the following:

Barren Box Storage and Wetland (BBSW)

BBSW Rehabilitation Plan has moved into the implementation stage with all major works to be completed by 2014 following which management will continue on an on-going basis.

The vision for the BBSW Rehabilitation Plan is 'To create an ecologically diverse and functioning Black Box wetland cell and surrounding grassy woodland/chenopod shrubland that also respects, preserves, and enhances the cultural significance of the area, by example to promote stewardship of regional natural resources.'

This vision will be achieved through the revegetation of the wetland cell, the management of weeds, the management of pest animals and the management of fire.

Since 2009, the entire 1,650 hectares of the wetland cell has been direct seeded or aerial sown with locally collected native vegetation species. The outer perimeter of the cell supports a Boree grassland environment and the inner and wetter sections support a Black Box community. A monitoring program is currently being developed to monitor the success of the revegetation program.

In October 2010, OEH (formerly NSW Department of Environment, Climate Change and Water (DECCW)) provided MI with 3000ML of Commonwealth Environmental Water for use at BBSW for use in the rehabilitation of the ephemeral wetland cell. The environmental water will aid in the re-establishment of Black Box *Eucalyptus largiflorens* and associated ephemeral wetland community and provide habitat for waterbirds and other wetland dependant species.

Thirty kilograms of Black Box seed was aerially sown over a 500 hectare area that was inundated following the delivery of the environmental water. Optimum conditions prevailed and monitoring quadrants will determine the success of the aerial sowing project.

BBSW Waterbird Monitoring

In order to understand the ecological outcomes of the wetland rehabilitation, it is important to understand what species are currently using the wetland. For this purpose a detailed waterbird monitoring program of the intermediate cell was initiated in April 2007 with the objective of these surveys to establish baseline data on waterbird species and abundance in the MIA.

A.5 AQUATIC ENVIRONMENT MANAGEMENT

The Barren Box Intermediate Cell Waterbird Study Final Report 2008-2010 was completed in June 2010 and concerns the Intermediate storage cell which covers an area of 320 hectares. The diversity, numbers and distribution of waterbirds within the Intermediate cell were quantified from mid March 2008 to the end of March 2010 and relationships were tested with seasons and variations in water volume in the cell.

Following completion of the waterbird study Murrumbidgee Irrigation agreed to extend the study period for a further two years with surveys conducted on a monthly basis to enable comparisons of abundance and species richness over a longer timeframe.

By contrast, the period covered by the 2010/11 report was exceptionally wet and natural wetlands were flooded over much of eastern Australia. The intermediate cell had high water volumes throughout almost all of the study period, with no significant drying during the summer months as occurred in previous years. Compared to previous years, the total number of waterbirds and the percentage of surveys on which most species were recorded were all significantly lower. The most likely explanation for the low diversity and numbers of waterbirds compared with the previous two years is that the birds were able to move to other wetlands to breed or feed.

Mirrool Creek Crown Reserve

The Mirrool Creek project is being implemented as an 'icon' project for the MIA.

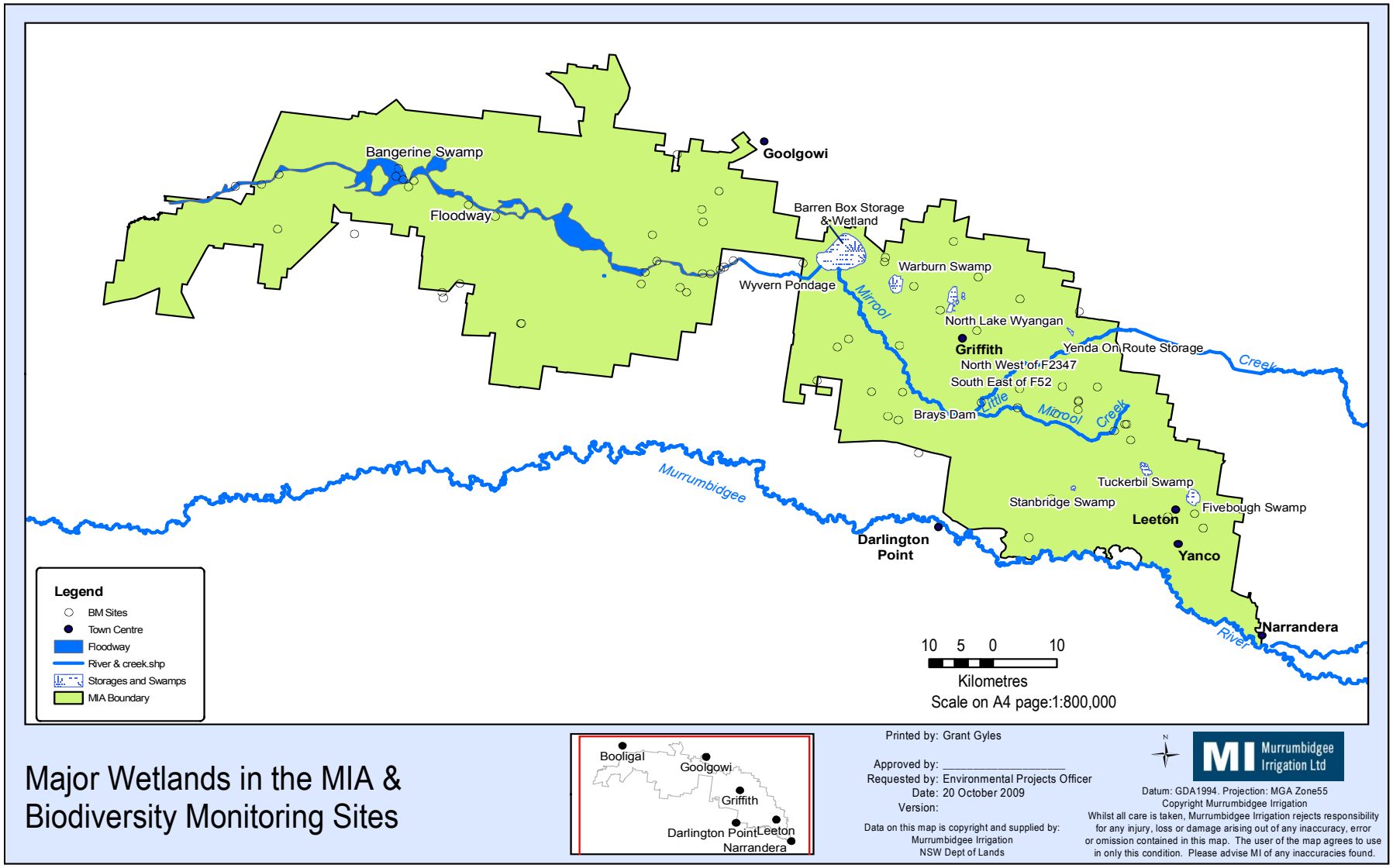
An engagement process was undertaken with adjoining landholders in 2010/11 to negotiate licence agreements between the Mirrool Creek Reserve Trust and interested parties. The licence agreements guide the management of the creek for biodiversity purposes in accordance with permissible uses.

One hundred and twenty five hectares was direct seeded on the creek in early 2011 with a further 300 hectares planned for direct seeding in spring 2011. Cultural Assessments conducted by Murrumbidgee Irrigations Cultural and Heritage Officers preceded all plantings. Sighted artefacts are visibly marked with marker flags and a two metre buffer zone is determined around each site to prevent disturbance. Artefacts include cores, tools, flaked materials, grinding stone fragments and hearths (ovens).

Monitoring quadrants will determine the success of the direct seeding program.

The hydrology model of Mirrool Creek was completed in November 2010. The model was used to determine bank heights to allow for a more natural flood regime to improve the ecology of the creek. Bank construction based model commenced in May 2011. To date 3.5 kilometres of bank reconstruction has been completed.

Figure 5.2.a: Major Wetlands in the MIA & Biodiversity Monitoring Sites



A.5.2 (3) NOXIOUS WEEDS

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Inspections have been carried out at BBSW, the downstream channel systems and at the floodway in Wyvern Station.

Barren Box Storage and Wetland

Inspections and treatment took place in February 2011. There were six plants found, five were in the Bio-wash and the other in Crumps Lease. The Crump Lease plant was quite large measuring 10 x 15 square meters.

Channel System

Only one plant was found, this was on Channel 3A.

Floodway

No plants were found in the floodway.

Outfall Channel

One plant measuring 4 x 4 meters squared was found downstream of the Floodway Offtake Doors.

Treatment

All Alligator Weed found has been treated with Brushoff. GPS co-ordinates have been taken and recorded. The two large plants found were hand removed and buried at BBSW, a follow up spray of the By-wash by Riverina Helicopters was conducted ready for November 2011 inspections.

Sagittaria - Griffith Area

Inspections of Sagittaria during 2010/11 were carried out monthly from September through to the end of June; plants are treated with Roundup Biactive in accordance with an APVMA off label permit for use to the rate of up to 10L per 100L or 40L per hectare. Permit: 11856.

In July 2010, MI treated approximately 17 hectares of drainage channels infested with Sagittaria with Casoron G, this was followed up with another treatment in July 2011. APVMA Permit: 11720

MI has approved two research projects aimed at controlling aquatic weeds including Sagittaria. One project involves a biological control agent, while the other aims to collect data relating to rates and efficacy for the registration of an alternate chemical with the APVMA.

A.6 GENERAL ENVIRONMENT MANAGEMENT

A.6.3 REPORTING REQUIREMENTS

A.6.3 (1) REGISTER OF ACTIVITIES

A *register of activities* is ordinarily required by a determining authority, generally being a Government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning and Assessment Act. However, as this remains a licence requirement, despite the privatisation of MI, it is addressed below.

No Statement of Environmental Effects (SEE) or Environmental Impact Statements (EIS) were undertaken in 2010/11. The table below lists the SEE's, EIS's and environmental assessments completed for the last five reporting years.

Table 6.3.a: Register of activities – July 2001 to June 2011

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline project	SEE	MI	February 2005

Source: MI Environmental Services

A.6.3 (2) SIGNIFICANT CHANGES AND CONDITION OF ENVIRONMENT ASSETS

Monitoring and management of environmental assets in the MIA

Remnant protection and local native species revegetation
Biodiversity incentives are available to MI customers to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant vegetation protection and enhancement through fencing and direct seeding; incentives in the form of seedlings, tree guards and fencing for new plantings, or plantings that provide vegetation links creating corridors for the movement of flora/fauna within the MIA.

For the reporting period 1 July 2010 to 30 June 2011, 50 hectares of new plantings, 160 hectares of enhanced remnants, and 86 hectares of direct seeding took place to increase the area of native vegetation within the MIA. This remnant protection and local native species revegetation was done under Property Vegetation Plans (PVP's) funded by the Murrumbidgee Catchment Management Authority and MI (via the MIA EnviroWise levy) NSW State Government and MIA EnviroWise.

Murrumbidgee Irrigation customers are required to complete PVP's to be eligible for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder. In 2010/11, 21 PVP's were completed and approved by the MCMA which will lead to the revegetation of 193 hectares of land and the management of 160 hectares of remnant vegetation.

Figure 6.3.a: Remnant Vegetation of the Murrumbidgee Irrigation Area

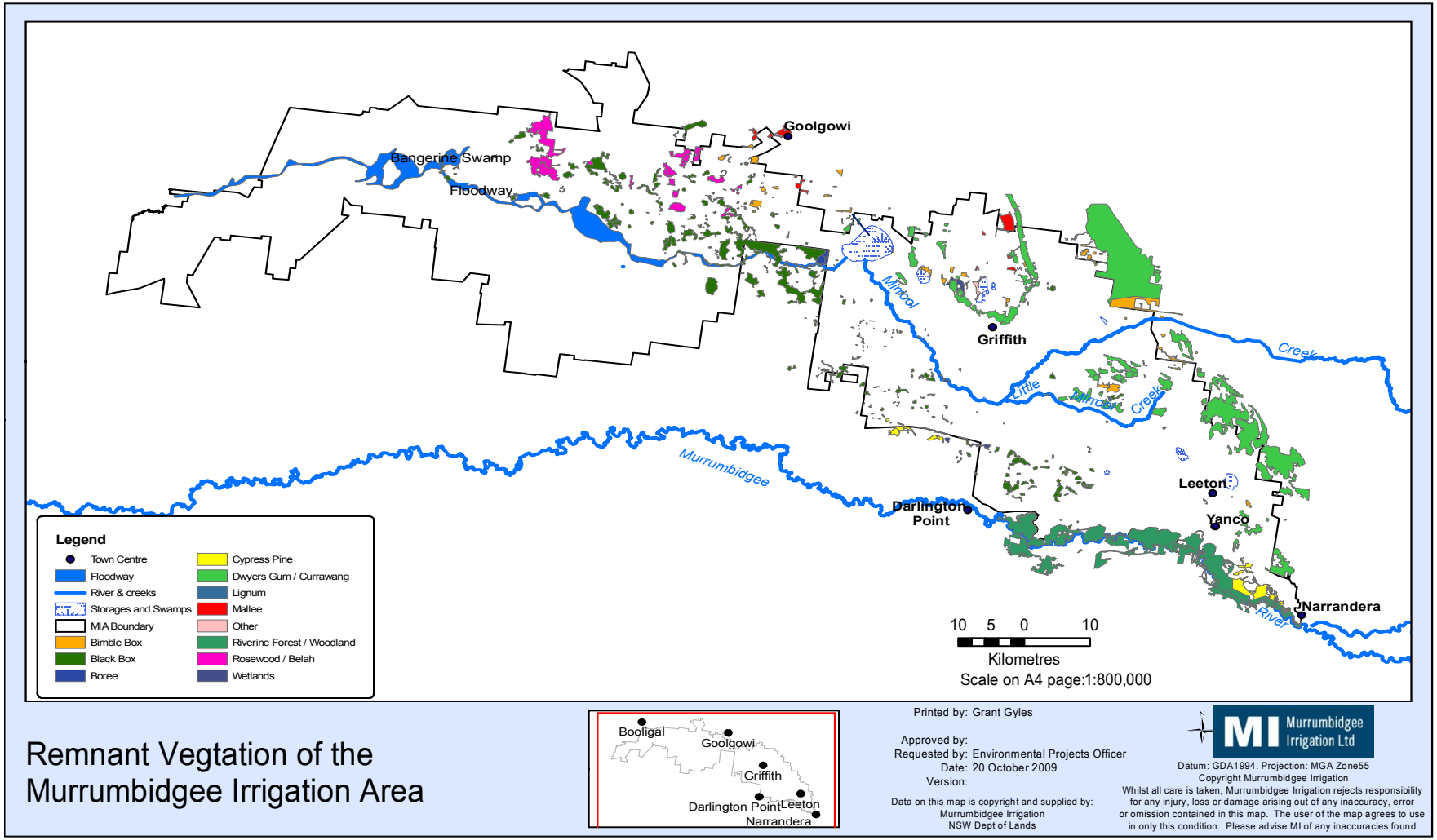
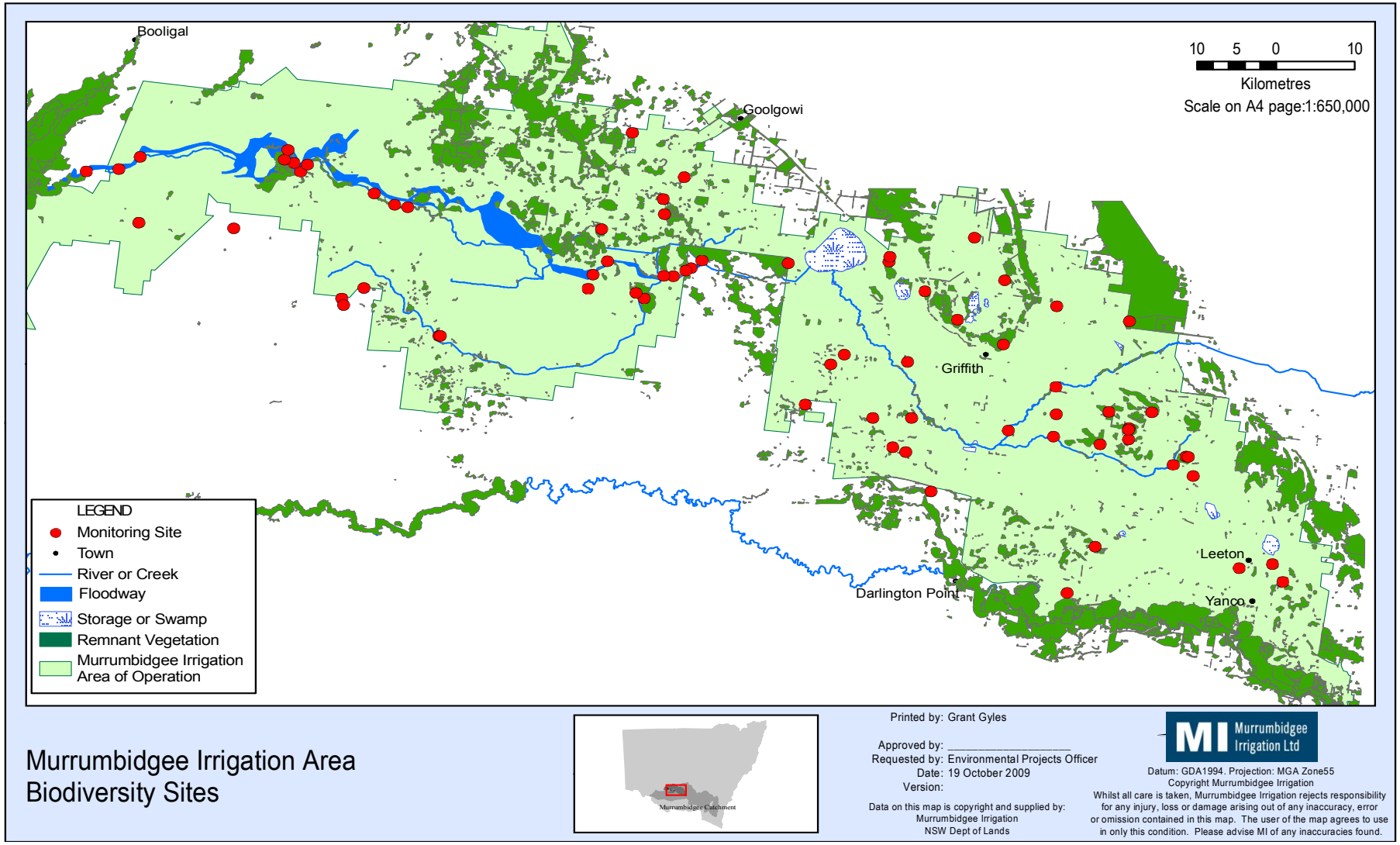


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



A.6.3 (3) SOIL SALINITY SURVEY (EVERY THREE YEARS)

Pending the outcome of the review of the company's licence with the NOW and the outcome of the CSIRO hydro-ecological assessment project, the soil salinity survey has been suspended.

MI is committed to develop a more effective way to monitor and improve soil salinity. Further it is expected that the outcomes from the CSIRO research will assist in the development of a more appropriate regional soil salinity assessment method. While the CSIRO project will not develop a methodology the outcomes will be used to guide the development of a new risk based approach to monitoring soil salinity.

The risk based approach will involve identifying an area where change is likely to occur or has recently occurred (such as the replacement of an open channel system with pressurised piping) and monitoring that area more in-depth for a predetermined period of time to establish if the change will have or has had an effect on soil salinity. The information collected will then be used in developing future programs. This approach will provide a more effective and targeted way to use our resources and will assist in identifying the salinity risk for future developments and planning in the MIA and Districts.

A.7 SALINITY MANAGEMENT AND ACCOUNTING

A.7.4 REPORTING REQUIREMENTS

A.7.4 (1) FLOW, SALT LOAD AND SALINITY DATA

Refer to Drainage Volumes, Table 2.2.k, page 19-20, for flow data.

Refer to Salt Loads, Table 2.2.l, page 22-23, for salt load data.

Refer to refer to Table M.5, page 72, for salinity data.

A.7.4 (2) NOTICE FOR COMPLIANCE WITH SALINITY AND DRAINAGE STRATEGY

No written notice was received for the period.

There were no changes in operations and practices that could change the long-term salt discharges from the Area of Operation. For more detail see commentary on Table 2.2.k.

A.7.4 (3) SALT LOAD DISCHARGES

Refer to Salt Loads, Table 2.2.l, page 22-23.

A.7.4 (4) SALINITY IN BARREN BOX OUTFALL DRAIN AGAINST BENCHMARK

Figure 7.4.a Salinity trend for Barren Box Outfall against benchmark

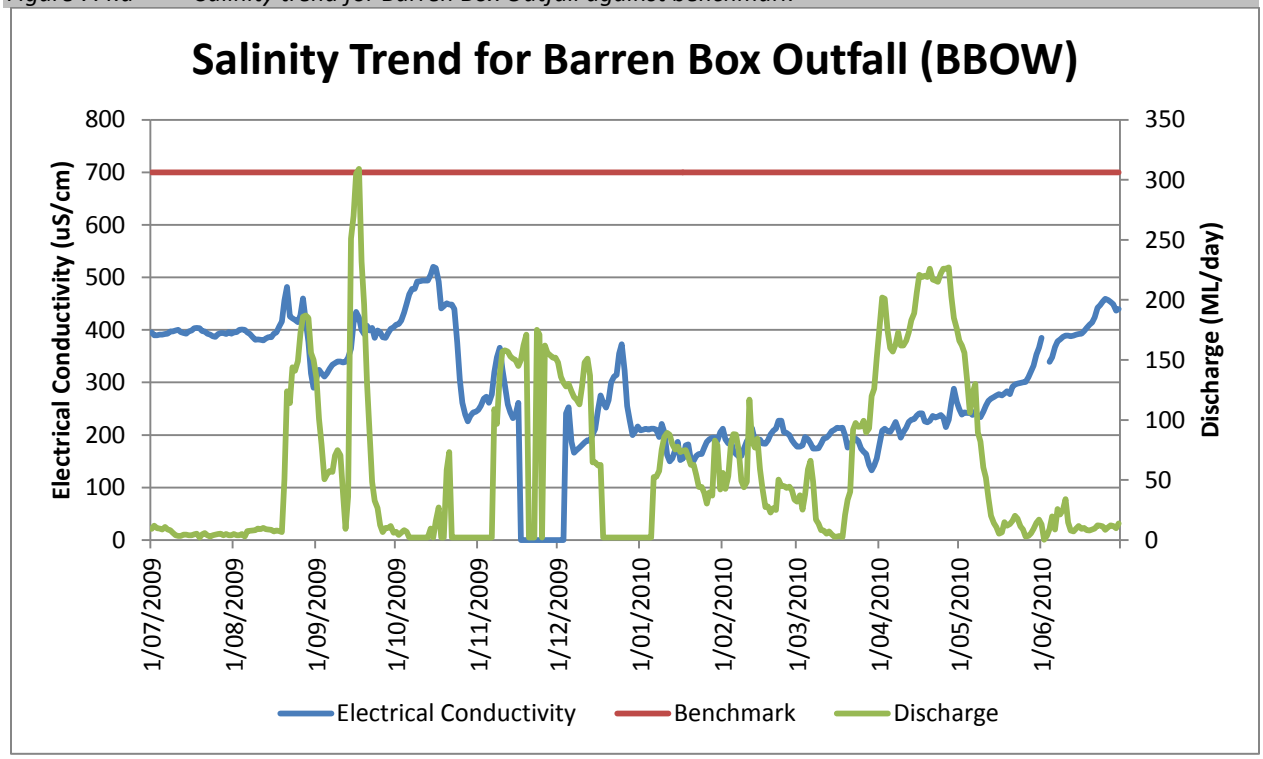


Figure 7.4.a shows the salinity trend for Barren Box Outfall against the benchmark of 700 EC. The figures presented are daily averages. The figure shows that during low flow or no flow conditions, the salinity levels are generally higher. It is evident that for the 2010/11 irrigation season the quality of water discharged from the Barren Box Outfall Channel for supply to the Wah Wah Irrigation District has been satisfactory with EC levels well below the identified 700 EC benchmark limit.

WATER QUALITY MANAGEMENT

Following new licence provisions negotiated with the OEH, the Water Quality Program that has been trialled over the past two seasons has been implemented under licence from July 1 2010. The details of the new Monitoring Program are explained in Section A.2.3 of this report.

As part of the risk based water quality program, supply water quality was measured three times during the season and trace levels of some chemicals were found and reported to the OEH. The program will continue to monitor the quality of supply entering our system identifying potential risk trends, aiming to better understand the potential impacts on linkages with drainage water quality. MI has no control over the quality of water in the Murrumbidgee River upstream of our major off takes, therefore it is important that this information is available in case of detections of those same chemicals in the drainage channels. As expected, the number of detections of chemicals in our drainage water increased compared to previous years. The reason for the increase is the more targeted approach of the new program and heavy rain fall events. It is expected that the increase in detections will happen for a number of years until we have gained a better understanding of where and when pollution occurs. This will then allow us to develop strategies and education programs to reduce the detections and therefore increase the quality of our drainage water. All notification and action level detections have been reported in Tables M3 and M4.

The risk based water quality sampling has been instrumental in identifying risk areas in each sub catchment and further isolating detections, in some instances allowing the point of contamination to be sealed off. After identifying risk areas, MI coordinated several media releases promoting safe use of pesticides in the MIA outlining obligations to comply with the Pesticide Act 1999 during the 2010/11 season. This information was also distributed through MI shareholder networks, key stakeholder and industry groups. Positive outcomes have included awareness of MI sensitive areas where potential for contamination exists.

Table M.1: Office of Environment and Heritage compliance requirements

OEH Licence	Issue/requirement	Compliance/reference	Page No.
	Location of monitoring sites	Table M.2	66
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	Requirements to monitor concentration of pollutants discharged		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Table M.3 & M.4	67-72
	Chlorpyrifos (Monthly)	Table M.3 & M.4	67-72
	Conductivity	Table M.5	72
	Diazinon (November)	Table M.3 & M.4	67-72
	Diuron (Monthly)	Table M.3 & M.4	67-72
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	67-72
	Flow (Monthly) LW6	Table 2.2.k Table 2.2.g	19-20 16
	Malathion (Oct/Nov)	Table M.3 & M.4	67-72
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Nitrogen (>5mg/L)	Table M.3 & M.4	67-72
	Phosphorus (>5mg/L)	Table M.3 & M.4	67-72
	Simazine (Monthly)	Table M.3 & M.4	67-72
	Thiobencarb (Nov)	Table M.3 & M.4	67-72
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Turbidity	Table M.5	72
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 2.2.k	19-20
M3	**Testing Methods – concentration limits**		
	Approved by OEH	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11 and 12		
	Atrazine (Monthly)	Table M.3 & M.4	67-72
	Chlorpyrifos (Monthly)	Table M.3 & M.4	67-72
	Conductivity (Monthly)	Table M.5	72
	Diazinon (Nov)	Table M.3 & M.4	68-73
	Diuron (Monthly)	Table M.3 & M.4	67-72
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	67-72
	Flow (Monthly)	Table 2.2.k	19-20
	Malathion (Oct/Nov)	Table M.3 & M.4	67-72
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Simazine (Monthly)	Table M.3 & M.4	67-72
	Thiobencarb (Nov)	Table M.3 & M.4	67-72
	Nitrogen (>5mg/L)	Table M.3 & M.4	67-72
	Phosphorus (>5mg/L)	Table M.3 & M.4	67-72
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Turbidity	Table M.5	72

*Table M.1: Office of Environment and Heritage compliance requirements (***cont.)**

DEC Licence	Issue/requirement	Compliance/reference	Page No.
	Monitoring Sites 13 and 14		
	Atrazine (Monthly)	Table M.3 & M.4	67-72
	Chlorpyrifos (Monthly)	Table M.3 & M.4	67-72
	Conductivity (Monthly)	Table M.5	72
	Diazinon (Nov)	Table M.3 & M.4	67-72
	Diuron (Monthly)	Table M.3 & M.4	67-72
	Endosulfan (Monthly) (alpha & beta)	Table M.3 & M.4	67-72
	Malathion (Oct/Nov)	Table M.3 & M.4	67-72
	Metolachlor (Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Simazine (Monthly)	Table M.3 & M.4	67-72
	Thiobencarb (Nov)	Table M.3 & M.4	67-72
	Nitrogen (Monthly)	Table M.3 & M.4	67-72
	Phosphorus (Monthly)	Table M.3 & M.4	67-72
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table M.3 & M.4	67-72
	Turbidity (Monthly)	Table M.5	72
	M7.2 Conductivity Sites 1 & 9	Table M.5	72
	M7.3 Molinate	Table M.3 & M.4	67-72
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Electronically recorded, Page 56	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	OEH contacted Table R.1, Page 76	
R3	**Written report**		
	R3.1 Send reports to OEH at their request, regarding environmental harm	OEH sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	OEH contacted, Table R.1, Page 76	
R5	**Annual report**		
	R5.1 Submit annual report to OEH	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 2.2.b Table 2.2.k A.3.2(4) Table R.1 Table R.1	13 19-20 40 73-76 73-76
	R5.4 Send copies to OEH, DII and MDBC	Submitted	

Table M. 2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	DEC Site No.	Continuous Monitoring Site
410167	BBOW	Barren Box Outfall Canal Wyvern	1	*
410174	MDJWE	Main Drain J Upstream of Warburn Escape	2	*
410085	LMC	Little Mirrool Creek	3	*
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	4	*
41010921	GMSRR	Gogeldrie Main Southern Drain	5	*
410083	YMS[#]	Yanco Main Southern Drain	6	*
41010005	ROCUDG	Cudgel Creek Roaches Escape	7	*
41010162	WS	Warburn Swamp	8	
41010955	MIRMCN	Mirrool Creek at McNamara Road	9	*
41010908	BYD	Bray's Dam Diversions and Bywash	10	
41010990	BBST	*This site no longer exists, due to the construction of Barren Box Storage and Wetlands*	11	
41010896	LW6	Lake Wyangan Causeway	12	
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	13	
41010157	TKBS	Tuckerbil Swamp By-pass drain	14	
41010163	MIRFLD	Mirrool Creek Floodway (when being used)	15	
Other Sites Required for DNR Licence				
41010903	BBO	Barren Box Outfall		
41010978	WWO	Willow Dam		

[#] **Note :** There was very little flow at these sites. Flow ceased draining to river and is now diverted (Pumped or gravity-fed) to the supply system.

Table M. 3: Benchmark sampling monitoring

Site	EMR	NARREG	STUR	BYD	BARDENS	3WAYS	PENFOLDS
Nitrite + Nitrate as N (LOR 0.01mg/L)							
Sep	NT	NT	NT	NT	NT	NT	NT
Jan	0.32	0.11	0.06	1.36	0.67	0.09	0.09
May	0.06	0.19	0.2	0.01	0.06	<0.01	<0.01
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)							
Sep	NT	NT	NT	NT	NT	NT	NT
Jan	0.5	0.7	0.5	2.2	1.7	0.6	0.6
May	0.4	0.5	0.4	0.5	1.2	0.5	0.4
Total Nitrogen as N (LOR 0.1mg/L)							
Sep	0.7	1.4	1.3	3	2.5	2	1.8
Jan	0.8	0.8	0.6	3.6	2.4	0.7	0.7
May	0.5	0.7	0.6	0.5	1.3	0.5	0.4
Total Phosphorus as P (LOR 0.01mg/L)							
Sep	0.1	0.19	0.1	0.29	0.25	0.21	0.12
Jan	<0.01	<0.01	0.14	0.14	0.12	0.05	0.23
May	0.14	0.2	0.14	0.51	0.16	<0.01	0.17
Biochemical Oxygen Demand							
Sep	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT
May	4	4	3	3	4	4	4
Simazine (LOR = 0.005 µg/L)							
Sep	0.026	0.141	0.037	0.629	0.39	0.416	0.369
Jan	0.012	0.011	<0.005	0.121	0.026	0.012	0.014
May	<0.005	0.021	0.209	0.016	0.007	<0.005	<0.005
Diuron (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	0.096	<0.005	<0.005	<0.005
May	0.019	0.658	0.723	1.52	0.775	0.656	0.036
Atrazine (LOR = 0.005 µg/L)							
Sep	0.011	0.202	0.034	0.525	0.278	0.308	0.265
Jan	0.014	0.017	<0.005	0.007	0.029	0.014	0.016
May	<0.005	0.023	<0.005	0.013	0.005	0.007	0.006
Molinate (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Metolachlor (LOL = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	0.07	0.048	0.061	0.042
Jan	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Table M. 4: Benchmark sampling monitoring (cont)

Malathion (LOR = 0.002 µg/L)							
Sep	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Jan	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
May	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diazinon (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thiobencarb (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorpyrifos (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trifluralin (LOR = 0.005 µg/L)							
Sep	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
May	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table M. 4: Trigger based sampling

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	EMR	WWO	FS	YMS	MDJY	LAG	GRI	ROCUDG
Nitrite + Nitrate as N (LOR 0.01mg/L)													
Jul	0.02	0.42	0.88	0.02	<0.01	NT	NT	NT	NT	0.6	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.94	NT	0.12
Oct	0.1	0.25	0.18	0.77	0.12	NT	NT	NT	NT	NT	0.05	NT	NT
Nov	0.45	0.97	1.19	0.34	0.51	NT	NT	3.14	NT	0.76	4.72	NT	0.02
Dec	NT	0.59	0.85	0.12	0.06	NT	NT	NT	NT	0.87	NT	NT	NT
Jan	0.67	NT	NT	0.67	1.36	0.32	NT	NT	NT	NT	0.02	NT	NT
Feb	0.32	0.76	0.69	0.46	0.38	NT	NT	0.82	1.9	0.37	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.78	0.54	NT	1.46	NT	0.28	NT	NT	0.39	NT	2.32	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)													
Jul	0.7	1.5	2.9	0.4	0.5	NT	NT	NT	NT	1.2	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2.1	NT	0.9
Oct	1	1	1.3	3	0.9	NT	NT	NT	NT	NT	23.9	NT	NT
Nov	1.6	2.1	2.7	2.1	1	NT	NT	2.9	NT	2.7	7.3	NT	2.5
Dec	NT	1.8	1.2	1.4	1.6	NT	NT	NT	NT	1.8	NT	NT	NT
Jan	1.7	NT	NT	2.1	2.2	0.5	NT	NT	NT	NT	2.2	NT	NT
Feb	0.7	0.7	0.8	1.8	0.9	NT	NT	1.9	1.4	0.9	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	1.1	1.2	NT	1.4	NT	1	NT	NT	1	NT	1	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Total Nitrogen as N (LOR 0.1mg/L)													
Jul	0.7	1.9	3.8	0.4	0.5	NT	NT	NT	NT	1.8	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	3	NT	1
Oct	1.1	1.2	1.5	3.8	1	NT	NT	NT	NT	NT	24	NT	NT
Nov	2	3.1	3.9	2.4	1.5	NT	NT	6	NT	3.5	12	NT	2.5
Dec	NT	2.4	2	1.5	1.7	NT	NT	NT	NT	2.7	NT	NT	NT
Jan	2.4	NT	NT	2.8	3.6	0.8	NT	NT	NT	NT	2.2	NT	NT
Feb	1	1.5	1.5	2.3	1.3	NT	NT	2.7	3.3	1.3	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	1.9	1.7	NT	2.9	NT	1.3	NT	NT	1.4	NT	3.3	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Total Phosphorus as P (LOR 0.01mg/L)													
Jul	0.02	0.27	0.67	0.02	<0.01	NT	NT	NT	NT	0.15	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	1.52	NT	0.12
Oct	0.05	0.2	0.29	0.28	0.43	NT	NT	NT	NT	NT	7.34	NT	NT
Nov	0.11	0.12	0.13	0.38	0.5	NT	NT	0.11	NT	0.22	1.96	NT	0.77
Dec	NT	0.07	0.22	<0.01	0.08	NT	NT	NT	NT	0.1	NT	NT	NT
Jan	0.12	NT	NT	0.15	0.14	<0.01	NT	NT	NT	NT	0.51	NT	NT
Feb	0.04	0.08	0.15	0.09	0.2	NT	NT	0.45	0.27	0.07	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.12	0.15	NT	0.22	NT	0.11	NT	NT	0.14	NT	0.16	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Table M. 4: Trigger based sampling (cont)

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	EMR	WWO	FS	YMS	MDJY	LAG	GRI	ROCUDG
Simazine (LOR = 0.005 µg/L)													
Jul	0.106	0.285	0.617	0.024	0.075	NT	NT	NT	NT	0.052	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.015	NT	<0.005
Oct	0.074	0.039	0.059	0.089	0.062	NT	NT	NT	NT	NT	4.86	NT	NT
Nov	0.08	0.086	0.099	0.054	0.031	NT	NT	5.09	NT	<0.005	0.113	NT	0.026
Dec	NT	0.04	<0.005	2.59	0.039	NT	NT	NT	NT	<0.005	NT	NT	NT
Jan	0.026	NT	NT	0.239	0.121	0.012	NT	NT	NT	NT	0.077	NT	NT
Feb	0.02	0.016	0.022	0.022	0.022	NT	NT	1.31	0.038	0.018	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.304	0.73	NT	0.015	NT	0.07	NT	NT	0.598	NT	0.135	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Diuron (LOR = 0.005 µg/L)													
Jul	0.099	0.333	0.831	0.057	<0.005	NT	NT	NT	NT	1.57	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.476	NT	<0.005
Oct	0.05	0.146	0.098	0.066	0.044	NT	NT	NT	NT	NT	3.14	NT	NT
Nov	0.609	0.313	0.446	0.094	<0.005	NT	NT	6.83	NT	0.113	6.35	NT	<0.005
Dec	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Jan	<0.005	NT	NT	1	0.096	<0.005	NT	NT	NT	NT	0.41	NT	NT
Feb	0.092	0.115	0.124	0.025	0.046	NT	NT	2.58	0.071	0.03	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	1.15	1.55	NT	4.58	NT	1.24	NT	NT	0.852	NT	0.301	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Atrazine (LOR = 0.005 µg/L)													
Jul	0.024	0.033	0.016	0.006	0.008	NT	NT	NT	NT	0.015	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.006	NT	<0.005
Oct	0.058	0.029	0.016	0.011	0.183	NT	NT	NT	NT	NT	0.183	NT	NT
Nov	0.098	0.134	0.186	1.08	0.208	NT	NT	0.047	NT	0.109	0.098	NT	0.45
Dec	NT	0.044	0.039	0.054	0.067	NT	NT	NT	NT	0.042	NT	NT	NT
Jan	0.029	NT	NT	0.076	0.007	0.014	NT	NT	NT	NT	0.029	NT	NT
Feb	0.016	0.012	0.018	0.038	0.016	NT	NT	<0.005	0.045	0.014	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.051	0.071	NT	0.01	NT	0.053	NT	NT	0.014	NT	0.292	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Molinate (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	<0.005
Oct	<0.005	5.69	1.03	36.31	12.43	NT	NT	NT	NT	29.2	0.013	NT	NT
Nov	0.212	0.169	1.15	1.61	0.892	NT	NT	0.014	NT	20.69	0.086	NT	<0.005
Dec	NT	0.893	1.04	0.158	0.494	NT	NT	NT	NT	2.33	NT	NT	NT
Jan	<0.005	NT	NT	0.013	<0.005	NT	NT	NT	NT	NT	0.014	NT	NT
Feb	<0.005	<0.005	<0.005	0.006	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	NT	NT	<0.005	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Table M. 4: Trigger based sampling (cont)

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	EMR	WWO	FS	YMS	MDJY	LAG	GRI	ROCUDG
Metolachlor (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	0.018
Oct	0.017	0.01	<0.005	<0.005	0.077	NT	NT	NT	NT	NT	0.043	NT	NT
Nov	0.012	0.022	0.011	0.55	0.058	NT	NT	<0.005	NT	<0.005	0.057	NT	0.321
Dec	NT	<0.005	<0.005	0.062	0.063	NT	NT	NT	NT	<0.005	NT	NT	NT
Jan	0.006	NT	NT	0.113	<0.005	<0.005	NT	NT	NT	NT	0.013	NT	NT
Feb	<0.005	<0.005	<0.005	0.074	<0.005	NT	NT	<0.005	0.292	0.286	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	NT	NT	<0.005	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Malathion (LOR = 0.002 µg/L)													
Jul	<0.002	0.045	0.468	<0.002	<0.002	NT	NT	NT	NT	0.178	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.002	NT	<0.002
Oct	<0.002	0.015	<0.002	<0.002	<0.002	NT	NT	NT	NT	NT	<0.002	NT	NT
Nov	<0.002	<0.002	<0.002	<0.002	<0.002	NT	NT	<0.002	NT	<0.002	<0.002	NT	<0.002
Dec	NT	<0.002	<0.002	<0.002	<0.002	NT	NT	NT	NT	<0.002	NT	NT	NT
Jan	<0.002	NT	NT	0.209	<0.002	<0.002	NT	NT	NT	NT	<0.002	NT	NT
Feb	<0.002	<0.002	<0.002	<0.002	<0.002	NT	NT	0.005	<0.002	<0.002	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	0.396	0.484	NT	<0.002	NT	0.411	NT	NT	0.081	NT	0.303	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Diazinon (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	<0.005
Oct	<0.005	<0.005	<0.005	0.018	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT
Nov	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	<0.005	<0.005	NT	<0.005
Dec	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Jan	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT
Feb	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	NT	NT	<0.005	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Thiobencarb (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	<0.005
Oct	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT
Nov	0.269	0.334	0.141	0.081	0.055	NT	NT	<0.005	NT	0.187	0.036	NT	<0.005
Dec	NT	0.162	0.074	<0.005	0.115	NT	NT	NT	NT	0.17	NT	NT	NT
Jan	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT
Feb	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	0.008	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	NT	NT	<0.005	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Table M. 4: Trigger based sampling (cont)

Site	BARDENS	MIRMCN	MDJWE	LMC	BYD	EMR	WWO	FS	YMS	MDJY	LAG	GRI	ROCUDG
Chlorpyrifos (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	0.019	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	<0.005
Oct	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT
Nov	0.011	<0.005	0.014	0.015	<0.005	NT	NT	<0.005	NT	0.03	<0.005	NT	<0.005
Dec	NT	0.008	0.009	<0.005	<0.005	NT	NT	NT	NT	0.008	NT	NT	NT
Jan	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT
Feb	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	0.08	NT	0.03	NT	NT	0.007	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Trifluralin (LOR = 0.005 µg/L)													
Jul	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	NT	<0.005
Oct	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT
Nov	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	NT	<0.005	<0.005	NT	<0.005
Dec	NT	<0.005	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT	NT
Jan	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT	NT	<0.005	NT	NT
Feb	<0.005	<0.005	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
May	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	NT	NT	<0.005	NT	<0.005	NT
Jun	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table M. 5: Monthly Conductivity and Turbidity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results (us/cm)												
YMS	NF	NF	NF	NF	NF	NF	NF	889	NF	NF	NF	NF
GMSRR	1	NF	0	166	145	166	170	172	216	179	NF	124
LAG	NF	449	394	263	312	NF	268	197	274	375	330	NF
ROCUDG	236	219	186	158	159	NF	238	189	186	208	203	174
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Turbidity results (NTU)												
YMS	NF	NF	NF	NF	NF	NF	NF	423	NF	NF	NF	NF
GMSRR	NT	NF	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
LAG	NF	NT	76.3	195.0	630.0	NT	126.0	NT	NT	NT	NT	NT
ROCUDG	NT	43.5	39.0	NT	54.20	NT	NT	NT	NT	NT	12.5	NT

EC Results Source: Thiess

Turbidity Source: MI field data

NT= Not tested

NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

Table R. 1: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Field Observations	Action Taken	Follow Up
Pesticide OEH Action Level				
MI Drainage site MDJWE	14/07/2010	Action level of Malathion	OEH notified via email 4/08/2010	Media Campaign for landholder locust chemical applications
Daltons	15/09/2010	Flood water. Action level of Metolachlor	OEH notified via email	Shandied with water through main canal
Drainage sites LMCU & LMC	19-20/10/2010	Action level of Molinate	OEH notified via email 27/10/2011	Further sampling conducted. Extensive media campaign advising withholding periods following chemical applications
Drainage Sites MDJY	28/10/2010	Action level of Molinate	OEH notified via email 3/11/2010	Further samples taken on the 29/10/2011
Yoogali & Fowler Rd DC North – 11 OE	29/10/2010-2/11/2010	Follow up from Action levels of drainage sites MDJY & MDJWE. Action level of Molinate	OEH notified via email 3/11/2010	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
Drainage Sites: LAG, FS, LMC & ROCUG	15/11/2010	LAG & FS- Action level of Diuron, LMC & ROCUG- Action level of Metolachlor	OEH notified via email 19/11/2010	Run off from storm events, risk based approach - continue to monitor trends
Drainage Sites MDJY & MDJWE	15-17/11/2011	Action level of Molinate and subsequent sub catchment sampling, Action level of Molinate	OEH notified via email 19/11/2010	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
Yoogali	29/11/2010-1/12/2010	Action level of Molinate and subsequent sub catchment sampling	OEH notified via email	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
Drainage Site LMC	11/01/2011	Action level of Malathion & Metolachlor	OEH notified via email 18/02/2011	Risk based approach - continue to monitor trends
Drainage Site YMS, MDJY	3/02/2011	Action level of Metolachlor	OEH notified via email 18/02/2011	Run off from storm events, risk based approach - continue to monitor trends
MI Drainage sites MIRMCN, MDJWE, WWO & GRI	24/05/2011	Action level of Malathion	OEH notified via email 14/06/2011	Meeting OEH & DII 6/06/2011. Media campaign, MI shareholder newsletter and industry group networking advising Landholder chemical use obligations planned for August to coincide with Fruit fly baiting program and government compulsory spray order

Pesticide OEH Notification level				
MI Drainage Sites: MDJY & MDJWE	14/07/2010	MDJY- Notification levels of Diuron & Malathion, MDJWE- Notification level Clorpyrifos	OEH notified via email	Media Campaign for landholder locust chemical applications
Daltons	13/09/2010	Flood water. Notification level of Metolachlor	OEH notified via email	Shandied with water through main canal
MI Drainage Sites: BYD, BARDENS, 3WAYS, PENFOLDS	27/09/2010	Notification level of Metolachlor	OEH notified via email	Risk based approach - continue to monitor trends
MI Drainage Sites: LMC, LAG & BYD	14/10/2010	LMC-Notification level of Diazinon, LAG- Notification level of Simazine, Diuron & Metolachlor, BYD- Notification level of Metolachlor	OEH notified via email	Risk based approach - continue to monitor trends
MI Drainage Sites MIRMCN & BYD	20/10/2010	Notification level of Molinate	OEH notified via email 27/10/2010	Further sampling conducted. Extensive media campaign advising withholding periods following chemical applications
Daltons	25/10/2010	Floodwater. Notification level of Metolachlor	OEH notified via email	
WYVERN	25/10/2010	Floodwater. Notification level of Metolachlor	OEH notified via email	Risk based approach - continue to monitor trends
MI Drainage Sites MDJWE, MDJY & Yoogali	2/11/2010	Notification level of Molinate	OEH notified via email 3/11/2010	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
MI Drainage Site MDJY	9/11/2010	Notification level of Molinate	OEH notified via email 10/11/2010	Risk based approach - continue to monitor trends
MI Drainage MI Site LMCU	15/11/2010	Notification level of Molinate	OEH notified via email 19/11/2010	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
MI Drainage Sites: FS, LMC, BARDENS, MDJWE, MDJY, MIRMCN, BYD & LAG	15/11/2010	FS-Notification level of Simazine, LMC, BARDENS, MDJWE & MDJY- Notification level of Chlorpyrifos, LAG- Notification level of Molinate, MIRMCN, BYD & LAG- Notification level of Metolachlor	OEH notified via email 19/11/2010	Run off from storm events, risk based approach - continue to monitor trends
Yoogali	22/11/2010	Notification level of Molinate	OEH notified via email	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
MI Drainage Site MDJY	29/11/2010	Notification level of Molinate	OEH notified via email	Successfully identified source of contamination, earth block placed to contain drainage water from entering system 28 days. Landholder interviewed
MI Drainage Sites: LMC & BYD	6/12/2010	Notification level of Metolachlor	OEH notified via email	Run off from storm events, risk based approach - continue to monitor trends
MI Drainage Sites LMC.	11/01/2011	Notification level of Diuron	OEH notified via email	Run off from storm events, risk based approach - continue to monitor trends

Pesticide OEH Notification level (cont)				
MI Drainage Sites FS & LMC	3/02/2011	FS-notification level of Diuron, LMC- Notification level of Metolachlor	OEH notified via email 18/02/2011	Run off from storm events, risk based approach - continue to monitor trends
MI Drainage Sites BYD	9/05/2011	Notification level of Diuron	OEH notified via email 26/05/2011	Risk based approach - continue to monitor trends
MI Drainage Sites BYD, MIRMCN, MDJWE, WWO & MDJY	24/05/2011	MIRMCN, MDJWE, BYD, WWO- Notification level of Diuron, MDJY- Notification level of Malathion, BYD & WWO- Notification level of Chlorpyrifos	OEH notified via email 14/06/2011	Meeting OEH & DII 6/06/2011. Media campaign, MI shareholder newsletter and industry group networking advising Landholder chemical use obligations planned for August to coincide with Fruit fly baiting program and government compulsory spray order
Other Pollution Events				
LMC	2/10/2010	Farm drainage into Little Mirrool Creek, Murrami reported leakage from rice bay.	On inspection no drainage was detected leaving the farm. Sample detected low levels of Molinate.	Further inspection of site was done to insure leak had been sealed.
LAG	3/10/2010	Reported small amount of water dripped out of recycle dam into DC1710 LAG drain from rat hole.	On inspection no drainage was detected leaving the farm	Site inspected
YMS	8/11/2010	Reported recycle pump had broken down and a small amount of treated and fresh water went into YMS before the leak was sealed.	Sample taken downstream showed low level of Molinate, below Notification level	Site inspected to ensure leak had been sealed.
DC- 2 - MP	29/10/2010	MI staff reported black polluted water entering DC -2 MP at Harwood Rd from pipe.	Site inspection with GCC 5/11/2010 requesting stop pollution & clean up order. Factory contacted and directed to cease flow and pipe removal.	Further contact made to GCC 10/11/2010 to request stop pollution action as water was observed entering drain from the pipe again. GCC placed clean up and stop pollution order. GGC advised clean up order rescinded due to advisement from independent report that clean up was not necessary. MI to conduct own sampling with any future pollution incidents.
DC 1311W	24/11/2010	GCC notified incident reported relating to a odorous substance entering MI drain on Hillston Rd, site inspection 24/11/2010 revealed discoloured water in drain from a factory to approx 400m downstream.	GCC compliance officer advised MI that GCC had issued a cleanup notice	Factory removed contaminated liquid via pump out truck supervised by MI.
DC 96 J	24/11/2010	GCC notified an incident reported relating to a odorous substance entering MI drain on Murray Rd, site inspection 24/11/2010 showed small amount of material in DC 96J . Minimal pollution not requiring removal.	Meeting with factory managers where the pollution occurred from	The factory arranged drain configuration modifications to ensure future factory wash down does not enter MI drainage system

Other Pollution Events (cont)				
Hanwood	13/12/2010	Water from ponds used to irrigate trees spilled into MI drain DC G	Manager contacted, spill was stoped soon as possible. .	Sample results taken from the ponds by the farm management on the 18/11/10 were sent to MI to check for pollutants and were found to be below guidelines.
Contour Road	14/2/2011	A small amount of water came across a worksite from a farm filling rice bays.	Site inspection and samples taken. The water did not reach Little Mirrool Creek	No Molinate detected
DC 727	9/03/2011	Landholder reported odorous material in drainage channel, site visit confirmed material entering through a pipe leading to house.	GCC notified	GCC advised a letter was sent to landholder. GCC advised MI that landholder has pumped out septic and site visit 29/6/2011 showed no further pollution. Landholder was also contacted on the 1/7/2011 and advised removal of any pipe leading from septic to MI drain. GCC requested to ensure pipe removal works are carried out.
Corynnia Channel	24/03/2011	Report of water quality causing livestock death.	Water quality samples taken	Pesticide results within guidelines.
Farm 2126	18/3/2011	Landowner reported a green algal scum present on surface of channel and domestic dam. Site inspection revealed no evidence of algae.	Water quality samples were taken and sent for BGA analysis. The supply channel was drained and refilled.	Results identified no potential toxic blue green algae
MDY at Yenda subway	18/3/2011	Report of fish kill (carp) from works manager, a small number of dead carp found, other carp observed swimming and appearing healthy	Potentially caused by water temperature change, monitor for further incidents	Liaise with works group to ensure any future incidents are investigated.
LVBC at rifle range Rd	18/03/2011	Works manger reported small number of dead fish at road bridge, No fish found.	Potentially caused by water temperature change, monitor for further incidents.	Liaise with works group to ensure any future incidents are investigated.
NBC	18/03/2011	Landholder reported sulphur odour in water used for domestic supply. No odour detected.	IS confirmed water supply continuous and no ponded water	No further issue
Mirrool Branch Channel Lat 30 O/T	7/04/2011	Car burnt out on channel bank	Small petrol film on water	The car was taken away and site cleaned up no contamination of supply water.
DC 808J Yenda	27/05/2011	Report of Fruit Fly baiting spraying directly towards DC 808J	Notified Office of Environment & Heritage & DII. Samples taken.	Meeting OEH & DII 6/06/2011
Channel 13 escape	23/05/2011	Landholder report of dead cumbungi in MI drainage channel	Samples taken for analysis	Results found no pollutants present

REFERENCES

Van der Lely, A. (2011). '*Groundwater Conditions and Behaviour in the MIA. Annual Report 2011.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2003). '*Salinity survey 2002-MIA: methods, data, analysis, results, findings.*'. Murrumbidgee Irrigation. NSW.

Van der Lely, A. (2002). '*Groundwater Conditions in the MIA - Annual Report 2001.*'. Murrumbidgee Irrigation. NSW.

GLOSSARY

APHA	American Public Health Association
BBSW	Barren Box Storage and Wetland
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DIPNR	Department of Infrastructure, Planning and Natural Resources
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&D	Murrumbidgee Irrigation Area and Districts
ML	Megalitre
mm	Millimetre
NOW	New South Wales Office of Water
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
OEH	Office of Environment and Heritage
PVP	Property Vegetation Plan
SEE	Statement of Environmental Effect
SFU	Single farming unit
SBS	Sustainable Business Plan
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Table 2.2.j (page 18) and Table M.2 (page 67) for complete listings of monitoring sites

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Murrumbidgee Irrigation Ltd

Murrumbidgee CATCHMENT MANAGEMENT AUTHORITY

NSW GOVERNMENT

MI Murrumbidgee Irrigation Ltd

Licence Compliance Report 2012











Growing opportunity - water and beyond.

The information in this document should be read as a whole document. The data contained in this LCR is for meeting MI's Licence Compliance only. MI does not guarantee the accuracy, reliability or suitability of excerpts of this data for any other purpose. Please contact Environmental Services, Murrumbidgee Irrigation on 02 6962 0200 for further information.

INTRODUCTION

Murrumbidgee Irrigation Limited (MI) has complied with the requirements under its licence with the NSW Office of Water (NOW) and Office of Environment and Heritage, views environmental sustainability as core business. MI has worked to ensure that the licences have been complied with for the 2011-12 reporting period. However, it needs to be noted that MI does not have any regulatory control over the activities of landholders that may impact on compliance with our licences.

The 2011/2012 season included significantly above average rainfall, full allocations and extreme flooding in March 2012. This resulted in a significant increase in monitoring activities associated with licence compliance.

Our environmental programs, which aim to exceed our environmental obligations, demonstrate our commitment to ensuring that our operations do not impact negatively on the environment.

Our environmental monitoring programs, the results of which are contained in this report, demonstrate that our programs are having an impact in ensuring the sustainability of the MIA.



Gillian Kirkup
Chairman
Murrumbidgee Irrigation Limited



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EXECUTIVE SUMMARY

Murrumbidgee Irrigation Limited (MI) operates under a Combined Water Supply Water Work Approval and Water Use Approval (40CA403245) issued by NSW Department of Primary Industries Office of Water (NOW) and Environmental Protection Licence 4561 in accordance with the Protection of the Environment Operations Act, 1997 administered by the NSW Environmental Protection Authority (EPA). These licences set the minimum standard for environmental management. The Company has a corporate objective to operate beyond compliance and its environmental programs have been developed to meet this objective.

STATEMENT OF COMPLIANCE

MI has met the licence compliance required for the 2011-12 licence period. Information pertaining to this compliance has been discussed in detail throughout this report. Compliance with licensing requirements is listed in Table 1 (a) below.

Table 1(a) - List of Compliance with Approval Number 40CA403245

Licence	Compliance Requirement	Section	Compliant?	Page Number
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Measuring and Reporting the Volume of Water Extracted.	6 & 7	Yes	Pages 9-27
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Statement of Compliance	12.3	Yes	Page 4
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Presentation and Data Analyses	12.4 to 12.8	Yes	Pages 9 to 25 and attached electronic data files as requested.
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Reporting on Water Management	12.10 to 12.13	Yes	Pages 1 to 74
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Reporting on Salinity and Saltloads	12.14 to 12.17	Yes	Pages 83 to 119
Combined Water Supply Work Approval & Water Use Approval	SCHEDULE 1- Quality Assurance for Monitoring and Reporting	13	Yes	Page 4
Environmental Protection Licence	SECTION 5- Monitoring and recording conditions	M1 to M7	Yes	Demonstrated throughout the report.
Environmental Protection Licence	SECTION 6- Reporting Conditions	R1 to R5.4	Yes	Demonstrated throughout the report.
Environmental Protection Licence	General Conditions- U2- Land and Water Management Plan	U2.1	Yes	Pages 119-122

All monitoring data is collected in accordance with the ANZECC Guidelines for water quality monitoring and trigger values assessed against the Water Works and Supply Licence and Section 3- Primary Industry of the ANZECC Guidelines. Calibration of all field equipment is conducted in accordance with HydroLab (In-situ multi parameter meter) and Hachi (turbidity meter) recommendations. Lab samples have been submitted to nationally accredited labs AgriSearch and Australian Laboratory Services (ALS). Chain of Custody documentation is available for review upon request

1. WATER SUPPLY WORKS AND DRAINAGE MANAGEMENT

In contrast to the drought conditions that have impacted on water availability since 2002/03, well above average rainfall in the catchment and MIA during 2010-2012 have resulted in full irrigation allocations. Heavy rainfall particularly from October 2011 to March 2012 which saw higher than average flow levels in the Murrumbidgee River and associated flooding in lagoon systems adjacent to the River, was the primary causal factor in MI river drains backing up in some instances. The heavy rainfall resulted in a significant increase in channel supply and drainage waters resulting in additional drainage to wetlands associated with the Murrumbidgee River. Flooding again occurred in March 2012, adding to an already increased groundwater table, partially inundated wetlands and a productive irrigation area at full allocation. The 2012 floods posed many implications in the management and movement of excess water across the irrigation network.

The Combined Water Supply Work Approval and Water Use Approval specifies continuous measurement of water flow (volumes) and salinity (salt loading), which is undertaken using flow gauging stations at key sites across the Irrigation supply and drainage channel network. Recent upgrades to flow gauging stations in 2011 at the three of our four river drain sites (ROCUDG, GMSRR and LAG) have ensured data integrity is maintained in monitoring Discharge from licensed monitoring sites under EPL4651. In March and April 2012 monitoring efforts were particularly difficult during the flood, with high volumes of rapidly flowing flood water, back siphoning from wetland/river systems at discharge points and access to equipment proved challenging.

2. GROUNDWATER MANAGEMENT

As stated in Attachment 2- Groundwater Condition Monitoring and Reporting, Under WSWA & WWUA bores are required to be read bi-monthly and six-monthly, however due to flooding in March this year some access to read monitoring Piezometer during this time proved difficult. Available data for this reporting period indicate that shallow and deep water tables have begun to rise from September 2010 consistently over the past two years. Particularly significant increases were observed in March 2011 and even more so in March 2012 due to more favourable irrigation conditions (availability of water entitlements), flooding and higher rainfall. The MIA has seen an increase from 9% of the MIA having water table levels within two metres of the surface level as reported in 2010-2011, to 24% in 2011-2012. Of particular concern are levels at Benerembah, Bilbul and Murrami.

3. WATER MANAGEMENT

Diversions to the Lower Mirrool Creek (LMC) floodway during extreme flooding in March 2012 and the months preceding were undertaken to assist in moving excess water from storages. Samples were conducted at this location during discharge and once discharge had ceased.

During 2011/2012, ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of MIA wetlands continued. The projects which are in various stages of completion encompass Barren Box Storage and Wetland (BBSW), Mirrool Creek Crown Reserve Rehabilitation and BBSW waterbird monitoring programs.

Control of alligator weed in the aquatic environment has continued over the past year. Inspections were carried out at BBSW, the channel supply and drainage system and the LMC floodway with 8 alligator weed plants found. All sites identified were chemically treated, weed removed where possible and GPS locations recorded. This extremely low number of plants demonstrates MI's commitment to managing, monitoring, eradicating and preventing the spread of this significant weed throughout the region.

Inspections and treatments of *Sagittaria graminea* during 2011-2012 were carried out monthly from September 2011 through to the end of June 2012. Chemical treatments are carried out in accordance with APVMA permits. In addition MI has approved two research projects aimed at controlling aquatic weeds

including Sagittaria. One project involves a biological control agent, while the other aims to collect data relating to rates and efficacy for the registration of an alternate chemical with the APVMA.

4. SALINITY MANAGEMENT AND ACCOUNTING

The requirements for monitoring and reporting of salinity, flow and salt loads were complied with.

5. GENERAL ENVIRONMENTAL MANAGEMENT

NSW OFFICE OF ENVIRONMENT AND HERITAGE ENVIRONMENTAL PROTECTION LICENCE 4651

EPL 4651 has detailed requirements for monitoring and recording of drainage water quality and potential impacts on ecosystem health.

The quality of drainage water is monitored within sub catchments using a risk based approach endorsed by OEH. Trigger monitoring is used to test water quality when predefined conditions occur. The supply water quality is monitored using benchmarking samples collected at three times throughout the irrigation season. In addition to the Water Quality Monitoring Program; MI is also required to investigate miscellaneous pollution incidents.

The MIA generally receives high quality water from the Murrumbidgee River and MI are committed to maintaining this standard within our system. To meet this requirement MI operate an integrated operational and regulatory water quality program. This program includes testing water flow, temperature, turbidity, pH, salinity, pollutants (including nutrients and pesticides) and responding to any complaints in relation to water quality.

The exceptional rainfall and runoff experienced in March 2012 impacted severely on water quality. As a result of this, MI experienced an algae outbreak within the Supply Channel Network and e-coli and faecal coliform levels were elevated. Vigilant monitoring during this period provided a valuable tool for MI to assess any risks associated with the abovementioned outbreaks and to apply remediation by flushing the network as soon as practically possible, given the extenuating circumstances.

The quality of drainage water is monitored within sub catchments using a risk-based approach endorsed by the OEH. Trigger monitoring is used to test the water when predefined conditions such as rainfall occur. Water samples are then tested for 12 different chemicals. There were 18 trigger events in 2011/12 resulting in 78 samples being collected across all 13 sub catchments and 1028 tests being undertaken. In total there were 19 action levels (14 directly related to floodwater) and 41 notification level detections (22 flood related). It should be noted that flood water from outside the MIA impacted on water quality February to April 2012

Measuring and assessing the drivers that impact soil and groundwater salinity at a regional scale continues to be difficult. It was concluded after the last soil survey that the current survey method does not provide an effective way to monitor the changes to soil salinity from irrigated agriculture and/or improve soil salinity. MI is committed to developing a more effective way to monitor and improve soil salinity. Groundwater salinity monitoring will be reviewed for the 2012-2013 reporting year. MI is presently developing a new risk based approach to monitoring soil and groundwater salinity.

6. LAND AND WATER MANAGEMENT PLAN

The principles of the Land and Water Management Plan (LWMP) are now incorporated in the Murrumbidgee Irrigation Limited Sustainable Business Strategy (MI SBS). The MI SBS continued to enhance the sustainability and profitability of the MIA and districts over the last year through a combination of education, incentives

and regional projects. The highlights for the past year were the construction and maintenance of the educational facilities at Barren Box Wetland which has included the assembly of a shelter, seating, information screen, walking trails and the necessary weed control program.

Protection and enhancement of local native species, remnant revegetation and other environmental assets is managed through the Property Vegetation Plans (PVP's). Biodiversity incentives are offered to landholders to undertake a PVP through the MI SBS. The aim of these incentives is to encourage landholders to protect remnant native vegetation sites of high ecological value within the MIA and/or set aside areas of their farm to return to native vegetation and manage these areas to achieve biodiversity targets, through a legally binding 10 to 15 year contract. A full description of works undertaken in protecting and enhancing remnant vegetation is presented in Sections A.1 and A.6.

The continued expansion of the community education program has seen more than 2,300 school students and community members participate in Environmental Education activities. There has been an increase in schools focusing on sustainability and this has meant the EnviroChampions program is now being offered in Wagga, Talbingo and West Wyalong areas. In addition, the EnviroChampions program was a finalist at the UNNA World Environment Day Sustainability Leadership Awards.

1. WATER SUPPLY AND DRAINAGE MANAGEMENT

1.1 CLIMATIC CONDITIONS

Well above average rainfall was again the predominent feature of the 2011-2012 reporting period, and the extreme flood event of March 2012. Total ETo recorded much higher than the previous season (1321 mm) with similar rainfall totals but with the addition of heavy sporadic falls from November to February as outlined in Table 1.1 (a) below.

Table 1.1 (a): Summary of Climatic Data

Month	ETo 2011-12 (mm)	Rainfall 2011-12 (mm)	Net ETo (ETo-Rainfall) (mm)	LTA ETO (1962-2011) (mm)	LTA Rainfall (1962-2011) (mm)
July	51.8	28.2	23.6	50.0	36.0
August	78.9	118.5	-39.6	78.1	35.9
September	135.3	156.4	-21.1	118.3	40.4
October	171	20.2	150.8	176.5	42.4
November	257.8	44	213.8	226.6	30.7
December	262.9	17.8	245.1	274.3	33.6
January	345.2	44.6	300.6	285.5	34.9
February	181.4	69	112.4	231.1	31.8
March	125.4	182.4	-57	192.1	31.3
April	115.8	20.6	95.2	115.8	28.0
May	55	23.2	31.8	66.8	35.4
June	40.3	11.6	28.7	44.3	35.6
Total	**1821**	**737**	**1084**	**1859**	**416**

The ET_{ref_t} (tall crop) is the FAO56 equation modified to represent tall crops (taller than 0.5m) and is to be used in semi arid or arid climates. The Griffith, Finley, Hay and Tullakool weather stations have traditionally used a Penman-Meyer equation (ETo) which is very similar to the ET_{ref_t} (ASCE tall crop) equation.

Source: CSIRO Griffith

Notes: *LTA = Long term average (1962-2011), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.*

Table 1.1 (b) shows a 100% announced allocation for both General and High Security. This being the same as the previous year, however Total Diversions increased by 33% directly related to hotter conditions, larger sporadic rainfall events and higher demand for irrgation as opposed to 2010-2011. As a result of this there was a substantial increase in deliveries to rice and horticulture cropping compared to the previous year as detailed in Table 1.6 (c).

Table 1.1 (b): Summary of climatic data, diversions and deliveries for 1995 to 2012

Year	Announced Allocation % General / High	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2011-12	**100/100**	**854,855**	**752,845**	**1084**	**1821**	**737**
2010-11	100/100	567,223^	490,329	653	1,391	739
2009-10	27/95	506,521	362,622	1,750	2,085	336
2008-09	21/95	393,973	276,233	1,820	2166	346
2007-08	13/95	335,687	210,297	1,766	2,127	361
2006-07	15/90	559,952^{+}	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423

Sources: ***MI Corporate Office & CSIRO Griffith***
Notes: ***2011-12*** *^ = Does not include 2,642 ML environmental allocation water diverted for DPI*
2010-11 *^ = Does not include 2,724 ML environmental allocation water diverted for DPI*
2005-06 ** = Does not include 2,146 ML environmental waterway diversions for DNR.*
2006-07^{+} *= Does not include 3,256 ML State Water environmental flows through Roaches Escape.*

1.2 DIVERSIONS AND VOLUME

A summary of Diversions and Volumes of water managed and supplied by MI has been presented in Tables 1.2 (a) and 1.2 (b) below. Table 1.2 (b) shows the summary of gross diversions entering the MI system at two regulated sites at Narrandera and the Sturt Canal. The sum of these diversions are shown as Total Diversions in Table 1.2 (a).

Table 1.2 (a): Summary of Gross Diversions Main and Sturt Canal 2011/12

Month	Sturt (ML)	Main (ML)
August	3,312	19,070
September	25,011	51,970
October	38,342	84,655
November	35,986	86,260
December	53,810	129,999
January	49,499	138,164
February	24,801	68,897
March	237	2,603
April	1,828	15,877
May	4,610	18,808
June	0	3,758
TOTAL	**237,436**	**620,061**

Note: ***237,436*** *+620,061 =857,497 ML (Includes environmental allocation)*

Table 1.2 (b): Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2011/12

	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
August	6,357	17,801	2,641
September	25,973	50,832	5,812
October	40,075	83,630	13,637
November	33,572	78,537	10,540
December	47,157	121,079	16,663
January	49,253	130,611	21,195
February	26,567	66,844	12,905
March	7,359	-11,268	1,365
April	3,904	15,562	19,823
May	7,885	18,881	19
June	1,775	3,355	-2,865
Total 2011-12	**249,877**	**575,864**	**101,735**
Total 2010-11	182,273	397,247	57,932
Total 2009-10	91,051	403,924	51,099
Total 2008-09	40,244	346,282	44,000
Total 2007-08	25,437	304,601	33,332
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130

Notes:

Diversions shown in Table 1.2(b) for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversion from Yanco via escapes + diversion from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape. Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

Table 1.2 (b) shows actual amounts for water channeled through each of the three main channel systems which make up the MIA:

1. The Main Canal System, which is primarily fed through the Narrandera Regulator.
2. The Sturt Canal System, which is primarily fed through the Sturt offtake.
3. The Wah Wah System, which was primarily fed through BBSW before the drought but now consists of mostly fresh water which has entered the system through the Narrandera and Sturt regulators.

The total amount of water channeled through all three systems combined is greater than the Net Total Irrigation Diversions shown in Table 1.2 (b) because of MI's innovative re-use program, details of which is included for each of the systems in Table 1.4 (b).

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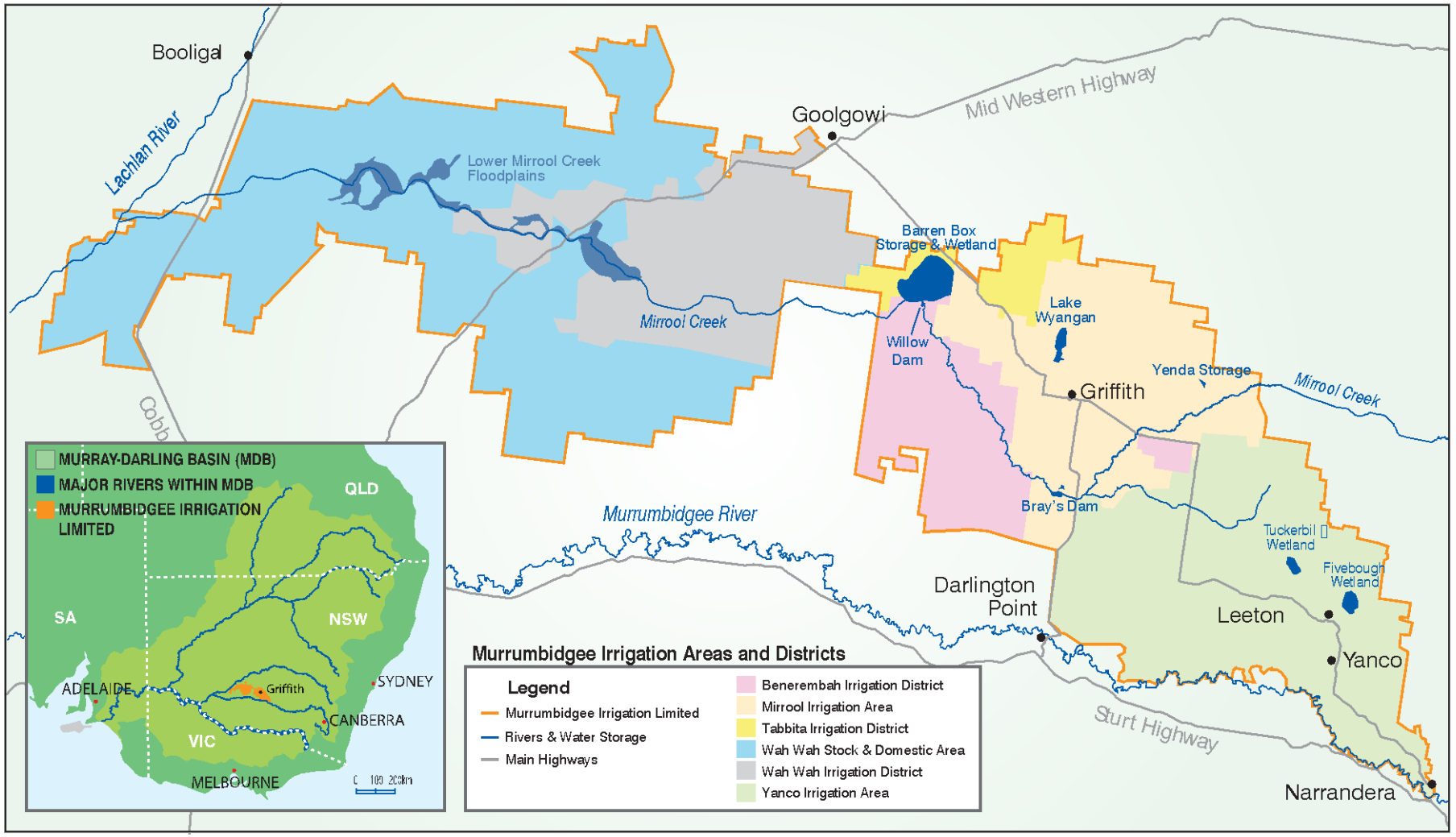
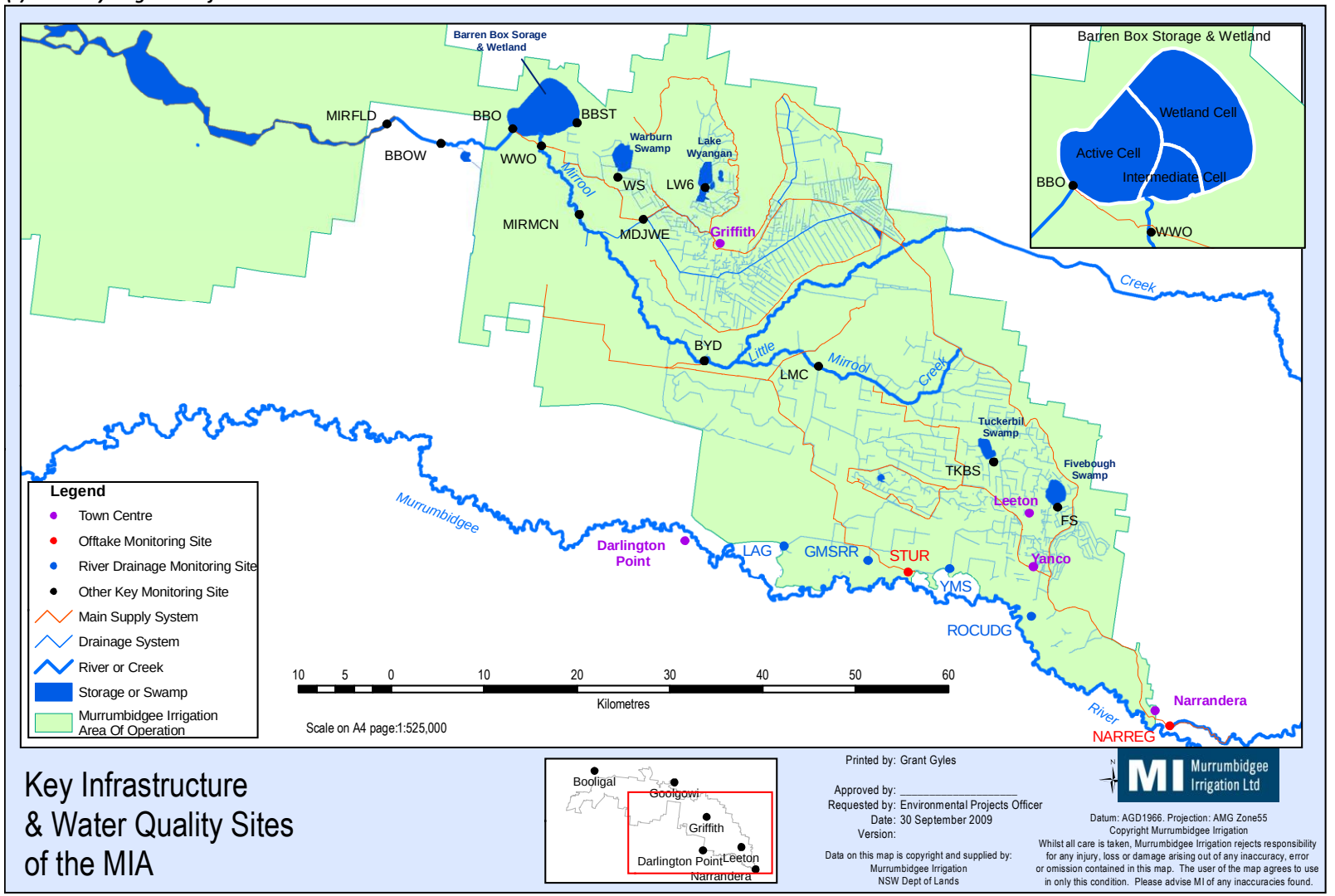


Figure 1.2 (c): Key irrigation infrastructure in the MIA



1.3 SUPPLY EFFICIENCY, STORAGE LEVELS

Supply Efficiency

Table 1.3 (a) below shows the simple efficiency of the system to be at 88% for 2011-2012 reporting period. This calculation shows an apparent loss of 116 GL. The water balance represented in Table 1.6 (a) more clearly reconciles the losses and gains of the system and takes into account drainage reuses during this period.

The noted improvements in simple efficiency is attributed to increased diversions during the periods of higher rainfall and flooding combined with management and operational changes. Stronger operational performance and, the addition of higher than average regional rainfall, have minimised conveyance losses, provided for more water in systems and decreased water demand thus improving efficiency.

Table 1.3 (a): Simple efficiency of the system —2004 to 2012

Parameter	2011/12	2010/11	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05
Diversions (ML)								
Sturt Canal	**237,436**	155859	81215	30943	21,266	60,280	233,388	145,728
Main Canal	**620,061**	414088	425306	363030	314,421	502,928	805,277	680,479
Less DNR Environmental Diversions	**2,642**	2724	1468	0	0	3,256	2,146	
NET TOTAL irrigation diversions	**854,855**	**567223**	**505,053**	393,973	335,687	559,952	1,036,519	826,207
Sales (ML) Metered & Unmetered	**752,845**	490,329	369,817	276,233	210,297	411,898	826,207	648,417
Conveyance (ML)	**102,010**	76,894	135,236	117,740	125,390	148,054	206,529	177,790
Simple Efficiency (%)	**88%**	**86%**	**73%**	70.1	62.6	73.6	80.1	78.5

Source: *MI Irrigation Services and Corporate Services*
Note: *Simple efficiency = Total Sales/Total Gross Diversions x 100*

Storage Levels

Barren Box Storage Storage and Wetland (BBSW)

In 2011-2012 BBSW transformed from a degraded swampland into an efficient water storage facility which has permanently returned on average 20,000 ML of water per annum under Water for Rivers for use in the Snowy River system. Storage at this site comprises of three cells:

- The active cell – storage capacity 24,500 ML
- The intermediate cell – storage capacity 4,500 ML
- The wetland cell covering 1,650 hectares with storage capacity 39, 500 ML

During the 2011-2012 season, irregular inflows were experienced in the wetland, active and intermediate cells, due to the significant rainfall experienced preluding in the summer months and

the March 2012 floods. In response to large inflows MI implemented flood mitigation steps to avoid breaching of individual cells at BBS, of which volumes are shown in Table 1.3 (b) below.

The combined outflows of 137,950 ML from the BBS cells, are also displayed in Table 1.4 (b) as:

- Barren Box Storage to Wah Wah Main @ B.B.S. Pumps.
- Barren Box Storage to Outfall (include flood releases).
- Barren Box Storage Licenced Diverters.

1.3 (b): Barren Box Storage (ML) 2011-2012

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	939	1,698	1,303	546	5,085	3,630	2,311	4,177	9,4267	0	0	0	113,956
Outflow	0	740	850	11,749	1560	1,300	2,350	3,450	15,085	41,357	21,630	7,506	107,577
Variation	939	958	453	-11,203	3,525	2,330	-39	727	79,182	-4,1357	-21,630	-7,506	6,379

Note: Outflows include Licensed Pumpers on BBS = 0 ML for 2011/12

Lake Wyangan

Water depths within both the northern and southern portions of the lake are regulated for various operational purposes including maintenance,management and flow supplementation for the adjacent supply channels in times of shortage. MI regulates the lake levels to satisfy various demands for commercial irrigation, environmental contributions and community objectives.

A total of 420 ML was diverted from the northern portion of the lake into the southern portion of the lake during the reporting period. Opportunistic water was pumped from the southern portion during the reporting period and utilised for irrigation purposes where possible. The volume of both portions of the lake were demonstrated to be slightly higher than recorded levels for the same time last year.

The monthly figures relating to the volumes pumped by MI from Lake Wyangan into Lake View Branch Canal are highlighted in Table 1.4 (b). Table 1.3 (c) below provides 2011-2012 monthly gauge heights (water depth) for both portions of the lake.

Table 1.3 (c): Gauge heights for South and North Lake Wyangan 2011-2012

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
Jul	0.95	765	1.22	3,130
Aug	0.90	730	1.24	3,170
Sep	0.98	786	1.22	3,130
Oct	0.98	786	1.17	3,030
Nov	1.10	880	1.12	2,930
Dec	1.17	936	1.03	2,750
Jan	1.16	928	0.94	2,588
Feb	1.37	1,103	1.01	2,710
Mar	1.95	1,660	1.98	4,650
Apr	1.54	1,256	1.92	4,530
May	1.14	912	1.88	4,450
Jun	1.19	952	1.90	4,490

Source: *MI Irrigation Services*
Gross Resources *= Gauge height converted into estimated megalitres.*

Yenda Storage

The figures in Table 1.3 (d) show inflows and outflows at the Yenda En-Route Storage. This storage is primarily used to compensate for differences between customer orders and diversions from the Narrandera Regulator.

Table 1.3 (d): Inflow and Outflow Yenda En-route Storage 2011-2012

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	22	575	1,247	1,410	1,956	1,404	1,886	1,446	1,425	1,430	1,287	632	14,720
Outflow	143	813	984	1,731	2,039	1,684	1,976	1,785	1,605	1,504	1,300	473	16,037
Variation	-121	-238	263	-321	-83	-280	-90	-339	-180	-74	-13	159	-1317

Bray's Dam Storage

Bray's Dam storage has the operational ability to capture and redistribute irrigation water that has been rejected after rainfall. Water can also be pumped from Mirrool Creek and reused in the irrigation network. The Figures in Table 1.3 (e) show inflows and outflows at Brays Storage Dam for this reporting year.

1.3 (e): Inflow and Outflow Brays Dam Storage 2011-2012

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow	26	267	1,334	3,390	3,353	5,532	765	1,148	0	0	1,835	0	17,650
Outflow	0	1637	243	3,098	3,689	4,518	1,087	2,128	0	28	3,703	315	20,446
Variation	26	-1,370	1,091	292	-336	1,014	-322	-980	0	-28	-1,868	-315	-2,796

1.4 DRAINAGE VOLUMES AND SALT LOADS

Table 1.4 (a): Description of licencenced monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	Frequency	Type	X-Coordi-nates	Y-Coordi-nates
Licenced Monitoring Sites						
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	Continuous	EC, Flow	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	Continuous	EC, Flow	427479	6171449
410083	YMS	Yanco Main Southern Drain	Continuous	EC, Flow	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	Continuous	EC, Flow	444891	6165663
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	When flowing	Pesticide EC	375673	6218725
Non Licenced Internal Monitoring Sites						
41010162	WS	Warburn Swamp	After trigger	EC, pH, NTU	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	Continuous	EC, Flow	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	After trigger	EC, pH, NTU	409886	6193089
41010896	LW6	Lake Wyangan Causeway	After trigger	EC, pH, NTU	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	After trigger	Pesticide	440983	6182501
410167	BBOW	Barren Box Outfall Canal Wyvern	Continuous	EC, Flow	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	Continuous	EC, Flow	403257	6208333
410085	LMC	Little Mirrool Creek	Continuous	EC, Flow	422126	6192597
41010903	BBO	Barren Box Storage	After trigger	EC, pH, NTU	389236	6218183
41010978	WWO	Willow Dam	After trigger	EC, pH, NTU	392197	6216283
410164	BOD1	Channel 13 escape at the outfall channel Wyvern	EC, Flow	EC, Flow	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel	EC, Flow	Continuous	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek	EC, Flow	Continuous	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road	EC, Flow	Continuous	396994	6205386

All continuous sites highlighted in Table 1.4 (a) above are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated four or more times a year. All sites are visited monthly for routine maintenance by Thiess contractors. Monthly field data is collected by MI Staff using a Hydro-lab, samplng temperature, EC and pH.

This list has been amended in accordance with changes to the combined Water Supply Work Approval and Water Use Approval No 40CA403245 with the NSW Office Of Water (NOW).

Table 1.4 (b): Drainage Volumes (ML) – July 2011 to June 2012

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	0.0	19070	51970	84655	86260	129999	138164	68897	2603	15877	18808	3758	**620061**
STUR**	**Monthly Total**	0.0	3312	25011	38342	35986	53810	49499	24801	237	1828	4610	0	**237436**
TOTAL														**857497**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	3.5R	14.9R	48.5	42.5	54.6K	53.5Z	77.3Z	134 R	[572]	55.6	33.3	19.8	
	Median	2.2R	9.2R	56.9	40.7	46.1K	50.3Z	68.0Z	83.8R	[473]	53.1	28.7	16.7	
	Inst.Max	19.0R	79.7R	76.5	69.8	89.7K	85.7Z	447 Z	798 R	[1460]	131	67.5	65.1	
	Inst.Min	0.8R	0.8R	5.9	21.4	34.6K	24.5Z	50.8Z	35.9R	[125]	24.9	18.1	8.4	
	Monthly Total	108.9R	462.6R	1455	1316	163 K	1657 Z	2395Z	3872 R	13150]	1668	1032	595	**29350**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0.0	2270	2530	4255	600	137	916	2058	960	1765	4753	1599	21843
BYD (Bywash)**	**Monthly Total**	0.0	1292	243	3098	3680	4518	1087	2128	0	0	3691	315	20052
MIRMCN (41010955)	**Mean**	33.3	127 R	230	224	589 Z	658 Z	648	444	4240	395	212	91.6	
	Median	22.1	127 R	247	188	569 Z	647 Z	658	387	3200	353	208	89.5	
	Inst.Max	151	351 R	351	650	918 Z	835 Z	884	942	11700	758	388	202	
	Inst.Min	7.8	1.9R	88.8	107	391 Z	470 Z	405	226	717	204	152	29.3	
	Monthly Total	1031	3925 R	6889	6955	17660Z	20400Z	20090	12880	131500	11860	6567	2748	**242500**
DRAINS														
MDJWE (410174)	**Mean**	16.3R	75.1R	147	[196]	331	331	333 R	253 R	[461]	236	134	52.2R	
	Median	12.2R	76.0R	143	[157]	323	328	317 R	217 R	[392]	228	137	45.8R	
	Inst.Max	125 R	328 R	230	[450]	743	481	844 R	1150 R	[1140	413	346	124 R	
	Inst.Min	4.4R	4.4R	56.4	[89.5]	207	226	198 R	146 R	[314]	122	76.7	9.7R	
	Monthly Total	505.9R	2329 R	4400	3718]	9939	10270	10320 R	7336 R	4606	7094	4166	1565R	**66250**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	-0.1K	[12.9]	74.9	[296]	265	362	379	[197]	1420	1370	817	361	
	Median	-0.3K	[8.1]	75.9	[312]	236	360	373	[230]	1480	1370	803	344	
	Inst.Max	2.8K	[46.7]	177	[423]	459	450	532	[357]	2050	1820	967	679	
	Inst.Min	-2.1K	[1.2]	3	[94.2]	153	266	148	[37.7]	41.6	969	700	2	
	Monthly Total	-3K	[168]	2247	[5324]	7941	11230	11750	[4337]	43880	41090	25340	10820	**164100**
YANCO AREA-RIVER DRAINS														
YMS (410083)**	**Mean**	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Inst.Max	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Inst.Min	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Monthly Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	63
GMSRR (41010921)	**Mean**	0.0R	27.5R	0.1R	0.0R	1.4R	0.5R	0.3R	0.7R	[26.3]	[0.1]	0.0R	0.0R	
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[15.9]	[0.0]	0.0R	0.0R	
	Inst.Max	0.0R	180 R	12.7R	0.0R	23.5R	12.2R	18.6R	22.4R	[122]	[0.6]	0.0R	0.0R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[10.9]	[0.0]	0.0R	0.0R	
	Monthly Total	0.000R	851.7R	2.471R	0.000R	42.98 R	15.17 R	9.357R	21.68 R	[78.77	[1.800	0.000R	0.000R	1024
LAG (41010940)	**Mean**	0.0R	0.2R	1.9R	1.9R	15.3R	59.8R	1.3R	10.6R	[110]	2.0=	0.0=	0.0=	
	Median	0.0R	0.0R	1.3R	0.9R	3.0R	82.0R	0.0R	1.1R	[107]	1.7=	0.0=	0.0=	
	Inst.Max	0.1R	2.3R	12.2R	8.2R	87.4R	131 R	10.8R	198 R	[245]	9.3=	0.4=	0.0=	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[38.8]	0.0=	0.0=	0.0=	
	Monthly Total	0.104R	6.424R	57.29 R	59.65R	457.6 R	1854 R	39.71 R	307.9 R	[330.6]	59.88=	0.064=	0.000=	3174
ROCUDG(41010005)	**Mean**	[0.9]	[0.1]	[1.0]	0.9K	[0.4]	[0.0]	7.8K	9.8K	[44.8]	[15.1]	12.4K	[3.7]	
	Median	[0.5]	[0.1]	[0.6]	0.6K	[0.4]	[0.0]	0.2K	6.4K	[44.8]	[10.6]	11.1K	[3.1]	
	Inst.Max	[5.3]	[0.4]	[5.7]	3.9K	[1.1]	[0.0]	47.7K	45.0K	[48.5]	[47.8]	23.8K	[9.7]	
	Inst.Min	[0.0]	[0.0]	[0.0]	0.0K	[0.0]	[0.0]	0.0K	1.7K	[37.1]	[4.2]	7.6K	[1.8]	
	Monthly Total	[23.36]	[0.720	[26.48]	28.08K	[2.671]	[0.000]	242.7 K	283.6 K	[89.6]	[422.1	383.3K	[88.18]	1591
TOTAL to river														**5852**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	50044	39961	21630	5256	**116891**
EXTRA SITES FOR DNR														
WWO**t		939.0	1698	1303	546	5085	3630	2311	4177	94267	0	0	0	**113956**
BBO**		0.0	740	850	11749	1560	1300	2350	3450	15085	41357	21630	7506	**107577**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0@	[4.3]	[4.5]	[7.9]	[6.7]	5.9@	11.6@	[12.7]	[138]	[ ]B	[ ]B	[2.6]	
	Median	0.0@	[4.0]	[4.3]	[6.6]	[4.7]	5.2@	11.4@	[10.1]	[138]	[ ]B	[ ]B	[2.2]	
	Inst.Max	0.0@	[12.1]	[10.0]	[18.4]	[26.1]	13.5@	38.6@	[43.4]	[138]	[ ]B	[ ]B	[6.9]	
	Inst.Min	0.0@	[0.0]	[0.9]	[0.1]	[0.7]	0.4@	3.8@	[1.9]	[138]	[ ]B	[ ]B	[0.6]	
	Monthly Total	0@	[64]	[32]	[237]	[193]	184@	361@	[344]	[138]	[ ]B	[ ]B	[39]	**1592**

Table 1.4 (b):Drainage Volumes (ML) – July 2011 to June 2012 (cont)

Monthly Flow Data (ML/d)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0.0=	0.8=	2.2	1.4	0.2=	0.3K	1.7K	3.8K	[23.7]	[0.3]	3	0.7Z	
	Median	0.0=	0.0=	1	0.3	0.0=	0.0K	0.8K	3.3K	[21.4]	[0.2]	1.9	0.0Z	
	Inst.Max	0.0=	4.8=	16.4	9.2	4.9=	3.9K	6.3K	11.9K	[37.1]	[1.7]	12.9	9.0Z	
	Inst.Min	0.0=	0.0=	0	0	0.0=	0.0K	0.0K	0.6K	[11.9]	[0.0]	0	0.0Z	
	Monthly Total	0.000=	26.33=	65.94	42.83	7.048=	10.72 K	51.80 K	110.1 K	[426.8	[2.207]	92.3	20.62Z	**856.7**
DCWIDG (41017001)	**Mean**	0.0=	0.2=	1.5K	0.9K	0.3=	0.2Z	4.3Z	4.5	[112]	1.3K	0.1K	0.0K	
	Median	0.0=	0.0=	1.1K	0.7K	0.1=	0.0Z	0.5Z	0.5	[125]	0.2K	0.0K	0.0K	
	Inst.Max	0.0=	3.4=	13.1K	8.5K	2.1=	1.6Z	122 Z	110	[199]	10.0K	1.9K	0.0K	
	Inst.Min	0.0=	0.0=	0.1K	0.0K	0.0=	0.0Z	0.0Z	0	[9.2]	0.0K	0.0K	0.0K	
	Monthly Total	0.000=	5.351=	44.95 K	26.92K	9.147=	7.528Z	132.5 Z	131.5	2569]	40.12K	3.628K	0.142K	**2971**
DCCENT (410172)	**Mean**	[0.1]	0.6V	0.5V	0.5K	[3.7]	[0.0]	[0.0]	[ ]B	[ ]B	2.1	1	1	
	Median	[0.0]	0.1V	0.1V	0.2K	[0.4]	[0.0]	[0.0]	[ ]B	[ ]B	1.2	0.6	0.5	
	Inst.Max	[2.9]	4.2V	3.0V	5.8K	[32.2]	[0.0]	[0.0]	[ ]B	[ ]B	9.7	4.1	5.8	
	Inst.Min	[0.0]	0.0V	0.0V	0.0K	[0.0]	[0.0]	[0.0]	[ ]B	[ ]B	0.4	0.1	0.1	
	Monthly Total	[3.403]	18.87V	14.29 V	15.15K	[70.62]	[0.000]	[0.000]	[ ]B	[ ]B	64.54	30.4	30.48	**247.8**

... Other authorities data
S ... Rating table suspended
= ... Pool reading only, no flow condition
R ... Rating table extrapolated
B ... Backed-up stage
[]... Some missing record during the period
K . . . Minor editing
V . . . Data used for operational purposes
~ ... Reliable Interpolation

? .... Irregular data, use with caution

@ ... Theoretical rating table applied
Z ... Med. edit >Q=15 (inc MW) or HYMAN imp.
** shown ## Supplied in house by MI

Table 1.4 (b) shows the monthly total flow volumes from the Murrumbidgee River entering the MIA measured at our two regulated sites; **Narrandera (NARREG)** after diversion at the Berembed Weir and the **Sturt Canal (STUR)** after diversion at the Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system. Details of each site are described below.

- **Little Mirrool Creek (LMC)** - Accepts all westerly surface drainage from the Yanco Irrigation Area which doesn't discharge back to the River or naturally flow to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- **Bray's Dam (BYD)** - Drainage diversion from LMC to the Benerembah Irrigation District.
- **Mirrool Creek at McNamara Road (MIRMCN)** - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- **Main Drain J (MDJWE)** - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- **Barren Box Outfall Wyvern (BBOW)** - Flows from Willow Dam, Barren Box and channel 13 escape discharging to Wah Wah Irrigation District.

There are four river channel wetland sites which potentially discharge to the Murrumbidgee River of which MI monitor in accordance with EPL4651.

- **Gogeldrie Main Southern (GMSRR)** - partial Leeton/Yanco drainage. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- **Yanco Main Southern (YMS)** - partial Gogeldrie drainage. Drainage channel has been blocked upstream of this point and captured water gravitates into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- **Gooragool Lagoon (LAG)** - partial Gogeldrie drainage. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by licensed customers.
- **Cudgel Creek downstream from Cudgel Creek (ROCUDG)** - Cudgel Creek area

The purpose of collecting this data is to identify drainage and supply volumes including daily and seasonal variations, for management and monitoring requirements compliant with EPL4651 and 40CA403245. Flow and water quality data is important in ensuring consideration of results in contributing to management decisions related to drainage re-use, asset design, purpose and function.

During the 2011-2012 year, MI diverted 857,497 ML of water from the Murrumbidgee River. This water contained approximately 70,451 tonnes of salt.

Approximately 28,376 tonnes were discharged into the Mirrool Creek Floodway and wetlands which are connected to the Murrumbidgee River in 122,743 ML of drainage water. A large proportion of the salt load a direct result of flood water entering from outside the MIA.

The increase in drainage from 2010-11 levels, is likely to be attributed to localised flooding in wetlands associated with the Murrumbidgee River (and catchment drainage) and the March 2012 floods which have led to increased runoff and excess water within the MIA into MI's channel and storage systems.
As the MIA is essentially a closed system, most of the salt that is imported into the area via supply water makes its way into our soils during irrigation activities. The equivalent of close to one quarter of the imported salt is exported to the Wah Wah Irrigation District, with the remainder to the area east of BBSW. Due to the rise in groundwater levels over the past two years, soils in some regions of the MIA are again under threat of salinisation. Through irrigation and rainfall, salts are now able to leach out of the rootzone into the groundwater system, settling into sediments within the rootzone during this rise, and remain if (and when) groundwater table levels receed. This in conjunction with salt loading in irrgation water (channel and bore water) have the potential to contirbute to changes in soil salinity, particularily in intensive irrgation areas. MI are working closer to investigate the impacts of the March 2012 flooding, increased irrigation/crop choice (due to favourable climatic conditions) and soil/groundwater salinity as part of the the 2012-2013 monitoring year.

Table 1.4 (c) *Salt Loads (Tonnes) – July 2011- June 2012*

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	**0.0**	**1565**	**4185**	**7833**	**5548**	**11110**	**7694**	**8698**	**155**	**1859**	**2065**	**372**	**51083**
STUR**	**Monthly Total**	**0.0**	**272**	**2014**	**3548**	**2315**	**4599**	**2756**	**3131**	**14**	**214**	**506**	**0**	**19368**
TOTAL														**70451**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	1.4R	3.6R	6.5	6.0	7.6K	[8.3]	[12.5]	23.1R	[173]	[13.1]	8.7K	5.3K	
	Median	1.1R	2.3R	7.1	5.9	6.3K	[9.5]	[10.2]	14.4R	[173]	[13.1]	8.0K	4.6K	
	Inst.Max	5.2R	31.0R	12.2	9.3	16.7K	[15.0]	[71.8]	153 R	[198]	[20.3]	16.3K	14.6K	
	Inst.Min	0.5R	0.3R	1.8	2.9	4.5K	[3.1]	[7.6]	6.9R	[134]	[7.5]	5.4K	2.8K	
	Monthly Total	43R	111R	194.0	185.0	229K	[141]	[338]	671R	[345]	[342]	271K	159K	**[3030]**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	0.0	469	413	803	68	16	99	215	68	445	1241	495	**4332**
BYD (Bywash)**	**Monthly Total**	0	199	40	585	419	518	118	222	0	0	964	98	**3162**
MIRMCN (41010955)	**Mean**	10.3	24.5R	39.7	37.2	69.5Z	71.7Z	65.6	65.8	612.0	107.0	54.4	23.1	
	Median	7.9	23.3R	41.2	35.8	64.8Z	76.0Z	65.8	55.6	587.0	90.8	55.1	24.9	
	Inst.Max	67.7	72.6R	80.6	66.6	132 Z	98.2Z	123.0	190.0	1180.0	199.0	158.0	43.0	
	Inst.Min	4.0	1.0R	14.6	20.3	41.8Z	33.2Z	41.4	27.3	167.0	57.7	30.1	10.6	
	Monthly Total	320.0	761R	1192.0	1154.0	2085Z	2222Z	2034.0	1908.0	18970.0	3207.0	1685.0	694.0	**36240R**
DRAINS														
MDJWE (410174)	**Mean**	[8.5]	[22.0]	31.3	[31.3]	46.7	45	40.9R	38.1R	[151]	85.4K	47.8K	17.2R	
	Median	[7.3]	[20.7]	31.7	[28.3]	44.1	44.5	38.5R	28.9R	[127]	78.9K	46.1K	19.4R	
	Inst.Max	[31.7]	[69.6]	80.5	[51.9]	124	65.3	117 R	152 R	[328]	186 K	126 K	35.2R	
	Inst.Min	[2.8]	[6.8]	16.1	[18.7]	30.2	29.6	24.9R	20.2R	[101]	44.4K	28.7K	5.3R	
	Monthly Total	[170]	[549]	938	[595]	1400	1394	1267R	1106R	[1513]	2561K	1483K	517R	**[13490]**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	0.0K	[3.1]	16.4	[92.9]	39.3	48.5	50.7K	[32.6]	266 K	299	164 Z	76.0Z	
	Median	-0.1K	[1.6]	16.6	[92.5]	33.2	46.2	51.1K	[37.2]	262 K	297	161 Z	86.5Z	
	Inst.Max	6.7K	[25.3]	65.3	[167]	107	72.7	78.8K	[71.0]	447 K	416	222 Z	122 Z	
	Inst.Min	-7.1K	[-7.1]	0	[9.0]	8.2	27.6	16.3K	[1.4]	4.1K	202	115 Z	-5.8Z	
	Monthly Total	-1K	[41]	491	[1672]	1179	1504	1573K	[716]	8232K	8961	5086Z	2281Z	**[31730]**
YANCO AREA-RIVER DRAINS														
YMS (410083)**	**Mean**	[ ]S	[ ]*	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Median	[ ]S	[ ]*	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Inst.Max	[ ]S	[ ]*	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Inst.Min	[ ]S	[ ]*	[ ]S	[ ]S	[ ]S	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	
	Monthly Total	[ ]S	[ ]*	[ ]S	[ ]S	63.0	[ ]*	[ ]*	[ ]*	[ ]S	[ ]S	[ ]S	[ ]M	63.0
GMSRR (41010921)	**Mean**	0.0R	2.7R	0.0R	0.0R	0.2R	0.1R	0.0R	0.1R	[2.6]	[0.0]	0.0R	0.0R	
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[2.3]	[0.0]	0.0R	0.0R	
	Inst.Max	0.0R	20.9R	2.0R	0.0R	3.6R	3.8R	2.1R	2.4R	[8.6]	[0.1]	0.0R	0.0R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[1.0]	[0.0]	0.0R	0.0R	
	Monthly Total	0R	83R	0R	0R	6R	4R	1R	2R	[8]	[0]	0R	0R	[104]
LAG (41010940)	**Mean**	[0.0]	0.2R	[0.3]	0.3R	1.1R	5.7R	0.2R	2.0R	[17.5]	0.3=	0.0=	0.0=	
	Median	[0.0]	0.0R	[0.2]	0.2R	0.5R	7.6R	0.0R	0.1R	[13.3]	0.3=	0.0=	0.0=	
	Inst.Max	[0.1]	3.7R	[1.2]	2.7R	7.4R	11.9R	2.0R	43.7R	[29.5]	1.4=	0.1=	0.0=	
	Inst.Min	[0.0]	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	[4.9]	0.0=	0.0=	0.0=	
	Monthly Total	[0]	7R	[6]	9R	35R	177R	7R	60R	[52]	10=	0=	0=	[363]
ROCUDG (41010005)	**Mean**	[0.1]	[0.0]	[0.1]	0.1K	[0.1]	[0.0]	0.7K	0.6K	[2.2]	[2.2]	2.1K	[0.9]	
	Median	[0.0]	[0.0]	[0.1]	0.1K	[0.0]	[0.0]	0.0K	0.4K	[2.2]	[1.7]	1.9K	[0.9]	
	Inst.Max	[0.4]	[0.0]	[0.5]	0.4K	[0.1]	[0.0]	3.9K	3.2K	[3.4]	[5.6]	3.6K	[2.1]	
	Inst.Min	[0.0]	[0.0]	[0.0]	0.0K	[0.0]	[0.0]	0.0K	0.1K	[1.7]	[0.8]	1.4K	[0.5]	
	Monthly Total	[2]	[0]	[2]	3K	[0]	[0]	21K	17K	[4]	[61]	65K	[23]	[199]
TOTAL														
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	10153	11611	5883	1517	**27647**
.														
WWO**t	**Monthly Total**	397	1030	1279	1326	2215	2363	2212	1995	26679	3446	1786	793	**45521**
BBO**	**Monthly Total**	-1	45	525	1860	1204	1646	1639	722	8650	9230	5563	2597	**31083**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.0@	[1.0]	[0.8]	[1.2]	[0.9]	0.8@	1.2@	[1.6]	[22.5]	[ ]B	[ ]B	[0.6]	
	Median	0.0@	[0.8]	[0.7]	[1.1]	[0.7]	0.6@	1.2@	[1.3]	[22.5]	[ ]B	[ ]B	[0.4]	
	Inst.Max	0.0@	[4.8]	[2.2]	[3.1]	[3.9]	3.1@	4.6@	[5.2]	[22.9]	[ ]B	[ ]B	[2.3]	
	Inst.Min	0.0@	[0.0]	[0.0]	[0.0]	[0.1]	0.1@	0.4@	[0.2]	[21.9]	[ ]B	[ ]B	[0.0]	
	Monthly Total	0@	[14]	[5]	[37]	[26]	26@	38@	[42]	[23]	[ ]B	[ ]B	[9]	**[220]**

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0.0K	0.3=	0.5	0.2	0.0=	0.1K	0.2K	0.6K	[6.9]	[0.1]	0.8	0.2Z	
	Median	0.0K	0.0=	0.3	0.1	0.0=	0.0K	0.1K	0.5K	[6.6]	[0.1]	0.6	0.0Z	
	Inst.Max	0.0K	3.6=	2.8	1.5	0.7=	0.6K	1.0K	1.4K	[17.3]	[0.7]	3.9	3.0Z	
	Inst.Min	0.0K	0.0=	0	0	0.0=	0.0K	0.0K	0.1K	[1.4]	[0.0]	0	0.0Z	
	Monthly Total	0K	8=	14	6	1=	2K	7K	18K	[124]	[1]	25	5Z	**[212]**
DCWIDG (41017001)	**Mean**	0.0=	0.0=	0.2K	0.2K	0.1=	0.1Z	0.9Z	0.9	[14.7]	0.2K	0.0K	0.0K	
	Median	0.0=	0.0=	0.2K	0.1K	0.0=	0.0Z	0.1Z	0.1	[18.6]	0.1K	0.0K	0.0K	
	Inst.Max	0.0=	1.7=	2.8K	1.9K	0.5=	0.6Z	26.0Z	24	[33.1]	1.2K	0.6K	0.0K	
	Inst.Min	0.0=	0.0=	0.0K	0.0K	0.0=	0.0Z	0.0Z	0	[0.9]	0.0K	0.0K	0.0K	
	Monthly Total	0=	1=	7K	5K	2=	2Z	27Z	27	[338]	6K	1K	0K	**[417]**
DCCENT (410172)	**Mean**	[0.0]	0.1V	0.1V	0.1K	[1.0]	[0.0]	[0.0]	[ ]B	[ ]B	0.6	0.2	0.4	
	Median	[0.0]	0.0V	0.0V	0.1K	[0.1]	[0.0]	[0.0]	[ ]B	[ ]B	0.4	0.1	0.2	
	Inst.Max	[0.6]	1.1V	0.9V	1.5K	[7.8]	[0.0]	[0.0]	[ ]B	[ ]B	2.1	0.6	3.1	
	Inst.Min	[0.0]	0.0V	0.0V	0.0K	[0.0]	[0.0]	[0.0]	[ ]B	[ ]B	0.1	0	0	
	Monthly Total	[1]	4V	3V	4K	[18]	[0]	[0]	[ ]B	[ ]B	19	5	12	**[67]**

We have used our monthly EC data in most cases

All data supplied by THEISS SERVICES accept when shown ## Supplied in house by MI

Other authorities data

S ... Rating table suspended

= ... Pool reading only, no flow condition

¥ ... Suspect/bad data from other authority

R ... Rating table extrapolated

V ... Data to be validated

~ ... Reliable Interpolation

M ... Equipment malfunction

[]... Some missing record during the period

B ... Backed-up stage

T ... Probe out of water/below instrument threshold

" ... No Data Exists

t Flows into BBS from Willow Dam

Salt loads Theiss Services unless # calculated using the formula below

Salt Load (Tonnes Per Day)= Drainage Volumes (ML) x Mean Monthly EC x 0.64/1000

NARREG and STURT salt loads calculated using the above formula, with the average EC calculated from mean monthly EC from the Murrumbidgee River at Wagga (http://waterinfo.nsw.gov.au/index.epl?site=410001)

Drainage Volumes to the Murrumbidgee River (ML)

Year	2005/06	2006/07	2007/08	2008/09	2009/10	2009/11	2011/12
Total	8,570	945	337	197	598	5,905	28,376*

*Large increase in salt load for the due to increased flows to wetlands and Mirrool Creek floodway following flood events in March-June 2012

1.5 DRAINAGE REUSE

MI has continued to actively pursue recovery and use of water from its drainage systems. Table 1.5 (a) provides information on reuse quantities. It should be noted that much of the historically reported quantities in this report are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used within the area of operations, nor is it drainage. This reflects a conversion of drains to connector systems between use sites. Contrary to this generally, Lake Wyangan prior to February to sporadically high summer rainfall events, was not considered as reuse as water was moved from the northern portion of the lake to the southern portion of the lake as there were concerns that the northern portion water levels were too high (due to larger rainfall events).

Table 1.5 (a): Reuse quantities (ML) for the MIA and Districts 2011-2012

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
GMSD Pumps (Yanco esc + Stormwater)	20	156	249	267	311	419	507	654	2 196	174	284	54	**5,291**
YMSD	0	82	186	135	119	162	182	265	5 040	109	61	0	**6,341**
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	235	0	0	0	0	45	29	0	0	**309**
Lake Wyangan Pumps to L.V.B.C.	0	129	107	140	60	168	174	78	135	636	601	226	**2,454**
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek Diversion to Benerembah (@ Brays)	0	2 270	2 530	4 255	600	137	916	2 058	960	1 765	4,753	1,599	**21,843**
Mirrool Creek Licensed Diverters (Creek Pumps)	0	0	369	900	18	1 597	667	0	0	249	114	0	**3,914**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	420	0	0	140	0	0	0	0	0	**560**
Mirrool Creek to Wah Wah Main	0	1 750	4 712	3 877	11 780	17 104	18 805	9 380	33 804	19 772	6,039	-1,399	**125,624**
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	0	550	100	2 159	650	1 300	2 350	3 300	0	0	0	2,250	**12,659**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	1 396	0	0	**1,396**
Barren Box Storage to Outfall (includes flood releases)	0	190	750	9 590	910	0	0	150	46 854	39 961	21 630	5,256	**125,291**
Barren Box Storage Licensed Diverters	0	0	0	0	0	19	0	0	0	0	0	0	**0**
Losses in Barren Box Storage	611	395	1 327	688	-385	2 166	2 458	1 787	1 700	-9337	2 030	2,214	**5,654**
Channel 13 Escape (Benerembah Drainage)	0	151	250	191	93	45	70	75	3 190	0	0	28	**4,093**
Sub Total	**631**	**5,673**	**10,580**	**22,857**	**14,156**	**23,117**	**26,269**	**17,747**	**93,924**	**54,754**	**35,512**	**10,228**	**315,429**
Less: First Use Water Diversions	968	324	798	1,011	6,396	8,286	7,811	1356	15,305	1,054	541	348	**44,198**
TOTAL WATER CAPTURED (Re-Used)	**-337**	**5,349**	**9,782**	**21,846**	**7,760**	**14,831**	**18,458**	**16,391**	**78,619**	**53,700**	**34,971**	**9,880**	**271,250**

Source: Irrigation Services

1.6 WATER BALANCE LOSS AND GAIN

Table 1.6 (a): Annual Water Balance Assessment MIA system (Gigalitres) 2009/10

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	Bench-mark	Median	Comment
Climatic																	
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	336	739	737	400	359	
Evaporation **(mm)**	1868	1750	1896	2032	2191	1998	1983	1935	2182	2127	2166	2085	1391	1694	1869	2018	CSIRO data
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	75	0	30	50	66	Look up table
Main Gross Data																	
Gross Diversions (1)	1036	819	1048	1142	960	862	826	1037	560	336	394	505	567	855	1154	794	MI data (11 year medians)
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	276	368	490	752	952	616	MI data (11 year medians)
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	118	137	77	103	202	178	(3)=(1)-(2)
Apparent Efficiency**(%)**	79	79	82	80	79	76	78	80	74	63	70	73	86	88	82	76	= (2)/(1)*100
Inevitable Real Losses																	
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	21	20	21	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	24	14	19	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	8	22	31	35	18	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	19	13	37	29	25	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	81	82	79	118	118	97	Inevitable Losses
System Flow Losses																	
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	1	6	0	33	9	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	0	0	116	48	5	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	0	1	6	116	81	13	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**82**	**85**	**234**	**199**	110	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	52	69	105	133	86	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**134**	**154**	**339**	**332**	196	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	-3	77	236	130	19	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows																	
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	54	83	24	160	99	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9	14	27	21		18	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0	0	0	1		3	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	4	4	3	67	5	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	72	114	49	227	126	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	72	120	49	260	134	(9)=(4)+(8)
Reconciliation																	
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	0	4	0	0	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-1	-14	-9	-20	-6	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	72	114	45	227	125	(12)=(8)-(10)

Table 1.6 (a): Annual Water Balance Assessment MIA system (Gigalitres) 2009/10 (cont)

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	Bench-mark	Median	Comment
Corrected Total System Supply (13)	1074	889	1089	1174	951	839	828	1055	563	318	396	501	630	1082	1264	806	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	-4	67	530	57	8	(14)=(7)/(12)*100
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**84**	**86**	**78**	**84**	85	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10	0.10	0.10	0.10		0.5	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.0	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19	0.19	0.19	0.19		0.52	

In 2011/12 irrigation diversions from the Murrumbidgee River were 855 GL with 752 GL being recorded deliveries (sales). This left an apparent loss of 103 GL which meant that MI's *apparent* operational efficiency was approximately 88%- an increase on 2010-2011 figures.

Of that loss, the *true loss* was estimated at about 234 GL. This included losses due to channel seepage and evaporation during storage and conveyance. The unexplained losses are estimated at 105 GL, using the standard formula of 14% of deliveries. The total losses are estimated at 339 GL, while the apparent loss was 103 GL. This means that 236 GL of water has been gained throughout the system. This is most likely due to increase of runoff during the floods combined with improved operating efficiency and increased potential for water to be reused within our system during periods outside the flood events. .

Storage volume changes are included for BBSW and Lake Wyangan. The variation in en-route storages at Yenda and Bray's Dam are minimal in comparison to the figures quoted in the table (gigalitres). Mirrool Creek Floodway releases are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

A comparison of the benchmark year and the current year shows that the system efficiency is 78%, which is lower than the benchmark of 84% predicted for 2011-2012, as expected due to the floods.

1.7 CROP STATISTICS

Irrigated Crop Statistics

The following charts show the distribution of crops grown this year in comparison to last year (2010/11) and the baseline year (1995/96). Irrigation supply to rice cropping again accounted for a large percentage of total deliveries. Overall distribution percentages trened similarly to the previous 2010-2011 reporting year.

Figure 1.6 (a): Distribution of Irrigated Crops from 1995-1996, 2010-2011 and 2011-2012 Reporting Periods- Comparison of Crop Type by Percentage of Megalitres Delivered

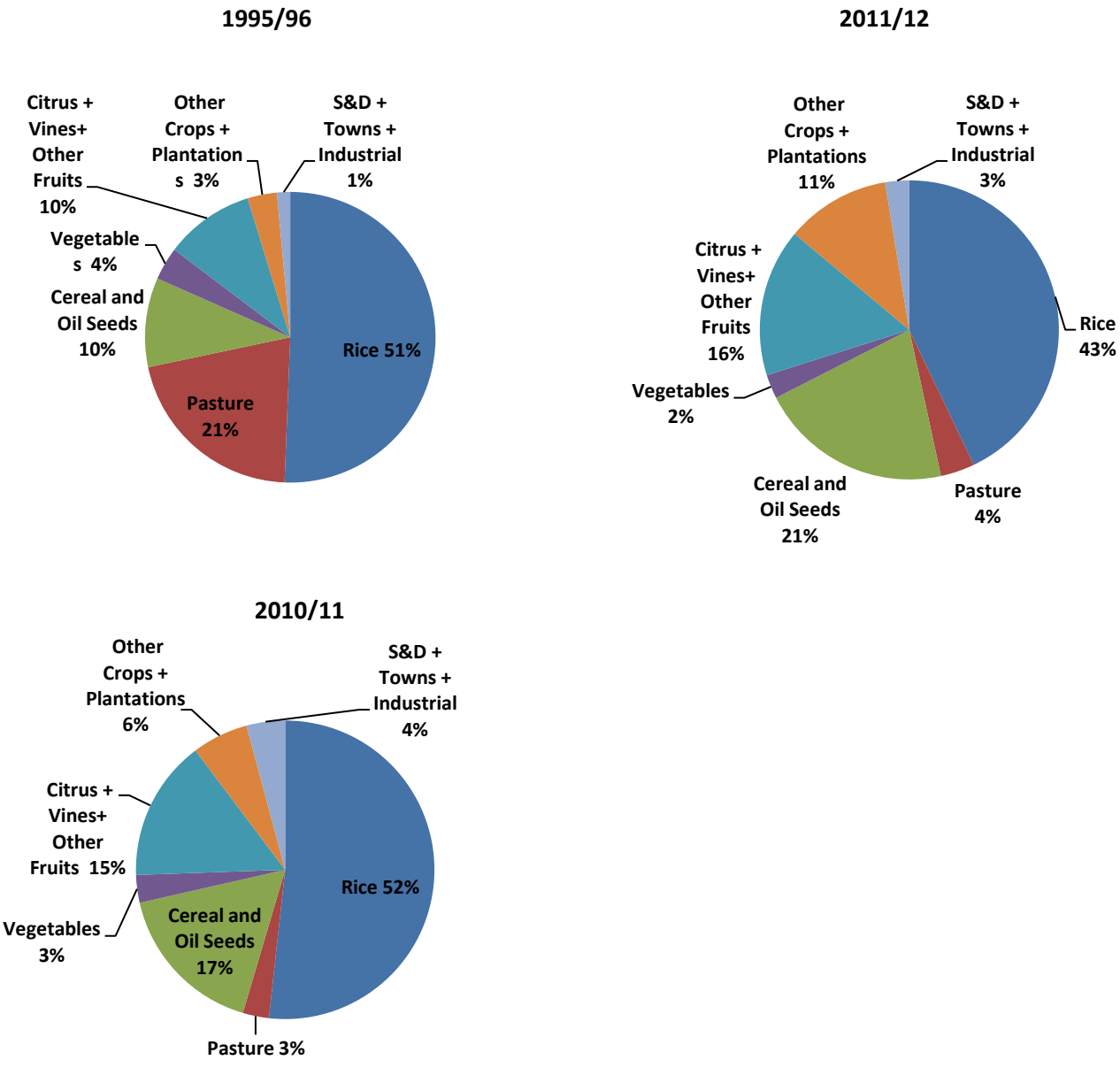


Table 1.7 (b): Historical deliveries to major crop types within the MIA

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2011/12	**320,033**	**27,438**	**156,155**	**19,017**	**119,003**	**84,369**	**19,263**
2010/11	253,699	13,924	82,696	14,717	74,912	29,927	20,455
2009/10	103,208	18,162	60,851	16,519	127,386	11,110	25,386
2008/09	34,450	14,447	43,688	13,108	132,721	8,168	29,651
2007/08	1,006	8,218	39,538	9,191	123,510	9,274	19,560
2006/07	41,296	23,419	149,441	15,577	138,234	13,834	30,097
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123
2004/05	101,494	77,364	247,267	22,736	150,601	7,078	41,877
2003/04	221,732	63,960	182,940	16,504	132,866	22,519	11,285
2002/03	251,424	64,093	237,612	14,970	138,929	24,983	22,101
2001/02	469,513	85,556	184,253	17,989	122,884	23,403	13,013
2000/01	479,757	112,668	108,690	18,794	98,285	39,262	0
1999/00	394,224	54,159	68,366	12,013	75,108	40,060	0
1998/99	477,563	101,791	65,231	24,967	105,522	47,504	0
1997/98	489,363	179,246	126,247	19,714	115,200	47,176	0
1996/97	519,053	187,441	143,746	23,464	104,561	40,461	66,379
1995/96	446,917	185,931	87,725	32,348	87,983	28,905	12,957

Table 1.6 (c): Historical Deliveries to Major Crop Types - ***% of Total ML Delivered within the MIA***

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2011/12	**42.9%**	**3.7%**	**20.9%**	**2.6%**	**16.0%**	**11.3%**	**2.6%**
2010/11	51.7%	2.8%	16.9%	3.0%	15.3%	6.1%	4.2%
2009/10	28.5%	5.0%	16.8%	4.6%	35.1%	3.1%	7.0%
2008/09	12.5%	5.2%	15.8%	4.7%	48.0%	3.0%	10.7%
2007/08	0.5%	3.9%	18.8%	4.4%	58.7%	4.4%	9.3%
2006/07	10.0%	5.7%	36.3%	3.8%	33.6%	3.4%	7.3%
2005/06	42.8%	7.9%	21.9%	3.3%	17.1%	1.1%	5.8%
2004/05	15.7%	11.9%	38.1%	3.5%	23.2%	1.1%	6.5%
2003/04	34.0%	9.8%	28.1%	2.5%	20.4%	3.5%	1.7%
2002/03	33.3%	8.5%	31.5%	2.0%	18.4%	3.3%	2.9%
2001/02	51.2%	9.3%	20.1%	2.0%	13.4%	2.6%	1.4%
2000/01	56.0%	13.1%	12.7%	2.2%	11.5%	4.6%	0%*
1999/00	61.0%	8.4%	10.6%	1.9%	11.6%	6.2%	0%*
1998/99	57.9%	12.3%	7.9%	3.0%	12.8%	5.8%	0%*
1997/98	50.1%	18.3%	12.9%	2.0%	11.8%	4.8%	0%*
1996/97	47.8%	17.3%	13.2%	2.2%	9.6%	3.7%	6.1%
1995/96	50.6%	21.1%	9.9%	3.7%	10.0%	3.3%	1.5%

Source: *MI Irrigation Services, Griffith.*

**Original figures included in 'Other Crop' deliveries*

Table 1.6 (d): Summary of deliveries and areas for the major crop groupings during 2011-2012

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)
CITRUS	7,616	37,369	4.9
COTTON	10,038	76,859	7.7
INDUSTRIAL	32	4,559	n/a
OTHER CROPS	287	6,393	n/a
OTHER FRUITS	3,030	17,039	5.6
PLANTATION	89	1,120	0.4
RICE	27,255	320,033	11.7
STOCK & DOMESTIC	356	12,975	n/a
SUMMER CEREALS	3,557	24,570	6.9
SUMMER OILSEEDS	2,334	14,532	6.2
SUMMER PASTURE	2,756	12,177	4.4
TOWN SUPPLY	5	9,494	n/a
VEGETABLES	2,635	19,017	7.2
VINES	18,985	64,595	3.4
WINTER CEREALS	44,972	106,254	2.4
WINTER OILSEEDS	4,432	10,799	2.4
WINTER PASTURE	7,225	15,261	2.1
TOTAL		**752,845**	

***Source**: All figures provided by MI Irrigation Services*

2. GROUNDWATER MANAGEMENT

A consultant, Ary van der Lely, was contracted by Murrumbidgee Irrigation Limited to produce an annual groundwater report for 2011/12. The report was received in August 2012. The information contained in the report has been integrated with information collected, interpreted and analysed by Murrumbidgee Irrigation Environmental Staff to produce section A.3 of the Annual Licence Compliance Report. This report will be reviewed by the Corporate Licensing Unit (CLU) of the NSW Office of Water and Environmental Protection Authority (EPA).

Following the conversion in December 2011 of MIs IC5 Water Management Works Licence to a Combined Water Supply Works and Water Use Approval, the groundwater section of the LCR has been amended to reflect the changes. The year 2001 has been used as the benchmark year for analysis as it was the last year with full scale rice growing prior to the onset of a dry period and lower irrigation allocations.

2.1 REPORTING REQUIREMENTS

Since 1996 more than 900 piezometers have been used for groundwater monitoring in and adjacent to the Murrumbidgee Irrigation Area (MIA), However due to structural related age, maintenance, access issues and unforseen damage the number of piezometers producing readings has gradually dropped over this period. Numbers used in recent years are highlighted in Table 2.1(a):.

Table 2.1 (a): Piezometers with a reading from 2007 - 2011

Read Piezometers	01 –Sep-01	01-Sep-07	01- Sep-09	01- Sep-11
All	918	835	796	762
Calivil	27	22	21	27
Lower Shepparton Formation	389	331	319	325
Upper Shepparton Formation	502	482	456	410

In addition to the figures provided in Table 2.1 (a) above, more piezometers are in use but of those tested a “DRY” reading was recorded. A dry reading can be attributed to drop in groundwater table below piezometer screens in drought years. There may also be a small portion of older piezometers that may have casing and silting issues, however this is yet to be verified in the field by MI. Further relevant statistics are shown at Table 2.1 (b).

Table 2.1 (b): Piezometer statistics (*1)

Reading Type	Sep- 2010	Mar- 2011	Sep- 2011	Mar- 2012
Read	789	793	799	786
Dry	87	75	76	65
Flooded	0	2	0	15
Out*	57	63	58	67
Available**	876	870	875	866

*Out encompasses those which have been damaged by farm machinery etc
**Available is the total list including the positive flooded and dry readings

During March 2012 several piezometers were flooded.

An independent review commissioned by consultant Ary VanDer Lely on MI groundwater data concludes that the number of piezometers available and used is declining but are still mostly satisfactory in providing data on regional groundwater resources. However, there are some gaps in the dataset spatially and the loss of certain location piezometers may have serious consequences for the ability to interpolate and visualise suitable groundwater contour maps and assisting in the calculation of meaningful regional groundwater statistics.

The location of Upper Shepparton Formation (USF) and Lower Shepparton Formation (LSF) piezometers in the MIA used for monitoring during September 2011/12 are highlighted within various groundwater maps in Section 3 of this report.

There are some issues with the maintenance of the Piezometer set:

- An asset condition assessment has yet to be undertaken on all monitoring Piezometer. There is the possibility that some Piezometer may be providing false readings due to poor condition.

- The loss of Piezometer in some areas such as Wah Wah may less of a serious issue than other districts. Wah Wah is overall a typically low intensity irrigation district with low water applications. The groundwater levels in the LSF have always been 12 metres below ground level and are changing very little over time (Sep '11 = 13.4m). Salinity issues in relation to high irrigation use and increase in groundwater table levels are considered of little threat in this region. It is recommended that Piezometer in the Wah Wah district should be reviewed upon completion of an asset condition assessment and monitoring requirements revised in accordance with trended data, location, access and suitability in monitoring relevant parameters.

- To date, for most piezometers the height of the pipe above ground has been re-measured and the coordinates have been checked for accuracy by GPS. At a meeting in November 2011 Murrumbidgee Irrigation committed itself to take responsibility for the continued upkeep of the database of piezometer readings and the checking of its accuracy. The current MI list is EXCEL, which perhaps should be re-designed as a more appropriate database consistent with the Company's current data storage software and compatible with GIS.

- The AHD levels of the piezometer set and available DEM level data may not always match, as found during the independent review by consultant Ary Van Der Lely. This will require further investigation and rectification.

- Groundwater salinity samples have not been collected since 2002. An asset condition assessment has not been undertaken for MI Piezometer and no bailing of piezometers has been carried out in the past 10 years. This raises concerns with Piezometer performance and asset condition. For example Piezometer G1187, G497, G470 and G752 in Benerembah are deep piezometers but have recently been showing very high groundwater levels inconsistent with the levels in surrounding areas.

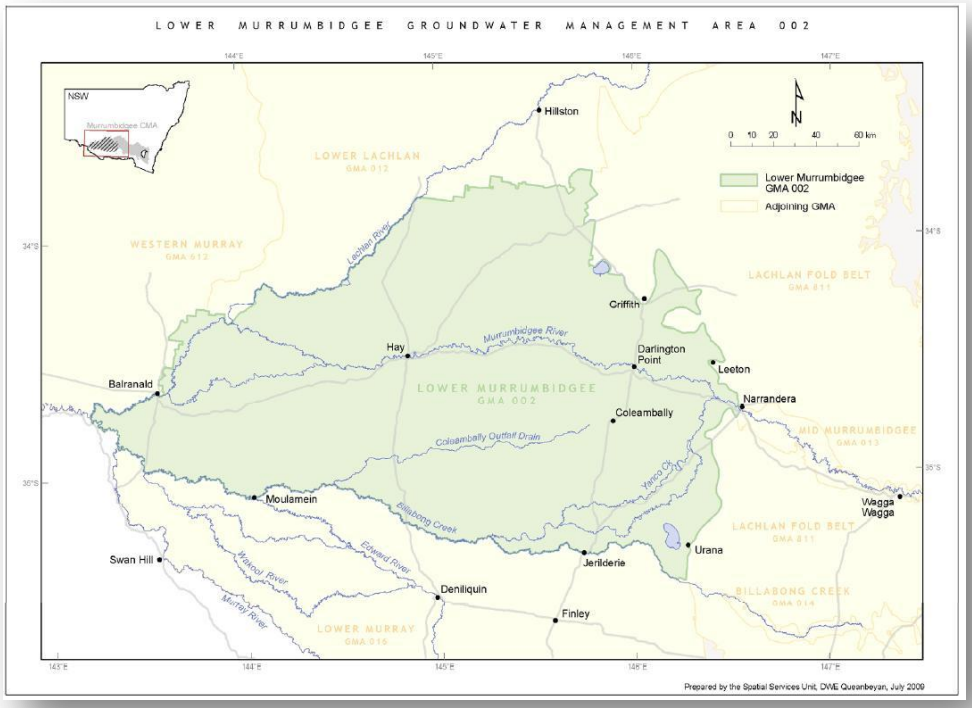
Groundwater levels for the Calivil Formation Piezometer are supplied by the NSW Office of Water. This information provides groundwater data for a further 50 regional piezometers in addition to 27 piezometers within the MIA owned by MI (Table 1). Piezometers from NSW Office of Water ranging from 35 m to 150 m were considered only, as the deeper layers are considered to be representative of the basal confined aquifer- the Renmark Formation. Groundwater pumping volumes for the region have not been considered for 2011/12.

2.2 BACKGROUND

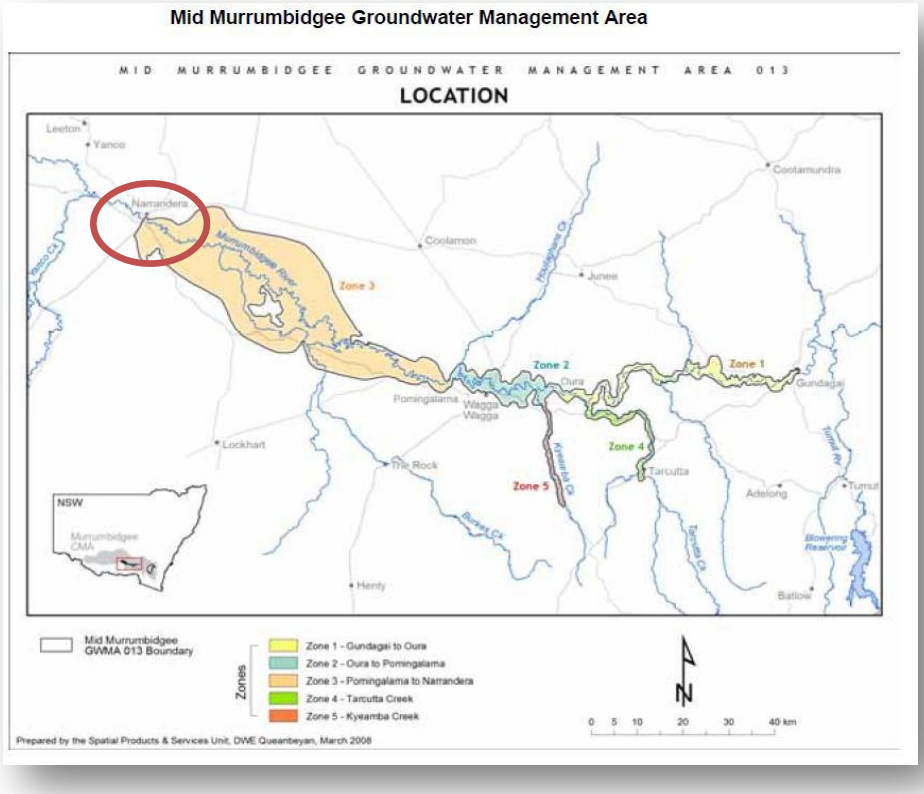
Description of Geology

A majority of the MIA regional falls within groundwater Management Area 002 which is comprised of the Lower Murrumbidgee groundwater resources- The Shepparton and Renmark Formations. For the purposes of this report the Shepparton Formation has also been subdivided into the Upper and Lower Shepparton formations (USF and LSF respectively). The remaining portion of the MIA (including some of Narrandera)

form part of the Mid Murrumbidgee GMA0013, (namely the Zone 3, western section of the management area. Map 2.3 (a) (a) refers to the Lower Murrumbidgee Groundwater Management Area 002 and Map 2.3 (b) highlights the Mid Murrumbidgee Groundwater Management Area 0013.



Map 2.3 (a) - Groundwater Management Zone 002- Lower Murrumbidgee (NSW, 2009)



Map 2.3 (b) - Groundwater Management Zone 0013- Mid Murrumbidgee (NSW, 2009)

GMA002- Lower Murrumbidgee Groundwater Management Area

The stratigraphical sequence of the MIA region varies from as early as the Middle Ordovician through to the Tertiary and Quaternary epochs. Pre- tertiary formations are thought to have originated during the middle-late Ordovician through to the Upper Devonian.

Middle Ordovician units are comprised of anadalusite and chiastolite slated containing graptolites associated with sandstone, quartzite, phyllite and schist with beds strongly folded, striking about N. 5^{o} W, are aligned parallel to the strike and dip steeply. Quartz reefs and lenses commonly intrude the beds with secondary minerals anadalusite, chiastolite, biotite and chlorite have been induced by regional metamorphism (Wynn, 1962). Weathering of the middle Ordovician is well advance and areas of outcrop are usually only indicated by the presence of abundant quartz shed and ferruginous nodules.

The late Ordovician can been seen in outcropping in the North East, containing outcrops of quartzite, Phyllite, schist, slate, siliceous sandstone and fine conglomerate. Structurally the rocks are similar to the Middle Ordovician having been strongly folded. The sediments have a wide distribution and likely represent a tightly folded sequence ranging in age from middle to late Ordovician.

Silurian deposits, known as the Square Head Beds are comprised on conglomerate, conglomeratic Sandstone and Sandstone located near Square Head Mountain, Beness Mountain and east of the Cocopara Range (Wynn, 1962). The Cocoparra Group of the Upper Devonian are comprised on sandstone, conglomerate, quartzite and shale uncomfortably overlying Ordovician and Silurian sediments (Wynn, 1962). The Cocopara Group can be divided into a lower and upper formation consisting of the basal bed (lower sequence) of the Barrat Conglomerate (about 700 m thick) of medium to coarse lithology typified by a predominance of white reed-quartz pebbles. Subordinate pebbles are of quartzite, slate of rhyolite with a typical sandy matrix. The upper formation (thought to be 1097 m thick north of Ardlethan) consists of monotonous succession of sandstone, quartzite and conglomerate with minor red shale bands. Representative beds of the upper formation can be viewed only in the Cocoparra Range and the Ardlethan Syncline.

Aquifer systems addressed in this report are of mainly tertiary and some quaternary origin. Tertiary sediments have a wide distribution but the majority are concealed by Quaternary aeolian and fluviaitile deposits.

GMA 002 is underlain by semi- consolidated flat lying Cainozoic sediments of mainly continental origin (NSW, 2009). The maximum thickness ranges from 170m in the east (at Narrandera) to about 400m at Balranald (Western end of the GMA). Cainozoic sediments overlie Palaeozoic and Mesozoic rocks that form basement rock. Sedimentary deposits are subdivided into three main units- the Shepparton Formation, the Calivil Formation and the Renmark Group. Figure 2.3 (c) below, extracted from *Lower Murrumbidgee Groundwater Sources- Groundwater Management Area 002 Groundwater Status Report 2009*, NSW Office of Water provides a conceptual representation of Tertiary geological sections across GMA 002.

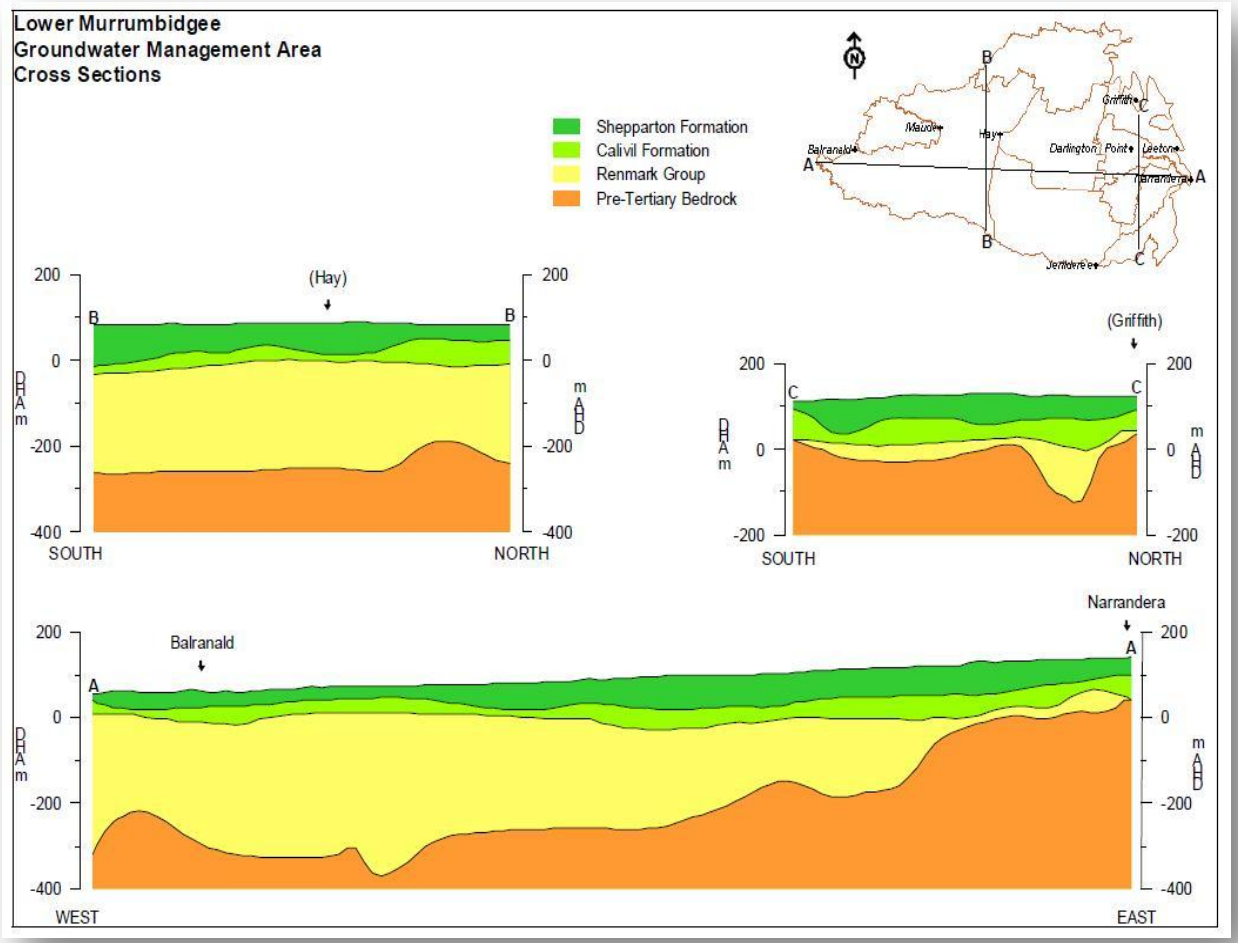


Figure2.3 (c) - Groundwater Management Zone 002- Geological Sections (NSW, 2009)

As highlighted in Figure 2.3 (c) above the Renmark group forms at the basal confined aquifer and is characterised by dark grey to black carbonaceous clay and dark brown lignite (NSW, 2009). It is also comprised of thick sequence grey, medium grained quartz sand which commonly comprise 30-50 % of the entire unit (NSW, 2009). Deep bores in the Griffith area (logs-249-252) have revealed two formations of unconsolidated sediments with the lower sequence being deposited under lacustrine conditions consisting of sand, gravel, pipe clay and brown coal ranging from Eocene to Pliocene (Wynn, 1962).

The Cavil Formation is a semi-confined to confined middle aquifer deposited during 5-15 million years ago (Late to middle Miocene) and is dominated by pale grey, coarse quartz sand with lenses of pale grey to white laolintic clay. The higher portion of sand, in some areas up to 70% of the composition, makes it the most productive aquifer of GMA002. Thickness ranges from 50 to 70 m in the eastern part of the management area with a maximum thickness of up to 90 m (NSW, 2009).

The Shepparton Formation which is of Late Pliocene to Pleistocene age directly overlies the Calivil Formation and is comprised on complex assemblages of clays, silts and sand that were deposited in a fluvio-lucustrine environment. Portion of sand is highly variable ranging from 20- 30% with thickness of sediments varying in averages closer to 65m (NSW, 2009). For the purposes of this report the Shepparton Formation has been divided into the Lower and Upper Shepparton Formations.

The origin of quaternary sediments have been heavily debated between geologists postulating fluviatile deposition during periods of high rainfall while the latter is the opinion that deposition has been mainly Aeolian and took place during arid phases. Sediments consist of largely sand, silt and clay and are traversed

by numerous 'prior streams'- ancient river channels attained widths many times that of the present Murrumbidgee River containing deposits of sand, clay and some gravel (Wynn, 1962). Prior streams over this period took the form of distributaries, diverging from a central river in the vicinity of Narrandera.

Other regional rock types not associated with the hydrogeological data of this report but are of significance to the region include co-magmatic granites intruding into the Upper Devonian sediments of tentative age of Carboniferous. Flows of rhyolite and dykes of the Upper Devonian and necks of the porphyry exist north and east of Ardlethan. A small flow of basalt located 13 km West North West of Griffith, fine grained, porphyritic in olivine and feldspar with regularly spaced columnar joints, partly or totally replaced by iddingsite (Wynn, 1962).

A summary of the water bearing units of GMA002 (Shepparton and Calivil/Renmark Formations) are highlighted in Figure 2.3 (d).

Description	Shallow (Shepparton)	Deep (Calivil/Renmark)
Age of water (years)	up to 3,000	2,000-20,000
Water Quality (mg/L)	Variable, generally 1,500-7,000, fresher quality closer to river and within irrigation areas.	Generally less than 1,000 in eastern parts, approximately over 40% of GMA.
Yields (L/s)	Variable, generally between 0.1 – 10, occasionally >10.	Variable, generally 50 - 350 occasionally >350.
Groundwater flow direction	generally east to west	generally east to west
Hydraulic gradient	1:4,300 (eastern part of GMA) 1:5,000 (western part of GMA)	1:1,900 (eastern part of GMA) 1:7,200 (western part of GMA)
Estimated rate of flow (m/yr)	0.04-0.20	0.1-11.5
Hydraulic conductivity (m/d)	0.5-2.0 (groundwater model)	2.0-60.0 (groundwater model)
Specific Yield/Storage Coefficient	0.10-0.25 (groundwater model)	1.00E-05 to 5.00E-03 (groundwater model)
Average thickness	65 m	100 in the eastern parts, >100 in the west
Volume of groundwater in storage (x1,000 GL)	532.5 (assuming a porosity of 0.25)	1,515.6 (assuming a porosity of 0.25)
Recharge to storage ratio	1:1,400	1:6,000
Volume of fresh groundwater in storage (x1,000 GL)	19.8 (assuming 37% of aquifer only)	330.0 (assuming average aquifer thickness of 100 m in recharge areas and 40% of aquifer only)

Figure 2.3 (d) - Groundwater Management Zone 002- Aquifer Characteristics (NSW, 2009)

The NSW Office of water commissioned a model of the Lower Murrumbidgee Groundwater Management Area, consisting of 3 layers representing the Shepparton, Calivil and Renmark aquifers. MI has been working with consultant Ary van der Lely and at times CSIRO to develop a suite of regional groundwater models for the Lower and Upper Shepparton formations. The models are in their final stages of review and still require field verification.

GMA0013- Mid Murrumbidgee Groundwater Management Area

Mid Murrumbidgee alluvial aquifer, which consists of unconsolidated Cainozoic alluvial sediments associated with the Murrumbidgee Valley from Gundagai to Narrandera, and the lower sections of the tributaries; Tarcutta and Kyeamba Creeks, as shown in Figure 2.3 (b). There are two distinct formations which are locally known as the Tertiary Lachlan Formation (from 2 to 12 million years old) and the

Quaternary Cowra Formation (1 to 2 million years old). These formations are equivalent to the Calivil Formation and Shepparton Formation respectively in the Murray Geological Basin (NSW, 2009).

The Murrumbidgee alluvial aquifer ranges in width from about 1 kilometre at Gundagai, to about 20 kilometres upstream of Narrandera. At Narrandera the bedrock boundary is very close to the river, and the aquifer narrows down to about 4 kilometres (NSW, 2009). GWMA 013 covers an area of 1236 square kilometres, and comprises the main body of the Murrumbidgee alluvial sediments and the lower sections of Kyeamba and Tarcutta Creeks. The Mid Murrumbidgee alluvial aquifer overlies Ordovician and Devonian metamorphosed sediments and granites. The depth of the unconsolidated sediments of the GWMA generally increases to the west, although there are some isolated bedrock highs beneath the management area (NSW, 2009). The depth of the alluvial sediments for the main sections of the alluvial valley in zones 2 and 3 are respectively shown in Figure 2.3 (e) below.

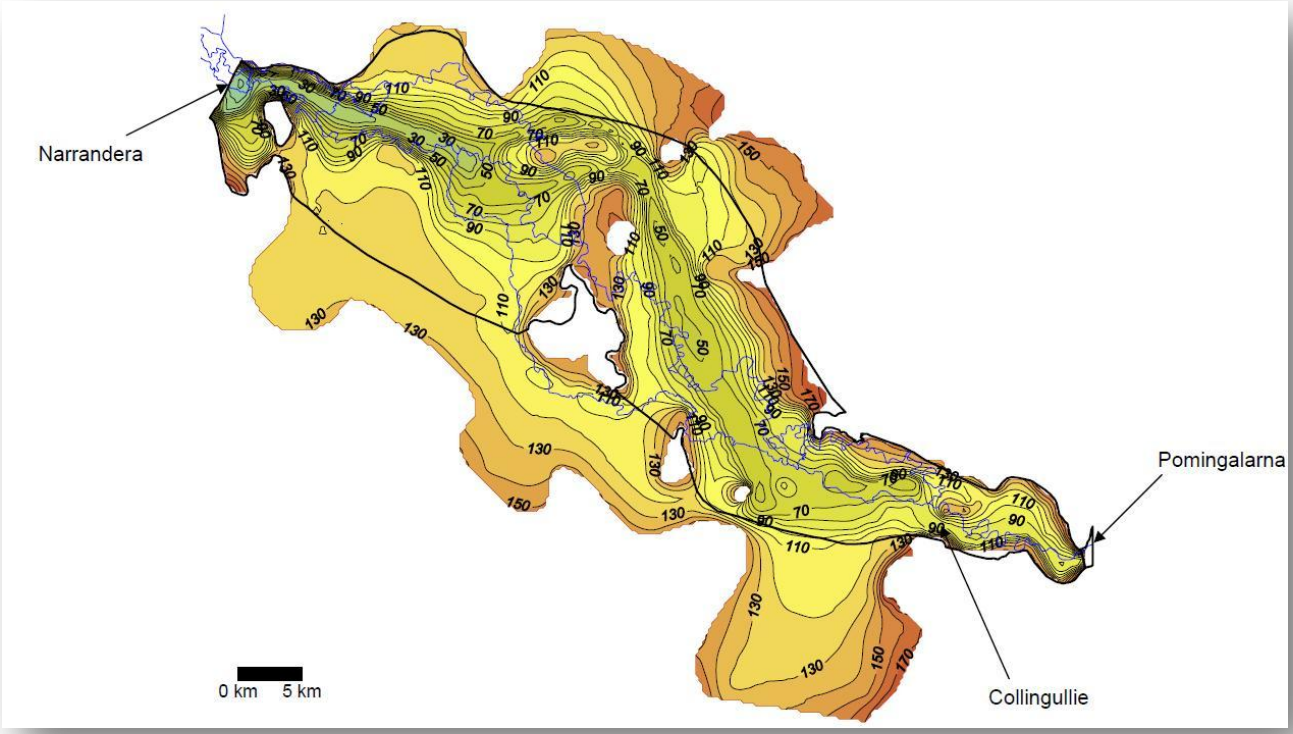


Figure 2.3 (e) - Groundwater Management Zone 0013- Depth of Alluvial Sediments (NSW, 2009)

The Lachlan Formation (lower of the two formations) is a confined aquifer system while the overlying Cowra Formation is a semi confined to unconfined aquifer system. These two formations are typical of alluvial sediments that exist in the south eastern Murray Darling Basin. Groundwater exploration bores have been drilled in the GWMA 013 since the late 1960s and early 1970s.

These bores where incorporated into the NSW Office of Water's observation network and have since been monitored regularly. MI has incorporated some of this data into the analysis of this report to assist in bridging gaps in the existing MI Piezometer monitoring network at Narrandera only.

Lachlan Formation sediments are commonly clean grey quartz sands and gravels, with intermittent layers of grey clay. The clay lenses are remnants of floodplain and/or wetland environments and were deposited in an environment of high rainfall and humidity (NSW, 2009). There are also records of the occurrence of wood fragments documented in drill logs and a palynological study of the sediments dated them as Pliocene in age (Wooley 1972). The formation commences from near Oura east of Wagga Wagga and increase in thickness to about 120m at Narrandera (37 to 160m below ground surface). Yields from the

aquifer vary depending upon the thickness and quality of sand and gravel layers intercepted. Yields range from about 10L/s at Oura to about 150L/s near Narrandera. Yields from individual bores depend on the bore construction (NSW, 2009).

The Cowra Formation consists of brown to yellow polymictic sediments of sands, gravel, silts, and clay. The polymictic nature of the formation suggests that mechanical weathering was dominant. The climate during the Quaternary was much drier than during the Tertiary, and the sediments in this layer reflect the typical flood/drought cycle of streams from a semi arid environment (Wooley 1972). The formation extends from ground surface down to varying depths. The formation increases in thickness from Gundagai in the east, where it extends to a depth of about 25 metres, to about 40m around Narrandera (NSW, 2009). The main poorly sorted gravel zones of the formation typically extend from about 2 to 24 metres below ground surface and are interlayered with clay and silt. Yields from the gravel layers are much lower than from the Lachlan Formation, with a maximum yield of about 15 L/s (NSW, 2009).

2.3 GROUNDWATER AND SURFACE WATER INTERACTION

The groundwater levels in the shallow Cowra aquifer indicate various degrees of connection with the Murrumbidgee River and Tarcutta Creek water levels (NSW, 2009). As highlighted in Figure 2.3 (F), the 1974 flood had a major impact on groundwater levels throughout the system. As a result of elevated groundwater levels associated with the flood event a reversal of groundwater flows associated with the elevated groundwater levels, from the aquifer to the river were documented for the following three to four years- making it a "gaining" river at Narrandera, indicating that the Murrumbidgee River is closely linked to the groundwater system, and that large flood events are a major recharge source for the Mid Murrumbidgee alluvial aquifers. The close relationship between the stream height and the groundwater levels are shown in Figure 5 for an area in close proximity to Narrandera at the western end of GWMA0013. At this location the river level is higher than the groundwater level in the Cowra aquifer. The groundwater levels have a similar long term trend to the river height between 1973 and 1997, with noticeable responses to river heights greater than 143m AHD (NSW, 2009).

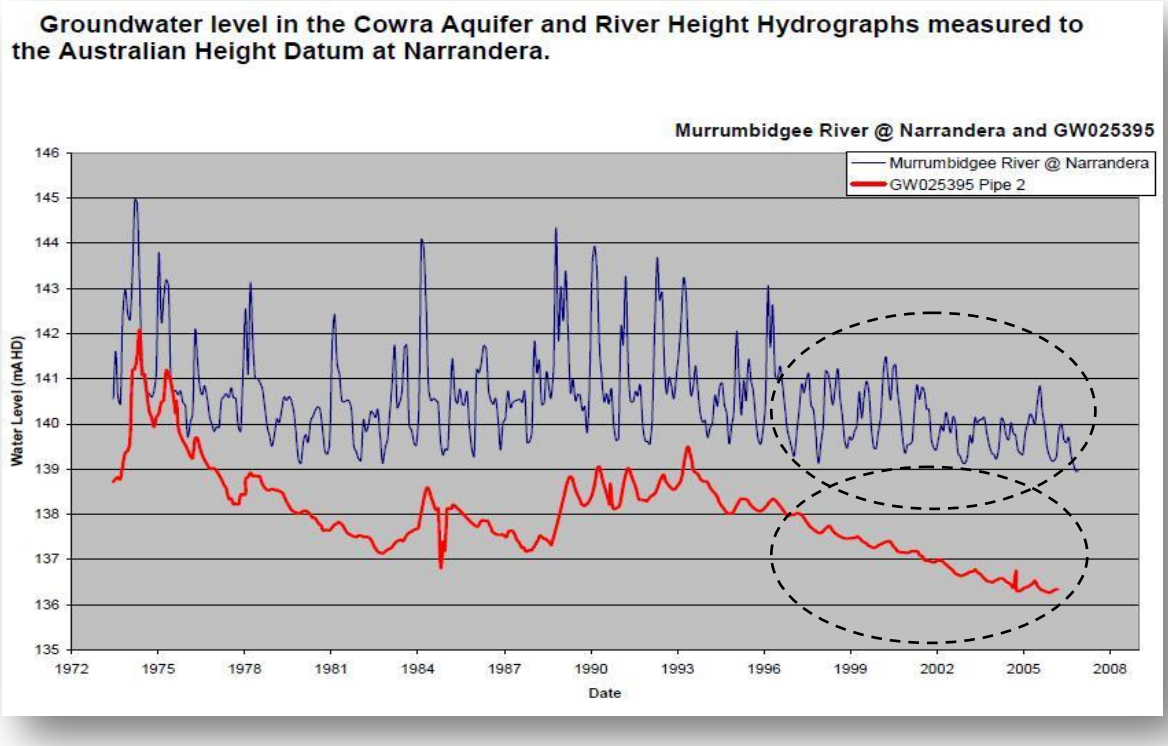


Figure 2.3 (f) - Groundwater Management Zone 0013- Groundwater Surface Water Interactions at Narrandera (NSW, 2009)

Post 1997, groundwater and river levels have experienced a constant declining trend and there is a reduced response in the groundwater levels to river height variations as highlighted in Figure 2.3 (f). During this period there has been a period of lower river level heights and a measurable influence of groundwater extraction from the Lachlan aquifer. It is likely the relationship is moving towards the behaviour of a disconnected system, where there is a constant rate of loss from the river system (NSW, 2009). MI have identified that more groundwater monitoring may be needed south and south east of Leeton and will look at addressing this in future monitoring programs. For the purposes of this report, discussion on groundwater trends will be directed only at the Upper and Lower Shepparton Formation.

Climatic and Water Use Data

Climatic data has been collected from CSIRO and MI's own meteorological stations. A list of regional weather stations is listed in Table 2.3 (g).

Table 2.3 (g) - MI and CSIRO Regional Weather Stations

Weather Station	Location	Type
Barren Box Station	Tabbita Irrigation District	Murrumbidgee Irrigation Site
Benerembah Station	Benerembah Irrigation District	Murrumbidgee Irrigation Site
Bringagee Station	Benerembah Irrigation District	Murrumbidgee Irrigation Site
Carathool Station	Wah Wah Stock and Domestic Irrigation District	Murrumbidgee Irrigation Site
Kooba Station	Yano Irrigation Area	Murrumbidgee Irrigation Site
Wamon Station	Yanco Irrigation Area	Murrumbidgee Irrigation Site
Yenda Station	Mirrool Irrigation Area	Murrumbidgee Irrigation Site
Hay Station	Town of Hay	CSIRO Site
Griffith Station	Hanwood	CSIRO Site

Table 2.3 (h) - BOM Representative Weather Stations in the MIA

Weather Station	Location	Type
Griffith Station	Griffith Airport	BOM
Yanco Station	Yanco Agricultural Institute	BOM
Leeton Station	Leeton	BOM
Narrandera Station	Narrandera Airport	BOM
Carrathool Station	Carrathool	BOM

Weather stations presented in table 2.3 (h) were used in the comparison of regional rainfall and groundwater data in this report. Figure 3 represents annual rainfall patterns for all stations in Table 2.3 (h) from BOM rain gauge stations spanning the period 1958-2011. Notable in Figure 2.3 (i) is the drop in annual rainfall between 2000 and 2008 where annual rainfall was below 450mm (with the exception on 2005-2006 at Narrandera where no data was available from this site). Figure 3 shows a rise in annual rainfall for 2009-2010 to between 400mm and 700mm. Figures 2.3 (j) to 2.3 (n) highlight individual annual rainfall data for each representative site. Information from 2001-2011 has been used in comparison to baseline groundwater data discussed in this report.

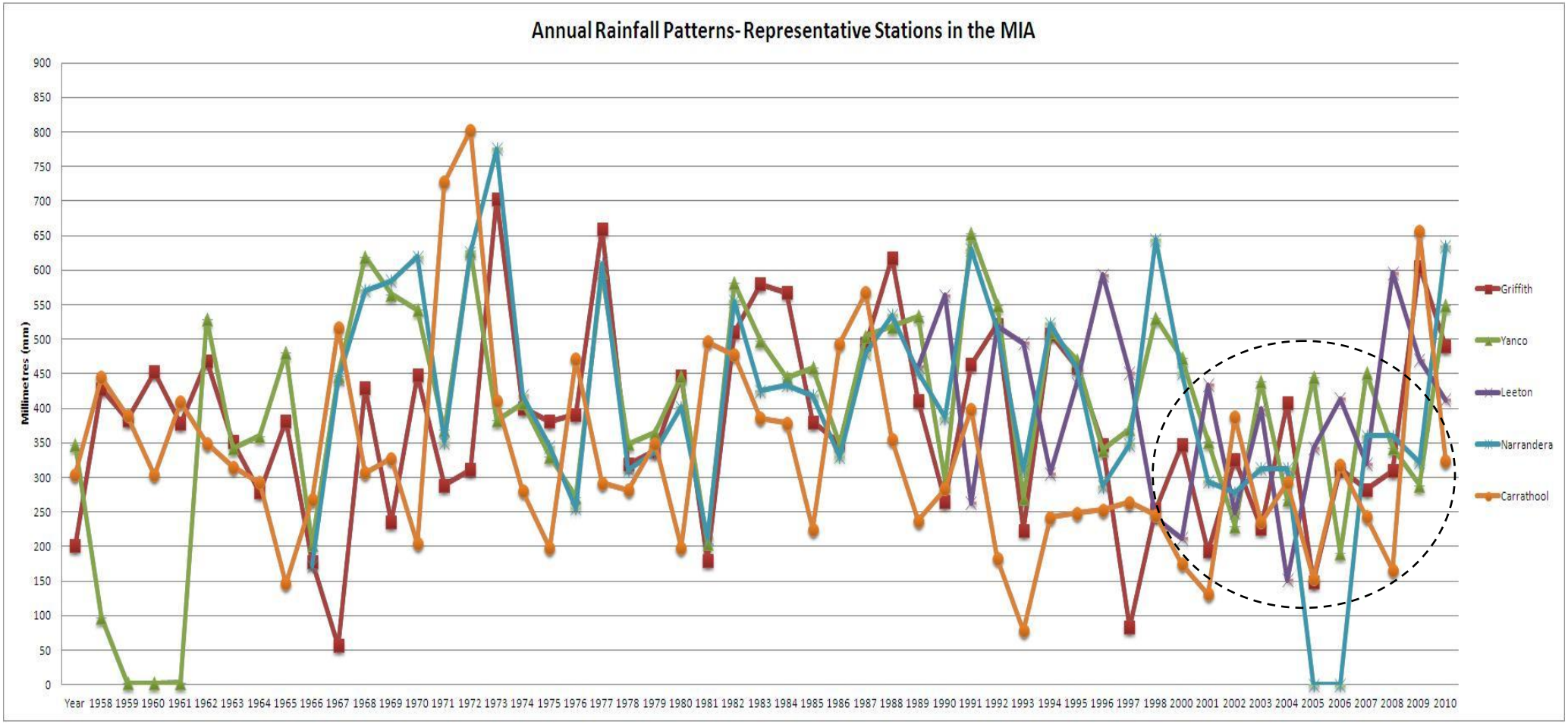


Figure 2.3 (i): Annual Rainfall Patterns of representative BOM gauge stations in the MIA with some records ranging from 1958-2011.

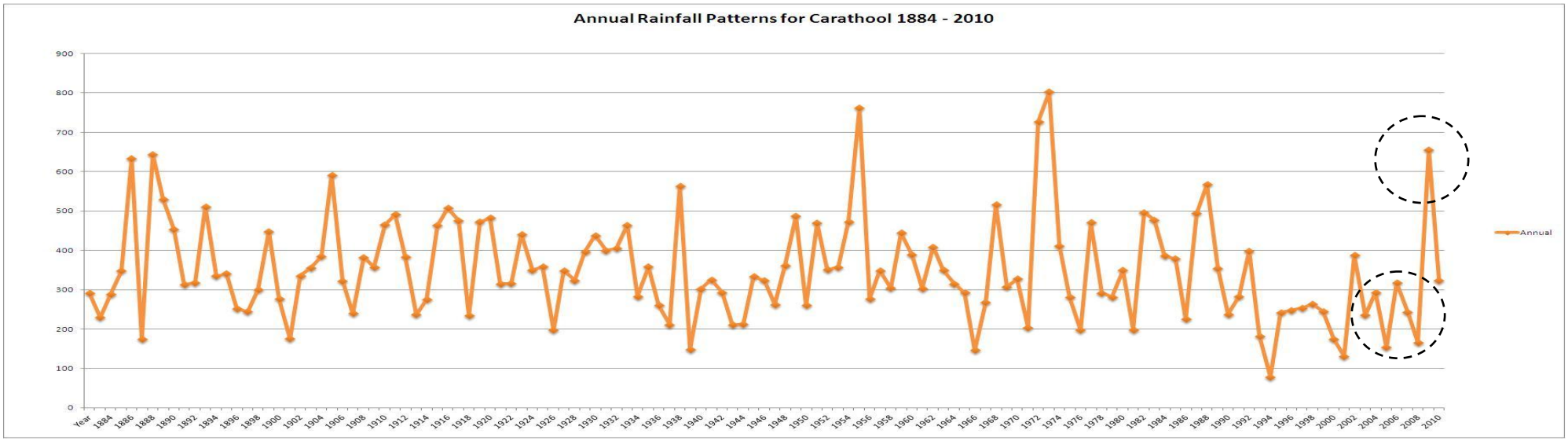


Figure 2.3 (j): Annual Rainfall Patterns of Gauge Station at Carathool from 1884- 2010.

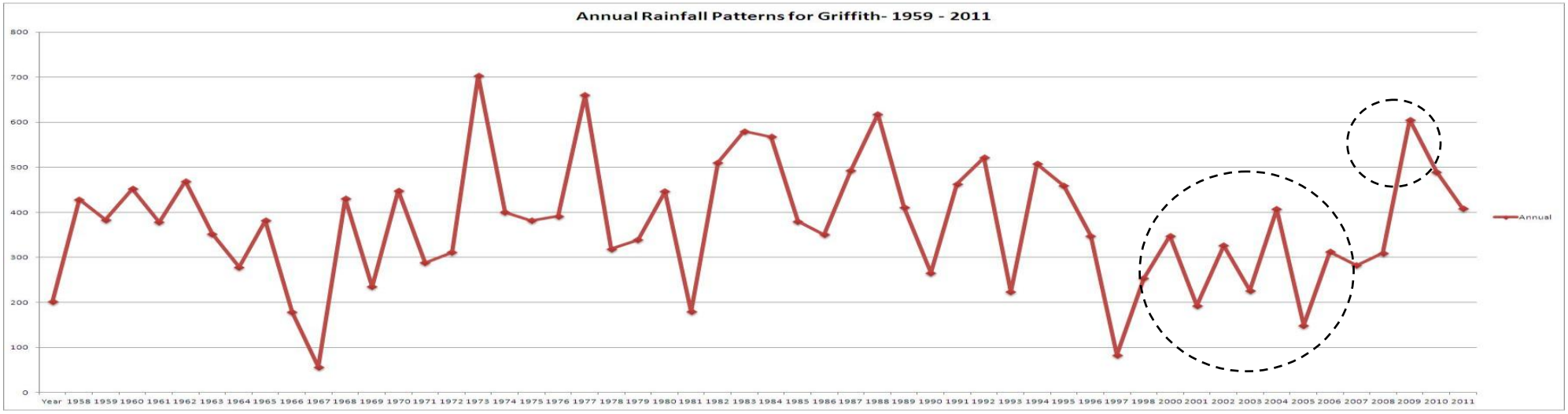


Figure 2.3 (k):- Annual Rainfall Patterns of Gauge Station at Griffith (Airport) from 1959-2011.

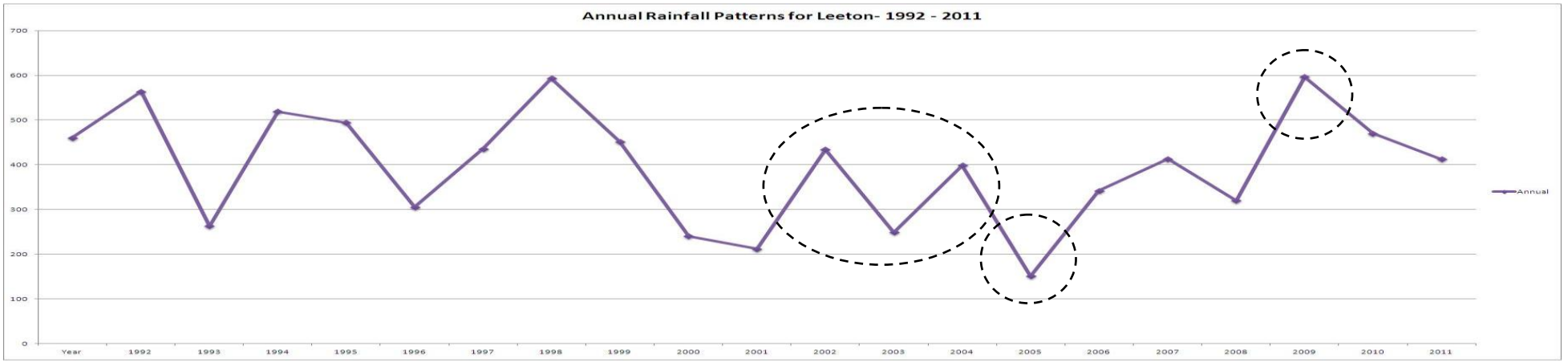


Figure 2.3 (l): Annual Rainfall Patterns of Gauge Station at Leeton 1991-2011.

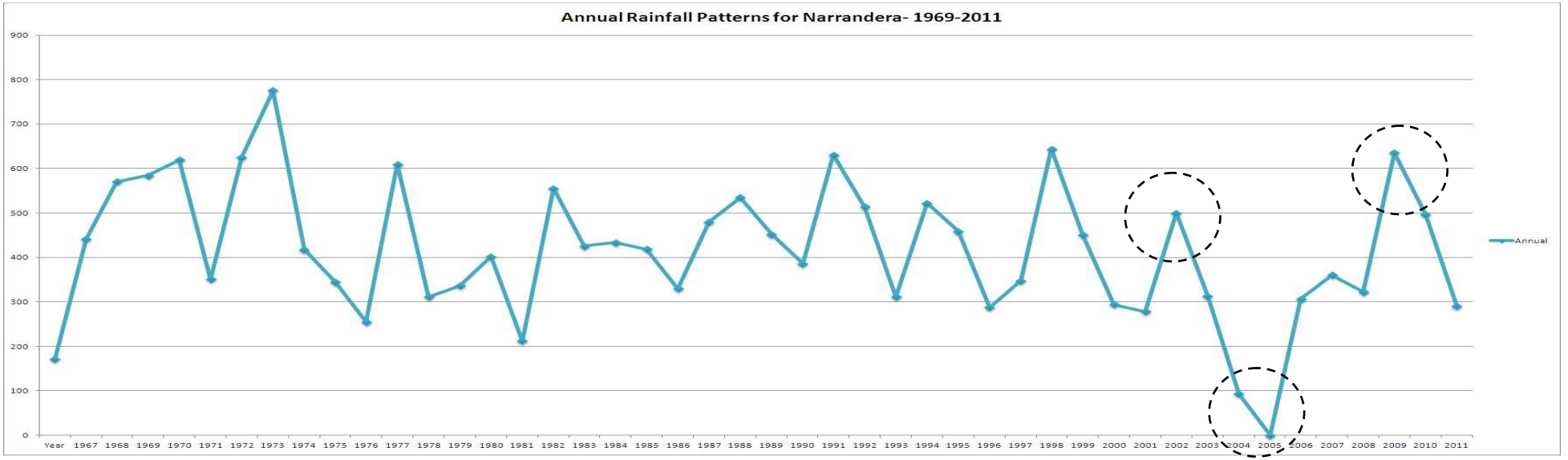


Figure 2.3 (m): Annual Rainfall Patterns of Gauge Station at Narrandera (Airport) from 1969- 2011.

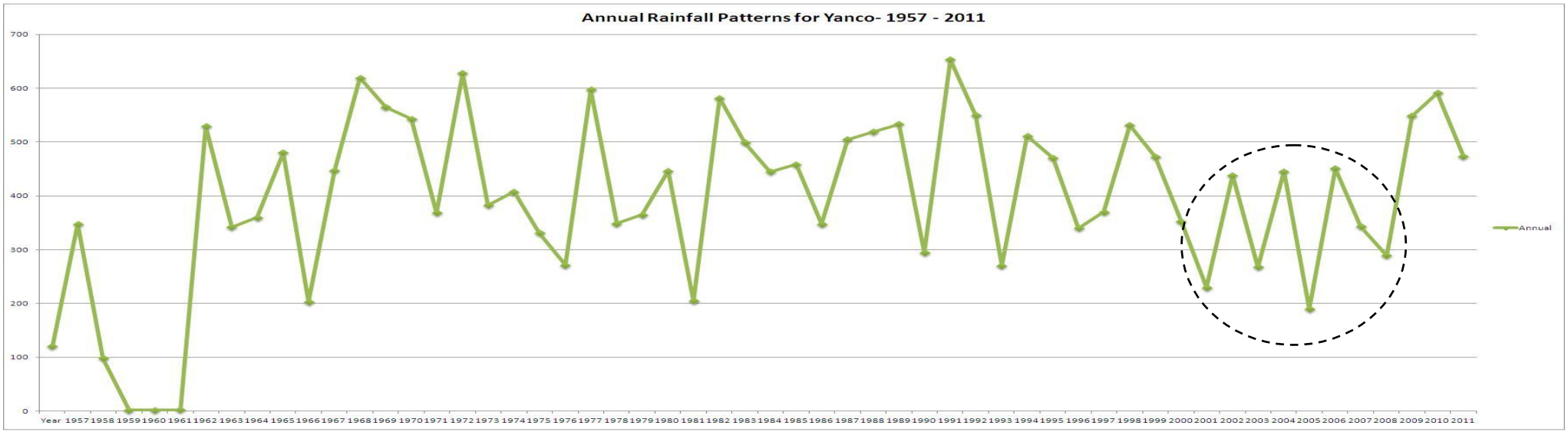


Figure 2.3 (n)- Annual Rainfall Patterns of Gauge Station at Yanco (Agricultural Institute) from 1957- 2011.

2.4 CROP WATER USAGE

MI collects data related to crop water ordering, supply and use. This information is useful in correlating contributing factors such as irrigation to rise in groundwater levels and in observing water quality parameters within channel and drainage systems.

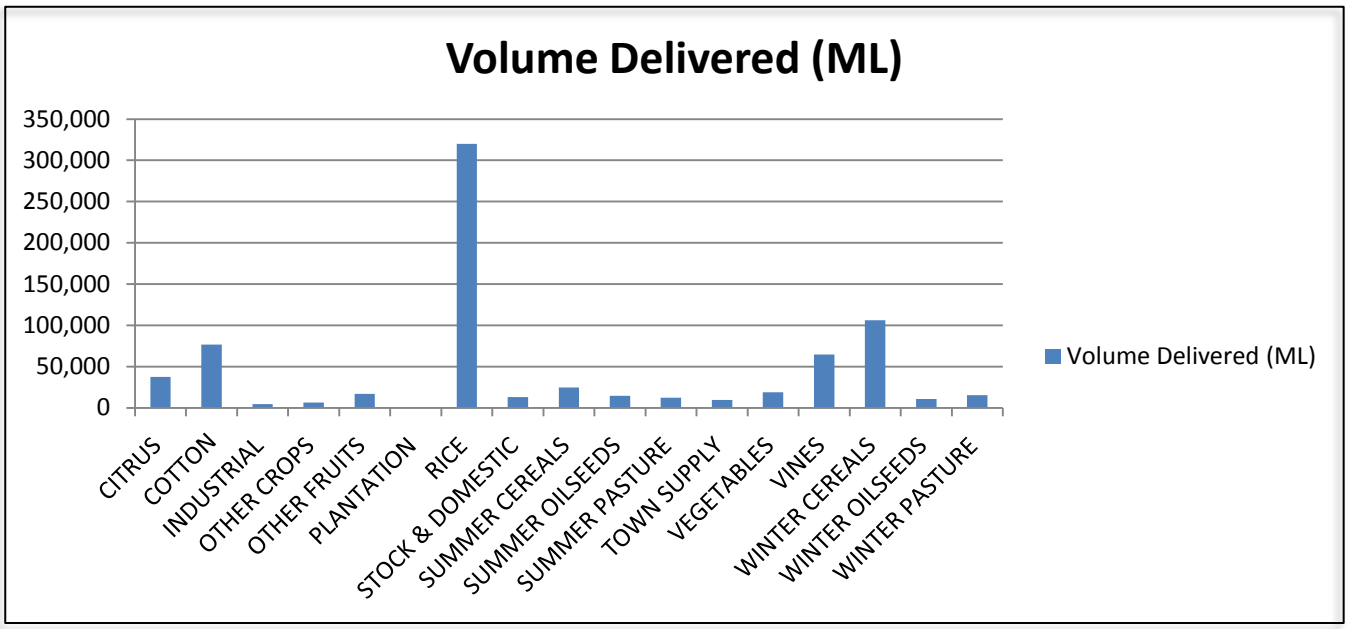


Figure 2.4 (a) - Volume (ML) of water delivered for Agriculture Use in the MIA by Crop Type.

Analysis of volume of water delivered by crop type shows that water for rice farming had the highest demand in 2011/12, followed by winter cereals, cotton and vines.

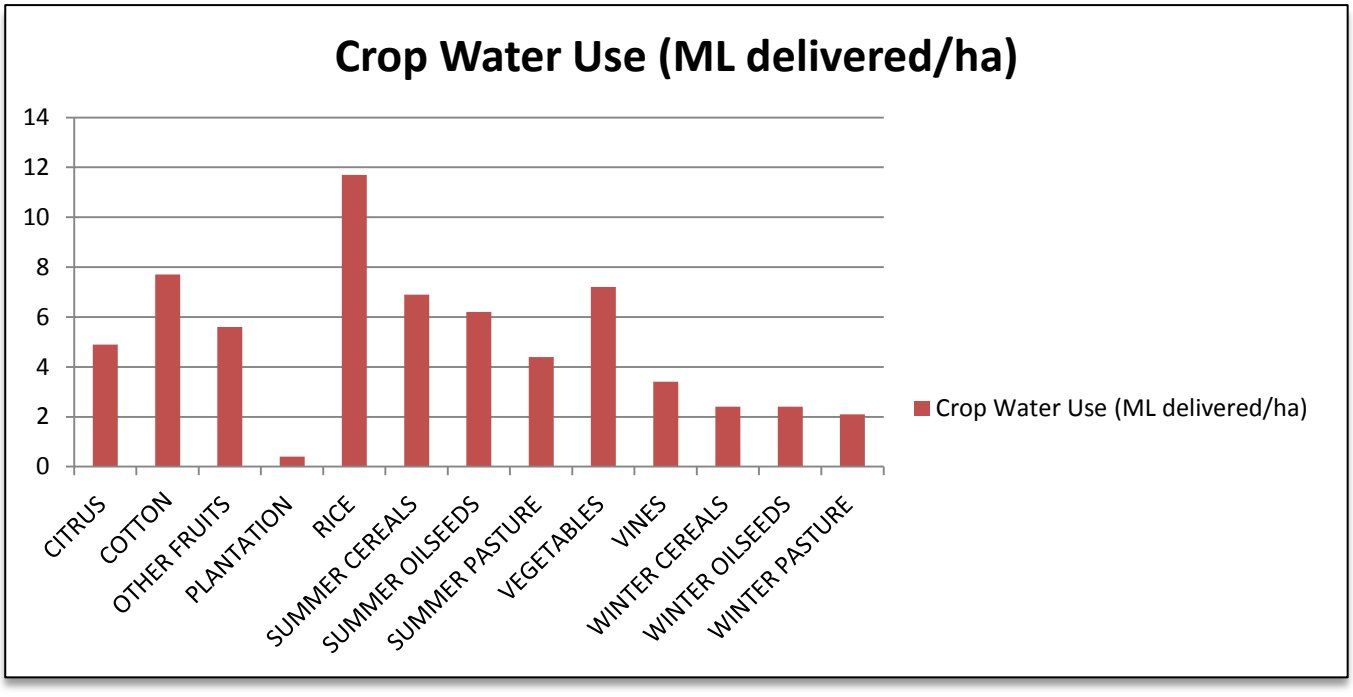


Figure 2.4 (b) - Crop Water Use (ML delivered/ ha) of water delivered for Agriculture Use in the MIA by Crop Type.

Analysis of crop water use shows that application of water per hectare was highest in rice farming followed by cotton, vegetables and summer cereals.

Rice Water Use and Rice Growing Practices

With the reintroduction of the full Rice Environmental Monitoring (REM) program following a prolonged period of drought, aerial photos of the MIA were captured in January 2011 and rice areas measured using GIS. This data was provided to all shareholders in post season surveys and used to verify rice water usage figures obtained from customer water orders.

A total of 319,195 ML supplied 27,179.5 hectares of rice grown in the MIA in the 2011/12 season with an average of 13ML/hectares recorded. It needs to be noted that the figures in Table 2.4 (d) are based on surface water irrigation only.

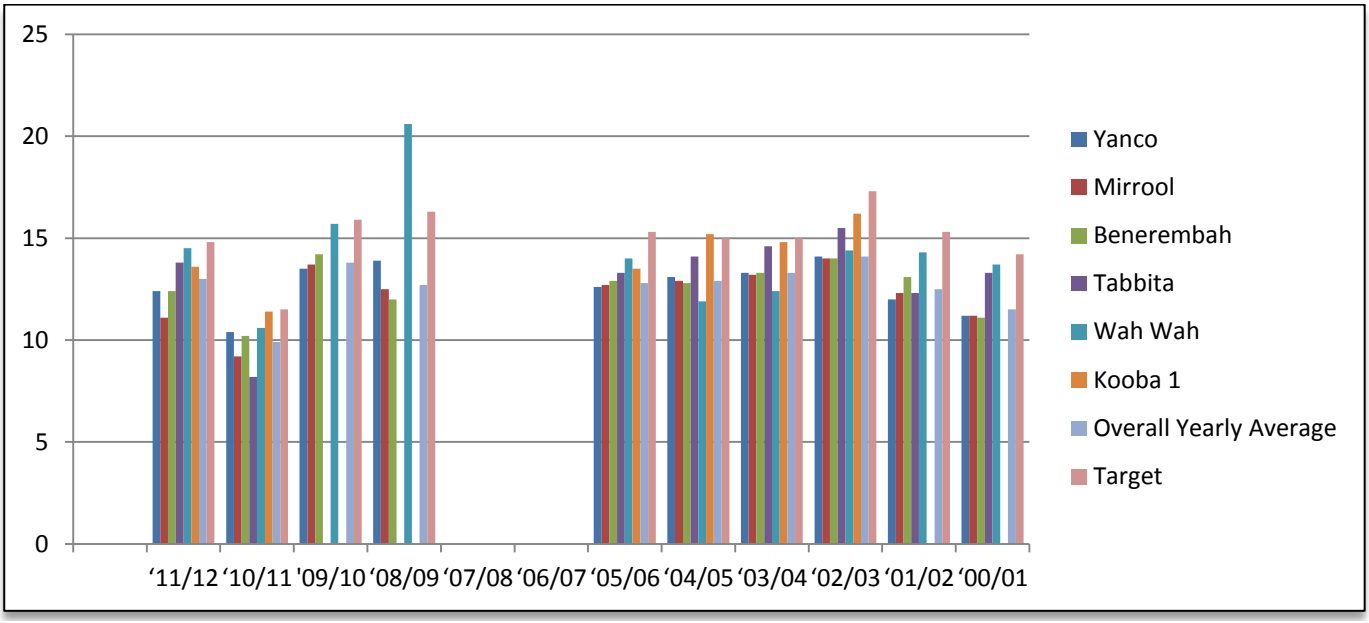


Figure 2.4 (c) - Rice Water Use (ML / ha) by region and rice growing year, including MIA yearly targets from 2001-2012.

Highlighted in figure 2.4 (c) above is the rice water use (ML/ha) by region from 2001-2012 seasons. It was noted that from 2007/08-2011/12 seasons that water use per hectare was close to crop water use targets for Benerembah, Kooba and Wah Wah

The NSW Office of Water is responsible for the management and recording of groundwater use. We have been made aware that groundwater has been used to grow rice, but information on how much was used or what crop it was used on has not been made available to MI.

Rice Growing Policy

This sub-section addresses the condition to implement measure to manage excessive groundwater accessions.

An updated rice policy, the MI Rice Growing Rules was implemented in October 2011. With the reintroduction of the full REM program, aerial photos of the MIA were captured in January 2011 and rice areas measured using GIS for the following seasons. This data was provided to all shareholders in post season surveys and used to verify rice water usage figures obtained from customer water orders.

Table 2.4 (d): Summary of historic rice water consumption for all areas and districts

			Average Rice Water Use (ML/ha)											
Irrigation Area or District	Total Rice Area (ha) 2011/12	Total Water to Rice (ML) 2011/12	'11/12	'10/11	'09/10	'08/09	'07/08	'06/07	'05/06	'04/05	'03/04	'02/03	'01/02	'00/01
Yanco	7821.9	96749	12.4	10.4	13.5	13.9	N/A	N/A	12.6	13.1	13.3	14.1	12	11.2
Mirrool	9884.9	108526	11.1	9.2	13.7	12.5	N/A	N/A	12.7	12.9	13.2	14	12.3	11.2
Benerembah	7931.7	93269	12.4	10.2	14.2	12	N/A	N/A	12.9	12.8	13.3	14	13.1	11.1
Tabbita	319.1	4314	13.8	8.2	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3
Wah Wah	919.9	11843	14.5	10.6	15.7	20.6	N/A	N/A	14	11.9	12.4	14.4	14.3	13.7
Kooba [1]	302	4494	13.6	11.4	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*
Total/average	27179.5	319195	13	9.9	13.8	12.7	N/A	N/A	12.8	12.9	13.3	14.1	12.5	11.5
Target			14.8	11.5	15.9	16.3	N/A	N/A	15.3	15	15	17.3	15.3	14.2

Sources: MI Irrigation and Environmental Services
Note: [1] Kooba's rice water use was previously calculated as part of Mirrool.

- *Targets based on Griffith and Hay CSIRO Stations*

2.5 REGIONAL GROUND WATER CONDITIONS

In previous reports MI have incorporated data for the generation of groundwater maps using 1996 as the benchmark, this has now been modified in the 2011-12 report to reflect a 2001 benchmark. Following 2001 there were drought conditions and significant changes in annual rainfall patterns. This section of the report will make comparisons of data collected in from September 2001, 2009 and the current year 2011/12. This is reflected in maps contained in this section.

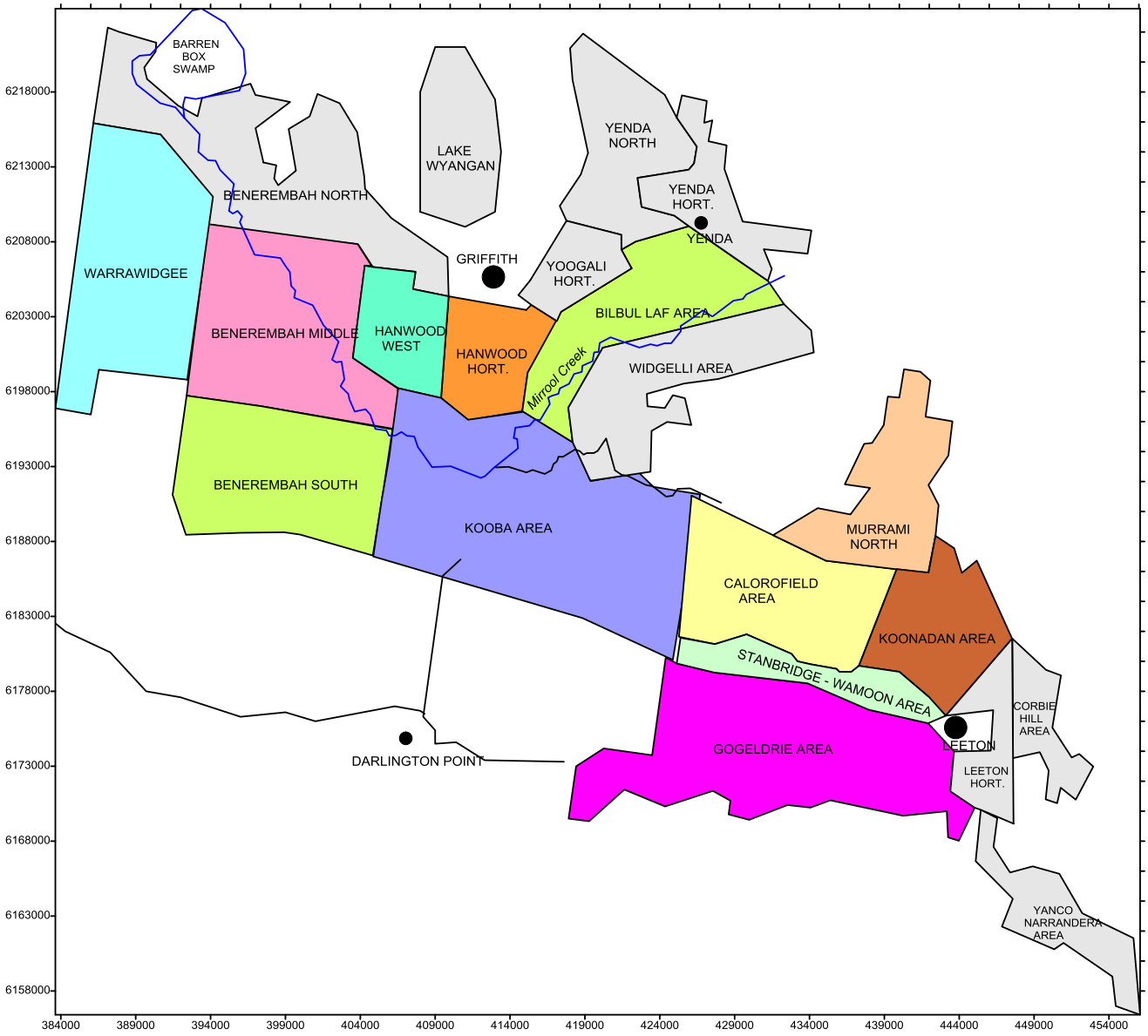


Figure 2.5(a): Hydrograph of average groundwater behaviour MIA USF zone, 2000 to 2012 (Van Der Lely, 2012)

Figure 2.5 (a) shows the outline of the hydro-zones used for the analysis of the 2011/12 groundwater conditions presented in this report. Delineation of hydro-zones is based on consideration of the stratigraphical conditions within the MIA, in particular the extent of the Upper Shepparton Formation based on geological characteristics within those zones. Many hydro-zones are identified within the MIA; these are briefly referred to in Table 2.5 (b) to 2.5 (d) below.

Tables 2.5 (b) to 2.5 (e): Hydro-zones of the MIA with Brief Comment of Stratigraphy (Van Der Lely, 2012)

b) Where USF Aquifer is Present

Name	USF comment	LSF comment	Comment
Warrawidgee	Narrow prior streams	More widespread	Significant clay layers
Benerembah Middle	Narrow prior streams	More widespread	Significant clay layers
Benerembah south	Significant USF	Widespread	Variable
Hanwood West	Sands present	More widespread	Significant clay layers
Hanwood hort.	Minor prior stream	Less significant	Significant clay layers
Bilbul LAF area	Minor Mirrool Creek deposits	Minor sands only	Very significant clay
Kooba area	Prior streams traversing	More significant	Some deep leakage
Calorofield area	Sands present	Probably significant	No
Koonadan area	Sands present	Not assessed	High WT area
Murrami North	Some sands present	Not present	Significant clay below
Stanbridge Wamoon	Prior stream area	Probably significant	Horticultural area
Gogeldrie area	Sands variable ?	Probably significant	Significant clay layers

c) Where No USF Aquifer is Present

Name	LSF comment	Comment
Benerembah North	Some presence	Calivil F. Within 15m depth
Lake Wyangan	Some limited presence	Surficial permeability, undulating
Yenda North	Hardly any sands	Clay profiles
Yenda Horticulture	Hardly any sands	Clay profiles
Widgelli area	Hardly any sands	Clay profiles
Corbie Hill area	No LSF	Hilly, surficial permeability
Wah Wah District	USF variable presence, LSF more significant	USF piezometers too small in number

d) Other Hydrozones (not analysed)

Name	USF comment	Comment
Yoogali horticulture	Some sands	Low permeability underneath
Leeton Horticulture	Sands at South Leeton	Variable
Yanco Narrandera	Sands near the River	Merging to foothills

The hydro-zones of group (b) are being reported here in terms of groundwater conditions. This report will not address group (c) hydro-zones as there have been no measurable piezometers in the USF. The LSF sands extend into north Benerembah, West to Wah Wah and east and south east to Yenda/Widgelli and North to Lake Wyangan, which are also depicted in the groundwater figures contained in this report.

The Lake Wyangan area and the Wah Wah District have been considered separately and reported independently from other LSF Hydro-zones. All analysis involving averages and other statistics will apply only to the USF hydro-zones. The hydro-zones of group (d) have been considered too small a size and deficient in data to warrant close analysis for the 2012 report.

MI will endeavour to encompass new monitoring points where data is deficient in the group (c) and (d) hydro-zones in future monitoring programs.

Van Der Lely (2012) plotted the averages of standing water level measurements collected by MI for LSF and USF across the hydrozones, Figure 2.5 (e) below shows a hydrograph of average groundwater behaviour in the USF and LSF zone from 2000 to 2012. As noted in Figure 2.5 (e), water levels in the upper and lower Shepparton formations fluctuate simultaneously, suggesting that they are intrinsically linked (Van Der Lely, 2012).

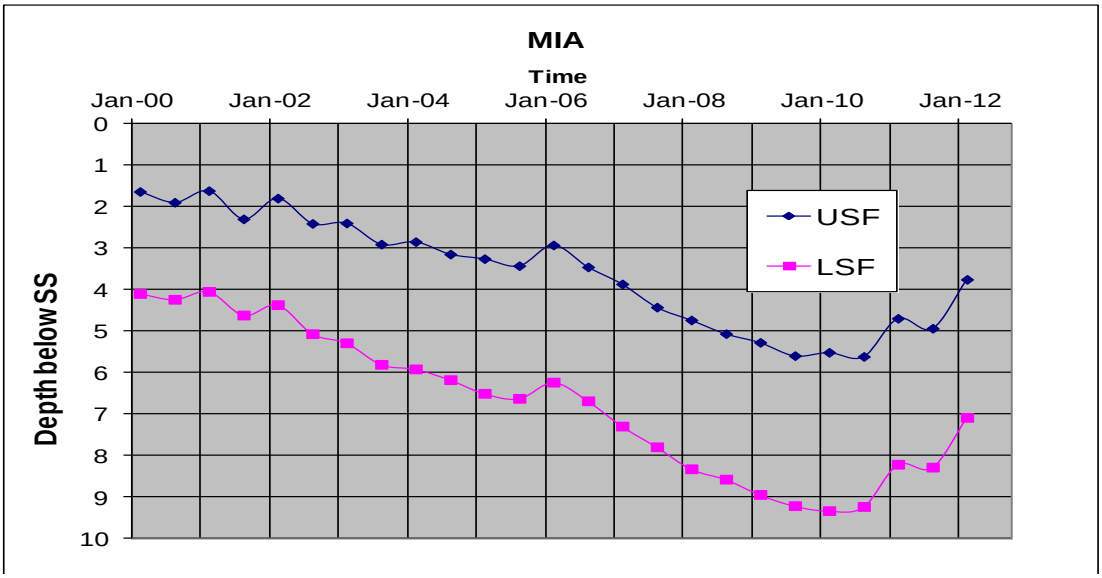


Figure 2.5 (e): Hydrograph of average groundwater behaviour MIA USF zone, 2000 to 2012 (Van Der Lely, 2012)

In the MIA, changes in groundwater levels happen at a broader scale due to the extent and location of the Shepparton Formation Aquifer. This aquifer system extends from somewhere between Narrandera and Leeton through to parts of Wah Wah. Causes and effects of increases in groundwater levels are witnessed on a broad scale in this aquifer and can occur from activities such as intensive irrigation, high rainfall and flood events. Therefore in theory what happens in Hanwood may affect groundwater levels at Benerembah and vice versa.

In the Murrumbidgee Irrigation Area MI is working towards keeping water tables below two metres from the surface; this is the point at which salinity risk is increased and has the potential to impact adversely on crop production.

Table 2.5 (f): ***Average Standing Water Level in USF Regions of the MIA from 2001-2012 (Water level below ground level)***

MONITORING REGION	AVERAGE 2001	AVERAGE 2009	AVERAGE Sep 2011	AVERAGE Mar 2012
Warrawidgee	2.96	5.63	4.87	3.90
Benerembah Middle	1.66	5.31	3.88	2.27
Benerembah South	2.38	6.53	5.71	3.99
Bilbul Area	1.73	4.13	3.62	2.81
Hanwood West	2.94	6.97	6.16	4.49
Hanwood Horticulture	2.45	2.90	4.70	3.38
Kooba Area	2.02	5.88	5.53	4.24
Murrami North Area	1.73	4.31	2.99	2.30
Calorofield Area	1.88	6.10	5.42	4.09
Koonadan Area	1.89	4.46	3.90	3.01
Stanbridge- Wamoon Area	3.32	6.59	6.56	5.89
Gogeldrie Area	3.49	7.30	6.86	5.56
Wah Wah District	11.84	12.87	13.42	13.40

Figure 2.5 (f) below, shows a hydrograph of average groundwater behaviour in the USF zone from 2000 to 2012 in Hydrozones where the USF is present.

Throughout this past year water levels have continued to rise on average at least 1 m a year from 2009-2012, likely attributed to high rainfall, flood events and increased irrigation due to favourable climatic patterns since 2010 (from drought to periods of rainfall).

Benerembah Middle has seen the largest rise of groundwater level in comparison to other regions over this period, which when correlated with rainfall data from Figure2.3 (i) and Rice Water Use data from Figure 2. 4 (d) which can be attributed to an increase in rice farming linked to favourable climatic patterns and water availability. Analysis of historical groundwater data undertaken by Van Der Lely (2012) and highlighted in Wynn (1962) presence of “prior streams” may also being a major contributing factor to quicker than expected rises in groundwater levels in Benerembah, providing for increased infiltration of irrigation water into the USF.

Due to this analysis, MI is particularly interested in groundwater level rise in Benerembah, Bilbul and Murrami North which are close to approaching 2.5m from surface level. It is important that MI continue to monitor and assist stakeholders in managing water for irrigation, particularly high intensive water-use crops, to ensure groundwater level does not reach 2 m and that salinity does not impact on Agriculture in the MIA. MI intends to undertake a soil and groundwater salinity program in these areas in 2012/13 where in which preliminary results will be available in the 2012-13 report.

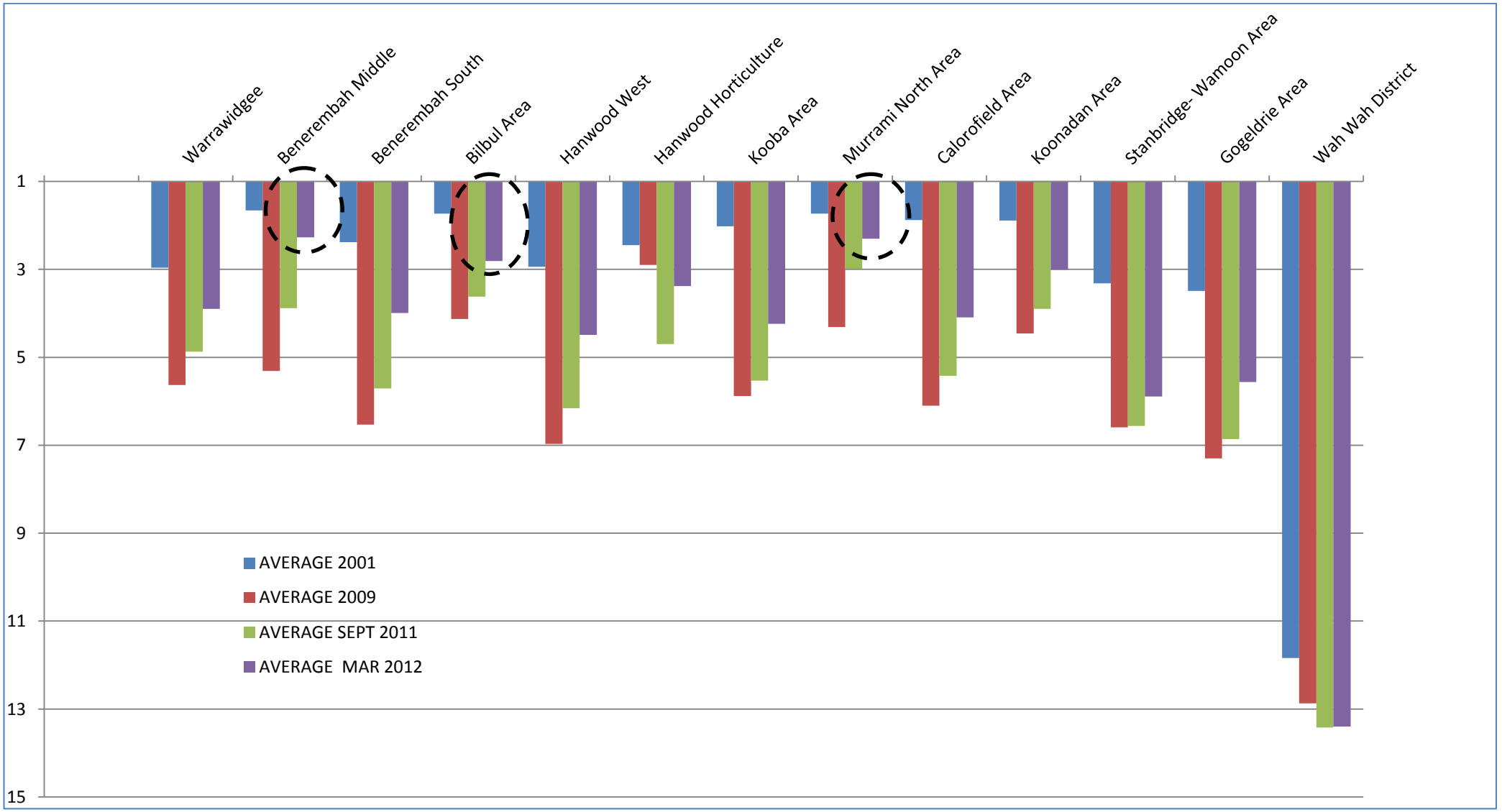
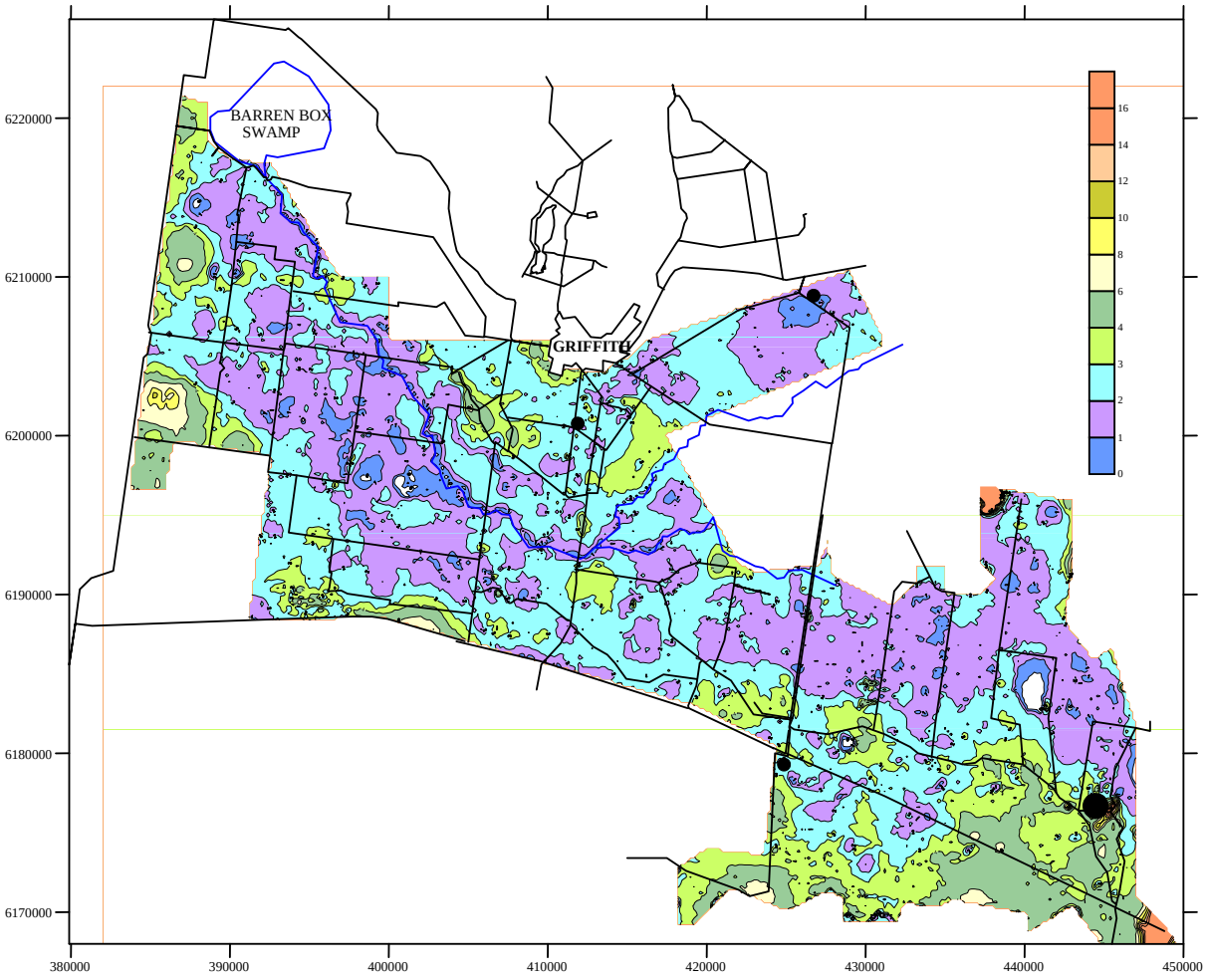
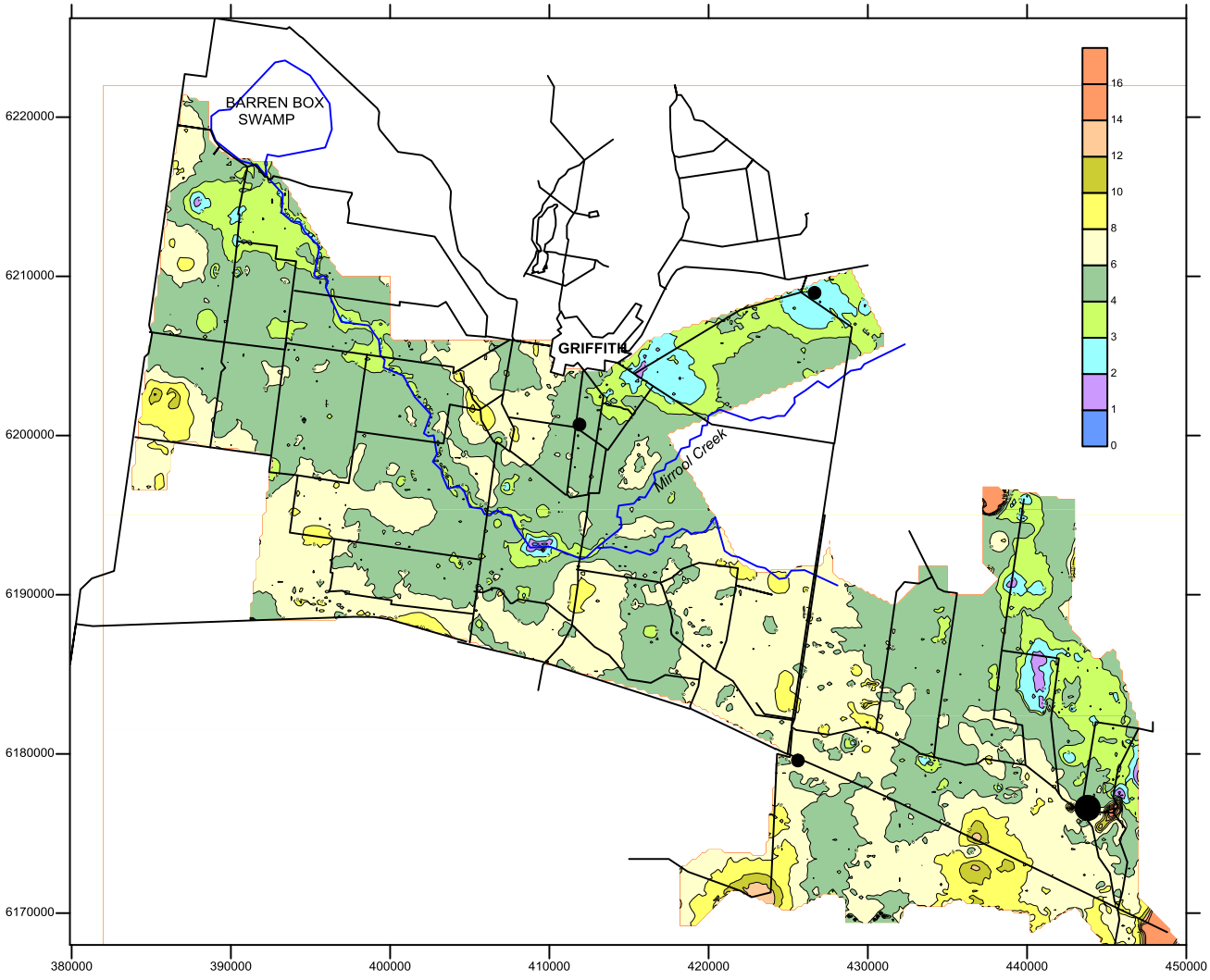


Figure 2.5 (g): Hydrograph of average groundwater behaviour MIA Shepparton Formation, 2000 to 2012



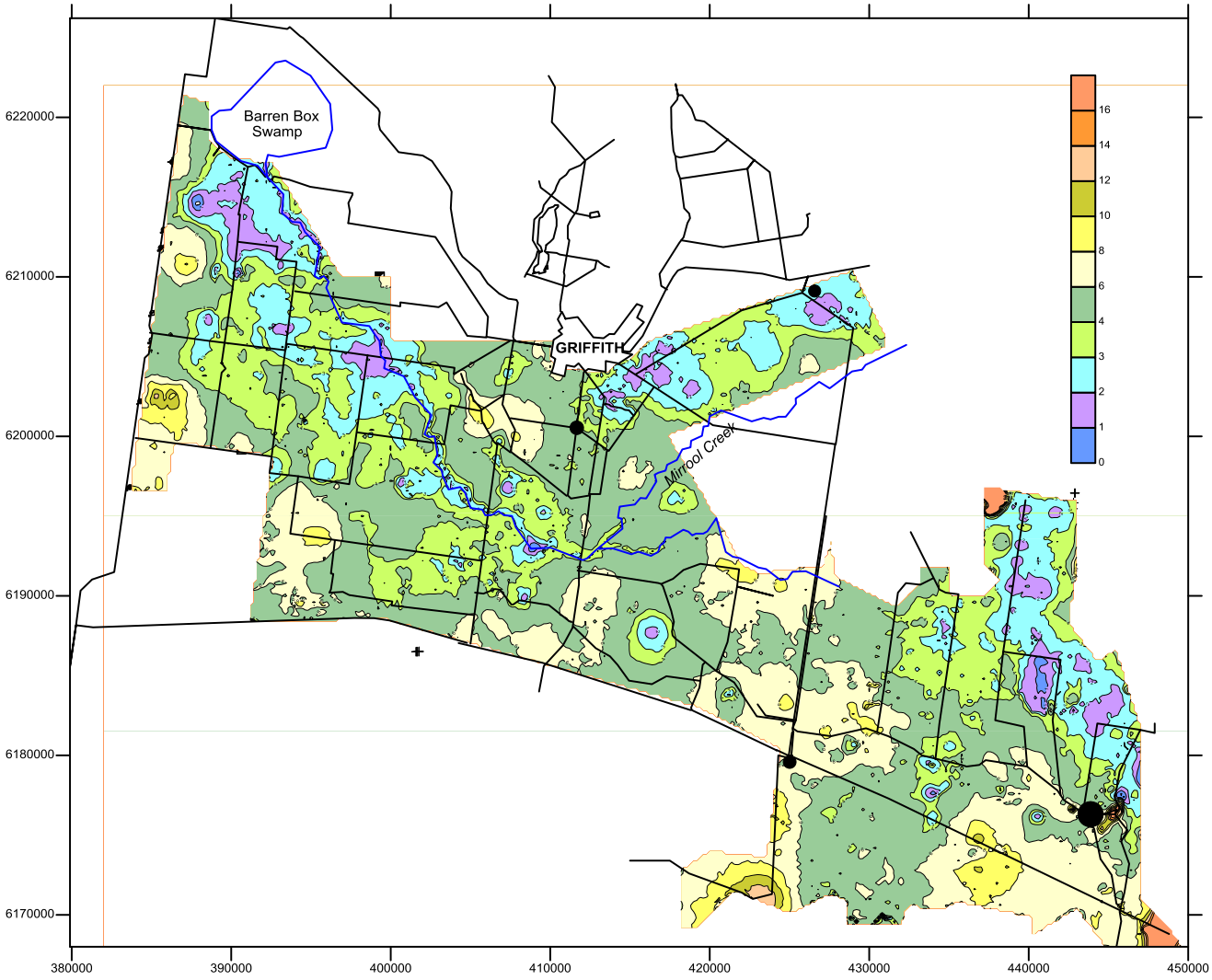
Map 2.5 (h): Groundwater contours for the MIA USF for Sep 2001(Van Der Lely, 2012)

Map 2.5 (h) has been generated in Surfer through data supplied by MI and models developed by commissioned consultant Ary Van Der Lely (2012). Results from this data show that in September 2001 that close to 70% of region had groundwater levels between 0-2 m with 20% between 3-4m below ground level. This is comparable with consistent with higher rainfall over 1994-1999 as shown in Figure 2.5 (g).



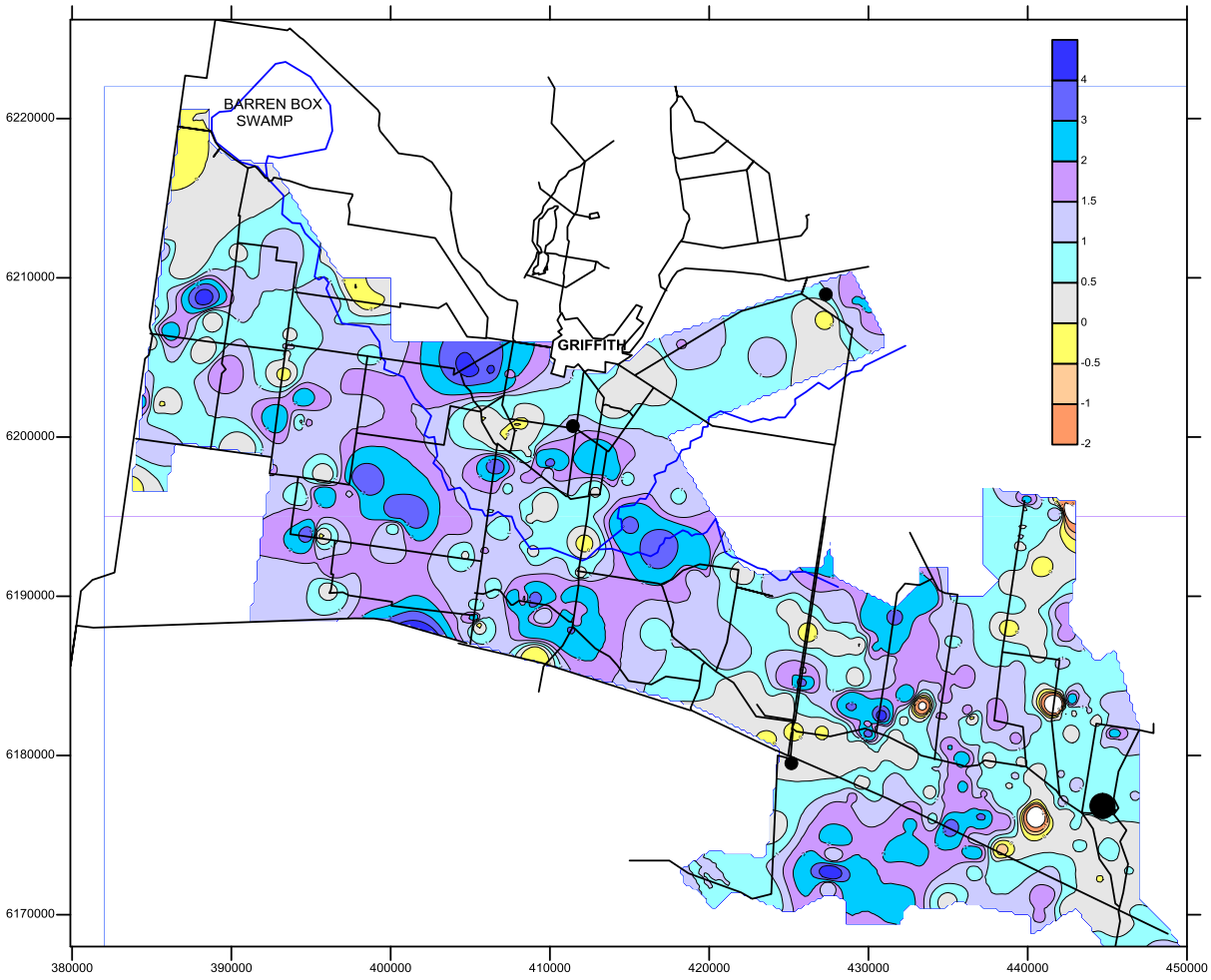
Map 2.5 (i): Groundwater contours for the MIA USF, September 2009

Map 2.5 (i) has been generated in Surfer through data supplied by MI and models developed by commissioned consultant Ary Van Der Lely (2012). Results from this data show that in September 2009 that close to 60% of region had groundwater levels between 3-5 m with 40% between 6-10m below ground level. This is a significant difference of that showed in Map 1.5 (h) an can be attributed to a decrease in rainfall during the drought (2000-2009), and a reduction in water availability for rice growing (no rice grown in 2007-08) and less water available for medium and low security crops.



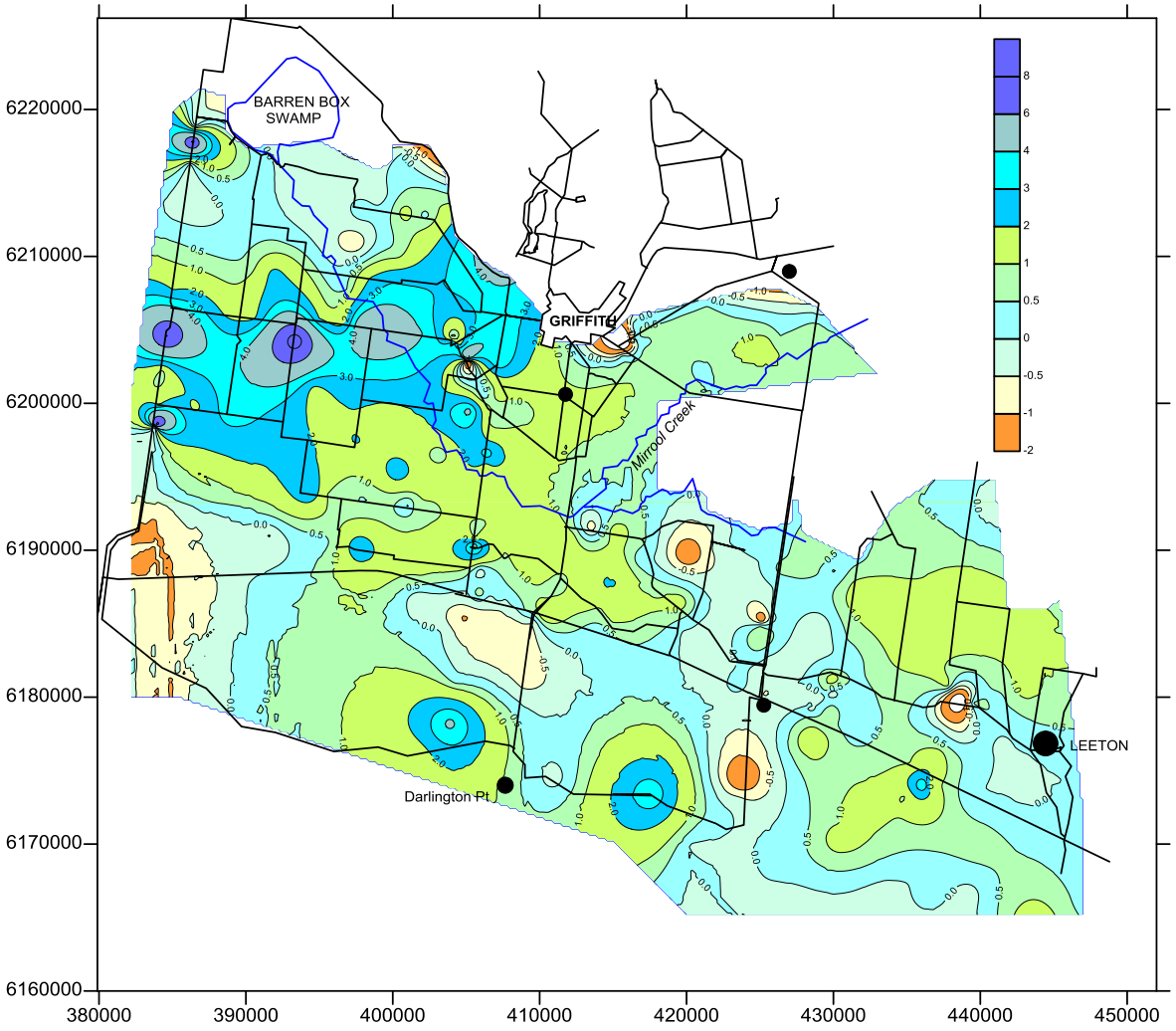
Map 2.5 (j): Groundwater Contours for the USF for September 2011 (Van Der Lely, 2012).

For September 2011 higher groundwater levels of the Koonadan/ Murrami, Benerembah and Bibul hydro zones ranged from 1-6m. This is comparative to a rise in rainfall and allocations across the region, moving from an 8-10 period year of drier conditions (drought) into wetter conditions. As a result there was an increase in rice growing in these regions due to favourable conditions and water availability which was not present in 2007-08 (Highlighted in Figure 2.4 (c). The rise in the groundwater table across these regions in particular can be considered to perhaps be linked to a number of factors such as higher than average rainfall within a short time scale, a similar increase in irrigation patterns simultaneously, and the stratigrpahy of the regions where the groundwater level was between 1-3 m from ground surface.



Map 2.5 (k)): Regional Groundwater Rises in the MIA (in metres) in the USF from September 2011 to March 2012 (Van Der Lely, 2012)

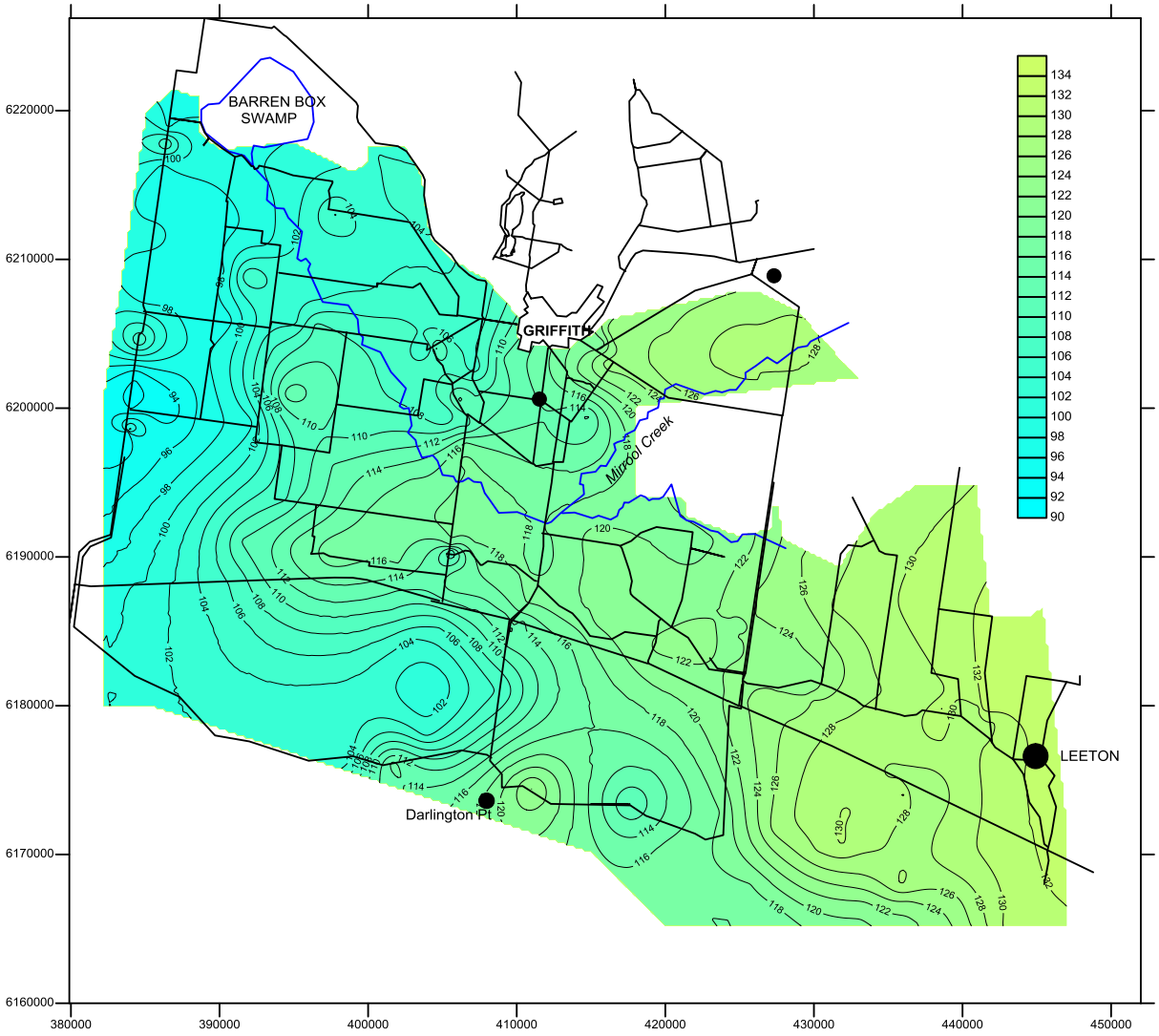
Map 2.5 (k) shows the rise of groundwater levels in the USF (in metres) from September 2011 to March 2012. The average increase across the mapped region was 1.28 metres (Van Der Lely, 2012). Area of greatest concern as discussed previously in this report was in the Benerembah Middle hydro-zone where groundwater level rise was above average. The Yenda area shows large increases as expected but there are few piezometers in that area to record and provide a localised observation suitable for modelling. A uniform rise across the regions for March 2012 may indicate impacts in groundwater level rise from flooding with the addition of larger than expected volumes of water than normally present at that time of the year over a shorter period of time.



Map 2.5 (l): Rise in groundwater pressures in the MIA LSF for the period Sept.2009 to Sept. 2011 (Van Der Lely, 2012).

Map 2.5 (l) applies to the MIA as well as the zones to the south (Kooba Station) and the area of North Benerembah where no USF aquifers occur. The average change within the USF defined area of the MIA LSF was 0.93 metres. It is shown that the area with the highest increase is in the Benerembah area. Whilst the explanation may be considered speculative, it is noted that during 2010/11 the rainfall was well above average both during winter and summer. This would have had an effect on the rates of deep groundwater pumping from the Calivil Formation. This pumping was quite intensive during the drought period of 2002-09, but it could be speculated that a significant reduction would have occurred in 2010-11 due to increased rainfall. That in turn would have had an effect on the LSF groundwater pressures as the USF and LSF are intrinsically linked. Van der Lely (2012) concludes that if the above is correct then it is also likely that there is a degree of connection between the LSF and the Calivil Formation in Benerembah becoming less so in the Mid Benerembah and Warrawidgee areas including Hanwood west (considered to be poor).

The Kooba Station area south of the MIA did not show rises in groundwater pressure as found for the MIA hydro-zones. From this it appears reasonable to conclude that the impact of groundwater conditions in the MIA is not being transferred to the south (Van Der Lely, 2012).



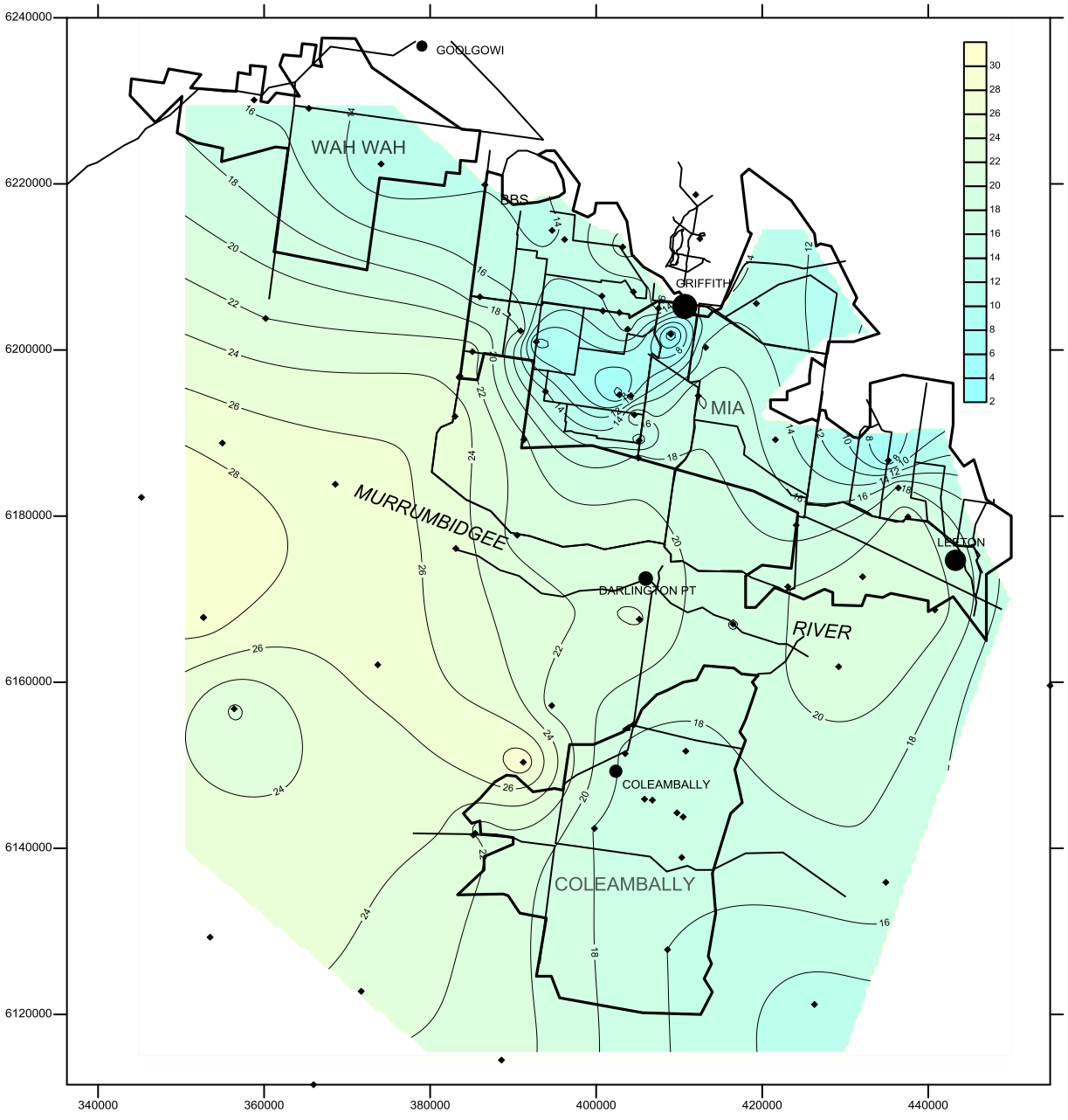
Map 2.5 (m): AHD contours of the MIA LSF September 2011 (Van Der Lely, 2012).

The AHD contours for September 2011 are the same as reported in previous years (Van Der Lely, 2012). The deep trough starting in the horticultural areas near Hanwood and extending westwards is clearly observed. This combined with the high groundwater levels from Yoogali southwards suggest that faulting in this area could be preventing escape of high groundwater pressures in the Bilbul and Yenda areas (Van Der Lely, 2012). This could be attributed to synclinal changes in structure where the Griffith Syncline and the Cocoparra Syncline may have altered preferential groundwater flow paths. This is due to the nature of the fold which in turns affects the availability of water. For example a broad, gentle fold can create a relatively shallow, confined aquifer that extends over a large area. However this could also be a good source of water if sufficient recharge can occur through the confining layer or if the aquifer can transmit enough water from areas where the confining layer is absent. More investigation into this will need to be undertaken by MI at a later stage.

Another theory for this change in groundwater behaviour could be attributed to the buried valleys built over time through the deposition of alluvium after synclinal changes. Alluvial deposits are divided into 4 categories based on manner of occurrence: Water courses, abandoned or buried valleys, plains and intermontane valleys. Abandoned or buried valleys are valleys no longer occupies by streams that formed them. Although such valleys may resemble water courses in permeability

and quantity of groundwater storage, their recharge and perennial yield are usually less. In some places gravel and sand beds form important aquifers under these plains in other places they are relatively thin and have limit productivity. More investigation into this will need to be undertaken by MI at a later stage.

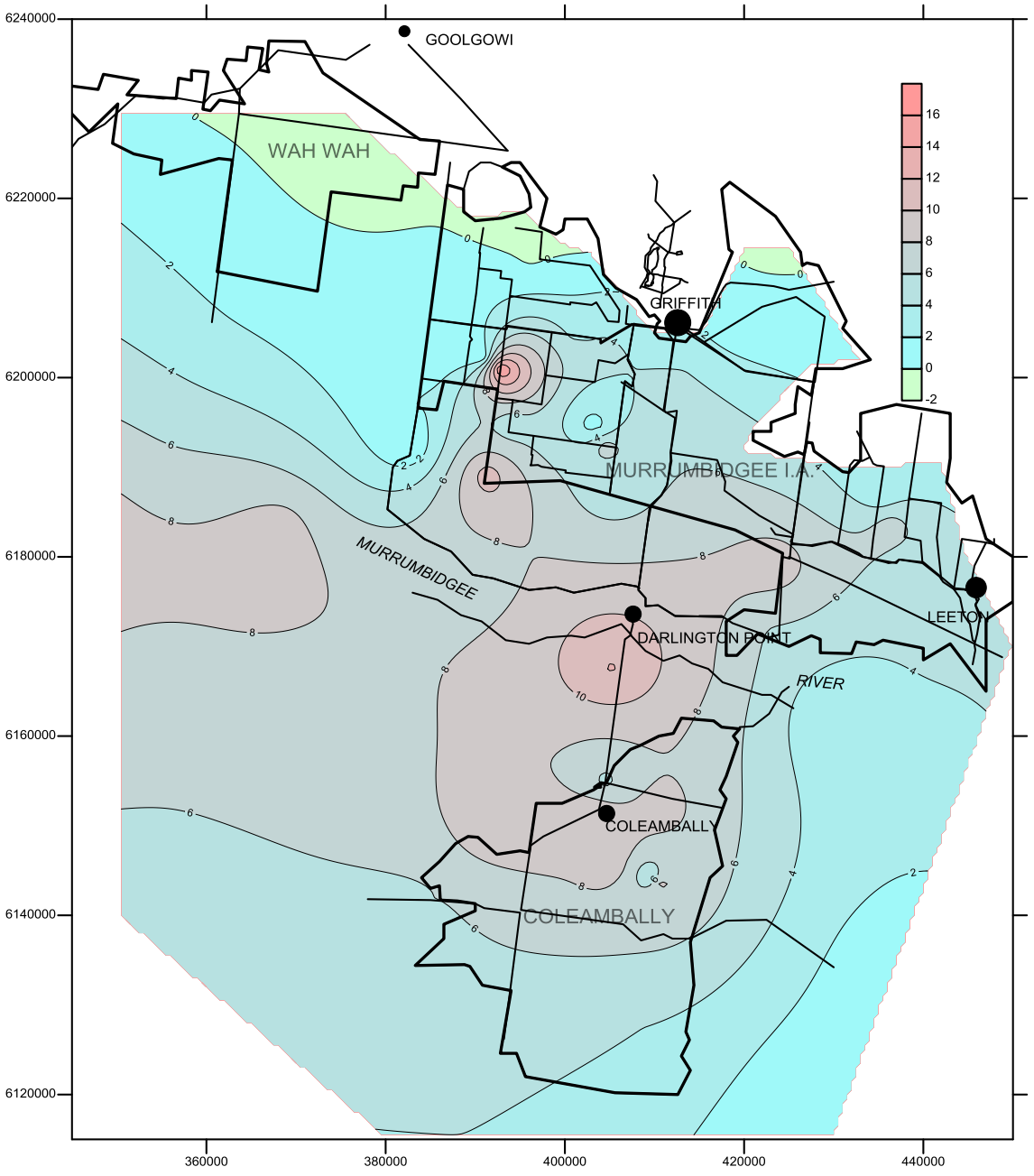
The lower AHD levels in the Kooba area are at least partially explained by groundwater pumping from the Calivil Formation where semi-confined conditions are present between the Calivil and Shepparton Formations.



Map 2.5 (n) Calivil Formation groundwater contours MIA, Wah Wah and Coleambally September 2011(Van Der Lely, 2012).

The Calivil Formation groundwater contour maps has been prepared using drill log, AHD and level data from deep (>35m) piezometers controlled by Murrumbidgee Irrigation and NSW Office of Water Observation Piezometers with depths ranging from 50-120 metres. Both autumn (February) and winter (end August, early September) standing water level data have been used.

Map 2.5 (n) shows that standing water levels are still much deeper than historical values about 20 metres below the land surface near Darlington Point gradually moving towards 2-4 meters at lower hydraulic areas at Benerembah, Yoogali, Bilbul and Murrami areas.



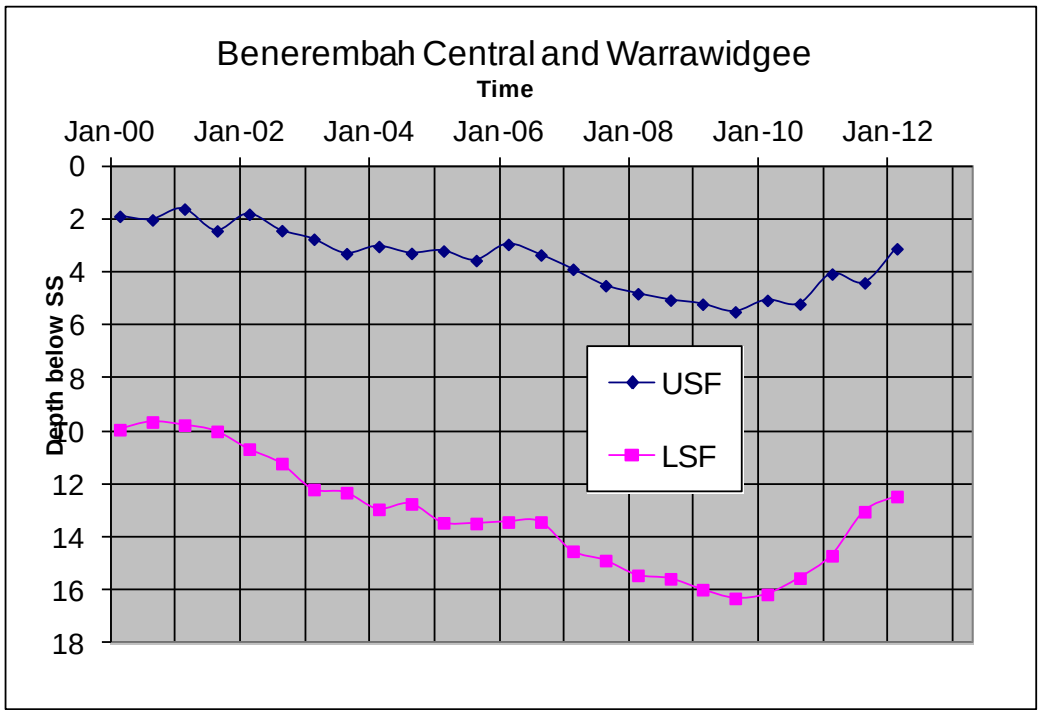
Map 2.5 (0): Rise in Calivil Formation pressure levels September 2009 to September 2011, MIA, CIA and WWID areas (Van Der Lely, 2012).

Map 2.5 (o) shows that in vast areas of Coleambally and to the west the pressure levels have recovered significantly over this two year period with rise in groundwater table of 10-14 meters, a likely consequence of recharge in the Calivil and Shepparton formations from high rainfall, localised flooding and increased recharge through associated flows in the Murrumbidgee River. It is also likely that pumping rates have declined due to such event events and less irrigation demand is required in wetter periods (double the LTA rainfall of 412 mm from 1962-2010 to 739 mm in 2011). Map (h) also highlights parts of Yenda and Wah Wah where groundwater levels decreased by 2 m, likely as a result of favourable farming conditions in wetter years and an increase in rice farming from that of 2007-2008. A very high recovery is also recorded for parts of the Benerembah district and other parts of the MIA, confirming earlier comments about this area.

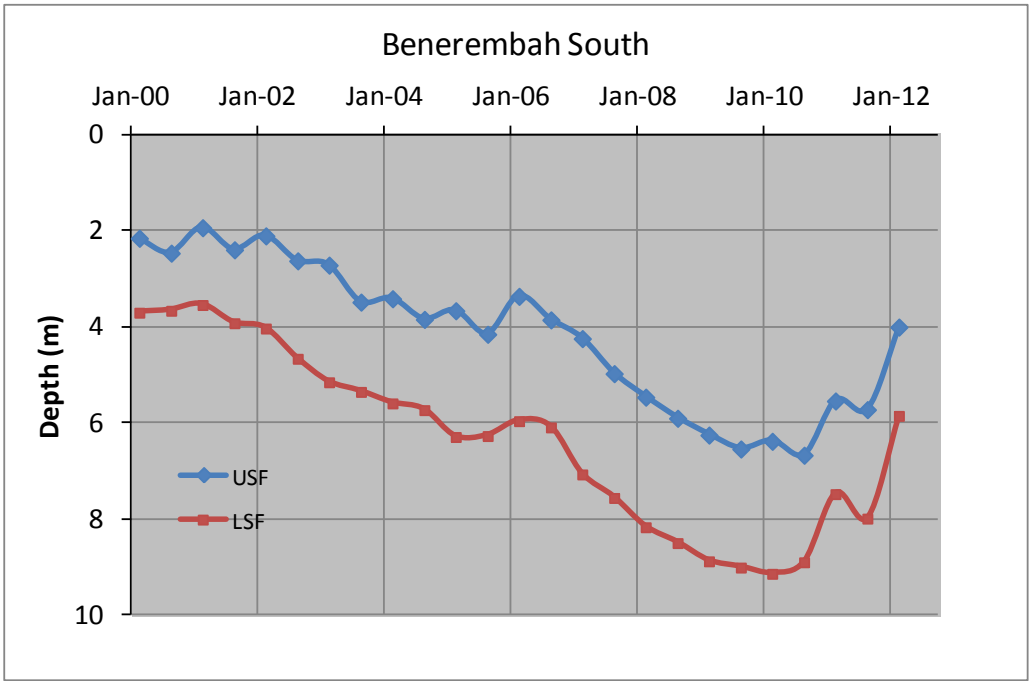
A detailed groundwater map for Benerembah, Mirrool and Yanco IA has been produced showing detail of each significant USF hydro-zone where in which groundwater levels are of concern to MI. That map will be accompanied with hydrographs.

Benerembah

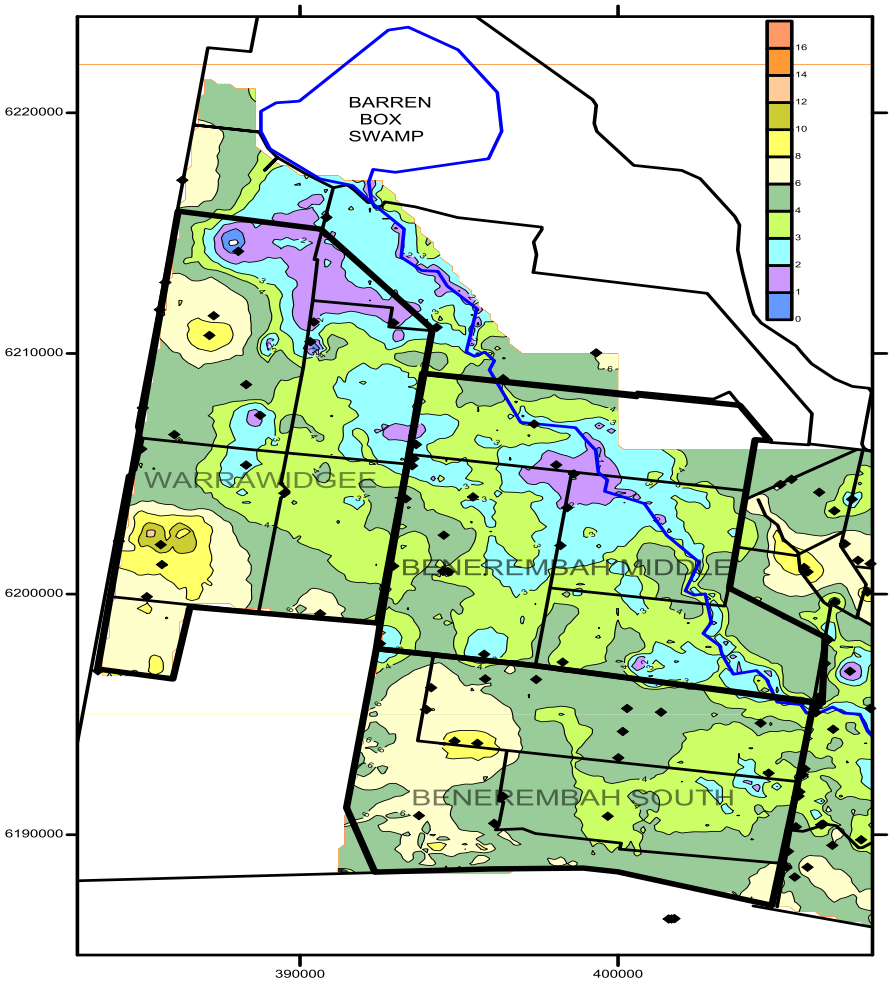
Figures A.3.4.1 (a) and A.3.4.1 (b) show hydrographs for Benerembah hydro-zones and Map (a) shows the detailed USF groundwater map for September 2011.



Figures 2.5 (p) : Hydrographs for Benerembah hydrozones (Benerembah Middle and Warrawidgee are combined)



Figures 2.5 (q): Hydrographs for Benerembah hydrozones (Benerembah south)



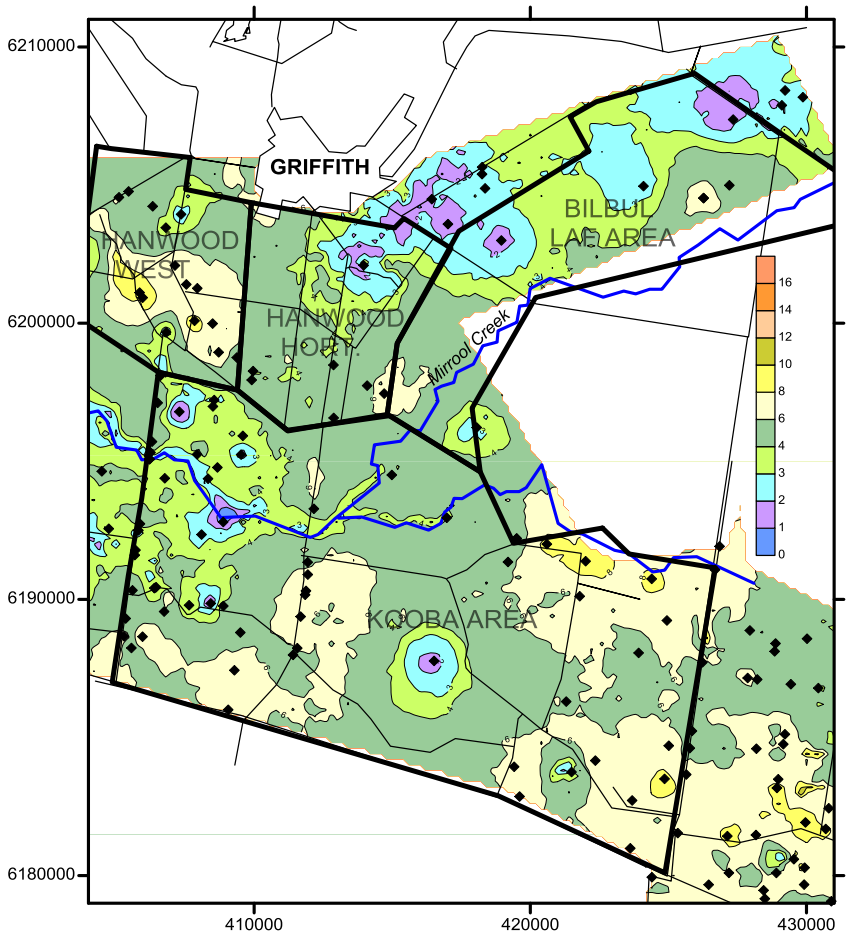
Map 2.5 (r): Groundwater contours for Benerembah USF hydro-zones, September 2011 (Van Der Leyley, 2012).

Map 2.5 (r) also shows the location of piezometers used for this mapping. The interpolation between data points in the vicinity of Mirrool Creek in north Warrawidgee is clear as is the effect of depressed lands adjacent to the creek- the intricate variation in groundwater contours is an effect of the DEM (Van Der Lely, 2012)[1]. A large gap between piezometer locations in Benerembah Middle is evident also in this map. The large area with shallow groundwater conditions in north Warrawidgee may have been influenced by the location of one or two piezometers in a narrow and shallow prior stream, which is usually saturated. Adjacent areas then show high groundwater levels as well due to interpolation of groundwater data points.

Even though interpolation of points has been exaggerated, it is evident that Benerembah and Warrawidgee are areas in which MI will be undertaking further investigation into the effects of increased recharge into the USF during wetter periods, favorable irrigation conditions and regional cropping choices (i.e. intensive irrigated crops such as rice, cotton etc).

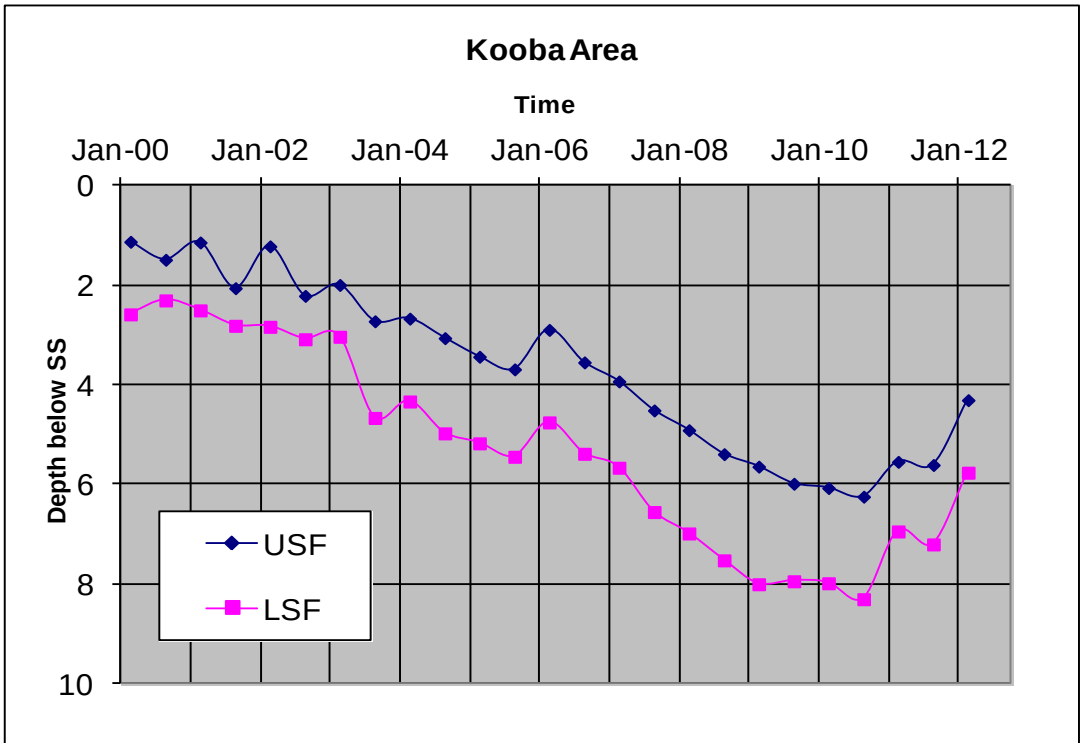
Mirrool

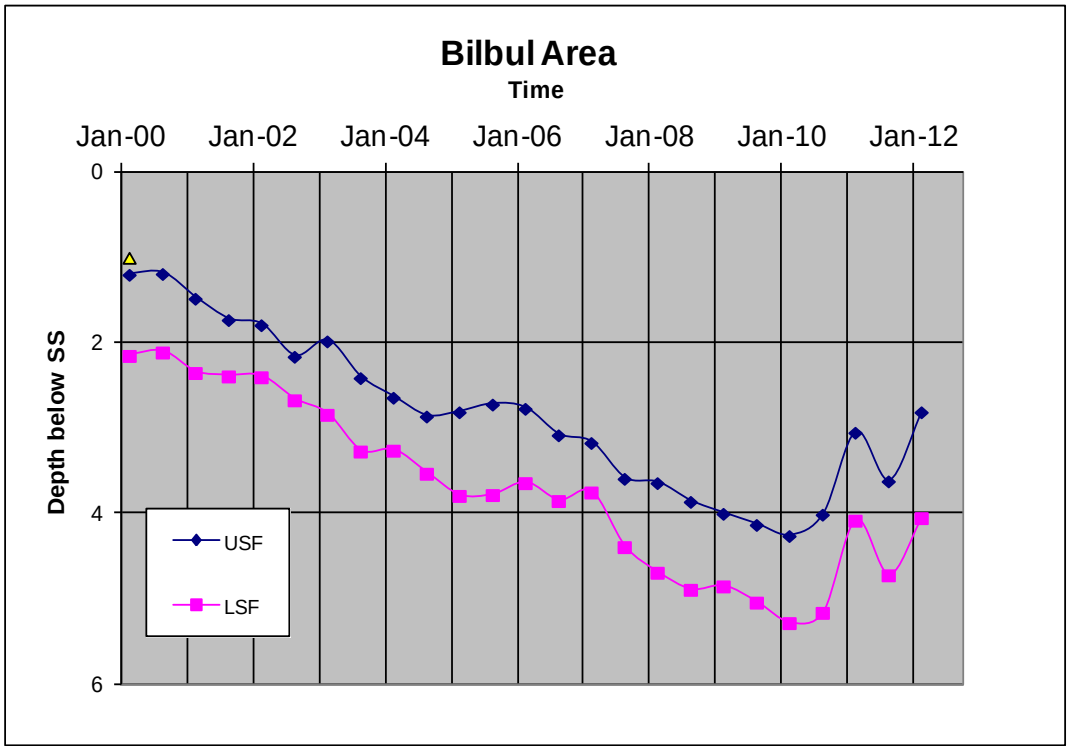
High groundwater levels near Mirrool Creek (Bilbul, Yoogali and Kooba hydrozones) is shown at Map 2.5 (s), also highlighting the Piezometer locations for the USF monitored bores. As there are few for the Hanwood horticultural area therefore a hydrograph for this hydro zone was not prepared.



2.5 (s): Detailed groundwater contour map for Mirrool IA hydro-zones September 2011 (Van Der Leyly, 2012)

[1] These maps were produced using DEM and AHD of groundwater levels. However, the statistics of Table 10 are based on grid files calculated from inverse to power 2.5 methods using depth to groundwater only.





Figures 2.5 (t) and 2.5 (u): Hydrographs of Kooba area and the Bilbul area USF groundwater levels 2001 to 2012 (Van Der Leyly, 2012)

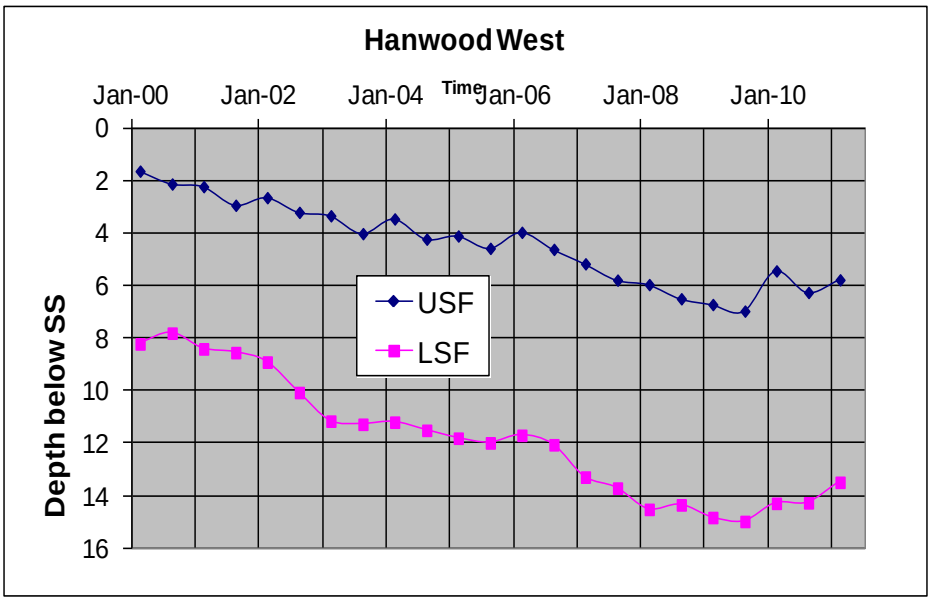


Figure 2.5 (v: Hydrograph of groundwater levels in the USF for the Hanwood west area 2000 to 2012 (Van Der Leyly, 2012)

It is noted that the difference between LSF and USF groundwater levels is high in Hanwood west, and less so in the Kooba area. In the Bilbul area this difference is also small. In all graphs it is clear that the LSF and USF are intrinsically linked (Van Der Lely, 2012). In all graphs it is also shows that during the drier periods (drought years) that there was a steady decline in the groundwater table over 8 years until a noticeable recovery took place from 2008-2010. Variations in levels at times over this period may be attributed to pumping regimes, crop types and small rainfall events at specific times in each region. Notably of concern in all regions is the proximity of the USF to surface level and the need for targeted monitoring and management of groundwater resources in these regions.

No map was prepared for Lake Wyangan area as there is less concern of the impacts of groundwater within 2.5m of surface level as that demonstrated in other parts of the MIA. For reporting purposed, changes in MI observed piezometers are represented in the graph below. There has been a small rise, not considered significant across the region. The piezometers with the highest groundwater levels are located close to the lake itself. Piezometers G2010 and G674 could possibly be providing recharge to the USF or a more likely scenario are both drilled within the water table (saturation zone) and not the USF due to the considerable difference in drilled depth from the other observation Piezometers.

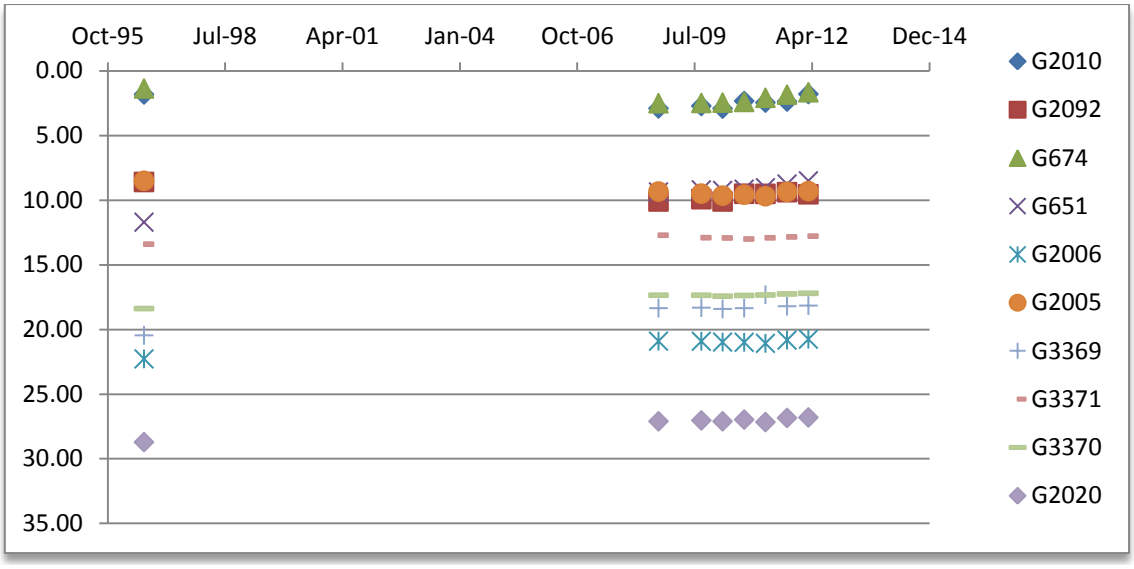
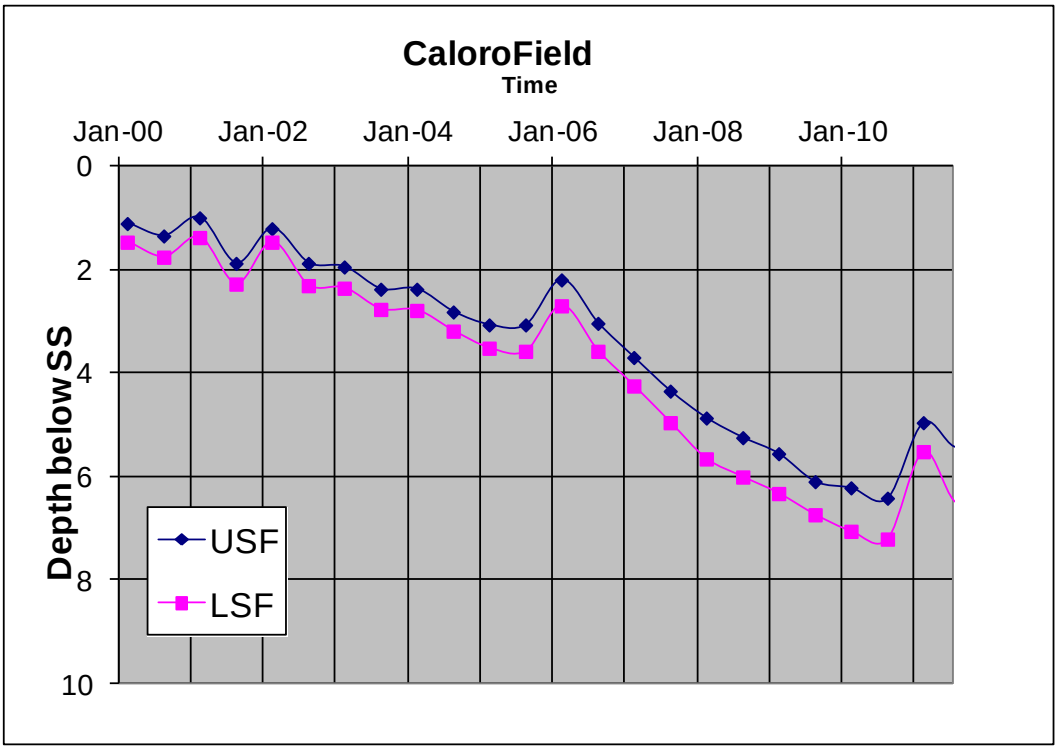
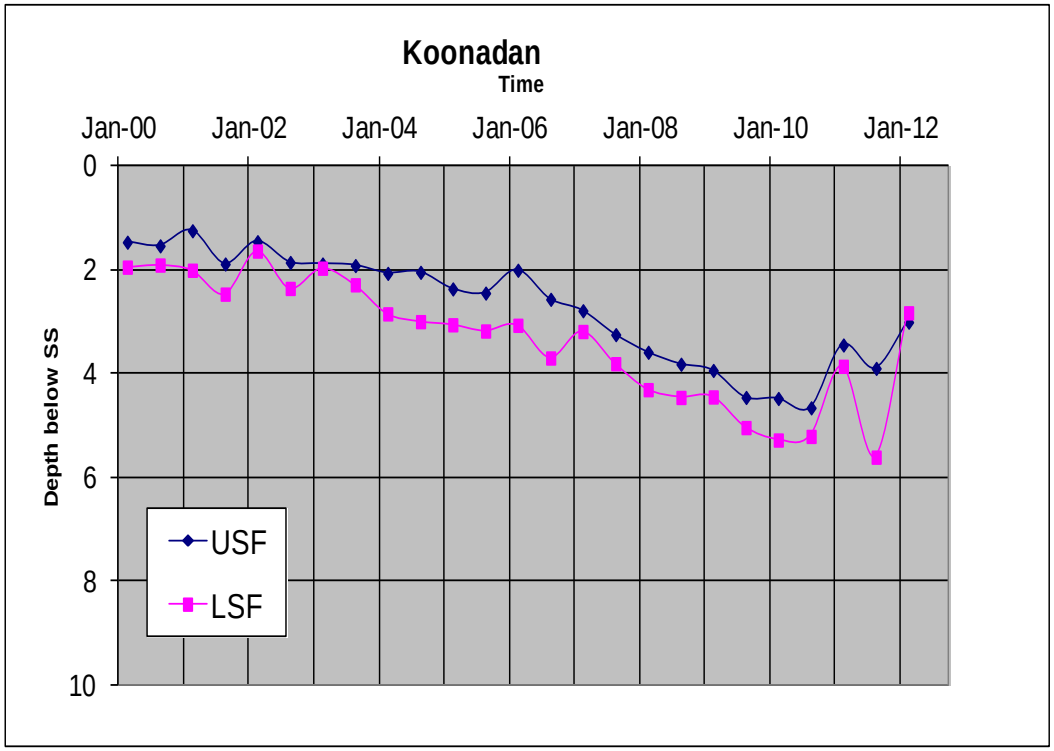


Figure 2.5 (w): Groundwater levels of Piezometer in the LSF and USF in the Lake Wyangan area

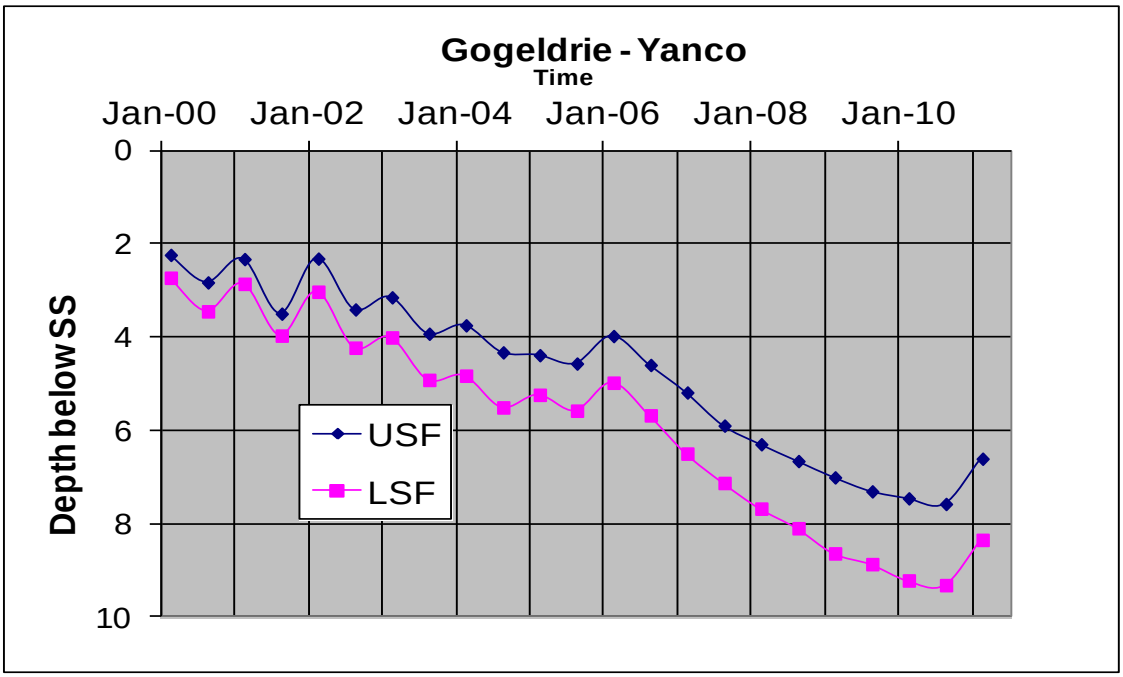
Yanco Irrigation Area

The hydrographs for Yanco IA hydro-zones are shown at Figures 2.5 (x) to (y) and the detailed groundwater map is shown at Map (a). All hydrographs suggest that the LSF and USF are linked closely in the Yanco IA (Van Der Lely, 2012).

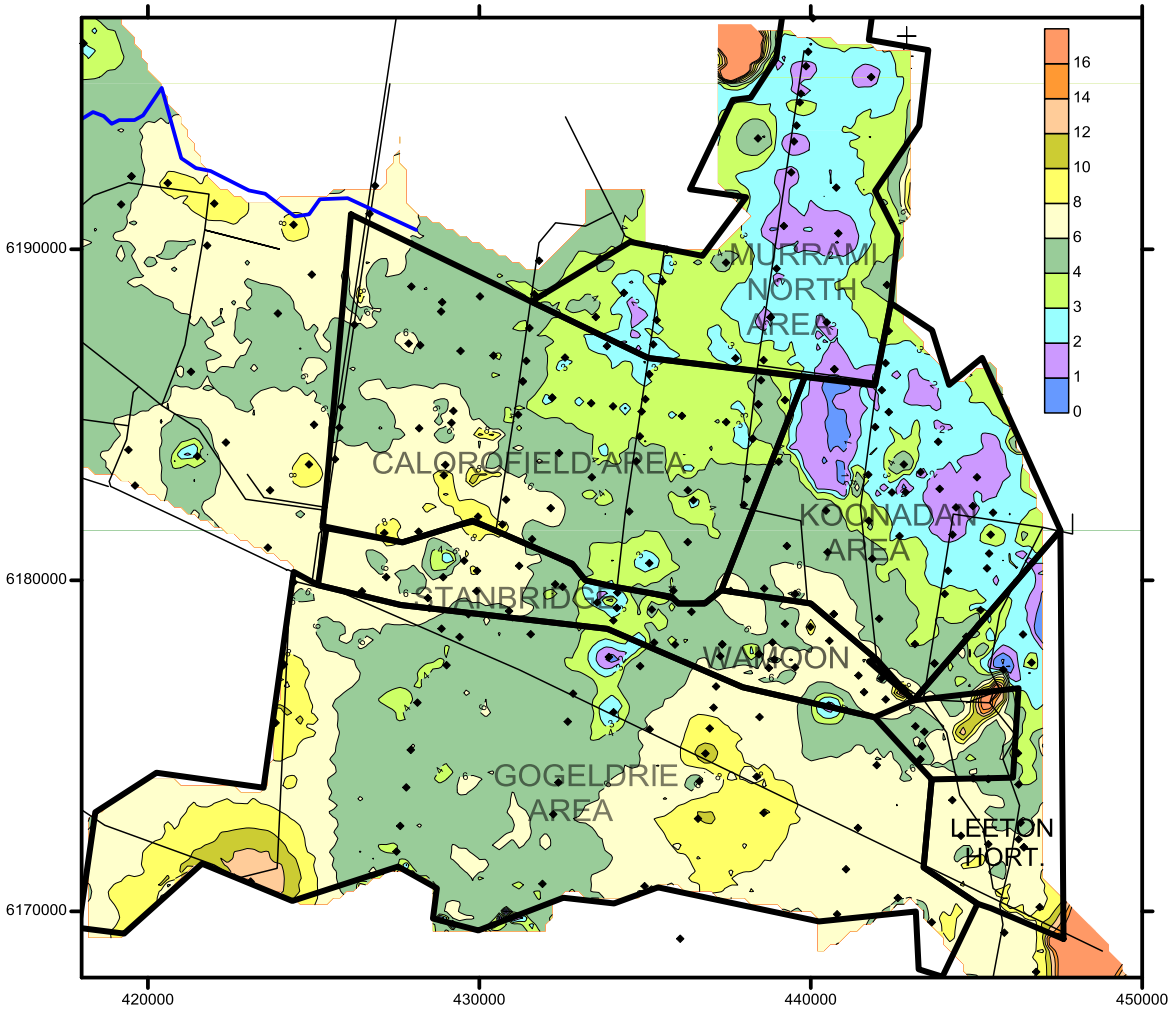




Figures 2.5 (x) and (y): Hydrographs for the Calorofield and Koonadan hydro-zones for the USF from 2001 to 2012(Van Der Lely, 2012)



2.5 (z): Hydrographs for the Gogeldrie hydro-zones for the USF from 2001 to 2012 (Van Der Lely, 2012)



Map 2.5 (z)- Yanco Irrigation Area Hydro zones- Groundwater Levels (Van Der Lely, 2012)

Map 2.5 (z) shows that the Murrami and Koonadan are located in the lowest points of the region. Van Der Lely (2012) claims that it has long thought that Tuckerbill and Five Bough Swamps may be recharge areas for the Shepparton Formation. Upon observation of Groundwater contours this could be a reasonable assumption. However field verification would be required, primarily because both wetlands have regulated flows into what would have once been ephemeral systems and are now surrounded by highly modified landscapes adding to possible increases in runoff. MI has insufficient evidence at presence to suggest definitively that this is the case and field verification via monitoring would be required to support Van Der Leyly (2012) theory.

Wah Wah District

There is at present insufficient data to produce and accurate groundwater contour map for the Wah Wah district. MI requires undertaking additional investigation into monitoring networks and historical data to ensure accuracy or reporting in the Wah Wah region. This will be conducted in a review of Water Resource Data for the MIA and associated gap analysis. MI would be happy to provide a copy of this report to the regulator upon its completion later this year. Some discussion of the Wah Wah groundwater levels has been undertaken in earlier sections of this report.

2.6 GROUNDWATER CONTAMINATION

There were no known, or reported, groundwater pollution events during 2011/12.

2.7 GROUNDWATER VOLUMES AND SALT LOADS (TILE DRAINS AND PUMP SITES)

Tubewells

There are 15 tubewells installed in the MIA by previous government departments to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational.

Table 3.2.b shows a notable increase in discharge volume compared to the previous seasons, a reflection of the above average rainfall over the past two seasons and flood event in March 2012. The total salt load increased accordingly. The total discharge volume during the 2011/12 season increased by 197% compared to the previous season, while the salt load increased by 65%, which means that the salinity levels of the discharge have decreased.

Table 2.7 (a): Groundwater volumes and salt loads extracted from tubewells

Name	2011/12 Discharge (ML/year)	2011/12 Salt Load (T/year)	2010/11 Discharge (ML/year)	2010/11 Salt Load (T/year)	2009/10 Discharge (ML/year)	2009/10 Salt Load (T/year)
Five Bridges	234	231	27	33	268	181
Gil Gil	620	1,044	482	907	493	790
Yanco West	399	508	154	306	304	420
South Leeton	-	-	193	347	30	47
Baulch's	-	-	-	-	-	-
Wamoon	1,031	501	275	169	407	250
East Wamoon	0	0	28	18	176	105
TOTAL	2,284	2,284	1,159	1,780	1,678	1,793

Source: MI Electrical Services, MI Environmental Services

The discharge from tubewells enters MI's drainage system and is therefore accounted for in the drainage volumes and salt load tables in Section 1.

Chart 2.7 (b): MIA Tubewell Locations

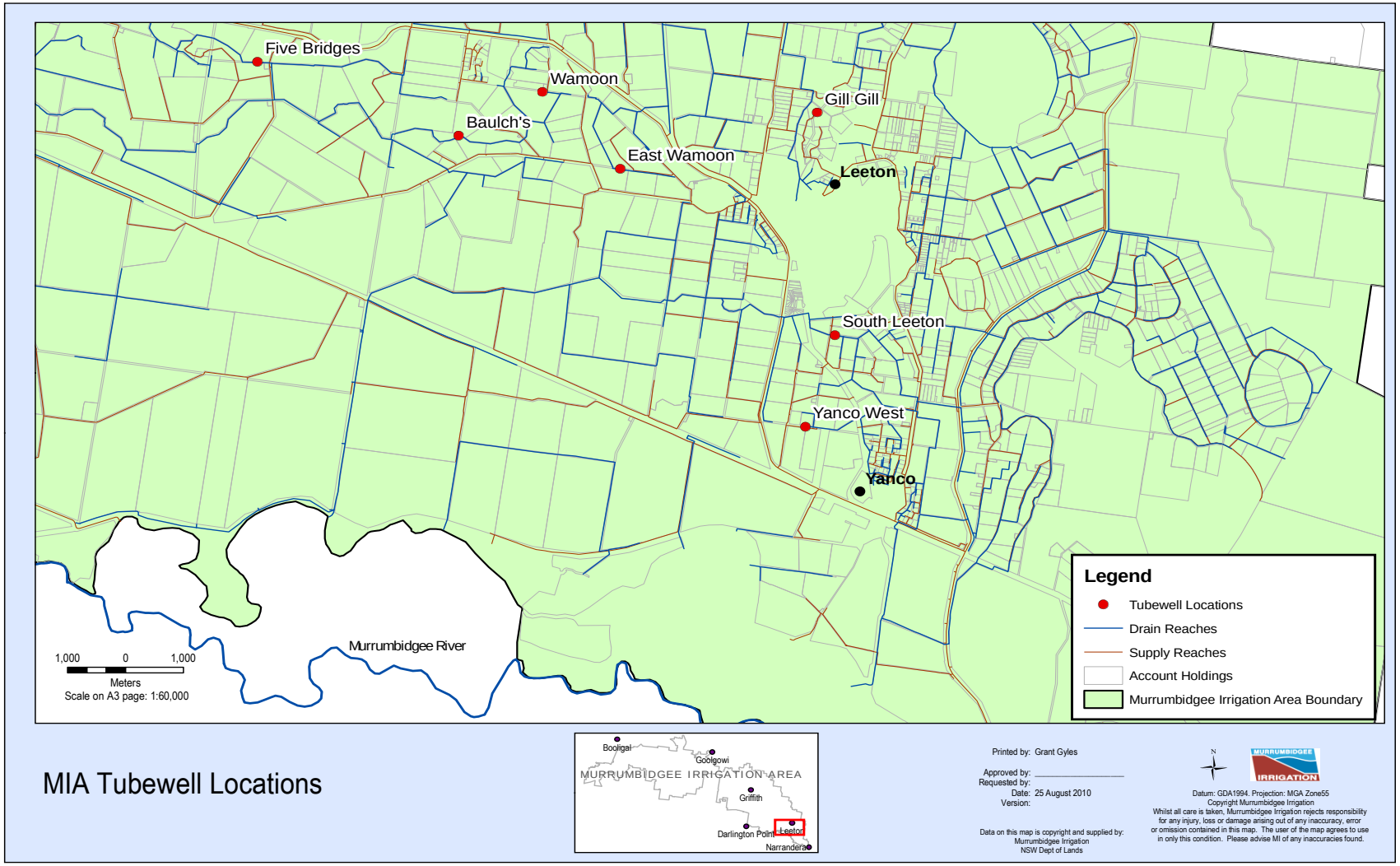


Figure 2.7 (c) Groundwater piezometers currently being read

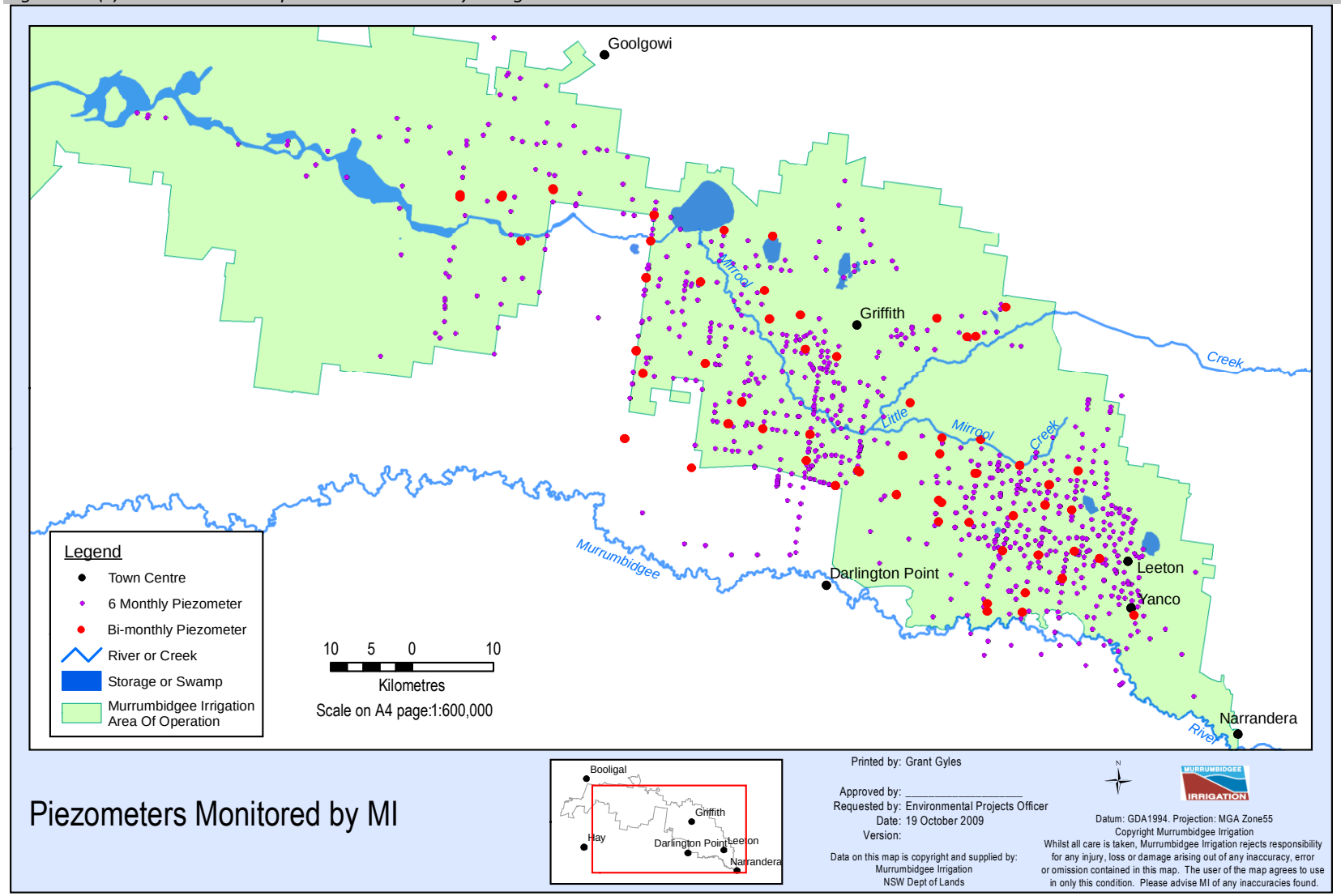
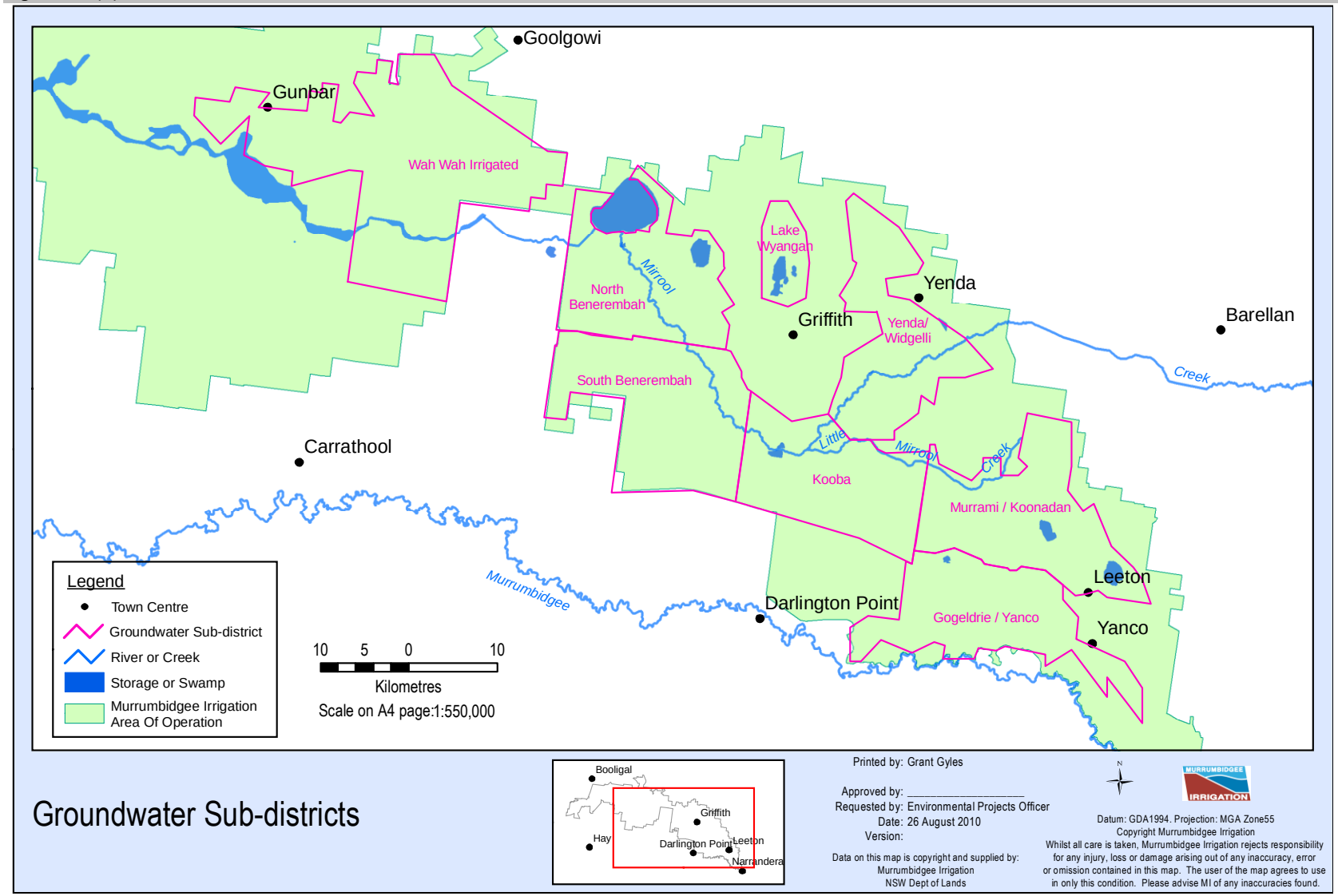


Figure 2.7 (d):Groundwater sub-districts



3. FLOODS AND FLOODPLAIN MANAGEMENT

3.1 REPORTING REQUIREMENTS

3.1(1) FLOOD LEVELS, FLOODPLAIN STRUCTURES, FLOOD RELEASES

Record rainfall during the beginning of March 2012 resulted in severe flooding across the MIA.
The effect of the flood on MI river drain sites varied, with high river flows resulting in many sites backing up. Flows through the river drain escapes are detailed in Table 1.4 (b), with details of works conducted during the event listed below.

Yanco Main Southern Escape (YMS)

A temporary door was installed on top of the escape during the recent river floods to prevent river water from entering our drainage system.

Gogeldrie Main Southern Escape (GMSSR)

No works were conducted at this site.

Gooragool Lagoon Escape (LAG)

No works conducted at this site

Cudgel Creek Escape (ROCUDG)

During the recent floods, the main canal breached at this escape as well as sections along the bank for approximately 1km both upstream and downstream of this site. Repairs needed to be made at the site to the surrounding embankment to ensure the main canal system was fully operational.

3.1(2) FLOOD REPORTING – LOWER MIRROOL CREEK FLOODWAY

Mirrool Creek Floodway (MIRFLD): activities conducted along D-3-FLOOD-010E.

Extra flows were achieved during the recent flood events by managing additional water in supply and drainage channels by diverting water via the outfall to release more flow from the Wah Wah Main.

The flood releases from the Mirrool Creek Floodway (113,701 ML) and Channel 13 (3,190) into the Lower Mirrool Creek Floodway from March 2012 to June 2012 totalled 116,891 ML.

3.1(3) REPORTING- LAKE TALBOT

NOW Work Approval 40CA403245 refers to Schedule 2 conditions related to Lake Talbot, and is split into the following reporting conditions:

Condition 7

MI continues to work with Narrandera Shire Council (NSC) and State Water to ensure sufficient water is available to maintain fish habitat. The level of Lake Talbot remained high during the 2011-2012 reporting period due to higher than average rainfall contributing to maintaining lake levels.

Condition 8

Lake Talbot was not emptied during the 2011-2012 season due to higher than average rainfall and the presence of the March 2012 floods and flood water remaining the months preceding it.

Condition 9

MI advised all customers of season closure through the winter period.

Condition 10

Internal controlling structures which regulate water levels in Lake Talbot are owned and manually operated by Narrandera Shire Council.

4. AQUATIC ENVIRONMENT MANAGEMENT

4.1 REPORTING REQUIREMENTS

4.1 (1) SIGNIFICANT CHANGE TO MAJOR WETLANDS

During 2010/2011, ongoing management and rehabilitation of major wetlands within the MIA aimed at improving the quality and extent of wetlands continued. The projects which are in various stages of completion include the following:

Barren Box Storage and Wetland (BBSW)

BBSW Rehabilitation Plan has moved into the implementation stage with all major works to be completed by 2014 following which management will continue on an on-going basis.

The vision for the BBSW Rehabilitation Plan is '*to create an ecologically diverse and functioning Black Box wetland cell and surrounding grassy woodland/chenopod shrubland that also respects, preserves, and enhances the cultural significance of the area, by example to promote stewardship of regional natural resources.'*

This vision will be achieved through the revegetation of the wetland cell, the management of weeds, the management of pest animals and the management of fire.

Since 2009, the entire 1,650 hectares of the wetland cell has been direct seeded or aerial sown with locally collected native vegetation species. The outer perimeter of the cell supports a Boree grassland environment and the inner and wetter sections support a Black Box community. A monitoring program is currently being developed to monitor the success of the revegetation program.

Significant and unprecedented floods in March 2012 across most of the region resulted in the wetland cell reaching total inundation and at the time of this report water still covered most of the wetland cell at shallow depths. It is envisioned that this will have an impact on previous aerial sowing and direct seeding within the wetland cell and monitoring of the site will be implemented to assess the impacts.

BBSW Waterbird Monitoring

In order to understand the ecological outcomes of the wetland rehabilitation, it is important to understand what species are currently using the wetland. For this purpose a detailed waterbird monitoring program of the intermediate cell was initiated in April 2007 with the objective of these surveys to establish baseline data on waterbird species and abundance in the MIA.

The Barren Box Intermediate Cell Waterbird Study Final Report 2008-2010 was completed in June 2010 and concerns the Intermediate storage cell which covers an area of 320 hectares. The diversity, numbers and distribution of waterbirds within the Intermediate cell were quantified from mid March 2008 to the end of March 2010 and relationships were tested with seasons and variations in water volume in the cell.

Following completion of the waterbird study Murrumbidgee Irrigation agreed to extend the study period for a further two years with surveys conducted on a monthly basis to enable comparisons of abundance and species richness over a longer timeframe.

By contrast, the period covered by the 2010/11 report was exceptionally wet and natural wetlands were flooded over much of eastern Australia. The intermediate cell had high water volumes throughout almost all of the study period, with no significant drying during the summer months as occurred in previous years. Compared to previous years, the total number of waterbirds and the percentage of surveys on which most species were recorded were all significantly lower. The most likely explanation for the low diversity and numbers of waterbirds compared with the previous two years is that the birds were able to move to other wetlands to breed or feed.

Mirrool Creek Crown Reserve

The Mirrool Creek project is being implemented as an 'icon' project for the MIA.

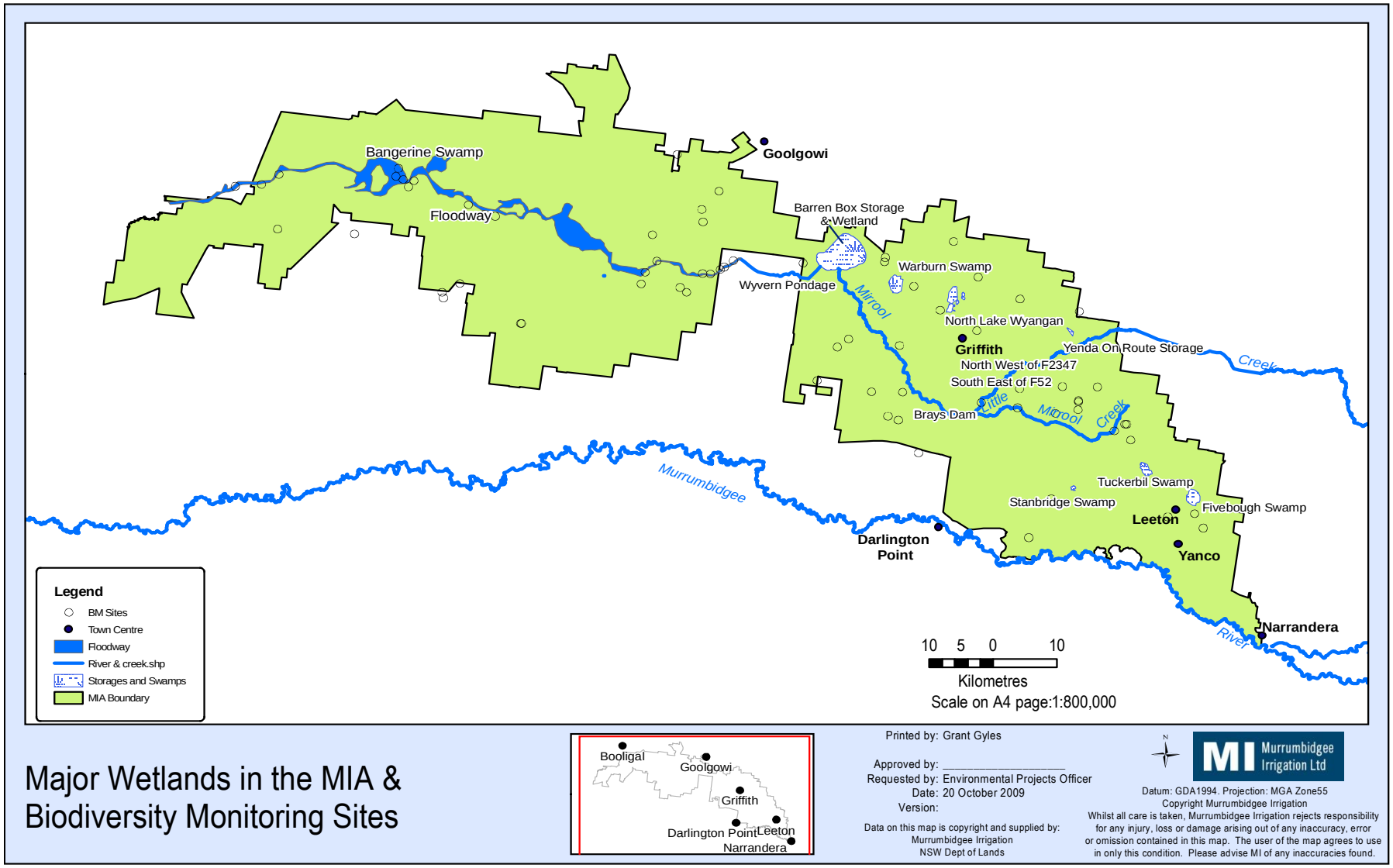
An engagement process was undertaken with adjoining landholders in 2010/11 to negotiate licence agreements between the Mirrool Creek Reserve Trust and interested parties. The licence agreements guide the management of the creek for biodiversity purposes in accordance with permissible uses.

One hundred and twenty five hectares was direct seeded on the creek in early 2011 with a further 300 hectares planned for direct seeding in spring 2011. Cultural Assessments conducted by Murrumbidgee Irrigations Cultural and Heritage Officers preceded all plantings. Sighted artefacts are visibly marked with marker flags and a two to five metre buffer zone is determined around each site to prevent disturbance. Artefacts include cores, tools, flaked materials, grinding stone fragments and hearths (ovens).

Monitoring quadrants will determine the success of the direct seeding program.

The hydrology model of Mirrool Creek was completed in November 2010. The model was used to determine bank heights to allow for a more natural flood regime to improve the ecology of the creek. Bank construction based model commenced in May 2011. To date 3.5 kilometres of bank reconstruction has been completed.

Figure 5.2.a: Major Wetlands in the MIA & Biodiversity Monitoring Sites



4.1 (2) NOXIOUS WEEDS

Alligator Weed in the MIA

The control program for Alligator Weed has continued over the last year. Inspections have been carried out at BBSW, the downstream channel systems and at the floodway in Wyvern Station.

Barren Box Storage and Wetland

Inspections and treatment took place in November 2011 and March 2012. No plants were found in the Bio-wash, 3 plants were found in Crumps Lease ranging in size from 1-2 meter square, site was inspected again on 14/6/2012 with no sightings reported. 3 new plants were found in D-2-2370-020E and treated; this drainage channel was inspected again on 14/6/2012 with no further sightings.

Channel System

One plant was found along S-5-CH01-180E and treated; this was again inspected on 23/2/2012 with no further sightings.

Floodway

No inspections were done in March in the floodway due to the flooding; the floodway will be inspected 1/10/2012.

Outfall Channel

One new plant was found 0.4km D/S of the 2 steel doors on the northern side, this site will be inspected again 1/10/2012.

Please note that all Alligator Weed found for this reporting period has been treated with Brushoff. GPS co-ordinates were recorded. Any large plants found are removed and buried at BBSW.

Sagittaria - Griffith Area

Past inspections of Sagittaria during 2010-2011 were carried out monthly from September through to the end of June; plants are treated with Roundup Biactive in accordance with an APVMA off label permit for use to the rate of up to 10L per 100L or 40L per hectare. Permit: 11856.In July 2012, MI treated approximately 7 hectares of drainage channels infested with Sagittaria with Casoron G, of which will be followed up with further treatment in July 2013 under APVMA Permit: 11720.

MI is also undertaking trail testing on some drains in the Leeton area in managing the weed Alisma by applying Casoron G, which will be expanded across the MIA if results are favourable. Additionally MI is contributing funding towards two research projects aimed at controlling aquatic weeds including Sagittaria. One project involves a biological control agent, while the other aims to collect data relating to rates and efficacy for the registration of an alternate chemical with the APVMA.

5. GENERAL ENVIRONMENT MANAGEMENT

5.1 REPORTING REQUIREMENTS

5.1 (1) REGISTER OF ACTIVITIES

A *register of activities* is ordinarily required by a determining authority, generally being a Government agency or a nominated state-owned corporation to address 'activities' under Part 5 of the Environmental Planning and Assessment Act. However, as this remains a licence requirement, despite the privatisation of MI, it is addressed below. The following table lists the Statement of Environmental Effects, Environmental Impact Statements, cultural and environmental assessments completed.

Table 6.3.a: Register of activities – July 2001 to June 2012

Project	Type	By Who	Completion Date
Barren Box water conservation project	Environmental Impact Statement	URS	December 2004
Stanbridge Pipeline Project	SEE	MI	February 2005
Hanwood Modernisation Project	SEE	MI	February 2012
Hanwood Modernisation Project	Cultural Assessment	MI	December 2011
Mirrool Creek Restoration	Cultural Assessment	MI	Ground work completed February-May 2012 Report Pending

Source: MI Environmental Services

5.1 (2) SIGNIFICANT CHANGES AND CONDITION OF ENVIRONMENT ASSETS

Monitoring and Management of Environmental Assets in the MIA

Remnant Protection and Local Native Species Revegetation

Biodiversity incentives are available to MI customers to implement activities on farm that will protect or enhance the natural resources of the MIA. The available incentives include remnant vegetation protection and enhancement through fencing and direct seeding; incentives in the form of seedlings, tree guards and fencing for new plantings, or plantings that provide vegetation links creating corridors for the movement of flora/fauna within the MIA.

For the reporting period 1 July 2011 to 30 June 2012, 18.5 hectares of new plantings and 45.2 hectares of direct seeding took place to increase the area of native vegetation within the MIA. This local native species revegetation was done under Property Vegetation Plans (PVP's) funded by the Murrumbidgee Catchment Management Authority and MI (via the MIA EnviroWise levy) NSW State Government and MIA EnviroWise. Murrumbidgee Irrigation customers are required to complete PVP's to be eligible for Biodiversity Incentive funding. PVP's are a legally binding contract between the MCMA and the landholder.

Figure 6.3.a: Remnant Vegetation of the Murrumbidgee Irrigation Area

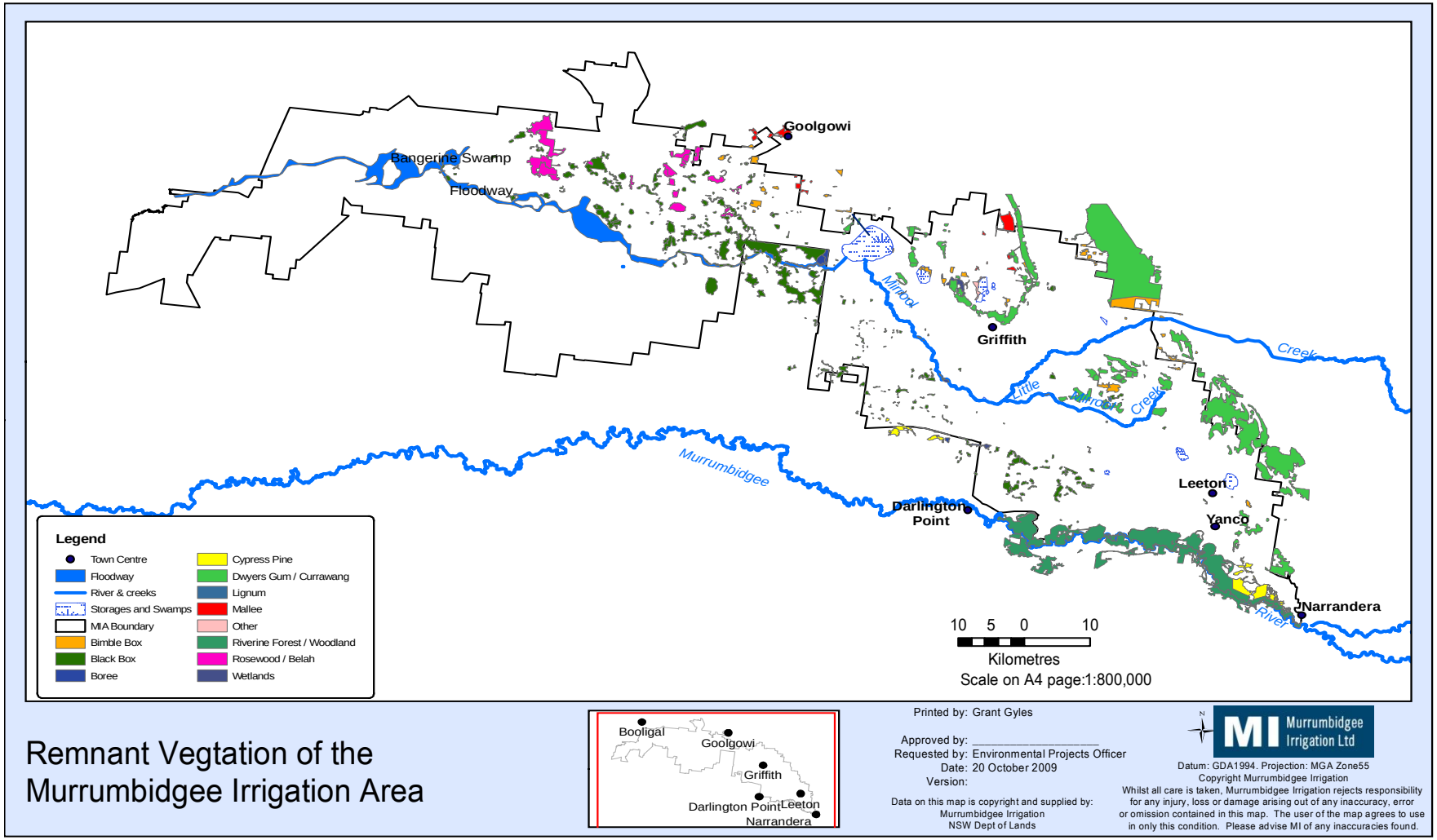
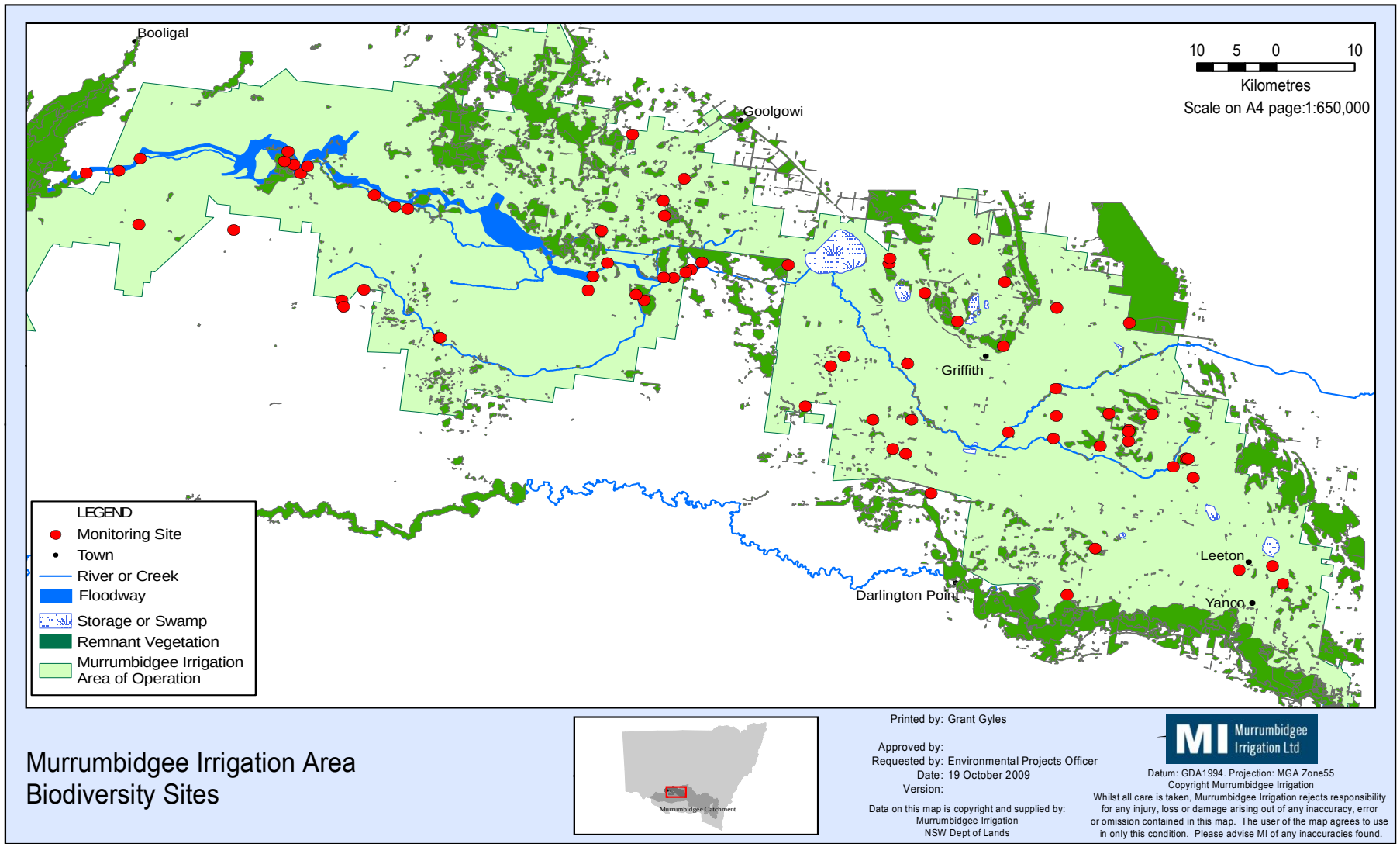


Figure 6.3.b: MIA Biodiversity Benchmark Monitoring Sites



5.1 (3) SOIL SALINITY SURVEY (EVERY THREE YEARS)

MI has been working with CSIRO and Independent Consultant Ary Van Der Lely over the past three years to develop a hydrogeological model of the MIA. This model is currently under review. In conjunction with the model review MI is currently undertaking a review of water and rice data and monitoring network gap analysis.

Results of this review will provide MI with information to tailor monitoring programs to areas of greatest risk to compromise of regional water resources, such as rise in groundwater table, areas more susceptible to soil salinity and specialised water quality monitoring at sites at higher risk of contamination (and impacts from increases in chemical/physical stressors such as EC).

MI intend to conduct a 3 year study into soil salinity in areas identified in the review in accordance with a risk-based approach .The risk based approach will involve identifying an area where change is likely to occur or has recently occurred (such as the replacement of an open channel system with pressurised piping, in areas where groundwater levels are less than 3m from surface level) and monitoring that area more in-depth for a predetermined period of time to establish if the change will have or has had an effect on soil salinity. The information collected will then be used for future reporting in the Licence Compliance Report. This approach will provide a more effective and targeted way to use our resources and will assist in identifying the salinity risk for future developments, farming practices and planning in the MIA and Districts.

5. SALINITY MANAGEMENT AND ACCOUNTING

5.1 REPORTING REQUIREMENTS

Flow at MI Monitoring sites are characterised in the graph below. Most notably flows were highest at MIRMCN. This site feeds directly into Barren Box from the Mirrool Creek system and was one of the major diversions for excess floodwater into the wetland from the irrigation network during the March floods. As a result the diversion flow at BBOW was also increased.

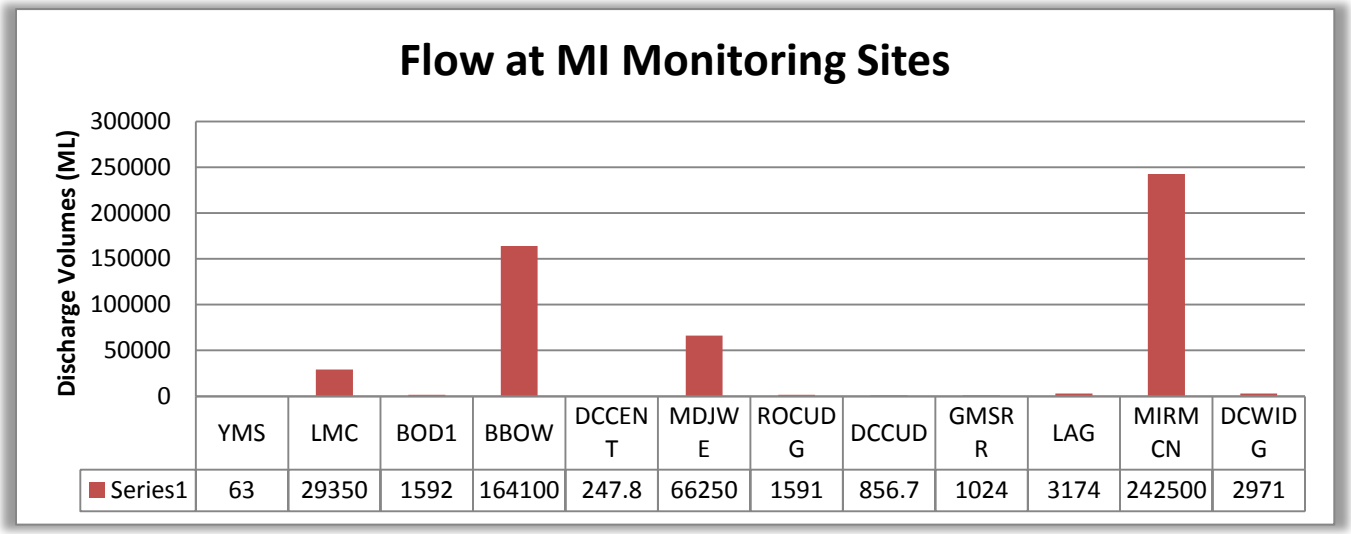


Figure 3.1 (a) - Flow Data for MI Drainage Channels Totals for 2011-12 reporting period.

LMC (Little Mirrool Creek) and MDJWE (Main Drain J) have flow levels ranging from 29,000 ML to 66,250 ML. Some of the larger flows can also be attributed to transport, diversion and movement of additional water during the March floods. LMC is located within the little Mirrool Creek system- taking additional water from surrounding farmland during the floods. MDJWE is Main Drain J which would have compensated additional flows from much of the smaller scaled farming areas surrounding Griffith during this time also.

As demonstrated in Figure 3.1 (b) below flows were generally highest in March with some lag experienced in April.

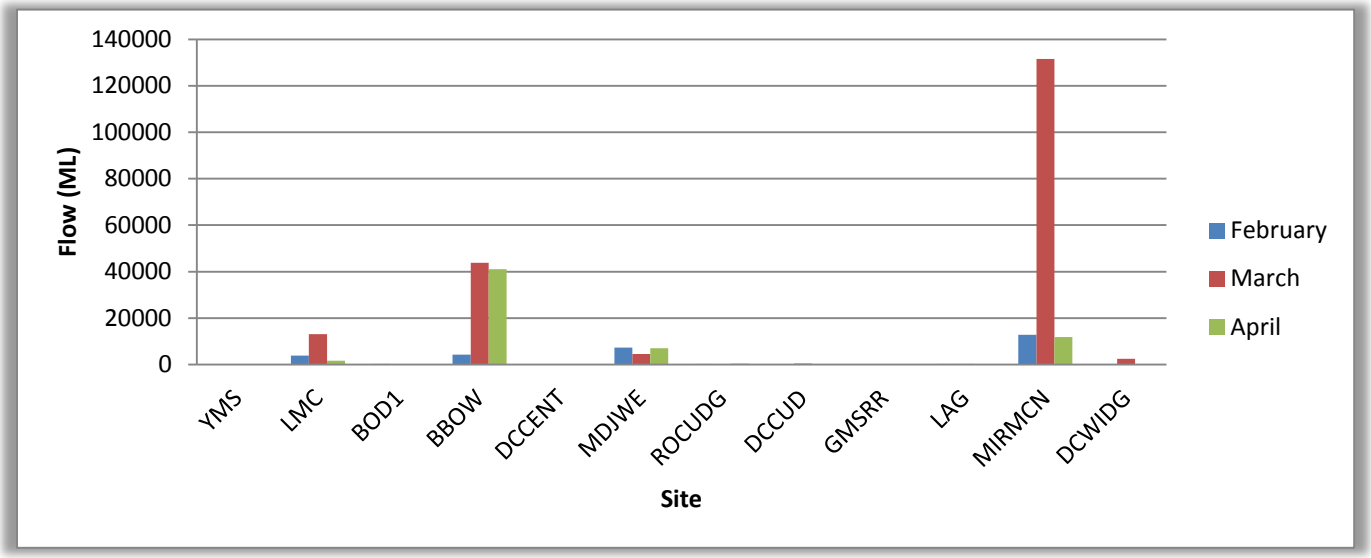


Figure 3.1 (b) - Flow Data for MI Drainage Channels February 2011-April 2012.

5.1 (1) FLOW, SALT LOAD AND SALINITY DATA

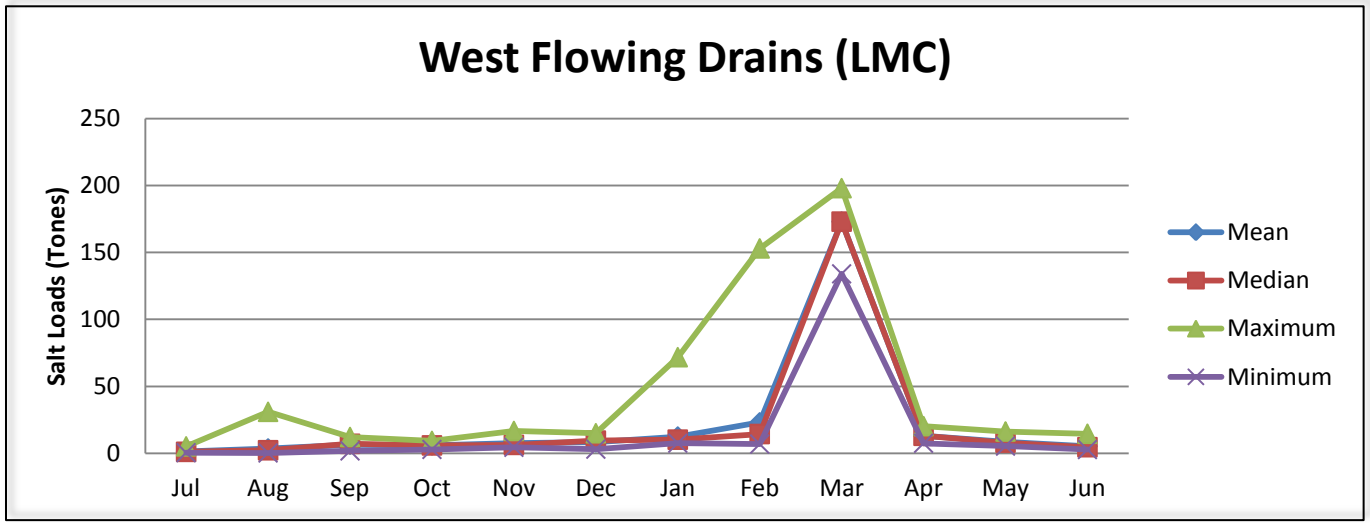


Figure 3.2 (a) - EC Data for West Flowing Drains (LMC) July 2011-June 2012.

Figure 3.2 (a) shows a significant increase in salt load levels during the period of March, coinciding with responses to higher than average rainfall and flooding. Also noted on this graph is the increase of maximum salt load levels from January and February are likely to be associated with summer rain and increased irrigation resulting in runoff from surrounding farms.

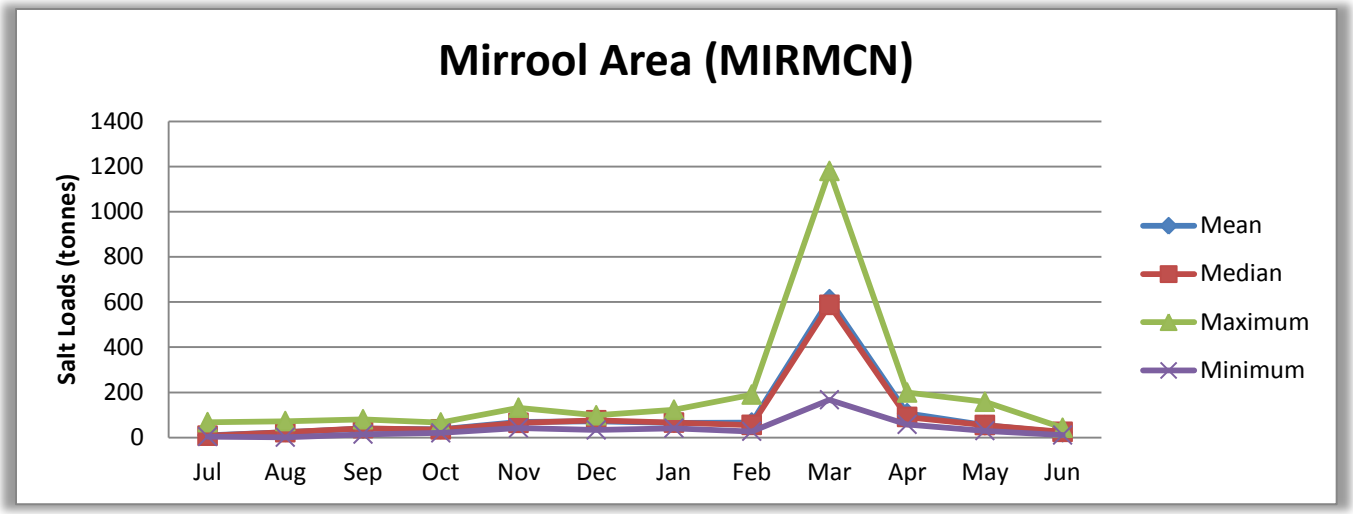


Figure 3.2 (b) - EC Data for Mirrool Area (MILRMCN) July 2011-June 2012.

As highlighted in Figure 3.2(b) above, a significant increase in saltloads during March was experienced during to flooding associated with high rainfall. Salt loading values over the rest of the period remained consistently less than 200 mg/L.

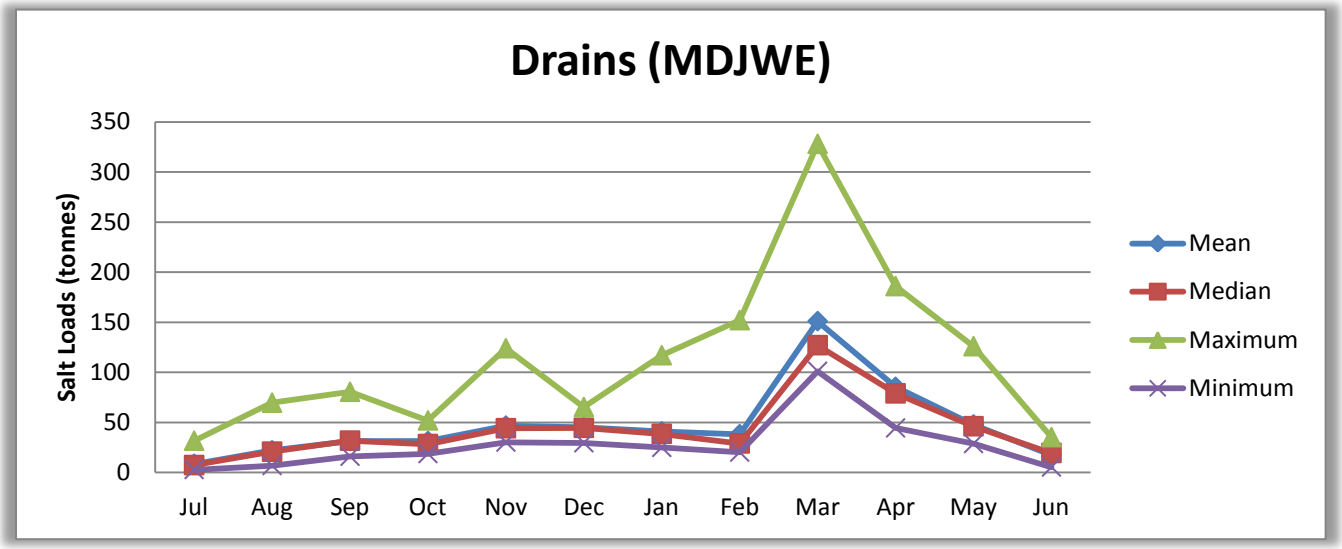


Figure 3.2(c) - EC Data for Drains (MDJWE) July 2011-June 2012.

As highlighted in Figure 3.2 (b) and (c) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall. It is also noted in this graph that an increase in the maximum saltload readings for the period from January 2012 to June 2012 has been consistently higher than the average saltload reading are likely to be related to increased flow from January to April (runoff from rainfall and March flood contributions).

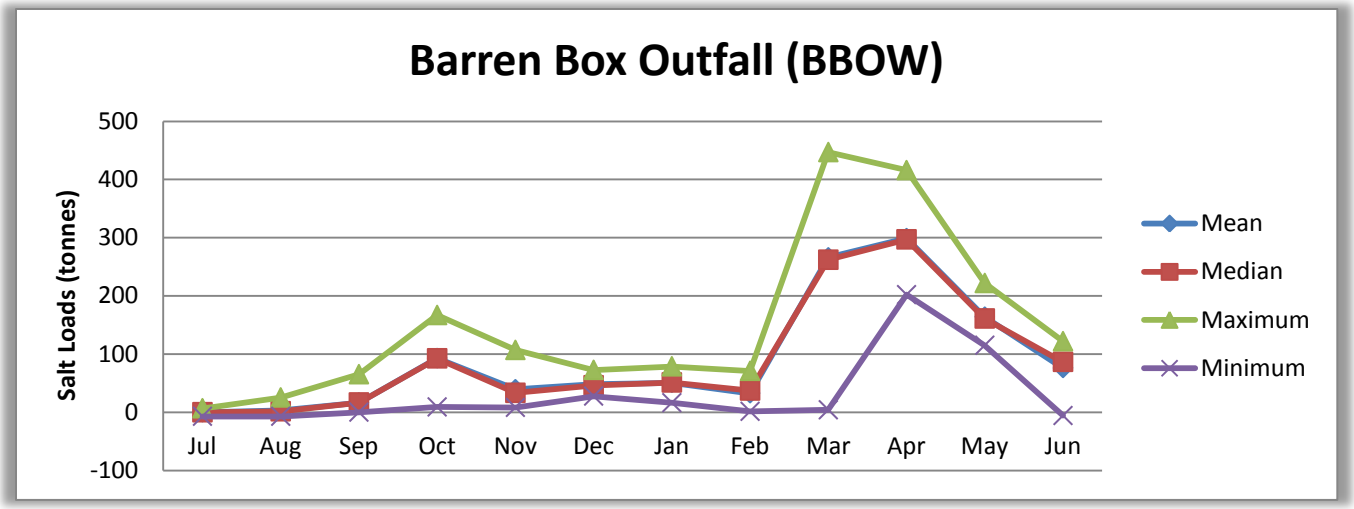


Figure 3.2 (d) - EC Data for Barren Box Outfall (BBOW) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (d) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall. Higher salt levels presented in March through to May could be as a result of excess water from flooding, high rainfall and evapotranspiration from excess supply and drainage water which was transported and stored in all 3 cells at Barren Box from the March floods.

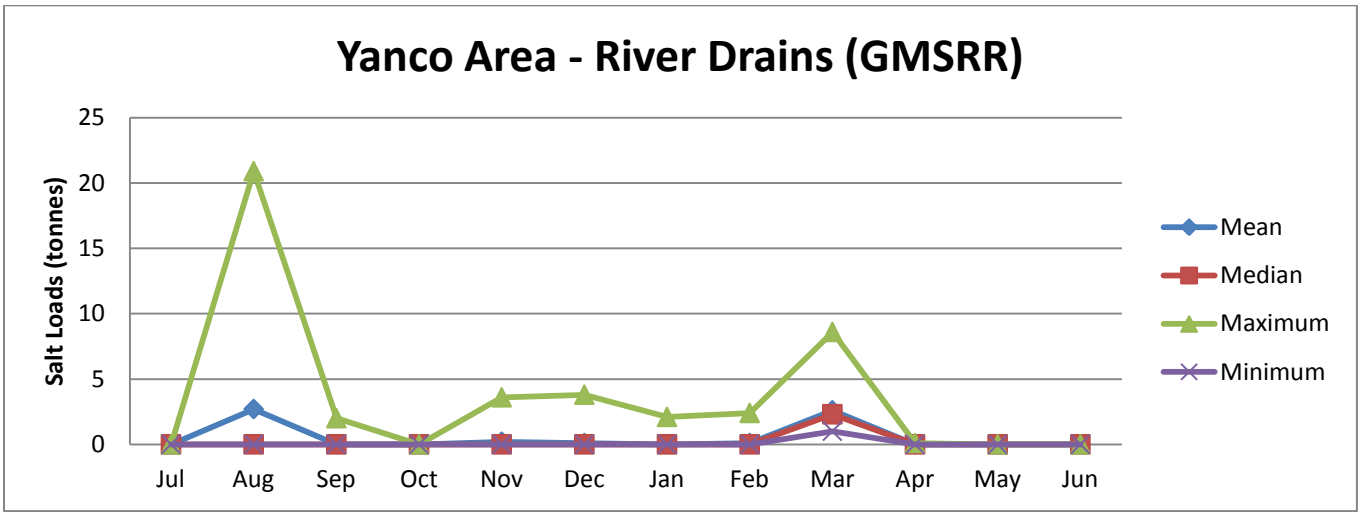


Figure 3.2 (e) - EC Data for Yanco Area- River Drains (GMSRR) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (e) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall. August spike is likely to be attributed to discharge (with sudden increase in flow).

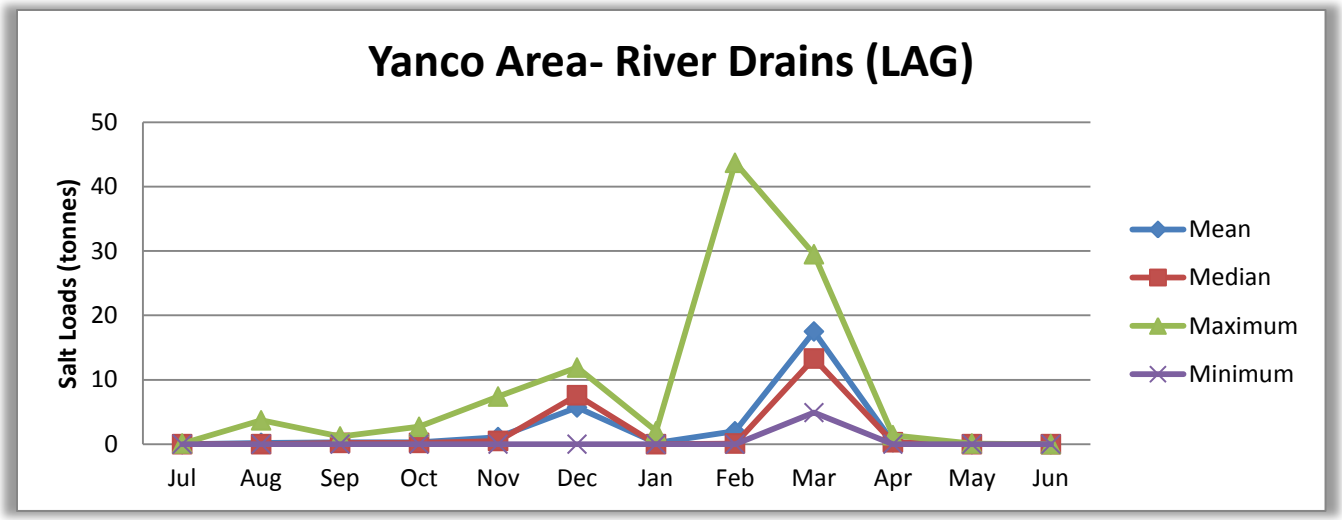


Figure 3.2 (f) - EC Data for Yanco Area- River Drains (LAG) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (f) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall. A spike in February readings may be attributed to a scheduled discharge associated with rainfall runoff from surrounding higher relief areas.

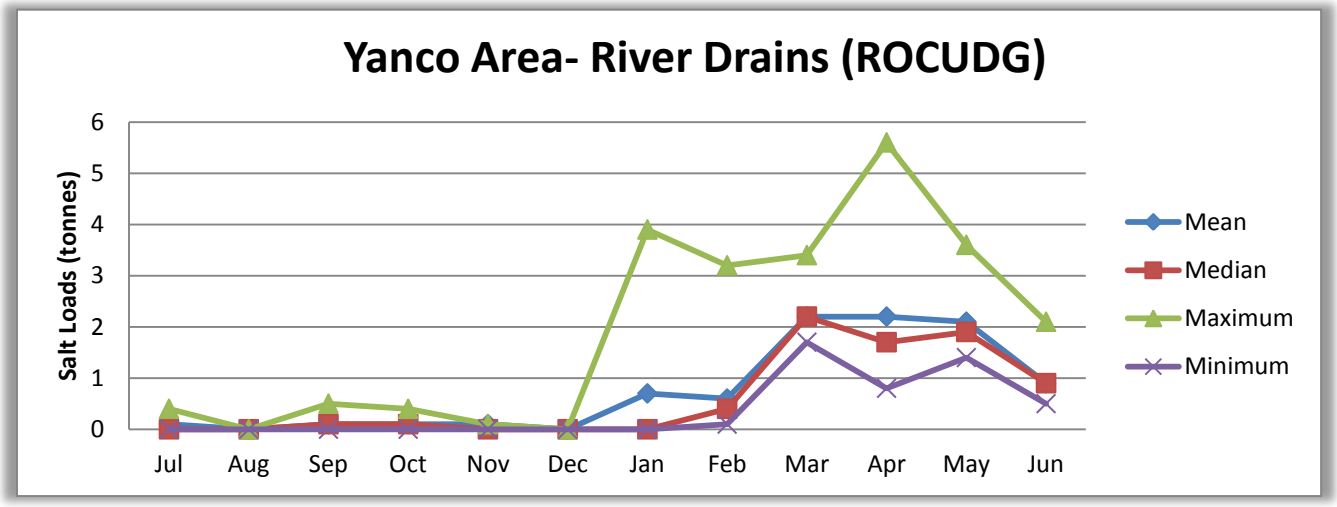


Figure 3.2 (g) - EC Data for Yanco Area- River Drains (ROCUDG) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (g) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall.

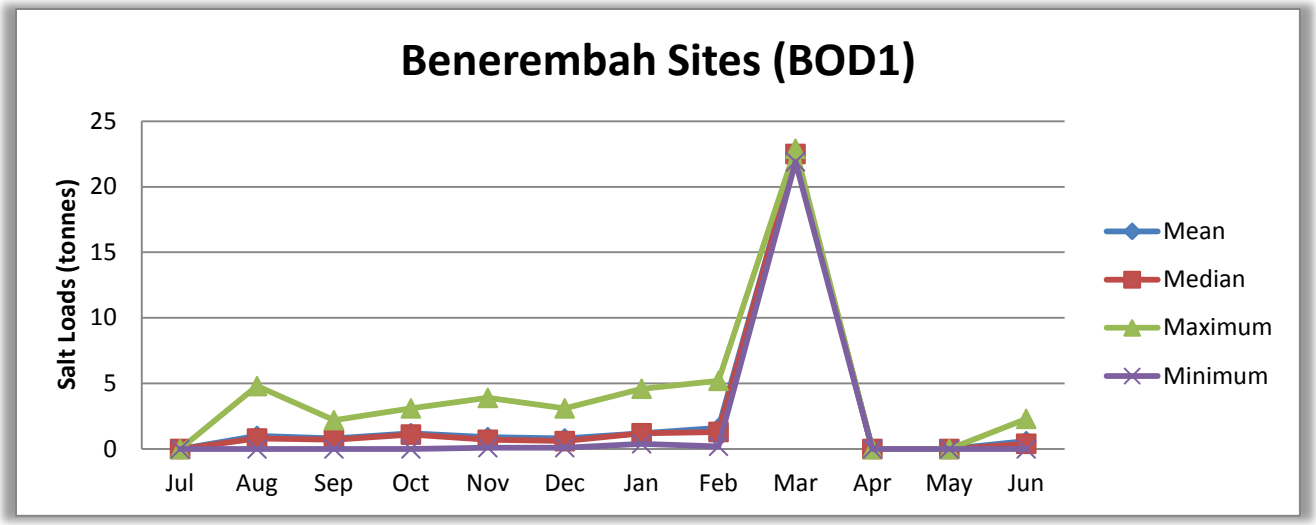


Figure 3.2 (h) - EC Data for Benerembah (BOD1) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (h) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall.

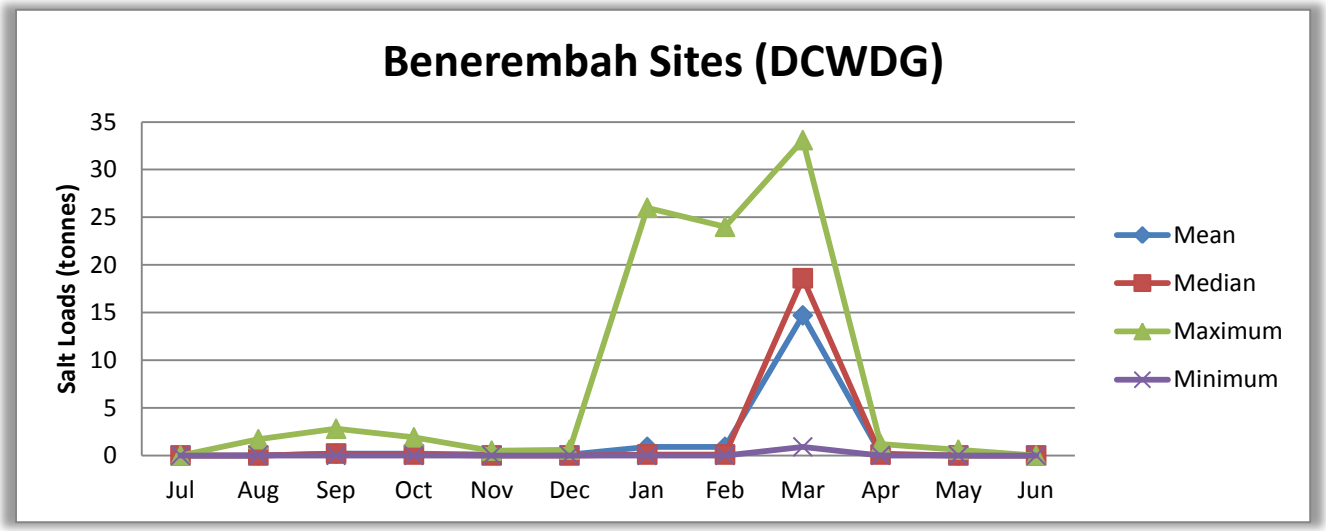


Figure 3.2 (i) - EC Data for Benerembah (DCWDG) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (i) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall. This site is also associated with the Mirrool Creek System which is an area where significant off farm drainage occurs. High summer rainfall and increased irrigation in hotter months may have contributed to increased EC levels in drainage water from January through to March.

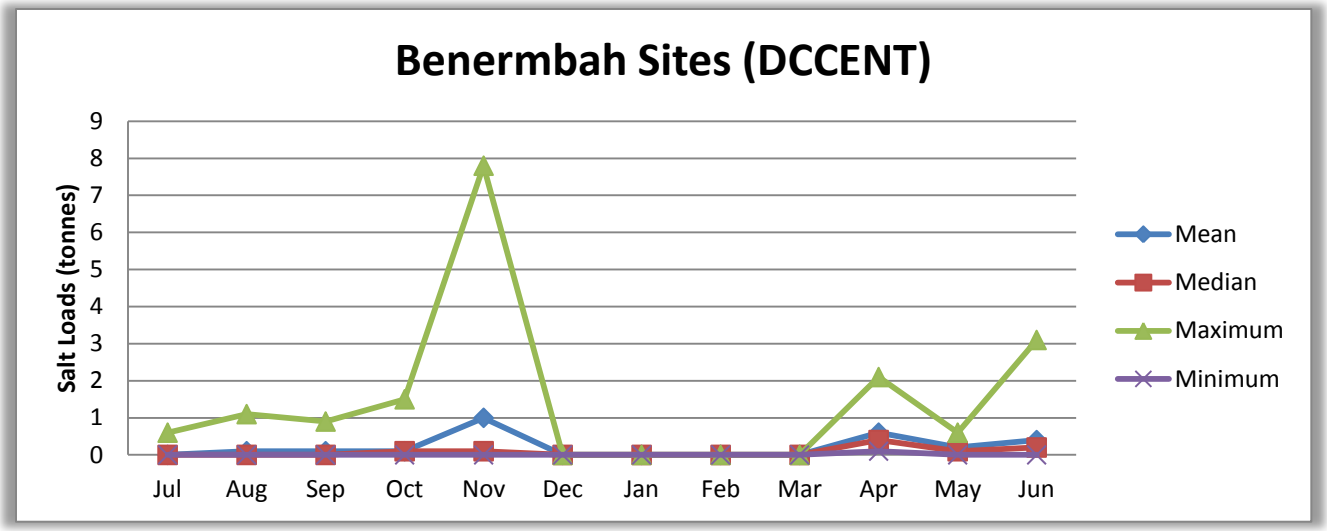


Figure 3.2 (j) - EC Data for Benerembah (DCCENT) July 2011-June 2012.

As highlighted in Figure 3.2 (j) to (i) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall.{the spike in November is very interesting, need to explore this.}

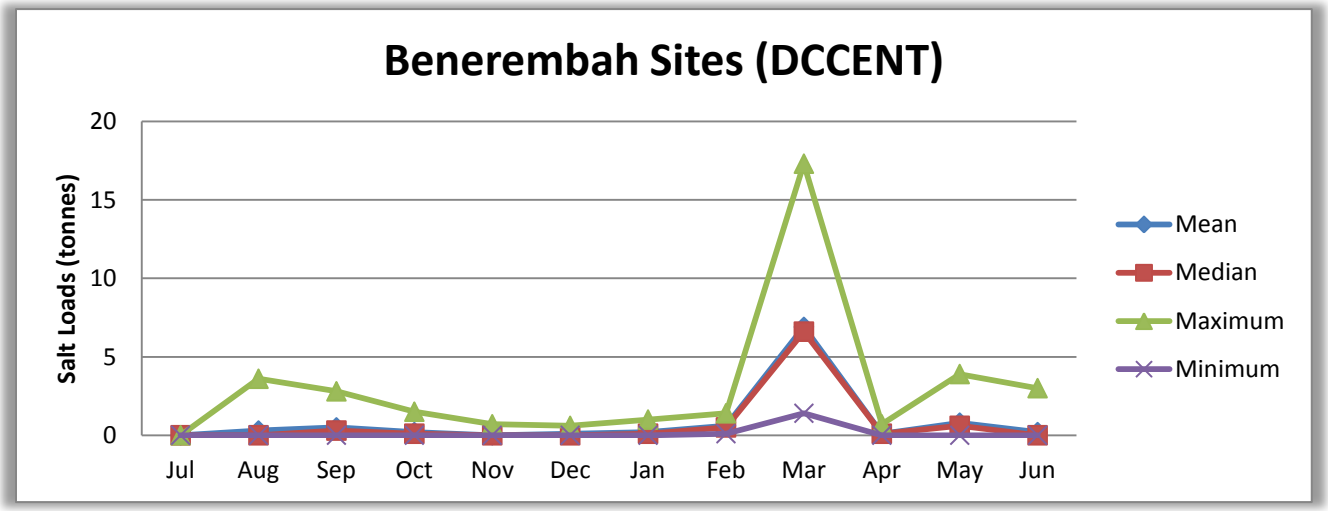


Figure 3.2 (k) - EC Data for Benerembah (DCCUD) July 2011-June 2012.

As highlighted in Figure 3.2 (a) to (k) above, a significant increase in salt loads during March was experienced during to flooding associated with high rainfall.

Refer to Drainage Volumes, Table 1.4 (b) for tabular flow data.

Refer to Salt Loads, Table 1.4 (c) for tabular salt load data.

5.1 (2) NOTICE FOR COMPLIANCE WITH SALINITY AND DRAINAGE STRATEGY

No written notice was received for the period.

There were no changes in operations and practices that could change the long-term salt discharges from the Area of Operation. However consideration has been taken in understanding the impacts of March 2012 floods and associated increases in salt loadings through drainage systems have been discussed in this report.

5.1 (3) SALT LOAD DISCHARGES

Refer to Salt Loads, Table 1.4 (c).

5.1(4) SALINITY IN BARREN BOX OUTFALL DRAIN AGAINST BENCHMARK

Figure 5.1 (a) shows the salinity trend for Barren Box Outfall against the benchmark of 700 EC. The figures presented are daily averages. The figure shows that during the flood in March 2012 through to May 2012 EC levels, even at their highest level remained less than MI's 700 uS/cm benchmark. EC levels during this period were however still higher than usual at 250 uS/cm, at the peak of flood. This was likely due to influx of floodwaters which were diverted into Barren Box for storage. Levels can be seen to be dissipating in June and July with the addition of regular flows.

Figure 5.1 (a) Salinity (EC Levels) and Discharge (Ml/d) trend for Barren Box Outfall Against MI EC Bench Mark

6. WATER QUALITY MANAGEMENT

MI implements its Water Quality Monitoring Program in line with OEH Environmental Protection Licence 4651. Details of the risk based Monitoring Program are explained in Section 6 of this report.

As part of the risk based water quality monitoring program, supply water quality was measured three times during the season. Two trace levels of chemicals were found at notification level and reported to the OEH. The program will continue to monitor the quality of supply entering our system identifying potential risk trends, aiming to better understand the potential impacts on linkages with drainage water quality. MI has no control over the quality of water in the Murrumbidgee River upstream of our major offtakes, therefore it is important that this information is available in case of detections of those same chemicals in the drainage channels due to the integrated nature of the system. As expected, the number of detections of chemicals in our drainage water increased compared to previous years.

The reason for this increase is the more targeted approach of the new program and heavy rain fall, including associated flood events where water entered the region from outside of the MIA. It is expected that the increase in detections will happen for a number of years until we have gained a better understanding of where and when pollution occurs and what the triggers are. This will then allow us to develop strategies and education programs to reduce the detections and therefore increase the quality of our drainage water. All notification and action level detections have been reported in Tables 4.1 and 4.5.

The risk based water quality sampling has been instrumental in identifying risk areas in each sub catchment and further isolating detections, in some instances allowing the point of contamination to be sealed off. After identifying risk areas during flood periods, MI coordinated several media releases advising of water quality suitability based on sampling and laboratory analysis. This information was also distributed through MI customer networks, key stakeholder and industry groups.

Table 4.1: Office of Environment and Heritage compliance requirements

OEH Licence	Issue/requirement	Compliance/ reference	.
	Location of monitoring sites	Table 1.4 (a)	
	Monitoring records		
	Recording procedures	Records filed	
	Record keeping protocol	as per licence	
	Sample collection	Recorded in water quality database	
	Requirements to monitor concentration of pollutants discharged		
	Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Risk Based)	Table 4.4	
	Chlorpyrifos (Risk Based)	Table 4.4	
	Conductivity	Table 4.5	
	Diazinon (November)	Table 4.4	
	Diuron (Risk Based)	Table 4.4	
	Endosulfan ((Risk Based) (alpha & beta)	Table 4.4	
	Flow (Monthly)	Table 4.4	
	Malathion (Oct/Nov)	Table 4.4	
	Metolachlor (Oct/Nov/Dec)	Table 4.4	
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Table 4.4	
	Nitrogen (>5mg/L)	Table 4.4	
	Phosphorus (>5mg/L)	Table 4.4	
	Simazine (Risk Based)	Table 4.4	
	Thiobencarb (Nov)	Table 4.4	
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table 4.4	
	Turbidity	Table 4.5	
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	Table 1.4 (a)	
	Testing Methods – concentration limits		
	Approved by OEH	USEPA & APHA	
	Recording of pollution complaints		
	Keep complaints log	Yes	
	Telephone complaints line		
	Operate telephone complaints line	Yes	
	Notify public of complaints line	Yes	
	Requirement to monitor volume or mass		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
	Environmental Monitoring		
	Monitoring of Sites 1,2,3,8,9,10,11 and 12		
	Atrazine (Risk Based)	Table 4.4	
	Chlorpyrifos (Risk Based)	Table 4.4	
	Conductivity (Monthly)	Table 4.5	
	Diazinon (Nov)	Table 4.4	
	Diuron (Risk Based)	Table 4.4	
	Endosulfan (Risk Based) (alpha & beta)	Table 4.4	
	Flow (Monthly)	Table 1.4 (a)	
	Malathion (Oct/Nov)	Table 4.4	
	Metolachlor (Oct/Nov/Dec)	Table 4.4	
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table 4.4	
	Simazine (Risk Based)	Table 4.4	
	Thiobencarb (Nov)	Table 4.4	
	Nitrogen (>5mg/L)	Table 4.4	
	Phosphorus (>5mg/L)	Table 4.4	
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table 4.4	
	Turbidity	Table 4.5	
	Monitoring Sites 13 and 14		
	Atrazine (Monthly)	Table 4.4	
	Chlorpyrifos (Monthly)	Table 4.4	
	Conductivity (Monthly)	Table 4.5	
	Diazinon (Nov)	Table 4.4	
	Diuron (Monthly)	Table 4.4	

Table 4.1: Office of Environment and Heritage compliance requirements (cont.)

DEC Licence	Issue/requirement	Compliance/reference	
	Monitoring Sites 13 and 14 (cont)		
	Endosulfan (Risk Based**)** (alpha & beta)	Table 4.4	
	Malathion (Oct/Nov)	Table 4.4	
	Metolachlor (Oct/Nov/Dec)	Table 4.4	
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Table 4.4	
	Simazine (Risk Based**)**	Table 4.4	
	Thiobencarb (Nov)	Table 4.4	
	Nitrogen (Risk Based**)**	Table 4.4	
	Phosphorus (Risk Based**)**	Table 4.4	
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Table 4.4	
	Turbidity (Monthly)	Table 4.5	
	M7.2 Conductivity Sites 1 & 9	Table 4.5	
	M7.3 Molinate	Table 4.4	
	M7.4 Channel sampling (as directed)	not requested	
	Requirement to record application of herbicides		
	Record chemical applications to control Alligator Weed	Electronically recorded, Page 56	
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	OEH contacted Table, Page	
R3	**Written report**		
	R3.1 Send reports to OEH at their request, regarding environmental harm	OEH sent report at their request	
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	OEH contacted, Table, Page	
R5	**Annual report**		
	R5.1 Submit annual report to OEH	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table Table Table Table	
	R5.4 Send copies to OEH, DII and MDBC	Submitted	

Table 4.2: Location of monitoring/discharge points and areas

Hydsys No.	Site Acronym	Site Description	Frequency	Type	X-Coordi-nates	Y-Coordi-nates
Licenced Monitoring Sites						
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	Continuous	EC, Flow	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	Continuous	EC, Flow	427479	6171449
410083	YMS#	Yanco Main Southern Drain	Continuous	EC, Flow	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	Continuous	EC, Flow	444891	6165663
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	When flowing	Pesticide EC	375673	6218725
Non Licenced Internal Monitoring Sites						
41010162	WS	Warburn Swamp	After trigger	EC, pH, NTU	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	Continuous	EC, Flow	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	After trigger	EC, pH, NTU	409886	6193089
41010896	LW6	Lake Wyangan Causeway	After trigger	EC, pH, NTU	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	After trigger	Pesticide	440983	6182501
410167	BBOW	Barren Box Outfall Canal Wyvern	Continuous	EC, Flow	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	Continuous	EC, Flow	403257	6208333
410085	LMC	Little Mirrool Creek	Continuous	EC, Flow	422126	6192597
41010903	BBO	Barren Box Storage	After trigger	EC, pH, NTU	389236	6218183
41010978	WWO	Willow Dam	After trigger	EC, pH, NTU	392197	6216283
410164	BOD1	Channel 13 escape at the outfall channel Wyvern	EC, Flow	EC, Flow	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel	EC, Flow	Continuous	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek	EC, Flow	Continuous	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road	EC, Flow	Continuous	396994	6205386

[#] **Note :** There was very little flow at these sites. Flow ceased draining to river and is now diverted (Pumped or gravity-fed) to the supply system.

Table 4. 3: Benchmark sampling monitoring

Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Nitrite + Nitrate as N (0.01mg/L)								
Sep	0.27	0.5	NT	0.46	0.26	0.28	0.24	0.33
Jan	0.11	0.13	NT	0.12	0.18	0.19	0.12	0.2
Apr	0.03	0.73	0.65	0.48	0.36	0.22	0.02	0.15
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Total Kjeldahl Nitrogen as N (0.1mg/L)								
Sep	0.6	0.9	NT	1.8	0.6	0.4	0.6	0.6
Jan	0.3	0.4	NT	0.4	0.5	0.4	0.2	0.4
Apr	0.5	1.1	1.7	0.8	0.5	0.5	0.4	0.3
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Total Nitrogen as N (0.1mg/L)								
Sep	0.9	1.4	NT	2.3	0.9	0.7	0.8	0.9
Jan	0.4	0.5	NT	0.5	0.7	0.6	0.3	0.6
Apr	0.5	1.8	2.4	1.3	0.9	0.7	0.4	0.4
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Total Phosphorus as P (0.01mg/L)								
Sep	<0.01	0.08	NT	0.06	<0.01	<0.01	<0.01	<0.01
Jan	<0.01	0.06	NT	0.03	0.05	0.02	<0.01	<0.01
Apr	0.07	0.31	0.31	0.17	0.05	0.05	0.06	0.04
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Biochemical Oxygen Demand (2mg/L)								
Sep	4	NT	NT	NT	3	NT	NT	NT
Jan	<2	NT	NT	NT	NT	NT	NT	NT
Apr	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Simazine (0.005µg/L)								
Sep	0.015	0.255	NT	0.06	0.017	<0.005	0.032	0.014
Jan	0.017	<0.005	NT	0.009	0.024	0.016	0.007	<0.005
Apr	0.072	0.097	0.153	0.084	<0.005	<0.005	0.066	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Diuron (0.005µg/L)								
Sep	<0.005	0.119	NT	0.066	<0.005	<0.005	0.036	<0.005
Jan	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Atrazine (0.005µg/L)								
Sep	0.008	0.018	NT	0.016	0.007	<0.005	0.009	<0.005
Jan	0.008	<0.005	NT	0.013	0.01	0.007	<0.005	<0.005
Apr	0.027	0.026	0.03	0.017	<0.005	<0.005	0.027	<0.005

Table 4. 4: Benchmark sampling monitoring (cont)

Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Molinate (0.005µg/L)								
Sep	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	0.006	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Metolachlor (0.005µg/L)								
Sep	<0.005	<0.005	NT	0.012	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	0.007	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	0.021	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Malathion (0.002µg/L)								
Sep	<0.002	<0.002	NT	<0.002	<0.002	<0.002	<0.002	<0.002
Jan	<0.002	<0.002	NT	<0.002	<0.002	<0.002	<0.002	<0.002
Apr	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Diazinon (0.005µg/L)								
Sep	<0.005	<0.005	NT	0.042	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Thiobencarb (0.005µg/L)								
Sep	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	0.019	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Chlorpyrifos (0.005µg/L)								
Sep	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Site	3WAYS	BARDENS	BBO	BYD	EMR	NARREG	PENFOLDS	STUR
Trifluralin (0.005µg/L)								
Sep	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Jan	<0.005	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005
Apr	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Nitrite + Nitrate as N (LOR 0.01mg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.06	NT	<0.01	0.01	0.08	0.36	0.24	NT	0.12	0.03	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	0.11	10	NT	NT	NT	NT	NT	<0.01	7.1
Feb	NT	0.3	NT	NT	3.59	0.78	0.66	NT	NT	0.63	0.02	NT
Feb	NT	NT	NT	NT	17.2	NT	NT	NT	NT	NT	NT	NT
Mar	NT	0.25	0.18	NT	NT	NT	NT	0.89	1.4	NT	NT	NT
Mar	NT	NT	0.02	NT	NT	NT	NT	NT	0.29	NT	NT	NT
Mar	NT	NT	0.14	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	0.43	NT	1.03	NT	0.05	NT	NT	NT	NT	NT	0.35	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	1	NT	0.7	0.4	2.2	0.8	1.4	NT	0.9	1	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	1.3	11.5	NT	NT	NT	NT	NT	0.9	3.8
Feb	NT	0.4	NT	NT	4.9	0.6	0.7	NT	NT	0.5	0.4	NT
Feb	NT	NT	NT	NT	5.1	NT	NT	NT	NT	NT	NT	NT
Mar	NT	1.3	1	NT	NT	NT	NT	0.6	1.3	NT	NT	NT
Mar	NT	NT	2.4	NT	NT	NT	NT	NT	1.1	NT	NT	NT
Mar	NT	NT	0.6	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	2.9	NT	1.9	NT	3.2	NT	NT	NT	NT	NT	4.2	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Total Nitrogen as N (LOR 0.1mg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	1.8	NT	NT	NT	0.8	NT	1.3	NT	1.6	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	1.1	NT	0.7	0.4	2.3	1.2	1.6	NT	1	1	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	1.4	21.5	NT	NT	NT	NT	NT	0.9	10.9
Feb	NT	0.7	NT	NT	8.5	1.4	1.4	NT	NT	1.1	0.4	NT
Feb	NT	NT	NT	NT	22.3	NT	NT	NT	NT	NT	NT	NT
Mar	NT	1.6	1.2	NT	NT	NT	NT	1.5	2.7	NT	NT	NT
Mar	NT	NT	2.4	NT	NT	NT	NT	NT	1.4	NT	NT	NT
Mar	NT	NT	0.7	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	3.3	NT	2.9	NT	3.2	NT	NT	NT	NT	NT	4.6	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Total Phosphorus as P (LOR 0.01mg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	0.06	NT	NT	NT	0.35	NT	0.18	NT	0.26	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.13	NT	0.43	0.28	0.37	0.09	0.23	NT	0.07	0.19	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	0.21	0.91	NT	NT	NT	NT	NT	0.17	0.36
Feb	NT	0.08	NT	NT	0.68	0.12	0.31	NT	NT	0.2	0.04	NT
Feb	NT	NT	NT	NT	1.58	NT	NT	NT	NT	NT	NT	NT
Mar	NT	0.27	0.32	NT	NT	NT	NT	0.32	0.34	NT	NT	NT
Mar	NT	NT	0.28	NT	NT	NT	NT	NT	0.21	NT	NT	NT
Mar	NT	NT	0.1	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	0.35	NT	0.34	NT	1.57	NT	NT	NT	NT	NT	1.37	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Simazine (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	0.386	NT	NT	NT	0.588	2.19	2.57	NT	5.54	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.324	NT	0.15	<0.005	1.15	0.311	0.263	NT	0.029	0.021	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	0.031	0.053	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	0.032	NT	NT	0.159	<0.005	<0.005	NT	NT	0.137	<0.005	NT
Feb	NT	NT	NT	NT	0.046	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	0.009	NT	NT	NT	NT	0.076	0.014	NT	NT	NT
Mar	NT	NT	0.541	NT	NT	NT	NT	NT	0.186	NT	NT	NT
Mar	NT	NT	0.136	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	0.06	NT	0.008	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Diuron (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	2.4	NT	NT	NT	<0.005	1.55	0.855	NT	1.42	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.266	NT	0.855	0.027	0.831	0.823	0.173	NT	0.102	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	0.259	0.739	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	0.17	NT	NT	4.68	<0.005	<0.005	NT	NT	1.68	<0.005	NT
Feb	NT	NT	NT	NT	20.4	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	0.516	0.039	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	0.391	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Atrazine (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	104	NT	NT	NT	0.012	0.033	0.019	NT	0.129	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.21	NT	0.053	0.022	0.038	0.036	0.016	NT	0.066	0.072	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	0.049	NT	NT	NT	NT	NT	0.162	0.166
Feb	NT	0.021	NT	NT	0.204	<0.005	<0.005	NT	NT	0.023	0.064	NT
Feb	NT	NT	NT	NT	0.084	NT	NT	NT	NT	NT	NT	NT
Mar	NT	0.007	0.028	NT	NT	NT	NT	0.028	<0.005	NT	NT	NT
Mar	NT	NT	1.42	NT	NT	NT	NT	NT	0.156	NT	NT	NT
Mar	NT	NT	0.134	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	0.039	NT	0.073	NT	<0.005	NT	NT	NT	NT	NT	0.038	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Molinate (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	<0.005	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.055	NT	0.014	0.095	0.096	0.089	0.337	NT	0.111	<0.005	NT
Nov	NT	5.2	NT	NT	NT	5.3	5.0	3.5	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	0.011	<0.005	NT
Feb	NT	NT	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	0.317	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Metolachlor (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	0.008	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.101	NT	0.028	<0.005	0.014	<0.005	<0.005	NT	0.031	0.085	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	0.018	NT	NT	NT	NT	NT	0.029	0.138
Feb	NT	0.031	NT	NT	0.402	<0.005	<0.005	NT	NT	<0.005	0.192	NT
Feb	NT	NT	NT	NT	0.093	NT	NT	NT	NT	NT	NT	NT
Mar	NT	0.009	0.028	NT	NT	NT	NT	0.018	0.01	NT	NT	NT
Mar	NT	NT	1.98	NT	NT	NT	NT	NT	0.182	NT	NT	NT
Mar	NT	NT	0.097	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	0.031	NT	0.098	NT	<0.005	NT	NT	NT	NT	NT	0.045	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Malathion (LOR 0.002µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.002	NT	NT	NT	<0.002	0.048	0.025	NT	0.013	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.002	NT	<0.002	<0.002	<0.002	0.051	0.018	NT	<0.002	<0.002	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.002	<0.002	NT	NT	NT	NT	NT	<0.002	<0.002
Feb	NT	<0.002	NT	NT	<0.002	<0.002	<0.002	NT	NT	<0.002	<0.002	NT
Feb	NT	NT	NT	NT	<0.002	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.002	<0.002	NT	NT	NT	NT	<0.002	<0.002	NT	NT	NT
Mar	NT	NT	<0.002	NT	NT	NT	NT	NT	<0.002	NT	NT	NT
Mar	NT	NT	<0.002	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.002	NT	<0.002	NT	<0.002	NT	NT	NT	NT	NT	<0.002	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Diazinon (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	<0.005	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	NT	<0.005	<0.005	<0.005	0.009	<0.005	NT	<0.005	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	NT
Feb	NT	NT	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	0.042	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Thiobencarb (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	<0.005	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.091	NT	0.023	<0.005	0.075	0.136	0.196	NT	0.066	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	NT
Feb	NT	NT	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Chlorpyrifos (LOR 0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	0.013	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	0.005	NT	<0.005	<0.005	<0.005	0.007	0.016	NT	<0.005	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	0.041	NT	NT	<0.005	<0.005	<0.005	NT	NT	0.053	<0.005	NT
Feb	NT	NT	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	BBE	BYD	EMR	GMSRR	LAG	LMC	MDJWE	MDJY	MIRFLD	MIRMCN	ROCUDG	YMS
Trifluralin (0.005µg/L)												
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	<0.005	NT	NT	NT	<0.005	<0.005	<0.005	NT	<0.005	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005	NT	<0.005	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	<0.005	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005
Feb	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	NT	<0.005	<0.005	NT
Feb	NT	NT	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT
Mar	NT	<0.005	<0.005	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT	NT	NT
Mar	NT	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	NT
Apr	<0.005	NT	<0.005	NT	<0.005	NT	NT	NT	NT	NT	<0.005	NT
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Nitrite + Nitrate as N (LOR 0.01mg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	2.45	0.25	NT	NT	NT	0.92	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.05	<0.01	NT	0.33	NT	NT	0.29	<0.01	0.01	NT	0.92
Mar	0.02	0.09	NT	0.44	NT	NT	NT	<0.01	NT	NT	0.08
Mar	<0.01	0.12	NT	NT	NT	NT	NT	NT	NT	NT	<0.01
Apr	0.18	NT	0.43	NT	NT	NT	NT	NT	NT	NT	0.06
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Total Kjeldahl Nitrogen as N (LOR 0.1mg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	2.7	0.6	NT	NT	NT	31.2	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.9	2.7	NT	2.2	NT	NT	0.9	2.1	0.7	NT	2.7
Mar	2.5	1.5	NT	0.9	NT	NT	NT	0.8	NT	NT	0.8
Mar	0.8	0.6	NT	NT	NT	NT	NT	NT	NT	NT	0.7
Apr	1.4	NT	2.9	NT	NT	NT	NT	NT	NT	NT	1.7
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Total Nitrogen as N (LOR 0.1mg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	5.2	0.8	NT	NT	NT	32.1	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	1	2.7	NT	2.5	NT	NT	1.2	2.1	0.7	NT	3.6
Mar	2.5	1.6	NT	1.3	NT	NT	NT	0.8	NT	NT	0.9
Mar	0.8	0.7	NT	NT	NT	NT	NT	NT	NT	NT	0.7
Apr	1.6	NT	3.3	NT	NT	NT	NT	NT	NT	NT	1.8
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Total Phosphorus as P (LOR 0.01mg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	0.41	0.24	NT	NT	NT	2.12	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.1	0.58	NT	0.68	NT	NT	0.07	0.22	0.13	NT	1.1
Mar	0.16	0.18	NT	0.27	NT	NT	NT	0.08	NT	NT	0.1
Mar	0.08	0.14	NT	NT	NT	NT	NT	NT	NT	NT	0.11
Apr	0.11	NT	0.35	NT	NT	NT	NT	NT	NT	NT	0.27
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Simazine (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	10.5	0.087	NT	NT	NT	0.205	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	0.005	<0.005	NT	0.047	NT	NT	<0.005	0.798	0.104	NT	<0.005
Mar	0.458	0.899	NT	0.046	NT	NT	NT	0.238	NT	NT	0.073
Mar	0.241	0.259	NT	NT	NT	NT	NT	NT	NT	NT	0.081
Apr	0.1	NT	0.06	NT	NT	NT	NT	NT	NT	NT	0.032
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Diuron (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	6.55	0.101	NT	NT	NT	0.093	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	<0.005	NT	NT	1.28	<0.005	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	0.445	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Atrazine (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	0.038	0.021	NT	NT	NT	0.017	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	0.03	NT	0.965	NT	NT	0.127	0.46	0.166	NT	0.023
Mar	0.266	0.548	NT	0.316	NT	NT	NT	0.198	NT	NT	0.584
Mar	0.215	0.05	NT	NT	NT	NT	NT	NT	NT	NT	0.222
Apr	0.07	NT	0.039	NT	NT	NT	NT	NT	NT	NT	0.045
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Molinate (LOR 0.1µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	0.007	0.01	NT	NT	NT	0.115	NT
Nov	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	0.045	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Metolachlor (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	0.642	NT	NT	<0.005	0.351	0.051	NT	0.08
Mar	0.21	0.171	NT	0.259	NT	NT	NT	0.233	NT	NT	0.096
Mar	0.187	0.12	NT	NT	NT	NT	NT	NT	NT	NT	0.074
Apr	0.043	NT	0.031	NT	NT	NT	NT	NT	NT	NT	0.009
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Malathion (LOR 0.002µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	<0.002	0.074	NT	NT	NT	0.087	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.002	<0.002	NT	<0.002	NT	NT	<0.002	<0.002	<0.002	NT	<0.002
Mar	<0.002	<0.002	NT	<0.002	NT	NT	NT	<0.002	NT	NT	<0.002
Mar	<0.002	<0.002	NT	NT	NT	NT	NT	NT	NT	NT	<0.002
Apr	<0.002	NT	<0.002	NT	NT	NT	NT	NT	NT	NT	<0.002
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Diazinon (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	<0.005	0.016	NT	NT	NT	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	<0.005	NT	NT	<0.005	0.02	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Thiobencarb (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	0.027	0.101	NT	NT	NT	0.163	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 4: Trigger based sampling (cont)

Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Chlorpyrifos (LOR 0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	0.008	0.006	NT	NT	NT	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Site	3WAYS	APOSTLES	BBE	COLIN R	FS	GRI	LW6	PENFOLDS	ROACHS	YENDAT	YOT
Trifluralin (0.005µg/L)											
Jul	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Aug	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sep	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Oct	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Nov	NT	NT	NT	NT	<0.005	<0.005	NT	NT	NT	<0.005	NT
Dec	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Jan	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Feb	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Mar	<0.005	<0.005	NT	<0.005	NT	NT	<0.005	<0.005	<0.005	NT	<0.005
Mar	<0.005	<0.005	NT	<0.005	NT	NT	NT	<0.005	NT	NT	<0.005
Mar	<0.005	<0.005	NT	NT	NT	NT	NT	NT	NT	NT	<0.005
Apr	<0.005	NT	<0.005	NT	NT	NT	NT	NT	NT	NT	<0.005
May	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
June	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 4. 5: Monthly Conductivity and Turbidity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results (us/cm)												
YMS	NF	NF	NF	NF	NF	NF	289	NF	NF	NF	NF	NF
GMSRR	NF	150	NF	NF	213	NF	206	NF	NF	NF	NF	NF
LAG	NF	NF	227	NF	102	169	425	298	NF	NF	NF	NF
ROCUDG	NF	NF	NF	NF	163	163	200	115	NF	305	NF	NF
Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Turbidity results (NTU)												
YMS	NF	NF	NF	NF	NF	NF	408	NF	NF	NF	NF	NF
GMSRR	NF	49.6	NF	NF	217	NF	314	NF	NF	NF	NF	NF
LAG	NF	NF	103	NF	41	135	119	97	NF	NF	NF	NF
ROCUDG	NF	NF	NF	NF	56	175	83	238	NF	26.8	NF	NF

Source: Murrumbidgee Irrigation field data
NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

Table 4. 51: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Pesticide OE&H Action Level				
BYD	18/08/2011	Action level of Atrazine	Email OEH 23/9/2011	Subcatchment analysis to determine regional source, continue to monitor
BYD	10/11/2011	Action level of Metolachlor	Email OE&H 6/12/2011	Media release advising chemical detections and Landholder application obligations
FS	10/11/2011	Action level of Diuron	Email OE&H 6/12/2011	Media release advising chemical detections and Landholder application obligations
FS	30/01/2012	Action level of Diuron	Email OEH 17/2/2012	Subcatchment analysis to determine regional source, continue to monitor
YMS	31/01/2012	Action level of Metolachor	Email OEH 17/2/2012	Subcatchment analysis to determine regional source, continue to monitor
LAG[1]	2/02/2012	Action level of Metolachlor	Email OEH 20/2/2012	Subcatchment analysis to determine regional source, continue to monitor
ROCUDG[1]	27/02/2012	Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
LAG[1]	27/02/2012	Action level of Diuron	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Daltons[1]	12/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Colin Roobie[1]	20/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Apostle Yard[1]	20/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal EMR[1]	20/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Penfolds[1]	20/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal 3Ways[1]	20/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
MIRFLD[1]	26/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Colin Roobie[1]	26/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Apostles Yard[1]	26/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal Penfolds[1]	26/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
Main canal 3Ways[1]	26/03/2012	Flood water Action level of Metolachlor	Email OEH 16/4/2012	Continue to monitor floodwater
[1] sample during periods of flood water entering from outside the MIA				

Table 4.5 of all events reported under R.2 and R.3 of the Environment Protection Licence (cont)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Pesticide OE&H Notification Level				
MIRMCN	18/08/2011	Notification level of Diuron, Simazine and Chlorpyrifos	Email OEH 23/9/2011	
BYD	18/08/2011	Notification level of Diuron	Email OEH 23/9/2011	
MDJWE	18/08/2011	Notification level of Diuron	Email OEH 23/9/2011	
BYD	20/09/2011	Notification level of Diazinon	Email OEH 14/10/2011	
FS	10/11/2011	Notification level of Simazine	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
MDJY	10/11/2011	Notification Level of Chlorpyrifos	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
MDJWE	10/11/2011	Notification Level of Malathion	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
MIRMCN	10/11/2011	Notification Level of Metolachlor	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
GRI	10/11/2011	Notification Level of Malathion	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
GRI	10/11/2011	Notification Level of Diazinon	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
YENDAT	10/11/2011	Notification Level of Malathion	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
GMSRR	10/11/2011	Notification Level of Metolachlor	Email OEH 6/12/2011	Media release advising chemical detections and Landholder application obligations
ROCUDG	14/11/2011	Notification Level of Metolachlor	Email OEH 6/12/2011	
MDJY	22/11/2011	Notification Level of Molinate	Email OEH 6/12/2011	
LMC	29/11/2011	Notification Level of Molinate	Email OEH 6/12/2011	
BYD	29/11/2011	Notification Level of Molinate	Email OEH 6/12/2011	
MDJWE	29/11/2011	Notification Level of Molinate	Email OEH 6/12/2011	
ROCUDG	30/01/2012	Notification Level of Diuron	Email OEH 17/2/2012	
FS	30/01/2012	Notification Level of Simazine	Email OEH 17/2/2012	
LAG[1]	2/02/2012	Notification Level of Diuron	Email OEH 20/2/2012	
MIRMCN[1]	27/02/2012	Notification Level of Diuron	Email OEH 16/4/2012	
MIRMCN[1]	27/02/2012	Notification Level of Chlorpyrifos	Email OEH 16/4/2012	
BYD[1]	27/02/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
BYD[1]	27/02/2012	Notification Level of Chlorpyrifos	Email OEH 16/4/2012	
LAG[1]	27/02/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal YOT[1]	5/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal EMR[1]	5/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal Yenda[1]	12/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal MC TR 80[1]	12/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	

Table 4.5: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence (cont)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Pesticide OE&H Notification Level (cont)				
Main Canal YOT[1]	20/03/2102	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal EMR[1]	20/03/2102	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal PENFOLDS[1]	20/03/2102	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal YOT[1]	26/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal EMR[1]	26/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal LW6[1]	26/03/2012	Notification Level of Diuron	Email OEH 16/4/2012	
Main Canal ROACHS[1]	26/03/2012	Notification Level of Metolachlor	Email OEH 16/4/2012	
Main Canal EMR[1]	2/04/2012	Notification Level of Metolachlor	Email OEH 27/4/2012	
Main canal 3Ways[1]	2/04/2012	Notification Level of Metolachlor	Email OEH 27/4/2012	
BBE[1]	2/04/2012	Notification Level of Metolachlor	Email OEH 27/4/2012	
ROCUDG[1]	18/04/2012	Notification Level of Metolachlor	Email OEH 14/5/2012	
BBO[1]	26/04/2012	Notification Level of Metolachlor	Email OEH 14/5/2012	
[1] sample during periods of flood water entering from outside the MIA				
Other Pollution Events				
D1-850-020E	5/08/2011	Customer reported dog death after drinking out of MI drainage channel which had dead sheep in it. Vet was contacted that conducted an autopsy and found that the dog had died from clostridial disease. This is caused by clostridium perfringens bacteria, which is common from food poisoning.	Field inspection 5/08/2011 found no water or dead sheep evident in any MI drainage systems surrounding the property	No further action
D-2-1311W	15/08/2011	Griffith City Council notified a pollution incident involving a factory by phone . A clean up notice along with a breach of prevention notice has been issued in relation to contaminated material (bottle caps & liquid) entering MI drain at the front of factory.	Field inspection 15/08/2011, advised that site will require liquid to be removed (pumped) from drain	Requested GCC advise appropriate location for removed material. Factory informed MI that the liquid that entered drain as wash down water with potentially some soft drink syrup. A plumber was contracted to block drain immediately to ensure no further contamination from the pipe outlet.
MDJ	13/09/2011	Truck observed pumping brown sludge liquid into MDJ 120m downstream of Old Willbriggie Rd. Advised cessation immediately	Met GCC contact on site. Company believed to be subcontracting to GCC	Requested stop pollution and clean up remaining sludge. Asked for details on GCC procedures for contractor waste disposal. GCC advise clean up notice and official caution notice issued. Site cleanup confirmed.
D-1-1314-010E	4/10/2011	Customer reported crop damage from MI scheduled weed spraying along the drain. Weeds coordinator inspection on 5/10/2011, it was noted with the weather conditions on the day, off target drift from MI was unlikely. Operator advised damaged crop was also being sprayed (other than MI) on the same day of the incident	Investigation using MI AWS wind data confirmed spray records. No MI off target spraying in direction of vines.	Following investigation it was concluded that MI spray operation did not cause the crop damage, No further action.

Table 4.5: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence (cont)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Other Pollution Events (cont)				
S-1-BC2-100E	5/10/2011	Truck reported by staff member had crashed into Murrumbidgee Irrigation supply channel	Field inspection on the 5/10/2011 found no fuel leakages or contamination	No further action
D-1-STRDEV-010E	1/10/2011	Small truck reported to crash into Murrumbidgee Irrigation drainage channel.	Field Inspection on the 1/11/2011 found no fuel leakages or contamination	No further action
BR - 1 - 902	10/11/2011	4 wheel motor bike in Main Canal at 6 mile Regulator Leeton.	Field inspection on the 10/11/2011 found no fuel leakages or contamination	No further action
MDJ	16/11/2011	Discoloured film on water entering MDJ from factory/farm drain	Site visit 25/11/2011 identified factory juice entering drain leading to MDJ	Advised GCC and met with owner 29/11/2011. Source material removed. Proposed upgrade planned DA with GCC, new requirements will ensure appropriate waste management plan.
S-1-5GBC	7/02/2012	Vehicle in supply channel on Houghton Road Yanco	Vehicle removed no spills	No further action
D-2MP-070-E	21/02/2012	Green slime reported in MI drain	Inspection identified source as water treatment facility	Samples taken for analysis identified BGA above guidelines. Source stopped immediately and actions taken to prevent further issues. Ongoing visual monitoring.
Stringers Reg	9/03/2012	Green slime reported	Field inspection	Water quality monitoring following floodwater, media releases in response to results above guidelines
DE-LVDR-030E	9/03/2012	Dead fish from drain in north lake	Field inspection identified dead fish following heavy rain and large inflows	Most likely caused by large flows and temperature sensitivity, no further fish kills.
DC-3	21/03/2012	GCC notified household effluent entering MI drain	Inspection revealed effluent dispersed	GCC to ensure no further contamination
D-2-128A	29/03/2012	Report of odorous water pumped into MI drain	Inspection and contact EPA	Factory pumped from stormwater dam after floods in line with licence EPL conditions, NFA
NBC	11/04/2012	Channel attendant report of algal scum at regulators	inspection samples taken	Sample results under guidelines, advised removing debris restricting flow around regulators to improve flow
DC 808J Yenda	11/06/2012	Resident reported pollution in drain	Field inspection identified discoloured water no odour	GCC notified and involved in site meeting with factory representative. Contractor identified as dumping watering truck excess, water discoloured from rust only. GCC issued contractor official warning notice
S-102-J	25/06/2012	Complaint relating to factory effluent pumped into MI Supply Channel 102-J. Foul smell, colouration and fish kills were noted.	Full water quality investigation conducted by MI in conjunction with GCC. Adjacent landholders and EPA notified.	MI & GCC coordinated removal of contaminated material. MI working with factory to improve waste water management.
Corinya Channel	25/06/2012	Sediment and Water Quality toxicity claim.	MI conducted comprehensive in-situ and lab sampling for sediment and water quality to investigate claim on the 28/6/2012.	Report to be written upon recieval of results from the Lab.
Corinya Channel	26/06/2012	Blue Green Algae Complaint- Wah Wah Customer via email. Upon visual inspection no sign of algae blooms in the Corinya Channel System.	MI conducted in-situ water quality sampling program and algae lab sampling to investigate claim on the 27/6/2012.	Laboratory results identified BGA levels below guidelines for use. NFA

Table 4.5: Summary of all events reported under R.2 and R.3 of the Environment Protection Licence (cont)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Other Pollution Events (cont)				
DC 808J	28/6/1021 reported at 5pm.	Complaint made in relation foul smell and black sludge in MI drain. Small amount of wine effluent present. Winery informed MI that the effluent was discharge into their stormwater storage and into our drain. They are working to find and repair the leak and removing effluent from the drain.	Field Inspection conducted 29/6/12	Pump out truck removed effluent from drain. Factory conducted an investigation to identify and rectify source entering stormwater. Continue to monitor.
BID/Kidman Way	5/07/2012	Truck crash in BID channel	Channel empty, no obvious fuel leaks	Ensured SES fuel collection boom remained in place until after the truck was removed, no further action

7. LAND AND WATER MANAGEMENT PLAN

7.1 ANNUAL ENVIRONMENT MANAGEMENT REPORT

In 1989, the Murrumbidgee Irrigation Area (MIA) community initiated the Murrumbidgee Irrigation Area and Districts Land and Water Management Plan (MIA&D LWMP) in response to threats to the area's future sustainability as a result of widespread flooding. It was agreed that the cost of implementation would be shared between the NSW and Australian governments and the MIA and Districts community. The MIA&D LWMP was implemented as MIA EnviroWise until 2010 when it was absorbed into the Murrumbidgee Irrigation Sustainable Business Strategy (MI SBS) to further integrate environmental management into MI operations. The MIA covers more than 660,000 hectares with a gross value of approximately $7 billion in value added agricultural production.

The total cost of implementing MIA&D LWMP has been calculated at $285.4 million over 30 years. MIA EnviroWise (Mark II) began development in 2009 with the aim of providing strategic framework for continued and innovative environmental management in the MIA. The strategic plan has been approved by the board of MI and now stands as the MI SBS. The vision underpinning and informing the MI SBS is that:

Murrumbidgee Irrigation is recognised as the best irrigation company in Australia in measuring and managing its water, energy, carbon and landscape footprint; preparing its business, its customers and its region to operate effectively in a more variable and difficult climate with less secure water resource availability; making extremely efficient and profitable use of irrigation water; differentiating its services based on environmental performance; and developing new sustainable business opportunities

The objectives of the MI SBS are to provide a strategic framework that will guide and support MI, its customers and the region, in order to:

1. Facilitate adaptation to a more variable and difficult climate;
2. Improve the management of irrigation water, the efficiency of the delivery system and the productivity of water use;
3. Maintain drainage water quality to be better than agreed standards and improve the environmental health of aquatic ecosystems;
4. MI aims to reduce emissions to the maximum extent possible across its operations;
5. Reduce energy use, improve energy efficiency and increase the proportion of renewable energy consumed, to the point where MI is a net producer of renewable energy by 2020;
6. Minimise MI's waste streams, and pursue opportunities to re-use or sell waste;
7. Ensure that areas of remnant vegetation and wetlands of high conservation value are managed under long-term stewardship arrangements, and enhanced by ongoing biodiversity and carbon plantings, to improve ecosystem function by 2020;
8. Recognise and reinforce the social and cultural dimensions of landscape, enterprise and natural resource management, and build community pride in the environmental performance of the MIA, through active community engagement;
9. Develop new sustainable business opportunities; and
10. Position the MIA to differentiate and promote its produce in more demanding and discerning markets on the basis of its environmental performance.

Environmental sustainability is core business for Murrumbidgee Irrigation Limited. The financial administration of government funds for the MI SBS is the responsibility of Murrumbidgee Irrigation Limited. The expenditure of these funds is administered in accordance with the cost share principles negotiated prior to the approval of the LWMP in 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001. The cost share percentages applied to each line item were negotiated based on the 'beneficiary pays' principle. Government funds were only directed to projects that could demonstrate clear public benefits.

Program Highlights

The program targets achieved for line items of the MI SBS for the reporting year are presented in Figure 1.1.a.

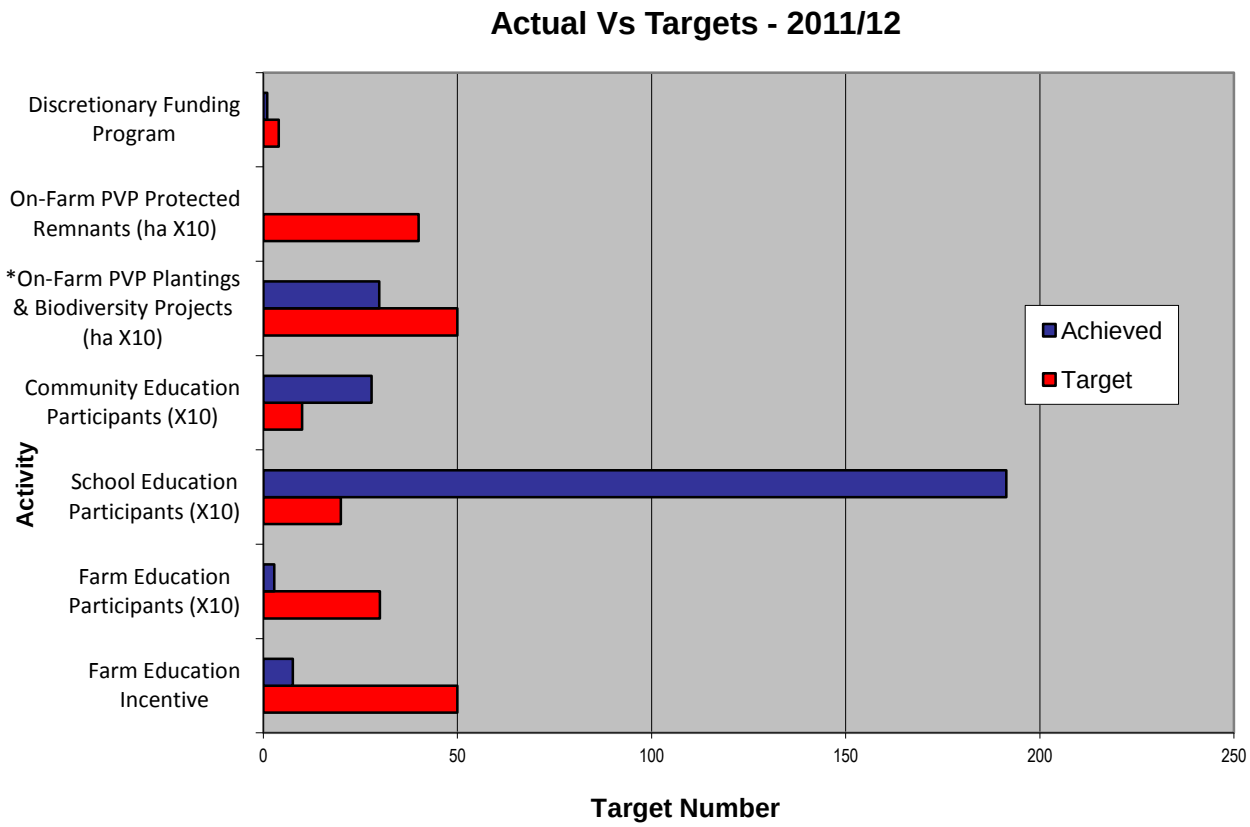
The highlights for the past year were the construction and maintenance of the educational facilities at Barren Box Wetland which has included the assembly of a shelter, seating, information screen, walking trails and the necessary weed control program.

The continued expansion of the community education program has seen more than 2,300 school students and community members participate in Environmental Education activities. There has been an increase in schools focusing on sustainability and this has meant the EnviroChampions program is now being offered in Wagga, Talbingo and West Wyalong areas. In addition, the EnviroChampions program was a finalist at the UNNA World Environment Day Sustainability Leadership Awards.

Implementation Activities

Implementation of the MI SBS is currently focused on improving the water use efficiency of farms in the MIA through education and extension programs with farmers, while still working with individual landholders as well as the wider community and regional organisations to protect and enhance the amount and diversity of native vegetation to improve habitat for native fauna. The program also works to incorporate the local Wiradjuri culture into natural resource management in the MIA again through on-ground implementation and work to educate school and community groups. The progress of the various projects against their targets for the 2011/12 reporting year is shown in Figure 1.1a

Figure 5.1(a): MI SBS Targets Achieved 2001-2012



*The reason why the plantings are well below target is that the planting period is in autumn, which is when the March flooding occurred. As a result, the delayed plantings will be conducted in the next financial year.

Outlined below is a summary of the achievements of the MI SBS against targets for 2011/2012:

- Once again the education incentive has proved to be very popular with the landholders of the MIA with 76 people taking the opportunity to undertake further education with the assistance of the MI SBS.
- For the regional biodiversity projects undertaken by MI, the majority of biodiversity plantings this year have been in the form of directly sown seed rather than the traditional planting of seedlings. There was 124 hectares of native vegetation direct seeded over the past 12 months along Mirrool Creek Reserve Trust.
- On farm in the MIA, 18.5 hectares of new tube stock plantings were completed in 2011/2012 - all of these were protected under legally binding Property Vegetation Plan (PVP) agreements. There was also a further 45.2 hectares of direct seeding completed across PVP sites. In addition to 2210m of new fencing constructed to secure the PVP areas over the past 12 months.
- In the 2011/2012 year there was again an increased focus on school education through the MI SBS program. This year there were in excess of 1,900 school children from within and outside the MIA attend education sessions run by MI environmental staff.
- In addition to the schools, the MI SBS renewed a focus on wider community education with in excess of 400 community members attending workshops coordinated and run by the MI education team. The primary focus of these workshops was related to energy efficiency and biodiversity. These workshops were very well supported by community members with a number of participants submitting positive feedback.

- The number of farm courses run by the MI Education team was reduced during 2011/12 with the focus on all farmers updating their chemical user courses.
- The Discretionary Funding for School and Small Community Groups program was again utilised with Griffith East Public School were successfully applying for a $1637 grant which they have used for a sustainable native garden.

Expenditure

The budget for the year was $1,943,799.00 and expenditure totalled $1,303,731.81 (33% under budget). Of the money invested in the MIA $936,525.85 was government funding while the remaining $367,205.96 came from the landholders of the MIA through their levy. The difference between the budget and expenditure can be explained as the after effects of the flood, as works on Mirrool Creek for direct seeding, fencing and environmental works all had to be delayed.

7.2 NEW DOCUMENTATION RELEVANT TO IMPLEMENTATION OF THE LWMP

Table 1.2.a. includes all the operational and guiding documents, along with documents generated because of research, relevant to the Land and Water Management Plan.

Table 5.2(a): Key reference documents relevant to the LWMP

Document	O/R	Submitted to DECCW	Endorsed by DECCW
DLWC (1998). *Draft MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	June 1998	Jan 2001
DLWC (1998). *MIA &D's Community Land And Water Management Plan (LWMP)*. Prepared by the LWMP Working Group and Taskforce.	R	July 1998	Jan 2001
Eldridge, D. (2002). *Condition And Biodiversity Of Vegetation Remnants In The MIA: A Baseline Survey And Recommendations For Future Monitoring.* Report for Murrumbidgee Irrigation. DLWC Parramatta.	R	June 1998	*
McCaffery, A. (2002). *MIA EnviroWise Summary Plan: A Summary Of The MIA and Districts' Community Land And Water Management Plan*	O	Sept 2002	*
Eldridge, D. (2003). *Condition And Biodiversity Of Vegetation Remnants In The MIA: Stage II. Preliminary Assessment Of Sites 45-71*. Report for Murrumbidgee Irrigation. DNR Parramatta	R	June 1998	*
Roberts, J. (2003). *Monitoring The Floodway*. Report for Murrumbidgee Irrigation. Report JR 02/2003. Canberra, ACT. September 2003.	R	June 1998	*
Driver, M. (2004). *Murrumbidgee Irrigation Area Landscape Plan*. Draft report prepared for Murrumbidgee Irrigation. Plain Sense Vegetation Management, Deniliquin. August 2004.	R	June 1998	*
Barren Box Swamp Project Amended EIS, prepared by URS. December 2004	R	December 2004	June 2005
Murrumbidgee Irrigation, Griffith. (2002). *Murrumbidgee Interim Rice Growing Rules:* Supplement to the Company Member Contract.	O	October 2005	*
Sass, S., Wassens, S., Swan, G., Thompson, L. (2004). *Reptile Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey*. Johnstone Centre Report No. 69b Charles Sturt University, Wagga Wagga.	R	December 2004	*

Document	O/R	Submitted to DECCW	Endorsed by DECCW
Van der Lely, A. (2004). *Groundwater Conditions In The MIA and Districts: Annual Report 2004*. Report for Murrumbidgee Irrigation.	R	Oct 2005 Electronic	*
Wassens, S., Sass, S., Swan, G., Thompson, L. (2004). *Frog Diversity In The Murrumbidgee Irrigation Area: A Baseline Survey.* Johnstone Centre Report No. 69a Charles Sturt University, Wagga Wagga.	R	October 2005	*
Harrison, L. and Roberts, J. (2005). *Inventory Of Wetlands In The Eastern MIA*. Report JR 05/2004, Canberra ACT. May 2005	R	October 2005	*
IQ Group (2005). *Farm Survey with Murrumbidgee Irrigation Account Holders*. IQ Group Toowong.	R	October 2005	*
Wassens, S., Car, C., Jansen, A. (2005). *Murrumbidgee Irrigation Area Invertebrate Biodiversity Benchmark*. School of Science and Technology, CSU, Wagga Wagga. Report prepared for MI. April 2005.	R	October 2005	*
Lewis BD (2005) *Biodiversity Benchmarking Survey Of The Murrumbidgee Irrigation Area: Mammals*. Report prepared for Murrumbidgee Irrigation (Griffith) by Lewis Ecological Surveys.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2005) *Revegetation Efforts in the MIA – A Baseline Survey 2003/2004*, Prepared by McCann K for MIA EnviroWise, February 2005.	R	October 2006 Electronic (on disc)	*
Taylor IR, Schultz M, Suesse R, Smallbone L (2004) *Management Of Egrets And Their Habitats In The Murrumbidgee Irrigation Area: Balancing The Needs Of Conservation And Irrigated Agriculture.* Technical Report No. 1 prepared for Murrumbidgee Irrigation by Institute of Land, Water and Society, School of Environmental and Information Science, Charles Sturt University.	R	October 2006 Electronic (on disc)	*
Webster R (2002) *Preliminary Analysis Of The Bird Data For Murrumbidgee Irrigation Remnants*. Prepared for Murrumbidgee Irrigation by Ecosurveys Pty Ltd.	R	October 2006 Electronic (on disc)	*
MIA EnviroWise (2002*) MIA EnviroWise Biodiversity Strategy*. Prepared by Biodiversity working group for MIA EnviroWise, 2002.	R	October 2006 Electronic (on disc)	*
Roberts, J. (2005). *An Audit Of Wetlands In The Eastern MIA*. Report JR, Canberra ACT. September 2005	R	October 2006 Electronic (on disc)	*
Van der Lely, A. (2005). *Groundwater Conditions In The MIA and Districts: Annual Report 2005*. Report for Murrumbidgee Irrigation, Griffith.	R	Oct 2005 Electronic (on disc)	
Van der Lely, A. (2006). *Groundwater Conditions In The MIA and Districts: Annual Report 2006*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Van der Lely, A. (2007). *Groundwater Conditions In The MIA and Districts: Annual Report 2007*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
MIA EnviroWise (2007) Five Year Review	R	February 2007	*
Hale, J (2008) Barren Box Wetland Rehabilitation Plan 2009-2014	R	December 2008	
Taylor, I R. (2008) Barren Box Intermediate Cell Waterbird Study	R	August 2008	
Van der Lely, A. (2008). *Groundwater Conditions In The MIA and Districts: Annual Report 2008*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Campbell, A. (2009). *MIA EnviroWise 2 Strategy.* Prepared for Murrumbidgee Irrigation by Triple Helix Consulting.	R	December 2009	

Document	O/R	Submitted to DECCW	Endorsed by DECCW
Lewis, B (2010). *Biodiversity Benchmarking Survey of the Murrumbidgee Irrigation Area: Birds.* Prepared for Murrumbidgee Irrigation by Lewis Ecological Surveys	R	March 2010	
Taylor, I R. & Schultz, M.C. (2010) *Barren Box Intermediate Cell Waterbird Study.* Prepared for Murrumbidgee Irrigation by CSU	R	June 2010	
Van der Lely, A. (2010). *Groundwater Conditions In The MIA and Districts: Annual Report 2010*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Taylor, I R. & Schultz, M.C. (2011) *Barren Box Intermediate Cell Waterbird Study.* Prepared for Murrumbidgee Irrigation by CSU	R	June 2011	
Van der Lely, A. (2011). *Groundwater Conditions In The MIA and Districts: Annual Report 2011*. Report for Murrumbidgee Irrigation, Griffith.	R	Electronic (on disc)	*
Van der Lely, A. (2012). *Groundwater Conditions in The MIA and Districts: Annual Report 2012*. Report for Murrumbidgee irrigation, Griffith.	R	2012	*
Murrumbidgee Irrigation, Griffith (2011). *MI Sustainable Business Strategy 2010-2015*	O	2012	
Murrumbidgee Irrigation, Griffith (2011). *Rice Growing Rules*, 2011	O	2012	
NSW Office of Water (2010). *Lower Murrumbidgee Groundwater Sources: Groundwater Management Area 002*- Groundwater Status Report 2009	R	2012	
NSW Office of Water (2010). *Lower Murrumbidgee Groundwater Sources: Groundwater Management Area 0013*- Groundwater Status Report 2009	R	2012	
NSW Office of Water (2010). *Lower Murrumbidgee Groundwater Sources: Resource condition assessment report*- 2010	R	2012	
NSW Department of Mines (1962). *The Geology of New South Wales*: Narrandera – 4 Mile Geological Series	R	2012	

Source: Murrumbidgee Irrigation Environmental Services
Notes: O/R = Operational/Reference
* = provided to DECCW

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4. NSW Office of Water (2010). *Lower Murrumbidgee Groundwater Sources: Resource condition assessment report- 2010*', Department of Primary Industries, NSW Government, 2001.
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6. Van der Lely, A. (2003). 'Salinity survey 2002-MIA: methods, data, analysis, results, findings.'. Murrumbidgee Irrigation. NSW.
7. Van der Lely, A. (2002). 'Groundwater Conditions in the MIA - Annual Report 2001.'. Murrumbidgee Irrigation. NSW.

9. GLOSSARY

APHA	American Public Health Association	m	Metre
BBSW	Barren Box Storage and Wetland		
CSIRO	Commonwealth Scientific Investigation and Research Organisation	MI	Murrumbidgee Irrigation Limited
CSU	Charles Sturt University	MIA	Murrumbidgee Irrigation Area
DEC	Department of Environment and Conservation	MIA&D	Murrumbidgee Irrigation Area and Districts
DECC	Department of Environment and Climate Change	ML	Megalitre
DIPNR	Department of Infrastructure, Planning and Natural Resources	mm	Millimetre
DNR	Department of Natural Resources	NOW	New South Wales Office of Water
DPI	Department of Primary Industries	NRM	Natural Resource Management
DWE	Department of Water and Energy	NTU	Nephloteric Turbidity Units
EC	Electrical Conductivity	OEH	Office of Environment and Heritage
		PVP	Property Vegetation Plan
EIS	Environmental impact statement	SEE	Statement of Environmental Effect
ELISA	Field testing Molinate kit	SFU	Single farming unit
		SBS	Sustainable Business Plan
EM31	Electromagnetic Induction Survey (31)	T	Tonnes
EPA	Environment Protection Authority	TN	Total nitrogen
ET	Evapotranspiration	TP	Total phosphorus
ETo	Reference Evapotranspiration	TSS	Total suspended solids
GL	Gigalitre	URS	Consulting company
ha	Hectare(s)	USEPA	United States EPA
IHS	Integrated Horticulture Supply	VMP	Vegetation Management Plan
L	Litre	WFP	Whole farm plan
LTA	Long term average	WUE	Water use efficiency
LWMP	Land and Water Management Plan		











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B8: Licence compliance report FY 2012-2013

Murrumbidgee Irrigation Ltd

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LICENCE COMPLIANCE REPORT 2013



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INTRODUCTION

This report is prepared by Murrumbidgee Irrigation Limited (MI) as part of licence requirements which MI holds with the NSW Office of Water (NOW) and the Environmental Protection Authority (EPA). It discusses our annual compliance performance, including the environmental performance and impacts of the works and infrastructure owned or controlled by MI and, in particular, the quality of irrigation waste water discharged from works and infrastructure.

Our environmental programs, which aim to exceed our environmental obligations, demonstrate our commitment to ensuring that our operations do not impact negatively on the environment.

Our environmental monitoring programs, the results of which are contained in this report, demonstrate that our programs are having an impact in ensuring the sustainability of the Murrumbidgee Irrigation Area (MIA).

Murrumbidgee Irrigation Limited (MI) views environmental sustainability as core business and has complied with the requirements under its licence with the NSW Office of Water (NOW). Full compliance was not achieved with our Environmental Protection Licence 4651. On four occasions monitoring did not take place due to equipment failure. New sampling equipment has been purchased to prevent non-compliances in the future. MI does not have any regulatory control over the activities of landholders, an external factor that may impact on compliance with our licences.



Gillian Kirkup
Chairman
Murrumbidgee Irrigation Limited



Peter Borrows
Chief Executive Officer
Murrumbidgee Irrigation





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EXECUTIVE SUMMARY

Murrumbidgee Irrigation Limited (MI) operates under a Combined Water Supply Water Work Approval and Water Use Approval (40CA403245) issued by the NSW Office of Water (NOW) and Environmental Protection Licence 4561 in accordance with the Protection of the Environment Operations Act, 1997 administered by the NSW Environmental Protection Authority (EPA). These licences set the minimum standard for environmental management. The Company has a corporate objective to operate beyond compliance and its environmental programs have been developed to meet this objective.

STATEMENT OF COMPLIANCE

MI has complied with the requirements under its licence with the NOW. Full compliance was not achieved with our Environmental Protection Licence 4651. On four occasions monitoring did not take place due to equipment failure. Compliance with licensing requirements is listed in Table 1 (a) below.

MI has met licence compliance for EPL4651 but failed to meet all monitoring conditions in relation to section M2 for 2012-13 reporting period. A summary of the non-compliance under M2 are provided in Annexure B.

Table 1 (a) - List of Compliance with Approval Number 40CA403245

Compliance Requirement	Report Section	Compliant?	Page Number
Combined Water Supply Work Approval and Water Use Approval **REPORTING AND NOTIFICATION REQUIREMENTS**			
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	Section 1 and 7	Yes	Pages 8 and 72
Statement of Compliance	Executive Summary	Yes	Page 4
Presentation of Data and Analyses	Section 1, 2, 3, 4 and 6, Annex A	Yes	Pages 8, 28, 53, 54, 63 and 103.
New Measures to Limit Groundwater Recharge and Discharge of Salt.	Section 2	Yes	Page 28
Reporting on Water Management	Section 1, 2, 3, 4 and 6	Yes	Pages 8, 28, 53, 54 and 63
Reporting on Salinity and Saltload	Section 6	Yes	Page 63
Reporting Groundwater Conditions	Section 2	Yes	Page 28
Combined Water Supply Work Approval and Water Use Approval **ENVIRONMENT PROTECTION AND MANAGEMENT REQUIREMENTS**			
Discharge of Noxious Aquatic Weeds	Section 4	Yes	Page 54
Discharge of Blue - Green Algae	Section 4	Yes	Page 54
Basin Salinity Management Strategy	Section 6	Yes	Page 63
Schedule 1 – Authorised supply works	Section 1	Yes	Page 8
Attachment 1 – Discharge Monitoring & Reporting	Section 1	Yes	Page 8
Attachment 2 – Groundwater Condition Monitoring & Reporting	Section 2	Yes	Page 28

Table 1 (b) - List of Compliance with EPL 4651

Compliance Requirement	Report Section	Compliant?	Page Number
Environmental Protection Licence 4651			
Section 5 - Monitoring and Recording Conditions	Section 1, 6, 7 and Annex A	No	Pages 8, 63, 72 and 103
Section 6 - Reporting Conditions	Section 1, 6, 7 and Annex A	Yes	Pages 8, 63, 72 and 103

All monitoring data is collected in accordance with the Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines for water quality monitoring and trigger values assessed against the Environment Protection Licence (EPL) and Section 3- Primary Industry of the ANZECC Guidelines. Calibration of all field equipment is conducted in accordance with HydroLab (In-situ multi parameter meter) and Hachi (turbidity meter) recommendations. Laboratory samples have been submitted to nationally accredited laboratories AgriSearch and Australian Laboratory Services (ALS). Chain of Custody documentation is available for review upon request.

1. WATER SUPPLY AND DRAINAGE MANAGEMENT

The 2012/13 irrigation season recorded rainfall and evapotranspiration figures similar to long term averages. Full allocations for both high and general security licences saw water sales return to pre-drought levels. A variety of opportunistic summer crops were grown across the region including rice and cotton in addition to the perennial crops such as citrus and grapes.

The licence specifies continuous measurement of flow and salinity levels at selected sites across the MIA, which is done using flow gauging stations that are maintained and calibrated by a licenced contractor.

2. GROUNDWATER MANAGEMENT

As part of Attachment 2 - Groundwater Condition Monitoring and Reporting of the Water Supply Works and Use Approval, bores are required to be read bi-monthly and six-monthly. MI identified the need to undertake an asset review of all bores due to yearly reductions in the licenced bore monitoring network, since September 2001. MI has commissioned Thiess Services Pty Ltd, to undertake a review of the current monitoring network and provide recommendations on future replacement and monitoring opportunities.

Groundwater levels have generally risen across the Murrumbidgee Irrigation Area (MIA) due to lag responses from the March 2012 floods as well as the increased irrigation activity due to full allocations.

3. FLOODS AND FLOOD PLAIN MANAGEMENT

With rainfall for the 2012/13 season being close to the long term average, no flood operations were put in place.

4. AQUATIC ENVIRONMENT MANAGEMENT

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At Barren Box Storage & Wetland (BBSW), the significant floods in March 2012 resulted in the wetland cell reaching total inundation, impacting on the success of aerial sowing and direct seeding within the wetland

cell. A monitoring plan has been developed for implementation in Spring 2013 to determine vegetation establishment and soil quality. Directions for future rehabilitation will be determined from this information.

Water bird monitoring over a four year period from 2008 to 2011 found that the number of birds at BBSW is in decline. This can be explained by splitting the study period into two periods which consist of 2008 – 2010 and 2011 - 2012. The main difference between the two periods was the drought conditions of the first period followed by the high rainfall in the second period. It is likely that the intermediate cell serves as a drought refuge for birds, whereas in wetter years birds travel to other wetlands to breed and feed. The intermediate cell is the only wetland regionally on which Great and Pied Cormorants breed regularly in large numbers.

Restoration of the Mirrool Creek continues with 280 hectares (ha) being direct seeded on Mirrool Creek, with a further 240 ha planned for direct seeding in Spring 2013.

The control program for Alligator Weed has continued over the last year. Inspections have been conducted at BBSW, downstream channel systems of BBSW and the floodway at Wyvern Station.

Inspections of *Sagittaria spp* during 2012/13 reporting period were carried out monthly from September 2012 through to the end of June 2013. Detected plants were treated with Roundup Biactive (360 g/L glyphosate) in accordance with an Australian Pesticides and Veterinary Medicines Authority (APVMA) off label Permit: 11856).

5. GENERAL ENVIRONMENTAL MANAGEMENT

For the reporting period between July 2012 to June 2013, 70 ha of new plantings and 16.2 ha of direct seeding took place to increase the area of native vegetation within the MIA. This local native species revegetation was implemented under Property Vegetation Plans (PVP) which were jointly funded by the Murrumbidgee Catchment Management Authority (CMA) and MI (via the MIA EnviroWise levy).

MI has been working with the Commonwealth Scientific Investigation and Research Organisation (CSIRO) and an independent consultant, Ary Van Der Lely, over the past three years to develop a hydrogeological model of the MIA. This model is currently on hold while MI is developing a hydrodynamic model of the MIA for use in operational and strategic planning. As part of this, MI is currently undertaking a review of water and rice environmental monitoring as well as a monitoring network gap analysis.

6. SALINITY ACCOUNTING AND MANAGEMENT

During the 2012/13 reporting period, 2,563 megalitres (ML) was discharged to the river via our river drain sites in comparison to 5,852 ML discharged during the 2011/12 reporting period.

A benchmark of 700 microSiemens per centimetre (µS/cm) is applied for the provision of water downstream of BBSW. MI managed to maintain salinity levels at BBSW and the Wah Wah Main below this benchmark.

7. WATER QUALITY MANAGEMENT

MI implements its Water Quality Monitoring Program in line with NSW Environment Protection Authority (EPA) Environmental Protection Licence (EPL) 4651. Licence provisions negotiated with the NSW EPA have been implemented from 1 July 2010. The contemporary program ensures effective management of water quality within the MIA.

Results from this reporting year revealed a decrease in the number of detections of chemicals in our drainage water, when compared to previous years. As part of MI's monitoring program which helps to understand water quality within our supply system, a targeted approach in monitoring drainage and drainage re-use, uses rainfall triggers at a catchment scale to determine water quality based risks and sampling requirements. Benchmarking will allow MI to capture data for drainage quality during a non rainfall event, such as contributions from escape flows or run-off from on-farm irrigation practices.

This year, risk based water quality sampling has been instrumental in identifying risk areas at a sub catchment level, enabling MI to understand the source of those detections, and in containing and managing such incidents.

During the current reporting period MI was involved in undertaking a number of specific water quality projects in response to trace residue pesticide detections as well as some more significant reported pollution incidents. MI's Water Monitoring Framework also shows our commitment to continuous improvement of the Water Quality Monitoring Programs. Special projects also assist MI to work more closely with councils and the EPA to ensure that water and land pollution incidents are addressed in accordance with the *Protection of the Environment Operations Act (POEO Act).*

1. WATER SUPPLY AND DRAINAGE MANAGEMENT

1.1 CLIMATIC CONDITIONS

The seasonal rainfall for the 2012/13 season was below the long term average. There was virtually no rainfall recorded for the month of January 2013 as outlined in Table 1.1 (a) below. Total Reference Evapotranspiration (ETo) levels recorded were slightly higher than the previous season (which recorded 1821 millimetres (mm)) but close to the long term average.

The lack of rainfall combined with elevated temperatures resulting in a net ETo of 306 mm created an increased surge of water demand which required diligent water operations in order to meet water demand in January 2013.

Table 1.1 (a): Summary of Climatic Data for July 2012 to June 2013 (CSIRO Griffith AWS Station only)

Month	Monthly Eto 2012-13 (mm)	Monthly Rainfall 2012-13 (mm)	Net ETo (ETo-Rainfall) (mm)	LTA ETO (1962-2012) (mm)	LTA Rainfall (1962-2012) (mm)
July	42.2	33.4	8.8	50	36
August	73.2	27.6	45.6	78	36
September	129.3	4.2	125.1	118	40
October	187.5	13.4	174.1	176	42
November	226.1	60.4	165.7	226	31
December	277.6	11.2	266.4	274	36
January	305.7	0.2	305.5	286	35
February	244.7	46.6	198.1	231	33
March	174.4	40.6	133.8	191	35
April	103.9	2.8	101.1	116	28
May	64	38.2	25.8	67	35
June	36.2	28.6	7.6	44	35
Total	**1,864.8**	**307.2**	**1,557.6**	**1,857**	**422**

The ET_{ref_t} (tall crop) is the FAO56 equation modified to represent tall crops (taller than 0.5m) and is to be used in semi arid or arid climates. The Griffith, Finley, Hay and Tullakool weather stations have traditionally used a Penman-Meyer equation (ETo) which is very similar to the ET_{ref_t} (ASCE tall crop) equation.

***Source**: CSIRO Griffith*

***Notes:** LTA = Long term average (1962-2012), weather data and LTA Rainfall from CSIRO Griffith, LTA ETo calculated from CSIRO weather data.*

As shown in Table 1.1 (b) below, a 100% announced allocation for both General and High Security has been constant over the reporting periods of 2010/11, 2011/12 and 2012/13.

Compared to 2011/12, the Total Diversions in 2012/13 increased by 21%, which was directly related to hotter conditions, sporadic rainfall events and an increased areas of summer crops, as detailed in Table 1.8 (c).

Table 1.1 (b): Summary of Climatic Data – Allocation History, Diversions and Deliveries for 1995 to 2012

Year	Announced Allocation % General / High	Total Diversions (ML)	Total Deliveries (ML)	Net ETo (mm)	ETo (mm)	Rainfall (mm)
2012-13	**100/100**	**1,079,843**	**940,979**	**1,557.6**	**1,64.8**	**422**
2011-12	100/100	854,855	752,845	1,084	1,821	737
2010-11	100/100	567,223^	490,329	653	1,391	739
2009-10	27/95	506,521	362,622	1,750	2,085	336
2008-09	21/95	393,973	276,233	1,820	2166	346
2007-08	13/95	335,687	210,297	1,766	2,127	361
2006-07	15/90	559,952^{+}	411,898	1,987	2,182	195
2005-06	54/95	1,036,519*	829,990	1,568	1,935	367
2004-05	40/95	826,207	648,417	1,713	1,983	270
2003-04	41/95	861,499	651,806	1,645	1,998	353
2002-03	38/95	960,119	754,112	1,938	2,191	253
2001-02	72/95	1,141,607	916,611	1,744	2,032	288
2000-01	90/95	1,048,053	857,455	1,471	1,887	416
1999-00	78/100	818,496	646,402	1,242	1,832	590
1998-99	85/100	1,036,169	825,390	1,331	1,868	537
1997-98	90/100	1,225,805	976,972	1,563	1,931	368
1996-97	100/100	1,325,021	1,085,105	1,610	1,958	348
1995-96	105/100	1,107,225	882,766	1,439	1,862	423

Sources: ***MI Corporate Office & CSIRO Griffith***

Notes: ***2011-12*** *^ = Does not include 2,642 ML environmental allocation water diverted for DPI*
2010-11 *^ = Does not include 2,724 ML environmental allocation water diverted for DPI*
2005-06 ** = Does not include 2,146 ML environmental waterway diversions for DNR.*
2006-07^{+} *= Does not include 3,256 ML State Water environmental flows through Roaches Escape.*

Figure: 1.1 (c) - MI Areas and Districts Map

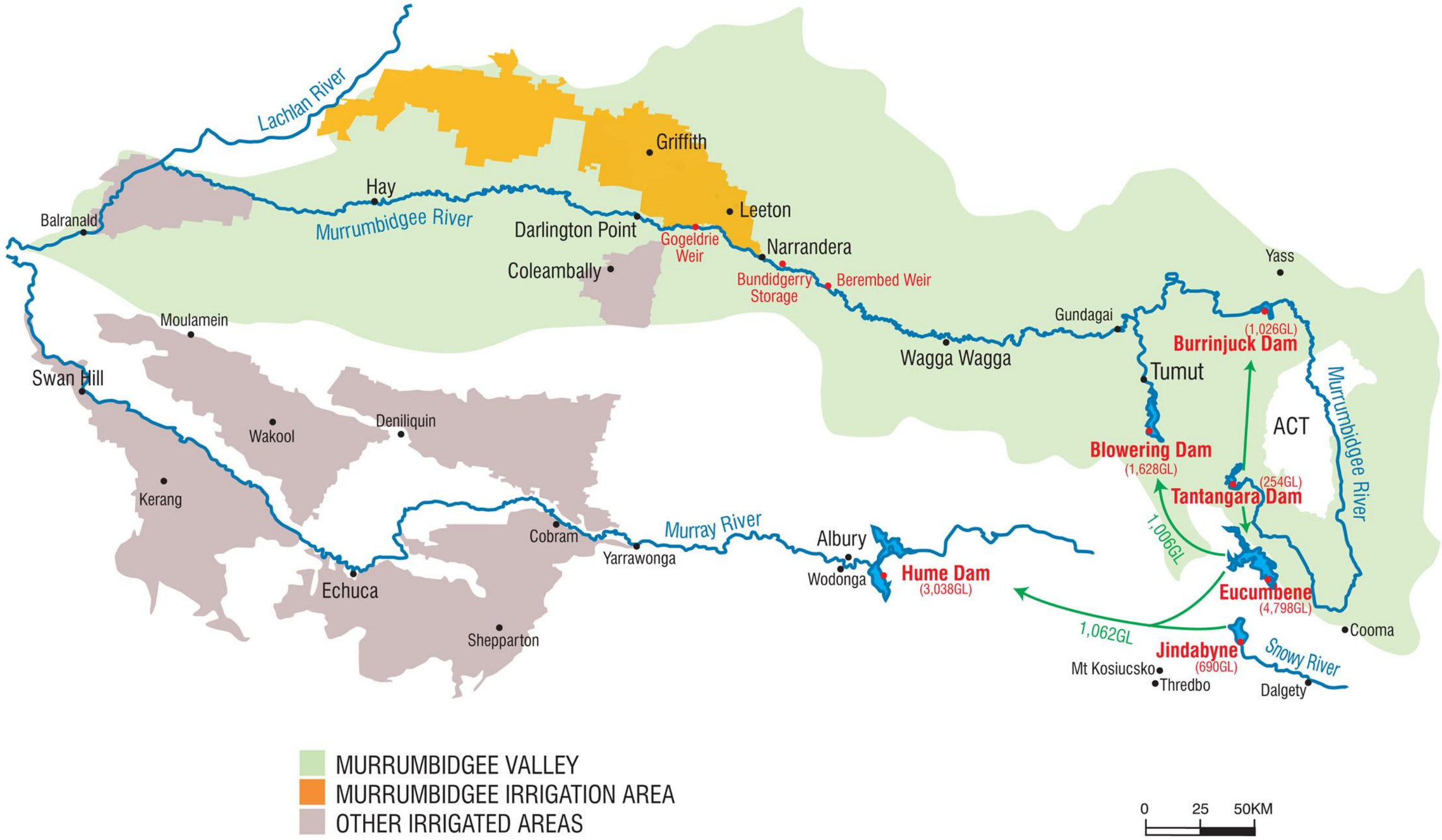
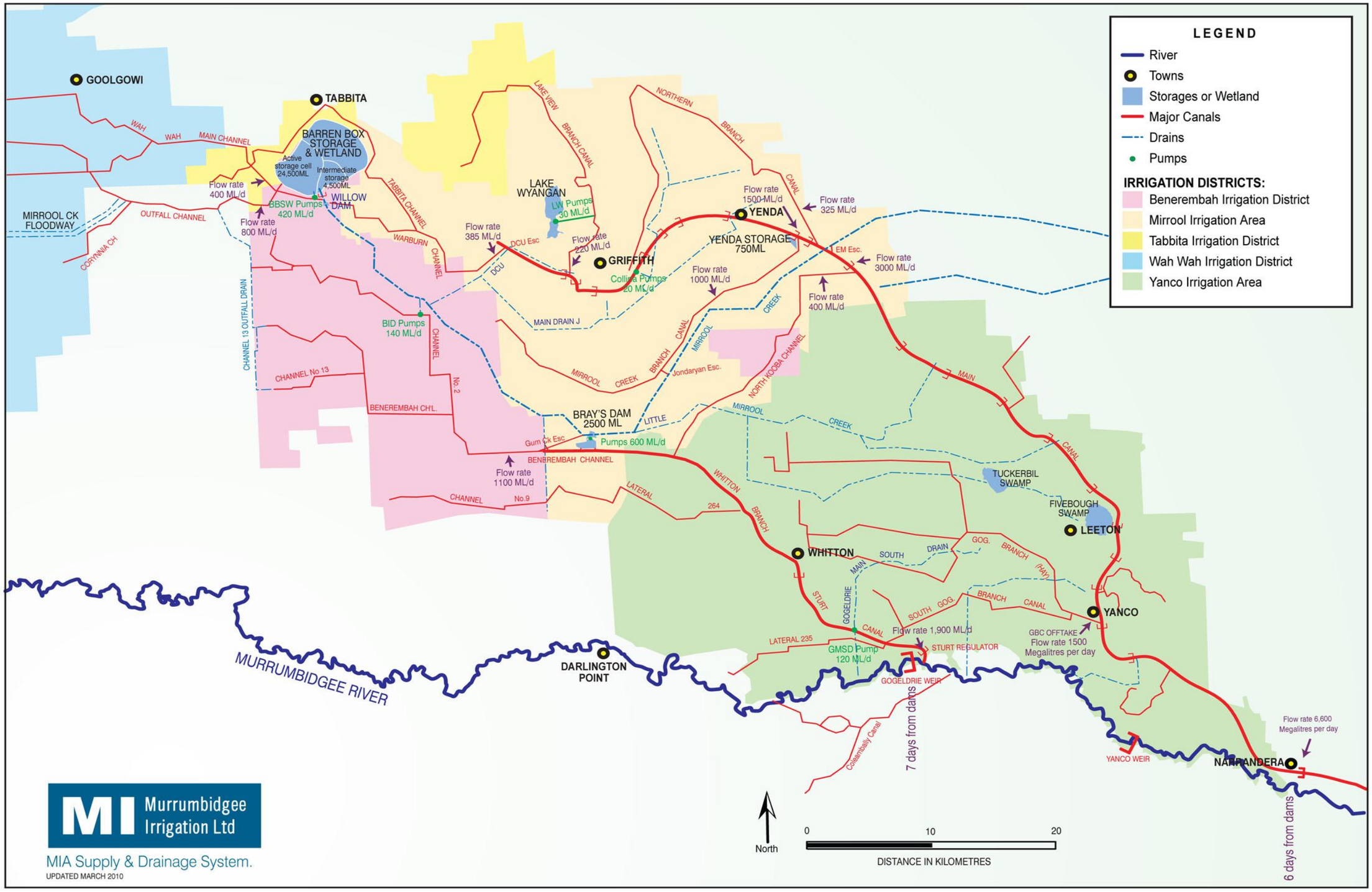


Figure 1.1 (d) - Key Irrigation Structures Map



1.2 DIVERSIONS AND VOLUME

A summary of diversions and volumes of water managed and supplied by MI has been presented in Tables 1.2 (a) and 1.2 (b) below. Table 1.2 (b) shows the summary of Gross Diversions entering the supply system from MI's two regulated sites at Narrandera Regulator and Sturt Canal. The sum of these diversions are shown as total diversions in Table 1.2 (a).

Table 1.2 (a): Summary of Gross Diversions at Narrandera Regulator and Sturt Canal 2012/13

Month	Sturt (ML)	Main (ML)	Total Diversions
July	2,592	5,107	7,699
August	11,995	21,712	33,707
September	26,331	58,169	84,500
October	48,763	100,317	149,080
November	36,259	82,614	118,873
December	50,537	134,198	184,735
January	61,669	176,242	237,911
February	34,452	107,253	141,705
March	7,367	39,463	46,830
April	9,047	27,510	36,557
May	10,598	25,291	35,889
June	1431	1,446	2877
TOTAL	**301,041**	**779,322**	**1,080,363**

Note: 301,041 +779,322 =1080,363 ML **(Includes environmental allocation - 520 ML)**

Table 1.2 (b): Summary of adjusted diversions to the Sturt, Main and Wah Wah canal systems, 2012/13

Month/Year	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
July	**2,411**	**4,798**	**280**
August	12,513	21,268	1,593
September	26,102	50,399	7,255
October	50,742	98,755	14,208
November	37,049	81,816	13,077
December	50,811	125,957	20,189
January	58,945	162,527	25,184
February	34,646	97,152	18,408
March	11,303	38,954	7,910
April	7,958	27,223	6,065
May	10,014	23,812	7,520
June	175	-589	1,124
Total 2012-13	**302,669**	**732,072**	**122,813**
Total 2011-12	249,877	575,864	101,735
Total 2010-11	182,273	397,247	57,932
Total 2009-10	91,051	403,924	51,099
Total 2008-09	40,244	346,282	44,000
Total 2007-08	25,437	304,601	33,332
Total 2006-07	84,057	490,872	52,695
Total 2005-06	229,065	776,856	115,670
Total 2004-05	145,728	680,479	100,155
Total 2003-04	174,150	687,349	94,027
Total 2002-03	176,488	783,631	98,915
Total 2001-02	229,155	912,452	145,490
Total 2000-01	223,518	824,535	167,255
Total 1999-00	165,440	653,056	151,020
Total 1998-99	200,260	835,909	165,385
Total 1997-98	212,875	977,720	161,130

Notes:

Diversions shown in Table 1.2 (b) for the STURT Canal include water diverted to the STURT at Gogeldrie Weir plus diversions from Yanco via escapes + diversions from GMSD Pumps (Yanco esc + sw) + deliberate diversion from Main via NK channel - deliberate downstream diversion to Gum Creek escape.

Diversions for the Main Canal include diversions at Narrandera Regulator - Cudgel Creek Diversions - Deliberate downstream diversion to Benerembah via NK Channel - downstream diversions to Yanco escapes - EMR & MCBC Escapes, DCU & Forresters escape and net Yenda storage reservoir diversions. Diversions for the Wah Wah Supply System include Mirrool Creek Diversions + Barren Box Diversions

Referring to Table 1.2 (b), note the figure for June 2013 for the Main Canal which is -589 ML, this was attributed to the draining of the Main Canal to administer maintenance works at Bundidgerry and Narrandera regulating structures.

For the current reporting period, Table 1.2 (b) above shows the actual amounts of water channeled through each of the three main channel systems. The three main channel systems which make up the MIA are:

1. The Main Canal System, which is primarily fed through the Narrandera Regulator.
2. The Sturt Canal System, which is primarily fed through the Sturt offtake.
3. The Wah Wah System is primarily fed through Mirrool Creek, which contains a mixture of escape and drainage water, supplemented by water from BBSW. If demand exceeds that, it is further supplemented with River water which enters the system through the Narrandera and Sturt regulators.

The total amount of water channeled through all three systems combined is greater than the Net Total Irrigation Diversions shown in Table 1.2 (a), due to MI's innovative Re-Use Program, details of which are included for each of the systems shown in Table 1.4 (b).

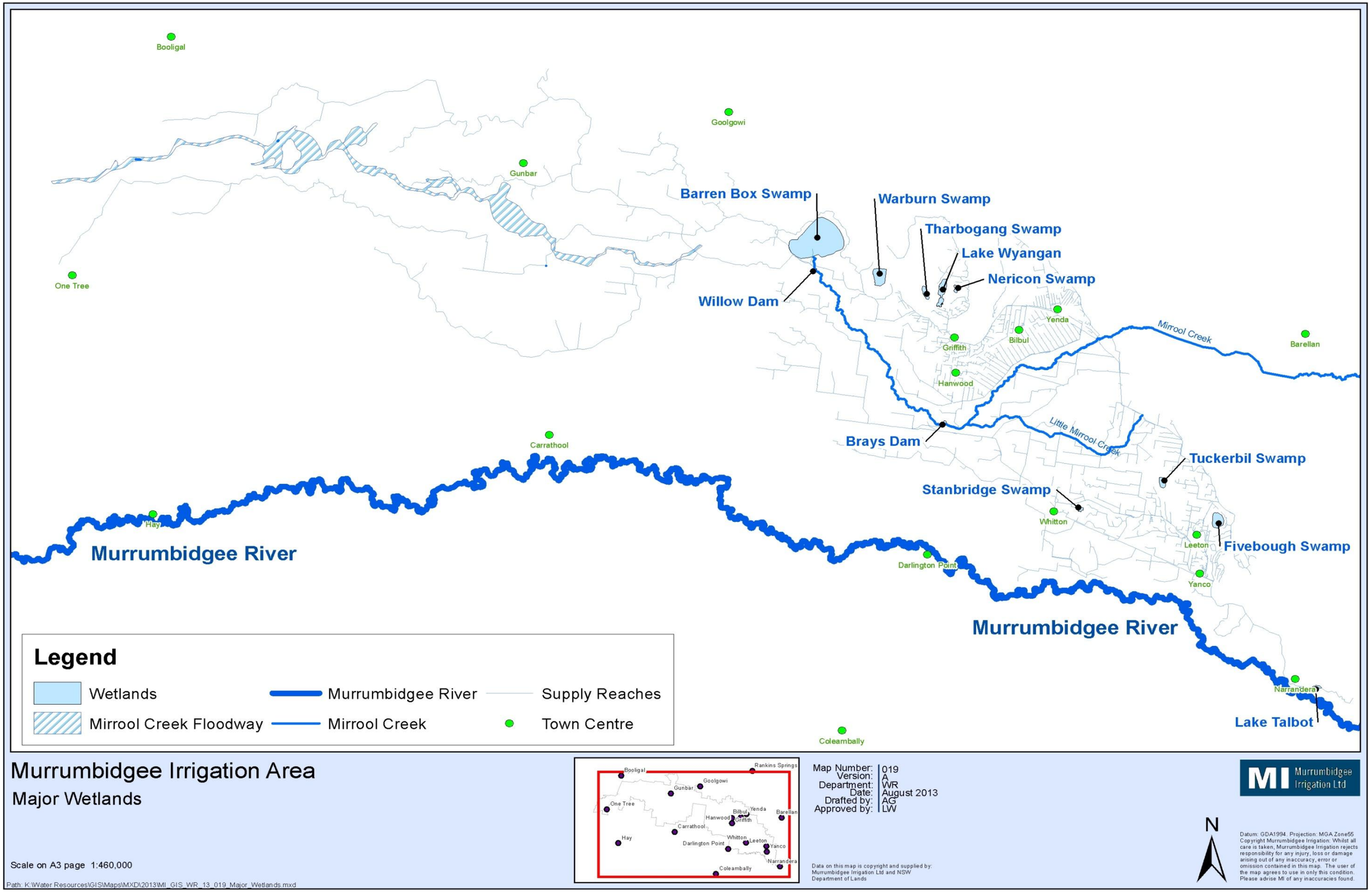
1.3 ENVIRONMENTAL WATER REQUIREMENTS - DELIVERIES

In May 2013, MI was asked by the Office and Environment and Heritage (OEH) to deliver 300 ML of water for environmental purposes to Coonancoocabil Lagoon. Water in relation to this request was delivered via Lateral 230 and Lateral 231 Drain Escapes. Watering commenced on Saturday 18 May 2013 with a daily discharge of 24-25 ML per day through to Thursday 30 May 2013. This consisted of a total of 12 days of constant flow.

In June 2013, MI was asked by the Office of Environment and Heritage (OEH) to deliver 235 ML of water for environmental purposes to Coonancoocabil Lagoon. Water in relation to this request was delivered via a diversion from the Gogeldrie Branch Canal (GBC) offtake in Division 2. Watering commenced on Wednesday 12 June 2013 with a daily discharge of 20-30 ML per day through to Friday 21 July 2013. This consisted of a total of ten days of constant flow.

Fluctuations in discharge over the ten day period were attributed to the availability of remaining water within MI's supply system during the start of the winter maintenance shutdown period and requirements in draining the Main Canal to meet project delivery timeframes for maintenance projects.

Figure 1.3 (a) - MIA Wetlands Map



1.4 SUPPLY EFFICIENCY, STORAGE LEVELS

Supply Efficiency

Table 1.4 (a) below, illustrates the simple efficiency of the system to be at 86% for the current 2012/13 reporting period.. Higher conveyance figures for 2012/13 in comparison to the 2011/12 figures are attributed to increased demand and full allocations.The water balance represented in Table 1.7 (a), see page 29, more clearly reconciles the losses and gains of the system and takes into account drainage reuses during this period.

Table 1.4 (a): Simple efficiency of the system —2004 to 2013

Parameter	2012/13	2011/12	2010/11	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05
Diversions (ML)									
Sturt Canal	**301,041**	**237,436**	155,859	81,215	30,943	21,266	60,280	233,388	145,728
Main Canal	**779,322**	**620,061**	414,088	425,306	363,030	314,421	502,928	805,277	680,479
Less DNR Environmental Diversions	**520**	**2,642**	2,724	1,468	0	0	3,256	2,146	
NET TOTAL irrigation diversions	**1,079,843**	**854,855**	**567223**	**505,053**	393,973	335,687	559,952	1,036,519	826,207
Sales (ML) metered & unmetered	**931,541**	**752,845**	490,329	369,817	276,233	210,297	411,898	826,207	648,417
Conveyance (ML)	**148,302**	**102,010**	76,894	135,236	117,740	125,390	148,054	206,529	177,790
Simple Efficiency (%)	**86.3%**	**88%**	**86%**	**73%**	70.1%	62.6%	73.6%	80.1%	78.5%

Source: *MI Irrigation Services and Corporate Services*
Note: *Simple efficiency = Total Sales/Total Gross Diversions x 100*

Storage Levels

Barren Box Storage Storage and Wetland (BBSW)

In 2006 BBSW was transformed from a degraded swampland into an efficient water storage facility which has permanently returned an average of 20,000 ML of water per annum under the Water for Rivers program for use in the Snowy River system. Storage at this site comprises of three cells:

- The Active Cell – storage capacity 24,500 ML
- The Intermediate Cell – storage capacity 4,500 ML
- The Wetland Cell covering 1,650 hectares with a storage capacity 39,500 ML

During the 2012/13 season, irregular inflows were experienced in the Active, Intermediate and Wetland Cells, due to the significant rainfall experienced precluding in the Summer months and the March 2012 floods. In response to large inflows MI implemented flood mitigation steps to avoid breaching of individual cells at BBSW. These volumes are displayed in Table 1.4 (c) below.

The combined outflows of 29,338 ML from the BBSW cells, are displayed in Table 1.4(c) below as:

- Barren Box Storage & Wetland to Wah Wah Main @ B.B.S.W Pumps (12,580 ML).
- Barren Box Storage & Wetland to Outfall (include flood releases) (19,458 ML).
- Barren Box Storage & Wetland Licenced Diverters (0 ML).

Inflows of 10,972 ML (see Table 1.4(c) were significantly lower than 2010/11 and 2011/12 due to storage capacity already present in the active and intermediate cells.

Table 1.4 (b): Barren Box Storage (ML) 2012-2013
Note: *Outflows include Licenced Pumpers on BBS = 0 ML for 2012/13*

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Yearly Totals
Inflow	480	180	40	70	165	1,366	2,800	1,867	1,031	356	660	1,957	10,972
Outflow	280	640	20	6,888	7,210	4,270	3,150	1,400	2,350	1,380	1,750	0	29,338
Variation	200	-460	20	-6,818	-7,045	-2,904	-350	467	-1,319	-1,024	-1,090	1,957	-18,366

Table 1.4 (c): Reuse Quantities (ML) for the MIA and Districts 2012-201

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
GMSD Pumps (Yanco esc + Stormwater)	58	267	326	238	399	379	469	370	527	199	220	155	**3,607**
YMSD	0	0	120	146	115	109	104	101	204	153	85	0	**1,137**
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lake Wyangan Pumps to L.V.B.C.	20	255	52	115	435	450	306	130	20	90	0	0	**1,873**
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek Diversion to Benerembah (@ Brays)	714	1,421	541	1,368	1,974	2,597	3,807	1,566	4,171	139	623	0	**18,921**
Mirrool Creek Licenced Diverters (Creek Pumps)	0	70	287	874	645	655	1,599	260	0	298	204	0	**4,892**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	370	310	150	260	0	0	0	0	0	**1,090**
Mirrool Creek to Wah Wah Main	0	953	7,160	8,755	8,614	17,981	22,508	17,290	6,770	7,205	8,160	796	**106,192**
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	0	0	0	0	500	2,200	3,150	1,400	2,200	1,380	1,750	0	**12,580**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	280	640	20	6,888	7,210	4,270	0	0	150	0	0	0	**19,458**
Barren Box Storage Licenced Diverters	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Losses in Barren Box Storage	-560	-6,719	-6,519	-1,419	-1,084	5,652	1,171	450	-3,069	504	-888	-1,376	**-13,857**
Channel 13 Escape (Benerembah Drainage)	0	0	75	239	135	0	0	0	80	0	0	328	**857**
Sub Total	**512**	**-3,113**	**2,062**	**17,574**	**19,253**	**34,443**	**33,374**	**21,567**	**11,053**	**9,968**	**10,154**	**-97**	**156,750**
Less: First Use Water Diversions	291	655	8,302	1,579	1,302	8,626	13,504	10,290	570	482	424	1,346	**47,371**
TOTAL WATER CAPTURED (Re-Used)	**221**	**-3,768**	**-6,240**	**15,995**	**17,951**	**25,817**	**19,870**	**11,277**	**10,483**	**9,486**	**9,730**	**-1,443**	**109,379**

Lake Wyangan

MI regulates the lake levels to satisfy various demands for commercial irrigation, environmental contributions and community objectives.

Water depths within both the northern and southern portions of the lake are regulated for various operational purposes including maintenance, management and flow supplementation for the adjacent supply channels during times of shortage.

For the current reporting period, a total of 18,366 ML was diverted from the southern portion of the lake into Lake View Branch Canal for water deliveries. This opportunistic water was pumped from the southern portion and utilised for irrigation purposes where possible. The volume of both portions of the lake were documented to be slightly lower than recorded levels for the previous reporting period 2011/12.

The monthly figures relating to the volumes pumped by MI from Lake Wyangan into Lake View Branch Canal are highlighted in Table 1.5 (b), page 24.

Table 1.4 (d) below provides 2012/13 monthly gauge heights (water depth) for both portions of the lake.

Table 1.4 (d): Gauge heights for South and North Lake Wyangan 2012/13

Month	Gauge Height (m)	Gross Resource (ML)	Gauge Height (m)	Gross Resource (ML)
	South Lake Wyangan		North Lake Wyangan	
Jul	1.21	968	1.85	4,390
Aug	1.08	864	1.81	4,310
Sep	1.24	992	1.72	4,130
Oct	1.32	1,058	1.56	3,330
Nov	1.31	1,049	1.53	3,750
Dec	1.18	944	1.2	3,090
Jan	0.98	786	1	2,690
Feb	1.16	928	1.1	2,890
Mar	1.19	952	1.05	2,790
Apr	1.18	944	0.98	2,656
May	1.3	1,040	1	2,690
Jun	1.13	904	1.16	3,010

Source: *MI Irrigation Services*
Gross Resources *= Gauge height converted into estimated megalitres.*

Yenda Storage

Table 1.4 (e) below, shows the inflows and outflows at the Yenda En-Route Storage. This storage is primarily used to compensate for differences between customer orders and diversions from the Narrandera Regulator.

Bray's Dam Storage

Bray's Dam storage has the operational ability to capture and redistribute irrigation water that has been rejected after rainfall. The figures in Table 1.4 (f) below show inflows and outflows at Brays Storage Dam for this reporting year.

Water can also be pumped from Mirrool Creek and reused in the irrigation network.

Table 1.4 (e): Inflow and Outflow Yenda En-route Storage 2012/013

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow (ML)	563	1,036	1,032	1,527	1,675	1,536	1,579	1,039	1,171	1,442	947	185	13,732
Outflow (ML)	525	992	1,077	1,560	1,917	1,782	1,364	1,336	1,311	1,726	566	203	14,359
Variation (ML)	38	44	-45	-33	-242	-246	215	-297	-140	-284	381	-18	-627

Table 1.4 (f): Inflow and Outflow Brays Dam Storage 2012/13

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Totals
Inflow (ML)	953	1,349	781	274	2,181	3,272	7,666	2,081	1,065	1,759	1,943	0	23,324
Outflow (ML)	78	293	160	483	2,261	3,843	5,373	1,172	738	975	1,305	2	16,683
Variation (ML)	875	1,056	621	-209	-80	-571	2,293	909	327	784	638	-2	6,641

1.5 DRAINAGE VOLUMES AND SALT LOADS

Table 1.5 (a): Description of licensenced and non-licensed monitoring/discharge sites used by Murrumbidgee Irrigation

Hydsys No.	Site Acronym	Site Description	Frequency	Type	X-Coordinates	Y-Coordinates
Licensed Monitoring Sites						
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	427479	6171449
410083	YMS	Yanco Main Southern Drain	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	444891	6165663
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	When flowing	EC, Flow, Turbidity, Pesticides, Nutrients, Metals	375673	6218725
Non Licensed Internal Monitoring Sites						
41010162	WS	Warburn Swamp	After trigger	EC, Temperature, pH, Turbidity	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	Continuous	EC, Flow, Temperature	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	After trigger	EC, Temperature, pH, Turbidity	409886	6193089
41010896	LW6	Lake Wyangan Causeway	After trigger	EC, Temperature, pH, Turbidity	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	After trigger	Pesticide	440983	6182501
410167	BBOW	Barren Box Outfall Canal Wyvern	Continuous	EC, Flow, Temperature	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	Continuous	EC, Flow, Temperature	403257	6208333
410085	LMC	Little Mirrool Creek	Continuous	EC, Flow, Temperature	422126	6192597
41010903	BBO	Barren Box Storage	After trigger	EC, Temperature, pH, Turbidity	389236	6218183
41010978	WWO	Willow Dam	After trigger	EC, Temperature, pH, Turbidity	392197	6216283

410164	BOD1	Channel 13 escape at the outfall channel Wyvern	Continuous - Downloaded Monthly	EC, Flow, Temperature	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel	Continuous	EC, Flow, Temperature	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek	Continuous	EC, Flow, Temperature	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road	Continuous	EC, Flow, Temperature	396994	6205386

All continuous sites highlighted in Table 1.5 (a) above are serviced by Thiess Hydrographic Services of Tatura, Victoria. The instruments are calibrated annually with an accuracy of $^{+}/_{-}$ 5%. Flow rating calibrations and tables are updated at least four times per year. All sites are visited monthly for routine maintenance by Thiess contractors.

Monthly field data is collected by MI Staff using a Hydro-lab and include sampling temperature, electrical conductivity (EC) and potential hydrogen (pH).

The information in Table 1.5 (a) has been amended in accordance with changes to the combined Water Supply Work Approval and Water Use Approval No 40CA403245 with the NSW Office Of Water (NOW).

Table 1.5(b): Drainage Volumes (ML) – July 2011 to June 2012

Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	TOTAL
						Monthly Flow Data (ML/d)								
RIVER SUPPLY														
NARREG**	**Monthly Total**	5107	21712	58169	100317	82614	1E+05	176242	107253	39463	27510	25291	1446	**779322**
STUR**	**Monthly Total**	2592	11995	26331	48763	36259	50537	61669	34452	7367	9047	10598	1431	**301041**
TOTAL														**1080363**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	12.8	30.6	59.1	73.4	76.3	67.5	146	81.9	89.1	30.4	41.3	27.6	
	Median	10.1	32.5	62.5	74	62.4	71.6	163	74	90.9	27.2	32.6	10.4	
	Inst.Max	77.8	72.2	104	122	360	116	241	323	205	61.7	107	273	
	Inst.Min	4.6	6.1	25.3	39.2	23.1	23.5	44.5	36.8	39.2	16.8	17.1	4.7	
	Monthly Total	395.8	948.6	1774	2275	2288	2091	4536	2294	2763	912	1281	828.4	22386.8
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	953	1349	781	274	2181	3272	7666	2081	1065	1759	1943	0	23324
BYD (Bywash)**	**Monthly Total**	78.0	293	160	483	2261	3843	5373	1172	738	975	1305	2	16683
MIRMCN (41010955)	**Mean**	49	180	550	395	423	584	874	733	289	263	263	148	
	Median	43.8	169	488	368	351	736	977	730	258	252	231	101	
	Inst.Max	170	453	824	789	1520	902	1150	1130	897	371	460	507	
	Inst.Min	7.9	44	253	274	159	187	462	486	157	165	118	23.4	
	Monthly Total	1520	5585	16510	12230	12680	18120	27080	20520	8973	7884	8143	4450	**143695**
DRAINS														
MDJWE (410174)	**Mean**	16.0R	90.8R	198	209	[212	263	269	299R	207R	120	124	46.6R	
	Median	9.9R	91.6R	156	211	[210	275	268	292R	197R	120	126	34.6R	
	Inst.Max	127R	263R	337	293	[588	399	385	798R	481R	199	240	273R	
	Inst.Min	4.0R	18.8R	63.2	123	[97.3]	149	150	185R	111R	80.7	57.3	12.6R	
	Monthly Total	496.9R	2815R	5954	6474	[5950]	8162	8344	8373	R6402	R3607	3838	1397R	**41145**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	31.2	45.6	115	290	331	368	465	383	185	229	167	37.4	
	Median	26.1	41.7	121	308	286	358	475	404	170	233	182	21.7	
	Inst.Max	94.7	114	178	438	599	520	592	515	397	286	282	89.1	
	Inst.Min	13.8	13	40.3	95.1	176	251	339	50.1	38.7	171	28.8	3.4	
	Monthly Total	966	1413	3442	8975	9920	11390	14430	10740	5750	6874	5168	1122	**80190**
YANCO AREA-RIVER DRAINS														
YMS (410083)	**Mean**	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.1=	0.0=	[0.0]	[ ]S	
	Median	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	
	Inst.Max	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	8.2=	0.0=	[0.0]	[ ]S	
	Inst.Min	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	[0.0]	[ ]S	
	Monthly Total	15.625	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	0.0=	15.625	31
GMSRR (41010921)	**Mean**	0.4R	0.0R	0.0R	0.4R	0.7R	0.2R	0.3R	0.3R	0.3R	0.0R	0.0R	0.0R	
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Inst.Max	5.9R	0.0R	0.0R	17.6R	26.9R	7.7R	12.7R	27.0R	25.1R	0.0R	0.0R	0.0R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	12.16R	0.000R	0.000R	12.38R	20.61R	7.184R	10.55R	7.938R	10.14R	0.000R	0.000R	0.000R	81
LAG (41010940)	**Mean**	0.2R	2.3R	2.6R	9.5R	3.7R	7.2R	1.4R	0.2R	0.7R	0.1R	0.3R	0.8R	
	Median	0.0R	0.2R	1.1R	6.8R	0.2R	0.4R	0.0R	0.0R	0.1R	0.0R	0.1R	0.0R	
	Inst.Max	10.5R	20.5R	22.7R	64.0R	48.8R	59.7R	33.5R	10.8R	12.3R	1.9R	2.6R	9.9R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	5.405R	70.92R	77.33R	293.7R	111.5R	221.9R	42.73R	4.484R	21.15R	1.788R	8.713R	25.16R	885
ROCUDG(41010005)	**Mean**	[2.6]	[2.3]	[1.4]	8.8R	2.6R	0.1R	1.0R	1.6R	0.6R	1.9R	1.3R	[77.8]	
	Median	[2.4]	[2.3]	[0.9]	2.0R	1.6R	0.0R	0.0R	0.0R	0.0R	0.2R	0.3R	[93.5]	
	Inst.Max	[4.3]	[2.8]	[4.5]	81.3R	13.3R	1.4R	9.2R	15.9R	5.3R	13.4R	10.6R	[119]	
	Inst.Min	[2.0]	[1.7]	[0.3]	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Monthly Total	[15.50]	[38.80]	[32.25]	273.6R	76.66R	1.713R	32.29R	46.17R	18.53R	57.42R	39.47R	[933.6]	1566
TOTAL														**2563**
SWAMPS														
WS**	**Monthly Total**	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	**0**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
EXTRA SITES														
WWO**t		280	640	20	6888	7210	4270	0	0	150	0	0	0	19458
BBpumps**#		0	0	0	0	500	2200	3150	1400	2200	1380	1750	0	12580
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.9@	13.9@	14.9@	18.3@	[9.5]	6.0@	4.9@	[9.0]	[16.1]	3.2@	7.7@	[43.0]	
	Median	0.5@	12.2@	13.0@	14.6@	[4.5]	4.6@	4.2@	[8.5]	[14.1]	0.9@	6.1@	[44.5]	
	Inst.Max	3.7@	35.3@	33.2@	36.2@	[38.5]	23.6@	13.2@	[18.6]	[28.9]	21.9@	23.9@	[51.5]	
	Inst.Min	0.0@	0.0@	4.2@	3.4@	[1.1]	0.5@	0.0@	[2.4]	[7.7]	0.0@	2.8@	[31.6]	
	Monthly Total	29@	431@	446@	566@	[246]	187@	152@	[215]	[452]	97@	239@	[172]	**3232**
						Monthly Flow Data (ML/d)								
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0.8R	3.6R	4.0R	3.5R	5.8R	1.0R	0.2R	0.3R	6.2R	1.4R	1.2R	2.6R	
	Median	0.0R	1.2R	4.2R	3.0R	4.2R	0.4R	0.0R	0.1R	5.6R	0.2R	0.5R	0.2R	
	Inst.Max	6.8R	15.5R	11.9R	14.3R	19.8R	8.5R	4.1R	3.1R	14.7R	6.5R	15.2R	20.4R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	24.37R	113R	119.4R	109R	173.2R	30.58R	6.866R	7.357R	192.4R	42.61R	38.09R	76.65R	**934**
DCWIDG (41017001)	**Mean**	0	1.1	1.0K	1.7	4.1	0.6K	1.4	0.8	2.8	0.7	0.5	1.2	
	Median	0	0.1	0.7K	1.5	1.2	0.3K	1.4	0	2.5	0.5	0.1	0.1	
	Inst.Max	0.2	16.3	9.5K	7.4	84.1	3.5K	4.8	27.6	11.9	4.1	4.2	18.2	
	Inst.Min	0	0	0.0K	0.1	0	0.0K	0	0	0.4	0.2	0	0	
	Monthly Total	0.987	33.98	29.96K	53.95	122	17.3K	42.87	21.61	86.68	20.29	14.78	36.8	**481**
DCCENT (410172)	**Mean**	0.5	1.6K	[2.2]	[1.9]	[0.8]	[0.0]	[]B	[6.4]	[2.5]	0.8	0.8	[15.1]	
	Median	0.4	1.1K	[1.5]	[1.4]	[0.4]	[0.0]	[]B	[6.3]	[2.2]	0.4	0.5	[19.3]	
	Inst.Max	2.4	11.5K	[8.4]	[8.0]	[4.2]	[0.1]	[]B	[14.8]	[7.1]	5.3	5.5	[20.6]	
	Inst.Min	0	0.0K	[0.3]	[0.2]	[0.0]	[0.0]	[]B	[0.0]	[0.1]	0	0.1	[0.8]	
	Monthly Total	15.49	50.39K	[55.22]	[55.23]	[21.20]	[0.061]	[]B	[121.4]	[73.88]	24.96	24.78	[45.17]	**488**
BID2 (41010717)**	**Monthly Total**					ND	ND	ND	ND	ND	ND	ND	ND	**ND**

@ ... Theoretical rating table applied *B ... Backed-up stage* *R ... Rating table extrapolated* *? ... Irregular data, use with caution* *M ... Equipment malfunction*

[] ... Some missing record in period *K ... Minor editing* *S ... Rating table suspended* *X ... Rating table exceeded* *T ... Probe out of water/below inst. threshold*

Table 1.5 (b) shows the monthly total flow volumes from the Murrumbidgee River entering the MIA measured at MI's two regulated sites:

1. **Narrandera Regulator (NARREG)** after diversion at the Berembed Weir.
2. **Sturt Canal (STUR)** after diversion at the Gogeldrie Weir.

The table also shows the monthly volumes of surface drainage measured at key points along the drainage system. Details of each site are as follows:

- **Little Mirrool Creek (LMC)** - Accepts all westerly surface drainage from the Yanco Irrigation Area that doesn't discharge back to the River or naturally flows to low-lying areas like Fivebough or Tuckerbil Swamps. This includes Leeton urban drainage.
- **Bray's Dam (BYD)** - Drainage diversion from LMC to the Benerembah Irrigation District.
- **Mirrool Creek at McNamara Road (MIRMCN)** - Drainage flow leaving the Mirrool and Yanco Irrigation Area prior to entry to Barren Box and Wah Wah.
- **Main Drain J (MDJWE)** - Drainage from the Mirrool Irrigation Area including Griffith/Yenda urban drainage, tile drainage and wastewater from the sewage treatment works.
- **Barren Box Outfall Wyvern (BBOW)** - Flows from Willow Dam, Barren Box and Channel 13 Escape discharging to Wah Wah Irrigation District.

There are four river channel wetland sites which potentially discharge to the Murrumbidgee River of which MI monitor in accordance with EPL4651.

- **Gogeldrie Main Southern (GMSRR)** – Collects some of the drainage from Leeton and Yanco. This discharge point has now been blocked. Drainage water past this point is pumped back into the Sturt Canal for supply to customers downstream. Only during periods of heavy rainfall will water enter the wetland downstream of this point.
- **Yanco Main Southern (YMS)** – Collects drainage from the Gogeldrie area. Drainage channel has been blocked upstream of this point and captured water gravitates into the Sturt Canal. Only during periods of heavy rainfall will water flow into the river lagoons.
- **Gooragool Lagoon (LAG)** - Also collects drainage from the Gogeldrie area. The majority of water measured at this point does not enter the wetland or lagoon as it is being used by licenced customers.
- **Cudgel Creek downstream from Cudgel Creek (ROCUDG)** - Cudgel Creek area

The purpose of collecting this data is to identify drainage and supply volumes including daily and seasonal variations, for management and monitoring requirements compliant with MI's licences. Flow and water quality data is important in contributing to management decisions related to drainage re-use, asset design, purpose and function.

During the 2012/13 reporting period, MI diverted 1,079,843 ML of water from the Murrumbidgee River. This water contained approximately 66325.2 tonnes of salt. EC readings were not conducted at Narrandera Regulator in February or June and Sturt Regulators in March or June. Absence of this data would account for a reduction in salt loadings in comparrison with the 2011/12 reporting period.

A total of 2563 ML of water discharged through the River Drain sites, carrying approximately 508 tonnes of salt. This water flows into wetlands which are connected to the Murrumbidgee River. The 2012/13 data highlights a signifficant reduction in drainage and salt loading from the 2011/12

reporting period, predominately in the absence of flood issues associated with the March 2012 floods.

Table 1.5 (c): Salt Loads (Tonnes/day) for 2012/13

Salt Loads (Tonnes/day) for 2012/13														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
RIVER SUPPLY														
NARREG**	**Monthly Total**	441.24	1667	4057.9	6869.7	6451	8760.45	12407	NA	1811	2148	1813	NA	**46426.4**
STUR**	**Monthly Total**	283.67	898.2	1971.7	3339.3	2529	3525.46	4341.5	1521.4	NA	735.3	752.9	NA	**19898.8**
TOTAL														**66325.2**
WEST FLOWING DRAINS														
LMC (410085)	**Mean**	4.1K	6.9?	9.1?	8.6	8.5K	8	15	12	[17.8]	[5.8]	5.8	5.2	
	Median	3.5K	6.7?	9.2?	8.8	6.7K	8.1	16.9	11.7	[18.1]	[5.6]	5.2	1.9	
	Inst.Max	37.1K	17.9?	15.5?	16.2	52.3K	15.3	26.3	48.1	[55.8]	[11.9]	17.1	65.5	
	Inst.Min	1.4K	2.4?	2.9?	4.7	3.3K	2.3	4.8	5.9	[10.4]	[3.1]	2.9	0.5	
	Monthly Total	127K	214?	272?	266	255K	249	466	336	[463]	[151]	181	155	**[3136]**
MIROOL AREA-MIROOL CREEK														
BYD (Diversions)**	**Monthly Total**	953	1349	781	274	2181	3272	7666	2081	1065	1759	1943	0	**23324**
BYD (Bywash)**	**Monthly Total**	78	293	160	483	2261	3843	5373	1172	738	975	1305	2	**16683**
MIRMCN (41010955)	**Mean**	19.4	33.7	81	52.7	92.9	75.4	79.2	61.1	52.6	64.6	34	31.4	
	Median	15.8	32.7	84.4	52.8	75.1	80.8	82.1	61.1	40.7	65.5	31.4	27.3	
	Inst.Max	147	78.1	122	91.8	292	125	103	106	147	96.9	68	143	
	Inst.Min	4.9	12.8	33.8	29.6	36.1	31.1	47.5	44.6	27.3	31	14.1	6.9	
	Monthly Total	601	1046	2431	1634	2786	2337	2456	1710	1631	1939	1055	941	**20570**
DRAINS														
MDJWE (410174)	**Mean**	[9.0]	22.5R	36	39.3K	[56.1]	43.9	34.1	35.1R	37.1R	14.9	19.6	14.7R	
	Median	[7.8]	22.9R	32.8	39.0K	[48.0]	41.6	35.5	32.7R	35.4R	14.5	19.2	12.9R	
	Inst.Max	[49.3]	73.4R	57.6	75.7K	[191]	89	51.1	120r	89.2R	23.8	53.1	58.5R	
	Inst.Min	[0.2]	3.0R	12.2	20.8K	[24.9]	26.7	11.4	22.7R	18.9R	9.4	9.6	3.8R	
	Monthly Total	[188]	696R	1079	1217K	[1570]	1362	1057	984R	1149R	446	607	442R	**[10800]**
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	**Mean**	6.4	8.9	15.9K	47.3K	72.4	64.7	60.7	40.7	32.4	38.0K	22.9K	7.8	
	Median	5.5	7	15.4K	50.6K	62.4	60.5	61.7	40.5	29.7	39.8K	24.1K	5.6	
	Inst.Max	24.6	31.8	27.5K	80.9K	150	132	85.1	65.1	82.4	54.1K	43.1K	30.8	
	Inst.Min	-6.9	1.6	3.9K	8.9K	20.9	26.7	29.2	2.3	2.5	19.1K	0.9K	-3.4	
	Monthly Total	198	277	476K	1466K	2171	2006	1881	1140	1006	1141K	709K	235	**12700**
YANCO AREA-RIVER DRAINS														
YMS (410083)**	**Mean**	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	31.25	
	Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	31.25	
	Inst.Max	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	31.25	
	Inst.Min	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	0	
	Monthly Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	31.25	**31.25**
GMSRR (41010921)	**Mean**	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	[0.0]	0.1R	0.0R	0.0R	0.0R	
(all water re-used)	**Median**	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	
	Inst.Max	0.7R	0.0R	0.0R	1.2R	3.8R	0.7R	0.0R	[0.0]	3.8R	0.0R	0.0R	0.0R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	1R	0R	0R	1R	3R	1R	0R	[0]	2R	0R	0R	0R	**[9]**
LAG (41010940)	**Mean**	0.0R	0.5R	0.3R	1.5R	0.6R	0.6R	0.1R	0.0R	0.1R	0.0R	0.0R	0.2R	
	Median	0.0R	0.1R	0.1R	0.7R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Inst.Max	0.3R	3.6R	3.9R	11.6R	20.0R	6.9R	3.6R	0.0R	1.8R	0.7R	0.4R	2.1R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	0R	14R	10R	46R	18R	19R	4R	0R	3R	1R	1R	5R	**121R**
ROCUDG (41010005)	**Mean**	[0.7]	[0.6]	[0.2]	0.8R	0.3R	0.0R	0.2R	0.2R	0.1R	0.2R	0.1R	[5.3]	
	Median	[0.6]	[0.6]	[0.2]	0.2R	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[7.1]	
	Inst.Max	[1.0]	[0.7]	[0.6]	6.6R	1.3R	0.1R	1.2R	2.1R	0.5R	1.0R	0.6R	[8.0]	
	Inst.Min	[0.5]	[0.4]	[0.1]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Monthly Total	[4]	[11]	[5]	24R	9R	0R	5R	6R	2R	5R	3R	[64]	**[140]**
TOTAL														**508**
FLOODWAY														
MIRFLD**	**Monthly Total**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
WWO**t	**Monthly Total**	0	0	0	0	0	0	1519	728.33	196.41	764.9	444.48	33.59	**3687**
BBO**	**Monthly Total**	0	0	0	0	0	0	1395.88	1217.6	158.06	1028.66	477.29	12.91	**4290**
BENEREMBAH SITES														
BOD1 (410164)	**Mean**	0.3@	2.3@	2.4@	2.4@	[1.2]	0.8@	0.8@	[1.1]	[3.0]	0.6@	1.0@	[8.4]	
	Median	0.2@	2.1@	2.2@	2.0@	[0.7]	0.7@	0.8@	[1.1]	[2.9]	0.2@	0.7@	[6.6]	
	Inst.Max	2.2@	6.1@	4.7@	6.6@	[4.8]	3.2@	2.3@	[2.7]	[7.0]	4.9@	9.3@	[15.9]	
	Inst.Min	0.0@	0.0@	0.7@	0.6@	[0.1]	0.0@	0.0@	[0.1]	[1.0]	0.0@	0.1@	[2.9]	
	Monthly Total	10@	72@	71@	75@	[33]	25@	25@	[28]	[82]	19@	32@	[42]	**[514]**

Monthly Salt Loads (Tonnes/day)														
Site	**Parameter**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**TOTAL**
DCCUD (41010713)	**Mean**	0.2R	0.7R	0.7R	0.6R	1.8R	0.4R	0.0R	0.0R	1.4R	0.3R	0.1R	0.8R	
	Median	0.0R	0.2R	0.7R	0.5R	1.1R	0.1R	0.0R	0.0R	0.9R	0.1R	0.1R	0.1R	
	Inst.Max	3.2R	4.5R	3.2R	1.9R	11.0R	3.5R	0.3R	0.3R	3.7R	2.0R	2.1R	7.7R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Monthly Total	5R	22R	21R	18R	53R	11R	1R	1R	42R	10R	4R	24R	**213R**
DCWIDG (41017001)	**Mean**	0	0.2	0.2K	0.2	0.7	0.2K	0.3	0	0.6	0.1	0.1	0.4	
	Median	0	0	0.1K	0.2	0.2	0.1K	0.3	0	0.5	0.1	0	0	
	Inst.Max	0.1	3.3	2.1K	0.8	17.9	1.2K	1	1.2	5.1	0.9	0.7	8.5	
	Inst.Min	0	0	0.0K	0	0	0.0K	0	0	0	0	0	0	
	Monthly Total	0	6	5K	7	22	5K	8	1	19	4	2	11	**91**
DCCENT (410172)	**Mean**	0.2	0.4K	[0.5]	[0.4]	[0.2]	[0.0]	[]B	[7.6]	[1.0]	0.3	0.3	[2.7]	
	Median	0.1	0.2K	[0.4]	[0.3]	[0.1]	[0.0]	[]B	[5.1]	[0.8]	0.2	0.2	[3.2]	
	Inst.Max	0.7	2.6K	[1.8]	[1.7]	[0.8]	[0.0]	[]B	[33.0]	[6.0]	1.3	3	[5.3]	
	Inst.Min	0	0.0K	[0.1]	[0.0]	[0.0]	[0.0]	[]B	[0.0]	[0.0]	0	0	[0.1]	
	Monthly Total	5	12K	[13]	[10]	[5]	[0]	[]B	[129]	[29]	10	8	[11]	**[233]**

@ ... Theoretical rating table applied *B ... Backed-up stage* *R ... Rating table extrapolated* *? ... Irregular data, use with caution* *M ... Equipment malfunction*

[] ... Some missing record in period *K ... Minor editing* *S ... Rating table suspended* *X ... Rating table exceeded* *T ... Probe out of water/below inst. threshold*

1.6 DRAINAGE REUSE

MI has continued to actively pursue recovery and reuse of water from its drainage systems. Table 1.6 (a) below provides information on reuse quantities. It should be noted that much of the historically reported quantities in this table are neither drainage nor reuse. This is because much of the water that is recovered at these sites has not been previously used for irrigation or other purposes, nor is it drainage off farm. As MI continues to operate its system more efficiently, some of the drains are now used as connector channels between use sites.

1.7 WATER BALANCE LOSS AND GAIN

Table 1.7 (a) shows the Annual Water Balance Assessment. The total gross diversions for 2012/13 were 1080 gigalitres (GL) with 932 GL of this being deliveries (sales). This left an apparent loss of 148 GL which meant that MI's *apparent* operational efficiency was approximately 86%, a minor decrease on 2011/12 figures. This is attributed to higher deliveries and therefore an increase in conveyence losses likely attributed to seepage and unmetered losses.

From the 148 GL loss, the *true loss (the portion of the loss that can be estimated or calcuated)* was estimated at about 98 GL. This included losses due to channel seepage and evaporation during storage and conveyance.

There were no diversions to the Lower Mirrool Creek floodway.

The unexplained losses are estimated at 130 GL, using the standard formula of 14% of deliveries. The total losses are estimated at 228 GL, while the apparent loss was 148 GL. This means that 80 GL of water has been gained throughout the system. This is most likely due to the improved operating efficiency and increased potential for water to be reused within the system.

Storage volume changes are included for Barren Box Storage and Wetland (BBSW) and Lake Wyangan. The variation in en-route storages at Yenda and Bray's Dam are minimal in comparison to the figures quoted in the table 1.7 (a) below. Mirrool Creek Floodway releases (of which there were none) are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

A comparison of the benchmark year and the current year shows that the system efficiency is 91%, which is higher than the median benchmark of 85%. This could be attributted to higher water sales and maximum allocation, coupled with efficent drainage reuse and management.

Table 1.7 (a): Annual Water Balance Assessment MIA system (Gigalitres) 2009/10

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	Benchmark	Median
Climatic																	
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	336	739	737	451	400	359
Evaporation **(mm)**	1,868	1,750	1,896	2,032	2,191	1,998	1,983	1,935	2,182	2,127	2,166	2,085	1,391	1,694	1,863	1,862	2018
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	75	0	30	45	48	66
Main Gross Data																	
Gross Diversions (1)	1,036	819	1,048	1,142	960	862	826	1,037	560	336	394	505	567	855	1,080	1,154	794
Total Deliveries (2)	823	646	857	917	754	652	648	830	412	210	276	368	490	752	932	952	616
Apparent Loss (3)	213	173	191	225	206	210	178	207	148	125	118	137	77	103	148	202	178
Apparent Efficiency **(%)**	79	79	82	80	79	76	78	80	74	63	70	73	86	88	86	82	76
Inevitable Real Losses																	
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	21	20	21	21	31	21
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	24	14	19	21	18	23
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	8	22	31	34	35	18
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	19	13	37	11	29	25
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10
Subtotal	110	110	104	125	107	93	85	98	86	79	81	82	79	118	96	118	97
System Flow Losses																	
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	1	6	0	0	33	9
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	0	0	116	2	48	5
Subtotal	43	46	23	18	8	7	4	10	1	0	0	1	6	116	2	81	13
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**82**	**85**	**234**	**98**	**199**	110
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	52	69	105	130	133	86
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**134**	**154**	**339**	**228**	**332**	196
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	-3	77	236	80	130	19
Mirrool Creek Flows																	
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	54	83	24	19	160	99
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9	14	27	21	17		18
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0	0	0	1	1		3
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	4	4	3	3	67	5
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	72	114	49	39	227	126
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	72	120	49	39	260	134
Reconciliation																	
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	0	4	0	0	0
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-1	-14	-9	-13	-20	-6
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	72	114	45	39	227	125
Corrected Total System Supply (13)	1,074	889	1,089	1,174	951	839	828	1,055	563	318	396	501	630	1,082	1,124	1,264	806
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	-4	67	530	146	57	8
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**84**	**86**	**78**	**91**	**84**	85
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10	0.10	0.10	0.10	0.10		0.5
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.0
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19	0.19	0.19	0.19	0.19		0.52

1.8 CROP STATISTICS

Irrigated Crop Statistics

The following charts show the distribution of crops grown this year in comparison to last year (2011/12) and the baseline year (1995/96).

Irrigation supply to rice cropping again accounted for the large percentage of total deliveries at 39%. Overall distribution percentages trended similarly to the previous 2011/12 reporting year. Details in relation to deliveries to major crop types have been summaried in Figure 1.8 (a) and Tables 1.8 (a) to 1.8 (c).

Figure 1.8 (a): Distribution of Irrigated Crops from 1995-1996, 2011/12 and 2012/13 Reporting Periods - Comparison of Crop Type by Percentage of Megalitres Delivered

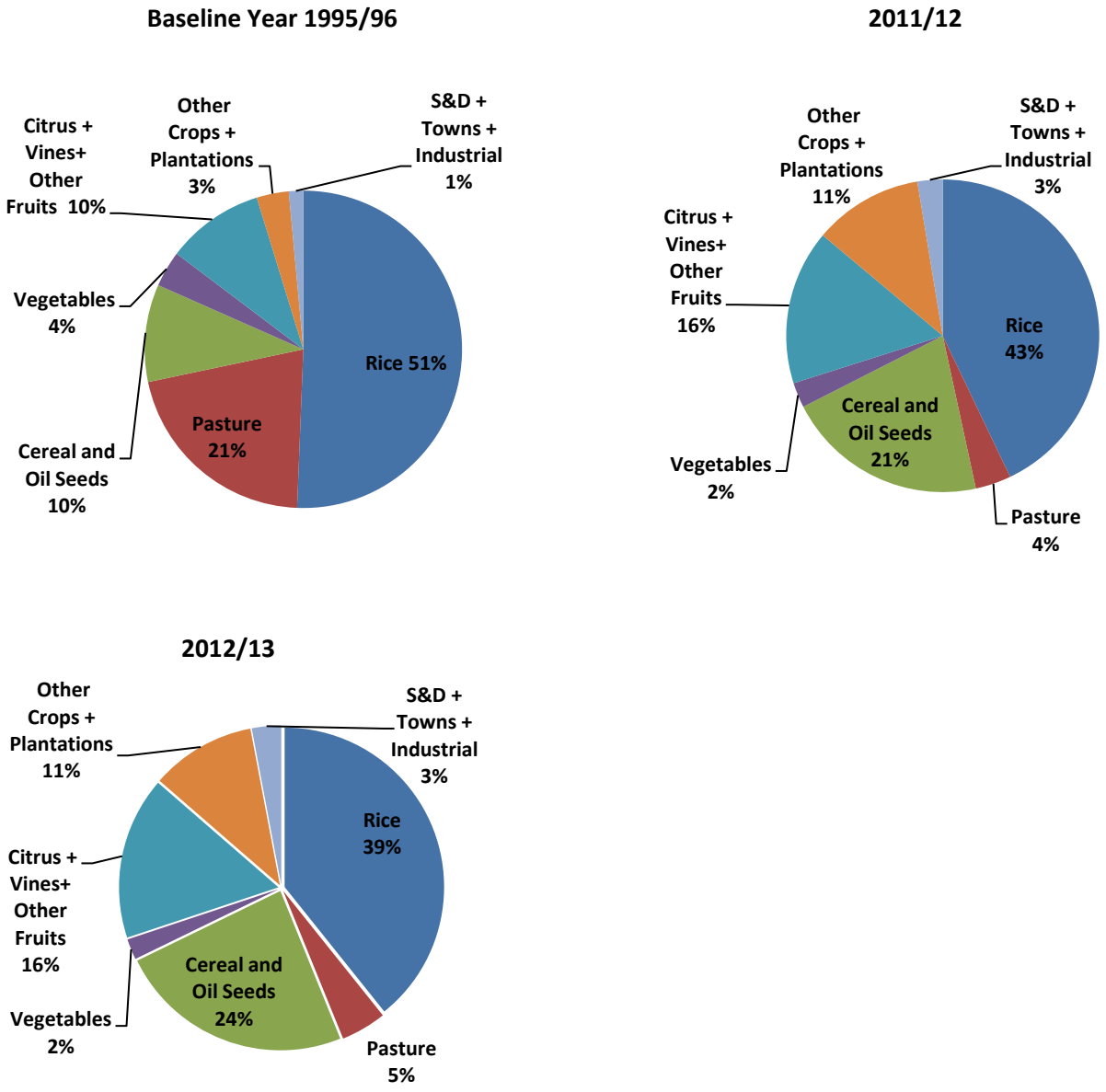


Table 1.8 (a): Historical deliveries to major crop types within the MIA

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2012/13	**369,393**	**43,369**	**225,135**	**19,772**	**155,169**	**100,194**	**27,947**
2011/12	**320,033**	**27,438**	**156,155**	**19,017**	**119,003**	**84,369**	**19,263**
2010/11	253,699	13,924	82,696	14,717	74,912	29,927	20,455
2009/10	103,208	18,162	60,851	16,519	127,386	11,110	25,386
2008/09	34,450	14,447	43,688	13,108	132,721	8,168	29,651
2007/08	1,006	8,218	39,538	9,191	123,510	9,274	19,560
2006/07	41,296	23,419	149,441	15,577	138,234	13,834	30,097
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123
2004/05	101,494	77,364	247,267	22,736	150,601	7,078	41,877
2003/04	221,732	63,960	182,940	16,504	132,866	22,519	11,285
2002/03	251,424	64,093	237,612	14,970	138,929	24,983	22,101
2001/02	469,513	85,556	184,253	17,989	122,884	23,403	13,013
2000/01	479,757	112,668	108,690	18,794	98,285	39,262	0
1999/00	394,224	54,159	68,366	12,013	75,108	40,060	0
1998/99	477,563	101,791	65,231	24,967	105,522	47,504	0
1997/98	489,363	179,246	126,247	19,714	115,200	47,176	0
1996/97	519,053	187,441	143,746	23,464	104,561	40,461	66,379
1995/96	446,917	185,931	87,725	32,348	87,983	28,905	12,957

Table 1.8 (b): Summary of deliveries and areas for the major crop groupings during 2012/13

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML delivered/ha)
CITRUS	7,738	44,776	5.8
COTTON	8,642	85,226	9.9
INDUSTRIAL	26	3,045	n/a
OTHER CROPS	365.3	12,962	n/a
OTHER FRUITS	3,265	23,103	7.1
PLANTATION	74.3	2,005	27
RICE	28,775	369,393	12.8
STOCK & DOMESTIC	310.8	13,979	n/a
SUMMER CEREALS	5,336	44,364	8.3
SUMMER OILSEEDS	4,149	27,617	6.7
SUMMER PASTURE	4,012	19,059	4.8
TOWN SUPPLY	6	10,923	n/a
VEGETABLES	3,098	19,772	6.4
VINES	19,423	87,290	4.5
WINTER CEREALS	64,437	135,386	2.1
WINTER OILSEEDS	11,644	17,769	1.5
WINTER PASTURE	12,120	24,310	2
TOTAL	173,420	**940,979**	

Table 1.8 (c): Historical Summary of deliveries and areas for the major crop groupings during 2012/13

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines+ Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial
2012/13	**39.3%**	**4.6%**	**23.9%**	**2.1%**	**16.5%**	**10.6%**	**3.0%**
2011/12	**42.90%**	**3.70%**	**20.90%**	**2.60%**	**16.00%**	**11.30%**	**2.60%**
2010/11	51.70%	2.80%	16.90%	3.00%	15.30%	6.10%	4.20%
2009/10	28.50%	5.00%	16.80%	4.60%	35.10%	3.10%	7.00%
2008/09	12.50%	5.20%	15.80%	4.70%	48.00%	3.00%	10.70%
2007/08	0.50%	3.90%	18.80%	4.40%	58.70%	4.40%	9.30%
2006/07	10.00%	5.70%	36.30%	3.80%	33.60%	3.40%	7.30%
2005/06	42.80%	7.90%	21.90%	3.30%	17.10%	1.10%	5.80%
2004/05	15.70%	11.90%	38.10%	3.50%	23.20%	1.10%	6.50%
2003/04	34.00%	9.80%	28.10%	2.50%	20.40%	3.50%	1.70%
2002/03	33.30%	8.50%	31.50%	2.00%	18.40%	3.30%	2.90%
2001/02	51.20%	9.30%	20.10%	2.00%	13.40%	2.60%	1.40%

2. GROUNDWATER MANAGEMENT

The information in this section of the report has been developed utilising field data and information collected during the 2012/13 reporting period with the inclusion of ten years of the past 16 years of historical groundwater data collected by Murrumbidgee Irrigation (MI). Information provided herein complies with reporting requirements under MI's Combined Water Supply Works and Water Use Approval Licence 40CA403245 and Environmental Protection Licence 4651.

The years 2001 and 2011 have been used as benchmarking years in the analysis as of this data as both represent full scale rice growing prior to the start and at the end of the drought period, 2002 to 2009.

2.1 REPORTING REQUIREMENTS

Since 1996, more than 900 piezometers have been used for groundwater monitoring in and adjacent to the Murrumbidgee Irrigation Area (MIA). However due to structural related age, maintenance, access issues and unforseen damage, the number of piezometers producing readings has gradually dropped. Changes to the number of piezometers in our monitoring network in recent years are highlighted in Table 2.1 (a).

Table 2.1 (a): Piezometer monitored from 2001 – 2011

Read Piezometers	01 –Sep-01	01-Sep-07	01-Sep-09	01-Sep-011	01-May-013*
Bores Read in the Year	918	835	796	762	881
Calivil	27	22	21	27	24
Lower Shepparton Formation	389	331	319	325	316
Upper Shepparton Formation	502	482	456	410	541

*(**Note:** May 2013 includes all bores assessed during Asset Review Program May 2013)*

Upon review of asset data collected in 2013 MI identified the need to undertake an asset review of all bores due to yearly reductions in the licenced bore monitoring network, since September 2001. MI has commissioned Thiess Services Pty Ltd, to undertake the review and provide recommendations on future replacement and monitoring opportunities. Data reported in the remaining section of this report only includes bores for which data is available for evaluation. Bores producing no data have been removed prior to data analysis.

A summary of the decline in the readability and accuracy of data collected from monitoring bores over the past two years are highlighted in Tables 2.1 (b) and 2.1 (c) below. Monitoring bores in the six monthly monitoring network show an increase in the number of readable bores (measurable groundwater and salinity levels) from 13% unreadable in March 2012 to 2% unreadable in March 2013. This could be attributed to the five bores that were inaccessible during the 2012 March floods. Monitoring bores in the two monthly monitoring network show a decrease in the number of readable bores by 38% in March this year compared to 22% read in March 2012. This could be attributed to an increase in the number of "out" bores due to landform changes, age, casing or silting issues resulting in an additional 16 bores being unreadable since September 2012.

Table 2.1 (b): Piezometer statistics for 6 Monthly Read Bores (includes two monthly bores)

Reading Type	Sep- 2011	Mar- 2012	Sep- 2012	Mar- 2013
Total Bores Visited in the Year	762	885	885	885
Dry	74	64	57	51
Flooded	0	13	5	0
Out*	27	35	34	60
Available**	661	773	789	774

*Out encompasses those which have been damaged by farm machinery etc
**Available is the total list including the positive flooded and dry readings

Table 2.1 (c): Piezometer statistics for two Monthly Read Bore

Reading Type	Sep- 2011	Mar- 2012	Sep- 2012	Mar- 2013
Read	108	108	108	108
Dry	5	4	5	5
Flooded	0	0	0	0
Out*	15	15	15	31
Available**	88	89	88	77

*Out encompasses those which have been damaged by farm machinery etc
**Available is the total list including the positive flooded and dry readings

The location of Upper Shepparton Formation (USF) and Lower Shepparton Formation (LSF) Piezometers in the MIA used for monitoring during September 2012/13 are highlighted within various groundwater maps and commentary in the later Section 2.4 of this report.

An asset condition assessment has been undertaken on all monitoring piezometers between March and June 2013. It was noted during the 2013 asset evaluation, of both the two and six monthly bore networks, that:

- Some piezometers have been providing false readings due to poor condition.
- The loss of piezometers in some areas such as those located within the Wah Wah district may be less of a serious issue than other districts. Salinity issues in relation to high irrigation use and increase in groundwater table levels are considered of little threat in this region.
- Efforts should be focused upon reliable monitoring networks in Murrami, Benerembah, Kooba and Hanwood, where groundwater levels fluctuate between 1.5m and 4m below surface level during wetter periods.
- The Australian Height Datum (AHD) levels of the piezometer set and available Digital Elevation Model (DEM) level data may not always match. This will require further investigation and rectification.
- MI Bore Logs have been transcribed from paper files to electronic format (Microsoft Excel). During this processes screen intervals and drilling methods have not been included. Aquifer formations have therefore been divided into categories using stratigraphy.
- Groundwater salinity samples were collected in March and April 2013 across the MI. Salinity levels have not previously been collected since 2002. Difficulty in collecting accurate salinity levels were encountered due to the absence of screen information from bore logs and inability to pump piezometers prior to sampling due to the size of casing. A uniform level for placement of the EC monitoring probe (3 m below standing water level) was used for all bores in the 2013 sampling period.

Groundwater pumping volumes for the region have not been considered during this analysis.

A map of the location of the two monthly and six monthly monitoring bores are presented in figures 2.1 (a) and 2.1 (b).

Figure 2.1 (a): Two Monthly Monitoring Bores

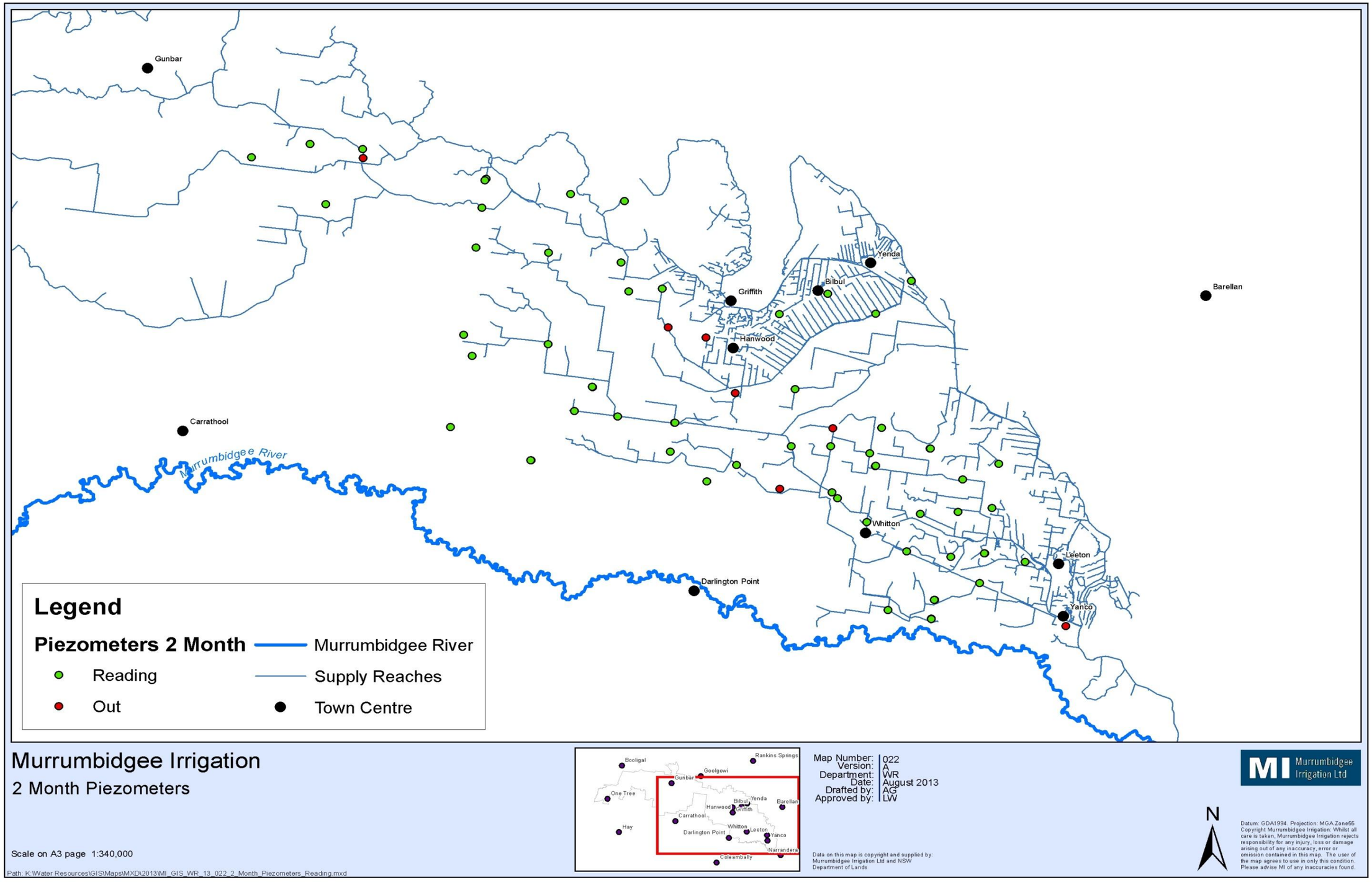
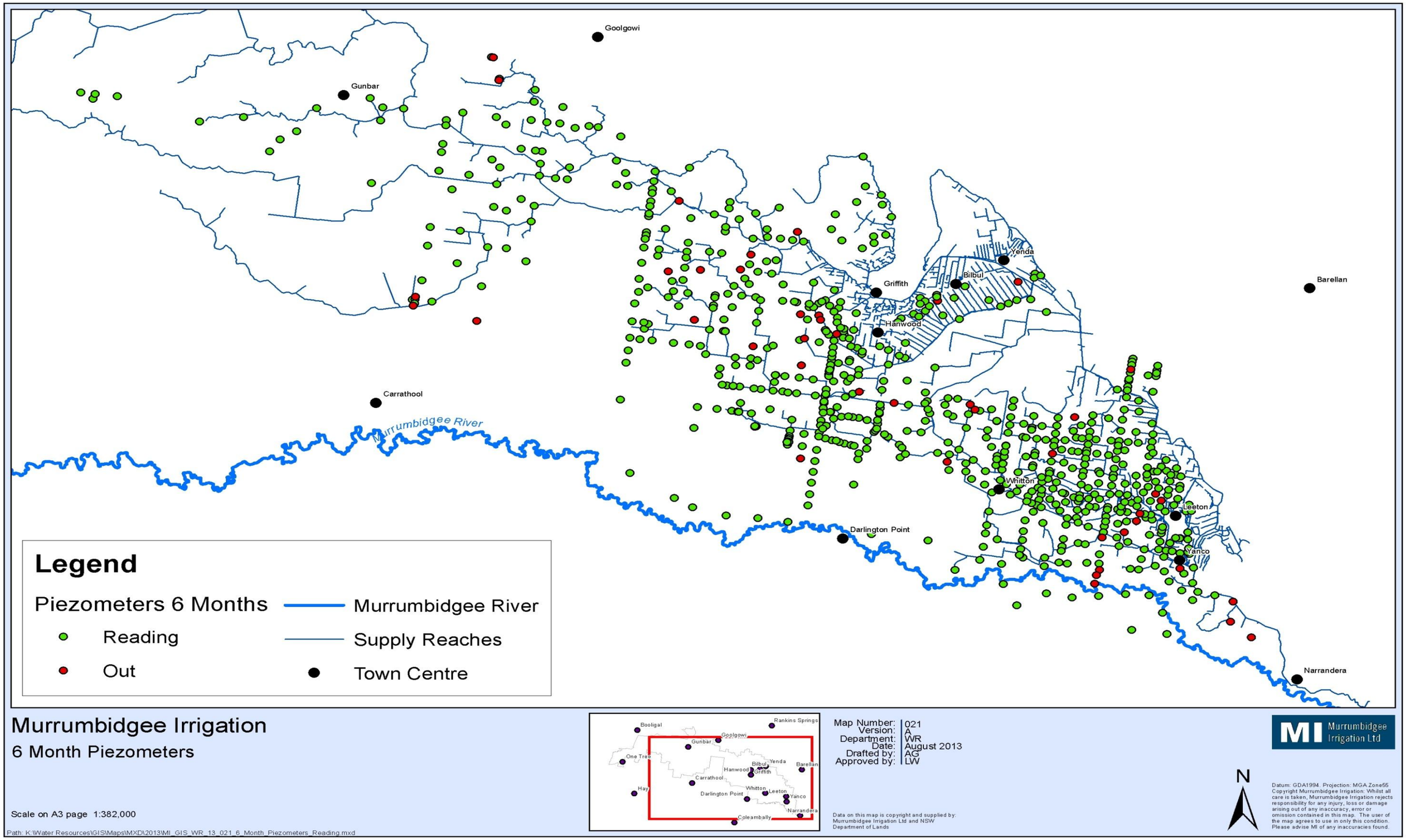


Figure 2.1 (b): Six Monthly Monitoring Bores



2.2 GROUNDWATER MONITORING AND ANALYSIS

2.2.1 CLIMATIC AND WATER USE DATA

Climatic data has been collected from CSIRO and MI's own meteorological stations. A list of regional weather stations is listed in Table 2.3 (a) below.

Table 2.2.1 (a) - MI and CSIRO Regional Weather Stations

Weather Station	Location	Type
Barren Box Station	Tabbita Irrigation District	Murrumbidgee Irrigation Site
Benerembah Station	Benerembah Irrigation District	Murrumbidgee Irrigation Site
Bringagee Station	Benerembah Irrigation District	Murrumbidgee Irrigation Site
Carathool Station	Wah Wah Irrigation District	Murrumbidgee Irrigation Site
Kooba Station	Yano Irrigation Area	Murrumbidgee Irrigation Site
Wamoon Station	Yanco Irrigation Area	Murrumbidgee Irrigation Site
Yenda Station	Mirrool Irrigation Area	Murrumbidgee Irrigation Site
Hay Station	Town of Hay	CSIRO Site
Griffith Station	Hanwood	CSIRO Site

Table 2.2.1 (b) - BOM Representative Weather Stations in the MIA

Weather Station	Location	Type
Griffith Station	Griffith Airport	BOM
Yanco Station	Yanco Agricultural Institute	BOM
Leeton Station	Leeton	BOM
Narrandera Station	Narrandera Airport	BOM
Carrathool Station	Carrathool	BOM

Weather stations presented in Figures 2.2.1 (a) and 2.2.1 (b) were used to extract data for comparison of regional rainfall and groundwater data in this report (with the exception of Hay CSIRO Station).

Figure 2.2.1 (d) and 2.2.1 (e), represent annual rainfall and evaporation patterns for all MI and CSIRO stations from July 2012 to June 2013. Evaporation figures show that the highest levels were experienced in December 2012 and February 2013 where ETo ranged from 200 mm to 300 mm across all stations for those months. Rainfall for the year was sporadic with most consistent rainfall for all stations witnessed in July 2012, October 2012, March 2013, and June 2013. Most notably was 139.3 mm recorded for Griffith in December 2012. Little or no rainfall was experienced across all regions for the months of January and February 2013.

Figure 2.2.1 (c): MI Weather Station Locations across the MIA

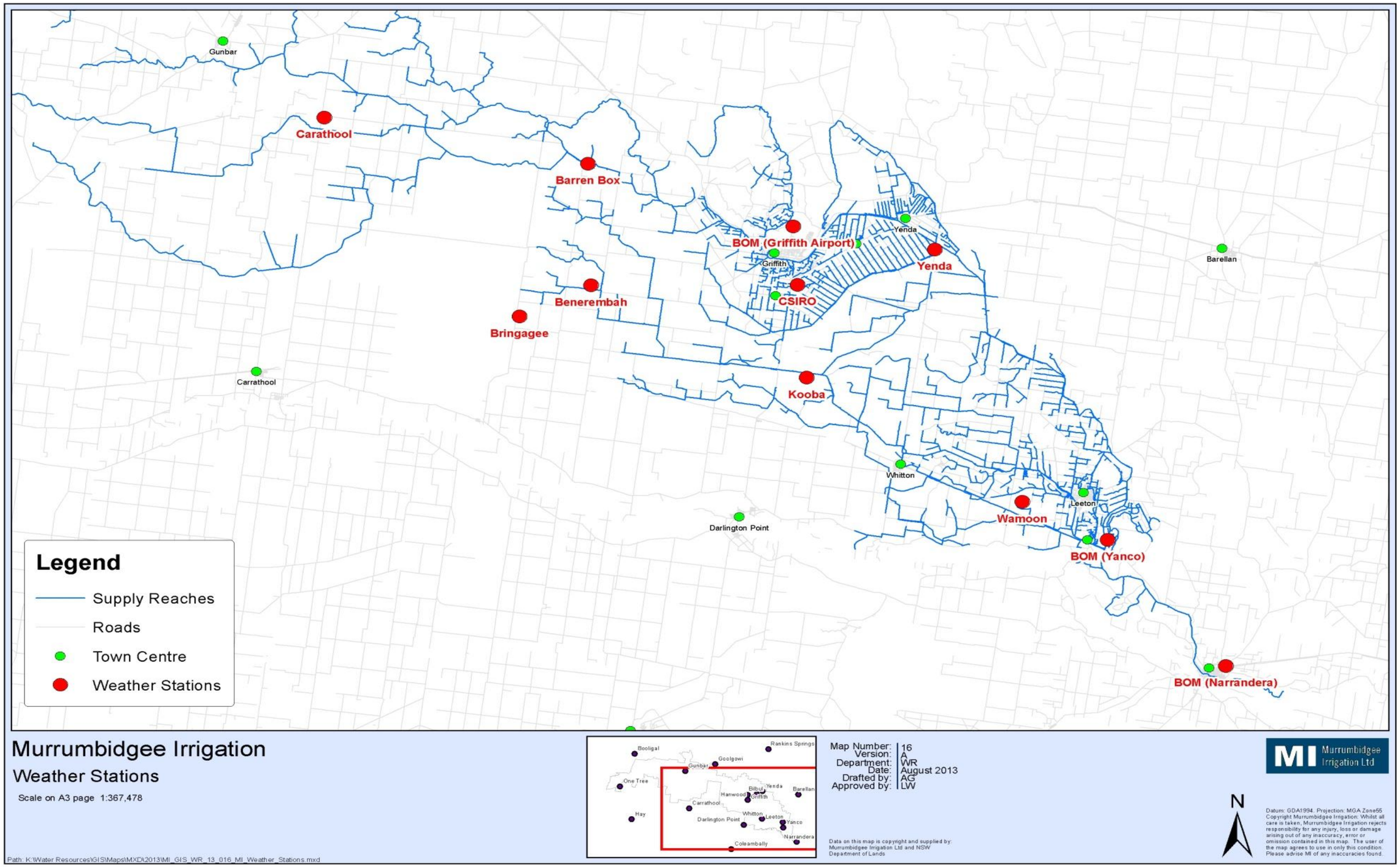


Figure 2.2.1 (d): Monthly Rainfall Patterns of representative MI/CSIRO weather stations in the MIA July 2012- June 2013.

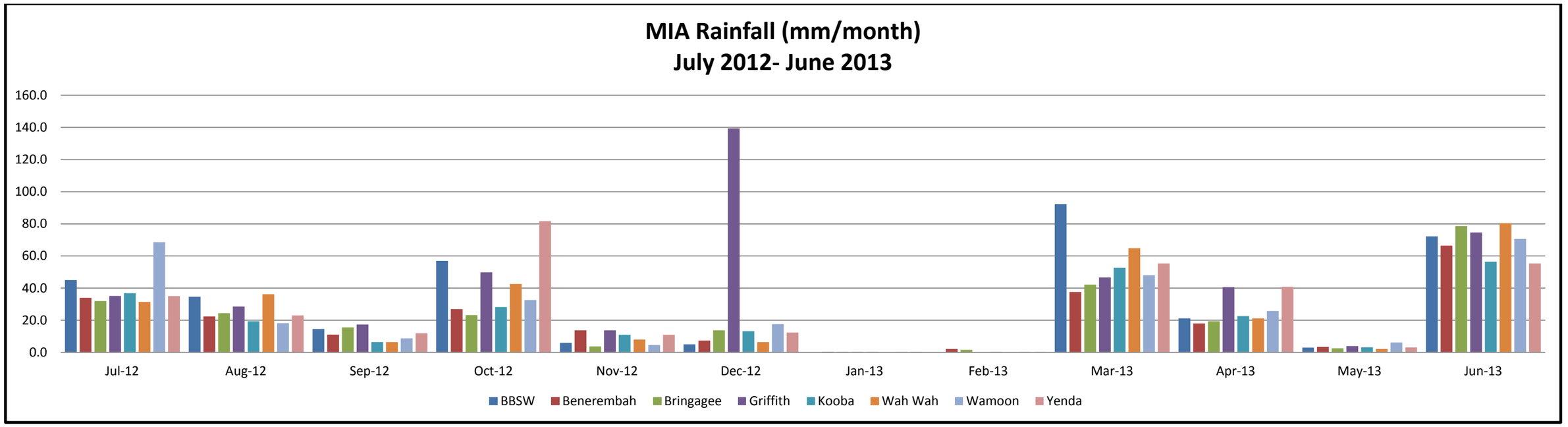
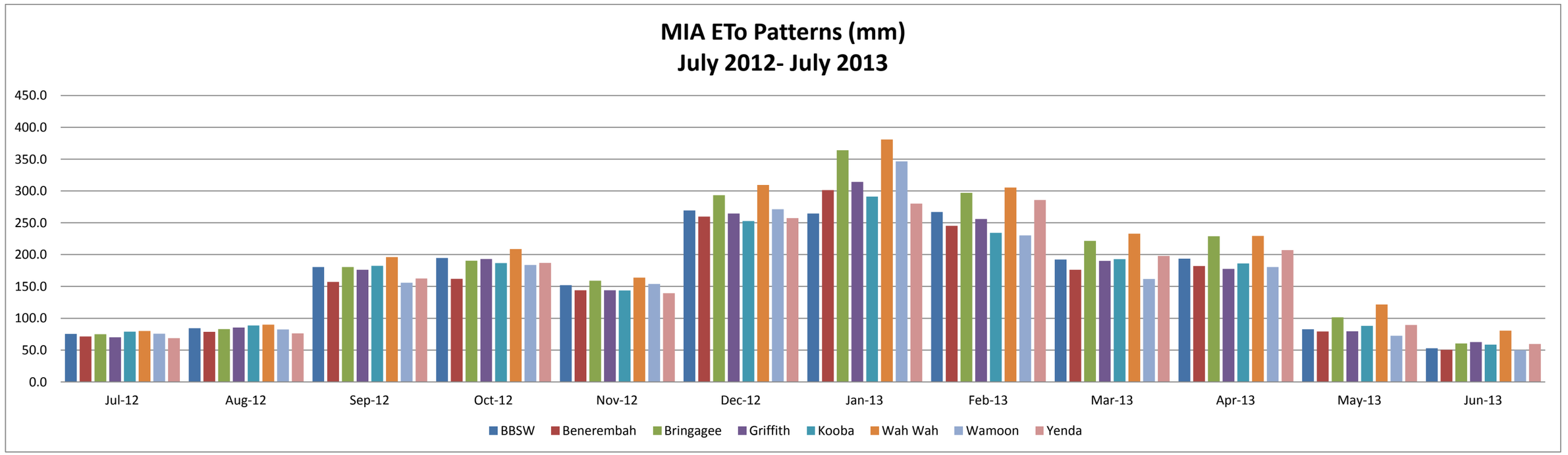


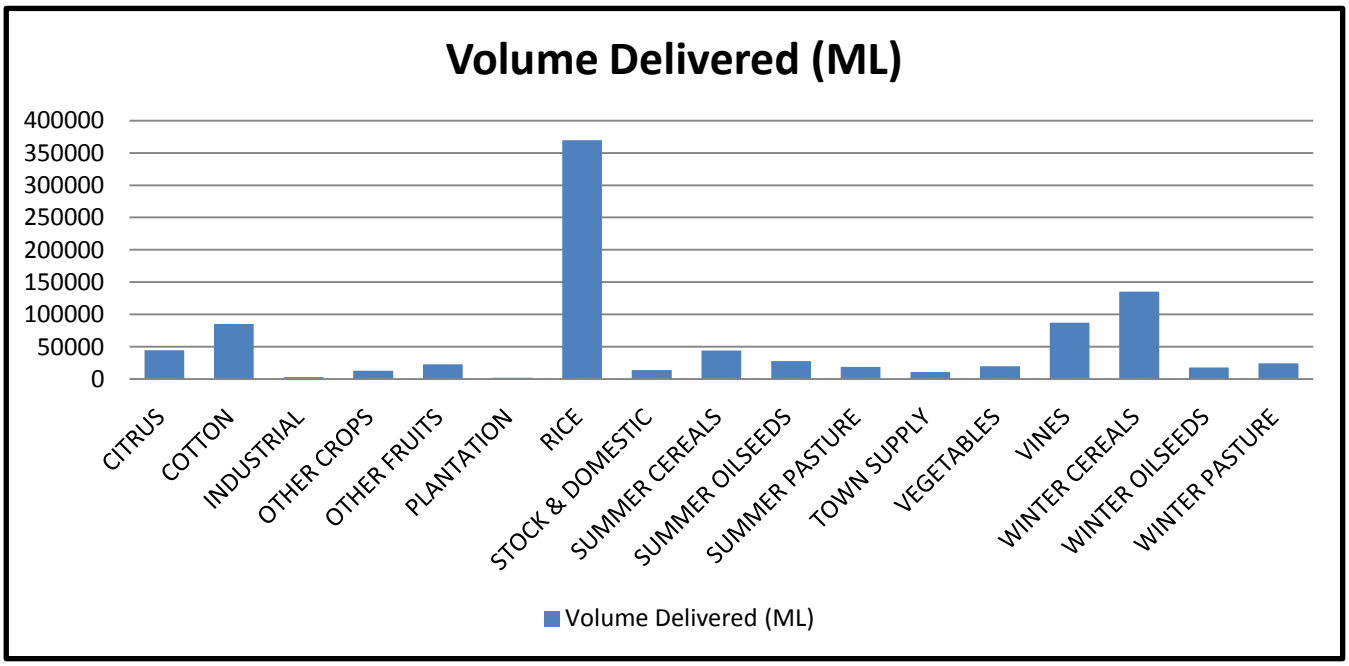
Figure 2.2.1 (e): Monthly Evaporation Patterns of representative MI/CSIRO weather stations in the MIA July 2012- June 2013.



2.3 CROP WATER USAGE

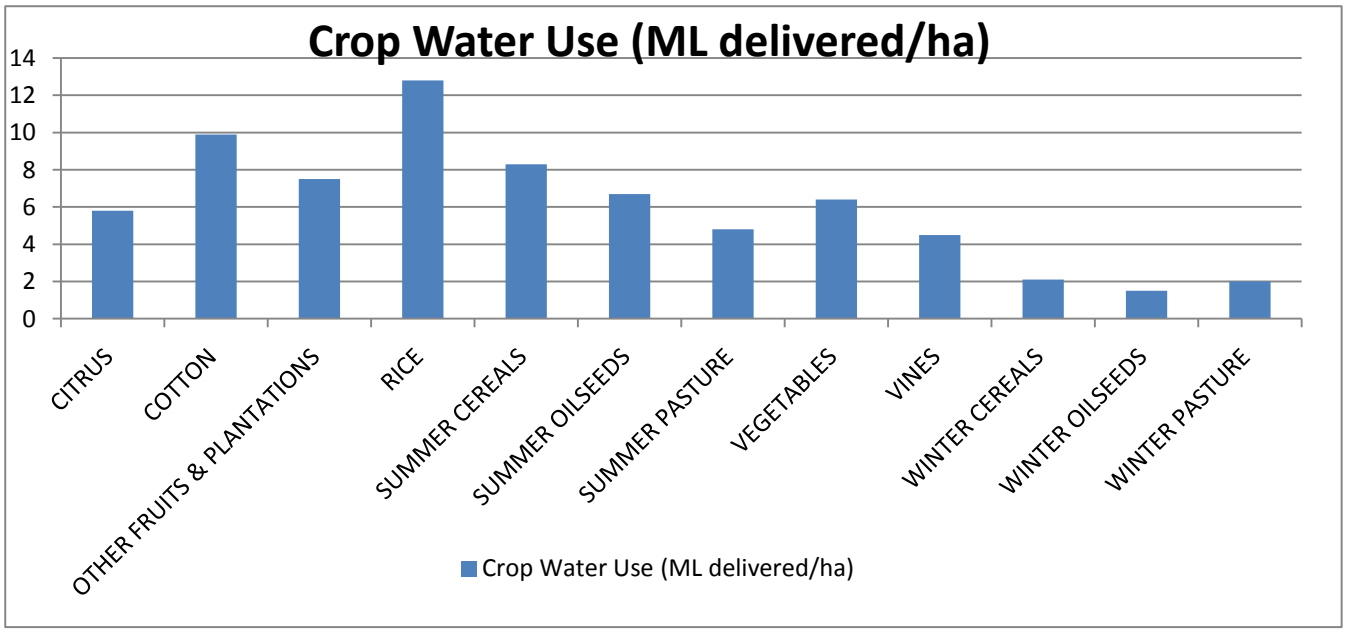
MI collects data related to crop water ordering, supply and use. This information is useful in correlating contributing factors such as irrigation to rise in groundwater levels and in observing water quality parameters within channel and drainage systems.

Figure 2.3 (a): Volumes (ML) of water delivered by Crop Type.



Analysis of volume of water delivered by crop type shows that water for rice farming had the highest demand in 2012/13, followed by winter cereals, vines and cotton.

Figure 2.3 (b): Crop Water Use by Crop type (ML delivered/ ha.)



Analysis of crop water use for the 2012-13 period shows that application of water per hectare (ha) was highest in rice, cotton and summer cereals.

2.3.1 RICE WATER USE AND RICE GROWING PRACTICES

With the reintroduction of the full Rice Environmental Monitoring (REM) program following a prolonged period of drought; aerial photos of the MIA were captured in January 2011 and rice areas measured using Geographic Information System (GIS). This data was provided to all shareholders in post season surveys and used to verify rice water usage figures obtained from customer water orders.

A total of 369,548 ML supplied 27,842 ha of rice grown in the MIA in the 2012/13 season with an average of 13ML/ha recorded. Figures in Table 2.3.1 (b) are based on surface water irrigation only.

Highlighted in figure 2.3.1 (a) below, is the rice water use (ML/ha) by region from 2001 - 2013 seasons. As demonstrated between the 2008/09 - 2011/12 seasons, water use per ha was close to crop water use targets for Yanco, Benerembah, and Kooba with Yanco exceeding the overall yearly average rice water use during the reporting period.

Figure 2.3.1 (a): Rice Water Use (ML / ha) by region and rice growing year, including MIA yearly targets from 2001-2013.

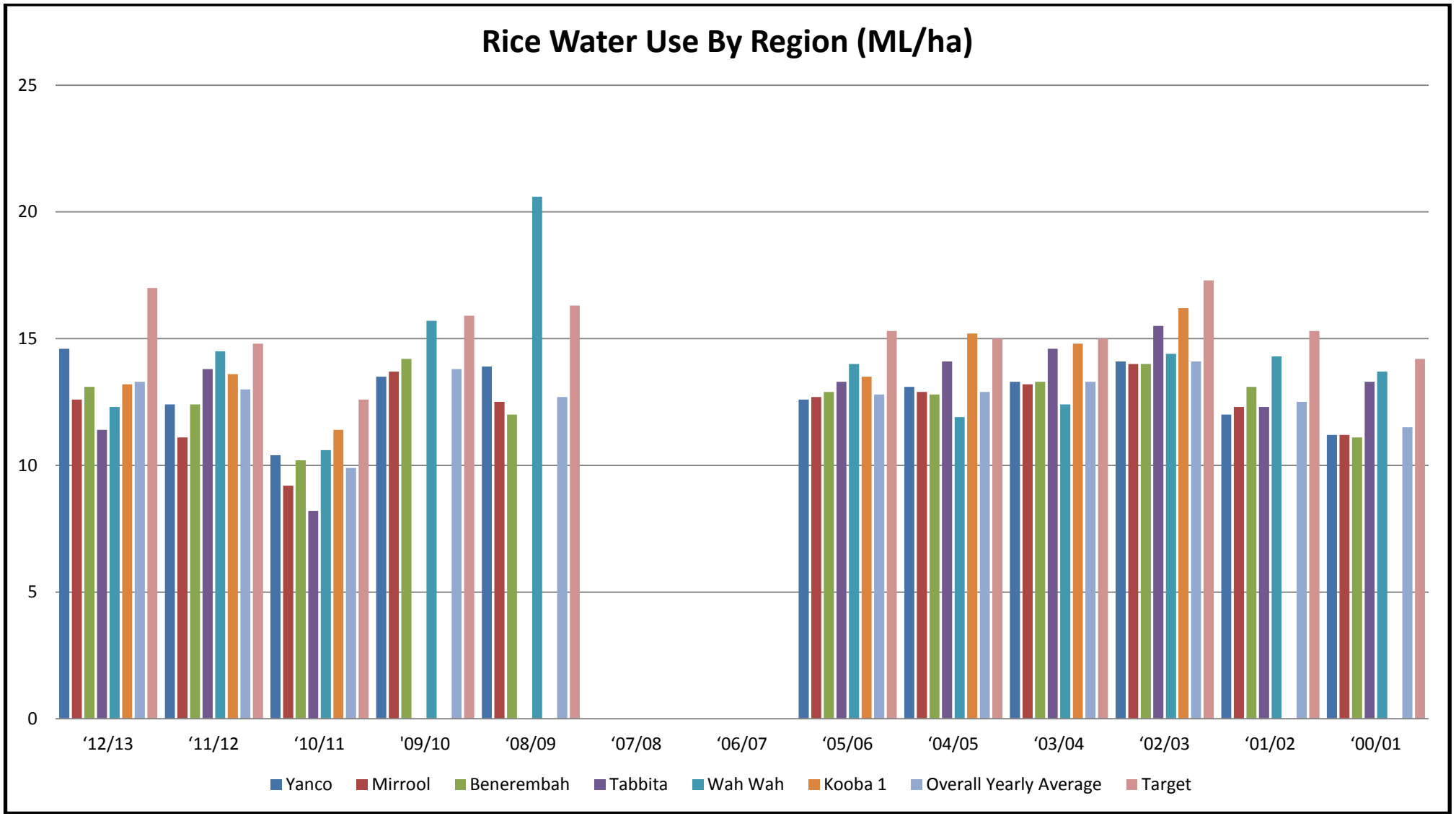


Table 2.3.1 (b): Summary of historic rice water consumption for all areas and districts

Average Rice Water Use (ML/ha)															
Irrigation Area or District	Total Rice Area (ha) 2012/13	Total Water to Rice (ML) 2012/13	12/13	'11/12	'10/11	'09/10	'08/09	'07/08	'06/07	'05/06	'04/05	'03/04	'02/03	'01/02	'00/01
Yanco	8110.6	118325.5	14.6	12.4	10.4	13.5	13.9	N/A	N/A	12.6	13.1	13.3	14.1	12	11.2
Mirrool	9977.9	125265.7	12.6	11.1	9.2	13.7	12.5	N/A	N/A	12.7	12.9	13.2	14	12.3	11.2
Benerembah	7831.0	102284.6	13.1	12.4	10.2	14.2	12	N/A	N/A	12.9	12.8	13.3	14	13.1	11.1
Tabbita	275.5	3128.8	11.4	13.8	8.2	N/A	N/A	N/A	N/A	13.3	14.1	14.6	15.5	12.3	13.3
Wah Wah	1313.4	16141.4	12.3	14.5	10.6	15.7	20.6	N/A	N/A	14	11.9	12.4	14.4	14.3	13.7
Kooba [1]	333.4	4401.8	13.2	13.6	11.4	N/A	N/A	N/A	N/A	13.5	15.2	14.8	16.2	*	*
Total/ average	27841.7	369547.8	13.3	13	9.9	13.8	12.7	N/A	N/A	12.8	12.9	13.3	14.1	12.5	11.5
Target			17	14.8	12.6	15.9	16.3	N/A	N/A	15.3	15	15	17.3	15.3	14.2

[1] *It should be noted that the from the figures shown in Table 2.4 (d), Kooba's rice water use was previously calculated as part of Mirrool. Targets for all rice growing regions are based on Griffith and Hay CSIRO weather station data.*

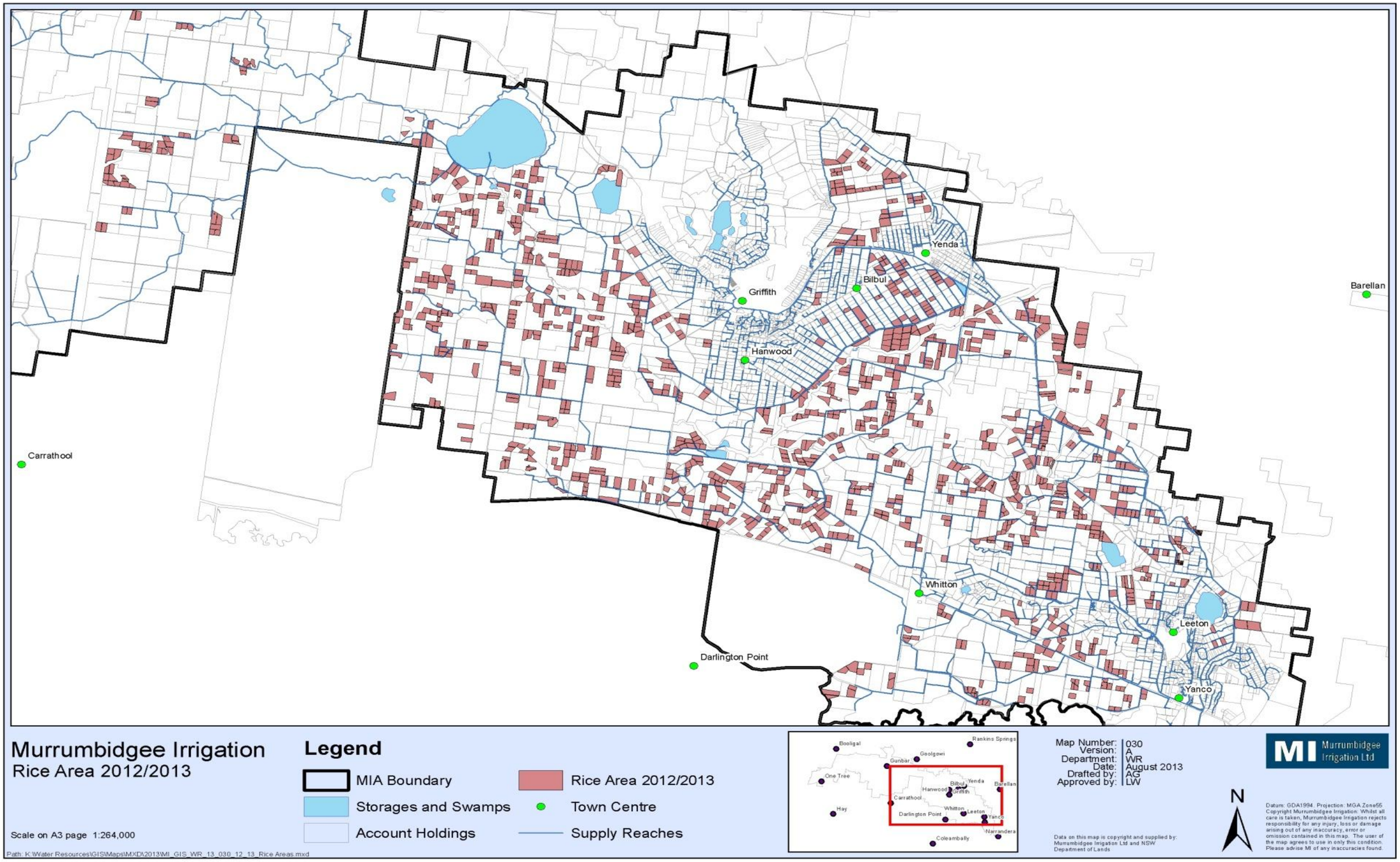
The NSW Office of Water (NOW) is responsible for the management and recording of groundwater use. MI have been made aware that groundwater has been used to grow rice, but information on how much was used or what crop it was used on has not been made available to MI.

2.3.2 RICE GROWING POLICY

This sub-section addresses the condition to implement measures to manage excessive groundwater accessions.

An updated rice policy, the MI Rice Growing Rules, was implemented in October 2011. No further changes to this policy have been made.

Figure 2.3.2 (a): MIA Rice Area Map 2012/13



2.4 REGIONAL GROUND WATER CONDITIONS

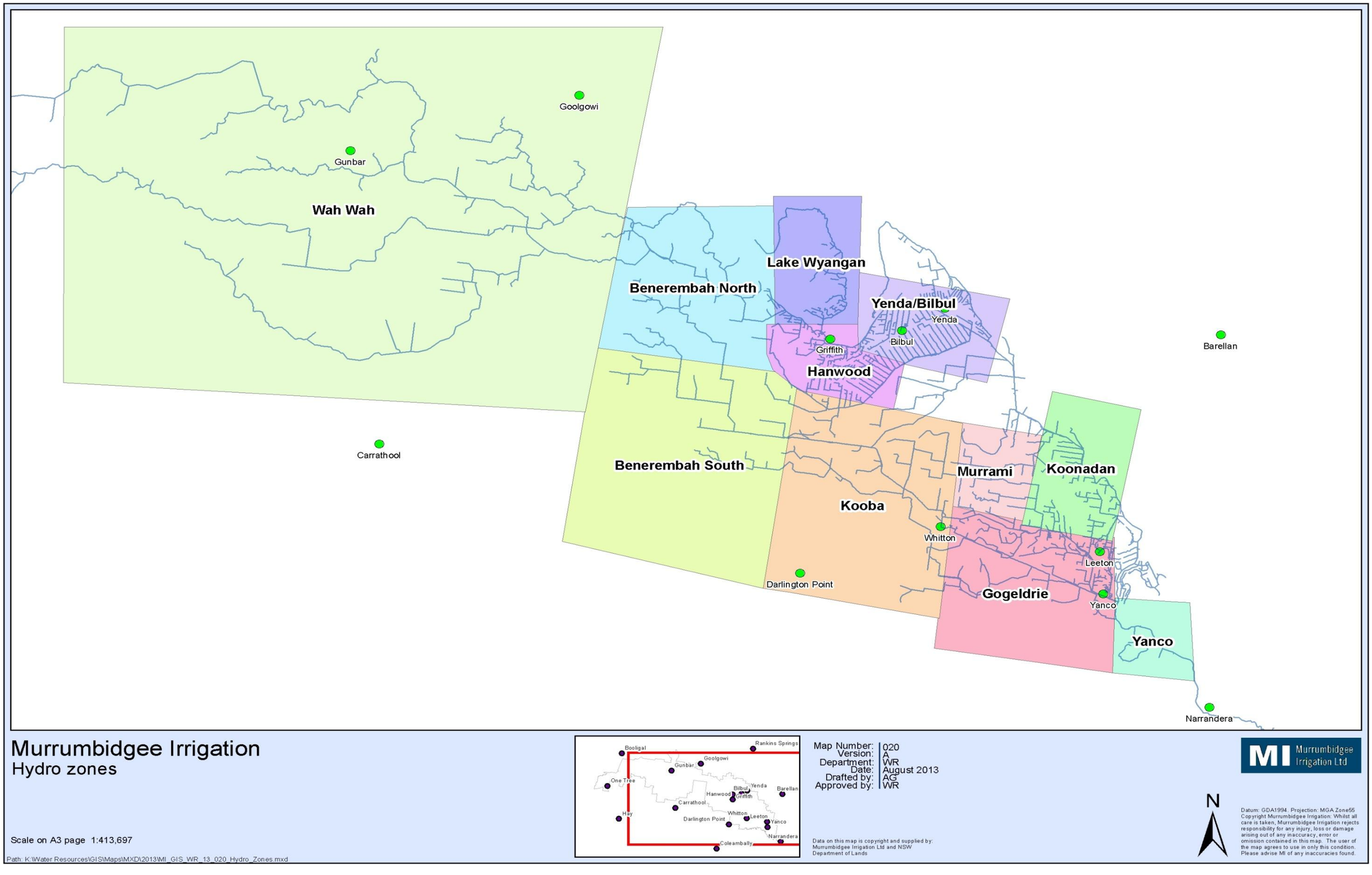
In previous licence compliance reports MI have incorporated data for the generation of groundwater maps using 1996 as the benchmark. In the 2011/12 Licence Compliance Report (LCR) this has been modified to reflect a 2001 benchmark. This has been carried through to the 2012/13 report.

Following 2001, there were drought conditions and significant changes in annual rainfall patterns. This section of the report will make comparisons of data collected from September 2011 to March 2013. This is reflected in maps contained in this section.

Hydrozones have been developed through previous work undertaken by Van Lely (2010) and MI (2011/12). Delineation of hydrozones is based on consideration of the stratigraphical conditions within the MIA, in particular the extent to which the Upper Shepparton Formation is separated from the Lower Shepperton Formation based on geological characteristics within each of those aquifer zones in conjunction with the geographical location of monitoring bores.

Figure 2.4 (a) below, shows the outline of the hydrozones used for the analysis of the 2012/13 groundwater conditions presented in this report.

Figure 2.4 (a): MIA Hydrozones Map 2012/13



Murrumbidgee Irrigation
Hydro zones

Scale on A3 page 1:413,697

Path: K:\Water Resources\GIS\Maps\MXD\2013\MI_GIS_WR_13_020_Hydro_Zones.mxd

Map Number: 020
Version: A
Department: WR
Date: August 2013
Drafted by: AG
Approved by: WR

Data on this map is copyright and supplied by: Murrumbidgee Irrigation Ltd and NSW Department of Lands

MI Murrumbidgee Irrigation Ltd

N

Datum: GDA1994. Projection: MGA Zone55
Copyright Murrumbidgee Irrigation: Whilst all care is taken, Murrumbidgee Irrigation rejects responsibility for any injury, loss or damage arising out of any inaccuracy, error or omission contained in this map. The user of the map agrees to use in only this condition. Please advise MI of any inaccuracies found.

Many hydrozones are identified within the MIA; these are briefly referred to in Table 2.4 (b) to 2.4 (d) below.

Tables 2.4 (b) to 2.4 (d): Hydro-zones of the MIA with Brief Comment of Stratigraphy (Van Der Lely, 2012)

b) Where USF Aquifer is Present

Name	USF comment	LSF comment	Comment
Warrawidgee	Narrow prior streams	More widespread	Significant clay layers
Benerembah Middle	Narrow prior streams	More widespread	Significant clay layers
Benerembah south	Significant USF	Widespread	Variable
Hanwood West	Sands present	More widespread	Significant clay layers
Hanwood hort.	Minor prior stream	Less significant	Significant clay layers
Bilbul LAF area	Minor Mirrool Creek deposits	Minor sands only	Very significant clay
Kooba area	Prior streams traversing	More significant	Some deep leakage
Calorofield area	Sands present	Probably significant	No
Koonadan area	Sands present	Not assessed	High WT area
Murrami North	Some sands present	Not present	Significant clay below
Stanbridge Wamoon	Prior stream area	Probably significant	Horticultural area
Gogeldrie area	Sands variable	Probably significant	Significant clay layers

c) Where No USF Aquifer is Present

Name	LSF comment	Comment
Benerembah North	Some presence	Calivil F. Within 15m depth
Lake Wyangan	Some limited presence	Surficial permeability, undulating
Yenda North	Hardly any sands	Clay profiles
Yenda Horticulture	Hardly any sands	Clay profiles
Widgelli area	Hardly any sands	Clay profiles
Corbie Hill area	No LSF	Hilly, surficial permeability
Wah Wah District	USF variable presence, LSF more significant	USF piezometers too small in number

d) Other Hydrozones (not analysed)

Name	USF comment	Comment
Yoogali horticulture	Some sands	Low permeability underneath
Leeton Horticulture	Sands at South Leeton	Variable
Yanco Narrandera	Sands near the River	Merging to foothills

The hydrozones of group (b) are being reported here in terms of groundwater conditions. This report will not address group (c) hydrozones, as there have been no measurable piezometers installed in the Upper Shepperton Formation. The Lower Shepperton Formation sands extend into north Benerembah, west to Wah Wah, east and south-east to Yenda/Widgelli and north to Lake Wyangan, which is also depicted in the groundwater figures contained in this report.

The hydrozones of group (d) have been considered too small in size and deficient in data to warrant close analysis for the 2012/13 report.

MI will endeavour to encompass new monitoring points where data is deficient in the group (c) and (d) hydrozones in future monitoring programs where warranted. This will be incorporated into any future recommendations for monitoring network changes to NSW Office of Water (NOW) in late 2013.

In the MIA (Murrumbidgee Irrigation Area), changes in groundwater levels happen at a broader scale due to the extent and location of the Shepparton Formation Aquifer. This aquifer system extends from somewhere between Narrandera and Leeton through to parts of Wah Wah. Causes and effects of increases in groundwater levels are witnessed on a broad scale in this aquifer and can occur from activities such as intensive irrigation, high rainfall and flood events. Therefore in theory what happens in Hanwood may affect groundwater levels at Benerembah and vice versa.

In the MIA, MI is working towards keeping water tables below two metres from the surface; this is the point at which salinity risk is increased and has the potential to impact adversely on crop production.

2.4.1 YANCO AND GOGELDRIE HYDROZONES

Yanco

The six monthly bore monitoring data in Figures 2.4.1 (a) and 2.4.1 (b) below for Yanco shows an increase in groundwater levels from March 2011 to those measured in March 2012 between 0.5 m – 4 m in bores across the region. Measurements from March 2013 highlight a rise of 0.5 m – 1.0 m in bores L595 and L2216. Levels in bore L685 remained at 7.1 m with Bore L2251 receding by 1.32 m. Overall bore readings in the Yanco Hydrozone for March 2013 remained between 4.5 m - 7.64 m below surface level.

For the months of September 2011 and 2012, groundwater levels ranged from 3.73 m - 8.28 m. Groundwater levels in September 2012 rose in response to lag time in aquifer recharge witnessed during the March 2012 floods. In bores L251, L592 and L595 groundwater levels in the September readings were between 4.5 m – 4.8 m nearly 1 m higher than those measured in March 2012.

Gogeldrie

In the six monthly monitoring bores drilled in the Lower Shepparton Formation within the Gogeldrie Hydrozone, (refer to Annex C - Figures 2.4.1 (c) and 2.4.1 (d)) average standing water levels measured in L2802, L2793, L2797, L2788, L1764, and L2795 varied from 12.5 m to 16.50 m for March 2013. L1764 rose 2.50 m in 2012 compared to levels measured in the same month in 2011 and again rose to 4.50 m by March 2013. L2795 rose 1.00 m in 2012 but receded 0.50 m in March 2013. On the other hand there was little variation in L2788 in which groundwater levels rose 1.50 m, in 2012 and 1 m in 2013.

The six monthly monitoring bores drilled in the Upper Shepperton Formation showed a rise of up to 1.50 m from March 2011 to March 2012 and a rise of less than 0.50 m from March 2012 to March 2013. Bores L1020S, L1826, L1902S, L1905S, L2312, and L2444 recorded consistent levels over the three years, with groundwater levels less than 2 m from the surface for the month of March. It is likely that as these bores have been drilled adjacent to supply channels those readings may be influenced by channel seepage. Bores L1861D, L1870D, L1897, L1980, L1982S, L2314D, L2994 showed groundwater levels consistently between 0.50 m - 4.00 m for the months of March 2011 to 2013.

The six monthly bore readings for September 2011 and 2012 rose to 0.10 m - 0.50 m across all bores. Of particular interest L1980 and L2799 both saw a 2.00 m rise in September 2012, likely attributed to lag recharge time from the March 2012 floods.

As shown in Figure 2.4.1 (e) below, two monthly bore readings for 2012/13 saw very little change in groundwater levels over the 12 month reporting period. Out of the 19 bores monitored in this network 17 bores were able to be read. Groundwater levels across bores ranged from 2.00 m - 10.80 m. Bore L1826 has reportable groundwater levels less than 2 m below surface level. This is likely attributed to seepage from adjacent supply channels. L1861D and L1861S saw a reduction in groundwater levels of 0.20 m in March 2013.

Figure 2.4.1 (a): Yanco Groundwater Levels – March 2011 to 2013

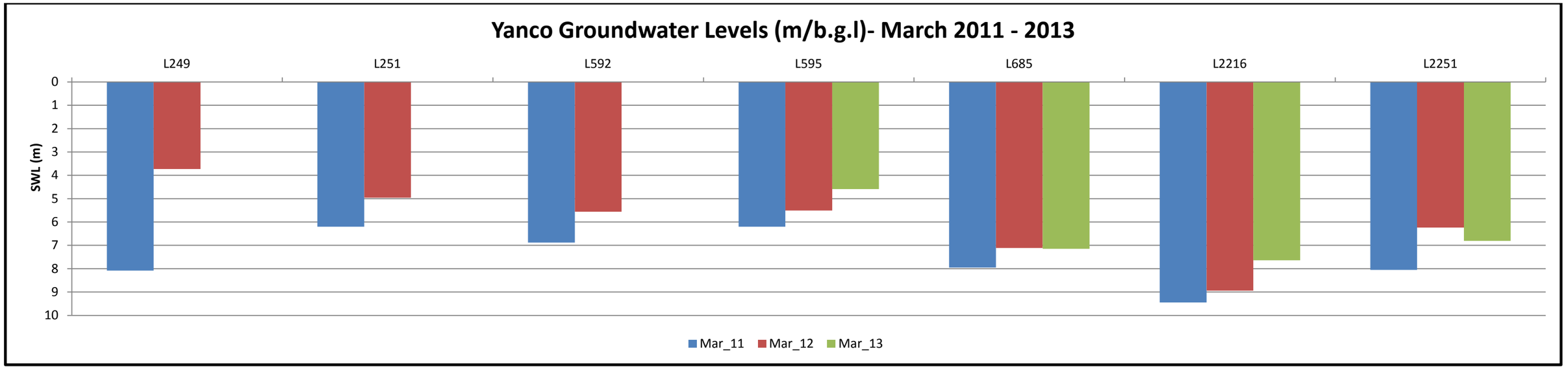


Figure 2.4.1 (b): Yanco Groundwater Levels – September 2011 to 2013

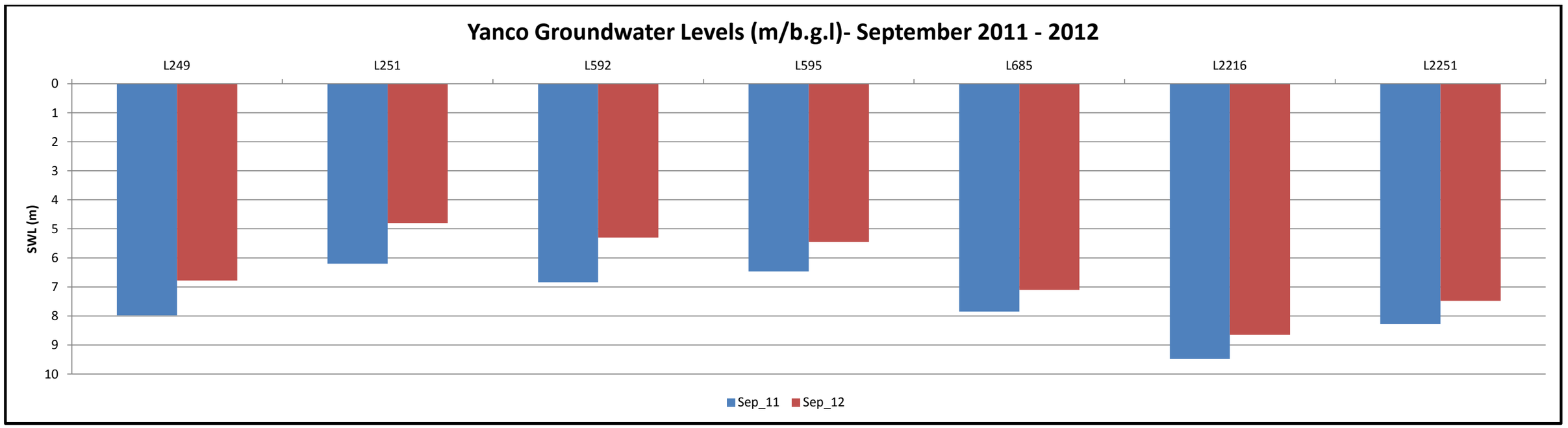
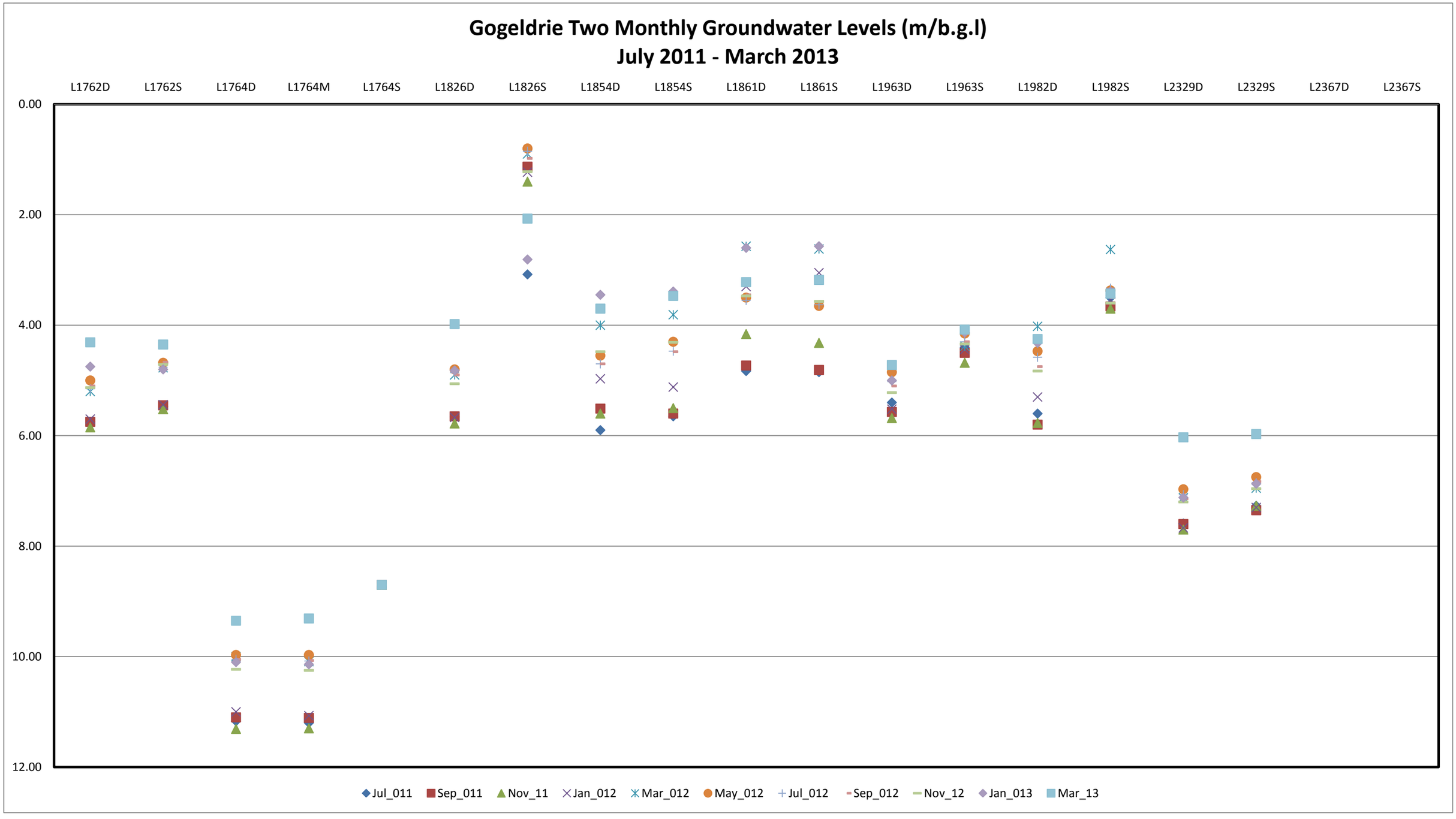


Figure 2.4.1 (e): Gogeldrie Two Monthly Groundwater Levels from July 2011 – March 2013



2.4.2 KOONADAN, KOOBA AND MURRAMI HYDROZONES

Koonadan

In the six monthly bore readings shown in Annex C - Figures 2.4.2 (a) and 2.4.2 (b), the Lower Shepperton Formation Bore L2275D displayed a reduction in groundwater levels of 1 - 2 m from March 2011-2013. This could be attributed to groundwater extraction via supply production bores. It is hard to assume a reduction of groundwater levels in the Lower Shepparton Formation at Koonadan from one monitoring bore.

In the Upper Shepperton Formation, nine bores consistently displayed groundwater levels within 2.0 m of surface level. L2279 is located 10 m from a supply channel. At the time of drilling this bore had a total depth of 33.0 m, however with the review undertaken in 2013, it now has a total depth of 10.42 m, providing for a false reading in L2279 (period of false reading unknown). L2995 with a total depth of 8.98 m is located 5 m from a supply channel; therefore it is likely that groundwater level readings from this bore are directly influenced by channel seepage. Bores L1708, L2865, L3085 and L3139 have total depths ranging from 2.90 m to 6.98 m suggesting a geological low point in the Koonadan Hydrozone, where groundwater levels would be at their closest to surface level. For bores L1551, L2047S and L2347S it is hard to ascertain reasoning behind elevated groundwater levels without having screen interval information correlated with stratigraphy. In the six monthly bore readings for September, groundwater levels rose by 0.10 m - 0.20 m between 2011 and 2012. Fifty one bores observed readings within 2 m of surface level and 44 bores within two or more metres of surface level.

Murrami

In six monthly bore readings shown in Annex C - Figures 2.4.2 (e) and 2.4.2 (f) for the Upper Shepperton Formation, groundwater levels in ten of the 76 monitoring bores in Murrami were within 2 m of surface level. Groundwater levels across the hydrozone ranged from 0.5 m to 11.5 m. Water level changes were most noticeable between March 2011 and March 2012, possibly due to additional recharge with the March 2012 floods. It was also noted that levels still remained high in March 2013, even after the preceding dry months of January and February 2013 indicating that irrigation may also be contributing to sustaining high groundwater levels. Rainfall experienced in March 2012 would have had little effect in groundwater level rise due to high evaporation and little or no rainfall events in January and February 2012. Groundwater levels were lower in September 2011 and 2012, with no bore readings under 2.0 m below surface level.

In the two month bore readings shown in Figure 2.4.2 (g), 1.0 m fluctuations in groundwater levels were witnessed across all monitoring bores over a 12 month period. Groundwater levels remained relatively steady over the 12 month period. A reduction of 1.0 m in groundwater levels in L1709D and L1946D as well as a reduction of 2.0 m in L1924D and 1924S occurred in the period from March 2012 to March 2013.

Kooba

In the six monthly bore readings shown in Annex C - Figures 2.4.2 (h) and 2.4.2 (i), groundwater levels range from 0.20 m – 25.0 m. Twenty three bores had groundwater levels below or within 2.0 m of ground surface level for monitoring undertaken in March 2011, March 2012 and March 2013. Twenty of the 23 bores had groundwater levels that remained below or within 2 m of ground surface level in September 2011 and September 2012. Of those 23 bores, levels in G203, G210, G1381, G2141 and G2120 may have been influenced from channel seepage as most were drilled within 10.0 m of unlined supply channels.

As shown in Figure 2.4.2 (j) the two monthly groundwater levels range from 2.10 m – 11.00 m. Monitoring bores G245, G1779 and G1661 within 2 m of surface level. G2452 has groundwater levels within 2 m of surface level in March 2012, attributed to episodic recharge. G1779 had groundwater levels close to 2.0 m in January 2013. Due to lack of rainfall displayed in December 2012 and January 2013, it's highly likely that a rise in groundwater levels can be attributed to irrigation.

Figure 2.4.2 (c): Map – Yanco, Gogeldrie and Koonad from September 2012 to March 2013 Groundwater Levels – Shallow Formation

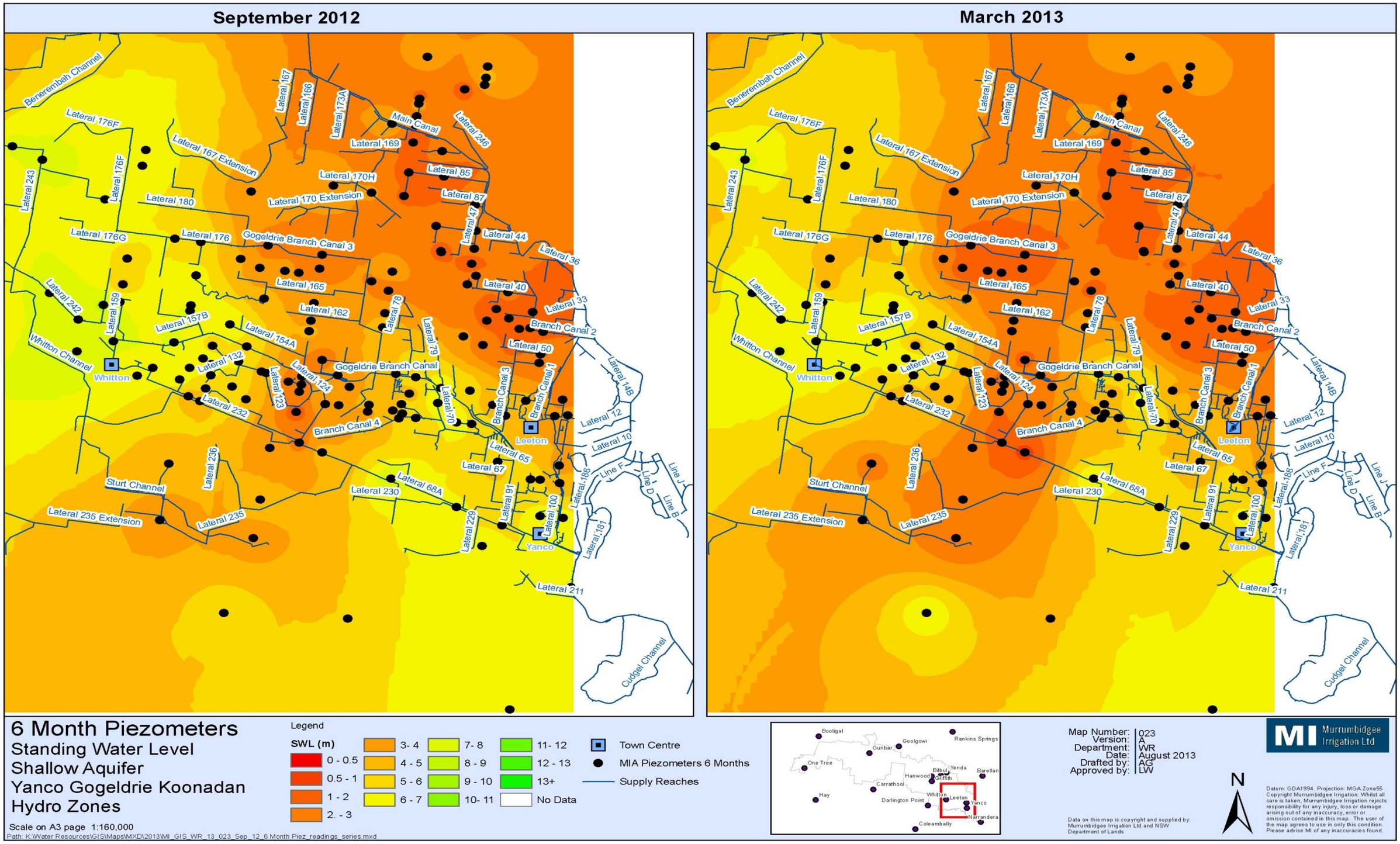


Figure 2.4.2 (d): Map - Yanco, Gogeldrie and Koonadan from September 2012 to March 2013 Groundwater Level's - Deep Formation

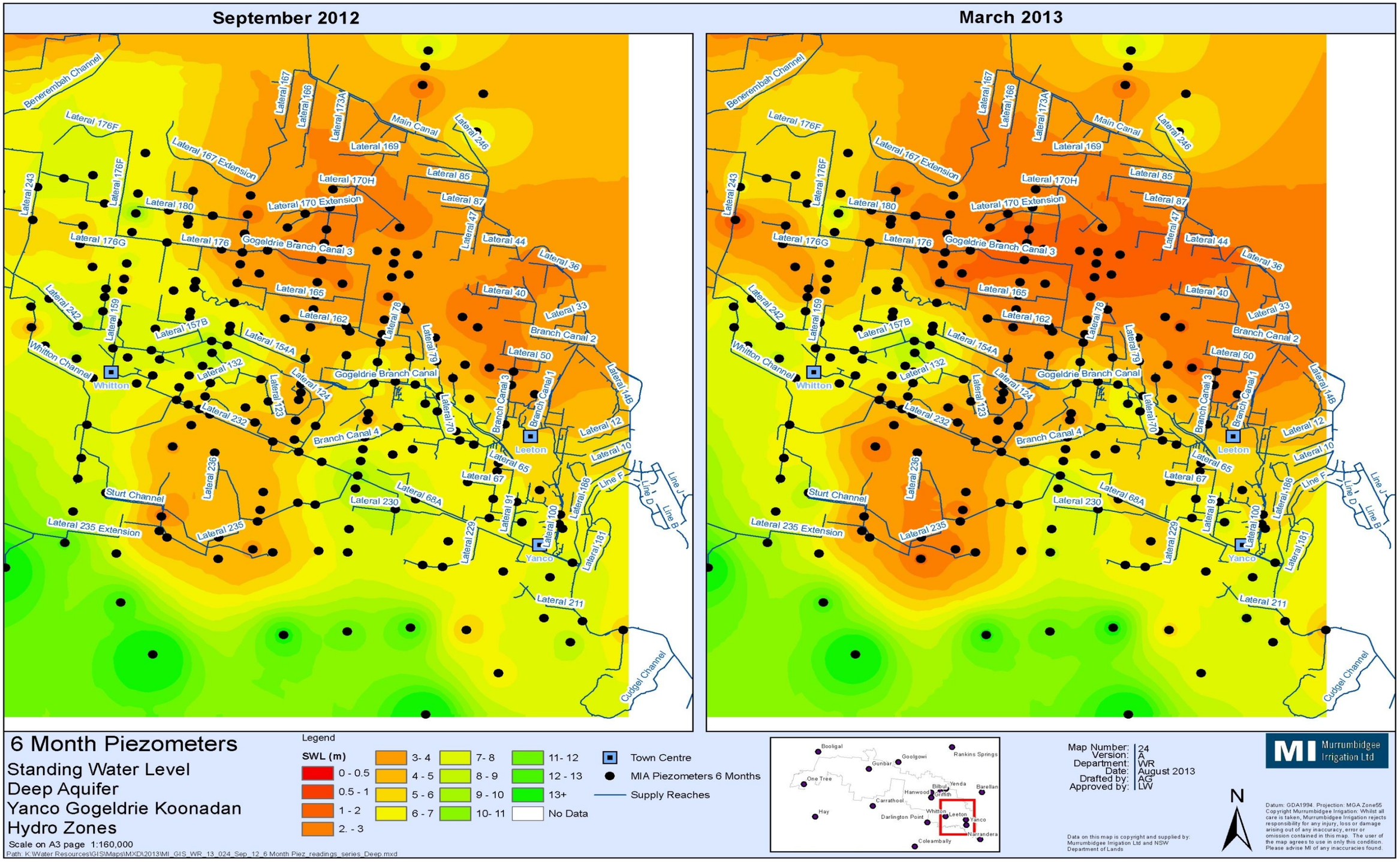


Figure 2.4.2 (g): Murrami Two Monthly Groundwater Levels from July 2011 to March 2013.

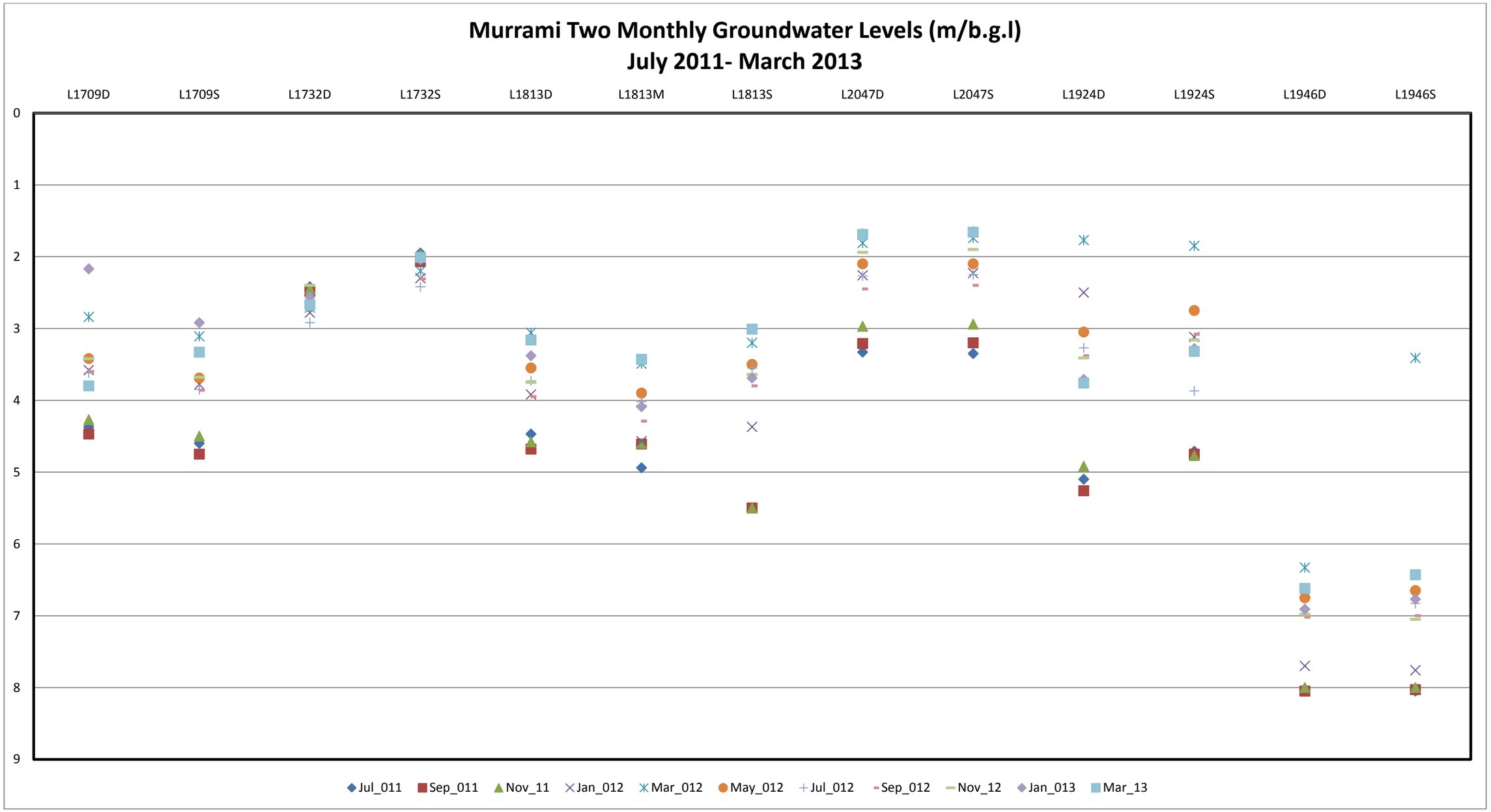


Figure 2.4.2 (j): Kooba Two Monthly Groundwater Levels from July 2011 – March 2013

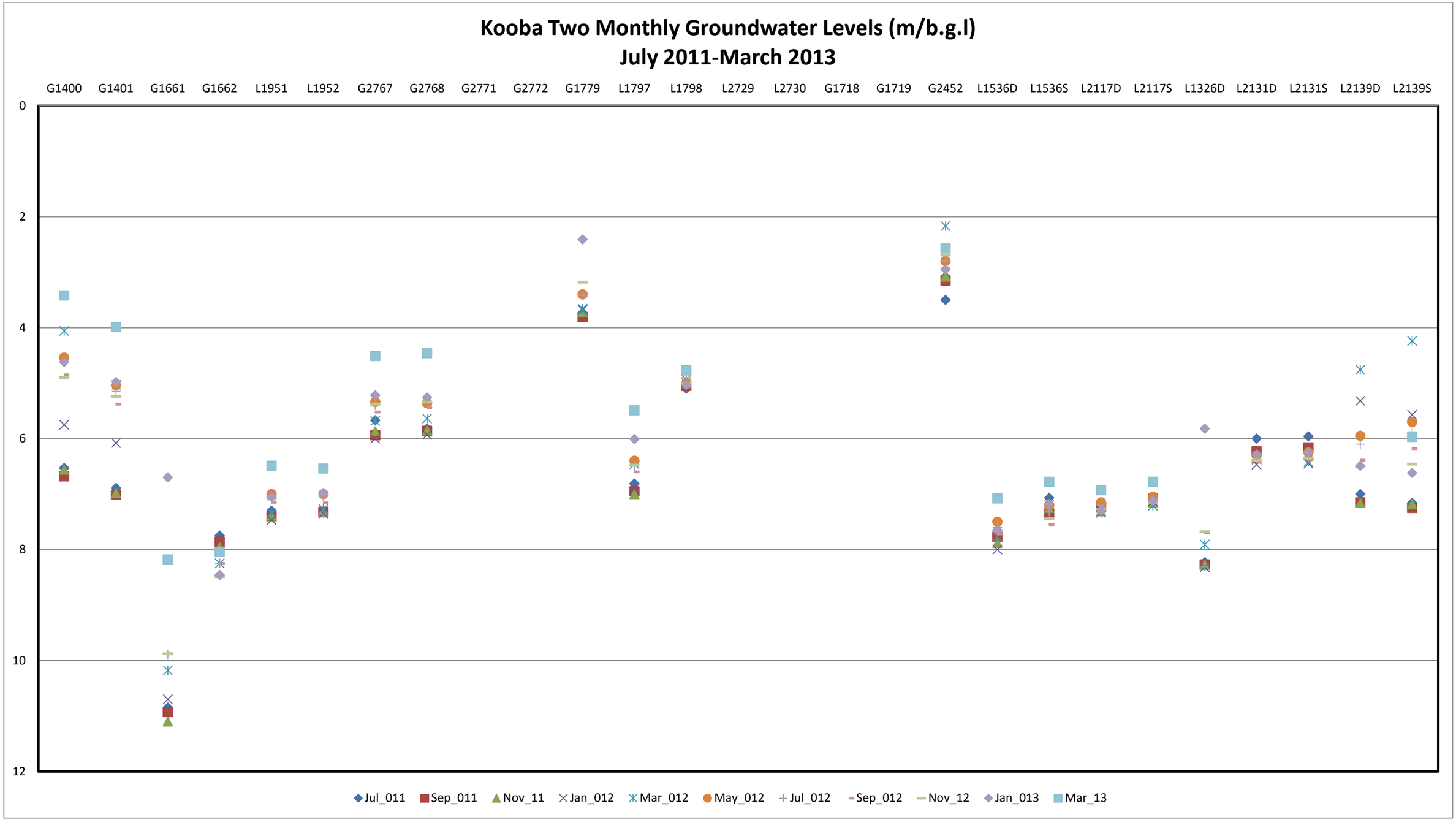


Figure 2.4.2 (k): Map - Kooba from September 2012 to March 2013 - Groundwater Level's – Shallow

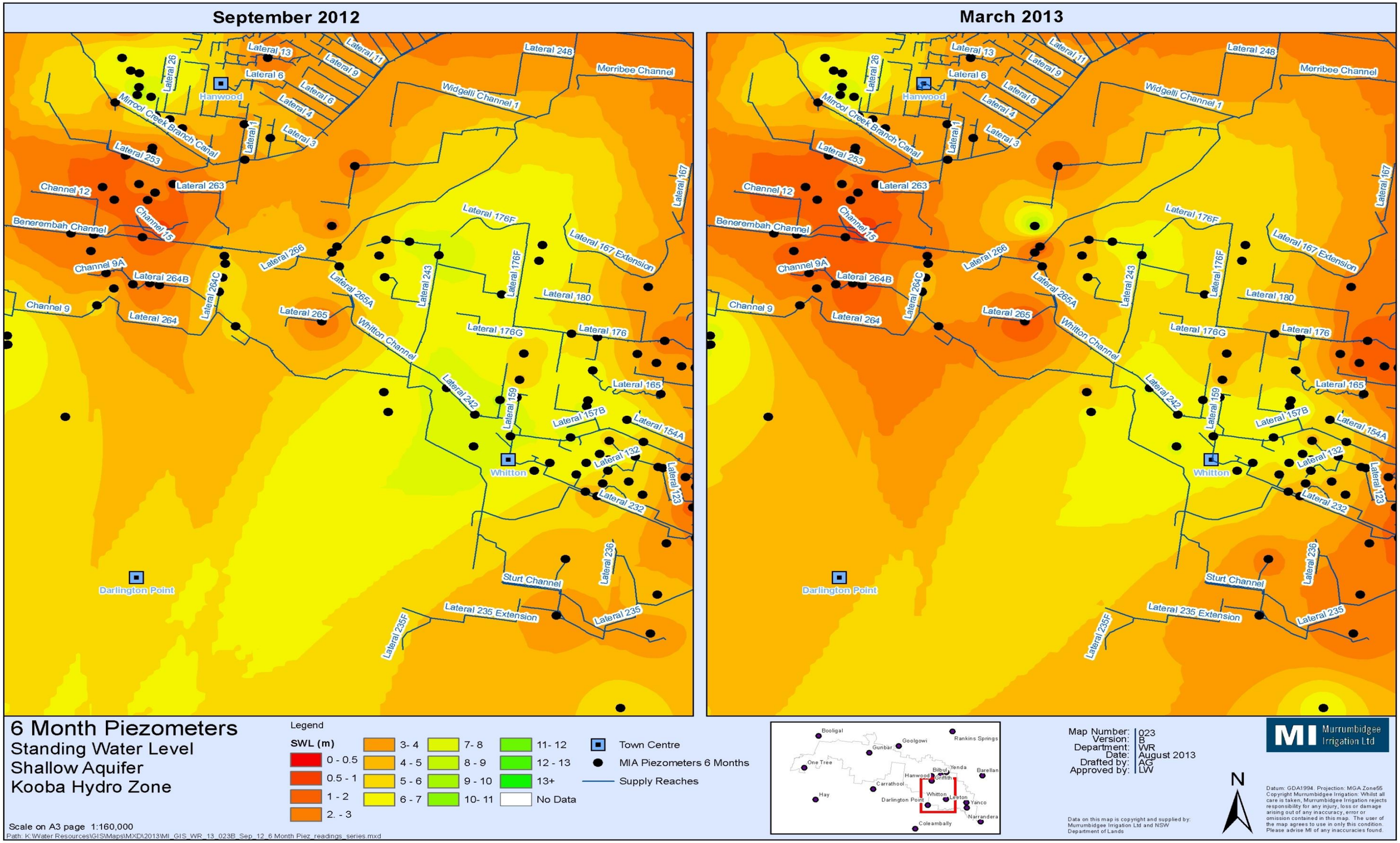
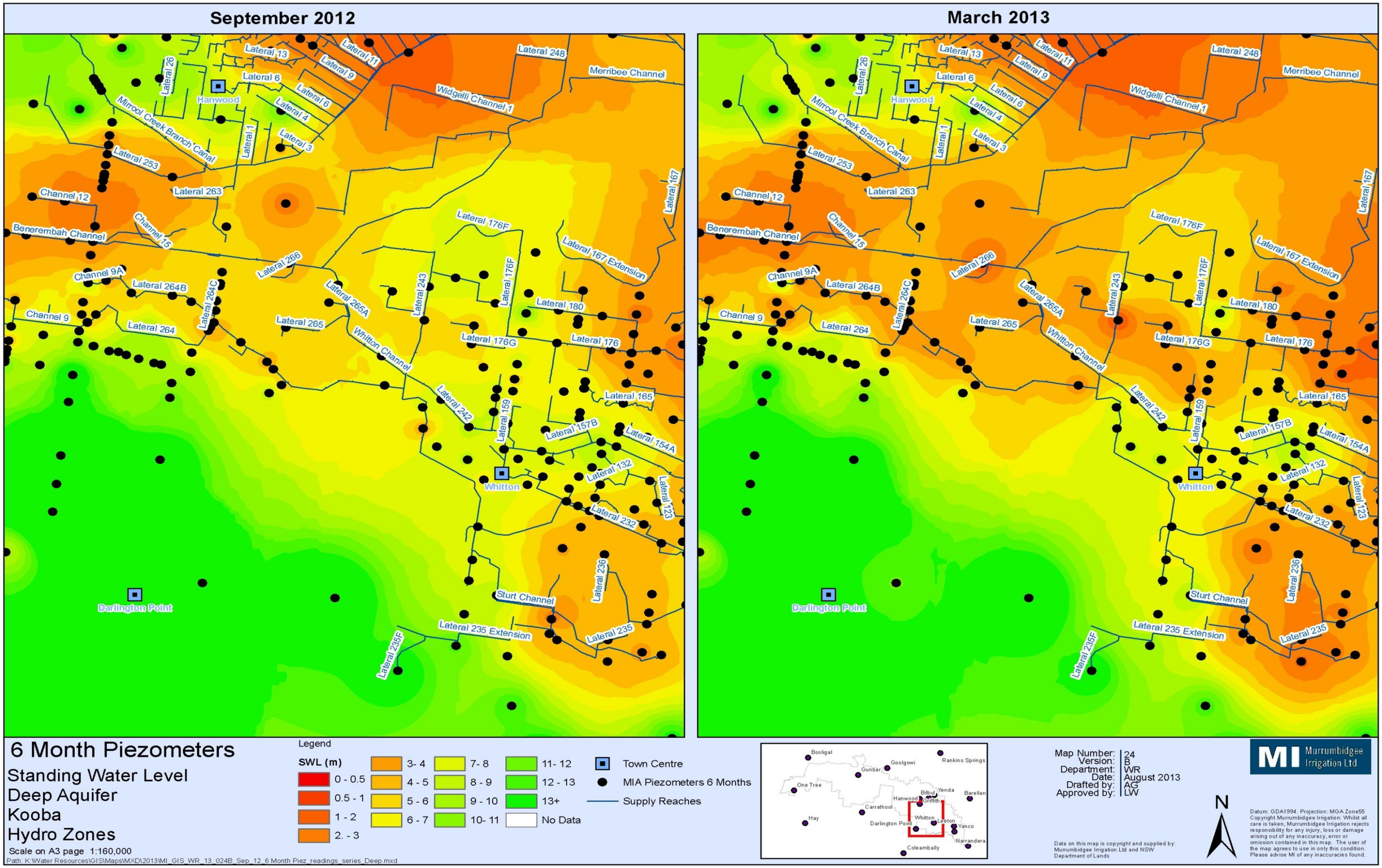


Figure 2.4.2 (l): Map of Kooba from September to March 2013 - Groundwater Level's – Deep



2.4.3 HANWOOD, YENDA/BILBUL AND LAKE WYANGAN HYDROZONES

Hanwood

Referring to Annex C - Figures 2.4.3 (a) and 2.4.3 (b), the six monthly groundwater levels in the Hanwood hydrozone ranged from 0.20 m-16.0 m. From the monitoring bores sampled in 2012/13, six displayed levels less than 2.0 m below ground surface level. G461, G462 and G1789 are likely to have groundwater artificially recharged by seepage from supply channels.

Amongst the two monthly bores as shown in Figure 2.4.3 (c) below, only Bore G458 could be measured during the 2012/13 reporting period. Groundwater levels in this bore recorded a 16.00 m rise between July 2012 and January 2013. This is likely attributed to irrigation, particularly in warmer months of December and January where there was no rainfall, higher demands for water and the need for intensive irrigation on warmer days.

Yenda and Bilbul

As shown in Annex C - Figures 2.4.3 (d) and 2.4.3 (e), the six monthly monitoring bores, groundwater levels range from 1.0 m to 5.0 m below ground surface level. G327 and G352 have recorded groundwater levels within 2.0 m of surface level. G352 has been drilled 10.0 m from an existing supply channel and has a total depth of 8.93 m. This implies that it is likely that seepage from the supply channel is contributing to recharge of groundwater within the vicinity of this monitoring bore. There is little variation to water levels measured in the months of March and September 2011/12 in this hydrozone.

In the two monthly bores as shown in Figures 2.4.3 (f) below, groundwater ranges from 0.40 m - 3.70 m. Two bores within this network have groundwater levels within 2.00 m of surface level. G352 and G1684 have different characteristics but groundwater at similar levels. G1684 is drilled within 20.00 m of a supply channel but has a total depth of 24.70 m. Without the ability to review screen data it is hard to ascertain the causal factors for elevated groundwater levels in this bore. Contributing factors could include channel seepage, irrigation and/or integrity (breach) of casing or possibility of a combination of these factors.

Lake Wyangan

In Annex C - Figures 2.4.3 (g) and 2.4.3 (h), the six monthly groundwater levels measured in March 2011, 2012 and 2013 range from 0.20 m-25.00 m with two bores showing groundwater levels within 2.00 m of surface level. Bore 674 and 2010 are located at topographically low points and within close proximity to potential recharge sources. Bore 674 is located 50 m from an existing supply channel in a swamp or low depression with a total depth of 17.81 m. Bore 2010 is also located 50 m from an existing supply channel between the northern and southern portion of Lake Wyangan and has a depth of 12.12 m. It is highly likely that both bores are receiving accelerated recharge due to the proximity of the aquifer in relation to ground surface level and due to geological low points within the landscape.

Figure 2.4.3 (c): Hanwood Two Monthly Bore Readings (G458) from July 2011 to March 2013

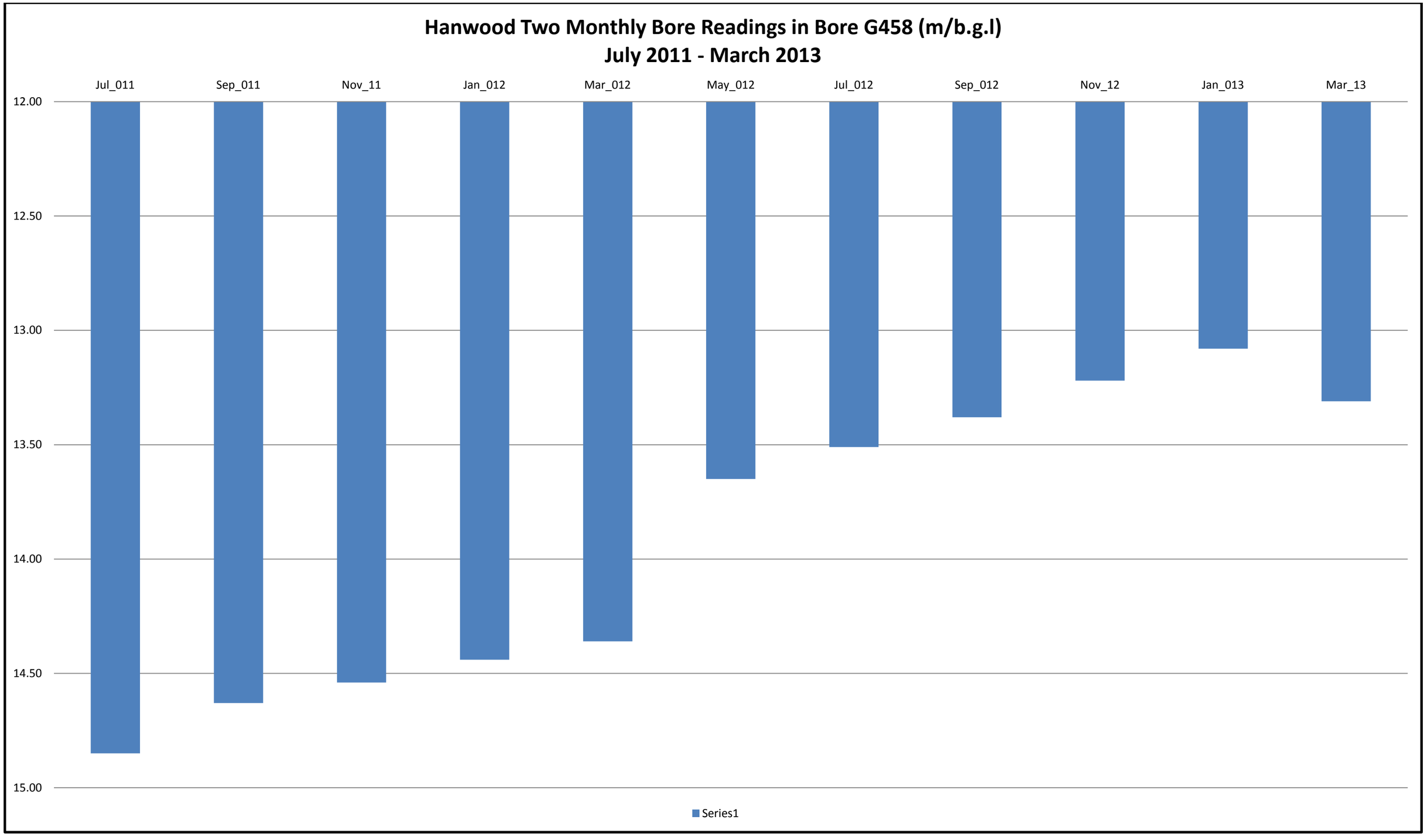


Figure 2.4.3 (f): Yenda and Bilbul Two Monthly Groundwater Levels from July 2011 to March 2013.

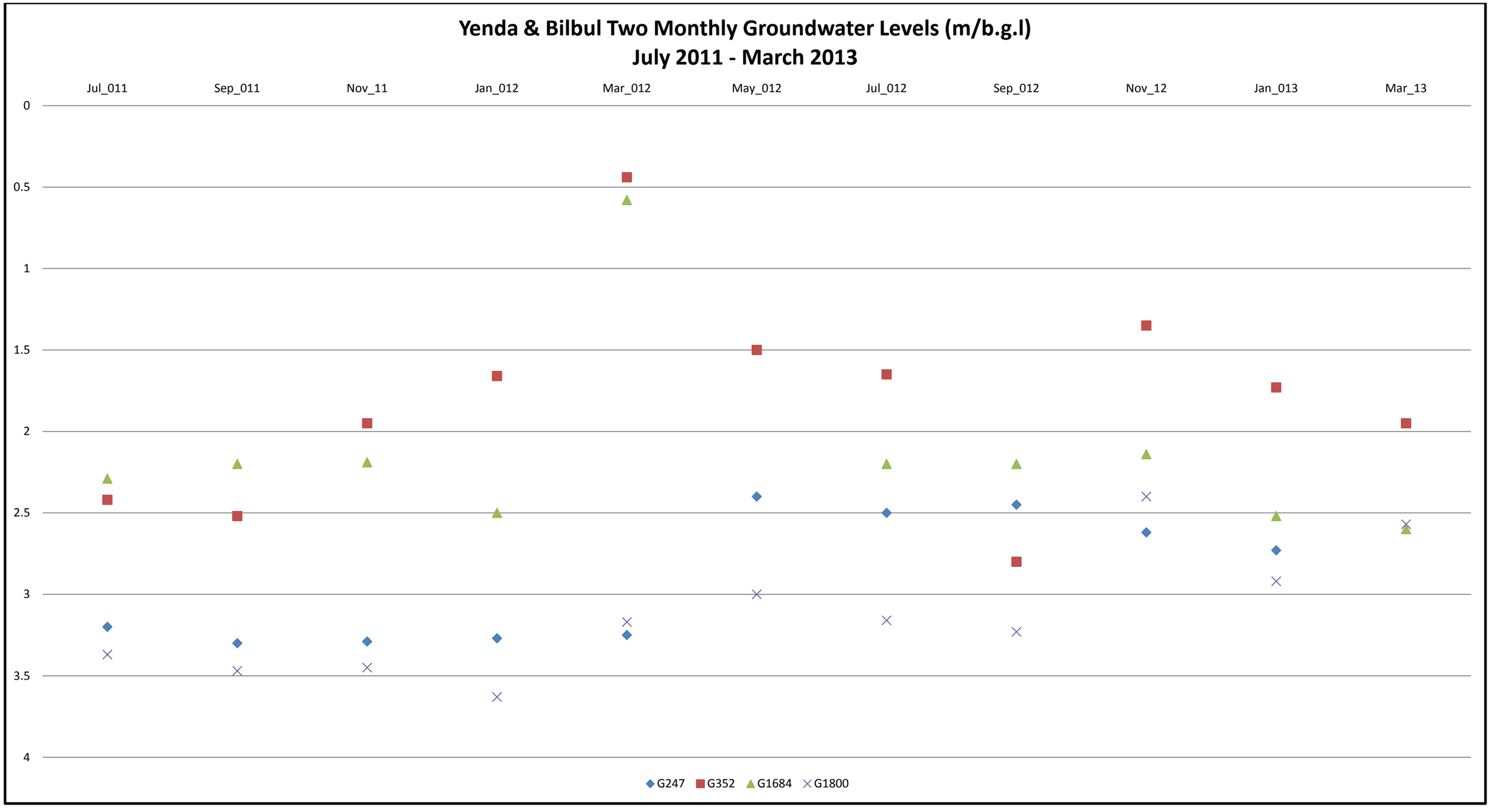


Figure 2.4.3 (i): Map of Hanwood, Yenda, Bilbul and Lake Wyangan from September 2012 to March 2013 - Groundwater Level's – Shallow

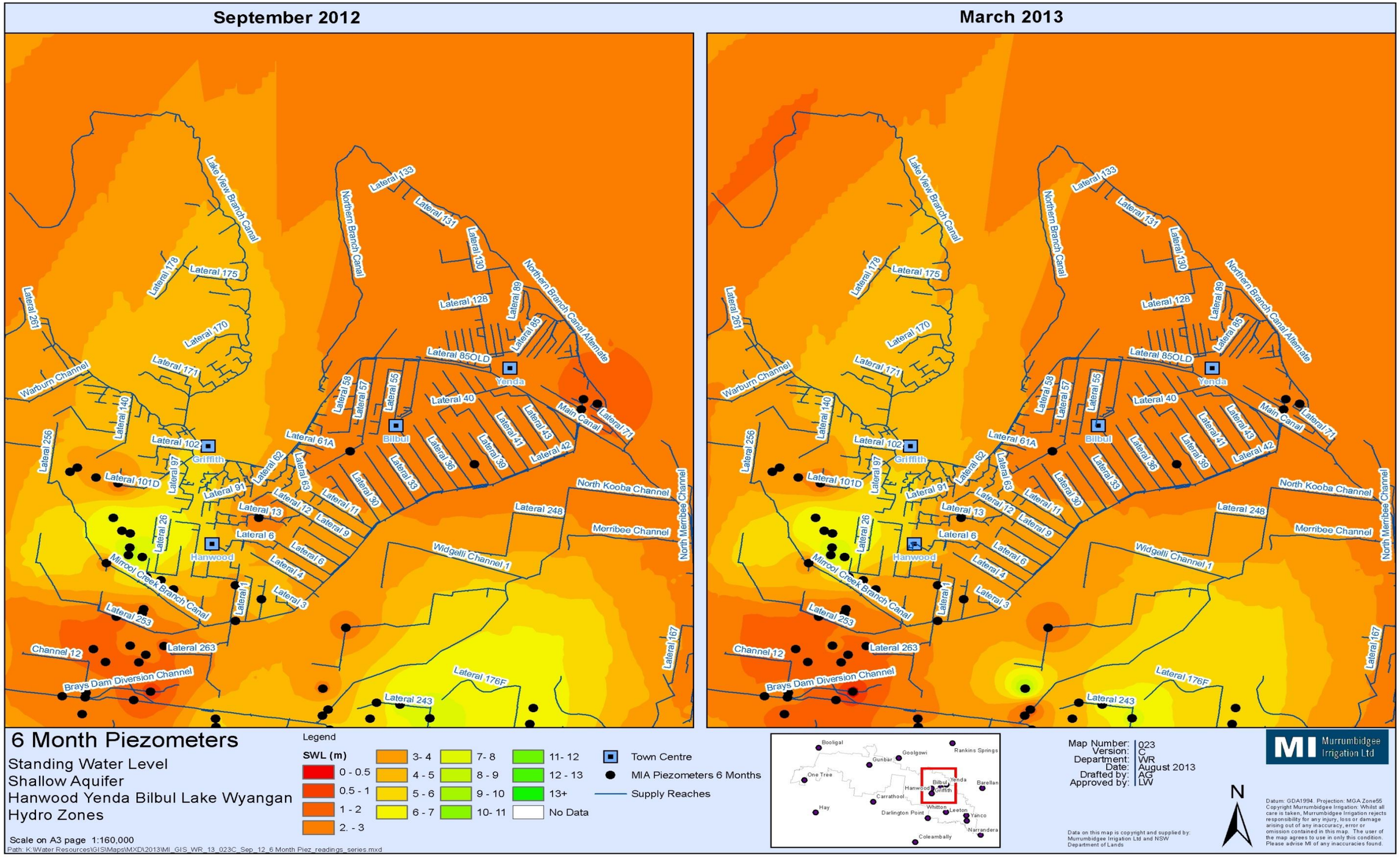
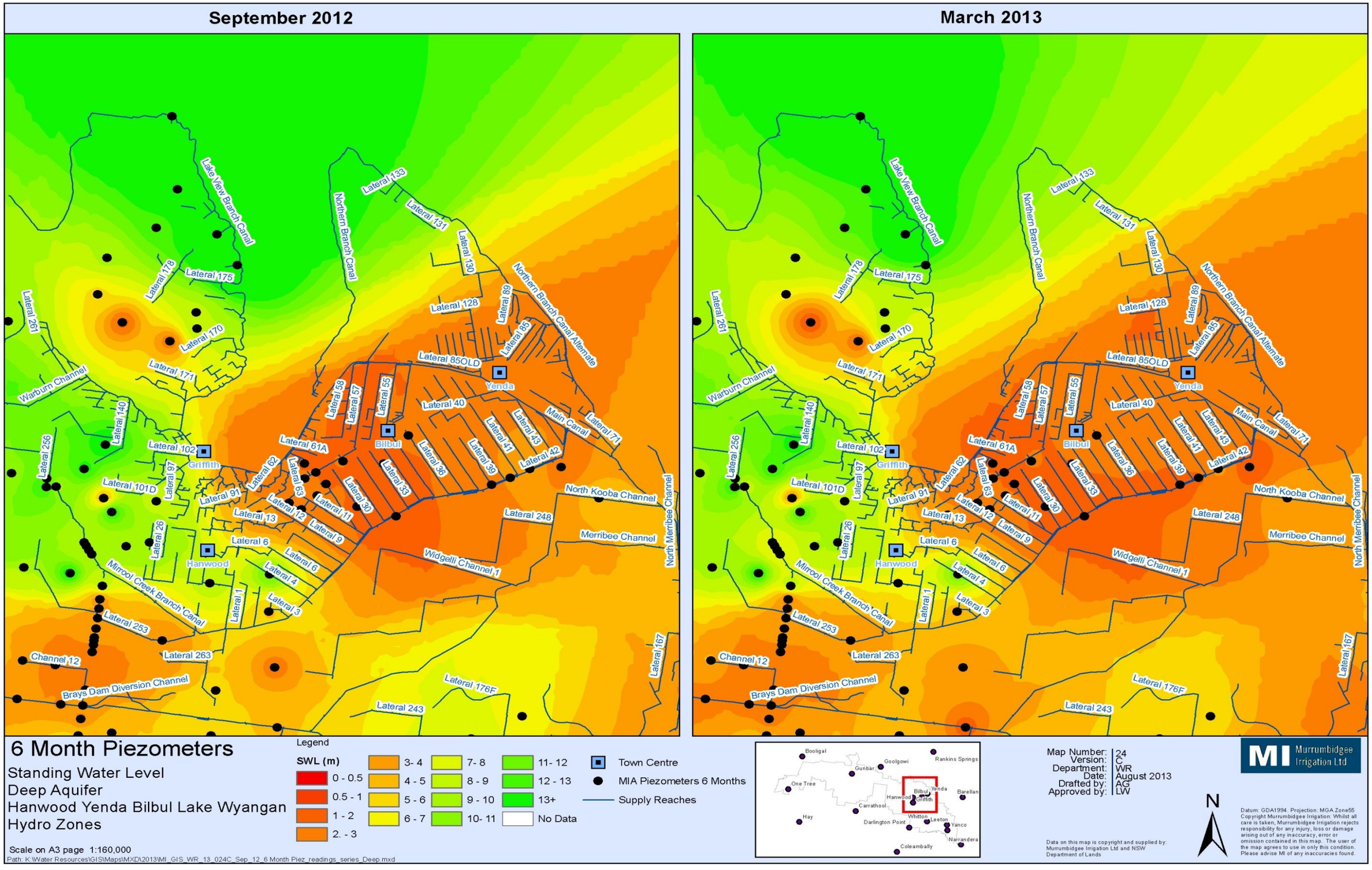


Figure 2.4.3 (j): Map of Hanwood, Yenda, Bilbul and Lake Wyangan from September 2012 to March 2013 - SWL's – Deep



2.4.4 BENEREMBAH AND WAH WAH HYDROZONES

Benerembah is one of the larger rice growing areas within the Murrumbidgee Irrigation Area (MIA). Groundwater level rise has been prevalent in the past 2 - 3 years since the break from the drought. The return of rice farming has been witnessed in 2011 - 2012 with 100% allocations for general security water.

North Benerembah

As shown in Annex C - Figures 2.4.4 (a) and 2.4.4 (b), in the six monthly bores, groundwater levels range from 0.20 m -19.00 m. Bores G1073, G1090, G2345S. G2734, G1139 and G3126 are drilled within 10 m of existing supply channels and have a total depth ranging from 7.50-11.00 m. It is likely that this collection of bores is being influenced from seepage from adjacent supply channels. Bores G470 and G535 are also located within 5.00 m of existing supply channels but have total depths ranging from 13.50 m - 17.85 m respectively. Due to the lack of bore construction information and screen setting for both bores a highly plausible theory for elevated groundwater levels in these two bores is the continuity between the lower and upper Shepperton formation, influence from seepage from adjacent supply channels and contributions from irrigation. G2821 with a total depth of 5.16 m is located 5.00 m from an existing creek line and G2369 is located 1 m adjacent to Mirrool Creek and is drilled at a depth of 1.02 m. Both of these bores show groundwater levels directly associated with bank storage in Mirrool Creek.

As shown in Figure 2.4.4 (c) below, the two monthly bores levels range from 0.50 m - 14.50 m. Bore G523 observed groundwater levels within 2 m of ground surface levels in November 2012 and January 2013. Its highly likely that contributions from irrigation are the leading cause for groundwater level rise in this monitoring bore for this period as a result of filling of rice bays in mid-late October and particularly warmer than average temperatures experienced in January 2013.

South Benerembah

As shown in Annex C - Figures 2.4.4 (d) and 2.4.4 (e) below, the six monthly groundwater levels range from 0.20 m – 25.00 m. There are 14 monitoring bores within this hydrozone with groundwater levels within 2.00 m of ground surface level. Bores G620, G1220 and G293 are located within 5 m of existing channels and have been drilled to total depths between 7.72 - 11.50 m. It is likely that these bores are being recharged from seepage from adjacent supply channels. Bores G407, G487, G514 and G555 have groundwater levels within 2.00 m of ground surface level during the months of March only, likely displaying groundwater levels influenced by episodic recharge during the March 2012 floods, recharge from intensive irrigation as well as topographic influence such as their proximity to major river and creek systems like Mirrool Creek and the Murrumbidgee River.

Bores G494, G2048, G2052, G2696, G2698, and G2856 have groundwater levels within 2.00 m of ground surface level in both March and September. Total drilled depths in these bores range from 7.40 m - 15.20 m, with some drilled as close as 15 m to existing supply channels. It's likely that contributions from channel seepage may be influencing groundwater levels in these bores as well as proximity of the Upper Shepperton Formation to ground surface level topography and irrigation also contributing to groundwater rise.

As shown in Figure 2.4.4 (f) below, the two monthly groundwater levels range from 0.20 m – 25.00 m. Seven bores within the two monthly monitoring network displayed groundwater levels within 2.00 m of ground surface level in January and March 2013, directly attributed to 100% water allocations and high water use during warmer months.

Wah Wah

As shown in Annex C - Figures 2.4.4 (i) and 2.4.4 (j) below, the six monthly, groundwater levels range from 2.50 m to 19.50 m. A reduction of 0.20-0.50 m in groundwater levels is witnessed between March and September each year where groundwater fluctuations are dependant directly on rainfall.

As shown in Figure 2.4.4 (k) below, the two monthly groundwater levels remain consistent across all monitoring bores. G3065S rose 1.50 m between January 2012 and March 2012 as a result of episodic recharge during the March 2012 Floods with groundwater levels remaining at steady state of 4.00 m - 4.30 m for the 12 months preceding the floods through to March 2013. This bore is drilled within a natural floodway to the Lachlan River, where alluvial sediments, prior streams and topography create ideal conditions for increased recharge to the aquifer

Figure 2.4.4 (c): North Benerembah Two Monthly Groundwater Levels from July 2011 to March 2013.

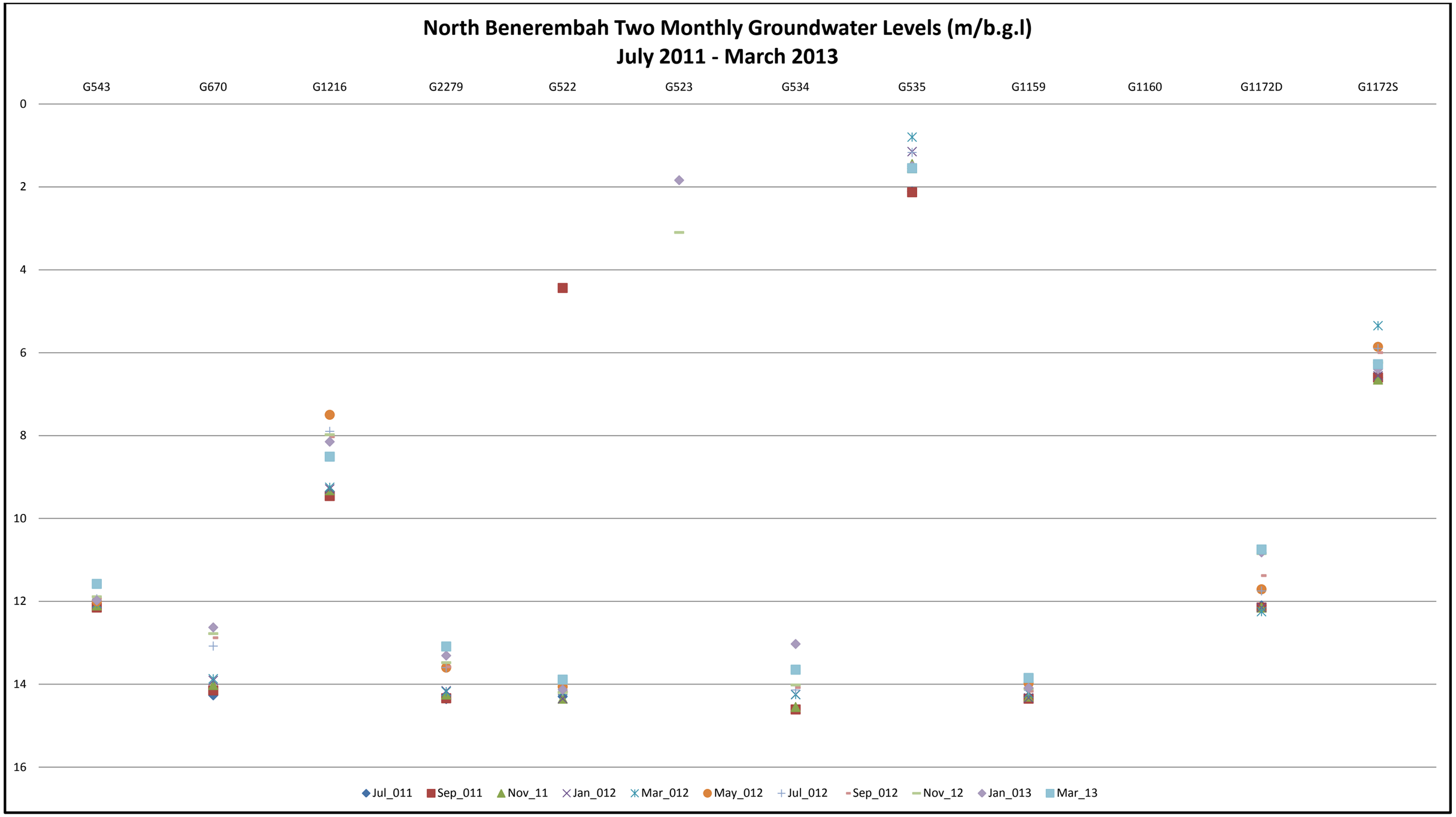


Figure 2.4.4 (f): South Benerembah Two Monthly Groundwater Levels from July 2011 to March 2013.

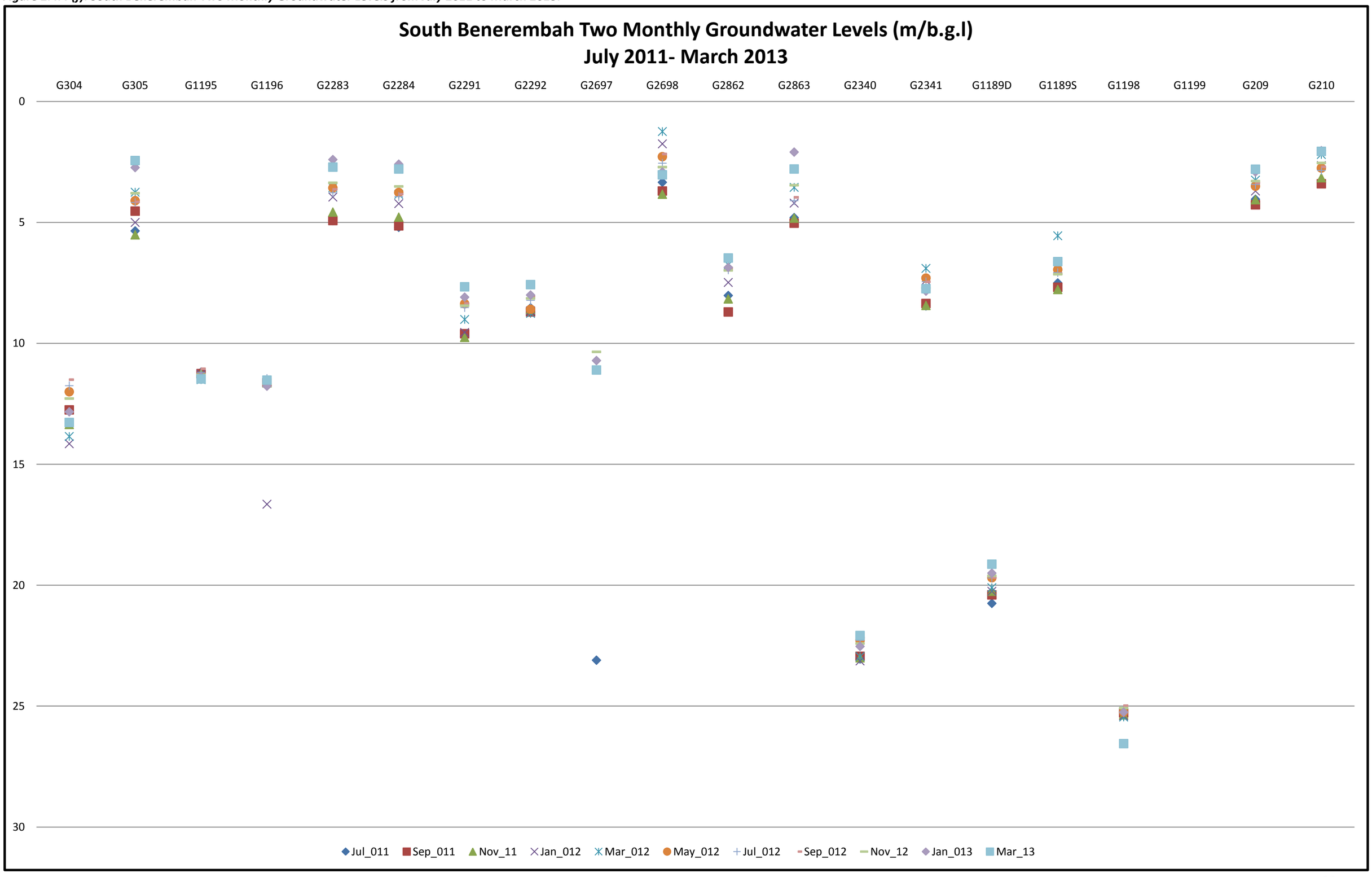


Figure 2.4.4 (g): Map of Benerembah from September 2012 to March 2013 Groundwater Levels – Shallow

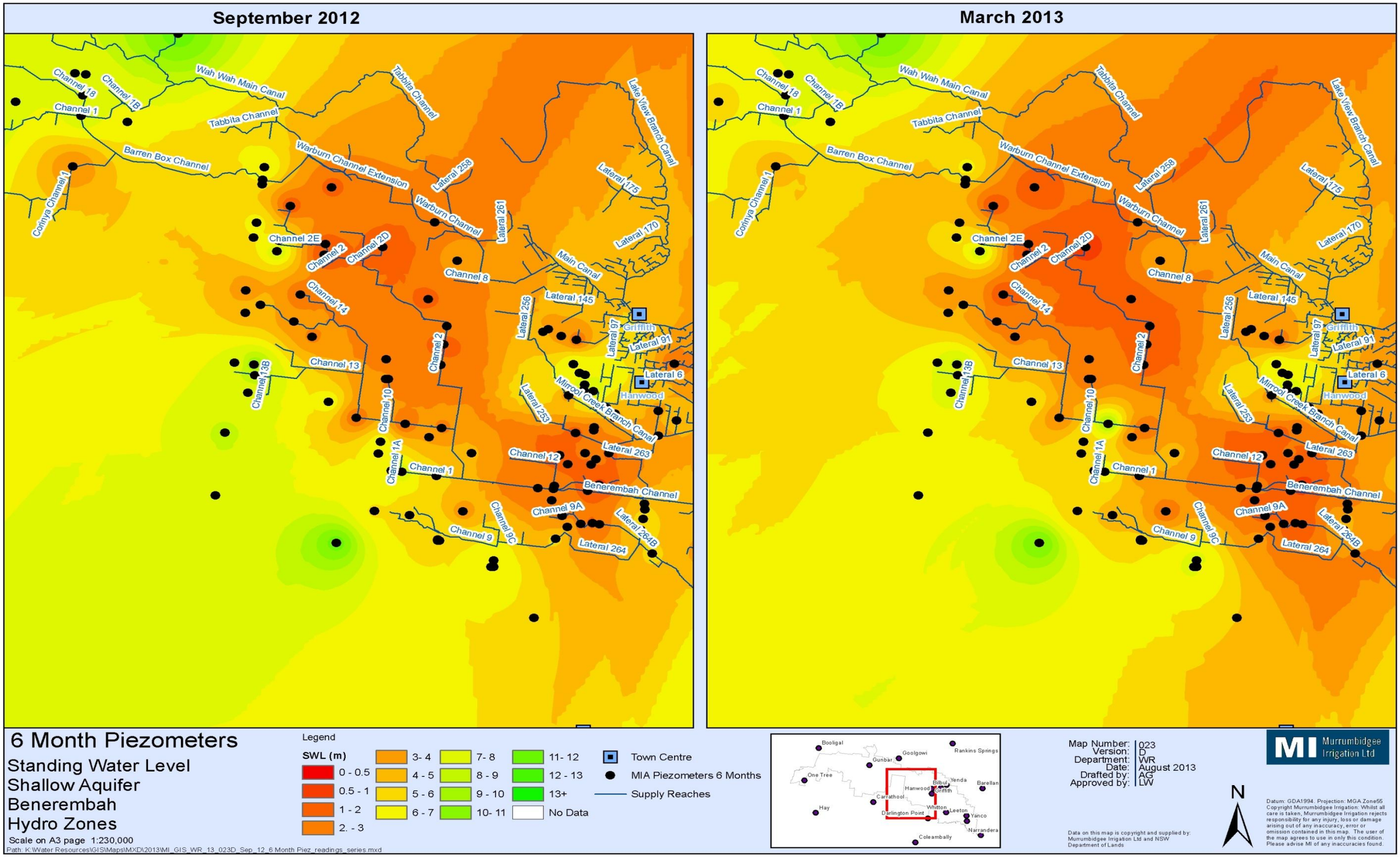


Figure 2.4.4 (h): Map- of Benerembah from September 2012 to March 2013 – Groundwater levels – Deep

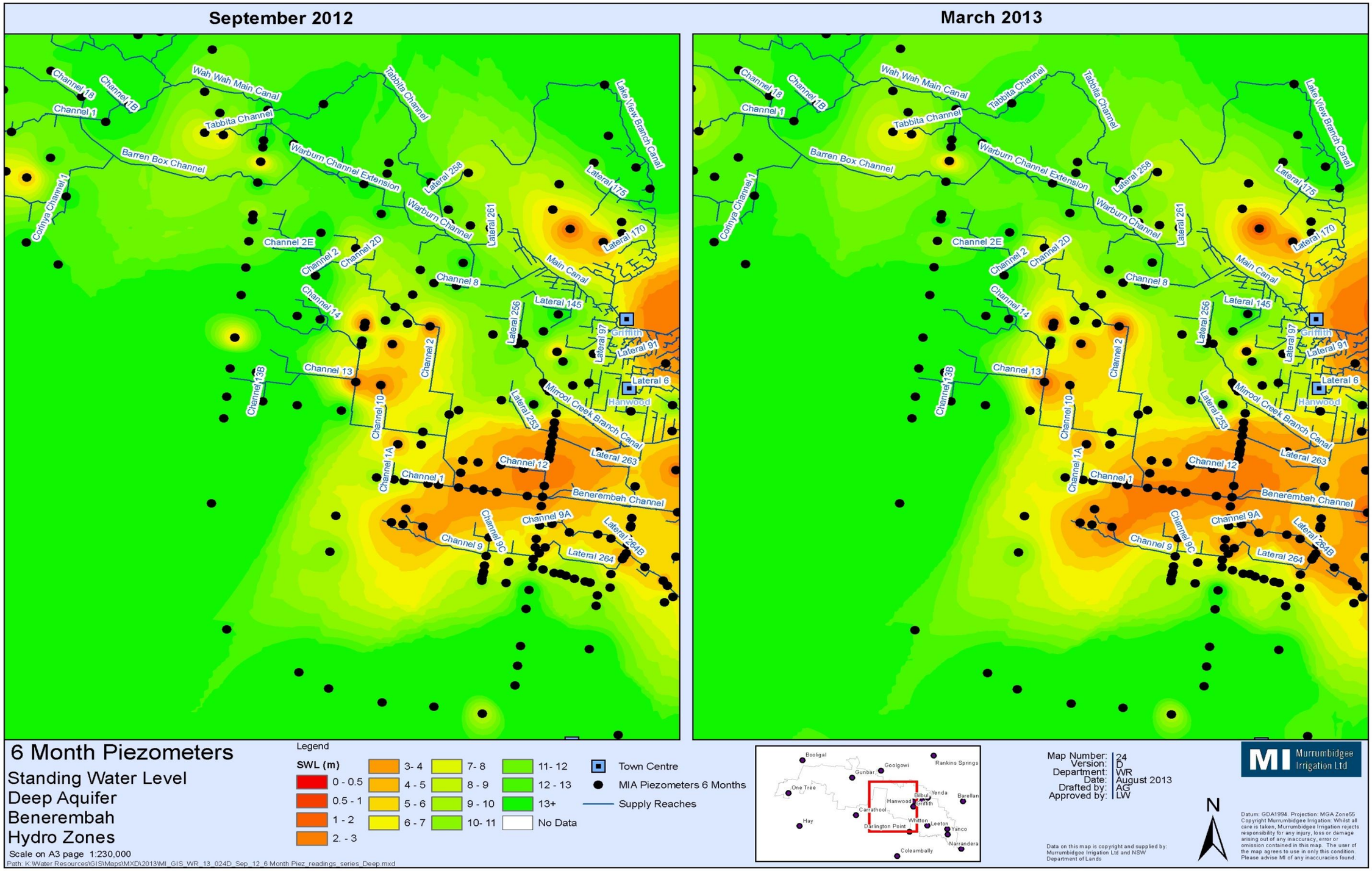


Figure 2.4.4 (k): Wah Wah Two Monthly Groundwater Levels from July 2011 to March 2013.

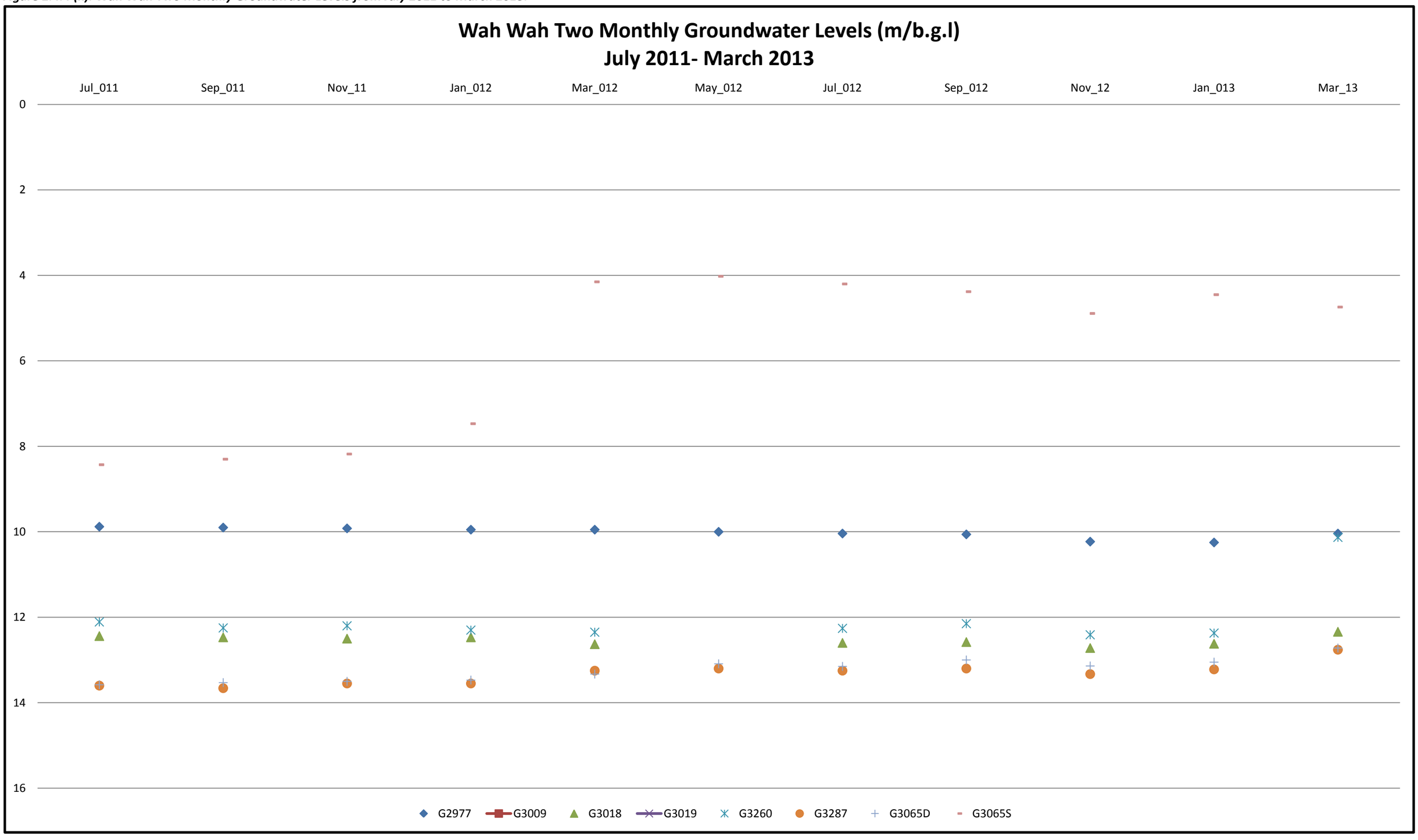


Figure 2.4.4 (l): Map of Wah Wah from September 2012 to March 2013 - SWL – Shallow

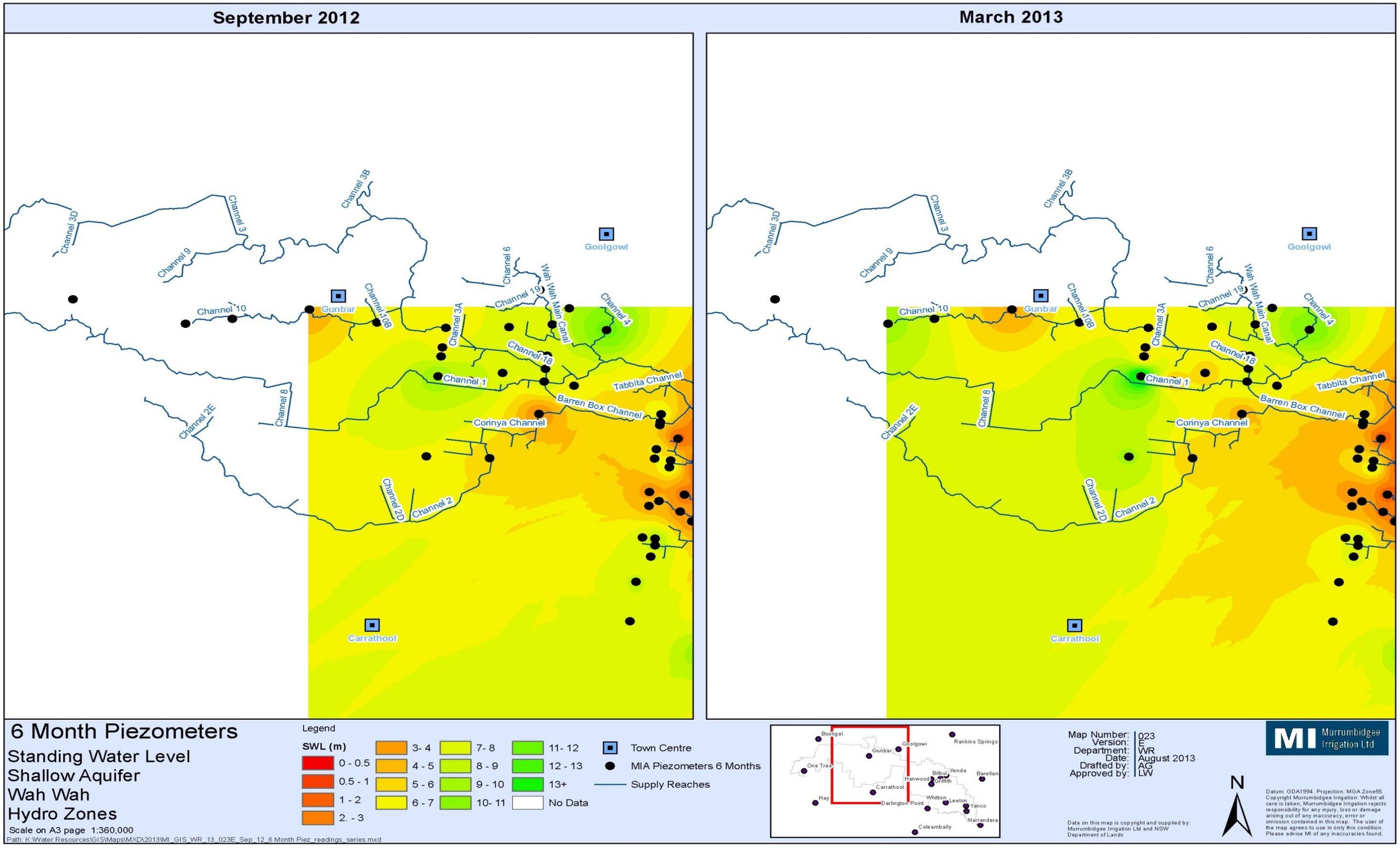
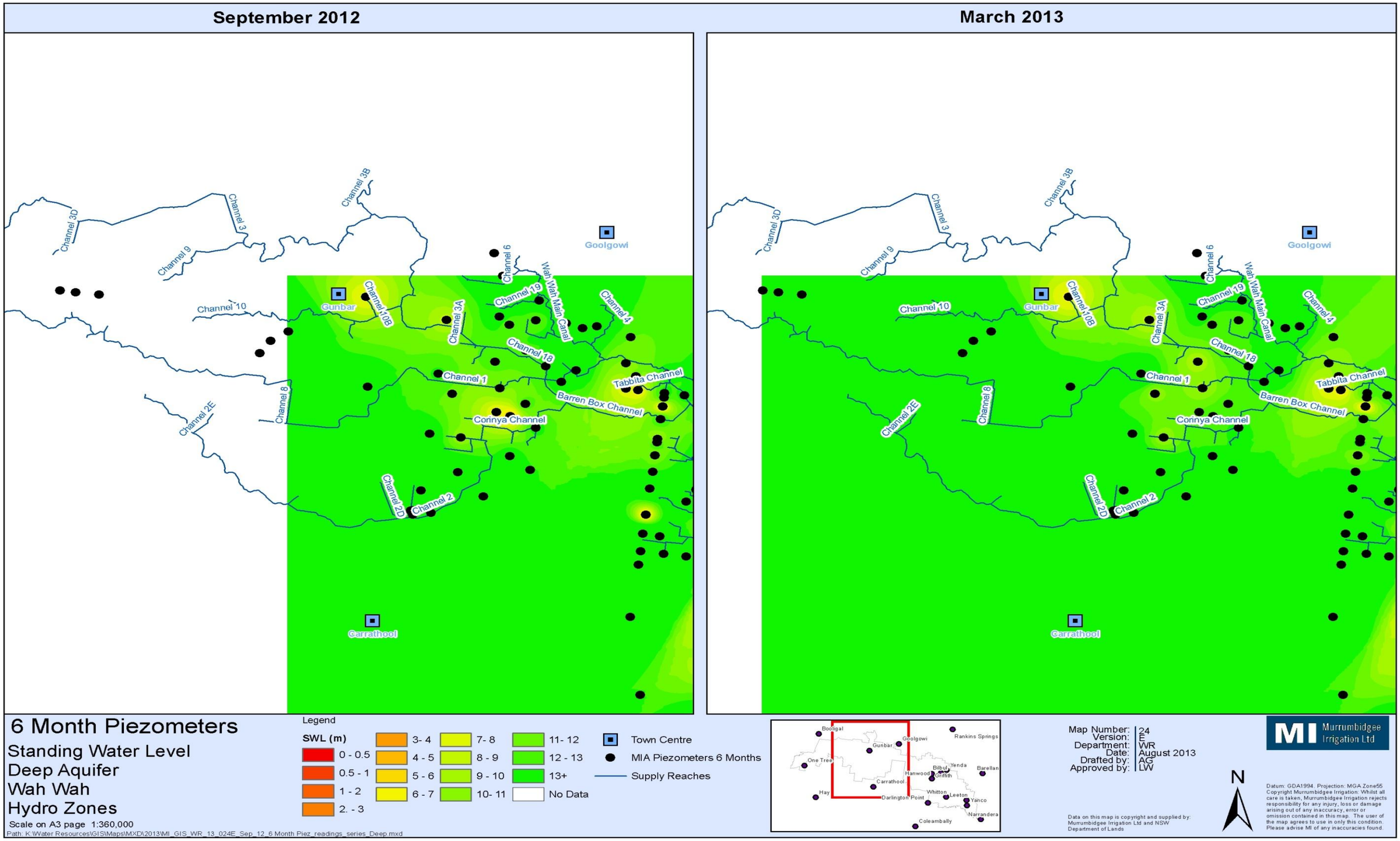


Figure 2.4.4 (m): Map-of Wah Wah from September 2012 to March 2013 – SWL - Deep



2.4.5 SEASONAL VARIATIONS ACROSS THE MIA

Data collected from this program is represented in the maps 2.4.5 (a) to 2.4.5 (b) generated from groundwater level readings in the two monthly bore network for the Upper and Lower Shepperton Formations.

In the two monthly monitoring bores, seasonal averages for groundwater levels did not fluctuate greatly between the four seasons in the Upper Shepperton Formation during the 2012/13 reporting period.

Autumn in comparison to winter, spring and summer showed gradual increases in groundwater levels across the MIA of 0.5 m in most areas, particularly noticeable in the Murrami, Yenda, Bilbul and Benerembah Irrigation Districts. This is likely a result of a combination of time lag experienced across the upper Shepperton Formation from summer irrigation and rainfall between the months of April, May and June.

In the two monthly bores, seasonal averages for groundwater levels fluctuated between 0.5 m-1.5 m across all seasons, with more notable rises in groundwater during autumn and spring in Yenda, Bilbul, Murrami and some small areas of the Benerembah Irrigation District. Changes to groundwater levels across both seasons can be attributed to lag recharge in deeper formations from contributions to the Upper Shepperton Formation during irrigation seasons via vertical leakage and contributions from rainfall during wetter months.

Monitoring Groundwater Salinity in the Shepperton Formations

In March 2013, MI began monitoring salinity levels across both the two monthly and six monthly bore networks. Data collected from this program is represented in the maps below, generated from Electrical Conductivity (EC) readings in the six monthly bore networks for the Upper and Lower Shepperton Formations.

EC readings in bores drilled within the Upper Shepperton Formation range from less than 500 µS/cm to more than 10,000 µS/cm. Most notably, EC readings in these bores occur in areas where groundwater levels are within 2 m of ground surface levels. Murrami, parts of North Benerembah and places associated with permanent water bodies (such as Lake Wyangan), depressions and ephemeral wetlands showed EC levels in excess of 10,000 µS/cm.

In Yanco, Whitton, Kooba, Koonadan North East Tharbogang and northern sections of Wah Wah contained monitoring bores reading between 0 – 2,000 µS/cm. In areas closer to the Murrumbidgee River it was evident that EC readings of 0-500 µS/cm may indicate geologically low points (recharge/discharge zones) where consistent recharge from rainfall, irrigation and in some instances the Murrumbidgee River occurs in the Upper Shepperton Formation.

Remaining areas within the MIA displayed groundwater levels ranging from 2,000-10,000 µS/cm in the Upper Shepperton Formation. Those with measurements between 7,000-10,000 µS/cm are located in hydrozones where groundwater levels in most monitoring bores were within 10 m of ground surface level. Those with readings ranging between 2,000-4,000 µS/cm represent EC levels that would be expected to be recorded for groundwater exposed to little direct recharge from external sources within the Upper Shepperton Formation.

EC readings in bores drilled within the Lower Shepperton Formation saw more than 40% with EC levels in excess of 10,000 µS/cm. Areas of particular concern include Murrami, North Leeton, Griffith, Tharbogang, Lake Wyangan and eastern sections of Wah Wah. Areas that displayed readings of 7,000-10,000 µS/cm in the Upper Shepperton had bores within the lower Shepperton displaying EC levels of more than 10,000 µS/cm, suggesting that water quality in the Upper Shepperton Formation is during drier periods of rainfall

influenced by water quality in the Lower Shepperton Formation through a process whereby salts may be deposited in upper layers through groundwater level rise and fall over time.

Similarly bores with EC levels in the Upper Shepperton ranging from 0 – 2,000 µS/cm displayed similar readings within the deeper formation suggesting that recharge events are influencing the Lower Shepperton Formation and/or vertical leakage between units occurs in areas due to topography and local natural recharge/discharge flow process superimposed on regional groundwater flow.

MI will continue to monitor groundwater salinity trends in monitoring bores in both the two monthly and six monthly bore monitoring networks over the next three years to reassess any changes in regional EC levels in response to groundwater level rise and fall and against localised irrigation patterns and other parameters.

Figure 2.4.5 (a): Map of Seasonal Variations of Groundwater Levels – Shallow Formation

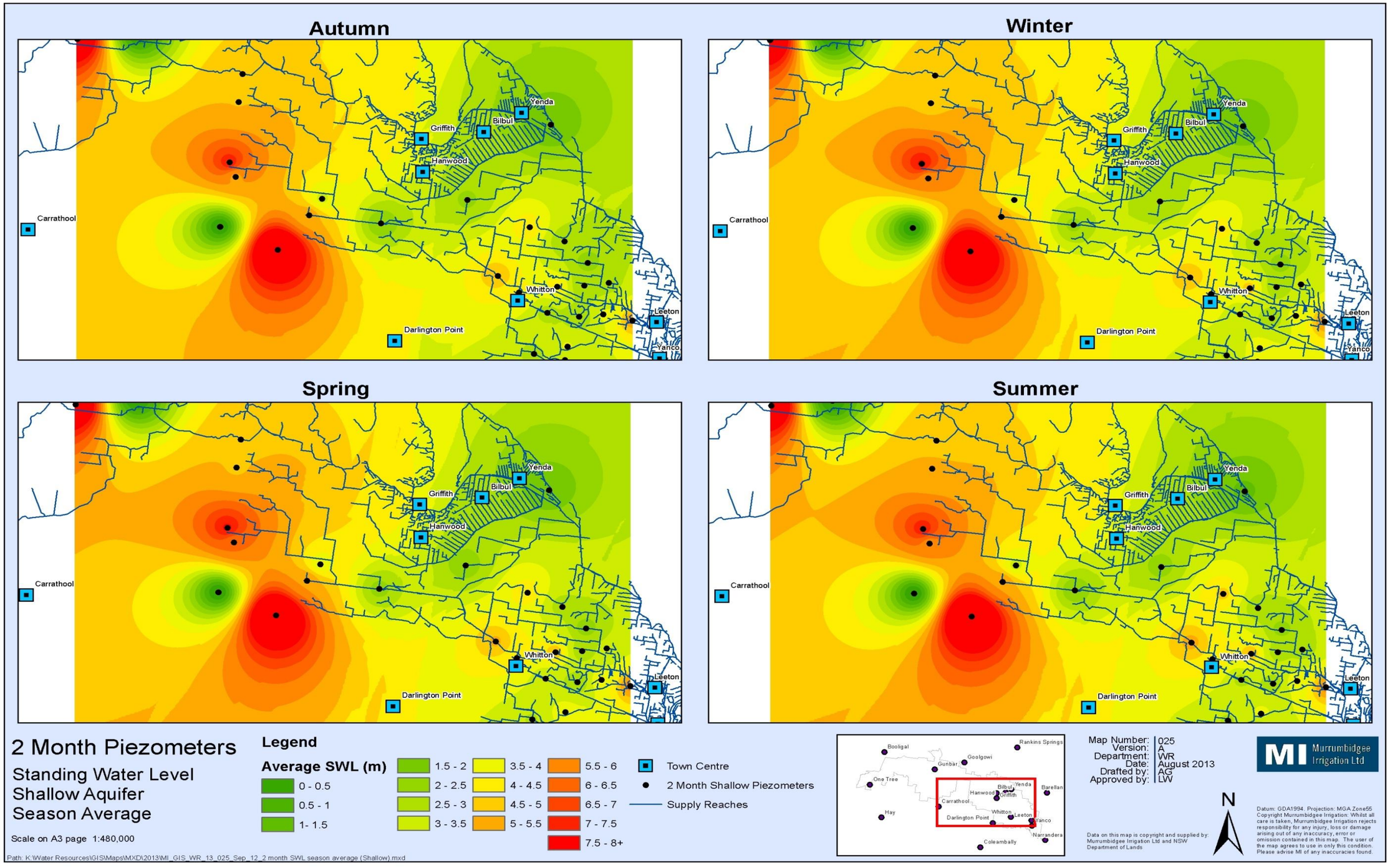


Figure 2.4.5 (b): Map of Seasonal Variations in Groundwater Levels - Deep Formation

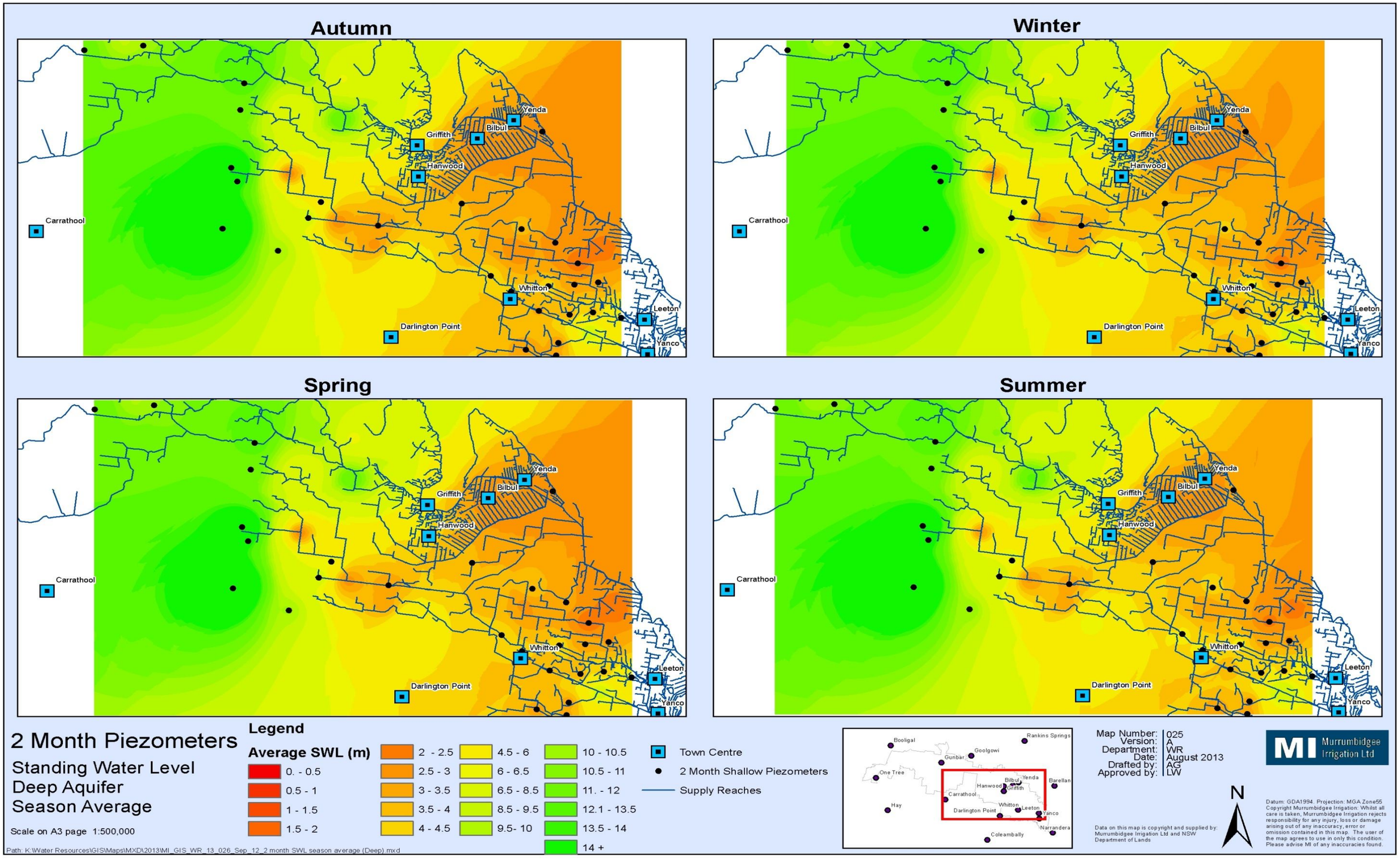
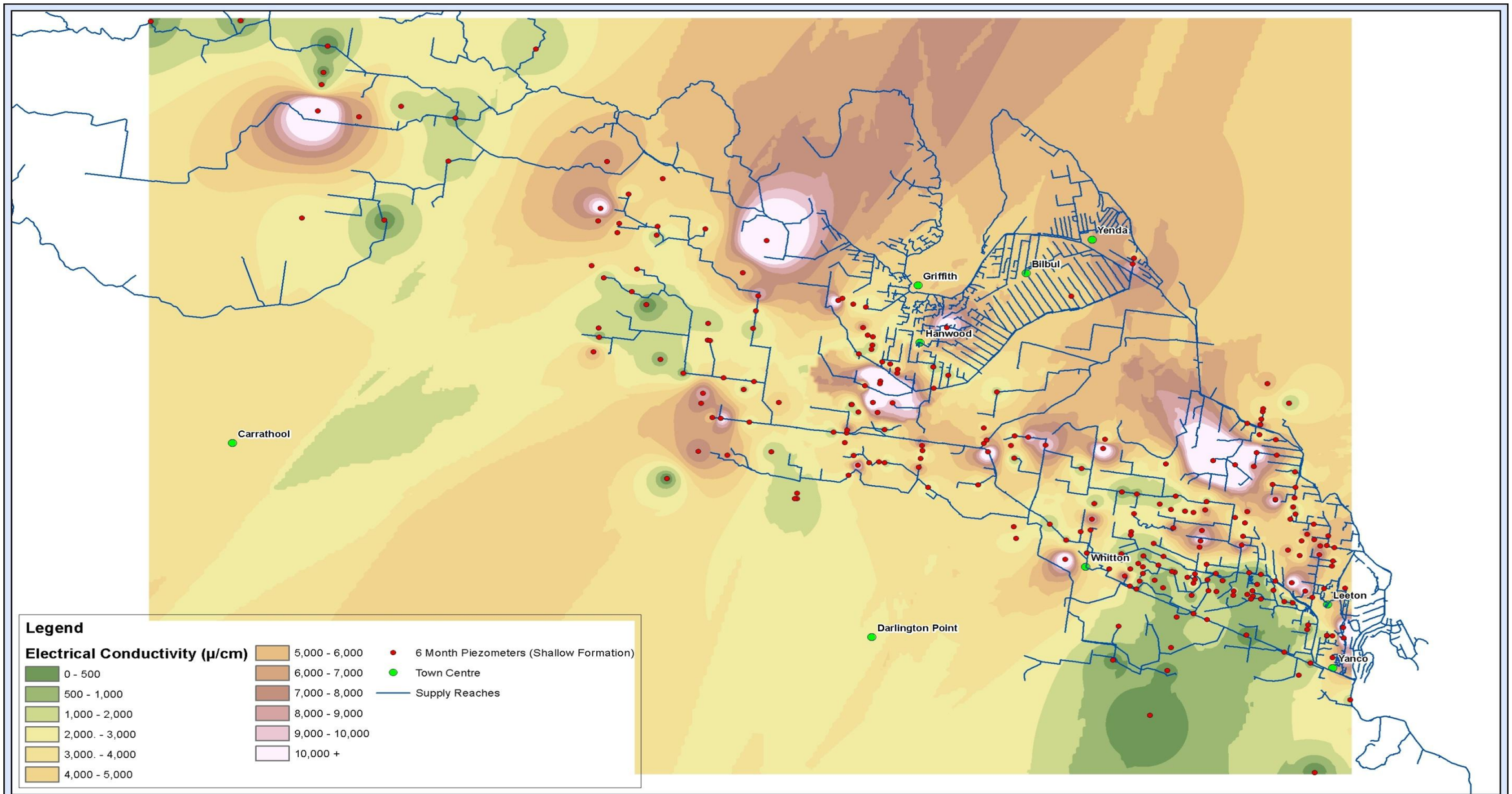
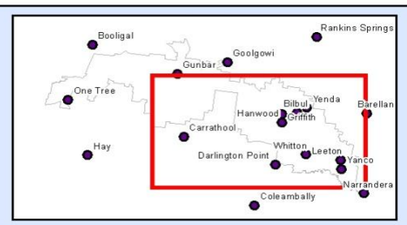


Figure 2.4.5 (c): Map – Electrical Conductivity Readings in Groundwater Bores - Shallow Formation



6 Month Piezometers Readings 2013

Shallow Formation Electrical Conductivity (µ/cm)



Map Number: 017
Version: A
Department: WR
Date: August 2013
Drafted by: AG
Approved by: LW

Murrumbidgee Irrigation Ltd

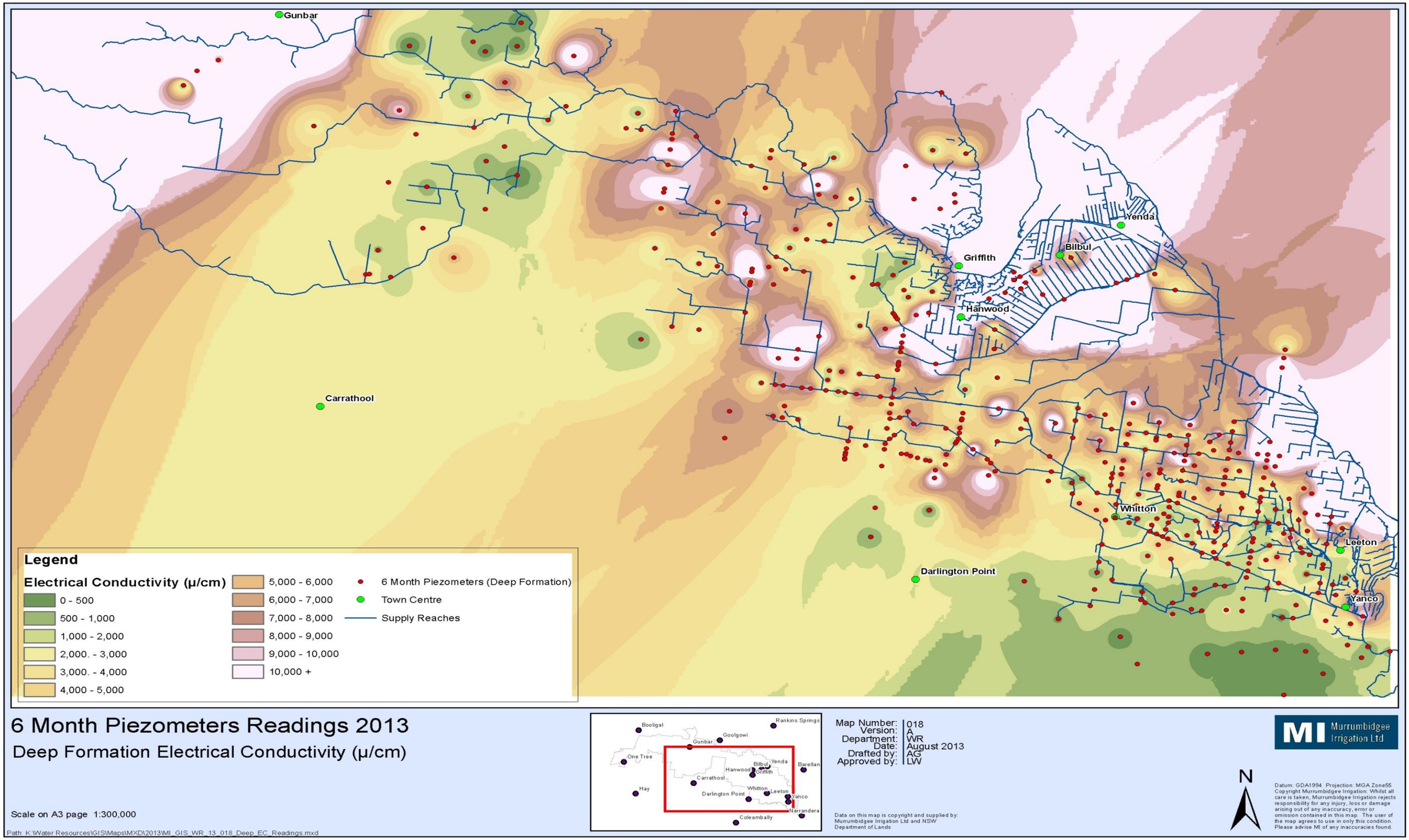
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Figure 2.4.5 (d): Map – Electrical Conductivity Readings in Groundwater Bores - Deep Formation



6 Month Piezometers Readings 2013

Deep Formation Electrical Conductivity (µ/cm)

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Map Number: 018
Version: A
Department: WR
Date: August 2013
Drafted by: AG
Approved by: LW

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2.5 GROUNDWATER CONTAMINATION

There were no known, or reported, groundwater pollution events during 2012/13.

2.6 GROUNDWATER VOLUMES AND SALT LOADS (TILE DRAINS AND PUMP SITES)

2.6.1 TUBEWELLS

There are fifteen tubewells installed in the MIA to provide drainage to horticultural areas, principally in the Yanco area. It is to be noted that eight of the tubewells are no longer operational. A map of tubewell locations is shown in Figure 2.6.1 (a).

Table 2.6.1 (a) below shows a notable decrease in discharge volume compared to the previous season, a reflection of a reduction in rainfall over the 2012/13 reporting period in comparison to the previous irrigation season. The total salt load decreased accordingly. The total discharge volume from Tubewells during the 2012/13 season decreased by 989 ML over the year with a reduction of 3874 tonnes of salt disposed into MI's Drainage System from 2011/12.

Table 2.6.1 (a): Groundwater volumes and salt loads extracted from tubewells

Name	2012/13 Discharge (ML/year)	2012/13 Salt Load (T/year)	2011/12 Discharge (ML/year)	2011/12 Salt Load (T/year)	2010/11 Discharge (ML/year)	2010/11 Salt Load (T/year)	2009/10 Discharge (ML/year)	2009/10 Salt Load (T/year)
Five Bridges	109	84	234	231	27	33	268	181
Gil Gil	499	1025	620	1,044	482	907	493	790
Yanco West	311	563	399	508	154	306	304	420
South Leeton	0	0	-	-	193	347	30	47
Baulch's	0	0	-	-	-	-	-	-
Wamoon	373	223	1,031	501	275	169	407	250
East Wamoon	0	0	0	0	28	18	176	105
TOTAL	1,292.	1895	2,284	2,284	1,159	1,780	1,678	1,793

***Source**: MI Electrical Services, MI Environmental Services*

Additional monitoring was undertaken at the South Leeton Tubewell, which in response to elevated levels in EC readings recorded during the March 2013. In June 2013 a pumping test on the bore was undertaken, recording EC levels every 10 minutes to gain an understanding of the relationships in EC levels over pumping time. Results of this test are represented in Table 2.6.1 (b) below.

Temperature, EC, time and pumping volumes were recorded over the 30 minute period. Result showed that over time, temperature decreased and salinity increased. There was not enough data collected to ascertain reasons as to why Tubewell EC readings measured in discharge from the south Leeton Tubewell were markedly higher than those tested in other monitoring Tubewells suggesting

that further investigation will be required at the South Leeton Tubewell over the 2013/14 reporting period.

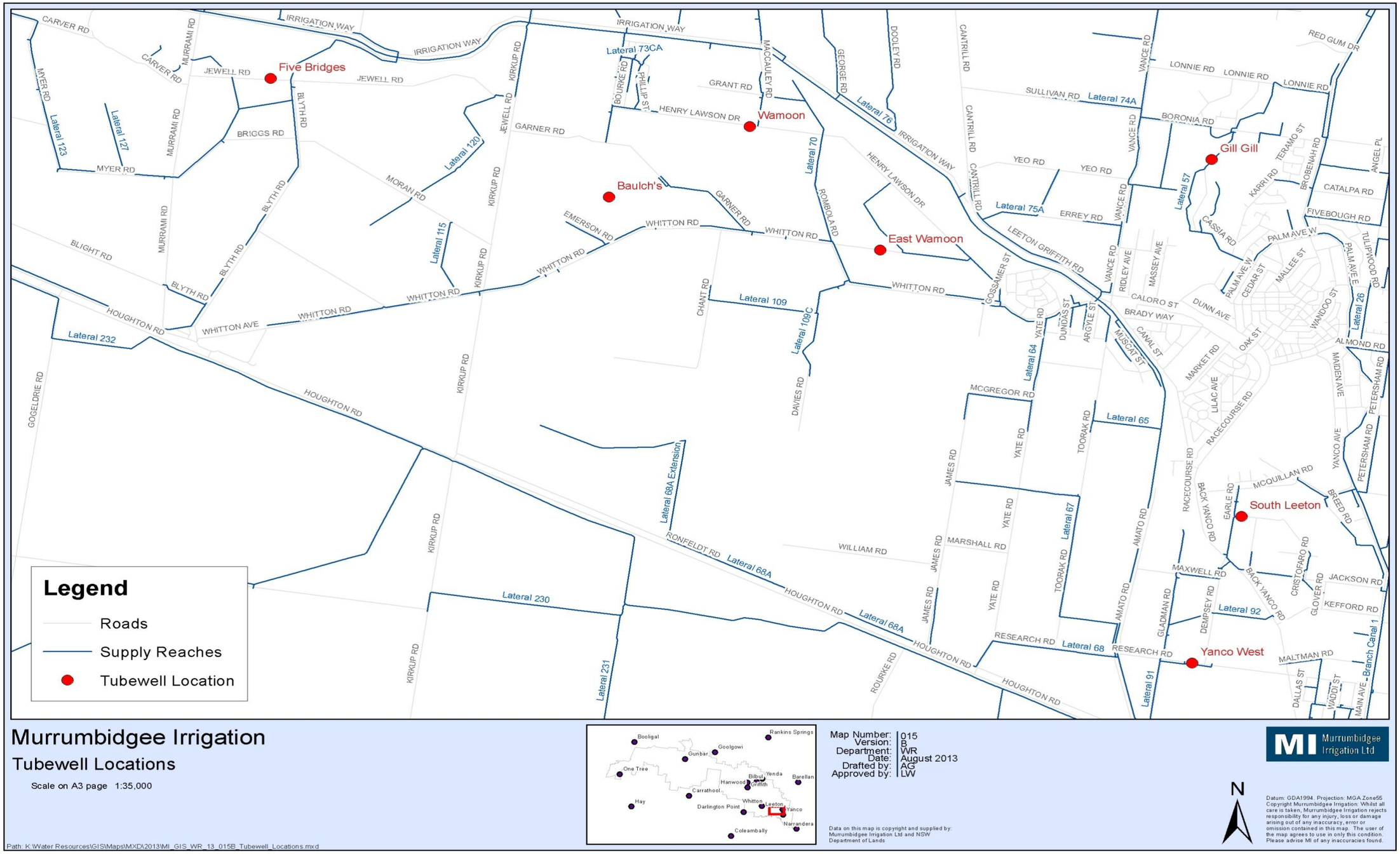
Table 2.6.1 (b): South Leeton Pump Test- June 2013

Duration	Depth to Screen (m)	Pump Setting (m)	Pump Status	Flow (L/s)	C)	EC Reading (µS/cm)	EC Loading (Tonnes)
10 min	12.80	12.26	On for Test	2.87	26.3	5532	93.11
20 min	12.80	12.26	On for Test	2.87	19.4	6005	74.55
30 min	12.80	12.26	On for Test	2.87	18.7	6075	72.70



Photo from South Leeton Tubewell Investigation - June 2013

Figure 2.6.1 (c): Map – MI Tubewell Locations



Murrumbidgee Irrigation

Tubewell Locations

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Map Number: 015
Version: B
Department: WR
Date: August 2013
Drafted by: AG
Approved by: LW

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3. FLOODS AND FLOODPLAIN MANAGEMENT

3.1 FLOOD LEVELS, FLOODPLAIN STRUCTURES, FLOOD RELEASES

Since the amount of rainfall that was recorded for the 2012/13 season was close to the long term average, no flood operations were put in place.

3.2 FLOOD REPORTING – LOWER MIRROOL CREEK FLOODWAY

The amount of rainfall recorded during the 2012/13 season was close to the long term average and as a consequence no flood operations were conducted at this site.

MI has been asked to include additional monitoring requirements at the floodway release structure under amendments made to EPL4651 in January 2013. MI met with Thiess Service Pty Ltd to assess options for the installation of an automated flow measuring device at the floodway. Due to the design of the floodway MI is unable to install an accurate flow measuring device at this site. MI will be working with Thiess Services to install flow measuring devices upstream and downstream of the floodway on Supply Channel S-5-BBOX-070E to calculate approximate discharges from the floodway during release. MI has also incorporated the testing of metals at this site during discharged flow.

3.3 LAKE TALBOT (Work Approval 40WA404855)

In late June 2013, Narrandera Shire Council (NSC) contacted MI with the request to drain Lake Talbot for weed control purposes. NSC also expressed concerned about the integrity of the channel bank as MI was in the process of draining the Main Canal for the purpose of winter maintenance works. Following discussions with NSW Department of Primary Industries, as per Condition 8 of the Approval, it was decided not to drain Lake Talbot.

4. AQUATIC ENVIRONMENT MANAGEMENT

4.1 SIGNIFICANT CHANGE TO MAJOR WETLANDS

The current reporting period of 2012/13 saw the continuation of improvement and rehabilitation of the major wetlands in the Murrumbidgee Irrigation Area (MIA). The project is aimed at improving the extent and quality of wetlands, and includes the following:

Barren Box Storage and Wetland (BBSW)

BBSW Rehabilitation Plan is currently in the implementation stage with all major works to be completed by 2014. The vision for the BBSW Rehabilitation Plan is '*to create an ecologically diverse and functioning Black Box wetland cell and surrounding grassy woodland/chenopod shrubland that respects, preserves, and enhances the cultural significance of the area'.*

This is being achieved through revegetation, management of weeds and pest animals as well as fire in the wetland cell. Since 2009, the entire 1,650 hectares of the wetland cell has been direct seeded or aerially sown with locally collected native vegetation species. The outer perimeter of the cell supports a Boree grassland environment and wetter middle sections support a Black Box community.

Significant floods in March 2012 resulted in the wetland cell reaching total inundation. It is envisioned that this will impact the success of aerial sowing and direct seeding within the wetland cell. A monitoring plan has been developed for implementation in Spring 2013 to determine vegetation establishment and soil quality. Directions for future rehabilitation will be determined from this information.

BBSW Waterbird Monitoring

A detailed waterbird monitoring program focusing on the intermediate cell was initiated in April 2007. The objective of these surveys was to establish baseline data on waterbird species and their abundance in BBSW.

From mid March 2008 to January 2012, the number of species of waterbird on the wetland was quantified at regular intervals, totalling 88 counts, with simultaneous measuring of water volume in the wetland. Data was then synthesised with the final report being completed in July 2012.

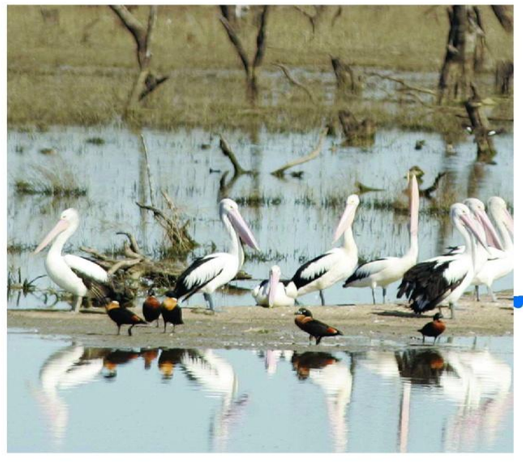
The first two years of the study (2008 - 2010) were characterised by little rainfall in the catchment and drought conditions over South East Australia, especially New South Wales. By contrast the third year was exceptionally wet (2010/11) and natural wetlands were flooded over most of Australia. The intermediate cell had high water volumes throughout almost all of the study period, with no significant drying during the summer months as occurred in previous years. Compared to previous years, the total number of waterbirds and the percentage of surveys on which most species were recorded were all significantly lower.

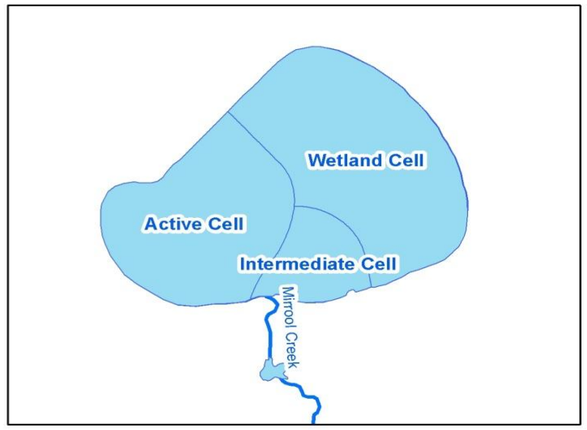
The fourth year (2011/12) also had high rainfall with most inland wetlands flooded across the country. The intermediate cell was fully flooded and the water volume fell steadily until August when volumes held steady until November. The number of species recorded and total number of water birds was higher than the 2010/11 season.

Each year over the four year study, unusual events have been recorded with particular species appearing in unprecedented amounts. An overall synthesis of main trends in numbers suggest that numbers of waterbirds in the intermediate cell are influenced by intrinsic events occurring within the intermediate cell and extrinsic events occurring in wetlands elsewhere, with the main event being water volume. In the first two years of study, the total number of waterbirds was positively correlated with water volume. A strong influence of extrinsic events is suggested by the low numbers of the great majority of species during the last two years of the study. The main difference between the two periods was the drought conditions of the first period followed by the high rainfall in the second period. It is likely that the intermediate cell serves as a drought refuge for birds, whereas in wetter years birds travel to other wetlands to breed and feed. The intermediate cell is the only wetland regionally on which Great and Pied Cormorants breed regularly in large numbers.

Figure 4.1 (a): MI GIS WR 13 032 Barren Box Swamp







Booligal
Goolgowi
Gunbar
One Tree
Yenda
Bilbul
Griffith
Barellan
Mirrool Creek
Hanwood
Little Mirrool Creek
Carrathool
Murrumbidgee River
Hay
Whitton
Leeton
Darlington Point
Yanco
Narrandera

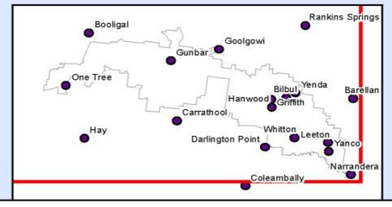
Legend

- MIA Boundary
- Storages and Swamps
- Murrumbidgee River
- Mirrool Creek
- Town Centre

Murrumbidgee Irrigation Area
Barren Box Storage and Wetland

Scale on A3 page 1:600,000

Path: \\filesvr\Environ\Water Resources\GIS\Maps\MXD\2013\MI_GIS_WR_13_032_Barren_Box_Swamp.mxd



Map Number: 032
Version: A
Department: WR
Date: July 2013
Drafted by: AG
Approved by: JH

MI Murrumbidgee Irrigation Ltd

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Data on this map is copyright and supplied by: Murrumbidgee Irrigation Ltd and NSW Department of Lands

Datum: GDA1994. Projection: MGA Zone55
Copyright Murrumbidgee Irrigation: Whilst all care is taken, Murrumbidgee Irrigation rejects responsibility for any injury, loss or damage arising out of any inaccuracy, error or omission contained in this map. The user of the map agrees to use in only this condition. Please advise MI of any inaccuracies found.

Mirrool Creek Crown Reserve

The Mirrool Creek project is being implemented as an 'icon' project for the MIA.

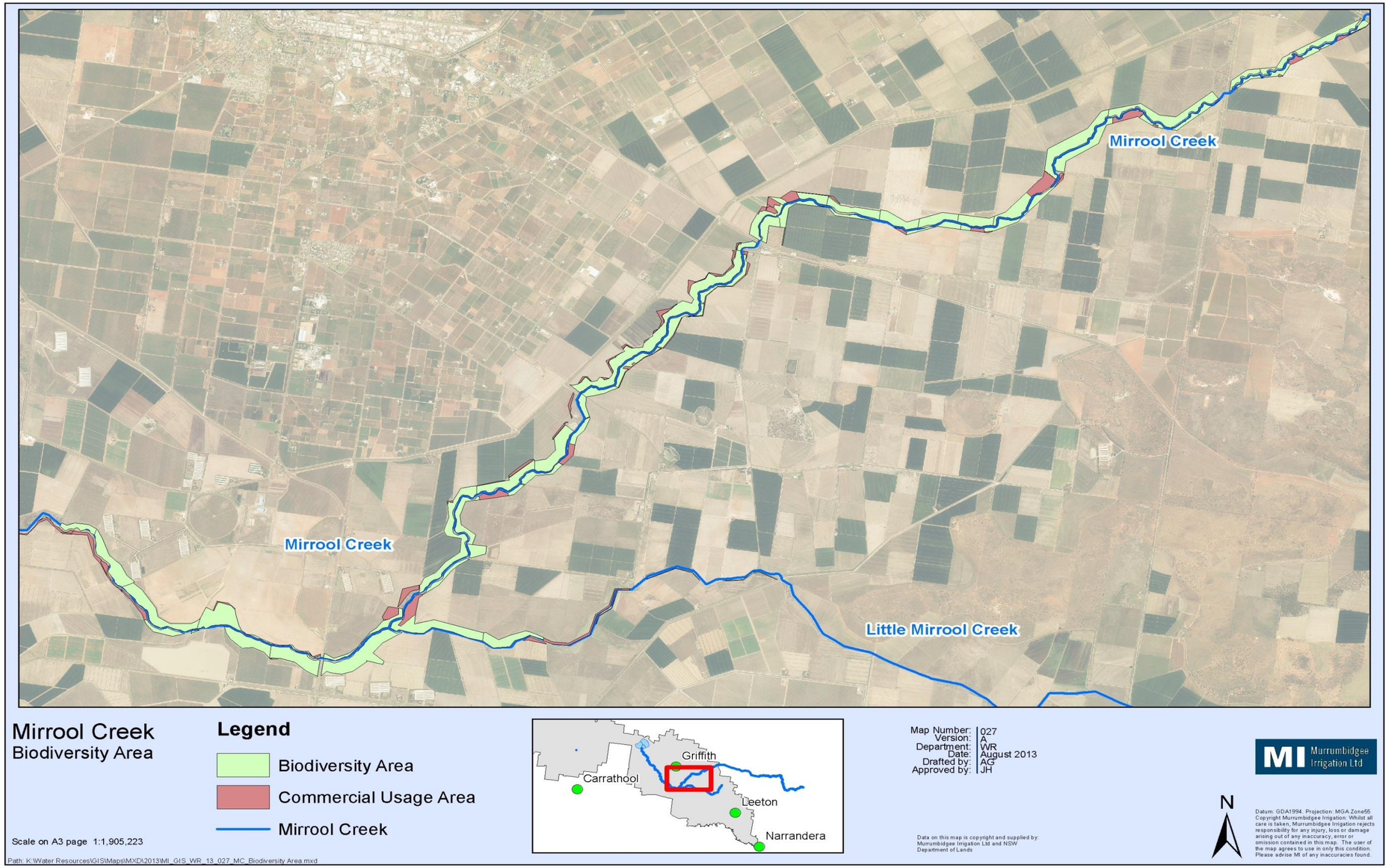
An engagement process was undertaken in 2010/11 to negotiate licences between the Mirrool Creek Reserve Trust and adjoining landholders. The licence agreements guide the management of the Creek for biodiversity purposes in accordance with permissible uses. All licences have been negotiated with 85% percent of landholders taking a licence for the crown area.

In 2012, 280 hectares (ha) was direct seeded on Mirrool Creek, with a further 240 ha planned for direct seeding in Spring 2013, which will complete the direct seeding of this area. Monitoring of the revegetation will then be carried out to determine the success of the direct seeding and identify potential problems for vegetation establishment.

In Autumn 2013, weed control was carried out on all reaches, including post plant spraying to control broad leaf weeds that outcompete seedlings, and Boxthorn removal. Fencing to control stock movement has been completed on nearly all licence areas where required.

Cultural Assessments conducted by Murrumbidgee Irrigation's Cultural and Heritage Officers preceded all plantings. Sighted artefacts were visibly marked with marker flags and buffer zones were determined around each site to prevent disturbance. Artefacts include cores, tools, flaked materials, grinding stone fragments and hearths (ovens).

Figure 4.1 (b): Map of Mirrool and Little Mirrool Creek Crown Reserve showing the area reserved for biodiversity purposes (revegetation) and commercial usage areas.



4.2 NOXIOUS WEEDS

Alligator Weed in the MIA
The control program for Alligator Weed has continued over the last year. Inspections have been conducted at Barren Box Storage and Wetland (BBSW), downstream channel systems of BBSW and the floodway at Wyvern Station.

Inspections and treatment took place in November 2012 and March 2013.

Barren Box Storage and Wetland
Three new plants were found in 2012 at drain site D-2-2370-020E and treated; this was again inspected on 4 February 2013 with minor re-growth reported.

No plants were found in the bi-wash area in 2012/13, however two plants were found in BBSW, one new plant noted near Johnsons Dam on 15 May 2013.

Johnsons Dam was inspected after treatment with eight small plants being reported.

Channel System
Four plants were found along supply channel S-5-CH01-220E on 23 November 2012, with an additional two plants discovered within the same section of channel on 13 February 2013.

On 19 February 2013 one small plant was found along supply channel S-5-CH03A-020E.

Floodway
A small plant was found in the Floodway on 12 January 2013.

Outfall Channel
Two plants were found along supply reach S-5-BBOX-060E on 5 November 2012 with another seven plants detected at supply reach S-5-BBOX-090E, an additional five noted on 7 February 2013 and two later noted on 23 April 2013.

Future Alligator Weed inspections will be undertaken in October 2013.

All Alligator Weed found for this reporting period was treated with Brushoff (600 g/kg metsulfuron methyl) and GPS co-ordinates have been recorded for future inspections of re-growth at these sites. Any large plants found are removed and buried at BBSW.

Sagittaria and Alisma Weed Management - Griffith and Leeton Areas

Inspections of *Sagittaria spp* during 2012/13 reporting period have been carried out monthly from September 2012 through to the end of June 2013. Detected plants are treated with Roundup Biactive (360 g/L glyphosate) in accordance with an APVMA off label Permit: 11856 for use of the rate of up to 10L per 100L or 40L per hectare.

In July 2013, MI treated approximately 9.7 hectares of drainage channels infested with Sagittaria with Casoron G (67.5 g/kg dichlobenil) under Australian Pesticides and Veterinary Medicines Authority (APVMA) Permit: 12717

In 2012/13 MI has also undertaken trial testing on some drains in the Leeton area in managing the weed *Alisma lanceolatum* by applying Casoron G.

4.3 DISCHARGE OF BLUE-GREEN ALGAE

MI undertake regular visual checks, field and lab sampling for blue green algae in supply and drainage channels including major storages prior to and during the irrigation season. Visual inspections are conducted on river drains during discharge sampling programs.

Complaints received in relation to algae, mostly during the summer months, are inspected with 24 hours of reporting with in-field and lab sampling undertaken. MI is also working with the University of Sydney to monitor algal behaviour in Barren Box Storage & Wetland and Willow Dam (where Mirrool Creek and Main Drain J contribute to supply water to the Wah Wah Irrigation Area and District). MI is also a member of the Regional Algal Coordination Committee and contributes to regular reporting at a local, regional and national level, adopting the committee's red light approach to monitoring and reporting of algae issues across the MIA.

No blue-green algae in a Red Level Action Mode was found in water discharged from MI's supply or drainage channels to waters outside of our Area of Operations.

5. GENERAL ENVIRONMENT MANAGEMENT

5.1 SIGNIFICANT CHANGES AND CONDITION OF ENVIRONMENT ASSETS

5.1.1 MONITORING AND MANAGEMENT OF ENVIRONMENTAL ASSETS IN THE MIA

Remnant Protection and Local Native Species Revegetation

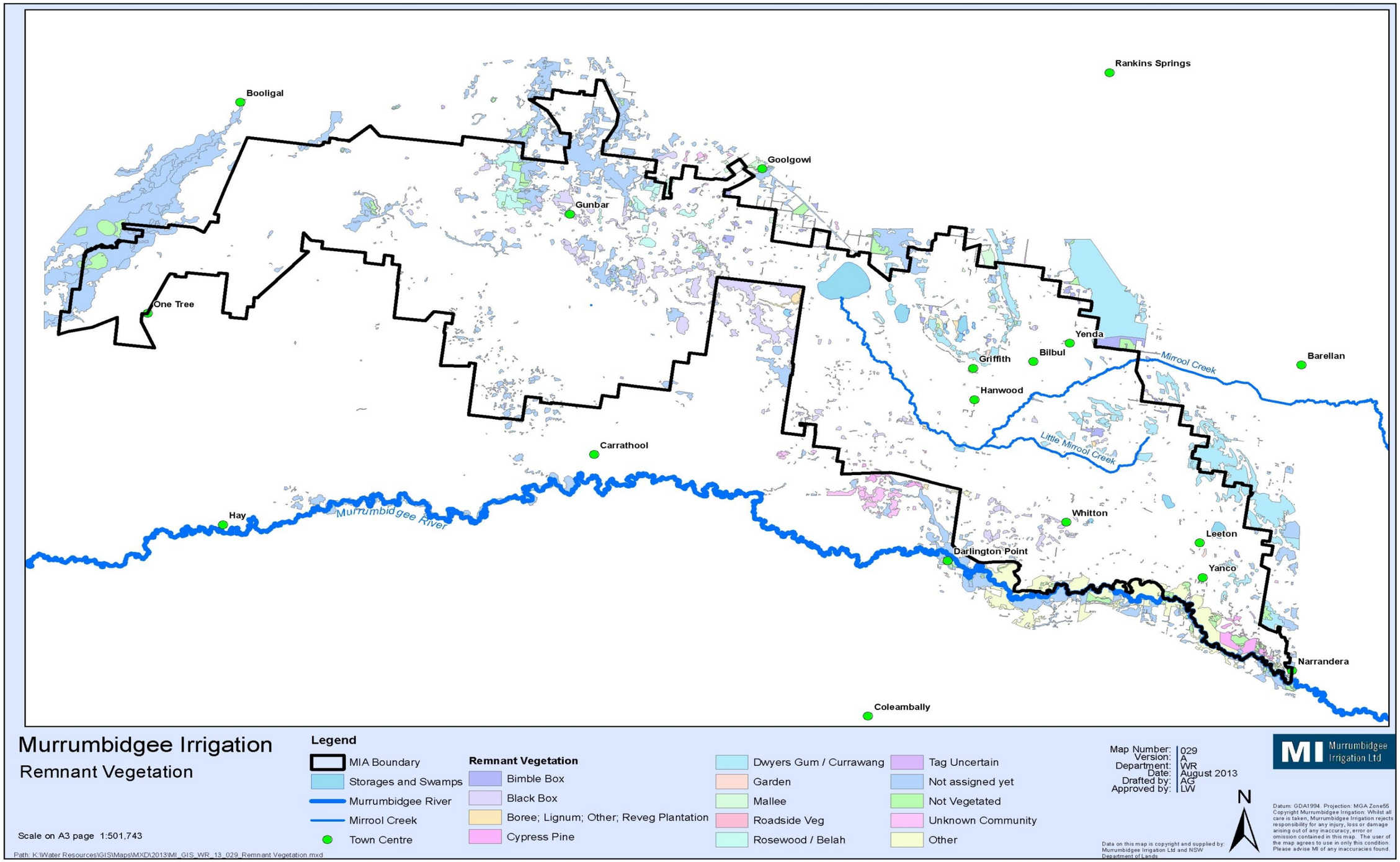
The Biodiversity Incentive Scheme to implement activities on farm to protect or enhance the natural resources of the MIA was finalised on the 30 June 2013.

Murrumbidgee Irrigation customers with Property Vegetation Plans (PVPs) approved by the Murrumbidgee Catchment Management Authority (CMA) prior to June 30 are still eligible for Biodiversity Incentive funding until full implementation of their contract. PVPs are a legally binding contract between the Murrumbidgee CMA and the landholder. They allocate money for revegetation activities and remnant vegetation protection and enhancement in the form of seedlings, tree guards, fencing and direct seeding.

For the reporting period between July 2012 to June 2013, 70 hectares (ha) of new plantings and 16.2 ha of direct seeding took place to increase the area of native vegetation within the MIA. This local native species revegetation was done under PVPs which were jointly funded by the Murrumbidgee CMA and MI (via the MIA EnviroWise levy).

Six PVPs were completed for the 2012/13 reporting year.

Figure 5.1 (a): Remnant Vegetation of the Murrumbidgee



5.2 SOIL SALINITY SURVEY (EVERY THREE YEARS)

MI has been working with CSIRO and an independent consultant, Ary Van Der Lely, over the past three years to develop a hydrogeological model of the MIA. This model is currently on hold while MI is developing a hydrodynamic model of the MIA for use in operational and strategic planning. As part of this, MI is currently undertaking a review of water and rice data as well as a monitoring network gap analysis.

Results of this review will provide MI with information to tailor monitoring programs to areas of greatest risk of compromise of the region's water resources, such as rising groundwater levels and areas more susceptible to soil salinity.

MI intends to conduct a three year study into soil salinity in areas identified in the review in accordance with a risk-based approach. The risk based approach will involve identifying an area where change is likely to occur or has recently occurred, such as the replacement of an open channel system with pressurised piping in areas where groundwater levels are less than 3 m from surface level. Monitoring that area more in-depth for a predetermined period of time will establish if the change will have or has had an effect on soil salinity.

The information collected will then be used for future reporting in the Licence Compliance Report. This approach will provide a more effective and targeted way to use our resources and will assist in identifying the salinity risk for future developments, farming practices and planning in the MIA and Districts.

Monitoring will commence in October 2013. MI has purchased field equipment to undertake sampling over the three year project. Data from this project will be presented to NSW Office of Water (NOW) at the end of the project; with milestone reporting included on a yearly basis in future reports.

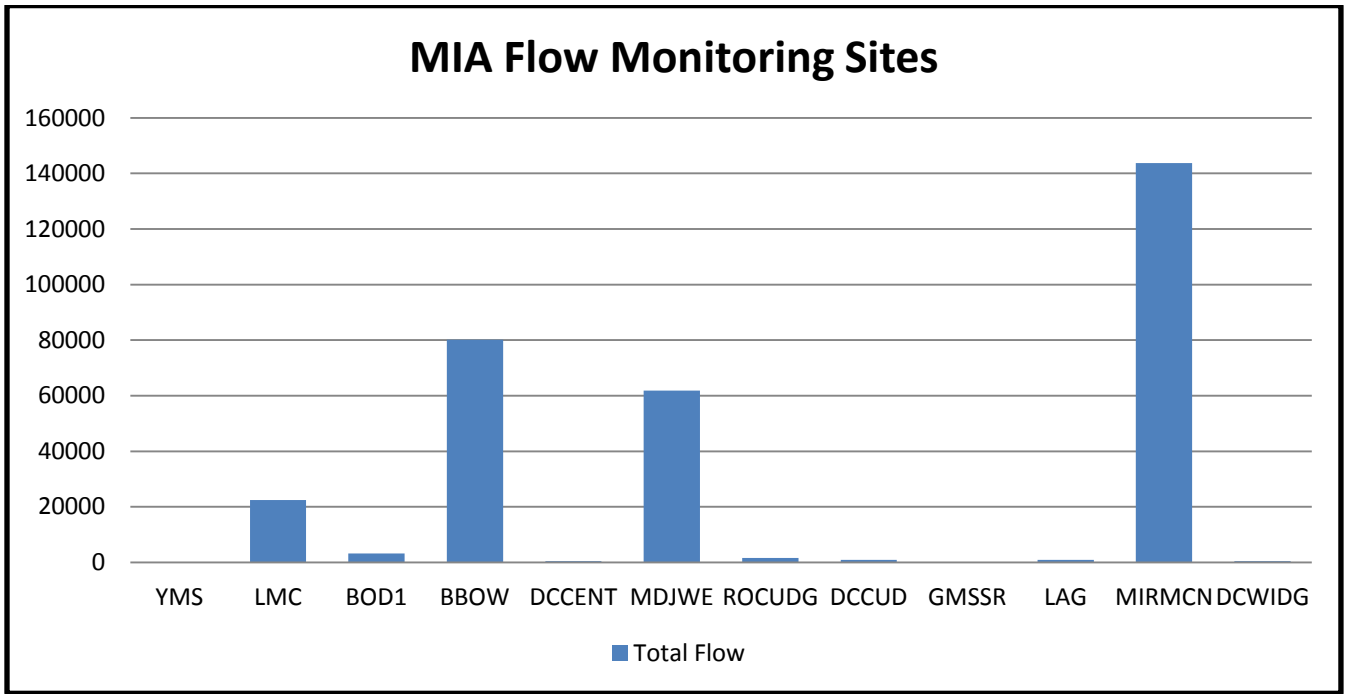
6. SALINITY ACCOUNTING AND MANAGEMENT

6.1 REPORTING REQUIREMENTS

For the current reporting year, flow data for MI Drainage Channels can be seen in Figure 6.1 below. Most notably, flows were highest at Mirrool Creek at McNamara Road (MIRMCN). This site feeds directly into Barren Box from the Mirrool Creek system and is one of the major channels used to divert water for drainage re-use within the MIA.

A total of 57 GL of drainage re-use was reported for the 2012/13 reporting period some of which would have attributed to drainage inputs from MIRMCN.

Figure 6.1: Flow Data for MI Drainage Channels Totals for 2012-13 reporting period.



Little Mirrool Creek (LMC) and Main Drain J, upstream of Warburn Escape (MDJWE) have contributed 22,390 ML and 61,810 ML respectively to drainage re-use. LMC is located within the Mirrool Creek system, taking additional water from surrounding farmland during rainfall events. Similarly MDJWE includes additional flows from much of the smaller scaled farming and urban areas surrounding Griffith during rainfall events. Supply and drainage monitoring site Barren Box Outfall Channel- Wyvern (BBOW), Mirrool Creek at McNamara's Road (MIRMCN) and sites BOD1 and DCWIDG account for supply and drainage Salinity (EC) and Flow (ML) re-use monitoring conducted as part of MI's internal monitoring program. This information is used to ensure that salinity in supply water is kept at an acceptable level for use.

As noted in the Figure 6.1 above, 2,563 ML of water was discharged to the river via our river drain sites at Cudgel Creek Roaches Escape (ROCUDG), Yanco Main Southern (YMS), Gogeldrie Main Southern Drain (GMSRR) and Gogeldrie Main Southern at Gooragool Lagoon (LAG) in comparison with previous years. No water was discharged from the Mirrool Creek Floodway (MIRFLD) during the 2012/13 reporting period.

6.2 FLOW, SALT LOAD AND SALINITY DATA

Figures 6.2 (a) to 6.2 (k) below, highlight monthly flows at the main drain reaches in the MIA for the 2012/13 reporting period.

Figure 6.2 (a): Salt load for Little Mirrool Creek 2012/13.

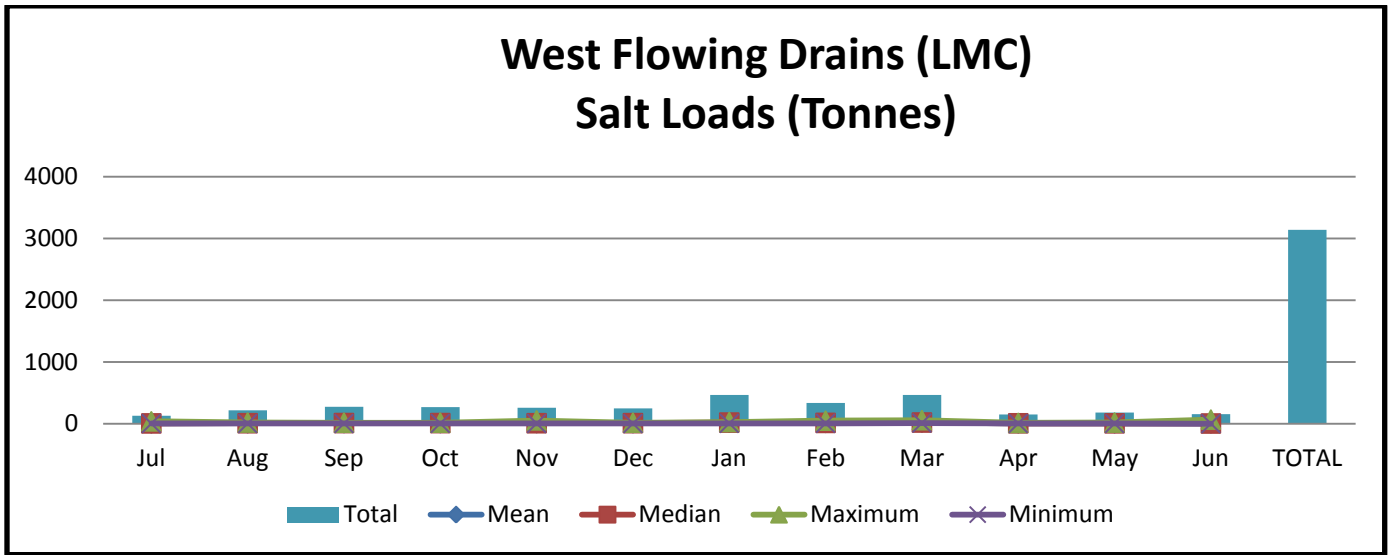
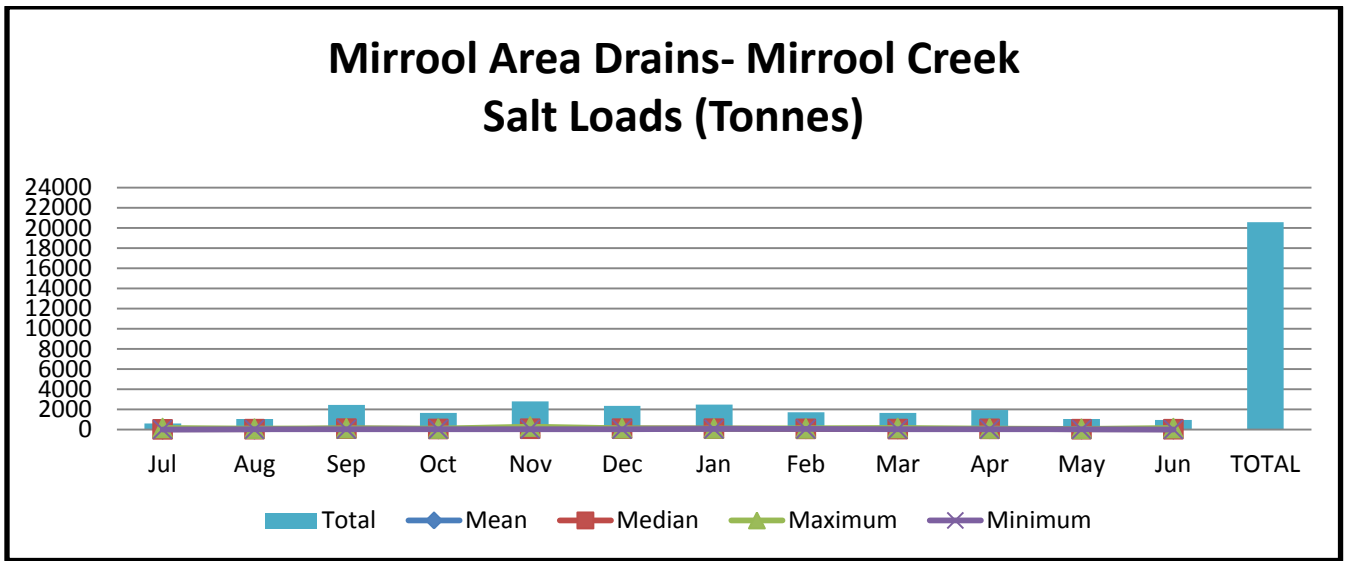


Figure 6.2 (a) shows there were no significant changes in salt load levels for LMC during the 2012/13 reporting period, with salt loadings below 500 tonnes per month. The highest readings were experienced in the month of January due to elevated temperatures around 40˚C increasing crop water demand to combat pressures from temperature rises, evaporation and lack of rain.

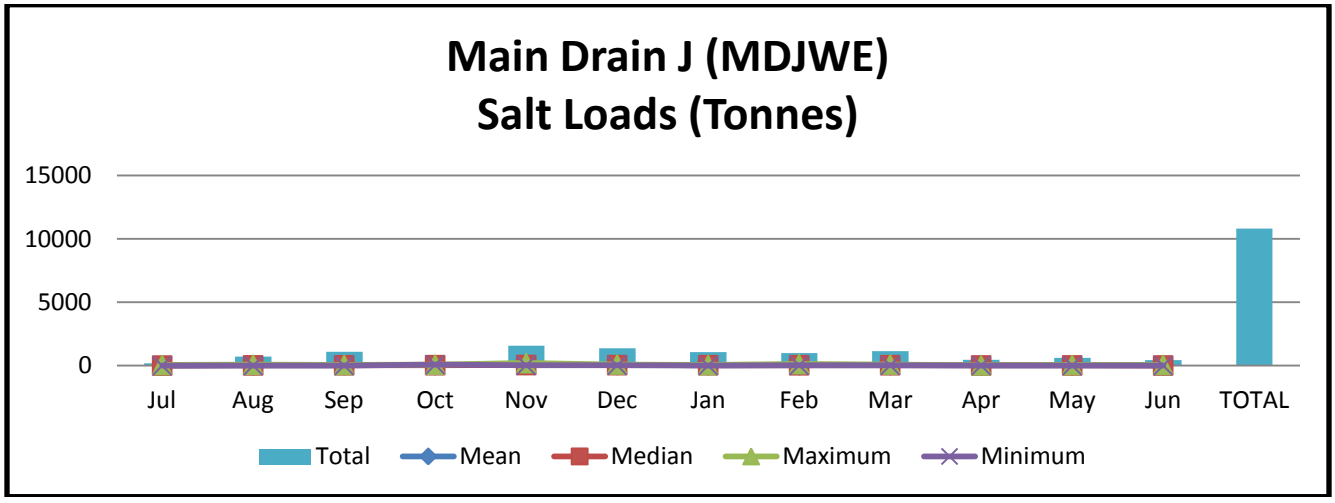
The Mirrool Area Drains capture runoff from farms surrounding little Mirrool Creek, including many rice farms.

Figure 6.2 (b): Salt load for Mirrool Area (MILMCN) 2012/13.



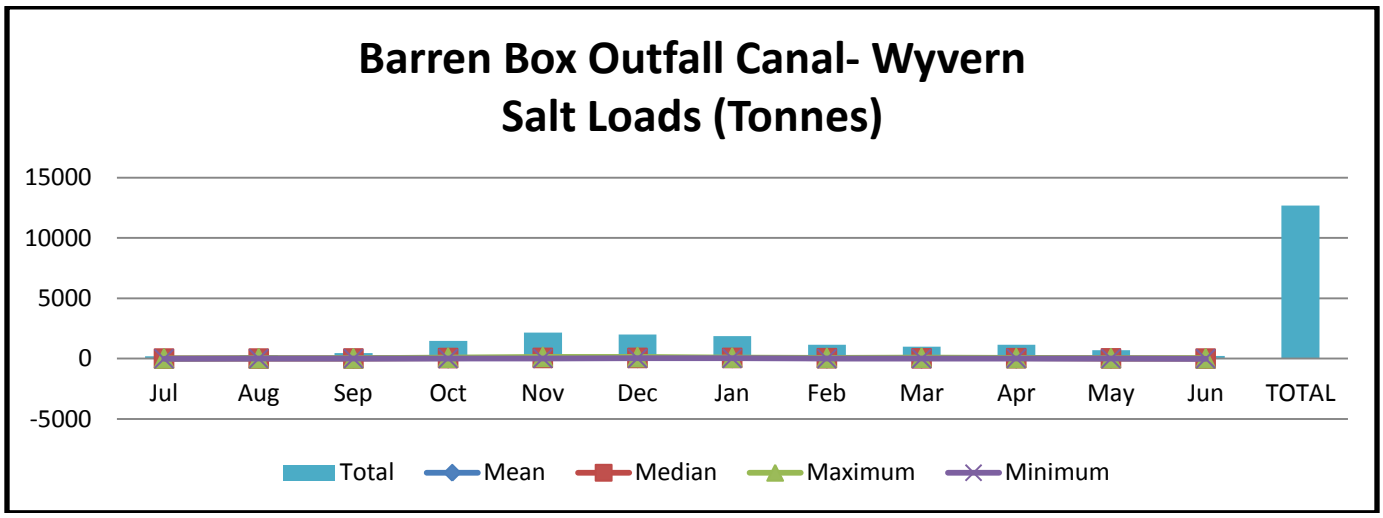
As shown in Figure 6.2 (b) above, there was an increase in salt loads from September 2012 to January 2013.

Figure 6.2 (c): Salt load for Drains (MDJWE) 2012/13.



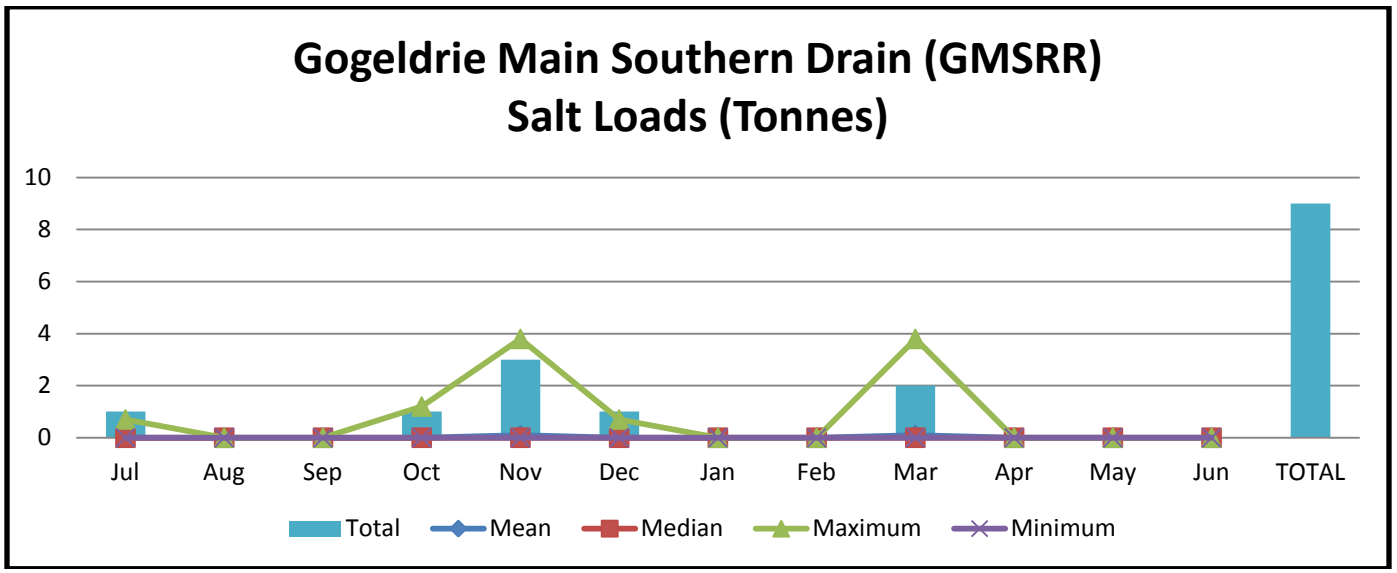
As highlighted in Figure 6.2 (c) above, the salt loads for Main Drain J were relatively low over the reporting period. This could be attributed to a decrease in rainfall and therefore less surface and sub-surface drainage assisting in the migration of salts off farms during runoff during this reporting period in comparison with the 2011/12 reporting period, and assumptions could be made that more water was retained during the 2012/13 period on farm due to drier conditions.

Figure 6.2 (d): Salt load for Barren Box Outfall (BBOW) 2012/13.



Salt loads for the Barren Box Outfall, see Figure 6.2 (d), can be attributed to the release of excess storage from Barren Box, captured from excess supply and drainage water which was transported and stored in all three cells at Barren Box Storage & Wetland from the March 2012 floods.

Figure 6.2 (e): Salt load for Yanco Area- River Drains (GMSRR) 2012/13.



As highlighted in Figure 6.2 (e) above, insignificant salt loads were reported in GMSRR due to low flow.

Figure 6.2 (f): Salt Load for Yanco Area- River Drains (LAG) 2012/13.

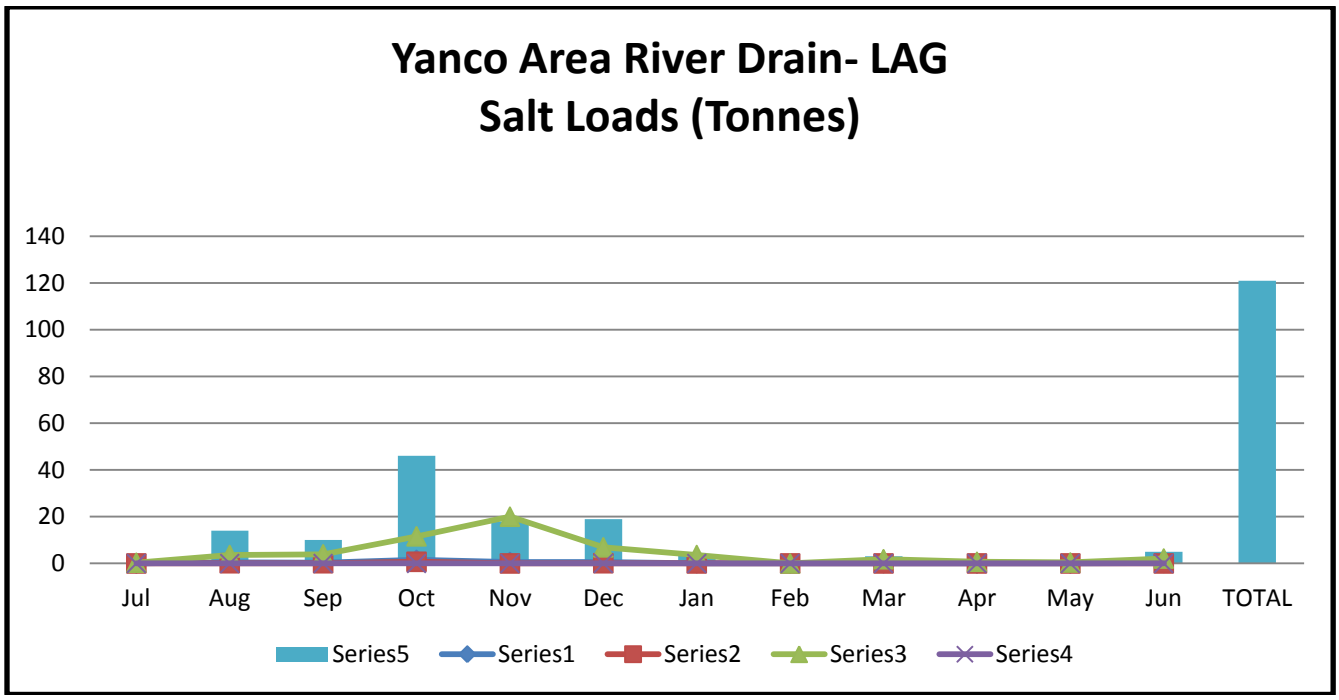
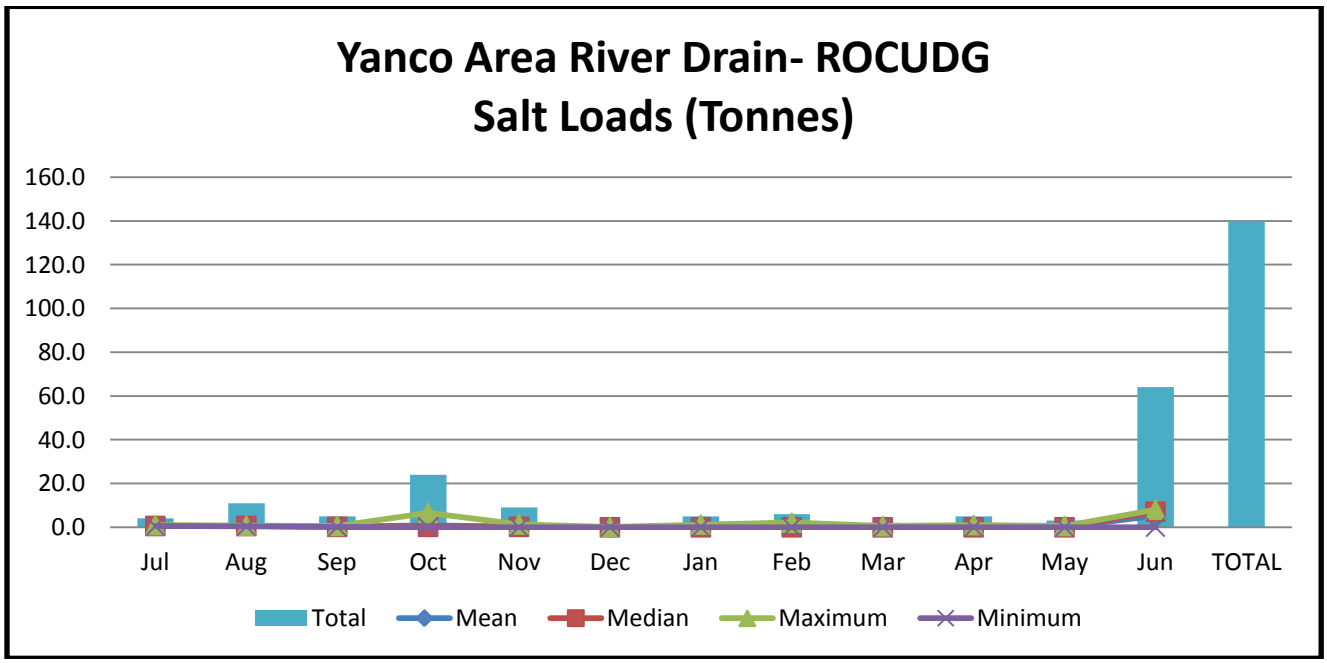


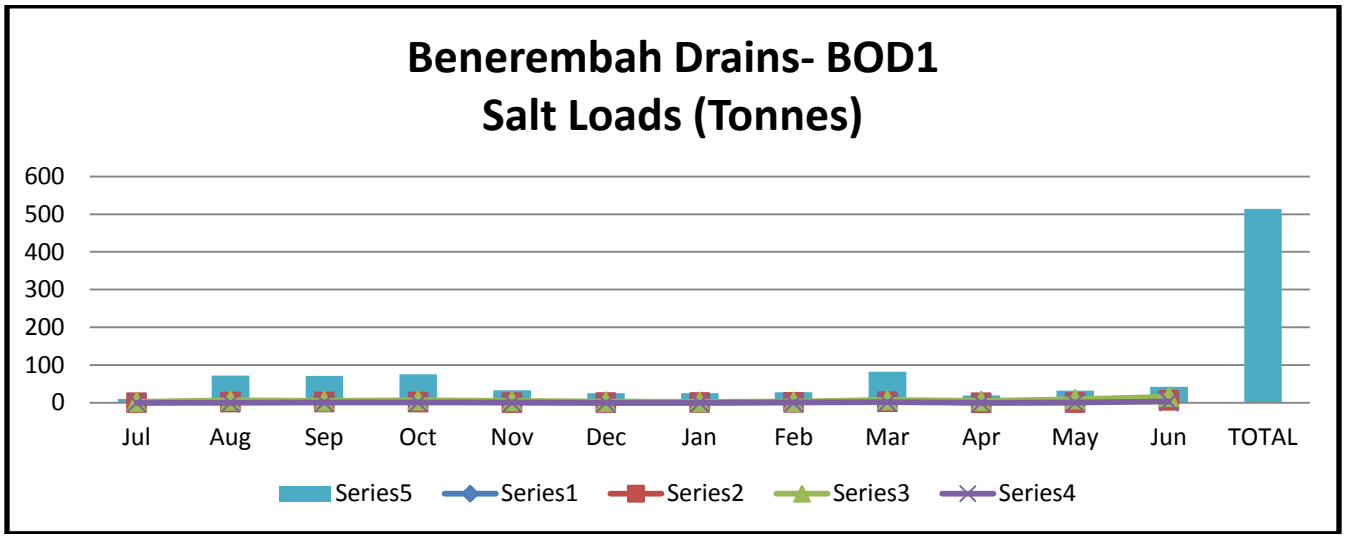
Figure 6.2 (f) shows low salt loads discharged from LAG due to low discharge volumes at this site during the 2012/13 reporting period.

Figure 6.2 (g): Salt load for Yanco Area- River Drains (ROCUDG) 2012/13.



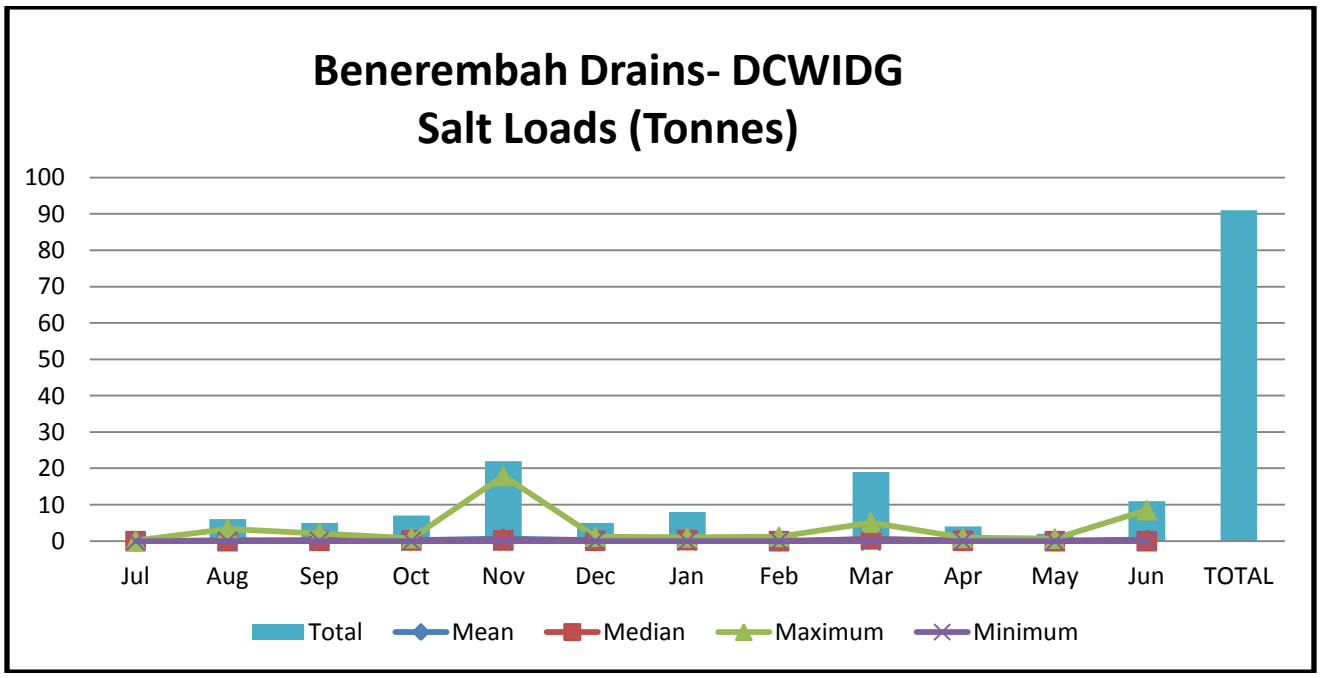
Despite low flows recorded in ROCUDG during the 2012/13 period Figure 6.2 (g) shows salt load of 64 tonnes in June 2013. This was due to the draining of the Main Canal for winter work requirements at Bundidgerry and Narrandera Regulators.

Figure 6.2 (h): Salt load for Benerembah (BOD1) 2012/13.



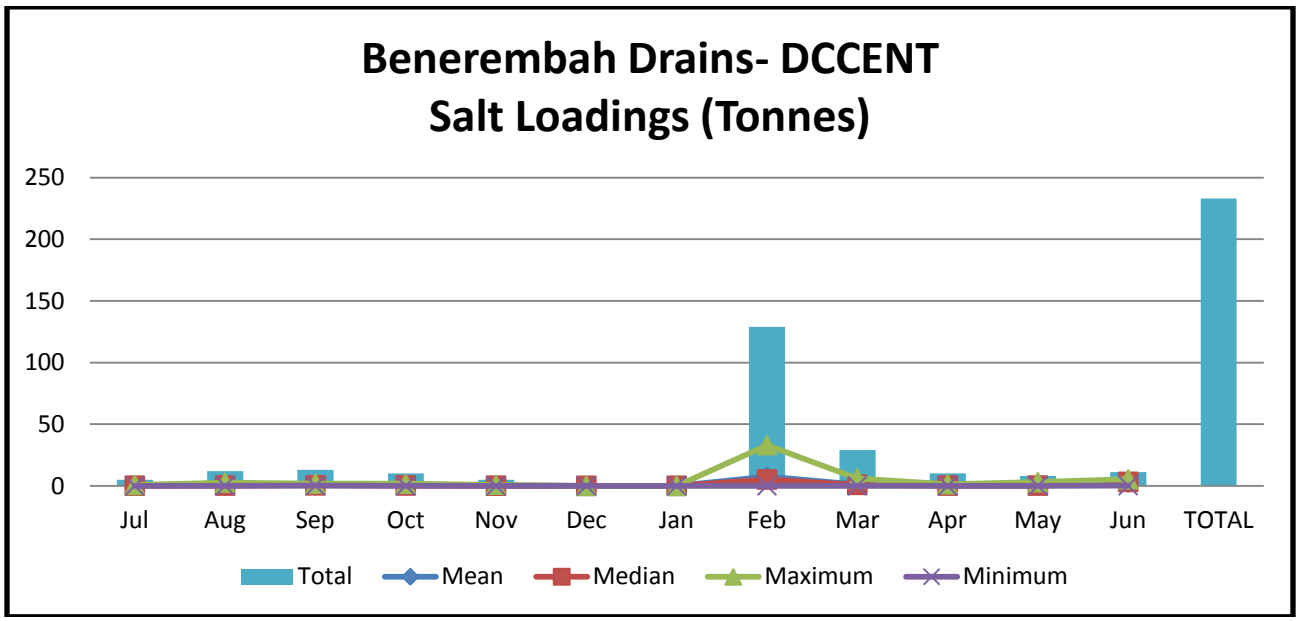
As shown in Figure 6.2 (h) low salt loads were recorded at this site over the reporting period.

Figure 6.2 (i): Salt load for Benerembah (DCWIDG) 2012/13.



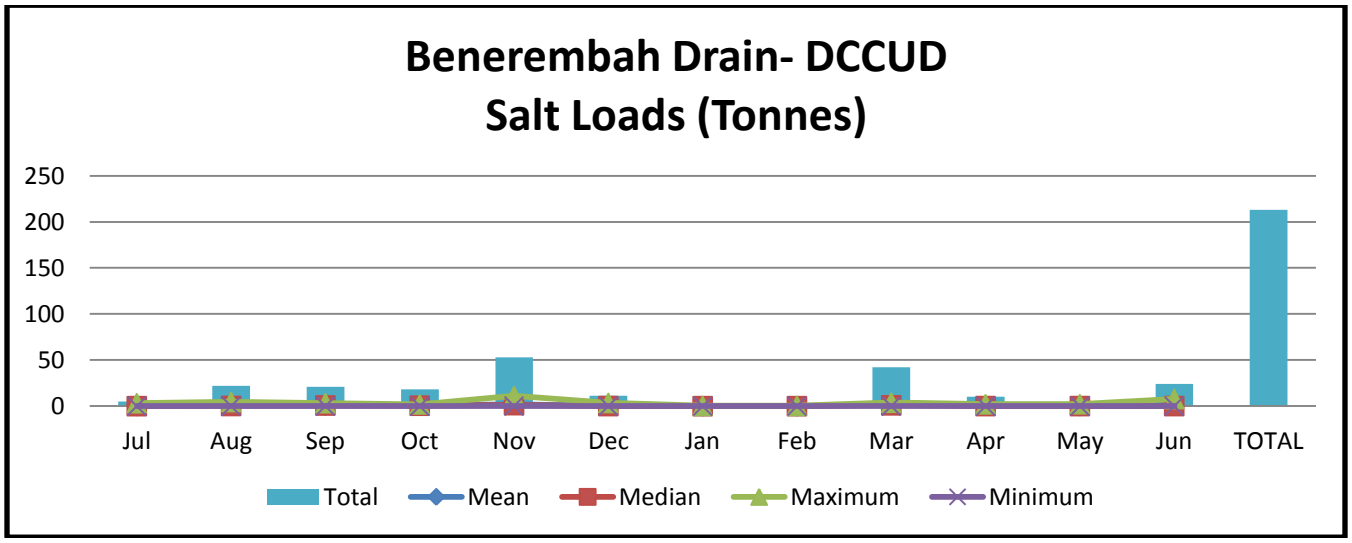
As highlighted in Figure 6.2 (i) low salt loads were recorded at this site over the reporting period.

Figure 6.2 (j): Salt load for Benerembah (DCCENT) 2012/13.



As highlighted in Figure 6.2 (j) low salt loads were recorded at this site over the reporting period. A small increase in salt loadings during February 2013 may be attributed to a reduction in escape flows due to higher water demand and use as a consequence of little rainfall experienced from December 2012 to February 2013. A reduction of escape flows coupled with higher evaporation could see an increase in drainage salt loadings. Groundwater could also be a contributor to this increase.

Figure 6.2 (k): Salt load for Benerembah (DCCUD) 2012/13.



As highlighted in Figure 6.2 (k) low salt loads were recorded at this site over the reporting period.

Refer to Drainage Volumes, Table 1.4 (b) for tabular flow data.

Refer to Salt Loads, Table 1.4 (c) for tabular salt load data.

6.3 NOTICE FOR COMPLIANCE WITH SALINITY AND DRAINAGE STRATEGY

No written notice was received for the current reporting period.

MI has worked towards ensuring that minimal discharge to the Murrumbidgee River from licenced drainage sites occurred over the 2012/13 reporting period. This meant a reduction in salt loads discharged to the Murrumbidgee River. MI manages salt loads in drainage reuse and en-route storages by blending with supply water to provide a suitable shandy ratio that sees a reduction in salinity levels for supply to customers.

6.4 SALT LOAD DISCHARGES

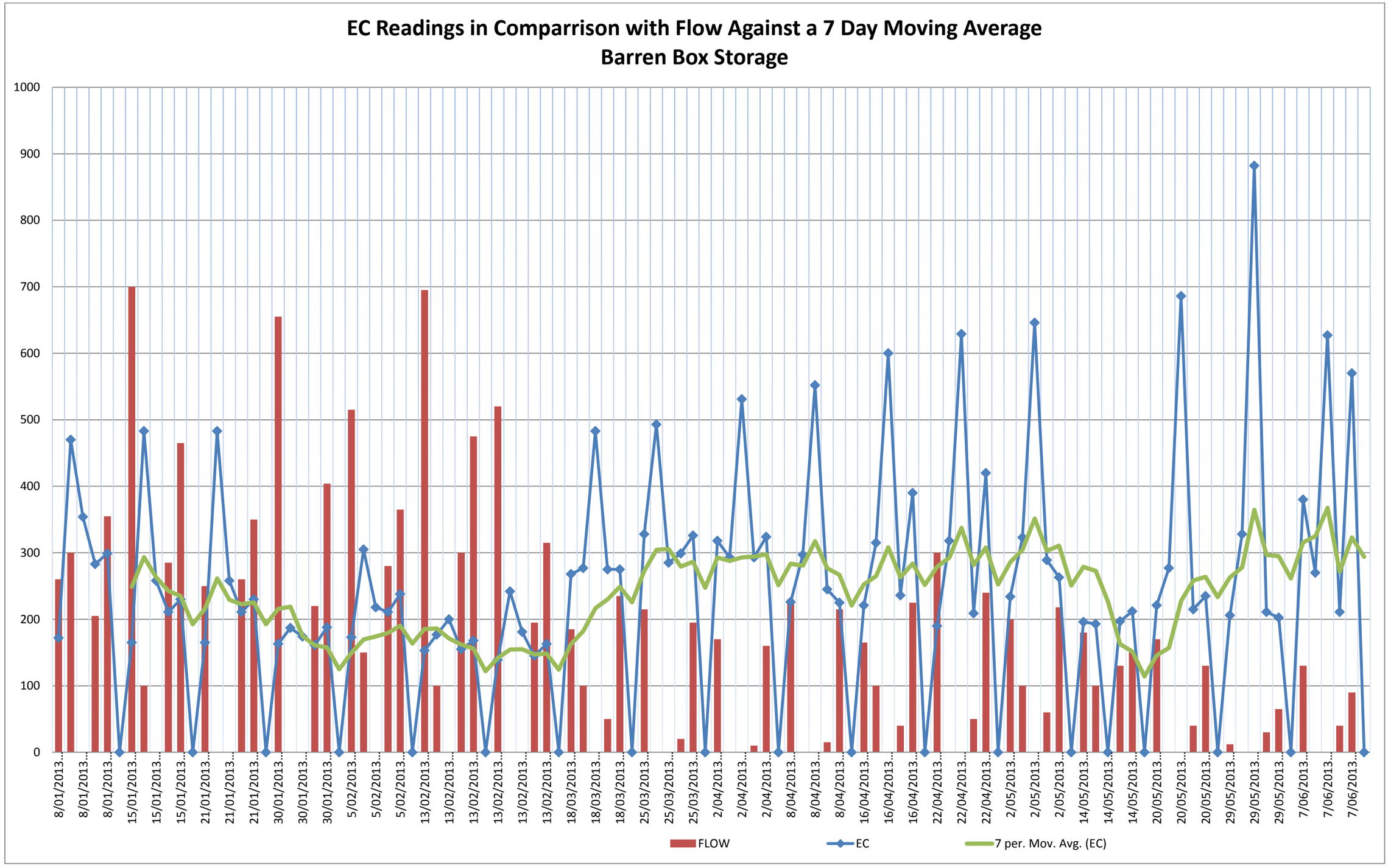
Refer to Salt Loads, Table 1.4 (c).

6.5 SALINITY IN BARREN BOX OUTFALL DRAIN AGAINST BENCHMARK

Figure 6.5 (a) below, shows the salinity trend for flows in and out of Barren Box Storage & Wetland (BBSW) and EC levels on a monthly basis from January 2013 - June 2013. A benchmark of 700 µS/cm is applied for the provision of water downstream of BBSW. The values presented in Figure 6.5(a) are monthly averages. The figures show that salinity levels in BBSW and the Wah Wah Main remained below the benchmark of 700 µS/cm.

Elevated levels in storages are attributed to increases to salt loads due to evaporation. In managing this issue MI is diligent in ensuring that water from both cells is released at levels below 700 µS/cm. In most cases, this is done by blending water from Barren Box with water from Mirrool Creek to reduce salinity levels (and thus reducing the salt load) before supplying water to customers via the Wah Wah Main Canal and Tabbita Channel systems.

Figure 6.5 (a): Monthly EC levels at Barren Box – July 2012 to December 2013



7. WATER QUALITY MANAGEMENT

MI implements its Water Quality Monitoring Program in line with NSW Environment Protection Authority (EPA) Environmental Protection Licence (EPL) 4651. Licence provisions negotiated with the NSW EPA have been implemented from 1 July 2010. The contemporary program ensures effective management of water quality within the Murrumbidgee Irrigation Area (MIA), further details of MI's Monitoring Program can be found at the link below.

In 2012, the NSW EPA advised changes to environment protection legislation affecting MI's EPL under the *Protection of the Environment Operations Act (POEO Act).* As a result of the changes, MI is required to report any pollution incident immediately, without delay, where material harm to the environment is caused or threatened. EPL licences are required to publish monitoring data results and provide a formal emergency response plan addressing management of environmental incidents within their licenced areas via their website.

Monitoring data and further detail in relation to pollution and chemical management can be viewed at: http://www.mirrigation.com.au/Environment/Water-Quality

In late 2012 and early 2013 minor amendments were made to MI's Environmental Protection Licence. Reporting on these changes has been incorporated into this report.

7.1 SUMMARY OF 2012/13 REPORTING PERIOD

Under MI's Risk Based Water Quality Framework, tri-annual benchmark sampling of water quality within MI's supply channels was n undertaken at strategic sites across the MIA during the irrigation season. Three trace level residues of chemicals detected at notification levels warranted official reporting to the NSW EPA.

The program will be revised in 2013 to encompass additional sites within MI's area of operation and to include more intense monitoring of water supply at MI's metered regulating structures to understand the quality of water entering our supply system. Additionally, MI will include benchmarking of drains during the irrigation season to gain an understanding of the potential risk of pollution in drainage water for re-use in supply.

Results from this reporting year revealed a decrease in the number of detections of chemicals in our drainage water, when compared to previous years. As part of MI's monitoring program which helps to understand water quality within our supply system, a targeted approach in monitoring drainage and drainage re-use uses rainfall triggers at a catchment scale to determine water quality based risks and sampling requirements. Benchmarking will allow MI to capture data for drainage quality during a non rainfall event, such as contributions from escape flows or run-off from on-farm irrigation practices.

This year, risk based water quality sampling has been instrumental in identifying risk areas at a sub catchment level, enabling MI to understand the source of those detections, and in containing and managing such incidents. Detections of 2012/13 Notification and Action Level and their concentrations are detailed in tables represented in 7.5(a) to 7.5(c) of this report.

7.2 WATER QUALITY PROJECTS 2012/13

During the current reporting period MI was involved in undertaking a number of specific water quality projects in response to trace residue pesticide detections as well as some more significant reported pollution incidents. MI's Water Monitoring Framework also shows our commitment to continuous improvement of the Water Quality Monitoring Programs. Special projects also assist MI to work more closely with councils and the EPA to ensure that water and land pollution incidents are addressed in accordance with the *POEO Act*. A brief description of these projects is provided below.

7.2.1 DICHLOBENIL TESTING PROGRAM

MI's Works Group implemented a weed control program to treat drainage channels that contain the noxious weed *Sagittaria* spp. with the herbicide Casoron G, which contains the active constituent Dichlobenil (67.5 g/kg). MI has implemented a water quality sampling strategy and testing program to ensure compliance with the APVMA emergency use permit PER12717 during the winter works period, to ensure applications posed no risk to water quality.

Weed treatments for Sagittaria in the MIA are administered during the winter shutdown period of July and August to enable MI to comply with permit requirements. The post season applications allow MI to monitor water quality and be aware of water quality parameters prior to return of the irrigation season.

Samples were taken prior to the initial application as well as during and following the final application. The sampling program encompassed monitoring in-situ water quality parameters and undertaking field sampling for laboratory analysis at strategic locations within MI's drainage system. Mitigation measures can be implemented, if required.

7.2.2 LAG INVESTIGATION AND TESTING PROGRAM

In response to trace residue pesticide detections at Gogeldrie Main Drain at Gooragool Lagoon (LAG), MI Water Resource staff conducted a soil and water quality sampling program to determine potential origins of the active constituent Metolachlor.

The sampling program included sediment and water quality (in-situ and laboratory samples) at;

- Four sites in the LAG drainage channel D-1-1710-040E;
- Two sites on a channel reserve were it was evident that silt had been excavated from the channel;
- One site on an adjacent Landholder Property in the farm drain and in field; and
- Three sites within the water recycling and holding dam located on private property.

MI, in conjunction with surrounding landowners, was able to establish the potential source and origin of elevated levels at LAG.

7.2.3 ALGAL FORECASTING PROJECT

MI continued its three year Algal Forecasting Project in conjunction with the University of Sydney with the project's monitoring equipment located at Barren Box Storage & Wetland (BBSW). The objectives of this research project are to:

- Monitor the physicochemical parameters and biological indicators within the water body using traditional water quality monitoring methods, and *in* situ continuous data loggers over the three year study period
- Determine the spatial and temporal extent of cyanobacteria blooms within the water body during the research program
- Propose a water quality monitoring program for ongoing assessment by the water manager
- Develop a lifecycle model coupled to a hydrodynamic model capable of hind casting and forecasting bloom events in BBSW.

MI will continue to work with the University of Sydney to use monitoring information to make informative decisions about algal management in our water storages.

7.2.4 CORYNNIA CHANNEL INVESTIGATION

MI commenced a project to investigate, monitor and report on the water quality and sediment within the Benerembah and Wah Wah Irrigation Districts' irrigation channels, downstream of BBSW. Weather station data, water orders as well as flow and diversion information have been collated with field data in order to understand the hydrodynamics of these systems. The sampling program includes sediment and water quality (in-situ and lab samples) for Electrical Conductivity, Dissolved Oxygen, Temperature, pH, Turbidity and Depth at a total of 14 sites.

7.2.5 BILBUL

In response to a complaint in relation to the illegal extraction of supply water by multiple residents along Supply Channel S-2-54B-030E, MI Water Resource Staff conducted a site inspection of the Lateral 54B. Upon inspection MI staff noted a number of PVC drains illegally installed by adjacent landholders draining suspected stormwater and effluent into the supply channel. There was also evidence of unlicenced pumps being used.

Concerns for water quality issues were raised in relation to drainage from residential blocks into supply water. MI staff conducted five separate water sampling programs upstream, downstream and within S-2-54B-030E to test for nutrients and faecal coliforms to identify the source. A pollution report was submitted to Griffith City Council (GCC), and plans have been made to collaboratively investigate the elevated pollutants within this area of the supply channel.

7.2.6 LAKE WYANGAN

MI has undertaken a project to investigate, monitor and report on the water quality within the Lake Wyangan Modernisation Project Area before, during and after construction. The project has involved the planning and implementation of a water quality sampling program (for in-situ and laboratory

samples) throughout the Lake Wyangan Modernisation Area at seven sites. This project will continue until the completion of the Modernisation Project in late 2013.

7.2.7 NORTHWEST GRIFFITH EFFLUENT INVESTIGATION

An investigation was conducted in relation to discharge of effluent along the road reserve leading to a drainage inlet (DI-2-1291-01). Consequently, the area was monitored to ensure that the likelihood of further pollution incidents were minimised.

A further complaint was received by MI regarding the discharge of effluent into a drainage channel (D-2-MP-020E). Upon investigation, the level of contaminants entering D-2-MP-020E was found to be higher than first reported, with two drainage points being identified as the source. Numerous site inspections were conducted by MI Water Resources staff as well as GCC. Sediment and water quality (in-situ and laboratory samples) for parameters were taken from 12 sites. A recommendation for site cleanup and future management were provided by MI to GCC.

Figure 7.2 (a): Map of Water Quality Project for 2012/13

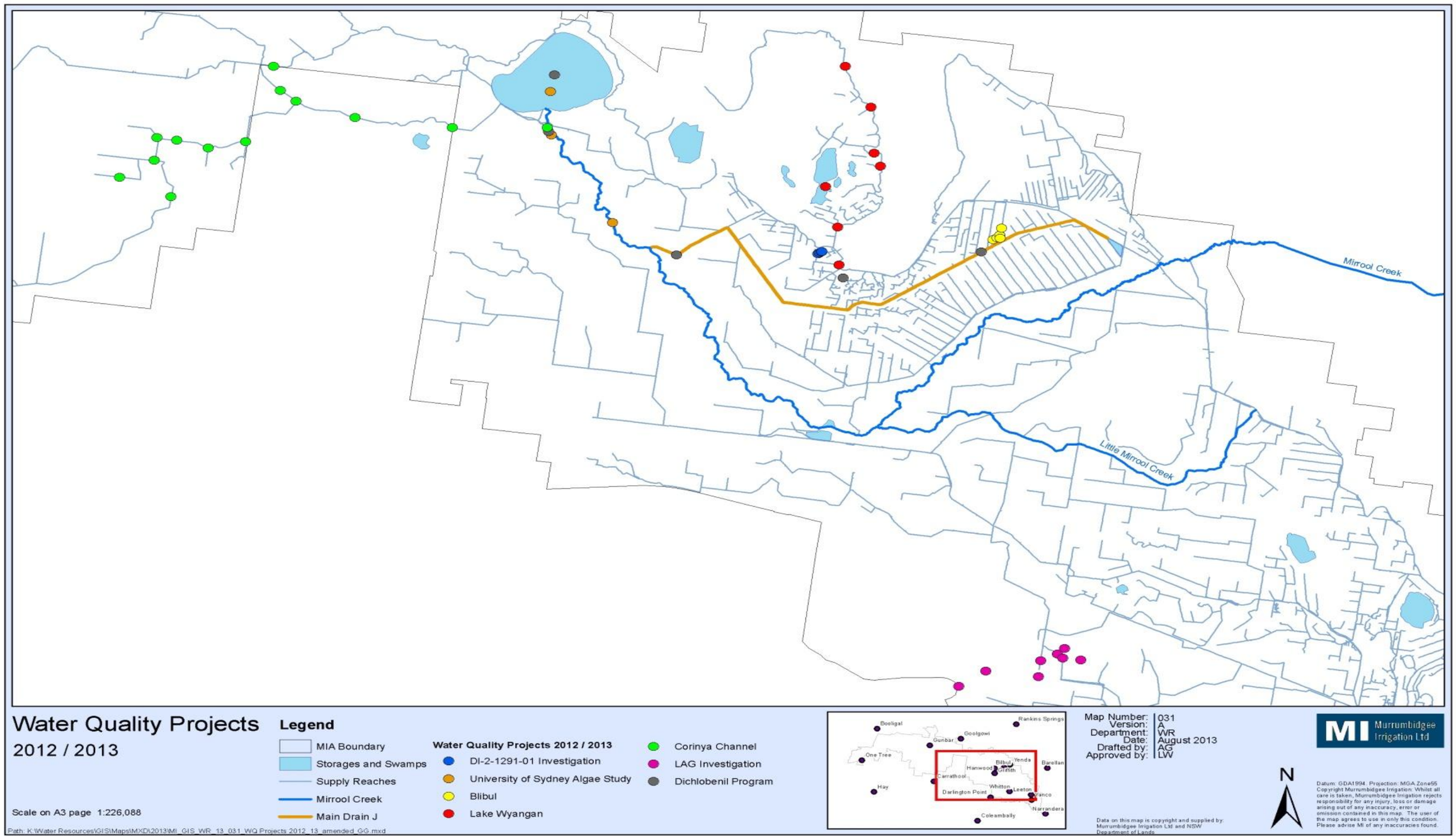
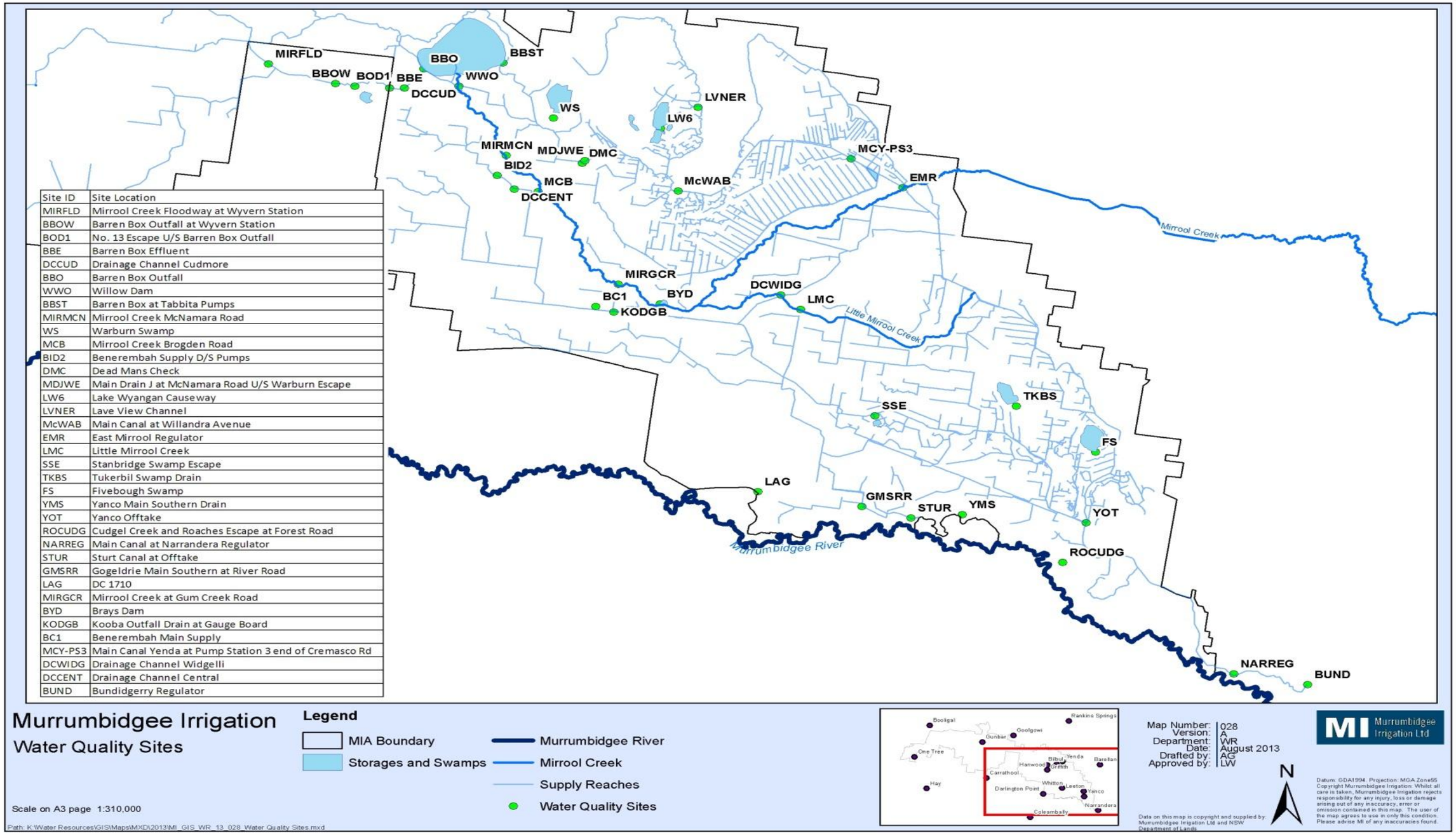


Figure 7.2 (b): Map of MI Water Quality Monitoring Sites



Site ID	Site Location
MIRFLD	Mirrool Creek Floodway at Wyvern Station
BBOW	Barren Box Outfall at Wyvern Station
BOD1	No. 13 Escape U/S Barren Box Outfall
BBE	Barren Box Effluent
DCCUD	Drainage Channel Cudmore
BBO	Barren Box Outfall
WWO	Willow Dam
BBST	Barren Box at Tabbita Pumps
MIRMCN	Mirrool Creek McNamara Road
WS	Warburn Swamp
MCB	Mirrool Creek Brogden Road
BID2	Benerembah Supply D/S Pumps
DMC	Dead Mans Check
MDJWE	Main Drain J at McNamara Road U/S Warburn Escape
LW6	Lake Wyangan Causeway
LVNER	Lave View Channel
McWAB	Main Canal at Willandra Avenue
EMR	East Mirrool Regulator
LMC	Little Mirrool Creek
SSE	Stanbridge Swamp Escape
TKBS	Tukerbil Swamp Drain
FS	Fivebough Swamp
YMS	Yanco Main Southern Drain
YOT	Yanco Offtake
ROCUDG	Cudgel Creek and Roaches Escape at Forest Road
NARREG	Main Canal at Narrandera Regulator
STUR	Sturt Canal at Offtake
GMSRR	Gogeldrie Main Southern at River Road
LAG	DC 1710
MIRGCR	Mirrool Creek at Gum Creek Road
BYD	Brays Dam
KODGB	Kooba Outfall Drain at Gauge Board
BC1	Benerembah Main Supply
MCY-PS3	Main Canal Yenda at Pump Station 3 end of Cremasco Rd
DCWIDG	Drainage Channel Widgelli
DCCENT	Drainage Channel Central
BUND	Bundidgerry Regulator

Murrumbidgee Irrigation
Water Quality Sites

Legend

- MIA Boundary
- Storages and Swamps
- Murrumbidgee River
- Mirrool Creek
- Supply Reaches
- Water Quality Sites

Map Number: 028
Version: A
Department: WR
Date: August 2013
Drafted by: AG
Approved by: LW

Scale on A3 page 1:310,000

Path: K:\Water Resources\GIS\Maps\MXD\2013\MI_GIS_WR_13_028_Water Quality Sites.mxd

Datum: GDA1994. Projection: MGA Zone55
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7.3 DATA REFERENCE IN LINE WITH LICENCE REQUIREMENTS

Table 7.3 (a): NSW EPA Compliance Requirements

OEH Licence	Issue/requirement	Compliance/reference	Page No.
	Location of monitoring sites	Table 7.4 (a)	109
M1	**Monitoring records**		
	M1.1 Recording procedures	Records filed	
	M1.2 Record keeping protocol	as per licence	
	M1.3 Sample collection	Recorded in water quality database	
M2	**Requirements to monitor concentration of pollutants discharged**		
	M2.1 Pollutant Monitoring (Sites 4,5,6,7,15)		
	Atrazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Chlorpyrifos (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Conductivity	Tables 7.5 (b) and 7.5 (c)	111-114
	Diazinon (November)	Tables 7.5 (b) and 7.5 (c)	111-114
	Diuron (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Endosulfan (Monthly) (alpha & beta)	Tables 7.5 (b) and 7.5 (c)	111-114
	Flow (Monthly)	Table 1.5(c) and Annexure A	27 & 132
	Malathion (Oct/Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Metolachlor (Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Molinate (Jan/Feb/ Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Nitrogen (>5mg/L)	Table 7.5 (c)	114
	Phosphorus (>5mg/L)	Table 7.5 (b)	111
	Simazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Thiobencarb (Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Turbidity	Table 7.6.6 (b)	125
	M2.2 Drainage volume monitoring (Continuously) 4,5,6,7	1.5 (c) and Annexure A	27 & 132
M3	**Testing Methods – concentration limits**		
	Approved by OEH	USEPA & APHA	
M4	**Recording of pollution complaints**		
	Keep complaints log	Yes	
M5	**Telephone complaints line**		
	M5.1 Operate telephone complaints line	Yes	
	M5.2 Notify public of complaints line	Yes	
M6	**Requirement to monitor volume or mass**		
	Monitor liquids, solids & air pollutants (Continuously) Sites 1,2,3,4,5,6,7,9	Not applicable	
M7	**Environmental Monitoring**		
	Monitoring of Sites 1,2,3,8,9,10,11 and 12		
	Atrazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Chlorpyrifos (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Conductivity (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Diazinon (Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Diuron (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Endosulfan (Monthly) (alpha & beta)	Tables 7.5 (b) and 7.5 (c)	111-114
	Flow (Monthly)	Table 1.5(c) and Annexure A	27 & 132
	Malathion (Oct/Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Metolachlor (Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Simazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Thiobencarb (Nov)	Tables 7.5 (b) and 7.5 (c)	111-114

	Nitrogen (>5mg/L)	Table 7.5 (b)	111
	Phosphorus (>5mg/L)	Table 7.5 (b)	114
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Turbidity	Table 7.6.6 (b)	125

Table 7.3 (b): NSW EPA Compliance Requirements (cont.)

DEC Licence	Issue/requirement	Compliance/reference	Page No.
	Monitoring Sites 13 and 14		
	Atrazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Chlorpyrifos (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Conductivity (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Diazinon (Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Diuron (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Endosulfan (Monthly) (alpha & beta)	Tables 7.5 (b) and 7.5 (c)	111-114
	Malathion (Oct/Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Metolachlor (Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Molinate (Jan/Feb/Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Simazine (Monthly)	Tables 7.5 (b) and 7.5 (c)	111-114
	Thiobencarb (Nov)	Tables 7.5 (b) and 7.5 (c)	111-114
	Nitrogen (Monthly)	Table 7.5 (c)	114
	Phosphorus (Monthly)	Table 7.5 (c)	114
	Trifluralin (Mar/Apr/May/Sep/Oct/Nov/Dec)	Tables 7.5 (b) and 7.5 (c)	111-114
	Turbidity (Monthly)	Table 7.6.6 (b)	125
	M7.2 Conductivity Sites 1 & 9	Table 7.6.6 (b)	125
	M7.3 Molinate	Tables 7.5 (b) and 7.5 (c)	111-114
	M7.4 Channel sampling (as directed)	not requested	
M8	**Requirement to record application of herbicides**		
	Record chemical applications to control Alligator Weed	Electronically recorded	N/A
R1	**Annual return documents**		
	Complete annual return	Submitted	
R2	**Notification of environmental harm**		
	Report issues as soon as possible	EPA contacted. Table R.1, For all notifications refer to MI Water Quality at www.mirrigation.com.au	N/A
R3	**Written report**		
	R3.1 Send reports to OEH at their request, regarding environmental harm	OEH sent report at their request	N/A
R4	**Reporting exceedence of chemical contingency plan levels**		
	Report exceedences within 24 hours	NSW EPA contacted, Table R.1, For an updated version refer to MI EPA Emergency Response Plan at www.mirrigation.com.au	N/A
R5	**Annual report**		
	R5.1 Submit annual report to EPA	Submitted	
	R5.2 Report environmental performance and impacts	Throughout this report	
	R5.3 Volumes of all inflows, surface water discharges and estimate of all accessions of water to groundwater. Irrigation waste water trends. A summary of all events reported R2 to R3. Report of implementation of the irrigation waste water control program.	Table 1.5(c) and Annexure A Section 2 - Groundwater Management Table 7.7 (a) Table 7.7 (a)	27 & 132 32 126 126
	R5.4 Send copies to OEH, DII and MDBC	Submitted	

7.4 INVENTORY OF MONITORING SITES

Table 7.4 (a) Location of Monitoring/Discharge Points and Areas

Hydsys No.	Site Acronym	Site Description	Frequency	Type	X-Coordinates	Y-Coordinates
Licensed Monitoring Sites						
41010940	LAG	Gogeldrie Main Drain at Gooragool Lagoon	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	418423	6173126
41010921	GMSRR	Gogeldrie Main Southern Drain river road	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	427479	6171449
410083	YMS	Yanco Main Southern Drain	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	436272	6170737
41010005	ROCUDG	Cudgel Creek Roaches Escape	Continuous	EC, Flow, Turbidity, Pesticides, Nutrients	444891	6165663
41010163	MIRFLD	Mirrool Creek Floodway Wyvern Station	When flowing	EC, Flow, Turbidity, Pesticides, Nutrients, Metals	375673	6218725
Non Licensed Internal Monitoring Sites						
41010162	WS	Warburn Swamp	After trigger	EC, Temperature, pH, Turbidity	400489	6213021
41010955	MIRMCN	Mirrool Creek at McNamara Road	Continuous	EC, Flow, Temperature	396408	6208929
41010908	BYD	Bray's Dam Diversions and Bywash	After trigger	EC, Temperature, pH, Turbidity	409886	6193089
41010896	LW6	Lake Wyangan Causeway	After trigger	EC, Temperature, pH, Turbidity	409838	6211717
41010159	FS	Fivebough Swamp by-pass drain (Quodling Road drain)	After trigger	Pesticide	447971	6177550
41010157	TKBS	Tuckerbil Swamp By-pass drain	After trigger	Pesticide	440983	6182501
410167	BBOW	Barren Box Outfall Canal Wyvern	Continuous	EC, Flow, Temperature	381371	6216677
410174	MDJWE	Main Drain J Upstream of Warburn Escape	Continuous	EC, Flow, Temperature	403257	6208333
410085	LMC	Little Mirrool Creek	Continuous	EC, Flow, Temperature	422126	6192597
41010903	BBO	Barren Box Storage	After trigger	EC, Temperature, pH, Turbidity	389236	6218183
41010978	WWO	Willow Dam	After trigger	EC, Temperature, pH, Turbidity	392197	6216283

410164	BOD1	Channel 13 escape at the outfall channel Wyvern	Continuous - Downloaded Monthly	EC, Flow, Temperature	383225	6216237
41010713	DCCUD	DC Cudmore at outfall channel	Continuous	EC, Flow, Temperature	387444	6216054
41017001	DCWIDG	DC Widgelli at Little Mirrool Creek	Continuous	EC, Flow, Temperature	420536	6194205
410172	DCCENT	DC Central at BID pumps Brogden Road	Continuous	EC, Flow, Temperature	396994	6205386

7.5 SCHEDULED CHEMICALS

Table 7.5 (a) below, shows the scheduled chemicals monitored for and their associated trigger levels for 'notification or action' level reporting to the NSW Environment Protection Authority.

Table 7.5 (a): Scheduled Chemicals in Murrumbidgee Irrigation's Screening Program

Chemical	Environmental Guidelines (µg/L)	Notification Level (µg/L)	Action Level (µg/L)
Atrazine	2	**13**	**45**
Chlorpyrifos	0.001	**0.01**	**0.11**
Diazinon	0.0006	**0.01**	**0.2**
Diuron	8	**1***	**5***
Endosulfan	0.01	**0.03**	**0.2**
Malathion	0.07	**0.05**	**0.2**
Metolachlor	8	**0.02**	**0.1**
Molinate	2.5	**3.4**	**14**
Simazine	10	**3.2**	**11**
Thiobencarb	1	**2.8**	**4.6**
Trifluralin	0.1	**2.6**	**4.4**

Source: NSW Environment Protection Authority

Table 7.5 (b): Benchmark Sampling Program

Diazinon (LOR = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	<0.005	<0.005
BARDENS	<0.005	<0.005	<0.005
BBOW	NT	<0.005	<0.005
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	<0.005	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Atrazine (LOR = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	0.017	0.008
BARDENS	<0.005	<0.005	0.019
BBOW	NT	<0.005	0.026
BERWEIR	NT	NT	0.021
BUNDIGERY	0.006	<0.005	0.006
BYD	<0.005	0.008	0.011
EMR	<0.005	<0.005	0.008
NARREG	<0.005	<0.005	0.006
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Chlorpyrifos (LOR = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	<0.005	<0.005
BARDENS	<0.005	<0.005	0.042
BBOW	NT	<0.005	0.044
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	0.097	<0.005	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Diuron (LOR = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	0.017	<0.005
BARDENS	0.055	<0.005	0.062
BBOW	NT	0.01	0.046
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	0.01	0.066
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	0.007	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Malathion (LOR = 0.002 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.002	<0.002	<0.002
BARDENS	<0.002	<0.002	<0.002
BBOW	NT	<0.002	<0.002
BERWEIR	NT	NT	<0.002
BUNDIGERY	<0.002	<0.002	<0.002
BYD	<0.002	<0.002	<0.002
EMR	<0.002	<0.002	<0.002
NARREG	<0.002	<0.002	<0.002
PENFOLDS	<0.002	NT	NT
STURT	<0.002	<0.002	<0.002

Metolachlor (LOL = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	0.006	<0.005
BARDENS	<0.005	<0.005	<0.005
BBOW	NT	0.011	<0.005
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	<0.005	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Molinate (LOL 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	<0.005	<0.005
BARDENS	<0.005	<0.005	<0.005
BBOW	NT	<0.005	<0.005
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	0.013	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Nitrite + Nitrate as N (LOR 0.01mg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	0.07	0.16	0.01
BARDENS	0.29	0.17	2.93
BBOW	NT	0.18	0.13
BERWEIR	NT	NT	0.36
BUNDIGERY	0.12	0.2	0.01
BYD	0.15	0.18	0.03
EMR	0.13	0.18	0.01
LAG	0.14	NT	NT
NARREG	0.13	0.19	0.01
PENFOLDS	0.06	NT	NT
STUR	0.14	NT	NT
STURT	NT	0.19	0.03
YMS	NT	NT	0.1

Simazine (LOR 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	0.256	0.069	0.039
BARDENS	1.86	0.017	0.189
BBOW	NT	0.053	0.156
BERWEIR	NT	NT	0.023
BUNDIGERY	0.392	0.033	0.025
BYD	0.863	0.014	0.353
EMR	1.12	0.015	0.063
NARREG	0.431	0.056	0.056
PENFOLDS	0.536	NT	NT
STURT	0.375	0.058	0.014

Thiobencarb (LOR 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	<0.005	<0.005
BARDENS	<0.005	<0.005	<0.005
BBOW	NT	<0.005	<0.005
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	<0.005	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Trifluralin (LOR = 0.005 µg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	<0.005	<0.005	<0.005
BARDENS	<0.005	<0.005	<0.005
BBOW	NT	<0.005	<0.005
BERWEIR	NT	NT	<0.005
BUNDIGERY	<0.005	<0.005	<0.005
BYD	<0.005	<0.005	<0.005
EMR	<0.005	<0.005	<0.005
NARREG	<0.005	<0.005	<0.005
PENFOLDS	<0.005	NT	NT
STURT	<0.005	<0.005	<0.005

Total Kjeldahl as N (LOR 0.1mg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	0.5	0.6	0.2
BARDENS	1.2	1.3	1.1
BBOW	NT	1.3	0.4
BERWEIR	NT	NT	0.2
BUNDIGERY	0.4	0.5	0.2
BYD	0.9	0.4	0.3
EMR	0.5	0.2	0.2
LAG	2.8	NT	NT
NARREG	0.4	0.2	0.2
PENFOLDS	0.6	NT	NT
STURT	0.3	0.2	0.2

Total Nitrogen as N (LOR 0.1mg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	0.6	0.8	0.2
BARDENS	1.5	1.5	4
BBOW	NT	1.5	0.5
BERWEIR	NT	NT	0.6
BUNDIGERY	0.5	0.7	0.2
BYD	1	0.6	0.3
EMR	0.6	0.4	0.2
LAG	2.9	NT	NT
NARREG	0.5	0.4	0.2
PENFOLDS	0.7	NT	NT
STURT	0.4	0.4	0.2

Total Phosphorus as P (LOR 0.1mg/L)			
Site	**Sep**	**Jan**	**May**
3 WAYS	0.12	0.06	0.03
BARDENS	0.18	0.16	0.13
BBOW	NT	0.16	0.06
BERWEIR	NT	NT	0.11
BUNDIGERY	0.1	0.04	0.04
BYD	0.06	0.03	0.02
EMR	0.11	0.02	0.04
LAG	0.67	NT	NT
NARREG	0.06	0.07	0.04
PENFOLDS	0.08	NT	NT
STURT	0.07	0.01	0.03

KEY	
	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

Table 7.5 (c): Trigger Based Sampling

Nitrite + Nitrate as N (LOR 0.1mg/L)												
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.28	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.29	NT	NT	0.32	NT	NT	NT	NT
FS	NT	NT	NT	NT	2.89	NT	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	1.52	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	1.66	1.98	8.91	0.51	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.15	NT	NT	2.18	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.76	NT	NT	0.28	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.32	NT	NT	0.14	NT	NT	NT	NT
ROCUDG	NT	NT	NT	0.03	0.12	NT	NT	0.02	0.01	NT	0.01	NT
WS	NT	NT	NT	NT	0.31	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	1.3

Total Nitrogen as N (LOR 0.1mg/L)												
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	1.6	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	1.9	NT	NT	0.8	NT	NT	NT	NT
FS	NT	NT	NT	NT	4.8	NT	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	3.6	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	4.3	3.7	6.2	2.3	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	1.4	NT	NT	3.6	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	2.2	NT	NT	1.2	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	1.5	NT	NT	0.9	NT	NT	NT	NT
ROCUDG	NT	NT	NT	1	1.6	NT	NT	1	0.8	NT	0.4	NT
WS	NT	NT	NT	NT	1.9	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	3.3

Total Phosphorus as P (LOR 0.1mg/L)												
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.13	NT	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.28	NT	NT	0.05	NT	NT	NT	NT
FS	NT	NT	NT	NT	0.49	NT	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.3	NT	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.39	0.53	0.58	0.46	NT	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.2	NT	NT	0.22	NT	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.17	NT	NT	0.22	NT	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.22	NT	NT	0.14	NT	NT	NT	NT
ROCUDG	NT	NT	NT	0.16	0.23	NT	NT	0.22	0.18	NT	0.03	NT
WS	NT	NT	NT	NT	0.11	NT	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.22

Atrazine (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.114	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.559	NT	NT	0.075	NT	NT	NT
FS	NT	NT	NT	NT	0.238	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.088	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.282	0.28	0.55	0.027	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.22	NT	NT	0.057	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.036	NT	NT	0.018	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.193	NT	NT	0.052	NT	NT	NT
ROCUDG	NT	NT	NT	0.024	0.069	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.018

Chlorpyrifos (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.095	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
LAG	NT	NT	<.005	<.005	<.005	<.005	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.25	NT	NT	0.007	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.138	NT	NT	0.007	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.098	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<.005

Diazinon (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.017	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.014	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
LAG	NT	NT	<.005	<.005	<.005	<.005	NT	NT	NT	NT	NT
LAG 1	NT	NT	NT	NT	NT	NT	<.005	NT	NT	NT	<.005
LMC	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.167	NT	NT	<.005	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.204	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	0.217	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<.005

Diuron (LOR = 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.116	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	10.7	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.348	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.554	0.282	0.987	2.9	1.35	NT	NT	NT	NT
LMC	NT	NT	NT	NT	<.005	NT	NT	0.054	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.714	NT	NT	0.087	NT	NT	NT
MIRMCN	NT	NT	NT	NT	<.005	NT	NT	0.089	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	0.785	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.668

Malathion (LOR = 0.002 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.002	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.002	NT	NT	0.002	NT	NT	NT
FS	NT	NT	NT	NT	0.002	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.002	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.002	0.002	0.002	0.002	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.002	NT	NT	0.002	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.002	NT	NT	0.002	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.002	NT	NT	0.002	NT	NT	NT
ROCUDG	NT	NT	NT	0.002	0.002	NT	NT	<.002	0.002	0.002	NT
WS	NT	NT	NT	NT	0.002	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.002

Metolachlor (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.089	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.512	NT	NT	0.009	NT	NT	NT
FS	NT	NT	NT	NT	0.11	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.029	0.881	0.131	0.008	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.172	NT	NT	<.005	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.017	NT	NT	0.017	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.191	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	0.021	0.014	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.055

Molinate (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	<.005	0.272	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	<.005	0.561	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	0.009	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.079	NT	NT	NT	NT	NT	NT
LAG	NT	NT	<.005	<.005	0.106	<.005	NT	NT	NT	NT	NT
LMC	NT	NT	NT	<.005	0.192	NT	NT	<.005	NT	NT	NT
MDJWE	NT	NT	NT	<.005	0.2	NT	NT	<.005	NT	NT	NT
MDJY	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT	NT
MIRMCN	NT	NT	NT	<.005	0.435	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	0.776	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	0.011

Simazine (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.347	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	4.23	NT	NT	0.024	NT	NT	NT
FS	NT	NT	NT	NT	3.14	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.892	0.267	1.49	0.198	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.378	NT	NT	0.065	NT	NT	NT
MDJWE	NT	NT	NT	NT	1.08	NT	NT	0.03	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.497	NT	NT	0.039	NT	NT	NT
ROCUDG	NT	NT	NT	0.278	0.254	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	1.75

Thiobencarb (LOR 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	0.031	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	0.032	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	0.047	NT	NT	NT	NT	NT	NT
LAG	NT	NT	0.016	<.005	0.02	0.048	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	0.075	NT	NT	<.005	NT	NT	NT
MDJWE	NT	NT	NT	NT	0.031	NT	NT	<.005	NT	NT	NT
MIRMCN	NT	NT	NT	NT	0.309	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<.005

Trifluralin (LOR = 0.005 µg/L)											
Site	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Jun**
BARDENS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
BYD	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
FS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
GRI	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
LAG	NT	NT	<.005	<.005	<.005	<.005	NT	NT	NT	NT	NT
LMC	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
MDJWE	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
MIRMCN	NT	NT	NT	NT	<.005	NT	NT	<.005	NT	NT	NT
ROCUDG	NT	NT	NT	<.005	<.005	NT	NT	<.005	<.005	<.005	NT
WS	NT	NT	NT	NT	<.005	NT	NT	NT	NT	NT	NT
YMS	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	<.005

KEY	
	Notification Level
XX	Action Level
LOR	Limit of Reporting
NT	Not Tested

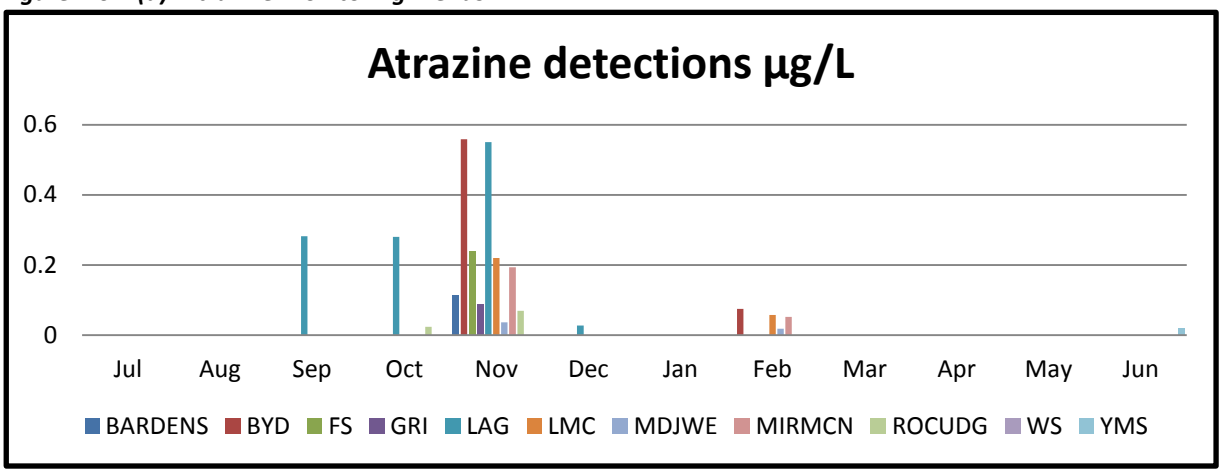
7.6 TRIGGER BASED SAMPLING TRENDS

Figures 7.6.1 (a) to 7.6.6 (a) illustrate pesticide detection trends at MI trigger sample sites, information relating to Environmental Protection Authority (EPA) guidelines for notification and action are highlighted in Table 7.5(a).

7.6.1 ATRAZINE MONITORING TRENDS

The trigger sampling program has identified trace level detections of Atrazine throughout the drainage network, at 10 of the 11 monitoring sites. Although all detections identified were below EPA notification level the detections highlight the persistence of this chemical within the MIA. The detections at sites in November followed a large storm event with 94 mm of rain, likely to have washed residues off farm. A MI Water Resources project is underway to identify and trend residues including Atrazine entering the MIA from the Bundidgerry Creek (a branch of the Murrumbidgee River) upstream of MI's area of operation following previous detections of the chemical at this site during benchmark sampling.

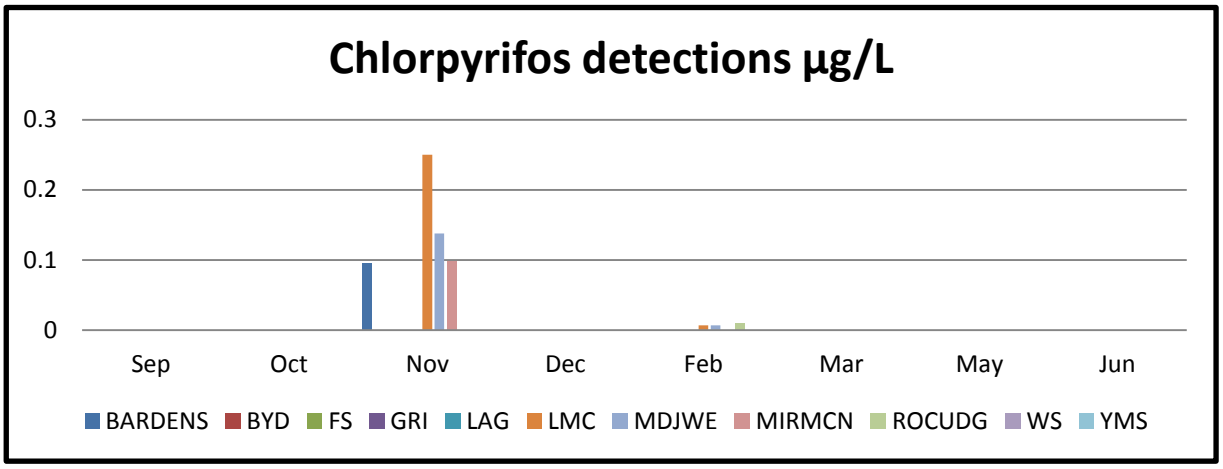
Figure 7.6.1 (a): Atrazine Monitoring Trends



7.6.2 CHLORPYRIFOS MONITORING TRENDS

The trigger sampling program has identified trace level detections of Chlorpyrifos throughout the drainage network. Of all the 22 detections, two were above EPA notification level and two were above the EPA action level, with 45% of yearly detections occurring in the month of November. Chlorpyrifos is a broad spectrum insecticide commonly applied to rice and cotton crops, which would have been in the stage of early establishment during November. These detections predominantly followed a large storm event with 94 mm of rain introducing residues in MI's drainage system via off farm drainage.

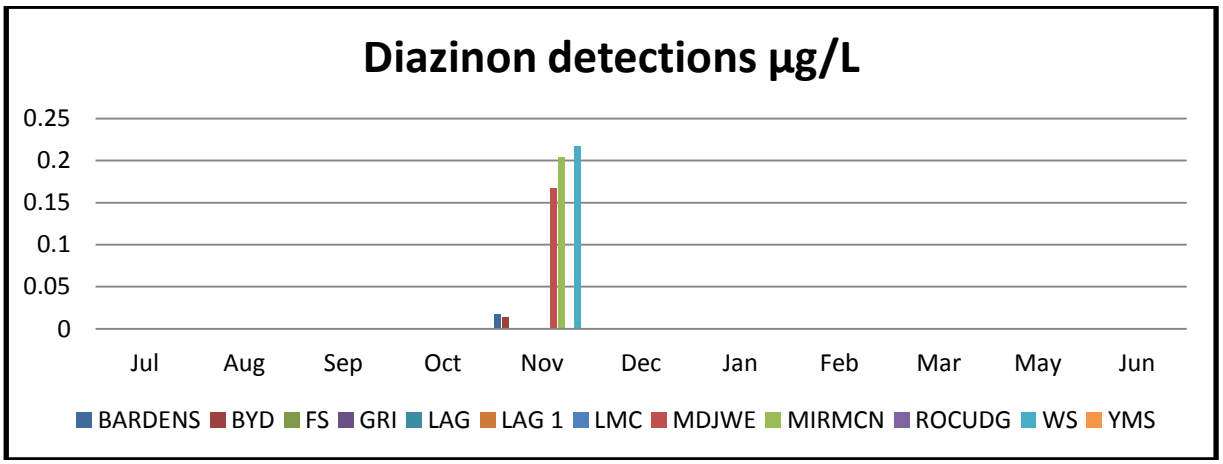
Figure 7.6.2 (a): Chlorpyrifos Monitoring Trends



7.6.3 DIAZINON MONITORING TRENDS

Diazinon is an insecticide utilised to control foliage and soil insects in agricultural crops. The trigger sampling program has identified trace level detections of this chemical throughout the drainage network. Of all 24 Diazinon detections, three were above EPA notification level and two were above the EPA action level. Nearly half (42%) of these detections occurred in November, as previously discussed, were identified after a large storm event (94 mm rain). This is likely to have occurred due to recent application of the chemical used in establishing rice and cotton crops, with residual chemical migrating off farm via runoff after rainfall.

Figure 7.6.3 (a): Diazinon Monitoring Trends

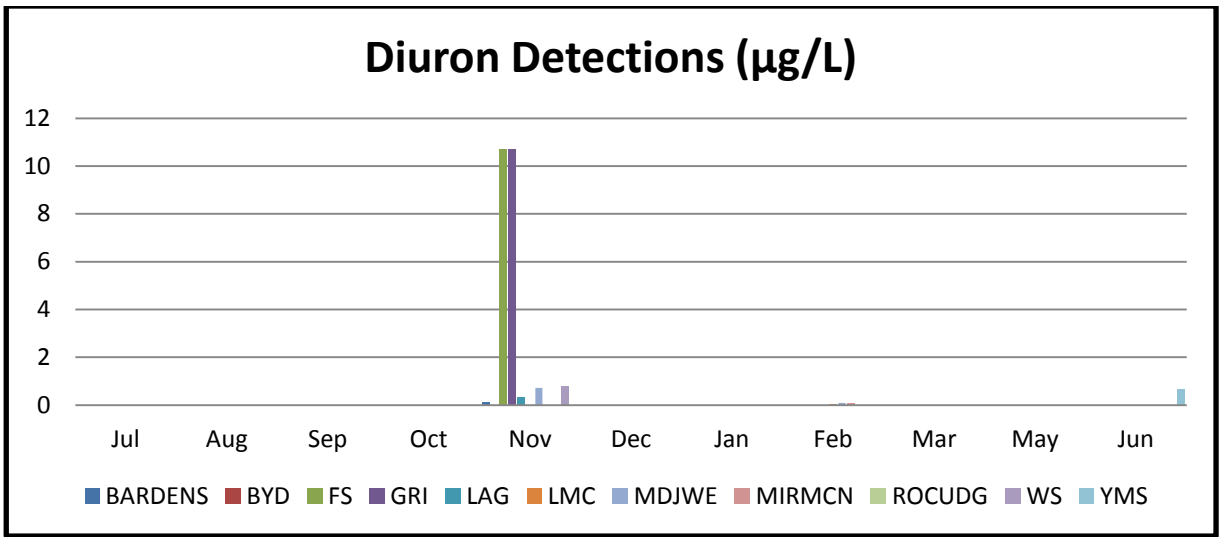


7.6.4 DIURON MONITORING TRENDS

Diuron is an herbicide and algaecide utilised in agriculture for broadacre and cotton crops. The trigger sampling program has identified trace level detections of this chemical throughout the drainage network. Of all 23 Diuron detections, two were above EPA notification level and one was above the EPA action level. Nearly half (44%) of all Diuron detections occurred in November, after a large storm event

(94 mm rain). This is likely to have occurred due to recent application of the chemical to establishing crops, with residual chemical washing off farm into MI's drainage system.

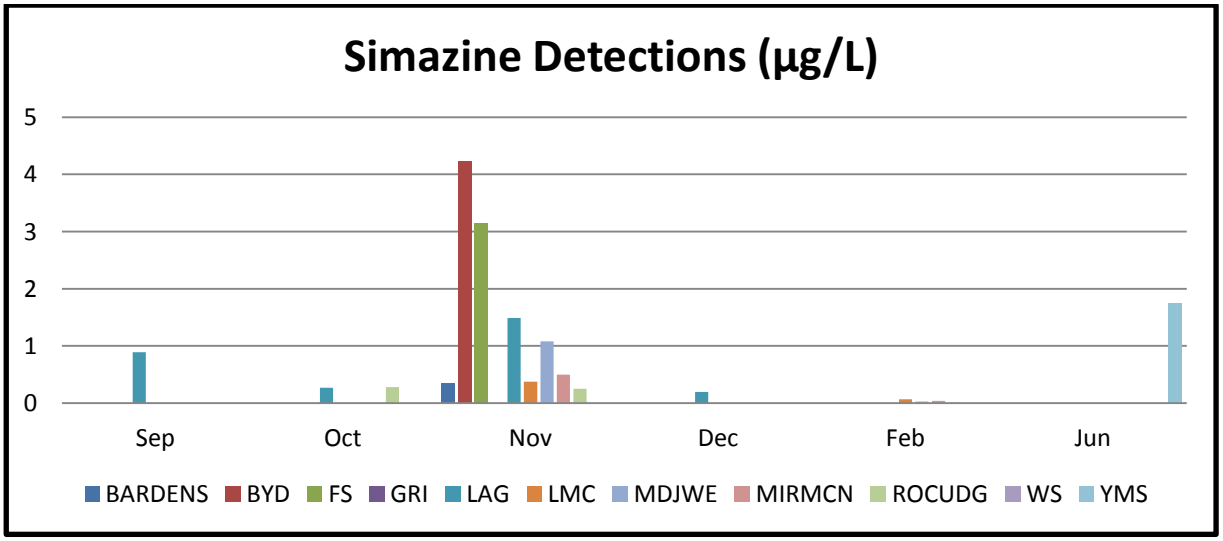
Figure 7.6.4 (a): Diuron Monitoring Trends



7.6.5 SIMAZINE MONITORING TRENDS

Simazine is an herbicide commonly used to control broad-leaved weeds and annual grasses. The trigger sampling program has identified trace level detections of this chemical throughout the drainage network. Of all 22 detections identified only one was above EPA notification level, and none were above the EPA action level. A high majority (45%) of detections occurred in November, after a large storm event (94 mm rain), likely to have caused applied chemical residues to wash off farm.

Figure 7.6.5 (a): Simazine Monitoring Trends



7.6.6 METOLACHLOR MONITORING TRENDS

Metolachlor is an organic compound which is used as an herbicide against grasses and broad leafed weeds. The trigger sampling program has identified 22 detections of Metolachlor throughout the drainage network. Of all 22 detections identified, 10 were identified as above EPA notification level, and six were above the EPA action level. A high majority (45%) of detections occurred in November, after a large storm event (94 mm rain), likely to have caused residues to wash off farm from establishing rice or cotton crops. A study was conducted late 2012 in response to higher than normal detection levels at LAG in October, to address concerns of potential impacts of Metolachlor on billabong systems downstream from the drainage discharge point.

Figure 7.6.6 (a) Metolachlor Monitoring Trends

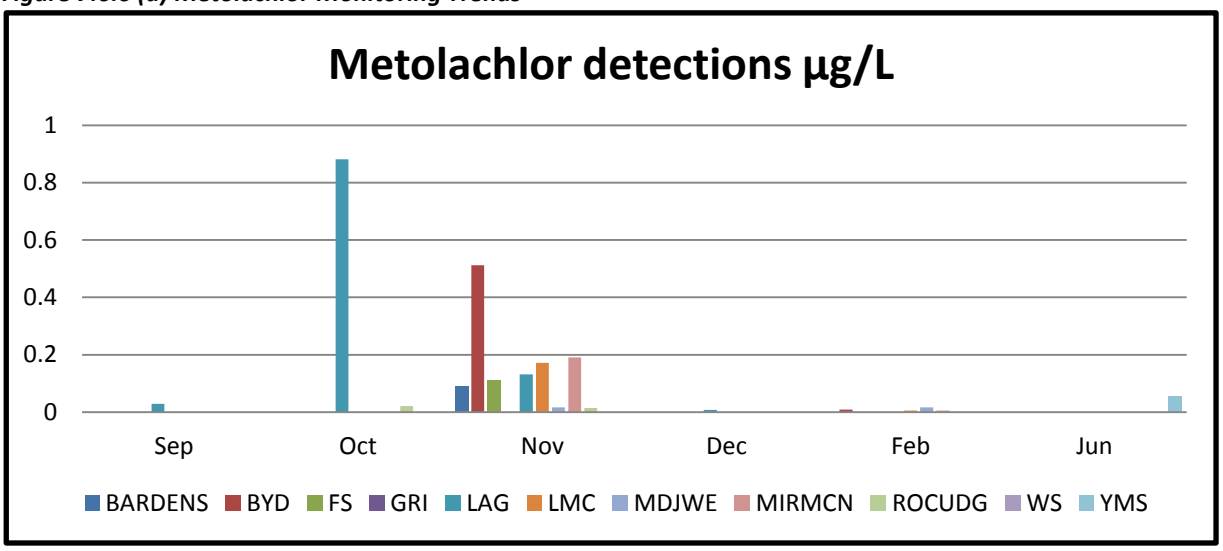


Table 7.6.6 (b) Monthly Conductivity and Turbidity monitoring

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
EC results (µs/cm)												
YMS	NF	NF	NF	NF	NF	NF	NF	NF	70	NF	309	NF
GMSRR	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
LAG	NF	NF	216	189	321	173	NF	NF	NF	NF	NF	NF
ROCUDG	250	470	NF	221	148	NF	NF	NF	214	NF	NF	NF

Site	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Turbidity results (NTU)												
YMS	NF	NF	NF	NF	NF	NF	NF	NF	NT	NF	132	NF
GMSRR	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
LAG	NF	NF	88	134	180	138	NF	NF	NF	NF	NF	NF
ROCUDG	77	93.5	NF	75.7	98.2	NF	NF	NF	NT	NF	NF	NF

Source: Murrumbidgee Irrigation field data

NF = No flow and also includes when the channel or bed surface is between the dry and saturated state and the extent of available water for testing is minimal or impractical to obtain grab samples

7.7 POLLUTION REGISTER

MI maintains the company pollution incident register. As events occur or are reported, observations, actions and licence compliance processes are recorded for future management and reporting purposes.

Table 7.7 (a): Summary of all events reported under R.2 and R.3 of the Environment Protection Licence

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Pesticide OE&H Action Level				
LAG discharge site	8/10/2012	Action level Metolachlor	EPA Notified via email 17/10/2012	Sampling program and investigation
LAG discharge site	2/11/2012	Action level Metolachlor	EPA Notified via email 9/11/2012	Sampling program and investigation
LAG discharge site	8/10/2013	Action level Metolachlor	EPA Notified via email 17/10/2012	Sampling program and investigation
LAG discharge site	22/10/2012	Action level Metolachlor	EPA Notified via email 9/11/2012	Sampling program and investigation
MIRMCN internal site	8/11/2012	Action level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
MIRMCN internal site	8/11/2012	Action level Diazinon	EPA Notified via email 5/12/2012	Continue to monitor trends
MDJWE internal site	8/11/2012	Action level Chlorpyrifos	EPA Notified via email 5/12/2012	Continue to monitor trends
WS internal site	8/11/2012	Action level Diazinon	EPA Notified via email 5/12/2012	Continue to monitor trends
BYD internal site	8/11/2012	Action level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
LMC internal site	8/11/2012	Action level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
LMC internal site	8/11/2012	Action level Chlorpyrifos	EPA Notified via email 5/12/2012	Continue to monitor trends
LAG discharge site	8/11/2012	Action level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
FS internal site	8/11/2012	Action level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
FS internal site	8/11/2012	Action level Diuron	EPA Notified via email 5/12/2012	Continue to monitor trends

Table 7.7 (a): Summary of all events reported under R.2 and R.3 of the Environment Protection Licence (Continued)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Pesticide OE&H Notification Level				
BYD internal site	17/09/2013	Notification level Chlorfyrifos	EPA Notified via email 5/10/2012	Continue to monitor trends
LAG discharge site	27/09/2012	Notification level Metolachlor	EPA Notified via email 17/10/2012	Continue to monitor trends
Bardens internal site	8/11/2012	Notification level Metolachlor	EPA Notified via email 5/12/2012	Continue to monitor trends
Bardens internal site	8/11/2012	Notification level Diazinon	EPA Notified via email 5/12/2013	Continue to monitor trends
Bardens internal site	8/11/2012	Notification level Chlorpyrifos	EPA Notified via email 5/12/2014	Continue to monitor trends
MIRMCN internal site	8/11/2012	Notification level Chlorpyrifos	EPA Notified via email 5/12/2015	Continue to monitor trends
MDJWE internal site	8/11/2012	Notification level Diazinon	EPA Notified via email 5/12/2016	Continue to monitor trends
BYD internal site	8/11/2012	Notification level Simazine	EPA Notified via email 5/12/2017	Continue to monitor trends
BYD internal site	8/11/2012	Notification level Diazinon	EPA Notified via email 5/12/2018	Continue to monitor trends
LAG discharge site	13/12/2012	Notification level Diuron	EPA Notified via email 21/12/2012	Continue to monitor trends
YMS discharge site	4/06/2013	Notification level Metolachlor	EPA Notified via email 5/7/2013	Continue to monitor trends

Table 7.7 (b): MI Pollution Register 2012/13

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Other Pollution Events				
Winery storage dam	2/08/2012	Stocked native fish death.	WQ samples taken for analysis.	All results within guidelines, advised winery. Potentially caused by temperature differential.
Brobenah Road	28/08/2012	Vehicle reported in drain.	Site inspection, vehicle removed no fuel leakages evident.	Report recorded no further action.
DC G	26/09/2012	Grey water pipe leading into drain.	Contacted GCC, owner notified and pipe was removed.	Report recorded no further action.
Brobenah Regulator	15/11/2012	10 pig carcases dumped in canal found at regulator.	Carcases removed and disposed.	Report recorded no further action.
S-2-BALBC-030L	21/11/2012	Landholder reported truck in channel leaking oil at farm 1832 entrance bridge.	Site visit immediately following notification identified small oil leak only, that had ceased.	Channel attendant flushed system prior to recommencing supply.
S-2-54B-030E	28/11/2012	ssLandholder reported neighbouring residents polluting supply channel with possible waste water.	Site Inspection conducted, water quality samples and photos taken. Illegal PVC drainage pipes and structures removed. Letter distributed notifying residents of the pollution incident and MI's management plans.	Management included emptying and flushing channel, testing water quality, desilt to remove sediment. MI working with GCC to ensure future water quality.
S-2-NBC-170L	10/12/2012	Landholder observed dumping rubbish on side of road.	Investigated photos taken and reported incident to GCC.	GCC ordered removal.
S-2-14-010E	1/02/2013	Vehicle reported in canal.	Site inspection, vehicle removed no fuel leakages evident.	Report recorded no further action.

Table 7.7 (b): MI Pollution Register 2012/13 (Continued)

Water Quality Monitoring Site	Date	Issue/Field Observations	Action Taken	Follow Up
Other Pollution Events				
S-2-14-010E	21/03/2013	Vehicle reported in canal.	Site inspection, vehicle removed no fuel leakages evident	Report recorded no further action.
Main Canal	5/04/2013	Vehicle reported in canal.	Site inspection, vehicle removed no fuel leakages evident.	Report recorded no further action.
Lake Talbot boat ramp	17/04/2013	Vehicle reported in lake	Site inspection, vehicle removed no fuel leakages evident.	Report recorded no further action.
S-2-WARB-170E - D-2-V-030E	29/05/2013	Reported purple sludge & discolouration of water	Site inspection, no obvious sludge/discolouration found.	Water flushed and refilled

8. REFERENCES

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9. GLOSSARY

AHD	Australian Height Datum
ANZECCC	Australian and New Zealand Environment and Conservation Council
APHA	American Public Health Association
APVMA	Australian Pesticides and Veterinary Medicines Authority
BBSW	Barren Box Storage and Wetland
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific Investigation and Research Organisation
CSU	Charles Sturt University
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DEM	Digital Elevation Model
DIPNR	Department of Planning and Infrastructure
DNR	Department of Natural Resources
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental impact statement
ELISA	Field testing Molinate kit
EM31	Electromagnetic Induction Survey (31)
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ET	Evapotranspiration
ETo	Reference Evapotranspiration
GBC	Gogeldrie Branch Canal
GIS	Geographic Information System
GL	Gigalitre
ha	Hectare(s)
IHS	Integrated Horticulture Supply
L	Litre
LCR	Licence Compliance Report
LTA	Long term average
LWMP	Land and Water Management Plan
m	Metre
MCMA	Murray Catchment Management Authority
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIA&D	Murrumbidgee Irrigation Area and Districts
µS/cm	MicroSiemens per centimetre
ML	Megalitre
mm	Millimetre
NOW	New South Wales Office of Water
NRM	Natural Resource Management
NTU	Nephloteric Turbidity Units
OEH	Office of Environment and Heritage
pH	Potential hydrogen
POEP Act	Protection of the Environment Operations Act
PVP	Property Vegetation Plan
REM	Rice Environmental Monitoring
SEE	Statement of Environmental Effect
SBS	Sustainable Business Plan
SOP	Standard Operating Procedure
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
URS	Consulting company
USEPA	United States EPA
VMP	Vegetation Management Plan
WFP	Whole farm plan
WUE	Water use efficiency

Note: See Tables 1.5 (a), 7.2 (b) and 7.4 (a) for complete listings of monitoring sites

10. ANNEX A

MURRUMBIDGEE IRRIGATION FLOW & SALT LOAD MONITORING ANNUAL REPORTING 2012 – 2013 FINANCIAL YEARS

Introduction

Thiess Environmental Monitoring Group is contracted by Murrumbidgee Irrigation Limited to conduct continuous level/flow and salinity monitoring at a range of locations distributed across its area of operations.

This report presents monthly statistics and annual summaries of total flow and salt load derived from the monitoring at 'Irrigation Drain & Weather Station' sites for the 2012 – 2013 financial year.

All data reported is extracted from Thiess Hydstra software archive to an accuracy of three (4) significant figures.

A data extraction process called HYTAB is used when extracting the data. HYTAB utilises a configuration file provided by MIL to format the data. This file stipulates reporting to four (4) significant figures. Using four significant figures implies an unrealistic level of accuracy for the data collection processes undertaken Thiess data reporting standards would recommend a maximum of three (3) significant figures.

Annual Flow Summaries

Discharge Volumes (ML)

Site	Parameter	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	TOTAL
YMS (410083)	Mean	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Inst.Max	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Inst.Min	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
LMC (410085)	Mean	12.8	30.6	59.1	73.4	76.3	67.5	146	81.9	89.1	30.4	41.3	27.6	
	Median	10.1	32.5	62.5	74	62.4	71.6	163	74	90.9	27.2	32.6	10.4	
	Inst.Max	77.8	72.2	104	122	360	116	241	323	205	61.7	107	273	
	Inst.Min	4.6	6.1	25.3	39.2	23.1	23.5	44.5	36.8	39.2	16.8	17.1	4.7	
	Total	395.8	948.6	1774	2275	2288	2091	4536	2294	2763	912	1281	828.4	22390
BOD1 (410164)	Mean	0.9@	13.9@	14.9@	18.3@	[9.5]	6.0@	4.9@	[9.0]	[16.1]	3.2@	7.7@	[43.0]	
	Median	0.5@	12.2@	13.0@	14.6@	[4.5]	4.6@	4.2@	[8.5]	[14.1]	0.9@	6.1@	[44.5]	
	Max.Daily	3.7@	35.3@	33.2@	36.2@	[38.5]	23.6@	13.2@	[18.6]	[28.9]	21.9@	23.9@	[51.5]	
	Min.Daily	0.0@	0.0@	4.2@	3.4@	[1.1]	0.5@	0.0@	[2.4]	[7.7]	0.0@	2.8@	[31.6]	
	Total	29@	431@	446@	566@	[246]	187@	152@	[215]	[452]	97@	239@	[172]	[3232]
BBOW (410167)	Mean	31.2	45.6	115	290	331	368	465	383	185	229	167	37.4	
	Median	26.1	41.7	121	308	286	358	475	404	170	233	182	21.7	
	Max.Daily	94.7	114	178	438	599	520	592	515	397	286	282	89.1	
	Min.Daily	13.8	13	40.3	95.1	176	251	339	50.1	38.7	171	28.8	3.4	
	Total	966	1413	3442	8975	9920	11390	14430	10740	5750	6874	5168	1122	80190
DCCENT (410172)	Mean	0.5	1.6K	[2.2]	[1.9]	[0.8]	[0.0]	[]B	[6.4]	[2.5]	0.8	0.8	[15.1]	
	Median	0.4	1.1K	[1.5]	[1.4]	[0.4]	[0.0]	[]B	[6.3]	[2.2]	0.4	0.5	[19.3]	
	Inst.Max	2.4	11.5K	[8.4]	[8.0]	[4.2]	[0.1]	[]B	[14.8]	[7.1]	5.3	5.5	[20.6]	
	Inst.Min	0	0.0K	[0.3]	[0.2]	[0.0]	[0.0]	[]B	[0.0]	[0.1]	0	0.1	[0.8]	

	Total	15.49	50.39K	[55.22]	[55.23]	[21.20]	[0.061]	[]B	[121.4]	[73.88]	24.96	24.78	[45.17]	[487.8]M
MDJWE (410174)	Mean	16.0R	90.8R	198	209	[212	263	269	299R	207R	120	124	46.6R	
	Median	9.9R	91.6R	156	211	[210	275	268	292R	197R	120	126	34.6R	
	Inst.Max	127R	263R	337	293	[588	399	385	798R	481R	199	240	273R	
	Inst.Min	4.0R	18.8R	63.2	123	[97.3]	149	150	185R	111R	80.7	57.3	12.6R	
	Total	496.9R	2815R	5954	6474	[5950]	8162	8344	8373	R6402	R3607	3838	1397R	[61810]
ROCUDG (41010005)	Mean	[2.6]	[2.3]	[1.4]	8.8R	2.6R	0.1R	1.0R	1.6R	0.6R	1.9R	1.3R	[77.8]	
	Median	[2.4]	[2.3]	[0.9]	2.0R	1.6R	0.0R	0.0R	0.0R	0.0R	0.2R	0.3R	[93.5]	
	Inst.Max	[4.3]	[2.8]	[4.5]	81.3R	13.3R	1.4R	9.2R	15.9R	5.3R	13.4R	10.6R	[119]	
	Inst.Min	[2.0]	[1.7]	[0.3]	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Total	[15.50]	[38.80]	[32.25]	273.6R	76.66R	1.713R	32.29R	46.17R	18.53R	57.42R	39.47R	[933.6]	[1566]
DCCUD (41010713)	Mean	0.8R	3.6R	4.0R	3.5R	5.8R	1.0R	0.2R	0.3R	6.2R	1.4R	1.2R	2.6R	
	Median	0.0R	1.2R	4.2R	3.0R	4.2R	0.4R	0.0R	0.1R	5.6R	0.2R	0.5R	0.2R	
	Inst.Max	6.8R	15.5R	11.9R	14.3R	19.8R	8.5R	4.1R	3.1R	14.7R	6.5R	15.2R	20.4R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Total	24.37R	113R	119.4R	109R	173.2R	30.58R	6.866R	7.357R	192.4R	42.61R	38.09R	76.65R	933.6R
GMSRR (41010921)	Mean	0.4R	0.0R	0.0R	0.4R	0.7R	0.2R	0.3R	0.3R	0.3R	0.0R	0.0R	0.0R	
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Inst.Max	5.9R	0.0R	0.0R	17.6R	26.9R	7.7R	12.7R	27.0R	25.1R	0.0R	0.0R	0.0R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Total	12.16R	0.000R	0.000R	12.38R	20.61R	7.184R	10.55R	7.938R	10.14R	0.000R	0.000R	0.000R	80.96R
LAG (41010940)	Mean	0.2R	2.3R	2.6R	9.5R	3.7R	7.2R	1.4R	0.2R	0.7R	0.1R	0.3R	0.8R	
	Median	0.0R	0.2R	1.1R	6.8R	0.2R	0.4R	0.0R	0.0R	0.1R	0.0R	0.1R	0.0R	
	Inst.Max	10.5R	20.5R	22.7R	64.0R	48.8R	59.7R	33.5R	10.8R	12.3R	1.9R	2.6R	9.9R	
	Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Total	5.405R	70.92R	77.33R	293.7R	111.5R	221.9R	42.73R	4.484R	21.15R	1.788R	8.713R	25.16R	884.8R
MIRMCN (41010955)	Mean	49	180	550	395	423	584	874	733	289	263	263	148	
	Median	43.8	169	488	368	351	736	977	730	258	252	231	101	
	Inst.Max	170	453	824	789	1520	902	1150	1130	897	371	460	507	
	Inst.Min	7.9	44	253	274	159	187	462	486	157	165	118	23.4	
	Total	1520	5585	16510	12230	12680	18120	27080	20520	8973	7884	8143	4450	143700

DCWIDG (41017001)	Mean	0	1.1	1.0K	1.7	4.1	0.6K	1.4	0.8	2.8	0.7	0.5	1.2	
	Median	0	0.1	0.7K	1.5	1.2	0.3K	1.4	0	2.5	0.5	0.1	0.1	
	Inst.Max	0.2	16.3	9.5K	7.4	84.1	3.5K	4.8	27.6	11.9	4.1	4.2	18.2	
	Inst.Min	0	0	0.0K	0.1	0	0.0K	0	0	0.4	0.2	0	0	
	Total	0.987	33.98	29.96K	53.95	122	17.3K	42.87	21.61	86.68	20.29	14.78	36.8	481.2

@	...	Theoretical rating table applied
[]	...	Some missing record during the period
?	...	Irregular data, use with caution
B	...	Backed-up stage
K	...	Minor editing
M	...	Equipment malfunction
R	...	Rating table extrapolated
S	...	Rating table suspended
T	...	Probe out of water/below instrument threshold
X	...	Rating table exceeded

Annual Salt Load Summaries

Monthly Salt Loads (tonnes)

Site		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
WEST FLOWING DRAINS														
LMC (410085)	Mean	4.1K	6.9?	9.1?	8.6	8.5K	8	15	12	[17.8]	[5.8]	5.8	5.2	
	Median	3.5K	6.7?	9.2?	8.8	6.7K	8.1	16.9	11.7	[18.1]	[5.6]	5.2	1.9	
	Maximum	37.1K	17.9?	15.5?	16.2	52.3K	15.3	26.3	48.1	[55.8]	[11.9]	17.1	65.5	
	Minimum	1.4K	2.4?	2.9?	4.7	3.3K	2.3	4.8	5.9	[10.4]	[3.1]	2.9	0.5	
	Total	127K	214?	272?	266	255K	249	466	336	[463]	[151]	181	155	[3136]
MIRROOL AREA - MIRROOL CREEK														
MIRMCN (41010955)	Mean	19.4	33.7	81	52.7	92.9	75.4	79.2	61.1	52.6	64.6	34	31.4	
	Median	15.8	32.7	84.4	52.8	75.1	80.8	82.1	61.1	40.7	65.5	31.4	27.3	
	Maximum	147	78.1	122	91.8	292	125	103	106	147	96.9	68	143	
	Minimum	4.9	12.8	33.8	29.6	36.1	31.1	47.5	44.6	27.3	31	14.1	6.9	
	Total	601	1046	2431	1634	2786	2337	2456	1710	1631	1939	1055	941	20570
DRAINS														
MDJWE (410174)	Mean	[9.0]	22.5R	36	39.3K	[56.1]	43.9	34.1	35.1R	37.1R	14.9	19.6	14.7R	
	Median	[7.8]	22.9R	32.8	39.0K	[48.0]	41.6	35.5	32.7R	35.4R	14.5	19.2	12.9R	
	Maximum	[49.3]	73.4R	57.6	75.7K	[191]	89	51.1	120r	89.2R	23.8	53.1	58.5R	
	Minimum	[0.2]	3.0R	12.2	20.8K	[24.9]	26.7	11.4	22.7R	18.9R	9.4	9.6	3.8R	
	Total	[188]	696R	1079	1217K	[1570]	1362	1057	984R	1149R	446	607	442R	[10800]
BARREN BOX OUTFALL CANAL WYVERN														
BBOW (410167)	Mean	6.4	8.9	15.9K	47.3K	72.4	64.7	60.7	40.7	32.4	38.0K	22.9K	7.8	
	Median	5.5	7	15.4K	50.6K	62.4	60.5	61.7	40.5	29.7	39.8K	24.1K	5.6	
	Maximum	24.6	31.8	27.5K	80.9K	150	132	85.1	65.1	82.4	54.1K	43.1K	30.8	
	Minimum	-6.9	1.6	3.9K	8.9K	20.9	26.7	29.2	2.3	2.5	19.1K	0.9K	-3.4	
	Total	198	277	476K	1466K	2171	2006	1881	1140	1006	1141K	709K	235	12700

YANCO AREA - RIVER DRAINS

YMS (410083)	Mean	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Maximum	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Minimum	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	
	Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
GMSRR (41010921)	Mean	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	[0.0]	0.1R	0.0R	0.0R	0.0R	
	Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	
	Maximum	0.7R	0.0R	0.0R	1.2R	3.8R	0.7R	0.0R	[0.0]	3.8R	0.0R	0.0R	0.0R	
	Minimum	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	
	Total	1R	0R	0R	1R	3R	1R	0R	[0]	2R	0R	0R	0R	[9]
LAG (41010940)	Mean	0.0R	0.5R	0.3R	1.5R	0.6R	0.6R	0.1R	0.0R	0.1R	0.0R	0.0R	0.2R	
	Median	0.0R	0.1R	0.1R	0.7R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Maximum	0.3R	3.6R	3.9R	11.6R	20.0R	6.9R	3.6R	0.0R	1.8R	0.7R	0.4R	2.1R	
	Minimum	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Total	0R	14R	10R	46R	18R	19R	4R	0R	3R	1R	1R	5R	121R
ROCUDG (41010005)	Mean	[0.7]	[0.6]	[0.2]	0.8R	0.3R	0.0R	0.2R	0.2R	0.1R	0.2R	0.1R	[5.3]	
	Median	[0.6]	[0.6]	[0.2]	0.2R	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[7.1]	
	Maximum	[1.0]	[0.7]	[0.6]	6.6R	1.3R	0.1R	1.2R	2.1R	0.5R	1.0R	0.6R	[8.0]	
	Minimum	[0.5]	[0.4]	[0.1]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
	Total	[4]	[11]	[5]	24R	9R	0R	5R	6R	2R	5R	3R	[64]	[140]

BENEREMBAH SITES

BOD1 (410164)	Mean	0.3@	2.3@	2.4@	2.4@	[1.2]	0.8@	0.8@	[1.1]	[3.0]	0.6@	1.0@	[8.4]	
	Median	0.2@	2.1@	2.2@	2.0@	[0.7]	0.7@	0.8@	[1.1]	[2.9]	0.2@	0.7@	[6.6]	
	Maximum	2.2@	6.1@	4.7@	6.6@	[4.8]	3.2@	2.3@	[2.7]	[7.0]	4.9@	9.3@	[15.9]	
	Minimum	0.0@	0.0@	0.7@	0.6@	[0.1]	0.0@	0.0@	[0.1]	[1.0]	0.0@	0.1@	[2.9]	
	Total	10@	72@	71@	75@	[33]	25@	25@	[28]	[82]	19@	32@	[42]	[514]

DCCUD (41010713)	Mean	0.2R	0.7R	0.7R	0.6R	1.8R	0.4R	0.0R	0.0R	1.4R	0.3R	0.1R	0.8R	
	Median	0.0R	0.2R	0.7R	0.5R	1.1R	0.1R	0.0R	0.0R	0.9R	0.1R	0.1R	0.1R	
	Maximum	3.2R	4.5R	3.2R	1.9R	11.0R	3.5R	0.3R	0.3R	3.7R	2.0R	2.1R	7.7R	
	Minimum	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
	Total	5R	22R	21R	18R	53R	11R	1R	1R	42R	10R	4R	24R	213R
DCWIDG (41017001)	Mean	0	0.2	0.2K	0.2	0.7	0.2K	0.3	0	0.6	0.1	0.1	0.4	
	Median	0	0	0.1K	0.2	0.2	0.1K	0.3	0	0.5	0.1	0	0	
	Maximum	0.1	3.3	2.1K	0.8	17.9	1.2K	1	1.2	5.1	0.9	0.7	8.5	
	Minimum	0	0	0.0K	0	0	0.0K	0	0	0	0	0	0	
	Total	0	6	5K	7	22	5K	8	1	19	4	2	11	91
DCCENT (410172)	Mean	0.2	0.4K	[0.5]	[0.4]	[0.2]	[0.0]	[]B	[7.6]	[1.0]	0.3	0.3	[2.7]	
	Median	0.1	0.2K	[0.4]	[0.3]	[0.1]	[0.0]	[]B	[5.1]	[0.8]	0.2	0.2	[3.2]	
	Maximum	0.7	2.6K	[1.8]	[1.7]	[0.8]	[0.0]	[]B	[33.0]	[6.0]	1.3	3	[5.3]	
	Minimum	0	0.0K	[0.1]	[0.0]	[0.0]	[0.0]	[]B	[0.0]	[0.0]	0	0	[0.1]	
	Total	5	12K	[13]	[10]	[5]	[0]	[]B	[129]	[29]	10	8	[11]	[233]

@	...	Theoretical rating table applied
[]	...	Some missing record during the period
?	...	Irregular data, use with caution
B	...	Backed-up stage
K	...	Minor editing
M	...	Equipment malfunction
R	...	Rating table extrapolated
S	...	Rating table suspended
T	...	Probe out of water/below instrument threshold
X	...	Rating table exceeded

Annual Site Visit Summary

SI No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
410083	YMS	12	12	0	This site not rated. No measurements done		No flow or total salt load data available. Murrumbidgee Irrigation to supply flow figures in order to quantify salt loads. Refer agreement with Grant Gyles.
410085	LMC	12	12	4	Good range of measurements conducted across various flow rates.	1* EC sensor (April 2013)	Level encoder is old technology and required maintenance during the year. This encoder needs to be replaced.
410164	BOD1	13	12	2	Difficult to take accurate measurements due to large x-sectional area and very slow velocities.	1* level sensor (March 2013)	Generally higher flows this year than in previous years but velocities still very low.
410167	BBOW	12	12	6	Calibration of Sontek velocity sensor has delivered improved quality data. Wide range of flows enabled good range of measurements to be obtained this year		Banks eroding following floods of 2012. Drain starting to silt up slightly.
410172	DCCENT	12	12	5	Measurement of higher flows indicate possible rating change. More measurements required above approximately 12 ML/day		Subject to backup from Mirrool Creek. Have noted some high EC levels this year
410174	MDJWE	13	12	6	Higher number of measurements made to establish new rating. More measurements still required.		Control repairs completed August 2012. Increased number of measurements obtained to establish new rating. New control has improved the stability of the flow rating – but inflows and diversions which occur between the monitoring station and the control continue to complicate flow monitoring.
41010005	ROCUDG	12	12	4	Site had a rating change applied during the year after re-levelling gauges and conducting measurements.		New bridge crossing installed downstream of control may 2013. Expect this will cause less backup than the old bridge.
41017001	DCWIDG	12	12	3	Generally only low flow measurements were conducted during the season as expected. No changes		Site is still equipped with an old Mindata logger. Recommend upgrade to latest technology

SI No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
					made to the rating.		
41010713	DCCUD	12	12	3	Rating adversely affected by livestock causing deterioration near monitoring site		Site is still equipped with an old Mindata logger. Recommend upgrade to latest technology. This site has flowed for a much longer period this season. Livestock entering drain have caused deterioration to bed and banks.
41010921	GMSRR	12	12	0	Site has been dry or not flowing during the year so no measurements taken	1*EC sensor (Nov 2012)	Outfall site not equipped with communications.
41010940	LAG	12	12	1	Only very low or no flows during site visits this year – no opportunities for more measurements.		Unstable natural control with changing cease to flow level. New rating developed June 2013 – Expect continual changes.
41010955	MIRMCN	13	12	5	Measurements generally close to rating this year.		Operating satisfactorily. Access deteriorated since floods of 2012.
			TOTALS	39		5	
General Comments :		Rodents continue to present a problem, though no damage to instruments has occurred. Thiess continues to lay baits to control vermin and implement other control measures as in previous years.					Signature: S HALL.

11. ANNEX B

DETAILS OF NON-COMPLIANCE WITH EPL4651

Licence Condition Not Complied With

M2.1 requirement to monitor concentration of pollutants discharged.

Summary Of The Particulars Of The Non-Compliance

Parameter Turbidity - due to a field instrument failure the parameter Turbidity (NTU) was unable to be taken during all flow periods at the following sites:

- Discharge & Monitoring Point 4 "LAG" – *required sampling 8 times during the reporting year, 4 samples were analysed for Turbidity.*
- Discharge & Monitoring Point 6 "YMS" – *required sampling 1 time during the reporting year, 0 samples were analysed for Turbidity.*
- Discharge & Monitoring Point 7 "ROCUDG" – *required sampling 7 times during the reporting year, 5 samples were analysed for Turbidity.*

Dates of Non-Compliance

June 2012, Equipment Failure- November 2012 to June 2013.

Location(s)

Discharge & Monitoring Point 4.
Lagoon Drain from Gogelderie Main Southern (LAG) on Map Titled "Key Infrastructure & Water Quality Sites of the MIA" dated 18 January 2013 and on EPA File LIC07/2304-03.

Discharge & Monitoring Point 6.
Yanco Main Southern Drain (YMS) on Map Titled "Key Infrastructure & Water Quality Sites of the MIA" dated 18 January 2013 and on EPA File LIC07/2304-03.

Discharge & Monitoring Point 7.
Cudgel Creek downstream of Roaches Escape (ROCUDG) on Map Titled "Key Infrastructure & Water Quality Sites of the MIA" dated 18 January 2013 and on EPA File LIC07/2304-03.

Cause Of Non-Compliance

Field instrument failure of in-field turbidity measuring device. 7 out of 15 turbidity measurements were not undertaken in the field due to this failure.

Action Taken To Mitigate Adverse Effects of the Non-Compliance
No adverse effects identified.

Action Taken To Prevent a Recurrence
Purchased new sampling equipment July 2013.
Licence Condition Not Complied With

M2.1 requirement to monitor concentration of pollutants discharged.

Summary of The Particulars Of The Non-Compliance

All licensed parameters – MI failed to sample during two discharge events July (2.8ML) and August (4.5ML) at:

- Discharge & Monitoring Point 7 "ROCUDG" –*sampling was not undertaken in accordance with licence requirements in the months of July and August 2012.*

Dates of Non-Compliance

July and August 2012.

Location(s)

Discharge & Monitoring Point 7.
Cudgel Creek downstream of Roaches Escape (ROCUDG) on Map Titled "Key Infrastructure & Water Quality Sites of the MIA" dated 18 January 2013 and on EPA File LIC07/2304-03.

Cause of Non-Compliance

MI failed to sample during two discharge events in July and August 2012.

Action Taken To Mitigate Adverse Effects of the Non-Compliance
No adverse effects identified.

Action Taken To Prevent a Recurrence
Monthly Compliance Checklists, which form part of a Companywide Compliance Management Framework, has been put in place from July 2013.

12. ANNEX C – GROUND WATER LEVEL TABLES

Figure 2.4.1 (c): Gogeldrie Groundwater Levels –March 2011 -2013

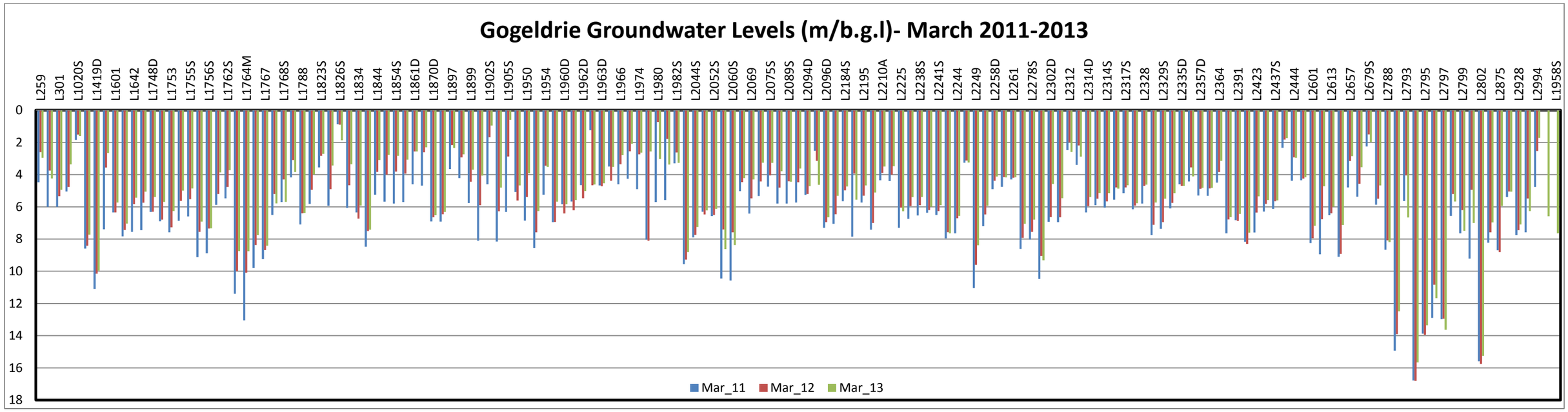


Figure 2.4.1 (d): Gogeldrie Groundwater Levels –September 2011 -2013

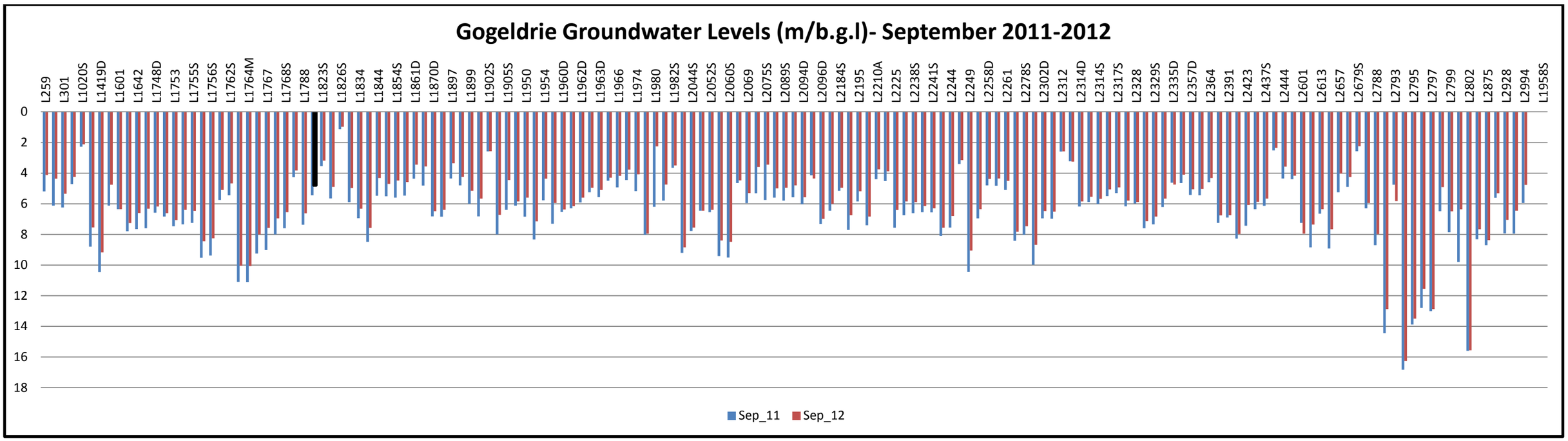


Figure 2.4.2 (a): Koonadan Groundwater Levels from March 2011 – 2013.

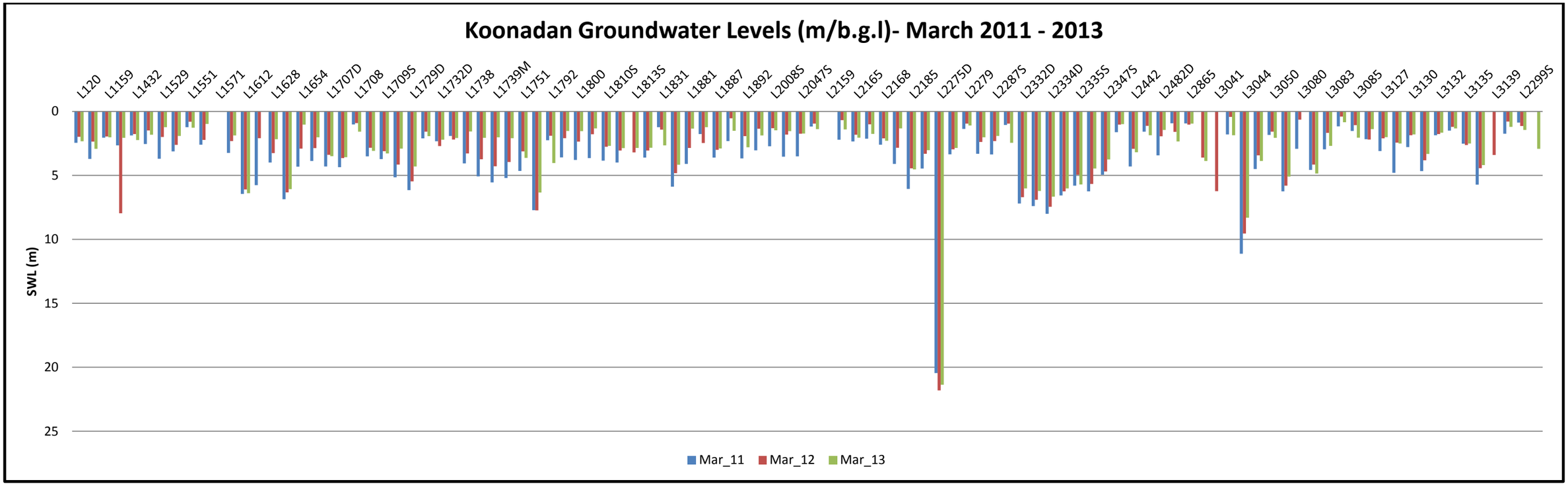


Figure 2.4.2 (b): Koonadan Groundwater Levels from September 2011 – 2012.

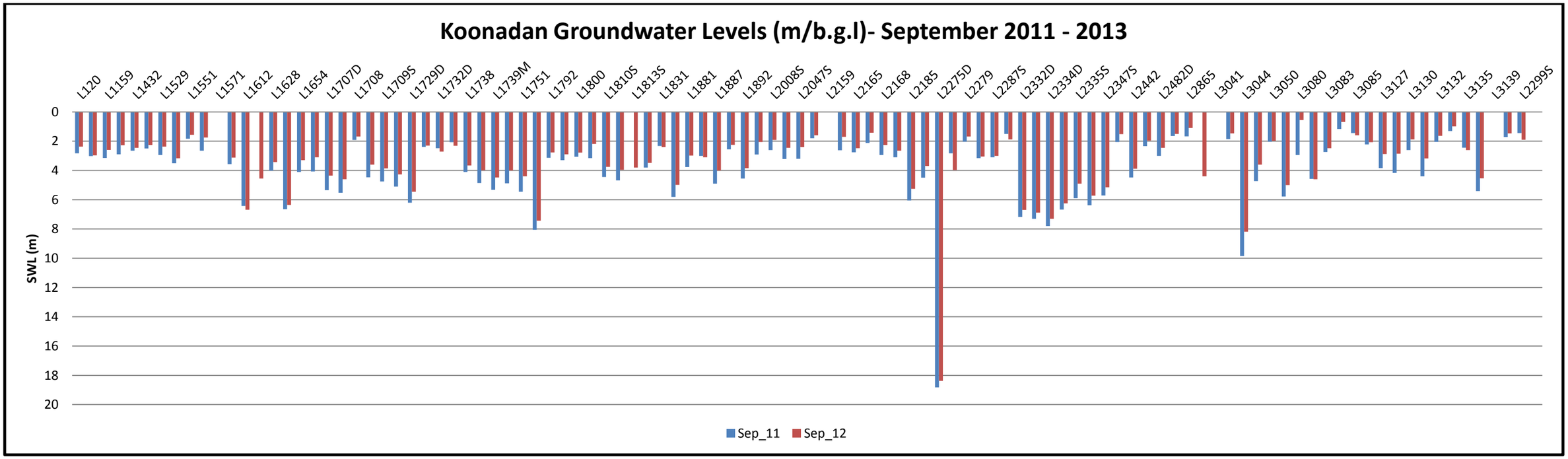


Figure 2.4.2 (e): Murrami Groundwater Levels from March 2011 - 2013

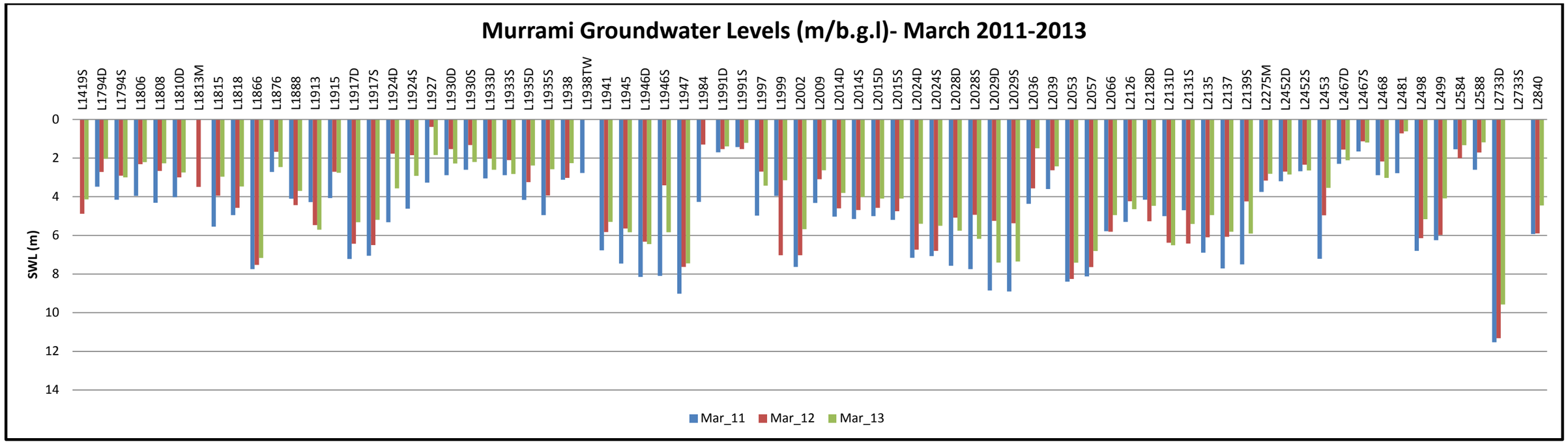


Figure 2.4.2 (f): Murrami Groundwater Levels from September 2011 – 2012.

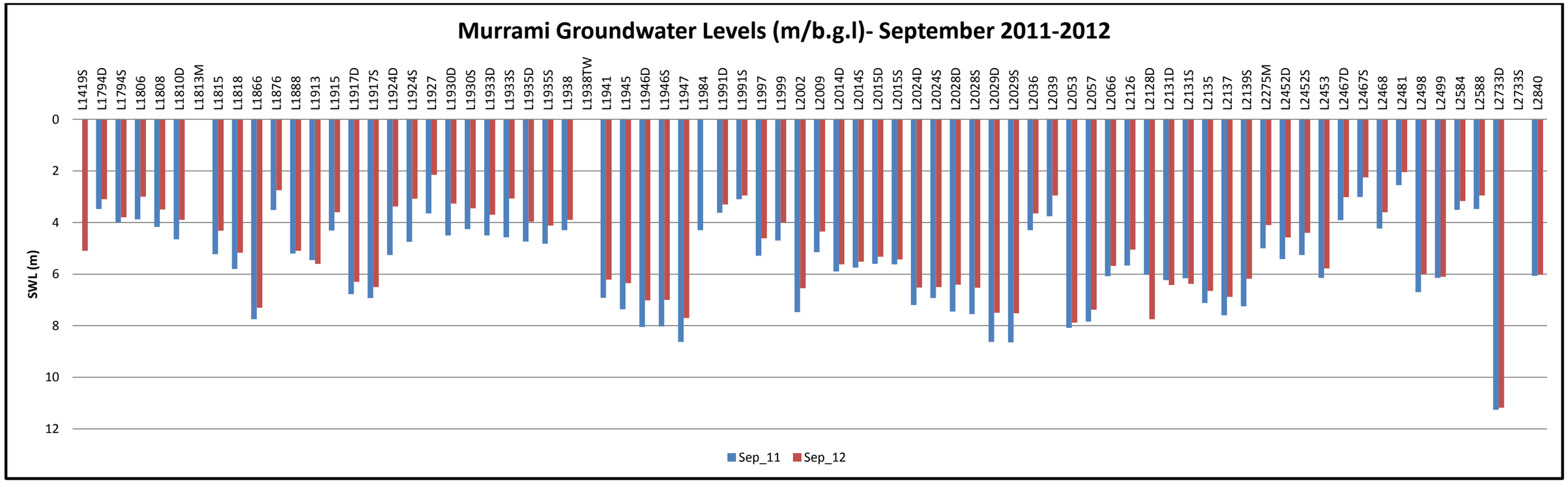


Figure 2.4.2 (h): Kooba Groundwater Levels from March 2012 - 2013

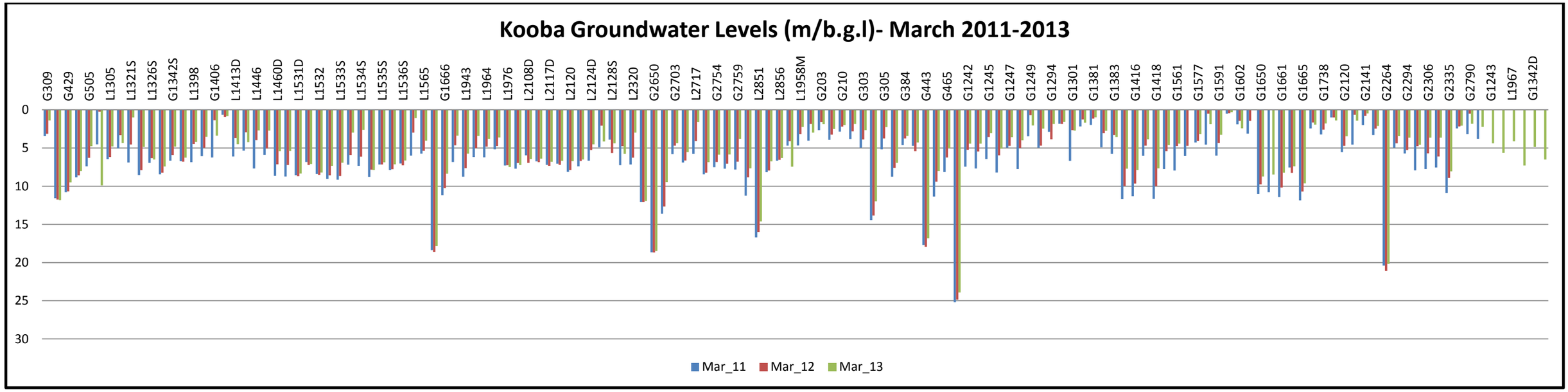


Figure 2.4.2 (i): Kooba Groundwater Levels from September 2011 – 2012

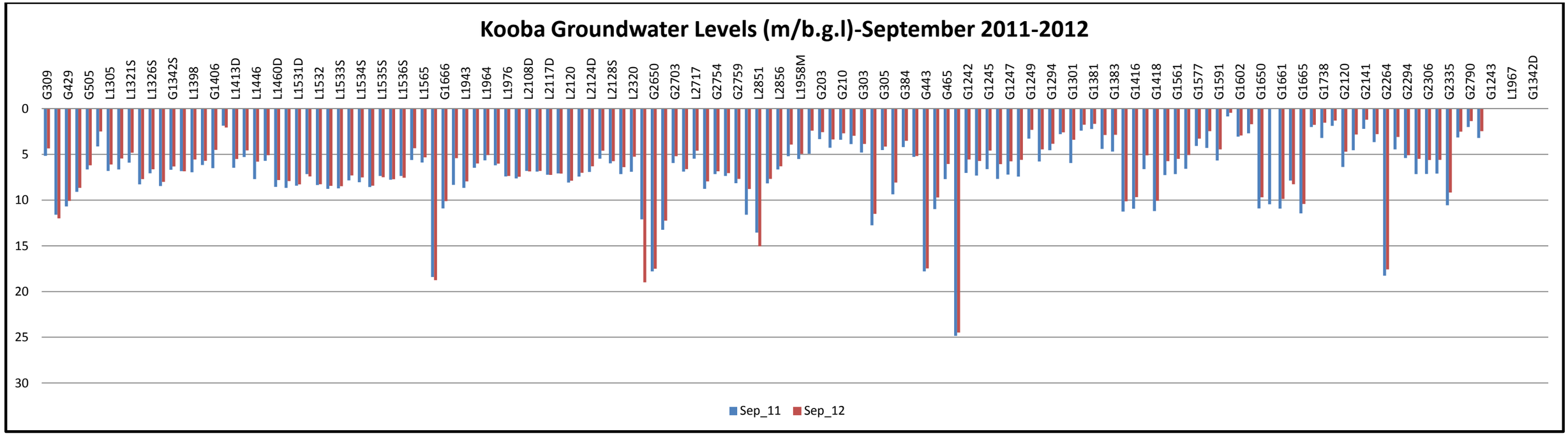


Figure 2.4.3 (a): Hanwood Groundwater Levels from March 2011 to 2013.

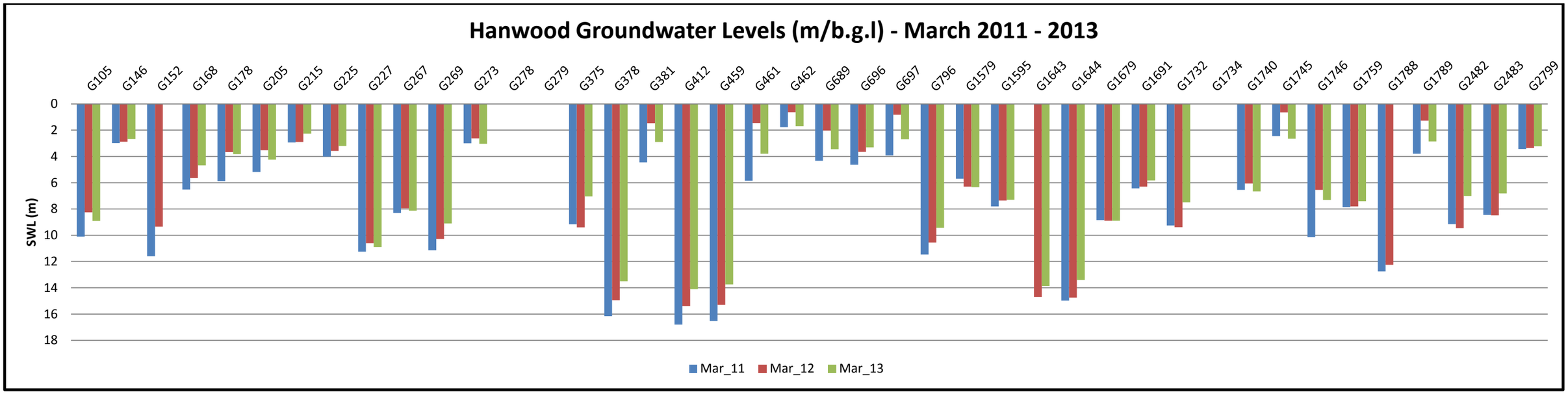


Figure 2.4.3 (b): Hanwood Groundwater Levels from September 2011 to 2012.

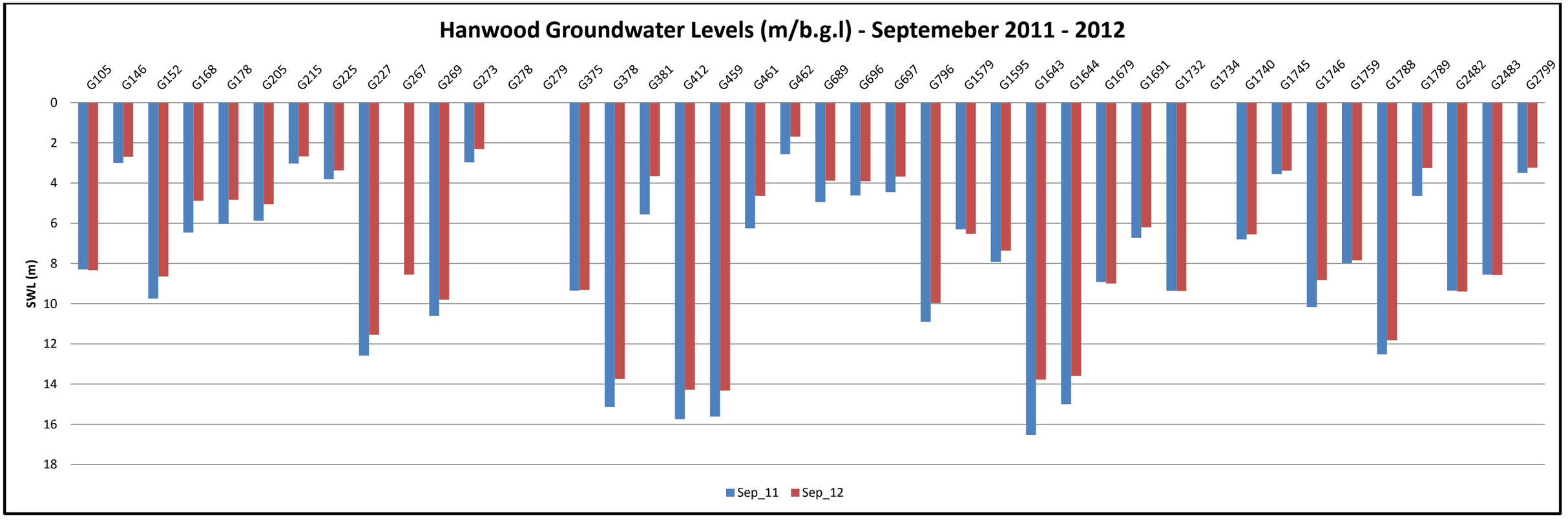


Figure 2.4.3 (d): Yenda and Bilbul Groundwater Levels from March 2011.

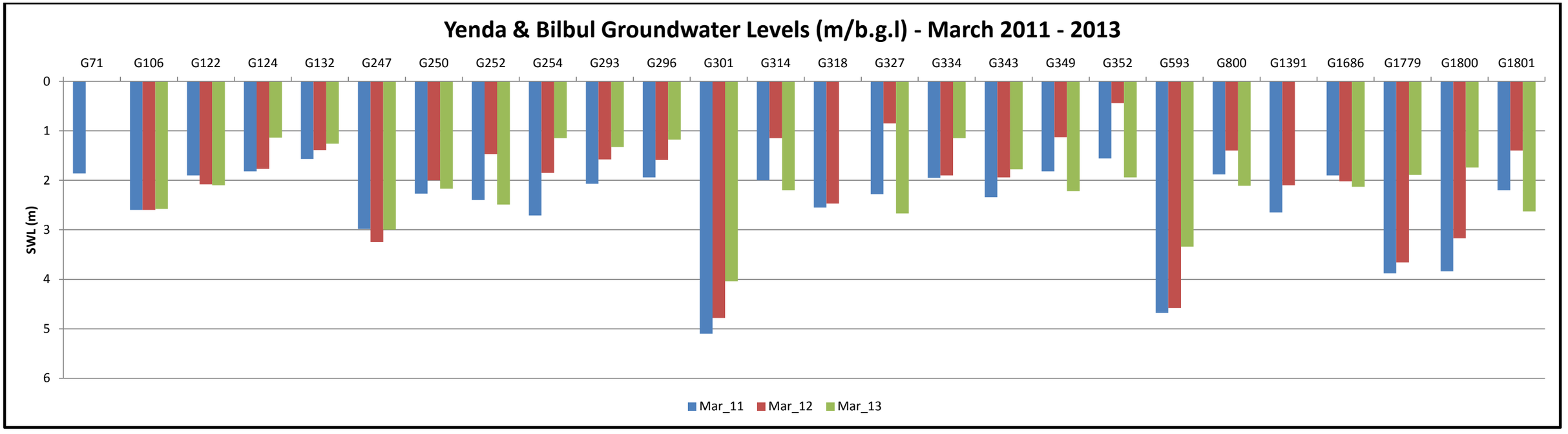


Figure 2.4.3 (e): Yenda and Bilbul Groundwater Levels from September 2011 to 2012.

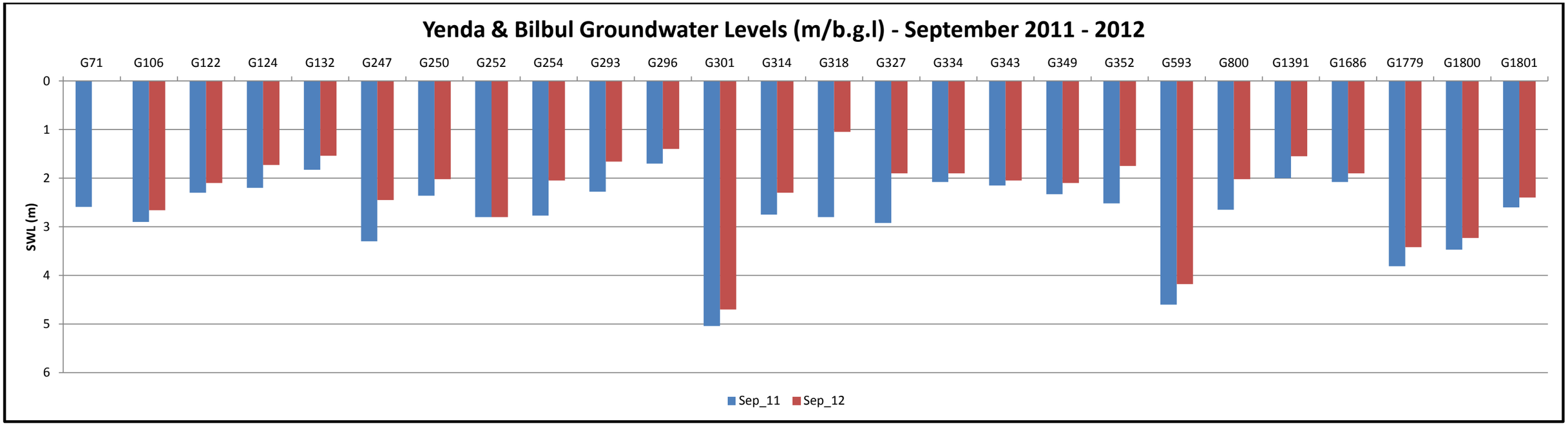


Figure 2.4.3 (g): Lake Wyangan Groundwater Levels from March 2011 to 2013.

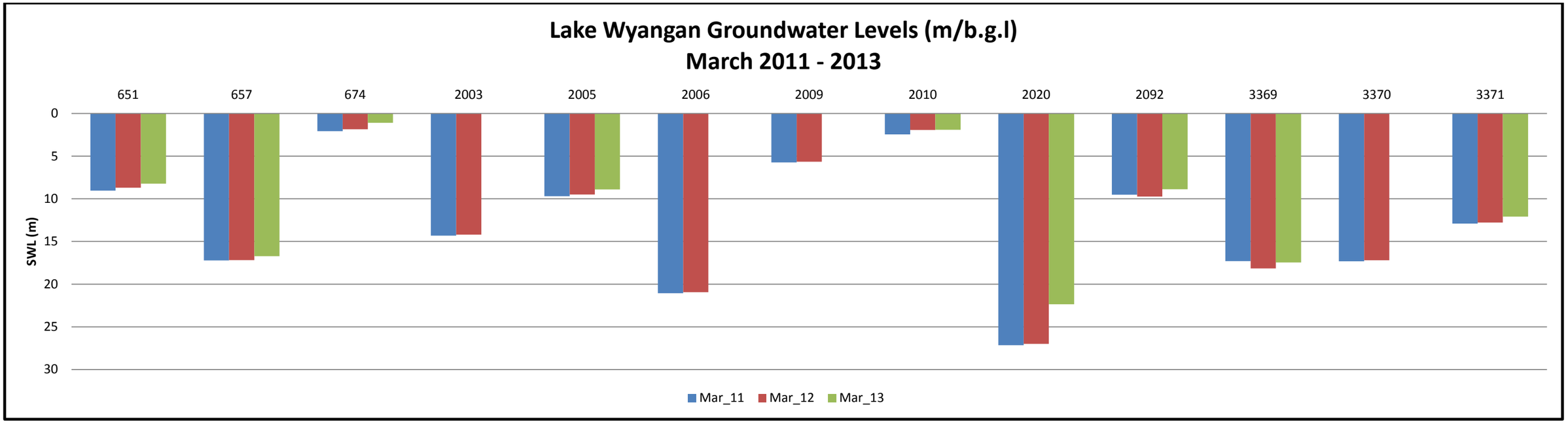


Figure 2.4.3 (h): Lake Wyangan Groundwater Levels from September 2011 to 2012.

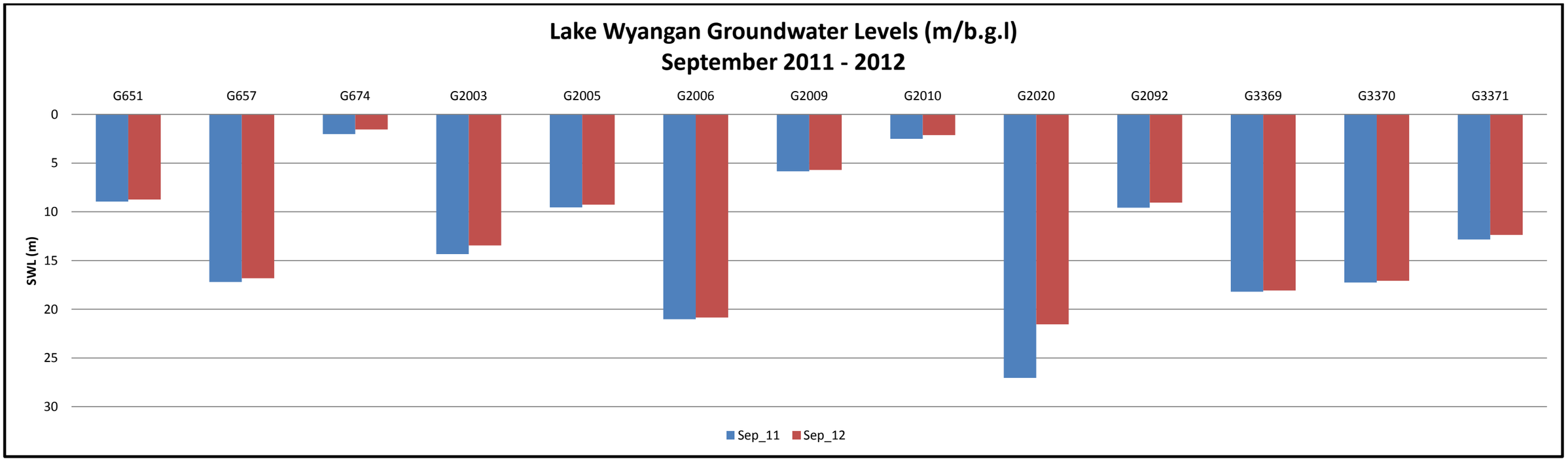


Figure 2.4.4 (a): North Benerembah Groundwater Levels from March 2011 to 2013.

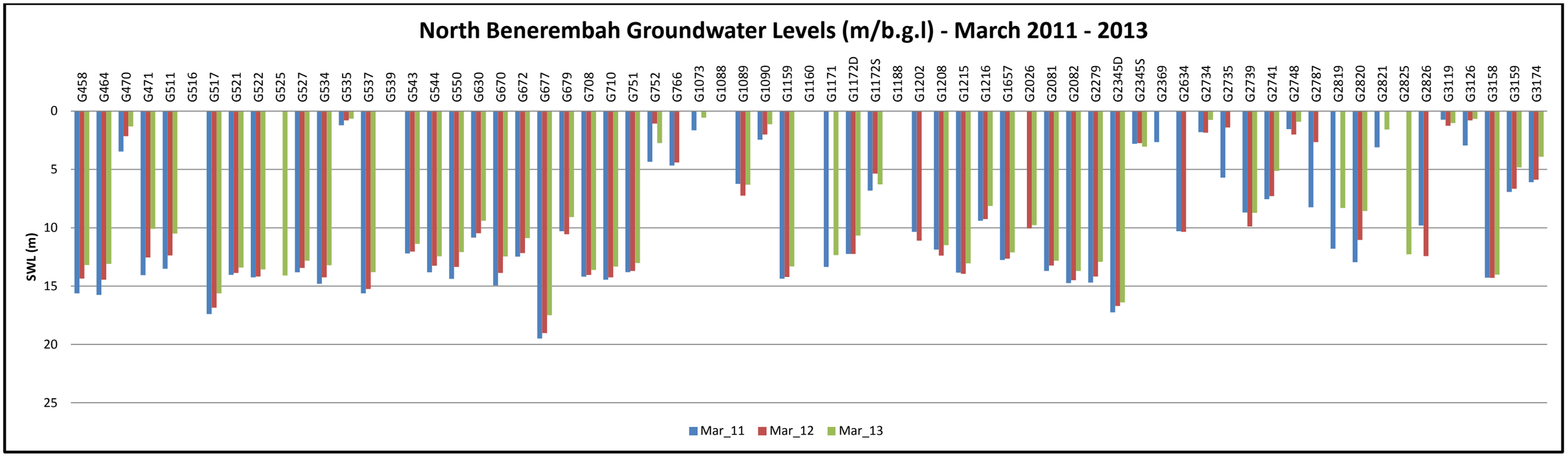


Figure 2.4.4 (b): North Benerembah Groundwater Levels from September 2011 to 2012.

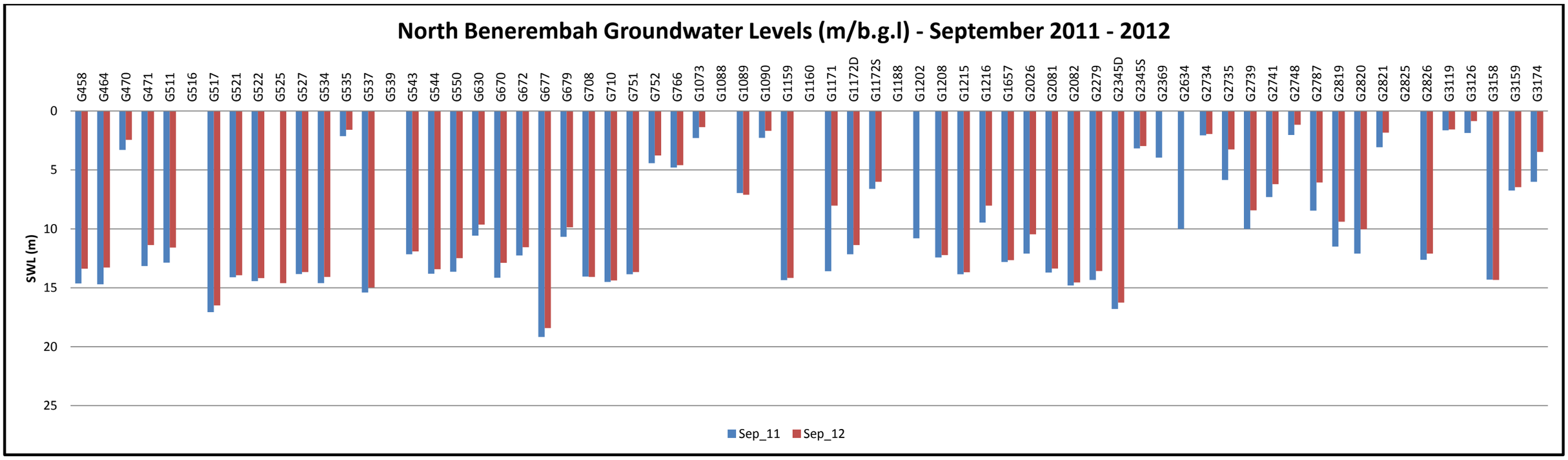


Figure 2.4.4 (d): South Beneremban Groundwater Levels from March 2011 to 2013.

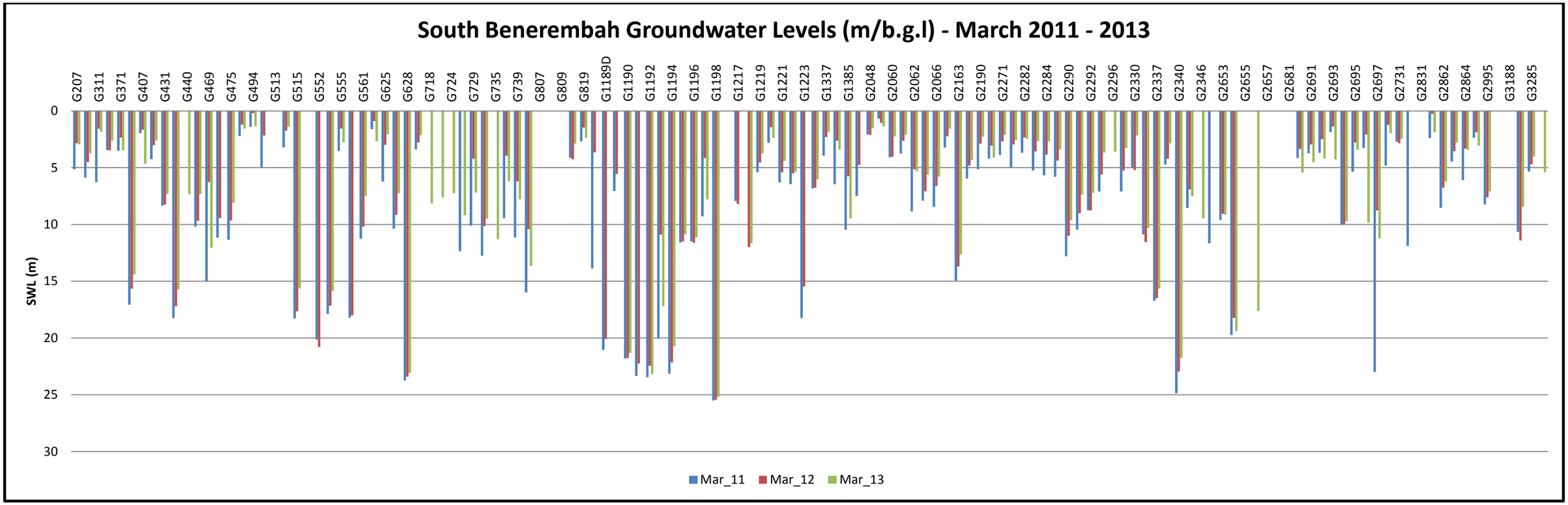


Figure 2.4.4 (e): South Beneremban Groundwater Levels from September 2011 and 2012.

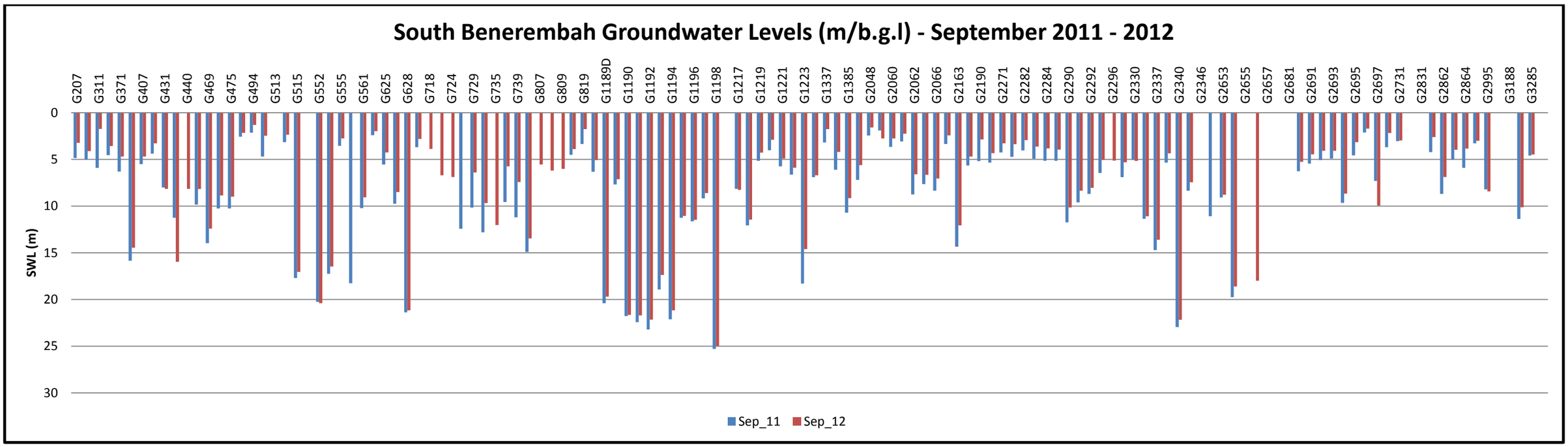


Figure 2.4.4 (i): Wah Wah Groundwater Levels from March 2011 to March 2013.

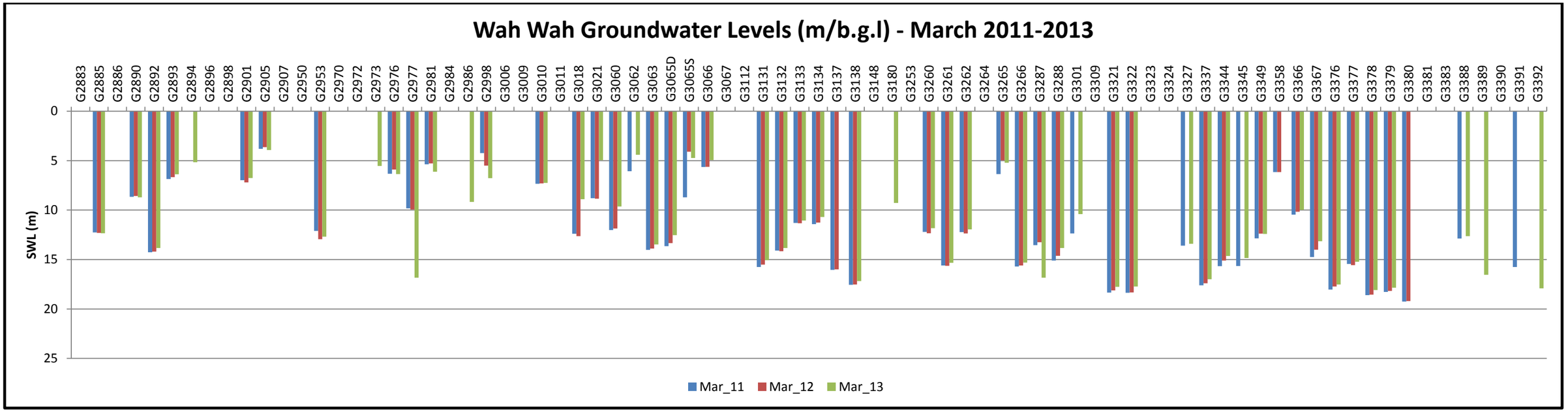
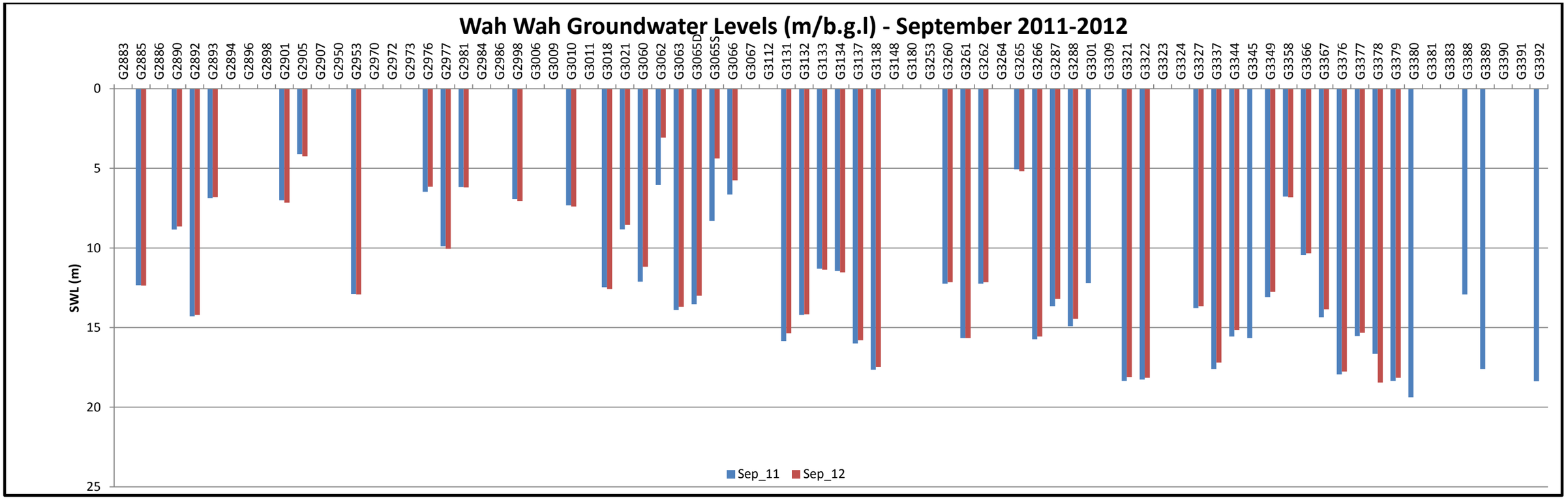


Figure 2.4.4 (j): Wah Wah Groundwater Levels from September 2011 to 2012.



13. ANNEX D - STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE (SOP) – WATER QUALITY SAMPLING

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose: MI staff is required to monitor the water quality across the MIA, through targeted sampling programs as well as in response to pollution or trigger events (rainfall).

Scope: The responsibility of detecting and managing water quality is shared by Water Resources and Irrigation Services.

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	**Record GPS points of all sites sampled** The following practices are particularly important: • Stagnant water should not be sampled and ensure that samples are free from floating film or organic material. In shallow stretches, samples should be collected from the middle stream. • Samples from still water bodies (lakes, ponds, reservoirs, dams etc) should generally be collected at multiple locations in the water body and at multiple depths, mixed together and a sub-sample collected. • When sampling still water bodies that are stratified, three equally sized samples should be collected from the surface, midzone and deeper waters, mixed together and a sub-sample collected. • Water samples from irrigation discharges should be taken from the hose/pipe connection to the irrigation system. Samples should be free of stagnant water and be representative of the water being applied to the irrigation area. • Boreholes should be adequately purged before collecting groundwater samples. • When a sample is to be analysed for suspended sediments or oil and grease, the bottles should not be rinsed with sample water. • When sampling water in streams or dams the mouth of the bottle should be submerged to at least 10 centimetres below the surface. • In flowing water, samples should be collected midstream with the mouth of the bottle facing into the current. • When collecting water samples the bottle should be filled to the top or allow some air space before sealing the bottle, depending on the parameter being analysed. For example	Falling in the water whilst conducting sampling. Having Lugals solution or chemicals in preserved bottles touching bare skin Ensure personal safety around fences adjacent to stock grazing areas and potential to be exposed to electric fences.	Life vest to be worn if the employee is working near water and is not a strong swimmer. Wear gloves and boots

	sample bottles for nutrient analysis should be filled to the top and for chlorophyll and bacteria samples require an air space.		
2	**In-Situ Sampling – Hydrolab** - Rinse sample bucket, collect a bucket of water from sample site. - Open Hydrolab to expose probes - Switch Hydrolab on and dip into bucket until the probes are submerged in sample water - Hold Hydrolab in sample until the readings stop fluctuating. Record EC, Temp, pH, depth on field sheet (date, sample site name, name of sampler ect)		
3	**In-Situ Sampling – Turbidity Meter** - Open hatch on turbidity meter - Remove vial of water - Fill vial with sample water - Close hatch - Turn turbidity meter on Record turbidity reading off screen onto field sheet (date, sample site name, name of sampler ect)		
4	**Trigger Sampling: Rain Event** (>15mm at Griffith Airport, Check BOM website) - Take in-situ readings with the Hydrolab 2 x pesticides (**Orange** Glass Bottle) 1 x Nutrients (**Purple** Bottle)		
5	**Trigger Sampling: Discharge to River** **Sites include:** LAG, ROCUDG, YMS, GMSR 2 x pesticides (**Orange** Glass Bottle) 1 x Nutrients (**Purple** Bottle) 1 x Metal (**Red** Bottle) 1x Filtered for Dissolved Metals (**Red** Bottle) Use the hand pump and filter paper before placing sample water in jar.		
6	**Pollution Incident:** Industry ect **BOD** 1 x **Green Bottle** (magnesium, sodium, BOD) **FECAL** 1 x Plastic jar with Yellow lid.		

Trigger Sampling Sites Map to be attached for Rain Events and River Drains

SOP – TESTING FOR BLUE GREEN ALGAE

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose: MI staff is required to take BGA samples to ensure the quality of the water for use across the MIA. Correct sample techniques must be used to ensure sample integrity, as a result the following SOP should be adhered to.

Scope: The responsibility of detecting and managing BGA blooms is shared by Irrigation Services and the Water Resources teams.

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	Visual inspections are conducted weekly as part of the EC run from October through till March or when symptoms fail to persist. Sites for visual inspection and those responsible include; - Barren Box Swamp & South Lake Wyangan (Environment team) - M.I Storages (Channel Attendants)	Having the affected water or Lugols solution touch bare skin. Falling in the water whilst conducting sampling. Ensure personal safety around fences adjacent to stock grazing areas and potential to be exposed to electric fences.	Wear correct PPE, including hat, gloves and boots. Life vest to be worn if the employee is working near water and is not a strong swimmer.
2	Signs of algal blooms are followed by a sampling regime. - Barren Box Swamp 1. Representative samples are taken in a boat across the cell (Refer to the Safe Boat & Outboard Operation) - Storages 1. Channel attendant to report algal bloom to the environment team. 2. Representative samples are taken in a boat across the cell (Refer to the Safe Boat & Outboard Operation)		
3	Sampling collection process; 1. Label ALS algal bottles with site name, name of sampler, time, date, company name. 2. Integrated samples where possible using a 40mm PVC pipe to capture the water column, pour into and fill ALS algal bottle, add Lugols solution. DO NOT SHAKE. WHERE NOT POSSIBLE TO USE PVC COLUMN SAMPLE		

	3. Use sample pole with standard sampling method (See Water Quality Sampling SOP), pour into and fill ALS algal bottle, add Lugols solution. DO NOT SHAKE.		
	Once sampling is completed; 1. Complete Chain of Custody (COC) form, place in esky with samples. 2. Complete TOLL consignment note, tear and place customer copy on pile, stick TOLL copy on lid of esky. 3. Email COC to ALS, to notify of incoming samples, request parameters analysis i.e. biovolume, If *Oscillatoria* is identified please provide a measured cell size for biovolume. 4. Send samples to TOLL for transport ASAP.		

1	2	3	4	5 SOP Hand Protection	6 SOP Foot Protection	7	8
							

SOP – CALIBRATION OF WATER QUALITY FIELD MONITORING EQUIPMENT

Operating procedure Developed By: Environment Team **Approved By:**

Review Completed By: **Approved By:**

Purpose:
Scope:

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	Hydrolab – yearly service - pH, EC standards		
2	Turbidity Meter		
3			

1 SOP Eye protection	2	3	4	5 SOP Hand Protection	6 SOP Foot Protection	7 SOP Protective Clothing	8
							

SOP – NOTIFICATIONS AND DRAINAGE RELEASE TO MIRROOL FLOODWAY

SOP 4 ***Notifications and Drainage Release To Mirrool Floodway***

Affected Job Holders

Job Holder Environmental Compliance Officer
Job Holder Environmental Field Officer
Job Holder Divisional Officer

Statutory Framework

Water Act 1912
Water Management Act 2000
Protection of the Environment Operations Act 1997
Irrigation Corporations Act (repealed)

Background

As part of its licence obligations Murrumbidgee Irrigation is required to carry out water quality sampling at Mirrool Creek Floodway (MIRFLD) when the floodway is being used.
If the required sampling is not undertaken Murrumbidgee Irrigation is required to identify the reasons for the licence breach in its Annual Return.

Breaches to licence conditions mean that MI is exposed to various operational and financial risks including fines, prosecution and stop work orders.[1]

As a matter of best practice and quality assurance Murrumbidgee Irrigation should ensure that adequate systems are in place to protect against licence breaches.

This why the proposed standard operating procedure has been developed.

Proposed Company Policy

Water quality sampling is to be conducted when the Mirrool Creek Floodway is being used.

Proposed Standard Operating Procedure

Notifications Required

1. *Prior to arranging maintenance works of assets/infrastructure or authorising any activity which may result in drainage discharge to the Mirrool Creek Floodway, Irrigation Services shall give prior notice to the Environmental Services Co-ordinator and Water Quality Field Officer.*
2. *The notice shall be sufficient to allow the field officer to organise water quality sampling at MIRFLD during the period of flow.*
3. *Irrigation Services shall advise the Environmental Services Co-ordinator the dates and any maintenance details when drainage discharge occurs.*

Policy *Notifications - Drainage Release To Mirrool Floodway*
Date *22 August 2006*
Prepared By *K Tyson*

[1] The Department of Environment and Conservation (EPA) can order MI to cease operating including supplying water for irrigated agriculture.

Authorised by _____ _____
Manager Environmental Services Date

_____ _____
Manager Irrigation Services Date

By signing off on the proposed policy, standard operating procedure and duty statement, both Business Unit Managers have committed to ensuring the following:

1. *The policy is added to the company's policy register*
2. *The standard operating procedure has been added to the Unit's Standard Operating Procedures and*
3. *A job position (duty statement) within the Unit has been updated to reflect the terms of the Standard Operating Procedure.*
4. *Any required training has been identified and added to the relevant job holders Training Plan.*

SOP – RISK ASSESSMENT AND ACTIONS FOR BLUE GREEN ALGAE

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose: To provide guidance in relation to management of Blue Green Algae incidents within the MIA

Scope: The management of Risk Assessment & Actions for BGA detections is the responsibility of the Water Resources Team.

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	Take appropriate safety precautions against potential hazards; ensure risk assessment of the site has been completed.	Contact with algae affected water. Falling in the water whilst conducting sampling.	Gloves (If a algae bloom is suspected) Hat, sunscreen, boots Ensure vehicle has first aid and a snake kit. Life vest to be worn if the employee is working near water and is not a strong swimmer.
2	Depending on results from sampling: Use reference *Guidelines Murrumbidgee Regional Algae Contingency Plan*, available from the NSW Office of Water website, based on the recreational & livestock guidelines (as there are no guidelines for Irrigation areas)		
	ACTIONS GREEN ALERT: (BIOVOLUME >.04 <0.4mm^3/L) • Continue routine monitoring AMBER ALERT: (0.4 to 6mm^3/L for all cyanobacteria) • Conduct follow up sampling (at a weekly minimum) to monitor trends until algal readings are below AMBER levels. • Report findings to Irrigation Services Manager & Executive of site (forewarn of potential future issues), continue to liaise until alert drops below amber. RED ALERT: Biovolume > 6mm^3/L, or 12,500 cells/mL or 25,000 cells/mL of *Anabaena Circinalis* or > 2.3mg/L *Microcystin* concentration. • Noitfy RACC & coordinate ALERT for all relevant landholders that the affected water is not suitable for stock. • Advise to AVOID CONTACT WITH THE WATER • Continue sampling (at a weekly minimum) until levels drop below RED ALERT action for 2 consecutive samples. • Report findings to Irrigation Services Manager & Executive of site (forewarn of potential future issues), continue to liaise until alert drops below amber.		

	2	3	4	5 SOP Hand Protection	6 SOP Foot Protection		8
							

SOP – INVESTIGATING POLLUTION INCIDENTS

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose: It is important that pollution incidents that affect MI's channel system are managed effectively, this SOP should be utilised by Water Resources and Irrigation Services staff.

Scope: Investigating pollution incidents that affect MI's channel system is the responsibility of the Water Resources Team, with the help of Irrigation Services.

Standard Operating Procedure		Potential Hazards	Personal Protective Equipment
1	If a Pollution Incident occurs it should be reported to the Water Resources Team.	Contact with pollutants, touch or breathe in. Falling in water whilst conducting investigation Ensure personal safety around fences adjacent to stock grazing areas and potential to be exposed to electric fences.	Gloves, boots Respirator if suspected gas contaminant Life vest is to be worn if the employee is working near water and is not a strong swimmer.
2	Visual inspection of the site should be undertaken by Water Resources staff ASAP. A pollution Incident form should be completed and photographs should also be taken.		
3	The incident should be reported to appropriate MI work groups or Executive, once full extent is understood and management decisions are to be made.		
4	If appropriate, the Pollution Incident should be reported to HAZMAT or Griffith City Council for appropriate management.		
5	If water or sediment sampling is required, Water Resources staff should complete this task ASAP, with reference to the appropriate SOP for Water Quality and Sediment Sampling Procedures. **Control Samples should also be taken upstream of the affected site for comparison**		
6	If local residents need to be informed of the incident, letters should be compiled by the Water Resources Team, checked by P.R as well as Executive, before being delivered via channel attendants or most appropriate MI employees.		
7	A report of the incident is to be compiled by the Water Resources Team, including photographs of the site, the pollution incident form, a map of the site, applicable lab results, including recommendations for management.		
8	Appropriate management of the incident may require cooperation between Water Resources, Irrigation & Infrastructure Services, i.e. if the affected channel needs to be flushed or emptied		

	for works involving unlicensed drain or pump removal.		
9	The affected site should be continually monitored until water quality has returned to a suitable level.		
10	The Pollution Register Spreadsheet in InfoXpert should be updated by the Water Resources Team.		

1 SOP Eye protection	**2**	**3**	**4**	**5 SOP Hand Protection**	**6 SOP Foot Protection**	7	**8**
							

SOP – NOTIFICATION AND DRAINAGE RELEASE AT LICENCED SITES

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose:

Scope: If the required sampling is not undertaken Murrumbidgee Irrigation is required to identify the reasons for the licence breach in its Annual Return. Breaches to licence conditions means that MI is exposed to various operational and financial risks including fines, prosecution and stop work orders.

Standard Operating Procedure		Potential Hazards	Personal Protective Equipment
1	Drainage sites include; LAG, ROCUDG, YMS, GMSR	Falling in the water whilst conducting sampling.	Life vest to be worn if the employee is working near water and is not a strong swimmer.
2	Irrigation Services notify the Environment Team if any water is released from these sites so that sampling can be undertaken.		
3	1. Prior to arranging maintenance works of assets/infrastructure or authorising any activity which may result in drainage discharge to the drainage sites listed, Irrigation Services shall give prior notice to the Environmental Services Coordinator and Water Quality Field Officer. 2. The notice shall be sufficient to allow the field officer to organise water quality sampling at the required sites during the period of flow. 3. Irrigation Services shall advise the Environmental Services Co-ordinator the dates and any maintenance details when drainage occurs.		

SOP – SENDING WATER QUALITY AND SEDIMENT SAMPLES TO THE LAB

Operating procedure Developed By: Water Resources Team **Approved By:**
Review Completed By: **Approved By:**

Purpose: MI staff is required to organise the transport of water quality and sediment samples to specific labs to be analysed.

Scope: This SOP should be utilised by compliance staff to manage the transport of water quality and sediment samples to specific labs to be analysed.

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	Once Sampling has been completed; 5. Complete Chain of Custody (COC) paperwork in the office, print a copy. 6. Place samples in esky with ice bricks and pad with shredded paper to avoid bottles breaking. 7. Place printed COC in esky with samples. 8. Complete TOLL consignment note, tear and place customer copy on pile in office, stick TOLL copy on lid of esky, tape down. Asbestos, Water Quality & Sediment Samples including general pesticides, nutrients, micro, metals, cations, ations, BOD Are to be sent to ALS at: 277 Woodpark Road, Smithfield, 2164, NSW 87 84 85 55 Blue Green Algae samples can also be accepted at this lab, but MI's BGA preferred lab is at: Lithgow Street, Fyshwick, Canberra, 2609, ACT Contact No: 02 62 02 54 12 9. Tape esky securely shut, and add appropriate stickers "This Way Up", "Fragile", "Must Stay Cold" ECT. 10. Email COC to ALS (cocsydney@alsenviro.com, CC loren.schiavon@alsglobal.com), to notify of incoming samples, if necessary request parameters analysis i.e. biovolume, If *Oscillatoria* is identified please provide a measured cell size for biovolume. 11. Drop samples off at Wade Transport (TOLL) ASAP	Lost Samples Samples Delivered outside withholding periods Damage or broken samples during freight Failure to keep samples cool during transportation	None need.

SOP – SAMPLING CORRESPONDENCE AND DOCUMENT CONTROL

Operating procedure Developed By: Water Resources Team **Approved By:**

Review Completed By: **Approved By:**

Purpose: To provide clear directions for the correct management of sampling correspondence and documents.

Scope: This SOP should be utilised by compliance staff to manage documentation and sample correspondence effectively.

Standard Operating Procedure		**Potential Hazards**	**Personal Protective Equipment**
1	• Naming protocol – refer to InfoXpert • Create purchase order; place order number on relevant Chain of Custody form (COC). • COC- emailing correct lab, (request quick return if necessary) • Fill in consignment note, tear off customer copy and attach to MI pile, stick billing copy to sample esky.	Miss-management of data Placing data incorrectly into data storage locations or loosing data. Out of date forms and procedures.	None required.
2	Update Chain of Custody (COC) Spreadsheet in InfoXpert • complete once sampling undertaken; once Certificate of Analysis (COA) comes back • COMPLIANCE: Trigger, pollution & bench sampling • COMPANY: Algae, dichlobenil (sagitaria), HIS particle analysis.		
3	SAVE: (refer to naming protocol) COC – proof of compliance folder COA – proof of compliance folder Email – From Lab containing results COC, SRN, COA to InfoXpert, in proof of compliance folder.		
4	Update Pollution Incident Register		
5	Receipt Purchase Order once invoice has been acquired from Lab.		

B9: Licence compliance report FY 2013-2014

2014

LICENCE COMPLIANCE REPORT



Murrumbidgee Irrigation Ltd

The information in this document should be read as a whole document. The data contained in this Licence Compliance Report is for meeting MI's Licence Compliance requirements only. MI does not guarantee the accuracy, reliability or suitability of excerpts of this data for any other purpose. Please contact Water Resources, Murrumbidgee Irrigation on 02 6962 0200 for further information.

LICENCE COMPLIANCE REPORT 2014

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ABN 39 084 943 037

INTRODUCTION

The Annual Compliance Report 2013/14 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation (MI) with the NSW Office of Water (NOW) and the NSW Environment Protection Authority (EPA). MI operates under a Combined Water Supply Work Approval and Water Use Approval (40CA403245) issued by NOW, and an Environment Protection Licence (EPL) 4651 issued by the EPA in accordance with the *Protection of the Environment Operations Act 1997*.

These licences set the minimum standard for environmental management. MI has a corporate objective to meet all legal and regulatory obligations. MI also has in place environmental programs which have been developed to extend beyond legal and regulatory compliance that demonstrate our commitment to ensuring MI's operations do not adversely impact on the environment.

Gillian Kirkup
Chairman
Murrumbidgee Irrigation Limited



Peter Borrows
Chief Executive Officer
Murrumbidgee Irrigation Limited



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EXECUTIVE SUMMARY

This report presents data for the current reporting year, data from the previous two reporting years and data from a year at least five years prior. This data is analysed and compared where required.

The climatic conditions across the Murrumbidgee Irrigation Area (MIA) influence all aspects of this report. The climatic conditions determine the volume of water required for irrigation, the amount of water discharged from the area and groundwater dynamics. While the total annual rainfall and evapotranspiration were close to the annual long term average, seasonal variability was greater than usual in 2013/14, with lower than average rainfall over the growing season and higher than average evapotranspiration.

The water allocations for the Murrumbidgee Valley were 63% for general security and 95% for high security water entitlements for 2013/14. A total of 832,758 ML was diverted into the MIA, a 23% decrease from 2012/13.

MI delivered water on behalf of the NSW Office of Environment and Heritage (OEH) for environmental purposes with a total of 1,186 ML diverted to Tuckerbil Swamp, Turkey Flats and Yanco Ag Lagoon.

Winter cereals were the dominant crop type grown in the MIA, however, rice had the highest water use and accounted for 34% of total deliveries.

Groundwater has receded from levels following the 2012 flood. The groundwater gradient continues to run east to west with highest groundwater levels in the Yanco and Mirrool Irrigation Areas and Benerembah Irrigation District. The quality of groundwater shows a consistent improvement when compared to previous years. This is likely attributed to fresh water recharge following two consecutive years of high rainfall and the March 2012 flood. A simple salt balance determined that 51,935 of the 52,177 tonnes of salt received through diversions was retained within the MIA. A three year Soil Salinity Survey is included with this report and provides further detail on salinity dynamics within the MIA.

Trigger based monitoring of EPL discharge points revealed an increase of *notification* and *action* level detections of specified chemicals compared to previous year. Under MI's Risk Based Water Quality Framework, tri-annual benchmark sampling of MI's supply and drainage system identified no trace level residues of chemicals at or above EPA notification levels.

STATEMENT OF COMPLIANCE

MI has met the conditions of the Combined Water Supply Work Approval and Water Use Approval (40CA403245) and Environment Protection Licence (EPL) 4651, with exceptions which are detailed in Tables 1a and 1b.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Water Supply Work Approval and Water Use Approval during 2013/14.

MI did not change or modify existing authorised discharge works listed in the Combined Water Supply Work Approval and Water Use Approval or construct new works that would allow further discharge from the area of operations during 2013/14.

In September 2013, MI did not notify the EPA of results received from samples collected at two licence discharge points within the timeframe required. While these results were posted on our website within the required timeframe, failure to notify the EPA by electronic mail within 24 hours of receiving results from samples is considered to be non-compliant under condition R5.1 of the EPL 4651. These events are listed in Table 1.1a below. These notifications were documented and subsequently notified to EPA. Irrespective, reporting procedures for licence discharge sites have been reviewed and improved to minimize the risk of a similar occurrence.

Table 1a: EPL 4651 non-compliant events.

Date	Details	Compliance Breach	Material Impact
10/9/2013	Failed to notify EPA within 24hrs of notification level detected at discharge Point 6 as required under section 6, condition R5.1 of EPL 4651.	No	None
17/9/2013	Failed to notify EPA within 24hrs of notification level detected at discharge Point 4 as required under section 6, condition R5.1 of EPL 4651.	No	None
Notification documentation was sent to EPA for both non-compliance events on 26/06/14			

Table 1b: Combined Water Supply Work Approval and Water Use Approval (40CA403245) non-compliance.

Licence Section	Licence Requirement	Details	Compliance Breach	Material Impact
Presentation of Data and Analyses	12.4 – Attachment 2: Presentation format	Failed to present data according to licence requirement due to sections 5.4, 5.2 and 5.3 of the report requiring the groundwater model to be completed in order to present the data in this format.	No	None

Table 1c: Summary of Compliance Requirements for 2013/14.

Combined Water Supply Work Approval and Water Use Approval (40CA403245)				
Licence Section	**Licence Requirement**	**Compliant**	**Report Section**	**Page Numbers**
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1	Yes	Section 1	10 - 14
	12.2			
Statement of Compliance	12.3	Yes	Statement of Compliance	7
Presentation of Data and Analyses	12.4 – Attachment 2: Presentation Format	No	Sections 5.4, 5.2, 5.3	49 - 103
	12.5	Yes	Sections 2, 3, 4 & 5.	15 - 118
	12.6	Yes	N/A	
	12.7	Yes		
	12.8	Yes	Appendix 1, 2 & 3	136 - 182
New Measures to Limit Groundwater Recharge and Discharge of Salt.	12.9	Yes	Section 6	119
Reporting on Water Management	12.10	Yes	Table 2.7	23
	12.11	Yes	Table 2.15	30
	12.12	Yes	Section 2.8	23
	12.13	Yes	Section 2.1 Table 3.1	15 33
Reporting on Salinity and Salt-load	12.14	Yes	Section 4.1	38
	12.15	Yes	Section 4.2	39
	12.16	Yes	Section 4.3	42
	Attachment 1: Discharge Monitoring and Reporting	Yes	Table 4.4	40
Reporting on Groundwater Conditions	12.17	Yes	Appendix 2	150
Quality Assurance for Monitoring & Reporting	13	Yes	Statement of Compliance Appendix 1, 2 & 3	7 136 - 182
Presentation of Data	14	Yes	No requests have been made by the Minister.	
ENVIRONMENT PROTECTION AND MANAGEMENT REQUIREMENTS				
Discharge of Noxious Aquatic Weeds	15	Yes	Section 7.1	120 - 121
Discharge of Blue-Green Algae	16	Yes	Section 7.2	121
Basin Salinity Management Strategy	17	Yes	No data held.	

Table 1b (continued): Summary of Compliance Requirements for 2013/14.

Environmental Protection Licence 4651				
Licence Section	**Compliance Requirement**	**Compliant**	**Report Section**	**Page Number**
Monitoring records	M1	Yes	N/A	
Requirement to monitor concentration of pollutants discharged	M2.1	Yes	Section 9	122
Testing methods – contraction limits	M3.1	Yes	Section 9	122
Recording of pollution complaints	M4	Yes	Section 11	132
Telephone complaints line	M5	Yes	Section 11	132
Requirement to monitor volume or mass	M6	Yes	Section 9.1	122
Other monitoring and recording conditions	M7	Yes	Section 10.3	131
Annual return documents	R1	Yes	Submitted	
Notification	R2	Yes	N/A	
Written Report	R3	Yes	N/A	
Annual system performance report	R4	Yes	Submitted	
Other reporting conditions	R5	No	Table 1a Table 1b	7

1. PLANS OF THE AREA OF OPERATIONS, AUTHORISED WORKS, MONITORING SITES AND WATER MANAGEMENT INFRASTRUCTURE

Murrumbidgee Irrigation's (MI) area of operations, authorised water supply works, storages and major supply and drainage channels are presented in Figure 1.1. The MIA is irrigated from water diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval 40CA403245.

No land has been included or excluded within the Area of Operations in 2013/14.

1.1 OPERATIONAL BACKGROUND

The MIA is supplied by water stored in Burrinjuck and Blowering dams in the upper Murrumbidgee catchment via two authorised supply works (Figure 1.2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STUR - Sturt Canal (after diversion from Gogeldrie Weir)

The water released from Burrinjuck and Blowering dams flows down the Murrumbidgee River to Berembed Weir where most of the water for the MIA is diverted via NARREG. The Main Canal has a flow capacity of 6,600 ML per day that feeds the supply channels that deliver irrigation water to customers. The balance of the MIA's water requirements are diverted at Gogeldrie Weir and directed to the Sturt Canal to supply customers in the southern and western regions of the MIA.

A complementary drainage system (Figure 1.1) captures drainage water, which includes catchment flows and off-farm drainage. Drainage water flows via Mirrool Creek towards Barren Box Storage and Wetland, and is then mixed with fresh water and reused in the Wah Wah, Benerembah and Tabbita Irrigation Districts.

MI's supply and drainage system is a virtually closed system in that it does not discharge to any other rivers or creeks outside the area of operations except during high rainfall events or increased flow of farm drainage during the irrigation season. There are five drainage sites which can potentially discharge outside the area of operations following these flow events (Figure 1.3):

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDGE – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain River Road

- MIRFLD – Mirrool Creek Floodway Wyvern Station

These sites are listed in the Approval as discharge sites in Schedule 1 - Attachment 2 and are monitored in accordance with EPL 4651.

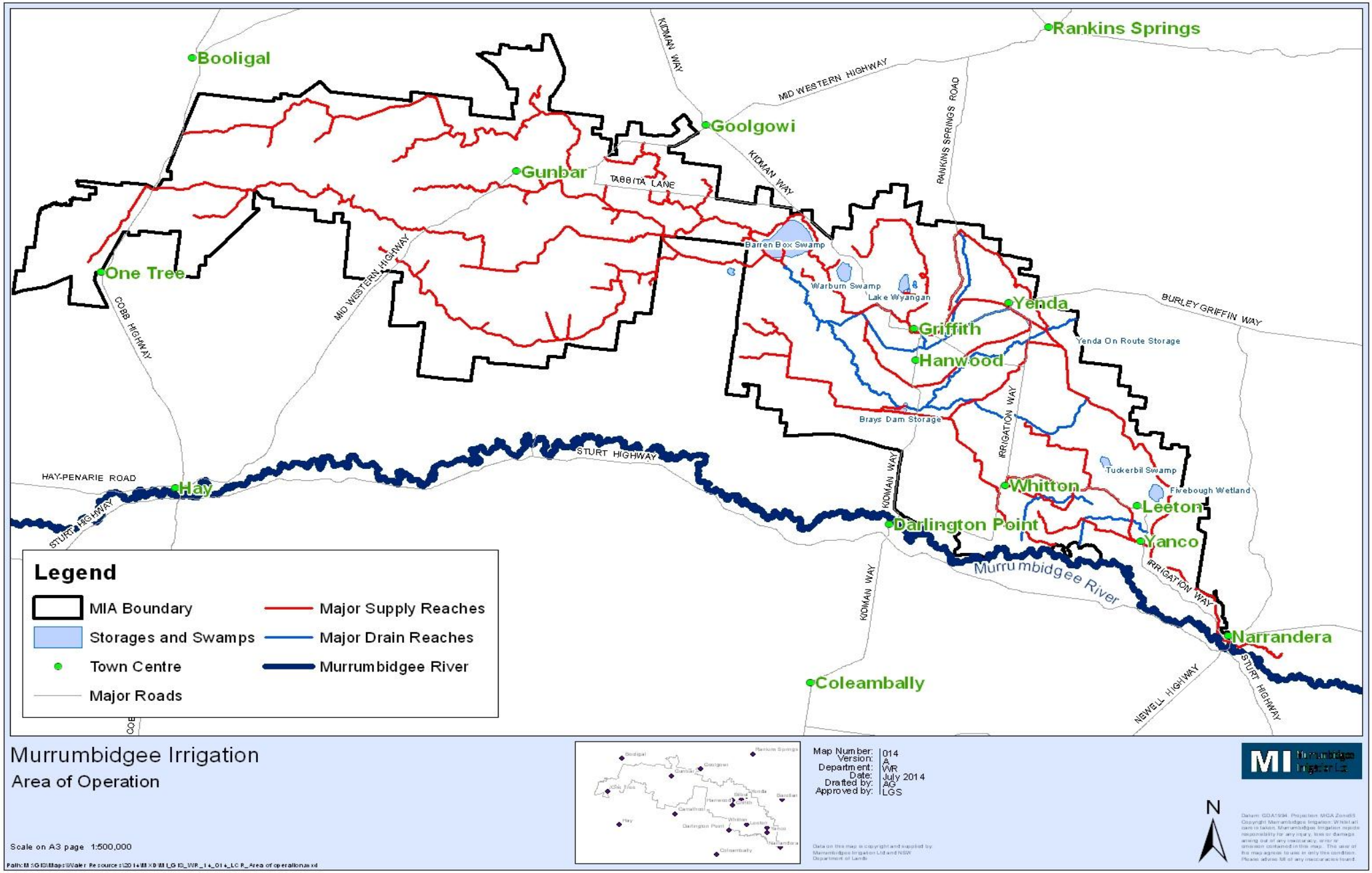


Figure 1.1 - Murrumbidgee Irrigation Area of Operation, Storages and Major Supply and Drainage Channels.

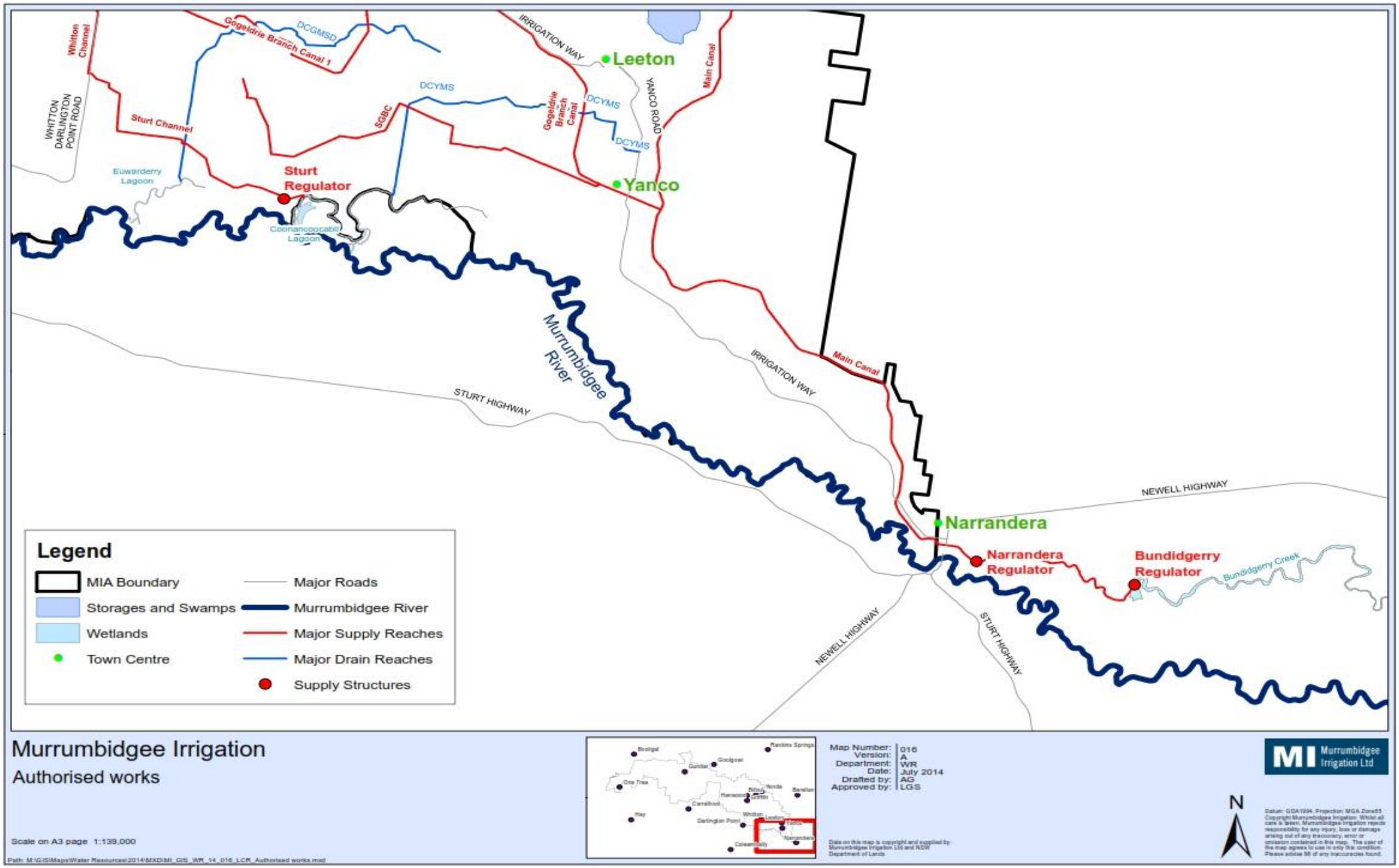


Figure 1.2 - Location of Murrumbidgee Irrigation's Authorised Supply Works.

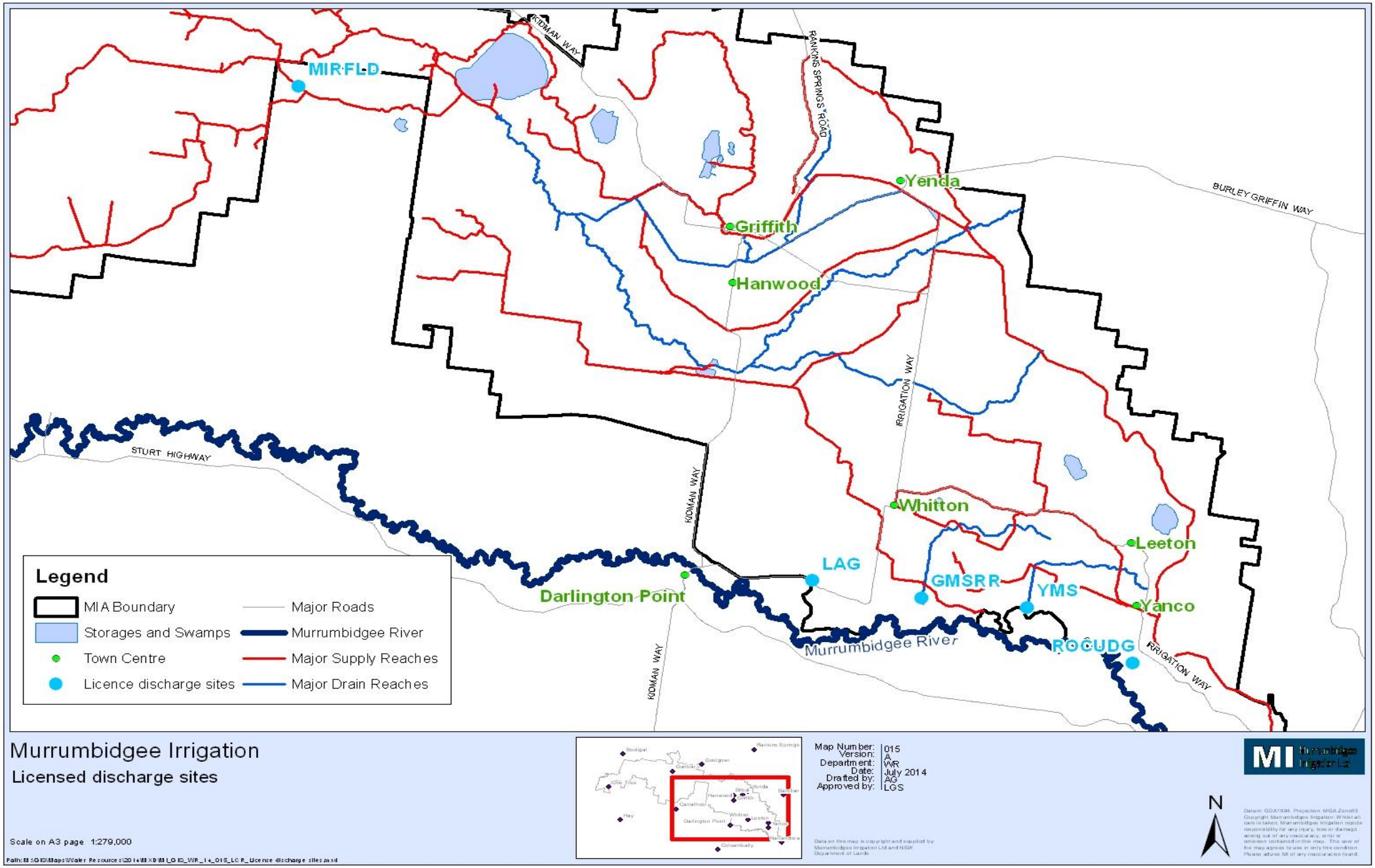


Figure 1.3 - Location of EPL Drainage Sites.

2. REPORTING OF WATER MANAGEMENT

2.1 CLIMATE CONDITIONS

The weather data for the MIA is monitored at eight weather stations as shown in Table 2.1. The locations of the weather stations are shown in Figure 2.2. These weather stations measure a suite of parameters including rainfall and evapotranspiration (ETo) on a daily basis and are operated by MI and CSIRO.

A summary of the total rainfall and ETo for 2013/14 for each weather station is presented in Table 2.1. For 2013/14, both the rainfall and ETo at the Griffith weather station (which has been in operation since 1962) were close to the long term average. However, seasonal variability was greater than usual with lower than average rainfall over the growing season and higher than average ETo, resulting in a higher crop water demand.

Table 2.1: Annual rainfall (mm) and ETo (mm) total for MIA weather station districts for 2013/14.

Weather district	Total rainfall (mm)	Total ETo (mm)
Barren Box Swamp & Wetland	295	1,874
Benerembah	283	1,874
Bringagee	297	2,076
Wah Wah	310	2,046
Kooba	365	1,857
Wamoon	364	1,895
Yenda	369	1,729
Griffith	440	1,860
Griffith Average* 2005/06 – 2012/13	395	1,779

* The ETo calculation was changed in 2010 to allow for a more accurate calculation of actual crop water requirements. Values for ETo have been recalculated back to 2005/06 and the ETo data presented in this report is therefore different from data reported previously.

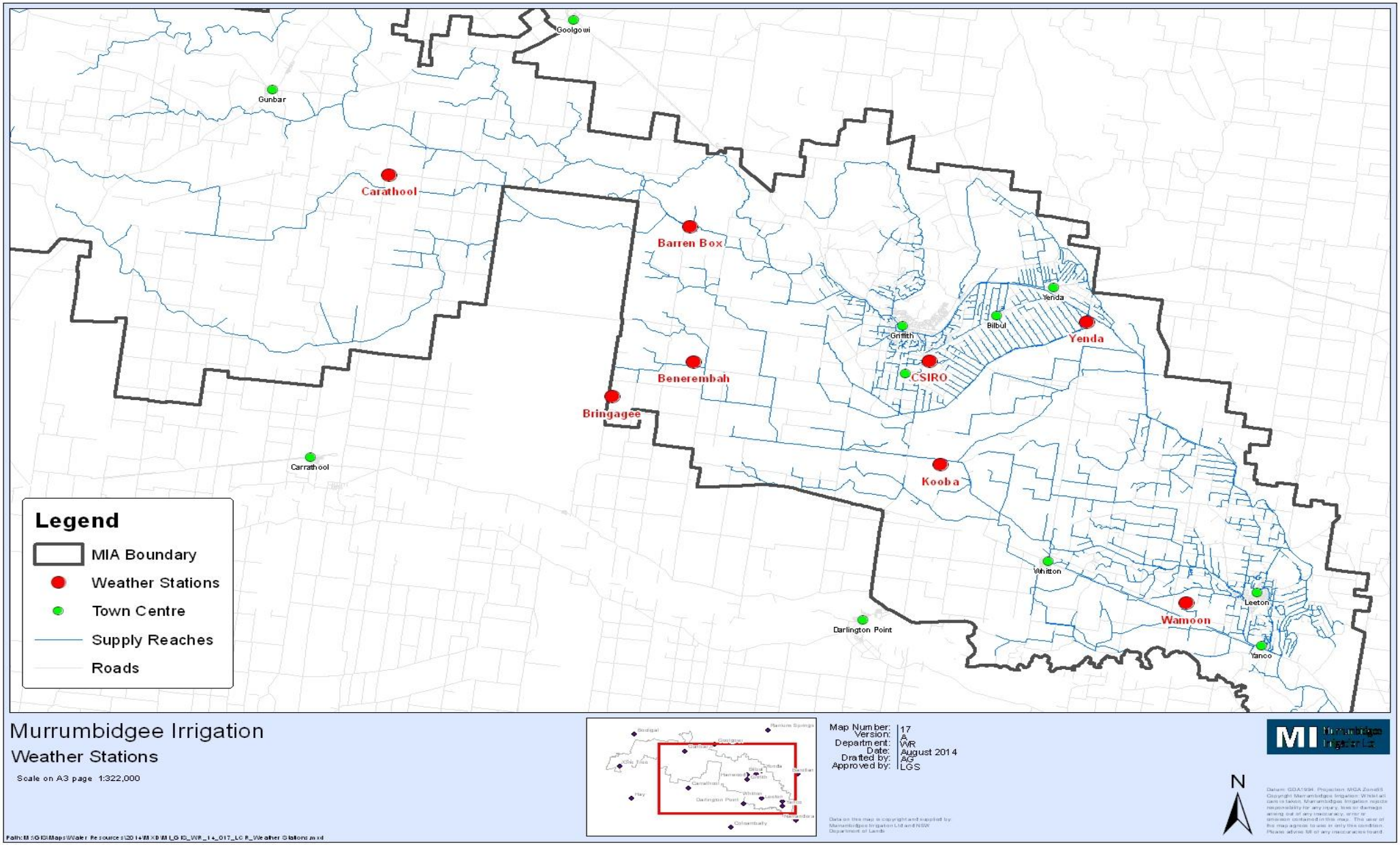


Figure 2.2: Location of weather monitoring stations in the MIA for 2013/14.

Weather data recorded at the Griffith weather station is displayed with Long Term Average (LTA) (1962-2013) data in Figure 2.3. Rainfall and ETo recorded at all other weather stations are shown in Figure 2.4. Rainfall in 2013/14 did not follow LTA trends. Above average rainfall was recorded in July 2013, and April, and May 2014.

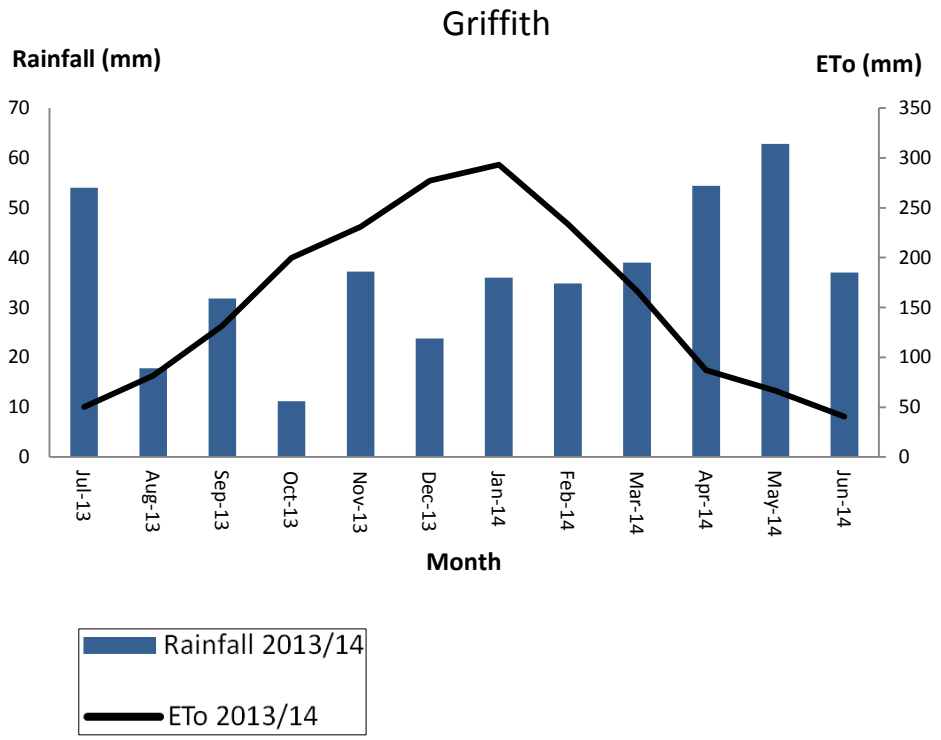


Figure 2.3: Rainfall (mm) and ETo (mm) for 2013/14 and LTA data recorded at Griffith weather station.

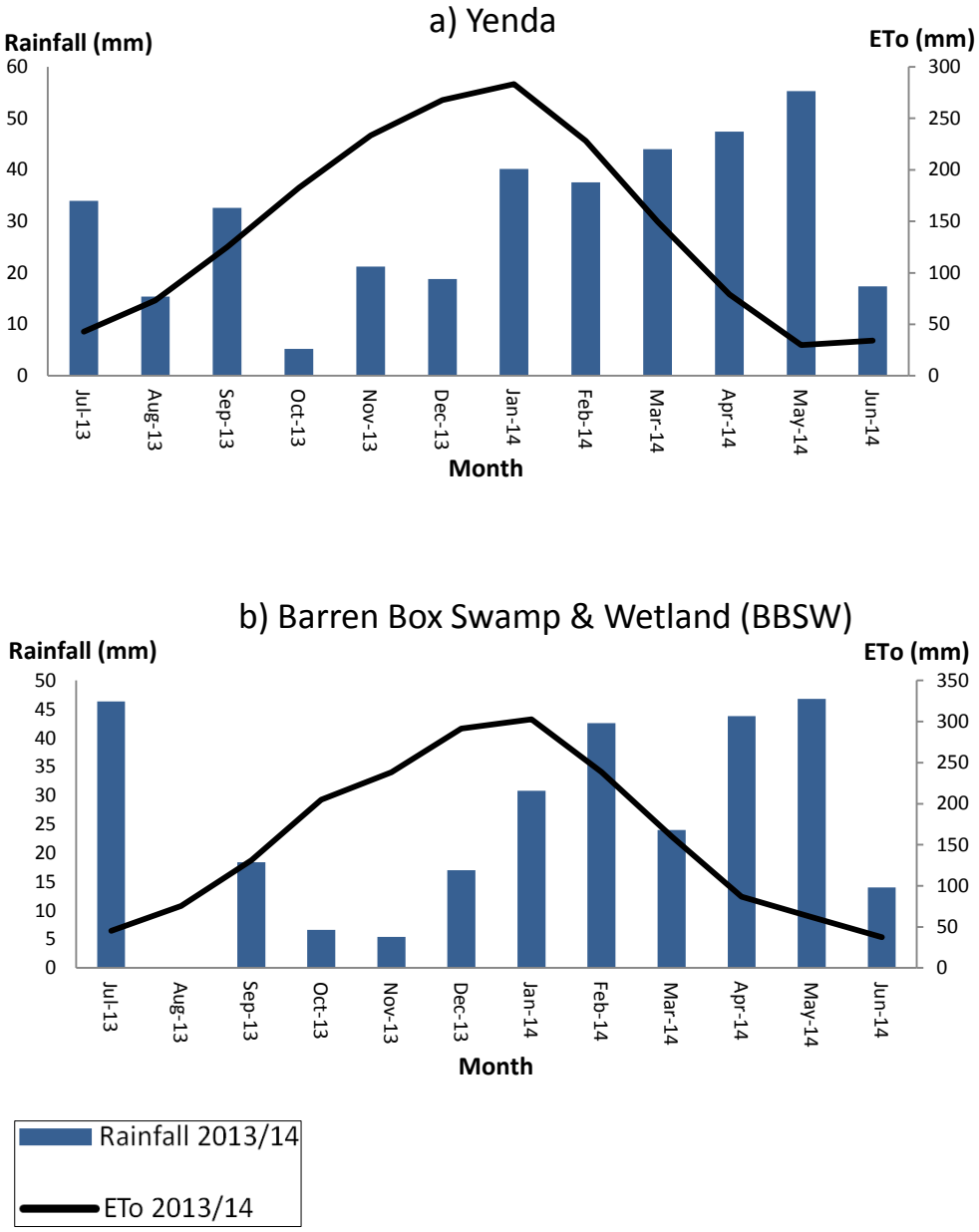


Figure 2.4: Monthly rainfall (mm) and evapotranspiration (mm) for a) Yenda, b) BBSW for 2013/14.

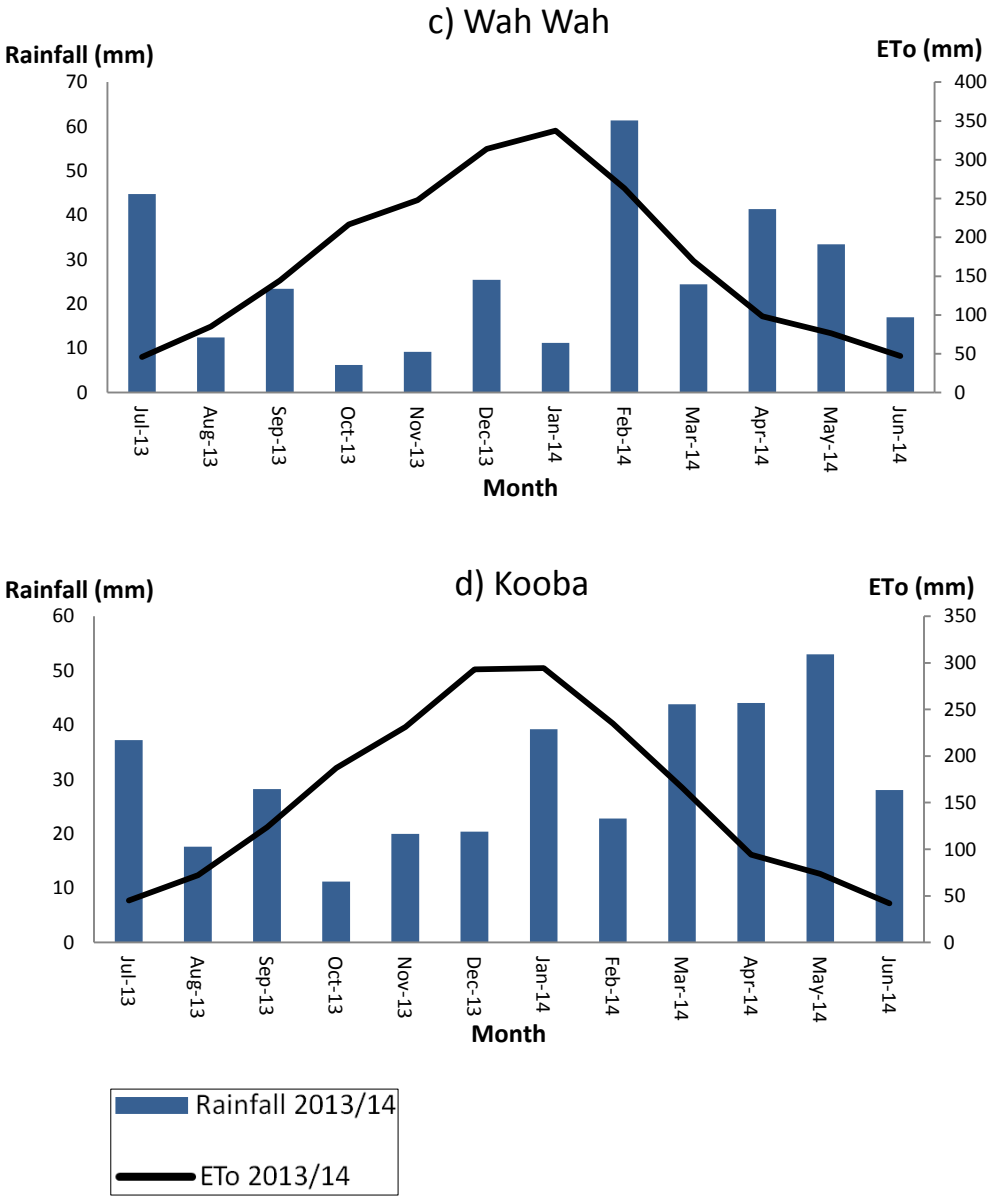


Figure 2.4 (continued): Monthly rainfall (mm) and evapotranspiration (mm) for c) Wah Wah, d) Kooba for 2013/14.

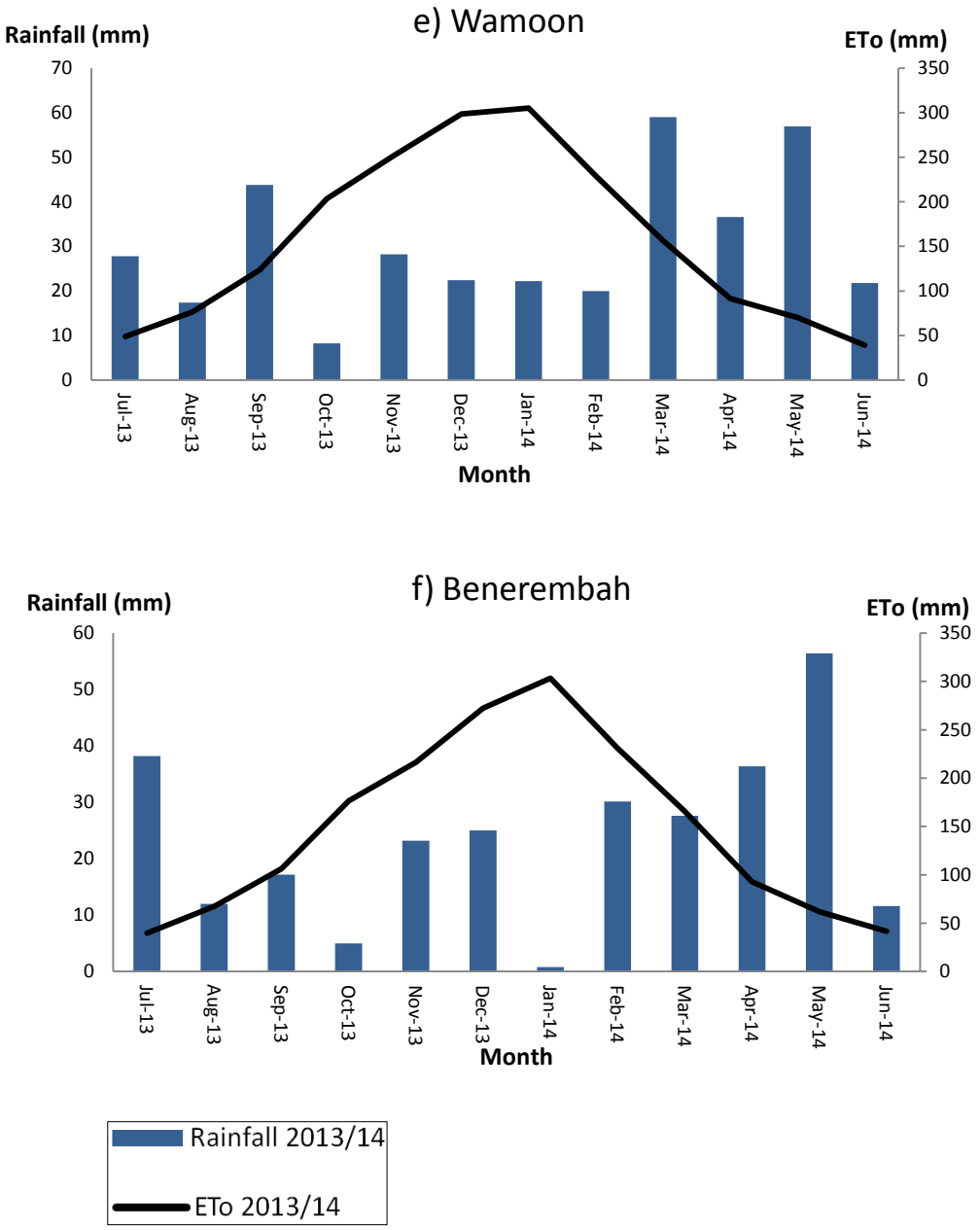


Figure 2.4 (continued): Monthly rainfall (mm) and evapotranspiration (mm) for e) Wamoon and f) Benerembah for 2013/14.

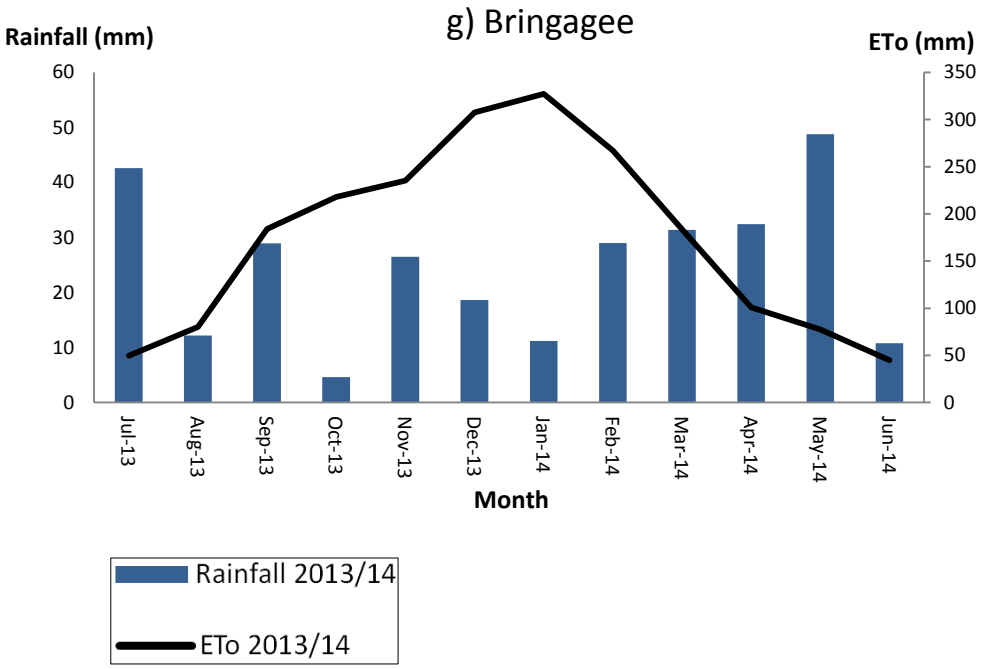


Figure 2.4 (continued): Monthly rainfall (mm) and evapotranspiration (mm) for g) Bringagee for 2013/14.

2.2 CALIBRATION REPORT FOR MAIN CANAL AND STURT CANAL AFFRA UNITS

The calibration report for the Main Canal and Sturt Canal AFFRA units has been provided by Thiess Hydrographic Services as part of the contract with MI to provide qualified hydrographic services in accordance with the conditions of the Combined Approval 40CA403245.

Refer to Table 2.5 for the Main Canal at NARREG AFFRA calibration report and Table 2.6 for the Sturt Canal at STUR AFFRA calibration report. The full report can be found in Appendix 1.

Table 2.5: Main Canal at NARREG (410127) calibration report.

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation
1/10/2013	7:25	1,194	1,233	-3.81%
13/10/2013	10:11	3,595	3,509	2.44%
7/11/2013	7:07	2,547	2,461	3.48%
8/01/2014	15:15	3,922	3,861	1.57%
12/02/2014	13:31	4,302	4,159	3.44%

Table 2.6: Sturt Canal at STUR (410129) calibration report.

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation
4/09/2013	8:28	1,289	1,257	2.54%
15/10/2013	7:31	1,511	1,535	-1.58%
3/12/2013	13:02	1,062	1,067	-0.50%
3/12/2014	14:58	566	573	-1.18%

2.3 DIVERSIONS AND WATER ALLOCATION

A monthly summary of gross water diversions is presented in Table 2.7. These volumes represent gross diversions entering the supply system from MI's two authorised water supply Works at NARREG and STUR. It is important to note that the total diversion volume of 832,758 ML does not include an environmental water diversion volume of 1,186 ML.

Table 2.7: Monthly summary of gross diversions (ML) at authorised supply works NARREG and STUR and total deliveries to customers (ML) for 2013/14.

Month	STUR (ML)	NARREG (ML)	Total diversion (ML)	Deliveries to customers (ML)
Jul-13	300	0	300	0
Aug-13	9,807	23,339	33,146	20,820
Sep-13	25,627	46,883	72,510	66,468
Oct-13	35,813	85,403	121,216	102,143
Nov-13	22,249	73,809	96,058	78,812
Dec-13	34,909	114,398	149,307	121,608
Jan-14	34,773	116,307	151,080	134,236
Feb-14	24,529	77,179	101,708	82,719
Mar-14	11,095	45,126	56,221	51,006
Apr-14	2,811	12,551	15,362	12,202
May-14	10,554	20,452	31,006	25,804
Jun-14	1,339	3,505	4,844	3,489
Total	**213,806**	**618,952**	**832,758**	**699,308**

Note: 213,806 + 618,952 = 832,758 ML **(does not include environmental allocation - 1186 ML)**

Table 2.8 compares allocations, diversions, total deliveries and climate data from the 2013/14 reporting year to previous years. Diversions for 2013/14 were down by 23% compared to the previous 2012/13 reporting period due to reduced allocation of general security water. Although full allocation was available for 2010/11 and 2011/12, high rainfall would have supplemented water demands, particularly in 2010/11 when ETo rates were low. Increased ETo during 2012/13 and 2005/06 is likely to have increased water demand, exhibited by high diversion volumes and ultimately high delivery volumes in both reporting years. Water allocations in 2005/06 were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

Table 2.8: Water allocation, total diversions and deliveries 2013/14 compared to previous years.

Year	Announced Allocation % General / High	Total Diversions (ML)	Total Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2013/14	**63/95**	**832,758**	**699,308**	**440**	**1,860**
2012/13	100/100	1,079,843	940,979	307	1,864
2011/12	100/100	854,855	752,845	737	1,821
2010/11	100/100	567,223	490,329	739	1,391
2005/06	54/95	1,036,519	829,990	367	1,935

Table 2.9 demonstrates the operational diversions required for the reuse of reclaimed drainage water and shows the adjusted volumes of water channelled through each of the main channel systems. The Main Canal is fed via NARREG and the Sturt Canal is fed via STUR, both supplied from Murrumbidgee River.

Wah Wah is a mixture of river water and reclaimed drainage water supplied from Barren Box Storage & Wetland (BBSW) and Mirrool Creek, respectively. During periods of peak demand Wah Wah is further supplemented with water entering the system from NARREG and STUR.

As shown in Table 2.9, due to the reclamation and reuse of drainage water, the total amount of water channelled through each of these systems is greater than the total gross diversions exhibited in Table 2.7.

Table 2.9: Monthly summary of adjusted diversions (ML) for 2013/14.

Month	Sturt Canal (ML)	Main Canal (ML)	Wah Wah (ML)
Jul-13	300	0	**0**
Aug-13	9,807	23,339	2,462
Sep-13	25,872	46,638	7,323
Oct-13	35,982	79,362	11,072
Nov-13	22,378	71,745	9,016
Dec-13	33,059	106,251	14,201
Jan-14	34,702	114,020	15,382
Feb-14	24,566	74,123	10,298
Mar-14	11,130	45,091	9,786
Apr-14	2,925	12,437	6,512
May-14	11,312	19,694	5,842
Jun-14	425	2,426	3,140
Total	**212,458**	**595,126**	**95,034**

2.4 ENVIRONMENTAL DIVERSION

During the 2013/14 irrigation season, MI was required by the Office of Environment and Heritage (OEH) to divert water for environmental purposes to Tuckerbil Swamp, Turkey Flats and Yanco Ag Lagoon as shown in Table 2.10. A total of 1,186 ML (including a 20% conveyance allowance) was diverted during November 2013 and January 2014.

Table 2.10: Environmental water diversions for 2013/14.

Location	Total (ML)
Tuckerbil Swamp	318
Turkey Flats	347
Yanco Ag Lagoon	522
Total	**1,186**

2.5 SUPPLY EFFICIENCY

Table 2.11 illustrates the simple efficiency of MI's supply system to be at 84.1% for 2013/14. Lower conveyance figures for 2013/14 compared to the previous year can be attributed to the reduction in allocations and reduced irrigation diversions. Efficiency is highly determined by conveyance, which is influenced by water availability and climatic conditions. However, the operational efficiency of the supply and drainage system has progressively increased over the years, mainly through infrastructure upgrades and system rationalisation, hence the improvement in simple efficiency from 2005/06 to 2013/14.

The water balance represented in Table 2.16 reconciles the losses and gains of the system more clearly and takes into account drainage reuses during the 2013/14 reporting period.

Table 2.11: Supply efficiency from 2005/06 to 2013/14.

Year	Sturt Canal	Main Canal	Less DNR Environmental Diversions	NET TOTAL Irrigation Diversions	Sales (ML)	Conveyance (ML)	Simple Efficiency (%)
2013/14	**213,806**	**618,952**	**1,186**	831,572	**699,308**	**132,264**	**84.1%**
2012/13	301,041	779,322	520	1,079,843	940,979	138,864	87.1%
2011/12	237,436	620,061	2,642	854,855	752,845	102,010	88.0%
2010/11	155,859	414088	2,724	567,223	490,329	76,894	86.0%
2005/06	233,388	805,277	2,146	1,036,519	826,207	206,529	80.1%

2.6 STORAGE LEVELS

Storage flows shown in Tables 2.12 to 2.16 do not include the initial balance of water held in these storages. These figures simply account for inflows and outflows from storages for the 2013/14 reporting year to give insight into system flows.

2.6.1 BARREN BOX STORAGE AND WETLAND

In 2006, BBSW was transformed from a degraded swampland into an efficient drainage receival basin and water storage facility which returns water under the Water for Rivers program for use in the Snowy River system. Storage at this site comprises of three cells:

- The Active Cell – storage capacity 24,500 ML
- The Intermediate Cell – storage capacity 4,500 ML
- The Wetland Cell covering 1,650 hectares (ha) with a storage capacity 39,500 ML

No flows were diverted into the Wetland Cell during 2013/14. As shown in Table 2.12, the total inflow for 2013/14 was 43,299 ML. This amount consisted of 38,091 ML from the Active Cell and only 5,208 ML from the Intermediate Cell.

Table 2.12: Barren Box Storage flows (ML) for 2013/14.

Month	Inflow (ML)	Outflow (ML)	Balance (ML)
Jul-13	3,446	0	3,446
Aug-13	1,300	1,220	80
Sep-13	3,210	1,790	1,420
Oct-13	7,241	3,845	3,396
Nov-13	3,121	1,690	1,431
Dec-13	6,909	1,385	5,524
Jan-14	2,300	3,130	-830
Feb-14	5,480	3,040	2,440
Mar-14	3,892	650	3,242
Apr-14	1,125	1,800	-675
May-14	1,060	1,075	-15
Jun-14	4,215	0	4,215
Total	**43,299**	**19,625**	**23,674**

2.6.2 YENDA STORAGE

The flows recorded for Yenda storage during 2013/14 are shown in Table 2.13 below. The Yenda Storage is primarily used to compensate for differences between customer orders and diversions from NARREG.

Table 2.13: Yenda Storage flows (ML) for 2013/14.

Month	Inflow (ML)	Outflow (ML)	Balance (ML)
Jul-13	120	0	120
Aug-13	1,083	1,387	-304
Sep-13	1,120	1,255	-135
Oct-13	1,339	1,338	1
Nov-13	1,253	1,214	39
Dec-13	1,308	1,341	-33
Jan-14	1,135	1,191	-56
Feb-14	1,139	1,109	30
Mar-14	1,000	1,125	-125
Apr-14	878	908	-30
May-14	1,182	1,248	-66
Jun-14	638	281	357
Total	**12,195**	**12,397**	**-202**

2.6.3 BRAY'S DAM STORAGE

Bray's Dam Storage (BYD) has the operational ability to capture and redistribute drainage water from off-farm drainage and following rainfall. Water can also be pumped directly from Mirrool Creek and reused in the irrigation network. The figures in Table 2.14 show inflows and outflows at BYD for the 2013/14 reporting year.

Table 2.14: Bray's Dam Storage flows (ML) for 2013/14.

Month	Inflow (ML)	Outflow (ML)	Balance (ML)
Jul	470	0	470
Aug	640	874	-234
Sep	1,401	578	823
Oct	6	27	-21
Nov	644	262	382
Dec	258	0	258
Jan	462	265	197
Feb	2,560	2,502	58
Mar	1,847	993	854
Apr	895	1,113	-218
May	2,401	1,892	509
Jun	1,481	454	1,027
Totals	**13,065**	**8,960**	**4,105**

2.6.4 LAKE WYANGAN

MI regulates Lake Wyangan levels to satisfy various demands for commercial irrigation, environmental contributions and community objectives. Water depths within the northern and southern portions of the lake are regulated for various operational purposes including maintenance, management and flow supplementation for the adjacent supply channels.

For the 2013/14 reporting period, a total of 347 ML was diverted from the southern portion of the lake into Lake View Branch Canal for water deliveries. This opportunistic water was pumped from the southern portion and utilised for irrigation purposes where possible.

During the month of May, a total of 960 ML was diverted into the North Lake at the request of Griffith City Council (GCC). These diversions aimed to raise the level of the lake and maintain the social and recreational values held by the community. All diversions during this period were debited against GCC's entitlement. The monthly volumes extracted from Lake Wyangan into Lake View Branch Canal are highlighted in Table 2.15.

2.7 DRAINAGE REUSE

MI has continued to actively pursue recovery and reuse of water from its drainage system. Table 2.15 provides monthly information on drainage reuse volumes for each drainage site for 2013/14.

It should be noted that the water recovered at these sites may also include water that is deliberately diverted from our supply system during peak demand periods. As MI continues to operate its system more efficiently, some of the drainage sites are now used as connector channels between supply sites.

Table 2.15: Monthly drainage reuse volumes (ML) for 2013/14.

Site	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Total
GMSD Pumps (Yanco esc + Stormwater)	62	115	548	543	443	558	702	559	832	383	205	360	**5,310**
YMSD	0	11	224	124	102	143	230	213	293	159	156	112	**1,767**
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lake Wyangan Pumps to L.V.B.C.	189	0	50	40	32	22	14	0	0	0	0	0	**347**
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mirrool Creek Diversion to Benerembah (@ Brays)	0	686	1,927	466	638	0	826	848	2,424	2,313	3,373	302	**13,803**
Mirrool Creek Licensed Diverters (Creek Pumps)	0	70	287	874	698	900	704	511	366	142	147	0	**4,699**
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	265	325	0	0	0	0	0	45	0	30	0	**665**
Mirrool Creek to Wah Wah Main	0	1,942	5,593	7,222	7,446	13,175	12,502	9,168	6,998	6,512	5,717	3,010	**72,185**
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	0	700	150	100	150	400	250	1,950	650	1,800	950	0	**7,100**
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Barren Box Storage to Outfall (includes flood releases)	0	520	1,640	3,745	1,540	985	2,880	1,090	0	0	125	0	**12,525**
Barren Box Storage Licensed Diverters	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Losses in Barren Box Storage	-357	846	1,812	1,951	-2,122	-1,107	2,611	3,391	1,787	1,557	2,359	-407	**12,321**
Channel 13 Escape (Benerembah Drainage)	0	0	90	105	30	41	0	40	0	0	0	130	**436**
Sub Total	**-106**	**5,155**	**12,646**	**15,170**	**8,957**	**15,117**	**20,719**	**17,770**	**13,395**	**12,866**	**13,062**	**3,507**	**131,158**
Less: First Use Water Diversions	0	2,462	7,323	11,072	9,016	14,201	15,382	10,298	9,786	6,512	5,842	3,140	**95,034**
TOTAL WATER CAPTURED (Re-Used)	**-106**	**2,693**	**5,323**	**4,098**	**-59**	**916**	**5,337**	**7,472**	**3,609**	**6,354**	**7,220**	**367**	**36,124**

2.8 WATER BALANCE

Table 2.16 below shows the Annual Water Balance Assessment. Total gross diversions for 2013/14 were 833 gigalitres (GL) used to generate water deliveries (sales) of 699 GL. The apparent system delivery loss was 134 GL, providing an apparent operational efficiency of approximately 84%, a minor decrease in comparison with the previous 2012/13 reporting period. This decrease can in part be attributed to a 233 GL reduction in water deliveries from the previous year that represents a reduced opportunity to maximise gross diversions.

In comparison, true system delivery loss (representing the portion of the loss that can be estimated or calculated) was estimated at about 86 GL. This included losses due to channel seepage and evaporation during storage and conveyance. There were no diversions to the Lower Mirrool Creek floodway. The unexplained losses are estimated at 98 GL resulting in total losses estimated at 183 GL. Therefore, it is estimated that 49 GL of water was gained throughout the system, most likely due to the improved operating efficiency and increased potential for water to be reused within the system.

Storage volume changes are included for BBSW and Lake Wyangan. The variation in en-route storages at Yenda and Bray's Dam are minimal in comparison to the figures recorded in the Table 2.16 below. Mirrool Creek Floodway releases (of which there were none) are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

Table 2.16: Annual Water Balance Assessment MIA system (GL) for 2013/2014.

Factor	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	Bench-mark	Median	Comment
Climatic																			
Rainfall **(mm)**	537	590	416	288	253	353	270	367	195	361	346	336	739	737	451	493	400	359	
Evaporation **(mm)**	1,868	1,750	1,896	2,032	2,191	1,998	1,983	1,935	2,182	2,127	2,166	2,085	1,391	1,694	1,863	1,859	1,862	2,018	CSIRO data
Type of Year **(% dry)**	33	25	48	78	90	68	75	60	93	73	78	75	0	30	45	35	48	66	Look up table
Main Gross Data																			
Gross Diversions	1,036	819	1,048	1,142	960	862	826	1,037	560	336	394	505	567	855	1,080	833	1,154	794	MI data (11 year medians)
Total Deliveries	823	646	857	917	754	652	648	830	412	210	276	368	490	752	932	699	952	616	MI data (11 year medians)
Apparent Loss	213	173	191	225	206	210	178	207	148	125	118	137	77	103	148	134	202	178	(3)=(1)-(2)
Apparent Efficiency **(%)**	79	79	82	80	79	76	78	80	74	63	70	73	86	88	86	84	82	76	= (2)/(1)*100
Inevitable Real Losses																			
Seepage from Channels	21	20	21	21	22	21	21	21	22	21	21	21	20	21	21	21	31	21	Based on % dry year
Evaporation from Channels	19	18	21	24	26	23	24	23	26	24	24	24	14	19	21	19	18	23	Based on % dry year
BBS + LW evaporation	31	29	34	39	21	11	4	15	10	8	8	8	22	31	34	6	35	18	Based on % dry year and area covered.
Wah Wah Losses (Div-Del)	29	34	19	31	28	28	26	29	18	16	18	19	13	37	11	30	29	25	No benchmark in License
Leaks, Theft, misc.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	Estimated
Subtotal	110	110	104	125	107	93	85	98	86	79	81	82	79	118	96	86	118	97	Inevitable Losses
System Flow Losses																			
Yanco drainage to River (4)	18	20	23	18	8	7	1	9	1	0	0	1	6	0	0	0	33	9	Old Bristol Rec. data
Floodway Releases	25	26	0	0	0	0	3	2	0	0	0	0	0	116	2	0	48	5	MI data
Subtotal	43	46	23	18	8	7	4	10	1	0	0	1	6	116	2	0	81	13	Flow Losses
Total True Losses (5)	**152**	**156**	**127**	**143**	**115**	**100**	**89**	**109**	**87**	**79**	**81**	**82**	**85**	**234**	**98**	**86**	**199**	110	Inevitable + Flow Losses
Unexplained Losses	115	90	120	128	106	91	91	116	58	29	39	52	69	105	130	98	133	86	Est (14% of deliveries)
Total System Losses (6)	**268**	**247**	**247**	**272**	**221**	**191**	**180**	**225**	**144**	**109**	**120**	**134**	**154**	**339**	**228**	**183**	**332**	196	True Losses + Errors
Assessed System Gains (7)	55	74	56	47	15	-19	2	18	-4	-17	2	-3	77	236	80	49	130	19	(7)=(6)-(3) (Long term value based on 18 yrs)
Mirrool Creek Flows																			
Willow Dam Flows	174	148	161	135	90	98	100	124	52	40	18	54	83	24	19	115	160	99	MI data
Bray's Dam Diversions	26	25	21	28	25	15	17	11	13	6	9	14	27	21	17	14	-	18	MI data
Benerembah pumps	9	4	7	7	3	4	2	2	3	0	0	0	0	1	1	1	-	3	MI data
Landholders pumping (Legacy 22c licences)	7	8	7	8	4	5	5	7	2	1	3	4	4	3	3	5	67	5	MI data
Total Drainage Mirrool Creek (8)	216	186	196	178	122	122	124	144	70	46	31	72	114	49	39	135	227	126	Sum
Total Drainage (9)	234	206	219	196	130	129	125	152	71	47	31	72	120	49	39	135	260	134	(9)=(4)+(8)
Reconciliation																			
Special Diversions WWID (10)	0	0	0	0	0	0	4	2	0	0	0	0	0	4	0	0	0	0	MI data
Reduction in BBS (11)	-17	-4	-15	-15	-24	-4	0	0	7	-1	0	-1	-14	-9	-13	8	-20	-6	MI data
Corrected Drainage To MC (12)	216	186	196	178	122	122	120	142	70	46	31	72	114	45	39	135	227	125	(12)=(8)-(10)
Corrected Total System Supply (13)	1,074	889	1,089	1,174	951	839	828	1,055	563	318	396	501	630	1,082	1,147	890	1,264	806	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	25	40	28	26	12	-16	2	13	-5	-36	7	-4	67	530	205	37	57	8	(14)=(7)/(12)*100
System Efficiency (%) (15)	**86**	**82**	**88**	**88**	**88**	**88**	**89**	**90**	**85**	**75**	**80**	**84**	**86**	**78**	**91**	**90**	**84**	85	(15)=((13)-(5))/(13)*100
BBS Fill Factor	1.00	1.00	1.00	1.00	0.45	0.20	0.00		0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-	0.5	
Lake Wyangan Fill Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	1.0	
Combined Fill Factor	1.00	1.00	1.00	1.00	0.51	0.28	0.10		0.24	0.19	0.19	0.19	0.19	0.19	0.19	0.19	-	0.52	

3. WATER USE

3.1 CROP STATISTICS

Each time customers order water they are required to allocate their water order to a particular crop.

Total area, water deliveries and crop water use data for 2013/14 are presented in Table 3.1. The water use data presented for the total area of crop are impacted by rainfall, ETo and irrigation practices and are indicative only.

Table 3.1: Summary of deliveries (ML) and areas (ha) for the major crop groupings during 2013/14.

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML /ha)
CITRUS	7,568	38,892	5.1
COTTON	8,657	73,327	8.5
INDUSTRIAL	28	3,345	n/a
OTHER CROPS	1,990	13,974	7.0
OTHER FRUITS	3,345	22,795	6.8
PLANTATION	98	375	3.8
RICE	19,417	237,957	12.3
STOCK & DOMESTIC	218.1	9,976	n/a
SUMMER CEREALS	3,707	21,086	5.7
SUMMER OILSEEDS	2,386	16,045	6.7
SUMMER PASTURE	2,887	14,445	5.0
TOWN SUPPLY	5	11,266	n/a
VEGETABLES	2,807	18,060	6.4
VINES	19,041	76,740	4.0
WINTER CEREALS	62,931	119,319	1.9
WINTER OILSEEDS	5,279	8,699	1.6
WINTER PASTURE	6,176	13,009	2.1
TOTAL	**146,541**	**699,308**	n/a

A comparison of crop water use for 2013/14 with previous years is presented in Table 3.2 and illustrated in Figure 3.3 below. Although winter cereals were the dominant crop type grown in the MIA during the 2013/14 reporting period, rice accounted for a large percentage of total water deliveries of 34% due to the higher irrigation requirement for rice production. The distribution of crop water use for 2013/14 is comparable to previous years. The charts in Figure 3.3 show that rice and cereal and oil seed are the main crop types that use the highest volume of water in the MIA. Total deliveries were reduced for each major crop type in 2013/14 compared to the previous

reporting year and can be attributed to the reduction in general security allocation in 2013/14. Cropping patterns compared with 2005/06 have remained the same, with the exception of cotton which has shown a significant increase and is now reported as a separate crop type.

Table 3.2: Total deliveries (ML) to major crop types in the MIA for 2013/14.

Year	Rice (ML)	Pasture (ML)	Cereal and Oil Seeds (ML)	Vegetables (ML)	Citrus + Vines + Other Fruits (ML)	Other Crops + Plantations (ML)	S&D + Towns + Industrial (ML)	Cotton (ML)
2013/14	**237,957**	**27,454**	**165,149**	**18,060**	**138,427**	**14,347**	**24,588**	**73,326**
2012/13	369,393	43,369	225,135	19,772	155,169	14,971	27,947	85,223
2011/12	320,033	27,438	156,155	19,017	119,003	7,512	19,263	76,857
2010/11	253,699	13,924	82,696	14,717	74,912	29,927	20,455	n/a
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

***Note**: Cotton was considered as 'other crops and plantations' before 2011/12.*

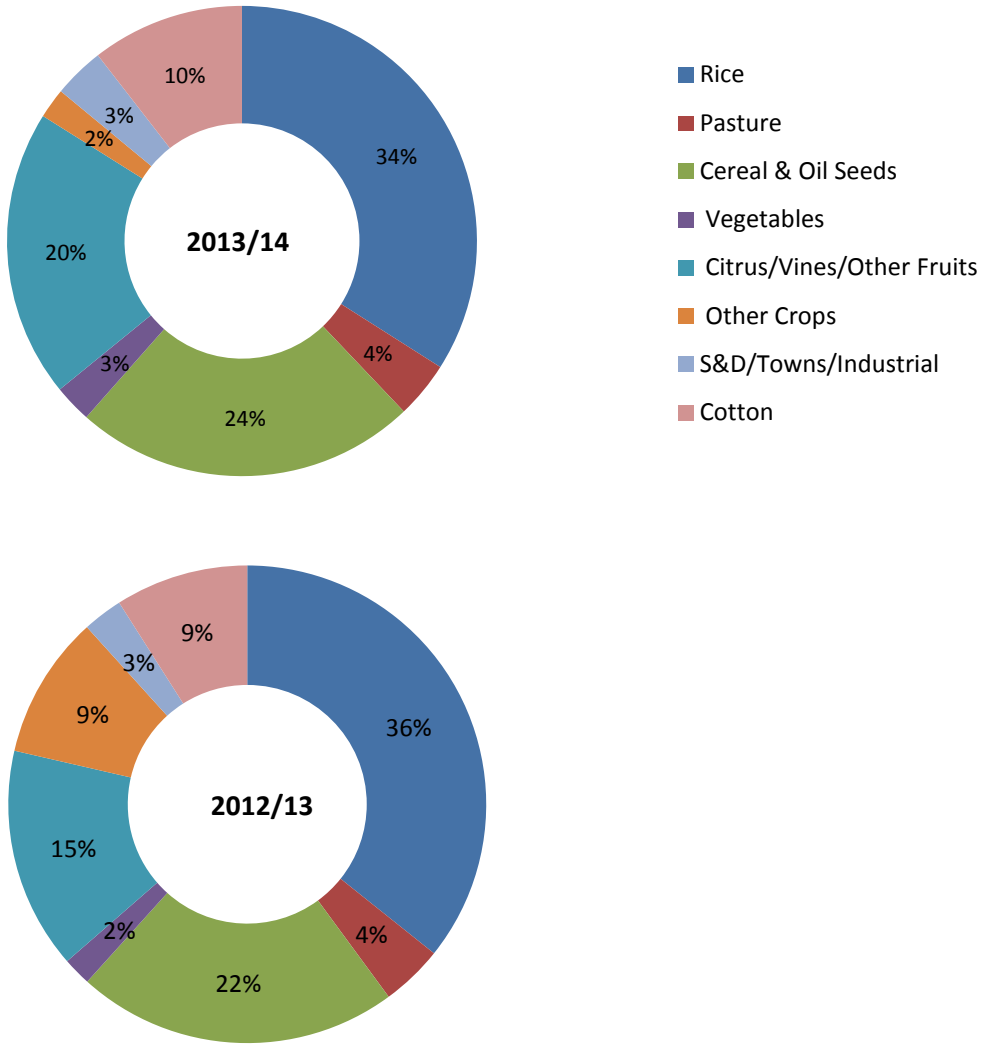


Figure 3.3: Crop water use for 2013/14 compared to previous years.

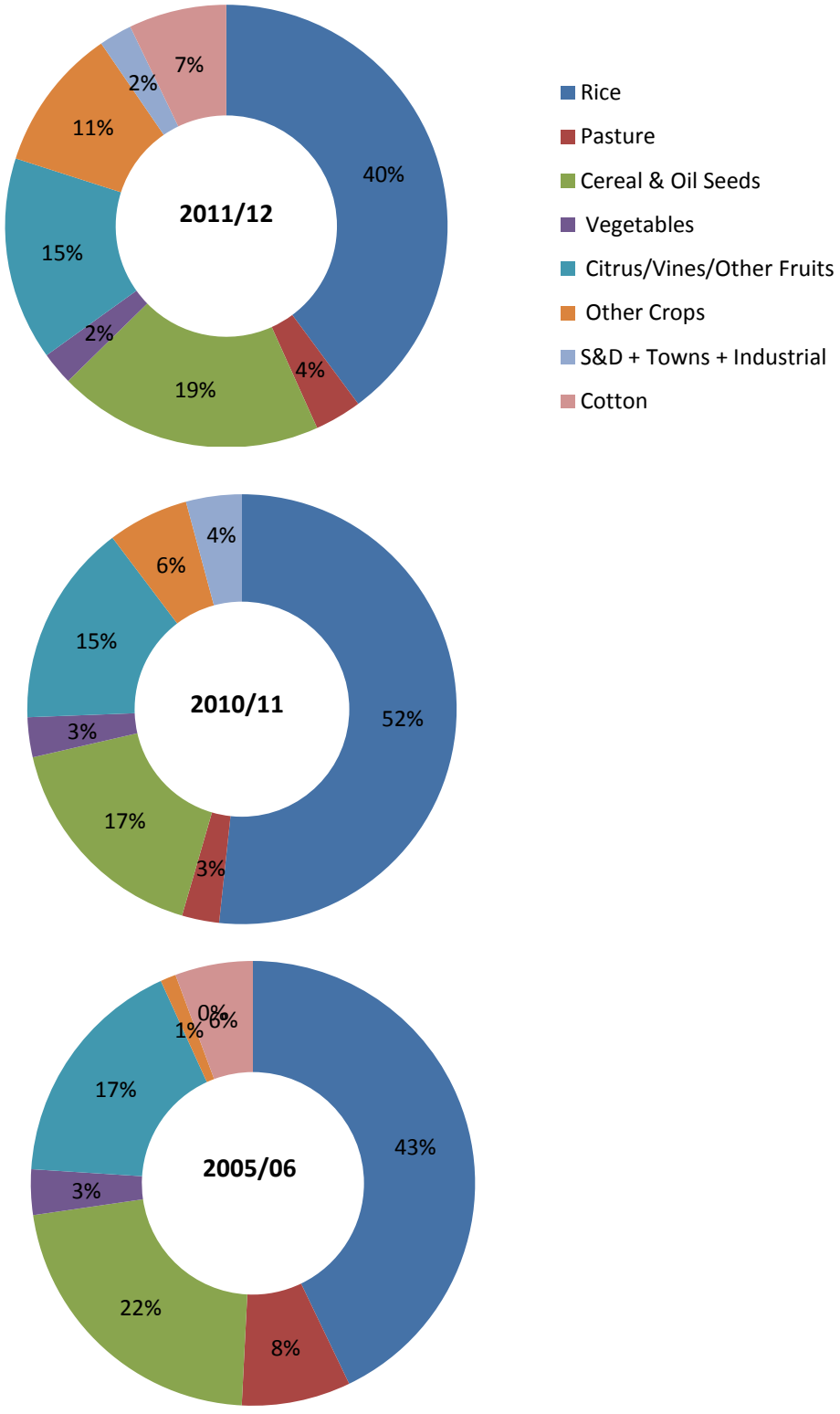


Figure 3.3 (continuted): Crop water use for 2013/14 compared to previous years.

3.2 IRRIGATION INTENSITY

The distribution of irrigation intensity is reported in Figure 3.4. This map identifies locations of landholdings using between 0-4 ML/ha, 4.1-8 ML/ha and >8.1 ML/ha.

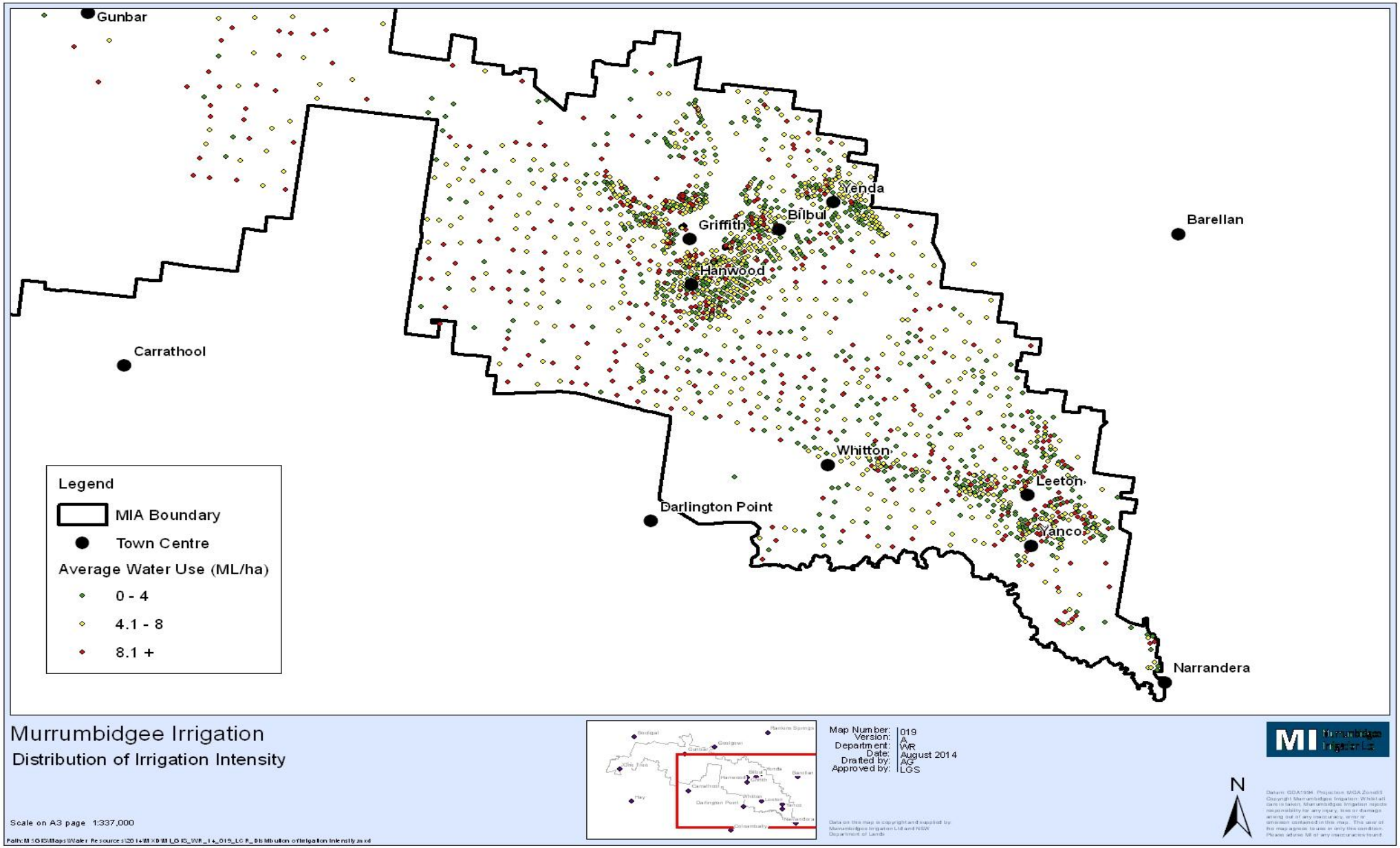


Figure 3.4: The distribution of irrigation intensity across the MIA

4. REPORTING ON SALINITY AND SALT-LOAD

4.1 EXTRACTED SALT-LOAD

The salt-load for NARREG and STUR are calculated using flow data reported by Theiss and salinity data from NSW Office of Water (NOW) monitoring site 410001, which is the closest monitoring point on the Murrumbidgee River to MI's offtakes. Mean salinity values from site 410001 were used for salt-load calculations for both NARREG and STUR. The mean EC values and extracted salt-loads are presented in Table 4.1. The installation of real-time EC monitoring devices are planned improvements for NARREG and STUR as part of MI's water quality monitoring program in 2014/15.

Table 4.1: Total extracted salt-load (t) for 2013/14.

Month	Site 410001 Mean EC	STUR (t)	NARREG (t)	Total Salt-load Extracted (t)
Jul-13	223	43	0	43
Aug-13	201	1,263	3,007	4,270
Sep-13	141	2,306	4,219	6,525
Oct-13	95	2,177	5,193	7,370
Nov-13	75	10,69	3,548	4,617
Dec-13	90	2,011	6,589	8,600
Jan-14	74	1,649	5,516	7,165
Feb-14	68	1,072	3,374	4,446
Mar-14	79	561	2,282	2,843
Apr-14	226	407	1,816	2,223
May-14	173	1,169	2,266	3,435
Jun-14	207	177	464	641
2013/14 total		**13,905**	**38,271**	**52,177**

During 2013/14, MI extracted an estimated 52,177 tonnes of salt from the Murrumbidgee River. The salt-load entering the MIA from supply works is lower compared to the last two reporting years (Table 4.2). A lower salt-load is expected with a reduced total volume of water diverted in 2013/14. The amount of salt extracted is generally related to the volume of water extracted which is represented by the strong relationship exhibited between total diversions and salt-loads in Figure 4.3. However, during 2011/12 the salt-load extracted from the Murrumbidgee River was considerably higher compared to the salt-load recorded for this reporting year, even though diversion figures were similar.

Table 4.2: Extracted salt-load for 2013/14 compared to previous years.

Year	Total diversions (ML)	STUR Salt-load(t)	NARREG Salt-load (t)	Total extracted Salt-load (t)
2013/14	832758	13905	38271	52177
2012/13	1079843	19899	46426	66325
2011/12	854855	19368	51083	70451
2009/10	506521	6568	35244	41792
2007/08	393973	1778	26816	28594

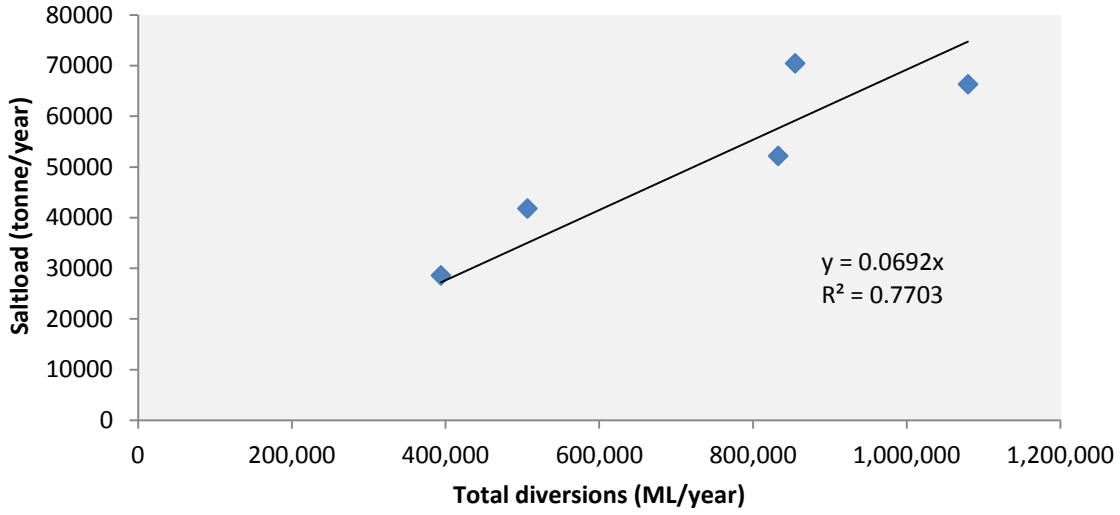


Figure 4.3: The relationship between salt-load (tonne/year) and total diversions (ML/year) from 2007/08 to 2013/14.

4.2 DISCHARGE SALT-LOADS

There are four river drain sites and one floodway site that can potentially discharge water out of MI's area of operation. The location of these sites is shown in Figure 1.3 and 9.3 of this report. Flow, salinity and salt-load data for these sites are presented in Table 4.4. The EC levels that are presented in Table 4.4 indicate that drainage water has a much higher salt content than supply water.

Table 4.4: Flow, salinity and salt-load data for EPL discharge sites 2013/14.

Yanco Main Southern Escape (YMS) 410083					
Month	Flow (ML)	Mean EC (uS/cm)	Min.EC (uS/cm)	Max. EC (uS/cm)	Salt-load (t)
Jul-13	0	-	-	-	0
Aug-13	0	-	-	-	0
Sep-13	10	677	200	1,490	4
Oct-13	0	-	-	-	0
Nov-13	0	-	-	-	0
Dec-13	0	-	-	-	0
Jan-14	0	-	-	-	0
Feb-14	0	-	-	-	0
Mar-14	23	651	240	1,090	9
Apr-14	0	-	-	-	0
May-14	0	-	-	-	0
Jun-14	1	1,255	422	2,030	1
total	**34**				**15**

Gooragool Lagoon Escape (LAG) 41010940					
Month	Flow (ML)	Mean EC (uS/cm)	Min.EC (uS/cm)	Max. EC (uS/cm)	Salt-load (t)
Jul-13	26	287	253	339	5R
Aug-13	10	331	216	513	3R
Sep-13	45	284	197	542	7R
Oct-13	24	224	136	331	[3]
Nov-13	12	214	84	402	1R
Dec-13	0	-	-	-	0
Jan-14	41	568	487	661	16R
Feb-14	35	306	171	506	6R
Mar-14	126	389	122	560	19R
Apr-14	15	387	177	921	3R
May-14	0	-	-	-	0
Jun-14	23	414	343	594	7R
total	357				**70**

Gogeldrie Main Southern Escape (GMSRR) 41010921					
Month	Flow (ML)	Mean EC (uS/cm)	Min.EC (uS/cm)	Max. EC (uS/cm)	Salt-load (t)
Jul-13	0	-	-	-	0
Aug-13	0	-	-	-	0
Sep-13	0	-	-	-	0
Oct-13	3	133.5	*	*	0.2R
Nov-13	2	136	*	*	0.2R
Dec-13	0	-	-	-	0
Jan-14	0	-	-	-	0
Feb-14	0	-	-	-	0
Mar-14	42	334	*	*	5R
Apr-14	0	-	-	-	0
May-14	0	-	-	-	0
Jun-14	1	285	*	*	0.2R
total	48				**5.6**

Cudgel Creek Escape (ROCUDG) 41010005					
Month	Flow (ML)	Mean EC (uS/cm)	Min.EC (uS/cm)	Max. EC (uS/cm)	Salt-load (t)
Jul-13	412	158	129	186	33R
Aug-13	38	150	100	186	3R
Sep-13	60	182	150	204	7R
Oct-13	20	221	188	269	3R
Nov-13	88	164	90	222	9R
Dec-13	88	115	90	186	7R
Jan-14	316	126	106	153	25
Feb-14	237	111	83	163	15
Mar-14	246	94	79	99	13
Apr-14	274	93	80	118	15
May-14	158	161	92	230	14
Jun-14	64	186	156	197	[7]
total	1,999				**151**

R extrapolation table used
***** no data because of R
- pool reading only, no flow condition

The total salt-load discharged from the area of operations in 2013/14 was 242 tonnes, which was similar to the amount recorded last year. The majority of water and salt discharged from the MIA in 2013/14 was due to a malfunctioning regulator door at monitoring site ROCUDG (see Section 9.1).

As shown in Figure 4.5, the significant flooding that occurred in March 2012 was responsible for the extremely high salt-load discharged to the Murrumbidgee River in 2011/12. The salt-load discharged during 2010/11 is most likely a result of increased drainage flows caused by high annual rainfall. Figure 4.6 further confirms that salt-load is strongly related to water volume.

Table 4.5: Discharged salt-load for 2013/14 compared to previous years.

Year	Total discharge to Murrumbidgee River (ML)	Total Salt-load discharged (t)
2013/14	2,438	242
2012/13	2,563	301
2011/12	122,743	28,376
2010/11	5,905	578
2009/10	598	80
2007/08	337	68

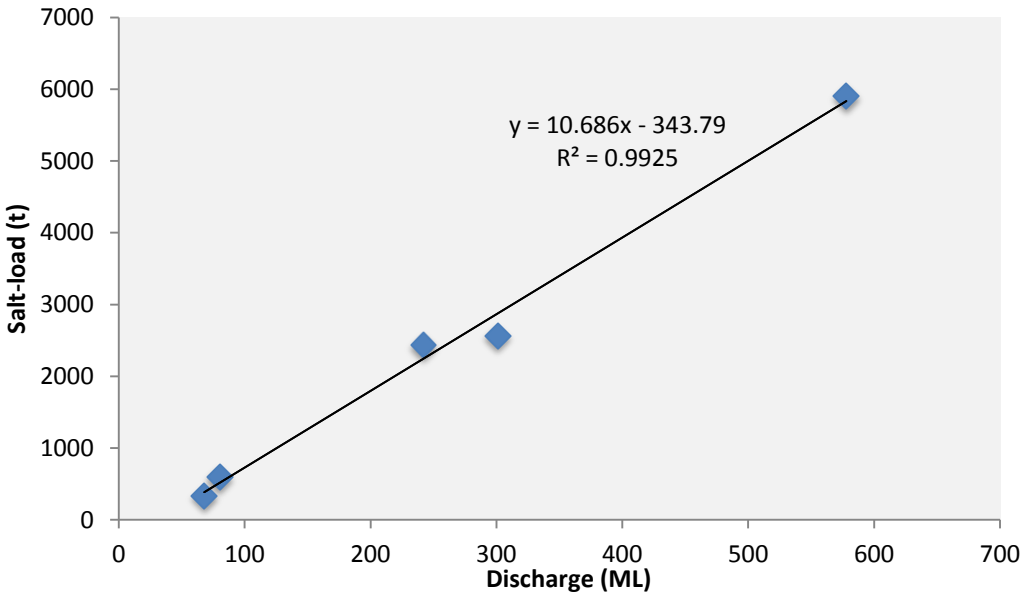


Figure 4.6: Relationship between discharge volume (ML) and salt-load (t) from 2007/08 to 2013/14 (excluding 2011/12).

4.3 SALT BALANCE

The basic salt balance presented in Table 4.7 suggests that of the 52,177 tonnes of salt received through diversions recorded at MI's authorised supply works, 242 tonnes was discharged back to the river, leaving a balance of 51,935 tonnes of salt which is estimated to have been retained within the MIA. It is important to note that this is an extremely simple salt balance, which does not account for salinity losses to shallow groundwater tables or take into account other factors that impact on total salt-loads.

Table 4.7: Salt balance for 2013/14

Extracted	Salt-load (t)
NARREG	38271
STUR	13905
Total extractions	**52,177**
Discharged	
YMS	15
GMSRR	6
LAG	70
ROCUDG	151
Total discharges	**242**
Balance 2013/14	**51,935**

5. REPORTING ON GROUNDWATER CONDITIONS

A current listing and condition each of piezometer used for groundwater monitoring under Combined Approval (40CA403245) is provided in Appendix 2.

Piezometer readings are taken at two-monthly and six-monthly intervals each year to assist in understanding the impacts of rainfall, flooding and irrigation on regional groundwater levels. The network is comprised of piezometers in the Shallow and Deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

The six-monthly piezometer network is sampled in the months of September and March to represent the beginning and end of each irrigation season over one financial calendar year. All piezometer monitoring is conducted in accordance with *MI's Standard Operating Procedure for Bore Monitoring* (Appendix 3). MI also samples a smaller network of piezometers every two months for internal evaluation and data trending. The monitoring of this network is also conducted in accordance with *MI's Standard Operating Procedure for Bore Monitoring*. Two-monthly bore data is not provided in this report but iis available upon request.

Piezometer levels are measured using a Heron EC Groundwater Standing Water Level Meter calibrated prior to commencement of each monitoring run and re-calibrated on every 100th piezometer sampled. Calibration is carried out in accordance with *MI's Operating Procedure for Calibration of Monitoring Equipment* and *Conductivity Plus Heron Instruments Instruction Sheet* (Appendix 4).

Data is collected using GPS enabled hand held field tablet devices. A full asset condition assessment of bores was conducted in March 2012 with staff undertaking visual checks bi-annually of the condition of the network (or in some cases every two months for the smaller network). A full Asset Condition Assessment for the bore network is scheduled every three years, including measuring the total depths of bores.

In September 2013 and March 2014, 993 piezometers were monitored. Out of the piezometers read during both periods 94% returned a reading and 6% were unable to be read (marked "OUT"). A breakdown of the total number and percentage of piezometers read by formation and the total number and percentage marked "OUT" is listed in Table 5.1.

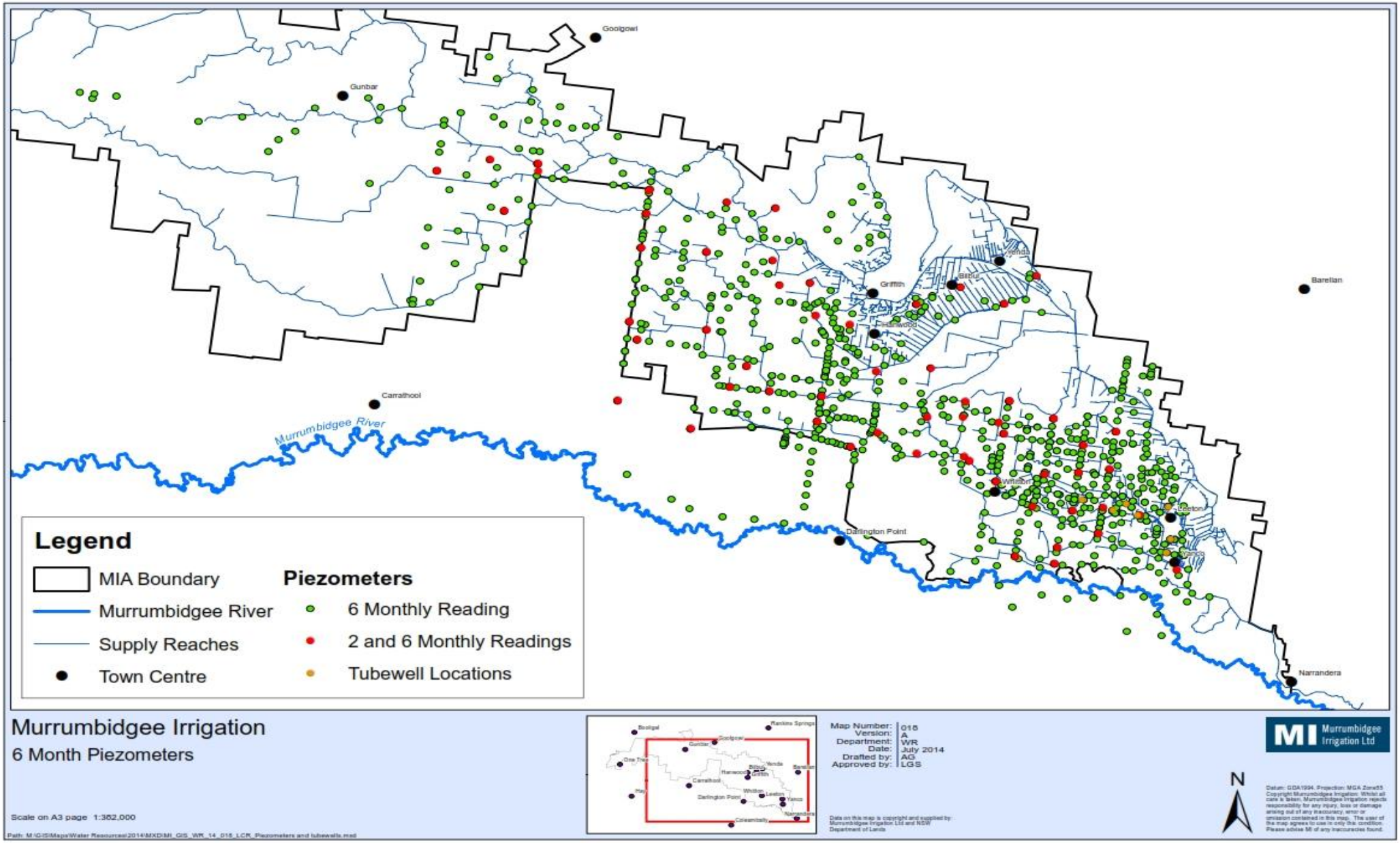


Figure 5.0: Location of tubewells and piezometers in the MIA for 2013/14.

Table 5.1: Total piezometers read for 2013/14by hydrogeolgical formation.

Total Read Piezometers	1-Sep-13	1-Mar-14	Out	Percentage Read	Percentage Out	Total Available
Bores Read in the Year	993	993	939	95%	5%	939

By Formation	1-Sep-13	1-Mar-14	Out	Percentage Read	Percentage Out	Total Available
Calivil	31	31	1	97%	3%	30
Lower Shepparton Formation	593	593	23	96%	4%	570
Upper Shepparton Formation	369	369	29	92%	8%	340

5.1 TUBEWELLS

MI is responsible for monitoring the discharge and salinity levels of five tubewells across the MIA and reports on the total yearly water and salt volumes discharged. Water quality measurements were taken in early July 2014 to mark the end of the reporting period and are only representative of water discharged at this time. The locations of monitored tubewells are shown in Figure 5.0.

Table 5.2 shows to total volumes and salt discharge from MIA tubewells for the 2013/14 reporting period, the three preceding years as well as readings from 2006/07 (height of the drought). A total volume of 9,681 ML was discharged from the tubewells carrying 18,905 t of salt into MI's drainage system for 2013/14 with the highest recorded discharge and salt loading occurring at Gil Gil. During this reporting period the tubewell at Baulch's was not operational due to pump failure and has not been operational within the last three reporting years.

An increase in total yearly discharge and consequently salt loadings has occurred at all sites (excluding Baulch's). Note Wamoon where pumping volumes were much lower than the previous 3 reporting years and 2006/07. Also notable was the significant increase in pumping at Yanco West and Gil Gil in comparison to 2006/7. This could be a product of excessively high groundwater tables coupled with 3 consecutive years of average and above average water sales.

Table 5.2: Tubewell readings for 2013/14

2013/14			2010/11		
Location	**ML**	**Salt (t)**	**Location**	**ML**	**Salt (t)**
FIVE BRIDGES	166	129	FIVE BRIDGES	27	34
GIL GIL	7,466	15,319	GIL GIL	482	908
YANCO WEST	1,722	3,114	YANCO WEST	0	0
SOUTH LEETON	45	184	SOUTH LEETON	194	347
BAULCH'S	0	0	BAULCH'S	0	0
WAMOON	149	89	WAMOON	275	169
EAST WAMOON	134	70	EAST WAMOON	29	18
TOTAL	**9,681**	**18,906**	**TOTAL**	**1,007**	**1,476**
2012/13					
FIVE BRIDGES	109	85			
GIL GIL	500	1,026			
YANCO WEST	311	563			
SOUTH LEETON	0	0			
BAULCH'S	0	0			
WAMOON	374	223			
EAST WAMOON	0	0			
TOTAL	**1,294**	**1,897**	**COMPARISON YEAR**		
2011/12			**2006/07**		
FIVE BRIDGES	234	231	FIVE BRIDGES	707	489
GIL GIL	620	1,044	GIL GIL	266	353
YANCO WEST	399	508	YANCO WEST	305	404
SOUTH LEETON	0	0	SOUTH LEETON	76	118
BAULCH'S	0	0	BAULCH'S	137	52
WAMOON	1,031	501	WAMOON	384	200
EAST WAMOON	0	0	EAST WAMOON	778	454
TOTAL	**2,284**	**2,284**	**TOTAL**	**2,653**	**2,070**

Changes in tubewell discharge volumes (and salt loadings) are dependent on a number of external factors including irrigation, rainfall, flooding and groundwater level rise (and fall) experienced in any given year and location.

Groundwater resources are classified on the basis of salinity in terms of Total Dissolved Solids (TDS) or Total Soluble Salts (TSS). Additional TDS data was collected for readings in the reporting period at each site to build baseline data to understand the potential origins of the water discharged from each tubewell. Four of the six tubewells are set to continuously pump, with tubewells in South Leeton and East Wamoon automated based on groundwater level and off peak demand for electricity.

Measured levels of electrical conductivity (EC) between 1,500 - 7,000 μ/cm and correspondingly high TDS may indicate discharged water from tubewells originates from groundwater sources. Together, with high groundwater tables, it is plausible that water discharged from some tubewells directly intercepts water from the Shepparton Formation due to high groundwater tables in these locations.

The EC and TDS measurements listed in Table 5.3 indicated that Yanco West, South Leeton and Gil Gil tubewells are intersecting groundwater tables from the Shepparton Formation whereas East Wamoon, Wamoon and Five Bridges may be discharging groundwater within recharge areas in the Shepparton Formation and/or Calivil Formation. Lower salinity levels measured in tubewells may demonstrate interaction or connectivity with the upper Shepparton Formation and/ or aquifer recharge zones representative of contributions of one or more localised inputs such as surface water irrigation, rainfall or channel seepage.

Table 5.3: EC and TDS readings for tubewells during 2013/14.

Site	Date	EC (u/cm)	TDS (mg/L)
Yanco west	11/07/2014	2,910	2,376
	11/07/2014	2,880	2,361
	11/07/2014	2,925	2,351
Average		**2,905**	**2,363**
South Leeton	11/07/2014	7,797	6,192
	11/07/2014	7,569	6,158
	11/07/2014	7,470	6,056
Average		**7,612**	**6,135**
East Wamoon	11/07/2014	838	700
	11/07/2014	810	691
	11/07/2014	811	678
Average		**820**	**690**
Gil Gil	11/07/2014	3,302	2,692
	11/07/2014	3,326	2,708
	11/07/2014	3,664	2,707
Average		**3,431**	**2,702**
Wamoon	11/07/2014	924	801
	11/07/2014	925	788
Average		**9245**	**795**
Five Bridges	11/07/2014	979	842
	11/07/2014	983	818
Average		**981**	**830**
Baulchs	11/07/2014	n/a	n/a

5.2 GROUNDWATER LEVELS

Groundwater contour maps have been developed to report changes in groundwater levels for March and September for 2013/14, 2012/13, 2011/12 reporting periods and 2006 as a benchmark year. The benchmark year is chosen as groundwater levels were recorded at their lowest during 2006 due to the drought.

Piezometers have been divided into two categories for the Shepparton Formation based on borehole lithology into “Shallow” and “Deep” Formations, dependent on the depth of bore, bore screen interval and targeted monitoring zone. This section of the report provides comparisons between the five reporting periods identified based on Formation.

Shepparton Formation (Shallow)

Shepparton Formation (Shallow) depth contours are presented in Figures 5.5 to 5.13. Groundwater contours in the Shallow Formation for March 2014 show a directional flow that is generally from east to west with a slight rise in groundwater levels from September 2013 across the MIA. This rise coincides with the end of the 2013/14 irrigation season, and is likely attributed to already elevated groundwater levels, localised recharge from rainfall, irrigation and channel seepage.

Overall groundwater levels in this formation were in decline in comparison with the previous three years. However, persistently high groundwater levels were recorded in the Yanco and Mirrool Irrigation Areas within 2 m, similar to those recorded for the preceding three years.

A comparison of groundwater levels for both months of March and September from 2011 to 2013 indicate level changes primarily driven by rainfall, recharge and flooding. Average recorded rainfall data for Griffith CSIRO AWS from 1995 to 2014 shows significant rainfall for 2010/11 of 739 mm and 737 mm in 2011/12, an average yearly increase of 400 mm for both years, which is higher than records from the preceding ten years. This indicates that the likely driving factor of groundwater recharge (and level rise) during this period was these consecutively above average rainfall years.

In March 2012 the MIA also experienced the largest overland flood in recorded history. The sheer volume of water present during the 2012 flood had not previously been recorded and coupled with record 24 hour rainfall in March proved to be the wettest recorded irrigation season in over 20 years.

Table 5.4 outlines the average yearly rainfall recorded for the MIA from 1995 to 2014.

Table 5.4: Average Yearly Rainfall 1995-2014 for the MIA.

Year	ETo (mm)	Rainfall (mm)	Net ETo (mm)
2013-14	**1860**	**440**	**1,420**
2012-13	1865	317	1,548
2011-12	1650	522	1,128
2010-11	1381	718	663
2009-10	1845	337	1,508
2008-09	1936	346	1,590
2007-08	1876	361	1,515
2006-07	1931	195	1,736
2005-06	1664	367	1,297
Average	**1,779**	**400**	**1,378**

Source: CSIRO Weather Data – Griffith

* The ETo calculation was changed in 2010 to allow for a more accurate calculation of actual crop water requirements. Values for ETo have been recalculated back to 2005/06 and the ETo data presented in this report is therefore different from data reported previously.

** Some inconsistencies were found in the reported rainfall data in previous reports. Data presented in this report are from the CSIRO weather station at Griffith and represent seasonal totals from 1 July to 30 June.

Groundwater levels in March 2011 were 2 metres lower in some areas of the MIA than those recorded for and reported for September 2011. On average an additional increase of 4 m or more between occurred again between September 2011 and March 2012. As a consequence of this water levels were still relatively high in September 2012 as a product of episodic recharge during the March 2012 floods. Levels did not begin to recede across the MIA in general by less than up to 2 metres until March 2014.

A comparison of groundwater levels measured in September and March from 2011-2014 and 2006 (Figures 5.4 to 5.13) highlight the influence of consecutive above average rainfall years on rise in groundwater levels and the significance of episodic recharge in the Shallow Shepparton Formation as a result of the 2012 floods. In fact, rainfall from 2004/05 (270 mm) and 2005/06 (367 mm) show below average rainfall for both years with groundwater levels fairly static and evidently in some areas up to 6 m deeper than those measured in 2012.

Areas of most notable concern in relation to groundwater level rise and fall from 2012 to 2014 include the Yanco Irrigation Area and parts of Benerembah Irrigation District and Mirrool Irrigation Area.

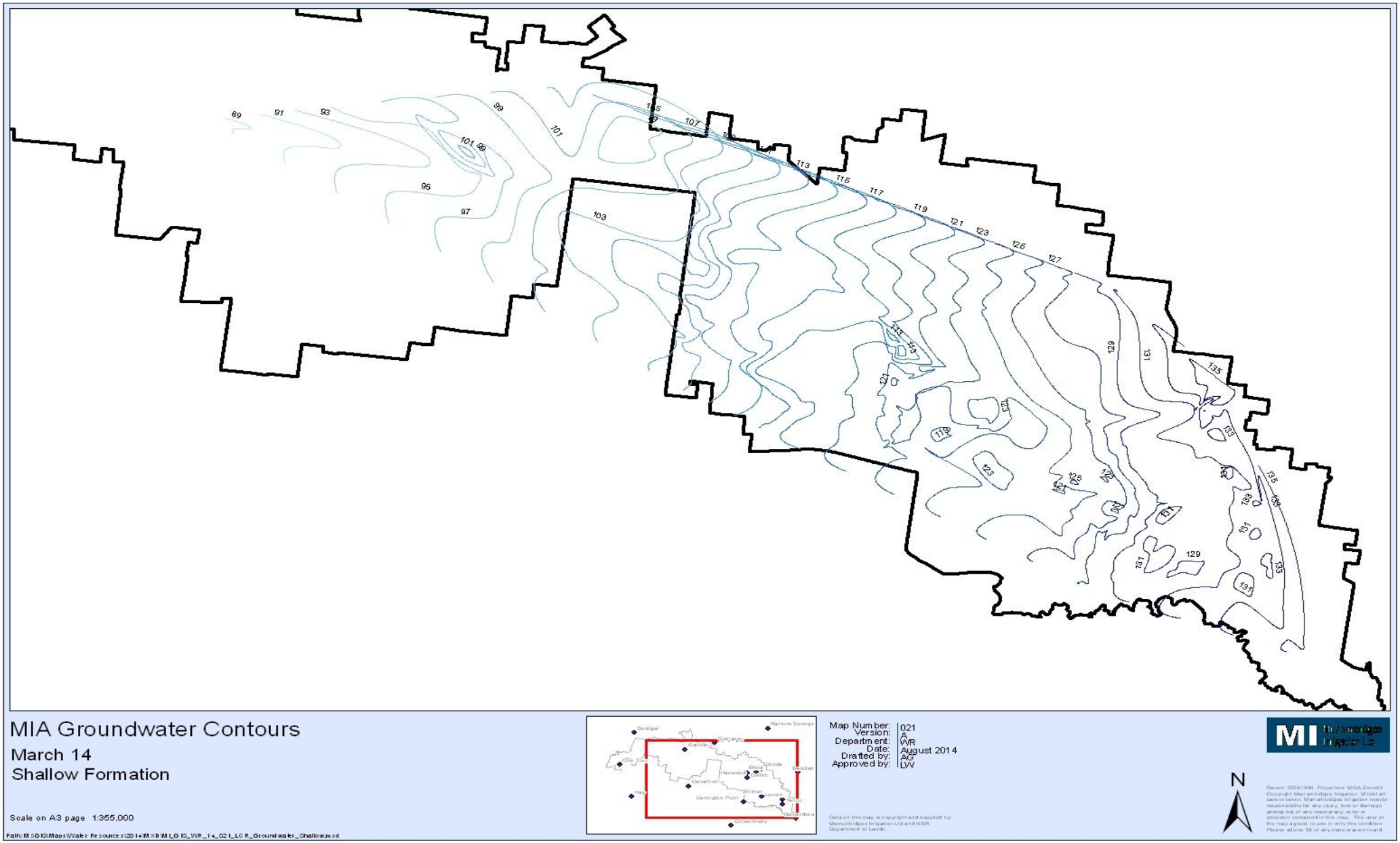


Figure 5.5: Groundwater levels in the Shallow Shepparton Formation - March 2014.

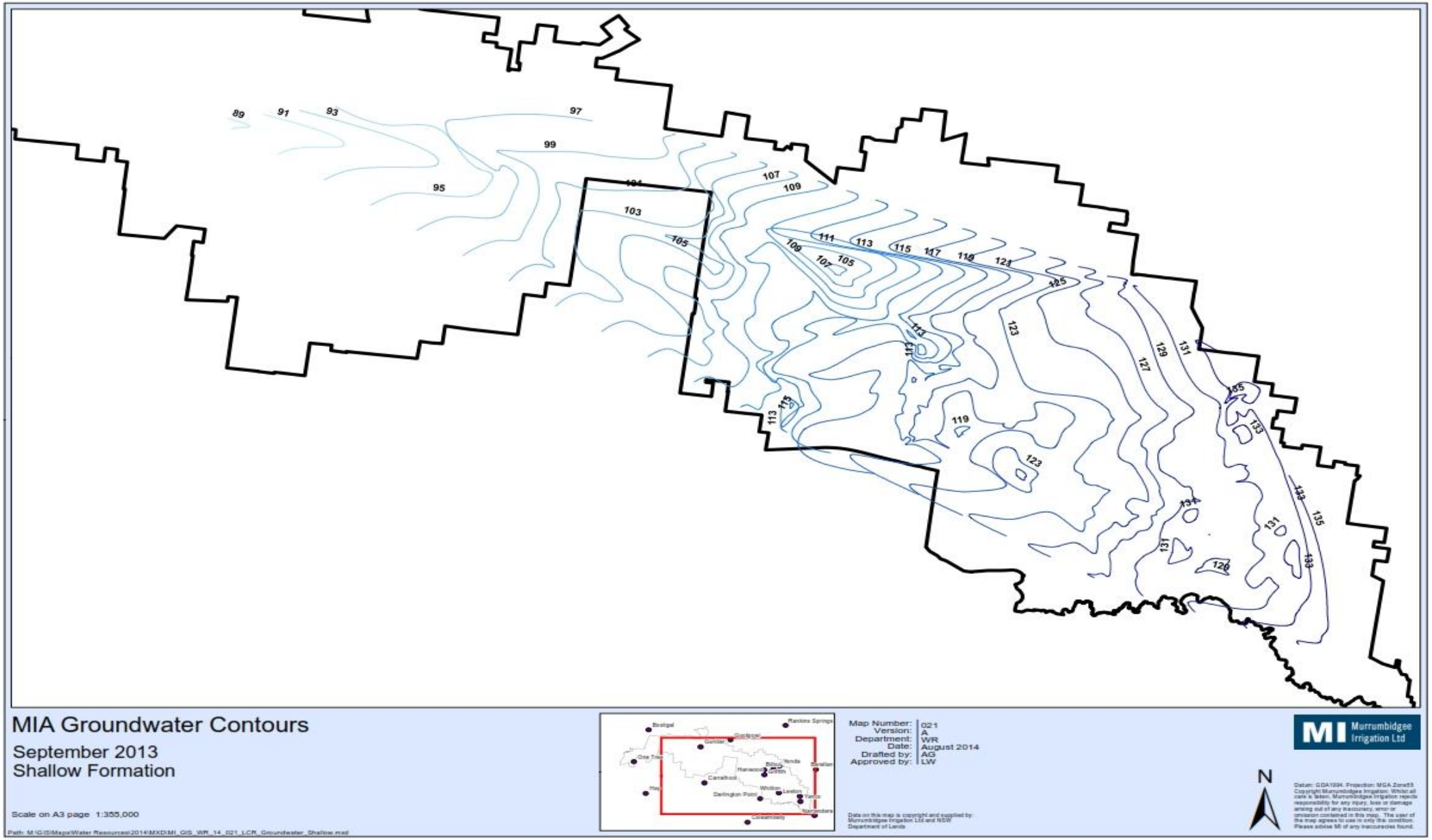


Figure 5.6: Groundwater levels in the Shallow Shepparton Formation - September 2013.

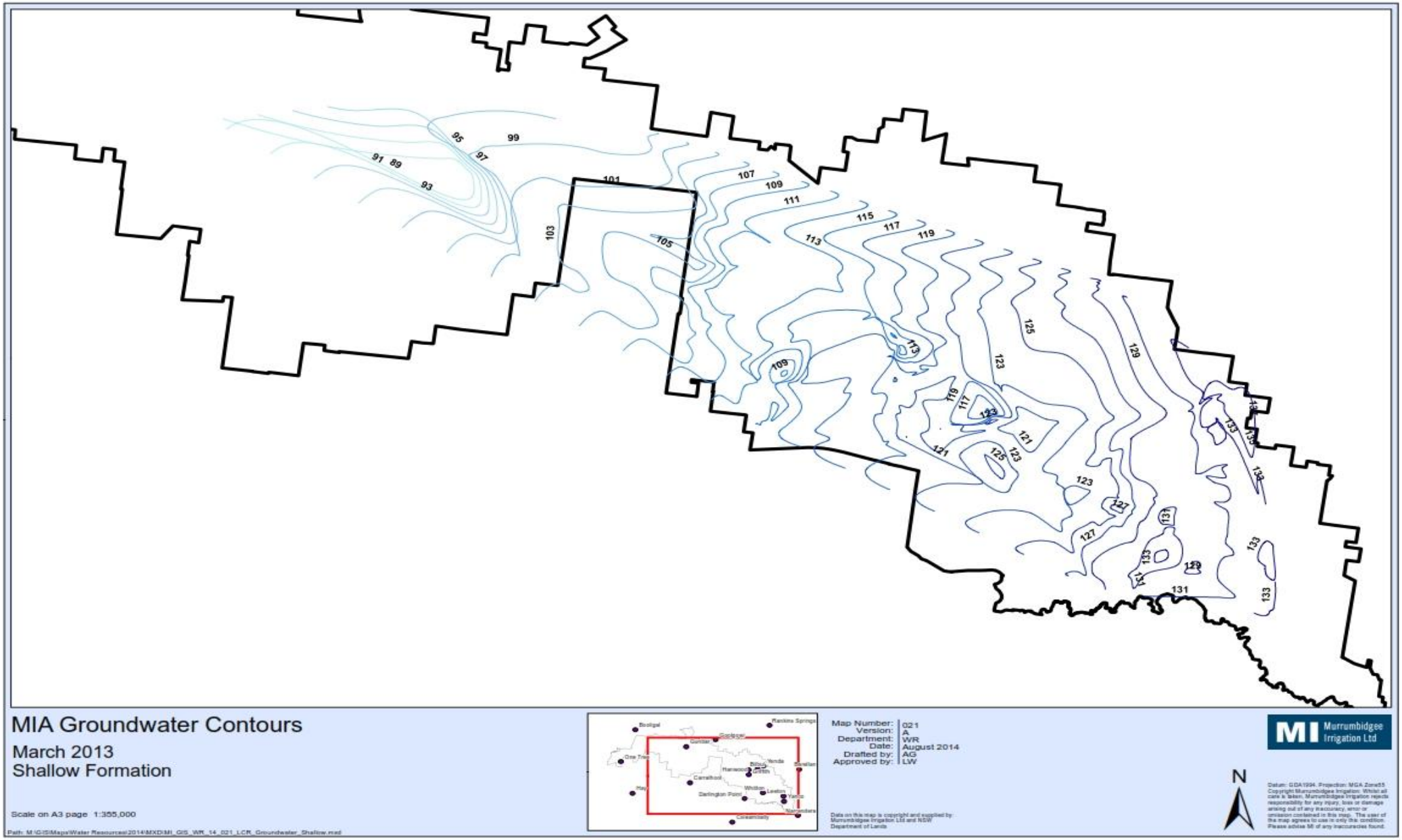


Figure 5.7: Groundwater levels in the Shallow Shepparton Formation - March 2013.

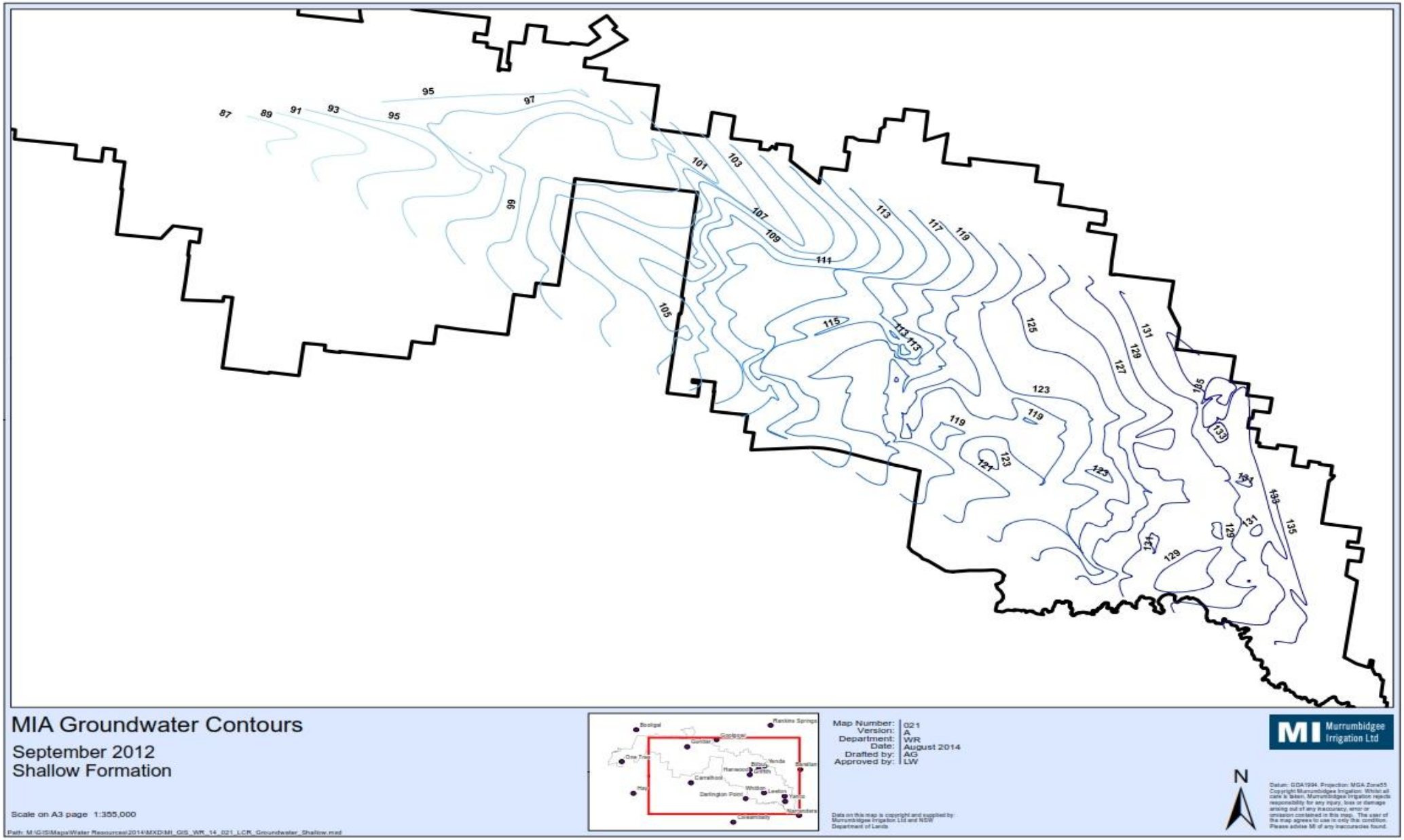


Figure 5.8: Groundwater levels in the Shallow Shepparton Formation - September 2012.

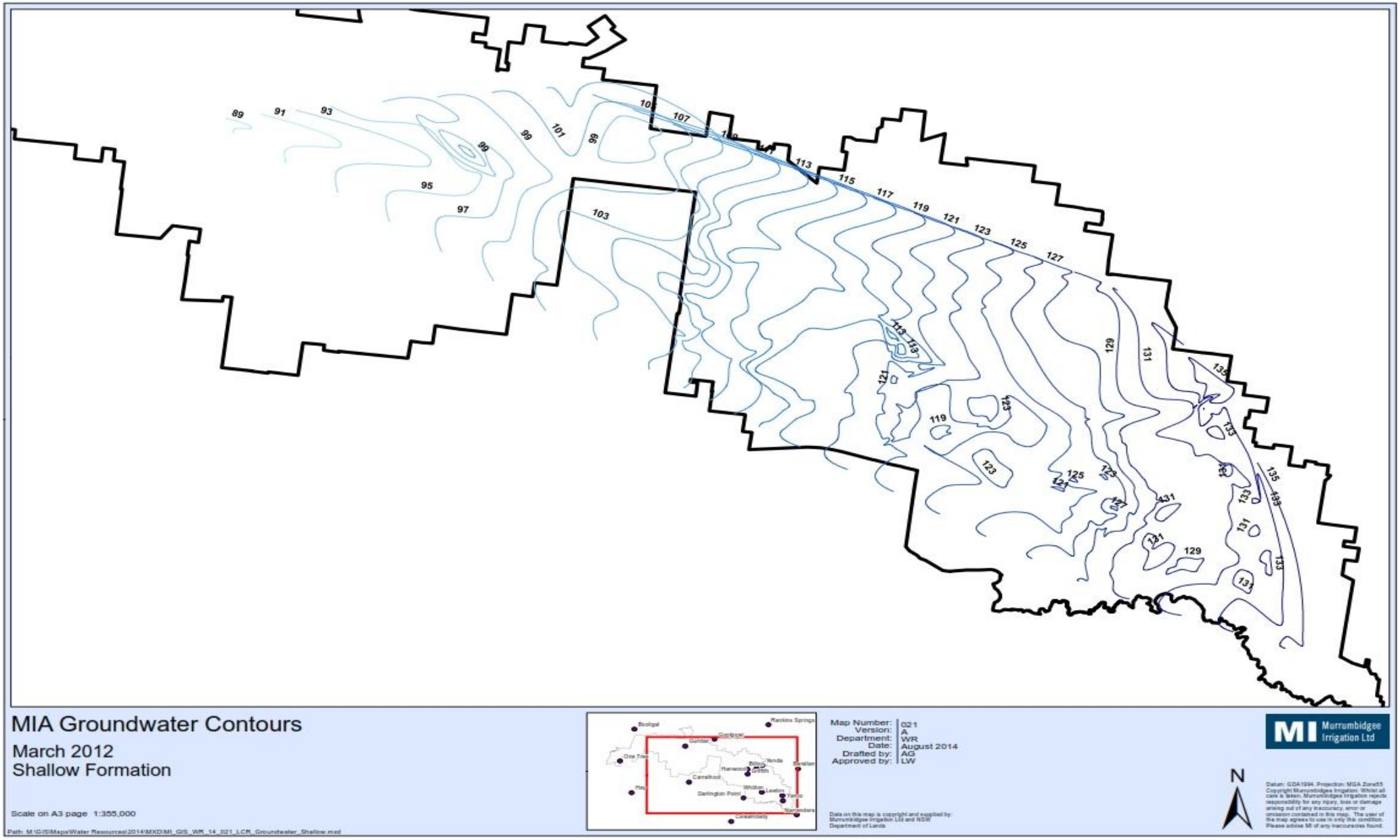


Figure 5.9: Groundwater levels in the Shallow Shepparton Formation - March 2012.

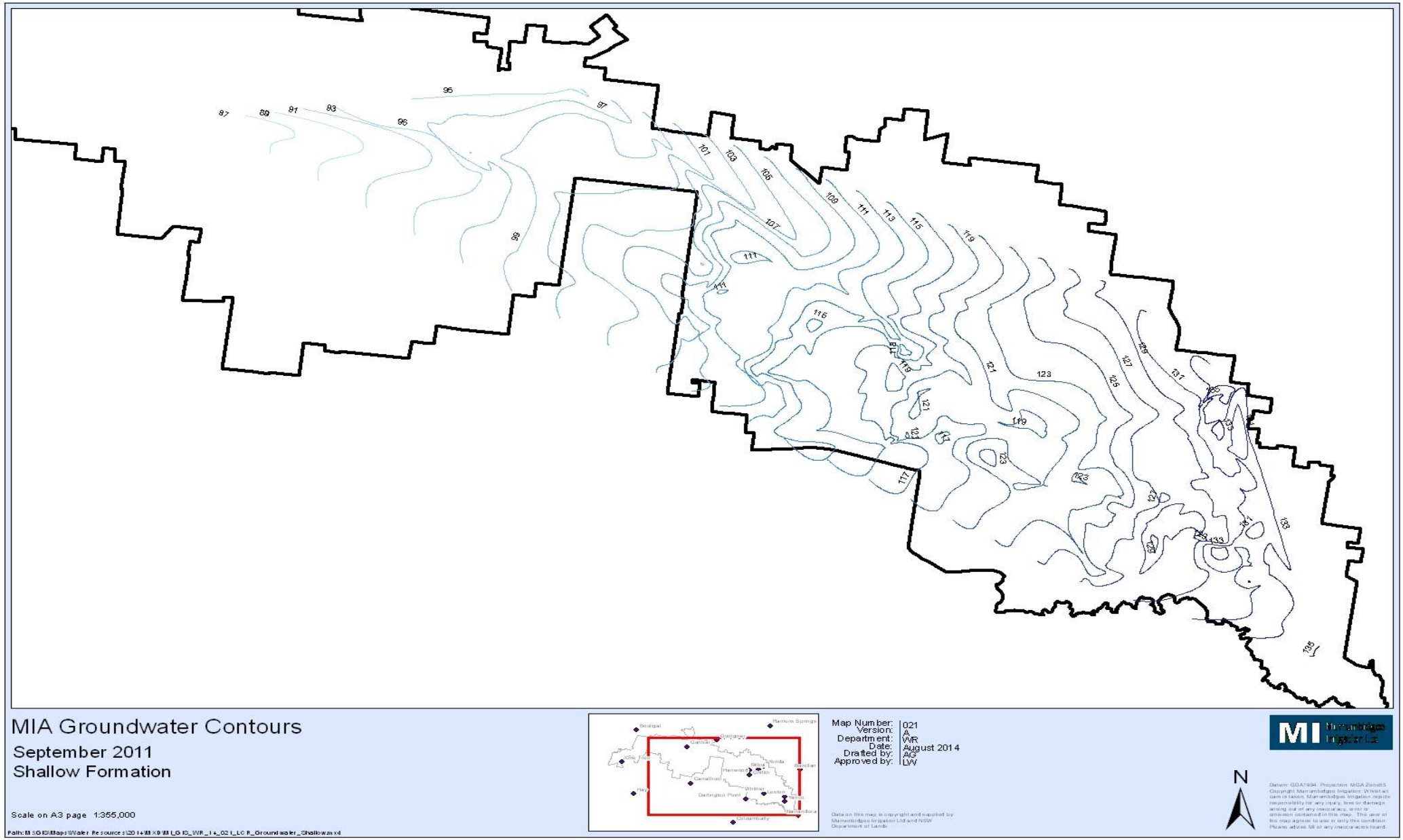


Figure 5.10: Groundwater levels in the Shallow Shepparton Formation - September 2011.

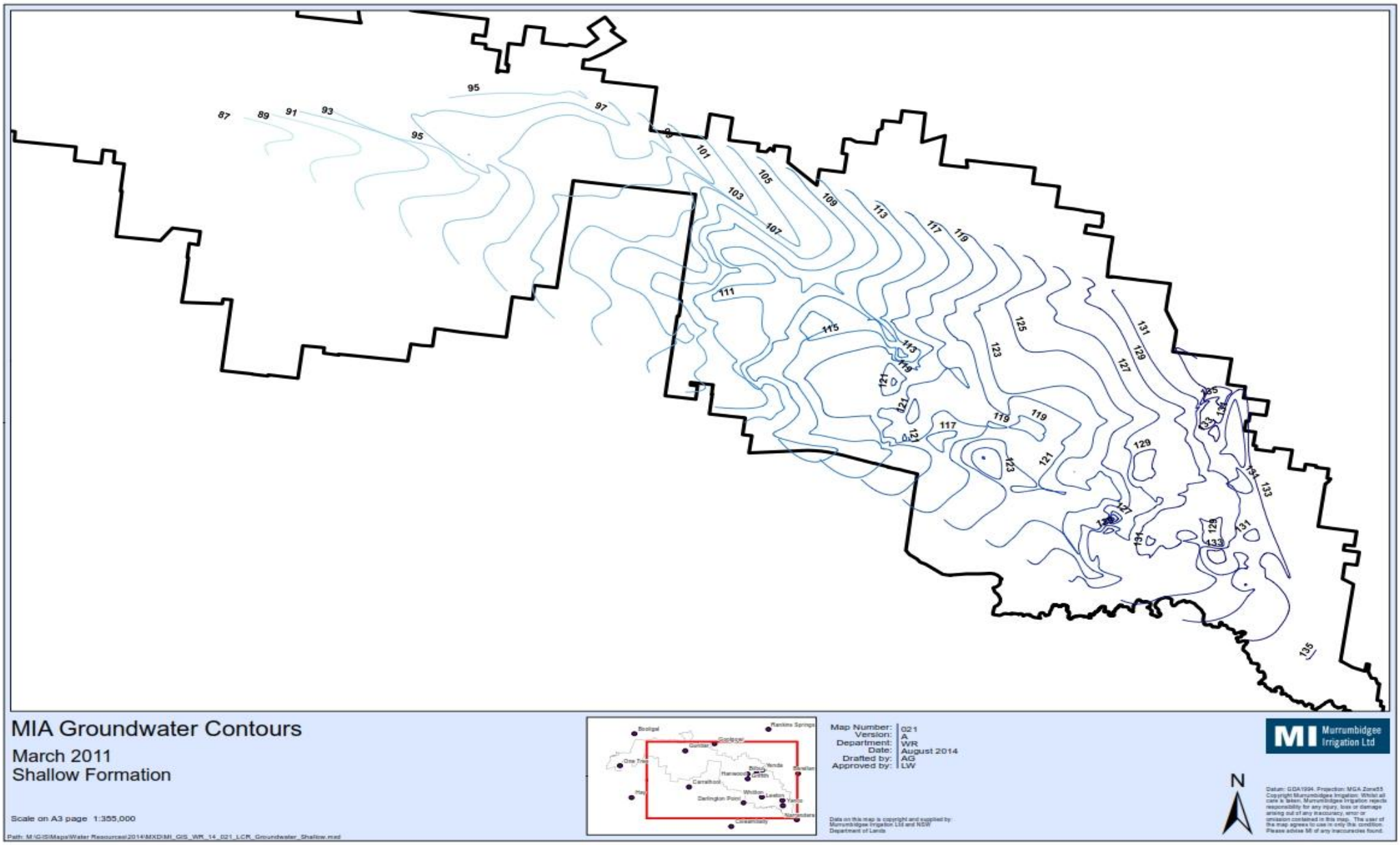


Figure 5.11: Groundwater levels in the Shallow Shepparton Formation - March 2011.

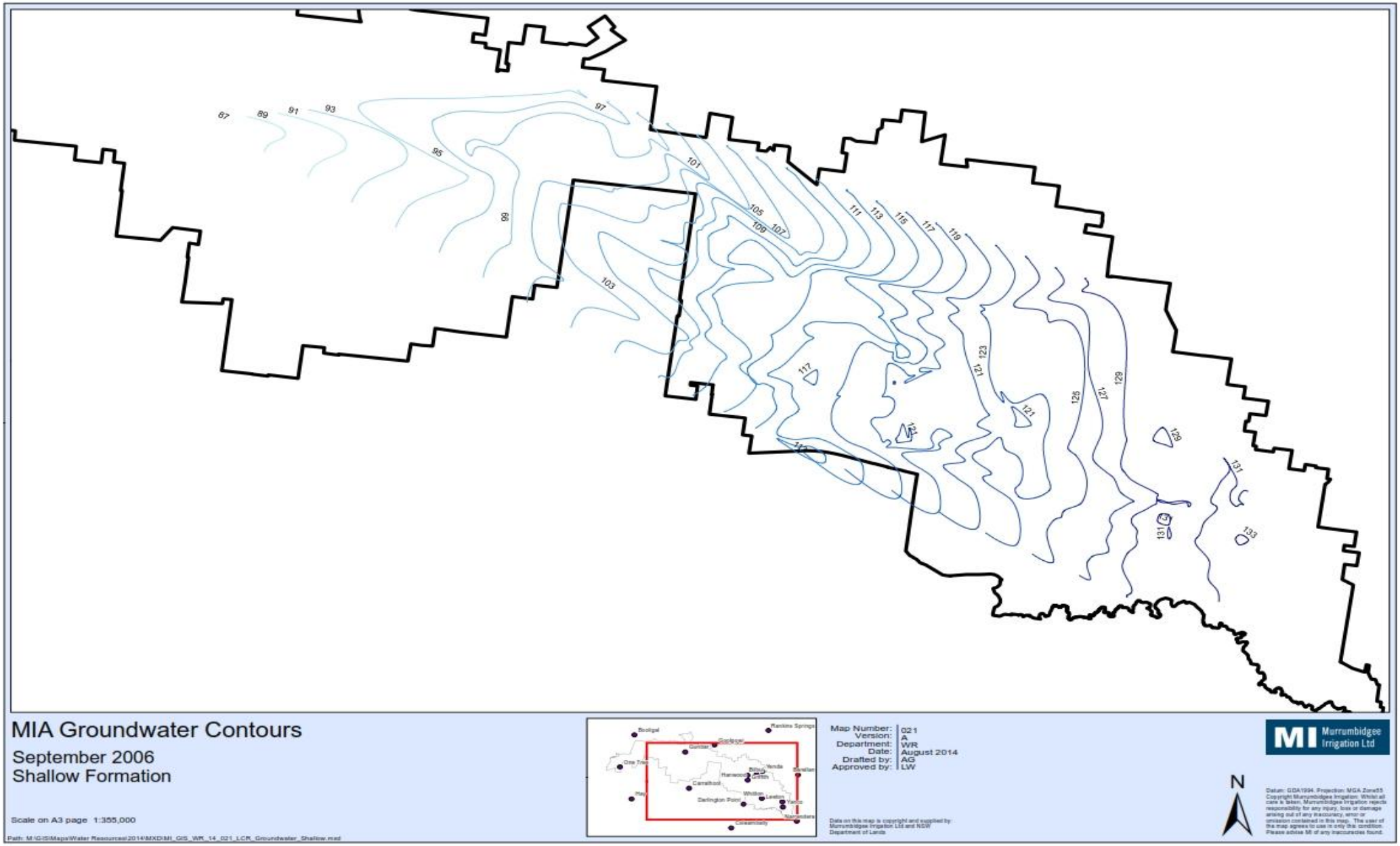


Figure 5.12: Groundwater levels in the Shallow Shepparton Formation - September 2006.

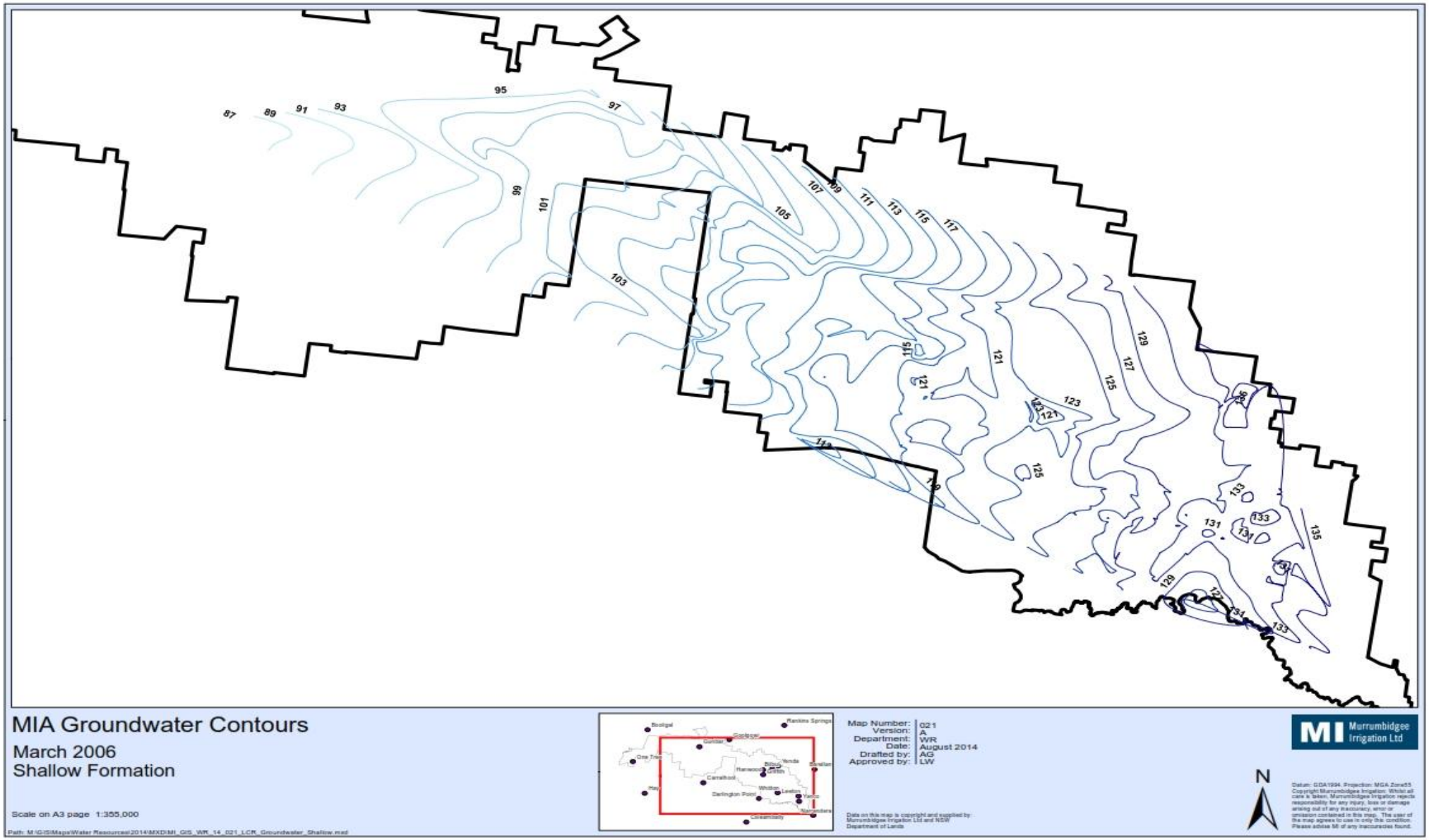


Figure 5.13: Groundwater levels in the Shallow Shepparton Formation - March 2006.

Shepparton Formation (Deep)

Shepparton Formation (Deep) depth contours are presented in Figures 5.14 to 5.20. Groundwater contours in the Deep Formation for March 2014 (Figure 5.14) show a directional flow generally from east to west and a slight rise in groundwater levels from September 2013 (Figure 5.15) across the MIA over a six month period. This is reflective for each year between March and September, but not of notable proportions in the Deep Formation.

A comparison of groundwater contours from March 2014 with those measured in March 2013, March 2012 and March 2006 show very little change in levels across the MIA in the Deep Formation.

Similar to the Shallow Shepparton Formation, areas of notable concern regarding groundwater levels in the Deep Shepparton Formation include the Yanco Irrigation Area, and to a lesser extent, Benerembah Irrigation District and the Mirrool Irrigation Area.

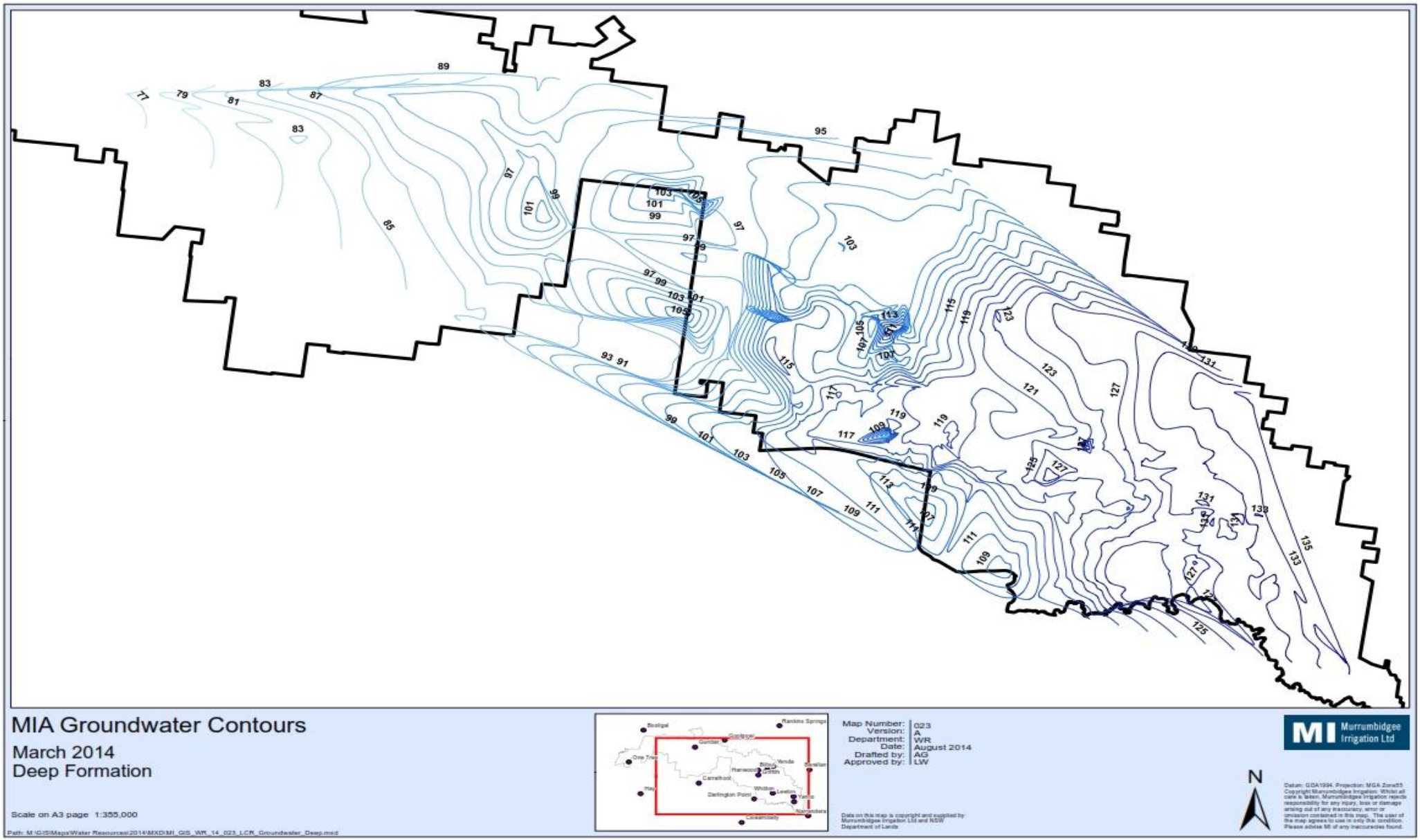


Figure 5.14: Groundwater levels in the Deep Shepparton Formation - March 2014.

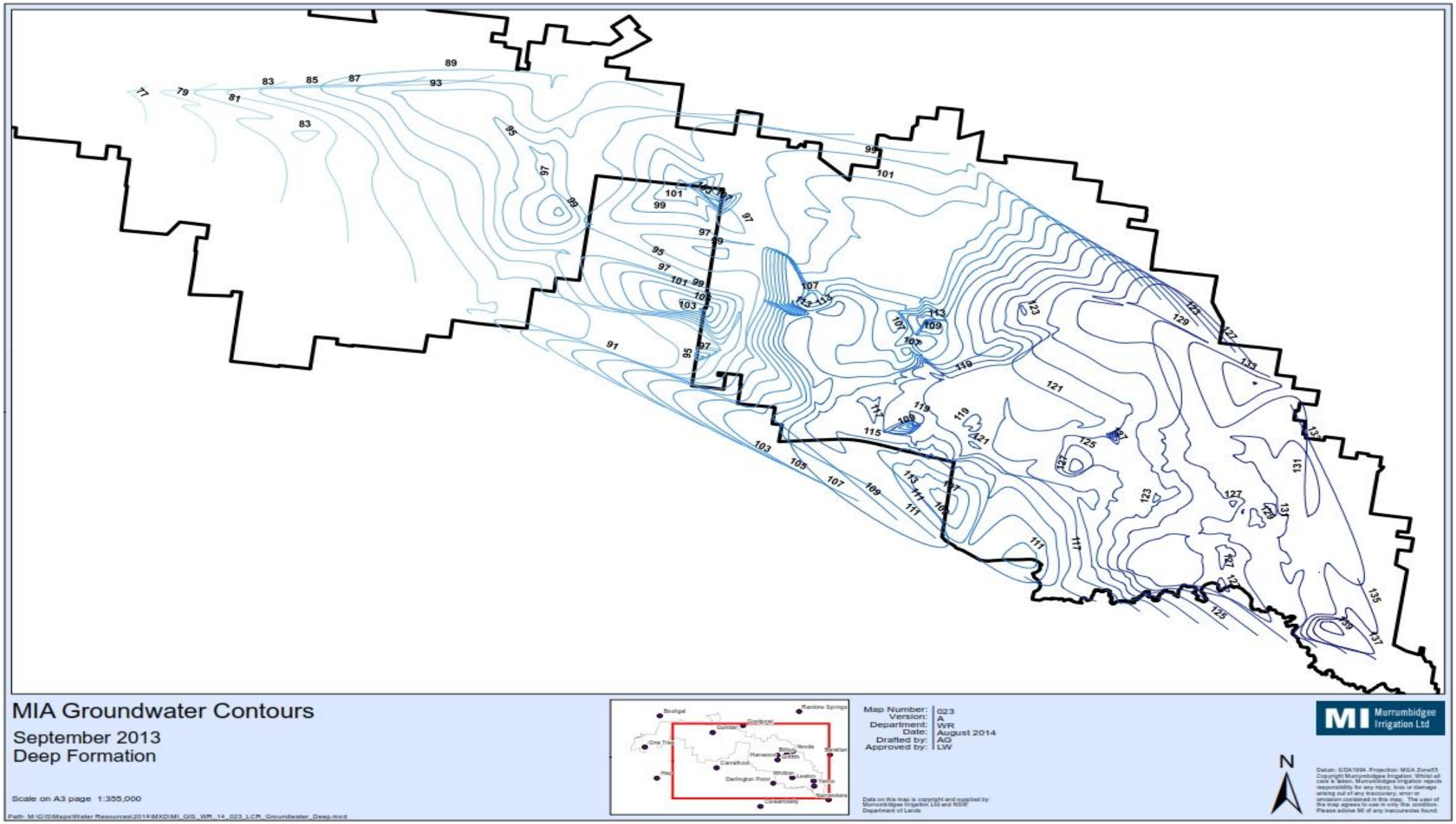


Figure 5.15: Groundwater levels in the Deep Shepparton Formation - September 2013.

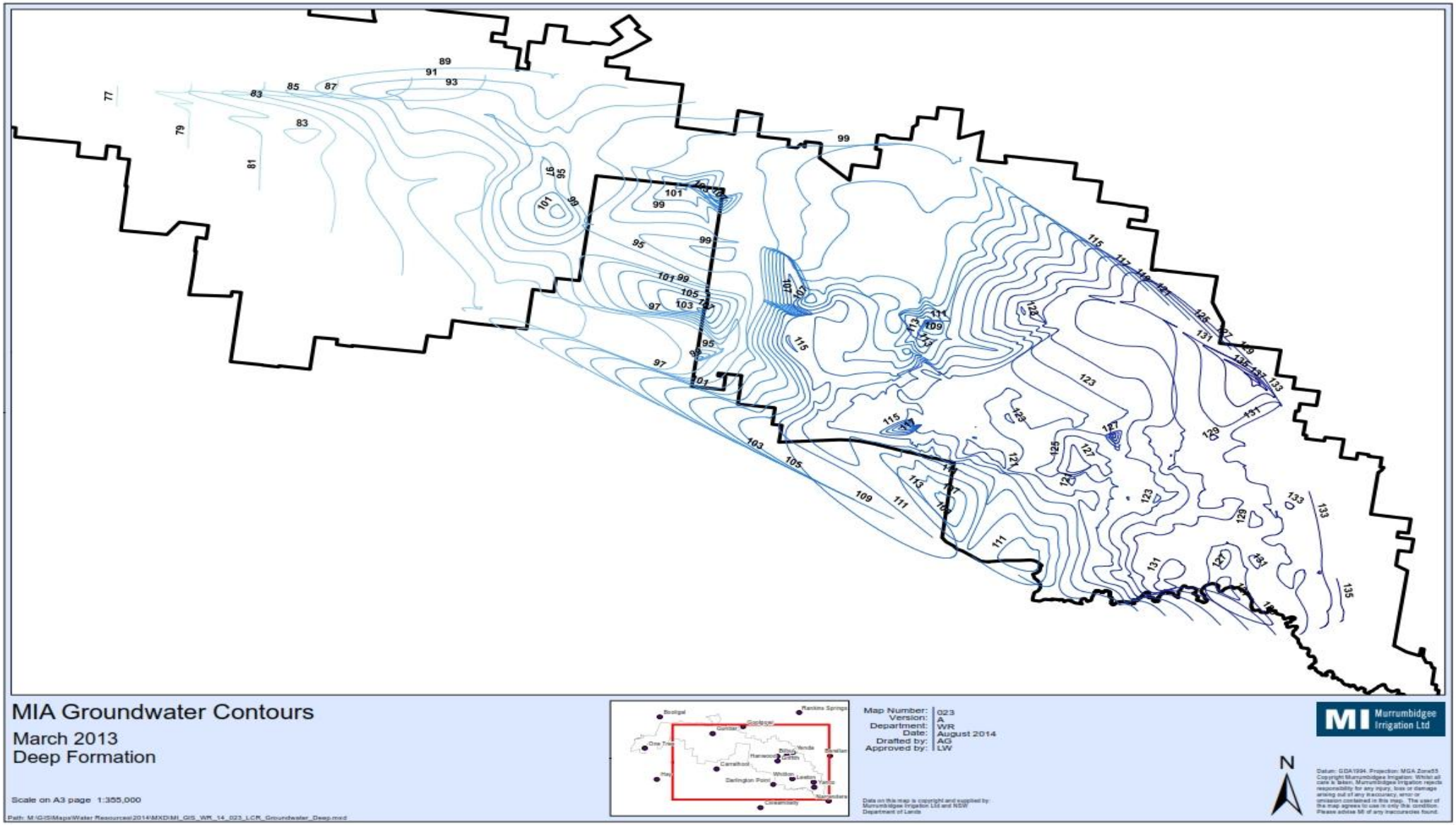


Figure 5.16: Groundwater levels in the Deep Shepparton Formation - March 2013.

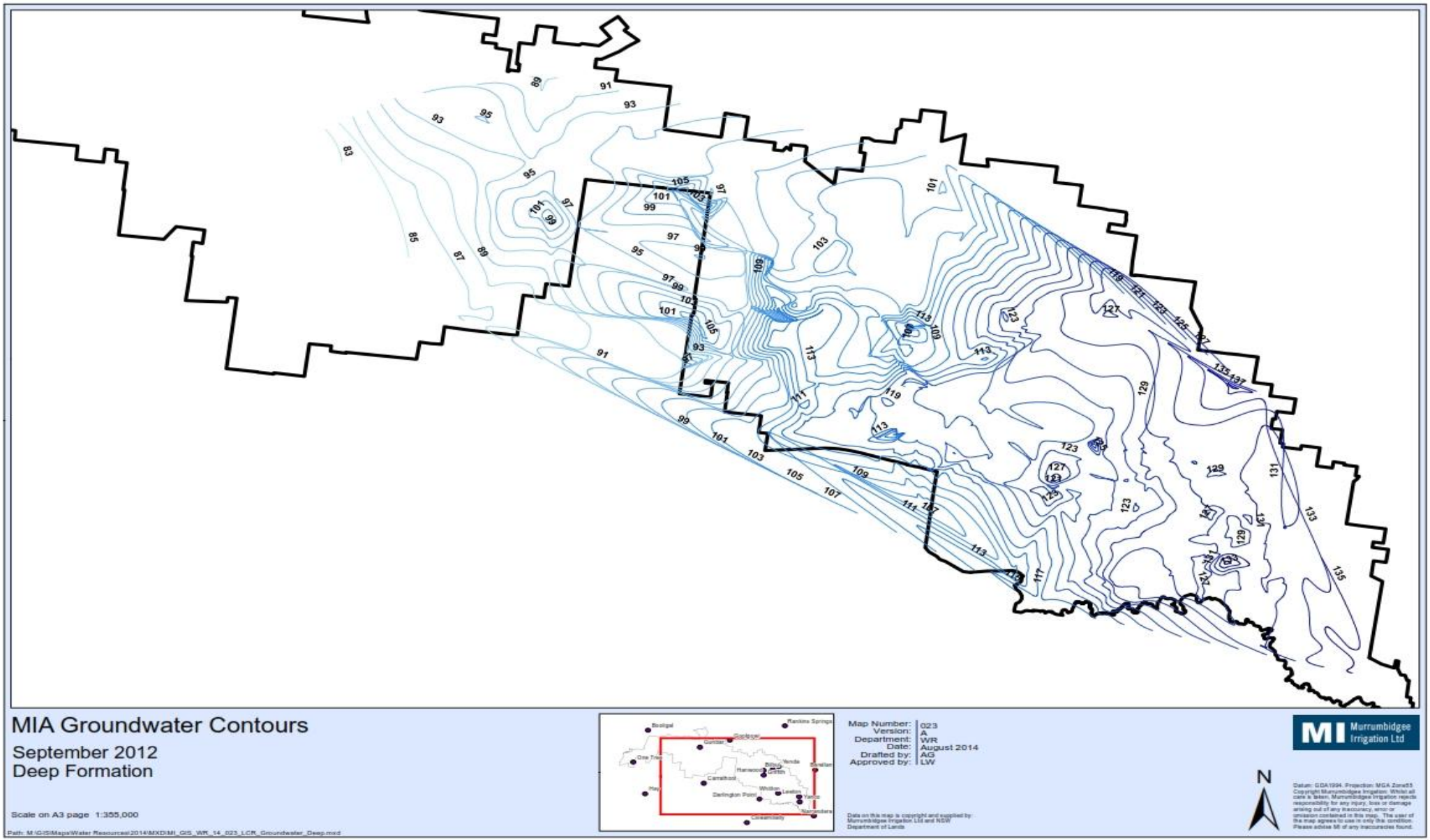


Figure 5.17: Groundwater levels in the Deep Shepparton Formation - September 2012.

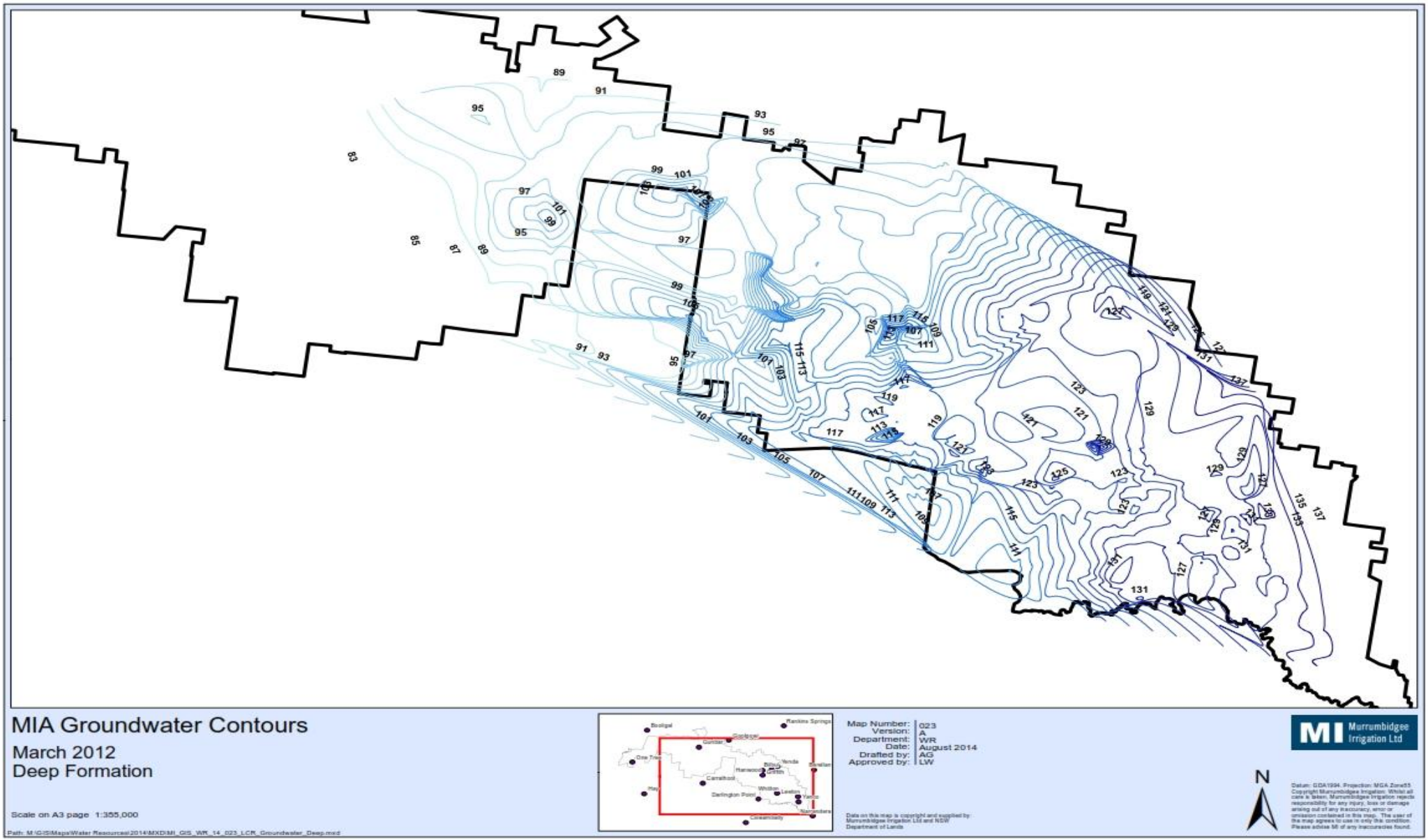


Figure 5.18: Groundwater levels in the Deep Shepparton Formation - March 2012.

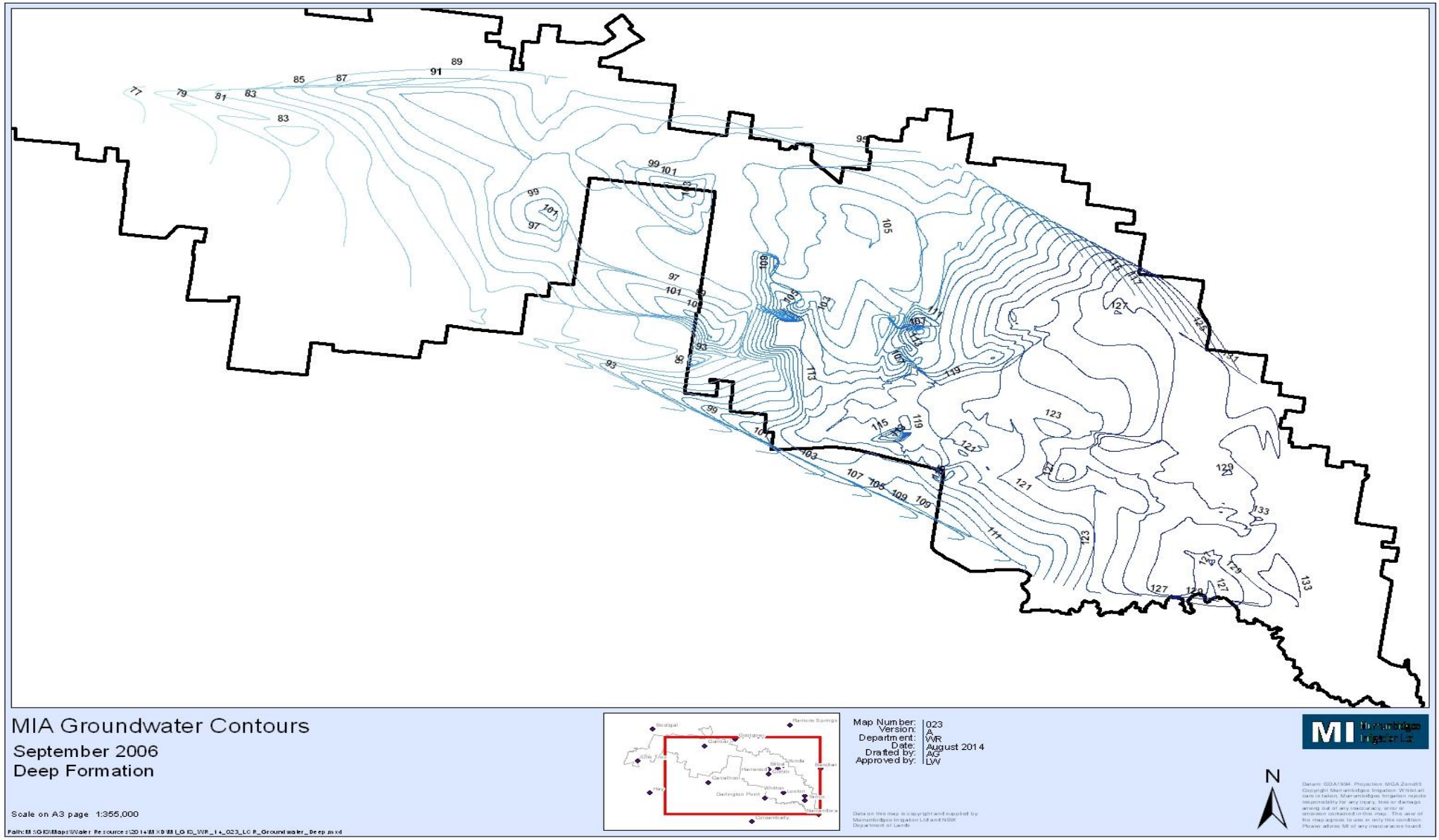


Figure 5.19: Groundwater levels in the Deep Shepparton Formation - September 2006.

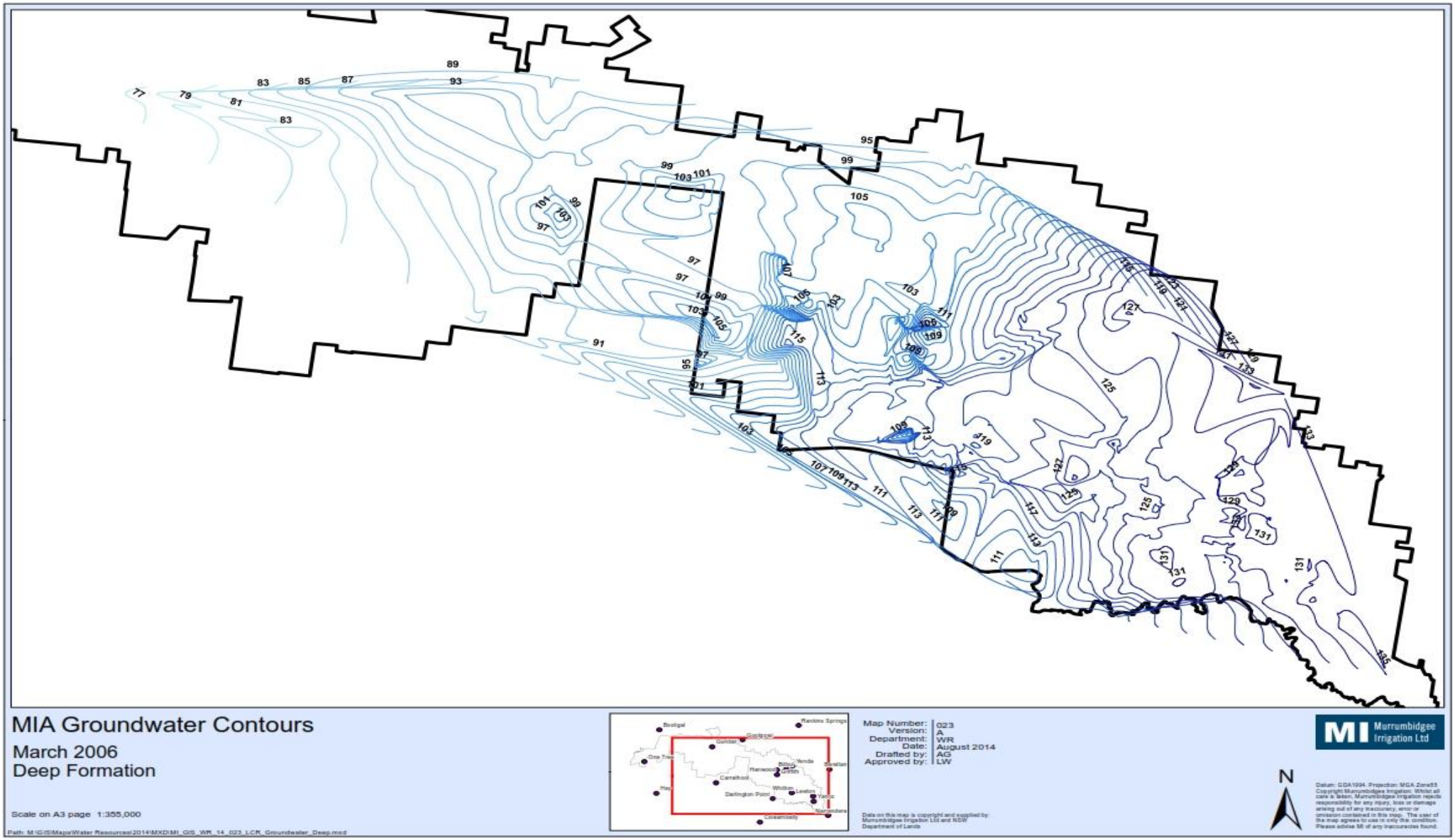


Figure 5.20: Groundwater levels in the Deep Shepparton Formation - March 2006.

Calivil Formation

MI monitors a small piezometer network representative of the Calivil Formation in the MIA. Calivil Formation depth contours are presented in Figures 5.21 to 5.27. Levels in this formation dropped in March 2014 by 2 - 4 metres from readings recorded in September 2013. Levels measured in March and September 2013 show no change over the six month period.

Increased groundwater levels were recorded in March 2012, likely a product of the floods. However, by September 2012 levels had decreased again by an average of two metres. Levels recorded in 2006 were almost 4 m deeper than those recorded in 2012/13.This data suggests that the Calivil formation may be influenced by flooding, either through direct recharge, aquifer exchange and to a lesser degree vertical leakage from the above Shepparton Formation. However, due to the limited number of bores monitored in this formation, it is difficult to ascertain the true origin and significance of level changes with any confidence.

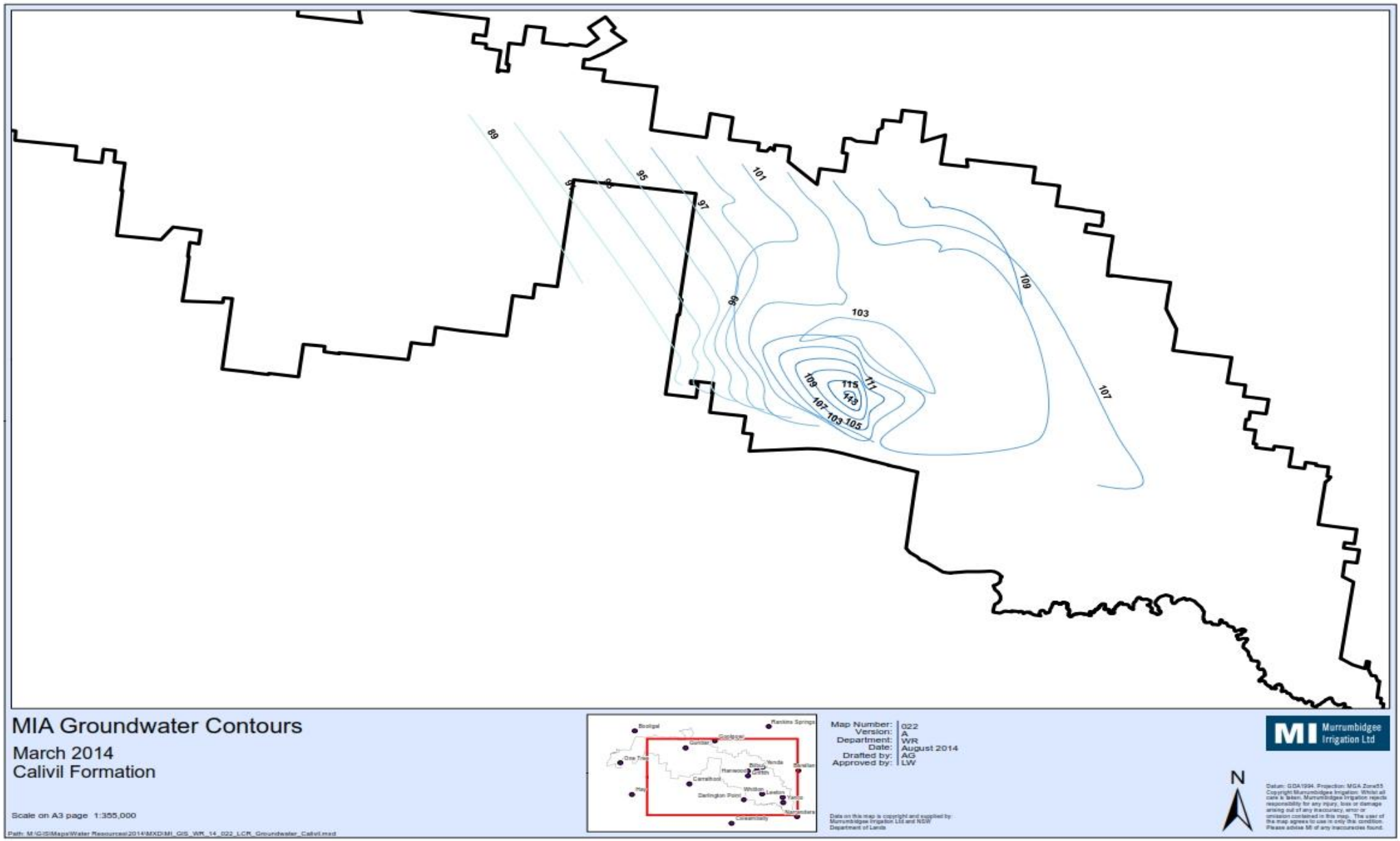


Figure 5.21: Groundwater levels in the Calivil Formation - March 2014.

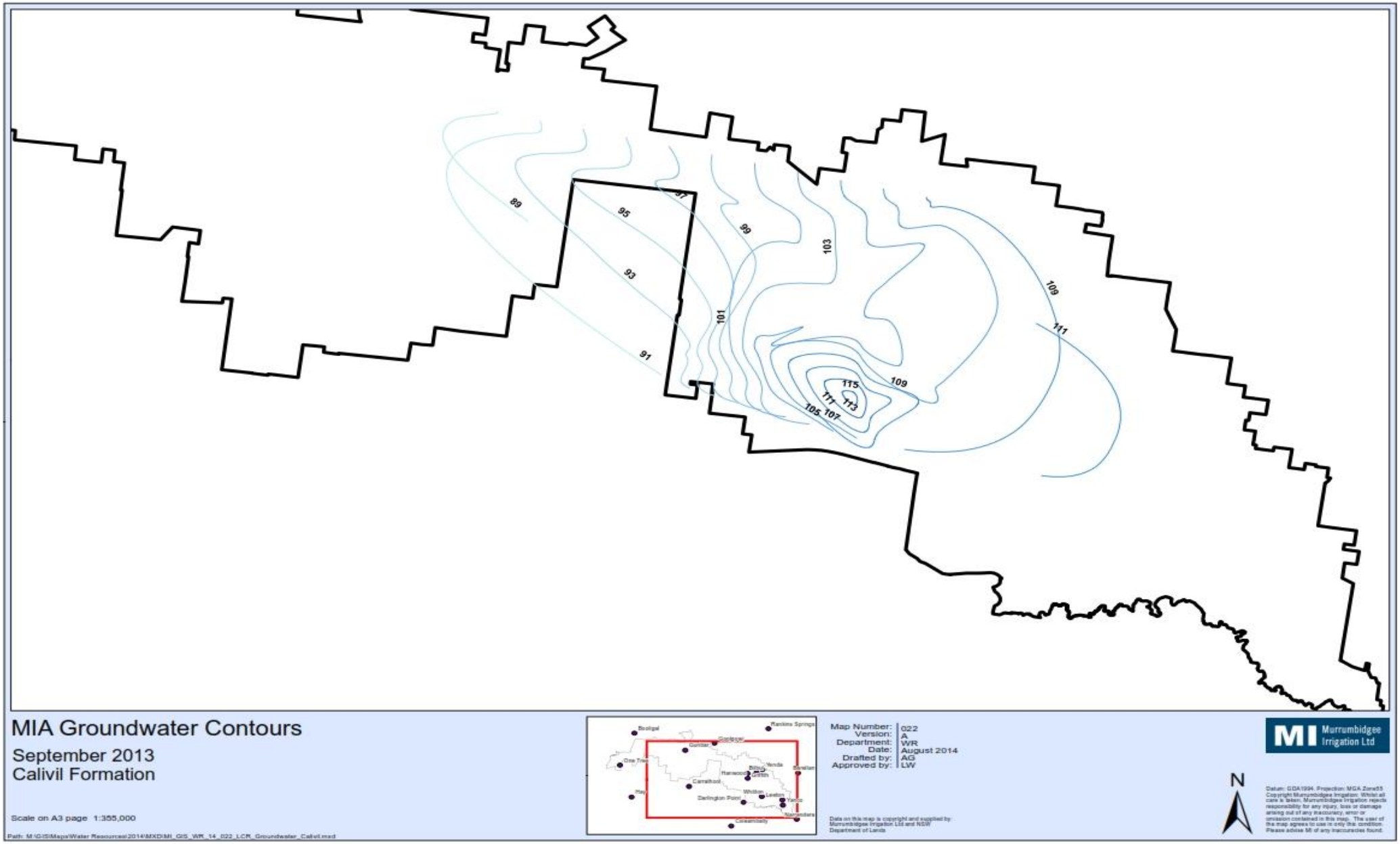


Figure 5.22: Groundwater levels in the Calivil Formation - September 2013.

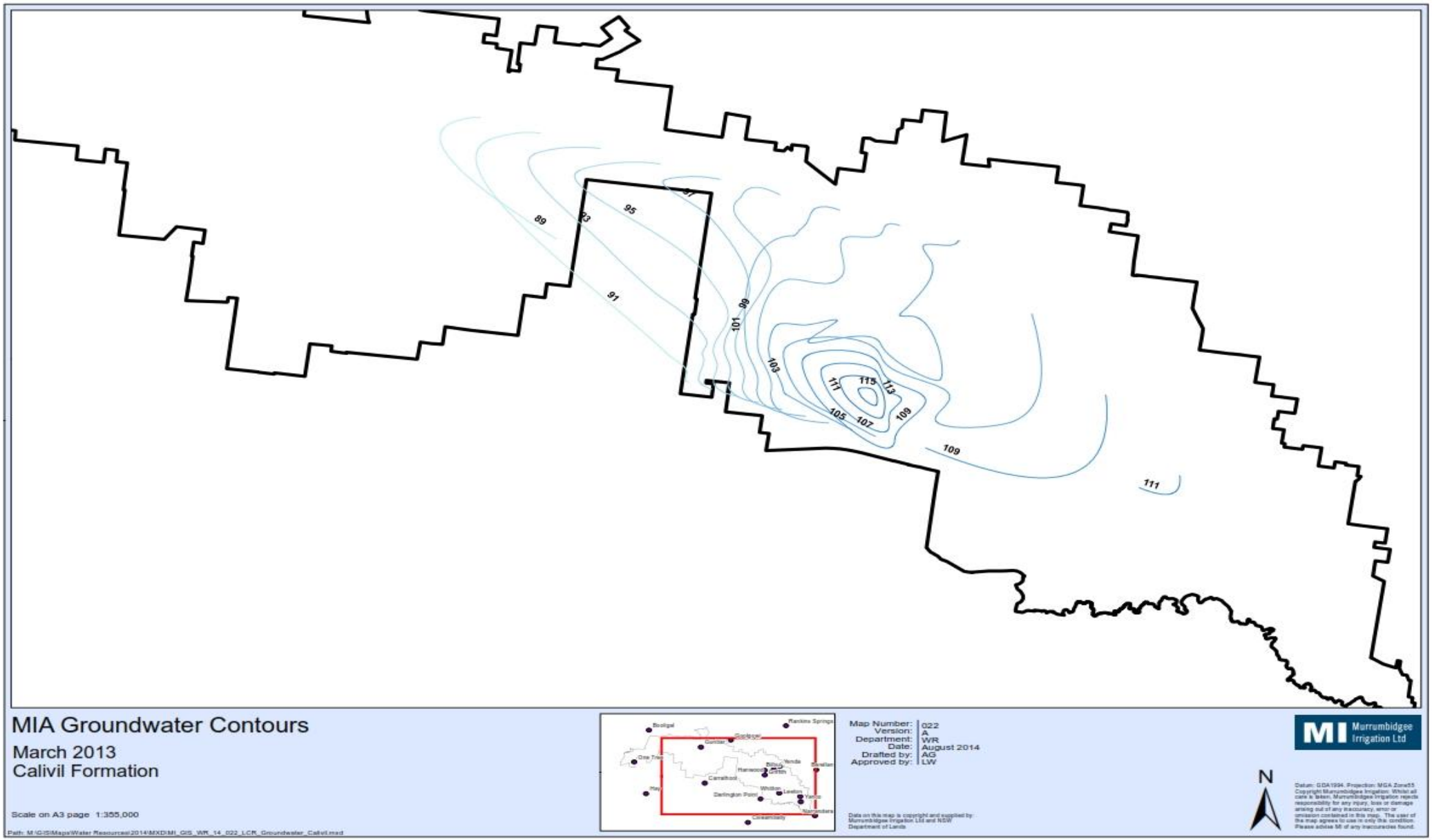


Figure 5.23: Groundwater levels in the Calivil Formation - March 2013.

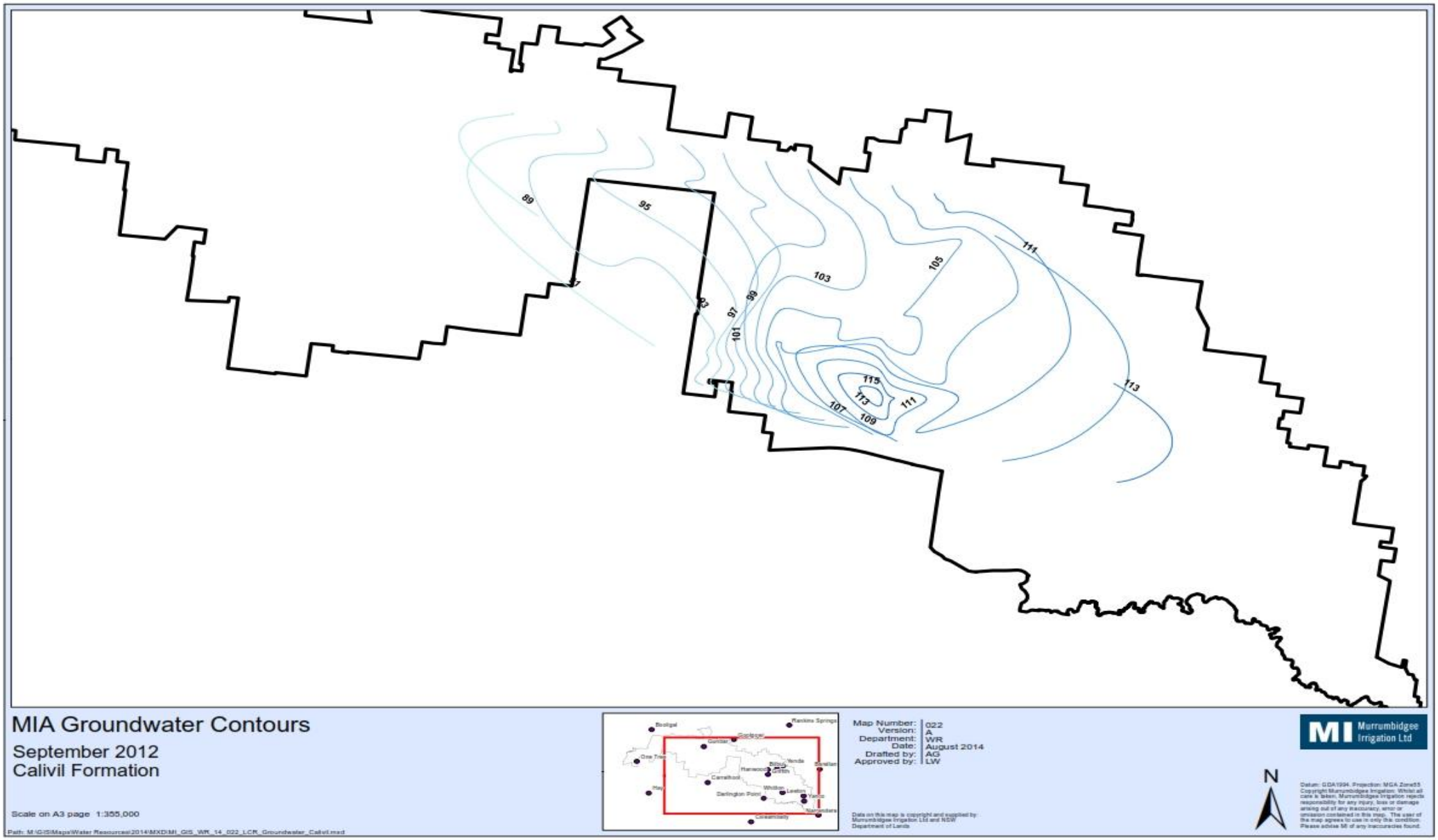


Figure 5.24: Groundwater levels in the Calivil Formation - September 2012.

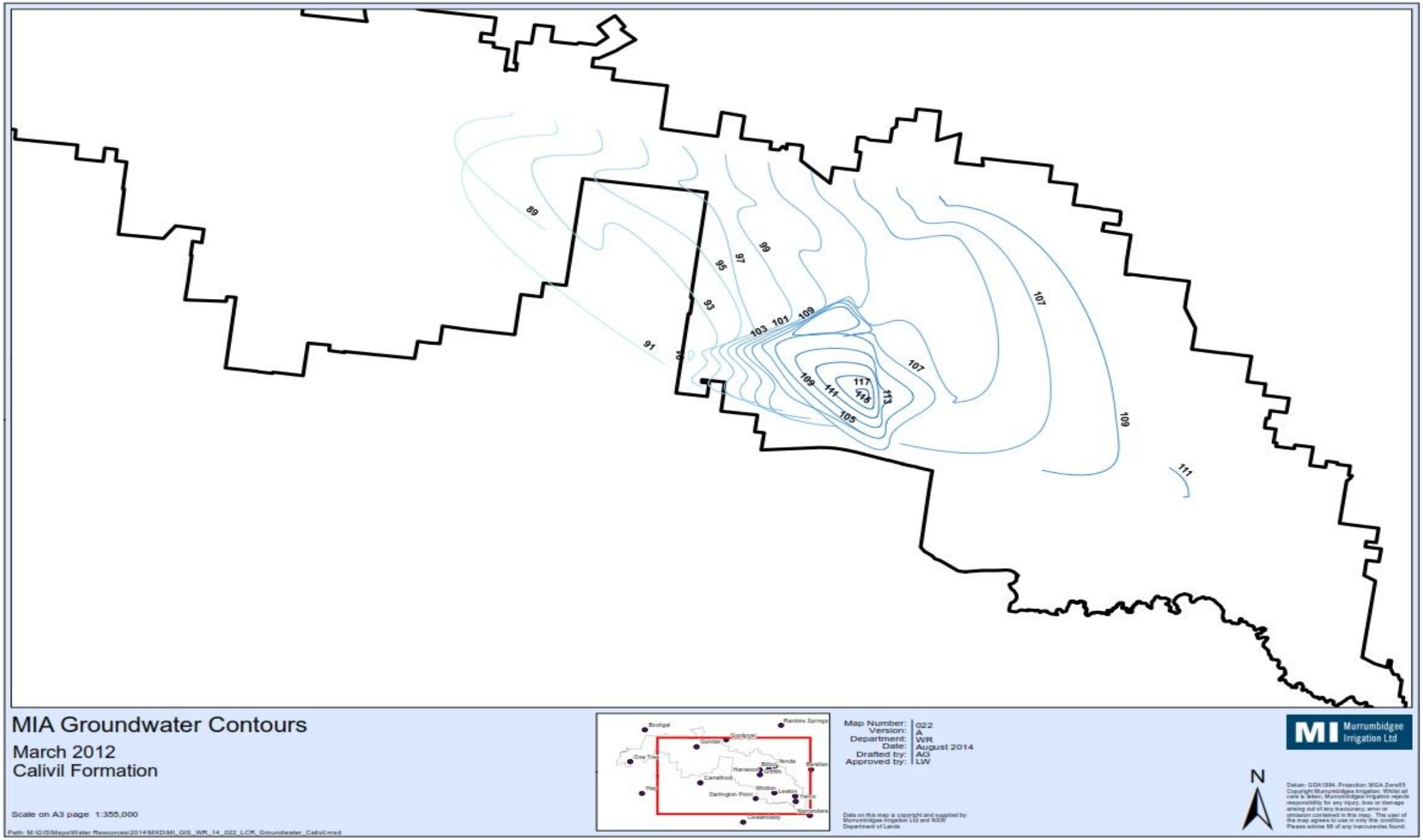


Figure 5.25: Groundwater levels in the Calivil Formation - March 2012.

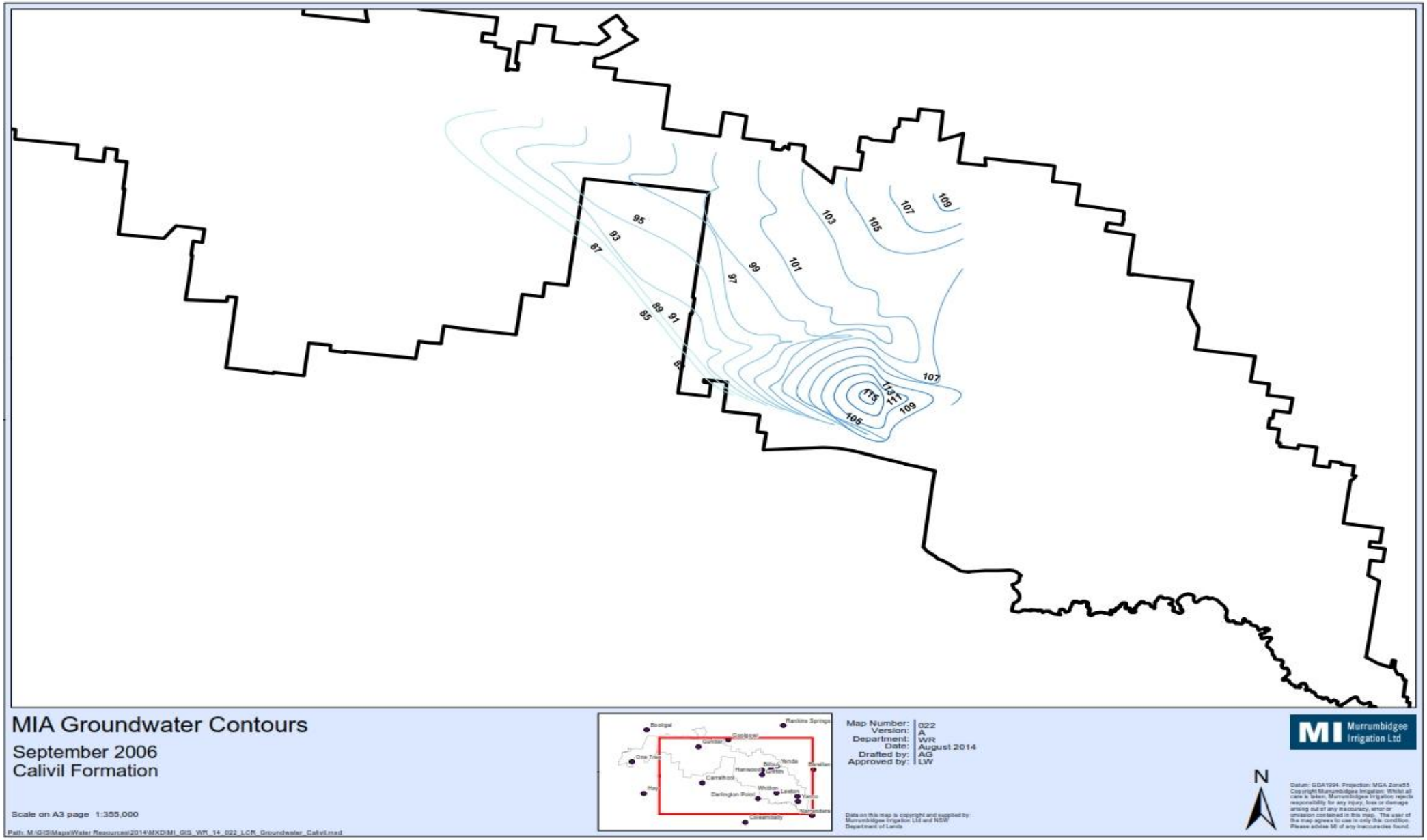


Figure 5.26: Groundwater levels in the Calivil Formation - September 2006.

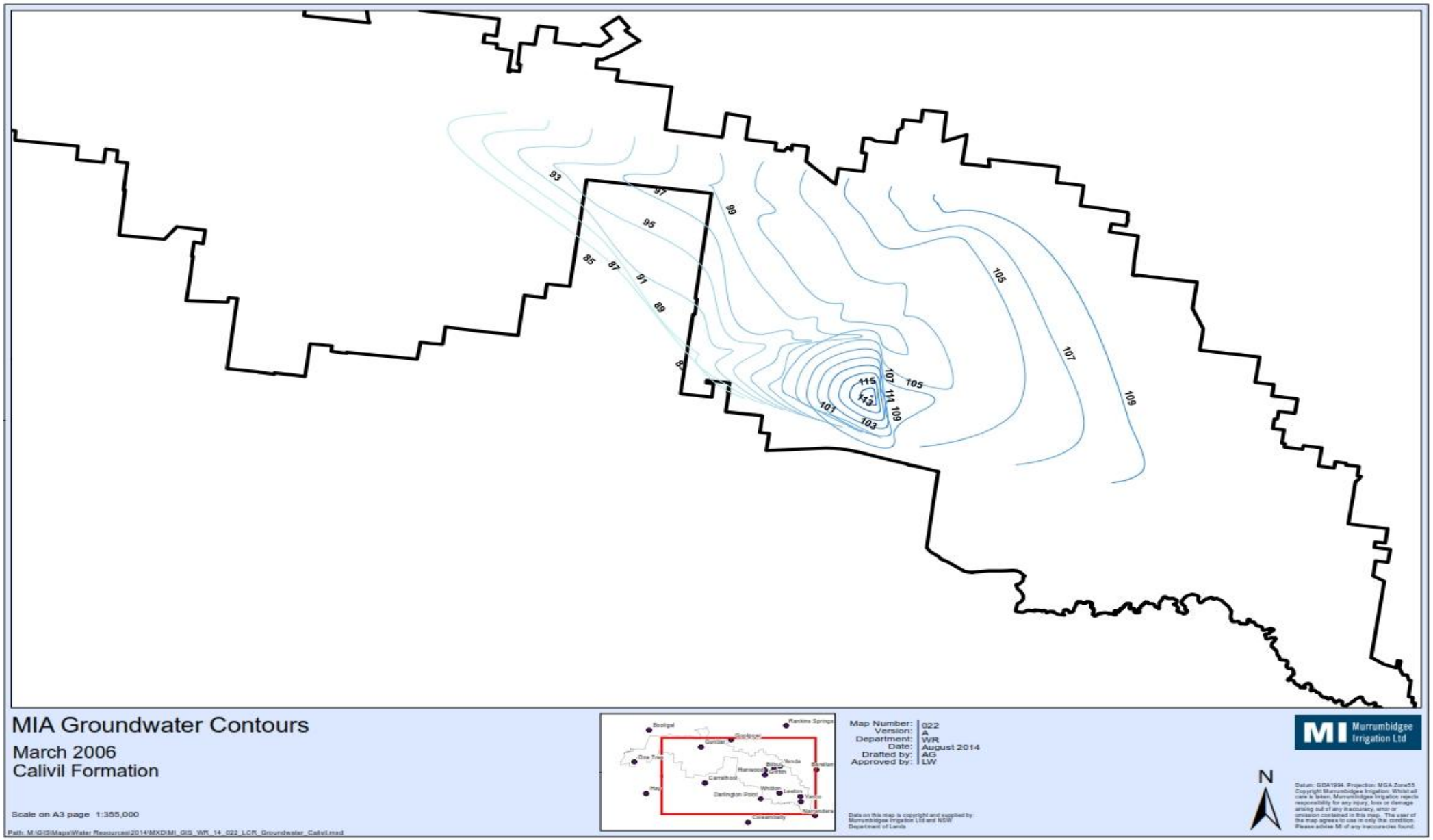


Figure 5.27: Groundwater levels in the Calivil Formation - March 2006.

5.3 GROUNDWATER SALINITY LEVELS

Groundwater salinity heat maps have been developed to report changes in groundwater salinity levels for 2013/14 and compared with changes in salinity levels from 1980, 1985, 1987, 1994, 1998 and 2002. Data collected in 1987 has been used as the baseline year adopted for assessing changes in groundwater quality prior to any impacts that may have been recorded after the 1989 and 2012 floods.

Shallow Shepparton Formation

Figures 5.30 to 5.37 demonstrate the salinity changes in the Shallow Shepparton Formation from 1980-2014. It should be noted that monitoring in 1987 and 1994 was not conducted for piezometers in the Yanco Irrigation Area. However, results have been recorded in the Yanco Irrigation Area from 1998 to present date.

Salinity readings in the Shallow Formation show that up to 40% of the piezometers recorded values between 5,000-12,000 µS/cm across the Benerembah and Tabbita Irrigation Districts and parts of the Mirrool Irrigation Area for 1980. However, data suggests that there was a decline in water quality (increase in salinity) in the Benerembah and Tabbita Irrigation Districts over the seven year period from 1980 to 1987.

Salinity readings from 1998 in the Yanco Irrigation Area were between 150-3,000 µS/cm with quality improving in piezometers drilled closest to the Murrumbidgee River. This suggests that there is a significant source of recharge from the Murrumbidgee River. Parts of the Mirrool Irrigation Area and Benerembah Irrigation District also show levels recorded between 150-3000 µ/cm. Average rainfall recorded for 1998 was 368 mm, which is fairly typical of this region. Therefore, it could be suggested that recharge via irrigation may have had more influence on water quality and recharge in the Shallow Shepparton Formation that year than perhaps witnessed during an episodic recharge event such as extremely high rainfall and/or flooding.

Salinity monitoring in 2002, 2013 and 2014 shows that the quality of water overall in the Shallow Shepparton Formation has improved dramatically across the MIA. The average rainfall recorded for the two years prior to 2002 showed three consecutive years of above average rainfall (537 mm in 1999, 590 mm in 2000 and 416 mm in 2001). This could suggest that rainfall was the main contributor to groundwater level change, recharge and thus water quality changes in the Shallow Shepparton in 2002. Favourable years for irrigation would also have contributed to the change over this period.

Groundwater level and quality changes in the Shallow Shepparton Formation in 2013/14 would also have been a direct result from rainfall recharge (preceding wet rainfall years of 522 mm in 2011/12 and 718 mm in 2012/13), episodic recharge from the March 2012 floods more so than irrigation.

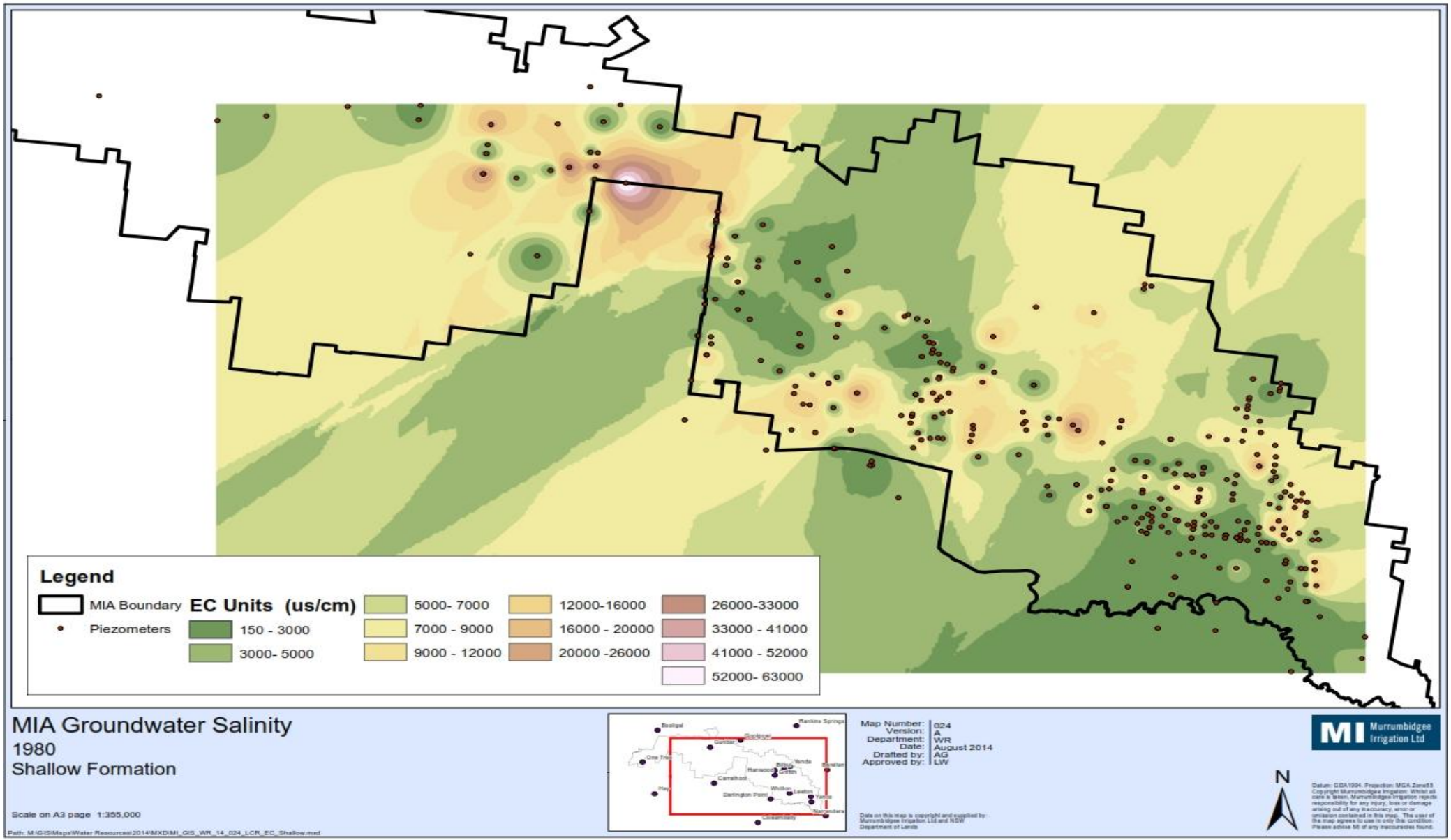


Figure 5.30: Salinity levels in the Shallow Shepparton Formation – 1980.

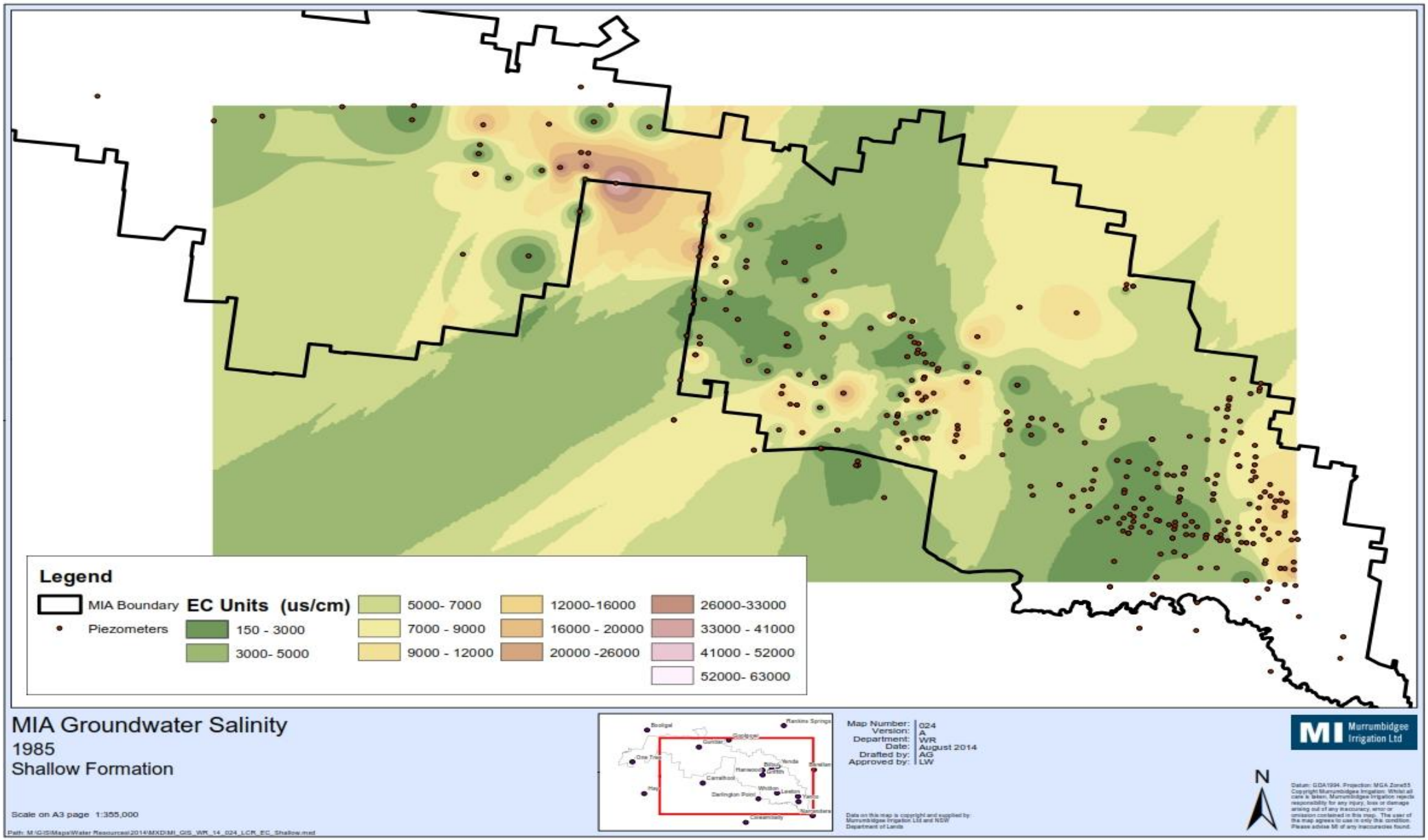


Figure 5.31: Salinity levels in the Shallow Shepparton Formation – 1985.

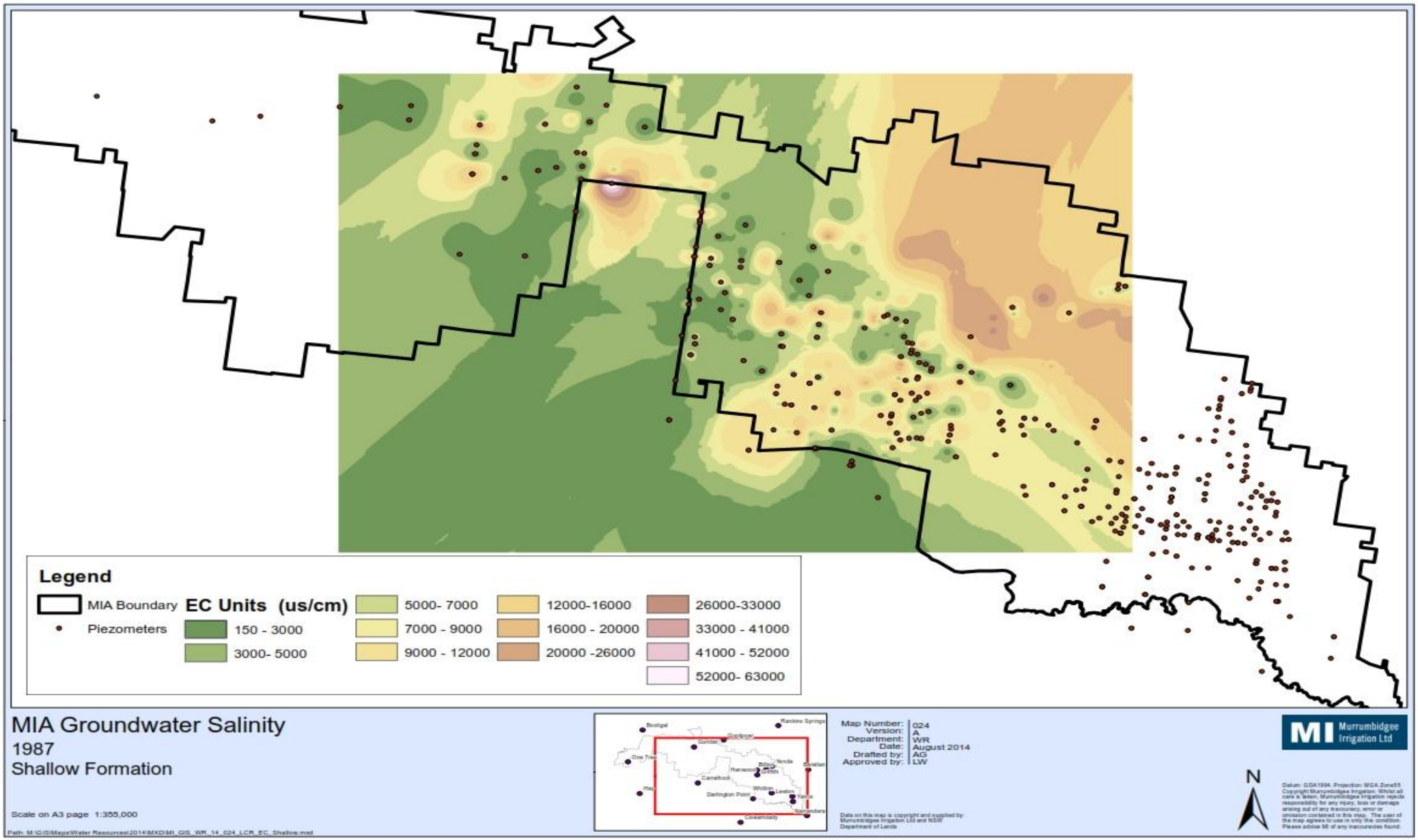


Figure 5.32: Salinity levels in the Shallow Shepparton Formation – 1987.

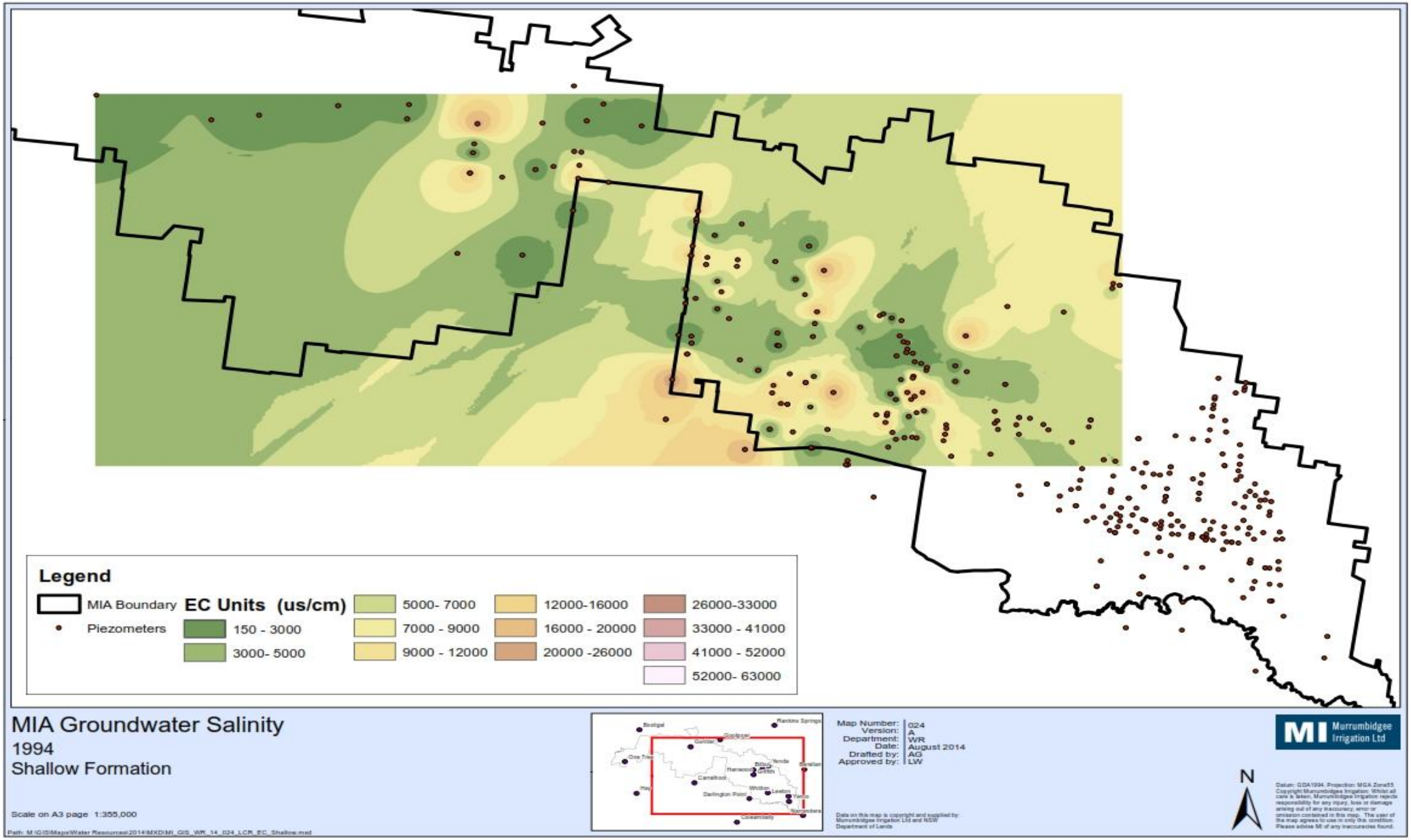


Figure 5.33: Salinity levels in the Shallow Shepparton Formation – 1994.

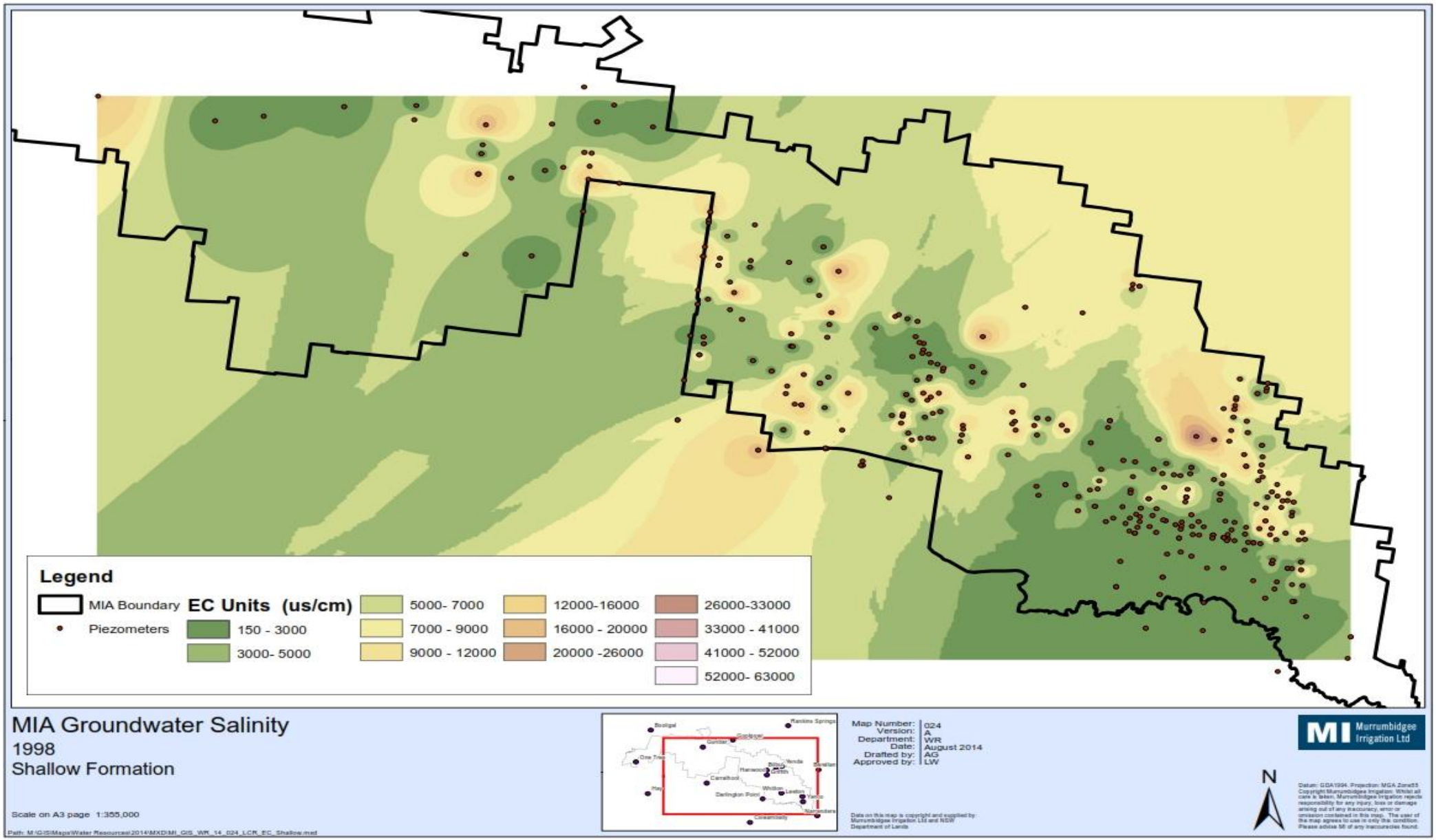


Figure 5.34: Salinity levels in the Shallow Shepparton Formation – 1998.

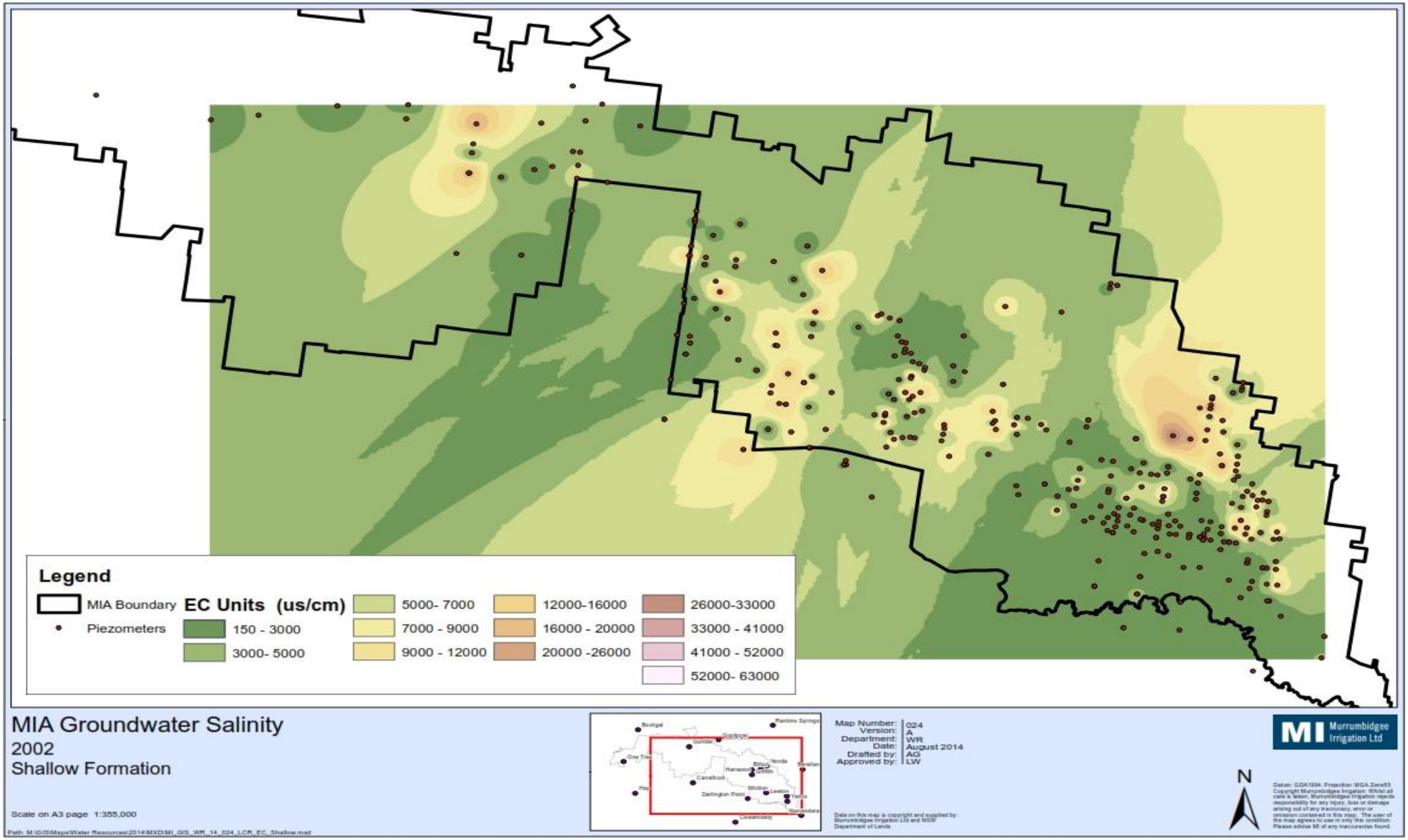


Figure 5.35: Salinity levels in the Shallow Shepparton Formation – 2002.

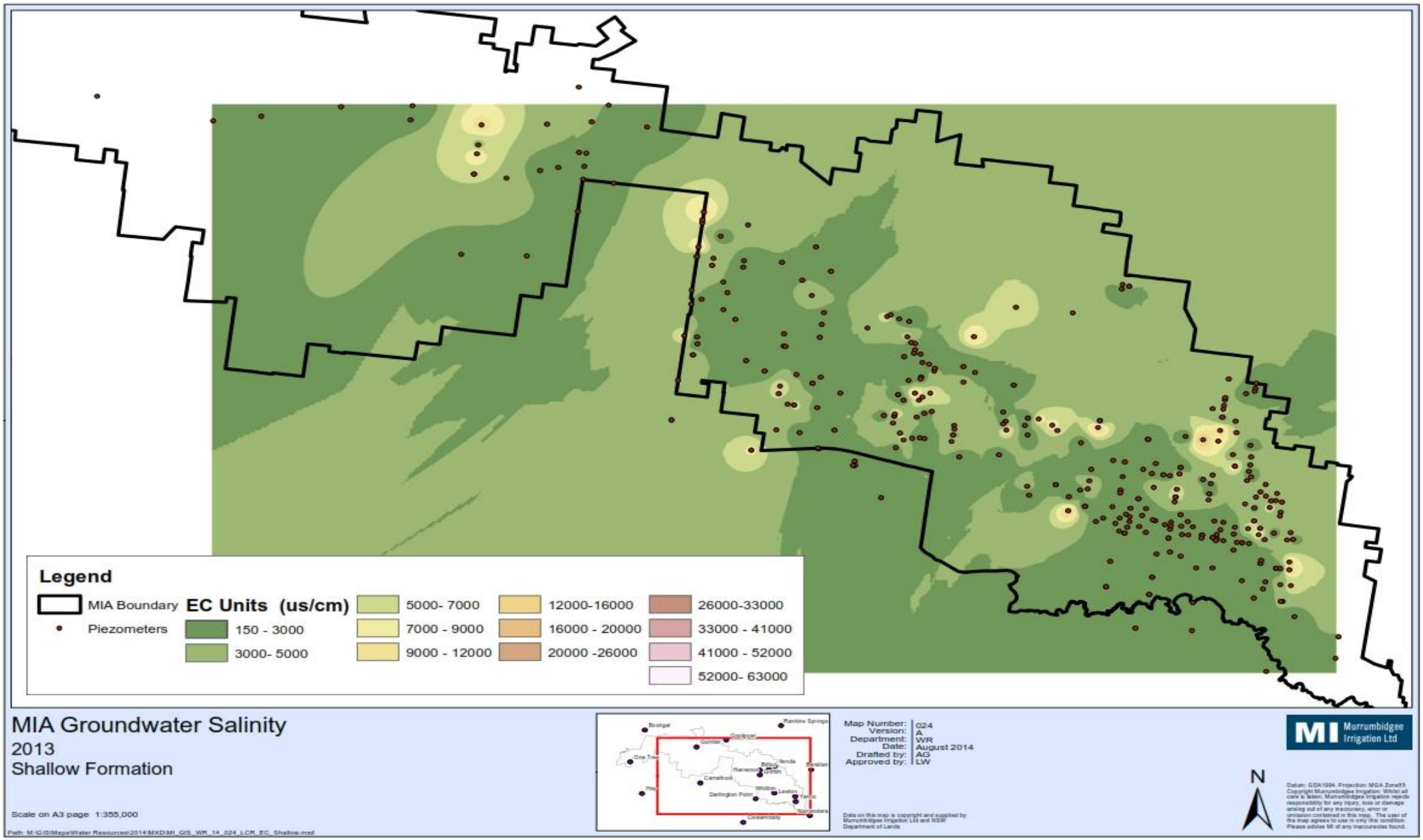


Figure 5.36: Salinity levels in the Shallow Shepparton Formation – 2013.

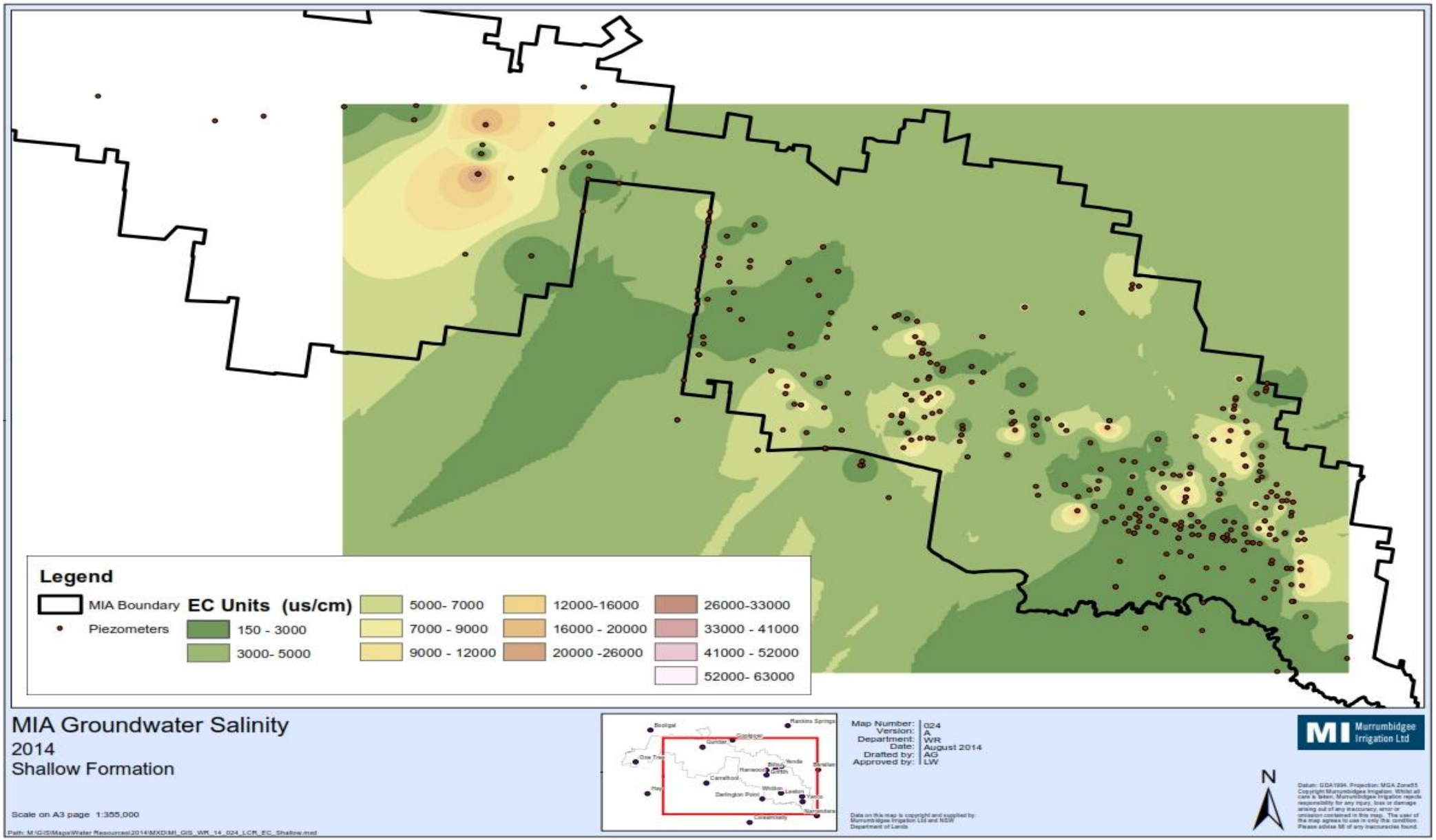


Figure 5.37: Salinity levels in the Shallow Shepparton Formation – 2014.

Deep Shepparton Formation

Figures 5.38 to 5.45 demonstrate the salinity changes in the Deep Shepparton Formation from 1980-2014. Salinity readings in the Deep Formation mirror changes shown in the Shallow Shepparton Formation in 1980, 1985, 1987, 1994 and 1998, albeit levels are marginally more saline in most of the Mirrool Irrigation Area and Benerembah Irrigation District (including areas adjacent to either side of Mirrool Creek and previous paleochannels in the Benerembah Irrigation District).

Dramatic changes in water quality are witnessed in bores adjacent to Mirrool Creek and most parts of the Benerembah Irrigation District in 2013, likely attributed to level changes and episodic recharge during the March 2012 flood. This may suggest a direct correlation between recharge with high rainfall and flooding on water quality in the Deep Shepparton Formation via present and past creek lines. Salinity readings in the Deep Shepparton Formation from 2014 suggests that water quality is digressing to a more saline state as groundwater levels recede, and less rainfall is present in the MIA, with notable changes within bores drilled close to Mirrool Creek and parts of the Benerembah Irrigation District.

Further investigation is required to ascertain root cause of water quality changes during this period. More detailed analysis of data from specific locations would have to be undertaken to analyse the extent of groundwater level changes and influences of localised recharge on water quality in the Deep Shepparton Formation.

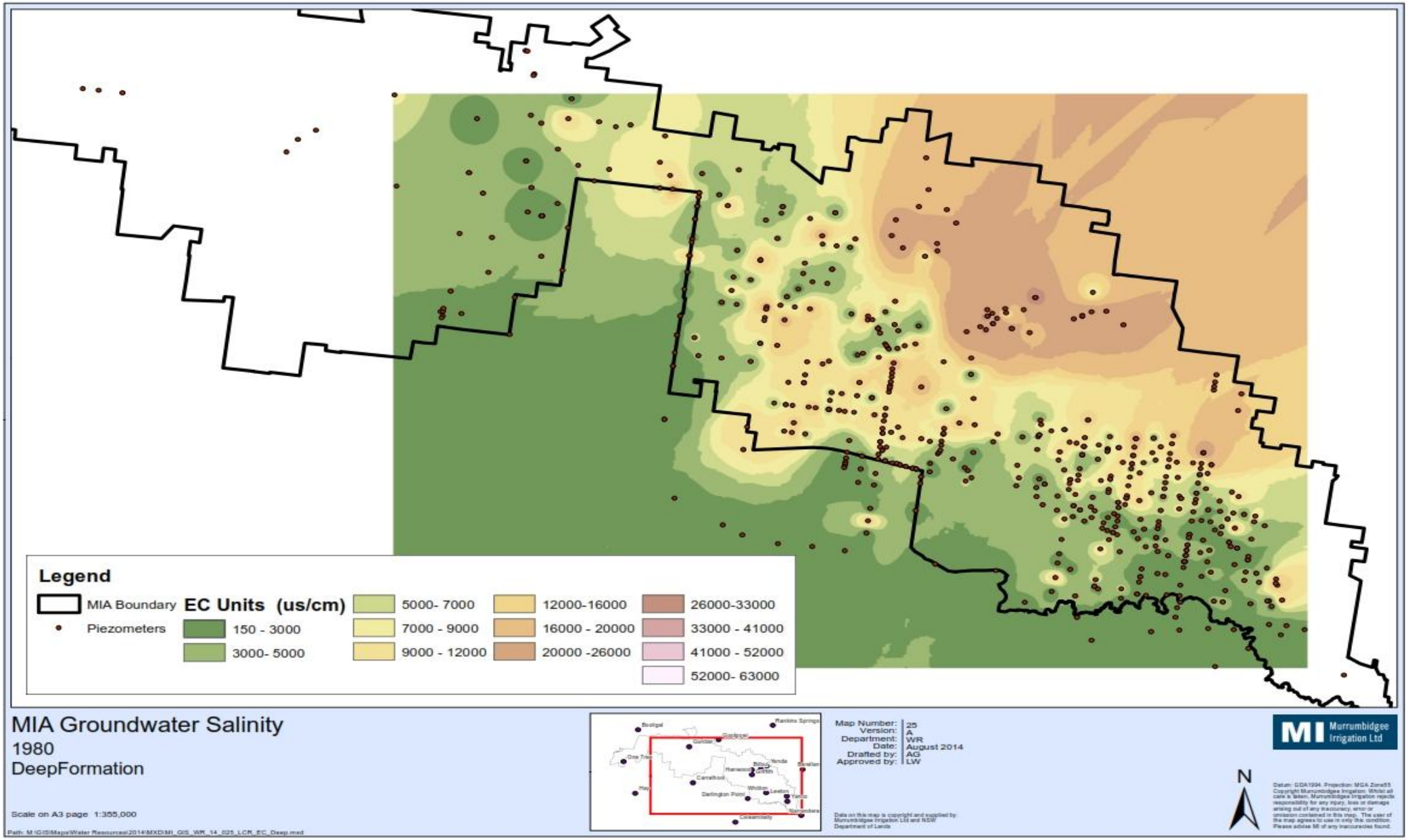


Figure 5.38: Salinity levels in the Deep Shepparton Formation – 1980.

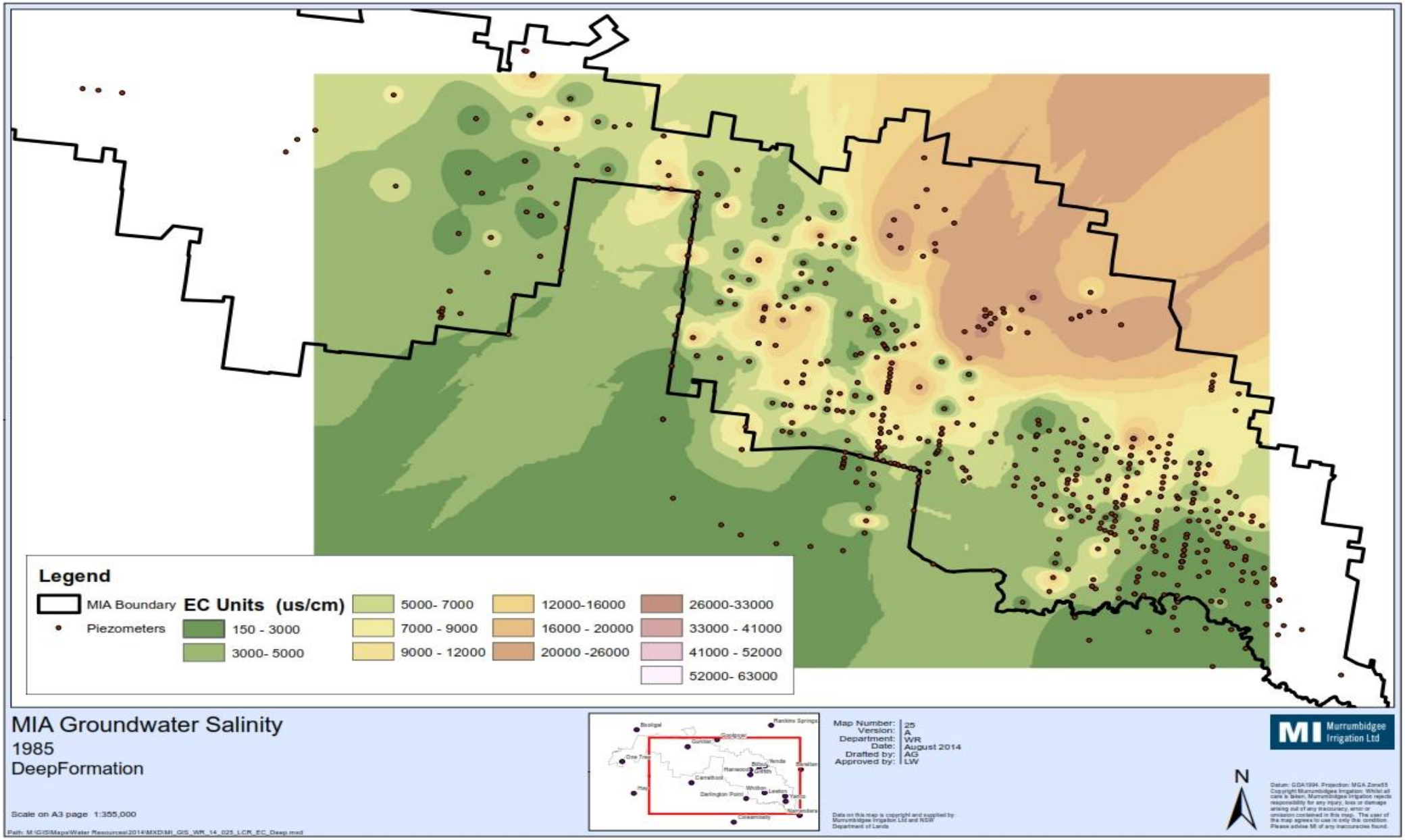


Figure 5.39: Salinity levels in the Deep Shepparton Formation – 1985.

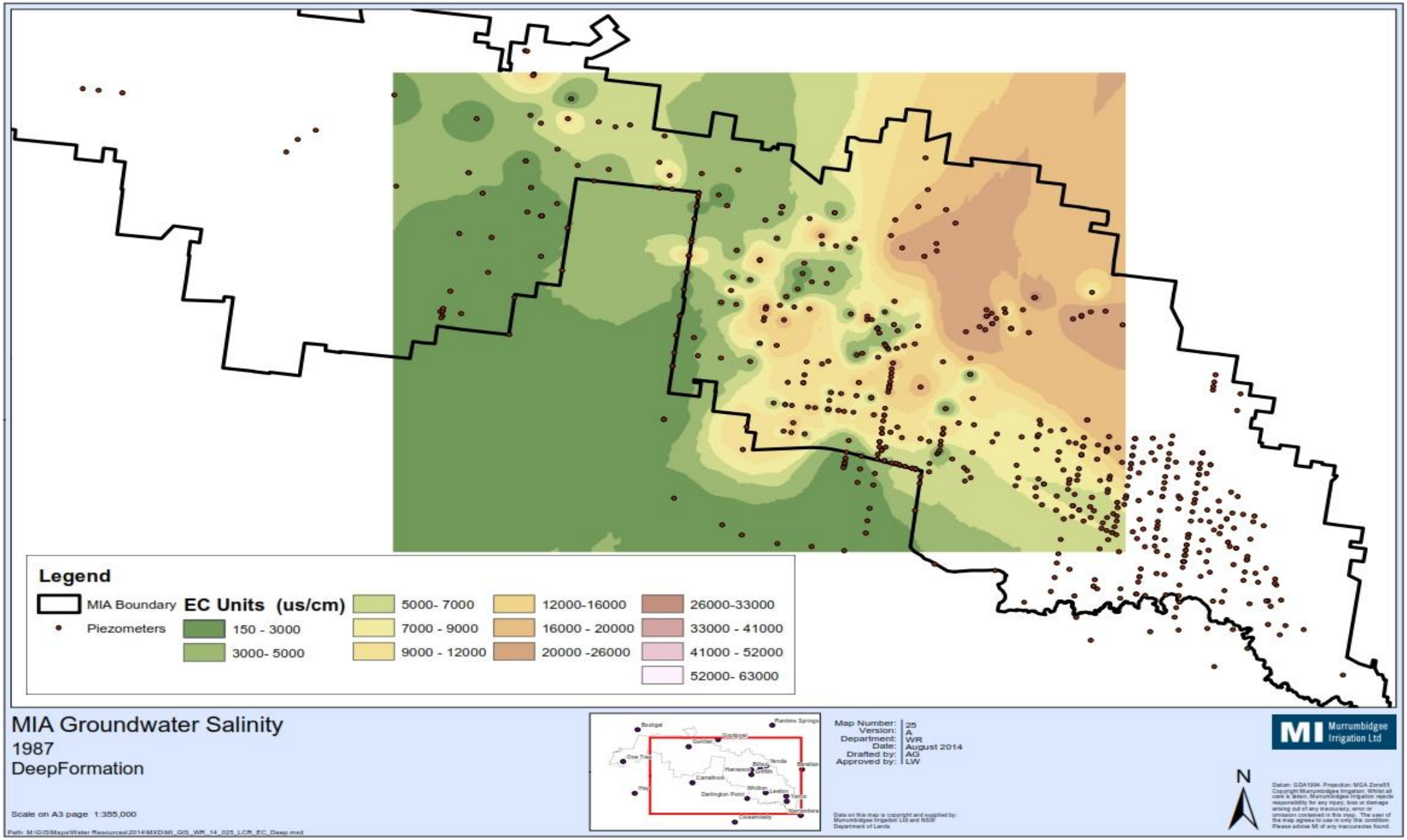


Figure 5.40: Salinity levels in the Deep Shepparton Formation – 1987.

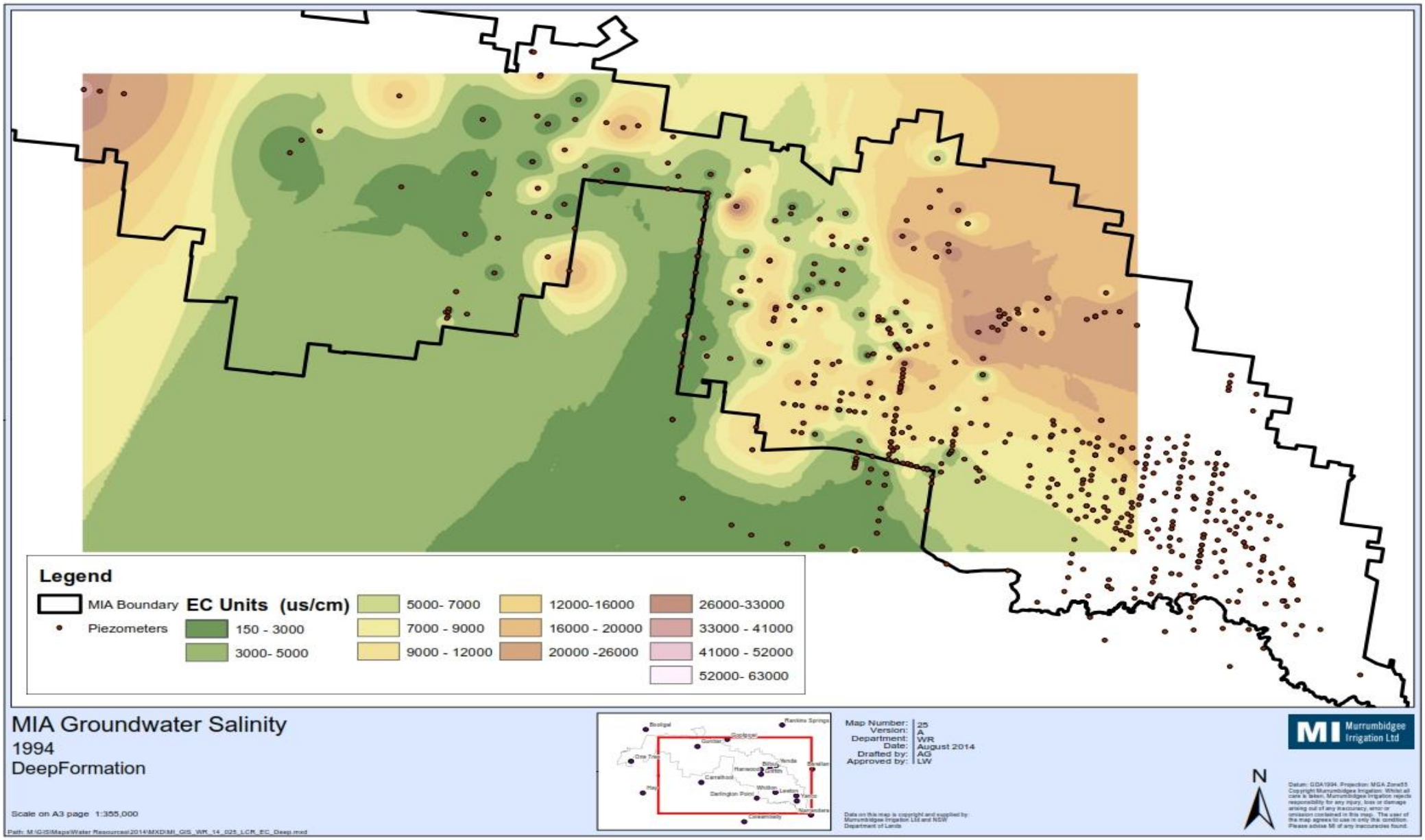


Figure 5.41: Salinity levels in the Deep Shepparton Formation – 1994.

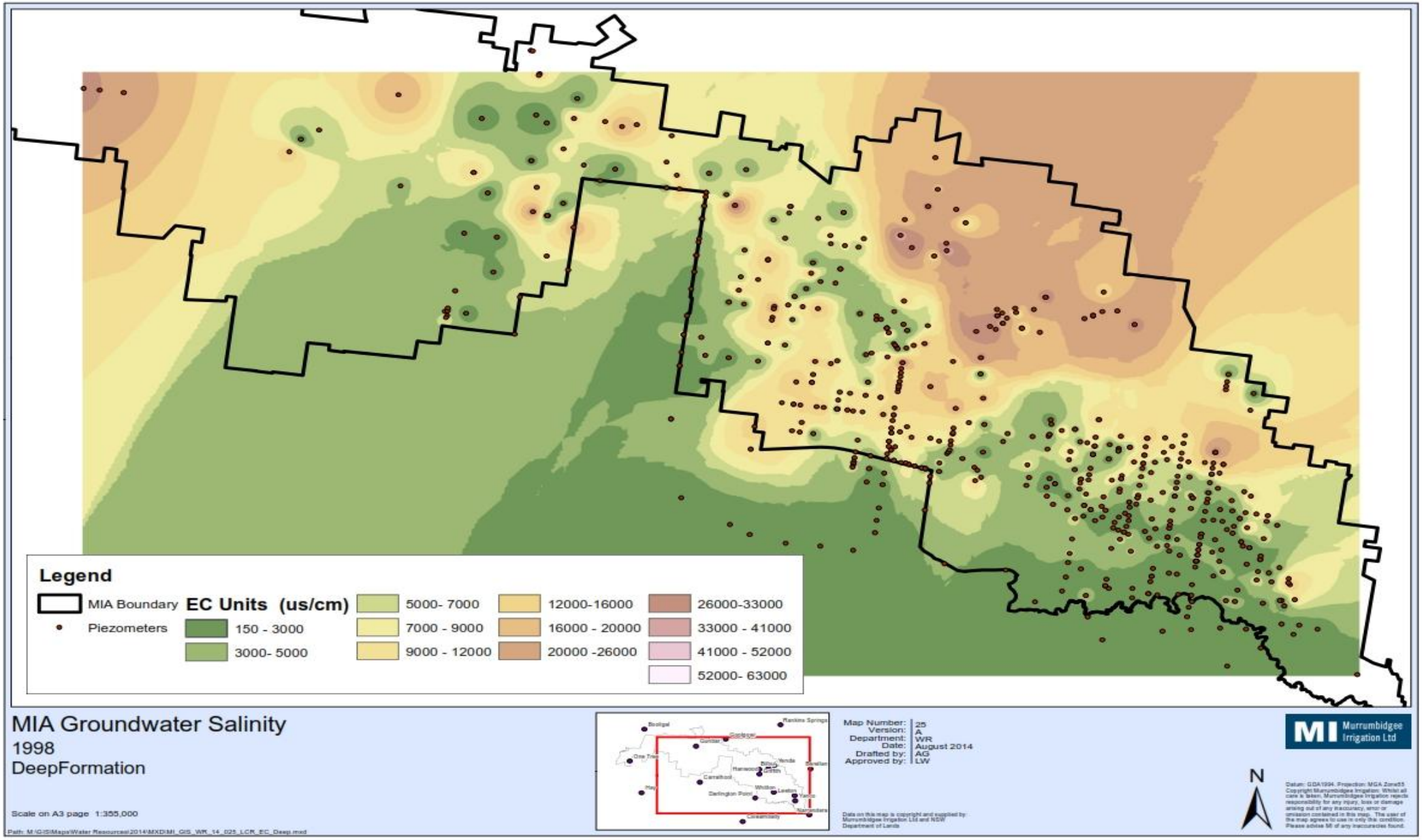


Figure 5.42: Salinity levels in the Deep Shepparton Formation – 1998.

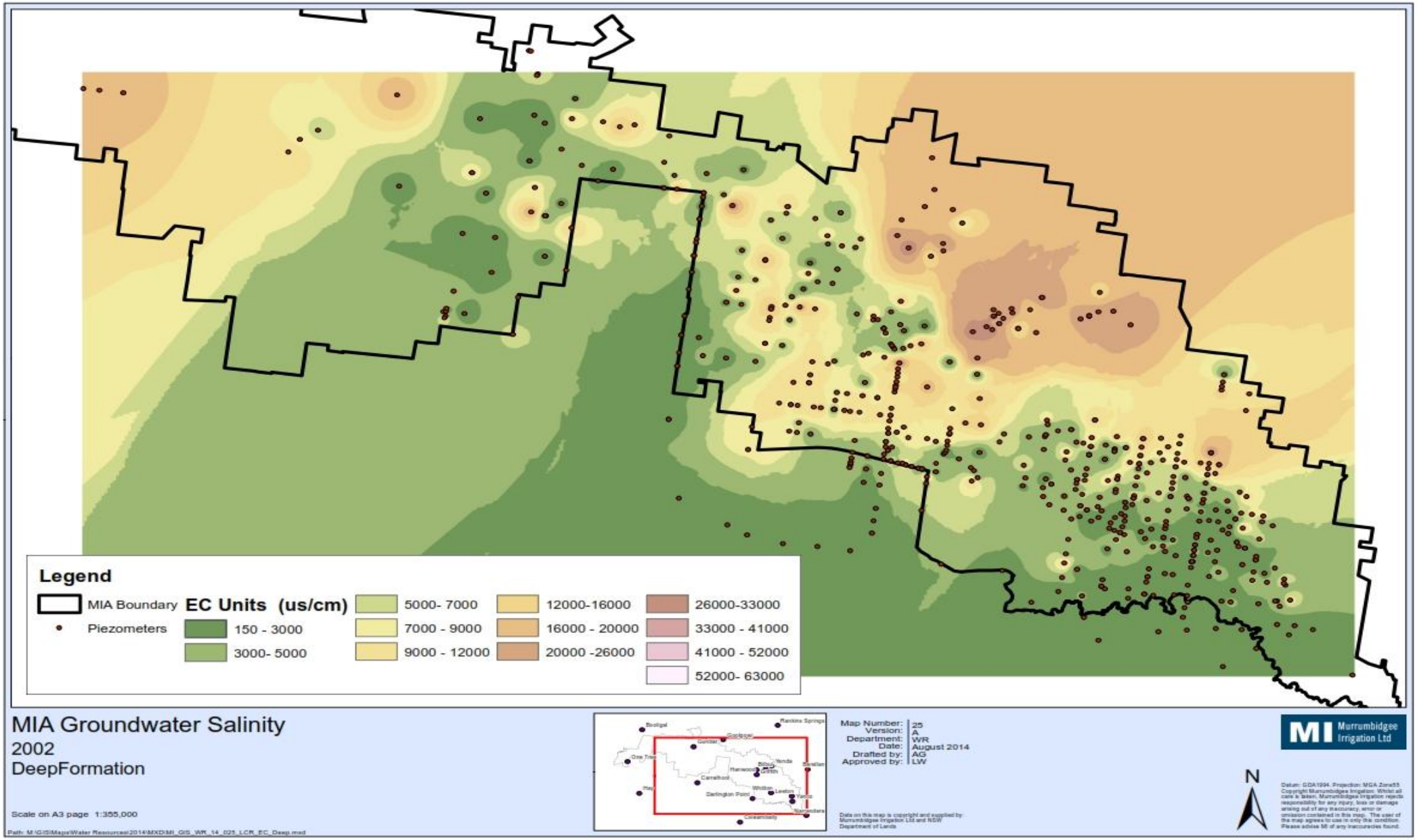


Figure 5.43: Salinity levels in the Deep Shepparton Formation – 2002.

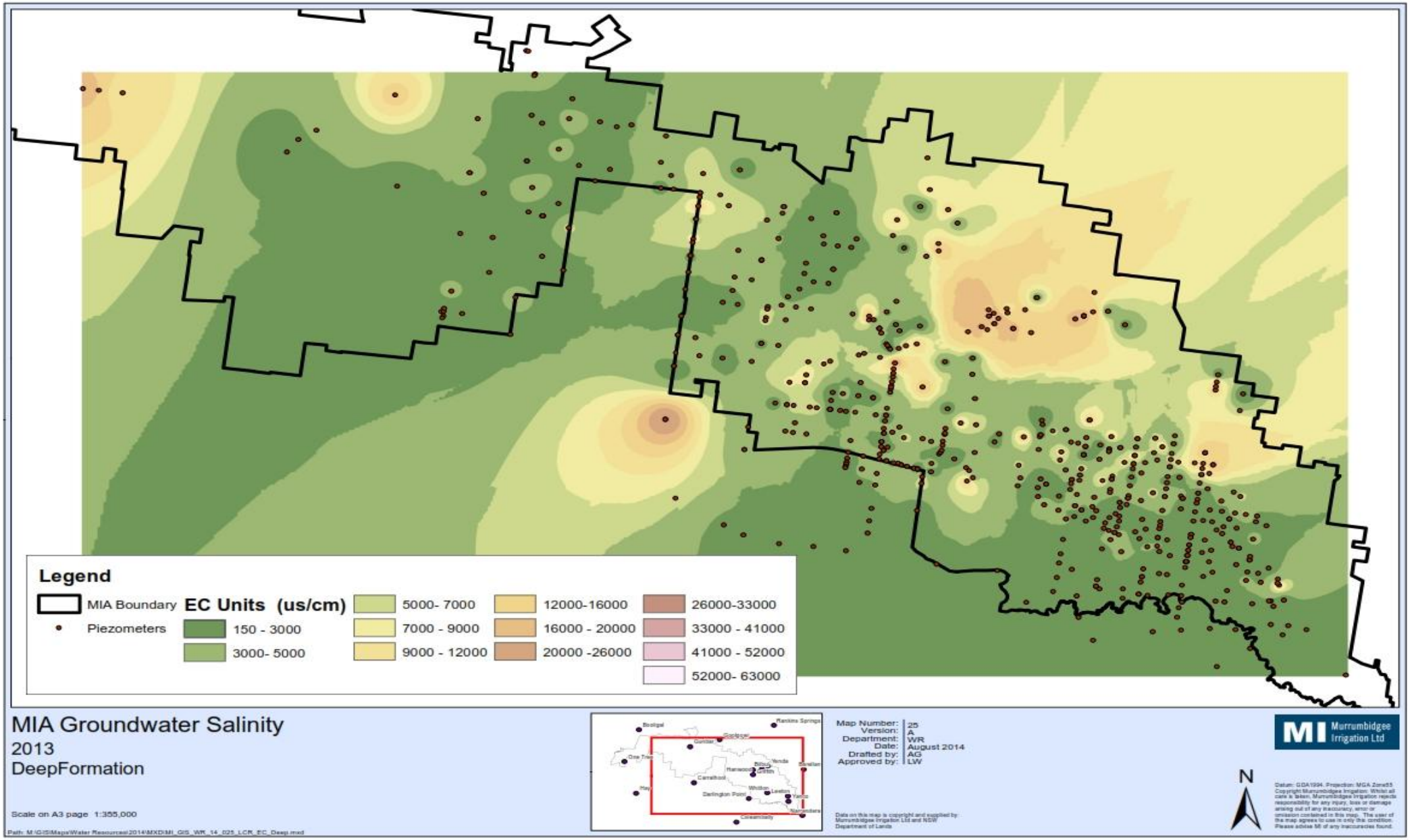


Figure 5.44: Salinity levels in the Deep Shepparton Formation – 2013.

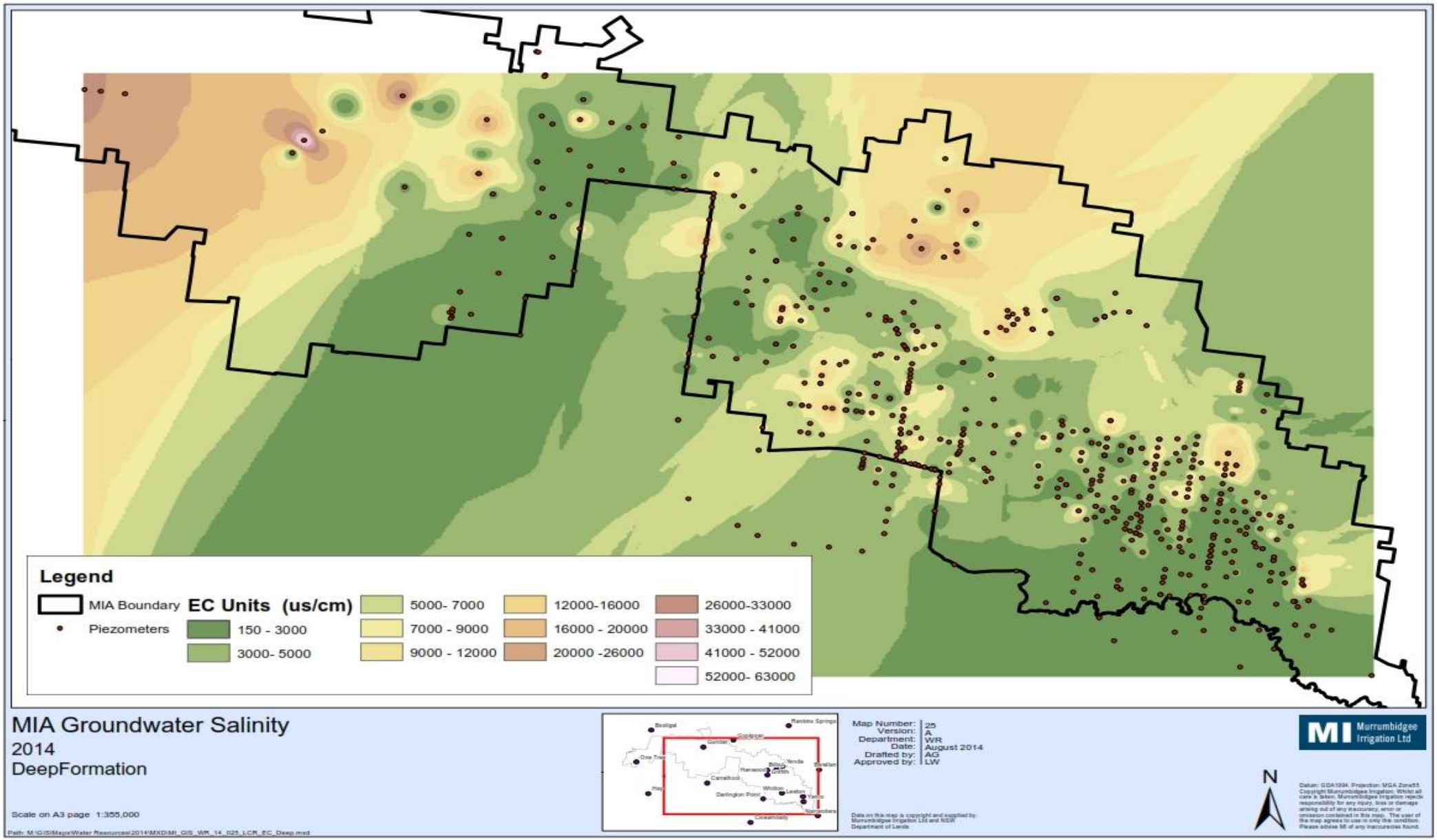


Figure 5:45: Salinity levels in the Deep Shepparton Formation – 2014.

Calivil Formation

Figures 5.46 to 5.53 demonstrate the salinity changes in the Calivil Shepparton Formation from 1980-2014. Due to the small amount of bores monitored by MI in the Calivil Formation, data is only available for a small portion of the Benerembah and Tabbita Irrigation Districts.

Salinity readings in the Calivil Formation mirror changes shown in the Deep Shepparton Formation for years 1980 and 1985, with no changes witnessed in 1987. An increase of salinity between 2000-4000 µ/cm was measured in the Calivil Formation over the seven years between 1987 and 1994. There was also a noted deterioration in water quality in the Deep Shepparton Formation of the same magnitude during this time.

Salinity levels in the Calivil Formation slightly improved in the four years between 1994 and 1998 and remained fairly static through to 2002. Salinity levels decreased between 1000-4000 µ/cm in 2013 in line with salinity levels in the Deep and Shallow Shepparton Formations as a result of changes in groundwater levels, rainfall and episodic recharge in the preceding three years from 2010-2013 (including the March 2012 floods).

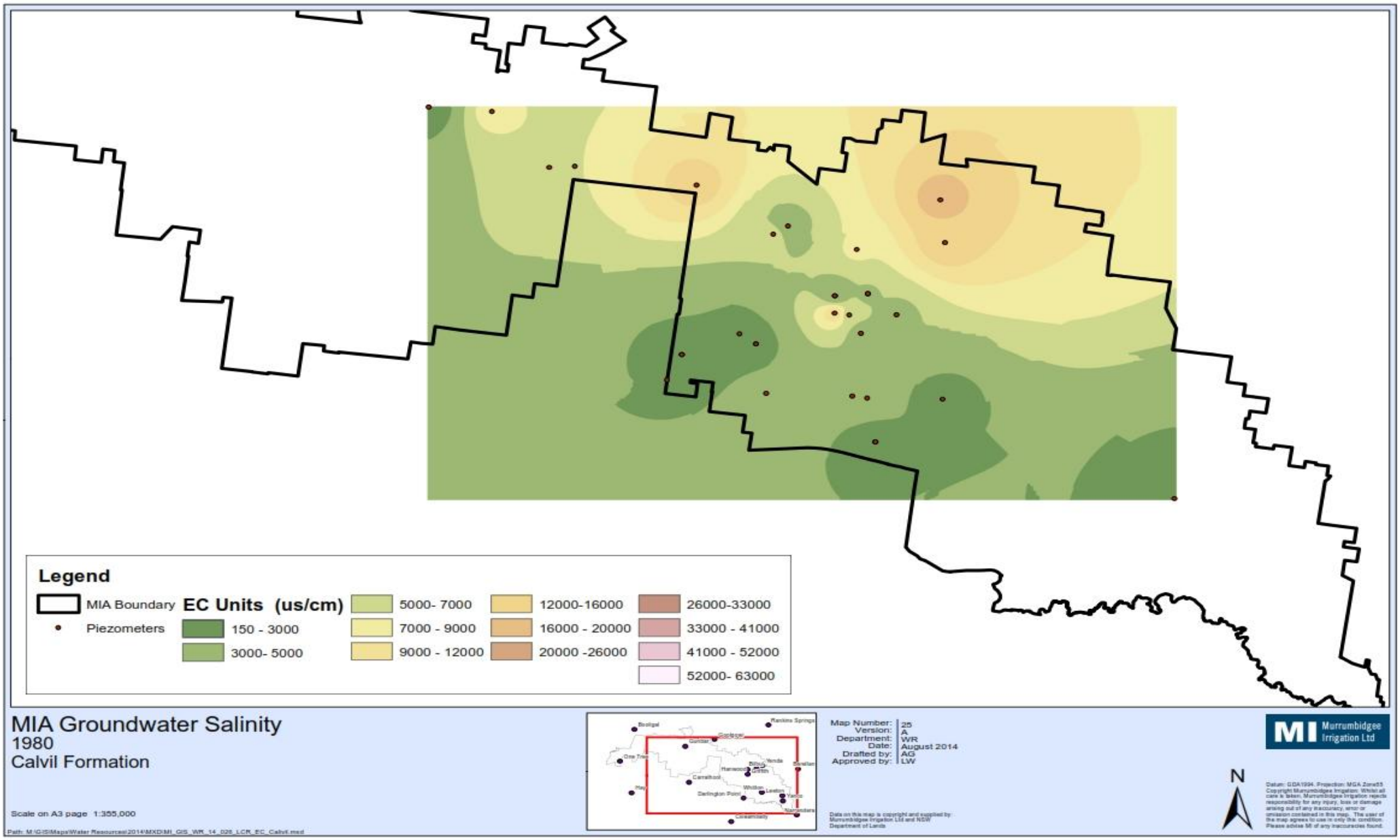


Figure 5.46: Salinity levels in the Calivil Formation – 1980.

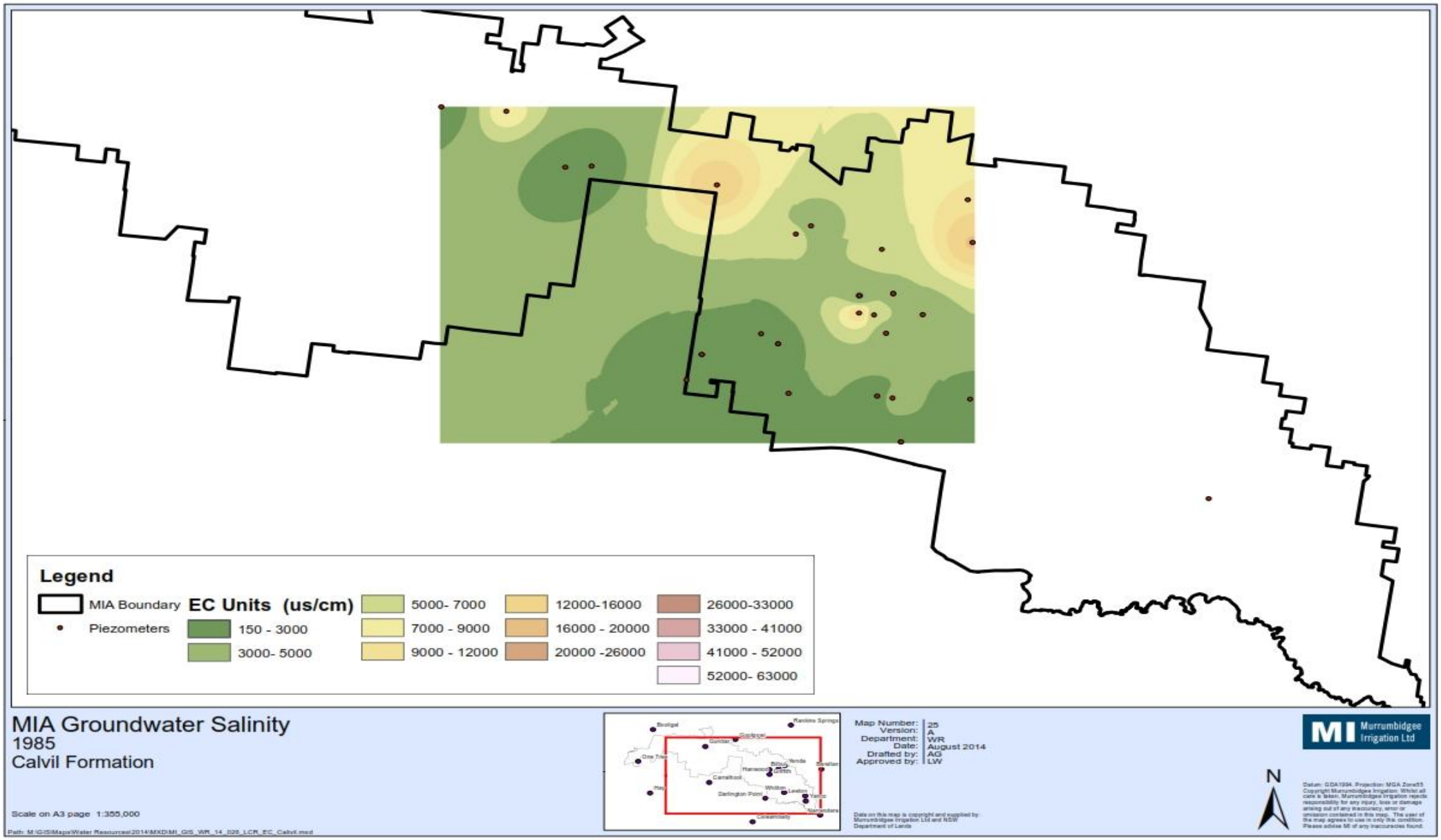


Figure 5.47: Salinity levels in the Calivil Formation – 1985.

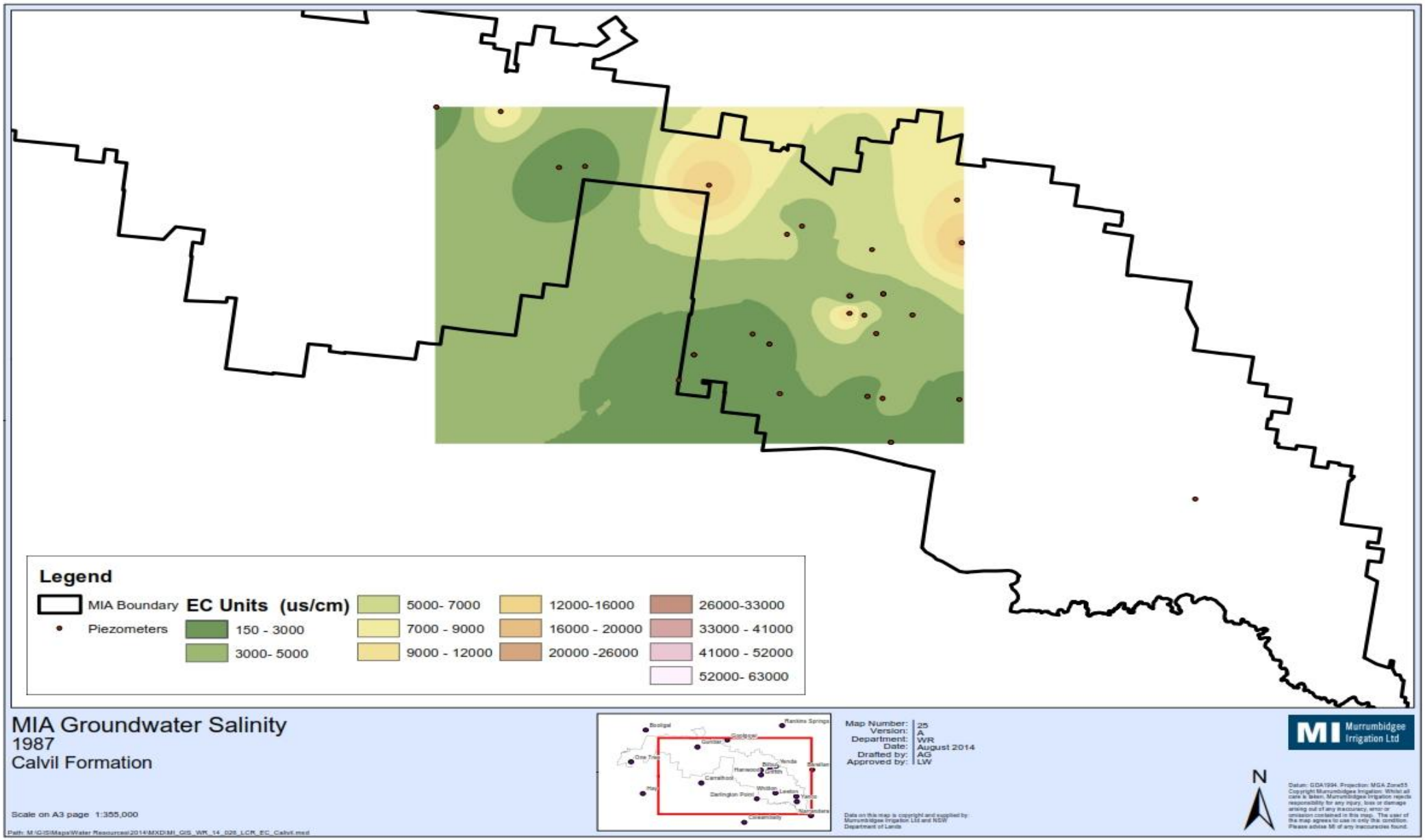


Figure 5.48: Salinity levels in the Calivil Formation – 1987.

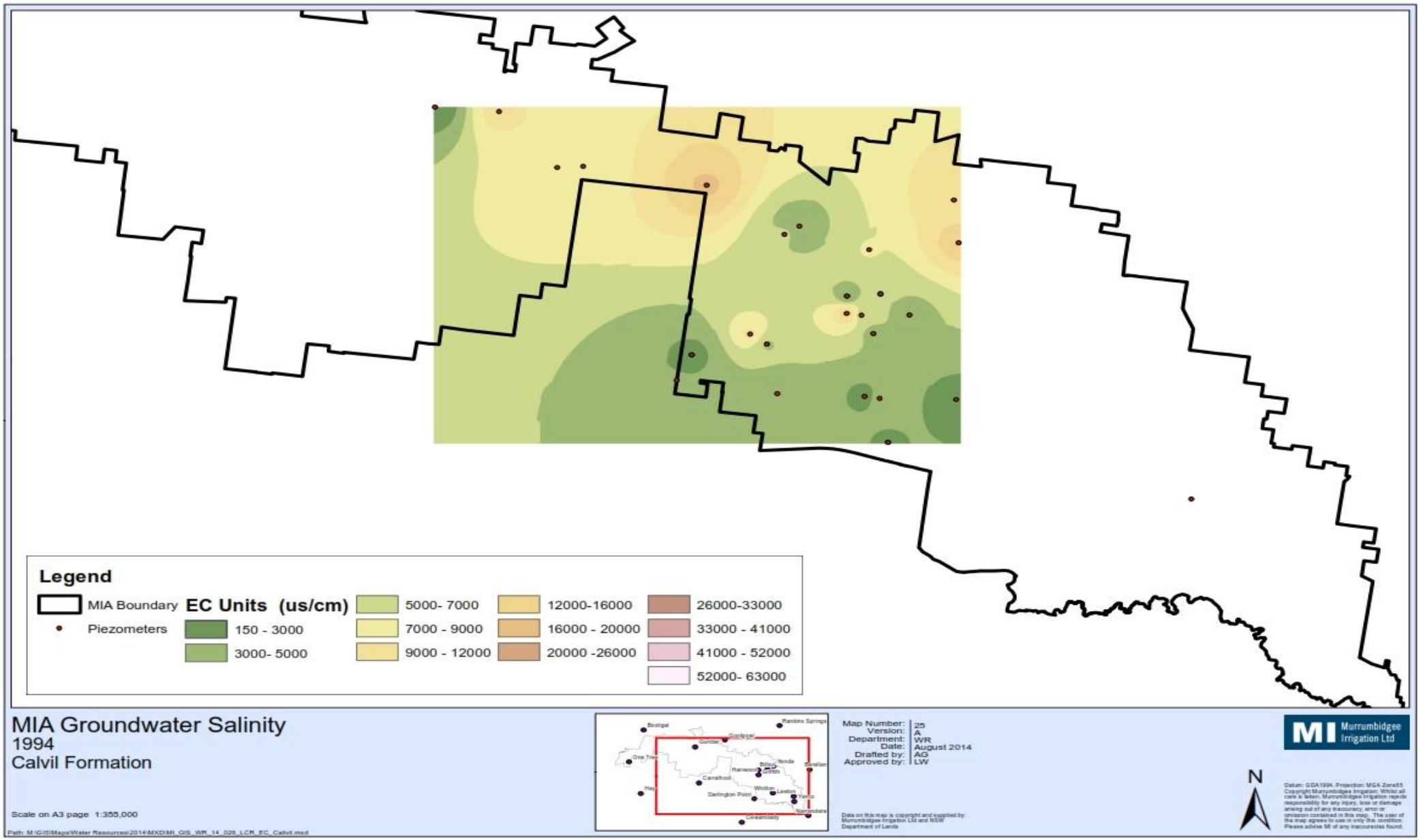


Figure 5.49: Salinity levels in the Calivil Formation – 1994.

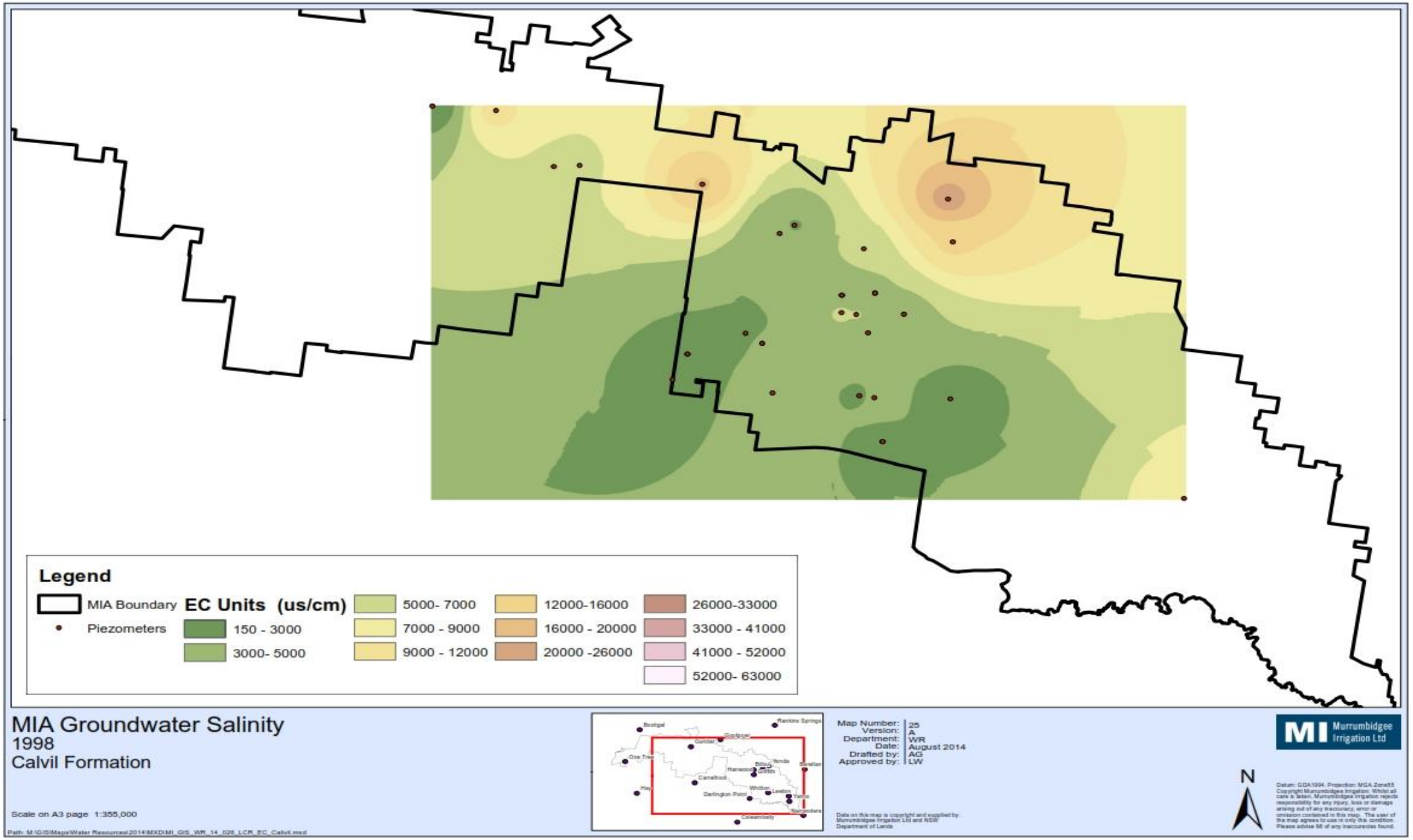


Figure 5.50: Salinity levels in the Calivil Formation – 1998.

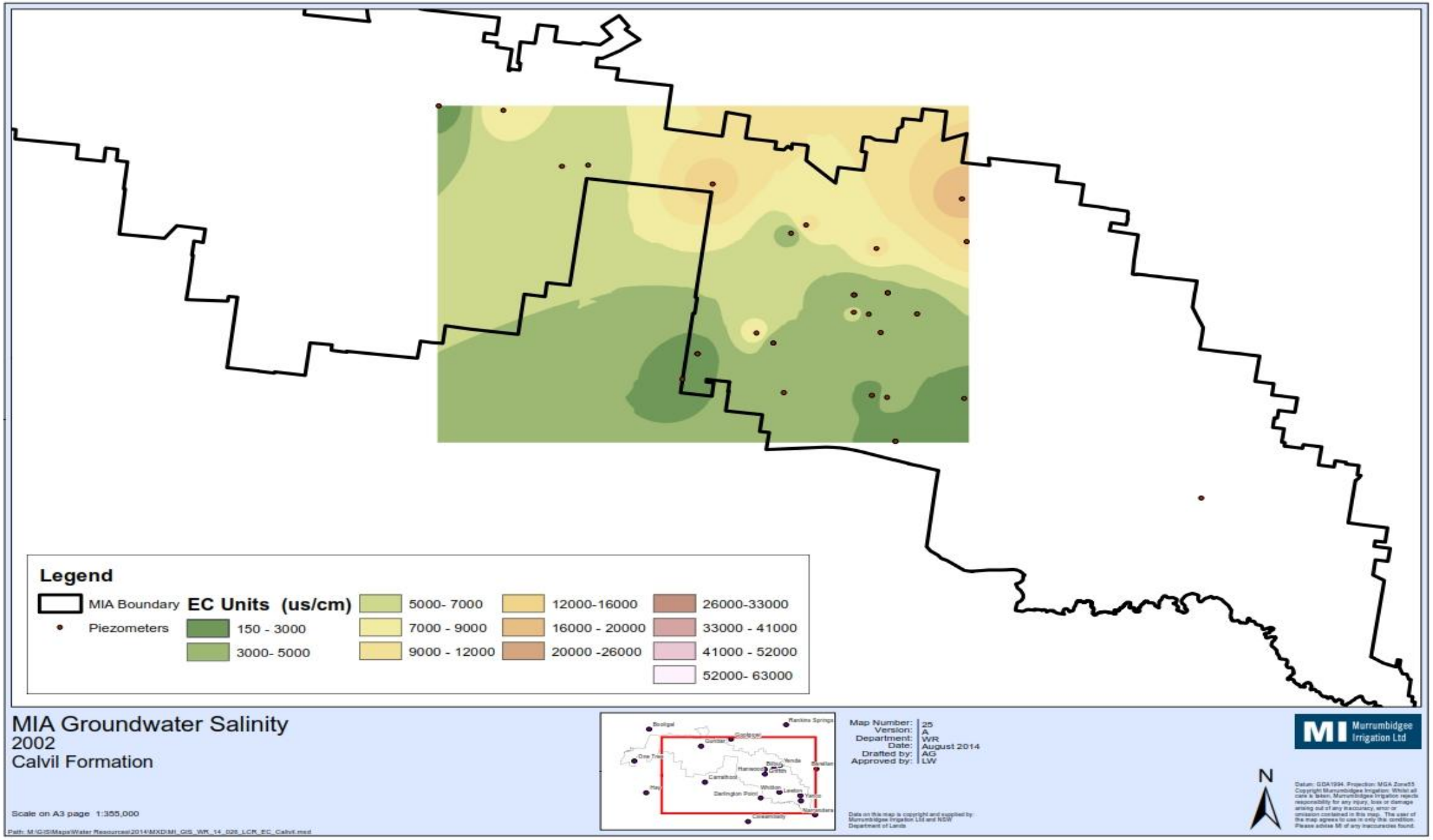


Figure 5.51: Salinity levels in the Calivil Formation – 2002.

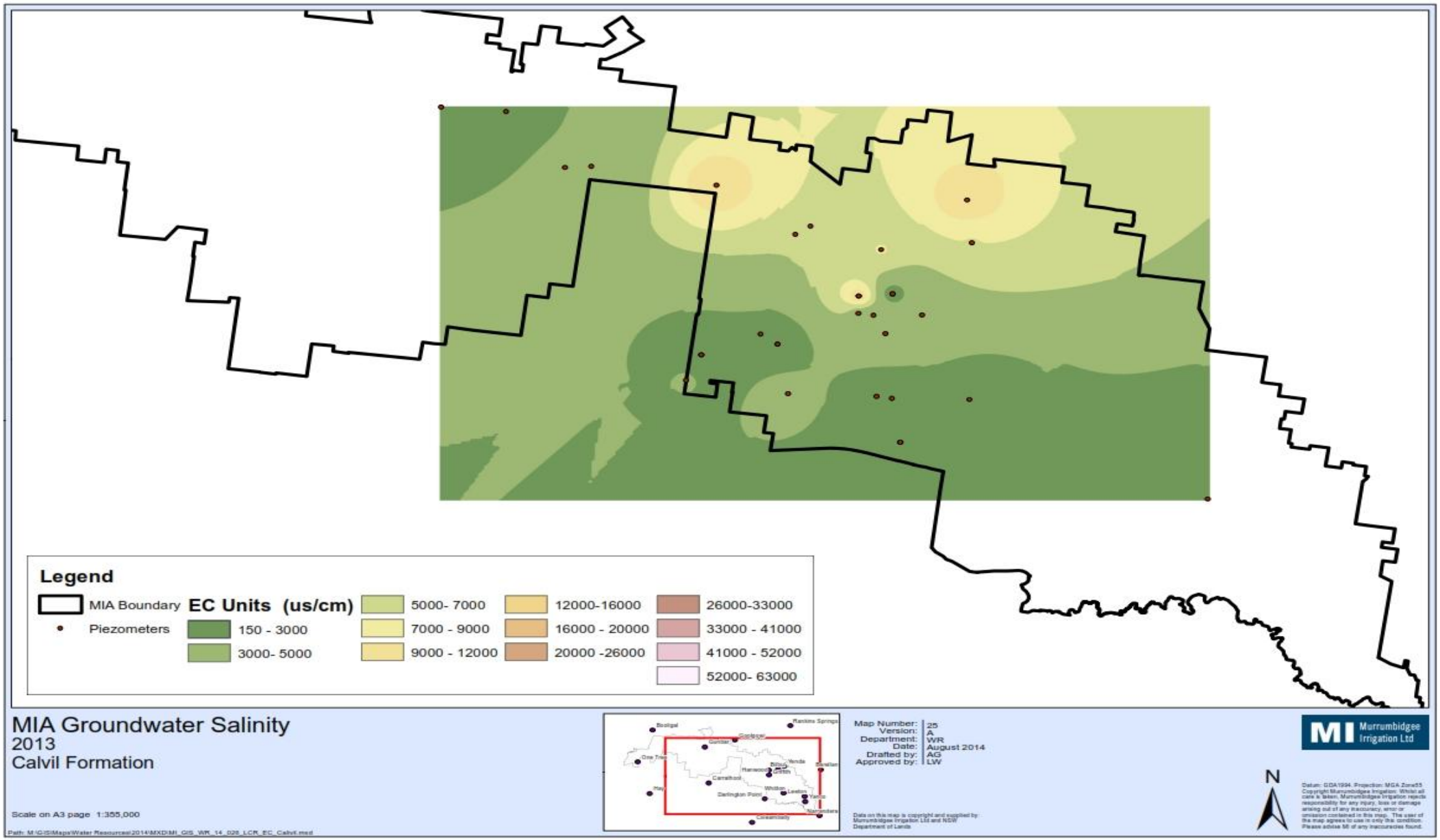


Figure 5.52: Salinity levels in the Calivil Formation – 2013.

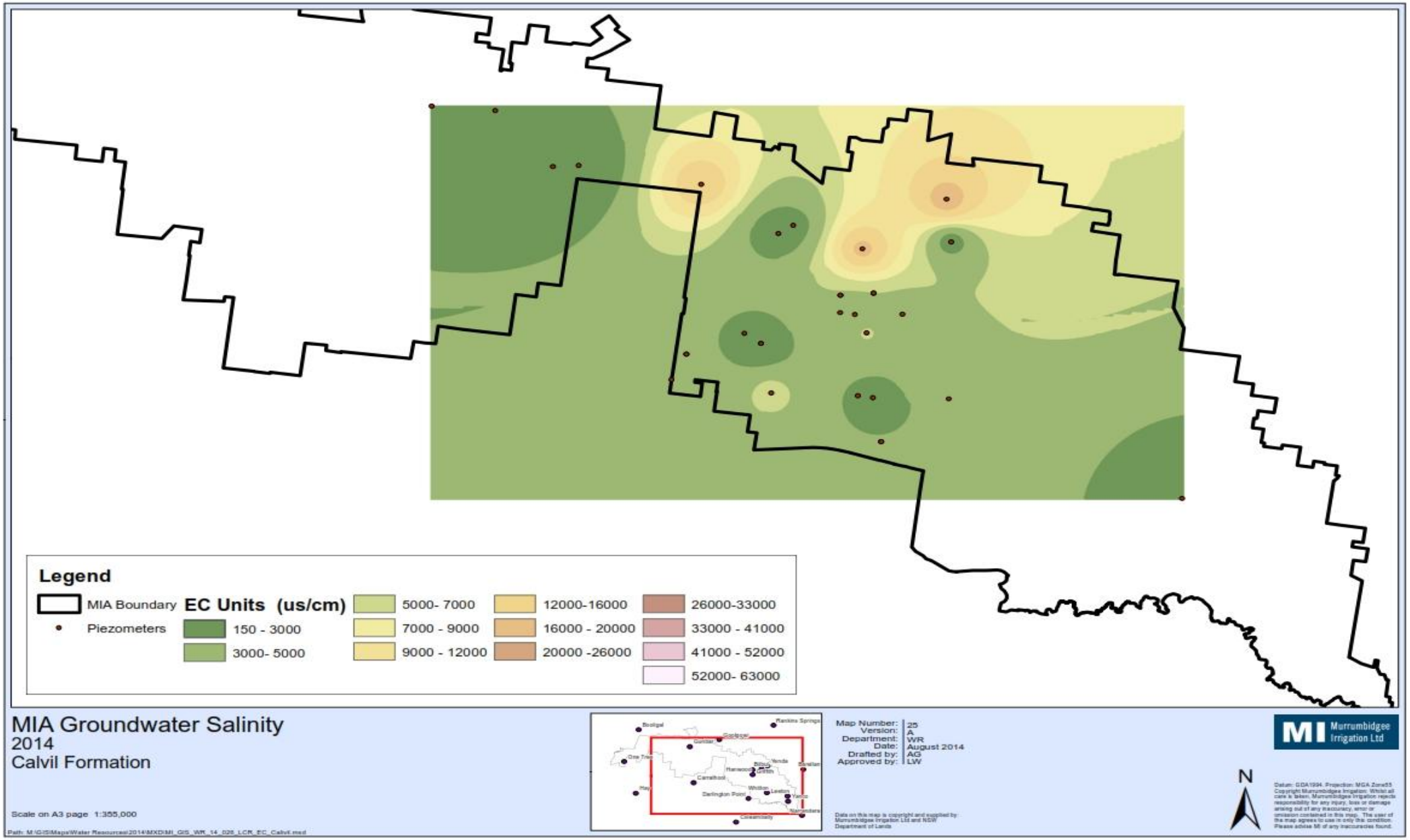


Figure 5.53: Salinity levels in the Calivil Formation – 2014.

5.4 PROXIMITY OF GROUNDWATER LEVELS TO SURFACE LEVEL ACROSS THE MIA

Combined Approval 40CA3245 requires MI to report in table format the area (ha) of shallow (<2 metres), moderate (2-4 metres) and >4 metres groundwater depth classes within MI's are of operation. Data is not collected by MI in a format accurate enough to report data as specified or outlined in this requirement. As part of a current review of our groundwater program requirements, MI will negotiate a solution to this non-compliance with NOW in November 2014.

MI has therefore presented this data utilising a methodology more accurately representative of this requirement in line with data held by the company. Groundwater depth classes in proximity to ground level have been presented spatially, identifying the location of the bores classified within each depth class. For the purpose of this report the Shepparton Formation has been divided into Shallow and Deep categories. Maps for the current reporting year and the preceding two years have been developed for the months of March and September. For the comparison year September levels only have been mapped to represent 2006 as variation between March and September groundwater levels for that year were negligible due to the drought.

The number of bores with groundwater levels within these depth classes and each formation is presented below.

Depth Classes- Shallow Shepparton Formation

Figures 5.54 to 5.60 spatially highlight the location and depth classes by year for the Shallow Shepparton Formation within each of the irrigation areas and districts.

The most notable year for depth class changes in groundwater levels in the Shallow Shepparton Formation were March 2012 and 2013. This is likely a product of rainfall recharge and flooding in March 2012 and a combination of already elevated groundwater levels, rainfall and favourable irrigation conditions experienced in March 2013. Overall, with the exception of March 2012 and March 2013, there has been very little change in depth classes in shallow piezometers in the Yanco and Benerembah Districts. Both have persistently presented bores within 2 meters or less of ground surface level which may indicate elevated groundwater levels due to topographic low points and proximity of the Shallow Shepparton Formation to ground level at these sites.

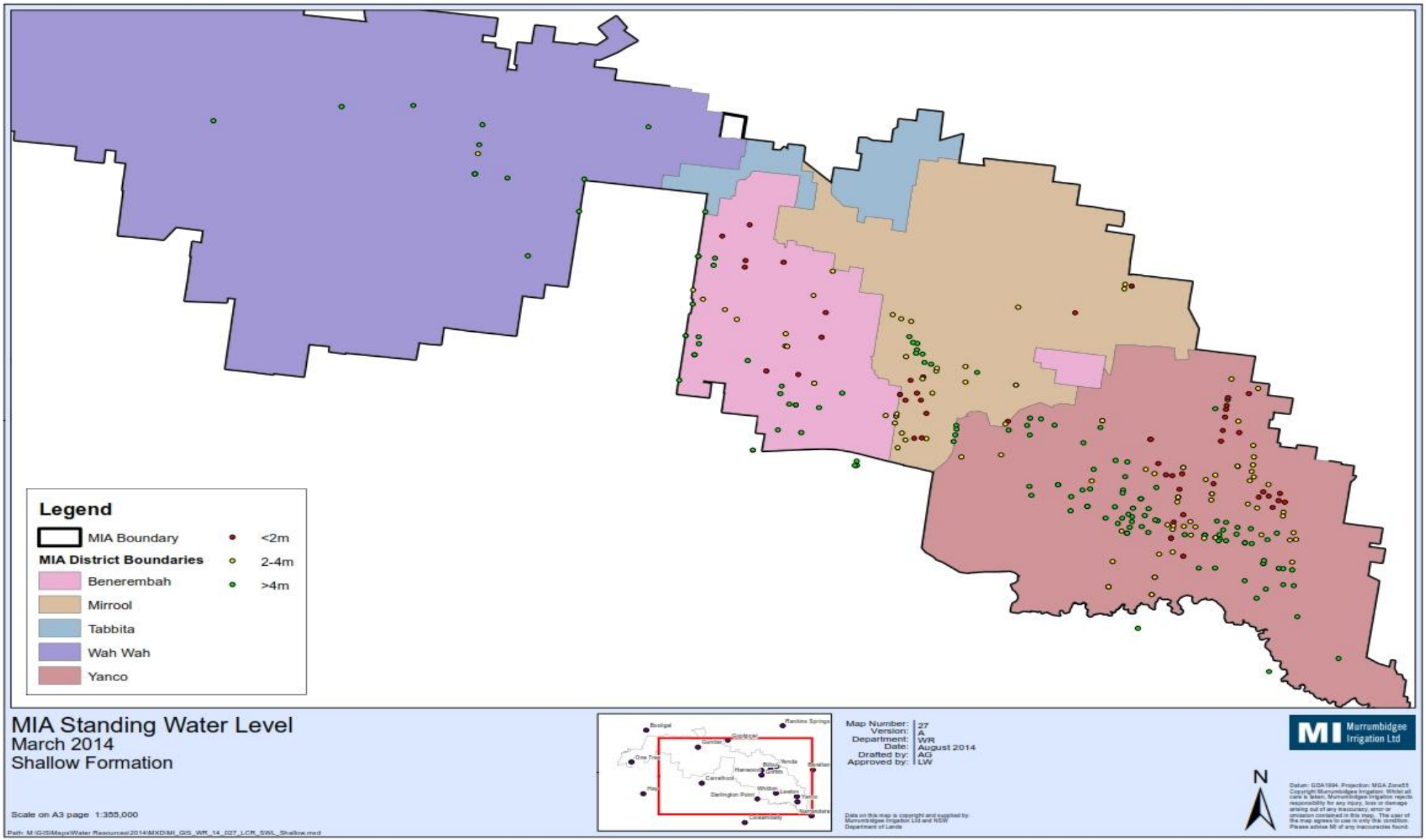


Figure 5.54: Standing water level depth classes - Shallow Shepparton Formation - March 2014.

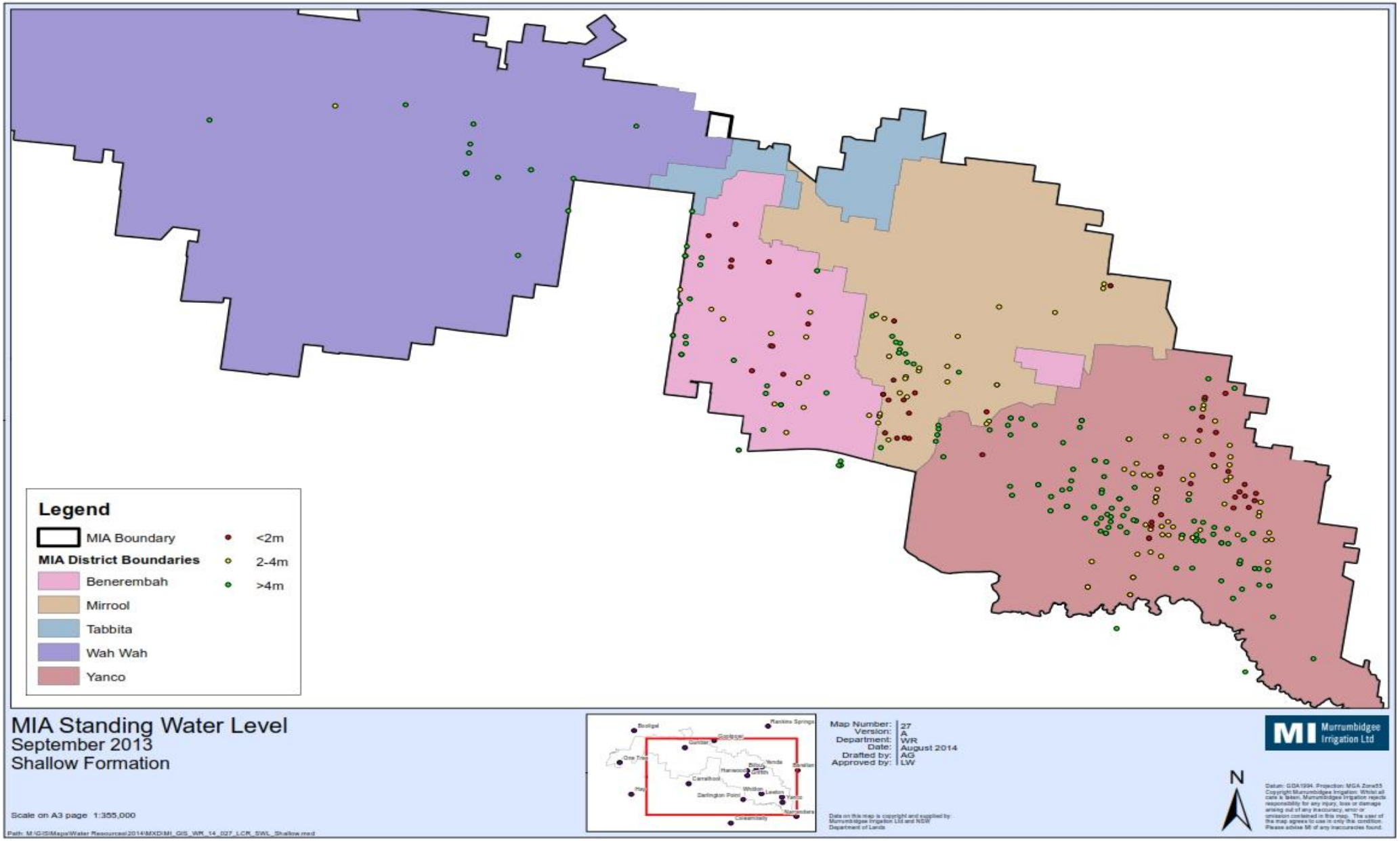


Figure 5.55: Standing water level depth classes - Shallow Shepparton Formation - September 2013.

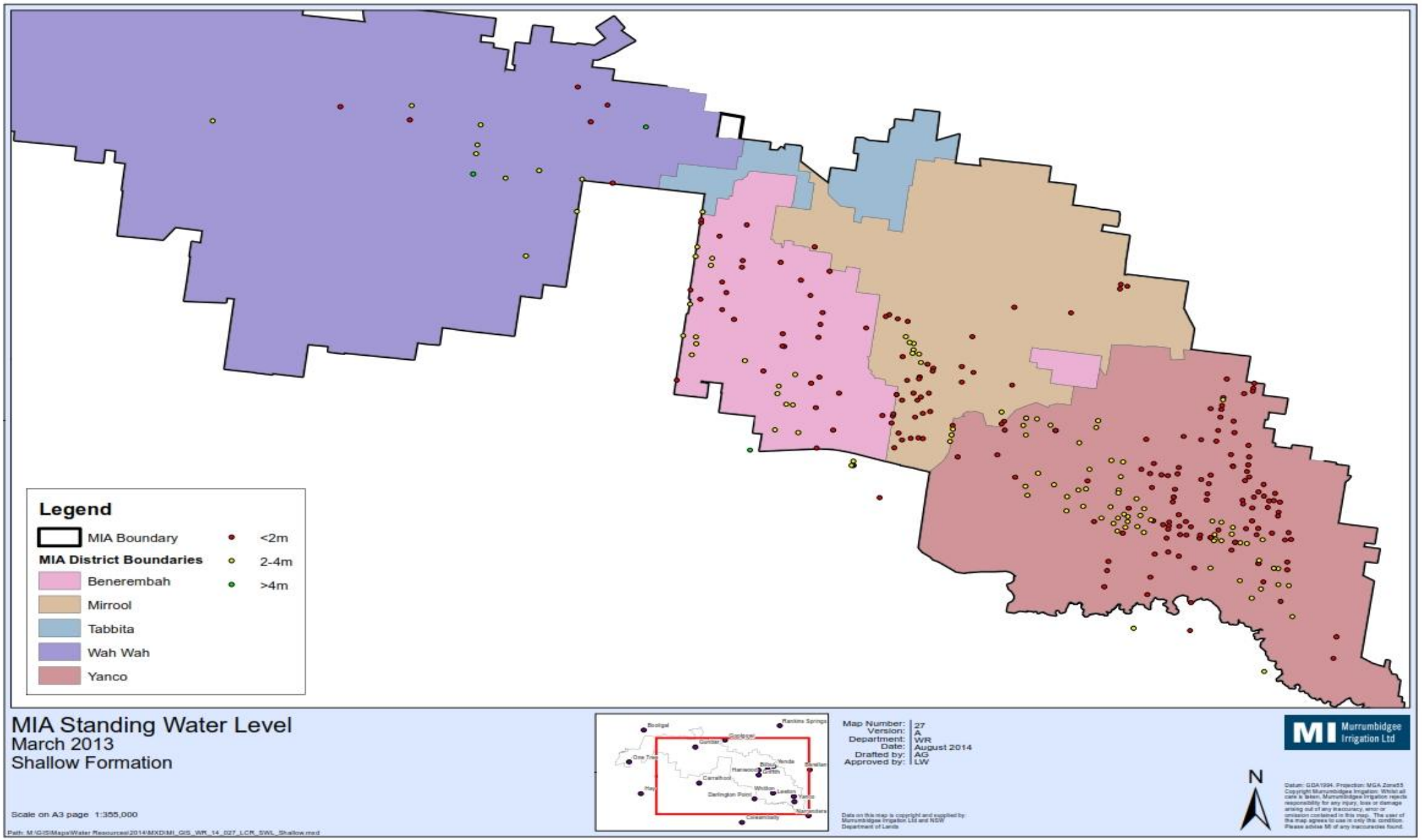


Figure 5.56: Standing water level depth classes - Shallow Shepparton Formation - March 2013.

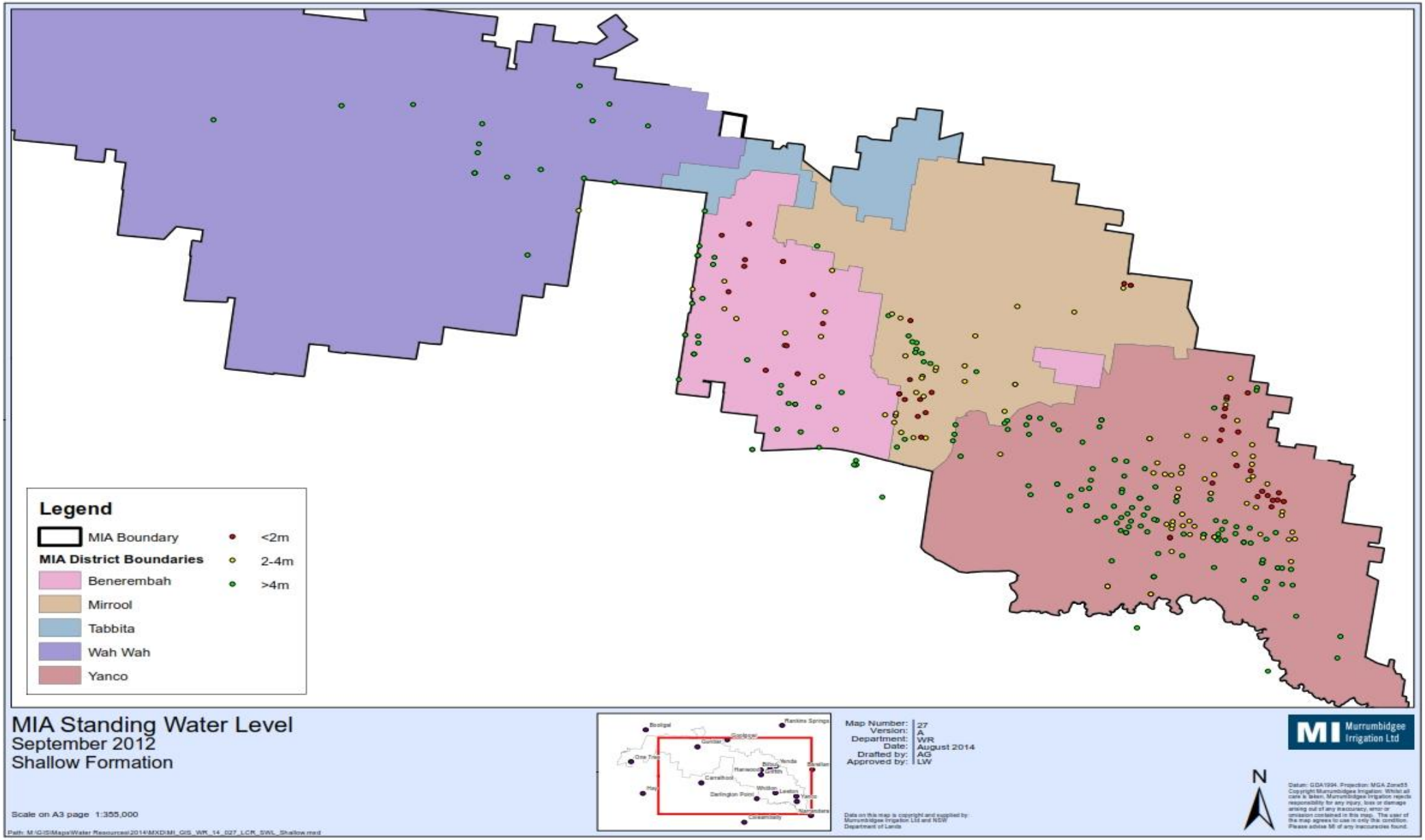


Figure 5.57: Standing water level depth classes - Shallow Shepparton Formation - September 2012.

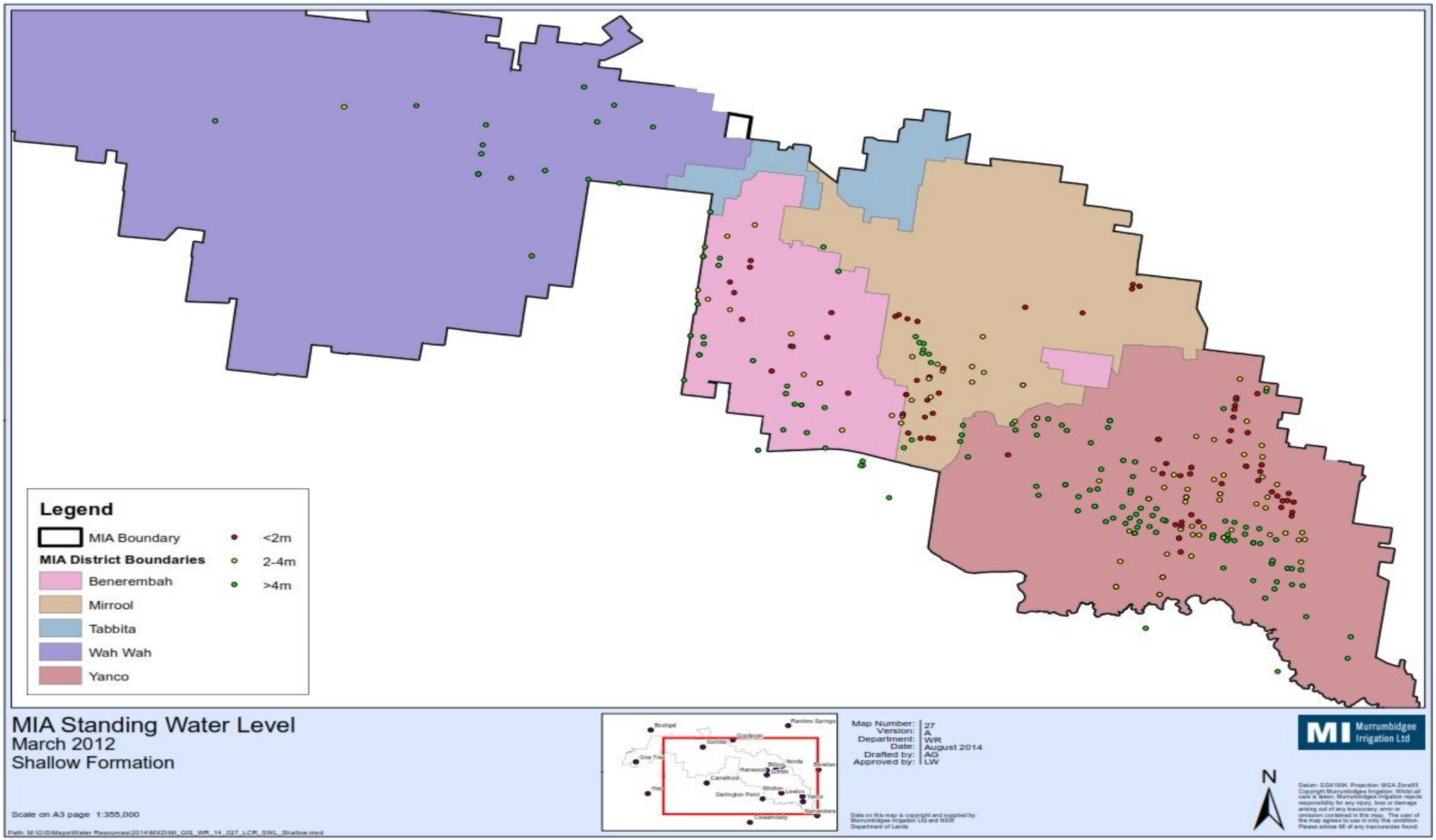


Figure 5.58: Standing water level depth classes - Shallow Shepparton Formation - March 2012.

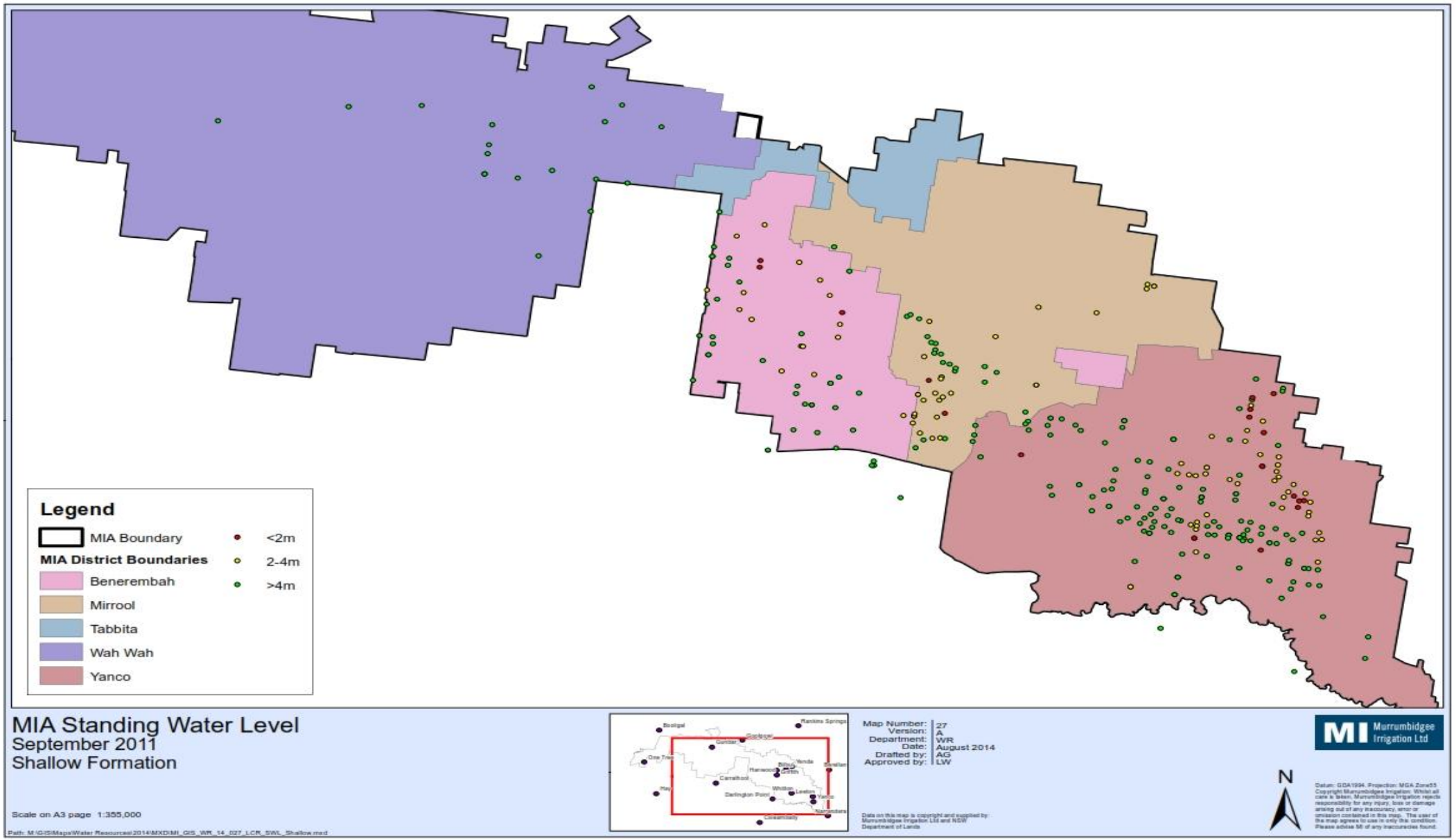


Figure 5.59: Standing water level depth classes - Shallow Shepparton Formation - September 2011.

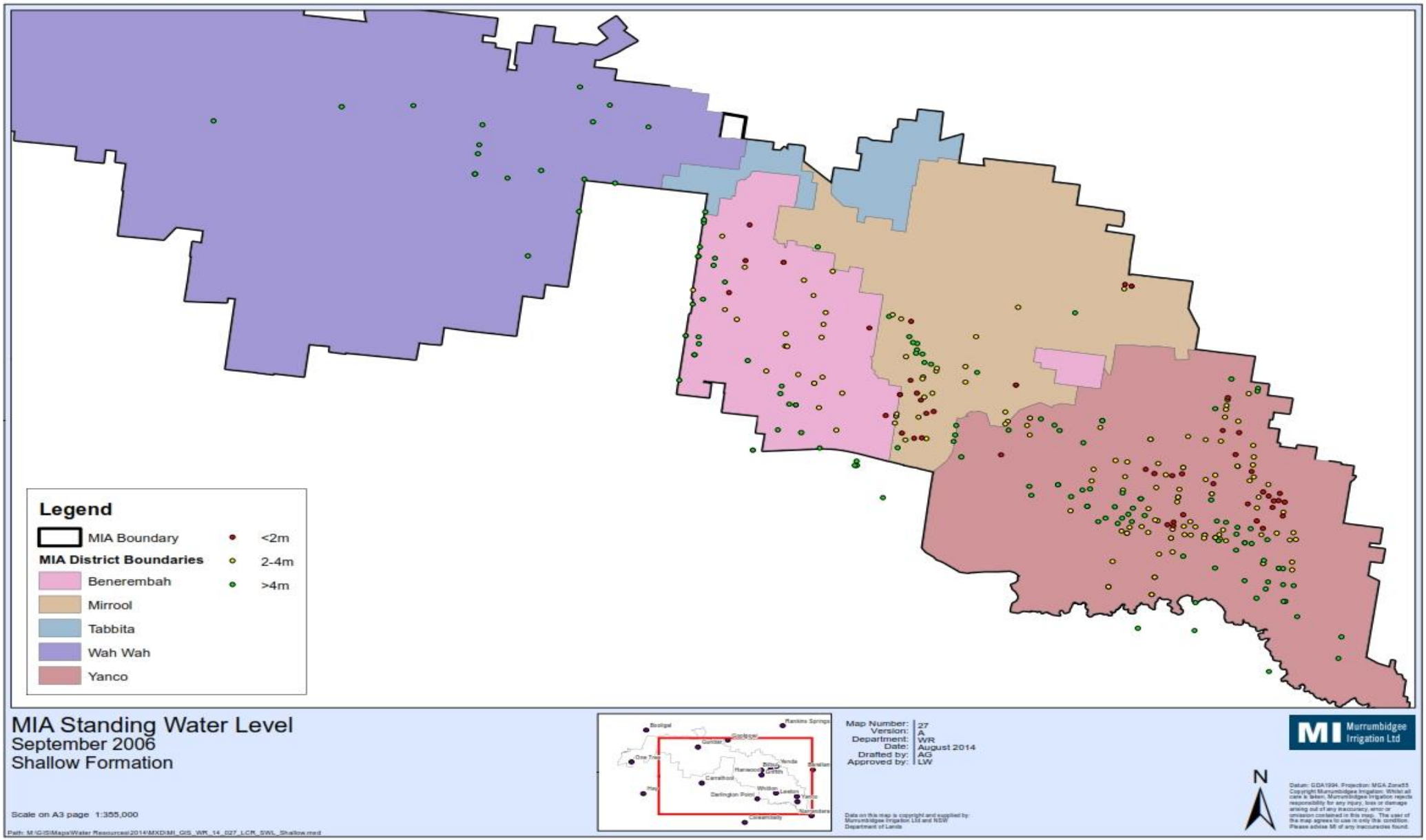


Figure 5.60: Standing water level depth classes - Shallow Shepparton Formation - September 2006.

Depth Classes- Deep Shepparton Formation

Figures 5.61 to 5.67 spatially highlight the location and depth classes by year for the Deep Shepparton Formation within each irrigation district.

Most piezometers within the Deep Formation can be categorised in the 2 – 4 metres or >4 metres depth classes. There is a small number of monitored piezometers that are <2 metres from ground level located within the Yanco Irrigation Area and Benerembah Irrigation District which may indicate elevated groundwater levels due to proximity of the Deep Formation to ground surface level at these particular sites.

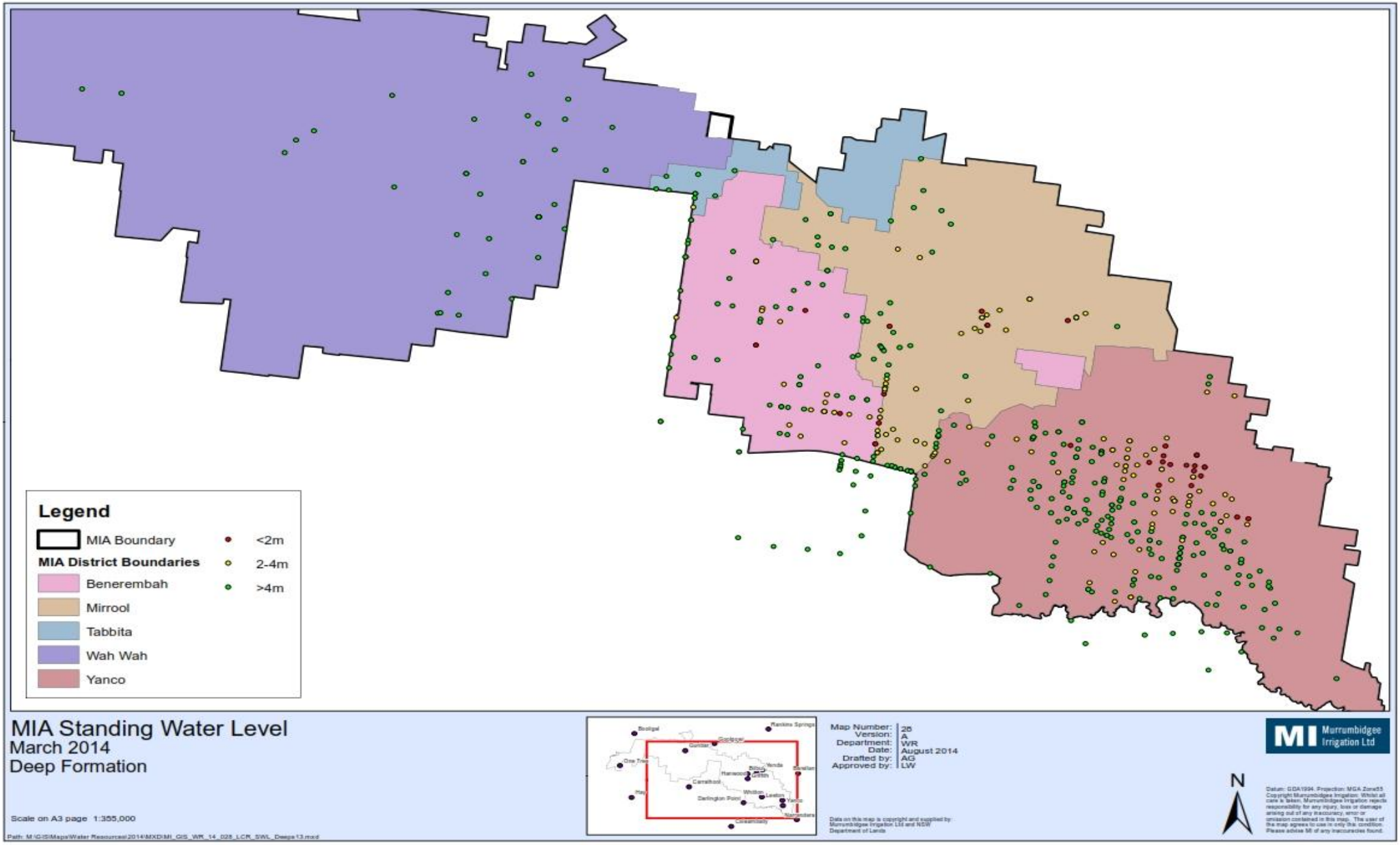


Figure 5.61: Standing water level depth classes - Deep Shepparton Formation - March 2014.

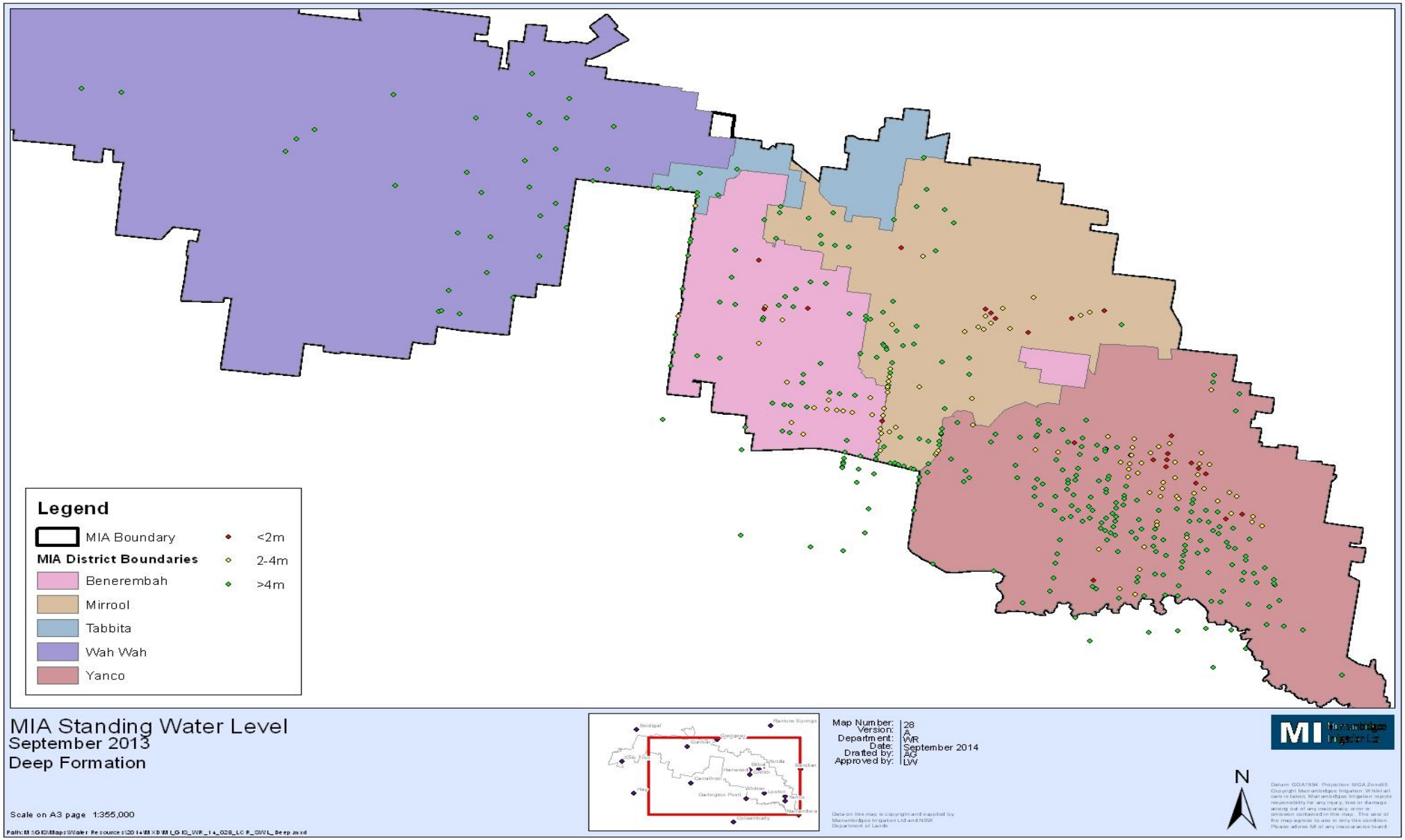


Figure 5.62: Standing water level depth classes - Deep Shepparton Formation - September 2013.

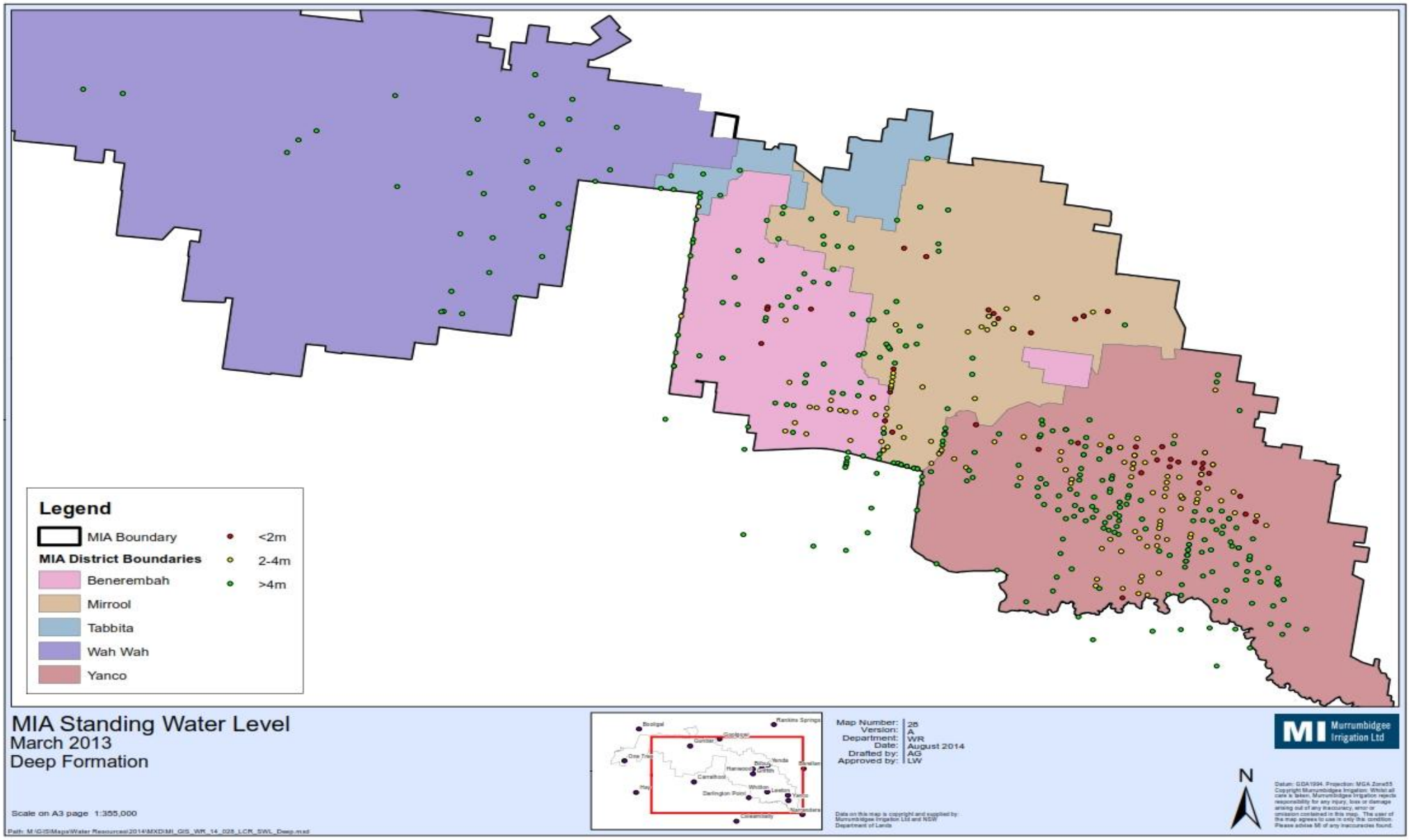


Figure 5.63: Standing water level depth classes - Deep Shepparton Formation - March 2013.

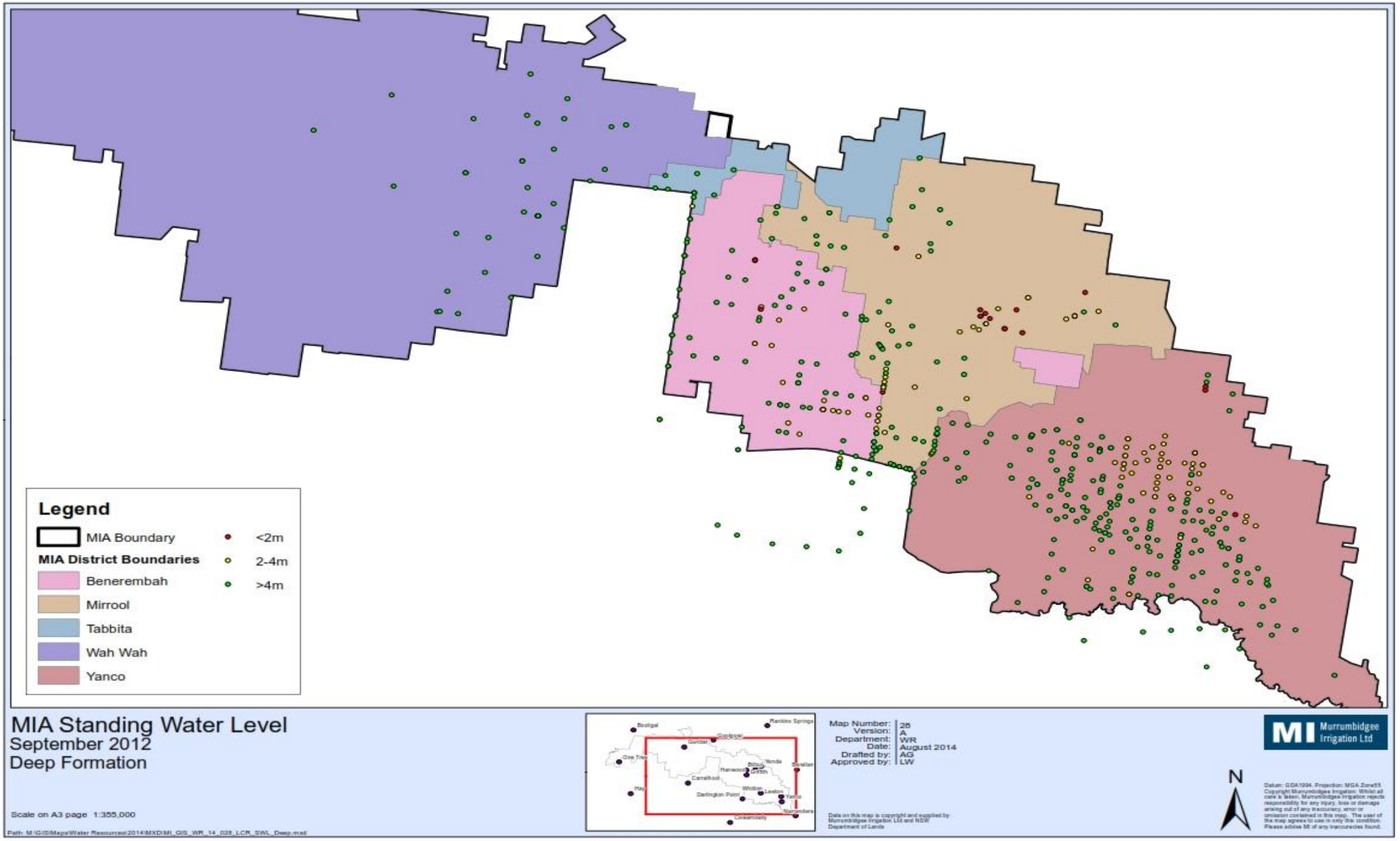


Figure 5.64: Standing water level depth classes - Deep Shepparton Formation - September 2012.

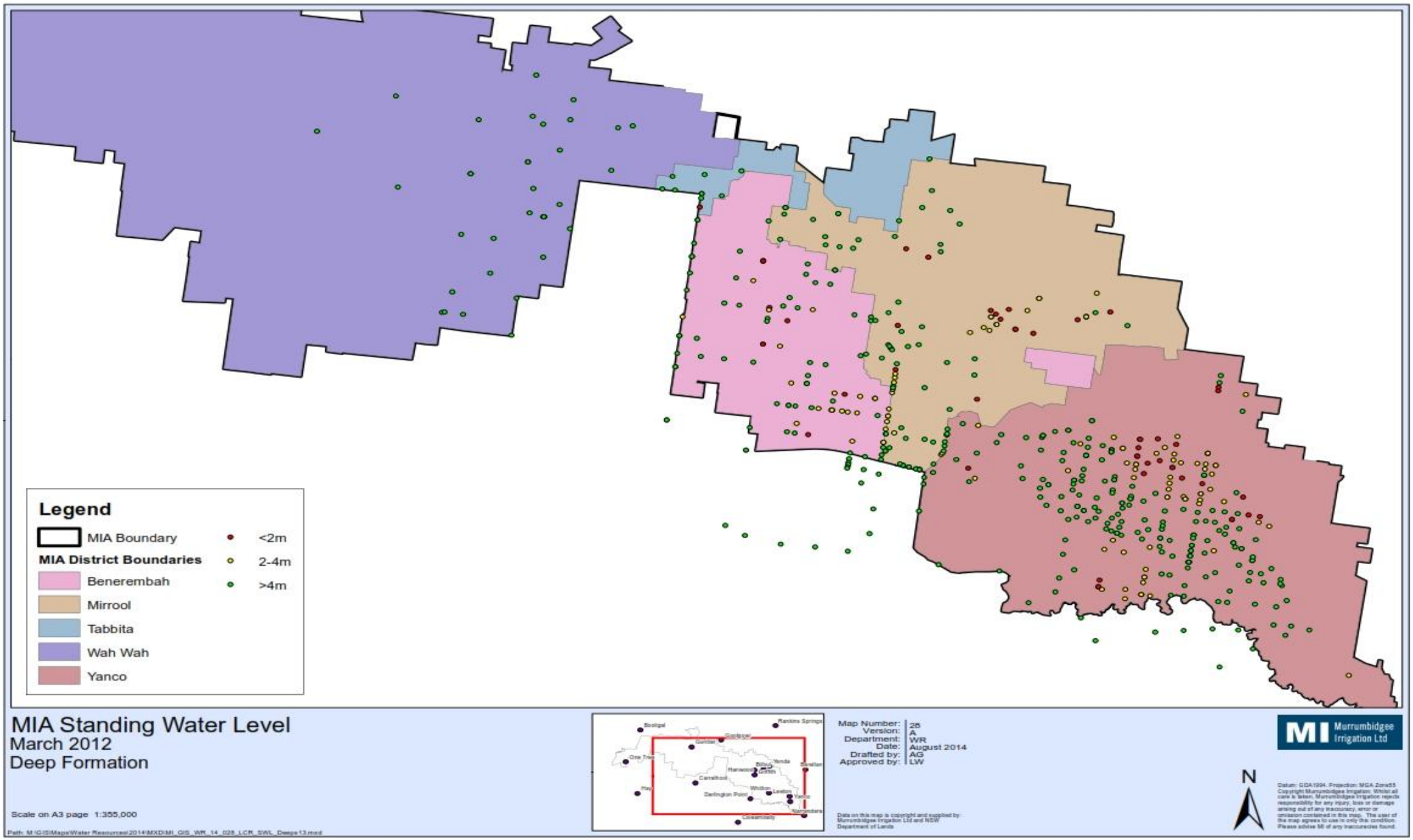


Figure 5.65: Standing water level depth classes - Deep Shepparton Formation - March 2012.

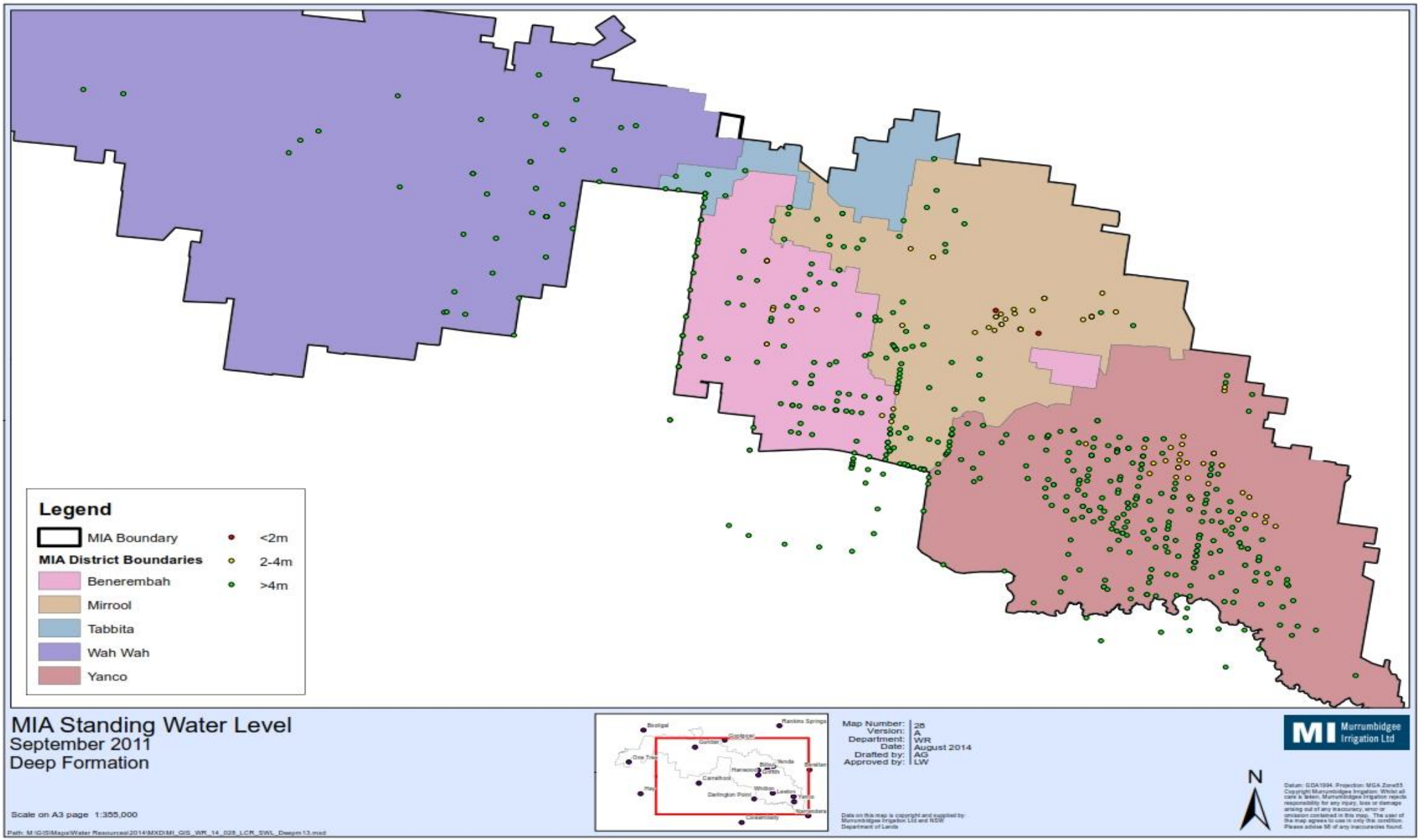


Figure 5.66: Standing water level depth classes - Deep Shepparton Formation - September 2011.

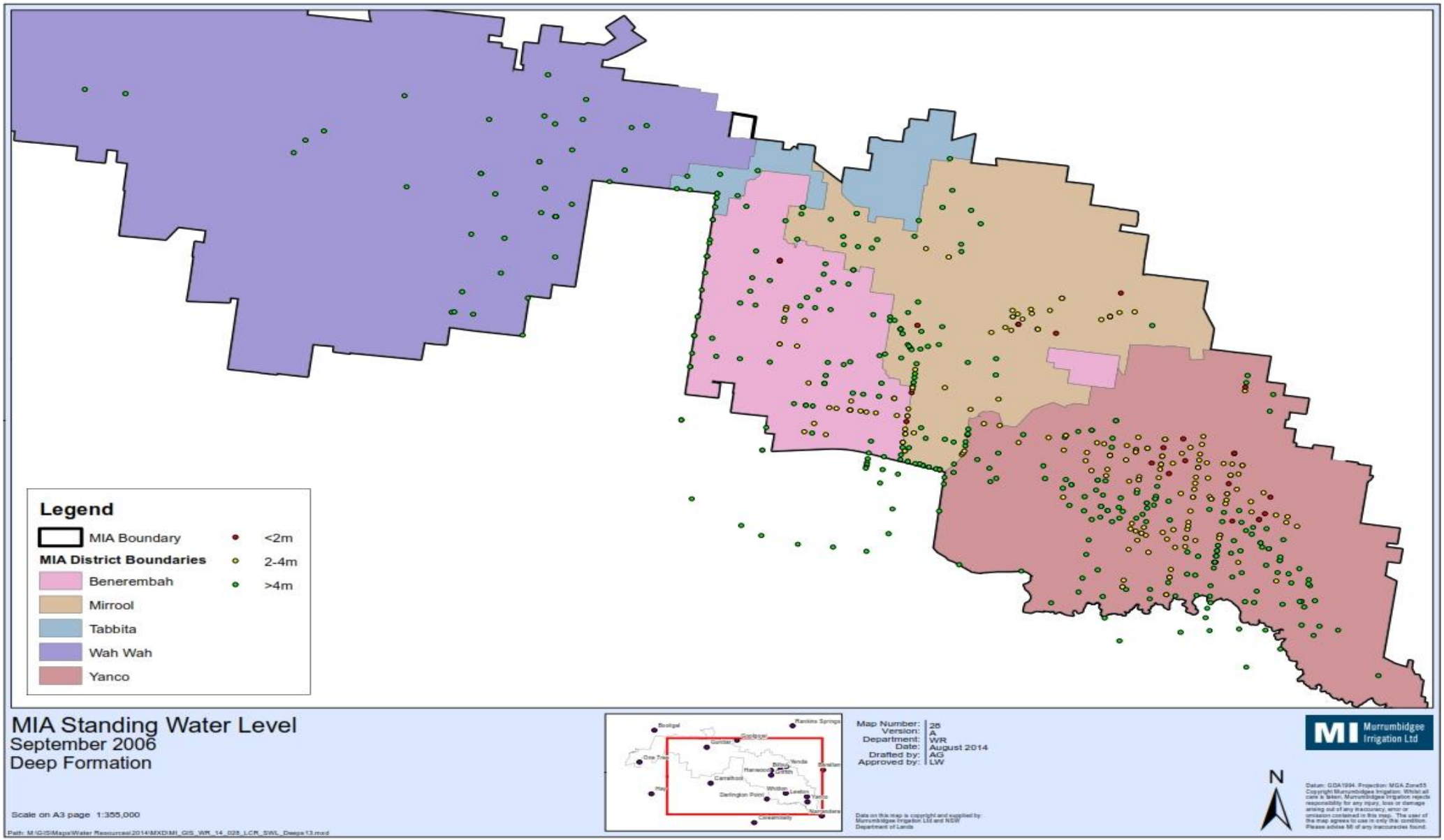


Figure 5.67: Standing water level depth classes - Deep Shepparton Formation - September 2006.

6. NEW MEASURES TO LIMIT GROUNDWATER RECHARGE AND DISCHARGE OF SALT

MI has implemented the following measures to monitor groundwater recharge and discharge of salt for the 2013/14 licence reporting period:

- MIA 2014 Soil Salinity Survey
- Review and re-issue of MI's Surface Water Quality Monitoring and Drainage Reuse Program
- Implementation (2 stations) and upgrade (4 stations) of real-time water quality monitoring stations in MI's drainage and supply network to monitor Electrical Conductivity (EC), flow and other water quality parameters
- Purchase of M9 field mobile Flow Measuring device for channel seepage investigations and evaluation on losses to groundwater. This will allow MI to understand and mitigate the impacts of channel seepage on groundwater levels through remediation.

MI is also planning, developing and partaking in the current projects to better understand groundwater and salinity changes and change drivers across the MIA:

- Surface Hydrological Supply and Drainage Model
- MIA Groundwater Model
- Real-time Supply and Drainage System Performance Monitoring (Flow, EC)
- Customer Metering Program

MI has also delivered water saving projects through automation, piping and the lining of sections of the channel system under the Australian Government's Sustainable Rural Water Use and Infrastructure Program under Round 2 of the Private Irrigation Infrastructure Operators Program in NSW (PIIOP2). This has reduced impacts of losses through channel seepage to groundwater systems at:

- Lake Wyangan, which included13.8 km of pipelines, 15.8 km of concrete re-lining for a main arterial completed in this reporting period, with channel automation of regulating structures to be completed in the next reporting period.
- Hanwood Laterals 18X and 12, which included 4 km of pipeline, completed in this reporting period.

7. ENVIRONMENTAL PROTECTION AND MANAGEMENT

7.1 DISCHARGE OF NOXIOUS AQUATIC WEEDS

7.1.1 ALLIGATOR WEED IN THE MIA

The control program for Alligator Weed has continued over the last year. Inspections have been conducted at BBSW, downstream channel systems of BBSW and the floodway at Wyvern Station. Inspections and treatment took place in November 2013 and March 2014.

Barren Box Storage and Wetland

Three plants were found in late 2013, one downstream of Willow Dam in the Bi-wash and two downstream of the BBSW pumps. These sites were inspected February 2014 with no regrowth reported.

Inspections conducted in February 2014 resulted in the discovery of eight plants. Six were land based plants in the bi-wash area while two plants were found on the BBSW side of the levee at Johnson's Dam.

Channel System

No plants were found in the channel system downstream of BBSW during the 2013/14 inspections.

Floodway

No plants were found in the floodway during the 2013/14 inspections.

Outfall Channel

Four plants were found in S-5-BBOX-090E (Wyvern Station) during inspections held in October 2013. No plants were found in the outfall channel system in the February 2014 inspections.

Future Alligator Weed inspections will be undertaken in October 2014 and February 2015.

All Alligator Weed found for this reporting period was treated with Brushoff (600 g/kg metsulfuron methyl) and GPS co-ordinates have been recorded for future inspections of re-growth at these sites. Any large plants found are removed and buried at BBSW.

7.1.2 SAGITTARIA AND ALISMA WEED MANAGEMENT - GRIFFITH AND LEETON AREAS

Inspections of Sagittaria and Alisma during 2013/14 reporting period have been carried out monthly from September 2013 through to the end of June 2014.

Approximately 23 ha of drainage and supply channels were inspected during this period.

Detected plants are treated with Roundup Biactive (360 g/L glyphosate) in accordance with an APVMA off label Permit: 11856 for use of the rate of up to 10 L per 100 L or 40 L per ha.

There was no discharge of any noxious weeds outside our area of operation.

7.2 DISCHARGE OF BLUE-GREEN ALGAE

There were no discharges of blue-green algae outside the area of operations during the 2013/14 reporting period.

8. ENVIRONMENTAL PROTECTION LICENCE 4651

This section of the report is based on the Environmental Protection Licence number 4651, licence version dated 2 July 2013 issued by the Environment Protection Authority (EPA).

9. WATER QUALITY MONITORING

All monitoring data is collected in accordance with the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for water quality monitoring. All testing methods are approved by OEH. All field equipment is operated in accordance with manufacturer recommendations and samples are analysed by a NATA accredited laboratory, Australian Laboratory Services (ALS).

MI's water quality monitoring programs encompass sites that are required to be monitored in accordance with EPL 4651 and strategic sites chosen within the supply and drainage system that are representative of water quality in key areas of the MIA. The current water quality monitoring site locations are displayed in Figure 9.3.

9.1 EPL DRAIN SITE MONITORING

The EPL discharge points and the volume of discharge from MI's area of operations are presented in Table 9.1. A total of 2,438 ML was discharged from the area of operations during 2013/14. No water entered Point 15 during 2013/14 and therefore, no monitoring was carried out at this discharge point. Point 15 will not be referred to hereafter.

Table 9.1: EPL discharge points and volume (ML) of discharge for 2013/14.

Month	Point 4. Gooragool Lagoon Escape (LAG)	Point 5. Gogeldrie Main Southern Escape (GMSSR)	Point 6. Yanco Main Southern Escape (YMS)	Point 7. Cudgel Creek Escape (ROCUDG)	Point 15. Mirrool Creek Floodway (MIRFLD)	Total (ML)
Jul-13	26	0	0	412	0	438
Aug-13	10	0	0	38	0	47
Sep-13	45	0	10	60	0	114
Oct-13	24	3	0	20	0	48
Nov-13	12	2	0	88	0	102
Dec-13	0	0	0	88	0	89
Jan-14	41	0	0	316	0	357
Feb-14	35	0	0	237	0	272
Mar-14	126	42	23	246	0	437
Apr-14	15	0	0	274	0	289
May-14	0	0	0	158	0	158
Jun-14	23	1	1	64	0	89
2013/14 total	**357**	**48**	**34**	**1,999**	**0**	**2,438**

The large flow recorded at Point 7 – ROCUDG was due to a malfunctioning regulating door. This structure is located on the Main Canal and releases supply water through Cudgel Creek and eventually flows to ROCUDG. Details on this issue and the proposed actions to rectify this were sent to the EPA on 20/02/2014.

9.2 SCHEDULED CHEMICALS

For each discharge point, MI is required to monitor the concentration of each chemical listed in Table 9.2 in an event that causes flow ≥2 ML/day. Endosulfan is the only chemical that is also required to be monitored following rainfall ≥15 mm/day, regardless of flow measured. When concentrations reach 'notification' or 'action' trigger levels, MI is required to notify the EPA.

Table 9.2: Scheduled chemicals in Murrumbidgee Irrigation's screening program.

Chemical	Environmental Guidelines (μg/L)	Notification Level (μg/L)	Action Level (μg/L)
Atrazine	2	**13**	**45**
Chlorpyrifos	0.001	**0.01**	**0.11**
Diazinon	0.0006	**0.01**	**0.2**
Diuron	8	**1***	**5***
Endosulfan	0.01	**0.03**	**0.2**
Malathion	0.07	**0.05**	**0.2**
Metolachlor	8	**0.02**	**0.1**
Molinate	2.5	**3.4**	**14**
Simazine	10	**3.2**	**11**
Thiobencarb	1	**2.8**	**4.6**
Trifluralin	0.1	**2.6**	**4.4**

Source: NSW Environment Protection Authority

Tables 9.4 to 9.7 identify notification and action level concentrations detected at each discharge point during 2013/14. It is worth noting that for sites sampled more than once during a month, only the highest results are displayed in these tables.

A large portion of notification and action level detections were made at Point 4 – LAG with Diuron and Metalochlor repeatedly found to be above notification and action level concentrations throughout 2013/14.

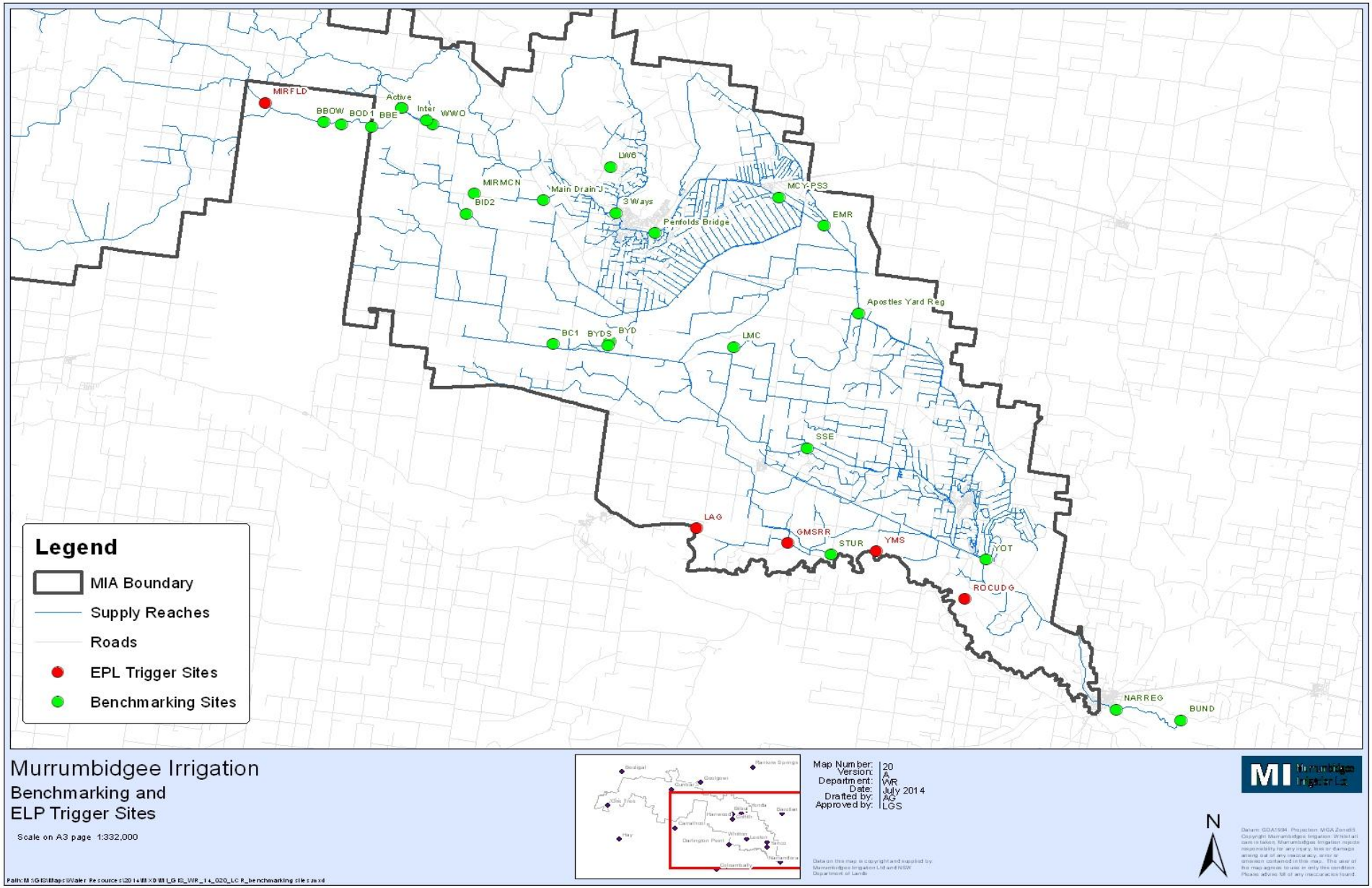


Figure 9.3: Location of water quality monitoring sites.

Table 9.4: Trigger based sampling results from Point 4 – LAG for 2013/14.

Point 4 - LAG												
Analyte	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
alpha-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Atrazine LOR (<0.005µg/L)	0.007	1.74	0.018	NT	0.033	NT	0.159	0.119	0.014	0.045	3.65	1.05
beta-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chlorpyrifos (LOR <0.005µg/L)	<0.005	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	<0.005	0.018	0.014
Diazinon (LOR <0.005µg/L)	<0.005	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Diuron (LOR <0.005µg/L)	0.112	0.719	<0.005	NT	0.107	NT	1.78	0.102	0.046	245	11.3	47.9
Electrical Conductivity @ 25°C	308.00	325.10	296.00	NT	102.30	NT	848	413	230	315.00	373.00	595.00
Endosulfan sum (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate (LOR 0.01µg/L)	NT	NT	NT	NT	<2	NT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Malathion (LOR <0.002µg/L)	<0.002	<0.002	<0.002	NT	<0.002	NT	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Metolachlor (LOR <0.005µg/L)	<0.005	0.029	<0.005	NT	0.027	NT	0.083	0.455	0.017	0.082	0.104	0.601
Molinate (LOR <0.002µg/L)	<0.005	<0.005	<0.005	NT	5.0	NT	0.018	<0.005	0.022	0.028	<0.005	<0.005
Nitrite + Nitrate as N (LOR 0.01 mg/L	3.21	1.43	0.04	NT	0.42	NT	62.6	0.15	0.03	8.38	3.03	10.2
pH Value	NT	8.28	7.80	NT	8.97	NT	7.11	NT	NT	NT	8.48	7.27
Simazine (LOR <0.005µg/L)	1.60	8.45	0.453	NT	0.038	NT	0.156	0.021	0.016	<0.005	4.98	2.82
Thiobencarb (LOR <0.005µg/L)	<0.005	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tot Kjeldahl Nitrogen N (LOR 0.1 mg/	6.8	4.1	1.7	NT	1.3	NT	6.2	2.1	1.6	23.5	6.6	3.1
Total Nitrogen as N (LOR 0.1 mg/L)	10.0	5.5	1.7	NT	1.5	NT	68.8	2.2	1.6	31.9	9.6	13.3
Total Phosphorus as P (LOR 0.1 mg/L	0.84	0.35	0.33	NT	0.34	NT	0.76	0.24	0.16	11.2	2.67	1.09
Trifluralin (LOR <0.005µg/L)	<0.010	<0.010	<0.010	NT	<0.010	NT	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Turbidity (LOR 0.1 NTU)	925	212.00	24.30	NT	94.16	NT	56.9	59.5	64.5	545	255	158

KEY	
Notification Level	LOR - limit of reporting
Action level	NT - not tested

Table 9.5: Trigger based sampling results from Point 5 – GMSRR for 2013/14.

Point 5 - GMSRR												
Analyte	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
alpha-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Atrazine LOR (<0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	0.035	2.45
beta-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Chlorpyrifos (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	0.020	0.009
Diazinon (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	<0.005
Diuron (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	0.180	0.120	0.386	3.70
Electrical Conductivity @ 25°C	NT	NT	NT	NT	NT	NT	NT	NT	180.00	NT	433.00	446.00
Endosulfan sum (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Malathion (LOR <0.002µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.002	0.004	<0.002	<0.002
Metolachlor (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	0.014
Molinate (LOR <0.002µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	0.011
Nitrite + Nitrate as N (LOR 0.01 mg/L	NT	NT	NT	NT	NT	NT	NT	NT	3.48	0.61	0.02	2.94
pH Value	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	8.23	7.52
Simazine (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	0.045	0.038	<0.546	9.21
Thiobencarb (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	<0.005
Tot Kjeldahl Nitrogen N (LOR 0.1 mg/	NT	NT	NT	NT	NT	NT	NT	NT	2.7	2.3	0.8	1.9
Total Nitrogen as N (LOR 0.1 mg/L)	NT	NT	NT	NT	NT	NT	NT	NT	6.2	2.9	0.8	4.8
Total Phosphorus as P (LOR 0.1 mg/L	NT	NT	NT	NT	NT	NT	NT	NT	0.24	0.23	0.07	0.46
Trifluralin (LOR <0.005µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	0.019	<0.010	<0.010
Turbidity (LOR 0.1 NTU)	NT	NT	NT	NT	NT	NT	NT	NT	614	247	147	247

KEY	
Notification Level	LOR - limit of reporting
Action level	NT - not tested

Table 9.6: Trigger based sampling results from Point 6 – YMS for 2013/14.

Point 6 - YMS												
Analyte	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Atrazine LOR (<0.005µg/L)	NT	NT	0.247	NT	NT	NT	NT	NT	0.013	0.029	<0.010	0.049
beta-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Chlorpyrifos (LOR <0.005µg/L)	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	0.011
Diazinon (LOR <0.005µg/L)	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	<0.005
Diuron (LOR <0.005µg/L)	NT	NT	0.690	NT	NT	NT	NT	NT	<0.005	<0.005	0.052	0.700
Electrical Conductivity @ 25°C	NT	NT	199.00	NT	NT	NT	NT	NT	259.00	292.00	788.00	402.00
Endosulfan sum (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Malathion (LOR <0.002µg/L)	NT	NT	<0.002	NT	NT	NT	NT	NT	<0.002	<0.002	<0.002	<0.002
Metolachlor (LOR <0.005µg/L)	NT	NT	<0.005	NT	NT	NT	NT	NT	0.034	0.126	0.013	0.027
Molinate (LOR <0.002µg/L)	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	<0.005
Nitrite + Nitrate as N (LOR 0.01 mg/L	NT	NT	1.20	NT	NT	NT	NT	NT	0.65	0.14	0.08	1.78
pH Value	NT	NT	7.70	NT	NT	NT	NT	NT	NT	NT	7.97	7.67
Simazine (LOR <0.005µg/L)	NT	NT	6.66	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	1.37
Thiobencarb (LOR <0.005µg/L)	NT	NT	<0.005	NT	NT	NT	NT	NT	<0.005	<0.005	<0.005	<0.005
Tot Kjeldahl Nitrogen N (LOR 0.1 mg/	NT	NT	2.2	NT	NT	NT	NT	NT	1.0	2.6	0.9	2.2
Total Nitrogen as N (LOR 0.1 mg/L)	NT	NT	3.4	NT	NT	NT	NT	NT	1.6	2.7	1.0	4.0
Total Phosphorus as P (LOR 0.1 mg/L	NT	NT	0.16	NT	NT	NT	NT	NT	0.12	0.32	0.08	0.36
Trifluralin (LOR <0.005µg/L)	NT	NT	<0.010	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	<0.010
Turbidity (LOR 0.1 NTU)	NT	NT	142.90	NT	NT	NT	NT	NT	499	318	105	368

KEY	
Notification Level	LOR - limit of reporting
Action level	NT - not tested

Table 9.7: Trigger based sampling results from Point 7 – ROCUDG for 2013/14

Point 7 - ROCUDG												
Analyte	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
alpha-Endosulfan	NT	NT	NT	NT	<0.5	NT	<0.010	<0.010	<0.010	NT	<0.010	<0.010
Atrazine LOR (<0.005µg/L)	NT	<0.005	0.007	NT	0.009	NT	<0.005	<0.005	<0.005	NT	0.009	0.037
beta-Endosulfan (LOR 0.01µg/L)	NT	NT	NT	NT	<0.5	NT	<0.010	<0.010	<0.010	NT	<0.010	<0.010
Chlorpyrifos (LOR <0.005µg/L)	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	NT	<0.005	<0.005
Diazinon (LOR <0.005µg/L)	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	NT	<0.005	<0.005
Diuron (LOR <0.005µg/L)	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	NT	<0.005	2.30
Electrical Conductivity @ 25°C	NT	105.00	108.00	NT	123.30	NT	109	116	89	NT	102	165.00
Endosulfan sum (LOR 0.01µg/L)	NT	NT	NT	NT	NT	NT	<0.010	<0.010	<0.010	NT	<0.010	<0.010
Endosulfan sulfate (LOR 0.01µg/L)	NT	NT	NT	NT	<0.5	NT	<0.010	<0.010	<0.010	NT	<0.010	<0.010
Malathion (LOR <0.002µg/L)	NT	<0.002	<0.002	NT	<0.002	NT	<0.002	<0.002	<0.002	NT	0.004	<0.002
Metolachlor (LOR <0.005µg/L)	NT	<0.005	<0.005	NT	0.009	NT	<0.005	<0.005	<0.005	NT	<0.005	0.037
Molinate (LOR <0.002µg/L)	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	NT	<0.005	<0.005
Nitrite + Nitrate as N (LOR 0.01 mg/L	NT	0.01	0.01	NT	0.02	NT	0.02	0.03	0.03	NT	0.05	4.47
pH Value	NT	NT	7.93	NT	NT	9.26	NT	NT	NT	NT	NT	7.74
Simazine (LOR <0.005µg/L)	NT	<0.005	0.058	NT	0.009	NT	0.008	<0.005	0.006	NT	0.015	1.91
Thiobencarb (LOR <0.005µg/L)	NT	<0.005	<0.005	NT	<0.005	NT	<0.005	<0.005	<0.005	NT	<0.005	<0.005
Tot Kjeldahl Nitrogen N (LOR 0.1 mg/	NT	1.0	0.9	NT	0.6	NT	0.6	0.4	0.6	NT	0.2	1.5
Total Nitrogen as N (LOR 0.1 mg/L)	NT	1.0	0.9	NT	0.6	NT	0.6	0.4	0.6	NT	0.2	6.0
Total Phosphorus as P (LOR 0.1 mg/L	NT	0.12	0.16	NT	0.24	NT	0.20	0.10	0.08	NT	0.03	0.30
Trifluralin (LOR <0.005µg/L)	NT	<0.010	<0.010	NT	<0.010	NT	<0.010	<0.010	<0.010	NT	0.019	<0.010
Turbidity (LOR 0.1 NTU)	NT	40.2	43.40	NT	31.60	NT	25.3	19.6	23.6	NT	14.0	226

KEY	
Notification Level	LOR - limit of reporting
Action level	NT - not tested

Historical comparisons of Diuron and Metolachlor detections recorded at LAG are presented in Table 9.8. The number of detections for these two chemicals has continued to increase when compared to previous years. A higher number of detections can be a result of increased sampling events following an increase of flow and rainfall triggers, which occurred during 2013/14.

A detailed monitoring investigation at LAG is proposed for 2014/15 after 2013/14 results identified trends of increasing *notification* and *action* level detections. This investigation will build on previous data collected from this site and will to focus on identifying source of contamination land use factors and potential opportunities to reduce flow through this site

Table 9.8: Historical Diuron and Metalochlor trends at Point 4 – LAG.

Point 4 - LAG	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2012/13												
Diuron (LOR <0.005µg/L)	0.112	0.719	<0.005	NT	0.107	NT	1.78	0.102	0.046	245	11.3	47.9
Metolachlor (LOR <0.005µg/L)	<0.005	0.029	<0.005	NT	0.027	NT	0.083	0.455	0.017	0.082	0.104	0.601
2012/13												
Diuron (LOR <0.005µg/L)	NT	NT	0.554	0.282	0.987	2.9	NT	NT	NT	NT	NT	NT
Metolachlor (LOR <0.005µg/L)	NT	NT	0.029	0.881	0.131	0.008	NT	0.054	NT	NT	NT	NT
2011/12												
Diuron (LOR <0.005µg/L)	NT	NT	NT	NT	0.027	NT	0.739	4.68	20.4	<0.005	NT	NT
Metolachlor (LOR <0.005µg/L)	NT	NT	NT	NT	<0.005	NT	0.018	0.402	NT	<0.005	NT	NT
2005/06												
Diuron (LOR <0.005µg/L)	0.3	NT	0.4	NT	NT	0.5	NT	<0.005	<0.005	0.3	NT	NT
Metolachlor (LOR <0.005µg/L)	NT	NT	0.2	NT	NT	0.5	NT	NT	NT	NT	NT	NT

KEY	
Notification Level	LOR - limit of reporting
Action level	NT - not tested

10. OTHER MONITORING AND REPORTING

Risk based water quality monitoring is conducted throughout the year. This monitoring is triggered by irrigation season, rainfall or pollution incidents.

10.1 WATER QUALITY BENCHMARK SAMPLING

Water quality benchmark (or baseline) data is collected to monitor the quality of water within the supply and drainage system at the start, middle and end of the irrigation season. Monitoring sites are representative of key risk areas that have the potential to impact on water quality during the irrigation season and are monitored to identify potential water quality issues associated with irrigation farming in the MIA. This benchmark sampling program has been in operation since 2008. The samples are analysed for physicochemical parameters, pesticides and nutrients and results are used to assess the performance of MI against EPL trigger levels. Laboratory results detected no trace level residues of chemicals (Table 9.2) at or above EPA notification levels during 2013/14.

Following a recent review of MI's internal Risk Based Monitoring Program, additional sites have been added to current sampling regimes and triggers re-evaluated to provide a comprehensive approach to identifying potential risks to water quality. This program will be implemented and trailled during 2014/15 season. Automated flow and water quality monitoring devices are also proposed for 2014/15 at key monitoring sites to assist in identifying water quality trends in both supply and drainage channels.

10.2 BLUE-GREEN ALGAE

Blue-green algae were detected in the Barren Box Active Cell in February 2014. Notifications were sent out to customers regarding this. Monitoring was conducted in accordance with the Murrumbidgee Regional Algal Coordinating Committee (RACC) Contingency Plan. Monitoring will recommence prior to the start of irrigation 2014/15 season to ensure early detection of blue-green algae, if it is to re-occur.

10.3 CHEMICAL USE

MI maintains a register that records details of every herbicide application in or near waters as per the EPL requirements. The register is maintained with MI's Asset Man system which is also accessible to all MI staff.

Herbicide application queries are recorded within Asset Man which outlines details, relevant photos and action taken. This register is available for inspection by authorised EPA personnel on request.

11. RECORDING OF COMPLAINTS

MI operates the business telephone line as a source to receive complaints from members of the public in relation to EPL requirements.

All complaints and concerns relating to pollution are recorded in a pollution register database as per EPL requirements. This database allows MI to record all the necessary details to better understand the nature of the complaint and to identify possible actions to limit the potential for further risk of pollution. This register is available for inspection by authorised EPA personnel on request.

12. REFERENCES

Murrumbidgee Irrigation online monitoring (managed by Thiess Hydrographic Services).
https://www.usutilityservices.com/sites/murrumbidgee/default.aspx

irriGATEWAY Weatherstations (managed by CSIRO)
http://weather.irrigateway.net/aws/index.php?aws_id=8&view=14day

New South Wales Office of Water, *Rivers and streams real time data*- M/Bidgee R @ Wagga
http://realtimedata.water.nsw.gov.au/water.stm

Murrumbidgee Irrigation Limited
http://www.mirrigation.com.au/

13. GLOSSARY

ANZECC	Australian and New Zealand Environment and Conservation Council
BBSW	Barren Box Storage and Wetland
CSIRO	Commonwealth Scientific Investigation and Research Organisation
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Reference Evapotranspiration
GIS	Geographic Information System
GL	Gigalitre
ha	Hectare(s)
LCR	Licence Compliance Report
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	MicroSiemens per centimetre
ML	Megalitre
NOW	New South Wales Office of Water
OEH	Office of Environment and Heritage
pH	Potential hydrogen
SOP	Standard Operating Procedure
T	Tonnes
TN	Total nitrogen
TP	Total phosphorus
TSS	Total soluble salts

14. APPENDIX

APPENDIX 1 - MURRUMBIDGEE IRRIGATION LTD - FLOW AND SALT LOAD MONITORING ANNUAL REPORT - JULY 2014

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Document History and Status

Revision	Date issued	Reviewed by	Approved by	Date Approved	Revision type
1	17/07/2014	K Bootland	G Ryan	17/07/2014	Final Report

Distribution of copies

Revision	Copy No.	Quantity	Issued to
Final	1	1	Murrumbidgee Irrigation
Final	2	1	Thiess Services Tatura
Final	3	1	Thiess Services Burwood

Printed	17/07/2014
Last saved	15/10/2014 3:14:00 PM
File name	0456Rpt.docx
Author	K Bootland
Project manager	G Ryan
Name of organisation	Murrumbidgee Irrigation
Name of project	MI – Drain Sites
Name of document	Flow and Salt Load Monitoring
Document version	Final Report
Project number	4047
Copy No	1

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4.0 Annual Site Visit Summary

1.0 Introduction

Thiess Environmental Monitoring Group is contracted by Murrumbidgee Irrigation Limited to conduct continuous level/flow and salinity monitoring at a range of locations distributed across their area of operations.

This report presents monthly statistics and annual summaries of total flow and salt load derived from the monitoring at drain sites for the 2013 – 2014 financial year.
Site 410083 contains no flow or salt load data as the rating table was suspended as of the 01/06/2010-present due to the installation of new gates.

All data reported is extracted from Thiess Hydstra software archive to an accuracy of three (3) significant figures.

A data extraction process called HYTAB is used when extracting the data. HYTAB utilises a configuration file provided by MIL to format the data. This file stipulates reporting to four (4) significant figures. Using four significant figures implies an unrealistic level of accuracy for the data collection processes undertaken Thiess data reporting standards would recommend a maximum of three (3) significant figures.

2.0 Annual Flow Summaries

Site	410083	YANKO MAIN SOUTHERN DRAIN @ OUTFALL (YMS)									Site	410083
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Inst.Max	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Inst.Min	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S

Site	410085	LITTLE MIRROOL CREEK D/S GOGELDRIE MAIN DRAIN (LMC)									Site	410085
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[12.0]	13.8R	83.0R	55.9K	59.0	80.7	73.2	63.1	90.4	47.3	25.0	41.0
Median	[7.2]	11.2R	59.1R	55.9K	54.5	78.7	64.1	57.6	57.9	27.6	20.2	24.9
Inst.Max	[105]	55.6R	548 R	89.4K	93.9	130	266	165	488	222	117	288
Inst.Min	[3.7]	2.0R	23.1R	31.7K	37.7	56.0	40.5	32.1	35.8	10.1	12.0	9.3
Total	[313.1]	427.0 R2489		R1732	K1769	2501	2269	1767	2803	1420	774.6	1230

Site	41010005	CUDGEL CREEK @ ROACHES OUTFALL (ROCUDG)									Site	41010005
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	13.3R	1.2R	2.0R	0.7R	2.9R	2.8R	10.2	8.5	7.9	9.1	5.1	[3.2]
Median	0.5R	1.2R	0.8R	0.2R	2.2R	1.6R	9.6	7.7	7.6	9.3	4.3	[2.9]
Inst.Max	103 R	3.7R	14.9R	3.4R	14.0R	20.5R	21.6	15.9	16.2	14.6	9.1	[5.8]
Inst.Min	0.0R	0.0R	0.3R	0.0R	0.0R	0.4R	4.0	3.7	2.7	3.6	2.7	[2.0]
Total	411.9 R	37.58 R	59.76 R	20.48 R	87.83 R	88.47 R	315.9	236.9	245.6	273.7	157.5	[63.81]

Site	41010713	DC CUDMORE U/S BARRENBOX OUTFALL									Site	41010713
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	2.2R	0.5R	3.0R	1.6R	2.7R	1.1R	0.0R	0.0R	[0.0]	[0.1]	0.8R	0.7R
Median	0.0R	0.1R	1.7R	1.3R	0.4R	0.0R	0.0R	0.0R	[0.0]	[0.1]	0.3R	0.0R
Inst.Max	22.7R	7.9R	14.4R	10.0R	15.4R	10.0R	0.0R	0.0R	[0.3]	[0.6]	5.3R	9.6R
Inst.Min	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R
Total	67.52 R	16.25 R	91.62 R	50.12 R	80.16 R	34.27 R	0.000R	0.000R	[0.316]	[2.362]	24.84 R	21.53 R

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN @ RIVER ROAD (GMSRR)									Site	41010921
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.0R	0.0R	0.0R	0.1R	0.1R	0.0R	0.0R	0.0R	1.4R	0.0R	0.0R	0.0R
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Inst.Max	0.0R	0.0R	0.0R	1.0R	2.5R	0.1R	0.0R	0.0R	44.4R	0.0R	0.0R	5.3R
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Total	0.000R	0.000R	0.000R	2.894R	1.596R	0.050R	0.000R	0.000R	42.28 R	0.000R	0.000R	1.017R

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)									Site	41010940
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.8R	0.3R	1.5R	0.8R	0.4R	0.0R	1.3R	1.2R	4.1R	0.5R	0.0R	0.8R
Median	0.0R	0.0R	0.1R	0.2R	0.0R	0.0R	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R
Inst.Max	26.1R	11.4R	10.2R	21.1R	12.0R	0.0R	42.6R	11.4R	68.5R	5.6R	0.3R	16.0R
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Total	26.22 R	9.614R	44.54 R	24.43 R	12.10 R	0.000R	40.82 R	34.78 R	126.3 R	14.98 R	0.119R	22.76 R

Site	41010955	WILLOW DAM (MIRROOL CREEK) @ MCNAMARA ROAD (MIRMCN)										Site	41010955
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2013/14
Year	2013/14												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	124	120	304	488	370	659	484	533	346	193	208 L	239	
Median	65.5	133	263	454	381	664	473	488	330	182	195 L	180	
Inst.Max	506	300	802	801	851	907	856	1040	760	524	470 L	631	
Inst.Min	23.4	31.3	147	182	171	319	276	212	173	69.6	86.5L	51.2	
Total	3840	3723	9129	15140	11100	20440	15000	14930	10740	5798	6434	L7175	

Site	410164	DC 13 ESCAPE U/S BARRENBOX OUTFALL										Site	410164
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2013/14
Year	2013/14												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[0.1]	3.7R	[15.9]	[12.0]	8.6R	8.5R	10.2R	[9.1]	10.3R	7.3R	6.0R	7.6R	
Median	[0.0]	2.2R	[14.4]	[12.2]	8.1R	8.5R	11.9R	[8.5]	8.5R	7.3R	5.8R	2.3R	
Inst.Max	[2.4]	14.6R	[36.1]	[27.8]	18.6R	18.3R	19.3R	[22.9]	22.6R	18.6R	14.4R	31.0R	
Inst.Min	[0.0]	0.0R	[5.8]	[0.7]	0.6R	0.4R	2.2R	[1.0]	1.9R	0.1R	0.4R	0.0R	
Total	[2]	115R	[460]	[301]	258R	263R	315R	[172]	320R	219R	186R	227R	

Site	410167	BARRENBOX OUTFALL D/S BENEREMBAH OUTFALL (BBOW)										Site	410167
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2013/14
Year	2013/14												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	10.3	39.7	129	222	201	228	[250]	187	132	175	123	36.4	
Median	7.7	31.2	139	236	193	214	[270]	176	133	182	122	34.4	
Inst.Max	79.1	169	224	389	323	388	[383]	409	264	250	192	141	
Inst.Min	-23.5	-17.9	20.4	57.6	103	85.2	[49.2]	21.2	12.8	78.3	60.2	-17.0	
Total	321	1231	3882	6891	6041	7059	[5254]	5238	4080	5261	3811	1093	

Site	41017001	M.I.A.DR @ D.C. WIDGELLI									Site	41017001
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.6	0.0	5.8	0.1	0.0	0.0	0.3	0.0	0.8	1.0	0.0	0.2
Median	0.1	0.0	0.7	0.1	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.1
Inst.Max	8.1	0.2	137	0.3	0.0	0.2	1.5	0.1	15.4	10.2	0.2	1.3
Inst.Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	19.70	1.122	175.4	3.680	0.000	0.140	9.185	0.221	25.25	29.42	1.263	6.686

Site	410172	DC CENTRAL DRAIN									Site	410172
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[2.2]	[0.3]	[2.5]	2.6R	0.6R	4.5R	0.5R	4.0R	0.4R	0.4R	0.5R	3.0R
Median	[0.5]	[0.3]	[1.1]	1.0R	0.3R	1.3R	0.0R	0.0R	0.0R	0.4R	0.5R	1.3R
Inst.Max	[13.9]	[0.4]	[11.1]	13.1R	15.7R	20.7R	16.7R	33.8R	8.3R	1.5R	2.4R	20.4R
Inst.Min	[0.1]	[0.1]	[0.1]	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R	0.1R	0.2R
Total	[45.30]	[1.610]	[61.80]	80.69 R	18.21 R	141.2 R	14.72 R	112.6 R	11.49 R	11.94 R	16.36 R	88.83 R

Site	410174	MAIN DRAIN J @ MCNAMARA ROAD (MDJWE)									Site	410174
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	21.1R	52.7R	153 R	206	[183]	290 R	277 R	[247]	210 R	120 R	126 R	106 R
Median	11.5R	39.2R	152 R	204	[190]	285 R	276 R	[239]	205 R	114 R	119 R	90.7R
Inst.Max	463 R	157 R	484 R	329	[671]	471 R	631 R	[429]	422 R	426 R	358 R	462 R
Inst.Min	5.6R	6.1R	60.5R	90.9	[17.8]	192 R	188 R	[157]	134 R	77.0R	81.9R	58.2R
Total	654.1 R	1634 R	4602 R	6392	5293]	8978 R	8581 R	6676]	6510 R	3611 R	3904 R	3189 R

3.0 Annual Salt Load Summaries

Site	410083	YANKO MAIN SOUTHERN DRAIN @ OUTFALL (YMS)									Site	410083
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Median	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Inst.Max	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Inst.Min	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S
Total	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S

Site	410085	LITTLE MIRROOL CREEK D/S GOGELDRIE MAIN DRAIN (LMC)									Site	410085
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[4.0]	4.5R	17.3R	[8.3]	[6.6]	[ ]M	[9.7]	8.0	12.0	8.8	5.6	8.5
Median	[2.1]	3.3R	13.0R	[8.6]	[6.6]	[ ]M	[8.4]	6.8	7.1	5.6	4.5	6.1
Inst.Max	[60.7]	17.4R	94.1R	[15.9]	[9.7]	[ ]M	[40.3]	27.2	76.4	50.3	30.7	69.8
Inst.Min	[0.9]	1.3R	5.7R	[3.8]	[5.0]	[ ]M	[4.9]	3.9	4.5	2.6	2.5	-0.1
Total	[104]	140R	518R	[250]	[13]	[ ]M	[223]	225	372	264	173	255

Site	41010005	CUDGEL CREEK @ ROACHES OUTFALL (ROCUDG)									Site	41010005
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	1.1R	0.1R	0.2R	0.1R	0.3R	0.2R	0.8	0.6L	0.4	0.5	0.5	[0.3]
Median	0.0R	0.1R	0.1R	0.0R	0.2R	0.1R	0.7	0.5L	0.4	0.5	0.4	[0.3]
Inst.Max	8.0R	0.3R	1.7R	0.5R	1.9R	2.0R	1.9	1.2L	0.9	0.8	0.7	[0.6]
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3	0.3L	0.1	0.2	0.3	[0.2]
Total	33R	3R	7R	3R	9R	7R	25	15L	13	15	14	[7]

Site	41010713	DC CUDMORE U/S BARRENBOX OUTFALL								Site	41010713
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release								Year	2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	1.1R	0.2R	0.9R	0.4R	0.3R	0.1R	0.0R	0.0R	[0.0]	[0.0]	0.2R	0.4R
Median	0.0R	0.0R	0.5R	0.3R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.1R	0.0R
Inst.Max	11.2R	3.8R	4.5R	2.5R	1.9R	1.1R	0.0R	0.0R	[0.1]	[0.1]	1.9R	7.0R
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	[0.0]	0.0R	0.0R
Total	34R	5R	26R	11R	9R	2R	0R	0R	[0]	[0]	7R	11R

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN @ RIVER ROAD (GMSRR)								Site	41010921
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release								Year	2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.2R	0.0R	0.0R	0.0R
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Inst.Max	0.0R	0.0R	0.0R	0.1R	0.3R	0.0R	0.0R	0.0R	5.7R	0.0R	0.0R	0.7R
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Total	0R	0R	0R	0R	0R	0R	0R	0R	5R	0R	0R	0R

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)								Site	41010940
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release								Year	2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.2R	0.1R	0.2R	[0.1]	0.0R	0.0R	0.5R	0.2R	0.6R	0.1R	0.0R	0.2R
Median	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Inst.Max	4.9R	4.3R	2.4R	[2.7]	0.5R	0.0R	17.8R	2.4R	12.7R	1.7R	0.1R	5.4R
Inst.Min	0.0R	0.0R	0.0R	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R
Total	5R	3R	7R	[3]	1R	0R	16R	6R	19R	3R	0R	7R

Site	41010955	WILLOW DAM (MIRROOL CREEK) @ MCNAMARA ROAD (MIRMCN)									Site	41010955
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year	2013/14
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	26.6	29.9	58.1	57.4	45.7	58.8	[57.8]	[46.8]	37.7	34.2	36.7L	51.7K
Median	24.4	32.9	53.4	47.3	41.3	54.0	[58.8]	[43.8]	34.2	31.5	33.5L	42.3K
Inst.Max	132	71.1	153	107	203	109	[78.5]	[109]	106	96.1	97.3L	118 K
Inst.Min	6.6	11.5	23.7	28.9	19.9	21.1	[34.4]	[22.7]	13.8	10.9	13.7L	20.6K
Total	825	927	1742	1780	1370	1822	[463]	[1077]	1168	1025	1137L	1550K

Site	410164	DC 13 ESCAPE U/S BARRENBOX OUTFALL									Site	410164
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, 6th sensor avail releaseYear										
2013/14												
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[0.0]	1.1R	[2.6]	[1.6]	0.8R	0.9R	1.0R	[1.0]	1.3R	1.2R	1.2R	1.5R
Median	[0.0]	0.6R	[2.5]	[1.7]	0.8R	1.0R	1.1R	[0.9]	1.1R	1.2R	1.1R	0.4R
Inst.Max	[0.6]	9.5R	[6.8]	[3.8]	2.1R	2.3R	2.4R	[2.3]	3.9R	3.7R	3.5R	7.1R
Inst.Min	[0.0]	0.0R	[1.0]	[0.1]	0.1R	0.0R	0.2R	[0.1]	0.2R	0.0R	0.1R	0.0R
Total	[0]	35R	[75]	[40]	24R	28R	32R	[19]	39R	37R	36R	45R

Site	410167	BARRENBOX OUTFALL D/S BENEREMBAH OUTFALL (BBOW)									Site	410167
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, 6th sensor avail releaseYear										
2013/14												
Year	2013/14											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	2.7	11.5	31.3	47.4	33.9	27.1	[43.8]	29.9	16.1K	29.5K	21.3	8.6
Median	2.1	10.1	28.3	45.6	34.9	20.8	[52.0]	25.4	15.3K	29.9K	21.5	7.7
Inst.Max	20.1	55.9	66.0	85.2	57.7	75.7	[92.8]	95.2	36.6K	42.9K	34.3	44.9
Inst.Min	-7.6	-7.6	3.4	11.8	13.9	7.9	[6.2]	2.1	1.4K	13.9K	11.4	-2.9
Total	85	357	939	1468	1016	841	[920]	838	499K	885K	661	257

Site	41017001	M.I.A.DR @ D.C. WIDGELLI									Site 41017001
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year 2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.2	0.0	1.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.1?
Median	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1?
Inst.Max	2.4	0.1	20.4	0.1	0.0	0.1	0.3	0.0	2.4	5.4	0.0	0.8?
Inst.Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0?
Total	5	0	31	1	0	0	2	0	4	6	0	3?

Site	410172	DC CENTRAL DRAIN									Site 410172
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year 2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	[0.7]	[0.1]	[0.5]	0.5R	0.1R	0.6R	0.0R	0.4R	0.1R	0.1R	0.2R	0.8R
Median	[0.2]	[0.1]	[0.3]	0.2R	0.1R	0.3R	0.0R	0.0R	0.0R	0.1R	0.2R	0.4R
Inst.Max	[11.9]	[0.2]	[2.5]	2.7R	3.1R	3.6R	1.6R	4.0R	1.6R	0.5R	0.5R	6.4R
Inst.Min	[0.1]	[0.1]	[0.0]	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R
Total	[14]	[1]	[13]	16R	4R	17R	1R	10R	3R	3R	6R	23R

Site	410174	MAIN DRAIN J @ MCNAMARA ROAD (MDJWE)									Site 410174
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release									Year 2013/14
Year	2013/14										
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	9.4R	14.7R	32.1R	33.2	[28.8]	34.8R	33.2R	[29.0]	23.6R	23.7R	24.5R	35.1R
Median	6.5R	14.9R	31.4R	29.9	[29.0]	34.2R	30.8R	[25.0]	23.9R	20.8R	24.1R	33.4R
Inst.Max	124 R	42.7R	105 R	61.4	[132]	103 R	93.6R	[74.0]	54.0R	97.3R	70.8R	92.1R
Inst.Min	2.3R	4.1R	13.5R	17.4	[3.2]	21.6R	22.6R	[16.0]	12.0R	10.8R	11.4R	21.2R
Total	290R	454R	964R	1028	[836]	1079R	1031R	[784]	732R	712R	759R	1054R

4.0 Annual Site Visit Summary

SI No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
410083	YMS	12	12	0	No Measurements done as there was no flow observed. All flow returned to Sturt Canal via recycle channel		Some issues with site power ,rectified later in the year by increasing the solar Generation.
410085	LMC	12	12	5	Good range of measurements conducted the later indicating a change in the rating may be required	1 EC SENSOR	Well pumped again this season, experienced issues with the Telstra GSM network so the integrations of the site in the SCADA network should be completed by late July 14 in conjunction of the installation of the new cabinet and slide . This will remove any OH&S issues with entering the well or climbing the ladder to the hut.
410164	BOD1	13	12	0	Difficult to take accurate measurements due to large x-sectional area and very slow velocities.		Site has been flowing for a larger part of the year than previous, but still not connected to the SCADA network
410167	BBOW	12	12	4	All measurement have confirmed the indexing equation in the logger		The site will be integrated into the SCADA radio network this July. Site has general given good results this year with less than previous year's period where the SW has been effected by weed over the velocity sensor.
410172	DCCENT	12	11	1	All flows observed at the time of visits were very low.	1 Logger	Logger battery leaked loss of a month's data replaced logger with MI spare Recommend site upgrade for the next year.
410174	MDJWE	13	12	8	Site has had an unexpected change of the control shape So earlier measurements where of lesser value		Later measurement have started to give enough data to produce new rating of the site ,Integrations to the SCADA network to be completed by July 2014..
41010005	ROCUDG	12	12	5	The rating for the Site has need review again this year	Logger sent For inspection	Installation of new road bridge downstream of the site has removed the possibility of debris building up as was the case with the old structure .Some periods of lost data due to shading of the solar panel and overcast weather conditions.

SI No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
						calibration	
41017001	DCWIDG	12	12	0	Only very low flow rates at time of visits	1 level sensor	Sensor replaced with MI spare.
41010713	DCCUD	12	12	2	Rating has been reviewed this season .Livestock entering drain have created some issues this season effecting the rating and getting stuck in the sump D/S of the V notch weir plate	1 level sensor	Level sensor changed due to a larger that acceptable amount of drift in the reading by the end of the period, Sensor was an old unit and no longer supported by the Manufacturer, so a new unit needed to be purchased.
41010921	GMSRR	12	12	0	Site has had insufficient flow during the season to allow a discharge measurement to be taken		Replaced 0 to 1 meter gauge board, site would be improved if integration to SCADA was possible this coming season, short period of data coded " as site backed up due to debris built up" on the control after a sudden rain event. Also some form of more permanent steps make be required to improve access to the gauges and for WQ sampling
41010940	LAG	12	12	3	Site has had a rating review during the year due to a change to the CTF value	1 level sensor	Level sensor changed to improve reliability of the data that triggers the Alarm when the flow reaches the" require to sample rate "Also some work to stabilize the control will be carried out when the equipment is available, beaching of the drain bed to improve the stability of the control. Also some form of more permanent steps make be required to improve access to the gauges and for WQ sampling
41010955	MIRMCN	13	12	4	Site has given good results During the period except when debris has built up on the bridge pylons creating an artificially high water level	1 EC sensor Replaced with MI spare.	On one occasion dead animals have been found D/S of the site unsure if it had been dump or had just drowned while drinking some ware upstream. The walk way to the Water Quality sensors is showing signs of deterioration and could possibly be removed and replaced by a sensor slide that follow the contour of the bank along with the installation of some steps, this could possibly be a better option that replacing the walkway , this is a similar problem at MDJWE 410174.
			TOTALS	32		6	
General Comments :							Signature: S HALL.

APPENDIX 2 – LISTING AND CONDITION OF PIEZOMETERS USED FOR GROUNDWATER MONITORING

BORE_ID	USE	TOP OF PIPE ABOVE NS (m)	NATURAL SURFACE (m AHD)	TOP OF PIPE (m AHD)	DEPTH BELOW TOP OF PIPE	EASTING	NORTHING	CONDITION
G1800	N	0.66	131.12	132.21	0.63	426273.87	6204528.85	
G2452	N	0.50	125.66	126.82	0.27	418059.03	6196220.83	
L1762D	N	0.39	134.51	135.54	0.43	437330.00	6178067.00	
L1762S	N	0.76	134.51	135.93	0.79	437329.00	6178065.00	
L1764D	N	0.63	135.66	137.08	0.67	436827.00	6174767.00	
L1764M	N	0.65	135.66	137.11	0.70	436825.00	6174768.00	
L1826D	N	0.57	133.09	134.32	0.55	433910.00	6177684.00	
L1826S	N	0.39	133.09	134.18	0.40	433911.00	6177685.00	
L1854D	N	0.55	134.54	135.60	0.58	432237.00	6172929.00	
L1854S	N	0.30	134.54	135.35	0.34	432232.00	6172932.00	
L1861D	N	0.26	133.63	134.60	0.34	431908.00	6170836.00	
L1861S	N	0.45	133.63	134.79	0.52	431905.00	6170831.00	
L1963S	N	0.39	131.50	132.76	0.46	429406.00	6178287.00	
L1982D	N	0.66	131.48	132.80	0.67	427509.00	6171809.00	
L1982S	N	0.21	131.48	132.37	0.24	427501.00	6171806.00	
L2329D	N	0.23	136.60	137.66	0.52	441441.00	6177124.00	
L2329S	N	0.19	136.60	137.67	0.52	441441.00	6177124.00	
L2367D	Y	0.00	139.16	139.88	0.34	445590.00	6170040.00	out
L1536D	N	0.28	129.10	130.10	0.40	422354.00	6184163.00	
L1536S	N	0.44	129.10	130.10	0.40	422354.00	6184164.00	
L2117D	N	0.24	129.96	130.82	0.25	425340.00	6181538.00	
L2117S	N	0.24	129.96	130.81	0.23	425340.00	6181539.00	
L1709D	N	0.11	133.62	134.81	0.21	438075.00	6183059.00	
L1709S	N	0.24	133.62	135.06	0.46	438075.00	6183060.00	

L1732S	N	0.16	133.51	134.46	0.21	438791.00	6187947.00	
L1813D	N	0.31	132.15	133.21	0.34	434609.00	6182653.00	
L1813M	N	0.00	132.15	133.50	0.64	434609.00	6182654.00	
L1813S	N	0.17	132.15	133.05	0.18	434610.00	6182652.00	
L2047D	N	0.17	132.10	133.15	0.21	435124.00	6186223.00	
L2047S	N	0.42	132.10	133.16	0.21	435126.00	6186224.00	
L1924D	N	0.31	132.28	132.89	0.27	431802.00	6189657.00	
L1924S	N	0.36	132.28	132.90	0.30	431805.00	6189654.00	
L1946D	N	0.26	131.84	132.23	0.23	430805.00	6182435.00	
L1946S	N	0.48	131.60	132.45	0.43	430807.00	6182437.00	
L2131D	N	0.22	129.38	130.27	0.34	426225.00	6187716.00	
L2131S	N	0.17	129.38	130.24	0.30	426232.00	6187720.00	
L2139S	N	0.39	128.94	129.77	0.34	426854.00	6191920.00	
G543	N	0.10	112.55	112.38	0.21	395221.50	6217740.77	
G670	N	0.10	116.30	117.53	0.10	401128.84	6206997.40	
G1216	N	0.37	113.01	113.50	0.10	400686.15	6216988.30	
G2279	N	0.19	117.03	118.12	0.64	400345.57	6210179.77	
G304	N	0.60	121.10	121.88	0.40	405345.48	6189304.36	
G305	N	0.30	121.10	121.85	0.39	405348.20	6189307.71	
G2698	N	0.00	117.36	117.28	0.20	392933.36	6201163.45	
G2862	N	0.05	119.78	120.52	0.05	397432.20	6196440.53	
G2863	N	0.10	119.78	120.53	0.06	397426.57	6196450.45	
G522	N	0.26	111.52	112.15	0.37	386595.33	6219441.77	
G523	N	0.00	0.00	112.08	0.30	386480.00	6219270.00	
G534	N	0.38	113.38	113.79	0.14	392942.92	6211275.97	
G2341	N	0.25	114.18	114.69	0.27	385185.68	6199890.29	
G1172D	N	0.00	110.75	111.14	0.15	385592.05	6211815.80	
G1172S	N	0.00	110.75	111.19	0.20	385591.10	6211818.01	
G1189D	N	0.00	112.12	112.60	0.14	384304.21	6202199.66	

G1189S	N	0.00	112.12	112.69	0.23	384305.11	6202200.78	
G1400	N	0.00	0.00	125.38	0.17	412089.93	6187827.80	
G1661	N	0.10	123.65	124.22	0.19	409053.36	6186004.26	
G1662	N	0.10	123.65	124.14	0.11	409061.64	6186003.23	
L1951	N	0.35	135.66	136.84	0.52	421798.60	6184791.38	
L1952	N	0.00	0.00	136.44	0.79	421799.38	6184789.83	
G2767	N	0.00	0.00	126.37	0.13	417670.31	6189898.26	
G2768	N	0.00	0.00	126.39	0.15	417670.31	6189898.26	
G2772	Y	0.00	0.00	126.70	0.30	416500.00	6185180.00	out
G1779	N	0.45	131.12	132.00	0.41	426273.87	6204528.85	
L1797	N	0.00	0.00	133.26	0.00	425665.72	6189123.87	
L1798	N	0.28	132.62	133.38	0.37	425666.13	6189124.01	
L2729	Y	0.06	0.00	129.73	0.26	421900.00	6191900.00	out
L2730	Y	0.00	0.00	129.73	0.26	421900.00	6191900.00	out
G1199	N	0.12	0.00	114.71	0.13	383001.06	6192002.84	
G2977	N	0.17	104.27	104.72	0.21	362748.55	6221817.05	
G3009	N	0.00	106.39	107.30	0.23	371400.00	6222571.00	
G3018	N	0.10	106.11	106.49	0.14	368697.40	6223272.82	
G3019	Y	0.00	0.00	106.50	0.15	374100.00	6221720.00	out
G3287	N	0.17	104.27	104.44	0.00	362749.44	6221819.28	
G3065D	N	0.15	107.06	107.21	0.00	370304.03	6216628.02	
G3065S	N	0.25	107.06	107.31	0.00	370304.03	6216628.02	
G209	N	0.38	121.98	122.95	0.80	405804.83	6192495.27	
G210	N	0.15	121.98	122.52	0.37	405810.33	6192496.44	
G278	Y	0.00	120.80	120.70	0.39	405136.42	6203007.60	out
G281	Y	0.00	0.00	121.53	0.33	409000.00	6201900.00	out
G282	Y	0.00	0.00	121.46	0.26	409000.00	6201900.00	out
G1718	Y	0.00	0.00	124.82	0.09	411970.00	6195770.00	out
G1719	Y	0.00	0.00	125.14	0.41	411970.00	6195770.00	out

G247	N	0.00	128.91	129.02	0.10	421392.10	6206753.60	
G352	N	0.12	132.76	131.97	0.28	429871.68	6208181.60	
G1195	N	0.56	0.00	117.95	0.45	391170.24	6188330.91	
G535	N	0.53	113.38	113.94	0.30	392940.17	6211274.83	
G1159	N	0.45	110.96	111.71	0.53	386185.04	6216246.01	
G1160	N	0.00	110.96	111.64	0.46	386181.34	6216247.08	
G1196	N	0.44	0.00	118.14	0.64	391168.35	6188335.33	
G2283	N	0.05	120.25	120.92	0.11	400011.62	6193197.94	
G2284	N	0.15	120.25	120.93	0.12	400010.72	6193196.82	
G2291	N	0.00	119.73	120.18	0.30	395579.31	6193793.71	
G2292	N	0.00	119.73	120.21	0.33	395578.34	6193798.14	
G3260	N	0.25	106.39	106.64	0.00	371400.00	6222571.00	
G279	Y	0.00	120.80	120.79	0.45	405136.43	6203006.49	out
G1684	N	0.00	0.00	125.84	0.13	416432.92	6204489.38	
L1764S	N	0.40	135.66	136.87	0.46	436826.00	6174767.00	
L1963D	N	0.18	131.50	132.55	0.24	429407.00	6178289.00	
L2367S	Y	0.00	139.16	139.85	0.30	445590.00	6170040.00	out
G458	N	0.10	118.24	118.66	0.35	404540.66	6207283.44	
G2697	N	0.00	117.36	117.34	0.26	392930.55	6201167.85	
G2340	N	0.30	114.18	114.72	0.30	385189.37	6199889.22	
G1401	N	0.00	0.00	125.70	0.48	412089.93	6187827.80	
G2771	Y	0.00	0.00	126.80	0.40	416500.00	6185180.00	out
G1198	N	0.10	0.00	114.70	0.12	383000.11	6192005.04	
L1732D	N	0.63	133.51	134.61	0.37	438790.00	6187947.00	
L1326D	N	0.24	127.86	127.90	0.00	421690.00	6189900.00	
L2139D	N	0.31	128.94	129.80	0.37	426848.00	6191926.00	
L120	N	0.26	133.77	134.69	0.27	441944.00	6184630.00	
L249	N	0.00	142.69	142.95	0.00	453333.00	6161051.00	
L251	N	0.00	141.47	141.88	0.00	451003.00	6163123.00	

L259	N	0.38	133.54	133.65	0.00	430116.00	6175981.00	
L261	N	0.18	132.24	132.94	0.06	427873.00	6171471.00	
L301	N	0.18	135.21	136.11	0.12	439528.00	6177370.00	
G307	N	0.00	125.01	125.32	0.17	413515.00	6191570.00	
G309	N	0.19	125.12	125.75	0.40	415103.00	6191331.00	
G373	N	0.12	123.58	124.40	0.27	409477.35	6184255.66	
G429	N	0.43	123.17	124.78	0.09	409555.38	6185039.29	
G500	N	0.44	124.90	125.86	0.50	414191.00	6184506.00	
G505	N	0.74	126.12	127.10	0.80	417470.61	6190222.95	
G508	N	0.10	124.66	125.03	0.18	416976.87	6192953.99	
L580	N	0.05	131.42	132.22	0.12	425501.00	6170615.00	
L592	Y	0.00	141.65	142.45	0.00	451319.00	6165740.00	**Out**
L595	N	0.43	140.51	140.12	0.00	449273.00	6166550.00	
L685	N	0.14	140.60	140.81	0.06	446803.00	6168172.00	
L1020D	N	0.22	132.39	133.15	0.24	434164.00	6179629.00	
L1020S	N	0.37	132.37	133.28	0.40	434168.00	6179629.00	
L1056	N	0.35	135.71	136.97	0.55	439989.00	6178593.00	
L1128	N	0.34	136.18	137.33	0.34	446042.00	6177459.00	
L1159	N	0.76	135.55	136.55	0.64	445382.00	6180810.00	
L1237	N	0.22	133.80	134.50	0.18	441737.00	6183191.00	
L1305	N	0.18	127.48	127.90	0.15	419534.00	6186452.00	
G1319	N	0.70	125.37	126.01	0.21	414769.00	6184929.00	
L1321S	N	0.29	128.24	128.70	0.46	421568.17	6188351.66	
L1326D	N	0.24	127.83	127.90	0.00	421789.00	6190113.00	
L1326S	N	0.40	127.83	127.90	0.38	421789.00	6190113.00	
L1327S	N	0.00	127.31	128.00	0.30	422003.00	6191382.00	
G1342S	N	0.30	127.99	128.75	0.34	419414.39	6183940.44	
G1359	N	0.25	128.32	128.99	0.22	419611.71	6182862.42	
L1398	N	0.00	125.85	136.86	1.49	414972.00	6187969.00	

G1402	N	0.27	125.10	125.65	0.08	412843.37	6187183.15	
G1406	N	0.00	125.33	125.85	0.12	414090.42	6186143.94	
G1410	N	0.44	126.19	126.74	0.37	416515.25	6187772.04	
L1413D	N	0.19	126.43	127.10	0.50	419505.00	6192203.00	
L1413S	N	0.32	126.43	127.10	0.50	419505.00	6192203.00	
L1419D	N	0.36	132.41	133.73	0.79	429985.00	6181294.00	
L1419S	N	0.61	132.47	133.53	0.58	429983.00	6181295.00	
L1432	N	0.19	134.41	136.00	0.27	445319.00	6180362.00	
L1446	N	0.70	128.47	129.72	0.00	424377.00	6185860.00	
L1448	N	0.25	128.26	128.90	0.30	423923.00	6188062.00	
L1460D	N	0.37	128.00	128.80	0.40	424396.00	6190742.00	
L1460S	N	0.45	128.00	128.80	0.40	424396.00	6190742.00	
L1482	N	0.07	134.33	134.82	0.34	442450.00	6182655.00	
L1529	N	0.39	133.62	135.12	0.58	443846.00	6184186.00	
L1531D	N	0.40	128.91	130.00	0.50	423620.00	6180987.00	
L1531S	N	0.07	128.90	130.00	0.50	423620.00	6180988.00	
L1532	N	0.07	129.40	129.80	0.50	422151.00	6181677.00	
L1533D	N	0.11	129.93	130.34	0.32	424859.00	6183504.00	
L1533S	N	0.19	130.33	130.41	0.39	424861.00	6183501.00	
L1534D	N	0.43	129.55	130.10	0.40	425014.00	6184704.00	
L1534S	N	0.60	129.55	130.10	0.40	425014.00	6184702.00	
L1535D	N	0.16	129.50	130.40	0.30	423686.00	6182719.00	
L1535S	N	0.23	129.58	130.40	0.30	423687.00	6182720.00	
L1536D	N	0.28	129.13	130.10	0.40	422354.00	6184163.00	
L1536S	N	0.44	129.11	130.10	0.40	422354.00	6184164.00	
L1537	N	0.52	135.23	136.55	0.55	444043.00	6179588.00	
L1551	N	0.15	133.76	134.61	0.18	443892.00	6182762.00	
L1560	N	0.63	133.85	134.93	1.13	442864.00	6182659.00	
L1563	N	0.16	125.21	134.78	0.55	417214.00	6191840.00	

L1565	N	0.16	125.59	134.50	0.30	417312.00	6190767.00	
L1571	Y	0.00	135.74	137.34	0.94	443274.00	6178874.00	**Out**
L1597	N	0.31	134.07	134.78	0.30	430294.00	6171471.00	
L1601	N	0.50	137.54	138.76	0.49	443571.00	6171535.00	
L1602	N	0.19	139.39	139.83	0.37	445840.00	6169356.00	
L1603	N	0.37	133.06	133.65	0.37	434363.00	6188683.00	
L1612	N	0.00	137.39	137.79	0.00	442387.00	6193049.00	
L1614	N	0.44	138.74	139.67	0.45	442712.00	6195070.00	
L1628	N	0.38	134.05	135.04	0.43	441749.00	6181801.00	
L1640	N	0.25	132.81	133.44	0.06	431201.00	6180438.00	
L1642	N	0.03	135.82	136.45	0.06	438457.00	6175870.00	
L1646	N	0.22	135.72	137.21	0.18	441065.00	6171272.00	
L1654	N	0.35	133.05	134.33	0.61	439222.00	6185445.00	
L1662	N	0.65	133.64	135.00	0.64	439033.00	6183583.00	
G1663	N	0.80	123.71	124.77	0.16	409010.20	6180981.36	
G1666	N	0.50	123.64	124.66	0.60	410446.52	6185630.05	
L1707D	N	0.20	134.30	135.24	0.30	437983.00	6182286.00	
L1707S	N	0.36	134.30	135.40	0.55	437982.00	6182281.00	
L1708	N	0.36	134.04	135.20	0.34	444891.00	6182244.00	
L1709D	N	0.11	133.61	134.81	0.21	438075.00	6183059.00	
L1709S	N	0.24	133.57	135.06	0.46	438075.00	6183060.00	
L1728	N	0.38	134.49	135.37	0.30	441857.00	6180653.00	
L1729D	N	0.25	135.30	136.21	0.27	441288.00	6179948.00	
L1729S	N	0.23	135.29	136.19	0.24	441292.00	6179949.00	
L1732D	N	0.63	133.52	134.61	0.37	438790.00	6187947.00	
L1732S	N	0.16	133.57	134.46	0.21	438791.00	6187947.00	
L1738	N	0.40	133.53	134.50	0.37	438578.00	6186653.00	
L1739D	N	0.51	133.51	134.90	0.61	438420.00	6185316.00	
L1739M	N	1.00	133.50	135.32	1.01	438420.00	6185318.00	

L1739S	N	0.43	133.51	134.78	0.49	438419.00	6185319.00	
L1748D	N	0.41	130.65	132.05	0.64	428446.00	6179466.00	
L1748S	N	0.67	130.67	132.20	0.64	428448.00	6179466.00	
L1751	N	0.25	134.47	135.24	0.37	437898.00	6181831.00	
L1752	N	0.92	134.51	136.18	1.10	437746.00	6180804.00	
L1753	N	0.48	135.02	136.99	0.73	437584.00	6179682.00	
L1755D	N	0.46	135.51	136.61	0.37	437144.00	6176794.00	
L1755S	N	0.81	135.51	136.94	0.70	437144.00	6176793.00	
L1756D	N	0.50	135.61	136.83	0.49	436953.00	6175526.00	
L1756S	N	0.30	135.61	136.54	0.18	436954.00	6175526.00	
L1762D	N	0.39	134.53	135.54	0.43	437330.00	6178067.00	
L1762S	N	0.76	134.51	135.93	0.79	437329.00	6178065.00	
L1764D	N	0.63	135.67	137.08	0.67	436827.00	6174767.00	
L1764M	N	0.65	135.66	137.11	0.70	436825.00	6174768.00	
L1764S	N	0.40	135.67	136.87	0.46	436826.00	6174767.00	
L1765D	N	0.21	134.27	135.44	0.26	436719.00	6174068.00	
L1765S	N	0.00	134.27	135.33	0.34	436719.00	6174068.00	
L1767	N	-0.51	134.75	136.32	0.52	436346.00	6170668.00	
L1768D	N	0.22	135.45	136.62	0.37	437069.00	6176155.00	
L1768S	N	0.06	135.44	136.62	0.37	437070.00	6176155.00	
L1784	N	0.00	135.73	136.76	0.15	443143.00	6178073.00	
L1788	N	0.08	138.03	138.64	0.15	443000.00	6172507.00	
L1792	N	0.34	132.74	133.32	0.12	435524.00	6189031.00	
L1794D	N	0.21	132.94	133.91	0.27	435661.00	6189992.00	
L1794S	N	0.48	132.93	134.11	0.49	435660.00	6189985.00	
L1798	N	0.28	132.62	133.38	0.37	435354.00	6187859.00	
L1800	N	0.34	132.23	133.32	0.37	435248.00	6187126.00	
L1805	N	0.31	132.03	132.94	0.46	435011.00	6185472.00	
L1806	N	0.28	132.43	133.32	0.37	434932.20	6185057.72	

L1808	N	0.34	132.17	133.65	0.70	434846.00	6184349.00	
L1810D	N	0.28	132.19	133.30	0.30	434742.00	6183596.00	
L1810S	N	0.10	132.28	133.17	0.15	434739.00	6183596.00	
L1813D	N	0.31	132.19	133.21	0.34	434609.00	6182653.00	
L1813M	N	0.00	132.21	133.50	0.64	434609.00	6182654.00	
L1813S	N	0.17	132.13	133.05	0.18	434610.00	6182652.00	
L1815	N	0.36	132.71	133.63	0.46	434526.00	6182079.00	
L1818	N	0.22	132.91	133.70	0.21	434363.00	6180972.00	
L1823D	N	0.17	133.11	134.01	0.20	434046.00	6178787.00	
L1823S	N	0.20	133.10	134.01	0.20	434046.00	6178788.00	
L1826D	N	0.57	133.10	134.32	0.55	433910.00	6177684.00	
L1826S	N	0.39	133.09	134.18	0.40	433911.00	6177685.00	
L1829	N	0.50	133.64	134.59	0.46	433851.00	6176668.00	
L1830	N	0.65	135.07	136.32	0.64	445125.00	6179101.00	
L1831	N	0.38	134.29	135.11	0.40	442258.00	6186561.00	
L1832	N	0.22	134.92	135.89	0.34	440509.00	6180849.00	
L1834	N	0.16	137.24	137.82	0.27	442629.00	6170406.00	
L1836R	N	0.56	138.73	139.51	0.52	444146.94	6168333.58	
L1844	N	0.47	133.49	134.52	0.46	432830.00	6176577.00	
L1851	N	0.15	134.13	135.01	0.58	432386.00	6173894.00	
L1854D	N	0.55	134.56	135.60	0.58	432237.00	6172929.00	
L1854S	N	0.30	134.51	135.35	0.34	432232.00	6172932.00	
L1856	N	0.28	134.71	135.49	0.37	432133.00	6172315.00	
L1861D	N	0.26	133.64	134.60	0.34	431908.00	6170836.00	
L1861S	N	0.45	133.50	134.79	0.52	431905.00	6170831.00	
L1866	N	0.03	131.14	131.94	0.21	428170.00	6181470.00	
L1870D	N	0.08	130.72	131.66	0.27	428909.00	6180095.00	
L1870S	N	0.25	130.72	131.80	0.43	428909.00	6180095.00	
L1876	N	0.27	132.96	133.53	0.30	436114.00	6184968.00	

L1881	N	0.95	132.76	133.94	0.85	436032.00	6186816.00	
L1883	N	0.30	133.32	134.12	0.37	437733.00	6186708.00	
L1887	N	0.26	133.33	134.18	0.40	436293.00	6182720.00	
L1888	N	0.23	133.16	134.02	0.06	436289.00	6181155.00	
L1890	N	0.00	133.32	134.15	0.12	435130.00	6180518.00	
L1892	N	0.16	134.23	136.55	0.24	435858.00	6179689.00	
L1897	N	0.03	133.79	134.65	0.15	435904.00	6178059.00	
L1898	N	0.18	134.05	134.90	0.18	435275.00	6178117.00	
L1899	N	0.21	134.07	134.84	0.24	434854.00	6177407.00	
L1902D	N	0.74	134.23	135.30	0.70	434049.00	6176014.00	
L1902S	N	0.38	134.05	134.96	0.37	434051.00	6176016.00	
L1905D	N	0.42	134.76	135.64	0.27	435140.00	6175502.00	
L1905S	N	0.24	134.74	135.81	0.46	435140.00	6175499.00	
L1913	N	0.26	130.38	131.43	0.24	429435.00	6186928.00	
L1915	N	0.38	132.84	133.86	0.52	433516.00	6187955.00	
L1917D	N	0.34	130.06	131.05	0.06	429214.00	6185113.00	
L1917S	N	0.57	129.90	131.25	0.84	429219.00	6185116.00	
L1920	N	0.70	132.42	133.87	0.70	430899.00	6179071.00	
L1924D	N	0.31	132.34	132.89	0.27	431802.00	6189657.00	
L1924S	N	0.36	132.09	132.90	0.30	431805.00	6189654.00	
L1927	N	0.37	131.05	132.10	0.64	431660.00	6188646.00	
L1930D	N	0.52	131.43	132.52	0.52	431511.00	6187618.00	
L1930S	N	0.48	131.24	132.50	0.49	431513.00	6187621.00	
L1933D	N	0.32	132.05	132.76	0.37	431409.00	6186625.00	
L1933S	N	0.38	132.00	132.81	0.43	431417.00	6186628.00	
L1935D	N	0.60	131.48	132.63	0.58	431313.00	6186009.00	
L1935S	N	0.60	131.49	132.62	0.55	431314.00	6186009.00	
L1938	N	0.17	131.48	132.09	0.12	431172.00	6185006.00	
L1938TW	Y	0.00	131.50	131.81	0.15	431170.00	6185001.00	**Out**

L1941	N	0.26	131.54	132.63	0.21	431020.00	6183951.00	
G1942	N	0.40	128.66	129.06	0.14	423796.27	6187089.06	
L1943	N	0.38	127.82	131.82	0.82	423042.00	6190583.00	
L1945	N	0.29	131.54	131.72	0.33	430851.00	6182737.00	
L1946D	N	0.26	131.76	132.23	0.23	430805.00	6182435.00	
L1946S	N	0.48	131.86	132.45	0.43	430807.00	6182437.00	
L1947	N	0.16	131.86	132.55	0.27	430697.00	6181688.00	
L1950	N	0.31	134.82	135.97	0.37	434010.00	6173324.00	
L1951	N	0.35	135.67	136.84	0.52	434821.00	6173212.00	
L1953	N	0.25	128.14	136.76	0.46	419679.00	6184917.00	
L1954	N	0.32	134.24	134.45	0.30	432839.00	6170675.00	
L1955	N	0.20	134.93	134.90	0.18	434987.00	6170761.00	
L1960D	N	0.34	132.01	132.96	0.27	429915.00	6179673.00	
L1960S	N	0.32	132.07	132.94	0.24	429915.00	6179674.00	
L1962D	N	0.28	131.81	132.77	0.34	429670.00	6178978.00	
L1962S	N	0.28	131.78	132.55	0.12	429670.00	6178976.00	
L1963D	N	0.18	131.52	132.55	0.24	429407.00	6178289.00	
L1963S	N	0.39	131.49	132.76	0.46	429406.00	6178287.00	
L1964	N	0.10	126.36	132.83	0.27	417025.00	6189279.00	
L1966	N	0.45	132.00	133.19	0.58	429012.00	6177436.00	
L1970	N	0.08	131.99	132.57	0.18	428133.00	6176305.00	
L1971	N	0.20	126.61	132.89	0.43	420041.00	6189865.00	
L1974	N	0.07	132.21	133.29	0.55	427933.00	6174877.00	
L1976	N	0.16	128.73	133.13	0.70	421493.00	6183749.00	
L1977M	N	0.36	132.16	132.19	0.43	427796.00	6173744.00	
L1980	N	0.26	132.34	132.85	0.24	427613.00	6172580.00	
L1982D	N	0.66	132.48	132.80	0.67	427509.00	6171809.00	
L1982S	N	0.21	131.52	132.37	0.24	427501.00	6171806.00	
L1984	Y	0.00	132.33	133.13	0.67	433642.00	6189726.00	**Out**

L1991D	N	0.22	131.18	132.13	0.40	432201.00	6185517.00	
L1991S	N	0.36	131.17	132.05	0.30	432200.00	6185517.00	
L1997	N	0.05	131.69	132.77	0.43	432409.00	6183843.00	
L1999	N	0.42	131.76	132.79	0.43	433396.00	6183113.00	
L2002	N	0.52	131.21	132.50	0.49	432156.00	6182180.00	
L2008D	N	0.15	132.38	133.26	0.12	438242.00	6184271.00	
L2008S	N	0.16	132.40	133.26	0.12	438246.00	6184276.00	
L2009	N	0.18	130.30	131.11	0.21	429100.00	6189914.00	
L2014D	N	0.32	130.83	131.66	0.37	428883.00	6188400.00	
L2014S	N	0.18	130.82	131.55	0.27	428880.00	6188403.00	
L2015D	N	0.20	130.77	131.41	0.30	428848.00	6188126.00	
L2015S	N	0.30	130.76	131.36	0.27	428847.00	6188119.00	
L2024D	N	0.54	129.93	131.40	0.55	429154.00	6184750.00	
L2024S	N	0.29	130.23	131.05	0.21	429161.00	6184757.00	
L2028D	N	0.26	130.39	131.20	0.19	428975.00	6183488.00	
L2028S	N	0.19	130.44	131.19	0.18	428977.00	6183488.00	
L2029D	N	0.12	131.36	132.05	0.15	428927.00	6183173.00	
L2029S	N	0.16	131.10	132.09	0.18	428930.00	6183172.00	
L2036	N	0.19	133.37	134.42	0.24	438500.00	6186044.00	
L2039	N	0.31	132.71	134.37	0.64	437449.00	6184779.00	
L2044D	N	0.31	132.63	133.45	0.21	429543.00	6180591.00	
L2044S	N	0.20	132.63	133.51	0.27	429543.00	6180592.00	
L2047D	N	0.17	132.10	133.15	0.21	435124.00	6186223.00	
L2047S	N	0.42	132.37	133.16	0.21	435126.00	6186224.00	
L2052D	N	0.18	130.62	131.26	0.18	427194.00	6180096.00	
L2052S	N	0.16	130.61	131.25	0.18	427192.00	6180097.00	
L2053	N	0.42	131.24	132.09	0.27	427531.00	6180948.00	
L2057	N	0.03	130.56	131.36	0.33	427326.00	6182563.00	
L2060D	N	0.20	131.78	132.71	0.21	429964.00	6181921.00	

L2060S	N	0.31	131.79	132.81	0.30	429962.00	6181924.00	
L2066	N	0.26	131.84	132.96	0.46	431594.00	6181241.00	
L2068	N	0.37	132.98	134.01	0.30	432513.00	6179802.00	
L2069	N	0.29	133.24	134.19	0.18	432627.00	6178707.00	
L2075D	N	0.27	134.06	135.08	0.27	437272.00	6177708.00	
L2075S	N	0.42	134.06	135.23	0.43	437272.00	6177708.00	
L2089D	N	0.38	133.00	133.97	0.34	431550.00	6178372.00	
L2089S	N	0.54	133.00	134.20	0.55	431551.00	6178371.00	
L2090	N	0.26	133.22	134.12	0.27	431994.00	6177578.00	
L2094D	N	0.33	131.56	132.61	0.34	428863.00	6178543.00	
L2094S	N	0.30	131.50	132.65	0.37	428860.00	6178539.00	
L2096D	N	0.15	131.15	131.93	0.24	426459.00	6179670.00	
L2096S	N	0.21	131.09	131.96	0.27	426458.00	6179669.00	
L2099	N	0.25	130.90	131.46	0.27	425263.00	6180226.00	
L2108D	N	0.25	129.78	130.79	0.24	426017.00	6181033.00	
L2108S	N	0.28	129.78	130.81	0.27	426017.00	6181033.00	
L2117D	N	0.24	129.96	130.82	0.25	425340.00	6181538.00	
L2117S	N	0.24	129.96	130.81	0.23	425340.00	6181539.00	
L2120	N	0.31	129.92	130.73	0.37	425532.00	6182902.00	
L2121	N	0.26	129.08	130.00	0.30	425647.00	6183659.00	
L2124D	N	0.25	128.95	129.86	0.34	425777.00	6184616.00	
L2124S	N	0.21	128.95	129.84	0.30	425776.00	6184615.00	
L2126	N	0.19	128.47	129.28	0.21	425853.00	6185235.00	
L2128D	N	0.27	129.19	129.99	0.27	425982.00	6186034.00	
L2128S	N	0.23	129.19	130.01	0.29	425982.00	6186033.00	
L2131D	N	0.22	129.39	130.27	0.34	426225.00	6187716.00	
L2131S	N	0.17	129.40	130.24	0.30	426232.00	6187720.00	
L2135	N	0.25	129.46	130.23	0.30	426520.00	6189767.00	
L2137	N	0.28	129.33	130.32	0.34	426688.00	6191071.00	

L2139D	N	0.31	128.85	129.80	0.37	426848.00	6191926.00	
L2139S	N	0.39	128.94	129.77	0.34	426854.00	6191920.00	
L2158	N	0.27	134.33	135.31	0.30	444279.00	6181379.00	
L2159	Y	0.00	135.07	135.97	0.21	442664.00	6179766.00	out
L2163	N	0.24	134.72	135.74	0.12	442992.00	6180494.00	
L2165	N	0.31	135.33	136.28	0.40	444143.00	6180288.00	
L2166	N	0.34	133.87	133.87	0.30	442145.00	6185746.00	
L2168	N	0.37	134.02	134.76	0.27	442355.00	6185083.00	
L2170	N	0.30	138.79	139.73	0.27	443825.00	6172383.00	
L2182	N	0.27	134.46	135.31	0.34	442682.00	6181337.00	
L2184D	N	0.27	132.90	134.12	0.37	432289.00	6179881.00	
L2184S	N	0.37	132.90	134.08	0.34	432289.00	6179881.00	
L2185	N	0.30	135.30	136.10	0.27	439282.00	6181038.00	
L2186	N	0.31	134.10	135.27	0.61	440462.00	6182105.00	
L2191	N	0.26	136.19	136.79	0.21	439401.00	6176167.00	
L2195	N	0.28	135.80	135.87	0.30	438901.00	6177608.00	
L2197	Y	0.00	136.53	137.21	0.23	440541.00	6176221.00	out
L2202	N	0.27	136.94	137.74	0.27	441609.00	6176622.00	
L2210A	N	0.12	134.05	134.62	0.34	438438.00	6177768.00	
L2210B	N	0.32	133.95	134.64	0.37	438438.00	6177767.00	
L2210TW	N	0.20	133.95	134.15	0.00	438438.00	6177767.00	
L2216	N	0.40	140.70	141.01	0.43	446799.00	6165903.00	
L2225	N	0.16	136.74	137.43	0.30	440796.00	6169911.00	
L2238D	N	0.00	135.81	136.67	0.30	438739.00	6177352.00	
L2238S	N	0.28	135.81	136.64	0.27	438739.00	6177352.00	
L2241D	N	0.18	138.71	139.65	0.27	446431.00	6171936.00	
L2241S	N	0.33	138.70	139.76	0.37	446430.00	6171936.00	
L2243	N	0.22	140.13	140.63	0.30	446910.00	6170128.00	
L2244	N	0.26	137.83	138.84	0.46	443175.00	6173521.00	

L2245	N	0.00	137.70	138.64	0.37	446254.00	6174776.00	
L2249	N	0.06	137.30	136.97	0.27	438579.05	6172973.45	
L2250	N	0.12	136.63	137.61	0.30	441992.00	6174417.00	
L2251	N	0.06	141.34	141.82	1.28	447367.00	6167012.00	
L2258D	N	0.22	135.78	136.49	0.21	443306.00	6174591.00	
L2258S	N	0.30	135.78	136.54	0.24	443306.00	6174591.00	
L2261	N	0.26	131.42	132.53	0.27	429884.00	6178023.00	
L2275D	N	0.21	133.18	134.06	0.24	436459.00	6182421.00	
L2275M	N	0.40	133.19	134.10	0.30	436459.00	6182420.00	
L2275S	N	0.32	133.19	134.10	0.30	436459.00	6182420.00	
L2278D	N	0.31	136.46	137.44	0.30	440558.00	6178172.00	
L2278S	N	0.32	136.41	137.17	0.30	440564.00	6178173.00	
L2279	N	0.37	134.33	135.13	0.34	445017.00	6183113.00	
L2280	N	0.17	131.23	136.68	0.30	425004.00	6173837.00	
L2287D	N	0.36	133.95	134.75	0.40	439622.00	6186502.00	
L2287S	N	0.22	133.95	134.62	0.27	439622.00	6186502.00	
L2299D	N	0.18	133.22	133.91	0.27	440714.00	6186377.00	
L2302D	N	0.25	137.01	137.79	0.30	442262.00	6176403.00	
L2302S	N	0.32	137.03	137.80	0.30	442263.00	6176402.00	
L2312	N	0.28	135.51	136.55	0.30	446406.00	6178365.00	
L2313	N	0.33	135.78	136.60	0.37	446664.00	6177515.00	
L2314D	N	0.25	136.99	137.85	0.24	443361.00	6174989.00	
L2314M	N	0.32	136.99	137.90	0.30	443362.00	6174990.00	
L2314S	N	0.41	136.99	137.95	0.37	443362.00	6174990.00	
L2317D	N	0.31	137.34	138.17	0.30	445359.00	6173998.00	
L2317S	N	0.30	137.33	138.16	0.30	445357.00	6174000.00	
L2318	N	-0.02	137.46	138.18	0.29	443429.00	6175424.00	
L2320	N	0.80	125.12	138.03	0.32	412450.00	6187512.00	
L2328	N	0.00	137.33	137.78	0.24	442137.00	6177032.00	

L2329D	N	0.23	136.62	137.66	0.52	441441.00	6177124.00	
L2329S	N	0.19	136.62	137.67	0.52	441441.00	6177124.00	
L2332D	N	0.38	135.99	136.90	0.33	440695.00	6178981.00	
L2332S	N	0.24	136.00	136.93	0.37	440696.00	6178981.00	
L2333	N	0.28	135.39	136.32	0.27	438846.00	6178124.00	
L2334D	N	0.26	135.73	136.79	0.33	439529.00	6179590.00	
L2334S	N	0.25	135.74	136.80	0.33	439529.00	6179589.00	
L2335D	N	0.04	135.89	136.82	0.37	438597.00	6179753.00	
L2335S	N	0.00	135.89	136.86	0.33	438597.00	6179753.00	
L2340	N	0.17	133.76	134.49	0.18	439223.00	6178688.00	
L2347D	N	0.21	135.43	136.24	0.30	442063.00	6178840.00	
L2347S	N	0.29	135.43	136.28	0.33	442064.00	6178839.00	
L2357D	N	0.10	137.04	137.70	0.37	443732.00	6177489.00	
L2357S	N	0.11	137.14	137.70	0.37	443733.00	6177490.00	
L2364	N	0.37	135.08	136.12	0.37	444694.00	6178298.00	
L2367D	Y	0.00	139.17	139.88	0.34	445374.00	6170038.00	out
L2367S	Y	0.00	139.15	139.85	0.30	445378.00	6170037.00	out
L2371	N	0.29	137.85	138.64	0.34	443651.00	6169669.00	
L2373	N	0.34	133.50	134.40	0.30	443313.00	6183272.00	
L2391	N	0.34	138.28	139.10	0.30	445359.00	6172029.00	
L2408	N	0.30	138.62	139.24	0.24	444532.00	6172284.00	
L2423	N	0.12	137.25	137.70	0.26	441426.00	6172521.00	
L2437D	N	0.44	137.90	138.56	0.27	444902.00	6174022.00	
L2437S	N	0.25	137.87	138.56	0.27	444902.00	6174023.00	
L2442	N	0.02	134.31	135.30	0.21	435204.00	6179118.00	
L2443	N	0.44	132.32	133.14	0.33	433553.00	6179330.00	
L2444	N	0.25	134.12	135.01	0.24	436403.00	6179049.00	
L2452D	N	0.20	130.86	132.02	0.32	430015.00	6188582.00	
L2452S	N	0.30	131.14	132.02	0.32	430020.00	6188576.00	

L2453	N	0.09	130.23	131.16	0.32	427950.00	6188874.00	
L2467D	N	0.23	131.91	132.59	0.24	432585.00	6186735.00	
L2467S	N	0.26	131.95	132.60	0.24	432585.00	6186729.00	
L2468	N	0.20	130.91	132.06	0.34	430429.00	6186788.00	
L2469	N	0.25	134.72	135.59	0.29	445502.00	6182044.00	
L2479	N	0.25	138.52	139.12	0.30	446272.00	6173832.00	
L2481	N	0.10	131.54	132.40	0.31	433852.00	6187074.00	
L2482D	N	0.28	131.90	132.98	0.33	434451.90	6187002.32	
L2490	N	0.37	133.98	135.01	0.33	444382.35	6182202.82	
L2498	N	0.36	129.48	130.48	0.32	428186.00	6184593.00	
L2499	N	0.30	129.93	131.16	0.24	427870.00	6187154.00	
L2584	N	0.38	131.82	132.76	0.27	433375.00	6185350.00	
L2588	N	0.37	131.91	132.96	0.30	434035.00	6185255.00	
L2601	N	0.06	136.07	137.21	0.23	438369.00	6174069.00	
L2602	N	0.53	136.31	137.26	0.30	439546.00	6173495.00	
L2613	N	0.37	139.58	140.40	0.30	446271.00	6172177.00	
L2646	N	0.22	134.79	136.44	0.29	436407.00	6171914.00	
L2648	N	0.23	124.98	136.24	0.26	411007.00	6174488.00	
G2650	N	0.10	127.63	127.77	0.05	417315.63	6173689.15	
G2651	N	0.32	130.84	131.36	0.20	423071.08	6171179.76	
L2657	N	0.23	133.69	135.84	0.37	432669.00	6175731.00	
L2679D	N	0.19	132.69	133.41	0.20	434151.00	6179166.00	
L2679S	N	0.10	132.60	133.56	0.35	434154.00	6179166.00	
L2690	N	0.35	131.50	132.50	0.31	428323.00	6178794.00	
G2703	N	0.10	125.12	125.89	0.29	419191.88	6191354.01	
L2705	N	0.54	126.80	131.78	0.25	419454.99	6190177.79	
L2717	N	0.19	125.08	128.93	0.26	416969.00	6191525.00	
L2733D	N	0.31	133.90	134.79	0.30	426406.00	6188711.00	
L2733S	N	0.33	133.90	134.76	0.30	426411.00	6188717.00	

G2747	N	0.50	127.03	127.55	0.19	420605.09	6192114.17	
L2751	Y	0.00	127.52	128.04	0.20	422512.00	6190725.00	out
L2752	Y	0.00	127.50	129.22	0.27	422511.00	6190725.00	out
G2754	N	0.22	128.78	129.43	0.23	424945.61	6189233.69	
G2755	N	0.45	128.96	129.34	0.14	424946.35	6189235.91	
G2759	N	0.26	129.37	129.69	0.25	424937.70	6184259.09	
L2762	N	0.13	130.69	129.21	0.21	423459.56	6172845.19	
L2763	Y	0.00	136.16	136.95	0.26	439185.00	6174741.00	out
L2788	N	0.14	139.70	140.37	0.24	445559.00	6167174.00	
L2791	N	0.17	130.73	132.41	0.94	425707.00	6168005.00	
L2793	N	0.37	0.00	133.46	0.54	430510.00	6166775.00	
L2794	N	0.47	0.00	133.02	0.28	427194.00	6165242.00	
L2795	N	0.29	0.00	134.54	0.28	433346.00	6166286.00	
L2796D	N	0.26	0.00	135.57	0.25	436321.00	6166465.00	
L2796S	N	0.29	0.00	135.60	0.28	436321.00	6166468.00	
L2797	N	0.29	0.00	137.87	0.30	439295.00	6166677.00	
L2798	N	0.23	0.00	137.65	0.28	441918.00	6166546.00	
L2799	N	0.37	137.97	139.33	0.36	443424.00	6164260.00	
L2800S	N	0.33	0.00	139.30	0.32	443926.00	6161526.00	
L2802	N	0.29	0.00	137.68	0.28	440020.00	6162061.00	
L2840	N	0.32	130.24	131.24	0.30	428217.00	6187101.00	
L2851	N	0.46	131.46	131.09	0.06	420298.00	6169854.00	
L2852	N	0.00	128.95	129.33	0.00	423854.00	6175696.00	
L2853	N	0.42	130.20	130.45	0.00	424105.00	6177463.00	
L2856	N	0.18	129.04	129.28	0.37	424402.00	6179941.00	
L2857D	Y	0.00	133.81	136.22	0.29	436396.00	6169876.00	out
L2857S	Y	0.00	133.81	136.29	0.29	436396.00	6169876.00	out
L2858	Y	0.00	0.00	136.09	0.28	435887.00	6168048.00	out
L2859	Y	0.00	0.00	135.38	0.40	436061.00	6169173.00	out

L2865	N	0.30	135.35	135.73	0.09	439410.00	6192323.00	
L2875	N	0.33	131.12	131.54	0.00	427135.00	6181429.00	
L2922	N	0.20	138.05	139.60	0.25	446333.00	6172679.00	
L2928	N	0.00	138.95	139.41	0.24	444273.00	6173360.00	
L2983	N	0.33	136.56	137.50	0.28	439868.00	6170011.00	
L2994	N	0.31	133.98	134.17	0.30	430268.00	6170338.00	
L3040	N	0.33	138.81	139.90	0.35	442808.00	6195833.00	
L3041	N	0.20	138.91	139.11	0.00	442754.00	6195464.00	
L3042	N	0.30	138.45	138.75	0.25	441825.00	6195202.00	
L3044	N	0.26	138.14	138.40	0.24	440124.00	6197376.00	
L3045	N	0.22	138.57	138.79	0.00	440068.00	6196978.00	
L3050	N	0.23	137.56	138.46	0.22	439859.00	6195530.00	
L3079	N	0.16	138.09	134.77	0.28	439999.00	6196518.00	
L3080	Y	0.00	138.18	138.18	0.00	439923.00	6195968.00	out
L3082	N	0.25	136.87	137.12	0.00	439672.00	6194437.00	
L3083	N	0.30	136.59	137.37	0.28	439573.00	6193739.00	
L3084	N	0.25	137.10	137.95	0.33	439705.00	6194701.00	
L3085	N	0.34	136.02	136.36	0.00	439496.00	6193258.00	
L3126	N	0.38	134.23	135.04	0.41	440486.00	6187791.00	
L3127	N	0.28	135.23	135.60	0.31	442354.00	6187532.00	
L3128	N	0.18	135.15	135.87	0.37	442300.00	6188924.00	
L3130	N	0.41	133.73	135.73	0.46	438970.00	6189416.00	
L3131	N	0.45	133.73	134.87	0.44	437444.00	6189597.00	
L3132	N	0.40	134.77	134.72	0.47	439189.00	6190704.00	
L3133	N	0.27	135.50	136.28	0.41	440834.00	6190482.00	
L3135	N	0.40	136.01	136.86	0.62	440770.00	6191864.00	
L3136	N	0.40	136.03	137.06	0.62	438410.00	6193349.00	
L3139	N	0.34	138.86	134.52	0.52	442894.00	6196443.00	
L1977	N	0.38	129.07	132.19	0.43	421506.45	6182642.14	

L1958M	N	0.09	127.81	133.41	0.24	418348.50	6185063.74	
L1560TW	N	0.00	133.86	134.93	1.13	442866.54	6182659.00	
L2299S	N	0.18	133.14	133.32	0.00	440711.27	6186420.00	
G71	Y	0.00	127.00	127.66	0.20	418362.26	6204880.13	out
G105	N	0.15	120.26	120.95	0.38	409308.81	6203296.30	
G106	N	0.15	126.91	127.28	0.40	417017.98	6203588.56	
G122	N	0.10	126.92	127.47	0.19	417018.92	6203586.35	
G124	N	0.70	126.43	127.07	0.13	417438.58	6204209.98	
G132	N	0.36	125.38	127.32	0.48	416415.73	6205279.92	
G146	N	0.00	125.25	126.79	0.09	415674.15	6203205.03	
G152	N	0.00	123.31	123.77	0.25	411885.14	6198949.26	
G168	N	0.07	125.10	126.13	0.24	414709.82	6197451.74	
G178	N	0.50	125.00	125.81	0.60	414091.91	6197738.84	
G195	N	0.37	124.57	125.60	0.46	414985.91	6194504.33	
G203	N	0.00	121.72	122.07	0.15	408554.80	6197217.13	
G205	N	0.32	122.14	123.09	0.37	409373.10	6198755.55	
G207	N	0.27	122.44	122.89	0.30	406506.78	6197114.78	
G208	N	0.64	121.86	123.22	0.75	406357.11	6196082.99	
G209	N	0.38	122.76	122.95	0.80	405804.83	6192495.27	
G210	N	0.15	122.53	122.52	0.37	405810.33	6192496.44	
G215	N	0.32	121.63	122.01	0.32	406814.16	6199674.14	
G225	N	0.07	123.45	124.33	0.15	414259.95	6202580.01	
G227	N	0.00	124.57	124.33	0.36	414747.99	6199416.11	
G247	N	0.00	128.93	129.02	0.10	421392.10	6206753.60	
G250	N	0.18	127.67	128.33	0.46	418928.07	6202996.48	
G252	N	0.73	125.36	126.72	1.01	416441.15	6204495.00	
G254	N	0.37	132.09	131.59	0.39	428719.50	6205091.18	
G267	N	0.27	120.39	121.09	0.25	407917.29	6200500.20	
G269	N	0.40	120.43	121.00	0.30	407870.11	6200900.09	

G273	N	0.16	124.40	125.21	0.27	413964.44	6202093.78	
G278	Y	0.00	120.79	120.70	0.39	405136.42	6203007.60	out
G279	Y	0.00	120.81	120.79	0.45	405136.43	6203006.49	out
G293	N	0.37	127.59	128.07	0.20	418951.09	6202994.47	
G296	N	0.20	127.84	128.88	0.23	420805.52	6202486.74	
G301	N	0.37	133.37	132.74	0.44	430510.83	6203443.47	
G302	N	0.15	121.88	122.08	0.20	405677.83	6191602.33	
G303	N	0.05	122.24	122.30	0.19	405577.44	6190897.07	
G304	N	0.60	121.07	121.88	0.40	405345.48	6189304.36	
G305	N	0.30	121.12	121.85	0.39	405348.20	6189307.71	
G306	N	0.00	122.27	122.92	0.28	405159.86	6187771.99	
G311	N	0.21	122.06	122.67	0.68	404479.46	6194633.31	
G314	N	0.40	127.13	127.78	0.44	418256.15	6205648.83	
G318	N	0.00	127.23	128.66	0.71	420203.35	6205276.39	
G327	N	0.20	132.38	131.60	0.25	429225.36	6208425.14	
G334	N	0.80	126.24	126.93	0.48	416956.48	6204814.53	
G343	N	0.10	130.86	131.31	0.19	425371.17	6204163.50	
G349	N	0.60	132.65	132.02	0.53	429108.82	6207887.53	
G352	N	0.12	132.82	131.97	0.28	429871.68	6208181.60	
G370	N	0.58	120.39	121.42	0.53	402645.53	6192838.77	
G371	N	0.25	121.39	122.23	0.35	402111.60	6189411.76	
G374	N	0.30	120.94	121.77	0.48	405186.88	6199485.86	
G375	N	0.32	121.26	121.55	0.29	406088.02	6200712.67	
G378	N	0.50	119.36	120.09	0.28	407188.76	6202713.23	
G381	N	0.00	119.57	119.95	0.34	406328.78	6204231.76	
G384	N	0.10	124.94	125.30	0.09	412880.52	6196570.93	
G388	N	0.60	125.18	126.12	0.48	412164.80	6193280.46	
G407	N	0.27	120.96	121.79	0.43	401352.16	6195093.17	
G408	N	0.00	120.68	120.83	0.19	401080.10	6193089.56	

G412	N	0.27	119.53	119.65	0.30	404058.31	6204041.29	
G431	N	0.37	115.60	116.33	0.37	396509.77	6205582.26	
G432	N	0.10	116.44	116.59	0.13	393386.29	6204291.75	
G440	N	0.30	122.01	122.85	0.30	403453.08	6187567.01	
G441	N	0.10	121.78	122.33	0.05	401924.16	6188014.60	
G443	N	0.22	124.02	124.24	0.26	404865.67	6185454.41	
G451	N	0.50	122.68	123.78	0.55	407990.32	6186307.66	
G458	N	0.10	118.24	118.66	0.35	404540.66	6207283.44	
G459	N	0.55	118.96	119.77	0.68	406883.61	6206283.42	
G461	N	0.10	118.90	119.55	0.24	405107.83	6204556.60	
G462	N	0.02	119.69	120.17	0.36	407356.95	6203941.46	
G464	N	0.25	118.01	118.55	0.20	402640.61	6204692.06	
G465	N	0.70	124.45	125.58	0.56	411653.30	6188863.98	
G469	N	0.28	117.12	117.64	0.31	401085.58	6204905.32	
G470	N	0.45	115.92	116.79	0.46	398058.62	6205368.58	
G471	N	0.23	115.95	116.53	0.25	394993.86	6205807.15	
G474	Y	0.00	119.48	119.99	0.41	397768.03	6198946.25	out
G475	N	0.00	119.99	120.58	0.18	397557.87	6197391.27	
G487	N	0.15	117.74	118.48	0.49	398191.76	6202017.39	
G494	N	0.00	117.72	117.74	0.07	398406.55	6203591.24	
G497	N	0.00	117.49	117.82	0.23	394673.13	6200935.89	
G511	N	0.33	115.53	116.07	0.33	398331.42	6208646.53	
G512	N	0.30	122.48	122.78	0.31	404662.60	6184029.42	
G513	N	0.00	124.51	124.51	0.47	404078.98	6179716.95	
G514	N	0.59	115.78	116.35	0.54	393569.90	6205629.15	
G515	N	1.20	112.62	114.50	0.50	388906.44	6206155.01	
G516	N	0.18	113.98	114.14	0.09	389954.69	6207595.87	
G517	N	0.30	113.71	114.55	0.44	390163.11	6209217.56	
G521	N	0.25	111.79	112.32	0.63	388688.65	6219167.33	

G522	N	0.26	111.55	112.15	0.37	386595.33	6219441.77	
G525	N	0.40	113.40	113.67	0.09	390709.45	6222186.57	
G527	N	0.36	113.86	114.22	0.23	393488.41	6216132.03	
G531	N	0.00	122.94	122.94	0.14	404470.75	6182591.23	
G532	N	0.43	124.67	125.10	0.20	404283.86	6181212.97	
G534	N	0.38	113.38	113.79	0.14	392942.92	6211275.97	
G535	N	0.53	113.43	113.94	0.30	392940.17	6211274.83	
G537	N	0.51	112.15	112.82	0.50	390552.80	6212441.73	
G539	Y	0.00	111.95	112.18	0.33	389555.69	6217874.42	out
G543	N	0.10	112.52	112.38	0.21	395221.50	6217740.77	
G544	N	0.45	114.05	114.69	0.65	394700.56	6213891.02	
G550	N	0.00	116.86	117.10	0.17	399860.31	6208446.73	
G551	N	0.30	122.94	123.24	0.39	403293.13	6185984.95	
G552	N	0.00	123.98	123.98	0.33	403066.69	6184356.72	
G554	N	0.10	113.91	114.36	0.14	390492.88	6205903.09	
G555	N	0.20	114.22	114.85	0.74	389509.63	6204191.32	
G557	Y	0.00	115.08	115.64	0.27	391219.40	6202406.89	out
G561	N	0.10	118.44	119.11	0.28	399381.25	6198714.23	
G593	N	0.30	131.59	132.88	0.87	427207.17	6204990.82	
G620	N	0.23	116.94	117.22	0.36	392516.78	6197944.57	
G625	N	0.54	119.07	120.20	0.67	398646.27	6193381.72	
G626	N	0.17	119.50	120.58	0.68	396263.46	6193700.42	
G628	N	0.31	124.03	124.34	0.31	403904.29	6178236.77	
G629	N	0.27	121.55	122.25	0.30	405922.45	6193319.36	
G630	N	0.10	113.91	114.30	0.27	402212.69	6212802.28	
G651	N	0.33	115.03	115.23	0.26	411236.30	6213259.06	
G657	N	0.00	122.30	122.79	0.34	412571.88	6213480.08	
G670	N	0.10	116.46	117.53	0.10	401128.84	6206997.40	
G672	N	0.34	115.16	115.62	0.28	399395.03	6213192.81	

G674	N	0.60	106.14	105.70	0.80	407694.59	6212739.15	
G677	N	0.40	122.73	123.48	0.48	403398.37	6212618.27	
G679	N	0.50	113.27	114.22	0.51	400829.72	6212994.05	
G689	N	0.30	123.84	124.57	0.52	412873.69	6198485.00	
G696	N	0.30	122.26	122.99	0.29	409912.60	6197942.32	
G697	N	0.18	122.16	122.71	0.10	409961.91	6198265.52	
G708	N	0.05	111.85	111.94	0.11	386720.64	6220443.65	
G710	N	0.60	111.47	111.88	0.02	386893.29	6221728.91	
G718	N	0.30	123.09	123.39	0.29	401801.49	6187275.79	
G722	N	0.30	121.79	122.09	0.18	401756.56	6187005.81	
G724	N	0.90	121.04	121.94	0.95	401729.89	6186834.73	
G727	N	0.28	122.32	122.60	0.25	401689.20	6186599.18	
G729	N	0.15	120.01	120.16	0.17	401684.75	6186499.32	
G734	N	0.75	121.73	122.48	0.66	401625.50	6186281.32	
G735	N	0.85	122.58	123.43	0.80	401616.74	6186154.79	
G738	N	0.55	119.14	119.69	0.61	401776.46	6186513.60	
G739	N	0.48	120.65	121.13	0.57	401592.89	6186498.35	
G751	N	0.30	111.05	111.55	0.28	386541.09	6218894.34	
G752	N	0.15	110.37	110.63	0.14	386401.98	6217817.97	
G766	N	0.00	111.75	112.47	0.66	385010.84	6206030.33	
G793	N	0.15	117.40	118.59	0.56	403848.92	6202475.42	
G796	N	0.16	120.94	122.03	0.70	408986.77	6201116.19	
G800	N	0.25	126.52	127.44	0.40	418252.84	6205394.85	
G807	N	0.36	120.00	121.06	0.41	398001.95	6188501.46	
G808	N	0.34	120.32	121.08	0.38	398116.70	6188511.59	
G809	N	0.87	120.02	121.53	0.90	397999.90	6188604.58	
G813	N	0.55	116.52	117.46	0.80	394496.35	6200946.10	
G819	N	0.00	117.31	117.82	0.61	394677.90	6200920.42	
G1073	N	0.16	113.75	114.31	0.45	394298.19	6211086.17	

G1088	N	0.60	110.52	111.17	0.52	386147.94	6215885.12	
G1089	N	0.60	110.12	110.87	0.66	386302.53	6217200.13	
G1090	N	0.00	111.83	111.99	0.13	390834.21	6215653.50	
G1159	N	0.45	110.96	111.71	0.53	386185.04	6216246.01	
G1160	N	0.00	110.94	111.64	0.46	386181.34	6216247.08	
G1171	N	0.00	109.98	109.97	0.18	385883.65	6213820.14	
G1172D	N	0.00	110.69	111.14	0.15	385592.05	6211815.80	
G1172S	N	0.00	110.48	111.19	0.20	385591.10	6211818.01	
G1187	N	0.30	111.38	112.03	0.28	384616.07	6204521.54	
G1188	N	0.08	111.29	111.75	0.41	385362.32	6209809.99	
G1189D	N	0.20	112.15	112.60	0.14	384304.21	6202199.66	
G1189S	N	0.20	112.17	112.69	0.23	384305.11	6202200.78	
G1190	N	0.00	113.13	114.06	0.51	383855.97	6198429.79	
G1191	N	0.00	113.60	113.93	0.26	384071.13	6200068.40	
G1192	N	0.03	113.78	113.91	0.10	383645.25	6196811.18	
G1193	N	0.30	115.07	115.78	0.48	388896.37	6199410.55	
G1194	N	0.35	113.93	114.77	0.29	386528.30	6199715.92	
G1195	N	0.56	0.00	117.95	0.45	391170.24	6188330.91	
G1196	N	0.44	0.00	118.14	0.64	391168.35	6188335.33	
G1197	N	0.76	118.08	119.38	0.72	391580.40	6191064.07	
G1198	N	0.10	0.00	114.70	0.12	383000.11	6192005.04	
G1199	N	0.12	0.00	114.71	0.13	383001.06	6192002.84	
G1202	Y	0.00	115.05	115.89	0.66	402759.19	6213849.32	out
G1208	N	0.33	115.25	115.66	0.30	399321.54	6214203.45	
G1215	N	0.35	115.36	115.74	0.32	398101.09	6216290.78	
G1216	N	0.37	113.02	113.50	0.10	400686.15	6216988.30	
G1217	N	0.08	113.77	113.91	0.11	383645.23	6196812.29	
G1218	N	0.17	113.10	113.76	0.21	383857.77	6198433.14	
G1219	N	0.15	119.87	120.32	0.14	395393.04	6190567.55	

G1220	N	0.15	120.16	121.14	0.39	397571.23	6190234.64	
G1221	N	0.05	120.38	121.01	0.08	396103.64	6190471.25	
G1222	N	0.50	119.28	120.48	0.51	393739.81	6190791.72	
G1223	N	0.65	116.36	117.31	0.72	391940.52	6199017.05	
G1224	N	0.45	116.04	116.81	0.38	390634.12	6199182.63	
G1242	N	0.15	123.74	124.66	0.24	411941.89	6190896.21	
G1244	N	0.15	124.91	125.18	0.77	411683.35	6189376.63	
G1245	N	0.15	125.07	125.37	0.56	411294.13	6187793.68	
G1246	N	0.00	124.84	125.13	0.32	411684.30	6189373.31	
G1247	N	0.00	124.55	124.92	0.12	410504.01	6186648.26	
G1248	N	0.30	123.43	124.26	0.39	407639.75	6189790.98	
G1249	N	0.30	123.46	124.23	0.36	407644.38	6189787.70	
G1287	N	0.48	122.41	123.35	0.78	406740.59	6189559.10	
G1294	N	0.45	122.10	123.04	0.53	406447.79	6190440.06	
G1296	N	0.00	122.12	122.93	0.54	406388.33	6190411.74	
G1301	N	0.05	124.70	125.03	0.15	411409.87	6187988.86	
G1337	N	0.20	120.43	120.86	0.35	406248.94	6195316.68	
G1380	N	0.50	120.94	121.36	0.45	406211.84	6195074.54	
G1381	N	0.40	120.99	121.14	0.23	406212.72	6195078.98	
G1382	N	0.44	121.28	122.10	0.54	406302.91	6195710.93	
G1383	N	0.35	122.33	123.04	0.41	406425.09	6196548.36	
G1384	N	0.40	121.59	122.49	0.42	406569.92	6197605.59	
G1385	N	0.58	119.76	120.54	0.58	406733.61	6198804.97	
G1387	N	0.26	121.42	122.64	0.55	405293.23	6188659.47	
G1391	Y	0.00	131.88	132.18	0.09	427345.16	6207371.67	out
G1412	N	0.48	123.49	124.53	0.53	408710.74	6186097.39	
G1416	N	0.40	122.69	123.62	0.36	407988.48	6186308.75	
G1417	N	0.10	124.18	124.75	0.21	410491.96	6189333.09	
G1418	N	0.48	123.49	124.54	0.54	408713.49	6186097.41	

G1560	N	0.25	123.92	124.72	0.31	411847.70	6190166.69	
G1561	N	0.20	123.90	124.64	0.21	411846.77	6190167.79	
G1568	N	0.00	124.20	124.73	0.46	409586.45	6189658.15	
G1577	N	0.10	123.31	123.42	0.18	409590.96	6195920.81	
G1578	N	0.10	119.99	120.08	0.16	406609.12	6198100.61	
G1579	N	0.22	120.16	121.04	0.19	407941.98	6201262.33	
G1591	N	0.20	123.00	123.80	0.45	407174.15	6191051.75	
G1594	N	0.00	122.67	122.77	0.16	408880.29	6192802.00	
G1595	N	0.15	120.21	120.60	0.24	407132.40	6202087.19	
G1602	N	0.45	121.86	122.50	0.48	405866.75	6192735.45	
G1613	N	0.00	122.97	123.14	0.04	408096.07	6192346.25	
G1643	N	0.00	119.34	119.83	0.31	407541.48	6204732.90	
G1644	N	0.20	118.89	119.32	0.24	405866.52	6204986.80	
G1650	N	0.10	122.60	123.13	0.20	407396.67	6186515.81	
G1657	N	0.10	113.37	113.43	0.10	395108.94	6216924.37	
G1660	N	0.10	122.10	122.67	0.14	406587.16	6186718.43	
G1661	N	0.10	123.67	124.22	0.19	409053.36	6186004.26	
G1662	N	0.10	123.68	124.14	0.11	409061.64	6186003.23	
G1665	N	0.15	122.62	123.27	0.34	407394.81	6186518.01	
G1670	N	0.00	122.45	123.21	0.26	405843.07	6186989.30	
G1671	N	0.00	122.50	123.28	0.33	405841.26	6186985.95	
G1679	N	0.00	121.01	121.83	0.32	407842.25	6200086.91	
G1686	N	0.11	125.46	125.74	0.03	416432.92	6204489.38	
G1691	N	0.05	122.94	123.06	0.09	408716.32	6198945.44	
G1705	N	0.10	123.38	123.65	0.17	409528.59	6195241.49	
G1732	N	0.40	121.05	121.84	0.61	405853.13	6201106.22	
G1734	Y	0.00	120.46	120.88	0.14	405305.20	6202425.96	out
G1738	N	0.00	121.87	122.29	0.07	406764.92	6194383.62	
G1740	N	0.00	120.69	120.94	0.08	407544.96	6201402.58	

G1745	N	0.35	119.52	120.09	0.43	406803.12	6203457.98	
G1746	N	0.20	120.22	120.68	0.59	404512.72	6204065.90	
G1759	N	0.10	120.76	121.47	0.23	408497.33	6199985.77	
G1766	Y	0.00	122.19	122.05	0.20	409627.35	6193021.09	out
G1779	N	0.45	131.12	132.00	0.41	426273.87	6204528.85	
G1788	N	0.05	118.81	118.94	0.17	404068.44	6204489.44	
G1789	N	0.42	118.77	119.84	0.61	405455.43	6204769.72	
G1800	N	0.66	131.12	132.21	0.63	426273.87	6204528.85	
G1801	N	0.00	129.20	130.15	0.00	424098.37	6204960.58	
G1818	N	0.10	122.73	123.05	0.13	407292.63	6196792.13	
G2003	N	0.00	124.21	123.90	0.25	412114.38	6218660.24	
G2005	N	0.00	112.34	113.00	0.30	406951.52	6216144.17	
G2006	N	0.00	125.36	124.30	0.30	413195.55	6215774.78	
G2009	N	0.00	108.95	109.70	0.25	406503.52	6214213.41	
G2010	N	0.30	107.70	107.35	0.14	409972.14	6211744.34	
G2020	N	0.20	123.22	123.10	0.20	410076.74	6223635.76	
G2026	N	0.23	118.76	119.13	0.28	402374.77	6204764.70	
G2048	N	0.10	115.43	116.04	0.18	393525.40	6205332.52	
G2052	N	0.17	116.27	116.50	0.18	398614.08	6204993.10	
G2060	N	0.05	121.22	121.89	0.27	404740.64	6192558.76	
G2061	N	0.40	121.26	122.24	0.62	404736.97	6192557.61	
G2062	N	0.10	118.78	119.49	0.28	394862.03	6193888.79	
G2065	N	0.14	117.83	118.38	0.25	394125.22	6196107.48	
G2066	N	0.10	117.70	118.03	0.23	393979.24	6195196.38	
G2081	N	0.05	114.15	114.30	0.40	394733.28	6214505.80	
G2082	N	0.37	115.22	115.87	0.46	396247.36	6215491.95	
G2092	N	0.36	114.89	115.43	0.31	411260.02	6212406.48	
G2095	N	0.10	121.52	121.98	0.26	405705.39	6191784.49	
G2120	N	0.20	125.10	125.37	0.32	411561.89	6188234.29	

G2128	N	0.00	123.85	124.57	0.45	408885.23	6189760.00	
G2141	N	0.30	124.05	124.50	0.56	408430.35	6189854.24	
G2163	N	0.15	117.70	118.03	0.23	393977.41	6195195.25	
G2166	N	0.00	120.66	121.13	0.02	396189.66	6190422.30	
G2176	N	0.10	121.54	122.20	0.25	408508.33	6196986.00	
G2190	N	0.20	116.57	116.99	0.26	394520.81	6202448.05	
G2257	N	0.00	113.20	112.76	0.36	386049.43	6206627.52	
G2264	N	0.20	126.15	126.69	0.20	412331.99	6194466.45	
G2271	N	0.00	119.55	121.12	0.17	399677.42	6190767.74	
G2274	N	0.40	119.50	120.41	0.45	396382.48	6191595.63	
G2279	N	0.19	117.04	118.12	0.64	400345.57	6210179.77	
G2280	N	0.00	121.59	122.24	0.26	406334.75	6195928.61	
G2282	N	0.00	120.11	120.80	0.16	401668.79	6192970.47	
G2283	N	0.05	120.27	120.92	0.11	400011.62	6193197.94	
G2284	N	0.15	120.29	120.93	0.12	400010.72	6193196.82	
G2285	N	0.00	120.41	120.78	0.08	400149.78	6194289.62	
G2290	N	0.30	118.12	119.34	0.94	394362.01	6193957.45	
G2291	N	0.00	119.75	120.18	0.30	395579.31	6193793.71	
G2292	N	0.00	119.48	120.21	0.33	395578.34	6193798.14	
G2294	N	0.14	124.29	124.90	0.35	411939.00	6191345.00	
G2295	N	0.00	119.41	120.19	0.38	397900.55	6193477.83	
G2296	N	0.00	119.46	120.16	0.35	397898.68	6193481.14	
G2299	N	0.10	123.93	124.60	0.22	411878.52	6190308.94	
G2306	N	0.15	122.30	122.60	0.25	405962.23	6188651.84	
G2307	N	0.20	122.30	122.61	0.25	405959.49	6188649.59	
G2309	N	0.17	121.45	121.94	0.24	405552.98	6188235.13	
G2330	N	0.15	121.41	121.92	0.22	405556.60	6188240.72	
G2334	N	0.00	122.82	123.50	0.27	405105.97	6187200.29	
G2335	N	0.34	122.54	123.28	0.31	407041.35	6186680.84	

G2337	N	0.20	122.01	122.63	0.24	405590.61	6190322.72	
G2338	N	0.23	122.42	122.61	0.22	405595.16	6190327.21	
G2340	N	0.30	114.17	114.72	0.30	385189.37	6199889.22	
G2341	N	0.25	114.19	114.69	0.27	385185.68	6199890.29	
G2345D	N	0.15	111.62	112.90	0.20	385058.99	6207733.38	
G2345S	N	0.15	111.56	112.70	0.25	385058.95	6207736.71	
G2346	N	0.35	118.49	118.42	0.32	402977.82	6199783.69	
G2369	Y	0.00	114.83	115.78	0.33	396387.84	6208949.08	out
G2452	N	0.50	125.88	126.82	0.27	418059.03	6196220.83	
G2482	N	0.28	121.45	121.62	0.20	406228.41	6200474.53	
G2483	N	0.00	120.63	121.17	0.26	405963.54	6200923.24	
G2485	Y	0.00	120.60	121.13	-0.01	407096.88	6200568.60	out
G2634	N	0.00	115.72	116.14	0.25	397791.69	6212965.88	
G2653	N	0.03	123.61	123.64	0.26	401661.66	6176109.35	
G2654	N	0.15	121.71	121.86	0.29	398315.10	6176607.81	
G2655	N	0.30	119.75	120.05	0.00	394765.36	6176939.74	
G2656	N	0.14	118.64	118.78	0.17	391060.00	6177991.63	
G2657	N	0.50	117.42	117.92	0.50	389028.80	6179216.42	
G2676	N	0.19	115.42	115.61	0.18	384063.31	6182453.18	
G2681	Y	0.00	119.89	120.49	0.24	403520.34	6199985.60	out
G2690	N	0.00	120.46	121.09	0.27	400291.32	6195240.48	
G2691	N	0.10	121.12	121.63	0.15	402927.69	6194874.58	
G2692	N	0.05	121.18	121.58	0.10	402920.34	6194874.50	
G2693	N	0.25	120.40	121.09	0.27	400285.74	6195245.97	
G2694	N	0.00	122.08	122.20	0.21	404488.68	6194631.18	
G2695	N	0.16	121.97	122.18	0.19	404484.96	6194635.58	
G2696	N	0.14	118.43	118.74	0.25	395792.60	6197499.27	
G2697	N	0.00	117.46	117.34	0.26	392930.55	6201167.85	
G2698	N	0.00	117.38	117.28	0.20	392933.36	6201163.45	

G2731	N	0.00	113.45	113.61	0.23	388306.44	6205361.53	
G2734	N	0.20	113.33	113.55	0.19	388745.83	6207429.65	
G2735	Y	0.00	113.05	113.74	0.44	388307.98	6208706.53	out
G2739	N	0.10	113.05	111.88	0.22	387151.62	6210747.80	
G2741	N	0.00	112.36	111.43	0.31	387286.39	6211566.81	
G2748	N	0.05	111.48	111.58	0.28	388059.59	6214242.27	
G2787	Y	0.00	114.34	114.15	0.25	391929.61	6208885.41	out
G2790	N	0.15	121.06	121.18	0.00	408331.73	6194368.10	
G2799	N	0.07	126.31	128.20	0.13	416269.03	6202852.18	
G2819	N	0.05	114.33	114.64	0.18	396849.25	6207774.15	
G2820	N	0.00	116.13	116.16	0.18	395669.14	6206836.14	
G2821	N	0.00	114.71	115.25	0.23	397361.58	6207066.67	
G2825	N	0.30	116.33	116.41	0.11	397377.40	6209657.55	
G2826	Y	0.00	115.59	115.69	0.13	397528.00	6210876.92	out
G2828	N	0.73	118.88	119.75	0.59	400018.91	6199039.37	
G2831	Y	0.00	119.58	120.49	0.19	403175.94	6196469.74	out
G2857	N	0.00	120.28	120.55	0.64	398260.19	6197171.59	
G2862	N	0.05	120.39	120.52	0.05	397432.20	6196440.53	
G2863	N	0.10	119.83	120.53	0.06	397426.57	6196450.45	
G2864	N	0.10	118.22	118.78	0.12	395825.17	6196475.97	
G2868	N	0.10	121.55	121.86	0.08	407933.21	6195249.17	
G2872	N	0.00	122.41	122.45	0.00	408670.67	6194776.22	
G2883	N	0.00	107.73	108.37	0.42	377075.21	6220690.78	
G2885	N	0.00	105.63	106.22	0.00	373039.50	6228388.84	
G2886	N	0.15	104.01	104.32	0.18	373496.98	6232335.65	
G2890	N	0.00	103.89	104.29	0.10	363606.05	6228400.24	
G2892	N	0.37	104.05	104.37	0.08	369162.81	6228820.56	
G2893	N	0.05	105.16	105.39	0.06	363204.83	6225328.69	
G2894	N	0.00	104.24	104.40	0.10	363060.20	6224234.05	

G2896	N	0.00	109.85	111.12	0.69	382536.09	6223110.89	
G2898	N	0.25	103.34	104.05	0.28	356263.37	6228363.31	
G2901	N	0.34	101.31	101.86	0.31	355079.03	6231256.87	
G2905	N	0.00	99.39	99.39	0.00	349143.42	6229963.70	
G2907	N	0.00	103.84	104.48	0.31	376572.71	6230124.89	
G2909	N	0.42	116.86	117.64	0.57	395440.77	6204038.78	
G2950	N	0.20	106.24	107.33	0.31	374813.15	6228123.07	
G2953	N	0.23	106.82	107.45	0.26	371950.92	6224687.40	
G2970	N	0.00	108.16	109.12	0.12	379477.11	6227630.39	
G2972	N	0.00	104.43	105.20	0.30	370239.54	6227840.54	
G2973	N	0.33	105.98	106.27	0.09	369530.88	6222236.27	
G2976	N	0.10	104.31	104.82	0.18	363543.57	6227742.71	
G2977	N	0.17	104.26	104.72	0.21	362748.55	6221817.05	
G2981	N	0.10	102.11	102.12	0.15	356481.23	6230060.38	
G2984	N	0.00	103.39	103.83	0.20	368613.29	6236613.44	
G2986	N	0.19	103.72	103.91	0.00	361476.58	6212067.45	
G2995	N	0.20	114.34	114.65	0.28	385657.88	6201225.89	
G2996	N	0.15	114.86	116.21	0.21	386105.25	6201892.37	
G2998	N	0.00	110.47	110.66	0.04	382537.11	6220009.71	
G3006	N	0.00	107.04	107.53	0.16	374270.21	6224340.43	
G3009	N	0.00	106.80	107.30	0.23	374062.11	6222724.99	
G3010	N	0.00	107.70	108.37	0.15	373947.36	6221169.58	
G3011	N	0.00	106.03	108.37	0.15	373532.83	6224431.49	
G3018	N	0.10	106.11	106.49	0.14	368697.40	6223272.82	
G3021	N	0.05	105.09	100.72	0.18	366095.75	6221289.61	
G3060	N	0.19	107.72	108.21	0.40	369231.76	6220067.06	
G3062	N	0.10	107.90	108.00	0.00	373392.19	6217266.86	
G3063	N	0.00	108.42	108.42	0.00	373025.60	6215198.92	
G3065D	N	0.15	105.61	105.76	0.00	370304.03	6216628.02	

G3065S	N	0.25	105.61	105.86	0.00	370304.03	6216628.02	
G3066	N	0.32	105.91	106.23	0.00	368178.57	6211866.76	
G3067	N	0.00	107.06	107.06	0.00	372442.25	6210045.70	
G3112	Y	0.00	103.61	103.51	0.10	368808.70	6236577.33	out
G3119	N	0.33	113.31	113.93	0.30	390433.40	6211306.87	
G3126	N	0.36	111.90	112.49	0.49	390328.74	6210489.38	
G3131	N	0.15	102.89	103.13	0.21	358848.48	6229918.61	
G3132	N	0.27	105.79	106.53	0.29	373372.89	6230780.13	
G3133	N	0.18	108.90	109.59	0.20	380507.07	6227474.91	
G3134	N	0.39	108.45	108.98	0.17	383584.44	6221507.79	
G3137	N	0.00	104.85	105.20	0.38	365445.51	6229370.55	
G3138	N	0.15	106.29	105.82	0.28	369522.18	6233806.63	
G3148	Y	0.00	106.25	103.87	0.21	369433.02	6233616.72	out
G3158	N	0.00	110.38	110.92	0.15	385830.48	6213419.11	
G3159	N	0.00	110.67	111.02	0.13	385768.90	6212952.55	
G3174	N	0.17	115.72	116.51	0.17	399314.80	6210024.58	
G3180	N	0.15	97.54	97.69	0.00	336071.79	6228227.06	
G3188	Y	0.00	117.87	118.14	0.33	403074.58	6203139.50	out
G3223	N	0.22	114.57	114.93	0.15	385621.08	6202052.83	
G3253	N	0.00	110.94	110.94	0.00	376229.67	6227988.71	
G3260	N	0.25	106.81	107.06	0.00	374066.72	6222725.05	
G3261	N	0.00	110.88	110.88	0.00	377963.00	6227400.19	
G3262	N	0.35	104.26	104.61	0.00	370244.16	6227840.61	
G3264	N	0.25	114.00	114.25	0.00	383050.11	6226293.47	
G3265	N	0.33	111.70	112.03	0.00	383826.37	6219839.40	
G3266	N	0.00	112.09	112.09	0.00	377294.70	6222245.29	
G3285	N	0.05	116.29	116.34	0.00	393327.46	6203961.69	
G3287	N	0.17	104.23	104.40	0.00	362749.44	6221819.28	
G3288	N	0.15	103.79	103.94	0.00	361796.64	6214484.68	

G3301	N	0.00	104.57	104.57	0.00	364196.84	6219372.37	
G3309	N	0.00	106.80	106.80	0.00	374062.11	6222724.99	
G3321	N	0.25	104.26	104.51	0.00	359807.20	6205039.04	
G3322	N	0.25	104.25	104.50	0.00	360095.45	6205095.49	
G3323	N	0.00	104.70	104.70	0.00	360045.15	6204519.05	
G3324	Y	0.00	104.51	104.51	0.00	360128.29	6205424.31	out
G3327	N	0.30	107.00	107.30	0.00	375738.90	6220840.71	
G3337	N	0.17	99.56	99.73	0.00	346908.83	6226974.87	
G3344	N	0.10	101.41	101.51	0.00	355261.66	6220212.99	
G3345	N	0.27	96.80	97.07	0.00	343890.81	6224357.40	
G3349	N	0.09	106.93	107.02	0.00	371918.73	6218107.59	
G3358	N	0.00	106.68	106.68	0.00	368849.95	6217096.98	
G3366	N	0.15	104.55	104.70	0.00	365125.77	6214013.99	
G3367	N	0.00	106.16	106.16	0.00	370258.03	6211728.26	
G3369	N	0.22	121.04	121.26	0.00	412216.62	6217385.88	
G3370	N	0.00	117.88	117.88	0.00	410324.73	6219775.60	
G3371	N	0.00	115.38	115.38	0.00	409322.86	6217745.44	
G3376	N	0.10	103.78	103.88	0.00	360875.91	6207531.87	
G3377	N	0.10	105.28	105.38	0.00	364786.93	6209775.36	
G3378	N	0.16	105.01	105.17	0.00	361970.04	6204779.46	
G3379	N	0.16	105.76	105.92	0.00	367504.32	6206773.90	
G3380	Y	0.00	106.57	106.57	0.00	366971.63	6202273.03	out
G3381	N	0.00	96.27	96.27	0.00	340988.37	6228822.60	
G3383	N	0.15	92.45	92.60	0.00	324184.19	6231200.31	
G3388	N	0.37	96.53	96.90	0.00	345044.13	6225875.07	
G3389	N	0.90	92.69	93.59	0.00	322814.15	6232013.42	
G3390	N	0.40	95.20	95.60	0.00	324423.92	6231817.16	
G3391	Y	0.00	104.71	104.71	0.00	359920.85	6204274.27	out
G3392	N	0.33	95.17	95.50	0.00	326892.45	6231521.03	

G1243	N	0.30	123.74	124.79	0.37	411968.00	6190901.00	
L1243	N	0.28	133.85	134.50	0.18	441684.03	6182257.99	
L1779S	N	0.57	128.34	147.89	0.65	420714.00	6185533.00	
L1967	N	0.10	126.33	133.22	0.46	414381.97	6185772.58	
L1958D	N	0.27	132.56	133.41	0.24	429931.00	6180284.00	
L1958S	N	0.22	132.55	133.44	0.27	429933.00	6180286.00	
L2729	N	0.06	129.24	129.73	0.26	423685.36	6174603.76	
L1110S	Y	0.23	136.70	138.16	0.34	440920.15	6177182.38	out
L1110D	Y	0.20	136.70	138.20	0.34	440922.42	6177182.38	out
G1342D	Y	0.16	127.99	128.75	0.34	419414.39	6183940.44	out
L1779D	N	0.47	119.58	147.89	0.65	403175.94	6196469.74	
L1327D	N	0.15	127.36	128.00	0.38	422002.00	6191382.00	

APPENDIX 3 - STANDARD OPERATING PROCEDURE PIEZOMETER (BORE) MONITORING

Operating procedure Developed By: Water Resources Team **Approved By:** Leonie Williams

Review Completed By: Grant Gyles **Approved By:** Leonie Williams

Purpose: MI staff is required to monitor groundwater levels and salinity across the MIA, through targeted sampling programs under licences held by the company.

Scope: Water Resources has the responsibility of monitoring groundwater levels and salinity in the MIA.

	Standard Operating Procedure	**Potential Hazards**	**Personal Protective Equipment**
1	**Record GPS points of all sites sampled** To get an accurate location, the GPS is required to be placed on top of the bore casing. All coordinates should be measured in GDA94 (Eastings, Northings).	Tall grass/vegetation, snakes, hot casing on steel constructed bores-especially summer, slips/trips/falls, Traffic on when working with road reserve. Ensure personal safety around fences adjacent to stock grazing areas and potential to be exposed to electric fences.	Steel Cap Ankle Boots/Wet boots, Sunscreen, HiVis Long Sleeved Shirt, Long Pants, Wide Brimmed Hat, sunglasses.
2	**Total Depth and Groundwater Levels** The total depth and depth to the water level should be measured within the bore. Total bore depth can be measured using a weight attached to a tape measure. A 100m tape measure is recommended for use due to range in depth of bores in MI's Network. TOTAL DEPTH 1. Lower the weight into the casing until it reaches the bottom of the hole- as this happens the tape will become slack. 2. Lift and drop the tape several times to 'feel' the bottom of the bore. 3. Remember to add the length of the weight onto the tape measurement (if this has not been accounted for. 4. Subtract the height of the casing above the ground level from the measurement. 5. Record the result as total depth (in meters) of the bore on the Bore Information Sheet. 6. Clean the tape before using it again. Depth to standing water level in the bore can be measured using a tape measure with an attachment designed to make a noise or signal when it touches the water surface. MI has the choice of two pieces of measuring		

	equipment to measure groundwater levels. The first being a plopper/sampler made from a stainless steel tube (15-20cm) attached to a tape measure. The hollow end of the plopper makes a 'plop' sound when it hits the water. There is also an electronic measuring device with a sonde (water level meter) attached to the end of the tape measure. A 'beep' is made when the probe hits the water and measurement provided for in meters on the unit display. GROUNDWATER LEVELS 1. Lower the plopper/sonde into the bore until it hits the water. 2. Lift and drop the plopper several times to find the exact water level. This should give a reading accurate to 1cm. 3. Remember to add the length of the plopper onto the tape measurement (if this has not been accounted for). 4. Subtract the height of the casing above the ground level from the measurement on the Bore Information Sheet. 5. Record the result as a water level in meters, with the date of measurement on the Bore Information Sheet. 6. To record the water level relative to the ground surface, the measure distance between the measuring point (e.g. top of casing) and the ground surface is subtracted. If the water level in the bore is below ground, record the results as negative (-) and positive (+) if it is above ground (water standing in the casing above ground). 7. Wash the tape and the plopper thoroughly with tap water before using it again to prevent contamination of the next bore. Dry and roll tape.		
3	**In- Situ Salinity Levels in Bores** Salinity levels in bores are measured using a water level/EC Meter. This device is comprised of a sonde attached to a 300m tape measure on a hand wound reel. The probe detects the presence of water between each end of the probe sending a signal (light and 'beep') to the operator. Measurements for Time, EC (µ/cm) and Temperature ( ).The water level is then determined by taking a reading directly from the tape, at the top of casing or borehole. It is run off a 9 volt battery GROUNDWATER LEVEL 1. Carefully lower the sonde into the bore until it hits the water. 2. Lift and drop the sonde several times to find the exact water level. This should give a		

	reading accurate to 1cm. 3. The length of the sonde has been accounted for on the length of the tape measure. 4. Subtract the height of the casing above the ground level from the measurement on the Bore Information Sheet. 5. Record the result as a water level in meters, with the date of measurement on the Bore Information Sheet. 6. To record the water level relative to the ground surface, the measure distance between the measuring point (e.g. top of casing) and the ground surface is subtracted. If the water level in the bore is below ground, record the results as negative (-) and positive (+) if it is above ground (water standing in the casing above ground). 7. Wash the tape and the plopper thoroughly with tap water before using it again to prevent contamination of the next bore. Dry and roll tape. EC AND TEMPERATURE MEASUREMENTS 8. Ensure that spar batteries, screw driver are packed with monitoring equipment. The field unit must be calibrated in accordance with the Groundwater Component of the Water Resources Calibration SOP. 9. Carefully lower the sonde into the bore until it hits the water. 10. Continue to lower the sonde down the bore hole until you reached the specified screen depth (located on the bore log). If this is unavailable, the sonde should be lowered at a consistent level across all bores read during the bore monitoring run. An agreed depth of 3m has been adopted for MI's monitoring network where specified screen levels are not available. 11. The length of the sonde has been accounted for on the length of the tape measure. Subtract the height of the casing above the ground level from the measurement to ensure that the probe has been administered to the correct depth. 12. Hold probe there until unit measurements displayed stabilize. 13. Record the result EC (µ), with the date and time of measurement on the Bore Information Sheet. 14. Wash the tape and the plopper thoroughly with tap water before using it again to prevent contamination of the next bore. Dry and roll tape.		

4	**Noting Of Additional Parameters** Whilst undertaking the bore run additional notes should be kept in relation to: 1. Condition of bore casing. 2. Maintenance requirements of bores and access tracks. 3. Ensuring all bore has caps and signs are visible. 4. Note any additional or potential hazards.		
5	**Data Recording And Evaluation** All data is to be stored in accordance with MI data management and storage policies and procedures also set out by the Water Resources business unit.		
6	**Equipment** All equipment is to be clean and returned to its rightful place with the Environment Store Room, Griffith Depot.		

APPENDIX 4 – STANDARD OPERATING PROCEDURE CALIBRATION AND MAINTENANCE OF WATER PERFORMANCE FIELD MONITORING EQUIPMENT

Operating procedure Developed By: Water Resources Team **Approved By:** Leonie Williams

Review Completed By: Lindsay Golsby-Smith **Approved By:** Leonie Williams

Purpose: MI staff are required to monitor surface water quality and groundwater quality across the MIA, through targeted sampling programs under licences held by the company. Part of this process is ensuring the calibration of equipment is done so in accordance with specified guidelines.
Scope: To provide staff with the appropriate procedures to calibrate, maintain and manage field sampling equipment to ensure quality control and quality assurance of data collected.

	Standard Operating Procedure	Potential Hazards	Personal Protective Equipment
1	**Hydrolab- Field Calibration** Calibration is required at a minimum on a monthly basis. Calibration must also be conducted before and after use during a Specialized Project and Pollution Incident. Calibration for use on supply water monitoring must be undertaken if monitoring on drainage waters has occurred prior to use. 1. Ensure new batteries are installed or that there is sufficient charge in the batteries to undertake calibration. 2. Refer to *Attachment C.1- Hydrolab Health and Safety_ Chemicals* before proceeding with Step 3. 3. Ensure calibration solutions are not out of date. 4. Ensure that you have thoroughly rinsed beaker 3 times with deionized water before proceeding to fill with calibration solution(s). 5. See *Attachment A.1 Hydrolab Calibration Instructions* for remaining steps for monthly calibration of the EC, pH and Turbidity Probes. 6. All hydrolab calibration results must be recorded on the Hydrolab	Spill of calibration solutions	Gloves Protective Eyewear Protective Clothing HiVis Vest/Shirt Boots/covered shoes

	Calibration Information Sheet. 7. All hydrolab calibration data should be scanned and stored electronically in line with Water Resources Quality Assurance Procedure. 8. Ensure that routine maintenance has been undertaken on the Hydrolab in accordance with *Attachment B.1- Hydrolab Maintenance*. The Hydrolab will be required to have a 2-yearly service provided that calibration and maintenance has been carried out on a monthly basis.		
2	**Groundwater Level Meter/EC Probe** Calibration of the groundwater level EC probe must be conducted on a monthly basis or ever 100 bores samples, whichever is first. 1. Ensure new batteries are installed or that there is sufficient charge in the batteries to undertake calibration. 2. Ensure calibration solutions are not out of date. 3. Ensure that you have thoroughly rinsed beaker 3 times with deionized water before proceeding to fill with calibration solution. 4. See *Attachment A.2 Heron EC Meter Calibration Sheet* for remaining steps for monthly calibration of the EC, pH and Turbidity Probes. 5. All hydrolab calibration results must be recorded on the Hydrolab Calibration Information Sheet. 6. All hydrolab calibration data should be scanned and stored electronically in line with Water Resources Quality Assurance Procedure. 9. Ensure that routine maintenance has been undertaken on the Hydrolab in accordance with *Attachment B.2- Heron Conductivity Plus Instruction Sheet*.		

3	**Soil Monitoring Probe (CDC401/pHC281)** Calibration of the soil monitoring probe must be done before and after monitoring each day. 1. Ensure new batteries are installed or that there is sufficient charge in the batteries to undertake calibration. 2. Ensure calibration solutions are not out of date. 3. Ensure that you have thoroughly rinsed beaker 3 times with deionized water before proceeding to fill with calibration solution(s). 4. See *Attachments A.3.1 to A.3.4 PHC281 and CDC401 User Manuals* for remaining steps for monthly calibration of the EC and pH Probes. 5. All hydrolab calibration results must be recorded on the Soil Monitoring Probe Calibration Sheet. 6. All Soil Monitoring Probe calibration data should be scanned and stored electronically in line with Water Resources Quality Assurance Procedure. 10. Ensure that routine maintenance has been undertaken on the Hydrolab in accordance with *Attachment B.3- Soil Probe User Manual*.		
3	**Water Filter (Manual) Hand Pump** All staff must ensure that the O-rings and body of hang pump (including hoses) are in good working condition. All staff is responsible for ensuring that filter papers are stocked and sufficient supplies are available in the Environment Store.		

4	**River Surveyor** No Calibration is required for the River Surveyor. For guidance on equipment Use and Maintenance see *Attachment A.4- River Surveyor Manual (Flow Measuring Device).*		
5	**GPS** 1. Ensure new batteries are installed or that there is sufficient charge in the batteries to undertake Calibration. 2. Ensure the GPS Datums are set in accordance with *Attachment A.5- Providing GPS Locations of Water Performance and Asset Locations.*		

1. SOP Eye protection	**2.**	**3.**	**4 .**	**5. SOP Hand Protection**	**6. SOP Foot Protection**	**7. SOP Protective Clothing**	**8.**
							



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Murrumbidgee Irrigation Ltd

ANNUAL COMPLIANCE REPORT

2015



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Murrumbidgee Irrigation Limited

Annual Compliance Report

2014/15

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Introduction

The Annual Compliance Report 2014/15 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation Limited (MI) with the Department of Primary Industries, Water (DPI Water) and the NSW Environment Protection Authority (EPA). MI operates under a Combined Water Supply Work Approval and Water Use Approval (40CA403245) issued DPI Water and an Environment Protection Licence (EPL) 4651 issued by the EPA.

These licences set the minimum standard for environmental management which are reflected in MI's risk-based approach to meeting its legal and regulatory obligations. MI also has in place environmental programs which have been developed to extend beyond legal compliance that demonstrate our commitment to ensuring MI's operations do not adversely impact the environment.



Brett Jones
Chief Executive Officer
Murrumbidgee Irrigation Limited



Gillian Kirkup
Chairman
Murrumbidgee Irrigation Limited





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Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
BBSW	Barren Box Storage and Wetland
BYD	Bray's Dam Storage
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPI Water	Department of Primary Industries, Water
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Reference Evapotranspiration
GIS	Geographic Information System
ha	Hectare(s)
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	MicroSiemens per centimetre
µg/L	Micrograms per litre
ML	Megalitre
OEH	Office of Environment and Heritage
SOP	Standard Operating Procedure
T	Tonnes

Executive summary

The first part of this report has been prepared to meet the conditions of Murrumbidgee Irrigation Limited's (MI) Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval). The data presented in these sections refer to the current reporting year, in comparison to data from the previous two reporting years and data from a year at least five years prior. The latter part of this report (from page 67) has been prepared to meet the conditions and requirements of Environmental Protection Licence (EPL) 4651. MI has fulfilled the compliance requirements as set out in the Combined Approval and EPL 4651 for 2014/15.

The climatic conditions across the Murrumbidgee Irrigation Area (MIA) influence all aspects of this report. The climatic conditions determine the volume of water required for irrigation, the amount of water discharged from the area and groundwater dynamics. Seasonal variability was greater than usual in 2014/15, with lower rainfall and higher evapotranspiration recorded across the MIA.

For 2014/15 the final water allocation for the Murrumbidgee Valley was 53% for general security and 95% for high security water entitlements, respectively. A total of 878,614 ML was diverted from the Murrumbidgee River into the MIA, a 5% increase from 2013/14. This total does not include 2,472 ML water delivered on behalf of the NSW Office of Environment and Heritage (OEH) for environmental purposes.

Winter cereals were the dominant crop type grown in the MIA. However, rice had the highest water use and accounted for 35% of total water deliveries.

Highest groundwater levels are located in the Yanco and Mirrool Irrigation Areas and the Benerembah Irrigation District. Groundwater salinity shows a decreasing trend from September to March for each irrigation season, which is most likely due to irrigation recharge and seasonal rainfall.

A simple salt balance determined that of the 58,858 tonnes of salt received through water diversions into the MIA, 96 tonnes was discharged back to the river, leaving a balance of 58,762 tonnes of salt retained within the MIA. This simple salt balance does not take into account other factors that influence the total salt load retained in the MIA. A three year Soil Salinity Survey is included with this report and provides further detail on salinity dynamics within the MIA.

Trigger based monitoring of EPL discharge points revealed a total of seven notification and/or action level EPL chemical detections for 2014/15. From the list of eleven EPL 4651 Scheduled Chemicals, only two were detected at *notification* and/or *action* level concentrations in 2014/15.

It is important to note that the MIA and Districts Land and Water Management Plan came to an end in 2014. Therefore, all of the conditions and requirements relating the Land and Water Management Plan are no longer addressed in this Annual Compliance Report.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of compliance

Murrumbidgee Irrigation Limited (MI) has met the conditions of the Combined Water Supply Work Approval and Water Use Approval (40CA403245) in 2014/15. Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. These internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Water Supply Work Approval and Water Use Approval during 2014/15.

MI did not change or modify existing authorised discharge works listed in the Combined Water Supply Work Approval and Water Use Approval or construct new works that would allow further discharge from the area of operations during 2014/15. A summary of the compliance requirements are cross referenced to this report and listed in Table 1.

Table 1 Combined Water Supply Work Approval and Water Use Approval (40CA403245) compliance summary

Licence section	Requirement	Compliant	Report Section
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1	Yes	2 Plan of Operations and Works
	12.2	Yes	
Statement of Compliance	12.3	Yes	1 Statement of Compliance
Presentation of Data and Analyses	12.4	Yes	2-7
	12.5	Yes	
	12.6	Yes	
	12.7	Yes	
	12.8	Yes	1 Statement of Compliance
New Measures to Limit Groundwater Recharge and Discharge of Salt	12.9	Yes	6 New Measures to Limit Groundwater Recharge and Discharge of Salt
Reporting on Water Management	12.10	Yes	3 Reporting on Water Management
	12.11	Yes	3.5 Water discharged from Area of Operations
	12.12	Yes	3.9 Water Balance
	12.13	Yes	3.2 Climate Conditions, and
			4 Water Use
Reporting on Salinity and Salt load	12.14	Yes	5 Salinity and Salt load
	12.15	Yes	
	12.16	yes	
Reporting on Groundwater Conditions	12.17	Yes	6 Groundwater Conditions

2 Plan of operations and works

Murrumbidgee Irrigation Limited's (MI) area of operations, storages and major supply and drainage channels are presented in Figure 1. The Murrumbidgee Irrigation Area (MIA) is irrigated from water diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval 40CA403245 via authorised supply works shown in Figure 2.

In 2014/15 a total of 4,700ha were included in MI's Area of Operations which is highlighted in Figure 1.

2.1 Operational background

The MIA is supplied by water stored in Burrinjuck and Blowering dams in the upper Murrumbidgee catchment via two authorised supply works:

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STUR - Sturt Canal (after diversion from Gogeldrie Weir)

The water released from Burrinjuck and Blowering dams flows down the Murrumbidgee River to Berembed Weir where most of the water for the MIA is diverted via NARREG which feeds the supply channels that deliver irrigation water to customers. The balance of the MIA's water requirements are diverted at Gogeldrie Weir and directed to the Sturt Canal to supply customers in the southern and western regions of the MIA.

A complementary drainage system captures drainage water, which includes catchment flows and off-farm drainage. Drainage water flows via Mirrool Creek towards Barren Box Storage and Wetland (BBSW), and is then combined with water flows from supply channels and reused in the Wah Wah, Benerembah and Tabbita Irrigation Districts.

MI's supply and drainage system is a virtually closed system in that it does not discharge to any other rivers or creeks outside the area of operations except during high rainfall events or increased flow of farm drainage during the irrigation season. There are five drainage sites which can potentially discharge outside the area of operations following these flow events (Figure 3). These sites are listed as discharge sites in the Combined Approval under Schedule 1 - Attachment 2 and are monitored in accordance with EPL 4651.

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDGE – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain, River Road
- MIRFLD – Mirrool Creek Floodway, Wyvern Station

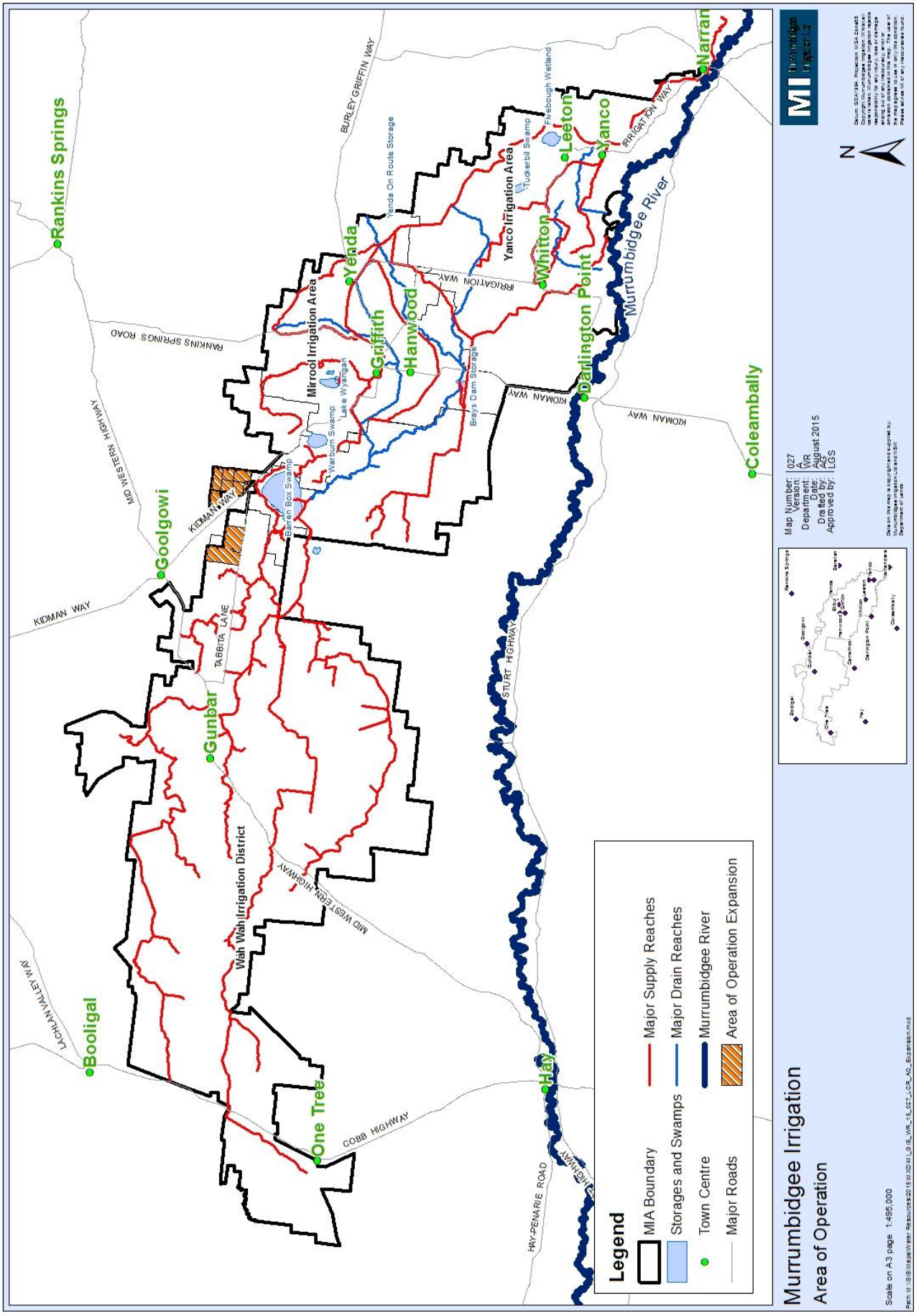


Figure 1 Murrumbidgee Irrigation area of operations, including area of expansion

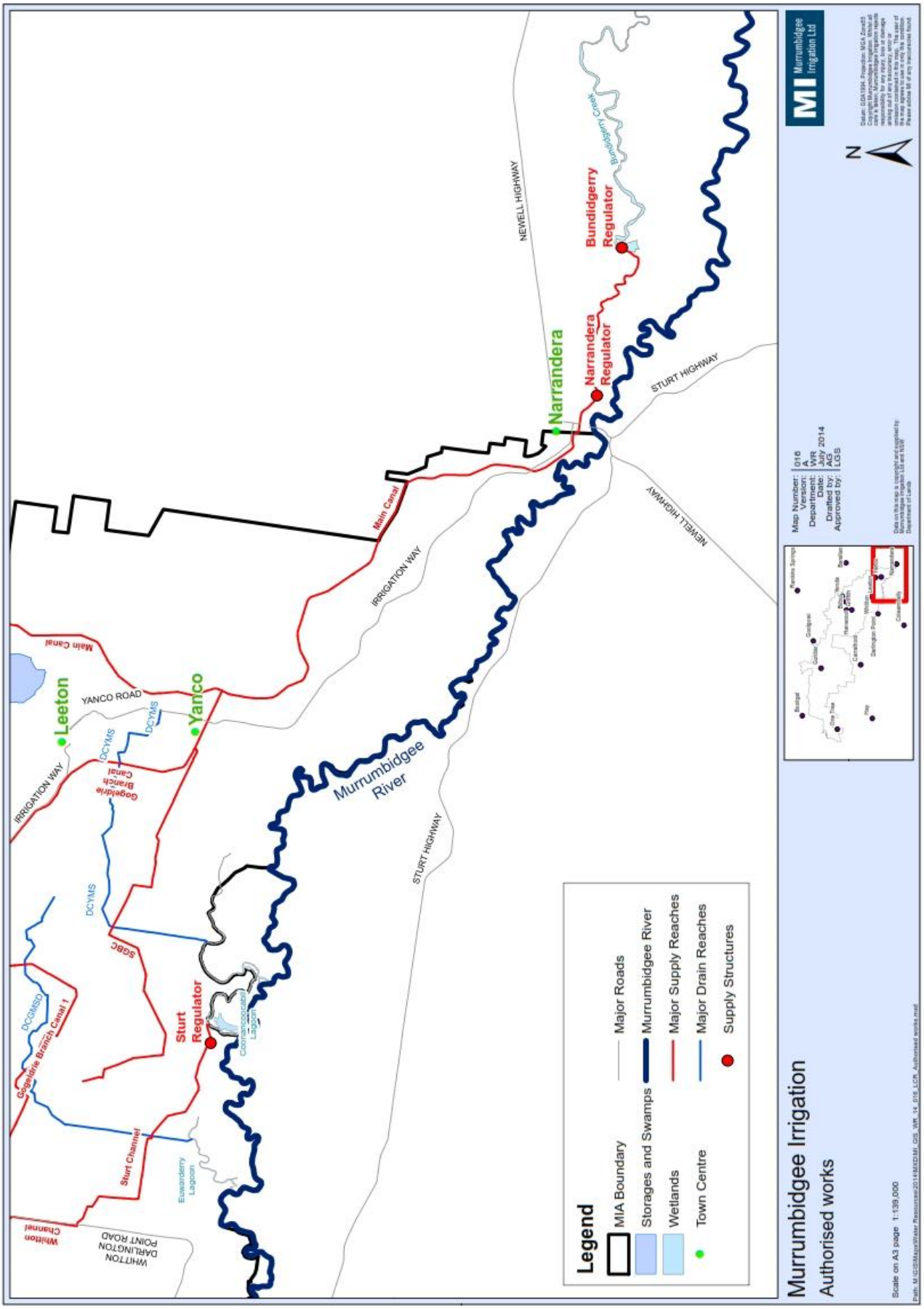


Figure 2 Location of authorised supply works

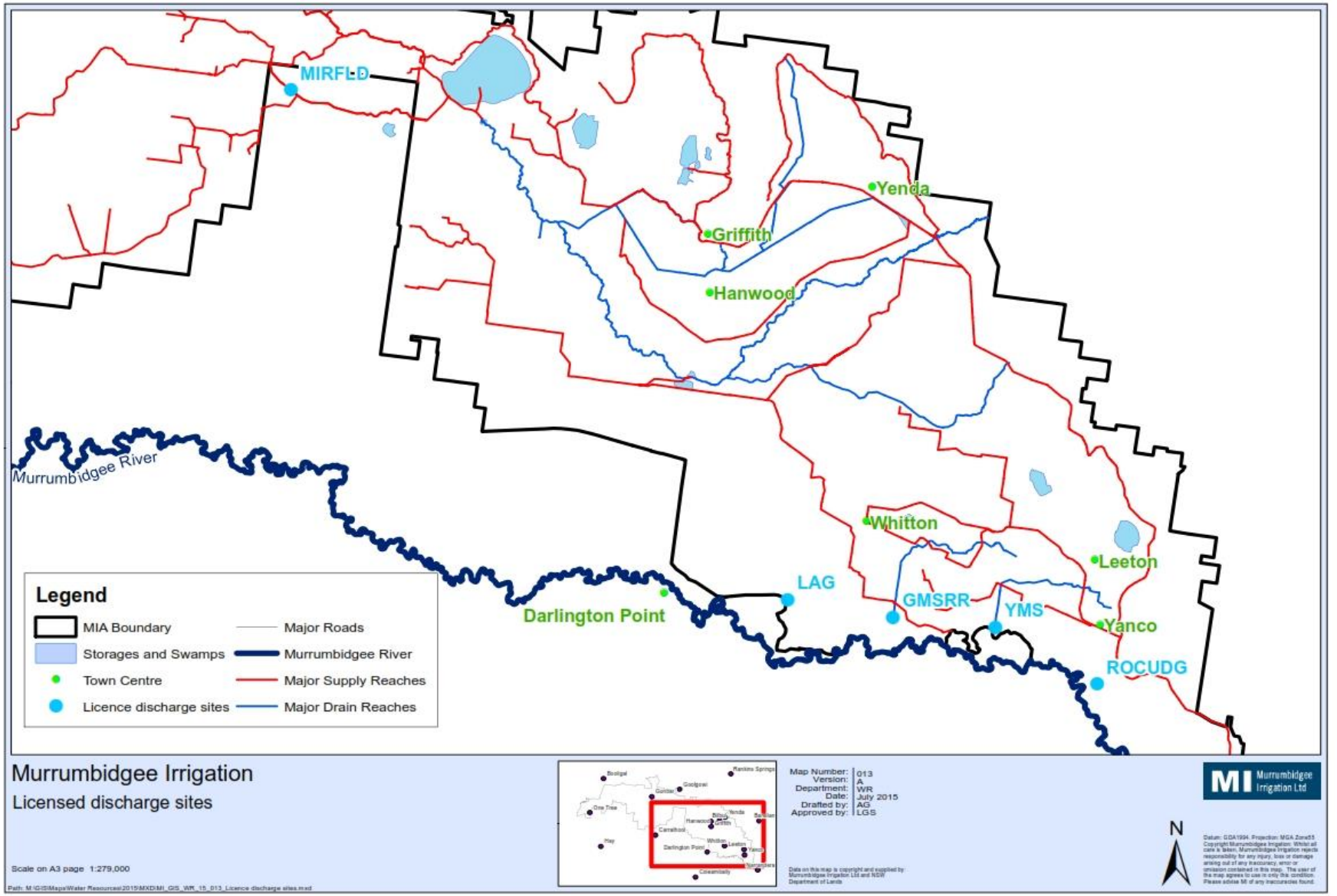


Figure 3 Monitoring and discharge points in the MIA

3 Reporting on water management

3.1 Climate conditions

The climatic data for the Murrumbidgee Irrigation Area (MIA) is monitored at eight weather stations across the MIA (Figure 4). These weather stations measure rainfall and evapotranspiration (ETo) on a daily basis and are operated by Murrumbidgee Irrigation Limited (MI) and CSIRO.

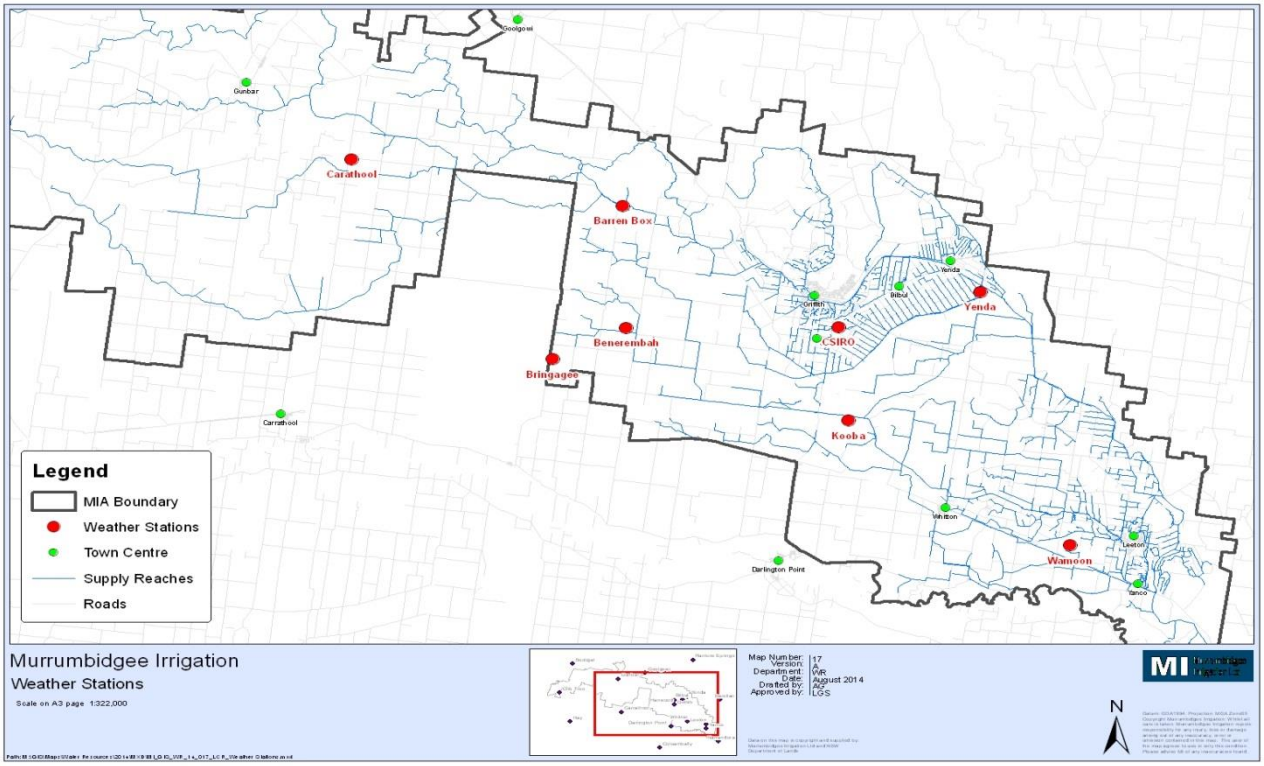


Figure 4 Location of weather monitoring stations in the MIA

Total Rainfall and ETo recorded at each weather station during 2014/15 is displayed in Table 2. Griffith recorded the highest rainfall (348 mm) and lowest ETo (1776 mm), whereas the lowest rainfall (253mm) and highest ETo was recorded at Carathool. The greater seasonal variability at Carathool is likely to have resulted in a higher crop water demand in this area.

Table 2 Annual rainfall (mm) and ETo (mm) total for MIA weather station districts for 2014/15

Weather Station	Total rainfall (mm)	Total ETo (mm)
Barren Box	299	2099
Benerembah	265	1900
Bringagee	263	2202
Carathool	253	2296
Kooba	272	2100
Wamoon	255	2012
Yenda	325	1870
Griffith (CSIRO)	348	1776

Weather data recorded at the Griffith weather station is displayed with Long Term Average (LTA) (1962-2014) data in Figure 5. Rainfall and ETo recorded at all other weather stations are shown in Figure 6. Above average rainfall was recorded in December, January, April and June. ETo for 2014/15 peaked in December, slightly earlier in the irrigation season when compared to historical LTA records.

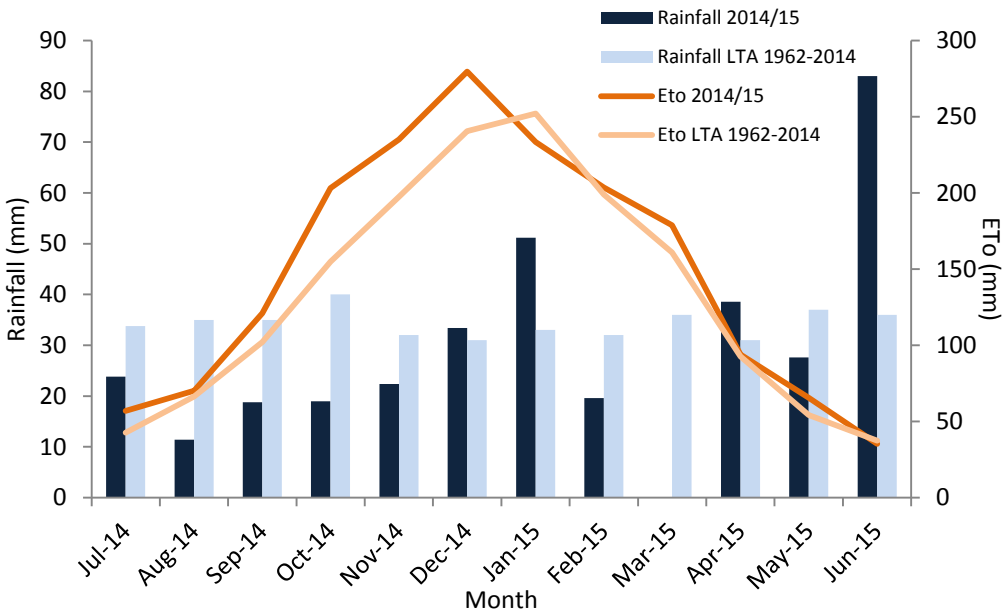


Figure 5 Rainfall (mm) and ETo (mm) for 2014/15 and LTA data recorded at Griffith weather station

Total rainfall recorded at all weather stations was lower than the previous year, except for the Barren Box weather station which recorded a 3.2 mm increase. Rainfall patterns shifted somewhat, with high rainfall occurring during the end of the season in 2014/15, as opposed to the beginning of the season 2013/14.

Highest ETo rates were recorded slightly earlier in 2014/15 compared to 2013/14 for all weather stations. All ETo rates were consistently higher across the MIA when compared to the previous year. Weather variability causes irrigation requirements to change from year to year. The amount and timing of rainfall and ETo rates are the two main weather variables that determine irrigation requirements. Therefore, the lower rainfall and higher ETo experienced during 2014/15 is likely to have influenced all aspects of this report.

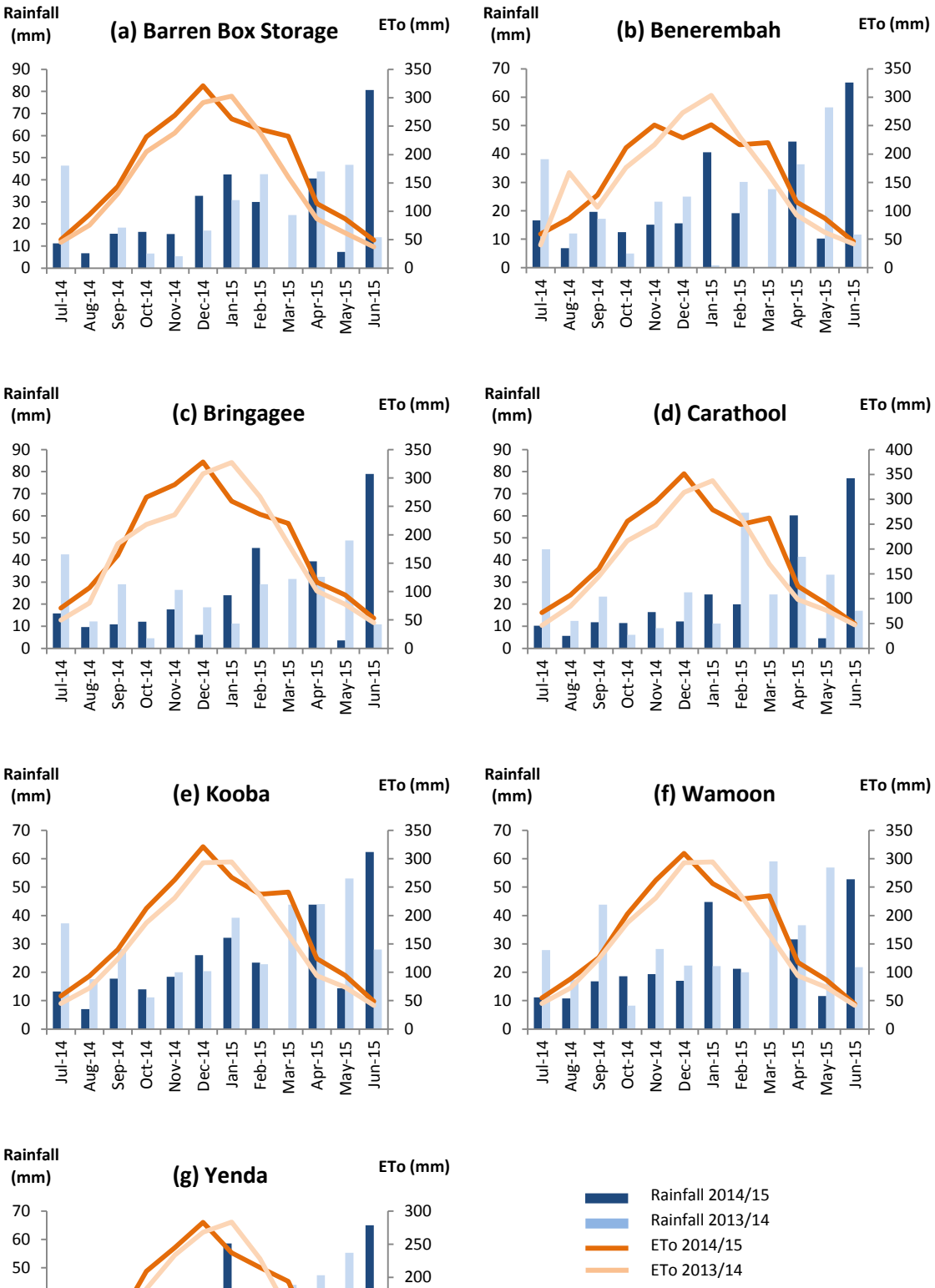


Figure 6 Rainfall (mm) and Evaporation (mm) at

(a) Barren Box Storage
(b) Benerembah
(c) Bringagee
(d) Carathool
(e) Kooba
(f) Wamoon
(g) Yenda.

3.2 Calibration report for Main Canal and Sturt Canal AFFRA units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Thiess Hydrographic Services as part of the contract with MI to provide qualified hydrographic services in accordance with the conditions of Combined Approval 40CA403245.

Refer to Table 3 for the NARREG AFFRA calibration report and Table 4 for the STURT AFFRA calibration report. The AFFRA units at both of these sites were upgraded by Thiess in November to ensure reliability and accuracy. A full version of the Calibration Report will be submitted with this Annual Compliance Report (ACR).

Table 3 Main Canal at NARREG (410127) calibration report

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation
20/08/2014	16:13	1,093	1,157	-5.53%*
20/08/2014	17:10	1,117	1,129	-1.10%
18/09/2014	16:01	2,000	2,018	-0.89%
5/11/2014	14:22	2,534	2,600	-2.52%
6/01/2015	13:59	3,789	3,864	-1.93%
19/03/2015	11:09	1,601	1,527	4.85%

** First measurement on 20/08/2014 returned a deviation outside of the allowable 5%. A second measurement undertaken on the same day returns a deviation well within the allowed 5%.*

Table 4 Sturt Canal at STUR (410129) calibration report

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation
21/08/2014	16:01	1,216	1,196	1.75%
1/09/2014	11:47	480	474	1.42%
12/09/2014	13:08	603	595	1.50%
10/10/2014	7:46	1,567	1,530	2.44%
5/02/2015	9:03	1,134	1,139	-0.40%

3.3 Diversions and water allocation

A monthly summary of gross water diversions is presented in Table 5. These volumes represent gross diversions entering the supply system from MI's two authorised water supply Works at NARREG and STUR. It is important to note that the total diversion volume of 878,614 ML does not include an environmental water diversion volume of 2,472 ML.

Table 5 Monthly summaries of gross diversions (ML) at authorised supply works NARREG and STUR and total deliveries to customers (ML) for 2014/15

Month	STUR	NARREG	Total diversion	Deliveries to customers
Jul-14	0	2,813	2,813	292
Aug-14	20,359	43,991	64,350	52,710
Sep-14	20,450	45,468	65,918	55,573
Oct-14	38,984	88,621	127,605	111,387
Nov-14	27,628	90,690	118,318	98,038
Dec-14	36,978	114,441	151,419	123,403
Jan-15	29,059	91,231	120,290	103,403
Feb-15	23,218	79,105	102,323	89,099
Mar-15	11,017	52,730	63,747	52,491
Apr-15	4,556	21,957	26,513	17,109
May-15	7,023	19,777	26,800	24,178
Jun-15	0	8,518	8,518	2,333
Total	**219,272**	**659,342**	**878,614**	**730,016**

The irrigation demand at Wah Wah is primarily supplied BBSW and Mirrool Creek. During periods of peak demand Wah Wah is further supplemented by river water entering the system from NARREG and STUR then diverted to Wah Wah via the Mirrool Creek. Table 6 shows the adjusted volumes of water channelled through each of the main channel systems. Due to the reclamation and reuse of drainage water, the total amount of water channelled through each of these systems is greater than the total gross diversions shown in Table 5.

Table 6 Monthly summary of adjusted diversions (ML) 2014/15

Month	Sturt Canal	Main Canal	Wah Wah
Jul-14	0	2,813	10
Aug-14	20,359	43,991	5,496
Sep-14	20,450	45,468	6,004
Oct-14	38,984	88,621	10,663
Nov-14	27,628	87,679	12,653
Dec-14	36,535	107,330	14,956
Jan-15	29,059	89,632	11,880
Feb-15	22,818	75,171	11,435
Mar-15	11,017	52,730	10,506
Apr-15	4,556	21,957	6,830
May-15	7,023	19,619	5,407
Jun-15	0	8,518	775
Total	**218,429**	**643,529**	**96,615**

Table 7 compares water allocations, diversions, total deliveries and climate data from the 2014/15 reporting year to previous years. Diversions for 2014/15 increased by 5% from 2013/14, most likely as a result of less rainfall experienced in 2014/15. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year. This is clearly demonstrated by comparing 2012/13 and 2011/12 total diversions. Even though allocation was at 100% for both years, total diversions were considerably different. The above average rainfall (737mm) experienced in 2011/12 resulted in a lower water supply demand, and subsequently a reduction in total diversions. In contrast, below average rainfall (307mm) seen in 2012/13 resulted in higher water supply demand, and therefore an increase in total diversions. When these low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. Flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

Table 7 Water allocation, total diversions and deliveries 2014/15 and previous years

Year	Announced Allocation (%) General / High	Total Diversions (ML)	Total Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2014/15	53/95	878,614	730,016	349	1,776
2013/14	63/95	832,758	699,308	440	1,860
2012/13	100/100	1,079,843	940,979	307	1,864
2011/12	100/100	854,855	752,845	737	1,821
2005/06	54/95	1,036,519	829,990	367	1,935

3.4 Environmental diversions

During the 2014/15 irrigation season, MI was required by the Office of Environment and Heritage (OEH) to divert water for environmental purposes to five locations as shown in Table 8. A total of 2,472 ML (including a 20% conveyance allowance) was diverted during the months of September 2014 to January 2015.

Table 8 Environmental water diversions for 2014/15

Location	Total (ML)
Tuckerbil Swamp	576
Turkey Flats	0
Yanco Ag Lagoon	978
Fivebough Swamp	678
Nericon Swamp	240
Total	**2,472**

3.5 Water discharged from area of operations

Monthly discharge volumes for each discharge monitoring point listed under the Combined Approval are shown in Table 9. A total of 671 ML was discharged from MI's area of operations in 2014/15. ROCUDG discharged the largest volume of water (403.7ML) due to excess flows from Cudgel Creek Escape during water delivery. Projects are underway to reduce these escape flows in this supply section. No water was discharged outside of MI's area of operation for environmental or river operational purposes.

Table 9 Monthly water volumes (ML) discharged from area of operations

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)
Jul-14	0.0	27.3	0.0	0.0
Aug-14	1.1	27.4	0.0	0.0
Sep-14	24.7	116.0	2.8	0.0
Oct-14	11.3	41.0	0.3	0.9
Nov-14	13.0	9.2	0.0	0.3
Dec-14	0.8	57.3	0.0	0.0
Jan-15	25.2	9.9	0.0	2.3
Feb-15	149.5	12.9	0.0	0.1
Mar-15	9.1	46.7	0.0	0.0
Apr-15	10.8	12.4	0.0	0.0
May-15	0.0	20.8	0.0	0.0
Jun-15	15.1	22.8	0.0	0.0
Total	**260.6**	**403.7**	**3.1**	**3.6**

NB. Site MIRFLD was not operational during 2014/15.

Table 10 gives total discharge volumes from MI's area of operation compared to previous years. During 2012/13 and 2013/14, water was released through MI's discharge points to allow channels to be drained for maintenance works, causing an increase in the total volume of water discharged from MI's area of operations. During 2014/15, no maintenance was scheduled for these areas, significantly reducing discharge volumes compared to the previous years. The increased efficiency of MI's drainage reuse system is exhibited in the reduction of discharge volumes from 2005/06.

Table 10 Total water volumes (ML) discharged from the MIA 2014/15 and previous years

Year	Total discharged (ML)
2014/15	671
2013/14	2,438
2012/13	2,563
2005/06	8,570

3.6 Supply efficiency

Table 11 illustrates the simple efficiency of MI's supply system to be at 83.3% for 2014/15, which is slightly lower than the previous year. The simple efficiency reflects how well the supply system is managed under the season's climatic conditions, whilst balancing irrigation demand and minimising system losses. Operational efficiencies can be improved through infrastructure upgrades and system rationalisation, as well as drainage reuse opportunities and management of water delivery. Seepage and surface evaporation rates can have a negative impact on both channel and storage efficiency. The water balance on page 19 of this report reconciles the losses and gains of the system and takes into account drainage reuse volumes for 2014/15.

The increase in efficiency from 2005/06 when compared to the more current reporting years is attributed the completion of MI's drainage reuse system.

Table 11 Supply efficiency from 2014/15 and previous years

Year	Sturt Canal	Main Canal	Environment Diversions	NET TOTAL Irrigation Diversions	Sales (ML)	Conveyance (ML)	Simple Efficiency (%)
2014/15	219,272	659,342	2,472	876,142	730,016	146,126	83.3%
2013/14	213,806	618,952	1,186	831,572	699,308	132,264	84.1%
2012/13	301,041	779,322	520	1,079,843	940,979	138,864	87.1%
2011/12	237,436	620,061	2,642	854,855	752,845	102,010	88.1%
2005/06	233,388	805,277	2,146	1,036,519	826,207	210,312	79.7%

3.7 Storage levels

Storage flows shown in Table 12 to 14 include the initial balance of water held in these storages. These figures represent inflows and outflows from storages for 2014/15 to give insight into system flows. Volumes are calculated by using storage level measurements recorded at the end of each month.

3.7.1 Barren Box Storage and Wetland (BBSW)

In 2006, BBSW was transformed from a degraded swampland into an efficient drainage basin and water storage facility which returns water under the Water for Rivers program for use in the Snowy River system. Storage at this site comprises of three cells:

- The Active Cell – storage capacity 24,500 ML
- The Intermediate Cell – storage capacity 4,500 ML
- The Wetland Cell covering 1,650 hectares (ha)

No flows were diverted into the Wetland Cell during 2014/15. As shown in Table 12, the total inflow was 37,921 ML, consisting of 15,556 ML into the Active Cell and a further 22,365 ML into the Intermediate Cell.

Table 12 Barren Box Storage flows (ML) for 2014/15

Month	Inflow	Outflow	Volume
Jul-14	2,102	0	18,515
Aug-14	1,040	1,270	17,004
Sep-14	2,000	745	17,930
Oct-14	2,660	5,265	12,884
Nov-14	2,920	4,975	8,944
Dec-14	3,555	3,980	6,979
Jan-15	4,772	4,450	5,864
Feb-15	4,318	3,950	5,562
Mar-15	3,360	3,800	4,885
Apr-15	2,925	3,000	5,030
May-15	1,570	1,250	5,553
Jun-15	6,699	350	13,332
Total	**37,921**	**33,035**	

3.7.2 Yenda Storage

The flows recorded for Yenda storage for 2014/15 are shown in Table 13. The Yenda Storage is primarily used to compensate for differences between customer orders and diversions from NARREG.

Table 13 Yenda Storage flows (ML) for 2014/15

Month	Inflow	Outflow	Volume
Jul-14	3	73	650
Aug-14	1,035	1,277	374
Sep-14	946	1,102	317
Oct-14	1,157	1,418	328
Nov-14	1,357	1,507	365
Dec-14	1,332	1,505	450
Jan-15	1,255	1,567	447
Feb-15	1,318	1,202	558
Mar-15	1,114	1,103	431
Apr-15	821	985	306
May-15	829	984	278
Jun-15	619	557	382
Total	**11,786**	**13,280**	

3.8 Bray's Dam Storage

Bray's Dam Storage has the operational ability to capture and redistribute drainage water from off-farm drainage and following rainfall. Water can also be pumped directly from Mirrool Creek and reused in the irrigation network. Table 14 show inflows and outflows at Bray's Dam for 2014/15.

Table 14 Bray's Dam Storage flows (ML) for 2014/15

Month	Inflow	Outflow	Balance
Jul-14	0	0	1,292
Aug-14	613	732	862
Sep-14	1,137	306	1,446
Oct-14	1,017	1,111	1,023
Nov-14	2,687	2,208	1,590
Dec-14	2,370	1,029	2,389
Jan-15	1,302	1,877	1,347
Feb-15	2,286	1,317	1,542
Mar-15	806	915	1,063
Apr-15	907	46	1,792
May-15	386	550	1,297
Jun-15	1,557	0	2,010
Total	**15,068**	**10,091**	

3.8.1 Lake Wyangan

MI is able to regulate water levels in Lake Wyangan to satisfy demand for commercial irrigation, environmental contributions and community amenity. Water depths within the northern and southern portions of the lake are regulated for various operational purposes including maintenance, management and to supplement flow in adjacent supply channels when required.

A total of 80 ML was diverted from the southern portion of the lake into Lake View Branch Canal for water deliveries in 2014/15.

A total of 1,538 ML was diverted into the North Lake at the request of Griffith City Council (GCC) to raise the level of the lake and were recorded against GCC's Water Entitlement. It is important to note that GCC is responsible for managing North Lake Wyangan with the objective of maintaining the social and recreational values held by the community. MI manages the southern portion of the lake for water delivery requirements. The monthly volumes extracted from Lake Wyangan into Lake View Branch Canal are highlighted in Table 15.

3.9 Drainage reuse

MI has continued to actively pursue recovery and reuse of water from its drainage system. Table 16 provides monthly information on drainage reuse volumes for each drainage site for 2014/15. Losses in Barren Box Storage are determined by calculating the difference between the initial storage volume and the storage balance after taking into account inflows and outflows. The negative losses for BBSW recorded for April, May and June in Table 15 represent system gains for those months. This does not indicate that there were no losses during this time, but that the gains to BBSW during these months were greater than the losses. These gains are likely to be due to excess rainfall in the catchment area.

It should be noted that the water recovered at these sites may also include water that is diverted from our supply system during peak demand periods. As MI continues to operate its system more efficiently, some of the drainage sites are now used as connector channels between supply sites.

Table 15 Monthly drainage reuse volumes (ML) 2014/15

Site	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Total
GMSD Pumps (Yanco esc + Stormwater)	76	488	421	358	319	190	261	301	237	196	202	135	3,184
YMSD	21	138	134	117	178	192	182	179	140	147	128	78	1,634
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake Wyangan Pumps to L.V.B.C.	15	50	0	0	15	0	0	0	0	0	0	0	80
Forrestor's Pump (Main Drain 'J' to Tabbita Channel)	0	0	0	0	0	0	0	0	0	0	0	0	0
Mirrool Creek Diversion to Benerembah (@ Brays)	0	2,792	2,148	2,778	3,749	1,009	3,731	1,883	1,342	726	1,742	0	21,900
Mirrool Creek Licensed Diverters (Creek Pumps)	0	70	287	874	645	1,169	400	605	387	99	166	0	4,702
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	0	0	0	0	0	0	0	4	0	4
Mirrool Creek to Wah Wah Main	10	4,406	5,129	6,502	7,728	14,896	11,880	11,420	10,506	6,830	5,407	700	85,414
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	0	300	0	300	50	3,920	4,450	3,950	3,800	3,000	1,250	350	21,370
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren Box Storage to Outfall (includes flood releases)	0	970	745	4,965	4,925	60	0	0	0	0		0	11,665
Barren Box Storage Licensed Diverters	0	0	0	0	170	112	168	170	22	1	0	0	643
Losses in Barren Box Storage	296	1,281	329	2,441	1,715	1,480	1,437	500	215	-219	-203	-1352	7,920
Channel 13 Escape (Benerembah Drainage)	0	320	130	80	0	0	0	15	0	0	0	75	620
Sub Total	**418**	**10,815**	**9,323**	**18,415**	**19,494**	**23,028**	**22,509**	**19,023**	**16,649**	**10,780**	**8,696**	**-14**	**159,136**
Less: First Use Water Diversions	**10**	**5,496**	**6,004**	**10,663**	**12,653**	**14,956**	**11,880**	**11,435**	**10,506**	**6,830**	**5,407**	**775**	**96,615**
TOTAL WATER CAPTURED (Re-Used)	**408**	**5,319**	**3,319**	**7,752**	**6,841**	**8,072**	**10,629**	**7,588**	**6,143**	**3,950**	**3,289**	**-789**	**62,521**

3.10 Water balance

Table 16 shows the Annual Water Balance assessment. Total gross diversions for 2014/15 were used to generate water deliveries of 730,016 ML. The apparent system delivery loss was 148,598 ML, providing an apparent operational efficiency of approximately 88%.

In comparison, true system delivery loss (representing the portion of the loss that can be estimated or calculated) was estimated at about 115,743 ML. This included losses due to channel seepage and evaporation during storage and conveyance. The unexplained losses are estimated at 102,202 ML, resulting in total losses estimated at 217,945 ML. Therefore, it is estimated that 69,347 ML of water was gained throughout the system, most likely due to the improved operating efficiency and increased potential for water to be reused within the system.

Storage volume changes are included for BBSW and Lake Wyangan. Mirrool Creek Floodway releases (of which there were none) are already included under System Flow Losses and Mirrool Creek inflows are included in the Bray's Dam diversions.

Table 15 Annual Water Balance (ML) 2014/15

Factor	2005/06	2012/13	2013/14	2014/15	Key
Climatic					
Rainfall (mm)	367	451	493	349	
Evaporation (mm)	1,935	1,863	1,859	1,776	
Type of Year (% dry)	60	45	35	55	
Main Gross Data					
Gross Diversions (1)	1,036,519	1,080,363	832,758	878,614	
Total Deliveries (2)	829,990	931,541	699,308	730,016	
Apparent Loss (3)	206,529	148,822	133,450	148,598	(3)=(1)-(2)
Apparent Efficiency (%)	80	86	84	83	
Inevitable Real Losses					
Seepage from Channels	21,200	20,900	20,700	21,000	
Evaporation from Channels	23,000	21,250	19,750	22,000	
BBS + LW evaporation	37,500	34,750	32,500	37,000	
Wah Wah Losses (Div-Del)	37,290	28,616	27,238	30,072	
Leaks, Theft, misc.	10,000	10,000	10,000	5,000	
Subtotal	128,990	115,516	110,188	115,072	
System Flow Losses					
Drainage Volume to River (4)	8,570	2563	2438	671	
Floodway Releases	3,945	0	0	0	
Subtotal	12,515	2563	2438	671	
Total True Losses (5)	**141,505**	**118,079**	**112,626**	**115,743**	
Unexplained Losses	116,199	130,416	97,903	102,202	
Total System Losses (6)	**257,704**	**248,495**	**210,529**	**217,945**	
Assessed System Gains (7)	51,175	99,673	77,079	69,347	(7)=(6)-(3)
Mirrool Creek Flows					
Willow Dam Flows	126,740	128,946	115,484	101,965	
Bray's Dam Diversions	10,735	18,921	13,803	21,900	
Benerembah pumps	2,040	1,090	665	4	
Landholders pumping (Legacy 22c licences)	6,662	4,892	4,699	4,613	
Total Drainage Mirrool Creek (8)	146,177	153,849	134,651	128,482	
Total Drainage (9)	154,747	156,412	137,089	129,153	(9)=(4)+(8)
Reconciliation					
Special Diversions WWID (10)	3,945	0	0	0	
Reduction in BBS (11)	-344	-13,857	-12,321	-7,920	
Corrected Drainage To MC (12)	142,232	153,849	134,651	128,482	(12)=(8)-(10)
Corrected Total System Supply (13)	1,087,350	1,166,179	897,516	940,041	(13)=(1)+(7)+(11)
Gains as % of Drainage to MC (14)	36	65	57	54	(14)=(7)/(12)*100
System Efficiency (%) (15)	**87**	**90**	**87**	**88**	(15)=((13)-(5))/(13)*100

4 Water use

4.1 Crop statistics

Each time customers order water they are required to allocate their water use to a particular crop or purpose. Total area, water deliveries and crop water use data for 2014/15 are presented in Table 17. It is important to note the water use data presented for the total area of crop are influenced by rainfall, ETo and irrigation practices and are indicative only.

Table 16 Summary of reported deliveries (ML) and areas (ha) for the major crop groupings during 2014/15

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML/ha)
Citrus	7,510	41,574	5.5
Cotton	7,775	60,678	7.8
Industrial	28	4,902	-
Other crops	267	19,751	-
Other fruits	3,562	28,702	8.1
Plantation	67	795	11.9
Rice	21,149	255,384	12.1
Stock & domestic	257	11,998	-
Summer cereals	2,974	19,656	6.6
Summer oilseeds	1,463	8,024	5.5
Summer pasture	2,797	13,154	4.7
Town supply	5	11,395	-
Vegetables	2,053	12,217	6.0
Vines	19,374	78,770	4.1
Winter cereals	55,069	137,514	2.5
Winter oilseeds	2,730	6,452	2.4
Winter pasture	8,204	19,053	2.3
Total	135,284	730,016	-

A comparison of crop water use for 2014/15 with previous years is presented in Table 18 and illustrated in Figure 7. Although winter cereals were the dominant crop type grown in the Murrumbidgee Irrigation Area (MIA), rice accounted for 35% of total water deliveries due to its higher irrigation requirement. The distribution of crop water use for 2014/15 is comparable to previous years. Figure 7 show that rice, cereals and oil seeds are the main crop types that consistently use the highest volume of water in the MIA.

Table 17 Total deliveries (ML) to major crop types in the MIA for 2014/15

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines + Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial	Cotton
2014/15	255,384	32,206	171,645	12,216	149,045	20,547	28,295	60,678
2013/14	237,957	27,454	165,149	18,060	138,427	14,347	24,588	73,326
2012/13	369,393	43,369	225,135	19,772	155,169	14,971	27,947	85,223
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

***Note**: Cotton was considered as 'other crops and plantations' before 2011/12.*

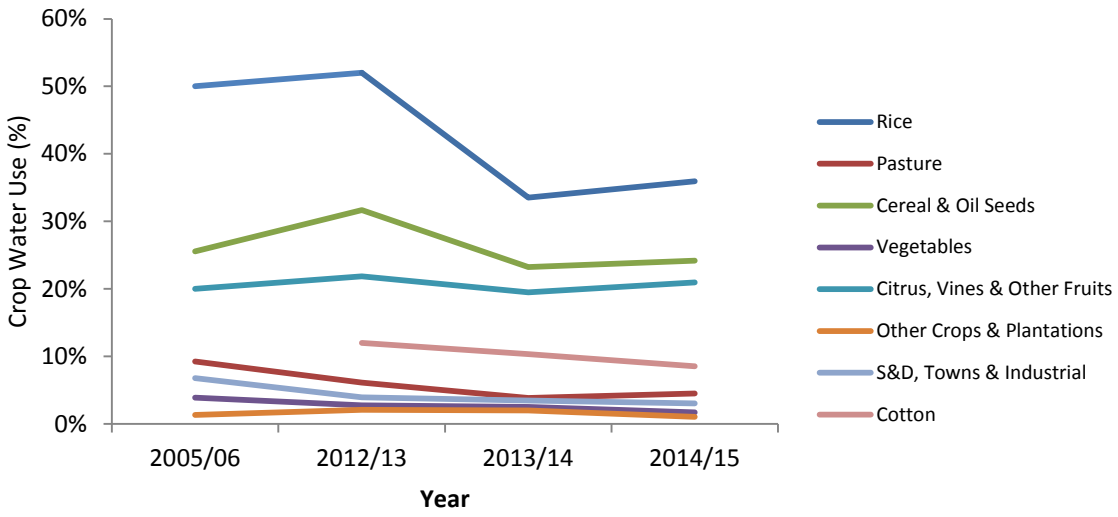


Figure 7 Crops water use (%) for total water deliveries from 2005/06, 2012/13, 2013/14 and 2014/15

4.2 Irrigation intensity

Irrigation intensity displayed in Figure 8 by water use (ML/ha) at a property level. This map identifies locations of landholdings using between 0 and 4 ML/ha, 4 and 1-8 ML/ha and above 8.1 ML/ha. The distribution of irrigation intensity indicates no apparent pattern in water use across the MIA or at an individual irrigation area or district level.

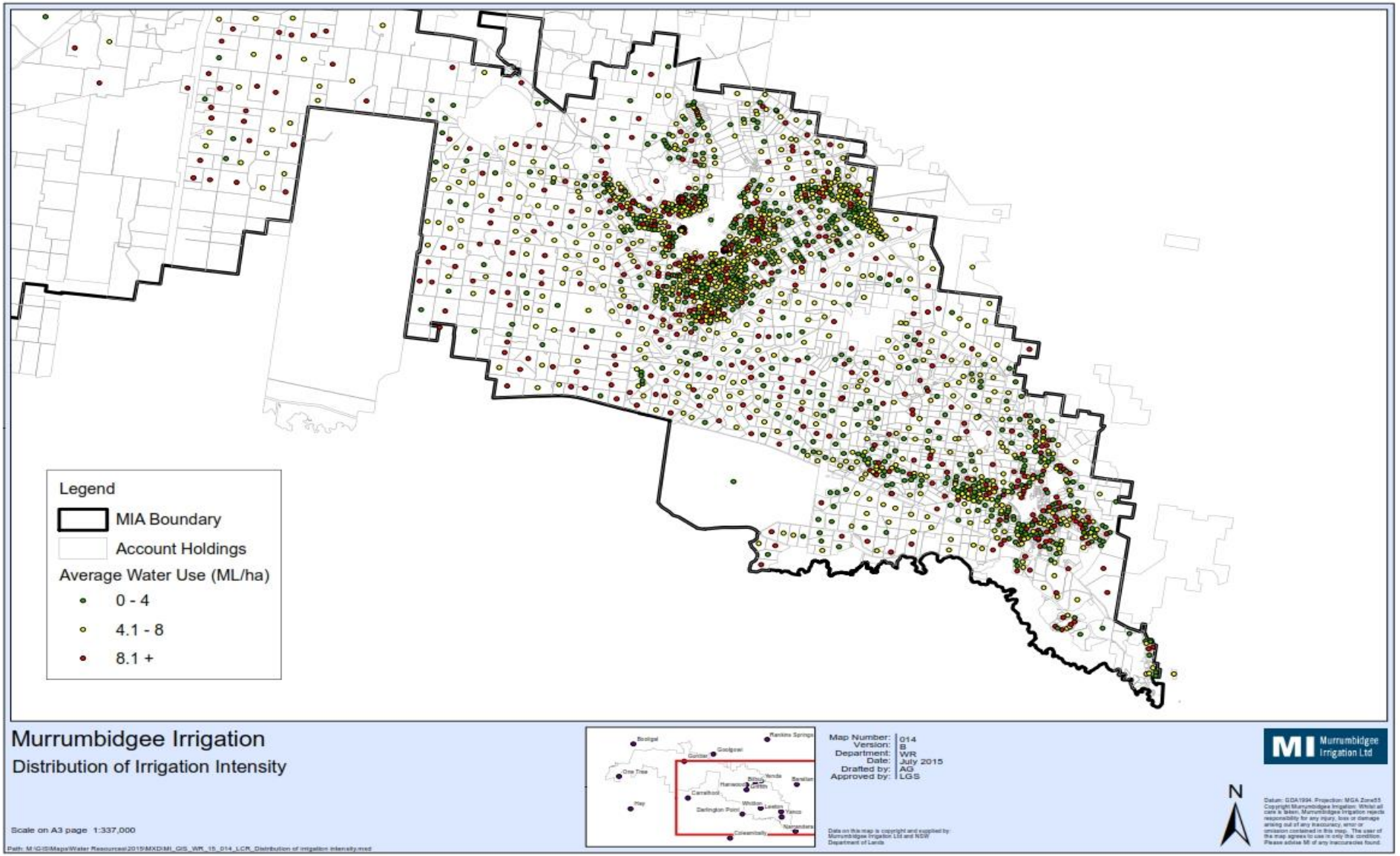


Figure 8 Distribution of irrigation intensity across the MIA

5 Salinity and salt load

5.1 Extracted salt load

The salt load for NARREG and STUR are calculated using flow data reported by Thiess and salinity data from DPI Water monitoring site 410001, which is the closest monitoring point on the Murrumbidgee River to MI's offtakes. Monthly mean salinity values from site 410001 were used for salt load calculations for both NARREG and STUR. The mean EC values and extracted salt loads are presented in Table 19.

Table 18 Total extracted salt load for 2014/15

Month	Site 410001 mean EC (µS/cm)	STUR (t)	NARREG (t)	Total salt load extracted
Jul-14	114	0	205	205
Aug-14	98	1,277	2,759	4,036
Sep-14	96	1,256	2,794	4,050
Oct-14	100	2,495	5,672	8,167
Nov-14	64	1,132	3,715	4,846
Dec-14	89	2,106	6,519	8,625
Jan-15	140	2,604	8,174	10,778
Feb-15	152	2,259	7,695	9,954
Mar-15	96	677	3,240	3,917
Apr-15	94	274	1,321	1,595
May-15	113	508	1,430	1,938
Jun-15	137	0	747	747
Total		14,587	44,270	58,858

During 2014/15, an estimated 58, 858 tonnes of salt entered the MIA from the Murrumbidgee River. The salt load entering the MIA from supply works is marginally higher compared to 2013/14 (Table 20). The amount of salt is relative to the volume of water diverted from the river, which is represented by the strong relationship exhibited between total diversions and salt loads in Figure 9.

Table 19 Extracted salt-load (t) for 2014/15 and previous years

Year	Diversions (ML)	Extracted salt load		
		STUR	NARREG	Total
2014/15	878,614	14,587	44,270	58,858
2013/14	832,758	13,905	38,271	52,177
2012/13	1,079,843	19,899	46,426	66,325
2007/08	393,973	1,778	26,816	28,594

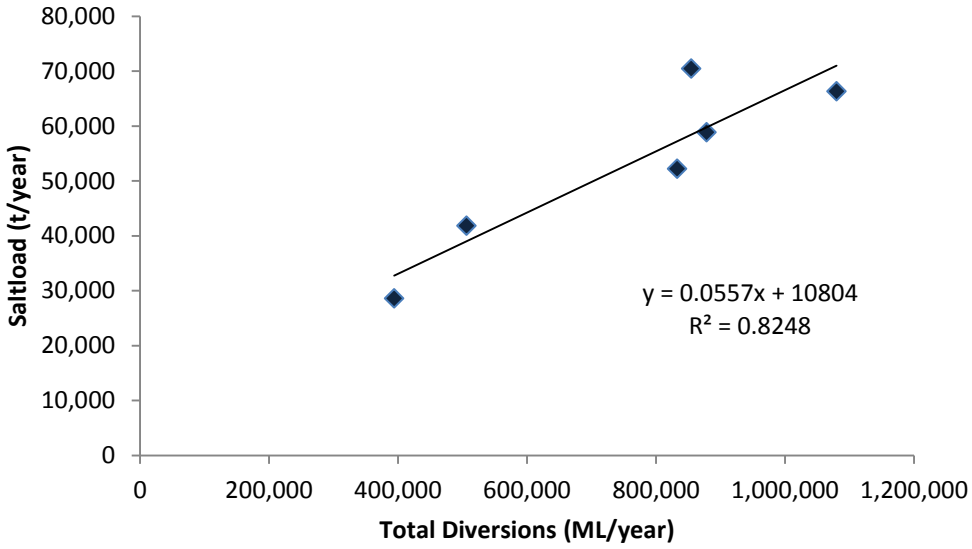


Figure 9 The relationship between salt load (t/year) and total diversions (ML/year) from 2007/08 to 2014/15

5.2 Discharged salt load

There are four river drain sites and one floodway site that are licenced to discharge water out of Murrumbidgee Irrigation Limited's (MI) area of operation. The locations of these sites are shown in Figure 3 of this report. Flow, salinity and salt load data for these sites are presented in Table 22 with previous year comparison presented in Table 21.

The total salt load discharged from the area of operations in 2014/15 was 96 tonnes, which was considerably lower compared to the amount recorded last year, corresponding to the volume of water discharged. The majority of salt discharged from the MIA in 2014/15 was from sites LAG and ROCUDG. EC values recorded at both sites suggest that the majority of the water discharged from these sites was supply water. In 2005/06 MI's drainage reuse system was not complete, which explains the high volumes and subsequent salt load discharged during this year.

Table 20 Discharged salt load for 2014/15 and previous years

Year	Water discharged (ML)	Discharged Salt load (t)
2014/15	675	96
2013/14	2,438	242
2012/13	2,563	301
2005/06	8,570	1,887

Table 21 Discharged salt load for 2014/15 compared to previous years

Yanco Main Southern Escape (YMS) 410083						Gooragool Lagoon Escape (LAG) 41010940				
Month	**Flow (ML)**	**Mean EC (µS/cm)**	**Min.EC (µS/cm)**	**Max. EC (µS/cm)**	**Salt load (t)**	**Flow (ML)**	**Mean EC (µS/cm)**	**Min.EC (µS/cm)**	**Max. EC (µS/cm)**	**Salt load (t)**
Jul-14	0	-	-	-	0	0.0	-	-	-	0
Aug-14	0	-	-	-	0	1.11	443	437	453	0.31
Sep-14	2.8	171	53	358	0.3	24.74	272	117	454	4.31
Oct-14	0.3	*	*	*	*	11.34	326	182	577	2.37
Nov-14	0	-	-	-	0	12.97	168	95.1	271	1.39
Dec-14	0	-	-	-	0	0.84	133	121	166	0.07
Jan-15	0	-	-	-	0	25.19	216	156	383	3.48
Feb-15	0	-	-	-	0	149.5	361	157	504	34.54
Mar-15	0	-	-	-	0	9.08	510	167	830	2.96
Apr-15	0	-	-	-	0	10.83	194	288	99	1.34
May-15	0	-	-	-	0	0.0	-	-	-	0
Jun-15	0	-	-	-	0	15.09	276	173	356	2.67
Total	**3.1**				**0.3**	**260.7**				**53**
Gogeldrie Main Southern Escape (GMSRR) 41010921						**Cudgel Creek Escape (ROCUDG) 41010005**				
Month	**Flow (ML)**	**Mean EC (µS/cm)**	**Min.EC (µS/cm)**	**Max. EC (µS/cm)**	**Salt load (t)**	**Flow (ML)**	**Mean EC (µS/cm)**	**Min.EC (µS/cm)**	**Max. EC (µS/cm)**	**Salt load (t)**
Jul-13	0.0	-	-	-	0	27.31	139	111	181	2.43
Aug-13	0.0	-	-	-	0	27.36	131	113	165	2.29
Sep-13	0.0	-	-	-	0	116.0	151	129	180	11.21
Oct-13	0.92	201	174	230	0.12	40.99	137	3.3	179	3.59
Nov-13	0.28	222	202	230	0.04	9.21	181	172	194	1.07
Dec-13	0.0	-	-	-	0	57.34	204	161	226	7.49
Jan-14	2.33	202	28	289	0.30	9.9	190	171	227	1.20
Feb-14	0.06	254	178	289	0.01	12.91	184	175	194	1.52
Mar-14	0.0	-	-	-	0	46.68	189	177	204	5.65
Apr-14	0.0	-	-	-	0	12.42	190	174	203	1.51
May-14	0.0	-	-	-	0	20.77	157	124	179	2.09
Jun-14	0.0	-	-	-	0	22.84	109	79.4	140	1.59
Total	**3.6**				**0.5**	**407.7**				**42**

* Probe out of water

5.3 Salt balance

The basic salt balance presented in Table 23 suggests that of the 58,858 tonnes of salt received through diversions recorded at MI's authorised supply works, 96 tonnes was discharged back to the river, leaving a balance of 58,762 tonnes of salt which is estimated to have been retained within the MIA. It is important to note that this is a simple salt balance that considers salt loads entering and leaving the MIA via extraction and discharge points only and does not account for salinity losses to shallow groundwater tables or takes into account other factors that impact total salt loads retained in the MIA.

Table 22 Salt balance for 2014/15 (t)

Extracted	Salt load (t)
STUR	14,587
NARREG	44,270
Total extracted	**58,858**
Discharged	**Salt load (t)**
YMS	0.3
GMSRR	0.5
LAG	53
ROCUDG	42
Total discharged	**96**
Balance	**58,762**

5.4 Salinity targets

As set out in our Network Service Plan (pg.7, *2.4 Water Quality)* MI endeavours to maintain Electrical Conductivity (EC) levels below 700 µS/cm for water diverted to Wah Wah customers, downstream of BBSW. This salinity target was achieved during 2014/15 for all monitored sites downstream of BBSW.

6 Groundwater conditions

6.1 Rationalisation project

In October 2014, Murrumbidgee Irrigation Limited (MI) commissioned an independent assessment of the current bore network listed in Appendix 1. This assessment identified duplicated and redundant bores occupying MI's current monitoring network that represent a rationalisation opportunity. DPI Water has accepted a recommendation to rationalise MI's current monitoring network by 30% from a total of 850 bores to 595 bores which will be monitored from September 2015. MI remains committed to ensuring the integrity of this groundwater monitoring network and has implemented a bore replacement program which will commence in early 2016.

6.2 Groundwater monitoring and reporting

A total of 850 piezometers are listed in Schedule 2 of the Combined Approval and the locations of these bores are displayed in Figure 10. A current listing and condition each of piezometer is provided in Appendix 1. In 2014/15 800 (90%) returned a reading and 85 (10%) were unable to be read (Table 24).

Table 23 Groundwater piezometer status summary

Total bores	Total destroyed	Total dry	Total blocked	Total read	Total unable to read
885	75	60	10	800	85

Groundwater levels and EC are measured in September to give insight into groundwater levels prior to the irrigation season and again in March to capture the effects irrigation may have on regional groundwater dynamics. MI also monitors a smaller portion of the bore network every two months for internal evaluation. The network is comprised of piezometers in the Shallow and Deep Shepparton Formation (based on borehole lithology) and a smaller monitoring network in the Calivil Formation.

Depth to water table maps have been developed to report changes in groundwater levels from March to September for 2013/14, 2012/13, 2011/12 and 2005/2006. The historical year 2005/06 was chosen as this was the peak of the drought for the MIA. EC maps have also been developed to report changes in groundwater salinity from March and September for 2014/15, 2013/14 and for September only in 2002 and 1980. Due to the limited data sets for 2012/13, data from 2002 and 1980 was chosen to represent suitable comparisons for salinity changes from a historical perspective.

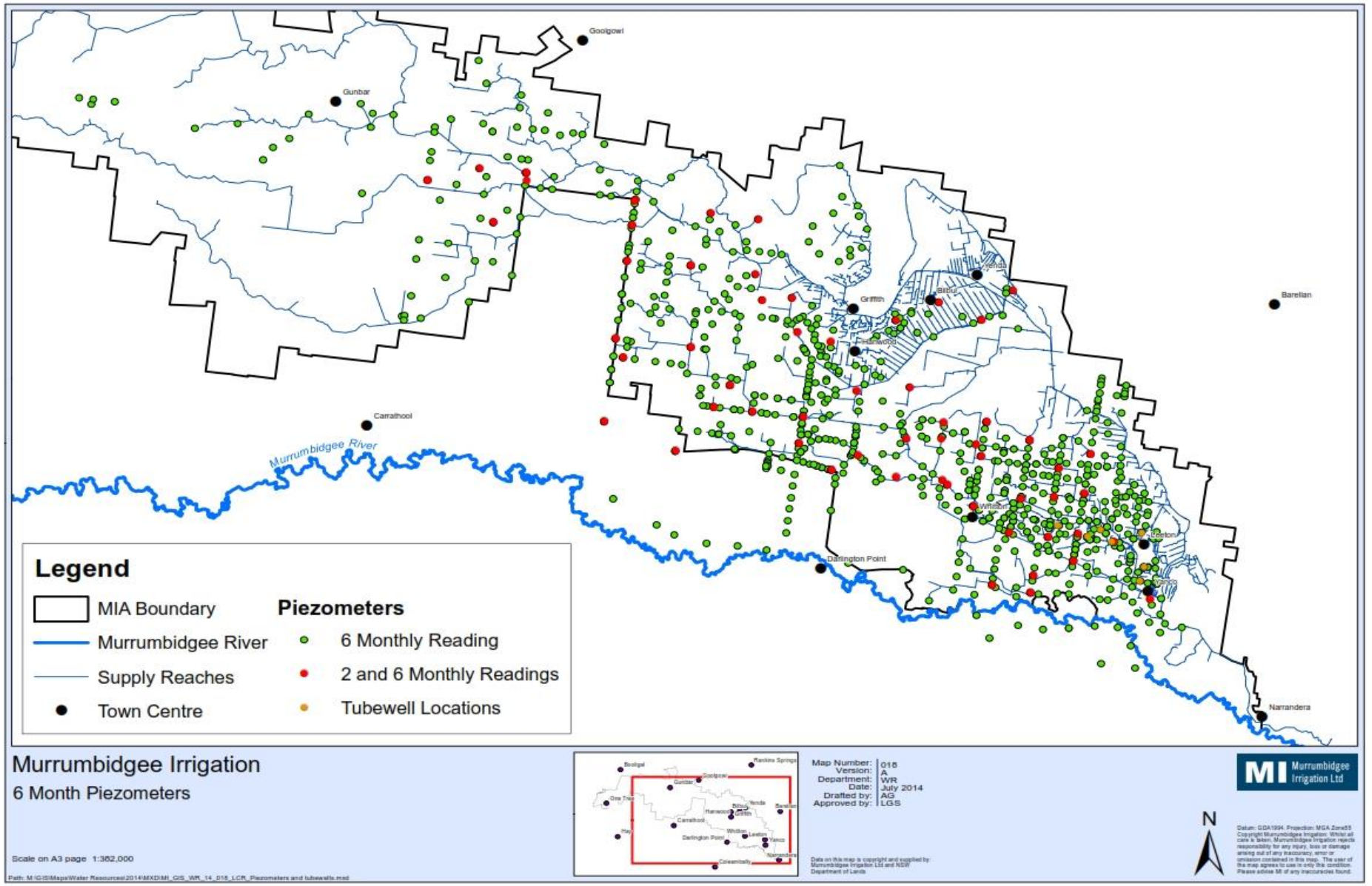


Figure 10 Location of piezometers and tubewells in the MIA 2014/15

6.3 Shallow Shepparton Formation

6.3.1 Groundwater levels

Table 25 shows the area (ha) for each groundwater depth class specified in the Combined Approval. This table was developed for the Shallow Shepparton Formation only as these depth classes were only relevant to this formation. The greatest area of groundwater between 0-2m below the natural surface was observed in 2014/15; however this was only a marginal increase when compared to previous years. This increase in area of shallow groundwater is likely a cumulative effect of concentrated rainfall events (notably in January) and high on-farm water use. The lowest recorded area for groundwater between 0-2m was in 2005/06, attributed to limited rainfall and irrigation during this time.

Table 24 Depth to water table area (ha) for Shallow Shepparton formation

Year	0-2 m	2-4 m	>4 m
2014/15	32,000	59,000	300,000
2013/14	30,000	66,500	310,000
2012/13	30,500	65,000	296,000
2005/06	N/A	N/A	N/A

NB. Figures are estimations only which have been generated using GIS tools

The change in area (ha) compared to the previous year for each depth class is presented in Table 26. It must be noted that these changes are calculated from areas that have been generated using GIS tools and must be considered as estimates only. Furthermore, the connectivity between all aquifers, particularly the Shallow and Deep Shepparton Formation presents a challenge when calculating depth class areas.

Table 25 Change in area (ha) of depth class compared to previous years

Year	0-2 m	2-4 m	>4 m
2014/15	+ 2000	- 7500	- 10,000
2013/14	- 500	+ 1,500	+ 14,000
2012/13	+ 10,500	+ 23,000	+ 6,000
2005/06	20,000	88,000	290,000

Depth to water table maps for the Shallow Shepparton Formation are presented in reporting years in Figures 11 to 18. Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall and irrigation variability, including water demand, irrigation practices and land use. The contour maps for the Shallow Shepparton from September to March for each reporting year show an increase in groundwater levels, which is assumed to be predominantly driven by recharge from irrigation.

When compared to recent years, 2005/06 groundwater levels (Figure 17 and 18) in the Shallow Shepparton appear to be consistently deeper across the MIA, with only small areas with groundwater 1-3m below surface level. Deeper groundwater levels are expected during periods of drought due to reduced recharge and increased groundwater pumping.

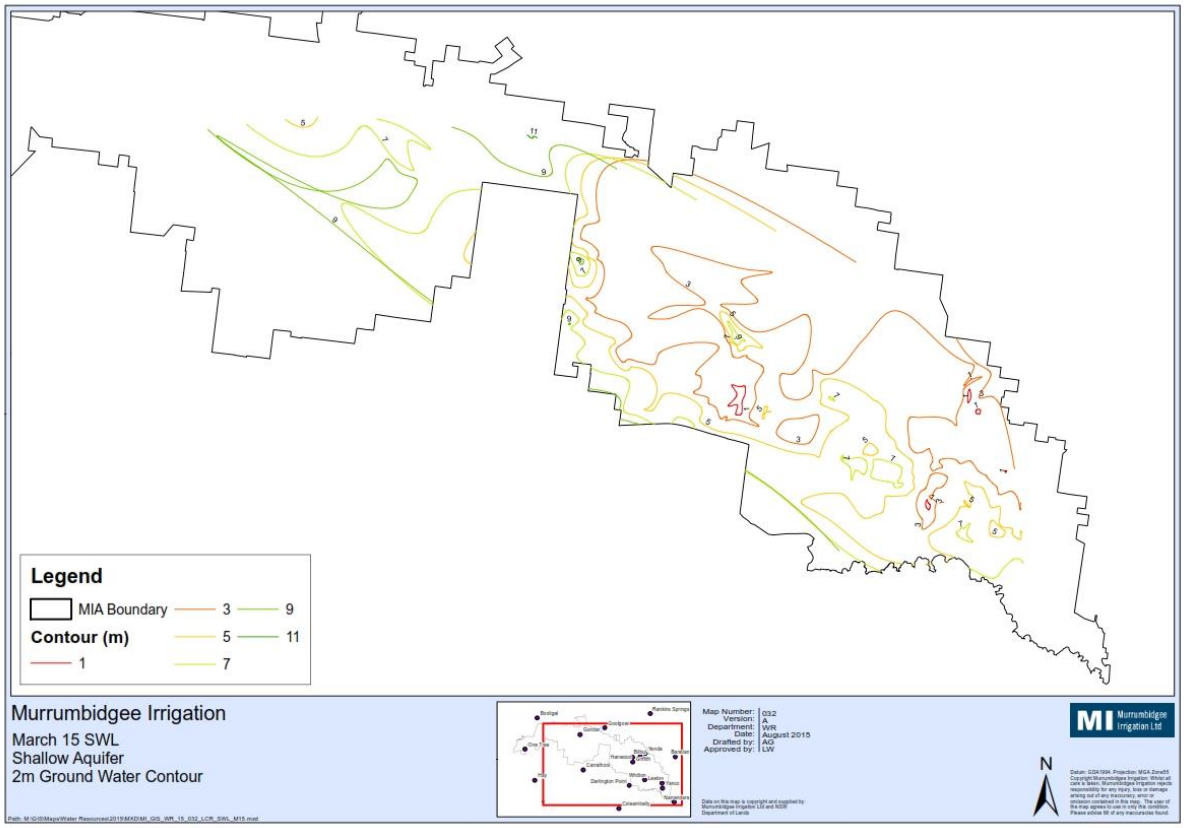


Figure 11 Depth (m) to water table in the Shallow Shepparton Formation, March 2015

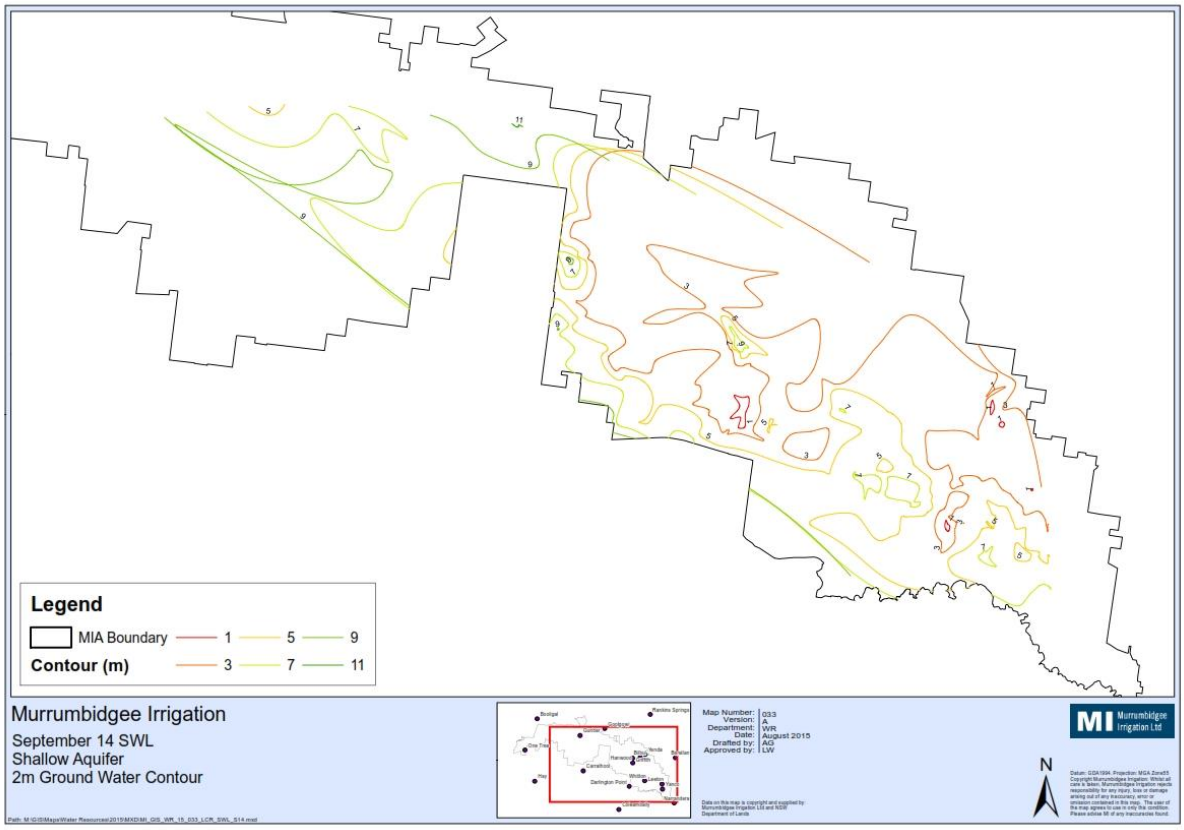


Figure 12 Depth (m) to water table in the Shallow Shepparton Formation, September 2014

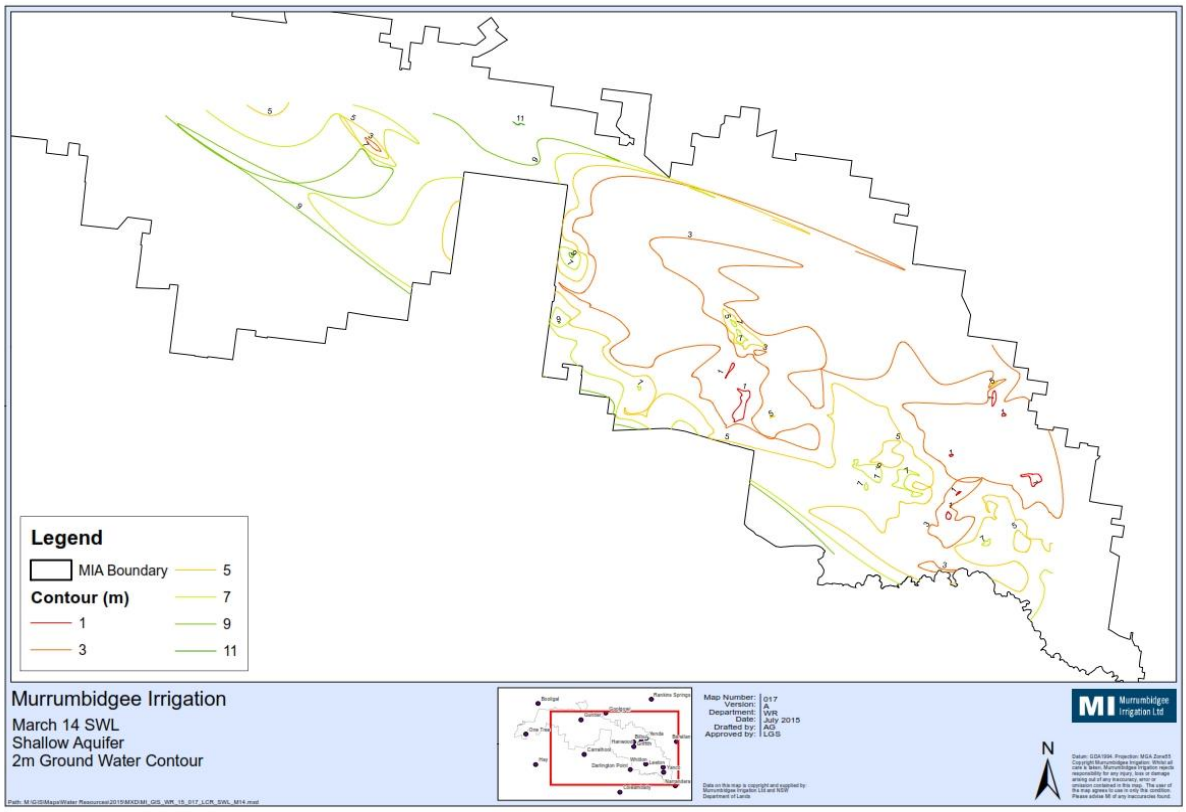


Figure 13 Depth (m) to water table in the Shallow Shepparton Formation, March 2014

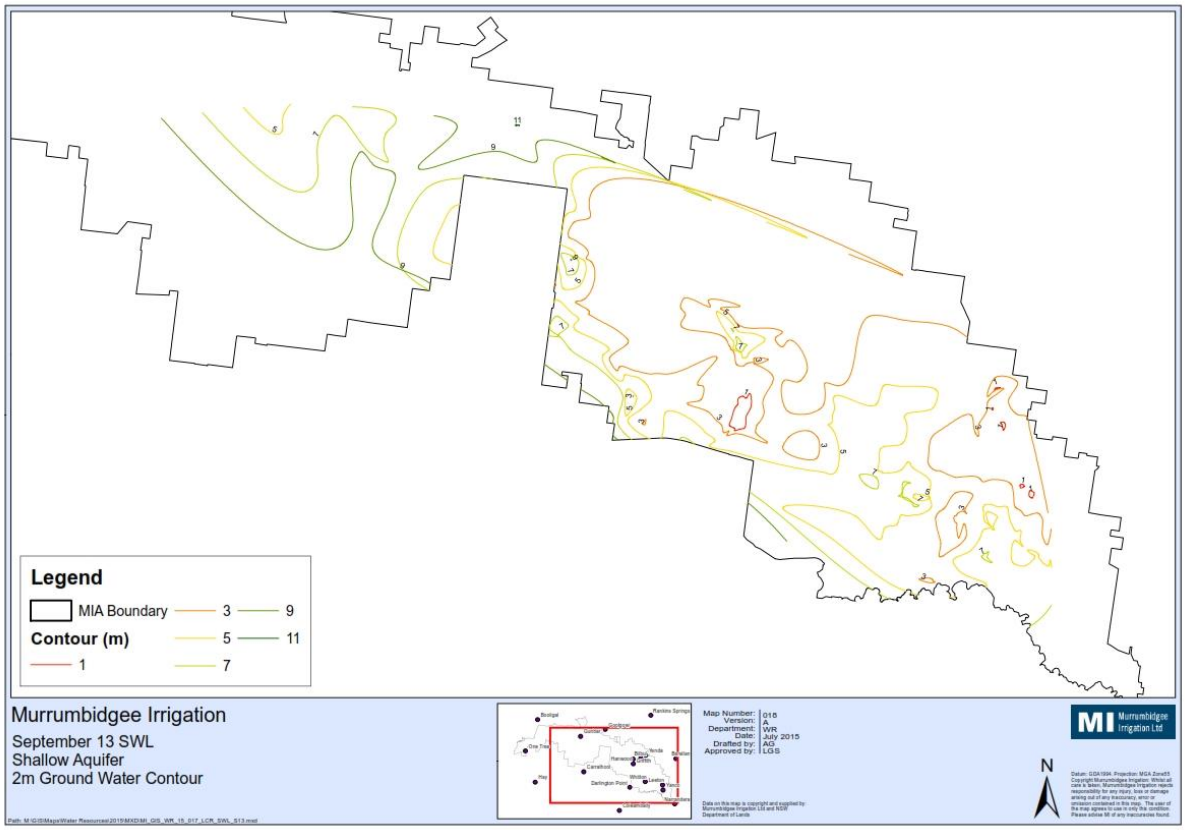


Figure 14 Depth (m) to water table in the Shallow Shepparton Formation, September 2013

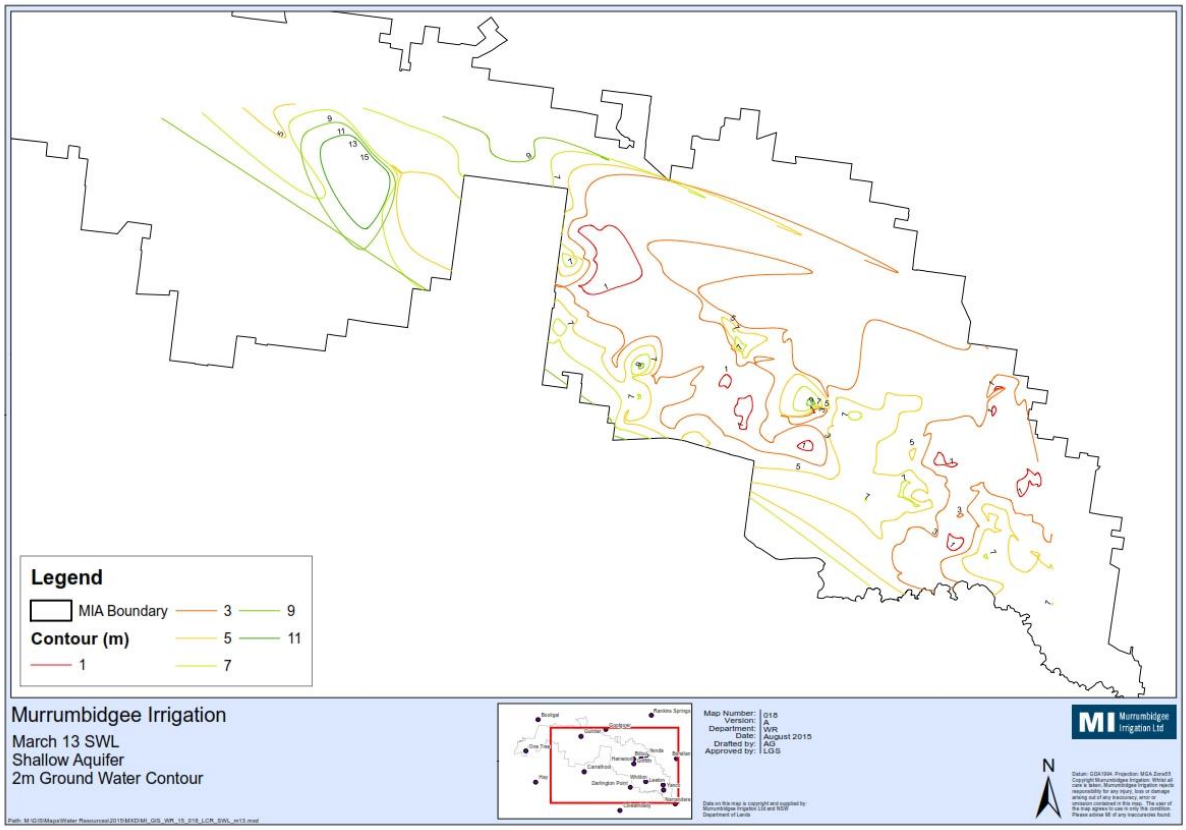


Figure 15 Depth (m) to water table in the Shallow Shepparton Formation, March 2013

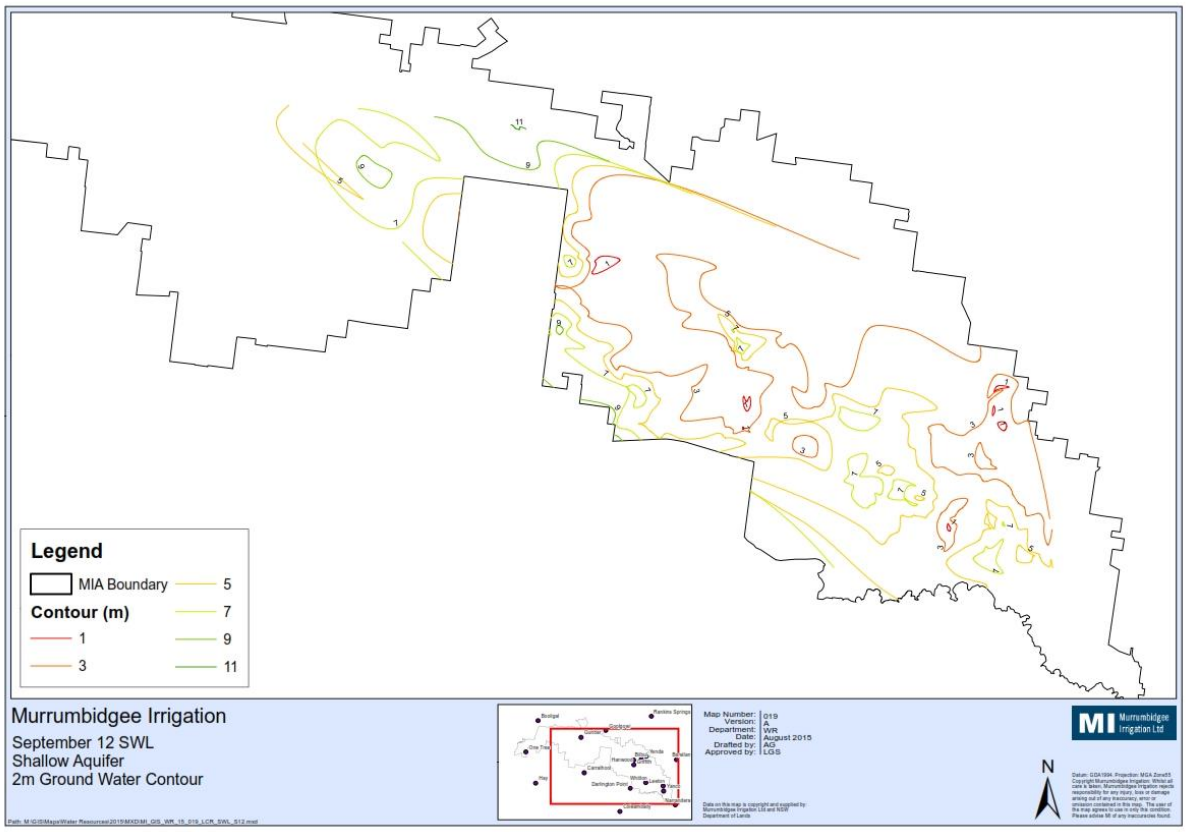


Figure 16 Depth (m) to water table in the Shallow Shepparton Formation, September 2012

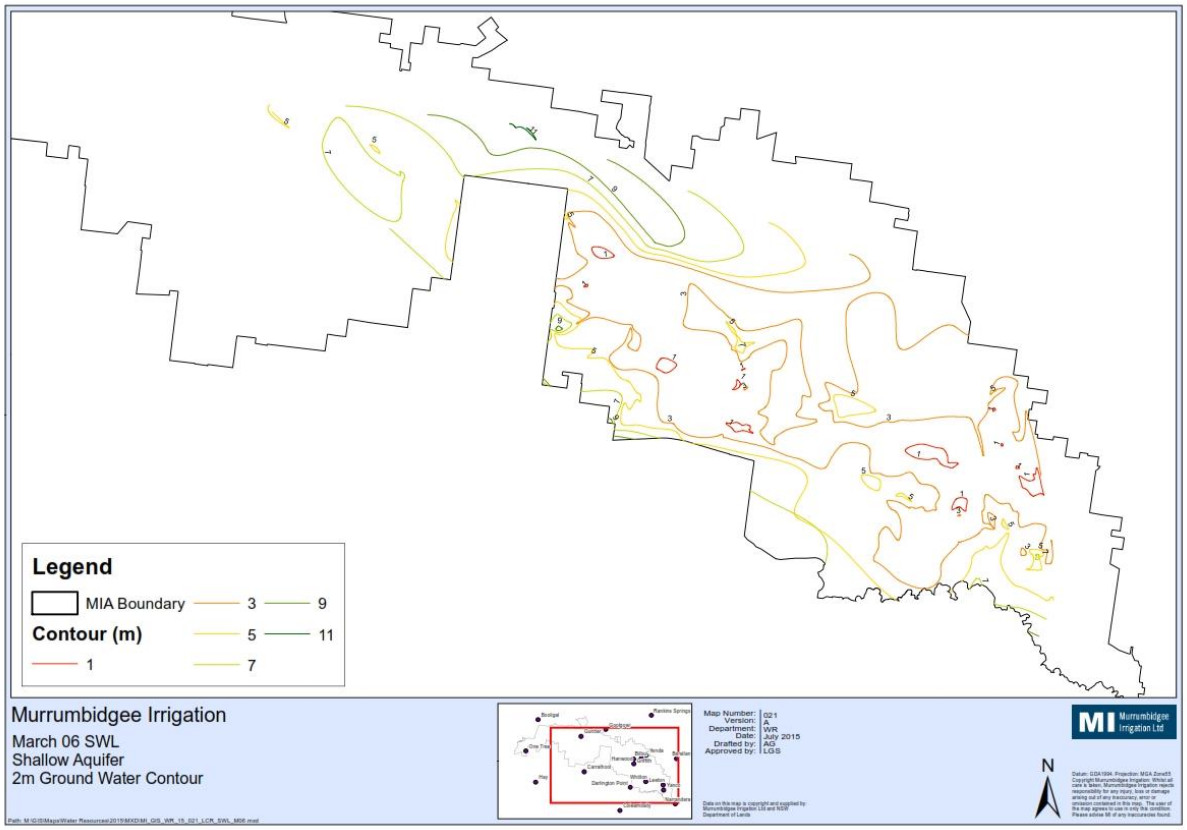


Figure 17 Depth (m) to water table in the Shallow Shepparton Formation, March 2006

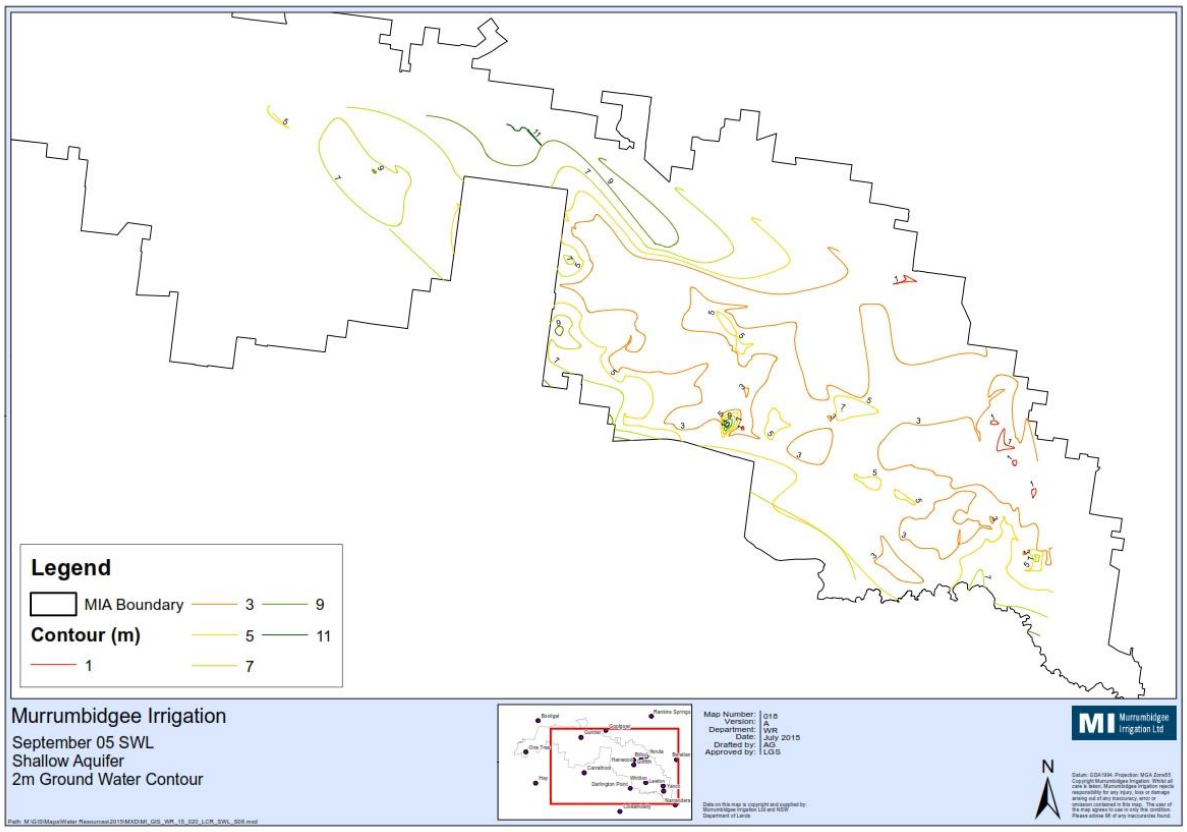


Figure 18 Depth (m) to water table in the Shallow Shepparton Formation, September 2005

6.3.2 Groundwater salinity

Groundwater salinity interval areas (ha) for September are shown in Table 27 with figures presenting a positive trend in groundwater quality. In reference to both historical years, the area of groundwater with high salinity has decreased and the area of lower salinity has increased. This shift in groundwater salinity may be a result of the fresh water recharge generated from the 2012 flood.

General salinity changes in the Shallow Shepparton Formation (Figure 19-24) from September to March for each reporting year show decreases in EC values across the MIA. These areas of reduced salinity correlate with high groundwater levels, highlighting potential recharge areas from irrigation and rainfall. Larger areas of low EC values for 2013/14 (Figure 21 and 22) are likely a direct result from rainfall recharge following the floods in 2012.

Table 26 Groundwater salinity area (ha) for the shallow Shepparton formation, using September data

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10,000 (µS/cm)	10,001-20,000 (µS/cm)	20,001-30,000 (µS/cm)	30,001-40,000 (µS/cm)	>40,000 (µS/cm)
2014/15	218,000	149,000	6,000	0	0	0	0
2013/14	167,000	144,700	14,000	4,000	0	0	0
2002	85,600	210,000	74,500	6,057	550	60	
1980	41,000	160,000	121,000	16,500	1,150	450	N/A

NB. Figures are estimations only which have been generated using GIS tools

Figure 23 and 24 present groundwater EC for September 2002 and 1980, both of which show larger areas of higher EC when compared to September EC values recorded in recent years (Figure 20 and 22). This indicates that groundwater quality has improved across the MIA which can be credited to increased rainfall in recent years and also favourable conditions for irrigation and subsequent groundwater recharge.

Salinity readings in close proximity to the Murrumbidgee River are consistently low in EC for historical and recent reporting years, suggesting there is a significant source of recharge from the Murrumbidgee River.

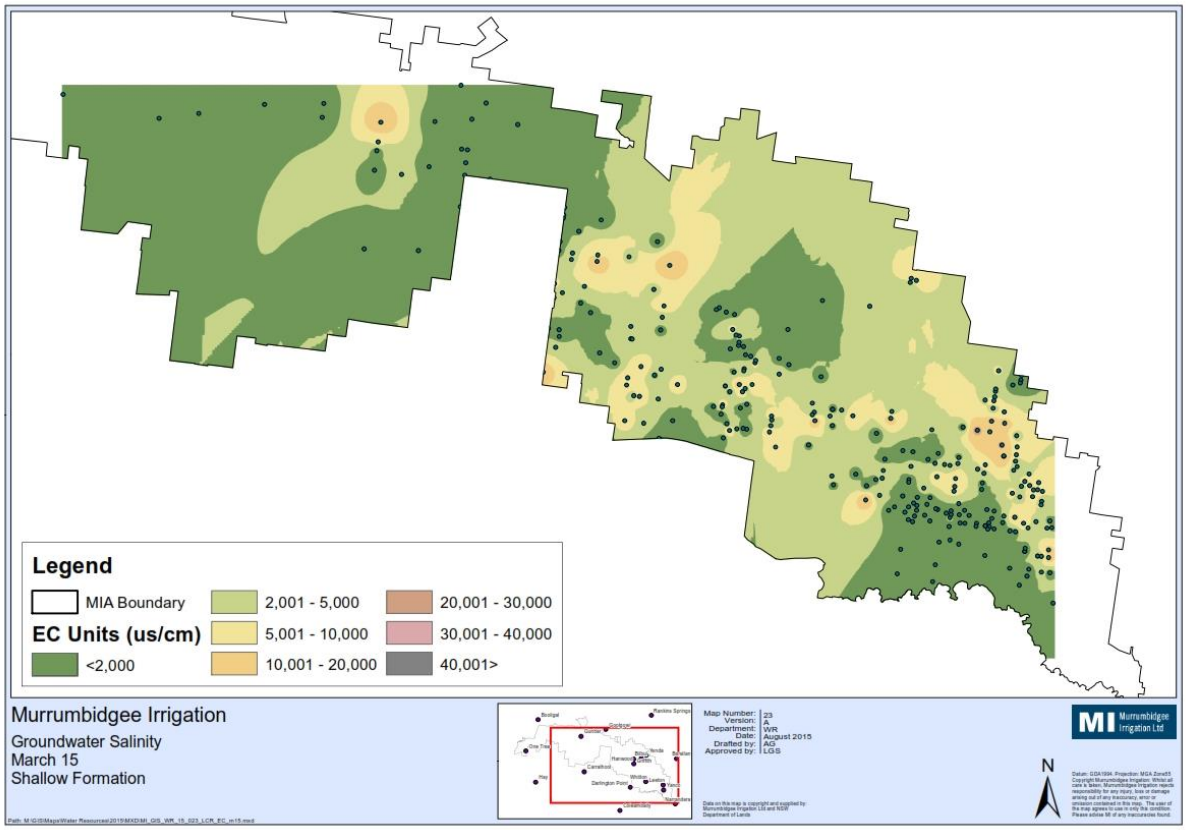


Figure 19 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, March 2015

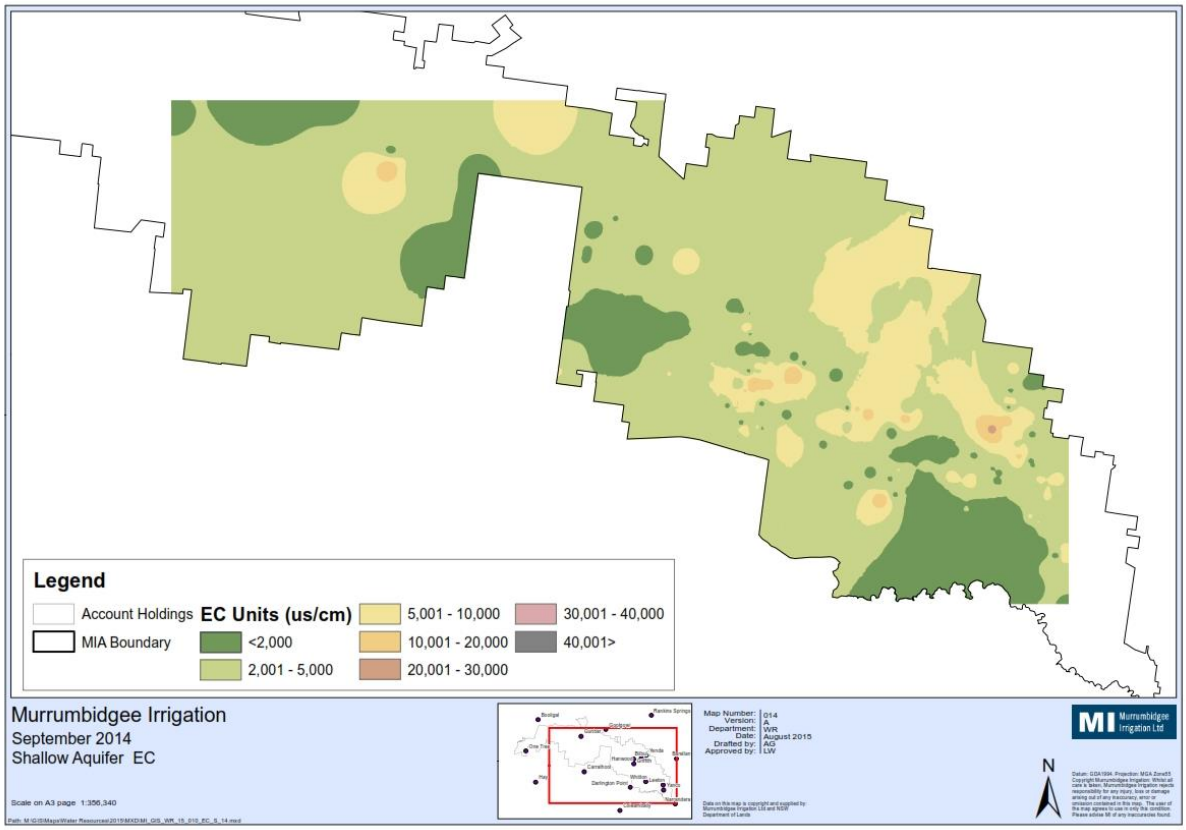


Figure 20 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2014

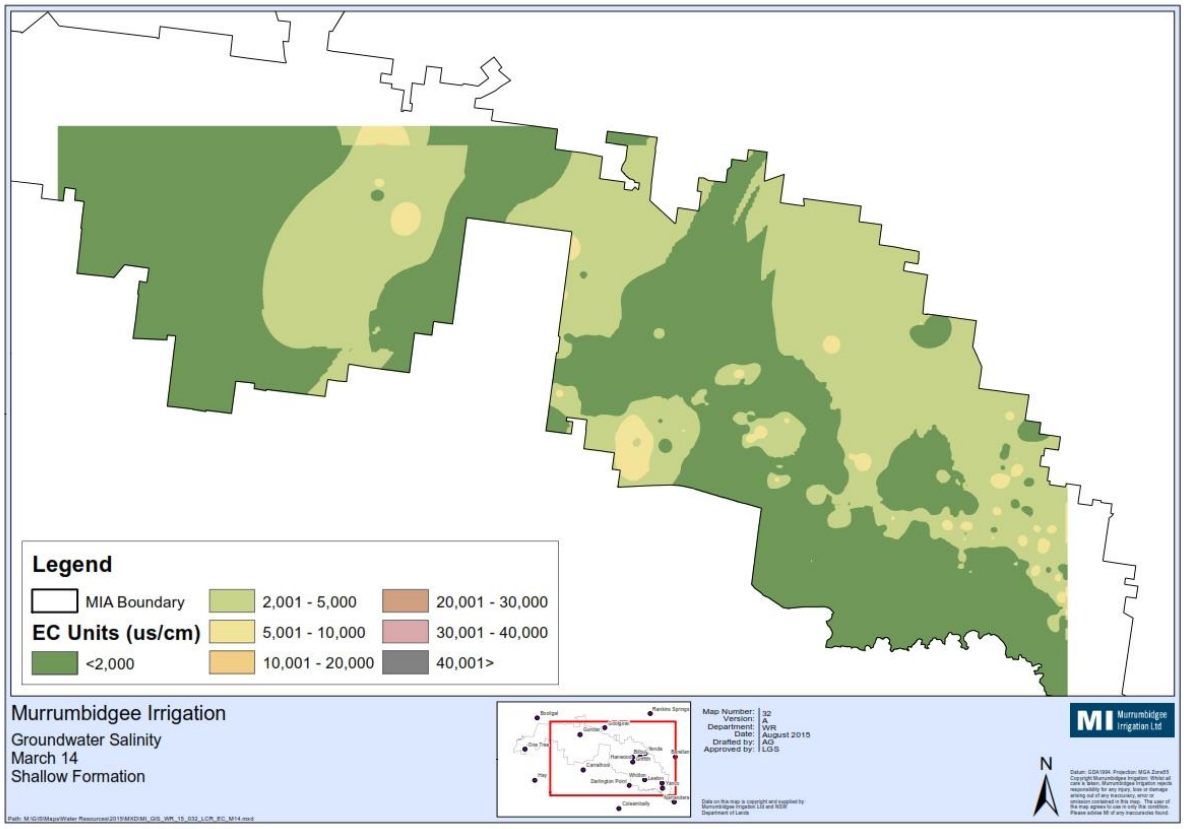


Figure 21 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, March 2014

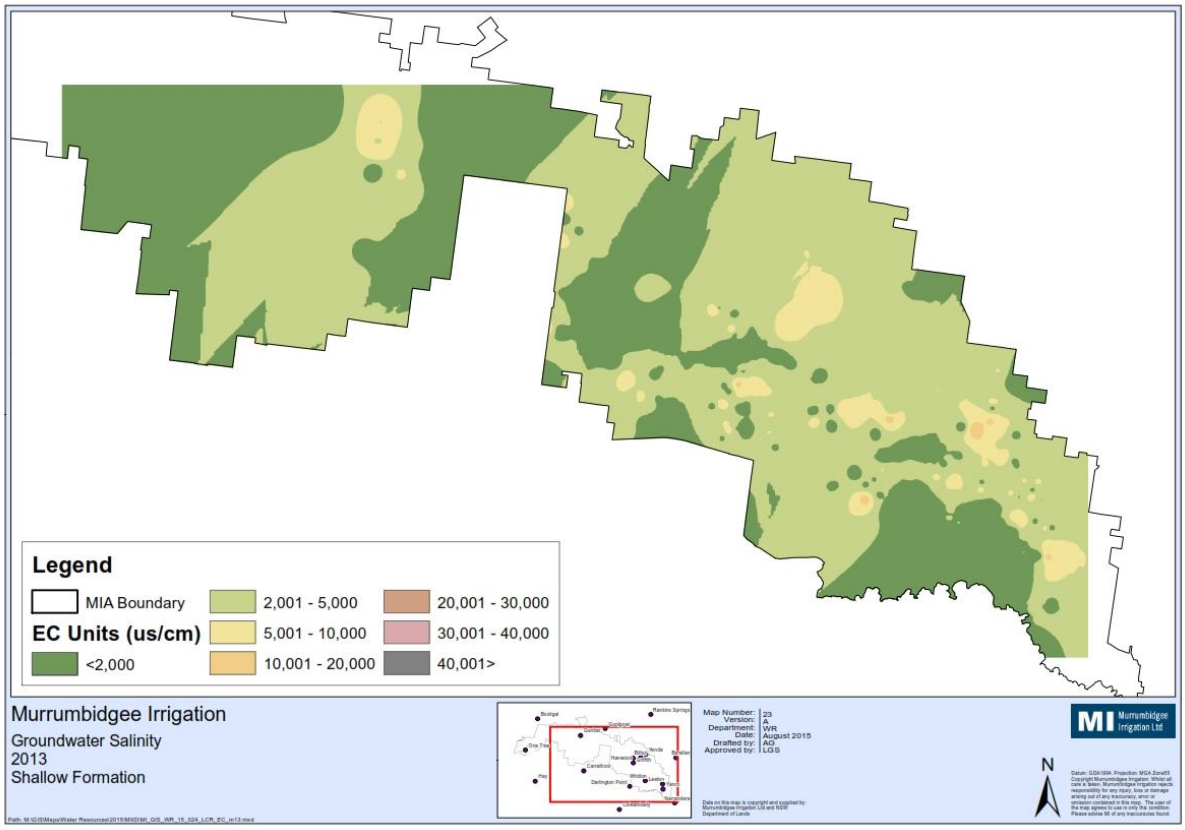


Figure 22 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2013

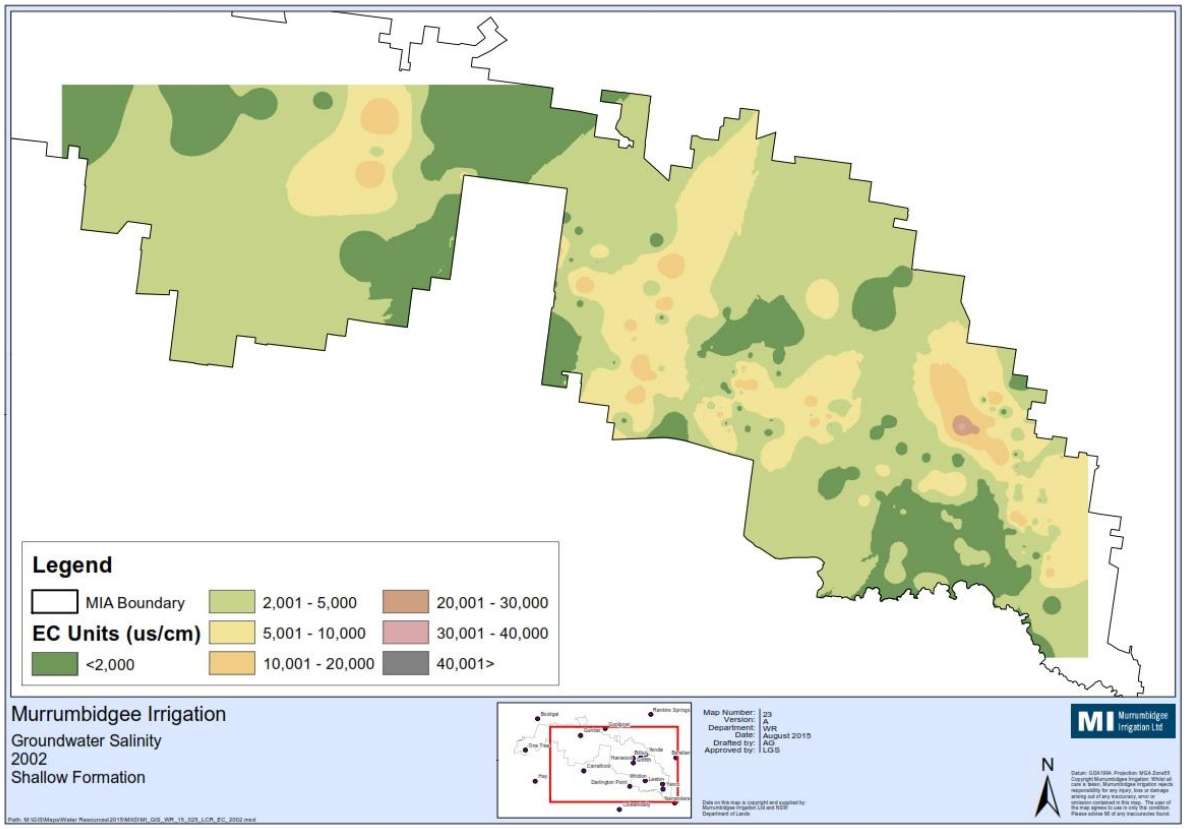


Figure 23 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2002

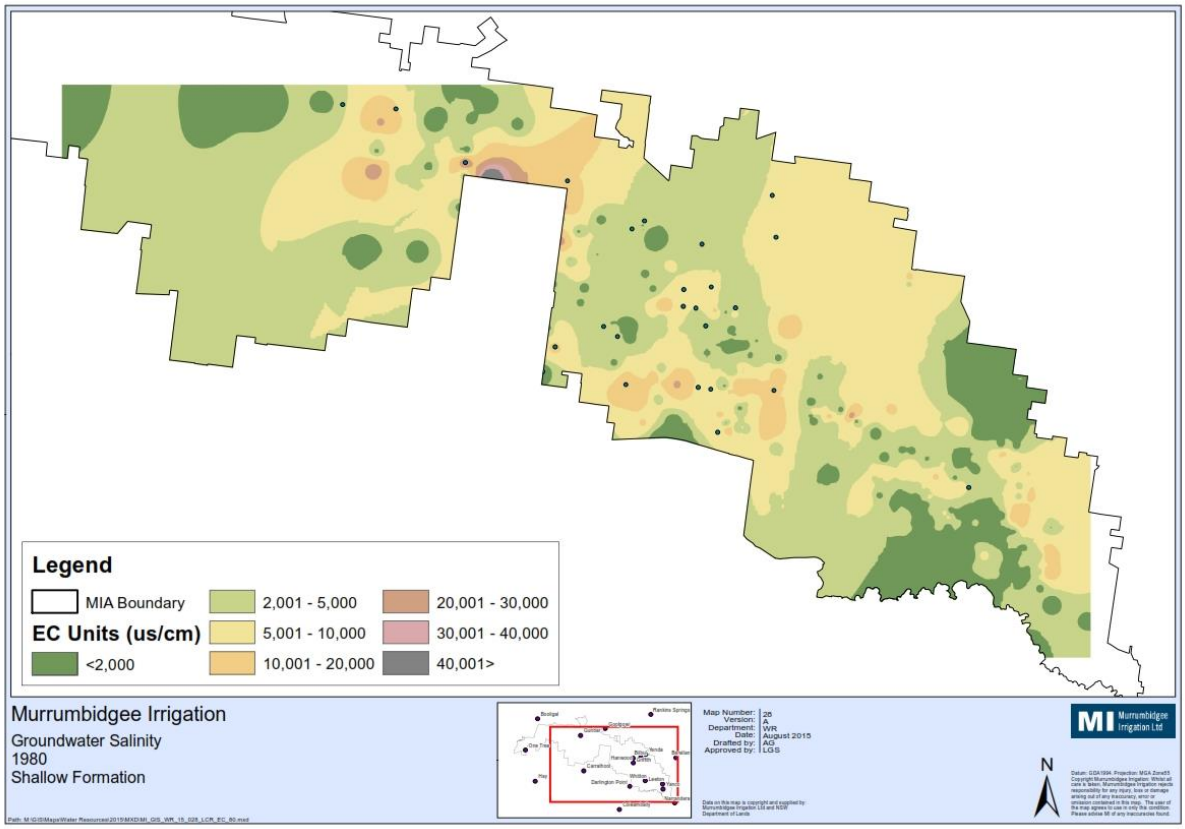


Figure 24 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 1980

6.4 Deep Shepparton Formation

6.4.1 Groundwater levels

Depth to water table maps for the Deep Shepparton Formation are presented in Figures 25 to 32. Groundwater levels in the Deep Shepparton Formation are also influenced by irrigation and rainfall either via infiltration through clay layers or connectivity with the Shallow Shepparton Formation. The trends observed in the Shallow Shepparton Formation also occur in the Deep Formation. The depth to water table maps show a consistent trend across the MIA for all reporting years, with slightly higher groundwater levels recorded after irrigation season when compared to levels recorded prior to irrigation season. These maps also highlight the general east to west directional flow of groundwater across the area.

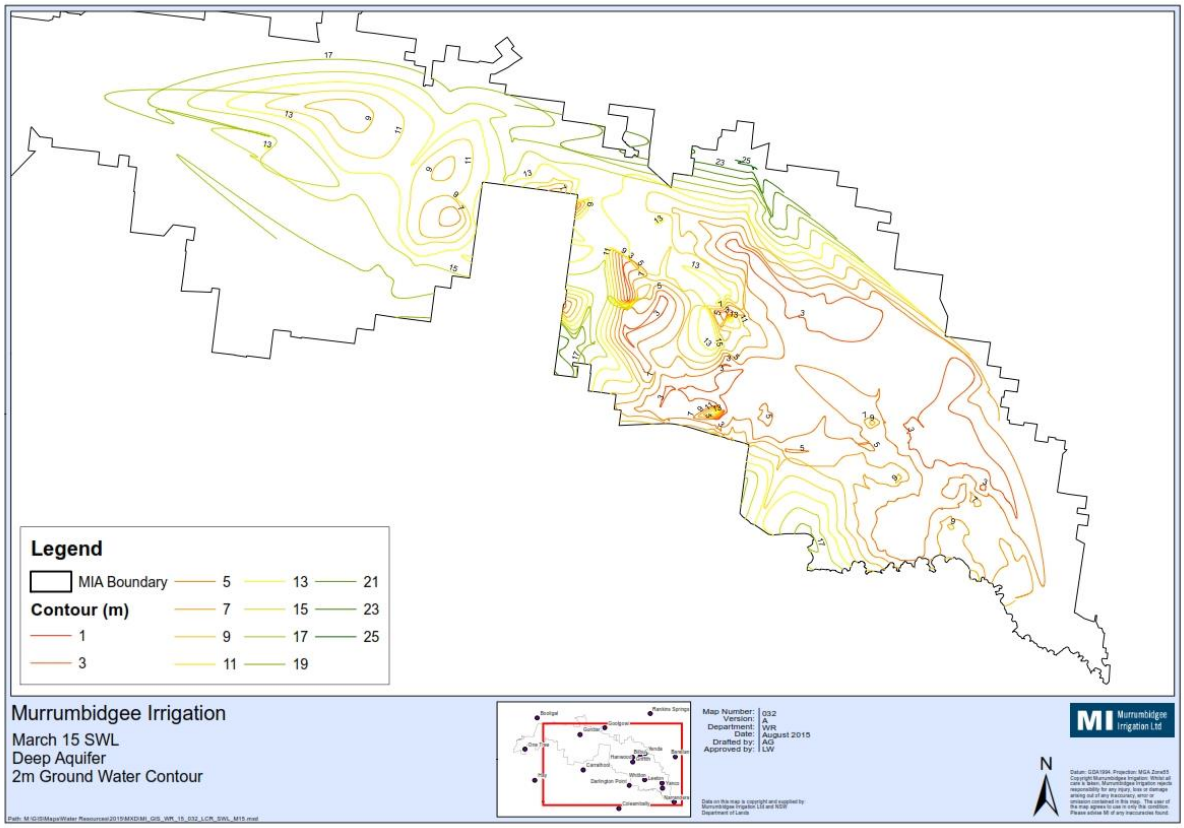


Figure 25 Depth (m) to water table in the Deep Shepparton Formation, March 2015

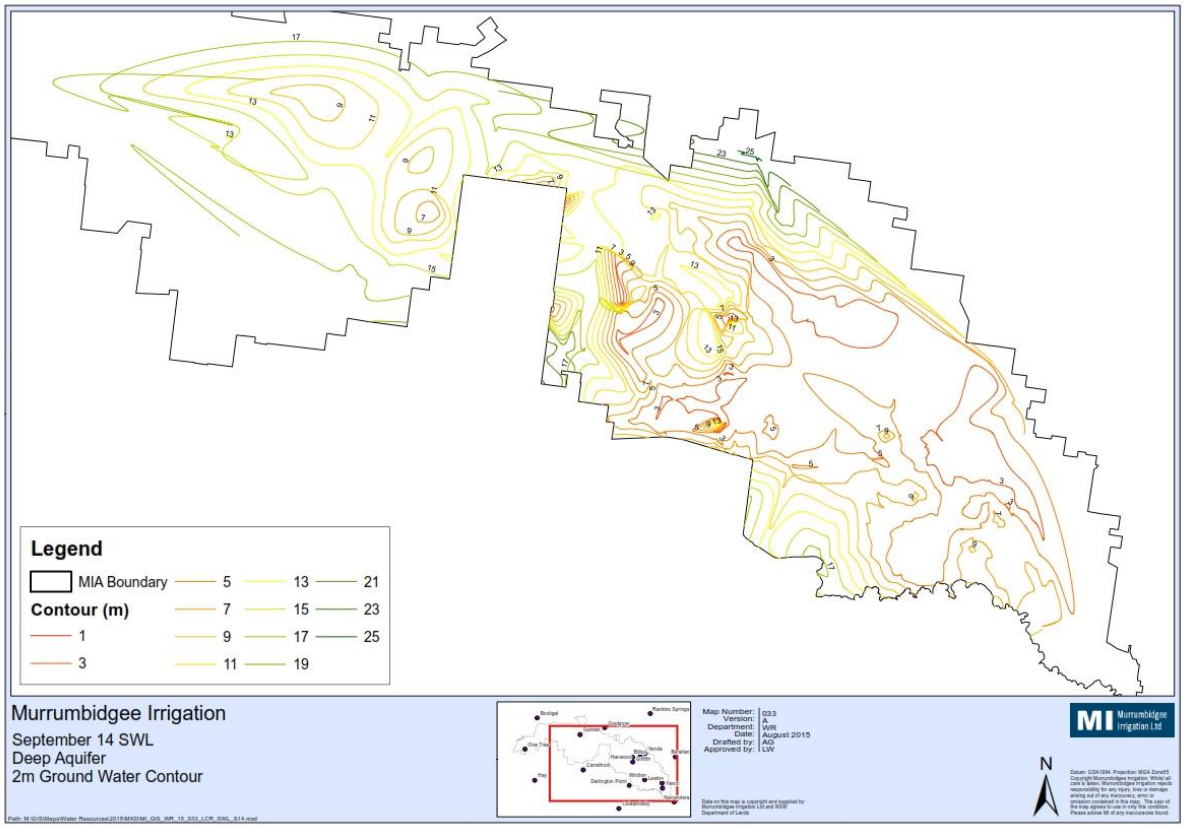


Figure 26 Depth (m) to water table in the Deep Shepparton Formation, September 2014

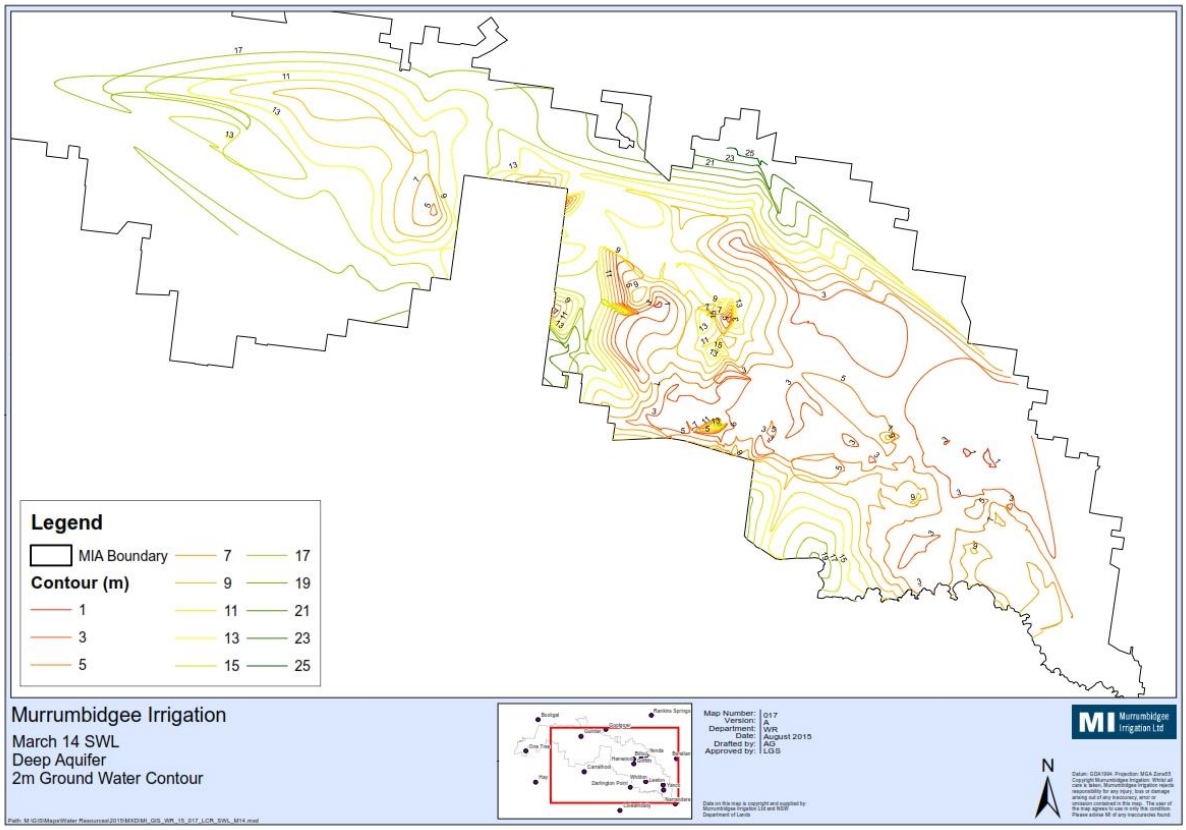


Figure 27 Depth (m) to water table in the Deep Shepparton Formation, March 2014

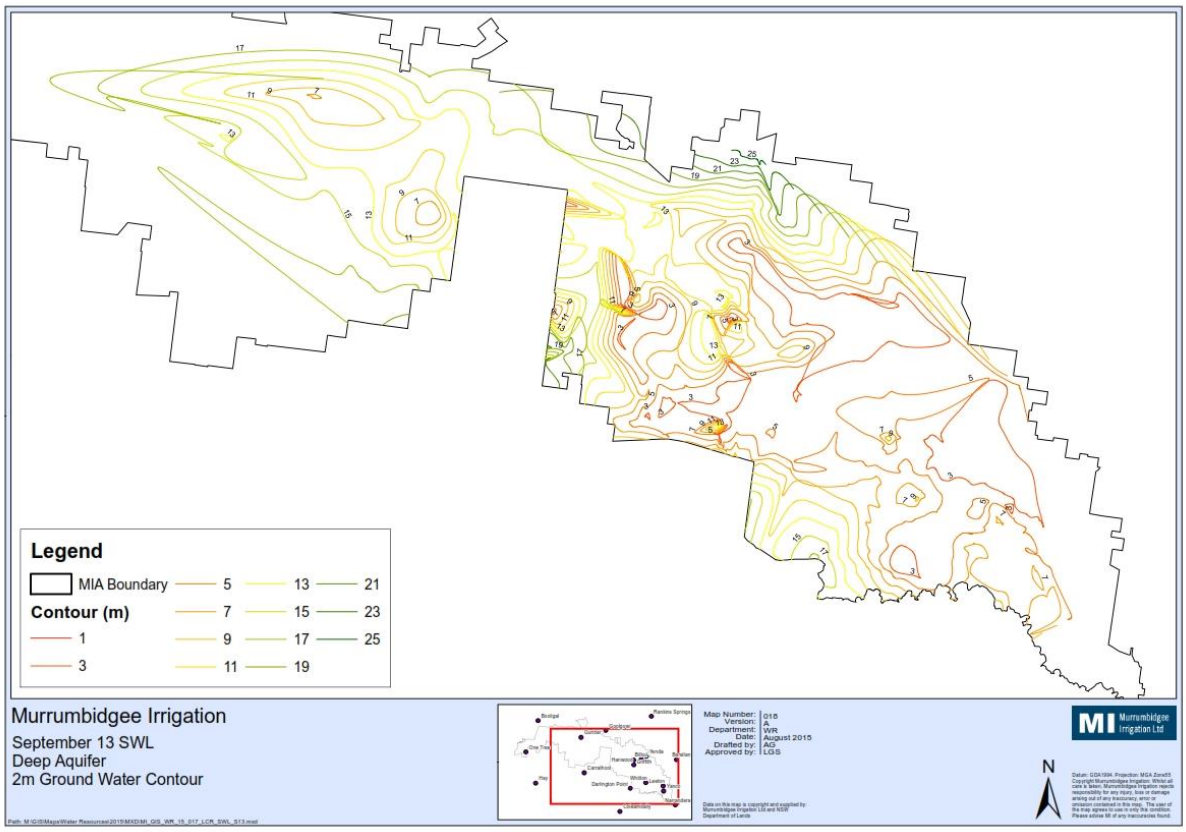


Figure 28 Depth (m) to water table in the Deep Shepparton Formation, September 2013

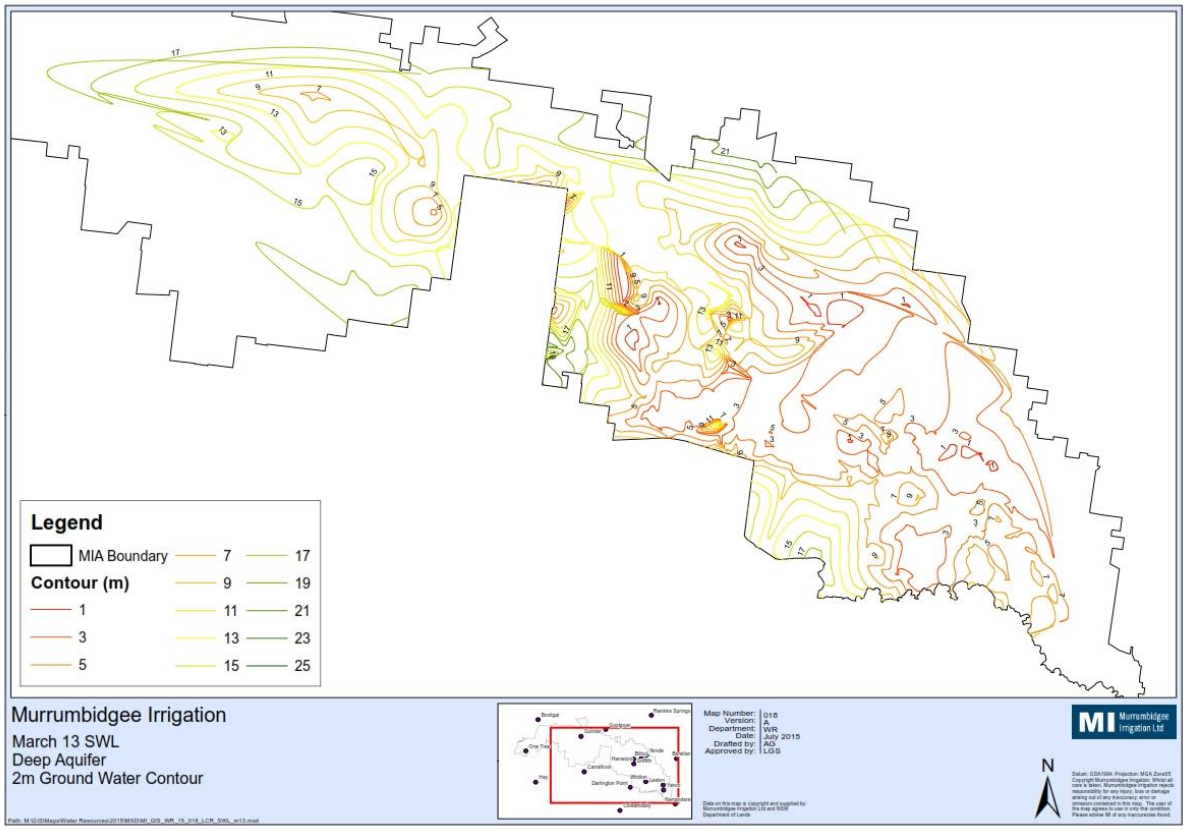


Figure 29 Depth (m) to water table in the Deep Shepparton Formation, March 2013

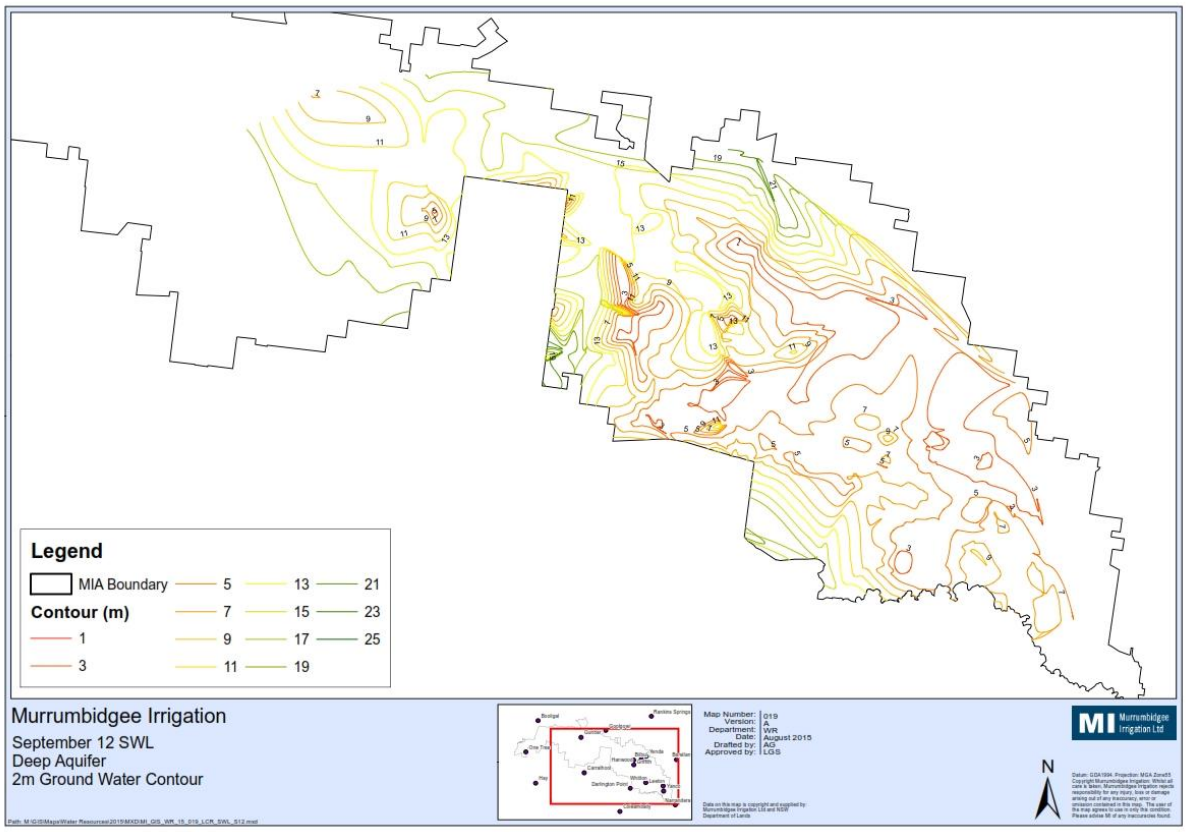


Figure 30 Depth (m) to water table in the Deep Shepparton Formation, September 2012

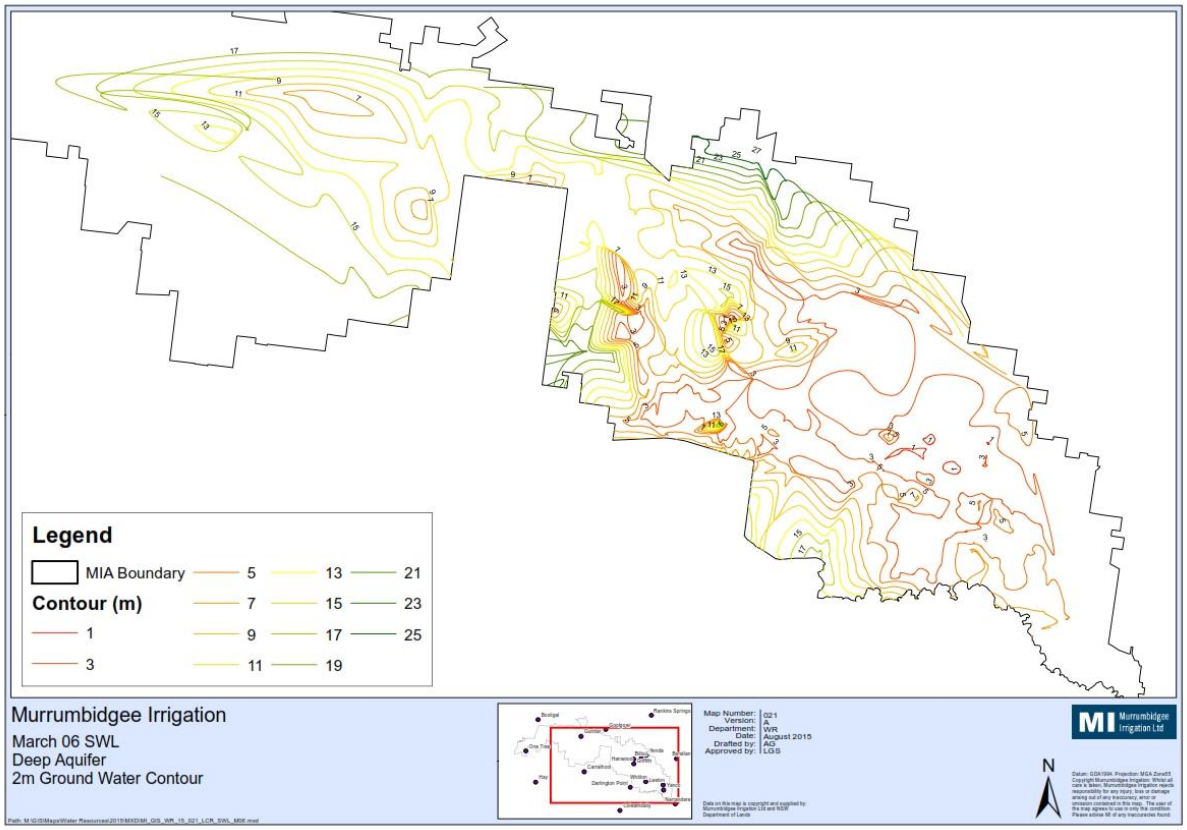


Figure 31 Depth (m) to water table in the Deep Shepparton Formation, March 2006

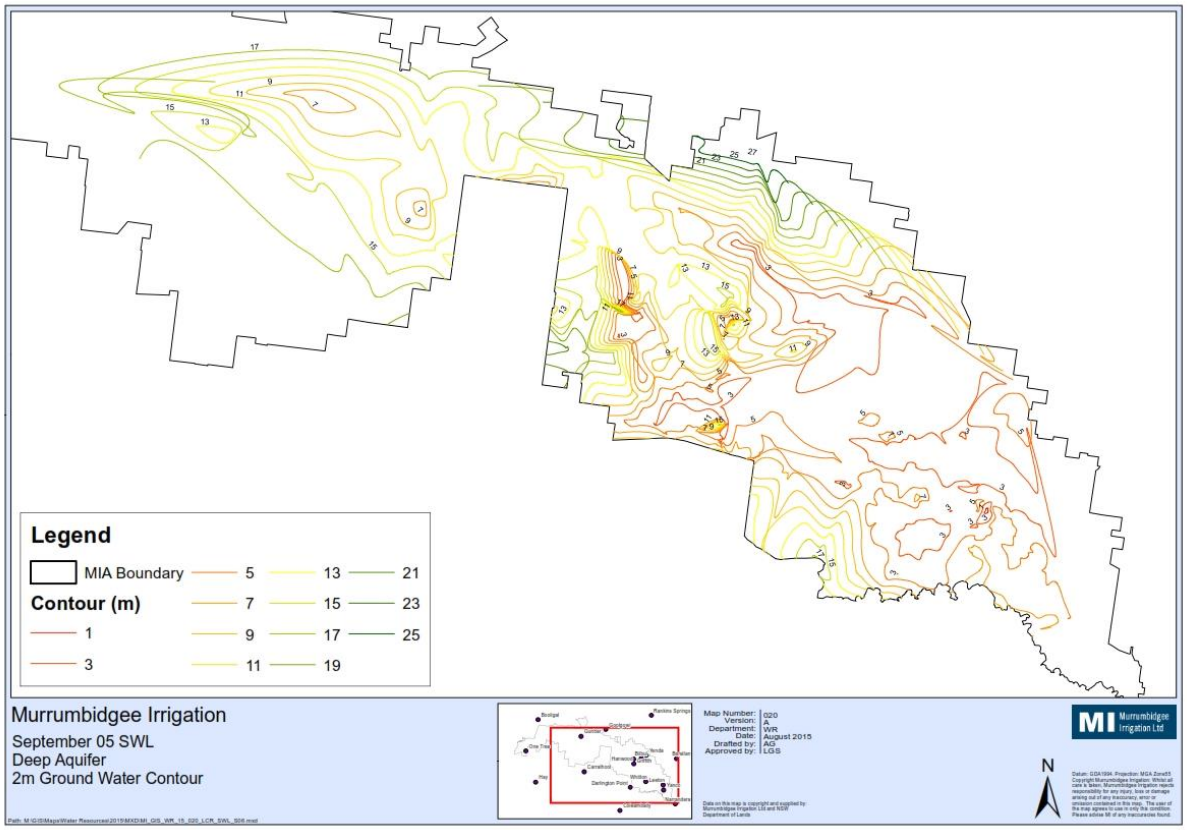


Figure 32 Depth (m) to water table in the Deep Shepparton Formation, September 2005

6.4.2 Groundwater salinity

Figures 33 to 38 show the salinity changes in the Deep Shepparton Formation. Salinity changes in the Deep Formation mirror changes shown in the Shallow Formation with lower EC values recorded following the irrigation season. The 2014 September EC readings (Figure 34) are comparable to both historical references, whereas EC readings for September 2013 (Figure 36) are considerably lower across the MIA, likely caused by recharge from the 2012 flood. The change in EC from March 14 (Figure 35) to September 2014 (Figure 34) suggest that water quality is digressing to a more saline state, similar to those observed in historical reference years. This salinity change is expected as groundwater levels recede and can also be attributed to the reduced rainfall (and therefore recharge) across the MIA in 2014/15.

High saline areas are observed in the Mirrool Irrigation Area and Benerembah Irrigation District, again, with the exception of 2013/14 reporting year, where lower EC values are observed in these areas. Due to the attenuation time for groundwater to infiltrate through layers or for gradient movement across the MIA, groundwater changes can be seen long after a flood event has occurred. The flood that occurred in 2012 is likely the cause of these lower EC values recorded in 2013/14.

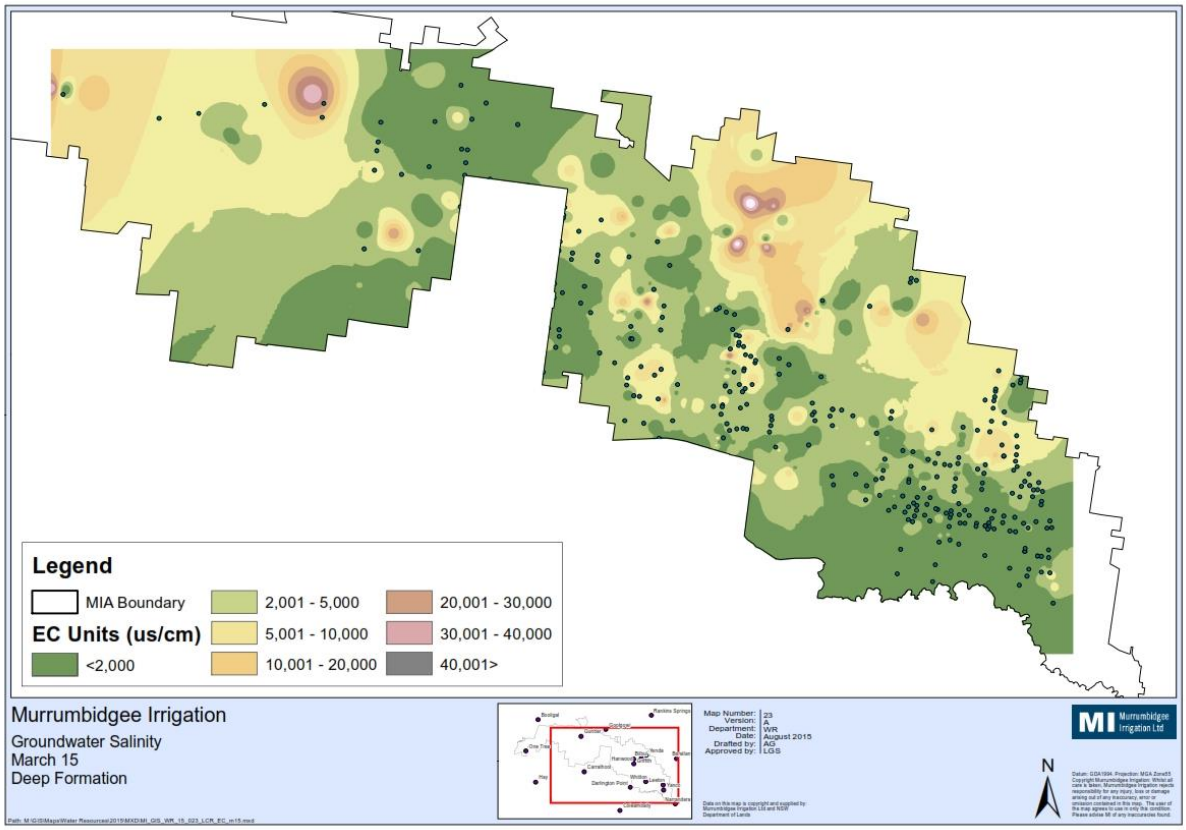


Figure 33 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2015

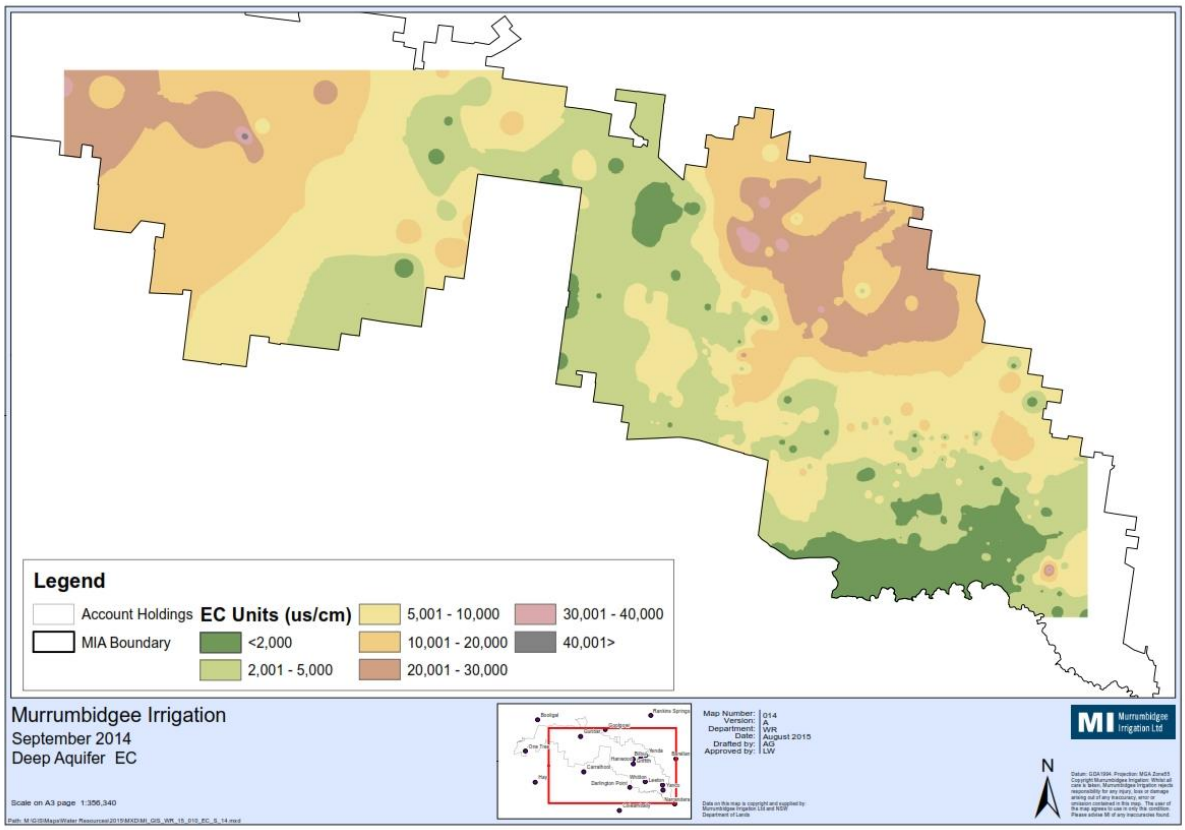


Figure 34 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2014

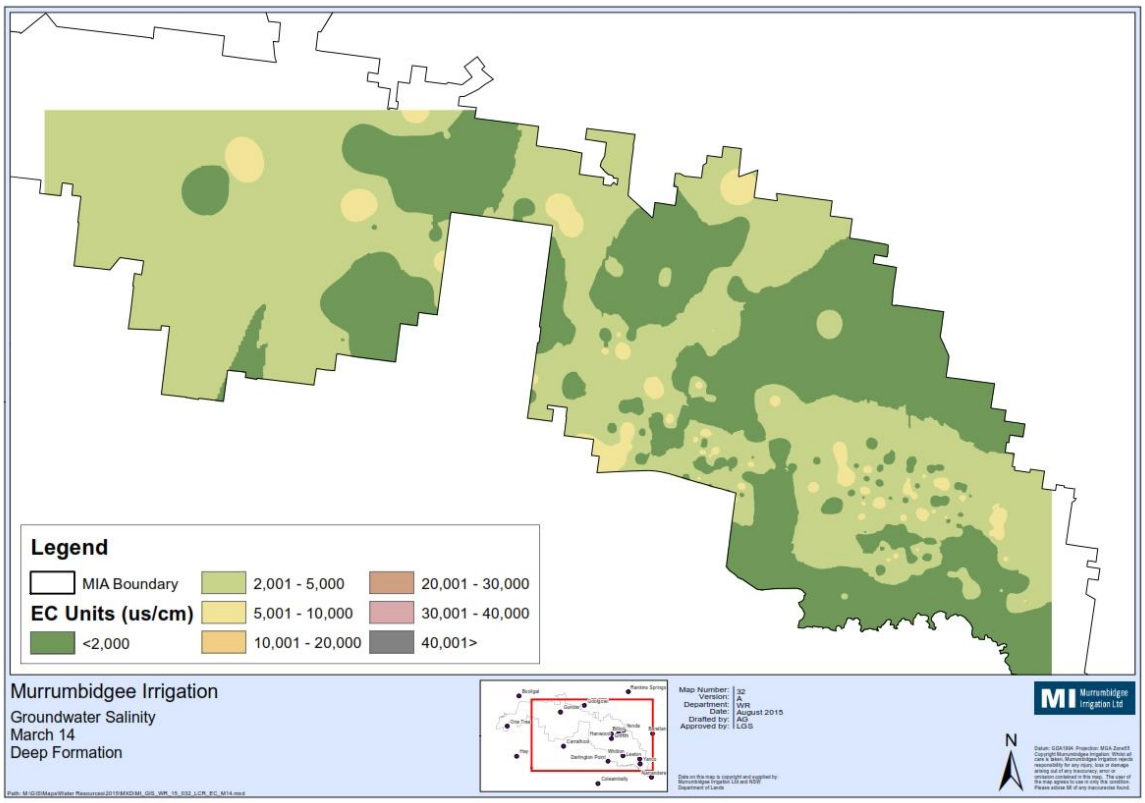


Figure 35 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2014

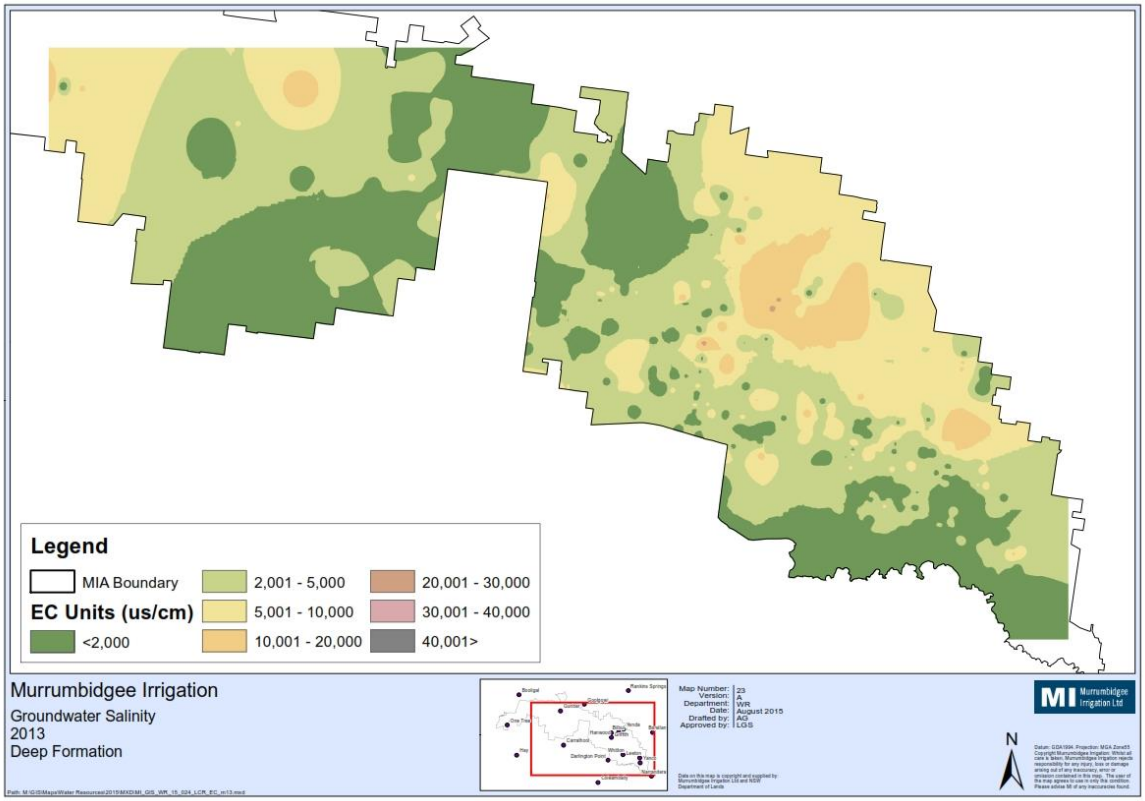


Figure 36 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2013

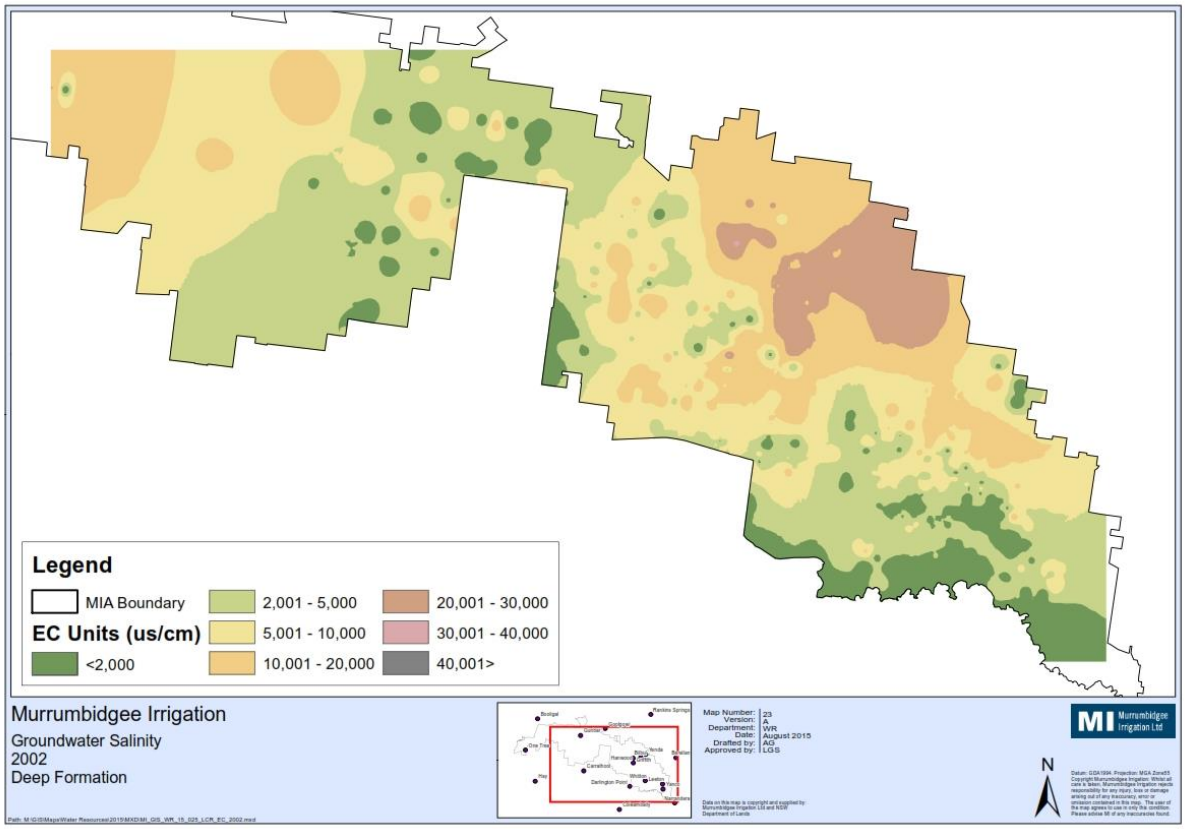


Figure 37 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2002

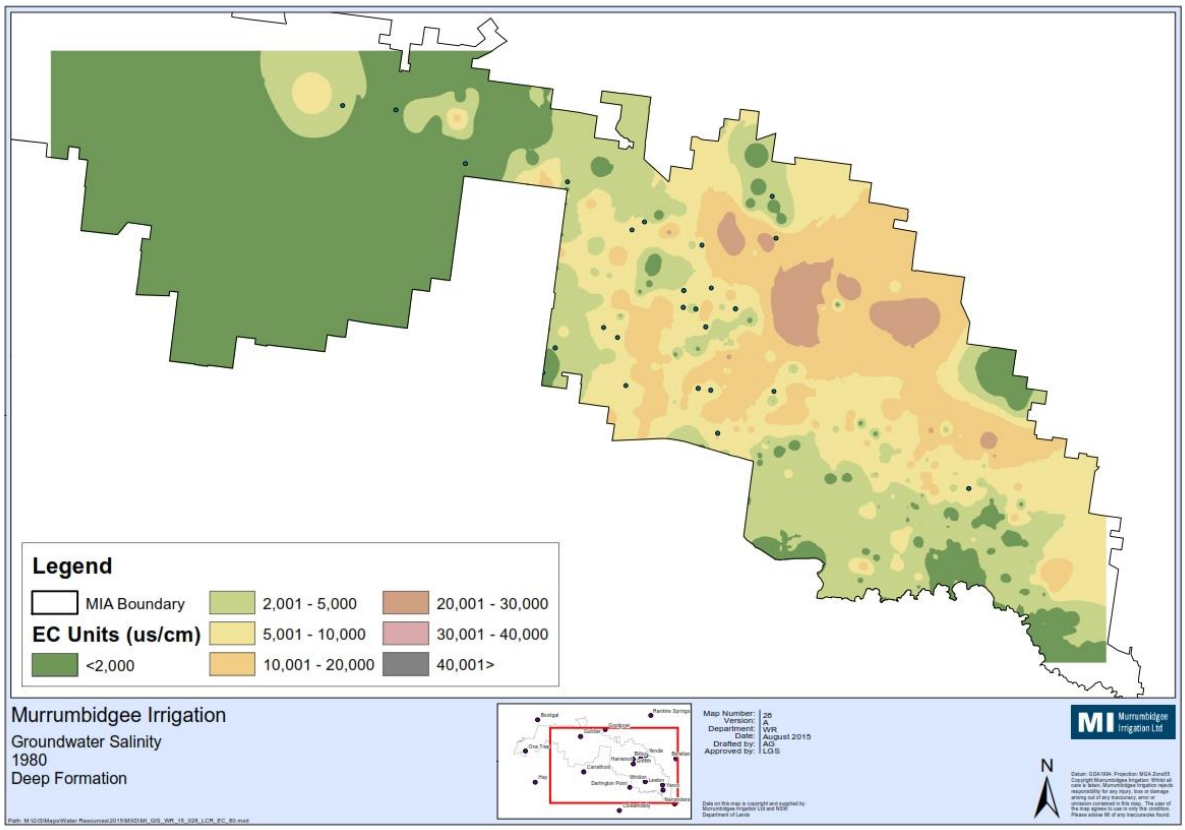


Figure 38 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 1980

6.5 Calivil Formation

6.5.1 Groundwater levels

Depth to water table maps for the Calivil Formation are presented in Figures 39 to 46. Level trend in this formation are the opposite of trends observed in the Shepparton Formation with groundwater levels decreasing following an irrigation season. This is likely attributed to increases in groundwater extraction during the irrigation season.

Levels recorded in 2005/06 were almost 4 m deeper than those recorded in 2012/13. It is expected that groundwater levels would be lower during drought periods due to limited recharge and increased groundwater pumping. Increased levels in 2012/13 also suggests that the Calivil Formation may be influenced by flooding, either through direct recharge, aquifer exchange or, to a lesser degree, vertical seepage from the above Shepparton Formation. However, due to the limited number of bores monitored in this formation, it is difficult to ascertain the true origin and significance of level changes with any confidence.

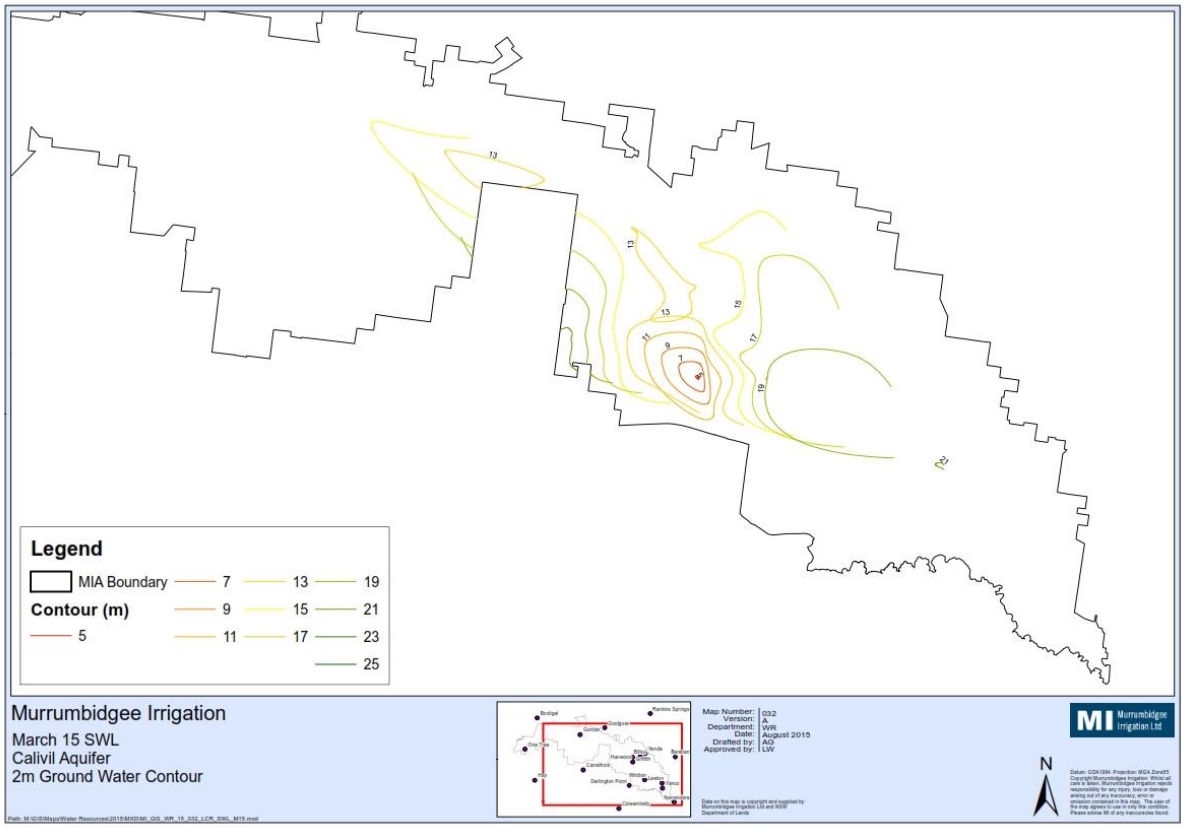


Figure 39 Depth (m) to water table in the Calivil Formation, March 2015

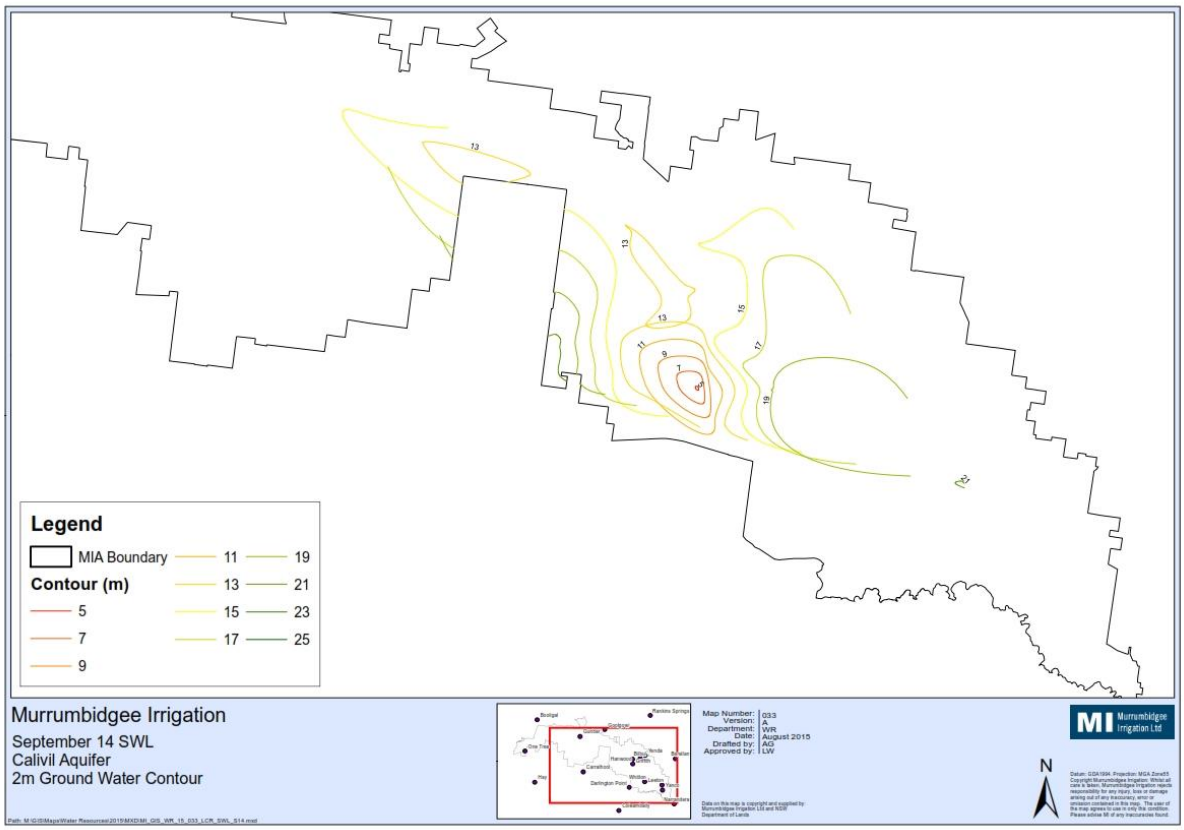


Figure 40 Depth (m) to water table in the Calivil Formation, September 2014

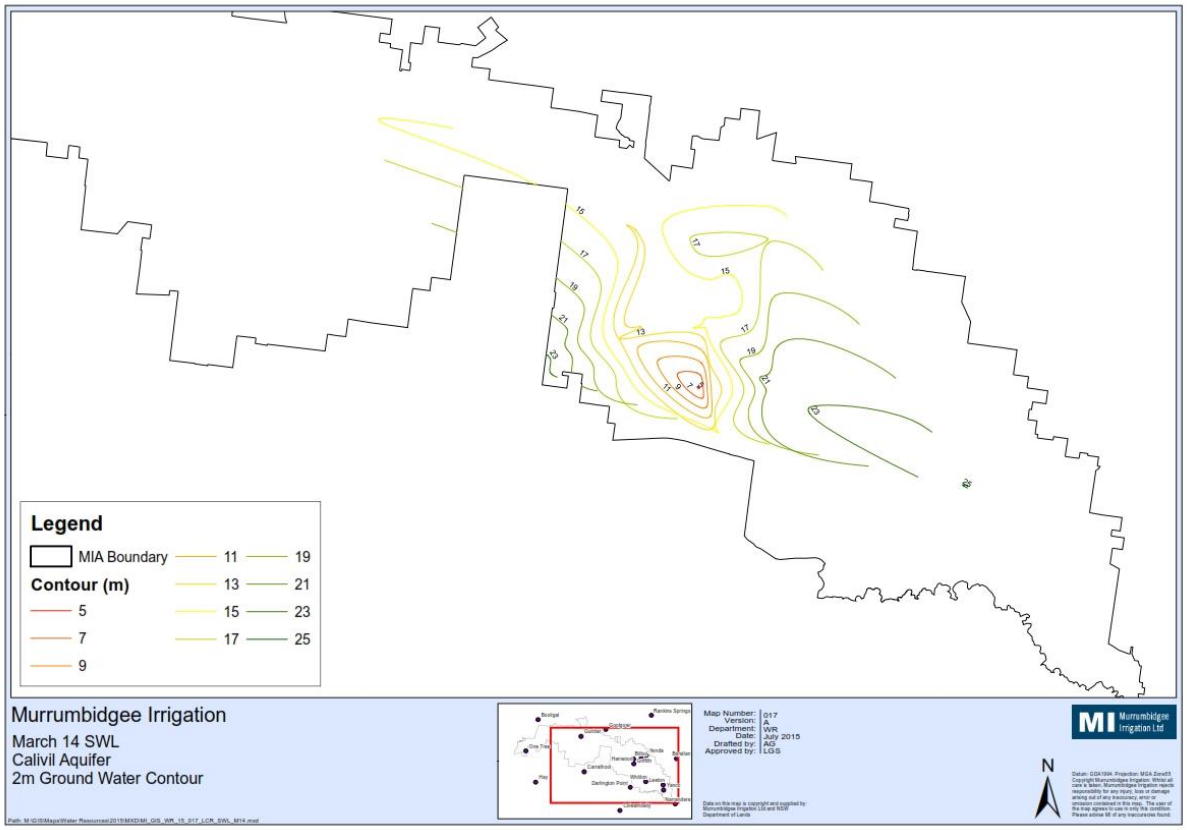


Figure 41 Depth (m) to water table in the Calivil Formation, March 2014

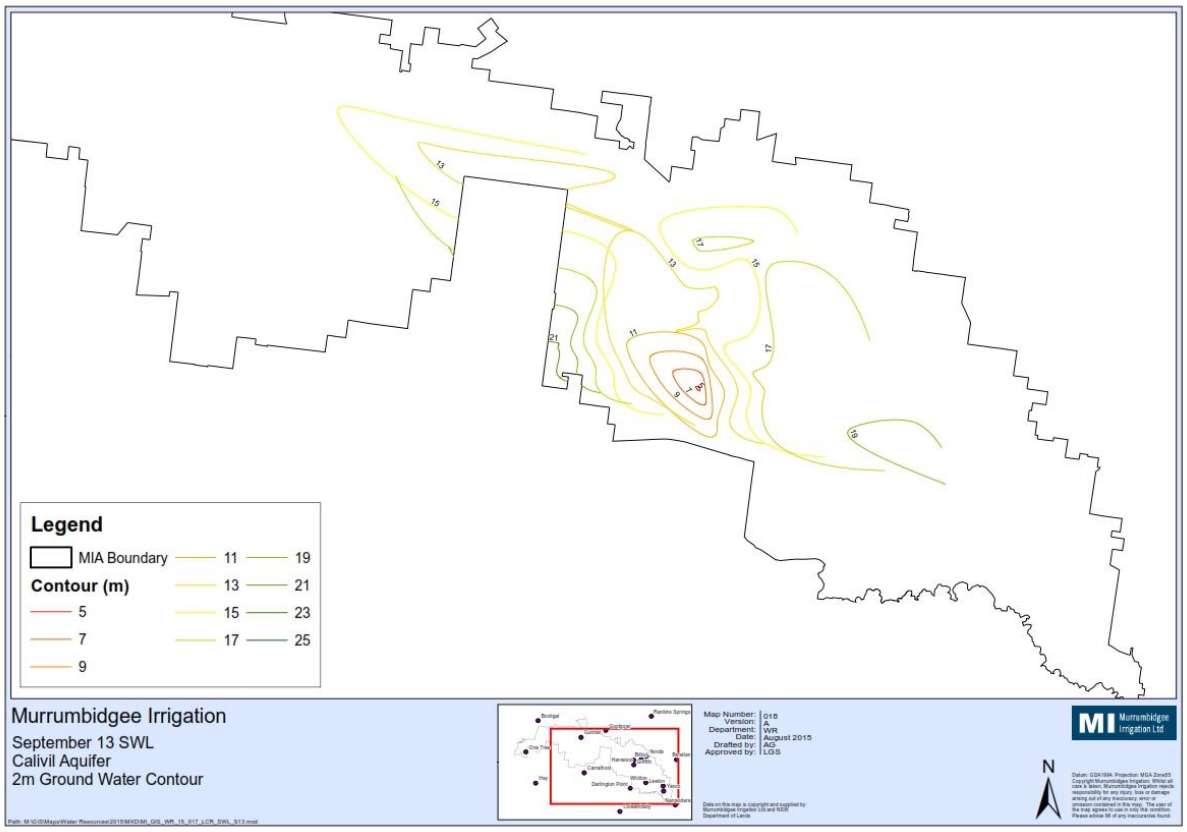


Figure 42 Depth (m) to water table in the Calivil Formation, September 2013

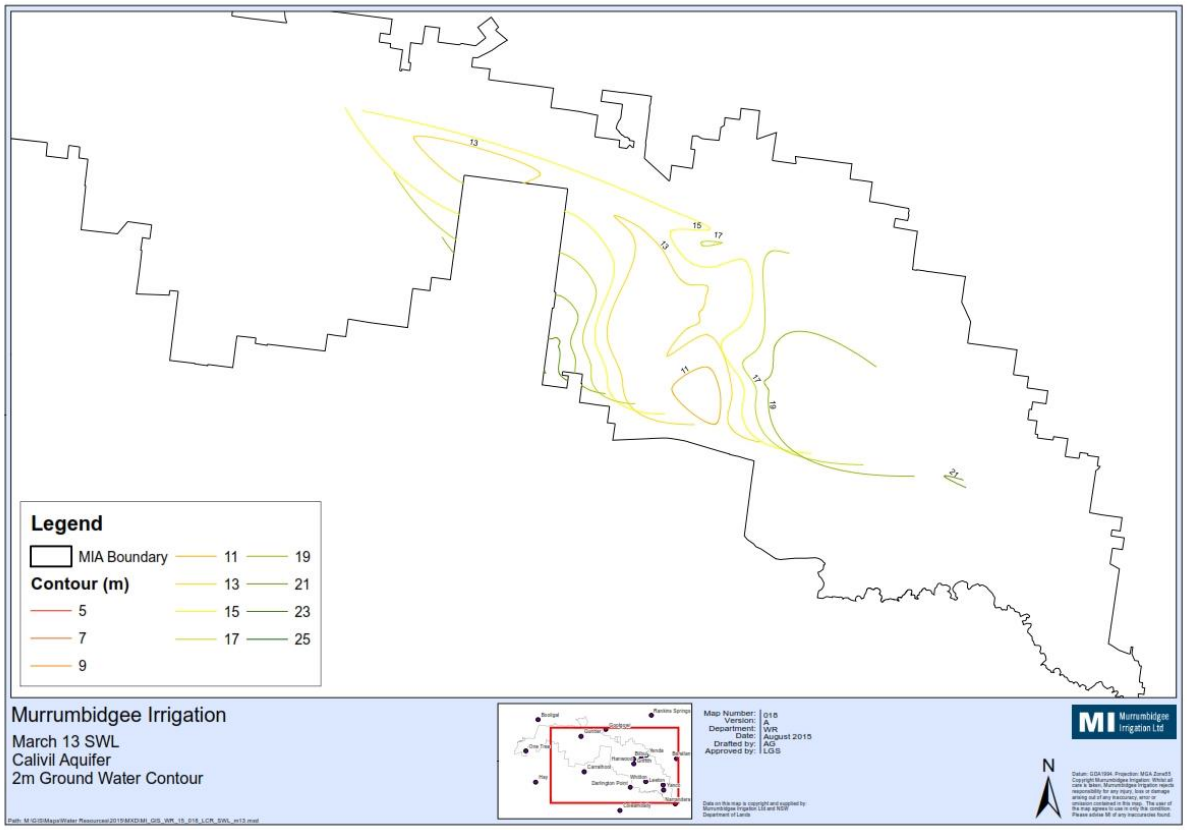


Figure 43 Depth (m) to water table in the Calivil Formation, March 2013

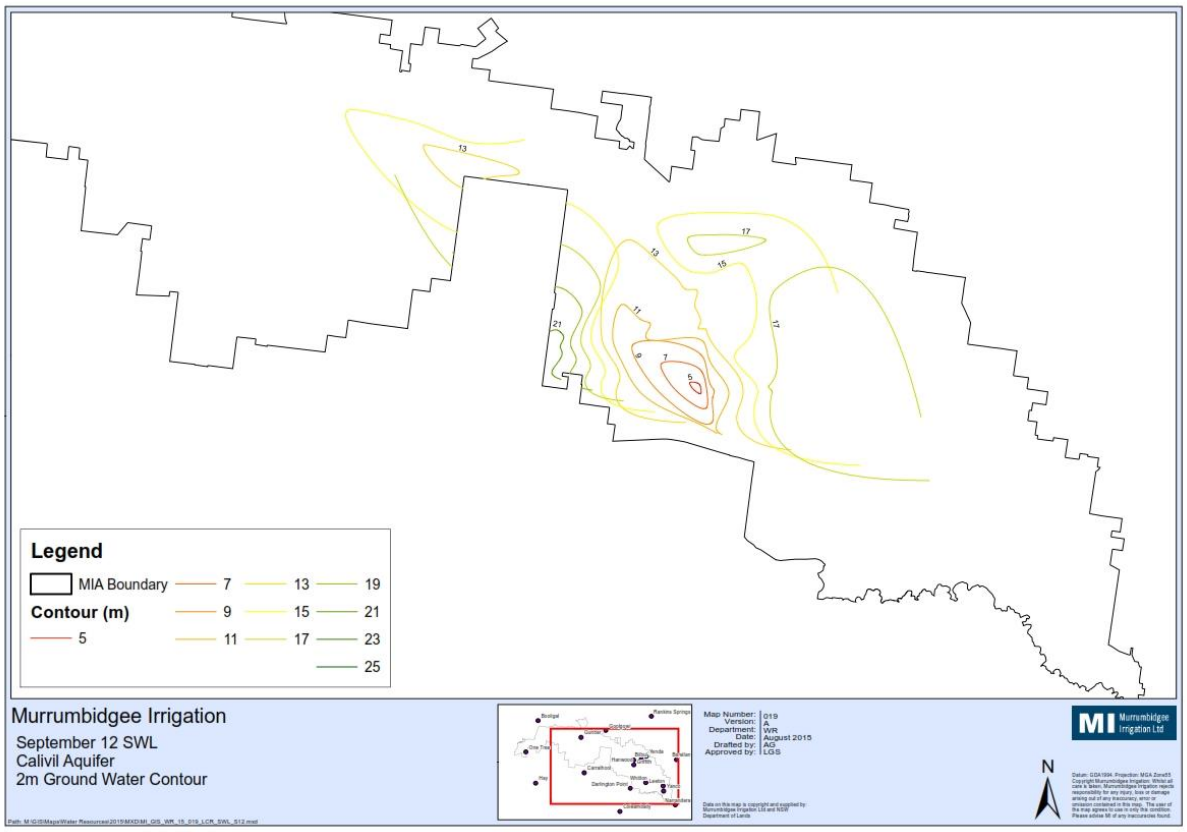


Figure 44 Depth (m) to water table in the Calivil Formation, September 2012

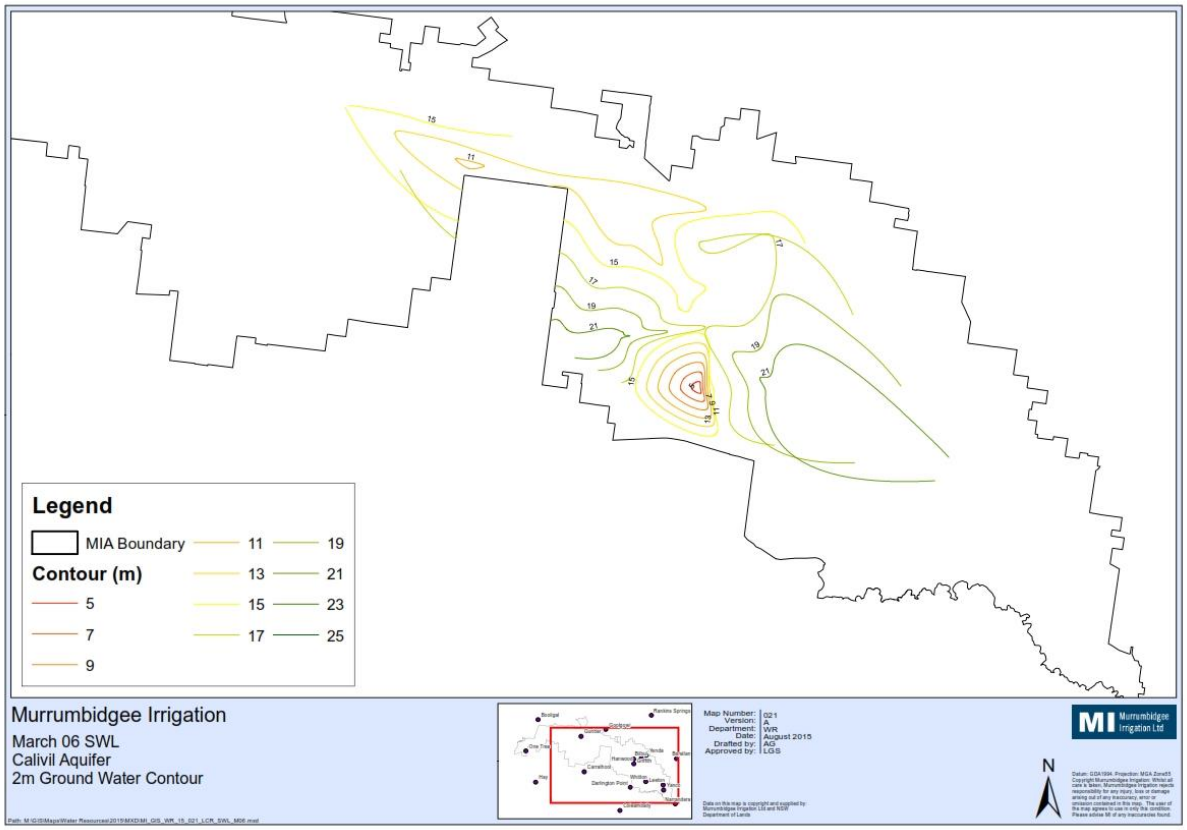


Figure 45 Depth (m) to water table in the Calivil Formation, March 2006

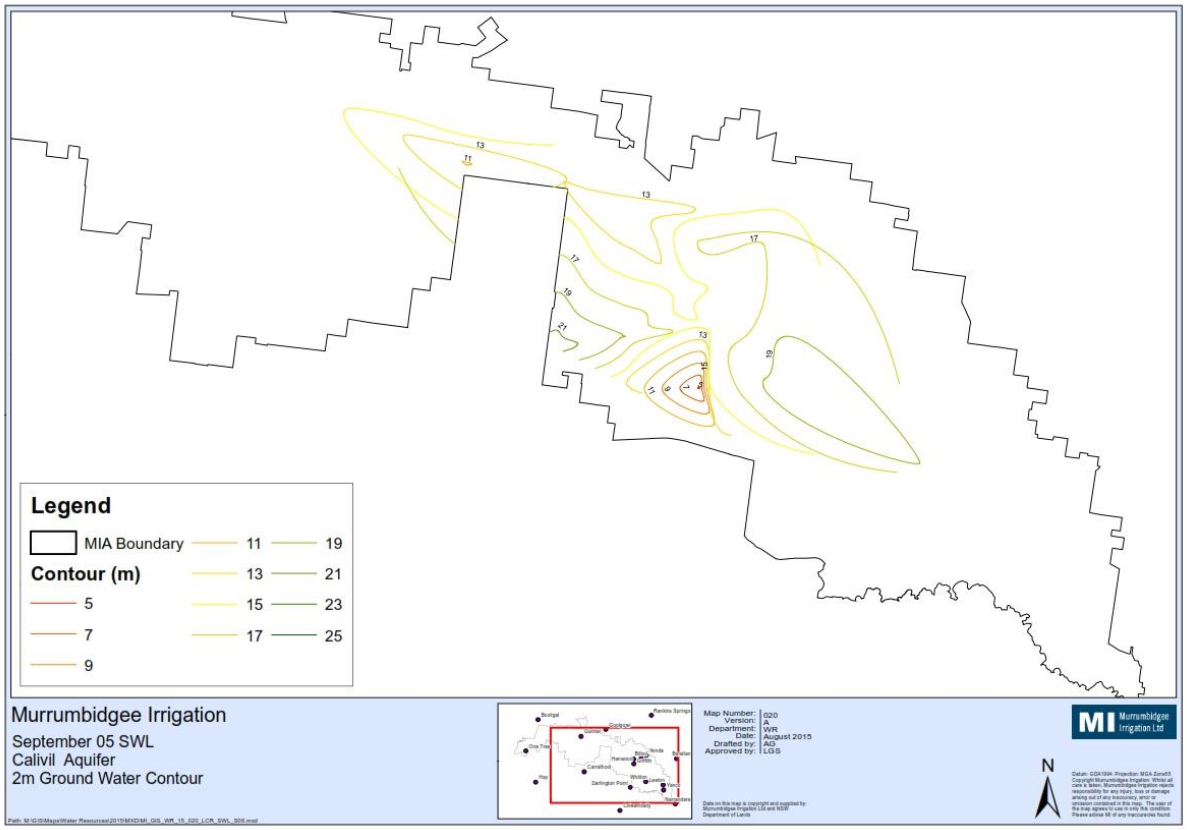


Figure 46 Depth (m) to water table in the Calivil Formation, September 2005

6.5.2 Groundwater salinity

Figures 47 to 52 show the salinity changes in the Calivil Formation compared to previous years. Due to the small amount of bores monitored by MI in the Calivil Formation, data is only available for a small portion of the MIA.

For 2013/14 salinity readings in the Calivil Formation mirror changes shown in the Shepparton Formation where lower EC values are displayed across the MIA. This can also be attributed to the flood experienced in 2012 and the lag time for the effects to be seen, which further suggests that the Calivil Formation is also influenced by surface water recharge likely from connectivity to the upper formations in some areas. This also highlights the significance of rainfall and episodic recharge events on the deeper formations in ensuring the reliability in the quality and quantity of water available for use in the Calivil Formation.

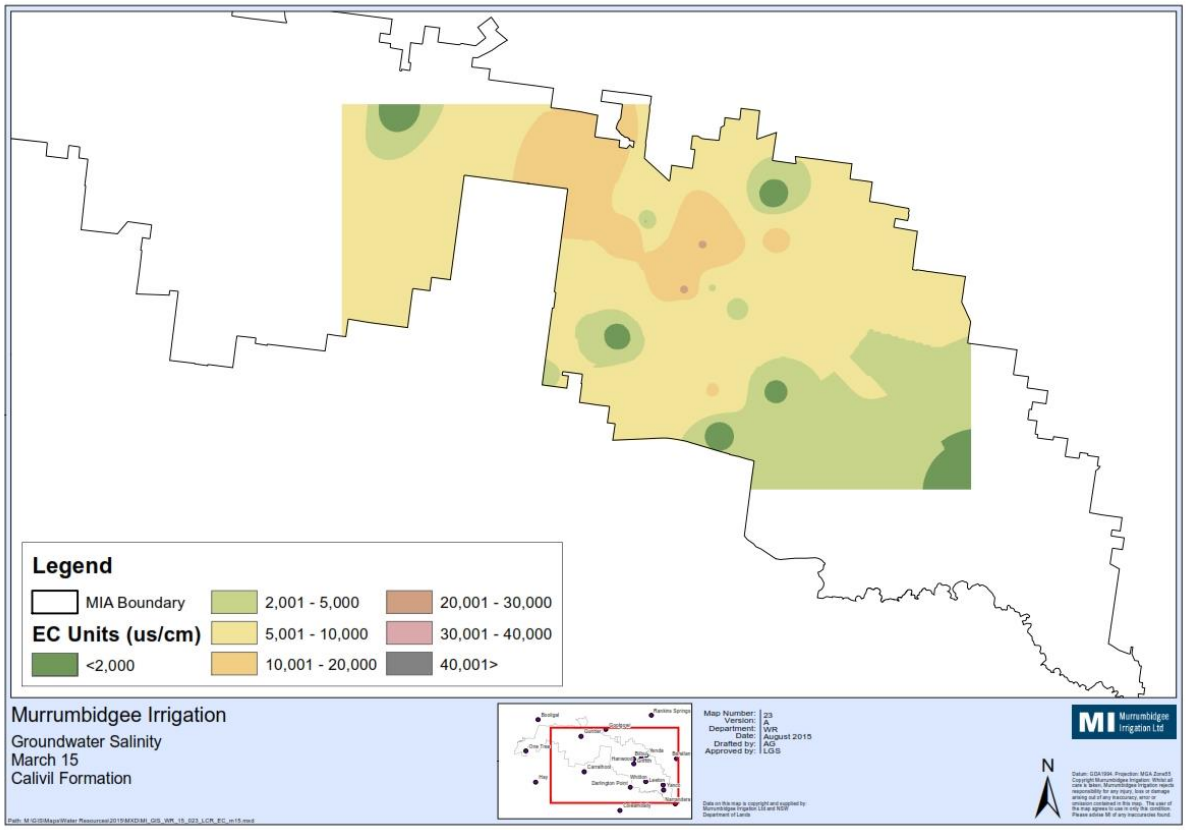


Figure 47 Groundwater salinity (µS/cm) in the Calivil Formation, March 2015

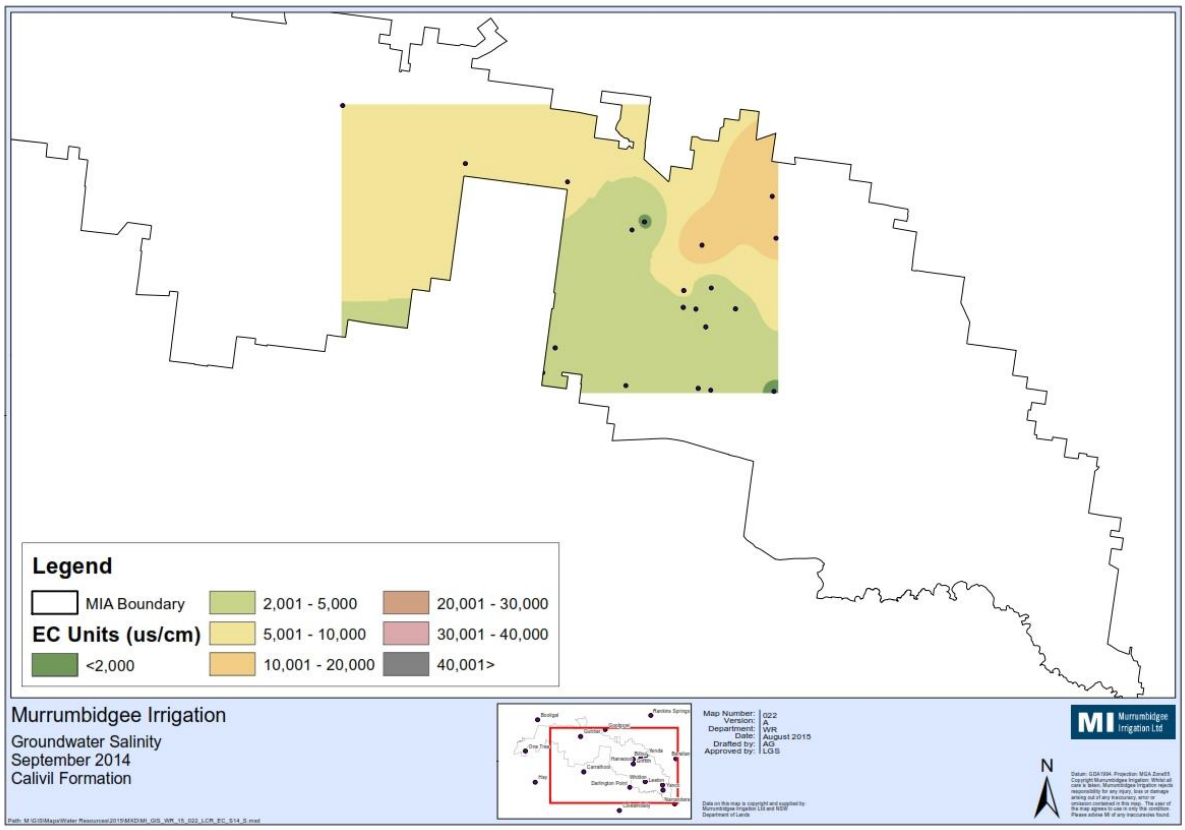


Figure 48 Groundwater salinity (µS/cm) in the Calivil Formation, September 2014

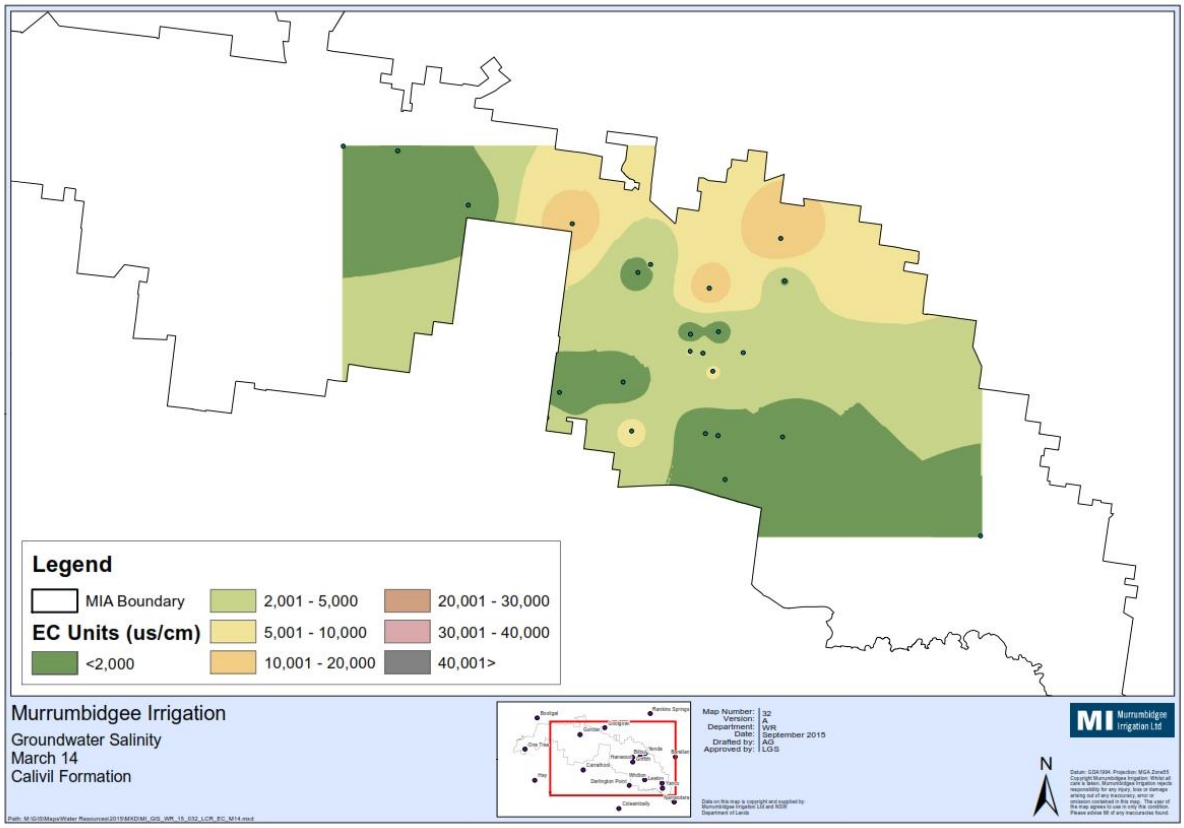


Figure 48 Groundwater salinity (µS/cm) in the Calivil Formation, March 2014

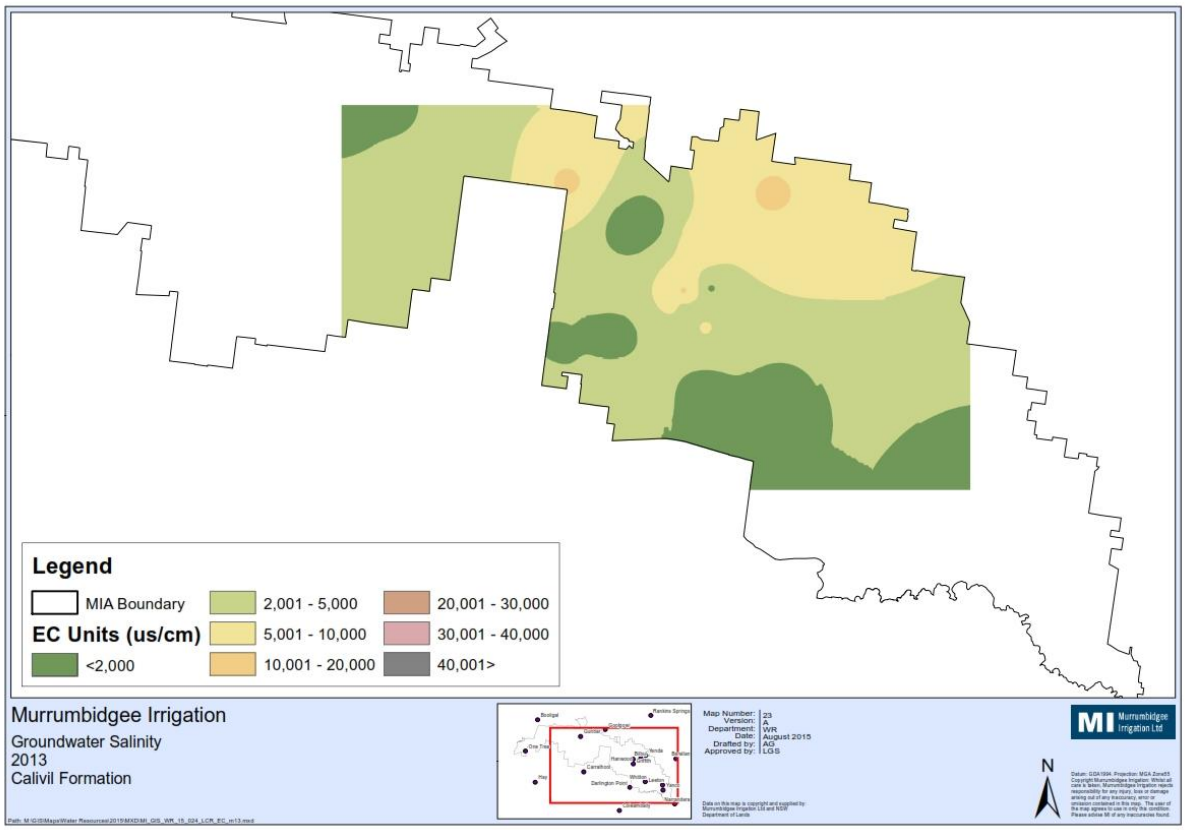


Figure 49 Groundwater salinity (µS/cm) in the Calivil Formation, September 2013

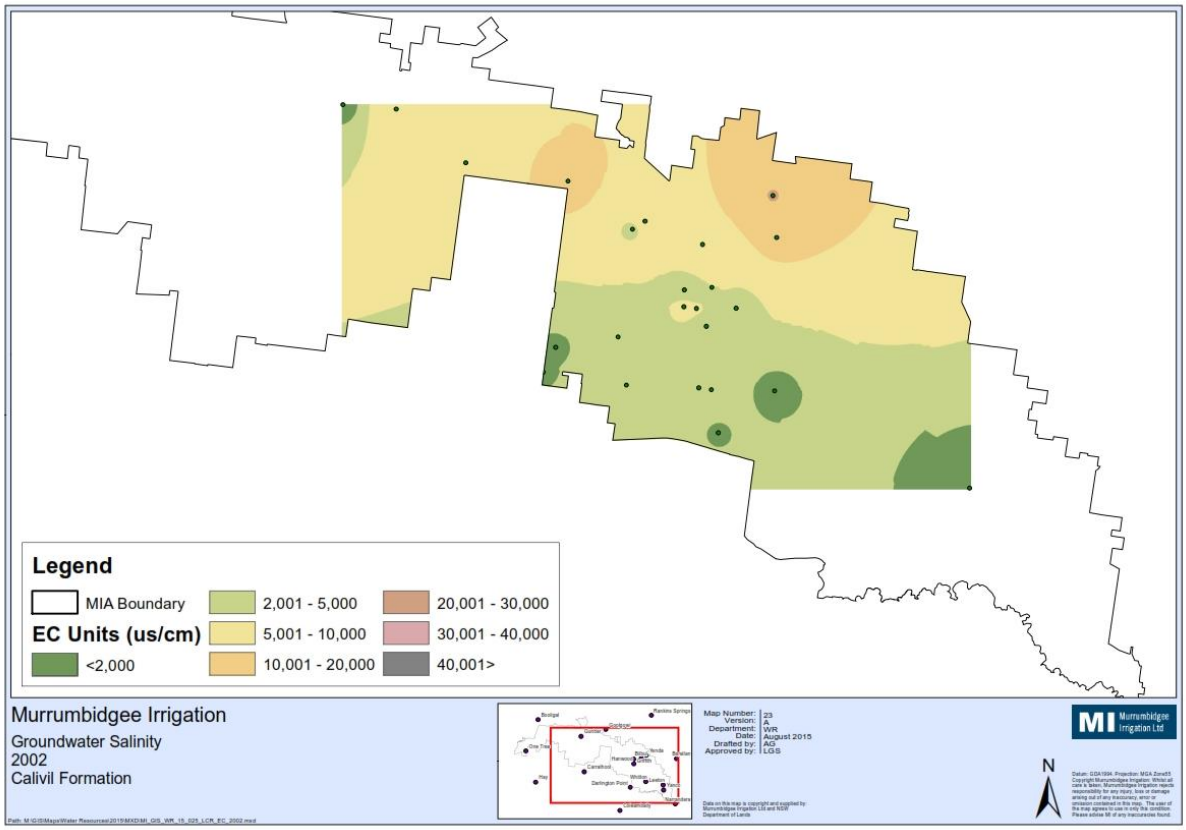


Figure 50 Groundwater salinity (µS/cm) in the Calivil Formation, September 2002

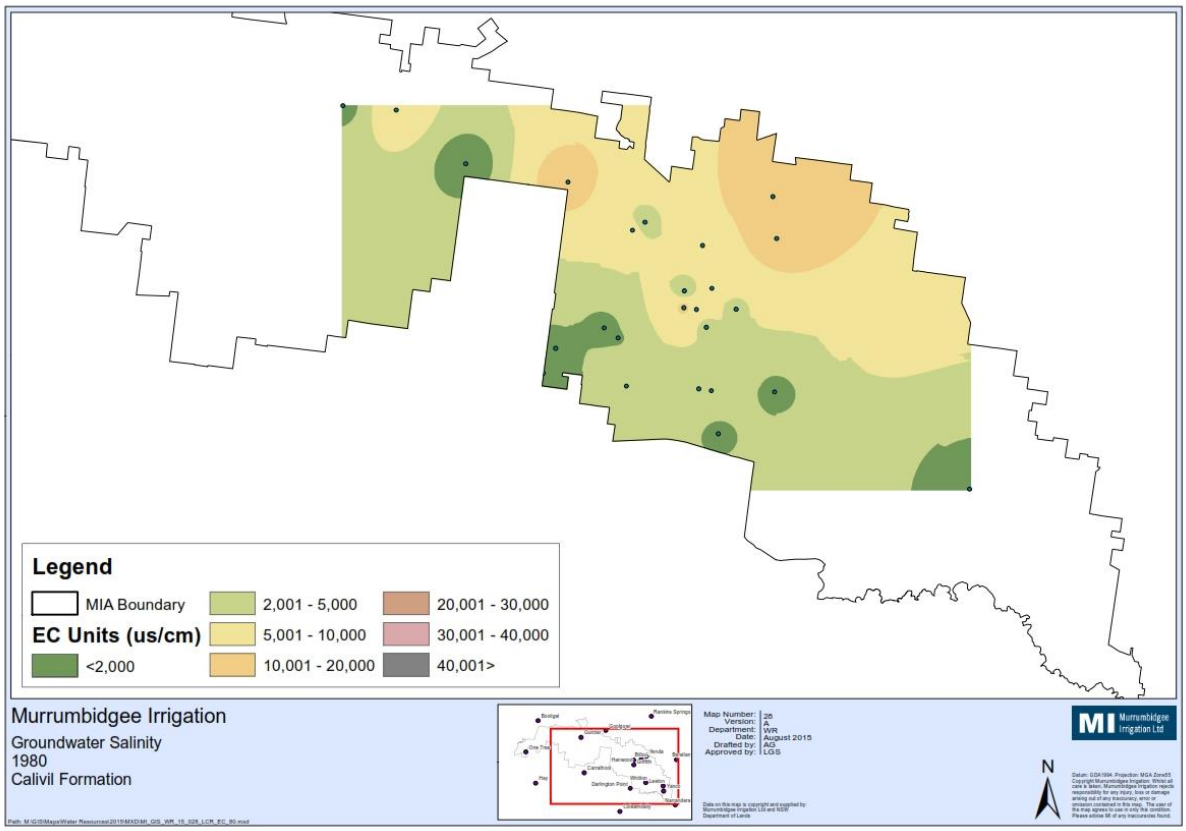


Figure 51 Groundwater salinity (µS/cm) in the Calivil Formation, September 1980

6.6 Tubewells

MI is responsible for monitoring the discharge and salinity levels for five tubewells across the MIA and report on the total yearly water and salt volumes discharged. Salinity measurements were taken in July 2015 to mark the end of the reporting period and are only representative of water discharged at this time. The locations of monitored tubewells are shown in Figure 10.

Changes in tubewell volumes and salt loadings are dependent on a number of external factors including irrigation, rainfall, flooding and groundwater level rise (and fall) experienced in any given year and location. Table 28 shows the total volumes and salt discharged from MIA tubewells for 2014/15 comparable to previous years. A total volume of 2,072 ML was discharged from the tubewells, carrying 2,103 tonnes of salt into MI's drainage system. The tubewell located at Baulch's has not been operational since 2010 due to pump failure.

The largest volume of water and subsequently largest salt load was extracted from tubewells in 2013/14, coinciding with increased levels of groundwater in the Shepparton Formation following the flood of 2012.

Table 27 Tubewell monitoring data 2014/15 and previous years

2014/15		
Location	**Volume (ML)**	**Salt load (t)**
Five Bridges	777	394
Gil Gil	585	1088
Yanco West	262	411
South Leeton	0	1
Baulch's	0	0
Wamoon	351	166
East Wamoon	97	43
Total	**2,072**	**2,103**

2013/14		
Location	**Volume (ML)**	**Salt load (t)**
Five Bridges	166	129
Gil Gil	7,466	15,319
Yanco West	1,722	3,114
South Leeton	45	184
Baulch's	0	0
Wamoon	149	89
East Wamoon	134	70
Total	**9,681**	**18,905**

2012/13		
Location	**Volume (ML)**	**Salt load (t)**
Five Bridges	109	85
Gil Gil	500	1,026
Yanco West	311	563
South Leeton	0	0
Baulch's	0	0
Wamoon	374	223
East Wamoon	0	0
Total	**1,294**	**1,897**

2006/07		
Location	**Volume (ML)**	**Salt load (t)**
Five Bridges	707	489
Gil Gil	266	353
Yanco West	305	404
South Leeton	76	118
Baulch's	137	52
Wamoon	384	200
East Wamoon	778	454
Total	**2,653**	**2,070**

7 New measures to limit groundwater recharge and discharge of salt

Murrumbidgee Irrigation Limited (MI) has implemented the following measures to monitor groundwater recharge and discharge of salt for the 2014/15 licence reporting period:

- A review of MI Rice Growing Rules and groundwater monitoring data
- A review and re-issue of MI's Surface Water Quality Monitoring and Drainage Reuse Program
- The development of two mobile water quality stations and implementation of real-time monitoring points in MI's drainage and supply network
- The development of an Operational Model (MIOPS) to better estimate channel seepage losses, and
- Investigations of seepage issues in parts of MI's supply system.

MI has also delivered water saving projects through automation, gravity piping and the channel lining of sections of the supply system under the Australian Government's Sustainable Rural Water Use and Infrastructure Program. This has reduced impacts of losses through channel seepage to groundwater systems at Lake Wyangan and Hanwood, which included the replacement of ageing lined channels with gravity pipelines, channel automation and on-farm water saving initiatives.

8 Environmental protection and management

8.1 Discharge of noxious aquatic seeds

During 2014/15 irrigation year there was no known potential or actual discharge of Class 1, 2 or 3 declared noxious aquatic weeds from MI's area of operation.

8.2 Discharge of blue-green algae

There was no known discharge of water containing blue-green algae in a Red Level Action Mode concentration outside the area of operations.

ENVIRONMENTAL PROTECTION LICENCE 4651

9 Statement of compliance

This licence authorises Murrumbidgee Irrigation Limited (MI) to undertake activities associated with Irrigated Agriculture. MI has fulfilled the compliance requirements as set out in Environmental Protection Licence (EPL) 4651 for 2014/15. Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. These internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

All Notification and Action level concentrations of scheduled chemicals detected at discharge points during flow events were reported to the Environment Protection Authority (EPA) in accordance with conditions set out in EPL 4651. A summary of the compliance requirements are cross referenced to this report and listed in Table 29. MI's internal Water Quality Framework provides a proactive approach to monitoring water quality and identifying potential water quality hazards. Internal monitoring programs are conducted throughout the year in MI's supply and drainage system including benchmark (or baseline) monitoring for the start, middle and end of the irrigation season.

MI is able to receive complaints from members of the public in relation to EPL requirements in writing or via telephone. MI maintains an environmental complaints register and pollution incident register which allows MI to record all the necessary details to better understand the nature of the complaint and to identify possible actions to limit the potential for further risk of pollution. MI also maintains a Pollution Incident Response Management Plan (PRIMP). No pollution incidents occurred during 2014/15 that activated this PIRMP.

Table 28 Environmental Protection Licence (EPL 4651) compliance report summary

Licence section	Requirement	Compliant	Report Section
Operating Conditions	**4**		
Maintain a Chemical Contingency Plan	O3.1	Yes	Internal document
Maintain a Chemical Control Plan	O3.5	Yes	Internal document
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	Internal document
Monitoring and Recording Conditions	**5**		
Monitoring Records	M1	Yes	N/A
Requirement to monitor concentration of pollutants discharged	M2	Yes	10 EPL Monitoring and Reporting
Testing Methods	M3	Yes	Internal documents
Recording of pollution complaints	M4	Yes	Available upon request from EPA
Telephone complaints line	M5	Yes	Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11 EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	10 Noxious Weed Management
Annual return documents	R1	Yes	Submitted 20/08/2015
Notification of environmental harm	R2	Yes	N/A
Written Report (of an event)	R3	Yes	N/A
Annual system performance report	R4	Yes	Section 9 – Section 11
Other reporting conditions	R5	Yes	11.2 Water Quality Monitoring

10 Noxious weed management

Murrumbidgee Irrigation Limited (MI) maintains a chemical control plan in accordance with the requirements set out in Environmental Protection Licence (EPL) 4651 and has a scheduled maintenance program aimed at managing noxious weeds within the Murrumbidgee Irrigation Area (MIA). MI maintains a register that records details of every herbicide application in or near waters as per EPL requirements which is maintained within an internal management system and accessible to all MI staff. MI is also an active member of the Western Riverina Noxious Weed Action Group (WRNWAG).

10.1 Alligator Weed in the MIA

Alligator weed occurrences are reported in accordance with the NSW Agricultural Alligator Weed Management Plan and *Noxious Weeds Act 1993.* Alligator weed awareness training is included in the Vegetation Control Officer Employee induction. MI has a team of accredited inspectors to verify the presence of alligator weed and administering the ongoing control program. These inspectors also monitor and maintain designated vehicle cleaning and inspection areas.

The control program for Alligator Weed has continued during 2014/15 with inspections conducted at BBSW, downstream channel systems of BBSW and the floodway at Wyvern Station during October 2014 and February 2015. Figure 53 shows the dates and locations where Alligator weed was found.

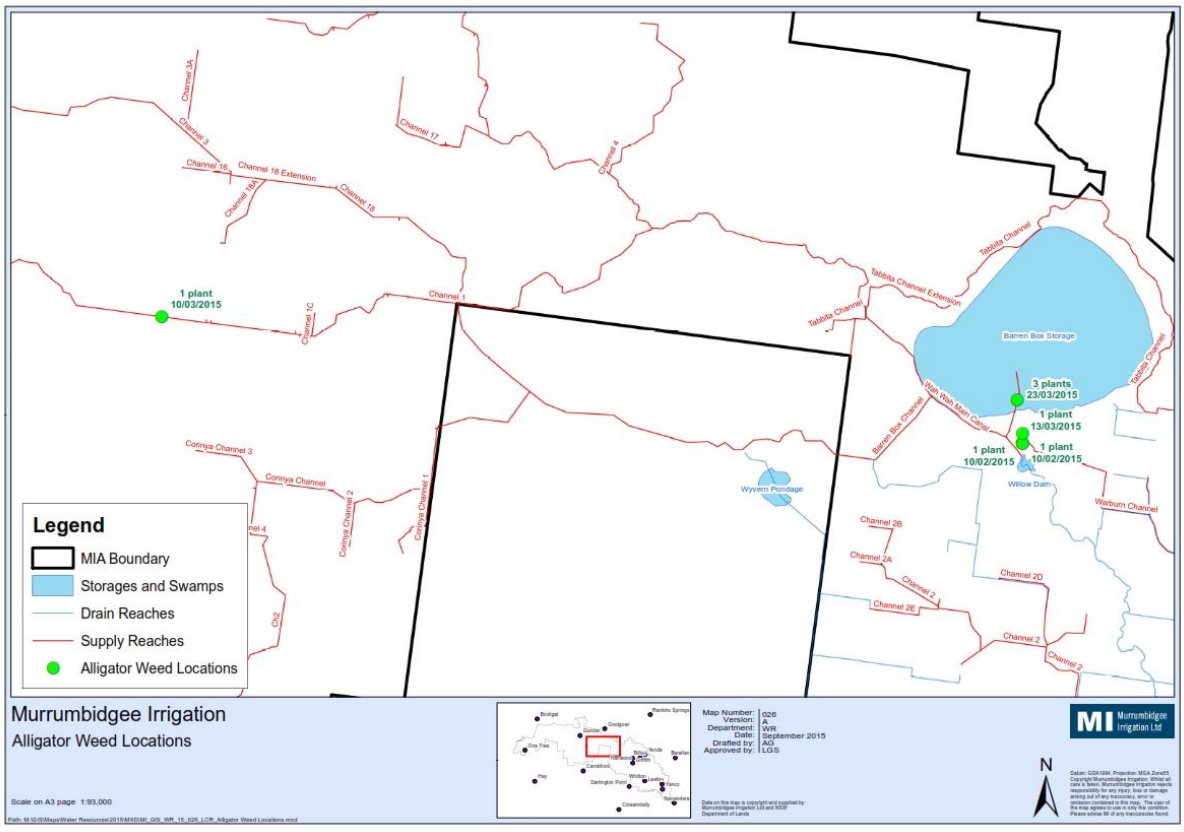


Figure 53 Locations of Alligator Weed identified 2014/15

A total of seven Alligator weed plants were found and treated at Barren Box Storage and Wah Wah irrigation channels for 2014/15. Two plants were found in February 2015:

- One in the By-wash (10/02/2015)
- One on land surrounding Barren Box Storage (10/02/2015)

Five plants were found during March 2015:

- One plant was found in Supply Channel 1 in the Wah Wah supply system (10/03/2015)
- Four plants were found in the By-wash (One on 13/03/2015 and three on 23/03/2015)

No Alligator Weed was found in any other supply channel downstream of BBSW. MI uses both manual and chemical methods to treat and control Alligator weed in the MIA. This information is documented in accordance with EPL 4651 monitoring and recording requirements.

10.2 Sagittaria and Alisma weed management

Inspections of Sagittaria and Alisma were carried out monthly from September 2014 through to the end of June 2015 covering approximately 23 ha of supply and drainage channels. In the event that Sagittaria and Alisma are found they were treated in accordance with APVMA Permit 11856. There was no known discharge of any noxious weeds outside our area of operation in 2014/15.

11 EPL monitoring and reporting

All water quality monitoring data is collected in accordance with national water quality guidelines. All field equipment is operated in accordance with manufacturer recommendations and samples are analysed by a NATA accredited laboratory.

Under MI's EPL 4651, five points (Figure 3) have been identified that allow water to be discharged outside the MIA, with the condition that all flows are recorded and specified water quality parameters are measured during flow events. No water was discharged outside of MI's Area of Operation for environmental or river operational purposes.

11.1 System performance

Table 30 presents total diversions into the MIA and total water discharged from the MIA for 2014/15 compared to previous years. During 2012/13 and 2013/14, water was released through MI's discharge points to allow channels to be drained for maintenance works, causing an increase in the total volume of water discharged from MI's area of operations. During 2014/15, no maintenance was scheduled for these areas, significantly reducing discharge volumes compared to the previous years. In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in this year.

Discharge volumes for each point are shown in Tables 32 – 35. Point 7 (ROCUDG) discharged the largest volume of water, due to excess flows from Cudgel Creek Escape during water delivery. Projects are underway to reduce these escape flows in this supply section. MI does not discharge irrigation waste water to ground waters in or outside the area of operations.

Table 29 Total water volumes (ML) 2014/15 and previous years

Year	Diversions	Discharged
2014/15	878,614	671
2013/14	832,758	2,438
2012/13	1,079,843	2,563
2005/06	1,036,519	8,570

11.2 Water quality monitoring

MI is also required to monitor the concentration of each chemical listed in Schedule 1 of EPL 4651 (Table 31). When concentrations reach 'notification' or 'action' trigger levels, the Environment Protection Authority (EPA) is required to be notified. For each 'notification' or 'action' level detection, the EPA was notified and results uploaded on MI's webpage, in accordance with EPL requirements. MI maintains a chemical contingency plan that outlines the monitoring, reporting and response procedures for discharge points listed in EPL 4651.

Table 30 Chemicals to be monitored at discharge points as listed in EPL 4651

Parameters	Environmental Guidelines (µg/L)	Notification Level (µg/L)	Action Level (µg/L)
Atrazine	2	13	45
Chlorpyrifos	0.001	0.01	0.11
Diazinon	0.0006	0.01	0.2
Diuron	8	1*	5*
Endosulfan	0.01	0.03	0.2
Malathion	0.07	0.05	0.2
Metolachlor	8	0.02	0.1
Molinate	2.5	3.4	14
Simazine	10	3.2	11
Thiobencarb	1	2.8	4.6
Trifluralin	0.1	2.6	4.4

Monthly summaries for each monitoring point are presented in Tables 32 – 35. Discharge Point 15 (MIRFLD) was not used during 2014/15 and therefore no monitoring data is available. Out of 29 sampling events, only seven detections of EPL chemicals were at notification or action level concentrations. These detections were found at LAG and YMS with the majority occurring in September and October. These chemical detections comprised of two notification levels of Metalochlor, three notifications and one action level of Diuron at LAG and one notification level of Metalochlor at YMS.

Although the largest volume of water discharged from the MIA was recorded at ROCUDG, there were no notification or action level detections recorded at this site. EC values recorded at this site (Table 21) suggest that the water discharged was majority supply water. LAG had the highest notification and action level detections during 2014/15 which can be attributed to the higher density of farmland in the surrounding area, when compared to ROCUDG.

Table 31 Monitoring results for Point 4 - LAG

Month	Discharge Volumes (ML)	No. of sampling events	No. of detections	Chemical detection details
Point 4 – LAG				
Jul-14	0.0	0	0	-
Aug-14	1.11	0	0	-
Sep-14	24.74	2	2	05/09/2014 Action level of Diuron (5.36 µg/L) 15/09/2014 Notification level of Metalochlor (0.187 µg/L)
Oct-14	11.34	2	2	17/10/2014 Notification level of Diuron (1.01 µg/L) 31/10/2014 Notification level of Diuron (1.75 µg/L)
Nov-14	12.97	2	0	No notification/action level detected
Dec-14	0.84	0	0	-
Jan-15	25.19	2	0	No notification/action level detected
Feb-15	149.5	1	2	13/02/2015 Notification level of Diuron (2.30 µg/L) Notification level of Metolachlor (0.03 µg/L)
Mar-15	9.08	2	0	No notification/action level detected
Apr-15	10.83	4	0	No notification/action level detected
May-15	0.0	0	0	-
Jun-15	15.09	1	0	No notification/action level detected
Total	**260.7**	**14**	**6**	

Table 32 Monitoring results for Point 5 - GMSRR

Month	Discharge Volumes (ML)	No. of sampling events	No. of detections	Chemical detection details
Point 5 – GMSRR				
Jul-14	0	0	0	-
Aug-14	0	0	0	-
Sep-14	0	0	0	-
Oct-14	0.92	0	0	-
Nov-14	0.28	0	0	-
Dec-14	0	0	0	-
Jan-15	2.33	0	0	-
Feb-15	0.06	0	0	-
Mar-15	0	0	0	-
Apr-15	0	0	0	-
May-15	0	0	0	-
Jun-15	0	0	0	-
Total	**3.6**	**0**	**0**	

Table 33 Monitoring results for Point 6 - YMS

Month	Discharge Volumes (ML)	No. of sampling events	No. of detections	Chemical detection details
Point 6 – YMS				
Jul-14	0	0	0	-
Aug-14	0	0	0	-
Sep-14	2.8	2	1	25/09/2014 Notification level of Metalochlor (0.058 µg/L)
Oct-14	0.3	0	0	-
Nov-14	0	0	0	-
Dec-14	0	0	0	-
Jan-15	0	0	0	-
Feb-15	0	0	0	-
Mar-15	0	0	0	-
Apr-15	0	0	0	-
May-15	0	0	0	-
Jun-15	0	0	0	-
Total	**3.1**	**2**	**1**	

Table 34 Monitoring results for Point 7 - ROCUDG

Month	Discharge Volumes (ML)	No. of sampling events	No. of detections	Chemical detection details
Point 7 – ROCUDG				
Jul-14	27	0	0	-
Aug-14	27	0	0	-
Sep-14	116	1	0	No notification/action level detected
Oct-14	41	1	0	No notification/action level detected
Nov-14	9	1	0	No notification/action level detected
Dec-14	57	2	0	No notification/action level detected
Jan-15	10	2	0	No notification/action level detected
Feb-15	13	1	0	No notification/action level detected
Mar-15	47	1	0	No notification/action level detected
Apr-15	12	2	0	No notification/action level detected
May-15	21	0	0	-
Jun-15	23	2	0	No notification/action level detected
Total	**404**	**13**	**0**	-

Appendix 1- Piezometer condition monitoring and reporting

Site ID	Use (Y/N)	Top of Pipe Above NS (m)	Natural Surface (AHD	Depth Below Top of Pipe (m)	Total Depth of Bore (m)	Easting (GDA94) Zone 55	Northing (GDA94) Zone 55	STATUS
G105	N	0.15	120.26	9.85	9.70	409308.81	6203296.30	DESTROYED
G106	Y	0.15	126.91	15.49	15.34	417017.98	6203588.56	READ
G1073	Y	0.16	113.75	7.31	7.15	394298.19	6211086.17	READ
G1088	Y	0.60	110.52	5.87	5.27	386147.94	6215885.12	DRY
G1089	N	0.60	110.12	8.92	8.32	386302.53	6217200.13	READ
G1090	Y	0.00	111.83	3.52	3.52	390834.21	6215653.50	READ
G1159	Y	0.45	110.96	25.04	24.59	386185.04	6216246.01	READ
G1160	Y	0.00	110.94	6.29	6.29	386181.34	6216247.08	DRY
G1171	Y	0.00	109.98	24.28	24.28	385883.65	6213820.14	READ
G1172D	Y	0.00	110.69	12.60	12.60	385592.05	6211815.80	READ
G1172S	Y	0.00	110.48	7.05	7.05	385591.10	6211818.01	READ
G1187	Y	0.30	111.38	17.64	17.34	384616.07	6204521.54	READ
G1188	Y	0.08	111.29	13.06	12.98	385362.32	6209809.99	DRY
G1189D	Y	0.02	112.15	26.69	26.67	384304.21	6202199.66	READ
G1189S	Y	0.20	112.17	8.96	8.76	384305.11	6202200.78	READ
G1190	Y	0.00	113.13	23.15	23.15	383855.97	6198429.79	READ
G1191	Y	0.00	113.60	31.22	31.22	384071.13	6200068.40	READ
G1192	Y	0.03	113.78	26.88	26.85	383645.25	6196811.18	READ
G1193	Y	0.30	115.07	22.00	21.70	388896.37	6199410.55	READ
G1194	Y	0.35	113.93	24.35	24.00	386528.30	6199715.92	READ
G1195	Y	0.56	0.00	12.49	11.93	391170.24	6188330.91	READ
G1196	Y	0.44	0.00	12.30	11.86	391168.35	6188335.33	READ
G1197	Y	0.76	118.08	23.32	22.56	391580.40	6191064.07	READ
G1198	Y	0.10	0.00	40.76	40.66	383000.11	6192005.04	READ
G1199	N	0.12	0.00	9.27	9.15	383001.06	6192002.84	BLOCKED
G1202	N	0.00	115.05	0.00	0.00	402759.19	6213849.32	DESTROYED
G1208	Y	0.33	115.25	20.57	20.24	399321.54	6214203.45	READ
G1215	Y	0.35	115.36	20.05	19.70	398101.09	6216290.78	READ
G1216	Y	0.37	113.02	19.62	19.25	400686.15	6216988.30	READ
G1217	Y	0.08	113.77	8.44	8.36	383645.23	6196812.29	READ
G1218	Y	0.17	113.10	12.56	12.39	383857.77	6198433.14	DRY
G1219	Y	0.15	119.87	18.34	18.19	395393.04	6190567.55	READ
G122	Y	0.10	126.92	6.58	6.48	417018.92	6203586.35	READ
G1220	Y	0.15	120.16	7.87	7.72	397571.23	6190234.64	READ
G1221	Y	0.05	120.38	8.61	8.56	396103.64	6190471.25	READ
G1222	Y	0.50	119.28	9.27	8.77	393739.81	6190791.72	READ
G1223	Y	0.65	116.36	9.55	8.90	391940.52	6199017.05	READ
G1224	Y	0.45	116.04	10.39	9.94	390634.12	6199182.63	READ
G124	N	0.70	126.43	31.30	30.60	417438.58	6204209.98	BLOCKED
G1242	Y	0.15	123.74	20.35	20.20	411941.89	6190896.21	READ
G1243	Y	0.30	123.74	10.99	10.69	411968.00	6190901.00	READ

G1244	Y	0.15	124.91	11.33	11.18	411683.35	6189376.63	READ
G1245	Y	0.15	125.07	26.62	26.47	411294.13	6187793.68	READ
G1246	Y	0.00	124.84	20.31	20.31	411684.30	6189373.31	READ
G1247	Y	0.00	124.55	10.10	10.10	410504.01	6186648.26	READ
G1248	Y	0.30	123.43	21.14	20.84	407639.75	6189790.98	READ
G1249	Y	0.30	123.46	7.72	7.42	407644.38	6189787.70	READ
G1287	Y	0.48	122.41	10.98	10.50	406740.59	6189559.10	READ
G1294	Y	0.45	122.10	12.40	11.95	406447.79	6190440.06	READ
G1296	Y	0.00	122.12	4.33	4.33	406388.33	6190411.74	READ
G1301	Y	0.05	124.70	7.84	7.79	411409.87	6187988.86	READ
G1319	Y	0.70	125.37	19.27	18.57	414769.00	6184929.00	READ
G132	Y	0.36	125.38	27.86	27.50	416415.73	6205279.92	READ
G1337	Y	0.20	120.43	15.76	15.56	406248.94	6195316.68	READ
G1342D	Y	0.16	127.99	7.18	7.02	419414.39	6183940.44	READ
G1342S	Y	0.30	127.99	14.53	14.23	419414.39	6183940.44	READ
G1359	Y	0.25	128.32	9.70	9.45	419611.71	6182862.42	READ
G1380	Y	0.50	120.94	10.87	10.37	406211.84	6195074.54	READ
G1381	Y	0.40	120.99	5.97	5.57	406212.72	6195078.98	READ
G1382	Y	0.44	121.28	17.20	16.76	406302.91	6195710.93	READ
G1383	Y	0.35	122.33	31.95	31.60	406425.09	6196548.36	READ
G1384	Y	0.40	121.59	16.30	15.90	406569.92	6197605.59	READ
G1385	Y	0.58	119.76	12.53	11.95	406733.61	6198804.97	READ
G1387	Y	0.26	121.42	0.26	0.00	405293.23	6188659.47	READ
G1391	N	0.00	131.88	0.00	0.00	427345.16	6207371.67	DESTROYED
G1402	Y	0.27	125.10	10.36	10.09	412843.37	6187183.15	READ
G1406	N	0.00	125.33	18.62	18.62	414090.42	6186143.94	DESTROYED
G1410	Y	0.44	126.19	7.22	6.78	416515.25	6187772.04	READ
G1412	Y	0.48	123.49	17.18	16.70	408710.74	6186097.39	READ
G1416	Y	0.40	122.69	15.70	15.30	407988.48	6186308.75	READ
G1417	Y	0.10	124.18	7.52	7.42	410491.96	6189333.09	READ
G1418	Y	0.48	123.49	17.51	17.03	408713.49	6186097.41	READ
G146	Y	0.00	125.25	24.22	24.22	415674.15	6203205.03	READ
G152	N	0.00	123.31	8.53	8.53	411885.14	6198949.26	BLOCKED
G1560	Y	0.25	123.92	24.88	24.63	411847.70	6190166.69	READ
G1561	Y	0.20	123.90	11.55	11.35	411846.77	6190167.79	READ
G1568	Y	0.00	124.20	19.96	19.96	409586.45	6189658.15	READ
G1577	Y	0.10	123.31	13.22	13.12	409590.96	6195920.81	READ
G1578	N	0.10	119.99	15.28	15.18	406609.12	6198100.61	BLOCKED
G1579	Y	0.22	120.16	9.92	9.70	407941.98	6201262.33	READ
G1591	Y	0.20	123.00	11.63	11.43	407174.15	6191051.75	READ
G1594	Y	0.00	122.67	9.70	9.70	408880.29	6192802.00	READ
G1595	Y	0.15	120.21	10.50	10.35	407132.40	6202087.19	READ
G1602	Y	0.45	121.86	8.44	7.99	405866.75	6192735.45	READ
G1613	N	0.00	122.97	0.00	0.00	408096.07	6192346.25	DESTROYED
G1643	Y	0.00	119.34	15.77	15.77	407541.48	6204732.90	READ
G1644	Y	0.20	118.89	26.27	26.07	405866.52	6204986.80	READ

G1650	Y	0.10	122.60	15.45	15.35	407396.67	6186515.81	READ
G1657	Y	0.10	113.37	13.15	13.05	395108.94	6216924.37	READ
G1660	Y	0.10	122.10	14.35	14.25	406587.16	6186718.43	READ
G1661	Y	0.10	123.67	21.20	21.10	409053.36	6186004.26	READ
G1662	Y	0.10	123.68	8.70	8.60	409061.64	6186003.23	READ
G1663	Y	0.80	123.71	30.87	30.07	409010.20	6180981.36	READ
G1665	Y	0.15	122.62	24.15	24.00	407394.81	6186518.01	READ
G1666	Y	0.50	123.64	20.68	20.18	410446.52	6185630.05	READ
G1670	N	0.00	122.45	0.00	0.00	405843.07	6186989.30	DESTROYED
G1671	N	0.00	122.50	0.00	0.00	405841.26	6186985.95	DESTROYED
G1679	Y	0.00	121.01	9.19	9.19	407842.25	6200086.91	READ
G168	Y	0.07	125.10	6.10	6.03	414709.82	6197451.74	READ
G1686	Y	0.11	125.46	12.11	12.00	416432.92	6204489.38	READ
G1691	Y	0.05	122.94	9.80	9.75	408716.32	6198945.44	READ
G1705	Y	0.10	123.38	11.92	11.82	409528.59	6195241.49	READ
G1732	Y	0.40	121.05	13.57	13.17	405853.13	6201106.22	READ
G1734	N	0.00	120.46	0.00	0.00	405305.20	6202425.96	DESTROYED
G1738	Y	0.00	121.87	11.10	11.10	406764.92	6194383.62	READ
G1740	Y	0.00	120.69	10.16	10.16	407544.96	6201402.58	READ
G1745	Y	0.35	119.52	12.87	12.52	406803.12	6203457.98	READ
G1746	Y	0.20	120.22	14.70	14.50	404512.72	6204065.90	READ
G1759	Y	0.10	120.76	9.43	9.33	408497.33	6199985.77	READ
G1766	N	0.00	122.19	0.00	0.00	409627.35	6193021.09	DESTROYED
G1779	Y	0.45	131.12	31.84	31.39	426273.87	6204528.85	READ
G178	Y	0.50	125.00	7.86	7.36	414091.91	6197738.84	READ
G1788	Y	0.05	118.81	2.17	2.12	404068.44	6204489.44	READ
G1789	Y	0.42	118.77	9.79	9.37	405455.43	6204769.72	READ
G1800	Y	0.66	131.12	14.41	13.75	426273.87	6204528.85	READ
G1801	Y	0.00	129.20	8.45	8.45	424098.37	6204960.58	READ
G1818	Y	0.10	122.73	7.32	7.22	407292.63	6196792.13	READ
G1942	Y	0.40	128.66	0.40	0.00	423796.27	6187089.06	READ
G195	Y	0.37	124.57	5.55	5.18	414985.91	6194504.33	READ
G2003	Y	0.00	124.21	0.00	0.00	412114.38	6218660.24	READ
G2005	Y	0.00	112.34	21.24	21.24	406951.52	6216144.17	READ
G2006	Y	0.00	125.36	0.00	0.00	413195.55	6215774.78	READ
G2009	N	0.00	108.95	0.00	0.00	406503.52	6214213.41	DESTROYED
G2010	Y	0.30	107.70	12.42	12.12	409972.14	6211744.34	READ
G2020	Y	0.20	123.22	25.14	24.94	410076.74	6223635.76	READ
G2026	Y	0.23	118.76	12.35	12.12	402374.77	6204764.70	READ
G203	Y	0.00	121.72	7.68	7.68	408554.80	6197217.13	READ
G2048	Y	0.10	115.43	12.92	12.82	393525.40	6205332.52	READ
G205	Y	0.32	122.14	8.94	8.62	409373.10	6198755.55	READ
G2052	Y	0.17	116.27	6.65	6.48	398614.08	6204993.10	READ
G2060	Y	0.05	121.22	17.44	17.39	404740.64	6192558.76	READ
G2061	Y	0.40	121.26	9.23	8.83	404736.97	6192557.61	READ
G2062	Y	0.10	118.78	9.23	9.13	394862.03	6193888.79	READ

G2065	Y	0.14	117.83	11.74	11.60	394125.22	6196107.48	READ
G2066	Y	0.10	117.70	10.82	10.72	393979.24	6195196.38	READ
G207	Y	0.27	122.44	12.19	11.92	406506.78	6197114.78	READ
G208	Y	0.64	121.86	24.21	23.57	406357.11	6196082.99	READ
G2081	Y	0.05	114.15	35.60	35.55	394733.28	6214505.80	READ
G2082	Y	0.37	115.22	38.73	38.36	396247.36	6215491.95	READ
G209	Y	0.38	122.76	25.59	25.21	405804.83	6192495.27	READ
G2092	Y	0.36	114.89	25.86	25.50	411260.02	6212406.48	READ
G2095	Y	0.10	121.52	12.07	11.97	405705.39	6191784.49	READ
G210	N	0.15	122.53	9.67	9.52	405810.33	6192496.44	DESTROYED
G2120	Y	0.20	125.10	14.15	13.95	411561.89	6188234.29	READ
G2128	Y	0.00	123.85	9.23	9.23	408885.23	6189760.00	READ
G2141	N	0.30	124.05	9.42	9.12	408430.35	6189854.24	DESTROYED
G215	Y	0.32	121.63	9.56	9.24	406814.16	6199674.14	READ
G2163	Y	0.15	117.70	37.71	37.56	393977.41	6195195.25	READ
G2166	Y	0.00	120.66	21.74	21.74	396189.66	6190422.30	READ
G2176	Y	0.10	121.54	5.66	5.56	408508.33	6196986.00	READ
G2190	Y	0.20	116.57	6.35	6.15	394520.81	6202448.05	READ
G225	Y	0.07	123.45	18.01	17.94	414259.95	6202580.01	READ
G2257	Y	0.00	113.20	10.73	10.73	386049.43	6206627.52	READ
G2264	Y	0.20	126.15	28.74	28.54	412331.99	6194466.45	READ
G227	N	0.00	124.57	21.72	21.72	414747.99	6199416.11	DESTROYED
G2271	N	0.00	119.55	11.00	11.00	399677.42	6190767.74	DESTROYED
G2274	Y	0.40	119.50	14.35	13.95	396382.48	6191595.63	READ
G2279	Y	0.19	117.04	33.19	33.00	400345.57	6210179.77	READ
G2280	Y	0.00	121.59	17.53	17.53	406334.75	6195928.61	READ
G2282	Y	0.00	120.11	20.00	20.00	401668.79	6192970.47	READ
G2283	Y	0.05	120.27	23.15	23.10	400011.62	6193197.94	READ
G2284	Y	0.15	120.29	13.49	13.34	400010.72	6193196.82	READ
G2285	Y	0.00	120.41	11.85	11.85	400149.78	6194289.62	READ
G2290	Y	0.30	118.12	28.13	27.83	394362.01	6193957.45	READ
G2291	Y	0.00	119.75	24.50	24.50	395579.31	6193793.71	READ
G2292	Y	0.00	119.48	11.05	11.05	395578.34	6193798.14	READ
G2294	Y	0.14	124.29	9.43	9.29	411939.00	6191345.00	READ
G2295	Y	0.00	119.41	23.60	23.60	397900.55	6193477.83	READ
G2296	Y	0.00	119.46	5.37	5.37	397898.68	6193481.14	READ
G2299	Y	0.10	123.93	13.09	12.99	411878.52	6190308.94	READ
G2306	Y	0.15	122.30	17.88	17.73	405962.23	6188651.84	READ
G2307	Y	0.20	122.30	9.15	8.95	405959.49	6188649.59	READ
G2309	Y	0.17	121.45	22.52	22.35	405552.98	6188235.13	READ
G2330	N	0.15	121.41	8.95	8.80	405556.60	6188240.72	DESTROYED
G2334	Y	0.00	122.82	14.10	14.10	405105.97	6187200.29	READ
G2335	Y	0.34	122.54	16.33	15.99	407041.35	6186680.84	READ
G2337	Y	0.20	122.01	16.20	16.00	405590.61	6190322.72	READ
G2338	Y	0.23	122.42	14.63	14.40	405595.16	6190327.21	READ
G2340	Y	0.30	114.17	25.02	24.72	385189.37	6199889.22	READ

G2341	Y	0.25	114.19	10.45	10.20	385185.68	6199890.29	READ
G2345D	Y	0.15	111.62	20.79	20.64	385058.99	6207733.38	READ
G2345S	Y	0.15	111.56	7.65	7.50	385058.95	6207736.71	READ
G2346	Y	0.35	118.49	15.00	14.65	402977.82	6199783.69	DRY
G2369	N	0.00	114.83	1.02	1.02	396387.84	6208949.08	DESTROYED
G2452	Y	0.50	125.88	9.30	8.80	418059.03	6196220.83	READ
G247	Y	0.00	128.93	3.84	3.84	421392.10	6206753.60	READ
G2482	Y	0.28	121.45	13.28	13.00	406228.41	6200474.53	READ
G2483	N	0.00	120.63	14.47	14.47	405963.54	6200923.24	DESTROYED
G2485	N	0.00	120.60	0.00	0.00	407096.88	6200568.60	DESTROYED
G250	Y	0.18	127.67	32.86	32.68	418928.07	6202996.48	READ
G252	Y	0.73	125.36	30.19	29.46	416441.15	6204495.00	READ
G254	Y	0.37	132.09	3.23	2.86	428719.50	6205091.18	BLOCKED
G2634	Y	0.00	115.72	10.16	10.16	397791.69	6212965.88	READ
G2650	Y	0.10	127.63	23.27	23.17	417315.63	6173689.15	READ
G2651	Y	0.32	130.84	15.41	15.09	423071.08	6171179.76	READ
G2653	Y	0.03	0.00	19.81	19.78	401661.66	6176109.35	READ
G2654	Y	0.15	0.00	23.91	23.76	398315.10	6176607.81	READ
G2655	Y	0.30	0.00	15.65	15.35	394765.36	6176939.74	DRY
G2656	Y	0.14	0.00	18.52	18.38	391060.00	6177991.63	READ
G2657	Y	0.50	0.00	17.90	17.40	389028.80	6179216.42	DRY
G267	Y	0.27	120.39	8.77	8.50	407917.29	6200500.20	DRY
G2676	Y	0.19	0.00	20.02	19.83	384063.31	6182453.18	DRY
G2681	Y	0.00	119.89	0.00	0.00	403520.34	6199985.60	READ
G269	Y	0.40	120.43	27.45	27.05	407870.11	6200900.09	READ
G2690	Y	0.00	120.46	34.70	34.70	400291.32	6195240.48	READ
G2691	Y	0.10	121.12	35.32	35.22	402927.69	6194874.58	READ
G2692	Y	0.05	121.18	13.54	13.49	402920.34	6194874.50	READ
G2693	Y	0.25	120.40	11.75	11.50	400285.74	6195245.97	READ
G2694	Y	0.00	122.08	28.13	28.13	404488.68	6194631.18	READ
G2695	Y	0.16	121.97	16.60	16.44	404484.96	6194635.58	READ
G2696	Y	0.14	118.43	8.99	8.85	395792.60	6197499.27	READ
G2697	Y	0.00	117.46	44.34	44.34	392930.55	6201167.85	READ
G2698	Y	0.00	117.38	15.20	15.20	392933.36	6201163.45	READ
G2703	Y	0.10	125.12	9.30	9.20	419191.88	6191354.01	READ
G273	N	0.16	124.40	8.36	8.20	413964.44	6202093.78	DESTROYED
G2731	Y	0.00	113.45	9.87	9.87	388306.44	6205361.53	READ
G2734	Y	0.20	113.33	11.30	11.10	388745.83	6207429.65	READ
G2735	N	0.00	113.05	0.00	0.00	388307.98	6208706.53	DESTROYED
G2739	Y	0.10	113.05	11.10	11.00	387151.62	6210747.80	READ
G2741	Y	0.00	112.36	7.50	7.50	387286.39	6211566.81	READ
G2747	Y	0.50	127.03	11.40	10.90	420605.09	6192114.17	READ
G2748	Y	0.05	111.48	8.54	8.49	388059.59	6214242.27	READ
G2754	Y	0.22	128.78	18.41	18.19	424945.61	6189233.69	READ
G2755	Y	0.45	128.96	8.20	7.75	424946.35	6189235.91	READ
G2759	Y	0.26	129.37	26.57	26.31	424937.70	6184259.09	READ

G278	N	0.00	120.79	0.00	0.00	405136.42	6203007.60	DESTROYED
G2787	N	0.00	114.34	0.00	0.00	391929.61	6208885.41	DESTROYED
G279	N	0.00	120.81	0.00	0.00	405136.43	6203006.49	DESTROYED
G2790	Y	0.15	121.06	13.30	13.15	408331.73	6194368.10	READ
G2799	Y	0.07	126.31	4.67	4.60	416269.03	6202852.18	READ
G2819	Y	0.05	114.33	22.49	22.44	396849.25	6207774.15	READ
G2820	Y	0.00	116.13	15.03	15.03	395669.14	6206836.14	DESTROYED
G2821	Y	0.00	114.71	5.16	5.16	397361.58	6207066.67	READ
G2825	Y	0.30	116.33	13.80	13.50	397377.40	6209657.55	READ
G2826	N	0.00	115.59	0.00	0.00	397528.00	6210876.92	DESTROYED
G2828	Y	0.73	118.88	12.58	11.85	400018.91	6199039.37	DRY
G2831	N	0.00	119.58	0.00	0.00	403175.94	6196469.74	DESTROYED
G2857	Y	0.00	120.28	7.40	7.40	398260.19	6197171.59	READ
G2862	Y	0.05	120.39	27.81	27.76	397432.20	6196440.53	READ
G2863	Y	0.10	119.83	11.89	11.79	397426.57	6196450.45	READ
G2864	Y	0.10	118.22	13.36	13.26	395825.17	6196475.97	READ
G2868	Y	0.10	121.55	10.03	9.93	407933.21	6195249.17	READ
G2872	N	0.00	122.41	2.56	2.56	408670.67	6194776.22	BLOCKED
G2883	Y	0.00	107.73	6.85	6.85	377075.21	6220690.78	DRY
G2885	Y	0.00	105.63	23.36	23.36	373039.50	6228388.84	READ
G2886	Y	0.15	104.01	9.55	9.40	373496.98	6232335.65	DRY
G2890	Y	0.00	103.89	8.90	8.90	363606.05	6228400.24	DRY
G2892	Y	0.37	104.05	21.81	21.44	369162.81	6228820.56	READ
G2893	Y	0.05	105.16	7.75	7.70	363204.83	6225328.69	READ
G2894	Y	0.00	104.24	6.11	6.11	363060.20	6224234.05	READ
G2896	N	0.00	109.85	10.05	10.05	382536.09	6223110.89	DESTROYED
G2898	Y	0.25	103.34	7.81	7.56	356263.37	6228363.31	DRY
G2901	Y	0.34	101.31	8.41	8.07	355079.03	6231256.87	READ
G2905	Y	0.00	99.39	7.75	7.75	349143.42	6229963.70	READ
G2907	Y	0.00	103.84	8.90	8.90	376572.71	6230124.89	DRY
G2909	N	0.42	116.86	17.14	16.72	395440.77	6204038.78	DESTROYED
G293	N	0.37	127.59	9.00	8.63	418951.09	6202994.47	DESTROYED
G2950	Y	0.20	106.24	5.77	5.57	374813.15	6228123.07	DRY
G2953	N	0.23	106.82	16.37	16.14	371950.92	6224687.40	DESTROYED
G296	N	0.20	127.84	6.22	6.02	420805.52	6202486.74	DESTROYED
G2970	Y	0.00	108.16	12.10	12.10	379477.11	6227630.39	DRY
G2972	Y	0.00	104.43	5.45	5.45	370239.54	6227840.54	DRY
G2973	Y	0.33	105.98	6.33	6.00	369530.88	6222236.27	DRY
G2976	Y	0.10	104.31	8.86	8.76	363543.57	6227742.71	READ
G2977	Y	0.17	104.26	10.55	10.38	362748.55	6221817.05	READ
G2981	Y	0.10	102.11	6.90	6.80	356481.23	6230060.38	READ
G2984	Y	0.00	103.39	12.70	12.70	368613.29	6236613.44	DRY
G2986	Y	0.19	103.72	10.24	10.05	361476.58	6212067.45	DRY
G2995	Y	0.20	114.34	9.18	8.98	385657.88	6201225.89	READ
G2996	N	0.15	114.86	0.15	0.00	386105.25	6201892.37	DESTROYED
G2998	Y	0.00	110.47	12.97	12.97	382537.11	6220009.71	READ

G3006	Y	0.00	107.04	10.96	10.96	374270.21	6224340.43	DRY
G3009	Y	0.00	106.80	5.45	5.45	374062.11	6222724.99	DRY
G301	Y	0.37	133.37	28.49	28.12	430510.83	6203443.47	READ
G3010	Y	0.00	107.70	9.00	9.00	373947.36	6221169.58	READ
G3011	Y	0.00	106.03	8.80	8.80	373532.83	6224431.49	DRY
G3018	Y	0.10	106.11	12.64	12.54	368697.40	6223272.82	READ
G302	N	0.15	121.88	11.42	11.27	405677.83	6191602.33	BLOCKED
G3021	Y	0.05	105.09	10.22	10.17	366095.75	6221289.61	READ
G303	Y	0.05	122.24	7.11	7.06	405577.44	6190897.07	READ
G304	Y	0.60	121.07	22.78	22.18	405345.48	6189304.36	READ
G305	Y	0.30	121.12	12.10	11.80	405348.20	6189307.71	READ
G306	Y	0.00	122.27	23.55	23.55	405159.86	6187771.99	READ
G3060	Y	0.19	107.72	14.41	14.22	369231.76	6220067.06	READ
G3062	Y	0.10	107.90	7.45	7.35	373392.19	6217266.86	READ
G3063	Y	0.00	108.42	13.47	13.47	373025.60	6215198.92	READ
G3065D	Y	0.15	105.61	26.90	26.75	370304.03	6216628.02	READ
G3065S	Y	0.25	105.61	17.38	17.13	370304.03	6216628.02	READ
G3066	Y	0.32	105.91	8.94	8.62	368178.57	6211866.76	READ
G3067	Y	0.00	107.06	15.00	15.00	372442.25	6210045.70	DRY
G307	Y	0.00	125.01	0.00	0.00	413515.00	6191570.00	READ
G309	Y	0.19	125.12	25.42	25.23	415103.00	6191331.00	READ
G311	Y	0.21	122.06	23.69	23.48	404479.46	6194633.31	READ
G3112	N	0.00	103.61	0.00	0.00	368808.70	6236577.33	DESTROYED
G3119	Y	0.33	113.31	9.88	9.55	390433.40	6211306.87	READ
G3126	Y	0.36	111.90	11.36	11.00	390328.74	6210489.38	READ
G3131	Y	0.15	102.89	34.64	34.49	358848.48	6229918.61	READ
G3132	Y	0.27	105.79	26.92	26.65	373372.89	6230780.13	READ
G3133	Y	0.18	108.90	11.48	11.30	380507.07	6227474.91	READ
G3134	Y	0.39	108.45	19.63	19.24	383584.44	6221507.79	READ
G3137	N	0.00	104.85	34.68	34.68	365445.51	6229370.55	DESTROYED
G3138	Y	0.15	106.29	23.53	23.38	369522.18	6233806.63	READ
G314	Y	0.40	127.13	3.70	3.30	418256.15	6205648.83	READ
G3148	N	0.00	106.25	0.00	0.00	369433.02	6233616.72	DESTROYED
G3158	Y	0.00	110.38	16.82	16.82	385830.48	6213419.11	READ
G3159	N	0.00	110.67	7.28	7.28	385768.90	6212952.55	BLOCKED
G3174	Y	0.17	115.72	9.62	9.45	399314.80	6210024.58	READ
G318	N	0.00	127.23	0.00	0.00	420203.35	6205276.39	BLOCKED
G3180	Y	0.15	97.54	9.70	9.55	336071.79	6228227.06	READ
G3188	N	0.00	117.87	0.00	0.00	403074.58	6203139.50	DESTROYED
G3223	Y	0.22	114.57	11.68	11.46	385621.08	6202052.83	READ
G3253	Y	0.00	110.94	17.45	17.45	376229.67	6227988.71	DRY
G3260	Y	0.25	106.81	37.86	37.61	374066.72	6222725.05	READ
G3261	N	0.00	110.88	19.70	19.70	377963.00	6227400.19	DESTROYED
G3262	Y	0.35	104.26	12.65	12.30	370244.16	6227840.61	READ
G3264	Y	0.25	114.00	13.65	13.40	383050.11	6226293.47	DRY
G3265	Y	0.33	111.70	8.73	8.40	383826.37	6219839.40	READ

G3266	Y	0.00	112.09	26.24	26.24	377294.70	6222245.29	READ
G327	Y	0.20	132.38	8.22	8.02	429225.36	6208425.14	READ
G3285	Y	0.05	116.29	15.58	15.53	393327.46	6203961.69	READ
G3287	Y	0.17	104.23	24.36	24.19	362749.44	6221819.28	READ
G3288	Y	0.15	103.79	33.55	33.40	361796.64	6214484.68	READ
G3301	Y	0.00	104.57	26.76	26.76	364196.84	6219372.37	READ
G3309	Y	0.00	106.80	5.58	5.58	374062.11	6222724.99	DRY
G3321	Y	0.25	104.26	20.37	20.12	359807.20	6205039.04	READ
G3322	Y	0.25	104.25	24.71	24.46	360095.45	6205095.49	READ
G3323	Y	0.00	104.70	13.31	13.31	360045.15	6204519.05	DRY
G3324	N	0.00	104.51	0.00	0.00	360128.29	6205424.31	DRY
G3327	n	0.30	107.00	21.67	21.37	375738.90	6220840.71	DESTROYED
G3337	Y	0.17	99.56	21.70	21.53	346908.83	6226974.87	READ
G334	Y	0.80	126.24	33.23	32.43	416956.48	6204814.53	READ
G3344	Y	0.10	101.41	27.74	27.64	355261.66	6220212.99	READ
G3345	Y	0.27	96.80	30.91	30.64	343890.81	6224357.40	READ
G3349	Y	0.09	106.93	22.14	22.05	371918.73	6218107.59	READ
G3358	Y	0.00	106.68	7.12	7.12	368849.95	6217096.98	DRY
G3366	Y	0.15	104.55	26.50	26.35	365125.77	6214013.99	READ
G3367	Y	0.00	106.16	15.65	15.65	370258.03	6211728.26	READ
G3369	Y	0.22	121.04	26.04	25.82	412216.62	6217385.88	READ
G3370	Y	0.00	117.88	0.00	0.00	410324.73	6219775.60	READ
G3371	Y	0.00	115.38	21.67	21.67	409322.86	6217745.44	READ
G3376	Y	0.10	103.78	23.46	23.36	360875.91	6207531.87	READ
G3377	Y	0.10	105.28	24.19	24.09	364786.93	6209775.36	READ
G3378	N	0.16	105.01	18.93	18.77	361970.04	6204779.46	DESTROYED
G3379	N	0.16	105.76	21.38	21.22	367504.32	6206773.90	DESTROYED
G3380	N	0.00	106.57	0.00	0.00	366971.63	6202273.03	DESTROYED
G3381	Y	0.00	96.27	5.46	5.46	340988.37	6228822.60	DRY
G3383	Y	0.15	92.45	7.06	6.91	324184.19	6231200.31	DRY
G3388	Y	0.37	96.53	14.39	14.02	345044.13	6225875.07	READ
G3389	Y	0.90	92.69	28.90	28.00	322814.15	6232013.42	READ
G3390	Y	0.40	95.20	13.91	13.51	324423.92	6231817.16	DRY
G3391	N	0.00	104.71	0.00	0.00	359920.85	6204274.27	DESTROYED
G3392	Y	0.33	95.17	25.53	25.20	326892.45	6231521.03	READ
G343	Y	0.10	130.86	13.10	13.00	425371.17	6204163.50	READ
G349	Y	0.60	132.65	9.22	8.62	429108.82	6207887.53	READ
G352	Y	0.12	132.82	9.05	8.93	429871.68	6208181.60	READ
G370	Y	0.58	120.39	23.32	22.74	402645.53	6192838.77	READ
G371	Y	0.25	121.39	24.85	24.60	402111.60	6189411.76	READ
G373	Y	0.12	123.58	16.00	15.88	409477.35	6184255.66	READ
G374	Y	0.30	120.94	28.73	28.43	405186.88	6199485.86	READ
G375	Y	0.32	121.26	16.42	16.10	406088.02	6200712.67	READ
G378	Y	0.50	119.36	16.93	16.43	407188.76	6202713.23	READ
G381	Y	0.00	119.57	9.86	9.86	406328.78	6204231.76	READ
G384	Y	0.10	124.94	8.79	8.69	412880.52	6196570.93	READ

G388	Y	0.60	125.18	11.27	10.67	412164.80	6193280.46	READ
G407	Y	0.27	120.96	13.42	13.15	401352.16	6195093.17	READ
G408	Y	0.00	120.68	21.79	21.79	401080.10	6193089.56	READ
G412	Y	0.27	119.53	30.17	29.90	404058.31	6204041.29	READ
G429	Y	0.43	123.17	14.20	13.77	409555.38	6185039.29	READ
G431	Y	0.37	115.60	10.30	9.93	396509.77	6205582.26	READ
G432	Y	0.10	116.44	29.49	29.39	393386.29	6204291.75	READ
G440	Y	0.30	122.01	8.80	8.50	403453.08	6187567.01	READ
G441	Y	0.10	121.78	21.20	21.10	401924.16	6188014.60	READ
G443	Y	0.22	0.00	25.54	25.32	404865.67	6185454.41	READ
G451	Y	0.50	122.68	29.06	28.56	407990.32	6186307.66	READ
G458	Y	0.10	118.24	37.16	37.06	404540.66	6207283.44	READ
G459	Y	0.55	118.96	30.30	29.75	406883.61	6206283.42	READ
G461	N	0.10	118.90	8.77	8.67	405107.83	6204556.60	BLOCKED
G462	Y	0.02	119.69	4.04	4.02	407356.95	6203941.46	READ
G464	Y	0.25	118.01	37.12	36.87	402640.61	6204692.06	READ
G465	Y	0.70	124.45	26.62	25.92	411653.30	6188863.98	READ
G469	Y	0.28	117.12	21.59	21.31	401085.58	6204905.32	READ
G470	Y	0.45	115.92	18.30	17.85	398058.62	6205368.58	READ
G471	Y	0.23	115.95	28.79	28.56	394993.86	6205807.15	READ
G474	N	0.00	119.48	0.00	0.00	397768.03	6198946.25	DESTROYED
G475	Y	0.00	119.99	8.35	8.35	397557.87	6197391.27	READ
G487	Y	0.15	117.74	8.85	8.70	398191.76	6202017.39	READ
G494	Y	0.00	117.72	8.60	8.60	398406.55	6203591.24	READ
G497	N	0.00	117.49	0.00	0.00	394673.13	6200935.89	DESTROYED
G500	Y	0.44	124.90	17.79	17.35	414191.00	6184506.00	READ
G505	Y	0.74	126.12	14.24	13.50	417470.61	6190222.95	READ
G508	Y	0.10	124.66	9.22	9.12	416976.87	6192953.99	READ
G511	Y	0.33	115.53	26.48	26.15	398331.42	6208646.53	READ
G512	Y	0.30	0.00	16.00	15.70	404662.60	6184029.42	DRY
G513	N	0.00	0.00	0.00	0.00	404078.98	6179716.95	DESTROYED
G514	Y	0.59	115.78	16.47	15.88	393569.90	6205629.15	READ
G515	Y	1.20	112.62	32.45	31.25	388906.44	6206155.01	READ
G516	Y	0.18	113.98	14.01	13.83	389954.69	6207595.87	DRY
G517	Y	0.30	113.71	22.38	22.08	390163.11	6209217.56	READ
G521	Y	0.25	111.79	16.13	15.88	388688.65	6219167.33	READ
G522	Y	0.26	111.55	23.26	23.00	386595.33	6219441.77	READ
G525	Y	0.40	113.40	15.00	14.60	390709.45	6222186.57	READ
G527	Y	0.36	113.86	18.57	18.21	393488.41	6216132.03	READ
G531	Y	0.00	0.00	8.46	8.46	404470.75	6182591.23	DRY
G532	Y	0.43	0.00	26.32	25.89	404283.86	6181212.97	READ
G534	Y	0.38	113.38	31.42	31.04	392942.92	6211275.97	READ
G535	Y	0.53	113.43	14.03	13.50	392940.17	6211274.83	READ
G537	Y	0.51	112.15	26.21	25.70	390552.80	6212441.73	READ
G539	N	0.00	111.95	0.00	0.00	389555.69	6217874.42	DESTROYED
G543	Y	0.10	112.52	13.90	13.80	395221.50	6217740.77	READ

G544	Y	0.45	114.05	31.93	31.48	394700.56	6213891.02	READ
G550	Y	0.00	116.86	24.74	24.74	399860.31	6208446.73	READ
G551	Y	0.30	0.00	16.51	16.21	403293.13	6185984.95	DRY
G552	N	0.00	0.00	0.00	0.00	403066.69	6184356.72	READ
G554	Y	0.10	113.91	22.25	22.15	390492.88	6205903.09	READ
G555	Y	0.20	114.22	7.74	7.54	389509.63	6204191.32	READ
G557	N	0.00	115.08	0.00	0.00	391219.40	6202406.89	DESTROYED
G561	Y	0.10	118.44	29.20	29.10	399381.25	6198714.23	READ
G593	N	0.30	131.59	8.60	8.30	427207.17	6204990.82	DESTROYED
G620	Y	0.23	116.94	10.57	10.34	392516.78	6197944.57	READ
G625	Y	0.54	119.07	13.84	13.30	398646.27	6193381.72	READ
G626	Y	0.17	119.50	11.30	11.13	396263.46	6193700.42	READ
G628	Y	0.31	0.00	41.33	41.02	403904.29	6178236.77	READ
G629	Y	0.27	121.55	26.19	25.92	405922.45	6193319.36	READ
G630	Y	0.10	113.91	11.63	11.53	402212.69	6212802.28	READ
G651	N	0.33	115.03	16.48	16.15	411236.30	6213259.06	DESTROYED
G657	Y	0.00	122.30	28.50	28.50	412571.88	6213480.08	READ
G670	Y	0.10	116.46	34.07	33.97	401128.84	6206997.40	READ
G672	Y	0.34	115.16	25.74	25.40	399395.03	6213192.81	READ
G674	Y	0.60	106.14	18.41	17.81	407694.59	6212739.15	READ
G677	Y	0.40	122.73	35.22	34.82	403398.37	6212618.27	READ
G679	Y	0.50	113.27	11.93	11.43	400829.72	6212994.05	READ
G689	Y	0.30	123.84	8.74	8.44	412873.69	6198485.00	READ
G696	Y	0.30	122.26	9.42	9.12	409912.60	6197942.32	READ
G697	Y	0.18	122.16	9.65	9.47	409961.91	6198265.52	READ
G708	Y	0.05	111.85	35.95	35.90	386720.64	6220443.65	READ
G71	N	0.00	127.00	0.00	0.00	418362.26	6204880.13	DESTROYED
G710	Y	0.60	111.47	24.24	23.64	386893.29	6221728.91	READ
G718	Y	0.30	0.00	11.33	11.03	401801.49	6187275.79	READ
G722	Y	0.30	0.00	9.31	9.01	401756.56	6187005.81	DRY
G724	Y	0.90	0.00	11.10	10.20	401729.89	6186834.73	READ
G727	Y	0.28	0.00	13.62	13.34	401689.20	6186599.18	READ
G729	Y	0.15	0.00	11.83	11.68	401684.75	6186499.32	READ
G734	Y	0.75	0.00	14.79	14.04	401625.50	6186281.32	READ
G735	Y	0.85	0.00	13.85	13.00	401616.74	6186154.79	DRY
G738	Y	0.55	0.00	10.53	9.98	401776.46	6186513.60	READ
G739	Y	0.48	0.00	12.36	11.88	401592.89	6186498.35	READ
G751	Y	0.30	111.05	26.74	26.44	386541.09	6218894.34	READ
G752	Y	0.15	110.37	14.60	14.45	386401.98	6217817.97	READ
G766	Y	0.00	111.75	5.74	5.74	385010.84	6206030.33	READ
G793	Y	0.15	117.40	44.45	44.30	403848.92	6202475.42	READ
G796	Y	0.16	120.94	16.84	16.68	408986.77	6201116.19	READ
G800	Y	0.25	126.52	13.85	13.60	418252.84	6205394.85	READ
G807	Y	0.36	120.00	6.37	6.01	398001.95	6188501.46	DRY
G808	Y	0.34	120.32	6.54	6.20	398116.70	6188511.59	DRY
G809	Y	0.87	120.02	8.01	7.14	397999.90	6188604.58	DRY

G813	Y	0.55	116.52	7.89	7.34	394496.35	6200946.10	READ
G819	Y	0.00	117.31	5.52	5.52	394677.90	6200920.42	READ
L1020D	Y	0.22	132.39	20.47	20.25	434164.00	6179629.00	READ
L1020S	Y	0.37	132.37	8.73	8.36	434168.00	6179629.00	READ
L1056	Y	0.35	135.71	13.24	12.89	439989.00	6178593.00	READ
L1110D	Y	0.20	136.70	1.42	1.22	440922.42	6177182.38	DRY
L1110S	Y	0.23	136.70	3.51	3.28	440920.15	6177182.38	DRY
L1128	Y	0.34	136.18	6.02	5.68	446042.00	6177459.00	READ
L1159	Y	0.76	135.55	8.24	7.48	445382.00	6180810.00	READ
L120	Y	0.26	133.77	10.58	10.32	441944.00	6184630.00	READ
L1237	Y	0.22	133.80	13.61	13.39	441737.00	6183191.00	READ
L1243	N	0.28	133.85	10.94	10.66	441684.03	6182257.99	DESTROYED
L1305	Y	0.18	127.48	22.41	22.23	419534.00	6186452.00	READ
L1321S	Y	0.29	128.24	11.96	11.67	421568.17	6188351.66	READ
L1326D	Y	0.24	127.83	21.35	21.11	421789.00	6190113.00	READ
L1326S	Y	0.40	127.83	22.49	22.09	421789.00	6190113.00	READ
L1327D	N	0.15	127.36	22.66	22.51	422002.00	6191382.00	READ
L1327S	Y	0.00	127.31	11.40	11.40	422003.00	6191382.00	READ
L1398	N	0.00	125.85	26.12	26.12	414972.00	6187969.00	DESTROYED
L1413D	Y	0.19	126.43	11.36	11.17	419505.00	6192203.00	READ
L1413S	Y	0.32	126.43	6.81	6.49	419505.00	6192203.00	READ
L1419D	Y	0.36	132.41	22.22	21.86	429985.00	6181294.00	READ
L1419S	Y	0.61	132.47	5.71	5.10	429983.00	6181295.00	READ
L1432	Y	0.19	134.41	11.24	11.05	445319.00	6180362.00	READ
L1446	Y	0.70	128.47	21.80	21.10	424377.00	6185860.00	READ
L1448	Y	0.25	128.26	15.15	14.90	423923.00	6188062.00	READ
L1460D	Y	0.37	128.00	19.84	19.47	424396.00	6190742.00	READ
L1460S	Y	0.45	128.00	13.83	13.38	424396.00	6190742.00	READ
L1482	Y	0.07	134.33	13.39	13.32	442450.00	6182655.00	READ
L1529	Y	0.39	133.62	11.94	11.55	443846.00	6184186.00	READ
L1531D	Y	0.40	128.91	20.60	20.20	423620.00	6180987.00	READ
L1531S	Y	0.07	128.90	10.22	10.15	423620.00	6180988.00	READ
L1532	Y	0.07	129.40	20.25	20.18	422151.00	6181677.00	READ
L1533D	Y	0.11	129.93	20.35	20.24	424859.00	6183504.00	READ
L1533S	Y	0.19	130.33	21.37	21.18	424861.00	6183501.00	READ
L1534D	Y	0.43	129.55	10.55	10.12	425014.00	6184704.00	READ
L1534S	Y	0.60	129.55	13.94	13.34	425014.00	6184702.00	READ
L1535D	Y	0.16	129.50	2.56	2.40	423686.00	6182719.00	READ
L1535S	Y	0.23	129.58	7.91	7.68	423687.00	6182720.00	READ
L1536D	Y	0.28	129.13	23.05	22.77	422354.00	6184163.00	READ
L1536S	Y	0.44	129.11	13.35	12.91	422354.00	6184164.00	READ
L1537	Y	0.52	135.23	15.04	14.52	444043.00	6179588.00	READ
L1551	Y	0.15	133.76	13.00	12.85	443892.00	6182762.00	READ
L1560	Y	0.63	133.85	7.25	6.62	442864.00	6182659.00	READ
L1560TW	Y	0.00	133.86	2.42	2.42	442866.54	6182659.00	READ
L1563	Y	0.16	125.21	11.81	11.65	417214.00	6191840.00	DRY

L1565	Y	0.16	125.59	24.16	24.00	417312.00	6190767.00	READ
L1571	N	0.00	135.74	0.00	0.00	443274.00	6178874.00	DESTROYED
L1597	Y	0.31	134.07	20.13	19.82	430294.00	6171471.00	READ
L1601	Y	0.50	137.54	6.86	6.36	443571.00	6171535.00	DRY
L1602	Y	0.19	139.39	11.05	10.86	445840.00	6169356.00	READ
L1603	Y	0.37	133.06	13.32	12.95	434363.00	6188683.00	READ
L1612	Y	0.00	137.39	6.45	6.45	442387.00	6193049.00	READ
L1614	Y	0.44	138.74	6.24	5.80	442712.00	6195070.00	READ
L1628	Y	0.38	134.05	9.78	9.40	441749.00	6181801.00	READ
L1640	Y	0.25	132.81	8.59	8.34	431201.00	6180438.00	READ
L1642	Y	0.03	135.82	7.65	7.62	438457.00	6175870.00	READ
L1646	Y	0.22	135.72	13.12	12.90	441065.00	6171272.00	READ
L1654	Y	0.35	133.05	15.57	15.22	439222.00	6185445.00	READ
L1662	Y	0.65	133.64	17.11	16.46	439033.00	6183583.00	READ
L1707D	Y	0.20	134.30	23.16	22.96	437983.00	6182286.00	READ
L1707S	Y	0.36	134.30	9.76	9.40	437982.00	6182281.00	READ
L1708	Y	0.36	134.04	4.78	4.42	444891.00	6182244.00	READ
L1709D	Y	0.11	133.61	13.56	13.45	438075.00	6183059.00	READ
L1709S	Y	0.24	133.57	5.85	5.61	438075.00	6183060.00	READ
L1728	Y	0.38	134.49	16.88	16.50	441857.00	6180653.00	READ
L1729D	Y	0.25	135.30	18.85	18.60	441288.00	6179948.00	READ
L1729S	Y	0.23	135.29	7.59	7.36	441292.00	6179949.00	READ
L1732D	Y	0.63	133.52	10.23	9.60	438790.00	6187947.00	READ
L1732S	Y	0.16	133.57	5.46	5.30	438791.00	6187947.00	READ
L1738	Y	0.40	133.53	13.55	13.15	438578.00	6186653.00	READ
L1739D	Y	0.51	133.51	18.11	17.60	438420.00	6185316.00	READ
L1739M	Y	1.00	133.50	16.81	15.81	438420.00	6185318.00	READ
L1739S	Y	0.43	133.51	10.17	9.74	438419.00	6185319.00	READ
L1748D	Y	0.41	130.65	13.43	13.02	428446.00	6179466.00	READ
L1748S	Y	0.67	130.67	8.19	7.52	428448.00	6179466.00	READ
L1751	Y	0.25	134.47	24.49	24.24	437898.00	6181831.00	READ
L1752	Y	0.92	134.51	8.85	7.93	437746.00	6180804.00	READ
L1753	Y	0.48	135.02	15.63	15.15	437584.00	6179682.00	READ
L1755D	Y	0.46	135.51	22.59	22.13	437144.00	6176794.00	READ
L1755S	Y	0.81	135.51	13.92	13.11	437144.00	6176793.00	READ
L1756D	Y	0.50	135.61	23.55	23.05	436953.00	6175526.00	READ
L1756S	Y	0.30	135.61	6.74	6.44	436954.00	6175526.00	READ
L1762D	Y	0.39	134.53	16.09	15.70	437330.00	6178067.00	READ
L1762S	Y	0.76	134.51	12.40	11.64	437329.00	6178065.00	READ
L1764D	Y	0.63	135.67	14.90	14.27	436827.00	6174767.00	READ
L1764M	Y	0.65	135.66	13.41	12.76	436825.00	6174768.00	READ
L1764S	Y	0.40	135.67	8.45	8.05	436826.00	6174767.00	DRY
L1765D	Y	0.21	134.27	20.29	20.08	436719.00	6174068.00	READ
L1765S	Y	0.00	134.27	0.00	0.00	436719.00	6174068.00	READ
L1767	Y	-0.51	134.75	19.54	20.05	436346.00	6170668.00	READ
L1768D	Y	0.22	135.45	9.40	9.18	437069.00	6176155.00	READ

L1768S	Y	0.06	135.44	13.23	13.17	437070.00	6176155.00	READ
L1779D	Y	0.47	119.58	20.27	19.80	403175.94	6196469.74	READ
L1779S	Y	0.57	128.34	13.06	12.49	420714.00	6185533.00	READ
L1784	Y	0.00	135.73	17.23	17.23	443143.00	6178073.00	READ
L1788	Y	0.08	138.03	12.16	12.08	443000.00	6172507.00	READ
L1792	Y	0.34	132.74	11.06	10.72	435524.00	6189031.00	READ
L1794D	Y	0.21	132.94	13.23	13.02	435661.00	6189992.00	READ
L1794S	Y	0.48	132.93	7.43	6.95	435660.00	6189985.00	READ
L1798	N	0.28	132.62	16.10	15.82	435354.00	6187859.00	DESTROYED
L1800	Y	0.34	132.23	13.54	13.20	435248.00	6187126.00	READ
L1805	Y	0.31	132.03	6.89	6.58	435011.00	6185472.00	READ
L1806	Y	0.28	132.43	13.23	12.95	434932.20	6185057.72	READ
L1808	Y	0.34	132.17	8.16	7.82	434846.00	6184349.00	READ
L1810D	Y	0.28	132.19	22.99	22.71	434742.00	6183596.00	READ
L1810S	Y	0.10	132.28	10.95	10.85	434739.00	6183596.00	READ
L1813D	Y	0.31	132.19	24.15	23.84	434609.00	6182653.00	READ
L1813M	N	0.00	132.21	0.00	0.00	434609.00	6182654.00	READ
L1813S	Y	0.17	132.13	5.09	4.92	434610.00	6182652.00	READ
L1815	Y	0.36	132.71	12.25	11.89	434526.00	6182079.00	READ
L1818	Y	0.22	132.91	17.96	17.74	434363.00	6180972.00	READ
L1823D	Y	0.17	133.11	10.37	10.20	434046.00	6178787.00	READ
L1823S	Y	0.20	133.10	17.60	17.40	434046.00	6178788.00	READ
L1826D	Y	0.57	133.10	7.02	6.45	433910.00	6177684.00	READ
L1826S	Y	0.39	133.09	4.89	4.50	433911.00	6177685.00	READ
L1829	Y	0.50	133.64	20.96	20.46	433851.00	6176668.00	READ
L1830	N	0.65	135.07	5.91	5.26	445125.00	6179101.00	DESTROYED
L1831	Y	0.38	134.29	11.13	10.75	442258.00	6186561.00	READ
L1832	Y	0.22	134.92	14.78	14.56	440509.00	6180849.00	READ
L1834	Y	0.16	137.24	8.78	8.62	442629.00	6170406.00	READ
L1836R	Y	0.56	138.73	8.80	8.24	444146.94	6168333.58	READ
L1844	Y	0.47	133.49	18.50	18.03	432830.00	6176577.00	READ
L1851	Y	0.15	134.13	8.97	8.82	432386.00	6173894.00	READ
L1854D	Y	0.55	134.56	6.79	6.24	432237.00	6172929.00	READ
L1854S	Y	0.30	134.51	7.22	6.92	432232.00	6172932.00	READ
L1856	Y	0.28	134.71	22.06	21.78	432133.00	6172315.00	READ
L1861D	Y	0.26	133.64	17.56	17.30	431908.00	6170836.00	READ
L1861S	Y	0.45	133.50	6.64	6.19	431905.00	6170831.00	READ
L1866	Y	0.03	131.14	8.25	8.22	428170.00	6181470.00	READ
L1870D	Y	0.08	130.72	19.63	19.55	428909.00	6180095.00	READ
L1870S	Y	0.25	130.72	7.61	7.36	428909.00	6180095.00	READ
L1876	Y	0.27	132.96	15.27	15.00	436114.00	6184968.00	READ
L1881	Y	0.95	132.76	8.33	7.38	436032.00	6186816.00	READ
L1883	Y	0.30	133.32	15.50	15.20	437733.00	6186708.00	READ
L1887	Y	0.26	133.33	13.91	13.65	436293.00	6182720.00	READ
L1888	Y	0.23	133.16	13.39	13.16	436289.00	6181155.00	READ
L1890	Y	0.00	133.32	4.87	4.87	435130.00	6180518.00	READ

L1892	N	0.16	134.23	6.46	6.30	435858.00	6179689.00	DESTROYED
L1897	Y	0.03	133.79	8.88	8.85	435904.00	6178059.00	READ
L1898	Y	0.18	134.05	8.64	8.46	435275.00	6178117.00	READ
L1899	Y	0.21	134.07	16.45	16.24	434854.00	6177407.00	READ
L1902D	Y	0.74	134.23	16.38	15.64	434049.00	6176014.00	READ
L1902S	Y	0.38	134.05	5.32	4.94	434051.00	6176016.00	READ
L1905D	Y	0.42	134.76	22.84	22.42	435140.00	6175502.00	READ
L1905S	Y	0.24	134.74	9.50	9.26	435140.00	6175499.00	READ
L1913	Y	0.26	130.38	6.94	6.68	429435.00	6186928.00	READ
L1915	Y	0.38	132.84	16.88	16.50	433516.00	6187955.00	READ
L1917D	Y	0.34	130.06	19.26	18.92	429214.00	6185113.00	READ
L1917S	Y	0.57	129.90	12.32	11.75	429219.00	6185116.00	READ
L1920	Y	0.70	132.42	6.65	5.95	430899.00	6179071.00	READ
L1924D	Y	0.31	132.34	20.48	20.17	431802.00	6189657.00	READ
L1924S	Y	0.36	132.09	4.23	3.87	431805.00	6189654.00	READ
L1927	Y	0.37	131.05	14.59	14.22	431660.00	6188646.00	READ
L1930D	Y	0.52	131.43	24.71	24.19	431511.00	6187618.00	READ
L1930S	Y	0.48	131.24	15.23	14.75	431513.00	6187621.00	READ
L1933D	Y	0.32	132.05	25.94	25.62	431409.00	6186625.00	READ
L1933S	Y	0.38	132.00	7.58	7.20	431417.00	6186628.00	READ
L1935D	Y	0.60	131.48	11.20	10.60	431313.00	6186009.00	READ
L1935S	Y	0.60	131.49	6.92	6.32	431314.00	6186009.00	READ
L1938	Y	0.17	131.48	14.31	14.14	431172.00	6185006.00	READ
L1938TW	N	0.00	131.50	0.00	0.00	431170.00	6185001.00	DESTROYED
L1941	Y	0.26	131.54	20.92	20.66	431020.00	6183951.00	READ
L1943	Y	0.38	127.82	0.38	0.00	423042.00	6190583.00	READ
L1945	Y	0.29	131.54	21.10	20.81	430851.00	6182737.00	READ
L1946D	Y	0.26	131.76	23.28	23.02	430805.00	6182435.00	READ
L1946S	Y	0.48	131.86	11.48	11.00	430807.00	6182437.00	READ
L1947	Y	0.16	131.86	13.41	13.25	430697.00	6181688.00	READ
L1950	Y	0.31	134.82	21.68	21.37	434010.00	6173324.00	READ
L1951	Y	0.35	135.67	23.80	23.45	434821.00	6173212.00	READ
L1953	Y	0.25	128.14	12.75	12.50	419679.00	6184917.00	READ
L1954	Y	0.32	134.24	18.65	18.33	432839.00	6170675.00	READ
L1955	Y	0.20	134.93	17.84	17.64	434987.00	6170761.00	READ
L1958D	Y	0.27	132.56	8.17	7.90	429931.00	6180284.00	READ
L1958M	Y	0.09	127.81	24.80	24.71	418348.50	6185063.74	READ
L1958S	Y	0.22	132.55	24.16	23.94	429933.00	6180286.00	READ
L1960D	Y	0.34	132.01	23.07	22.73	429915.00	6179673.00	READ
L1960S	Y	0.32	132.07	8.99	8.67	429915.00	6179674.00	READ
L1962D	Y	0.28	131.81	20.58	20.30	429670.00	6178978.00	READ
L1962S	Y	0.28	131.78	7.30	7.02	429670.00	6178976.00	READ
L1963D	Y	0.18	131.52	20.44	20.26	429407.00	6178289.00	READ
L1963S	Y	0.39	131.49	11.75	11.36	429406.00	6178287.00	READ
L1964	Y	0.10	126.36	10.79	10.69	417025.00	6189279.00	READ
L1966	Y	0.45	132.00	13.70	13.25	429012.00	6177436.00	READ

L1967	Y	0.10	126.33	9.72	9.62	414381.97	6185772.58	READ
L1970	Y	0.08	131.99	14.33	14.25	428133.00	6176305.00	READ
L1971	Y	0.20	126.61	14.09	13.89	420041.00	6189865.00	READ
L1974	Y	0.07	132.21	14.27	14.20	427933.00	6174877.00	READ
L1976	Y	0.16	128.73	15.28	15.12	421493.00	6183749.00	READ
L1977	Y	0.38	129.07	12.76	12.38	421506.45	6182642.14	READ
L1977M	Y	0.36	132.16	17.19	16.83	427796.00	6173744.00	READ
L1980	Y	0.26	132.34	7.50	7.24	427613.00	6172580.00	READ
L1982D	Y	0.66	132.48	23.31	22.65	427509.00	6171809.00	READ
L1982S	Y	0.21	131.52	5.76	5.55	427501.00	6171806.00	READ
L1984	N	0.00	132.33	0.00	0.00	433642.00	6189726.00	DESTROYED
L1991D	Y	0.22	131.18	13.04	12.82	432201.00	6185517.00	READ
L1991S	Y	0.36	131.17	6.09	5.73	432200.00	6185517.00	READ
L1997	Y	0.05	131.69	11.40	11.35	432409.00	6183843.00	READ
L1999	Y	0.42	131.76	13.38	12.96	433396.00	6183113.00	READ
L2002	Y	0.52	131.21	13.76	13.24	432156.00	6182180.00	READ
L2008D	Y	0.15	132.38	3.65	3.50	438242.00	6184271.00	READ
L2008S	Y	0.16	132.40	10.47	10.31	438246.00	6184276.00	READ
L2009	Y	0.18	130.30	23.59	23.41	429100.00	6189914.00	READ
L2014D	Y	0.32	130.83	14.07	13.75	428883.00	6188400.00	READ
L2014S	Y	0.18	130.82	14.98	14.80	428880.00	6188403.00	READ
L2015D	Y	0.20	130.77	19.96	19.76	428848.00	6188126.00	READ
L2015S	Y	0.30	130.76	14.37	14.07	428847.00	6188119.00	READ
L2024D	Y	0.54	129.93	13.11	12.57	429154.00	6184750.00	READ
L2024S	Y	0.29	130.23	12.35	12.06	429161.00	6184757.00	READ
L2028D	Y	0.26	130.39	19.86	19.60	428975.00	6183488.00	READ
L2028S	Y	0.19	130.44	9.70	9.51	428977.00	6183488.00	READ
L2029D	Y	0.12	131.36	20.32	20.20	428927.00	6183173.00	READ
L2029S	Y	0.16	131.10	11.18	11.02	428930.00	6183172.00	READ
L2036	Y	0.19	133.37	15.43	15.24	438500.00	6186044.00	READ
L2039	Y	0.31	132.71	11.04	10.73	437449.00	6184779.00	READ
L2044D	Y	0.31	132.63	20.18	19.87	429543.00	6180591.00	READ
L2044S	Y	0.20	132.63	9.00	8.80	429543.00	6180592.00	READ
L2047D	Y	0.17	132.10	13.37	13.20	435124.00	6186223.00	READ
L2047S	Y	0.42	132.37	5.40	4.98	435126.00	6186224.00	READ
L2052D	Y	0.18	130.62	7.36	7.18	427194.00	6180096.00	READ
L2052S	Y	0.16	130.61	19.60	19.44	427192.00	6180097.00	READ
L2053	Y	0.42	131.24	20.21	19.79	427531.00	6180948.00	READ
L2057	Y	0.03	130.56	10.49	10.46	427326.00	6182563.00	READ
L2060D	Y	0.20	131.78	16.94	16.74	429964.00	6181921.00	READ
L2060S	Y	0.31	131.79	14.50	14.19	429962.00	6181924.00	READ
L2066	Y	0.26	131.84	7.88	7.62	431594.00	6181241.00	READ
L2068	Y	0.37	132.98	11.20	10.83	432513.00	6179802.00	READ
L2069	Y	0.29	133.24	22.65	22.36	432627.00	6178707.00	READ
L2075D	Y	0.27	134.06	20.79	20.52	437272.00	6177708.00	READ
L2075S	Y	0.42	134.06	7.90	7.48	437272.00	6177708.00	READ

L2089D	Y	0.38	133.00	21.41	21.03	431550.00	6178372.00	READ
L2089S	Y	0.54	133.00	10.26	9.72	431551.00	6178371.00	READ
L2090	Y	0.26	133.22	22.84	22.58	431994.00	6177578.00	READ
L2094D	Y	0.33	131.56	20.73	20.40	428863.00	6178543.00	READ
L2094S	Y	0.30	131.50	7.97	7.67	428860.00	6178539.00	READ
L2096D	Y	0.15	131.15	14.17	14.02	426459.00	6179670.00	READ
L2096S	Y	0.21	131.09	6.33	6.12	426458.00	6179669.00	READ
L2099	Y	0.25	130.90	22.30	22.05	425263.00	6180226.00	READ
L2108D	Y	0.25	129.78	23.96	23.71	426017.00	6181033.00	READ
L2108S	Y	0.28	129.78	7.93	7.65	426017.00	6181033.00	READ
L2117D	Y	0.24	129.96	23.16	22.92	425340.00	6181538.00	READ
L2117S	Y	0.24	129.96	11.93	11.69	425340.00	6181539.00	READ
L2120	Y	0.31	129.92	20.96	20.65	425532.00	6182902.00	READ
L2121	Y	0.26	129.08	21.81	21.55	425647.00	6183659.00	READ
L2124D	Y	0.25	128.95	24.56	24.31	425777.00	6184616.00	READ
L2124S	Y	0.21	128.95	9.07	8.86	425776.00	6184615.00	READ
L2126	Y	0.19	128.47	19.69	19.50	425853.00	6185235.00	READ
L2128D	Y	0.27	129.19	21.59	21.32	425982.00	6186034.00	READ
L2128S	Y	0.23	129.19	7.84	7.61	425982.00	6186033.00	READ
L2131D	Y	0.22	129.39	22.53	22.31	426225.00	6187716.00	READ
L2131S	Y	0.17	129.40	13.23	13.06	426232.00	6187720.00	READ
L2135	Y	0.25	129.46	28.11	27.86	426520.00	6189767.00	READ
L2137	Y	0.28	129.33	21.46	21.18	426688.00	6191071.00	READ
L2139D	Y	0.31	128.85	24.30	23.99	426848.00	6191926.00	READ
L2139S	Y	0.39	128.94	11.23	10.84	426854.00	6191920.00	READ
L2158	Y	0.27	134.33	10.28	10.01	444279.00	6181379.00	READ
L2159	N	0.00	135.07	0.00	0.00	442664.00	6179766.00	DESTROYED
L2163	Y	0.24	134.72	16.74	16.50	442992.00	6180494.00	READ
L2165	Y	0.31	135.33	19.59	19.28	444143.00	6180288.00	READ
L2166	Y	0.34	133.87	11.85	11.51	442145.00	6185746.00	READ
L2168	Y	0.37	134.02	9.82	9.45	442355.00	6185083.00	READ
L2170	Y	0.30	138.79	6.12	5.82	443825.00	6172383.00	DRY
L2182	Y	0.27	134.46	5.12	4.85	442682.00	6181337.00	READ
L2184D	Y	0.27	132.90	21.57	21.30	432289.00	6179881.00	READ
L2184S	Y	0.37	132.90	11.72	11.35	432289.00	6179881.00	READ
L2185	Y	0.30	135.30	15.45	15.15	439282.00	6181038.00	READ
L2186	Y	0.31	134.10	14.47	14.16	440462.00	6182105.00	READ
L2191	Y	0.26	136.19	24.01	23.75	439401.00	6176167.00	READ
L2195	Y	0.28	135.80	8.93	8.65	438901.00	6177608.00	READ
L2197	N	0.00	136.53	0.00	0.00	440541.00	6176221.00	DESTROYED
L2202	Y	0.27	136.94	14.69	14.42	441609.00	6176622.00	READ
L2210A	Y	0.12	134.05	11.54	11.42	438438.00	6177768.00	READ
L2210B	Y	0.32	133.95	2.56	2.24	438438.00	6177767.00	DRY
L2210TW	Y	0.20	133.95	11.42	11.22	438438.00	6177767.00	READ
L2216	Y	0.40	140.70	22.40	22.00	446799.00	6165903.00	READ
L2225	Y	0.16	136.74	14.17	14.01	440796.00	6169911.00	READ

L2238D	N	0.00	135.81	7.49	7.49	438739.00	6177352.00	DESTROYED
L2238S	Y	0.28	135.81	10.23	9.95	438739.00	6177352.00	READ
L2241D	Y	0.18	138.71	6.19	6.01	446431.00	6171936.00	READ
L2241S	Y	0.33	138.70	8.20	7.87	446430.00	6171936.00	READ
L2243	Y	0.22	140.13	13.22	13.00	446910.00	6170128.00	READ
L2244	Y	0.26	137.83	26.80	26.54	443175.00	6173521.00	READ
L2245	Y	0.00	137.70	6.04	6.04	446254.00	6174776.00	READ
L2249	N	0.06	137.30	14.97	14.91	438579.05	6172973.45	DESTROYED
L2250	Y	0.12	136.63	14.74	14.62	441992.00	6174417.00	READ
L2251	Y	0.06	141.34	14.30	14.24	447367.00	6167012.00	READ
L2258D	Y	0.22	135.78	11.17	10.95	443306.00	6174591.00	READ
L2258S	Y	0.30	135.78	5.08	4.78	443306.00	6174591.00	READ
L2261	Y	0.26	131.42	15.47	15.21	429884.00	6178023.00	READ
L2275D	Y	0.21	133.18	62.16	61.95	436459.00	6182421.00	READ
L2275M	Y	0.40	133.19	24.70	24.30	436459.00	6182420.00	READ
L2275S	Y	0.32	133.19	14.89	14.57	436459.00	6182420.00	READ
L2278D	Y	0.31	136.46	28.30	27.99	440558.00	6178172.00	READ
L2278S	Y	0.32	136.41	11.73	11.41	440564.00	6178173.00	READ
L2279	Y	0.37	134.33	10.79	10.42	445017.00	6183113.00	READ
L2280	N	0.17	131.23	15.90	15.73	425004.00	6173837.00	DESTROYED
L2287D	Y	0.36	133.95	23.82	23.46	439622.00	6186502.00	READ
L2287S	Y	0.22	133.95	17.40	17.18	439622.00	6186502.00	READ
L2299D	Y	0.18	133.22	3.35	3.17	440714.00	6186377.00	READ
L2299S	Y	0.18	133.14	7.68	7.50	440711.27	6186420.00	READ
L2302D	Y	0.25	137.01	22.19	21.94	442262.00	6176403.00	READ
L2302S	Y	0.32	137.03	7.20	6.88	442263.00	6176402.00	READ
L2312	Y	0.28	135.51	3.38	3.10	446406.00	6178365.00	DRY
L2313	Y	0.33	135.78	3.91	3.58	446664.00	6177515.00	DRY
L2314D	Y	0.25	136.99	19.84	19.59	443361.00	6174989.00	READ
L2314M	Y	0.32	136.99	13.74	13.42	443362.00	6174990.00	READ
L2314S	Y	0.41	136.99	7.36	6.95	443362.00	6174990.00	READ
L2317D	Y	0.31	137.34	15.27	14.96	445359.00	6173998.00	READ
L2317S	Y	0.30	137.33	7.10	6.80	445357.00	6174000.00	READ
L2318	Y	-0.02	137.46	13.49	13.51	443429.00	6175424.00	READ
L2320	Y	0.80	125.12	13.64	12.84	412450.00	6187512.00	READ
L2328	Y	0.00	137.33	9.00	9.00	442137.00	6177032.00	READ
L2329D	Y	0.23	136.62	25.19	24.96	441441.00	6177124.00	READ
L2329S	Y	0.19	136.62	10.90	10.71	441441.00	6177124.00	READ
L2332D	Y	0.38	135.99	10.22	9.84	440695.00	6178981.00	READ
L2332S	Y	0.24	136.00	18.21	17.97	440696.00	6178981.00	READ
L2333	Y	0.28	135.39	9.78	9.50	438846.00	6178124.00	READ
L2334D	Y	0.26	135.73	27.50	27.24	439529.00	6179590.00	READ
L2334S	Y	0.25	135.74	10.00	9.75	439529.00	6179589.00	READ
L2335D	Y	0.04	135.89	9.01	8.97	438597.00	6179753.00	READ
L2335S	Y	0.00	135.89	6.70	6.70	438597.00	6179753.00	READ
L2340	Y	0.17	133.76	5.03	4.86	439223.00	6178688.00	READ

L2347D	Y	0.21	135.43	9.50	9.29	442063.00	6178840.00	READ
L2347S	Y	0.29	135.43	14.25	13.96	442064.00	6178839.00	READ
L2357D	Y	0.10	137.04	17.16	17.06	443732.00	6177489.00	READ
L2357S	Y	0.11	137.14	9.30	9.19	443733.00	6177490.00	READ
L2364	Y	0.37	135.08	11.69	11.32	444694.00	6178298.00	READ
L2367D	N	0.00	139.17	0.00	0.00	445374.00	6170038.00	DESTROYED
L2367S	N	0.00	139.15	0.00	0.00	445378.00	6170037.00	DESTROYED
L2371	Y	0.29	137.85	17.02	16.73	443651.00	6169669.00	READ
L2373	Y	0.34	133.50	12.75	12.41	443313.00	6183272.00	READ
L2391	Y	0.34	138.28	8.24	7.90	445359.00	6172029.00	READ
L2408	Y	0.30	138.62	13.38	13.08	444532.00	6172284.00	READ
L2423	Y	0.12	137.25	9.64	9.52	441426.00	6172521.00	READ
L2437D	Y	0.44	137.90	18.52	18.08	444902.00	6174022.00	READ
L2437S	Y	0.25	137.87	12.37	12.12	444902.00	6174023.00	READ
L2442	Y	0.02	134.31	8.67	8.65	435204.00	6179118.00	READ
L2443	Y	0.44	132.32	5.76	5.32	433553.00	6179330.00	READ
L2444	Y	0.25	134.12	11.27	11.02	436403.00	6179049.00	READ
L2452D	Y	0.20	130.86	11.92	11.72	430015.00	6188582.00	READ
L2452S	Y	0.30	131.14	14.62	14.32	430020.00	6188576.00	READ
L2453	Y	0.09	130.23	8.31	8.22	427950.00	6188874.00	READ
L2467D	Y	0.23	131.91	24.73	24.50	432585.00	6186735.00	READ
L2467S	Y	0.26	131.95	9.91	9.65	432585.00	6186729.00	READ
L2468	Y	0.20	130.91	14.89	14.69	430429.00	6186788.00	READ
L2469	Y	0.25	134.72	11.87	11.62	445502.00	6182044.00	READ
L2479	Y	0.25	138.52	6.87	6.62	446272.00	6173832.00	READ
L2481	Y	0.10	131.54	17.02	16.92	433852.00	6187074.00	READ
L2482D	Y	0.28	131.90	16.36	16.08	434451.90	6187002.32	READ
L249	N	0.00	142.69	0.00	0.00	453333.00	6161051.00	READ
L2490	Y	0.37	133.98	12.47	12.10	444382.35	6182202.82	READ
L2498	Y	0.36	129.48	12.50	12.14	428186.00	6184593.00	READ
L2499	Y	0.30	129.93	12.50	12.20	427870.00	6187154.00	READ
L251	N	0.00	141.47	0.00	0.00	451003.00	6163123.00	READ
L2584	Y	0.38	131.82	10.70	10.32	433375.00	6185350.00	READ
L2588	Y	0.37	131.91	12.02	11.65	434035.00	6185255.00	READ
L259	Y	0.38	133.54	10.78	10.40	430116.00	6175981.00	READ
L2601	Y	0.06	136.07	8.48	8.42	438369.00	6174069.00	READ
L2602	Y	0.53	136.31	20.64	20.11	439546.00	6173495.00	READ
L261	Y	0.18	132.24	8.04	7.86	427873.00	6171471.00	READ
L2613	Y	0.37	139.58	15.59	15.22	446271.00	6172177.00	READ
L2646	Y	0.22	134.79	20.22	20.00	436407.00	6171914.00	READ
L2648	Y	0.23	124.98	13.87	13.64	411007.00	6174488.00	DRY
L2657	Y	0.23	133.69	18.71	18.48	432669.00	6175731.00	READ
L2679D	Y	0.19	132.69	20.55	20.36	434151.00	6179166.00	READ
L2679S	Y	0.10	132.60	7.72	7.62	434154.00	6179166.00	READ
L2690	Y	0.35	131.50	20.92	20.57	428323.00	6178794.00	READ
L2705	Y	0.54	126.80	14.35	13.81	419454.99	6190177.79	READ

L2717	Y	0.19	125.08	14.28	14.09	416969.00	6191525.00	READ
L2729	Y	0.06	129.24	18.03	17.97	423685.36	6174603.76	READ
L2733D	Y	0.31	133.90	13.39	13.08	426406.00	6188711.00	READ
L2733S	Y	0.33	133.90	6.84	6.51	426411.00	6188717.00	DRY
L2751	N	0.00	127.52	0.00	0.00	422512.00	6190725.00	DESTROYED
L2752	N	0.00	127.50	0.00	0.00	422511.00	6190725.00	DESTROYED
L2762	Y	0.13	130.69	18.86	18.73	423459.56	6172845.19	READ
L2763	N	0.00	136.16	0.00	0.00	439185.00	6174741.00	DRY
L2788	Y	0.14	139.70	13.30	13.16	445559.00	6167174.00	READ
L2791	Y	0.17	130.73	22.06	21.89	425707.00	6168005.00	READ
L2793	Y	0.37	0.00	9.38	9.01	430510.00	6166775.00	READ
L2794	Y	0.47	0.00	9.50	9.03	427194.00	6165242.00	READ
L2795	Y	0.29	0.00	20.80	20.51	433346.00	6166286.00	READ
L2796D	Y	0.26	0.00	20.31	20.05	436321.00	6166465.00	READ
L2796S	Y	0.29	0.00	9.40	9.11	436321.00	6166468.00	DRY
L2797	Y	0.29	0.00	22.87	22.58	439295.00	6166677.00	READ
L2798	Y	0.23	0.00	16.36	16.13	441918.00	6166546.00	READ
L2799	Y	0.37	137.97	21.78	21.41	443424.00	6164260.00	READ
L2800S	Y	0.33	0.00	14.14	13.81	443926.00	6161526.00	READ
L2802	Y	0.29	0.00	23.23	22.94	440020.00	6162061.00	READ
L2840	Y	0.32	130.24	8.63	8.31	428217.00	6187101.00	READ
L2851	Y	0.46	131.46	18.32	17.86	420298.00	6169854.00	READ
L2852	N	0.00	128.95	11.96	11.96	423854.00	6175696.00	DESTROYED
L2853	Y	0.42	130.20	16.28	15.86	424105.00	6177463.00	READ
L2856	Y	0.18	129.04	14.34	14.16	424402.00	6179941.00	READ
L2857D	N	0.00	133.81	0.00	0.00	436396.00	6169876.00	DESTROYED
L2857S	N	0.00	133.81	0.00	0.00	436396.00	6169876.00	DESTROYED
L2858	N	0.00	0.00	0.00	0.00	435887.00	6168048.00	DESTROYED
L2859	N	0.00	0.00	0.00	0.00	436061.00	6169173.00	DESTROYED
L2865	N	0.30	135.35	3.23	2.93	439410.00	6192323.00	DESTROYED
L2875	Y	0.33	131.12	16.80	16.47	427135.00	6181429.00	READ
L2922	Y	0.20	138.05	12.58	12.38	446333.00	6172679.00	READ
L2928	Y	0.00	138.95	15.77	15.77	444273.00	6173360.00	DRY
L2983	Y	0.33	136.56	19.24	18.91	439868.00	6170011.00	READ
L2994	Y	0.31	133.98	19.91	19.60	430268.00	6170338.00	READ
L301	Y	0.18	135.21	6.58	6.40	439528.00	6177370.00	READ
L3040	Y	0.33	138.81	4.65	4.32	442808.00	6195833.00	READ
L3041	Y	0.20	138.91	7.76	7.56	442754.00	6195464.00	DRY
L3042	Y	0.30	138.45	5.22	4.92	441825.00	6195202.00	READ
L3044	Y	0.26	138.14	24.06	23.80	440124.00	6197376.00	READ
L3045	Y	0.22	138.57	12.44	12.22	440068.00	6196978.00	READ
L3050	Y	0.23	137.56	12.76	12.53	439859.00	6195530.00	READ
L3079	Y	0.16	138.09	13.21	13.05	439999.00	6196518.00	READ
L3080	N	0.00	138.18	0.00	0.00	439923.00	6195968.00	DESTROYED
L3082	Y	0.25	136.87	7.20	6.95	439672.00	6194437.00	READ
L3083	Y	0.30	136.59	7.35	7.05	439573.00	6193739.00	READ

L3084	Y	0.25	137.10	5.27	5.02	439705.00	6194701.00	READ
L3085	Y	0.34	136.02	7.32	6.98	439496.00	6193258.00	READ
L3126	Y	0.38	134.23	9.48	9.10	440486.00	6187791.00	READ
L3127	Y	0.28	135.23	10.47	10.19	442354.00	6187532.00	READ
L3128	Y	0.18	135.15	0.18	0.00	442300.00	6188924.00	READ
L3130	Y	0.41	133.73	8.98	8.57	438970.00	6189416.00	READ
L3131	Y	0.45	133.73	10.56	10.11	437444.00	6189597.00	READ
L3132	Y	0.40	134.77	7.81	7.41	439189.00	6190704.00	READ
L3133	Y	0.27	135.50	10.64	10.37	440834.00	6190482.00	READ
L3135	Y	0.40	136.01	9.10	8.70	440770.00	6191864.00	READ
L3136	Y	0.40	136.03	10.40	10.00	438410.00	6193349.00	READ
L3139	Y	0.34	138.86	4.24	3.90	442894.00	6196443.00	DRY
L580	Y	0.05	131.42	6.63	6.58	425501.00	6170615.00	DRY
L592	N	0.00	141.65	0.00	0.00	451319.00	6165740.00	DESTROYED
L595	Y	0.43	140.51	9.13	8.70	449273.00	6166550.00	READ
L685	Y	0.14	140.60	9.54	9.40	446803.00	6168172.00	READ



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Murrumbidgee Irrigation

ANNUAL COMPLIANCE REPORT 2016

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Murrumbidgee Irrigation Limited

Annual Compliance Report

2015/16

Introduction

The Annual Compliance Report 2015/16 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation Limited (MI) with the Department of Primary Industries, Water (DPI Water) and the NSW Environment Protection Authority (EPA). MI operates under a Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) issued by DPI Water and an Environment Protection Licence (EPL) 4651 issued by the EPA.

MI is committed to achieving organisational excellence through operating safely, efficiently and effectively, all of which contribute towards the measure of MI's environmental and compliance performance. MI achieved full compliance with EPL 4651 and Combined Approval for the 2015/16 reporting year.



Brett Jones
Chief Executive Officer
Murrumbidgee Irrigation Limited



Frank Sergi
Chairman
Murrumbidgee Irrigation Limited

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Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
BBSW	Barren Box Storage and Wetland
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPI Water	Department of Primary Industries, Water
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Reference crop evapotranspiration
GIS	Geographic Information System
ha	Hectare(s)
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	MicroSiemens per centimetre
µg/L	Micrograms per litre
ML	Megalitre
OEH	Office of Environment and Heritage
SOP	Standard Operating Procedure
t	Tonnes
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
YMS	EPL Point 6 - Yanco Main Southern Drain
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station

Executive Summary

The first part of this report has been prepared to meet the conditions of Murrumbidgee Irrigation Limited's (MI) Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval). The data presented in these sections refer to the current reporting year, in comparison to data from the previous two reporting years and data from a year at least five years prior. The latter part of this report (from page 57) has been prepared to meet the conditions and requirements of Environmental Protection Licence (EPL) 4651. MI has fulfilled the compliance requirements as set out in the Combined Approval and EPL 4651 for 2015/16.

The climatic conditions across the Murrumbidgee Irrigation Area (MIA) influence all aspects of this report. The climatic conditions determine the volume of water required for irrigation, the amount of water discharged from the area and groundwater dynamics. In 2015/16 the MIA experienced high rainfall, with above average rainfall recorded in December of 2015, and January, May, June and July of 2016.

For 2015/16 the final water allocation for the Murrumbidgee Valley was 37% for general security and 95% for high security water entitlements. A total of 643,957 ML was diverted from the Murrumbidgee River into the MIA, a 37% reduction compared to 2014/15. This total does not include 1,857 ML water delivered on behalf of the NSW Office of Environment and Heritage (OEH) for environmental purposes.

Trigger based monitoring of EPL discharge points revealed an increase in detections when compared to 2014/15. Nineteen notification and/or action level EPL chemical detections were made in 2015/16, compared to seven in 2014/15. This increase in detections from last year can be attributed to increased discharge volumes at EPL sites caused by high rainfall events.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of Compliance

MI has met the conditions of the Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) in 2015/16. A summary of the compliance requirements are cross referenced to this report and listed in Table 1.This Combined Approval authorises MI to construct and use water supply works to extract and convey water for any purpose within MI's Area of Operation.

Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations. Internal Standard Operating Procedures (SOPs) are reviewed regularly.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2015/16. MI did not change or modify existing authorised discharge works listed in the Combined Approval or construct new works that would allow further discharge from the area of operations during 2015/16.

Table 1 Combined Water Supply Work Approval and Water Use Approval (40CA403245) reporting summary

Licence section	Requirement	Report Section
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1 12.2	2. Plan of Operations and Works
Statement of Compliance	12.3	1. Statement of Compliance
Presentation of Data and Analyses	12.4 12.5 12.6	Section 1 - 6
	12.7	Provided on USB
	12.8	1. Statement of Compliance
New Measures to Limit Groundwater Recharge and Discharge of Salt	12.9	7. New Measures to Limit Groundwater Recharge and Discharge of Salt
Reporting on Water Management	12.10	3.3 Diversions and Water Allocation
	12.11	3.5 Water discharged from Area of Operation
	12.12	3.9 Water Balance
	12.13 (a) (b)	3.1 Climate Conditions
	(c) – (j)	4. Water Use
Reporting on Salinity and Salt load	12.14 12.15 12.16	5. Salinity and Salt load
Reporting on Groundwater Conditions	12.17	6. Groundwater Conditions

2 Plan of operations and works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. The MIA is irrigated from water diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval via authorised supply works shown in Figure 2.

In 2015/16, the boundary of MI's Area of Operations did not change.

2.1 Operational background

The MIA is supplied by water stored in Burrinjuck and Blowering dams in the upper Murrumbidgee catchment via two authorised supply works:

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STUR - Sturt Canal (after diversion from Gogeldrie Weir)

The water released from Burrinjuck and Blowering dams flows down the Murrumbidgee River to Berembed Weir where majority of the water for the MIA is diverted via NARREG which feeds the supply channels that deliver irrigation water to customers. The balance of the MIA's water requirements are diverted at Gogeldrie Weir and directed to the Sturt Canal to supply customers in the southern and western regions of the MIA.

A complementary drainage system captures drainage water, which includes catchment flows, escape flows and off-farm drainage. Majority of this water flows via Mirrool Creek towards Barren Box Storage and Wetland, and is then combined with water flows from supply channels and reused in the Wah Wah, Benerembah and Tabbita Irrigation Districts.

MI's supply and drainage system is a virtually closed system in that it does not discharge to any other rivers or creeks outside the area of operations except during high rainfall events or increased flow of farm drainage during the irrigation season. There are five drainage sites which can potentially discharge outside the area of operations following these flow events (Figure 3). These sites are listed as discharge sites in the Combined Approval under Schedule 1 - Attachment 2 and are monitored in accordance with EPL 4651.

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDG – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain River Road
- MIRFLD – Mirrool Creek Floodway Wyvern Station

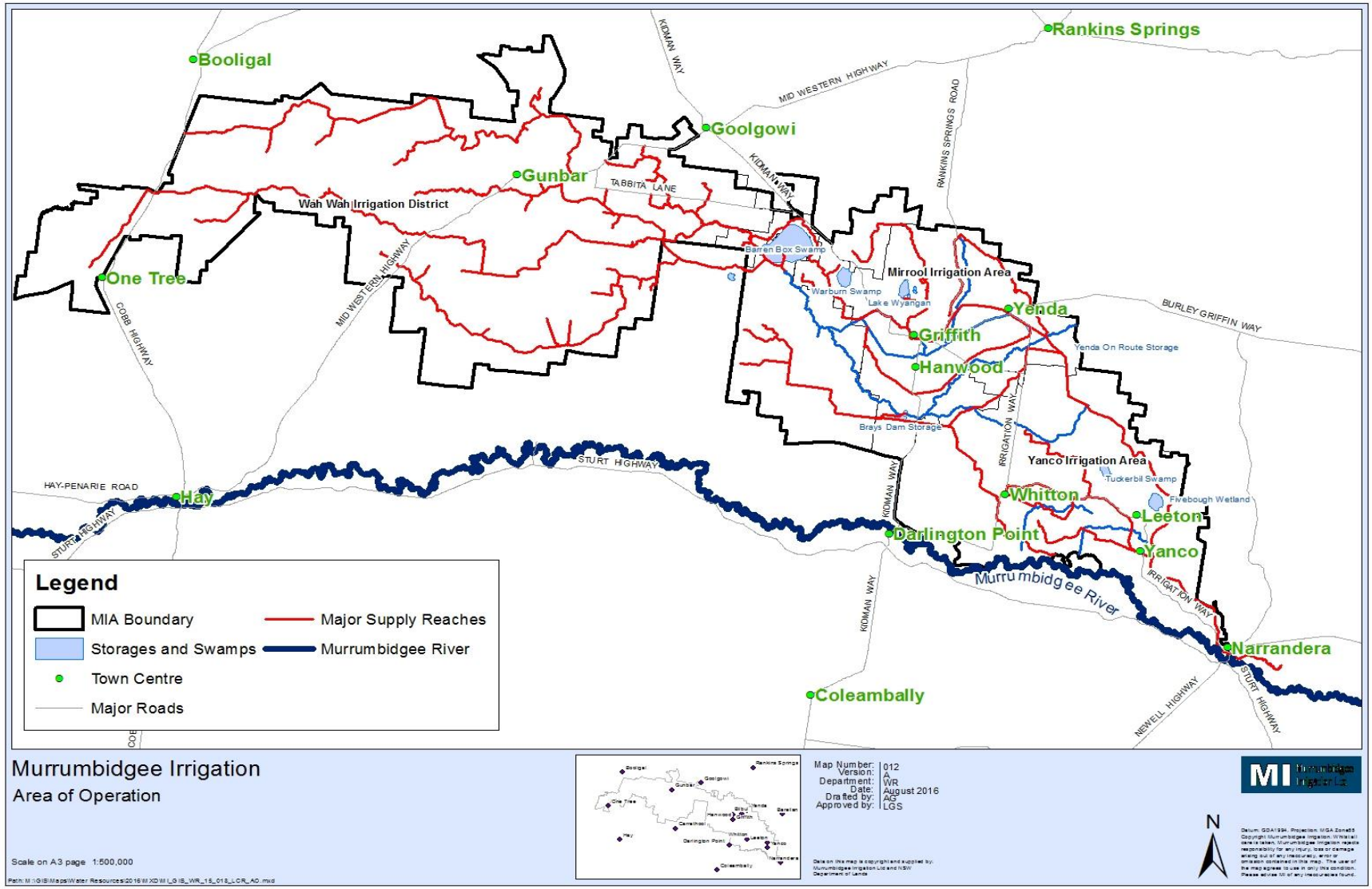


Figure 1 Murrumbidgee Irrigation's Area of Operation

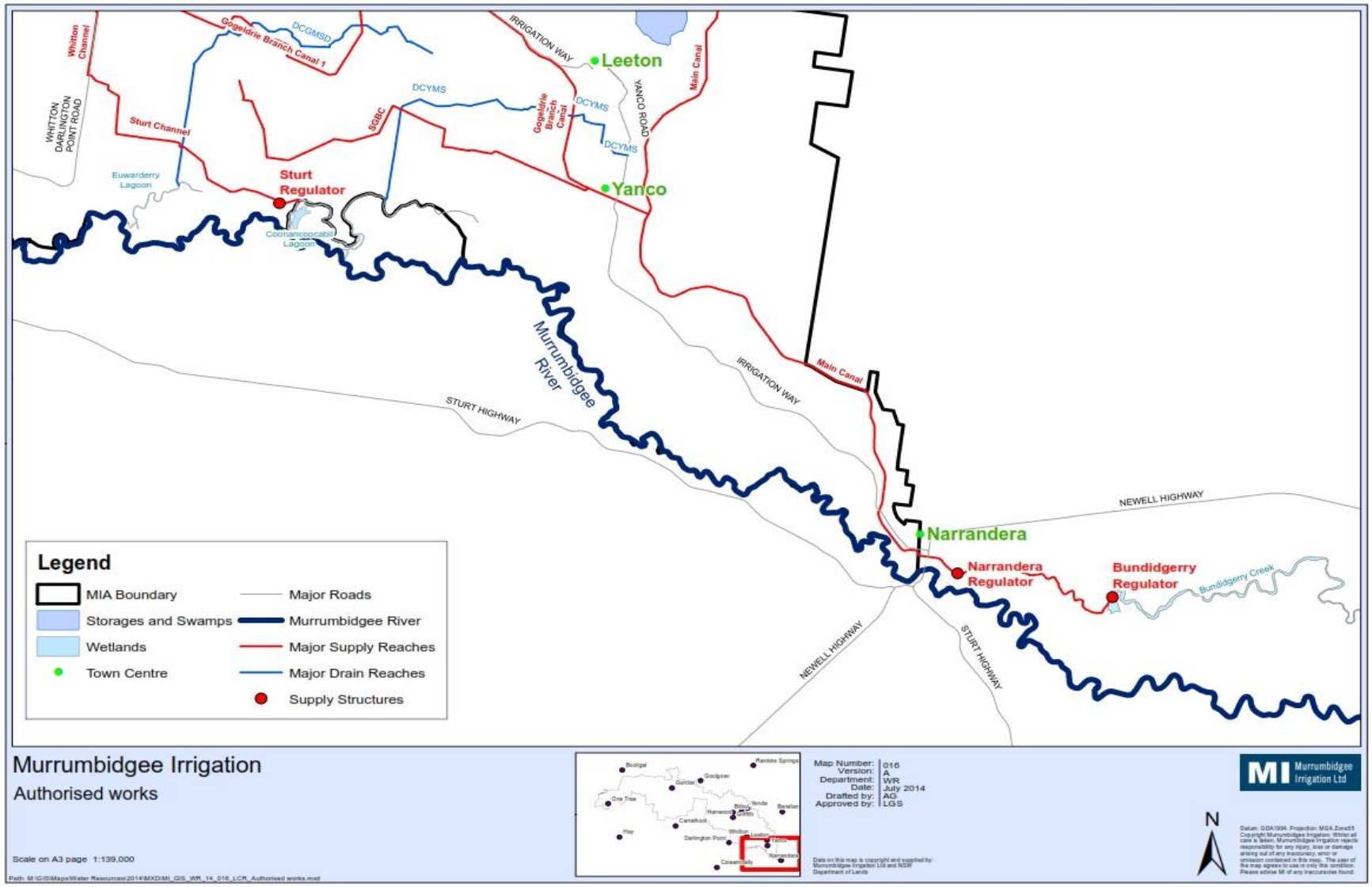


Figure 2 Location of authorised supply works

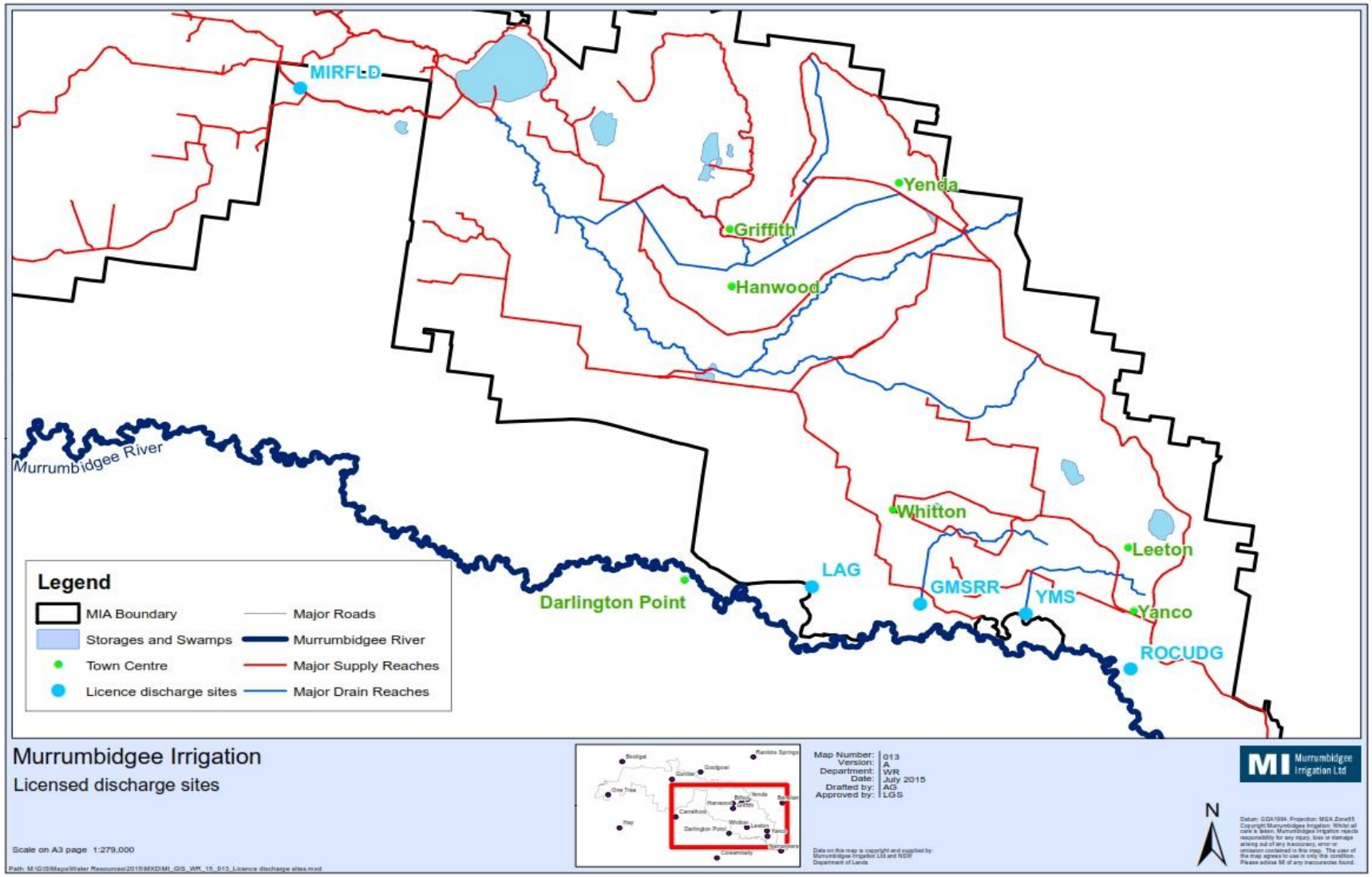


Figure 3 Licence monitoring and discharge points in the MIA

3 Reporting on Water Management

3.1 Climate conditions

The climatic data for the MIA is monitored at eight weather stations across the MIA (Figure 4). These weather stations measure rainfall and evapotranspiration (ETo) on a daily basis and are operated by MI and CSIRO.

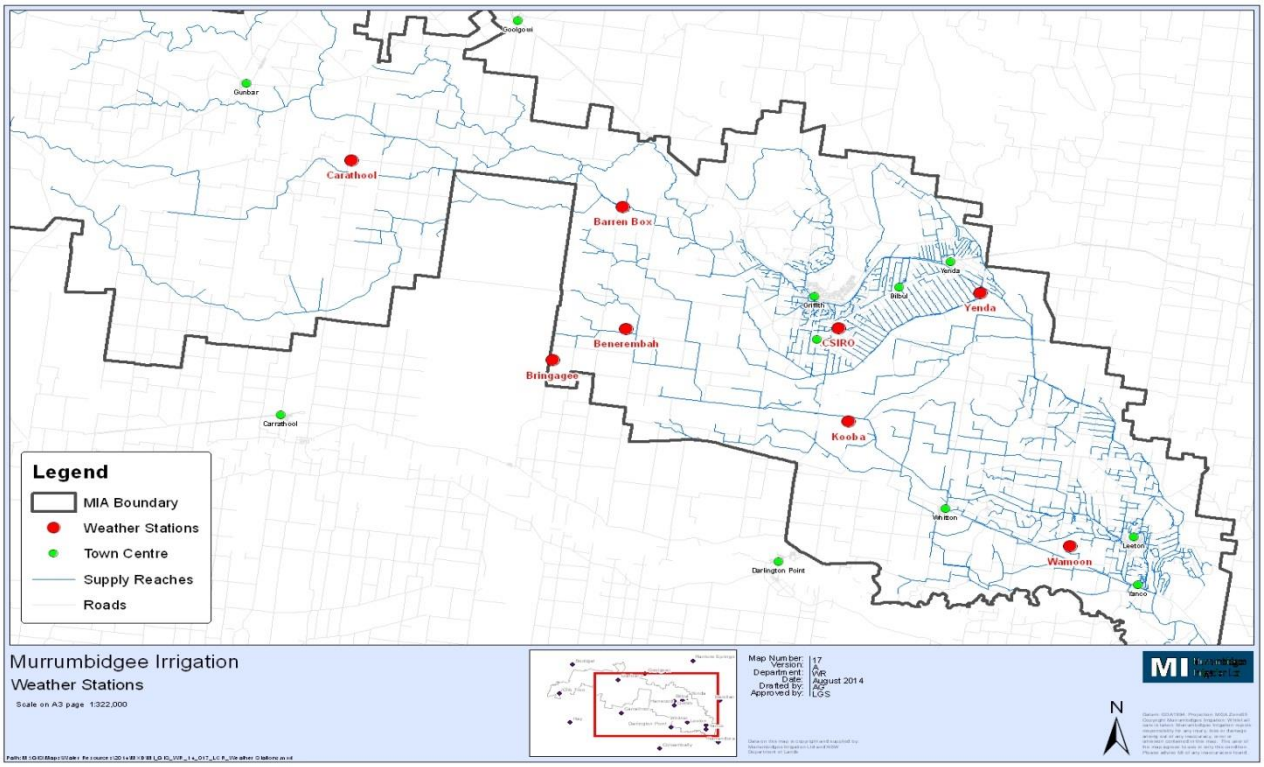


Figure 4 Location of weather monitoring stations in the MIA

Total Rainfall and ETo recorded at each weather station during 2015/16 is displayed in Table 2. Griffith recorded the highest rainfall (529 mm) and lowest ETo (1712 mm), whereas lowest rainfall (419 mm) and highest ETo (2085 mm) was recorded at Carathool.

Table 2 Annual rainfall (mm) and ETo (mm) total for MIA weather station districts for 2015/16

Weather Station	Total rainfall (mm)	Total ETo (mm)
Barren Box	445	1975
Benerembah	468	1860
Bringagee	451	2061
Carathool	419	2085
Kooba	443	1987
Wamoon	435	1986
Yenda	429	1778
Griffith (CSIRO)	529	1712

Weather data recorded at the Griffith weather station is displayed with Long Term Average (LTA 1962-2015) data in Figure 5. Above average rainfall was recorded in December and January, coinciding with peak ETo. May, June and July also experienced above average rainfall for 2015/16, and also the lowest ETo, as expected for this time of year. This would have resulted in higher water retention in the area. ETo for 2015/16 peaked in December, slightly earlier in the irrigation season when compared to historical LTA records.

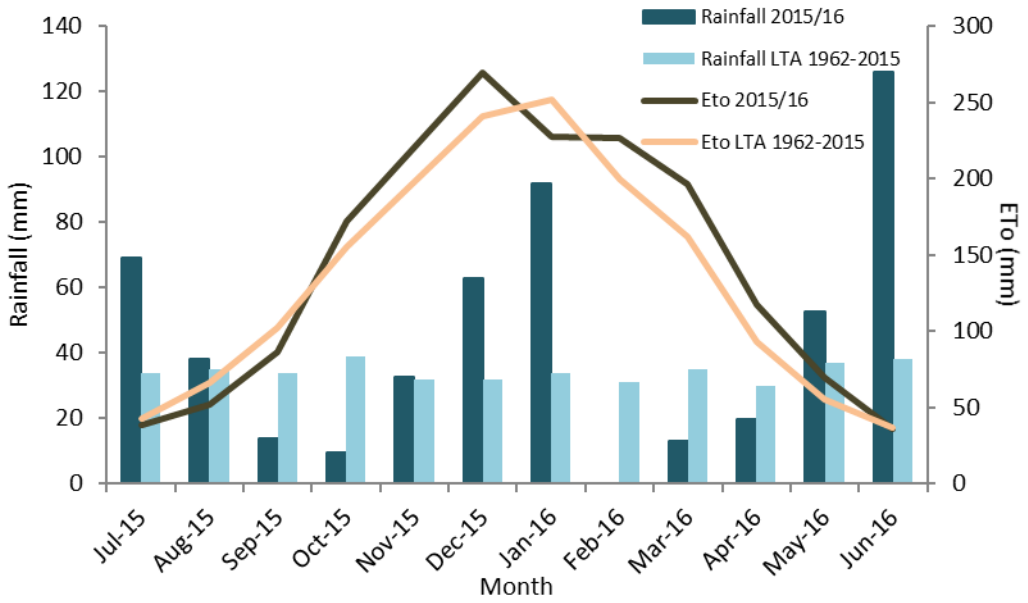


Figure 5 Rainfall (mm) and ETo (mm) for 2015/16 and LTA data recorded at Griffith weather station

Rainfall and ETo recorded at all other weather stations are shown in Figure 6, with comparison to 2014/15 figures. Total rainfall recorded at all weather stations was higher than the previous year, with an average 150mm increase recorded at each weather station. The MIA experienced high monthly rainfall throughout 2015/16 when compared to the previous year, with the exception of February when rainfall was significantly lower.

Peak ETo was recorded in December for 2015/16 and 2014/15. All ETo rates were consistently lower across the MIA when compared to the previous year. Weather variability causes irrigation requirements to change from year to year. The amount and timing of rainfall and ETo rates are the two main weather variables that determine irrigation requirements. Therefore, the higher rainfall and lower ETo experienced during 2015/16 is likely to have influenced all aspects of this report.

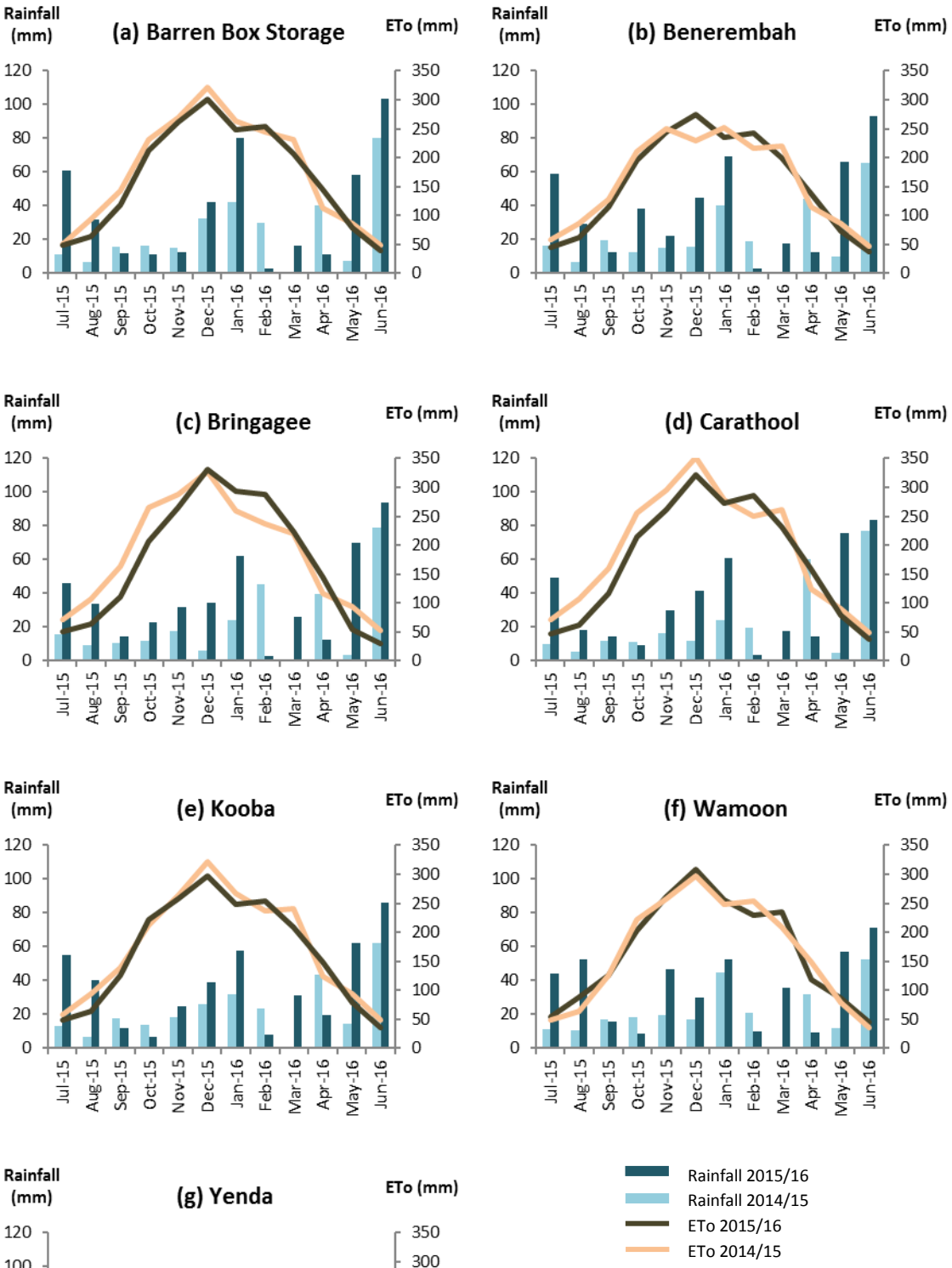


Figure 6 Rainfall (mm) and Evaporation (mm) at:
(a) Barren Box Storage
(b) Benerembah
(c) Bringagee
(d) Carathool
(e) Kooba
(f) Wamoon
(g) Yenda.

3.2 Calibration Report for Main Canal and Sturt Canal AFFRA Units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of the contract with MI to provide qualified hydrographic services in accordance with the conditions of Combined Approval 40CA403245.

Refer to Table 3 for the NARREG AFFRA calibration report and Table 4 for the STURT AFFRA calibration report.

Table 3 Main Canal at NARREG (410127) calibration report

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation (%)
18/08/2015	10:50	621	645	-3.71
18/08/2015	11:46	620	639	-2.97
19/10/2015	13:17	2,641	2,727	-3.51
13/01/2016	11:30	3,530	3,620	-2.47
13/04/2016	11:51	942	1,008	-6.55*

** Site was particularly windy, leading to deviation between measurement and recorded flow. A measurement was taken at the next available time during flow conditions and confirmed the measurement to be 5.0% and within acceptable deviation limits. Details of this measurement are available upon request and will be included in 2016/17 report.*

Table 4 Sturt Canal at STUR (410129) calibration report

Date	Time	Calibration Measurements: Q Measured discharge ML/day	AFFRA Sensor: Q Recorded mean ML/day	Deviation (%)
8/12/2015	15:42	829	849	-2.37
11/02/2016	13:38	952	953	-0.10
7/03/2016	16:07	732	747	-2.01
15/04/2016	14:20	220	145	51.52*
21/04/2016	11:37	92	88	4.55

**This measurement was affected by the wind, and has not been considered for comparison. A measurement was done the following week to confirm the flow was in an acceptable deviation range.*

3.3 Diversions and Water Allocation

A monthly summary of gross water diversions is presented in Table 5. These volumes represent gross diversions entering the supply system from MI's two authorised water supply Works at NARREG and STUR. It is important to note that the total diversion volume of 643,957 ML does not include an environmental water diversion volume of 2,977 ML.

Table 5 Monthly summaries of gross diversions (ML) at authorised supply works NARREG and STUR and total deliveries to customers (ML) for 2015/16

Month	STUR	NARREG	Total diversion	Deliveries to customers
Jul-15	2,210	778	2,988	2,988
Aug-15	5,343	17,997	23,340	15,285
Sep-15	8,107	22,513	30,620	24,126
Oct-15	32,890	78,054	110,944	93,050
Nov-15	16,399	61,029	77,428	60,027
Dec-15	21,758	83,934	105,692	91,528
Jan-16	21,487	79,972	101,459	84,202
Feb-16	18,033	60,838	78,871	64,463
Mar-16	9,891	46,064	55,955	44,425
Apr-16	4,876	28,446	33,322	24,005
May-16	45	8,902	8,947	6,185
Jun-16	50	14,341	14,391	15,994
Total	141,089	502,868	643,957	526,278

The irrigation demand at Wah Wah is primarily supplied from Barren Box Storage & Wetland (BBSW) and Mirrool Creek. During periods of peak demand Wah Wah is further supplemented by river water entering the system from NARREG and STUR then diverted to Wah Wah via the Mirrool Creek. Table 6 shows the adjusted volumes of water channelled through each of the main channel systems. Due to the reclamation and reuse of drainage water, the total amount of water channelled through each of these systems is greater than the total gross diversions shown in Table 5.

Table 6 Monthly Summary of adjusted diversions (ML) 2015/16

Month	Sturt Canal	Main Canal	Wah Wah
Jul-15	2,210	778	1,255
Aug-15	5,343	10,877	8,112
Sep-15	8,107	20,253	3,649
Oct-15	32,890	75,588	8,412
Nov-15	16,399	60,258	9,373
Dec-15	21,758	83,549	10,583
Jan-16	21,487	76,673	9,143
Feb-16	18,033	60,838	6,010
Mar-16	9,891	46,064	7,354
Apr-16	4,876	28,061	7,076
May-16	45	8,764	2,364
Jun-16	50	14,341	6,300
Total	141,089	486,044	79,631

Table 7 compares water allocations, diversions, total deliveries and climate data from the 2015/16 reporting year to previous years. Total diversions for 2015/16 do not include water diverted for environmental purposes and were the lowest since 2010/11 reporting year, which was also a low allocation year. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year. Above average rainfall was recorded for 2015/16,

however, it is likely that any effect on water supply demand will not be recognised until next reporting year since the majority of this rainfall was experienced in June. When low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. Flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

Table 7 Water allocation, total diversions and deliveries 2015/16 compared to previous years

Year	Announced Allocation (%) General / High	Total Diversions (ML)	Total Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2015/16	37/95	643,957	526,278	529	1712
2014/15	53/95	878,614	738,814	349	1,776
2013/14	63/95	832,758	699,308	440	1,860
2005/06	54/95	1,036,519	829,990	367	1,935

3.4 Environmental diversions

During the 2015/16 irrigation season, MI was required by the Office of Environment and Heritage (OEH) to divert water for scheduled Environmental Water Release (EWR) to five locations as shown in Table 8. A total of 1,857 ML was diverted, with the majority of water diverted in November.

Table 8 Environmental water diversions for 2015/16

Month	Gooragool Lagoon	Tuckerbill Swamp	Fivebough Swamp	Nericon Swamp	Campbell's Swamp
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0
Oct-15	0		25	0	0
Nov-15	541	370	175	138	206
Dec-15	0	0	0	102	0
Jan-16	0	0	0	0	200
Feb-16	0	0	0	0	0
Mar-16	0	0	0	0	0
Apr-16	0	0	0	0	0
May-16	0	0	100	0	0
Jun-16	0	0	0	0	0
Total	541	370	300	240	406

3.5 Water discharged from Area of Operations

Monthly discharge volumes for each discharge monitoring point listed under the Combined Approval are shown in Table 9. A total of 1,620 ML was discharged from MI's area of operations in 2015/16. Table 10 gives total discharge volumes from MI's Area of Operation compared to previous years. In 2015/16 the highest volume was discharged from LAG, however 541 ML was deliberately diverted for an EWR to Gooragool Lagoon on direction from OEH in November.

Table 9 Monthly water volumes (ML) discharged from Area of Operations

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-15	1.9	17.3	0	0	0
Aug-15	24.7	60.6	0	0	0
Sep-15	13.7	100.7	0	0	0
Oct-15	52.2	12.3	0	0	0
Nov-15 EWR	26.5 541	62.4	0	0	0
Dec-15	5.81	1.1	0	0	0
Jan-16	0	0	0	0	0
Feb-16	0	0	0	0	0
Mar-16	10.3	0	0	0.1	0
Apr-16	0.2	3.7	0	0	0
May-16	6	0	0	0.1	0
Jun-16	229.2	0	105.2	64.1	281.2
Total	911.5	258.1	105.2	64.3	281.2

The EWR should not be included when comparing the total volumes discharged in 2015/16 to previous years (Table 10). The total volume discharged in 2015/16 was higher when compared to 2014/15, due to the high rainfall received in May and June (Figure 6). During 2013/14, water was released through MI's discharge points to allow channels to be drained for maintenance works, causing a higher volume of water to be discharged. The increased efficiency of MI's drainage reuse system is exhibited in the reduction of discharge volumes from 2005/06.

Table 10 Total water volumes (ML) discharged from the MIA compared to previous years

Year	Total discharged (ML)
2015/16	1,079*
2014/15	671
2013/14	2,438
2005/06	8,570

** does not include EWR of 541.5 ML for LA*

3.6 Supply efficiency

Table 11 illustrates the simple efficiency of MI's supply system to be at 82% for 2015/16. The simple efficiency provides insight into how the supply system is managed under the season's climatic conditions, whilst balancing irrigation demand and minimising system losses. Operational efficiencies can be achieved through infrastructure upgrades and system rationalisation, as well as drainage reuse opportunities and management of water delivery. The water balance on page 15 of this report reconciles the losses and gains of the system and takes into account drainage reuse volumes for 2015/16. The increase in efficiency from 2005/06 when compared to the more current reporting years is attributed the completion of MI's drainage reuse system.

Table 11 Supply efficiency from 2015/16 and previous years

Year	Sturt Canal	Main Canal	Environment Diversions	NET TOTAL Irrigation Diversions	Deliveries (ML)	Conveyance (ML)	Simple Efficiency (%)
2015/16	141,089	505,845	2,977	643,957	526,278	117,679	82%
2014/15	219,272	661,814	2,472	878,614	738,814	139,800	84%
2013/14	213,806	620,138	1,186	832,758	699,308	133,450	84%
2005/06	233,388	805,277	2,146	1,036,519	829,990	206,529	80%

3.7 Storage levels

Storage flows shown in Table 12 to 14 include the initial balance of water held in these storages. These figures represent inflows and outflows from storages for 2015/16 to give insight into system flows. Volumes are calculated by using storage level measurements recorded at the end of each month.

3.7.1 Barren Box Storage and Wetland (BBSW)

In 2006, BBSW was transformed into an efficient water storage facility which returned water under the Water for Rivers program for use in the Snowy River system. Storage at this site comprises two cells:

- The Active Cell – storage capacity 24,500 ML
- The Intermediate Cell – storage capacity 4,500 ML

Table 12 Barren Box Storage flows (ML) for 2015/16

Month	Inflow	Outflow	Volume
Jul-15	6,020	830	20,598
Aug-15	9,173	4,970	25,179
Sep-15	5,110	2,275	27,284
Oct-15	6,514	6,287	24,958
Nov-15	3,231	6,555	19,326
Dec-15	3,710	7,910	13,148
Jan-16	5,465	4,790	11,729
Feb-16	2,905	2,745	8,442
Mar-16	2,480	3,242	6,089
Apr-16	470	1,850	4,005
May-16	3,763	350	6,943
Jun-16	18,818	200	26,162
Total	**67,659**	**42,004**	

3.7.2 Yenda Storage

The flows recorded for Yenda storage for 2015/16 are shown in Table 13. The Yenda Storage is primarily used to compensate for differences between customer orders and diversions from NARREG.

Table 13 Yenda Storage flows (ML) for 2015/16

Month	Inflow	Outflow	Volume
Jul-15	299	111	582
Aug-15	300	372	510
Sep-15	396	535	332
Oct-15	2,054	2,104	465
Nov-15	1,304	1,456	422
Dec-15	1,633	1,852	478
Jan-16	1,673	1,798	516
Feb-16	1,393	1,472	607
Mar-16	1,252	1,572	413
Apr-16	1,006	1,147	394
May-16	246	295	370
Jun-16	321	285	527
Total	**11,877**	**12,999**	

3.7.3 Bray's Dam Storage

Bray's Dam Storage has the operational ability to capture and redistribute drainage water from off-farm drainage and following rainfall. Water can also be pumped directly from Mirrool Creek and reused in the irrigation network. Table 14 show inflows and outflows at Bray's Dam for 2015/16.

Table 14 Bray's Dam Storage flows (ML) for 2015/16

Month	Inflow	Outflow	Balance
Jul-15	819	267	2,098
Aug-15	554	306	2,153
Sep-15	4	806	1,029
Oct-15	2,860	2,241	1,082
Nov-15	2,924	1,758	1,414
Dec-15	3,695	2,893	1,334
Jan-16	3,158	1,981	1,785
Feb-16	1,373	1,328	1,149
Mar-16	1,875	1,505	1,015
Apr-16	2,244	1,809	937
May-16	1,379	376	1,674
Jun-16	2,357	1,181	2,353
Total	**23,242**	**16,451**	

3.8 Drainage reuse

MI has continued to actively pursue recovery and reuse of water from its drainage system. Table 15 provides monthly information on drainage reuse volumes for each drainage site for 2015/16. Barren Box Storage to Outfall also includes 281 ML of water diverted to Mirrool Creek Floodway.

It should be noted that the water recovered at these sites may also include water that is diverted from our supply system during peak demand periods. As MI continues to operate its system more efficiently, some of the drainage sites are now used as connector channels between supply sites.

Table 15 **Monthly drainage reuse volumes (ML) 2015/16**

Drainage reuse site	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	**Total**
GMSD Pumps (Yanco esc + Stormwater)	24	104	157	319	399	333	608	331	411	191	221	445	3,543
YMSD	134	236	118	136	204	136	121	80	178	135	110	343	1,931
Collina Pump (N.B.C. Drainage + Stormwater)	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake Wyangan Pumps to L.V.B.C.	0	0	0	0	0	0	0	0	0	0	0	0	0
Brays Dam Storage to Benerembah Channel (BID Outlet)	0	0	0	0	0	0	0	0	0	0	0	766	766
Mirrool Creek Diversion to Benerembah (@ Brays)	317	151	1,510	3,709	2,527	3,277	1,778	1,656	2,253	1,573	559	3,321	22,631
Mirrool Creek Pumps to Benerembah Channel (BID Pumps)	0	0	0	65	20	0	0	0	0	0	0	0	85
Mirrool Creek to Wah Wah Main	310	3,112	1,374	2,125	2,818	1,460	4,503	3,210	4,112	5,226	2,014	5,610	35,874
Mirrool Creek & Barren Box Licensed Diverters	22	75	350	1,771	868	631	749	781	468	3	18	141	5,877
Barren Box Storage to Wah Wah Main @ B.B.S. Pumps	350	500	50	1,860	1,050	2,750	700	450	3,342	1,850	350	200	13,452
Barren Box Storage to Wah Wah Main @ Pipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren Box Storage to Outfall (includes Mirrool Creek Floodway releases)	480	4,470	2,225	4,427	5,505	5,160	4,090	2,295	0	0	0	0	28,652
Channel 13 Escape (Benerembah Drainage)	115	30	0	0	0	0	155	55	0	0	0	490	845
Sub Total	1,752	8,678	5,784	14,412	13,391	13,747	12,704	8,858	10,764	8,978	3,272	11,316	113,656
Less: First Use Water Diversions	0	7,120	2,260	2,466	771	385	3,299	0	0	385	138	0	16,824
Total Water Re-Used	1,752	1,558	3,524	11,946	12,620	13,362	9,405	8,858	10,764	8,593	3,134	11,316	96,832

3.9 Water balance

Table 16 shows the Annual Water Balance for MI's network. For the 2015/16 reporting year, the annual water balance has been refined to provide a clearer representation of system operations. These changes include more storage and additional drainage and water re-use information that include Yenda en-route storage and the Brays Dam complex. The amount of water captured and re-used through MI's drainage network is a major component of this Annual Water Balance. The drainage network was not operational in 2005/06 and therefore this year cannot provide a comparison to current years. The drainage network was completely operational in 2009/10 and has been chosen as this historic comparison year for this reporting requirement.

Total gross diversions for 2015/16 were used to generate water deliveries of 526,278 ML. The apparent conveyance was a total of 117,679 ML providing a simple efficiency of 82%. The total water captured and reused was 96,832 ML. Combined with the gross diversions of 643,957 ML, a corrected total system supply is therefore 740,789 ML, resulting in real conveyance being 214,511 ML and system efficiency of 71%.

A breakdown of the total water captured and re-used is provided for in Table 15. Water captured and re-used represents the additional water that was diverted to supplement total deliveries. This includes all water captured from surface drainage, rainfall runoff and all flows that have been re-diverted to the Wah Wah Irrigation district via Mirrool Creek. The total true losses have been assessed at 131,494 ML, leaving unaccounted losses at 83,017 ML of the total system losses.

Table 16 Annual Water Balance (ML) 2015/16

Factor	2009/10	2013/14	2014/15	2015/16
Climatic				
Rainfall (mm)	336	493	349	529
Evaporation (mm)	2,085	1,859	1,776	1,712
Type of Year (% dry)	75	35	55	26
Main gross data				
Gross diversions	505,176	832,758	878,614	643,957
Total deliveries	368,269	699,308	738,814	526,278
Conveyance	136,907	133,450	139,800	117,679
Simple efficiency (%)	73	84	84	82
Water captured and re-used	**52,570**	**134,651**	**128,482**	**96,832**
Corrected total system supply	557,746	967,409	1,007,096	740,789
Real conveyance value	189,477	268,101	268,282	214,511
Inevitable real losses				
Net storage	5,918	23,612	8,369	31,324
Change in storage volume	1,442	7,224	-3,395	13,421
Storage loss	**4,476**	**16,388**	**11,764**	**17,903**
Seepage from channels	21,000	20,700	21,000	20,500
Evaporation from channels	24,000	19,750	22,000	18,200
Unauthorised use/theft	10,000	10,000	5,000	10,526
System fill	18,000	18,000	18,000	18,000
Subtotal	**84,836**	**115,674**	**82,738**	**129,874**
System flow losses				
Drainage volume to river	598	2,438	671	1,339
Floodway releases	0	0	0	281
Subtotal	598	2,438	671	1,620
Total true losses	85,434	118,112	83,409	131,494
Unaccounted losses	104,043	149,989	193,671	83,017
Total system losses	189,477	268,101	268,282	214,511
System efficiency (%)	**66%**	**72%**	**73%**	**71%**

Water Use

3.10 Crop statistics

For each water order customers are required to nominate their water use to a particular crop or purpose. This data is not validated at the farm level and is therefore an estimate only. This data is used to report the total area, water deliveries and crop water use for 2015/16 which are presented in Table 17. It is important to note the water use data presented for the total area of crop are also influenced by rainfall, ETo and irrigation practices, which are not considered in these figures.

Table 17 Summary of reported deliveries (ML) and areas (ha) for the major crop groupings during 2015/16

Crop	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML /ha)
Citrus	7,865	35,582	4.5
Cotton	12,647	79,812	6.3
Industrial	27	5,812	-
Other crops	525	21,853	-
Other fruits	4,229	27,889	6.6
Plantation	2,857	877	0.3
Rice	12,265	136,805	11.2
Stock & domestic	268	14,247	-
Summer cereals	1,587	7,179	4.5
Summer oilseeds	503	2,512	5.0
Summer pasture	1,612	7,938	4.9
Town supply	5	11,773	-
Vegetables	1,667	10,011	6.0
Vines	18,631	65,318	3.5
Winter cereals	44,755	82,500	1.8
Winter oilseeds	2,350	4,660	2.0
Winter pasture	4,262	11,511	2.7
Total	116,053	526,278	

A comparison of crop water use for 2015/16 with previous years is presented in Table 18 and illustrated in Figure 7. Although winter cereals were the dominant crop type grown in the MIA, rice accounted for the highest portion of total water delivered per crop type (26%) due to its higher irrigation requirement. This is shown in Figure 7, which also highlights the rise in total water delivered for cotton compared to 2014/15.

Table 18 Total deliveries (ML) to major crop types in the MIA for 2015/16

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines + Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial	Cotton
2015/16	136,805	19,449	96,851	10,011	128,789	22,729	31,832	79,812
2014/15	255,384	32,206	171,645	12,216	149,045	20,547	28,295	60,678
2013/14	237,957	27,454	165,149	18,060	138,427	14,347	24,588	73,326
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

***Note**: Cotton was considered as 'other crops and plantations' before 2011/12*

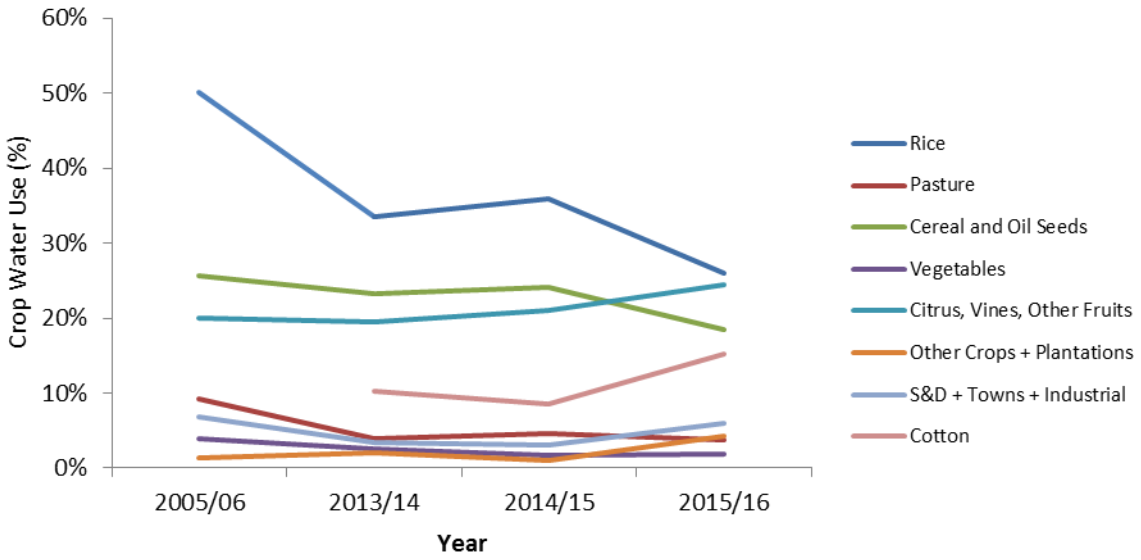


Figure 7 Crops water use (%) for total water deliveries from 2005/06, 2013/14, 2014/15 and 2015/16

3.11 Irrigation intensity

Irrigation intensity is displayed in Figure 8 by water use (ML/ha) at a property level. This map identifies locations of landholdings using between 0 and 4 ML/ha, 4 and 4.1-8 ML/ha and above 8.1 ML/ha.

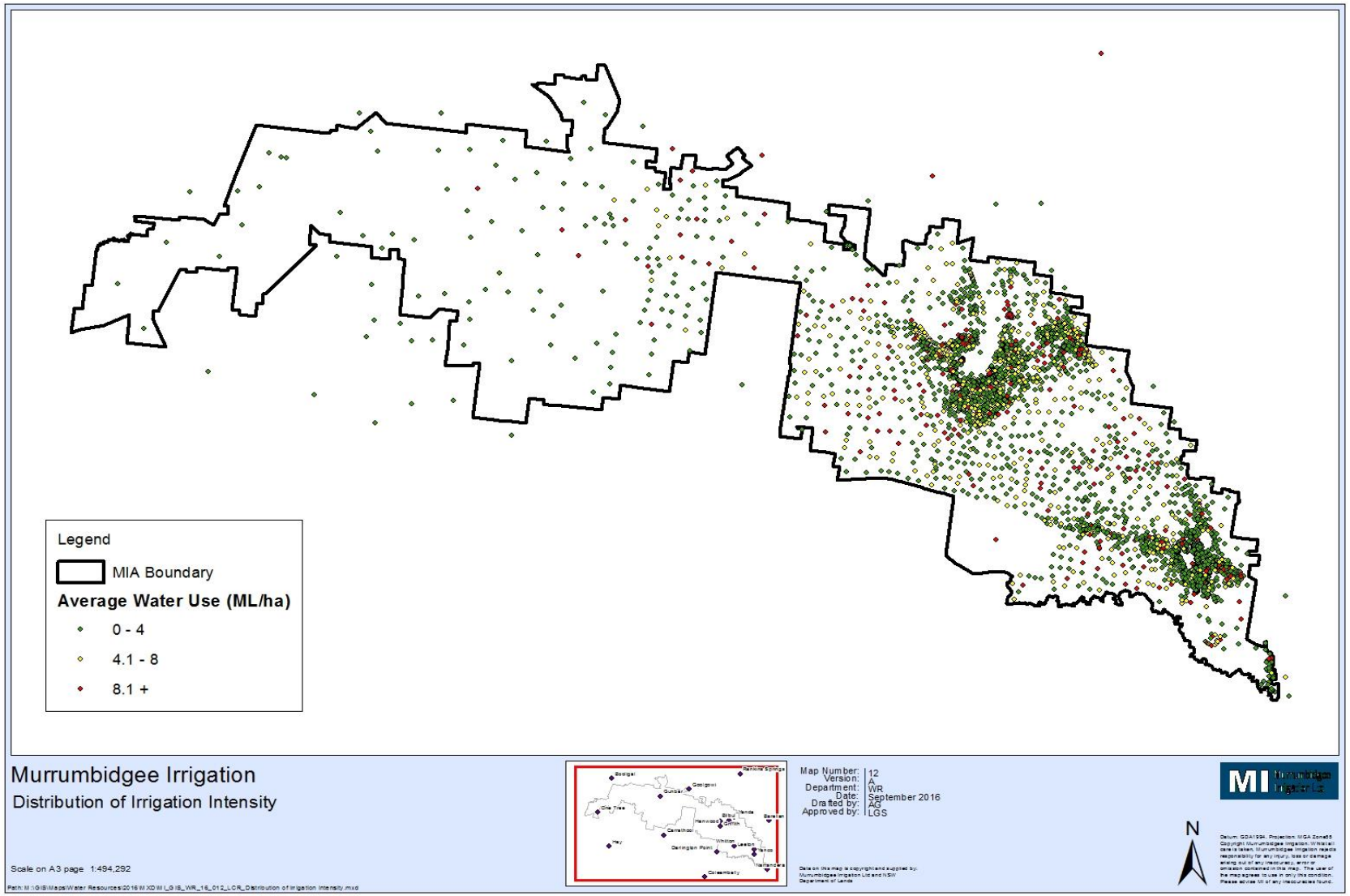


Figure 8 Distribution of irrigation intensity across the MIA

4 Salinity and salt load

4.1 Extracted salt-load

The salt load for NARREG and STUR are calculated using flow data reported by Ventia and salinity data from DPI Water monitoring site 410001, which is the closest monitoring point on the Murrumbidgee River to MI's offtakes. Monthly mean salinity values from site 410001 were used for salt load calculations for both NARREG and STUR. The mean EC values and extracted salt loads are presented in Table 19.

Table 19 Total extracted salt load for 2015/16

Month	Site 410001 mean EC (µS/cm)	STUR (t)	NARREG (t)	Total salt load extracted
Jul-15	225	318	112	430
Aug-15	206	704	2,373	3,077
Sep-15	220	1,141	3,170	4,311
Oct-15	101	2,126	5,045	7,171
Nov-15	149	1,564	5,820	7,384
Dec-15	88	1,225	4,727	5,953
Jan-16	92	1,265	4,709	5,974
Feb-16	101	1,166	3,933	5,098
Mar-16	150	950	4,422	5,372
Apr-16	150	468	2,731	3,199
May-16	153	4	872	876
Jun-16	200	6	1,845	1,851
Total		10,939	39,758	50,696

During 2015/16, an estimated 50,696 tonnes of salt entered the MIA from the Murrumbidgee River. The salt load entering the MIA from supply works is lower compared to 2014/15 (Table 20). The amount of salt is relative to the volume of water diverted from the river, which is represented by the strong relationship exhibited between total diversions and salt loads in Figure 9.

Table 20 Extracted salt-load (t) for 2015/16 compared to previous years

Year	Diversions (ML)	Extracted salt load		
		STUR	NARREG	Total
2015/16	643,957	10,939	39,758	50,696
2014/15	878,614	14,587	44,270	58,858
2013/14	832,758	13,905	38,271	52,177
2007/08	393,973	1,778	26,816	28,594

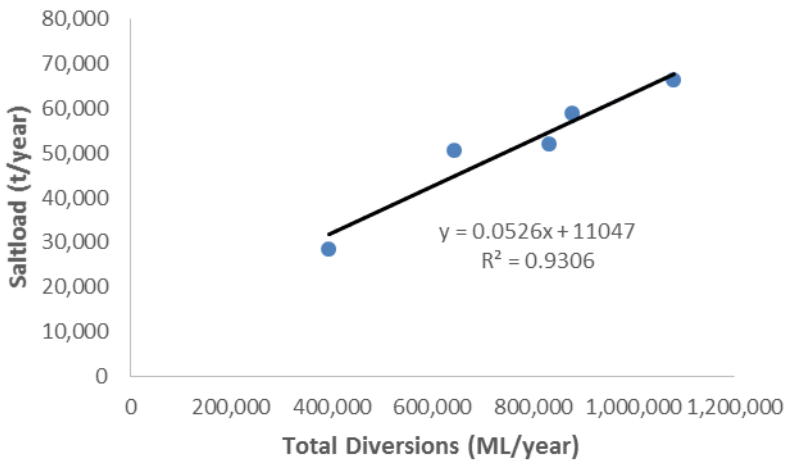


Figure 9 The relationship between salt load (t/year) and total diversions (ML/year)

4.2 Discharged salt load

There are four river drain sites and one floodway site that are licensed to discharge water out of MI's area of operation. The locations of these sites are shown in Figure 3 of this report. Flow, electrical conductivity (EC) and salt load data for these sites are presented in Table 22 with previous year comparison presented in Table 21.

An estimated 201 tonnes was discharged from MI's Area of Operation in 2015/16, which was higher compared to the amount recorded last year, corresponding to the volume of water discharged. The majority of salt discharged from the MIA in 2015/16 was from site LAG, however 541.2ML was diverted for environmental water, carrying a salt load of 70 tonne. In 2005/06 MI's drainage reuse system was not complete, which explains the high volumes and subsequent salt load discharged during that year.

Table 21 Discharged salt load for 2015/16 compared to previous years

Year	Water discharged (ML)	Discharged Salt load (t)
2015/16	1,620	201
2014/15	675	96
2013/14	2,438	242
2005/06	8,570	1,887

Table 22 Flow, EC values and salt loads for EPL sites 2015/16

Month	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)
Yanco Main Southern Escape (YMS) 410083						**Gooragool Lagoon Escape (LAG) 41010940**				
Jul-15	0	-	-	-	0	1.9	319	176	413	0.4
Aug-15	0	-	-	-	0	24.7	419	69	773	6.6
Sep-15	0	-	-	-	0	13.7	*	*	*	1.3
Oct-15	0	-	-	-	0	52.2	330	191	830	11.0
Nov-15	0	-	-	-	0	567.5	204	56	373	74.0
Dec-15	0	-	-	-	0	5.81	*	*	*	0.6
Jan-16	0	-	-	-	0	0	-	-	-	0
Feb-16	0	-	-	-	0	0	-	-	-	0
Mar-16	0	-	-	-	0	10.3	*	*	*	0.1[1]
Apr-16	0	-	-	-	0	0.2	**	**	**	0.02[1]
May-16	0	-	-	-	0	6.0	**	**	**	0.6[1]
Jun-16	105.2	**	**	**	10.1[1]	229.2	**	**	**	22[1]
Total	**105.2**				**10.1**	**911.5**	*541ML diverted for EWR in November*			**117**
Gogeldrie Main Southern Escape (GMSRR) 41010921						**Cudgel Creek Escape (ROCUDG) 41010005**				
Jul-15	0	-	-	-	0	17.3	95	84	108	1.1
Aug-15	0	-	-	-	0	60.6	104	89	150	4.0
Sep-15	0	-	-	-	0	100.7	146	125	203	9.4
Oct-15	0	-	-	-	0	12.3	*	*	*	1.2[1]
Nov-15	0	-	-	-	0	62.4	145	90	190	5.8
Dec-15	0	-	-	-	0	1.1	*	*	*	0.1[1]
Jan-16	0	-	-	-	0	0	-	-	-	0
Feb-16	0	-	-	-	0	0	-	-	-	0
Mar-16	0.1	*	*	*	0.01[1]	0	-	-	-	0
Apr-16	0	-	-	-	0	3.7	*	*	*	0.4[1]
May-16	0.1	*	*	*	0.01[1]	0	-	-	-	0
Jun-16	64.1	*	*	*	6.15[1]	0	-	-	-	0
Total	**64.3**				**6.17**	**258.1**				**20**
Mirrool Creek Floodway (MIRFLD) 41010163						* Probe out of water ** Equip malfunction				
Total	**281.2**	**264.1**	one EC reading during flow		**47.5**	[1] Salt load determined using discharge average of 150 µS/cm				

4.3 Salt balance

The basic salt balance presented in Table 23 suggests that of the 50,696 tonnes of salt received through diversions recorded at MI's authorised supply works, 201 tonnes was discharged back to the river, leaving an estimated balance of 50,495 tonnes of salt retained within the MIA. It is important to note that this is a simple salt balance that considers salt loads entering and leaving the MIA via extraction and discharge points only and does not account for salinity losses to shallow groundwater tables or takes into account other factors that impact total salt loads in the MIA.

Table 23 Salt balance for 2015/15 (t)

Extracted	**Salt load (t)**
STUR	10,939
NARREG	39,758
Total extracted	**50,696**
Discharged	**Salt load (t)**
YMS	10.1
GMSRR	6.2
LAG	117
ROCUDG	20
MIRFLD	48
Total discharged	**201**
Balance	**50,495**

4.4 Salinity targets

As set out in our Network Service Plan (pg.7, *2.4 Water Quality)* MI endeavours to maintain Electrical Conductivity (EC) levels below 700 µS/cm for water diverted to Wah Wah customers, downstream of BBSW. This salinity target was achieved during 2015/16 sites monitored at and downstream of BBSW.

5 Groundwater conditions

5.1 Groundwater Monitoring and Reporting

A total of 641 piezometers are listed in Schedule 2 of the Combined Approval and the locations of these bores are displayed in Figure 10. A current listing and condition of each of piezometer is provided in Appendix 1. In 2015/16, 578 piezometers returned a reading, which equates to 92.5% of the total piezometer network listed in Schedule 1.

Table 24 Groundwater piezometer status summary

Total bores	Total destroyed	Total dry	Total read	Total unable to read
641	35	14	593	48

Groundwater levels and EC are measured in September to give insight into groundwater levels prior to the irrigation season and again in March to identify regional groundwater trends. The network consists of piezometers in the Shallow and deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

Depth to water table maps have been developed to report changes in groundwater levels from September to March for 2015/16, 2013/14, 2012/13, and 2005/2006. The historical year 2005/06 was chosen as this was the peak of the drought for the MIA. EC maps have also been developed to report changes in groundwater salinity from September to March for 2015/16, 2014/15, 2013/14 and for September only in 2002 and 1980. Due to the limited data sets from 2005/06, data from 2002 and 1980 was chosen to represent suitable comparisons for salinity changes from a historical perspective.

In consultation with DPI Water, an alternative presentation format for requirement 1 of Attachment 2 of the Combined Approval was agreed upon to better represent the water table depth data for the rationalised bore network for 2015/16. It was also agreed that due to accuracy limitations for calculating groundwater depth areas, requirement 3 and 4 would be removed from the 2015/16 reporting requirement. A copy of this consent from DPI Water is available upon request.

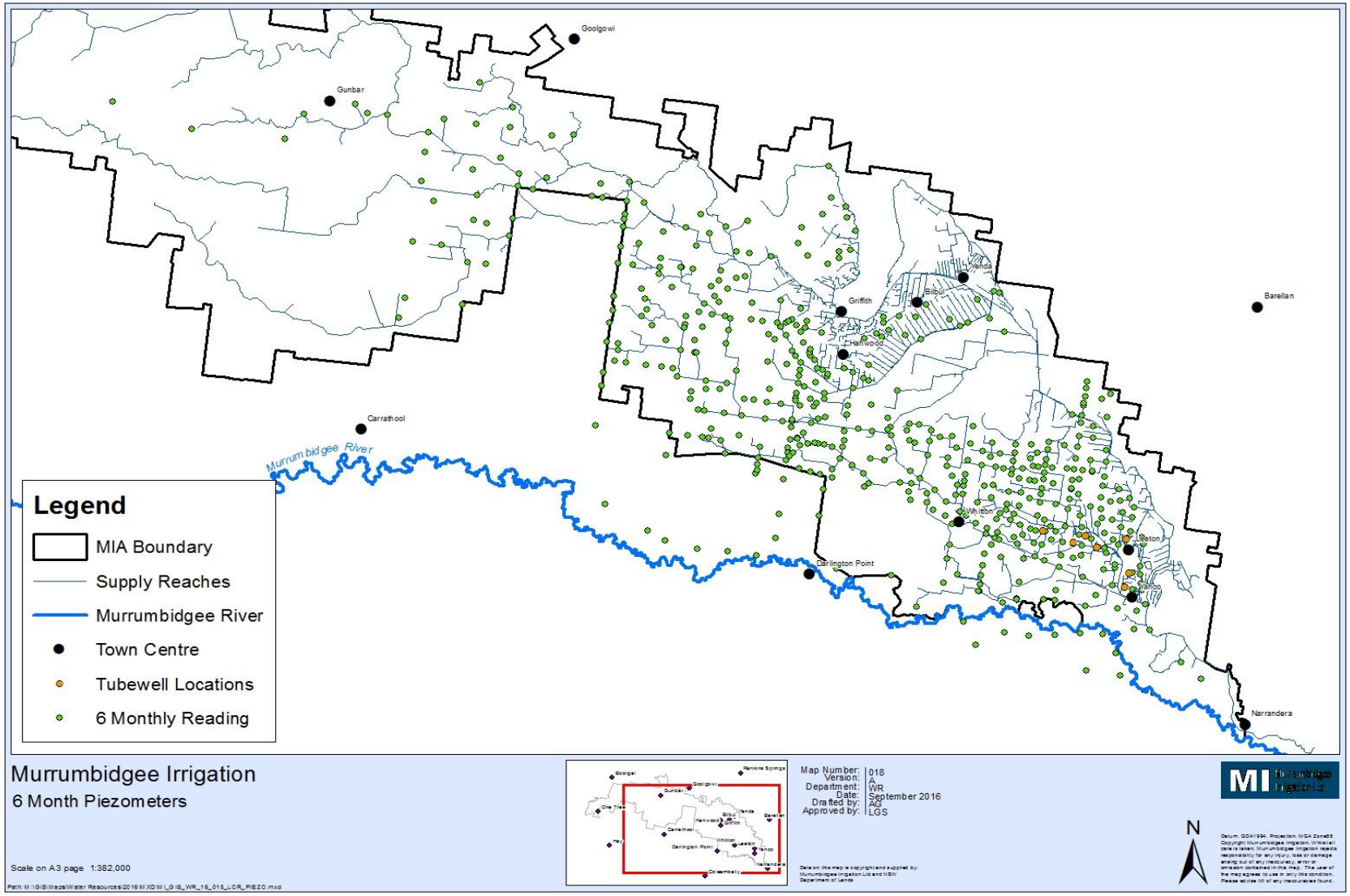


Figure 10 Location of piezometers and tubewells in the MIA 2015/16

5.2 Shallow Shepparton Formation

5.2.1 Groundwater levels

Depth to water table maps for the shallow Shepparton Formation are presented in reporting years in Figures 11 to 18. Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall and in part, irrigation. Due to on farm water use efficiencies and changes in land management practices, the impact on groundwater from irrigation is likely to be minimal. The maps for the shallow Shepparton from September to March for each reporting year show an increase in groundwater levels, driven by season rainfall and irrigation. The presentation format for 2015/16 provides a clear view of the change in groundwater levels and the marginal rise in localised areas from September to March. This rise coincides with the high rainfall recorded in December and January and peak irrigation season.

When compared to recent years, 2005/06 groundwater levels (Figure 17 and 18) in the shallow Shepparton Formation appear to be consistently deeper across the MIA, with only small areas with groundwater 1-3m below surface level. This is likely a result of reduced recharge from rainfall and increased groundwater pumping in response to drought conditions in 2005/06.

2015/16

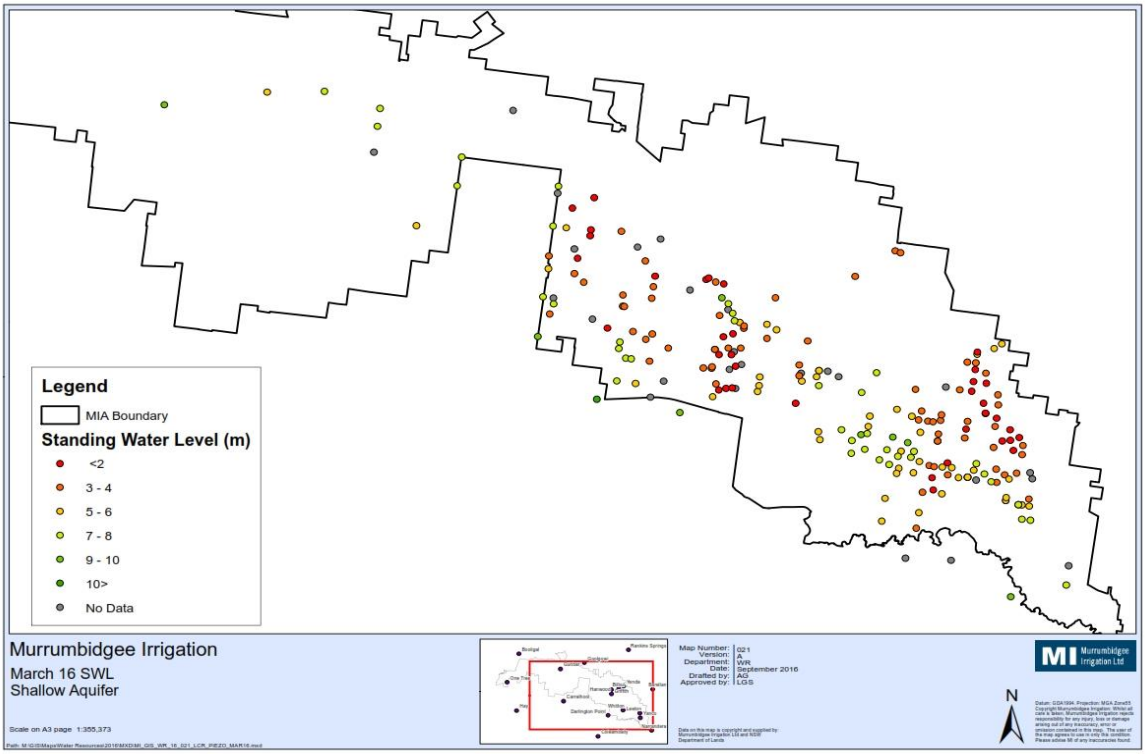


Figure 11 Depth (m) to water table in the Shallow Shepparton Formation, March 2016

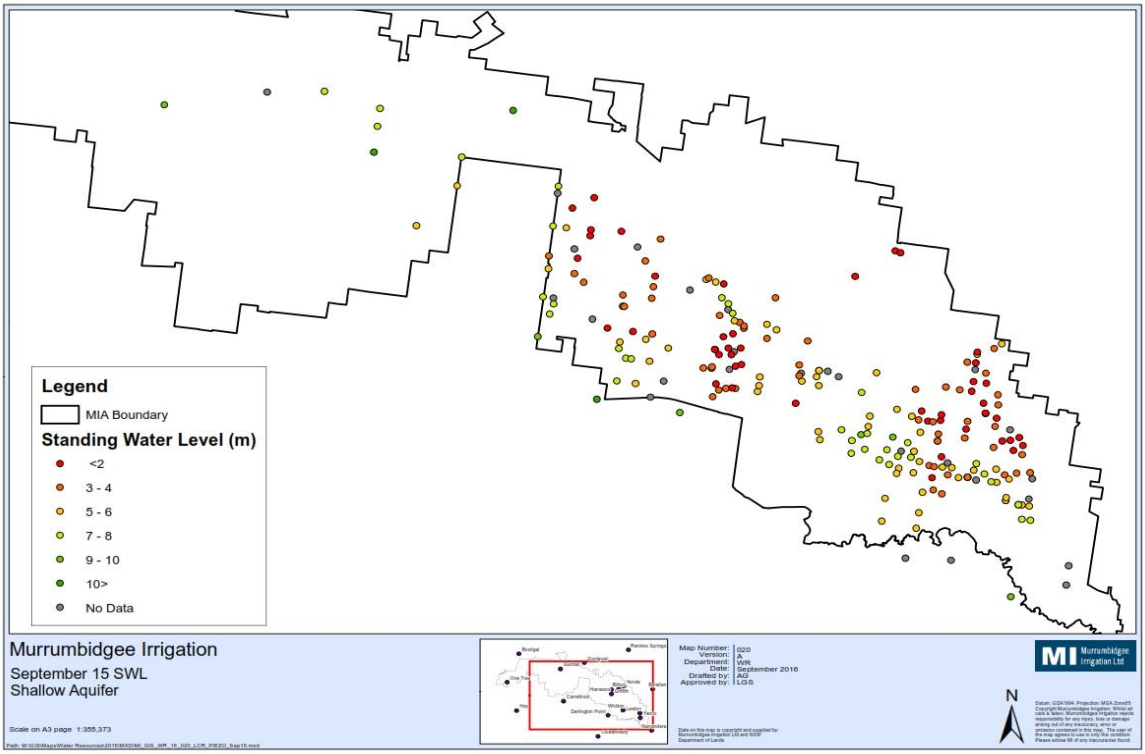


Figure 12 Depth (m) to water table in the Shallow Shepparton Formation, September 2015

2014/15

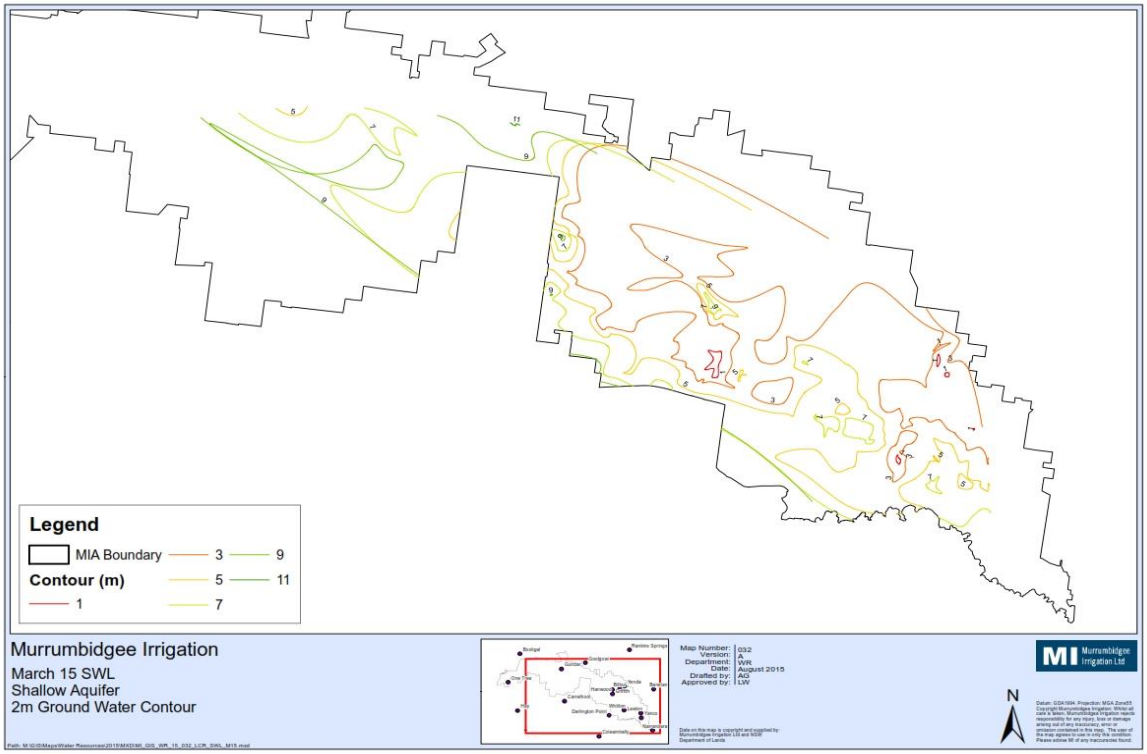


Figure 13 Depth (m) to water table in the Shallow Shepparton Formation, March 2015

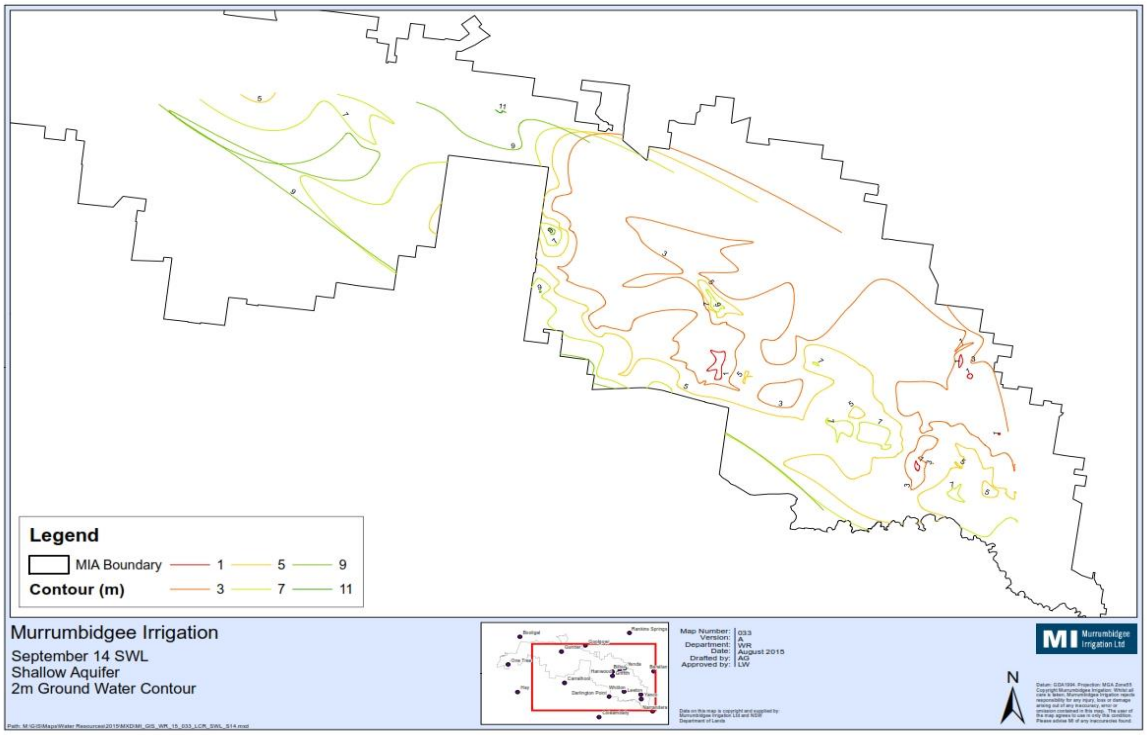


Figure 14 Depth (m) to water table in the Shallow Shepparton Formation, September 2014

2013/14

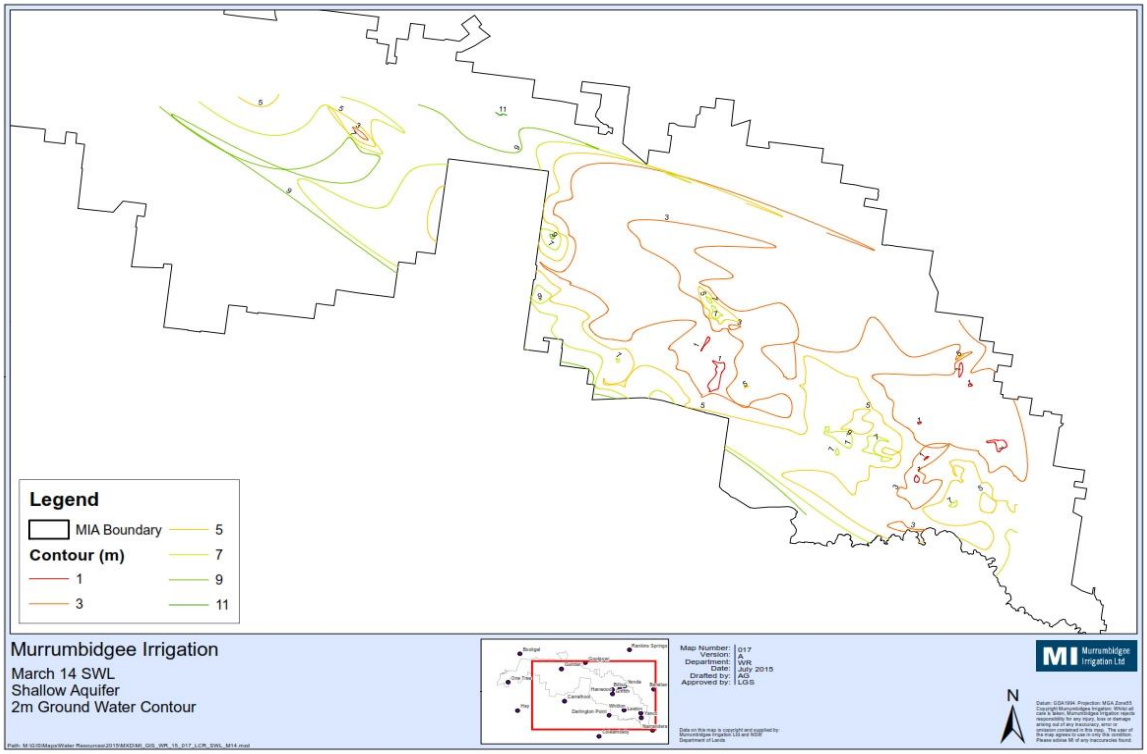


Figure 15 Depth (m) to water table in the Shallow Shepparton Formation, March 2014

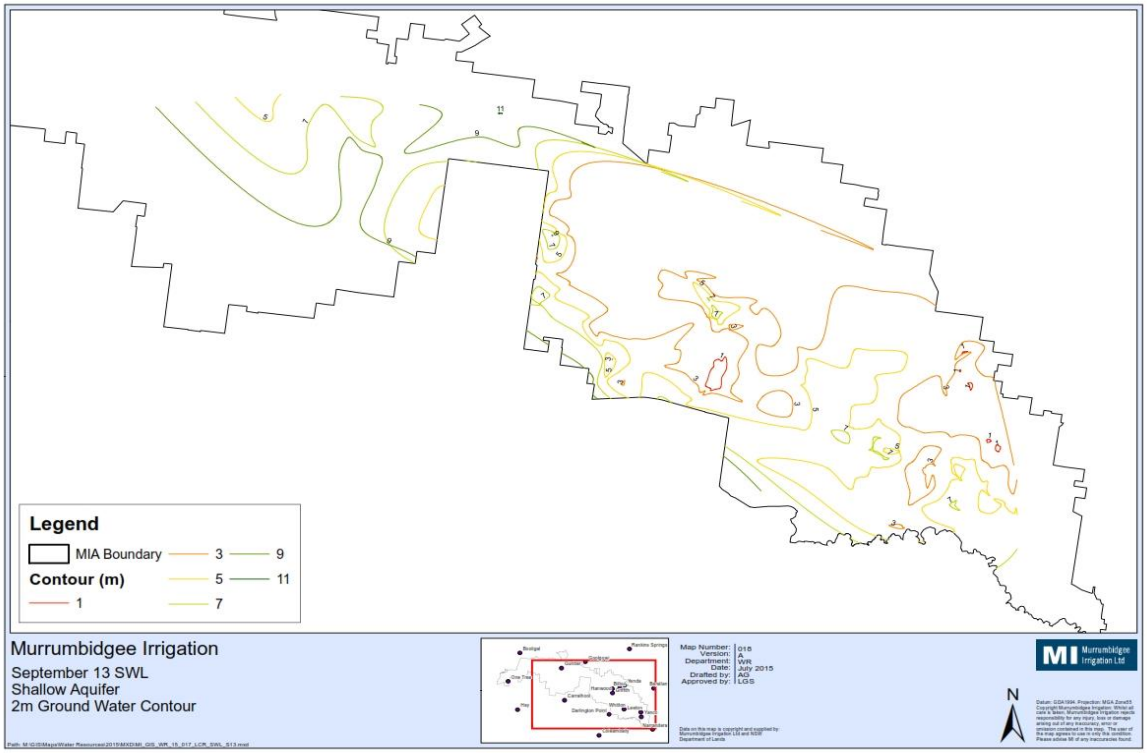


Figure 16 Depth (m) to water table in the Shallow Shepparton Formation, September 2013

2005/06

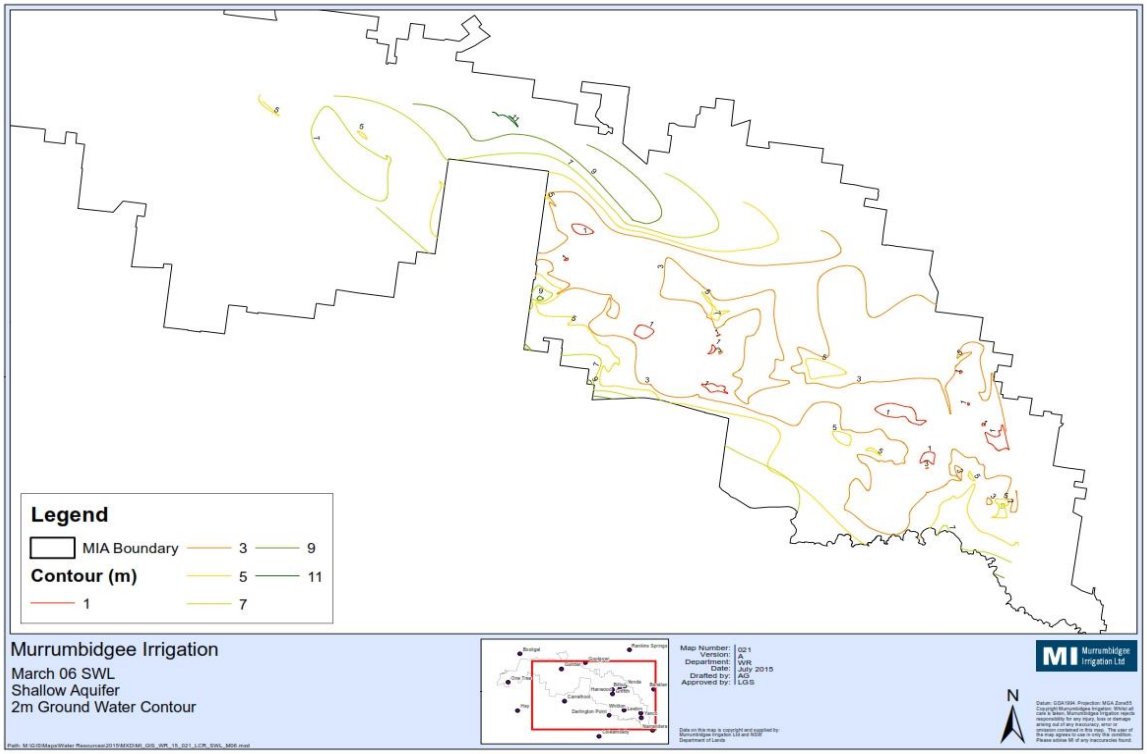


Figure 17 Depth (m) to water table in the Shallow Shepparton Formation, March 2006

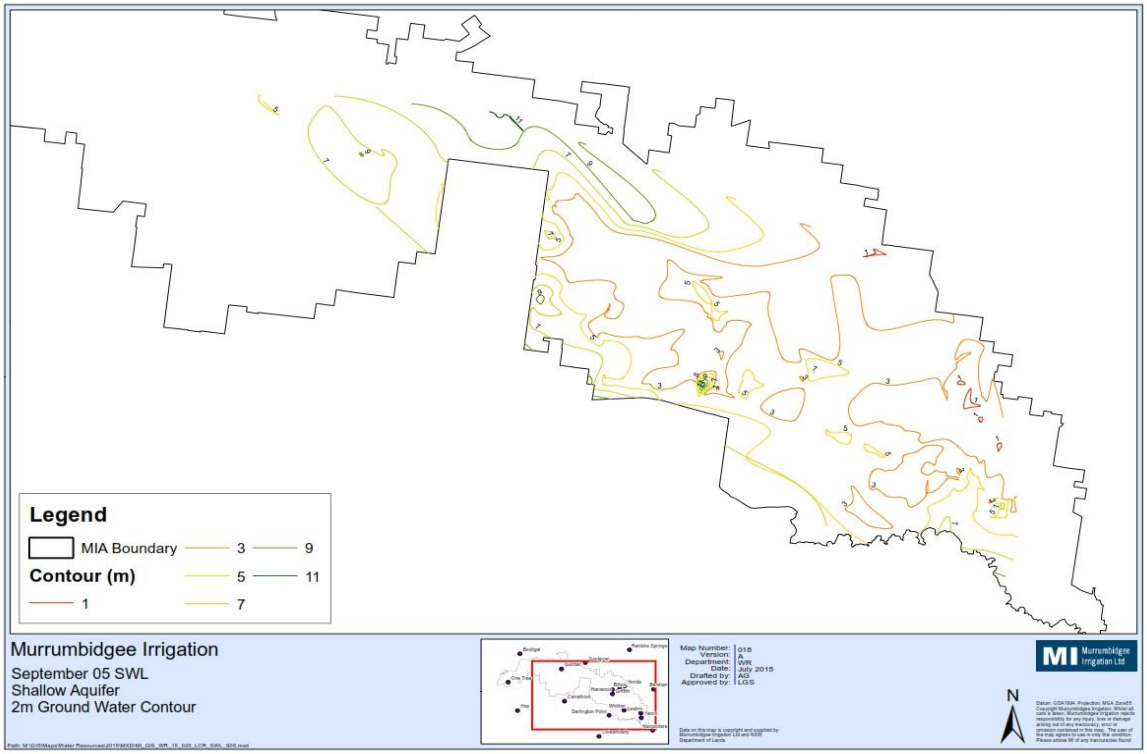


Figure 18 Depth (m) to water table in the Shallow Shepparton Formation, September 2005

5.2.2 Groundwater salinity

Groundwater salinity interval areas (ha) for September are shown in Table 27 with figures presenting a positive trend in groundwater quality. In reference to both historical years, the area of groundwater with high salinity has decreased and the area of lower salinity has increased. This shift in groundwater salinity may be a result of the fresh water recharge generated by rainfall events.

General salinity changes in the Shallow Shepparton Formation (Figure 19-26) from September to March for each reporting year show decreases in EC values across the MIA. These areas of reduced salinity correlate with an increase in groundwater levels, highlighting potential recharge areas from irrigation and rainfall.

Table 25 Groundwater salinity area (ha) for the shallow Shepparton formation, using September data

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)
2015/16	230,527	118,258	19785	3322	98	0	0
2014/15	218,000	149,000	6,000	0	0	0	0
2013/14	167,000	144,700	14,000	4,000	0	0	0
2002	85,600	210,000	74,500	6,057	550	60	
1980	41,000	160,000	121,000	16,500	1,150	450	N/A

NB. Figures are estimations only which have been generated using a GIS tool and provides limited accuracy.

Figure 25 and 26 present groundwater EC for September 2002 and 1980, both of which show larger areas of higher EC when compared to September EC values recorded in recent years (Figure 19-24). This indicates that groundwater quality has improved across the MIA.

Salinity readings in close proximity to the Murrumbidgee River are consistently low in EC for historical and recent reporting years, suggesting there is a significant source of recharge from the Murrumbidgee River.

2015/16

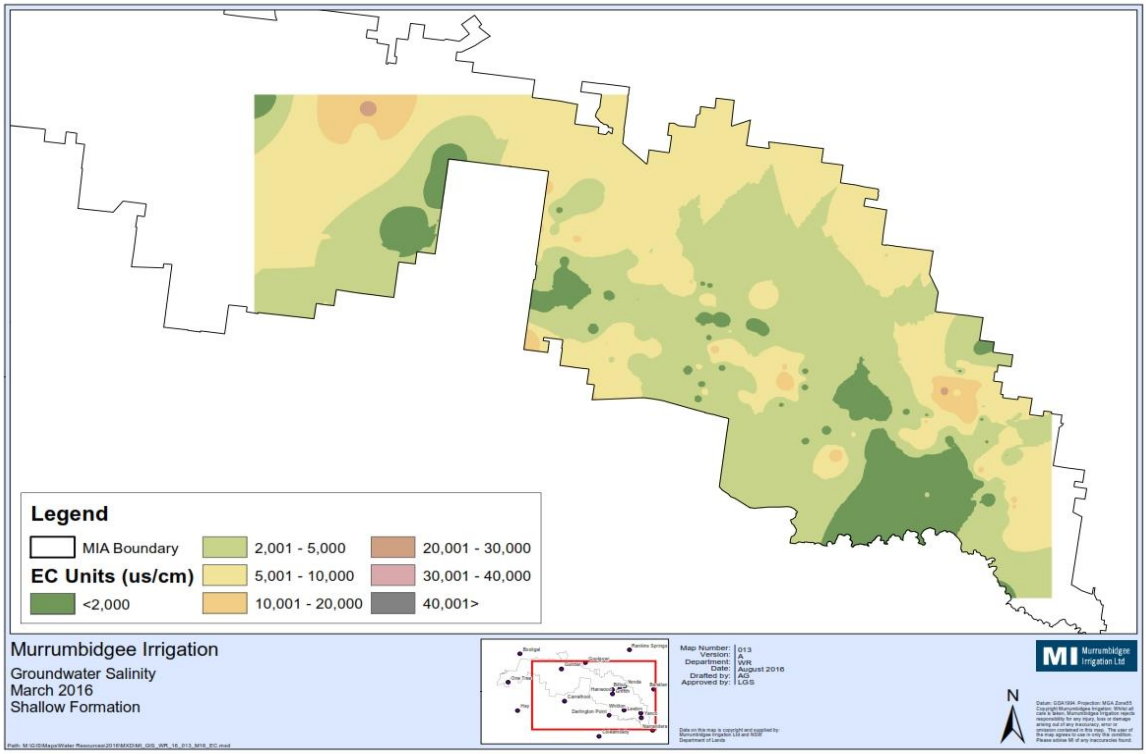


Figure 19 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, March 2016

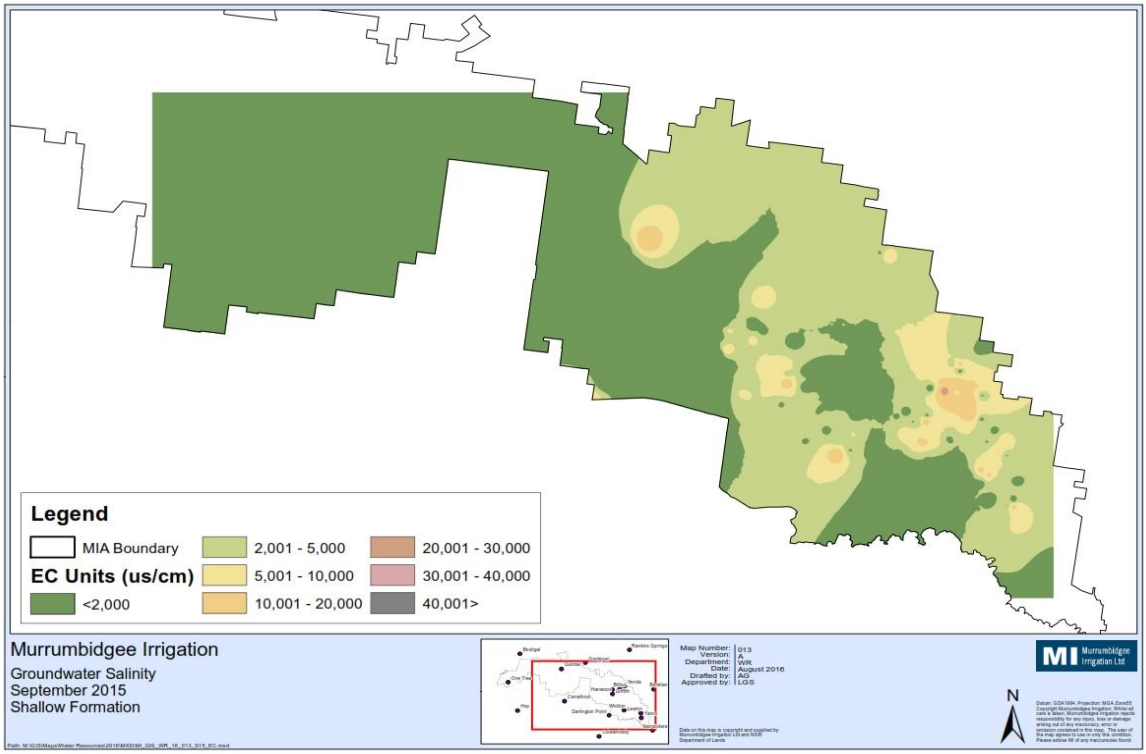


Figure 20 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2015

2014/15

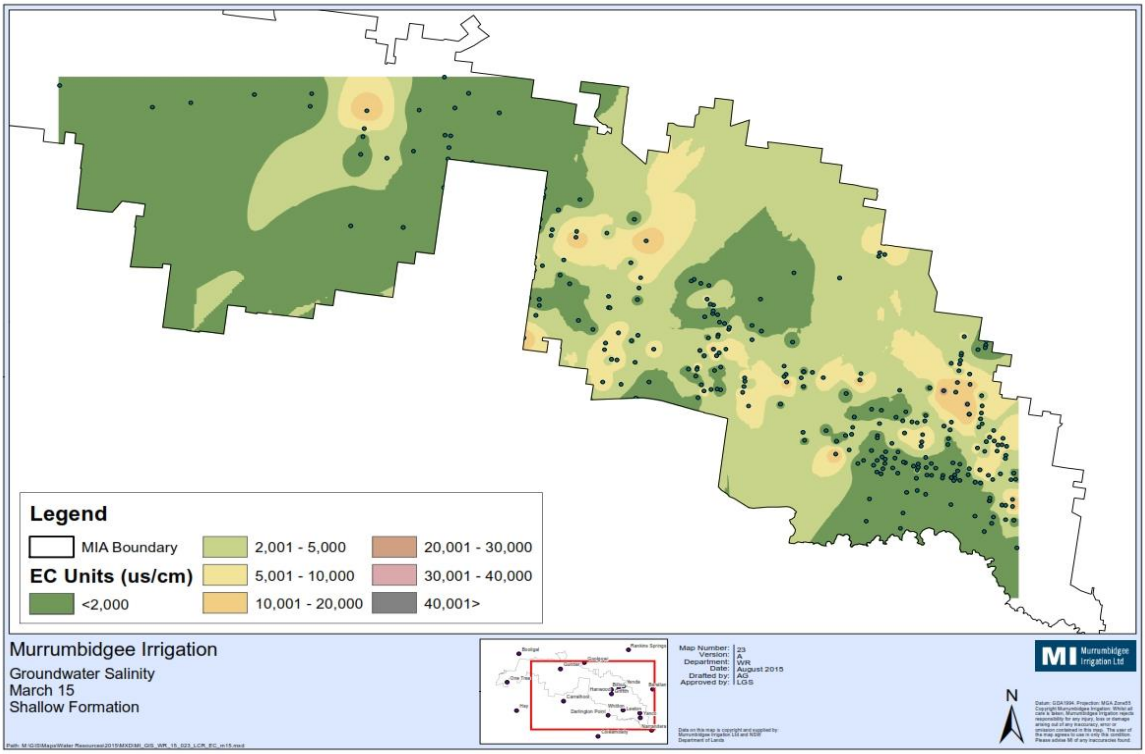


Figure 21 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, March 2015

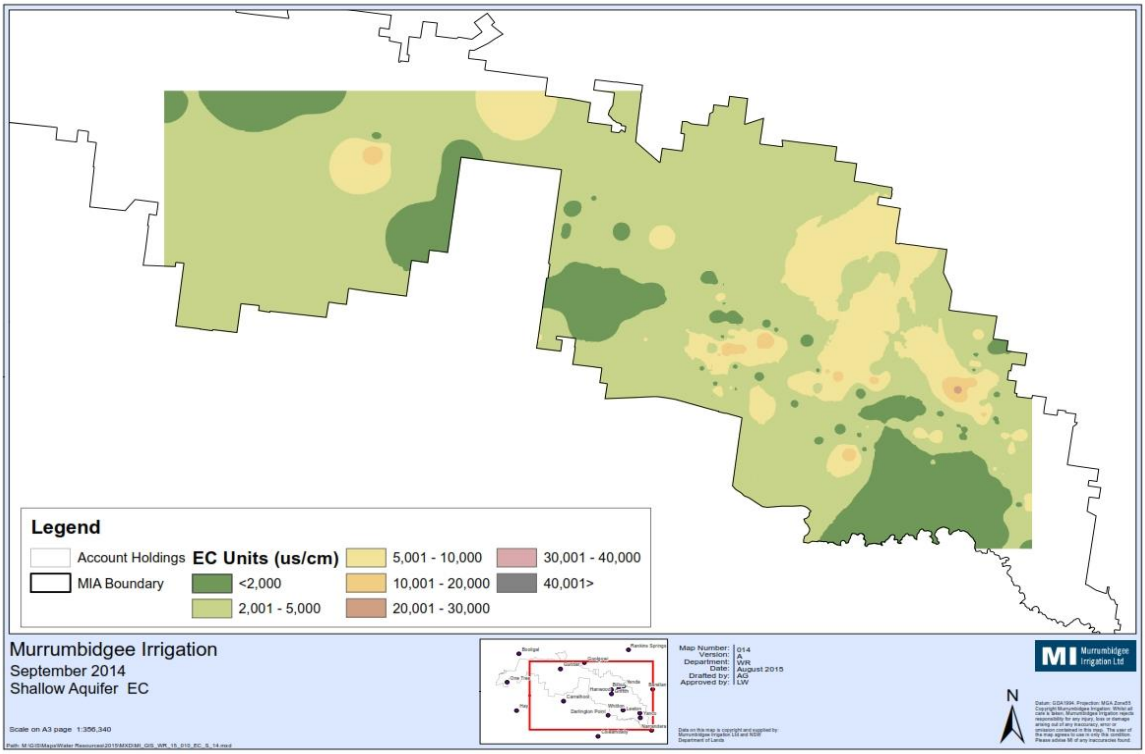


Figure 22 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2014

2013/14

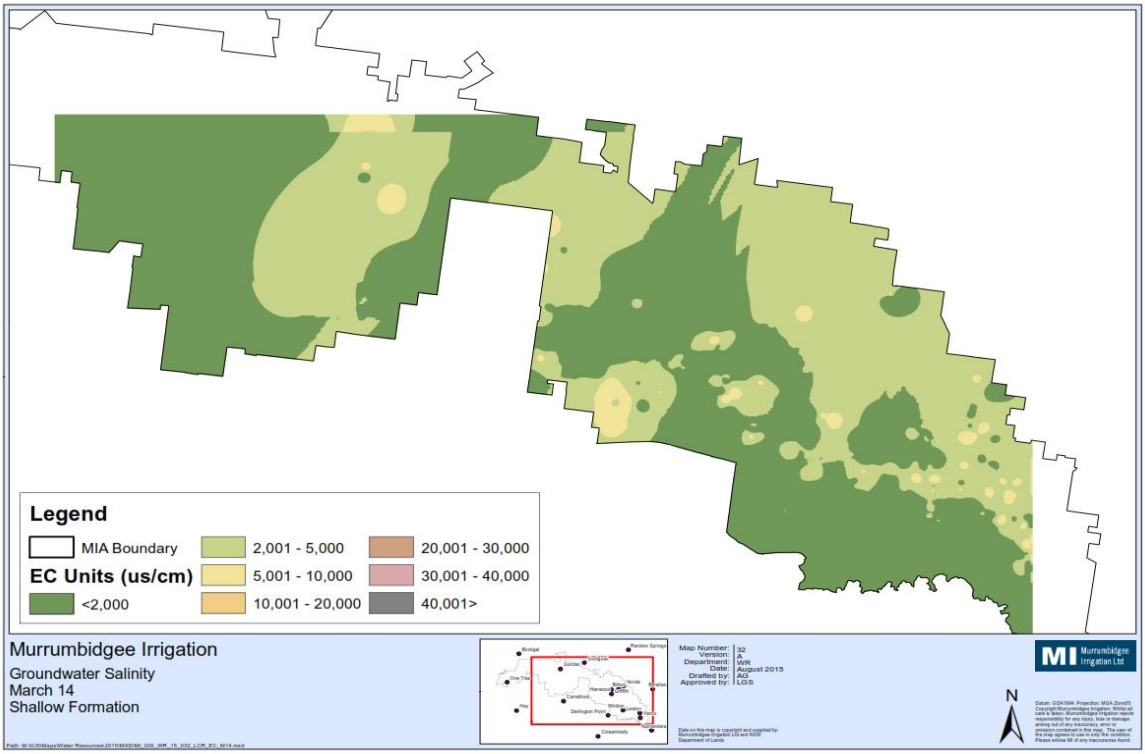


Figure 23 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, March 2014

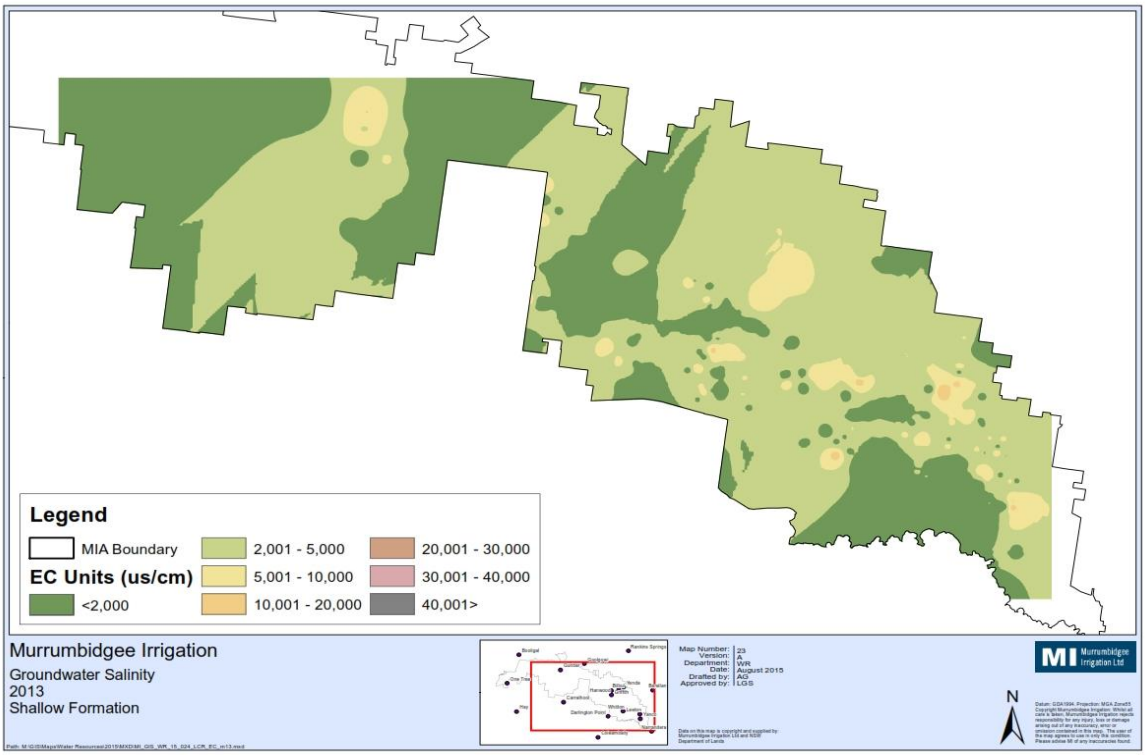


Figure 24 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2013

1980/2002

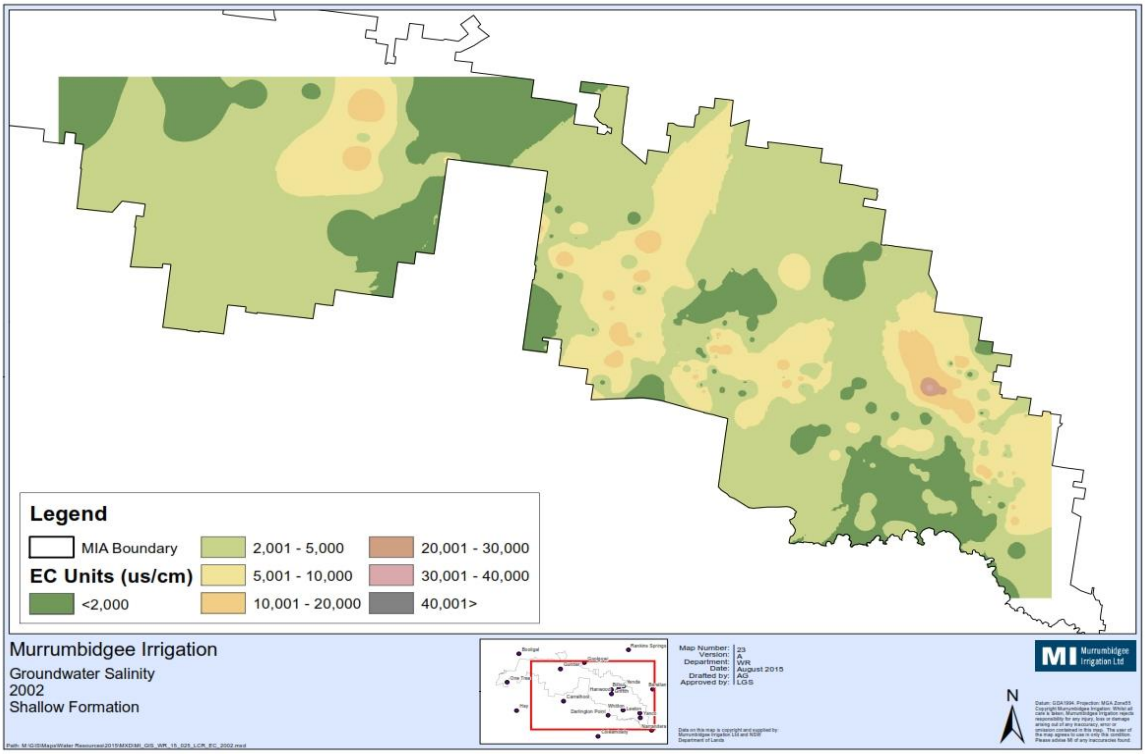


Figure 25 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 2002

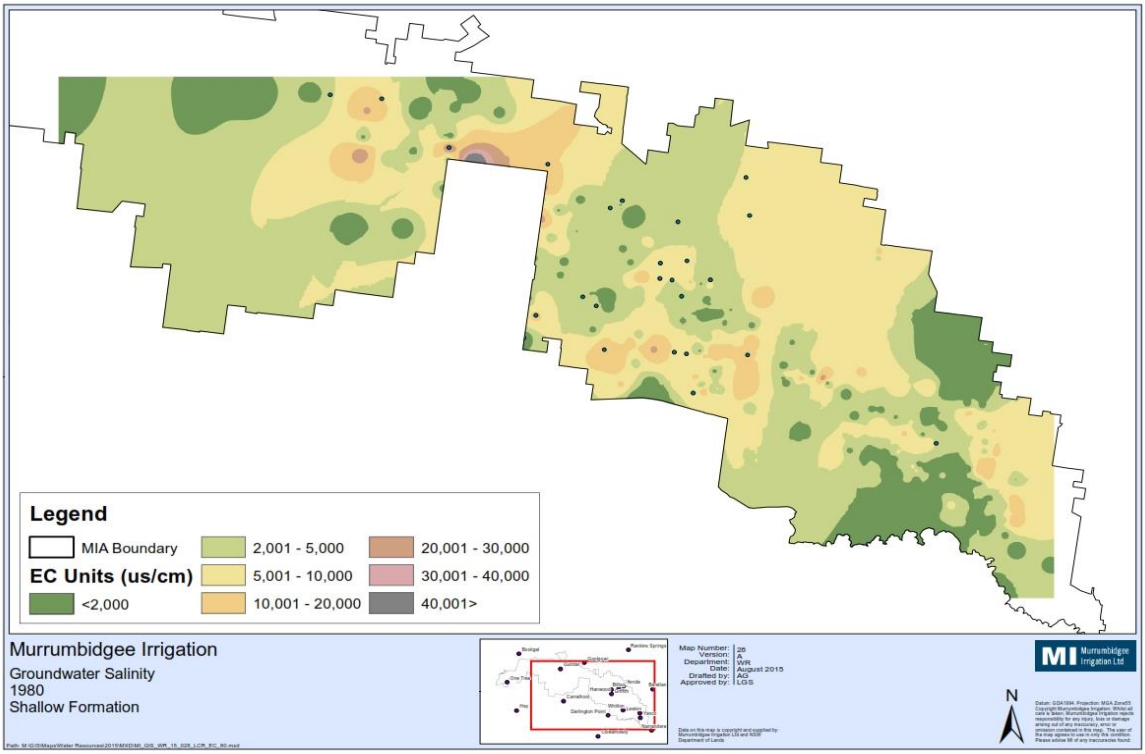


Figure 26 Groundwater salinity (µS/cm) in the Shallow Shepparton Formation, September 1980

5.3 Deep Shepparton Formation

5.3.1 Groundwater levels

Depth to water table maps for the deep Shepparton Formation are presented in Figures 27 to 34. Groundwater levels in the deep Shepparton Formation can be influenced by connectivity with the shallow Shepparton Formation, therefore the trends observed in the shallow Shepparton Formation also occur in the deep Formation. These maps also highlight the general east to west directional flow of groundwater across the area. The depth to water table maps show a consistent trend across the MIA for all reporting years, with slightly higher groundwater levels recorded in March when compared to levels recorded in September. In the alternative presentation format for 2015/16 seen in Figure 27 and Figure 28, it is clear to see that recharge areas are localised and that the rise is minimal.

2015/16

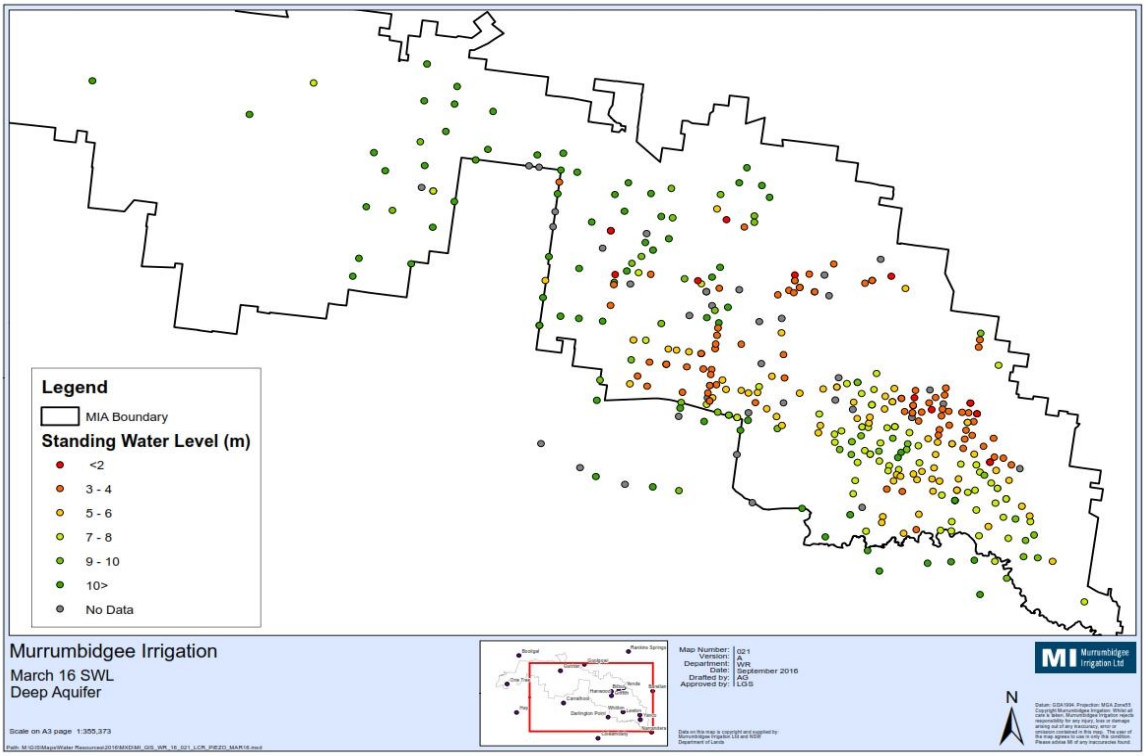


Figure 27 Depth (m) to water table in the Deep Shepparton Formation, March 2016

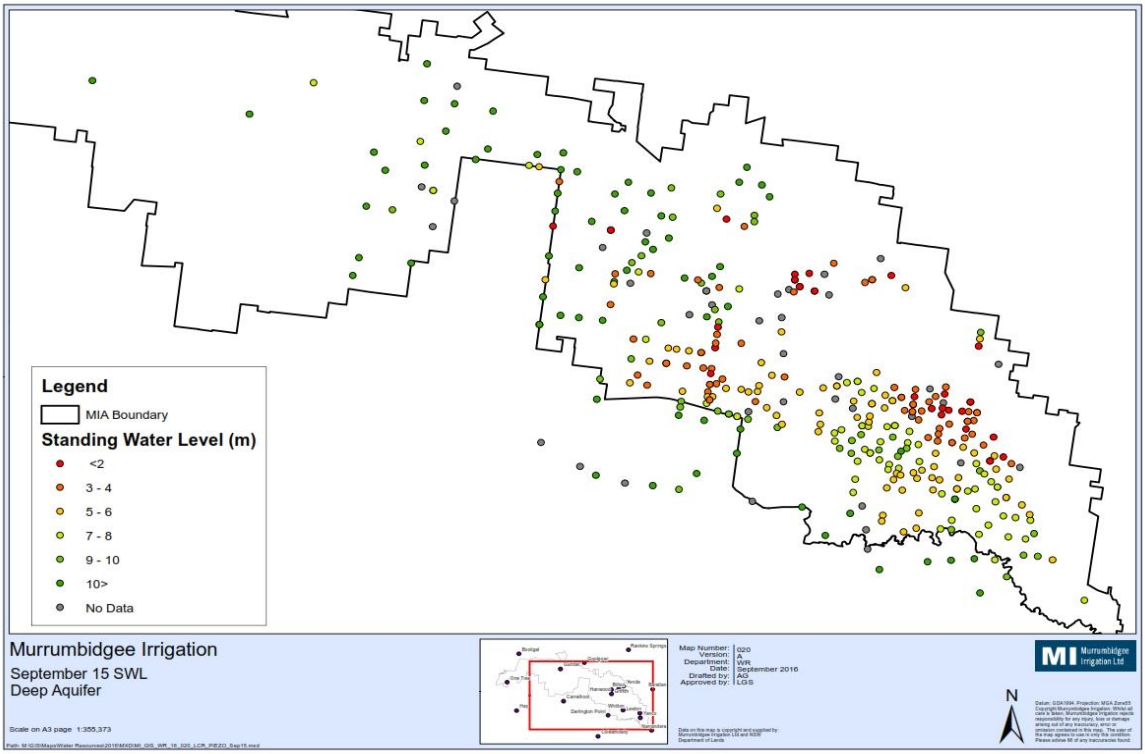


Figure 28 Depth (m) to water table in the Deep Shepparton Formation, September 2015

2014/15

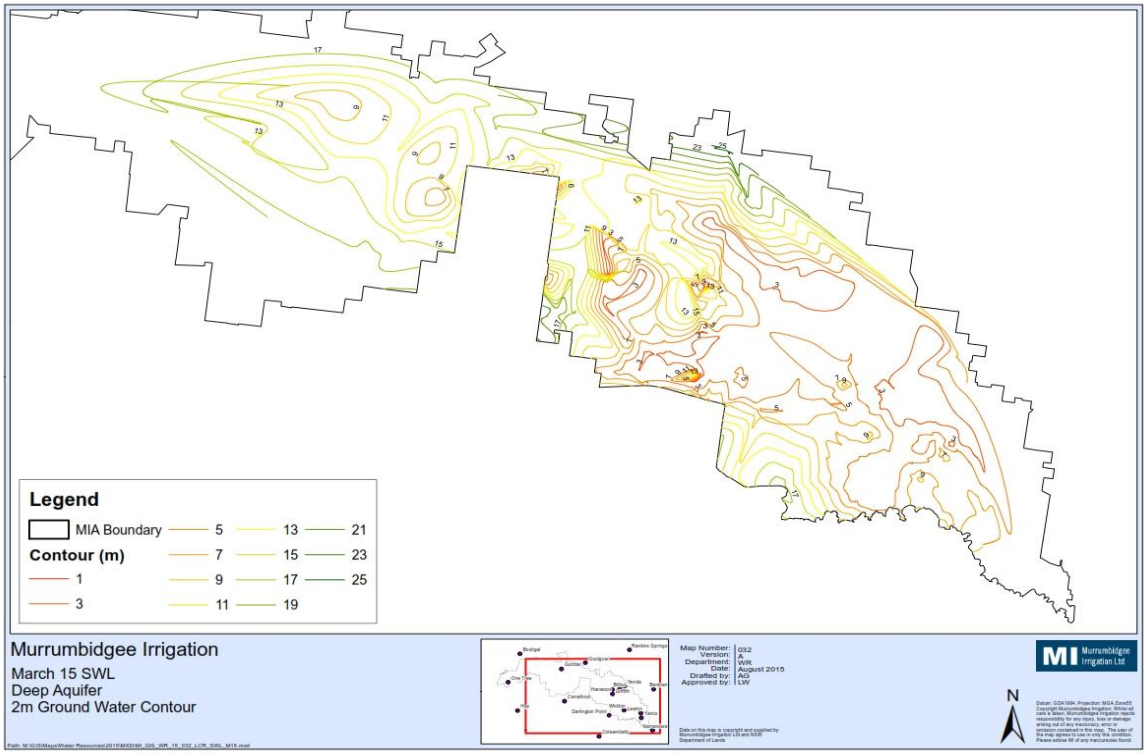


Figure 29 Depth (m) to water table in the Deep Shepparton Formation, March 2015

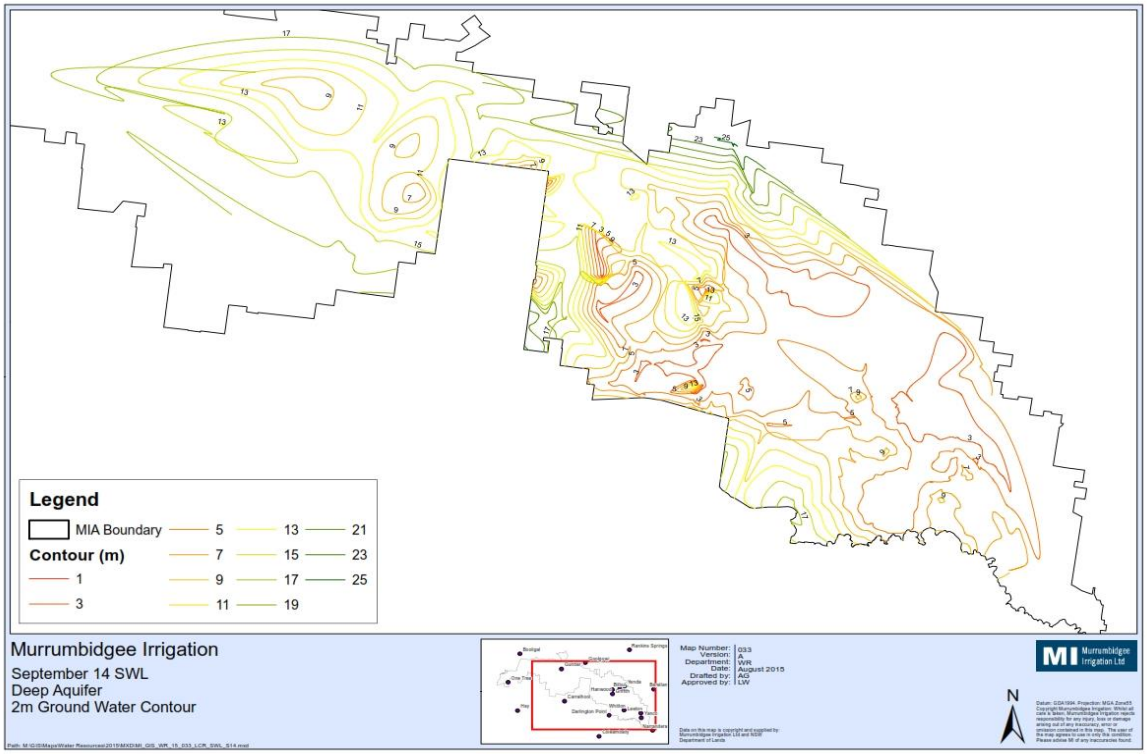


Figure 30 Depth (m) to water table in the Deep Shepparton Formation, September 2014

2013/14

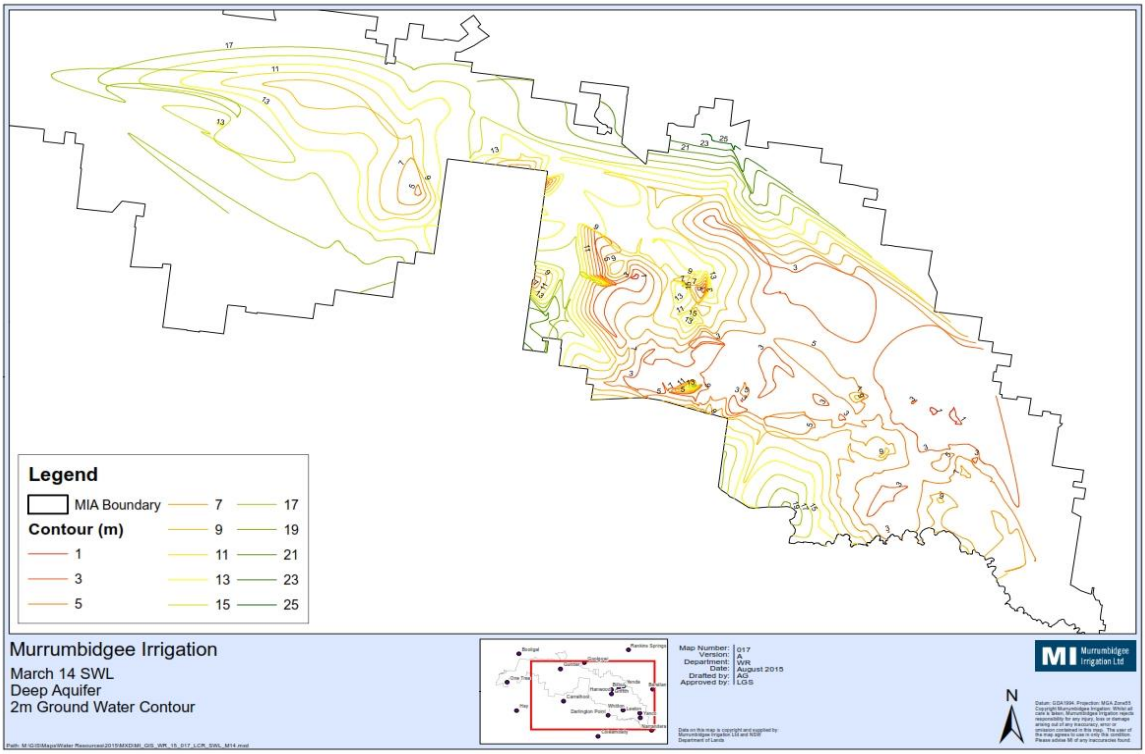


Figure 31 Depth (m) to water table in the Deep Shepparton Formation, March 2014

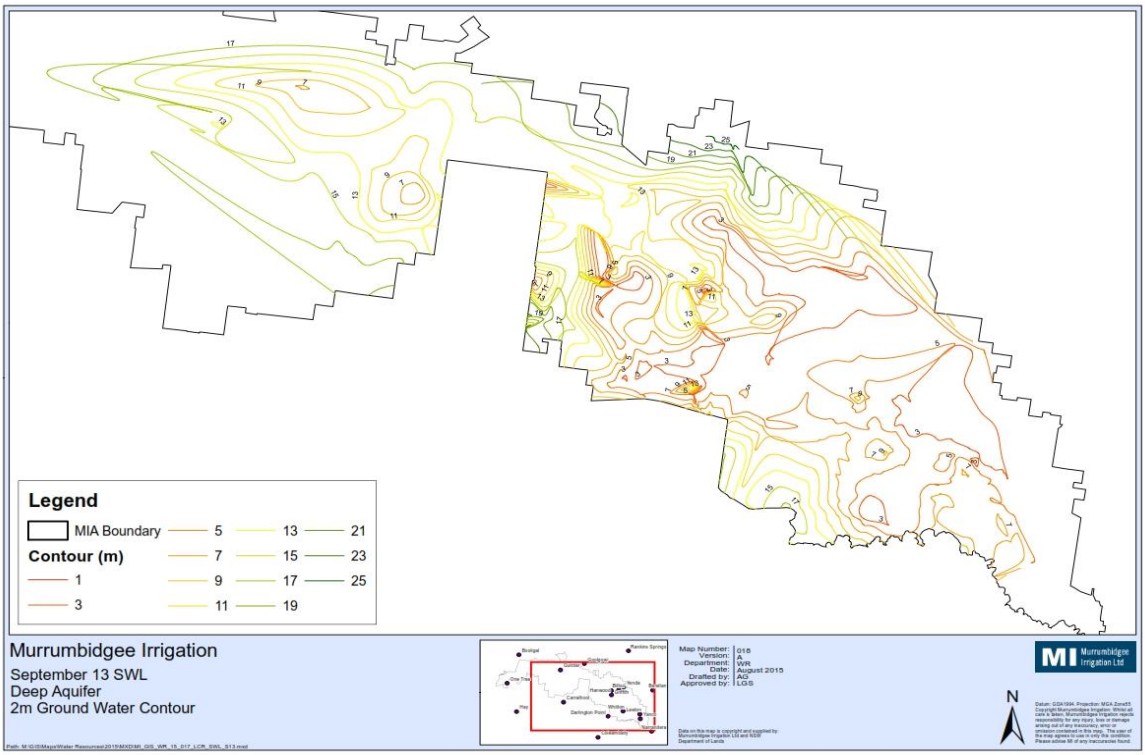


Figure 32 Depth (m) to water table in the Deep Shepparton Formation, September 2013

2005/06

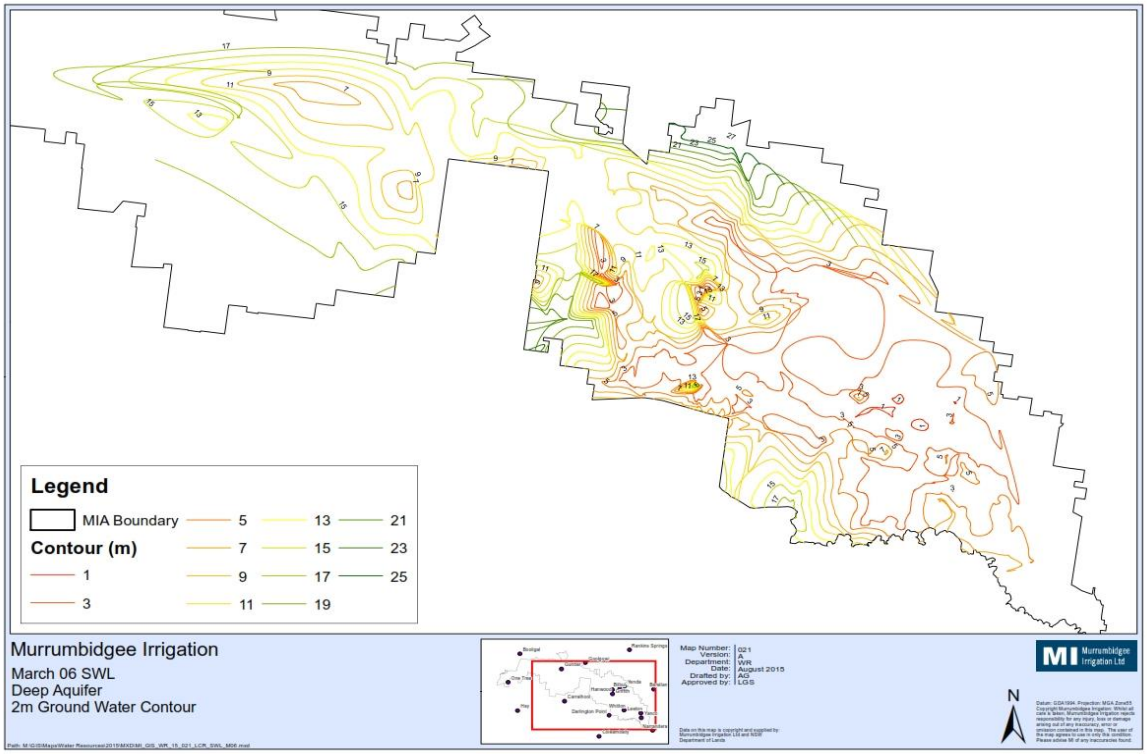


Figure 33 Depth (m) to water table in the Deep Shepparton Formation, March 2006

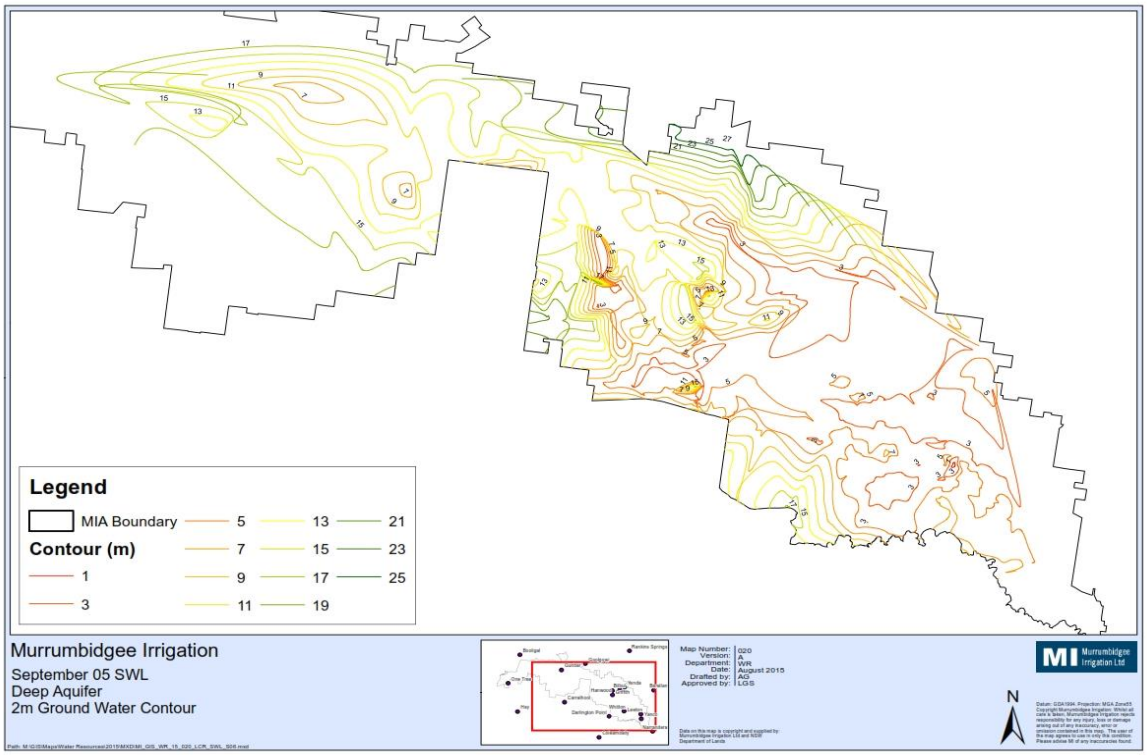


Figure 34 Depth (m) to water table in the Deep Shepparton Formation, September 2005

5.3.2 Groundwater salinity

Figures 35 to 42 show the salinity changes in the Deep Shepparton Formation. Salinity changes in the Deep Formation mirror changes shown in the Shallow Formation with lower EC values recorded following the irrigation season. The change in EC from September 15 (Figure 36) to March 16 (Figure 35) suggest that water quality is digressing to a more saline state, similar to those observed in historical reference years. The 2014 September EC readings (Figure 34) are comparable to both historical references, whereas EC readings for September 2013 (Figure 36) are considerably lower across the MIA, likely caused by recharge from the 2012 flood.

High saline areas are observed in the Mirrool Irrigation Area and Benerembah Irrigation District, again, with the exception of 2013/14 reporting year, where lower EC values are observed in these areas. Due to the attenuation time for groundwater to infiltrate through layers or for gradient movement across the MIA, groundwater changes can be seen long after a flood event has occurred. The flood that occurred in 2012 is likely the cause of these lower EC values recorded in 2013/14.

2015/16

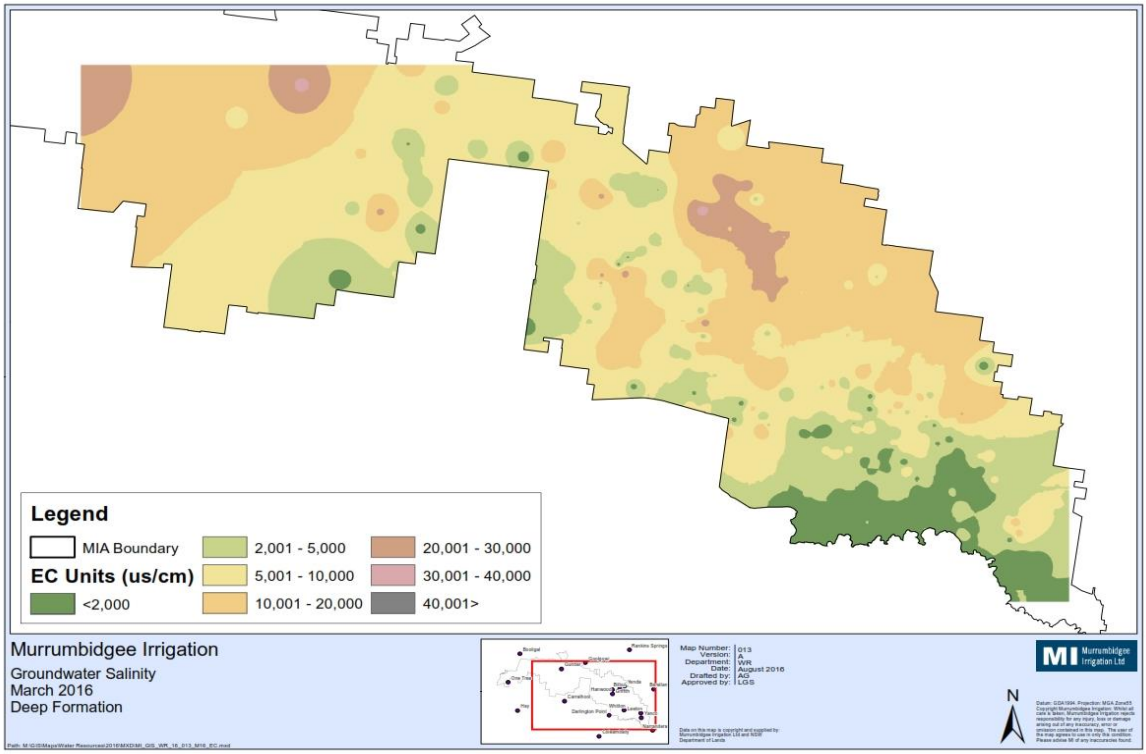


Figure 35 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2016

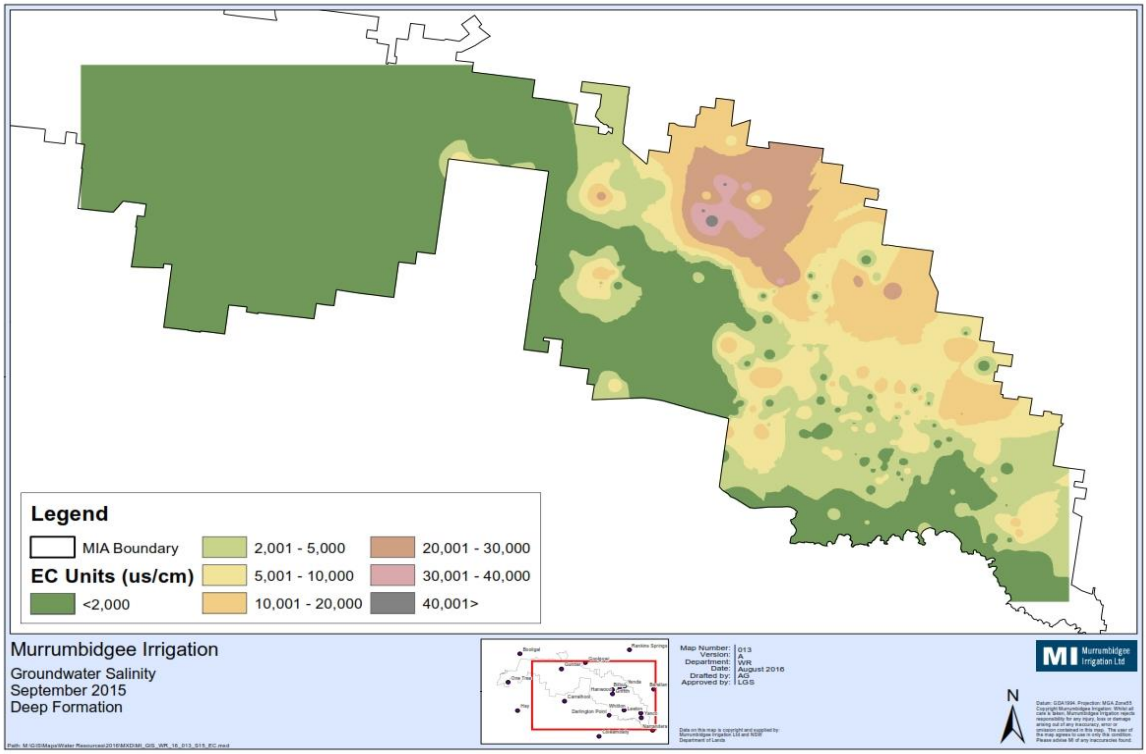


Figure 36 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2015

2014/15

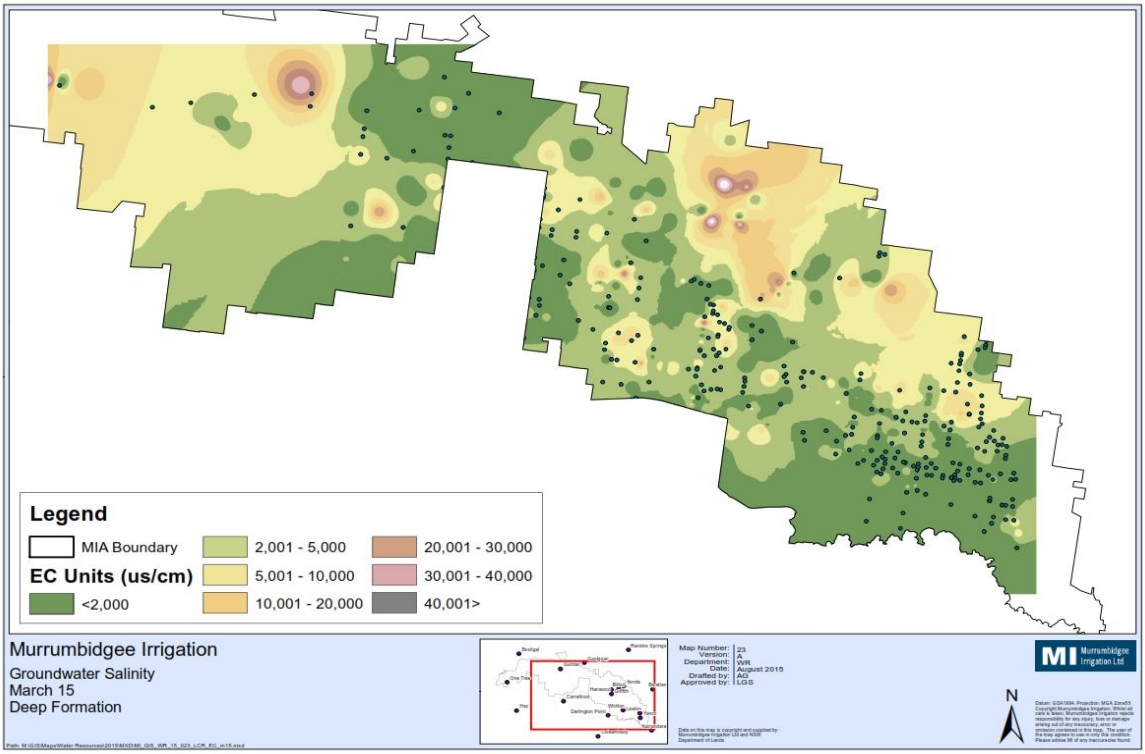


Figure 37 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2015

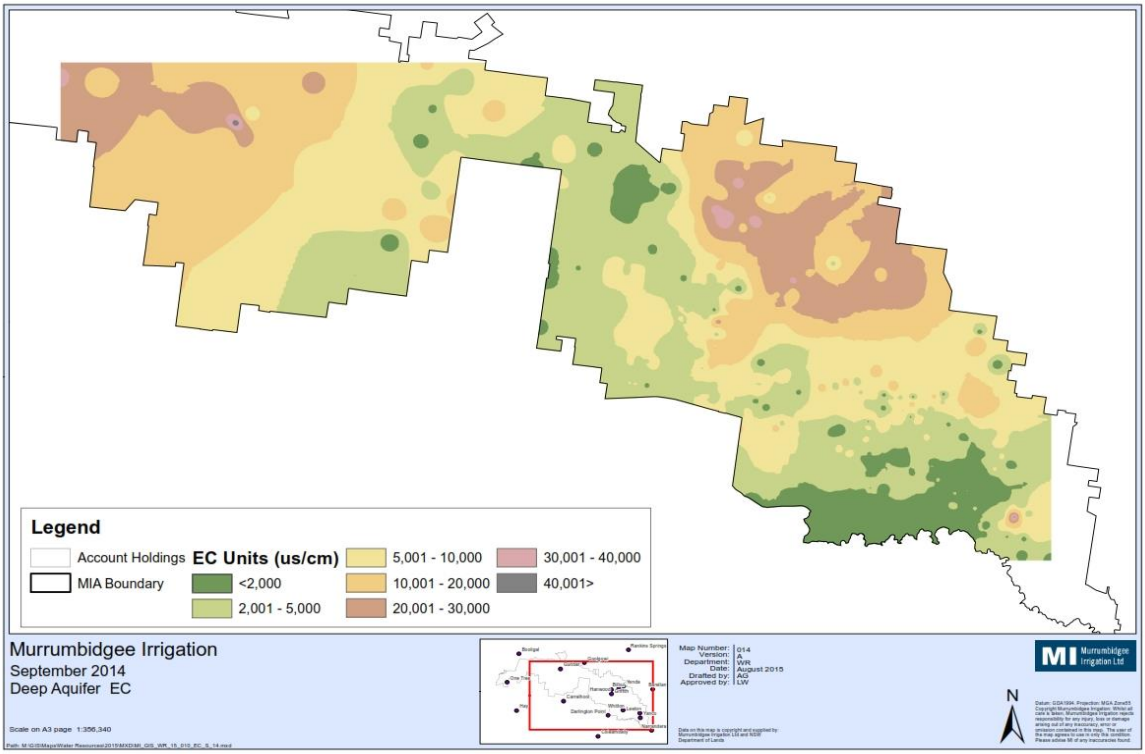


Figure 38 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2014

2013/14

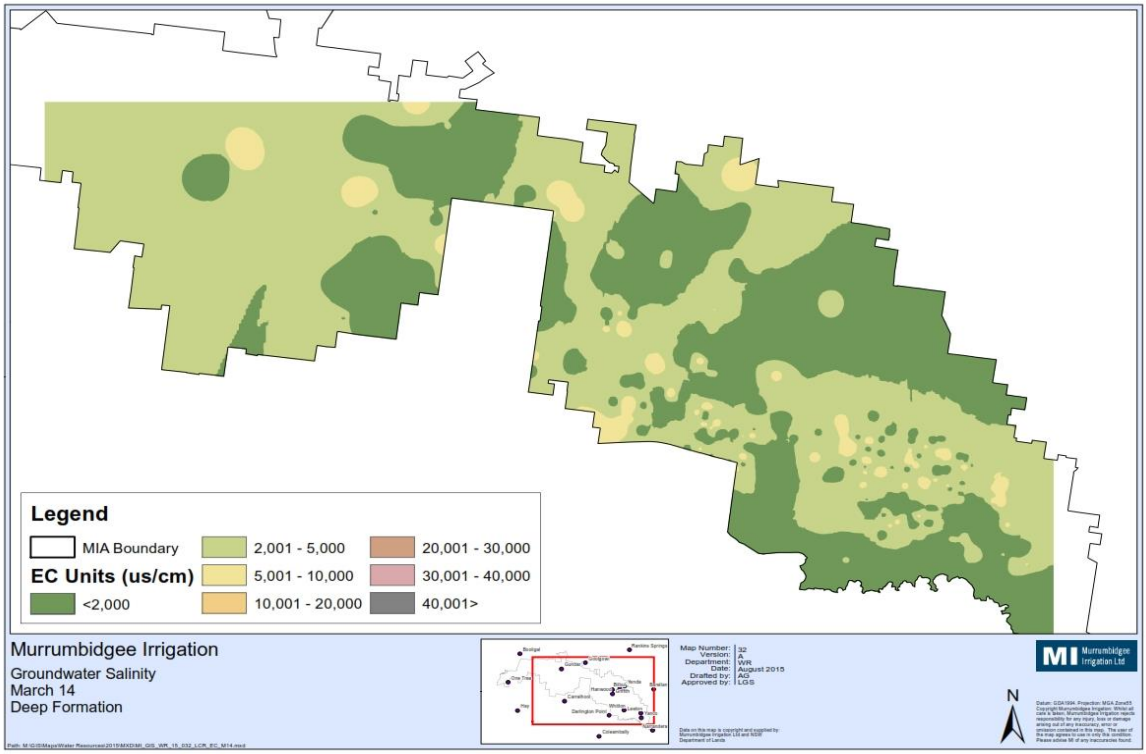


Figure 39 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2014

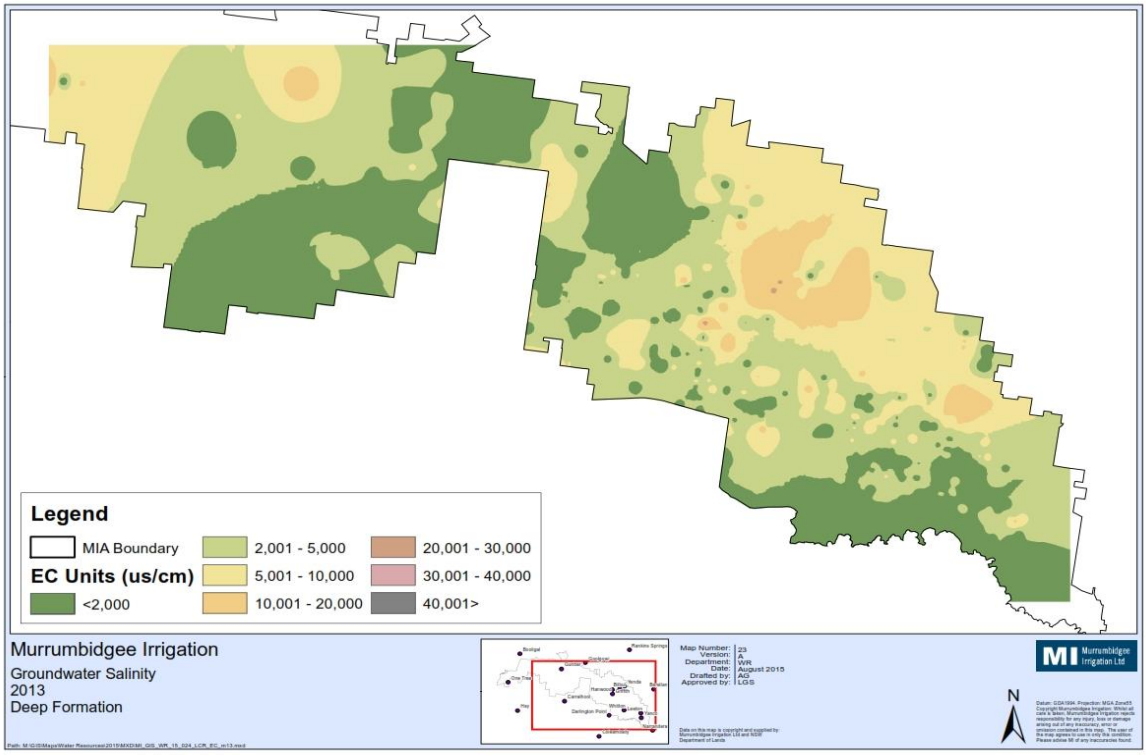


Figure 40 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2013

2005/06

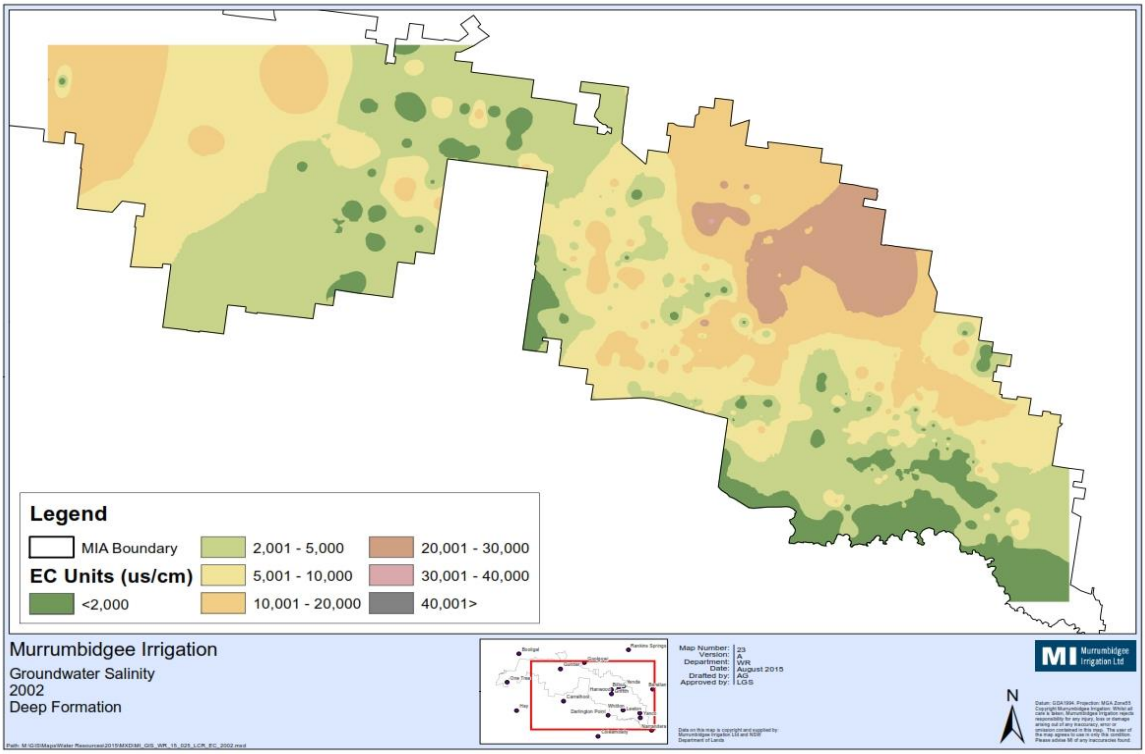


Figure 41 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2002

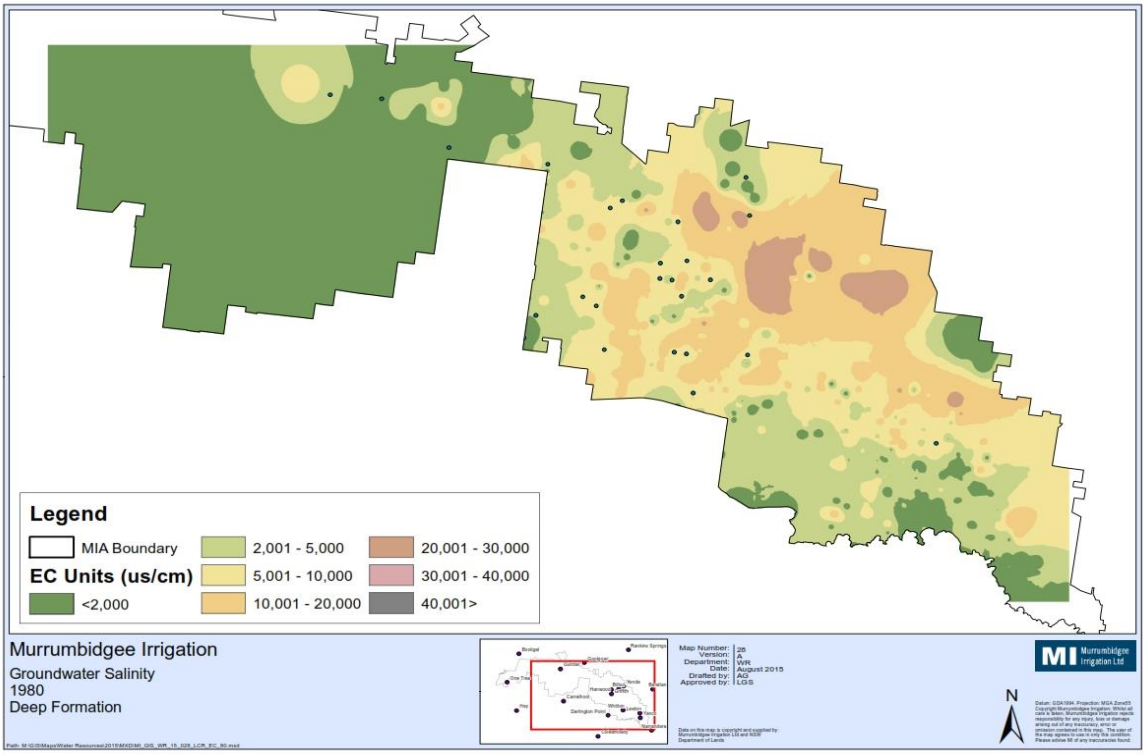


Figure 42 Groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 1980

5.4 Calivil Formation

5.4.1 Groundwater levels

Depth to water table maps for the Calivil Formation are presented in Figures 43 to 50. Level trends in this formation generally represents drawdown from shallow aquifers which will display a time lag effect when compared to level trends in upper aquifers. Data for 2015/16 and 2014/15 shows minimal change to groundwater level from September to March, suggesting that this formation is not easily influenced by the upper formations.

However, the increased levels seen in 2012/13 (post flood) suggests that the Calivil Formation may be influenced by large flooding events, either through direct recharge, aquifer exchange or, to a lesser degree, vertical seepage from the above Shepparton Formation. However, due to the limited number of bores monitored in this formation, it is difficult to ascertain the true origin and significance of level changes with any confidence. Levels recorded in 2005/06 were almost 4 m deeper than those recorded in 2012/13. It is expected that groundwater levels would be lower during drought periods due to limited recharge and increased groundwater pumping.

2015/16

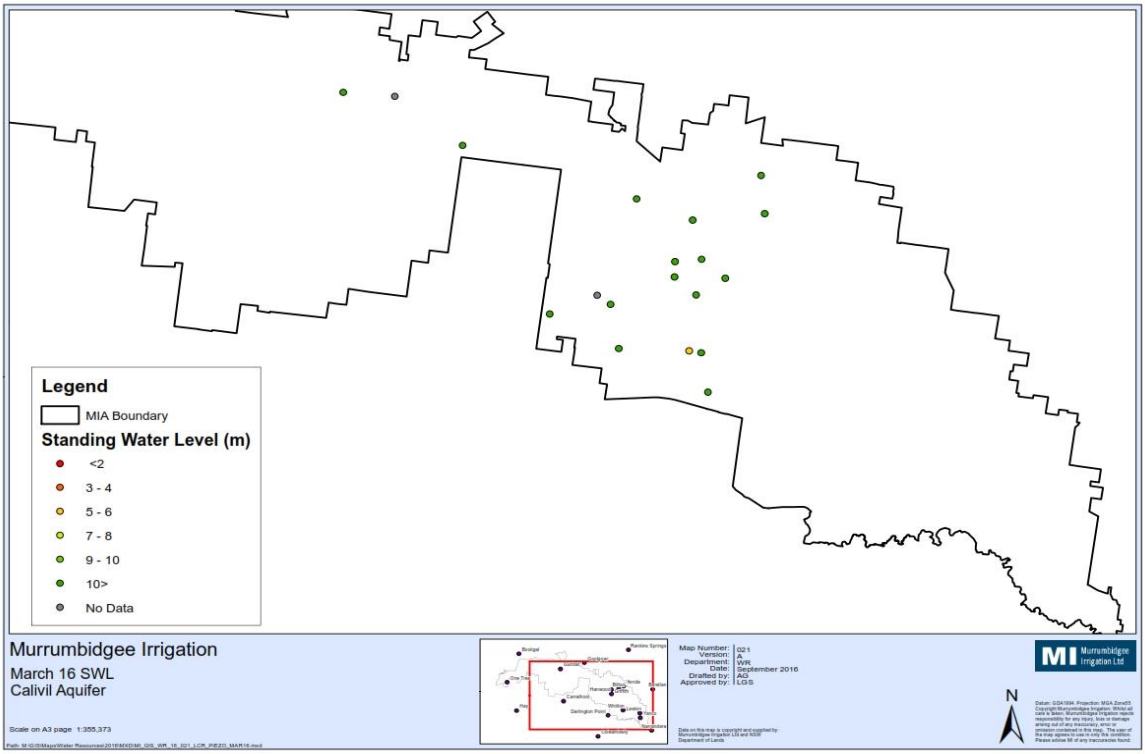


Figure 43 Depth (m) to water table in the Calivil Formation, March 2016

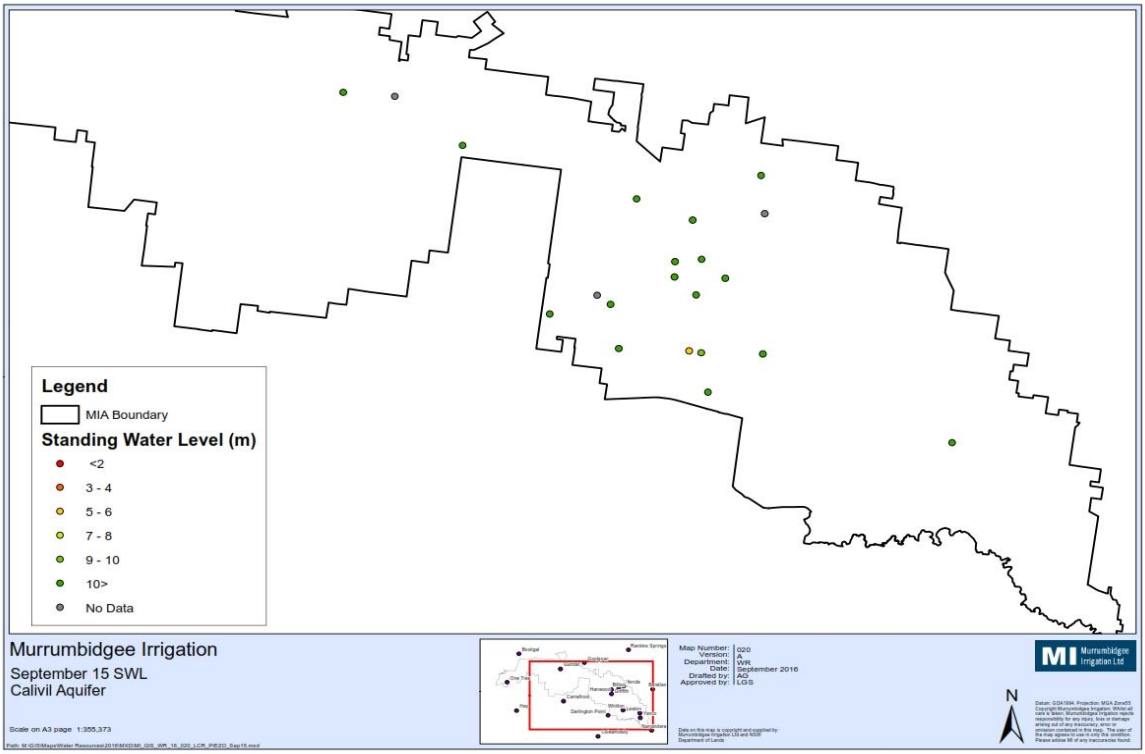


Figure 44 Depth (m) to water table in the Calivil Formation, September 2015

2014/15

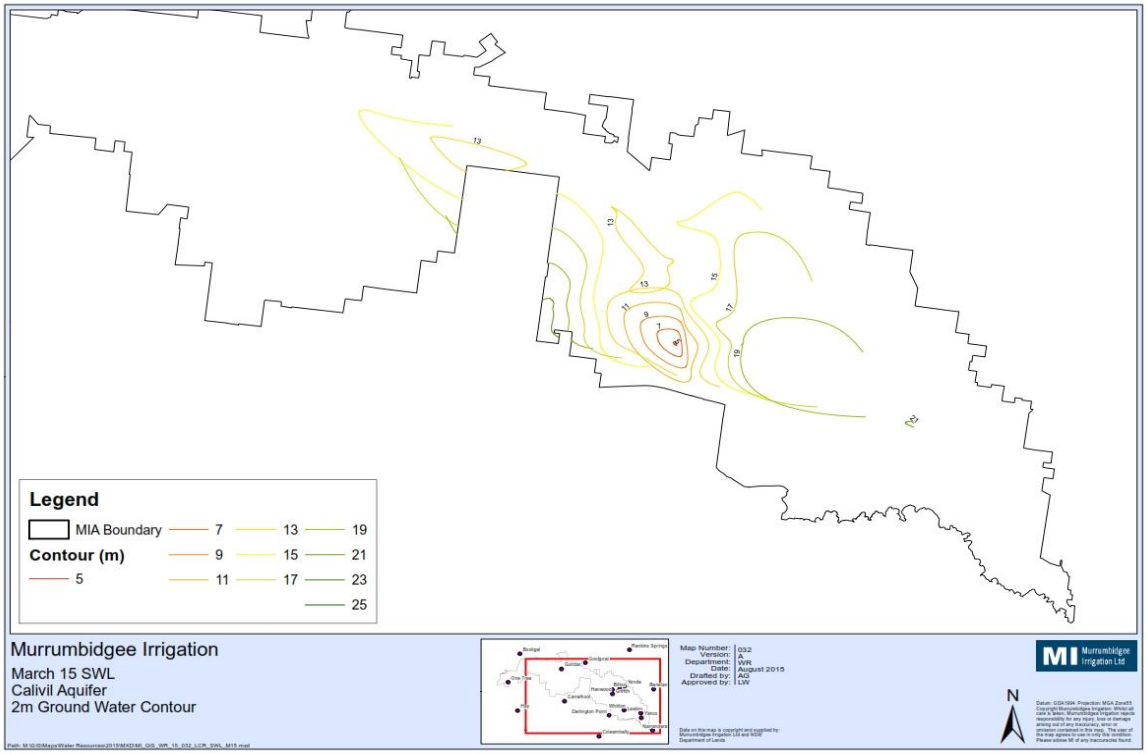


Figure 45 Depth (m) to water table in the Calivil Formation, March 2015

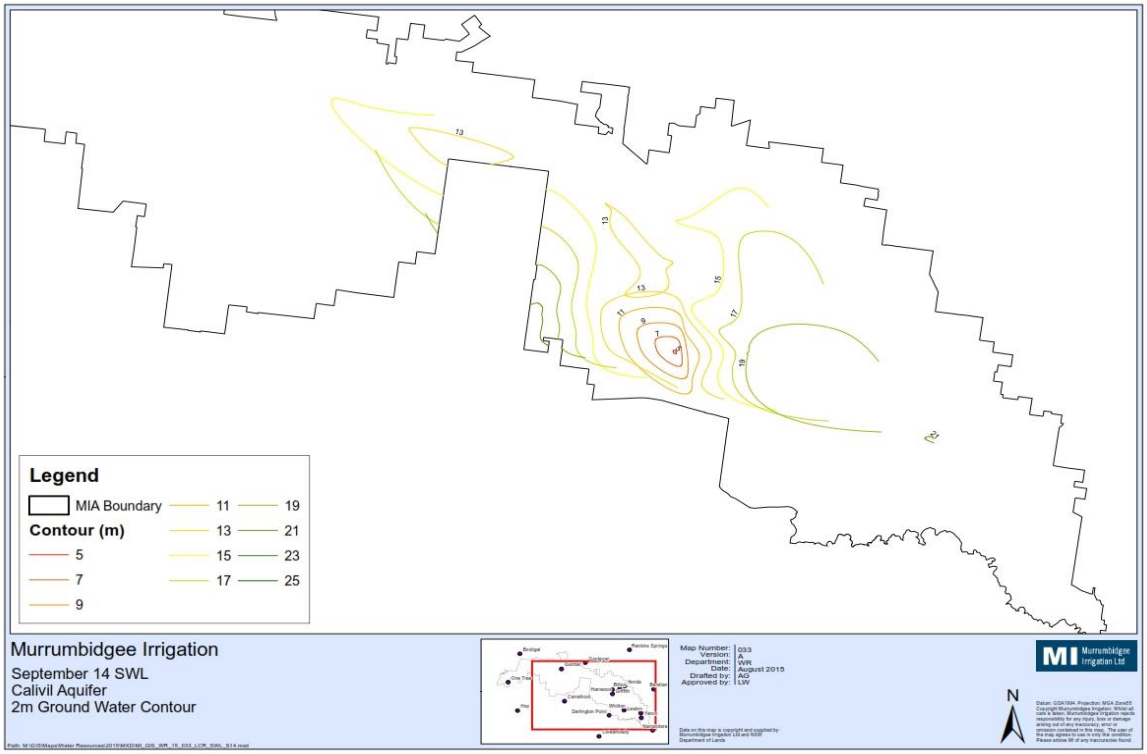


Figure 46 Depth (m) to water table in the Calivil Formation, September 2014

2013/14

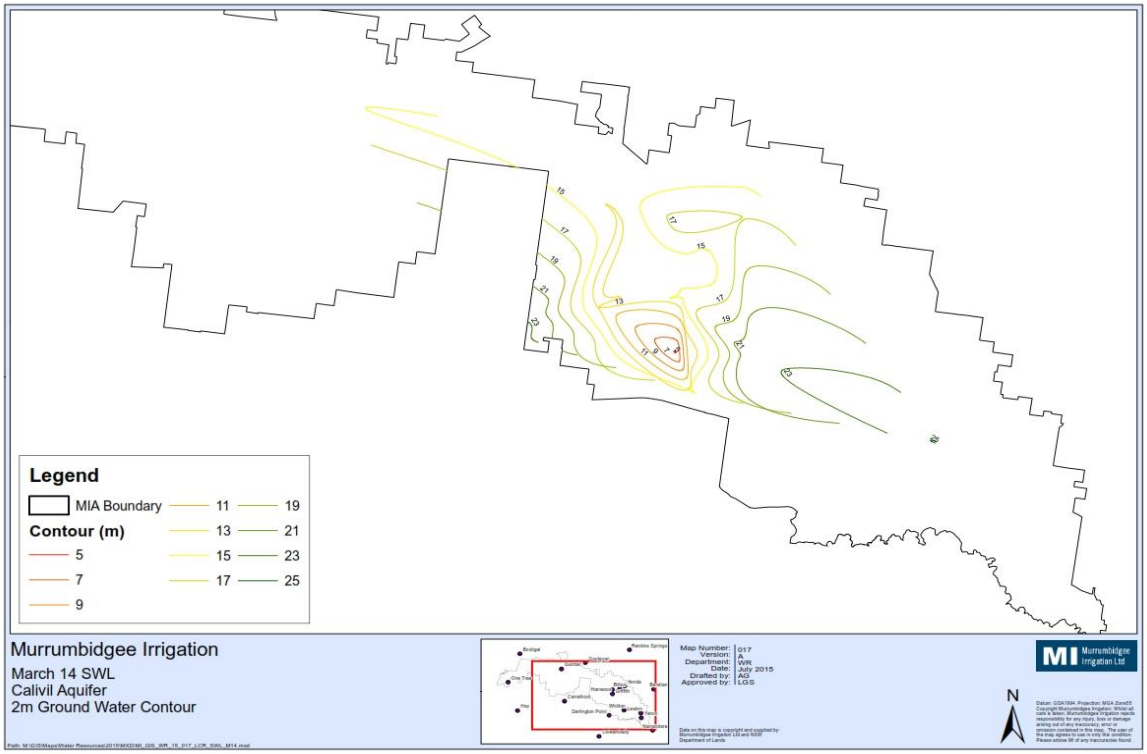


Figure 47 Depth (m) to water table in the Calivil Formation, March 2014

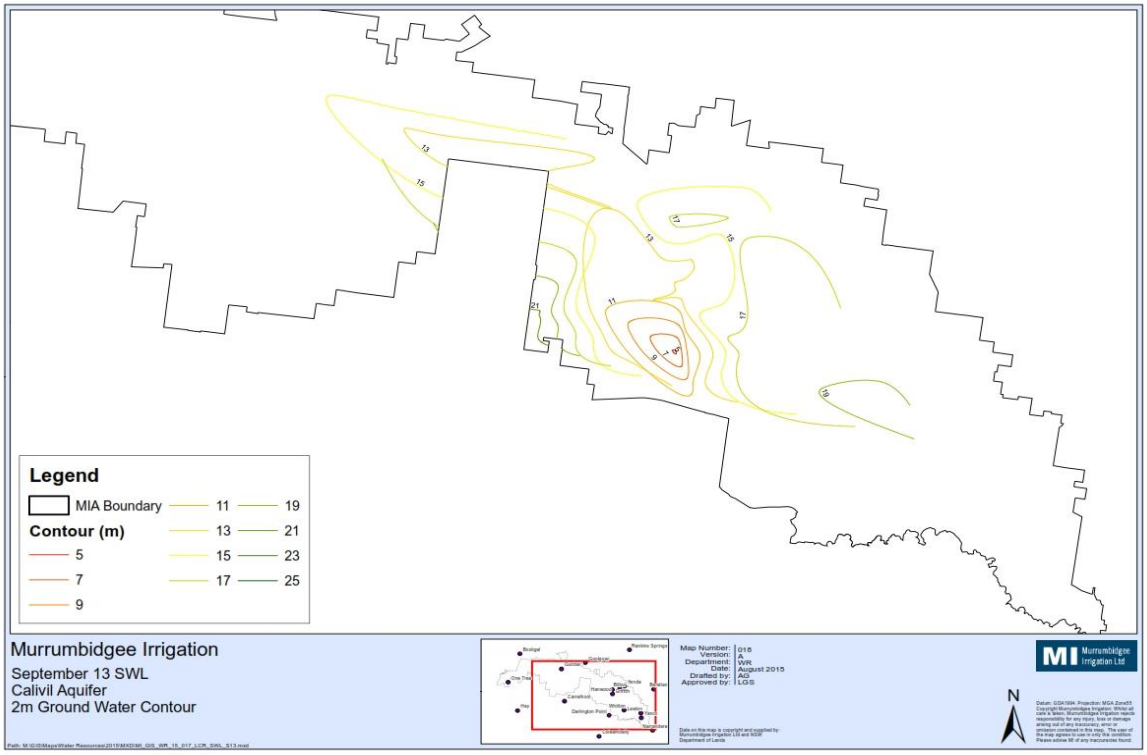


Figure 48 Depth (m) to water table in the Calivil Formation, September 2013

2005/06

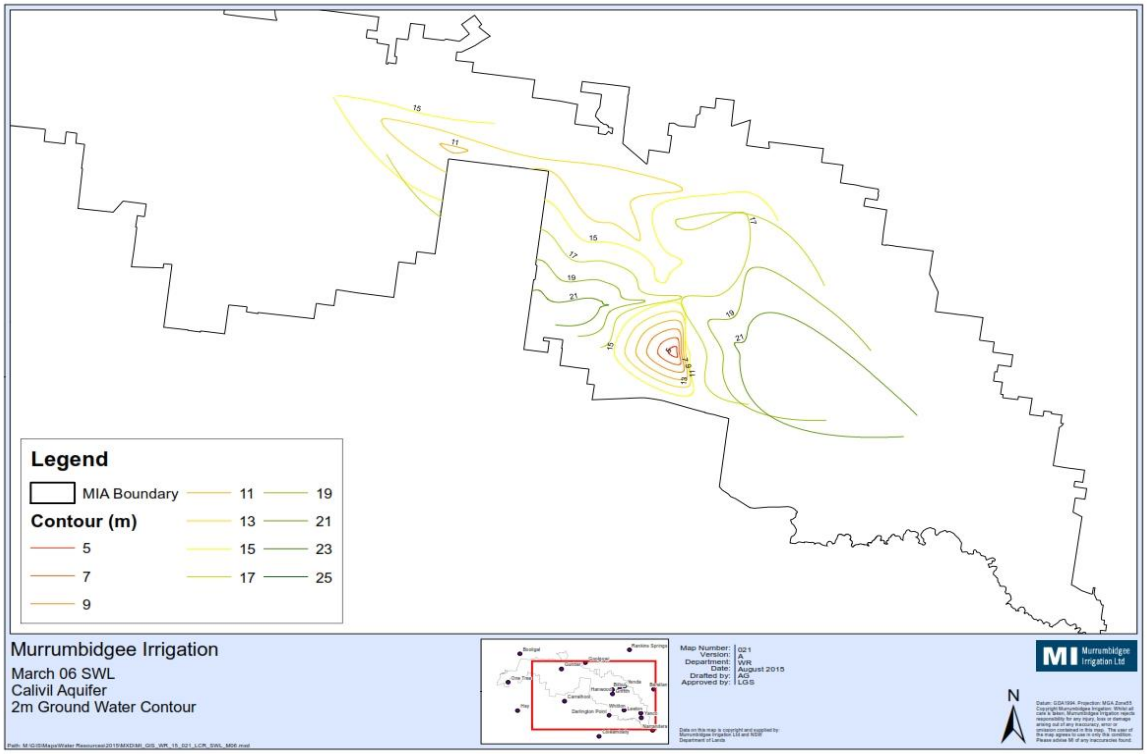


Figure 49 Depth (m) to water table in the Calivil Formation, March 2006

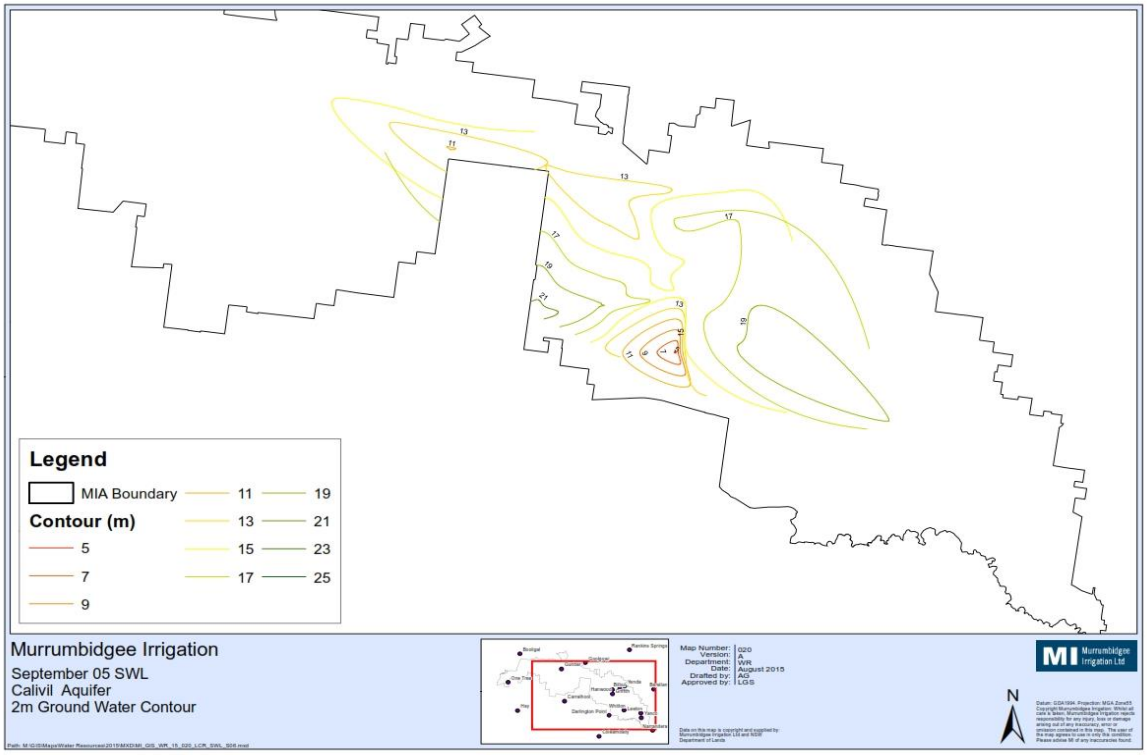


Figure 50 Depth (m) to water table in the Calivil Formation, September 2005

5.4.2 Groundwater salinity

Figures 51 to 58 show the salinity changes in the Calivil Formation compared to previous years. Due to the small amount of bores monitored in the Calivil Formation, data is only available for a small portion of the MIA.

Salinity readings in the Calivil Formation for 2013/14 mirror changes shown in the Shepparton Formation where lower EC values are displayed across the MIA. This can also be attributed to the flood experienced in 2012 and the lag time for the effects to be seen, which further suggests that the Calivil Formation is also influenced by surface water recharge, likely from connectivity to the upper formations in some areas. This also highlights the significance of rainfall and episodic recharge events on the deeper formations.

2015/16

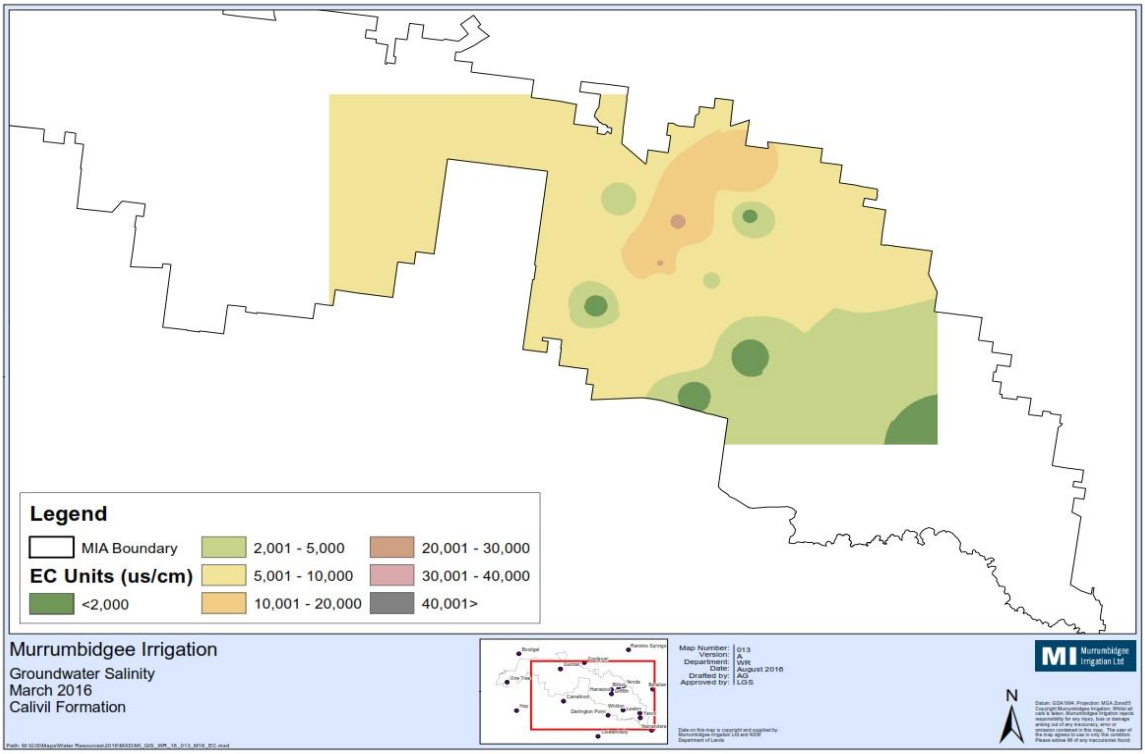


Figure 51 Groundwater salinity (µS/cm) in the Calivil Formation, March 2016

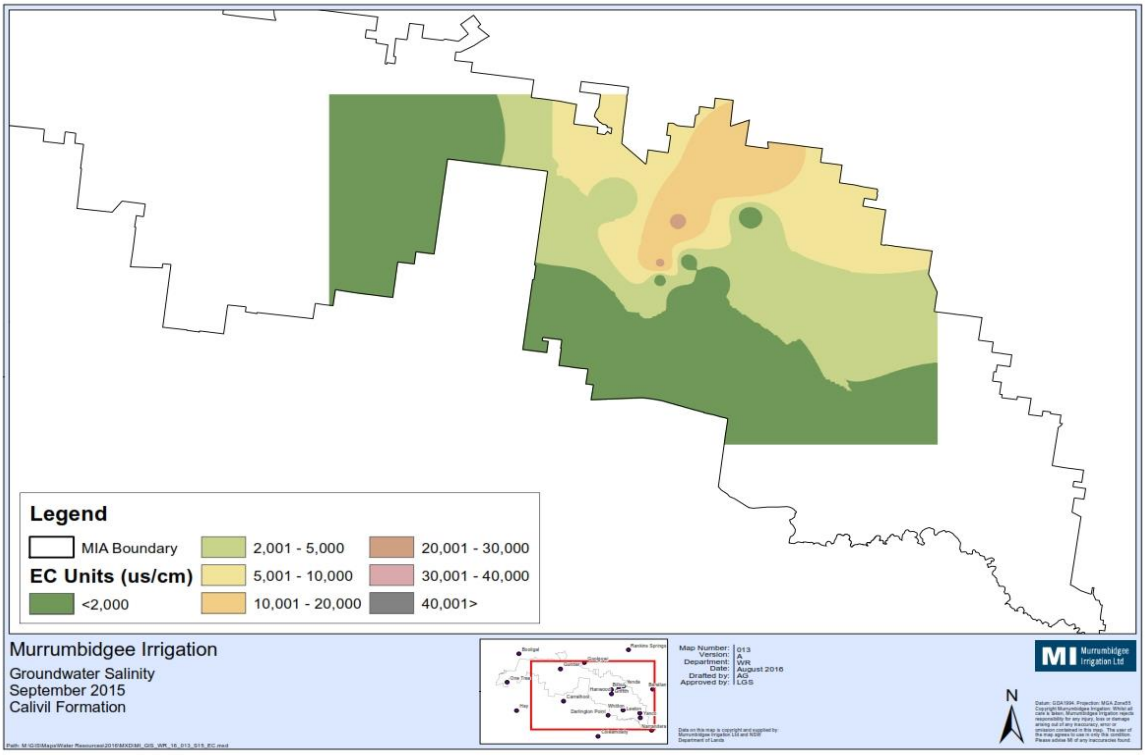


Figure 52 Groundwater salinity (µS/cm) in the Calivil Formation, September 2015

2014/15

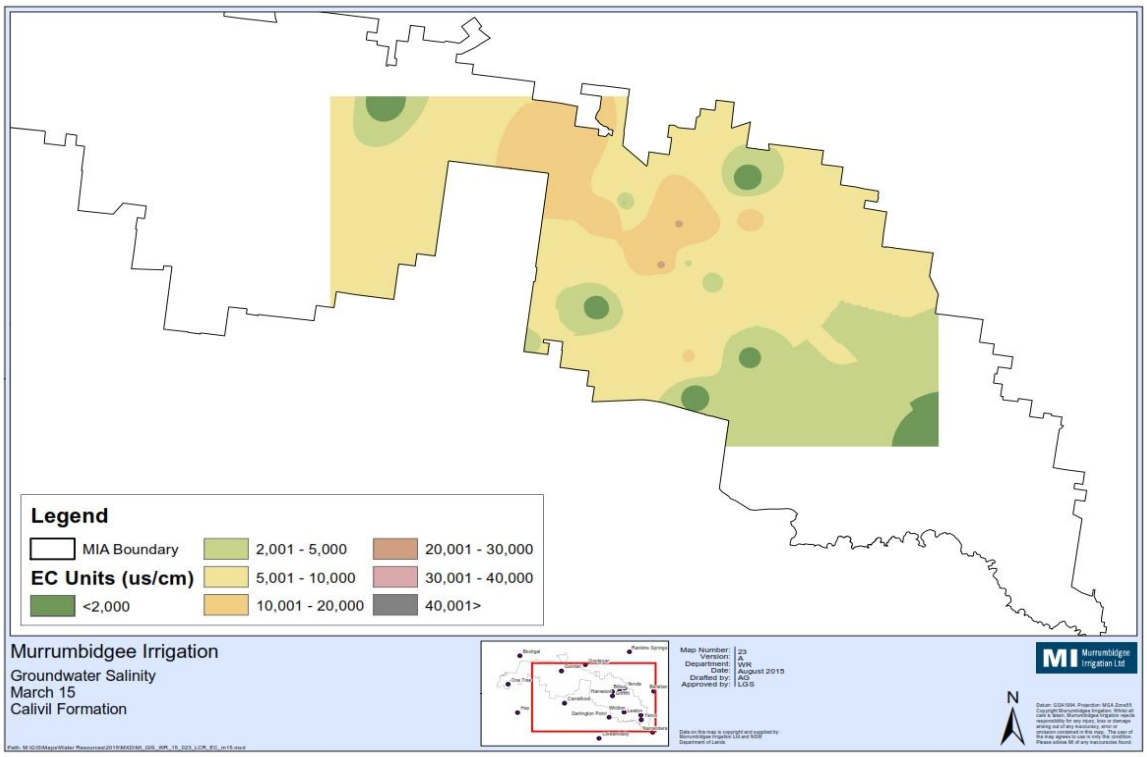


Figure 53 Groundwater salinity (µS/cm) in the Calivil Formation, March 2015

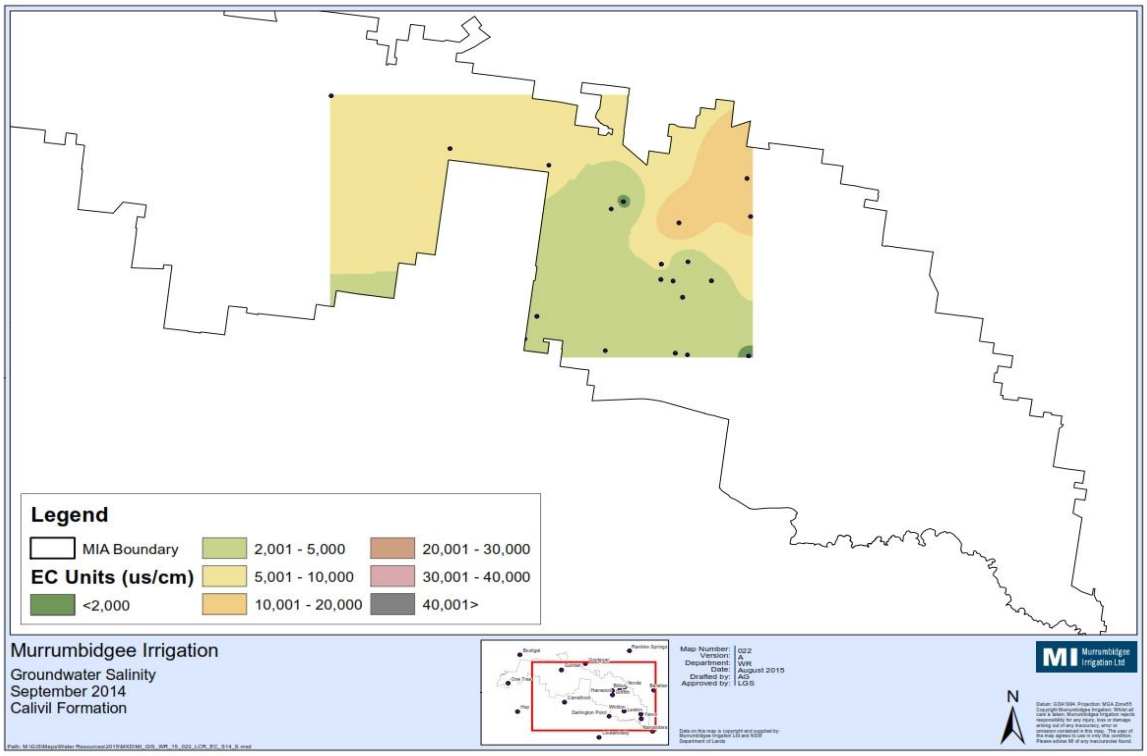


Figure 54 Groundwater salinity (µS/cm) in the Calivil Formation, September 2014

2013/14

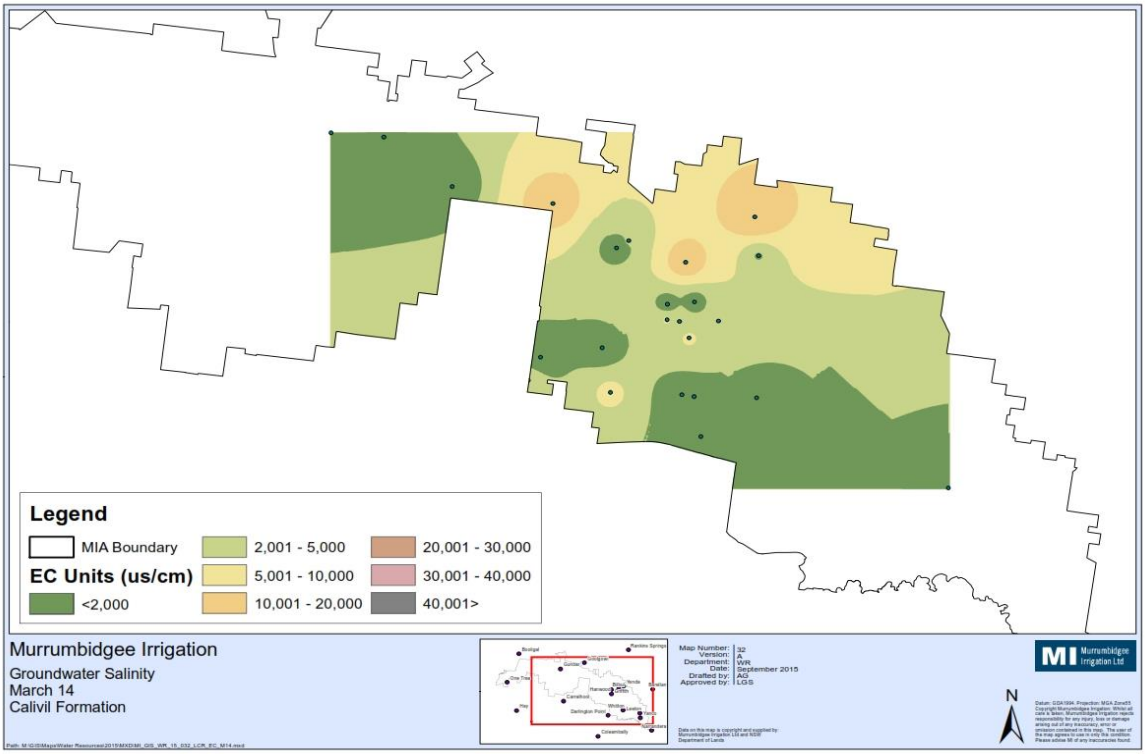


Figure 55 Groundwater salinity (µS/cm) in the Calivil Formation, March 2014

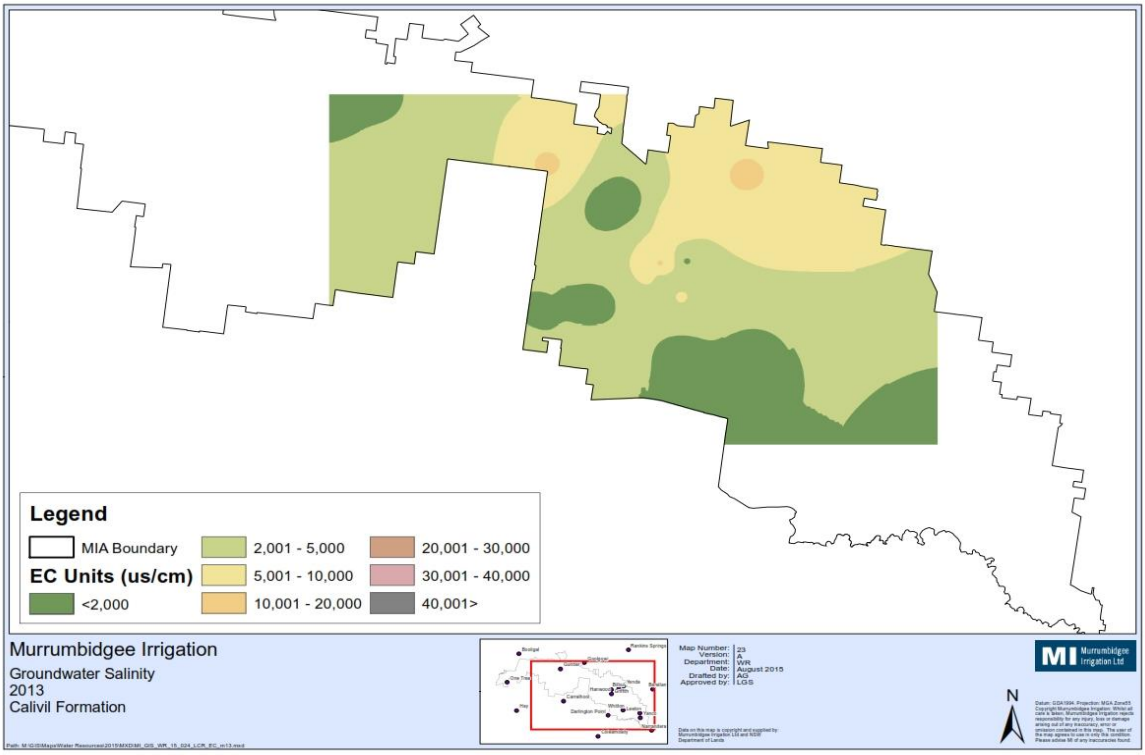


Figure 56 Groundwater salinity (µS/cm) in the Calivil Formation, September 2013

1980/2002

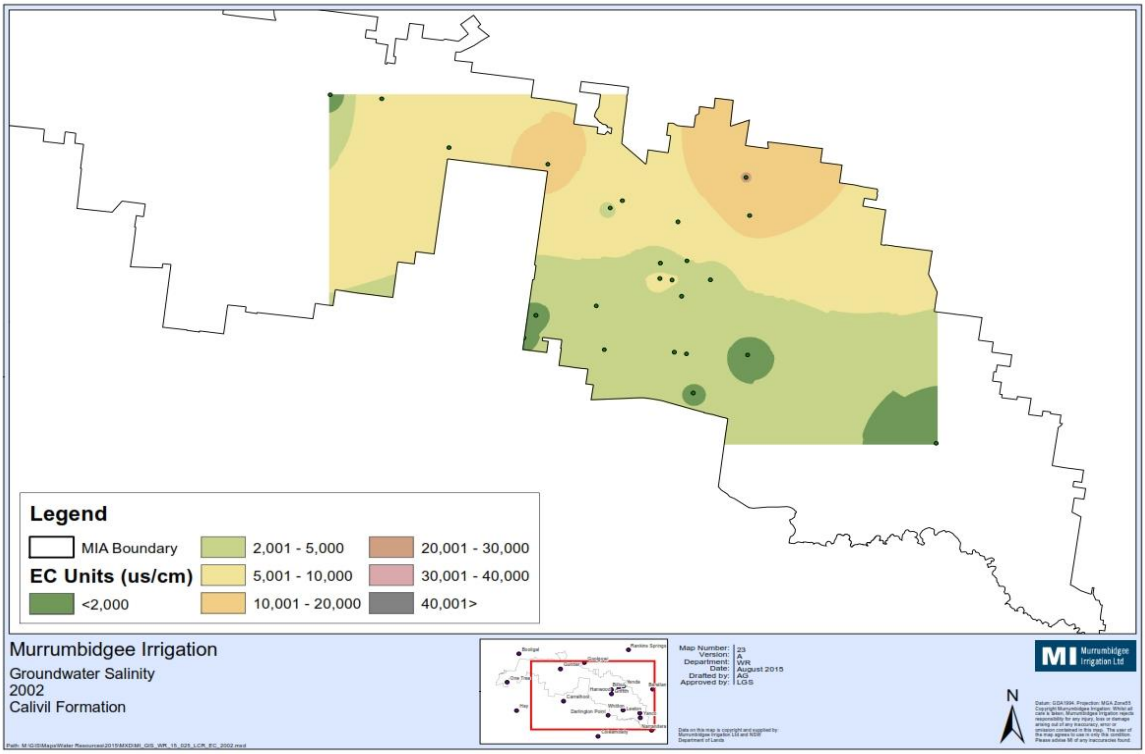


Figure 57 Groundwater salinity (µS/cm) in the Calivil Formation, September 2002

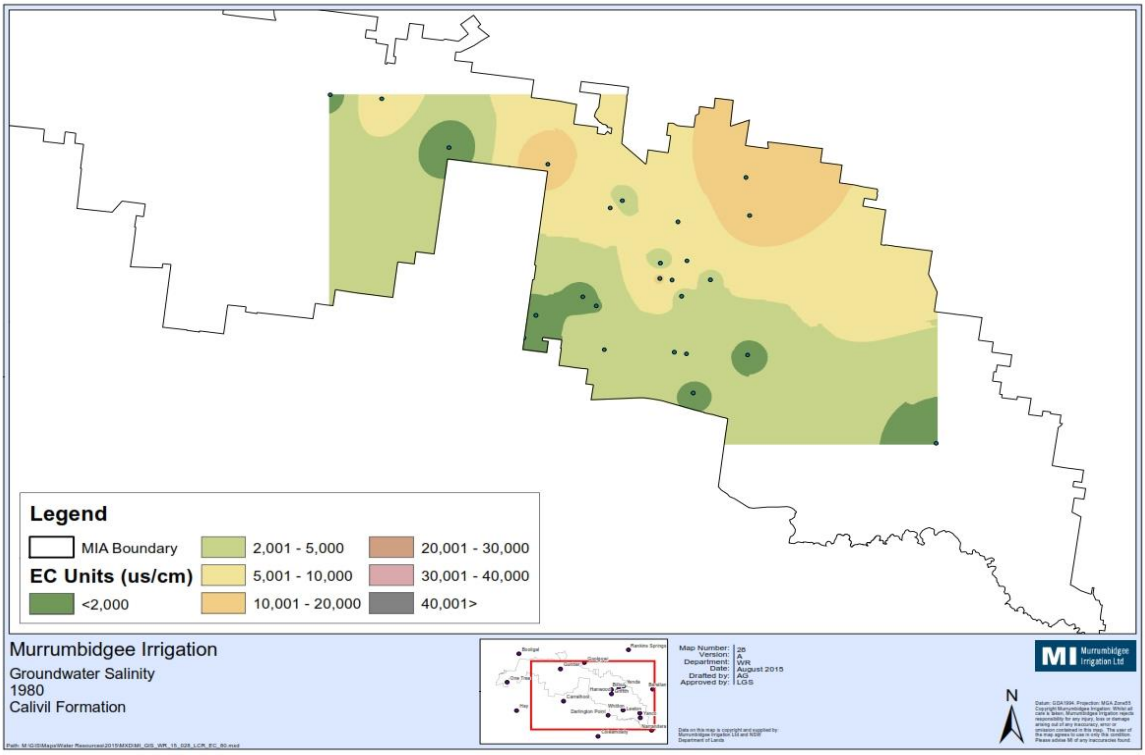


Figure 58 Groundwater salinity (µS/cm) in the Calivil Formation, September 1980

5.5 Tubewells

MI monitors the water and salt load discharged from seven tubewells within the MIA. Salinity measurements were taken in August 2016 and are only representative of water discharged at this time. The locations of monitored tubewells are shown in Figure 10.

Table 28 shows the total volumes and salt discharged from MIA tubewells for 2015/16 compared to previous years. A total volume of 1,873 ML was discharged from the tubewells, carrying 3,012 tonnes of salt into MI's drainage system. The higher salt load in 2015/16 is likely due to an increased volume pumped from the South Leeton tubewell which services an aquifer historically higher in EC. The tubewell located at Baulch's has not been operational since 2010 due to pump failure.

Table 26 Tubewell monitoring data 2015/16 compared to previous years

2015/16			2014/15		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	658	357	Five Bridges	777	394
Gil Gil	412	755	Gil Gil	585	1088
Yanco West	274	680	Yanco West	262	411
South Leeton	261	1,090	South Leeton	0	0
Baulch's	0	0	Baulch's	0	0
Wamoon	175	88	Wamoon	351	166
East Wamoon	93	40	East Wamoon	97	43
Total	**1,873**	**3,012**	**Total**	**2,072**	**2,102**
2013/14			**2006/07**		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	384	241	Five Bridges	707	489
Gil Gil	599	1315	Gil Gil	266	353
Yanco West	448	833	Yanco West	305	404
South Leeton	175	853	South Leeton	76	118
Baulch's	0	0	Baulch's	137	52
Wamoon	533	315	Wamoon	384	200
East Wamoon	81	43	East Wamoon	778	454
Total	**2,220**	**3,601**	**Total**	**2,653**	**2,070**

6 New measures to limit groundwater recharge and discharge of salt

MI continues to deliver water saving projects through automation, gravity piping and the channel lining of sections of the supply system under the Private Irrigation Infrastructure Operations Program (PIIOP). This has included works at Cudgel Creek to reduce the discharge of water and associated saltload discharged from MI's Area of Operation.

The PIIOP works has also helped reduce impacts of losses through channel seepage to groundwater systems at Lake Wyangan, Hanwood and Yenda which has included the replacement of ageing earthen channels with channel lining or gravity pipelines as well as channel automation and on-farm water saving initiatives.

7 Environmental Protection and Management

7.1 Discharge of noxious aquatic weeds

During 2015/16 irrigation year there was no known potential or actual discharge of Class 1, 2 or 3 declared noxious aquatic weeds from MI's Area of Operation.

7.2 Discharge of Blue-Green Algae

There was no known discharge of water containing blue green algae outside MI's Area of Operation in 2015/16.

ENVIRONMENTAL PROTECTION LICENCE 4651

8 Statement of Compliance

This licence authorises MI to undertake activities associated with Irrigated Agriculture. MI has fulfilled the compliance requirements as set out in EPL 4651 for 2015/16. A summary of the compliance requirements are cross referenced to this report and listed in Table 27.

Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations. Internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

MI is able to receive complaints from members of the public in relation to MI's activities via the business telephone number. Direction on how to make a compliant can be found on MI's website (www.mirrigation.com.au/Contact-Us).

Table 27 Environmental Protection Licence (EPL 4651) Monitoring and Reporting Requirements

Licence section	Requirement	Compliant	Report Section
Administrative Conditions	**1**	Yes	N/A
Discharges to Air and Water and Applications to Land	**2**	Yes	N/A
Limit Conditions	**3**	Yes	N/A
Operating Conditions	**4**	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	*Proposed changes sent to EPA for approval*
Maintain a Chemical Control Plan	O3.5	Yes	*Proposed changes sent to EPA for approval*
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	www.mirrigation.com.au/Environment/Water-Quality
Monitoring and Recording Conditions	**5**	Yes	
Monitoring Records	M1	Yes	Available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	Internal documents
Recording of pollution complaints	M4	Yes	Available upon request from EPA
Telephone complaints line	M5	Yes	1. Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11. EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	10. Noxious Weed Management
Annual return documents	R1		Submitted 26/08/2016
Notification of environmental harm	R2	Yes	N/A
Written Report (of an event)	R3	Yes	N/A
Annual system performance report	R4	Yes	Full Report
Other reporting conditions	R5	Yes	Section 11

9 Noxious Weed Management

MI maintains a Chemical Control Plan in accordance with the requirements set out in EPL 4651 and has a scheduled maintenance program aimed at managing noxious weeds within the MIA. MI records details for each herbicide application in or near waters as per EPL requirements which is maintained within an internal management system.

10 EPL monitoring

Under MI's EPL 4651, five points (Figure 3) are licenced to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded and specified water quality parameters are measured during flow or rainfall events.

10.1 System performance

Table 30 presents total diversions into the MIA and total water discharged from the MIA for 2015/16 compared to previous years. In 2015/16, 1,620 ML was discharged, which included 541 ML that was diverted as an Environmental Water Release (EWR) on direction from Office of Environment and Heritage (OEH). The higher volume discharged during 2015/16 was also due to the high annual rainfall during the year. In 2013/14, water was released through MI's discharge points to allow channels to be drained for maintenance works, causing an increase in the total volume of water discharged from MI's Area of Operations. In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in this year. MI does not discharge irrigation waste water directly to ground waters in or outside the area of operations. However, based on the estimated seepage losses accounted for in the water balance on page 15, groundwater accessions in the MIA can be estimated at 20,500 ML.

Table 28 Total water volumes (ML)

Year	Diversions	Discharged
2015/16	643,957	1,620*
2014/15	878,614	671
2013/14	832,758	2,438
2005/06	1,036,519	8,570

** Includes 541 ML for EWR*

10.2 Water Quality Monitoring

MI is also required to monitor the concentration of each chemical listed in Schedule 1 of EPL 4651 (Table 31). When concentrations reach 'notification' or 'action' trigger levels, the EPA is required to be notified. For each 'notification' or 'action' level detection, the EPA was notified and results uploaded on MI's webpage, in accordance with EPL requirements. MI maintains a Chemical Contingency Plan that outlines the monitoring, reporting and response procedures for discharge points listed in EPL 4651.

Table 29 Chemicals to be monitored at discharge points as listed in EPL 4651

Parameters	Environmental Guidelines (µg/L)	Notification Level (µg/L)	Action Level (µg/L)
Atrazine	2	13	45
Chlorpyrifos	0.001	0.01	0.11
Diazinon	0.0006	0.01	0.2
Diuron	8	1*	5*
Endosulfan	0.01	0.03	0.2
Malathion	0.07	0.05	0.2
Metolachlor	8	0.02	0.1
Molinate	2.5	3.4	14
Simazine	10	3.2	11
Thiobencarb	1	2.8	4.6
Trifluralin	0.1	2.6	4.4

Monthly summaries for each monitoring Point are presented in Tables 32 – 36. Monitoring consisted of 24 sampling events, with 19 notification or action level detections, all of which were reported to the EPA in accordance with R5.1. The results were also made available on MI's website in line with legislative requirements. Chemical detections were found at all sites, with the highest number of detections recorded at Monitoring Point 4, coinciding with the largest volume of water discharged. The high rainfall event in June caused the release of drainage water from farms into MI works that would normally be recycled on farm.

Throughout the 2015/16 season, MI has continued to work with landholders to better understand risk areas and reduce the potential for contaminants to enter MI works. Strategies have included monitoring programs aimed at isolating point sources and liaising with Landholders to promote risk awareness and best drainage practices.

Table 30 Monitoring results for Point 4 - LAG

Point 4 – LAG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-15	1.97	0	0	-
Aug-15	24.7	2	0	-
Sep-15	13.7	1	1	3/9/2015 Notification level Diuron (1.62µg/L)
Oct-15	52.1	3	2	6/10/2015 Notification level Diuron (1.12µg/L) 13/10/15 Notification level Diuron (2.17µg/L)
Nov-15	567.4 *(541 EWR)*	3	2	2/11/2015 Notification level Metolachlor (0.022 µg/L) 4/11/2015 Notification level Metolachlor (0.046 µg/L)
Dec-15	5.8	1	2	5/12/2015 Notification level Metolachlor (0.030 µg/L), Action level Thiobencarb (54.4 µg/L)
Jan-16	0	0	0	-
Feb-16	0	0	0	-
Mar-16	10.6	1	0	-
Apr-16	0.2	0	0	-
May-16	6.1	1	1	9/5/2016 Notification Diazinon (0.013 µg/L)
Jun-16	232.7	2	5	6/6/2016 Notification level Simazine (9.24 µg/L), Action level Diuron (14.1 µg/L) 20/6/2016 Notification level Metolachlor (0.027 µg/L), Action level Simazine (11.2 µg/L) & Diuron (21.2 µg/L)
Total	915.2	14	13	

Table 31 Monitoring results for Point 5 - GMSRR

Point 5 – GMSRR				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-15	0	0	0	-
Aug-15	0	0	0	-
Sep-15	0	0	0	-
Oct-15	0	0	0	-
Nov-15	0	0	0	-
Dec-15	0	0	0	-
Jan-16	0	0	0	-
Feb-16	0	0	0	-
Mar-16	0.11	0	0	-
Apr-16	0	0	0	-
May-16	0.08	0	0	-
Jun-16	64.1	1	1	20/6/2016 Notification level Metolachlor (0.028 µg/L)
Total	64.3	1	1	

Table 32 Monitoring results for Point 6 - YMS

Point 6 – YMS				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-15	0	0	0	-
Aug-15	0	0	0	-
Sep-15	0	0	0	-
Oct-15	0	0	0	-
Nov-15	0	0	0	-
Dec-15	0	0	0	-
Jan-16	0	0	0	-
Feb-16	0	0	0	-
Mar-16	0	0	0	-
Apr-16	0	0	0	-
May-16	0	0	0	-
Jun-16	105.2	2	3	6/6/2016 No notification/action level detected 20/6/2016 Notification level Diuron (3.20 µg/L) & Chlorpyrifos (0.019 µg/L), Action level Metolachlor (0.102 µg/L)
Total	105.2	2	3	

Table 33 Monitoring results for Point 7 - ROCUDG

Point 7 – ROCUDG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-15	17.4	0	0	-
Aug-15	60.7	1	0	-
Sep-15	100.7	2	0	-
Oct-15	12.3	1	0	-
Nov-15	62.4	1	1	2/11/2016 Notification level Metolachlor (0.024 µg/L)
Dec-15	1.04	0	0	-
Jan-16	0	0	0	-
Feb-16	0	0	0	-
Mar-16	0	0	0	-
Apr-16	3.7	0	0	-
May-16	0	0	0	-
Jun-16	0	0	0	-
Total	258.1	6	1	

Table 34 Monitoring results for Point 15 - MIRFLD

Point 15 – MIRFLD				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-15	0	0	0	-
Aug-15	0	0	0	-
Sep-15	0	0	0	-
Oct-15	0	0	0	-
Nov-15	0	0	0	-
Dec-15	0	0	0	-
Jan-16	0	0	0	-
Feb-16	0	0	0	-
Mar-16	0	0	0	-
Apr-16	0	0	0	-
May-16	0	0	0	-
Jun-16	281.2	1	1	25/6/2016 Action level Metolachlor (0.216 µg/L)
Total	281.2	1	1	

Appendix 1- Piezometer condition monitoring and reporting

Site_ID	Use Y/N	Top of Pipe Above NS (m)	Natural Surface (AHD)	Depth Below Top of Pipe (m)	Total depth of Bore (m)	Easting (GDA94) Zone 55	Northing (GDA94) Zone 55	STATUS
G1171	Y	0	109.98	24.28	24.28	385883.65	6213820.14	BLOCKED
G1387	Y	0.26	121.42	14.56	14.3	405293.23	6188659.47	BLOCKED
G152	Y	0	123.31	8.53	8.53	411885.14	6198949.26	BLOCKED
G1663	Y	0.8	123.71	30.87	30.07	409010.20	6180981.36	BLOCKED
G1766	Y	0	122.19	11.10	11.1	409627.35	6193021.09	BLOCKED
G2128	Y	0	123.85	9.23	9.23	408885.23	6189760.00	BLOCKED
G2271	Y	0	119.55	11.00	11	399677.42	6190767.74	BLOCKED
G2998	Y	0	110.47	12.97	12.97	382537.11	6220009.71	BLOCKED
G3137	Y	0	104.85	34.68	34.68	365445.51	6229370.55	BLOCKED
G3223	Y	0.22	114.57	11.68	11.46	385621.08	6202052.83	BLOCKED
G388	Y	0.6	125.18	11.27	10.67	412164.80	6193280.46	BLOCKED
G523	Y	0.000	0.00	10.30	10.30	386480.00	6219270.00	BLOCKED
L1563	Y	0.16	125.21	11.81	11.65	417214.00	6191840.00	BLOCKED
L1794S	Y	0.48	132.93	7.43	6.95	435660.00	6189985.00	READ
L1813M	Y	0	132.21	11.58	11.58	434609.00	6182654.00	BLOCKED
G105	N	0.15	120.26	9.85	9.7	409308.81	6203296.30	DESTROYED
G1172D	N	0	110.69	12.60	12.6	385592.05	6211815.80	DESTROYED
G1224	N	0.45	116.04	10.39	9.94	390634.12	6199182.63	DESTROYED
G1247	N	0	124.55	10.10	10.1	410504.01	6186648.26	DESTROYED
G1391	N	0	131.88	13.00	13	427345.16	6207371.67	DESTROYED
G1613	N	0	122.97	7.40	7.4	408096.07	6192346.25	DESTROYED
G1719	N	0.000	0.00	0.00	0.00	411970.00	6195770.00	DESTROYED
G1732	N	0.4	121.05	13.57	13.17	405853.13	6201106.22	DESTROYED
G1942	N	0.4	128.66	22.00	21.6	423796.27	6187089.06	DESTROYED
G227	N	0	124.57	21.72	21.72	414747.99	6199416.11	DESTROYED
G2369	N	0	114.83	1.02	1.02	396387.84	6208949.08	DESTROYED
G2735	N	0	113.05	9.10	9.1	388307.98	6208706.53	DESTROYED
G2747	N	0.5	127.03	11.40	10.9	420605.09	6192114.17	DESTROYED
G278	N	0	120.79	34.80	34.8	405136.42	6203007.60	DESTROYED
G2787	N	0	114.34	16.00	16	391929.61	6208885.41	DESTROYED
G279	N	0	120.81	11.50	11.5	405136.43	6203006.49	DESTROYED
G2826	N	0	115.59	28.50	28.5	397528.00	6210876.92	DESTROYED
G2872	N	0	122.41	2.56	2.56	408670.67	6194776.22	DESTROYED
G2909	N	0.42	116.86	17.14	16.72	395440.77	6204038.78	DESTROYED
G296	N	0.2	127.84	6.22	6.02	420805.52	6202486.74	DESTROYED

G3174	N	0.17	115.72	9.62	9.45	399314.80	6210024.58	DESTROYED
G318	N	0	127.23	22.70	22.7	420203.35	6205276.39	DESTROYED
G3188	N	0	117.87	6.00	6	403074.58	6203139.50	DESTROYED
G557	N	0	115.08	38.20	38.2	391219.40	6202406.89	DESTROYED
L1321S	N	0.29	128.24	11.96	11.67	421568.17	6188351.66	DESTROYED
L1327D	N	0.15	127.36	22.66	22.51	422002.00	6191382.00	DESTROYED
L1327S	N	0	127.31	11.40	11.4	422003.00	6191382.00	DESTROYED
L1398	N	0	125.85	26.12	26.12	414972.00	6187969.00	DESTROYED
L1798	N	0.28	132.62	16.10	15.82	435354.00	6187859.00	DESTROYED
L1830	N	0.65	135.07	5.91	5.26	445125.00	6179101.00	DESTROYED
L1935D	N	0.6	131.48	11.20	10.6	431313.00	6186009.00	DESTROYED
L1984	N	0	132.33	18.29	18.29	433642.00	6189726.00	DESTROYED
L2280	N	0.17	131.23	15.90	15.73	425004.00	6173837.00	DESTROYED
L301	N	0.18	135.21	6.58	6.4	439528.00	6177370.00	DESTROYED
L592	N	0	141.65	9.44	9.44	451319.00	6165740.00	DESTROYED
G1160	Y	0	110.94	6.29	6.29	386181.34	6216247.08	DRY
G2346	Y	0.35	118.49	15.00	14.65	402977.82	6199783.69	DRY
G2655	Y	0.3	0.00	15.65	15.35	394765.36	6176939.74	DRY
G2657	Y	0.5	0.00	17.90	17.4	389028.80	6179216.42	DRY
G267	Y	0.27	120.39	8.77	8.5	407917.29	6200500.20	DRY
G2676	Y	0.19	0.00	20.02	19.83	384063.31	6182453.18	DRY
G2977	Y	0.17	104.26	10.55	10.38	362748.55	6221817.05	DRY
G3133	Y	0.18	108.90	11.48	11.3	380507.07	6227474.91	DRY
G3265	Y	0.33	111.70	8.73	8.4	383826.37	6219839.40	DRY
G3358	Y	0	106.68	7.12	7.12	368849.95	6217096.98	DRY
G735	Y	0.85	0.00	13.85	13	401616.74	6186154.79	DRY
G809	Y	0.87	120.02	8.01	7.14	397999.90	6188604.58	DRY
L1764S	Y	0.4	135.67	8.45	8.05	436826.00	6174767.00	DRY
L2210B	Y	0.32	133.95	2.56	2.24	438438.00	6177767.00	DRY
L2312	Y	0.28	135.51	3.38	3.1	446406.00	6178365.00	READ
L2313	Y	0.33	135.78	3.91	3.58	446664.00	6177515.00	READ
L2648	Y	0.23	124.98	13.87	13.64	411007.00	6174488.00	READ
L2793	Y	0.37	0.00	9.38	9.01	430510.00	6166775.00	READ
L2796S	Y	0.29	0.00	9.40	9.11	436321.00	6166468.00	READ
G106	Y	0.15	126.91	15.49	15.34	417017.98	6203588.56	READ
G1073	Y	0.16	113.75	7.31	7.15	394298.19	6211086.17	READ
G1089	Y	0.6	110.12	8.92	8.32	386302.53	6217200.13	READ
G1090	Y	0	111.83	3.52	3.52	390834.21	6215653.50	READ
G1159	Y	0.45	110.96	25.04	24.59	386185.04	6216246.01	READ
G1172S	Y	0	110.48	7.05	7.05	385591.10	6211818.01	READ
G1187	Y	0.3	111.38	17.64	17.34	384616.07	6204521.54	READ

G1189D	Y	0.2	112.15	26.87	26.67	384304.21	6202199.66	READ
G1189S	Y	0.2	112.17	8.96	8.76	384305.11	6202200.78	READ
G1190	Y	0	113.13	23.15	23.15	383855.97	6198429.79	READ
G1192	Y	0.03	113.78	26.88	26.85	383645.25	6196811.18	READ
G1193	Y	0.3	115.07	22.00	21.7	388896.37	6199410.55	READ
G1194	Y	0.35	113.93	24.35	24	386528.30	6199715.92	READ
G1195	Y	0.56	0.00	12.49	11.93	391170.24	6188330.91	READ
G1196	Y	0.44	0.00	12.30	11.86	391168.35	6188335.33	READ
G1197	Y	0.76	118.08	23.32	22.56	391580.40	6191064.07	READ
G1198	Y	0.1	0.00	40.76	40.66	383000.11	6192005.04	READ
G1215	Y	0.35	115.36	20.05	19.7	398101.09	6216290.78	READ
G1216	Y	0.37	113.02	19.62	19.25	400686.15	6216988.30	READ
G1217	Y	0.08	113.77	8.44	8.36	383645.23	6196812.29	READ
G1218	Y	0.17	113.10	12.56	12.39	383857.77	6198433.14	READ
G1219	Y	0.15	119.87	18.34	18.19	395393.04	6190567.55	READ
G122	Y	0.1	126.92	6.58	6.48	417018.92	6203586.35	READ
G1220	Y	0.15	120.16	7.87	7.72	397571.23	6190234.64	READ
G1221	Y	0.05	120.38	8.61	8.56	396103.64	6190471.25	READ
G1222	Y	0.5	119.28	9.27	8.77	393739.81	6190791.72	READ
G1223	Y	0.65	116.36	9.55	8.9	391940.52	6199017.05	READ
G1244	Y	0.15	124.91	11.33	11.18	411683.35	6189376.63	READ
G1246	Y	0	124.84	20.31	20.31	411684.30	6189373.31	READ
G1248	Y	0.3	123.43	21.14	20.84	407639.75	6189790.98	READ
G1249	Y	0.3	123.46	7.72	7.42	407644.38	6189787.70	READ
G1287	Y	0.48	122.41	10.98	10.5	406740.59	6189559.10	READ
G1294	Y	0.45	122.10	12.40	11.95	406447.79	6190440.06	READ
G1296	Y	0	122.12	4.33	4.33	406388.33	6190411.74	READ
G1301	Y	0.05	124.70	7.84	7.79	411409.87	6187988.86	READ
G1319	Y	0.7	125.37	19.27	18.57	414769.00	6184929.00	READ
G132	Y	0.36	125.38	27.86	27.5	416415.73	6205279.92	READ
G1337	Y	0.2	120.43	15.76	15.56	406248.94	6195316.68	READ
G1342D	Y	0.16	127.99	7.18	7.02	419414.39	6183940.44	READ
G1342S	Y	0.3	127.99	14.53	14.23	419414.39	6183940.44	READ
G1359	Y	0.25	128.32	9.70	9.45	419611.71	6182862.42	READ
G1380	Y	0.5	120.94	10.87	10.37	406211.84	6195074.54	READ
G1381	Y	0.4	120.99	5.97	5.57	406212.72	6195078.98	READ
G1385	Y	0.58	119.76	12.53	11.95	406733.61	6198804.97	READ
G1400	Y	0.000	0.00	19.10	19.10	412089.93	6187827.80	READ
G1401	Y	0.000	0.00	15.40	15.40	412089.93	6187827.80	READ
G1402	Y	0.27	125.10	10.36	10.09	412843.37	6187183.15	READ
G1406	Y	0	125.33	18.62	18.62	414090.42	6186143.94	READ

G1410	Y	0.44	126.19	7.22	6.78	416515.25	6187772.04	READ
G1416	Y	0.4	122.69	15.70	15.3	407988.48	6186308.75	READ
G1417	Y	0.1	124.18	7.52	7.42	410491.96	6189333.09	READ
G146	Y	0	125.25	24.22	24.22	415674.15	6203205.03	READ
G1560	Y	0.25	123.92	24.88	24.63	411847.70	6190166.69	READ
G1561	Y	0.2	123.90	11.55	11.35	411846.77	6190167.79	READ
G1568	Y	0	124.20	19.96	19.96	409586.45	6189658.15	READ
G1577	Y	0.1	123.31	13.22	13.12	409590.96	6195920.81	READ
G1578	Y	0.1	119.99	15.28	15.18	406609.12	6198100.61	READ
G1579	Y	0.22	120.16	9.92	9.7	407941.98	6201262.33	READ
G1591	Y	0.2	123.00	11.63	11.43	407174.15	6191051.75	READ
G1594	Y	0	122.67	9.70	9.7	408880.29	6192802.00	READ
G1595	Y	0.15	120.21	10.50	10.35	407132.40	6202087.19	READ
G1602	Y	0.45	121.86	8.44	7.99	405866.75	6192735.45	READ
G1643	Y	0	119.34	15.77	15.77	407541.48	6204732.90	READ
G1644	Y	0.2	118.89	26.27	26.07	405866.52	6204986.80	READ
G1660	Y	0.1	122.10	14.35	14.25	406587.16	6186718.43	READ
G1661	Y	0.1	123.67	21.20	21.1	409053.36	6186004.26	READ
G1662	Y	0.1	123.68	8.70	8.6	409061.64	6186003.23	READ
G1666	Y	0.5	123.64	20.68	20.18	410446.52	6185630.05	READ
G168	Y	0.07	125.10	6.10	6.03	414709.82	6197451.74	READ
G1684	Y	0.000	0.00	24.70	24.70	416432.92	6204489.38	READ
G1686	Y	0.11	125.46	12.11	12	416432.92	6204489.38	READ
G1691	Y	0.05	122.94	9.80	9.75	408716.32	6198945.44	READ
G1705	Y	0.1	123.38	11.92	11.82	409528.59	6195241.49	READ
G1738	Y	0	121.87	11.10	11.1	406764.92	6194383.62	READ
G1745	Y	0.35	119.52	12.87	12.52	406803.12	6203457.98	READ
G1746	Y	0.2	120.22	14.70	14.5	404512.72	6204065.90	READ
G1759	Y	0.1	120.76	9.43	9.33	408497.33	6199985.77	READ
G1779	Y	0.45	131.12	31.84	31.39	426273.87	6204528.85	READ
G178	Y	0.5	125.00	7.86	7.36	414091.91	6197738.84	READ
G1788	Y	0.05	118.81	2.17	2.12	404068.44	6204489.44	READ
G1789	Y	0.42	118.77	9.79	9.37	405455.43	6204769.72	READ
G1800	Y	0.66	131.12	14.41	13.75	426273.87	6204528.85	READ
G1801	Y	0	129.20	8.45	8.45	424098.37	6204960.58	READ
G1818	Y	0.1	122.73	7.32	7.22	407292.63	6196792.13	READ
G195	Y	0.37	124.57	5.55	5.18	414985.91	6194504.33	READ
G2003	Y	0	124.21	37.90	37.9	412114.38	6218660.24	READ
G2005	Y	0	112.34	21.24	21.24	406951.52	6216144.17	READ
G2006	Y	0	125.36	31.80	31.8	413195.55	6215774.78	READ
G2009	Y	0	108.95	20.80	20.8	406503.52	6214213.41	READ

G2010	Y	0.3	107.70	12.42	12.12	409972.14	6211744.34	READ
G2020	Y	0.2	123.22	25.14	24.94	410076.74	6223635.76	READ
G2026	Y	0.23	118.76	12.35	12.12	402374.77	6204764.70	READ
G203	Y	0	121.72	7.68	7.68	408554.80	6197217.13	READ
G2048	Y	0.1	115.43	12.92	12.82	393525.40	6205332.52	READ
G205	Y	0.32	122.14	8.94	8.62	409373.10	6198755.55	READ
G2052	Y	0.17	116.27	6.65	6.48	398614.08	6204993.10	READ
G2060	Y	0.05	121.22	17.44	17.39	404740.64	6192558.76	READ
G2061	Y	0.4	121.26	9.23	8.83	404736.97	6192557.61	READ
G2062	Y	0.1	118.78	9.23	9.13	394862.03	6193888.79	READ
G2065	Y	0.14	117.83	11.74	11.6	394125.22	6196107.48	READ
G2066	Y	0.1	117.70	10.82	10.72	393979.24	6195196.38	READ
G207	Y	0.27	122.44	12.19	11.92	406506.78	6197114.78	READ
G2082	Y	0.37	115.22	38.73	38.36	396247.36	6215491.95	READ
G209	Y	0.38	122.76	25.59	25.21	405804.83	6192495.27	READ
G2092	Y	0.36	114.89	25.86	25.5	411260.02	6212406.48	READ
G2095	Y	0.1	121.52	12.07	11.97	405705.39	6191784.49	READ
G210	Y	0.15	122.53	9.67	9.52	405810.33	6192496.44	READ
G2141	Y	0.3	124.05	9.42	9.12	408430.35	6189854.24	READ
G215	Y	0.32	121.63	9.56	9.24	406814.16	6199674.14	READ
G2163	Y	0.15	117.70	37.71	37.56	393977.41	6195195.25	READ
G2190	Y	0.2	116.57	6.35	6.15	394520.81	6202448.05	READ
G225	Y	0.07	123.45	18.01	17.94	414259.95	6202580.01	READ
G2264	Y	0.2	126.15	28.74	28.54	412331.99	6194466.45	READ
G2274	Y	0.4	119.50	14.35	13.95	396382.48	6191595.63	READ
G2279	Y	0.19	117.04	33.19	33	400345.57	6210179.77	READ
G2280	Y	0	121.59	17.53	17.53	406334.75	6195928.61	READ
G2283	Y	0.05	120.27	23.15	23.1	400011.62	6193197.94	READ
G2284	Y	0.15	120.29	13.49	13.34	400010.72	6193196.82	READ
G2291	Y	0	119.75	24.50	24.5	395579.31	6193793.71	READ
G2292	Y	0	119.48	11.05	11.05	395578.34	6193798.14	READ
G2294	Y	0.14	124.29	9.43	9.29	411939.00	6191345.00	READ
G2295	Y	0	119.41	23.60	23.6	397900.55	6193477.83	READ
G2296	Y	0	119.46	5.37	5.37	397898.68	6193481.14	READ
G2306	Y	0.15	122.30	17.88	17.73	405962.23	6188651.84	READ
G2307	Y	0.2	122.30	9.15	8.95	405959.49	6188649.59	READ
G2309	Y	0.17	121.45	22.52	22.35	405552.98	6188235.13	READ
G2330	Y	0.15	121.41	8.95	8.8	405556.60	6188240.72	READ
G2337	Y	0.2	122.01	16.20	16	405590.61	6190322.72	READ
G2338	Y	0.23	122.42	14.63	14.4	405595.16	6190327.21	READ
G2340	Y	0.3	114.17	25.02	24.72	385189.37	6199889.22	READ

G2341	Y	0.25	114.19	10.45	10.2	385185.68	6199890.29	READ
G2345D	Y	0.15	111.62	20.79	20.64	385058.99	6207733.38	READ
G2345S	Y	0.15	111.56	7.65	7.5	385058.95	6207736.71	READ
G2452	Y	0.5	125.88	9.30	8.8	418059.03	6196220.83	READ
G247	Y	0	128.93	3.84	3.84	421392.10	6206753.60	READ
G2482	Y	0.28	121.45	13.28	13	406228.41	6200474.53	READ
G250	Y	0.18	127.67	32.86	32.68	418928.07	6202996.48	READ
G252	Y	0.73	125.36	30.19	29.46	416441.15	6204495.00	READ
G254	Y	0.37	132.09	3.23	2.86	428719.50	6205091.18	READ
G2650	Y	0.1	127.63	23.27	23.17	417315.63	6173689.15	READ
G2653	Y	0.03	0.00	19.81	19.78	401661.66	6176109.35	READ
G2654	Y	0.15	0.00	23.91	23.76	398315.10	6176607.81	READ
G2656	Y	0.14	0.00	18.52	18.38	391060.00	6177991.63	READ
G269	Y	0.4	120.43	27.45	27.05	407870.11	6200900.09	READ
G2690	Y	0	120.46	34.70	34.7	400291.32	6195240.48	READ
G2691	Y	0.1	121.12	35.32	35.22	402927.69	6194874.58	READ
G2692	Y	0.05	121.18	13.54	13.49	402920.34	6194874.50	READ
G2693	Y	0.25	120.40	11.75	11.5	400285.74	6195245.97	READ
G2694	Y	0	122.08	28.13	28.13	404488.68	6194631.18	READ
G2695	Y	0.16	121.97	16.60	16.44	404484.96	6194635.58	READ
G2696	Y	0.14	118.43	8.99	8.85	395792.60	6197499.27	READ
G2697	Y	0	117.46	44.34	44.34	392930.55	6201167.85	READ
G2698	Y	0	117.38	15.20	15.2	392933.36	6201163.45	READ
G2703	Y	0.1	125.12	9.30	9.2	419191.88	6191354.01	READ
G273	Y	0.16	124.40	8.36	8.2	413964.44	6202093.78	READ
G2731	Y	0	113.45	9.87	9.87	388306.44	6205361.53	READ
G2734	Y	0.2	113.33	11.30	11.1	388745.83	6207429.65	READ
G2741	Y	0	112.36	7.50	7.5	387286.39	6211566.81	READ
G2748	Y	0.05	111.48	8.54	8.49	388059.59	6214242.27	READ
G2754	Y	0.22	128.78	18.41	18.19	424945.61	6189233.69	READ
G2755	Y	0.45	128.96	8.20	7.75	424946.35	6189235.91	READ
G2767	Y	0.000	0.00	20.50	20.50	417670.31	6189898.26	READ
G2768	Y	0.000	0.00	13.00	13.00	417670.31	6189898.26	READ
G2790	Y	0.15	121.06	13.30	13.15	408331.73	6194368.10	READ
G2799	Y	0.07	126.31	4.67	4.6	416269.03	6202852.18	READ
G2819	Y	0.05	114.33	22.49	22.44	396849.25	6207774.15	READ
G2820	Y	0	116.13	15.03	15.03	395669.14	6206836.14	READ
G2821	Y	0	114.71	5.16	5.16	397361.58	6207066.67	READ
G2825	Y	0.3	116.33	13.80	13.5	397377.40	6209657.55	READ
G2857	Y	0	120.28	7.40	7.4	398260.19	6197171.59	READ
G2862	Y	0.05	120.39	27.81	27.76	397432.20	6196440.53	READ

G2863	Y	0.1	119.83	11.89	11.79	397426.57	6196450.45	READ
G2864	Y	0.1	118.22	13.36	13.26	395825.17	6196475.97	READ
G2868	Y	0.1	121.55	10.03	9.93	407933.21	6195249.17	READ
G2885	Y	0	105.63	23.36	23.36	373039.50	6228388.84	READ
G2892	Y	0.37	104.05	21.81	21.44	369162.81	6228820.56	READ
G2893	Y	0.05	105.16	7.75	7.7	363204.83	6225328.69	READ
G2901	Y	0.34	101.31	8.41	8.07	355079.03	6231256.87	READ
G2905	Y	0	99.39	7.75	7.75	349143.42	6229963.70	READ
G293	Y	0.37	127.59	9.00	8.63	418951.09	6202994.47	READ
G2953	Y	0.23	106.82	16.37	16.14	371950.92	6224687.40	READ
G2976	Y	0.1	104.31	8.86	8.76	363543.57	6227742.71	READ
G2981	Y	0.1	102.11	6.90	6.8	356481.23	6230060.38	READ
G2995	Y	0.2	114.34	9.18	8.98	385657.88	6201225.89	READ
G301	Y	0.37	133.37	28.49	28.12	430510.83	6203443.47	READ
G3010	Y	0	107.70	9.00	9	373947.36	6221169.58	READ
G3018	Y	0.1	106.11	12.64	12.54	368697.40	6223272.82	READ
G304	Y	0.6	121.07	22.78	22.18	405345.48	6189304.36	READ
G305	Y	0.3	121.12	12.10	11.8	405348.20	6189307.71	READ
G306	Y	0	122.27	23.55	23.55	405159.86	6187771.99	READ
G3060	Y	0.19	107.72	14.41	14.22	369231.76	6220067.06	READ
G3062	Y	0.1	107.90	7.45	7.35	373392.19	6217266.86	READ
G3063	Y	0	108.42	13.47	13.47	373025.60	6215198.92	READ
G3065D	Y	0.15	105.61	26.90	26.75	370304.03	6216628.02	READ
G3065S	Y	0.25	105.61	17.38	17.13	370304.03	6216628.02	READ
G3066	Y	0.32	105.91	8.94	8.62	368178.57	6211866.76	READ
G307	Y	0	125.01	20.90	20.9	413515.00	6191570.00	READ
G309	Y	0.19	125.12	25.42	25.23	415103.00	6191331.00	READ
G311	Y	0.21	122.06	23.69	23.48	404479.46	6194633.31	READ
G3119	Y	0.33	113.31	9.88	9.55	390433.40	6211306.87	READ
G3126	Y	0.36	111.90	11.36	11	390328.74	6210489.38	READ
G3131	Y	0.15	102.89	34.64	34.49	358848.48	6229918.61	READ
G3132	Y	0.27	105.79	26.92	26.65	373372.89	6230780.13	READ
G3134	Y	0.39	108.45	19.63	19.24	383584.44	6221507.79	READ
G3138	Y	0.15	106.29	23.53	23.38	369522.18	6233806.63	READ
G3180	Y	0.15	97.54	9.70	9.55	336071.79	6228227.06	READ
G3260	Y	0.25	106.81	37.86	37.61	374066.72	6222725.05	READ
G3261	Y	0	110.88	19.70	19.7	377963.00	6227400.19	READ
G3266	Y	0	112.09	26.24	26.24	377294.70	6222245.29	READ
G327	Y	0.2	132.38	8.22	8.02	429225.36	6208425.14	READ
G3285	Y	0.05	116.29	15.58	15.53	393327.46	6203961.69	READ
G3287	Y	0.17	104.23	24.36	24.19	362749.44	6221819.28	READ

G3288	Y	0.15	103.79	33.55	33.4	361796.64	6214484.68	READ
G3301	Y	0	104.57	26.76	26.76	364196.84	6219372.37	READ
G3322	Y	0.25	104.25	24.71	24.46	360095.45	6205095.49	READ
G3327	Y	0.3	107.00	21.67	21.37	375738.90	6220840.71	READ
G3337	Y	0.17	99.56	21.70	21.53	346908.83	6226974.87	READ
G3366	Y	0.15	104.55	26.50	26.35	365125.77	6214013.99	READ
G3367	Y	0	106.16	15.65	15.65	370258.03	6211728.26	READ
G3369	Y	0.22	121.04	26.04	25.82	412216.62	6217385.88	READ
G3370	Y	0	117.88	23.00	23	410324.73	6219775.60	READ
G3371	Y	0	115.38	21.67	21.67	409322.86	6217745.44	READ
G3376	Y	0.1	103.78	23.46	23.36	360875.91	6207531.87	READ
G3379	Y	0.16	105.76	21.38	21.22	367504.32	6206773.90	READ
G3392	Y	0.33	95.17	25.53	25.2	326892.45	6231521.03	READ
G343	Y	0.1	130.86	13.10	13	425371.17	6204163.50	READ
G352	Y	0.12	132.82	9.05	8.93	429871.68	6208181.60	READ
G370	Y	0.58	120.39	23.32	22.74	402645.53	6192838.77	READ
G371	Y	0.25	121.39	24.85	24.6	402111.60	6189411.76	READ
G373	Y	0.12	123.58	16.00	15.88	409477.35	6184255.66	READ
G374	Y	0.3	120.94	28.73	28.43	405186.88	6199485.86	READ
G381	Y	0	119.57	9.86	9.86	406328.78	6204231.76	READ
G384	Y	0.1	124.94	8.79	8.69	412880.52	6196570.93	READ
G407	Y	0.27	120.96	13.42	13.15	401352.16	6195093.17	READ
G431	Y	0.37	115.60	10.30	9.93	396509.77	6205582.26	READ
G432	Y	0.1	116.44	29.49	29.39	393386.29	6204291.75	READ
G441	Y	0.1	121.78	21.20	21.1	401924.16	6188014.60	READ
G443	Y	0.22	0.00	25.54	25.32	404865.67	6185454.41	READ
G451	Y	0.5	122.68	29.06	28.56	407990.32	6186307.66	READ
G458	Y	0.1	118.24	37.16	37.06	404540.66	6207283.44	READ
G459	Y	0.55	118.96	30.30	29.75	406883.61	6206283.42	READ
G461	Y	0.1	118.90	8.77	8.67	405107.83	6204556.60	READ
G462	Y	0.02	119.69	4.04	4.02	407356.95	6203941.46	READ
G469	Y	0.28	117.12	21.59	21.31	401085.58	6204905.32	READ
G470	Y	0.45	115.92	18.30	17.85	398058.62	6205368.58	READ
G471	Y	0.23	115.95	28.79	28.56	394993.86	6205807.15	READ
G487	Y	0.15	117.74	8.85	8.7	398191.76	6202017.39	READ
G494	Y	0	117.72	8.60	8.6	398406.55	6203591.24	READ
G500	Y	0.44	124.90	17.79	17.35	414191.00	6184506.00	READ
G508	Y	0.1	124.66	9.22	9.12	416976.87	6192953.99	READ
G511	Y	0.33	115.53	26.48	26.15	398331.42	6208646.53	READ
G515	Y	1.2	112.62	32.45	31.25	388906.44	6206155.01	READ
G521	Y	0.25	111.79	16.13	15.88	388688.65	6219167.33	READ

G522	Y	0.26	111.55	23.26	23	386595.33	6219441.77	READ
G527	Y	0.36	113.86	18.57	18.21	393488.41	6216132.03	READ
G532	Y	0.43	0.00	26.32	25.89	404283.86	6181212.97	READ
G534	Y	0.38	113.38	31.42	31.04	392942.92	6211275.97	READ
G535	Y	0.53	113.43	14.03	13.5	392940.17	6211274.83	READ
G537	Y	0.51	112.15	26.21	25.7	390552.80	6212441.73	READ
G543	Y	0.1	112.52	13.90	13.8	395221.50	6217740.77	READ
G544	Y	0.45	114.05	31.93	31.48	394700.56	6213891.02	READ
G555	Y	0.2	114.22	7.74	7.54	389509.63	6204191.32	READ
G561	Y	0.1	118.44	29.20	29.1	399381.25	6198714.23	READ
G620	Y	0.23	116.94	10.57	10.34	392516.78	6197944.57	READ
G628	Y	0.31	0.00	41.33	41.02	403904.29	6178236.77	READ
G651	Y	0.33	115.03	16.48	16.15	411236.30	6213259.06	READ
G657	Y	0	122.30	28.50	28.5	412571.88	6213480.08	READ
G670	Y	0.1	116.46	34.07	33.97	401128.84	6206997.40	READ
G672	Y	0.34	115.16	25.74	25.4	399395.03	6213192.81	READ
G674	Y	0.6	106.14	18.41	17.81	407694.59	6212739.15	READ
G677	Y	0.4	122.73	35.22	34.82	403398.37	6212618.27	READ
G679	Y	0.5	113.27	11.93	11.43	400829.72	6212994.05	READ
G689	Y	0.3	123.84	8.74	8.44	412873.69	6198485.00	READ
G696	Y	0.3	122.26	9.42	9.12	409912.60	6197942.32	READ
G697	Y	0.18	122.16	9.65	9.47	409961.91	6198265.52	READ
G710	Y	0.6	111.47	24.24	23.64	386893.29	6221728.91	READ
G718	Y	0.3	0.00	11.33	11.03	401801.49	6187275.79	READ
G738	Y	0.55	0.00	10.53	9.98	401776.46	6186513.60	READ
G752	Y	0.15	110.37	14.60	14.45	386401.98	6217817.97	READ
G766	Y	0	111.75	5.74	5.74	385010.84	6206030.33	READ
G793	Y	0.15	117.40	44.45	44.3	403848.92	6202475.42	READ
G800	Y	0.25	126.52	13.85	13.6	418252.84	6205394.85	READ
G813	Y	0.55	116.52	7.89	7.34	394496.35	6200946.10	READ
G819	Y	0	117.31	5.52	5.52	394677.90	6200920.42	READ
L1056	Y	0.35	135.71	13.24	12.89	439989.00	6178593.00	READ
L1159	Y	0.76	135.55	8.24	7.48	445382.00	6180810.00	READ
L120	Y	0.26	133.77	10.58	10.32	441944.00	6184630.00	READ
L1237	Y	0.22	133.80	13.61	13.39	441737.00	6183191.00	READ
L1305	Y	0.18	127.48	22.41	22.23	419534.00	6186452.00	READ
L1326D	Y	0.24	127.83	21.35	21.11	421789.00	6190113.00	READ
L1326S	Y	0.4	127.83	22.49	22.09	421789.00	6190113.00	READ
L1413D	Y	0.19	126.43	11.36	11.17	419505.00	6192203.00	READ
L1413S	Y	0.32	126.43	6.81	6.49	419505.00	6192203.00	READ
L1419D	Y	0.36	132.41	22.22	21.86	429985.00	6181294.00	READ

L1419S	Y	0.61	132.47	5.71	5.1	429983.00	6181295.00	READ
L1446	Y	0.7	128.47	21.80	21.1	424377.00	6185860.00	READ
L1448	Y	0.25	128.26	15.15	14.9	423923.00	6188062.00	READ
L1460D	Y	0.37	128.00	19.84	19.47	424396.00	6190742.00	READ
L1460S	Y	0.45	128.00	13.83	13.38	424396.00	6190742.00	READ
L1529	Y	0.39	133.62	11.94	11.55	443846.00	6184186.00	READ
L1531D	Y	0.4	128.91	20.60	20.2	423620.00	6180987.00	READ
L1531S	Y	0.07	128.90	10.22	10.15	423620.00	6180988.00	READ
L1532	Y	0.07	129.40	20.25	20.18	422151.00	6181677.00	READ
L1533D	Y	0.11	129.93	20.35	20.24	424859.00	6183504.00	READ
L1533S	Y	0.19	130.33	21.37	21.18	424861.00	6183501.00	READ
L1534D	Y	0.43	129.55	10.55	10.12	425014.00	6184704.00	READ
L1534S	Y	0.6	129.55	13.94	13.34	425014.00	6184702.00	READ
L1535D	Y	0.16	129.50	2.56	2.4	423686.00	6182719.00	READ
L1535S	Y	0.23	129.58	7.91	7.68	423687.00	6182720.00	READ
L1536D	Y	0.28	129.13	23.05	22.77	422354.00	6184163.00	READ
L1536S	Y	0.44	129.11	13.35	12.91	422354.00	6184164.00	READ
L1537	Y	0.52	135.23	15.04	14.52	444043.00	6179588.00	READ
L1551	Y	0.15	133.76	13.00	12.85	443892.00	6182762.00	READ
L1560	Y	0.63	133.85	7.25	6.62	442864.00	6182659.00	READ
L1560TW	Y	0	133.86	2.42	2.42	442866.54	6182659.00	READ
L1565	Y	0.16	125.59	24.16	24	417312.00	6190767.00	READ
L1602	Y	0.19	139.39	11.05	10.86	445840.00	6169356.00	READ
L1603	Y	0.37	133.06	13.32	12.95	434363.00	6188683.00	READ
L1612	Y	0	137.39	6.45	6.45	442387.00	6193049.00	READ
L1628	Y	0.38	134.05	9.78	9.4	441749.00	6181801.00	READ
L1640	Y	0.25	132.81	8.59	8.34	431201.00	6180438.00	READ
L1642	Y	0.03	135.82	7.65	7.62	438457.00	6175870.00	READ
L1646	Y	0.22	135.72	13.12	12.9	441065.00	6171272.00	READ
L1654	Y	0.35	133.05	15.57	15.22	439222.00	6185445.00	READ
L1662	Y	0.65	133.64	17.11	16.46	439033.00	6183583.00	READ
L1709D	Y	0.11	133.61	13.56	13.45	438075.00	6183059.00	READ
L1709S	Y	0.24	133.57	5.85	5.61	438075.00	6183060.00	READ
L1728	Y	0.38	134.49	16.88	16.5	441857.00	6180653.00	READ
L1729D	Y	0.25	135.30	18.85	18.6	441288.00	6179948.00	READ
L1729S	Y	0.23	135.29	7.59	7.36	441292.00	6179949.00	READ
L1732D	Y	0.63	133.52	10.23	9.6	438790.00	6187947.00	READ
L1732S	Y	0.16	133.57	5.46	5.3	438791.00	6187947.00	READ
L1738	Y	0.4	133.53	13.55	13.15	438578.00	6186653.00	READ
L1739D	Y	0.51	133.51	18.11	17.6	438420.00	6185316.00	READ
L1739M	Y	1	133.50	16.81	15.81	438420.00	6185318.00	READ

L1739S	Y	0.43	133.51	10.17	9.74	438419.00	6185319.00	READ
L1748D	Y	0.41	130.65	13.43	13.02	428446.00	6179466.00	READ
L1748S	Y	0.67	130.67	8.19	7.52	428448.00	6179466.00	READ
L1751	Y	0.25	134.47	24.49	24.24	437898.00	6181831.00	READ
L1753	Y	0.48	135.02	15.63	15.15	437584.00	6179682.00	READ
L1764D	Y	0.63	135.67	14.90	14.27	436827.00	6174767.00	READ
L1764M	Y	0.65	135.66	13.41	12.76	436825.00	6174768.00	READ
L1767	Y	-0.51	134.75	19.54	20.05	436346.00	6170668.00	READ
L1768D	Y	0.22	135.45	9.40	9.18	437069.00	6176155.00	READ
L1768S	Y	0.06	135.44	13.23	13.17	437070.00	6176155.00	READ
L1779D	Y	0.47	119.58	20.27	19.8	403175.94	6196469.74	READ
L1779S	Y	0.57	128.34	13.06	12.49	420714.00	6185533.00	READ
L1784	Y	0	135.73	17.23	17.23	443143.00	6178073.00	READ
L1788	Y	0.08	138.03	12.16	12.08	443000.00	6172507.00	READ
L1792	Y	0.34	132.74	11.06	10.72	435524.00	6189031.00	READ
L1794D	Y	0.21	132.94	13.23	13.02	435661.00	6189992.00	READ
L1800	Y	0.34	132.23	13.54	13.2	435248.00	6187126.00	READ
L1805	Y	0.31	132.03	6.89	6.58	435011.00	6185472.00	READ
L1808	Y	0.34	132.17	8.16	7.82	434846.00	6184349.00	READ
L1810D	Y	0.28	132.19	22.99	22.71	434742.00	6183596.00	READ
L1810S	Y	0.1	132.28	10.95	10.85	434739.00	6183596.00	READ
L1813D	Y	0.31	132.19	24.15	23.84	434609.00	6182653.00	READ
L1813S	Y	0.17	132.13	5.09	4.92	434610.00	6182652.00	READ
L1818	Y	0.22	132.91	17.96	17.74	434363.00	6180972.00	READ
L1826D	Y	0.57	133.10	7.02	6.45	433910.00	6177684.00	READ
L1826S	Y	0.39	133.09	4.89	4.5	433911.00	6177685.00	READ
L1854D	Y	0.55	134.56	6.79	6.24	432237.00	6172929.00	READ
L1854S	Y	0.3	134.51	7.22	6.92	432232.00	6172932.00	READ
L1861D	Y	0.26	133.64	17.56	17.3	431908.00	6170836.00	READ
L1861S	Y	0.45	133.50	6.64	6.19	431905.00	6170831.00	READ
L1866	Y	0.03	131.14	8.25	8.22	428170.00	6181470.00	READ
L1876	Y	0.27	132.96	15.27	15	436114.00	6184968.00	READ
L1881	Y	0.95	132.76	8.33	7.38	436032.00	6186816.00	READ
L1883	Y	0.3	133.32	15.50	15.2	437733.00	6186708.00	READ
L1890	Y	0	133.32	4.87	4.87	435130.00	6180518.00	READ
L1892	Y	0.16	134.23	6.46	6.3	435858.00	6179689.00	READ
L1897	Y	0.03	133.79	8.88	8.85	435904.00	6178059.00	READ
L1899	Y	0.21	134.07	16.45	16.24	434854.00	6177407.00	READ
L1902D	Y	0.74	134.23	16.38	15.64	434049.00	6176014.00	READ
L1902S	Y	0.38	134.05	5.32	4.94	434051.00	6176016.00	READ
L1905D	Y	0.42	134.76	22.84	22.42	435140.00	6175502.00	READ

L1905S	Y	0.24	134.74	9.50	9.26	435140.00	6175499.00	READ
L1913	Y	0.26	130.38	6.94	6.68	429435.00	6186928.00	READ
L1915	Y	0.38	132.84	16.88	16.5	433516.00	6187955.00	READ
L1924D	Y	0.31	132.34	20.48	20.17	431802.00	6189657.00	READ
L1924S	Y	0.36	132.09	4.23	3.87	431805.00	6189654.00	READ
L1927	Y	0.37	131.05	14.59	14.22	431660.00	6188646.00	READ
L1930D	Y	0.52	131.43	24.71	24.19	431511.00	6187618.00	READ
L1930S	Y	0.48	131.24	15.23	14.75	431513.00	6187621.00	READ
L1933D	Y	0.32	132.05	25.94	25.62	431409.00	6186625.00	READ
L1933S	Y	0.38	132.00	7.58	7.2	431417.00	6186628.00	READ
L1935S	Y	0.6	131.49	6.92	6.32	431314.00	6186009.00	READ
L1941	Y	0.26	131.54	20.92	20.66	431020.00	6183951.00	READ
L1943	Y	0.38	127.82	21.56	21.18	423042.00	6190583.00	READ
L1946D	Y	0.26	131.76	23.28	23.02	430805.00	6182435.00	READ
L1946S	Y	0.48	131.86	11.48	11	430807.00	6182437.00	READ
L1947	Y	0.16	131.86	13.41	13.25	430697.00	6181688.00	READ
L1953	Y	0.25	128.14	12.75	12.5	419679.00	6184917.00	READ
L1955	Y	0.2	134.93	17.84	17.64	434987.00	6170761.00	READ
L1958M	Y	0.09	127.81	24.80	24.71	418348.50	6185063.74	READ
L1962D	Y	0.28	131.81	20.58	20.3	429670.00	6178978.00	READ
L1962S	Y	0.28	131.78	7.30	7.02	429670.00	6178976.00	READ
L1963D	Y	0.18	131.52	20.44	20.26	429407.00	6178289.00	READ
L1963S	Y	0.39	131.49	11.75	11.36	429406.00	6178287.00	READ
L1964	Y	0.1	126.36	10.79	10.69	417025.00	6189279.00	READ
L1966	Y	0.45	132.00	13.70	13.25	429012.00	6177436.00	READ
L1970	Y	0.08	131.99	14.33	14.25	428133.00	6176305.00	READ
L1971	Y	0.2	126.61	14.09	13.89	420041.00	6189865.00	READ
L1974	Y	0.07	132.21	14.27	14.2	427933.00	6174877.00	READ
L1976	Y	0.16	128.73	15.28	15.12	421493.00	6183749.00	READ
L1977	Y	0.38	129.07	12.76	12.38	421506.45	6182642.14	READ
L1977M	Y	0.36	132.16	17.19	16.83	427796.00	6173744.00	READ
L1980	Y	0.26	132.34	7.50	7.24	427613.00	6172580.00	READ
L1982D	Y	0.66	132.48	23.31	22.65	427509.00	6171809.00	READ
L1982S	Y	0.21	131.52	5.76	5.55	427501.00	6171806.00	READ
L1991D	Y	0.22	131.18	13.04	12.82	432201.00	6185517.00	READ
L1991S	Y	0.36	131.17	6.09	5.73	432200.00	6185517.00	READ
L1997	Y	0.051	131.69	11.40	11.35	432409.00	6183843.00	READ
L1999	Y	0.42	131.76	13.38	12.96	433396.00	6183113.00	READ
L2002	Y	0.52	131.21	13.76	13.24	432156.00	6182180.00	READ
L2008D	Y	0.15	132.38	3.65	3.5	438242.00	6184271.00	READ
L2008S	Y	0.16	132.40	10.47	10.31	438246.00	6184276.00	READ

L2009	Y	0.18	130.30	23.59	23.41	429100.00	6189914.00	READ
L2015D	Y	0.2	130.77	19.96	19.76	428848.00	6188126.00	READ
L2015S	Y	0.3	130.76	14.37	14.07	428847.00	6188119.00	READ
L2024D	Y	0.54	129.93	13.11	12.57	429154.00	6184750.00	READ
L2024S	Y	0.29	130.23	12.35	12.06	429161.00	6184757.00	READ
L2029D	Y	0.12	131.36	20.32	20.2	428927.00	6183173.00	READ
L2029S	Y	0.16	131.10	11.18	11.02	428930.00	6183172.00	READ
L2044D	Y	0.31	132.63	20.18	19.87	429543.00	6180591.00	READ
L2044S	Y	0.2	132.63	9.00	8.8	429543.00	6180592.00	READ
L2047D	Y	0.17	132.10	13.37	13.2	435124.00	6186223.00	READ
L2047S	Y	0.42	132.37	5.40	4.98	435126.00	6186224.00	READ
L2052D	Y	0.18	130.62	7.36	7.18	427194.00	6180096.00	READ
L2052S	Y	0.16	130.61	19.60	19.44	427192.00	6180097.00	READ
L2057	Y	0.03	130.56	10.49	10.46	427326.00	6182563.00	READ
L2066	Y	0.26	131.84	7.88	7.62	431594.00	6181241.00	READ
L2069	Y	0.29	133.24	22.65	22.36	432627.00	6178707.00	READ
L2075D	Y	0.27	134.06	20.79	20.52	437272.00	6177708.00	READ
L2075S	Y	0.42	134.06	7.90	7.48	437272.00	6177708.00	READ
L2089D	Y	0.38	133.00	21.41	21.03	431550.00	6178372.00	READ
L2089S	Y	0.54	133.00	10.26	9.72	431551.00	6178371.00	READ
L2090	Y	0.26	133.22	22.84	22.58	431994.00	6177578.00	READ
L2108D	Y	0.25	129.78	23.96	23.71	426017.00	6181033.00	READ
L2108S	Y	0.28	129.78	7.93	7.65	426017.00	6181033.00	READ
L2117D	Y	0.24	129.96	23.16	22.92	425340.00	6181538.00	READ
L2117S	Y	0.24	129.96	11.93	11.69	425340.00	6181539.00	READ
L2121	Y	0.26	129.08	21.81	21.55	425647.00	6183659.00	READ
L2124D	Y	0.25	128.95	24.56	24.31	425777.00	6184616.00	READ
L2124S	Y	0.21	128.95	9.07	8.86	425776.00	6184615.00	READ
L2126	Y	0.19	128.47	19.69	19.5	425853.00	6185235.00	READ
L2128D	Y	0.27	129.19	21.59	21.32	425982.00	6186034.00	READ
L2128S	Y	0.23	129.19	7.84	7.61	425982.00	6186033.00	READ
L2131D	Y	0.22	129.39	22.53	22.31	426225.00	6187716.00	READ
L2131S	Y	0.17	129.40	13.23	13.06	426232.00	6187720.00	READ
L2135	Y	0.25	129.46	28.11	27.86	426520.00	6189767.00	READ
L2139D	Y	0.31	128.85	24.30	23.99	426848.00	6191926.00	READ
L2139S	Y	0.39	128.94	11.23	10.84	426854.00	6191920.00	READ
L2158	Y	0.27	134.33	10.28	10.01	444279.00	6181379.00	READ
L2163	Y	0.24	134.72	16.74	16.5	442992.00	6180494.00	READ
L2166	Y	0.34	133.87	11.85	11.51	442145.00	6185746.00	READ
L2184D	Y	0.27	132.90	21.57	21.3	432289.00	6179881.00	READ
L2184S	Y	0.37	132.90	11.72	11.35	432289.00	6179881.00	READ

L2185	Y	0.3	135.30	15.45	15.15	439282.00	6181038.00	READ
L2186	Y	0.31	134.10	14.47	14.16	440462.00	6182105.00	READ
L2191	Y	0.26	136.19	24.01	23.75	439401.00	6176167.00	READ
L2210A	Y	0.12	134.05	11.54	11.42	438438.00	6177768.00	READ
L2210TW	Y	0.2	133.95	11.42	11.22	438438.00	6177767.00	READ
L2241D	Y	0.18	138.71	6.19	6.01	446431.00	6171936.00	READ
L2241S	Y	0.33	138.70	8.20	7.87	446430.00	6171936.00	READ
L2243	Y	0.22	140.13	13.22	13	446910.00	6170128.00	READ
L2245	Y	0	137.70	6.04	6.04	446254.00	6174776.00	READ
L2250	Y	0.12	136.63	14.74	14.62	441992.00	6174417.00	READ
L2251	Y	0.06	141.34	14.30	14.24	447367.00	6167012.00	READ
L2258D	Y	0.22	135.78	11.17	10.95	443306.00	6174591.00	READ
L2258S	Y	0.3	135.78	5.08	4.78	443306.00	6174591.00	READ
L2261	Y	0.26	131.42	15.47	15.21	429884.00	6178023.00	READ
L2275D	Y	0.21	133.18	62.16	61.95	436459.00	6182421.00	READ
L2275M	Y	0.4	133.19	24.70	24.3	436459.00	6182420.00	READ
L2275S	Y	0.32	133.19	14.89	14.57	436459.00	6182420.00	READ
L2278D	Y	0.31	136.46	28.30	27.99	440558.00	6178172.00	READ
L2278S	Y	0.32	136.41	11.73	11.41	440564.00	6178173.00	READ
L2279	Y	0.37	134.33	10.79	10.42	445017.00	6183113.00	READ
L2287D	Y	0.36	133.95	23.82	23.46	439622.00	6186502.00	READ
L2287S	Y	0.22	133.95	17.40	17.18	439622.00	6186502.00	READ
L2299D	Y	0.18	133.22	3.35	3.17	440714.00	6186377.00	READ
L2299S	Y	0.18	133.14	7.68	7.5	440711.27	6186420.00	READ
L2302D	Y	0.25	137.01	22.19	21.94	442262.00	6176403.00	READ
L2302S	Y	0.32	137.03	7.20	6.88	442263.00	6176402.00	READ
L2314D	Y	0.25	136.99	19.84	19.59	443361.00	6174989.00	READ
L2314M	Y	0.32	136.99	13.74	13.42	443362.00	6174990.00	READ
L2314S	Y	0.41	136.99	7.36	6.95	443362.00	6174990.00	READ
L2317D	Y	0.31	137.34	15.27	14.96	445359.00	6173998.00	READ
L2317S	Y	0.3	137.33	7.10	6.8	445357.00	6174000.00	READ
L2328	Y	0	137.33	9.00	9	442137.00	6177032.00	READ
L2329D	Y	0.23	136.62	25.19	24.96	441441.00	6177124.00	READ
L2329S	Y	0.19	136.62	10.90	10.71	441441.00	6177124.00	READ
L2334D	Y	0.26	135.73	27.50	27.24	439529.00	6179590.00	READ
L2334S	Y	0.25	135.74	10.00	9.75	439529.00	6179589.00	READ
L2340	Y	0.17	133.76	5.03	4.86	439223.00	6178688.00	READ
L2347D	Y	0.21	135.43	9.50	9.29	442063.00	6178840.00	READ
L2347S	Y	0.29	135.43	14.25	13.96	442064.00	6178839.00	READ
L2357D	Y	0.1	137.04	17.16	17.06	443732.00	6177489.00	READ
L2357S	Y	0.11	137.14	9.30	9.19	443733.00	6177490.00	READ

L2364	Y	0.37	135.08	11.69	11.32	444694.00	6178298.00	READ
L2371	Y	0.29	137.85	17.02	16.73	443651.00	6169669.00	READ
L2391	Y	0.34	138.28	8.24	7.9	445359.00	6172029.00	READ
L2408	Y	0.3	138.62	13.38	13.08	444532.00	6172284.00	READ
L2437D	Y	0.44	137.90	18.52	18.08	444902.00	6174022.00	READ
L2437S	Y	0.25	137.87	12.37	12.12	444902.00	6174023.00	READ
L2442	Y	0.02	134.31	8.67	8.65	435204.00	6179118.00	READ
L2443	Y	0.44	132.32	5.76	5.32	433553.00	6179330.00	READ
L2444	Y	0.25	134.12	11.27	11.02	436403.00	6179049.00	READ
L2452D	Y	0.2	130.86	11.92	11.72	430015.00	6188582.00	READ
L2452S	Y	0.3	131.14	14.62	14.32	430020.00	6188576.00	READ
L2453	Y	0.09	130.23	8.31	8.22	427950.00	6188874.00	READ
L2467D	Y	0.23	131.91	24.73	24.5	432585.00	6186735.00	READ
L2467S	Y	0.26	131.95	9.91	9.65	432585.00	6186729.00	READ
L2468	Y	0.2	130.91	14.89	14.69	430429.00	6186788.00	READ
L2469	Y	0.25	134.72	11.87	11.62	445502.00	6182044.00	READ
L2479	Y	0.25	138.52	6.87	6.62	446272.00	6173832.00	READ
L2481	Y	0.1	131.54	17.02	16.92	433852.00	6187074.00	READ
L2482D	Y	0.28	131.90	16.36	16.08	434451.90	6187002.32	READ
L249	Y	0	142.69	16.76	16.76	453333.00	6161051.00	READ
L2498	Y	0.36	129.48	12.50	12.14	428186.00	6184593.00	READ
L2499	Y	0.3	129.93	12.50	12.2	427870.00	6187154.00	READ
L251	Y	0	141.47	10.05	10.05	451003.00	6163123.00	READ
L2584	Y	0.38	131.82	10.70	10.32	433375.00	6185350.00	READ
L2588	Y	0.37	131.91	12.02	11.65	434035.00	6185255.00	READ
L259	Y	0.38	133.54	10.78	10.4	430116.00	6175981.00	READ
L2602	Y	0.53	136.31	20.64	20.11	439546.00	6173495.00	READ
L2646	Y	0.22	134.79	20.22	20	436407.00	6171914.00	READ
L2657	Y	0.23	133.69	18.71	18.48	432669.00	6175731.00	READ
L2679D	Y	0.19	132.69	20.55	20.36	434151.00	6179166.00	READ
L2679S	Y	0.1	132.60	7.72	7.62	434154.00	6179166.00	READ
L2690	Y	0.35	131.50	20.92	20.57	428323.00	6178794.00	READ
L2705	Y	0.54	126.80	14.35	13.81	419454.99	6190177.79	READ
L2717	Y	0.19	125.08	14.28	14.09	416969.00	6191525.00	READ
L2762	Y	0.13	130.69	18.86	18.73	423459.56	6172845.19	READ
L2788	Y	0.14	139.70	13.30	13.16	445559.00	6167174.00	READ
L2791	Y	0.17	130.73	22.06	21.89	425707.00	6168005.00	READ
L2794	Y	0.47	0.00	9.50	9.03	427194.00	6165242.00	READ
L2795	Y	0.29	0.00	20.80	20.51	433346.00	6166286.00	READ
L2796D	Y	0.26	0.00	20.31	20.05	436321.00	6166465.00	READ
L2797	Y	0.29	0.00	22.87	22.58	439295.00	6166677.00	READ

L2798	Y	0.23	0.00	16.36	16.13	441918.00	6166546.00	READ
L2799	Y	0.37	137.97	21.78	21.41	443424.00	6164260.00	READ
L2800S	Y	0.33	0.00	14.14	13.81	443926.00	6161526.00	READ
L2802	Y	0.29	0.00	23.23	22.94	440020.00	6162061.00	READ
L2851	Y	0.46	131.46	18.32	17.86	420298.00	6169854.00	READ
L2852	Y	0	128.95	11.96	11.96	423854.00	6175696.00	READ
L2853	Y	0.42	130.20	16.28	15.86	424105.00	6177463.00	READ
L2856	Y	0.18	129.04	14.34	14.16	424402.00	6179941.00	READ
L2865	Y	0.3	135.35	3.23	2.93	439410.00	6192323.00	READ
L2875	Y	0.33	131.12	16.80	16.47	427135.00	6181429.00	READ
L2922	Y	0.2	138.05	12.58	12.38	446333.00	6172679.00	READ
L2983	Y	0.33	136.56	19.24	18.91	439868.00	6170011.00	READ
L2994	Y	0.31	133.98	19.91	19.6	430268.00	6170338.00	READ
L3040	Y	0.33	138.81	4.65	4.32	442808.00	6195833.00	READ
L3042	Y	0.3	138.45	5.22	4.92	441825.00	6195202.00	READ
L3044	Y	0.26	138.14	24.06	23.8	440124.00	6197376.00	READ
L3050	Y	0.23	137.56	12.76	12.53	439859.00	6195530.00	READ
L3079	Y	0.16	138.09	13.21	13.05	439999.00	6196518.00	READ
L3082	Y	0.25	136.87	7.20	6.95	439672.00	6194437.00	READ
L3084	Y	0.25	137.10	5.27	5.02	439705.00	6194701.00	READ
L3085	Y	0.34	136.02	7.32	6.98	439496.00	6193258.00	READ
L3126	Y	0.38	134.23	9.48	9.1	440486.00	6187791.00	READ
L3127	Y	0.28	135.23	10.47	10.19	442354.00	6187532.00	READ
L3128	Y	0.18	135.15	9.98	9.8	442300.00	6188924.00	READ
L3130	Y	0.41	133.73	8.98	8.57	438970.00	6189416.00	READ
L3131	Y	0.45	133.73	10.56	10.11	437444.00	6189597.00	READ
L3132	Y	0.4	134.77	7.81	7.41	439189.00	6190704.00	READ
L3133	Y	0.27	135.50	10.64	10.37	440834.00	6190482.00	READ
L3135	Y	0.4	136.01	9.10	8.7	440770.00	6191864.00	READ
L3136	Y	0.4	136.03	10.40	10	438410.00	6193349.00	READ
L580	Y	0.05	131.42	6.63	6.58	425501.00	6170615.00	READ
L595	Y	0.43	140.51	9.13	8.70	449273.00	6166550.00	READ



Murrumbidgee Irrigation

ANNUAL COMPLIANCE REPORT 2017

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Murrumbidgee Irrigation Limited
Annual Compliance Report
2016/17

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Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
BBSW	Barren Box Storage and Wetland
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPI Water	Department of Primary Industries, Water
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Reference crop evapotranspiration
GIS	Geographic Information System
ha	Hectare(s)
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	Micro Siemens per centimetre
µg/L	Micrograms per litre
ML	Megalitre
OEH	Office of Environment and Heritage
SOP	Standard Operating Procedure
t	Tonnes
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
YMS	EPL Point 6 - Yanco Main Southern Drain
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of Compliance

Murrumbidgee Irrigation (MI) has met the conditions of the Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) in 2016/17. A summary of the compliance requirements are cross referenced to this report and listed in Table 1. Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are met. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations. Internal Standard Operating Procedures (SOPs) are reviewed regularly.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2016/17. MI did not construct new works that would allow further discharge from the area of operations during 2016/17. In 2016/17, the boundary of MI's Area of Operations increased by 13,242 hectares which is identified in Figure 1.

Table 1 Combined Water Supply Work Approval and Water Use Approval (40CA403245) reporting summary

Licence section	Requirement	Report Section
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1	2. Plan of Operations and Works
	12.2	
Statement of Compliance	12.3	1. Statement of Compliance
Presentation of Data and Analyses	12.4	Section 1 - 6
	12.5	
	12.6	
	12.7	Provided on USB
	12.8	1. Statement of Compliance
New Measures to Limit Groundwater Recharge and Discharge of Salt	12.9	7. New Measures to Limit Groundwater Recharge and Discharge of Salt
Reporting on Water Management	12.10	3.3 Diversions and Water Allocation
	12.11	3.5 Water discharged from Area of Operation
	12.12	3.9 Water Balance
	12.13 (a) (b)	3.1 Climate Conditions
	(c) – (j)	4. Water Use
Reporting on Salinity and Salt load	12.14	5. Salinity and Salt load
	12.15	
	12.16	
Reporting on Groundwater Conditions	12.17	6. Groundwater Conditions

2 Plan of Operations and Works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. The Murrumbidgee Irrigation Area (MIA) is supplied by water stored in Burrinjuck and Blowering dams and released to the Murrumbidgee River. Water is diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval, via two authorised supply works (Figure 2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STURT - Sturt Regulator (after diversion from Gogeldrie Weir)

There are five (5) sites which have the ability to discharge water outside MI's area of operations, which are presented in Figure 2. These sites are monitored in accordance with MI's Combined Approval and Environmental Protection Licence (EPL) 4651. MI's five discharge monitoring points are:

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDG – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain River Road
- MIRFLD – Mirrool Creek Floodway Wyvern Station

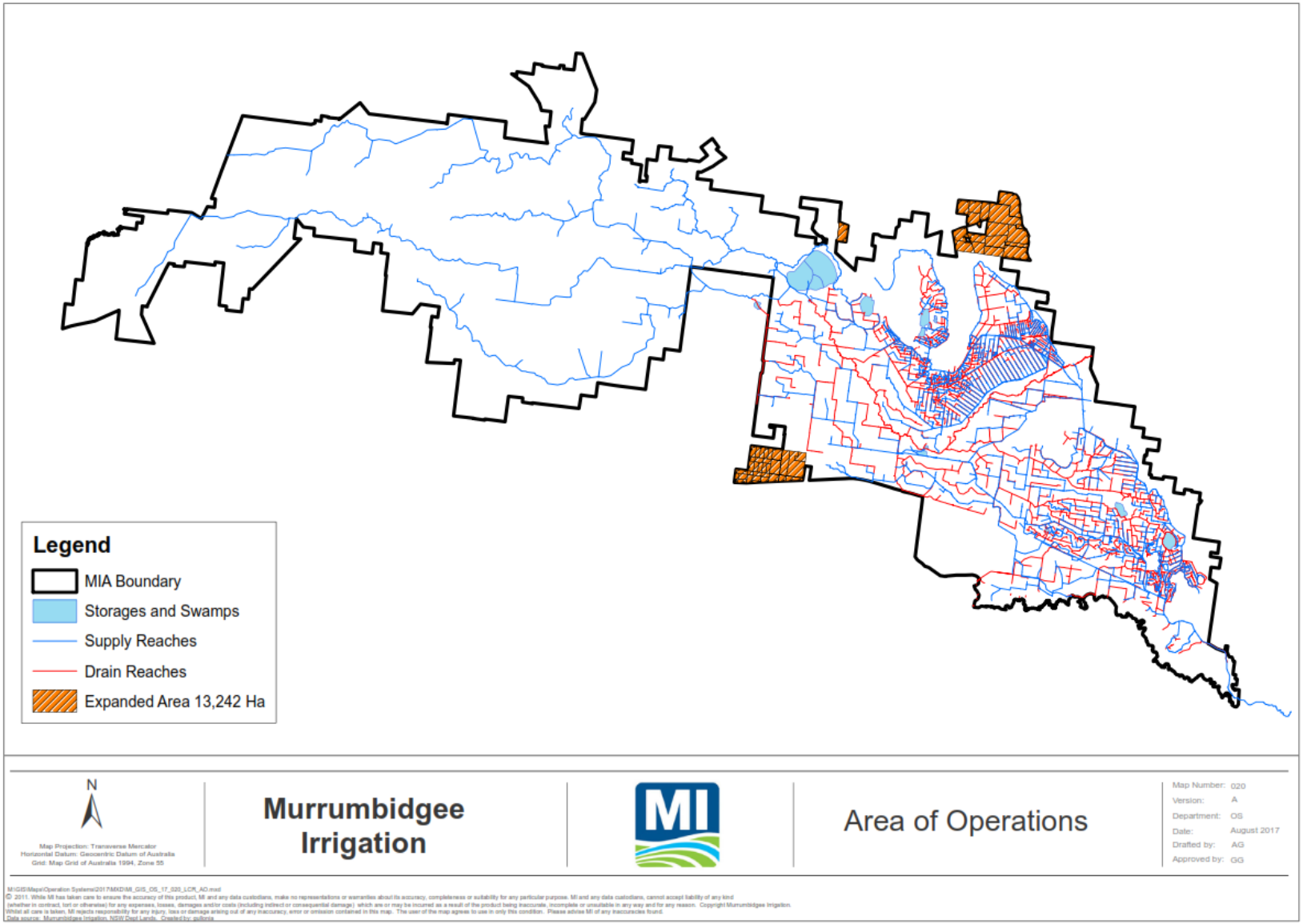


Figure 1 Murrumbidgee Irrigation's Area of Operation, identifying areas of expansion

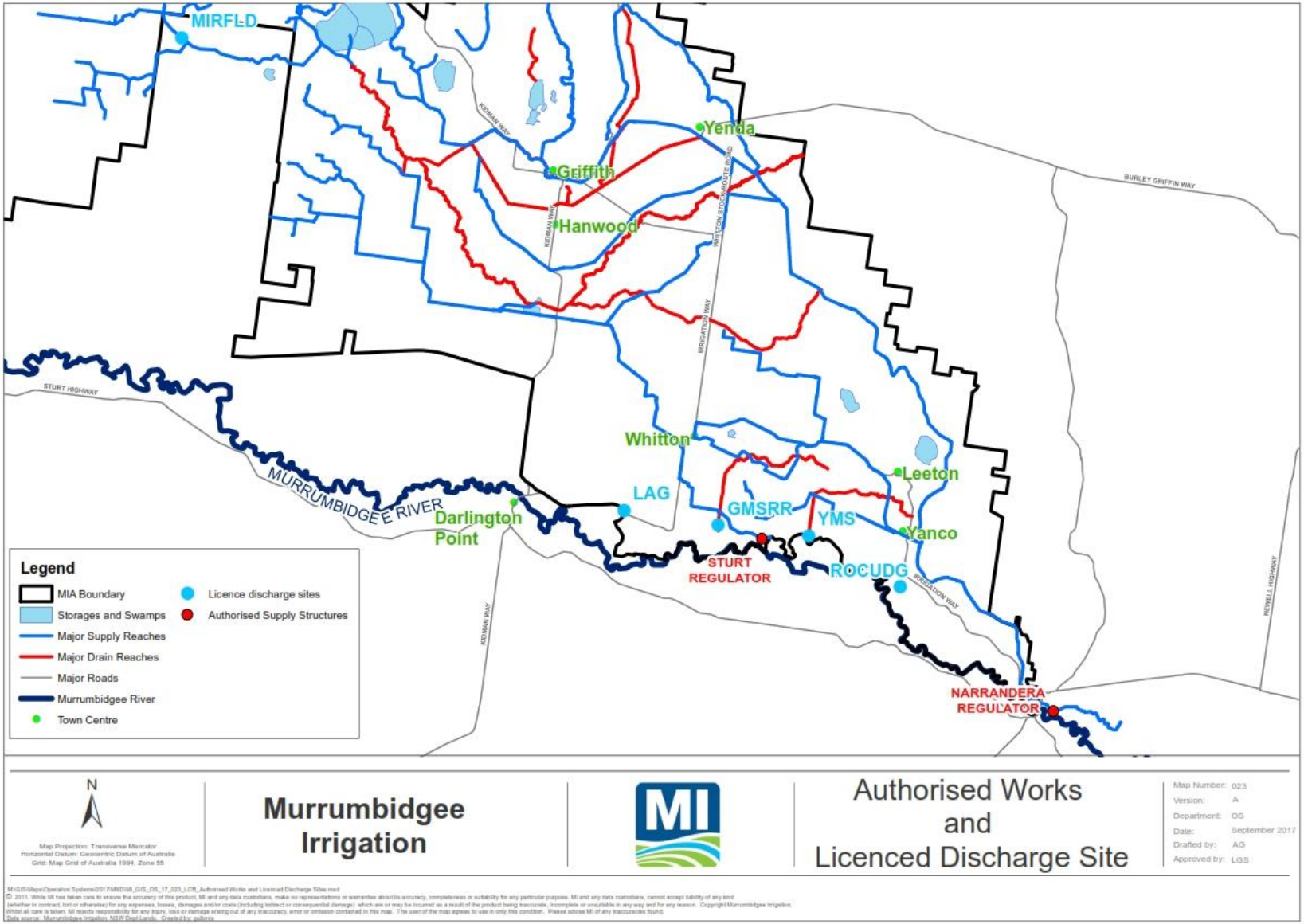


Figure 2 Location of authorised supply works and licence discharge points

3 Reporting on Water Management

3.1 Climate conditions

Rainfall and evapotranspiration (ETo) data recorded at the Griffith CSIRO weather station is presented in Table 2 and Barren Box Storage and Wetland (BBSW) weather station is presented in Table 3. A 1/150-year flood event spanned across 2015/16 and 2016/17 reporting periods, which explains the high rainfall recorded for both years. The timing and amount of rainfall received in the upper catchment resulted in 100% allocation for general and high security for 2016/17.

Table 2 Griffith CSIRO weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2016/17	556	1593
2015/16	529	1712
2014/15	348	1776
2005/06	357	1935

Table 3 Barren Box Storage and Wetland weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2016/17	450	1516
2015/16	445	1975
2014/15	299	2099
2005/06	Not installed	

3.2 Calibration Report for Main Canal and Sturt Canal AFFRA Units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of the contract with MI to ensure flow measurements meet the conditions of Combined Approval 40CA403245. The calibration report summary for the NARREG AFFRA is presented in Table 4 and the STURT AFFRA presented in Table 5. The full calibration report is included with the submission of this report.

Table 4 Main Canal at NARREG (410127) calibration report

Date	Time	Calibration Measurements:	AFFRA Sensor:	Deviation
16/08/2016	12:50	561	564	-0.50%
10/11/2016	13:41	2352	2398	-1.92%
25/01/2017	14:21	4192	4385	-4.40%
16/03/2017	8:59	1858	1812	2.54%

Table 5 Sturt Canal at STURT (410129) calibration report

Date	Time	Calibration	AFFRA Sensor:	Deviation
16/11/2016	13:17	569	528	7.69%*
16/11/2016	14:18	556	506	9.96%*
1/12/2016	13:40	1265	1281	-1.25%
15/02/2017	11:29	1110	1136	-2.29%
6/04/2017	15:36	156	159	-2.00%

* There were high winds during these measurements, so they have been disregarded for calibration purposes. Another measurement was carried out at this site at the next available time during flow conditions (1/12/2016) where the calibration deviation was confirmed to be within the required range.

3.3 Diversions and Water Allocation

A monthly summary of gross water diverted from the Murrumbidgee River is presented in Table 6. These volumes represent gross diversions entering the supply system via MI's two authorised water supply works at NARREG and STURT. The total diversion volume of 780,083 ML includes an environmental water diversion volume of 986 ML diverted for the Office of Environment and Heritage (OEH). Deliveries to customers does not include 49,225 ML of captured water delivered, which is outlined further in the water balance in section 3.7 of this report.

Table 6 Monthly summaries of water diversions (ML) deliveries to customers (ML), 2016/17

Month	STURT	NARREG	Total diversion	Deliveries to customers
Jul-16	1,091	3,409	4,500	4,500
Aug-16	1,229	7,440	8,669	2,047
Sep-16	170	627	797	1,459
Oct-16	11,167	21,227	32,394	22,202
Nov-16	27,878	80,518	108,396	87,941
Dec-16	28,057	95,936	123,993	99,852
Jan-17	44,198	140,342	184,540	151,841
Feb-17	33,758	106,624	140,382	120,076
Mar-17	16,045	62,363	78,408	65,190
Apr-17	11,746	37,043	48,789	26,260
May-17	20,352	28,172	48,524	32,978
Jun-17	543	148	691	6,748
Total	**196,234**	**583,849**	**780,083**	**621,094**

Table 7 compares water allocations, diversions, total deliveries and climate data from the 2016/17 reporting year to previous years. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year. Above average rainfall was recorded throughout the catchment in 2016/17, resulting in a 100% allocation announcement for general and high security water.

When low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. However, it must be noted flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

Table 7 Water allocation, total diversions and deliveries 2016/17 compared to previous years

Year	Announced Allocation (%) General / High	Diversions (ML)	Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2016/17	100/100	780,083	621,094	556	1,593
2015/16	37/95	643,957	526,278	529	1,712
2014/15	53/95	878,614	730,016	349	1,776
2005/06	54/95	1,036,519	829,990	367	1,935

3.4 Environmental diversions

At the request of OEH, 986 ML of environmental water was delivered to three locations as shown in Table 8.

Table 8 Environmental water diversions for 2016/17

Month	Yanco Ag	Nericon Swamp	Campbell's Swamp
Jul-16	0	0	0
Aug-16	0	0	0
Sep-16	0	0	0
Oct-16	0	0	0
Nov-16	0	0	0
Dec-16	240	0	0
Jan-17	144	0	0
Feb-17	0	0	0
Mar-17	0	0	0
Apr-17	0	126	292
May-17	0	108	77
Jun-17	0	0	0
Total	384	234	368

3.5 Water discharged from Area of Operations

Monthly discharge volumes for each discharge monitoring point listed under the Combined Approval are shown in Table 9. A total of 122,091 ML was discharged from MI's area of operations in 2016/17 with 121,363 ML released to the Mirrool Creek Floodway (MIRFLD) in response to floodwater flows from the upper catchment.

Table 9 Monthly water volumes (ML) discharged from the MIA

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-16	65.1	0	0	11.8	640
Aug-16	11.5	73.7	0	0	0
Sep-16	66.7	5.1	0	0	57,180
Oct-16	0	0	0	2.4	63,543
Nov-16	28.6	11.8	0	6.2	0
Dec-16	50.7	58.6	0	12.5	0
Jan-17	6.7	13.1	0	15.1	0
Feb-17	8.4	0	0	10.1	0
Mar-17	34.6	0	0	9.2	0
Apr-17	31.4	13.4	0	8.3	0
May-17	85.8	60.3	0	1.2	0
Jun-17	14.4	12.3	0	0	0
Total	**403.9**	**248.1**	**0**	**76.8**	**121,363**

Table 10 shows total discharge volumes from MI's Area of Operation compared to previous years. The total volume discharged in 2016/17 was significantly higher when compared to all other years due to the floodwater diverted to the MIRFLD.

Table 10 Annual water volumes (ML) discharged from the MIA

Year	Total discharged (ML)
2016/17	122,092
2015/16	1,079
2014/15	671
2005/06	8,570

3.6 Supply efficiency

Table 11 illustrates the simple efficiency of MI's supply system to be at 80% for 2016/17. The simple efficiency provides insight into how the supply system is managed under the season's climatic conditions, whilst balancing irrigation demand and minimising system losses. The water balance on page 15 of this report reconciles the losses and gains of the system and takes into account drainage reuse volumes for 2016/17.

Table 11 Supply efficiency from 2016/17 and previous years

Year	Sturt Canal	Main Canal	Environment Diversions	NET TOTAL Irrigation Diversions	Deliveries (ML)	Conveyance (ML)	Simple Efficiency (%)
2016/17	196,23	583,849	986	779,097	621,094	158,003	80%
2015/16	141,08	505,845	2,977	643,957	526,278	117,679	82%
2014/15	219,27	661,814	2,472	878,614	738,814	139,800	84%
2005/06	233,38	805,277	2,146	1,036,519	829,990	206,529	80%

3.7 Water balance

Table 12 shows the Annual Water Balance for MI's network. For the 2016/17 reporting year, the annual water balance has been refined to provide a clearer representation of system operations.

Total gross diversions of 780,083 ML for 2016/17 were used to generate water deliveries of 621,094 ML. High rainfall received in the local and upper catchment caused large volumes of water to enter MI's Area of Operation via upper Mirrool Creek or via overland flow. An estimated 198,200 ML of flood water entered MI's drainage works, with 121,363 ML released to the Mirrool Creek Floodway and an additional 49,225 ML delivered to customers. Therefore, the total volume of water delivered to customers for 2016/17 was 670,319 ML.

Table 12 Annual Water Balance (ML)

Incoming Diversions	**2016/17**	**2015/16**	**2014/15**	**2005/06**
River diversions	780,083	643,957	881,086	1,036,519
Internal storage diversions	2,218	0	0	Unknown
Captured flood water	198,200	0	0	0
Total	**980,501**	**643,957**	**881,086**	**1,036,519**
Outgoing				
Deliveries to customers (river and storages)	621,094	526,278	730,016	829,990
Deliveries to customers (captured flood water)	49,225	0	0	0
Environmental water diversions (EWR)	986	2,629	2,472	Unknown
Net change in storages	30,043	13,421	4,864	Unknown
Conveyance	127,960	101,629	143,734	206,529
Floodway discharges	121,363	0	0	
Overland flood discharge	25,600	0	0	0
Customer flood discharge	4,230	0	0	0
Total	**980,501**	**643,957**	**881,086**	**1,036,519**

4 Water Use

4.1 Crop statistics

For each water order customers are required to nominate their water use to a particular crop or use. This data is not validated at the farm level and is therefore an estimate only. Table 13 shows water deliveries and estimated crop water use for 2016/17. It is important to note the water use data presented for the total area of crop are also influenced by rainfall, ETo and irrigation practices, which are not considered in these figures.

Table 13 Summary of water deliveries for major crop groupings 2016/17

Crop/Purpose	Area (ha)	Volume Delivered(ML)	Crop Water Use (ML/ha)
Citrus	7,858	35,820	4.6
Cotton	11,957	82,004	6.9
Industrial	27	6,442	-
Other crops	413	6,566	-
Other fruits	1,261	5,261	4.2
Plantation	2,843	1,255	0.4
Rice	27,424	304,200	11.1
Stock & domestic	267	10,347	-
Summer cereals	2,229	12,524	5.6
Summer oilseeds	1,234	5,940	4.8
Summer pasture	2,608	11,016	4.2
Town supplies	-	9,844	-
Vegetables	2,324	10,129	4.4
Vines	18,323	68,176	3.7
Winter cereals	24,835	34,308	1.4
Winter oilseeds	2,744	4,708	1.7
Winter pasture	7,085	15,014	2.1
Not Defined	-	46,764	-
Total	**113,432**	**670,319**	-

A comparison of crop water use for 2016/17 with previous years is presented in Table 14. Rice growing was the predominant crop type grown in the MIA and accounted for the highest portion of total water delivered per crop type (45%). The 100% allocation and internal surplus water available to customers in 2016/17 provided opportunity for customers to increase their area of non-permanent plantings.

Table 14 Total deliveries to major crop types 2016/17 compared to previous years

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines + Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial	Cotton
2016/17	304,200	26,030	57,479	10,129	109,257	71,376	9,844	82,004
2015/16	136,805	19,449	96,851	10,011	128,789	22,729	31,832	79,812
2014/15	255,384	32,206	171,645	12,216	149,045	20,547	28,295	60,678
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

Note: Cotton was included in 'other crops and plantations' for 2005/06

4.2 Irrigation intensity

Irrigation intensity is displayed in Figure 3 by water use (ML/ha) at a property level. This map identifies locations of landholdings using between 0 and 4 ML/ha, 4 and 4.1-8 ML/ha and above 8.1 ML/ha.

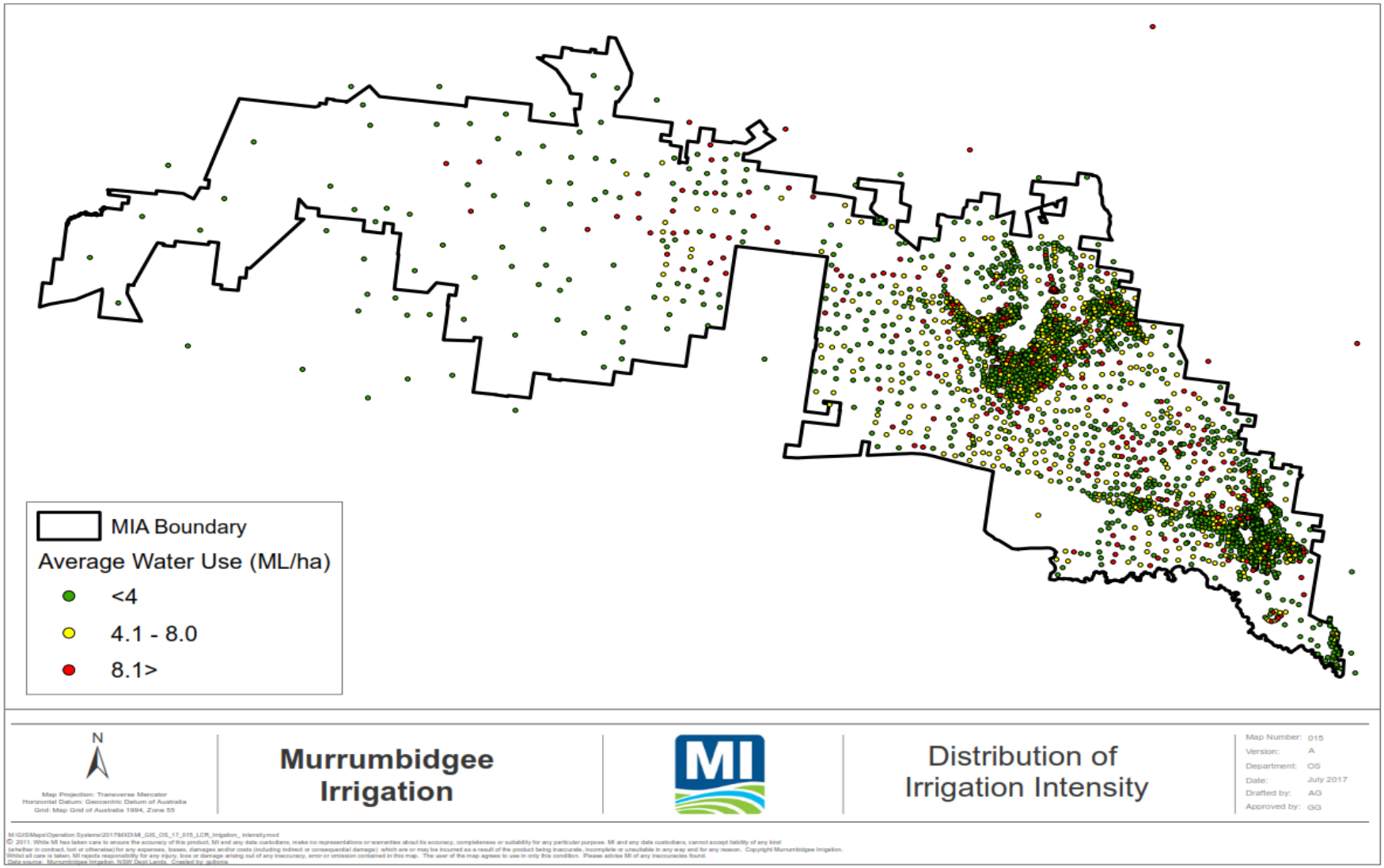


Figure 3 Distribution of irrigation intensity across the MIA

5 Salinity and Salt Load

5.1 Extracted salt-load

The salt load for NARREG and STUR are calculated using flow data reported by Ventia and salinity data from DPI Water monitoring site 410001, which is the closest monitoring point on the Murrumbidgee River to MI's offtakes. Monthly mean salinity values from site 410001 were used for salt load calculations for both NARREG and STUR. The mean electrical conductivity (EC) values and extracted salt loads are presented in Table 15.

Table 15 Total extracted salt load for 2016/17

Month	Site 410001 mean EC (µS/cm)	STUR (t)	NARREG (t)	Total salt load extracted
Jul-16	158	110	345	455
Aug-16	149	117	711	828
Sep-16	138	15	55	70
Oct-16	95	679	1,290	1,969
Nov-16	84	1,499	4,329	5,828
Dec-16	82	1,474	5,040	6,515
Jan-17	81	2,296	7,289	9,584
Feb-17	62	1,331	4,205	5,536
Mar-17	90	922	3,582	4,503
Apr-17	121	910	2,871	3,781
May-17	175	2,285	3,162	5,447
Jun-17	242	84	23	107
Total		**11,722**	**32,903**	**44,625**

Table 16 presents the total extracted saltloads for 2016/17 and previous years. During 2016/17, an estimated 44,625 tonnes of salt entered MI's area of operation from the Murrumbidgee River. Generally, the amount of salt is relative to the volume of water diverted from the river, however the 2016/17 saltload is lower than 2015/16, even though an extra 130,000 ML was diverted.

Table 16 Extracted salt-load (t) for 2016/17 compared to previous years

Year	Diversions (ML)	Extracted salt load		
		STUR	NARREG	Total
2016/17	780,083	11,722	32,903	44,625
2015/16	643,957	10,939	39,758	50,696
2014/15	878,614	14,587	44,270	58,858
2007/08	393,973	1,778	26,816	28,594

5.2 Discharged salt load

There are five discharge monitoring points that have the ability to discharge water out of MI's area of operation. The locations of these sites are shown in Figure 2 of this report. Flow, EC and salt load data for these sites is presented in Table 18 with previous year comparison presented in Table 17.

An estimated 34,230 tonnes were discharged from MI's Area of Operation in 2016/17. The majority of salt was discharged to the MIRFLD, which corresponds to the large volume of water discharged at this site. Due the flood experienced in 2016/17 and the large volume of water discharged to MIRFLD, this total volume discharged from MI's area of operation cannot be compared to previous years.

Table 17 Discharged salt load 2016/17 compared to previous years

Year	Water discharged (ML)	Discharged Salt load (t)
2016/17	122,092	34,230
2015/16	1,620	201
2014/15	675	96
2005/06	8,570	1,887

Table 18 Monthly summary of flow, EC and salt loads at monitoring points for 2016/17

Month	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)
	Yanco Main Southern Escape (YMS) 410083					Gooragool Lagoon Escape (LAG) 41010940				
Jul-16	0.00	-	-	-	0.0	65.14	313	221	600	2.0
Aug-16	0.00	-	-	-	0.0	11.54	851	245	3930	4.0
Sep-16	0.00	-	-	-	0.0	66.69	373	139	4280	13.0
Oct-16	0.00	-	-	-	0.0	0.00	-	-	-	0.0
Nov-16	0.00	-	-	-	0.0	28.55	363	114	1360	6.0
Dec-16	0.00	-	-	-	0.0	50.65	788	170	3370	12.0
Jan-17	0.00	-	-	-	0.0	6.71	511	333	813	2.0
Feb-17	0.00	-	-	-	0.0	8.35	319	81.4	703	1.0
Mar-17	0.00	-	-	-	0.0	34.63	398	168	554	8.0
Apr-17	0.00	-	-	-	0.0	31.41	273	106	444	4.0
May-17	0.00	-	-	-	0.0	85.84	282	160	521	15.0
Jun-17	0.00	-	-	-	0.0	14.36	192	22.2	334	2.0
Total	**0.00**				**0.0**	**403.87**				**69**
	Gogeldrie Main Southern Escape (GMSRR) 41010921					Cudgel Creek Escape (ROCUDG) 41010005				
Jul-16	11.78	150	98	193	1.0	0.00	-	-	-	0.0
Aug-16	0.00	-	-	-	0.0	73.66	164	148	184	8.0
Sep-16	0.00	-	-	-	0.0	5.11	167	49	195	0.0
Oct-16	2.35	193	141	296	0.0	0.00	-	-	-	0.0
Nov-16	6.2	267	207	337	1.0	11.77	335	191	512	3.0
Dec-16	12.52	275	133	424	2.0	58.61	366	203	573	10.0
Jan-17	15.11	252	75	350	2.0	13.07	154	123	217	1.0
Feb-17	10.09	200	0	373	1.0	0.00	-	-	-	0.0
Mar-17	9.16	280	179	353	2.0	0.00	-	-	-	0.0
Apr-17	8.34	245	189	332	1.0	13.35	311	292	366	2.0
May-17	1.23	263	181	326	0.0	60.26	254	175	294	8.0
Jun-17	0.00	-	-	-	0.0	12.26	158	143	176	1.0
Total	**76.77**				**10**	**248.09**				**33**
	Mirrool Creek Floodway (MIRFLD) 41010163									
Jul-16	640	-	-	-						
Sep-16	57,180	-	-	-						
Oct-16	63,543	-	-	-						
Total	**121,363**	Mean EC 439 (during flow)			**34,118**					

5.3 Salt load summary

The salt loads presented in Table 19 suggest that of the 44,625 tonnes of salt received through diversions recorded at MI's authorised supply works (NARREG and STURT) 34,230 tonnes was discharged and an estimated 10,395 tonnes were retained within the MIA. It is important to note that this is a simple annual salt balance that considers salt loads entering and leaving via authorised works, as per MI's Combined Approval and does take into account other factors that impact total salt loads in the MIA.

Table 19 Salt load summary for 2016/17

Extracted	**Salt load (t)**
STUR	11,722
NARREG	32,903
Total extracted	**44,625**
Discharged	**Salt load (t)**
YMS	0.0
GMSRR	76.77
LAG	403.87
ROCUDG	248.09
MIRFLD	34,118
Total discharged	**34,230**
Retained	**10,395**

5.4 Salinity targets

As set out in our Network Service Plan (pg.7, *2.4 Water Quality)* MI endeavours to supply water to Wah Wah customers with EC levels below 700 µS/cm. This target was not met for 2016/17 with monitoring data suggesting that water exceeding 700 EC may have been supplied to customers for 11 days between 18/02/2017 – 04/03/2017, with EC reaching a maximum 732 µS/cm. The monitoring data has been submitted with this report.

6 Groundwater Conditions

6.1 Groundwater Monitoring and Reporting

A total of 641 piezometers are listed in Schedule 2 of the Combined Approval and the locations of these bores are displayed in Figure 4. In September 2016/17, 582 piezometers were monitored, which equates to 90.7% of the total piezometer network. High rainfall and associated localised flooding caused 28 piezometers to be inaccessible.

Table 20 Groundwater piezometer status summary (September 2016)

Total bores	Total destroyed	Total dry	Total read	Total unable to read
641	31	12	582	59*

*Includes 28 flooded, inaccessible piezometers

Groundwater levels and salinity (reported as EC) are measured in September to give insight into groundwater levels prior to the irrigation season and again in March to identify regional groundwater trends. The network consists of piezometers in the shallow and deep Shepparton Formation and a smaller monitoring network in the Calivil Formation. In 2015, DPI Water approved a rationalised monitoring network of 641 piezometers. In consultation with DPI Water, an alternative presentation format for requirement 1 of Attachment 2 of the Combined Approval was approved for 2016/17. Depth to water table and salinity are reported on one map for each formation for September and March for previous year, except for the historical reference years.

Depth to water table is reported for 2016/17, 2015/16, 2014/15, and 2005/2006. The 2005/06 reporting year was chosen for reference for depth to water table to coincide with the peak of the millennium drought for the MIA. Groundwater salinity is reported for 2016/17, 2015/16, 2014/15, 2002 and 1980. Due to the limited data sets from 2005/06, data from 2002 and 1980 was chosen to represent suitable comparisons for salinity changes from a historical perspective.

Table 21 Number and percent of total piezometers read within each depth range

Year	Number <2M of surface	Number 2-4M of surface	Number >4M of surface	% <2M of surface	% 2-4M of surface	% >4M of surface	Total
2016	78	123	363	14%	22%	64%	564
2015	76	121	368	13%	21%	65%	565
2014	55	176	506	7%	24%	69%	737
2005	55	225	342	9%	36%	55%	622

6.2 Groundwater salinity

The number of piezometers read within salinity ranges for September are shown in Table 22 and the percent of total piezometers measured within each range are presented in Table 23. The data identifies similar groundwater salinity trends throughout years reported for the Shallow Shepparton, Deep Shepparton and Calivil formations, including benchmark year 1980. In 2015, the lower number of total piezometers monitored for EC was a result of equipment failure during the monitoring program. DPI Water was notified and additional equipment was purchased.

Table 22 Number of piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2016	247	126	86	57	19	5	1	541
2015	165	92	65	48	16	7	3	396
2014	267	232	124	57	18	7	2	707
1980	250	211	180	152	47	2	1	843

Table 23 Percent of total piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2016	46%	23%	16%	11%	4%	1%	0%	541
2015	42%	23%	16%	12%	4%	2%	1%	396*
2014	38%	33%	18%	8%	3%	1%	0%	707
1980	30%	25%	21%	18%	6%	0%	0%	843

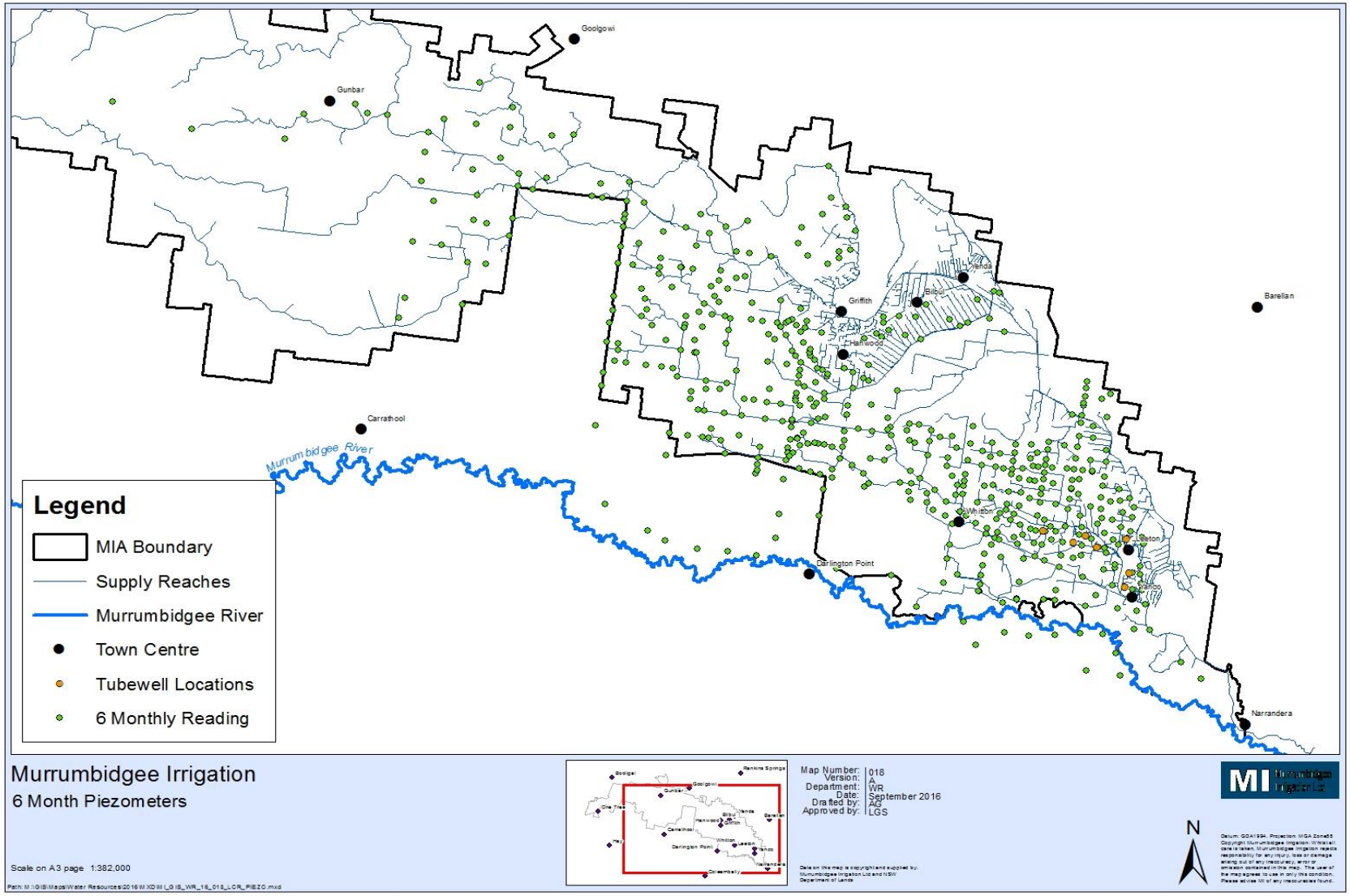


Figure 4 Location of piezometers and tubewells in the MIA 2016/17

6.3 Shallow Shepparton Formation

Depth to water table and salinity maps for piezometers in the shallow Shepparton Formation are presented in Figures 5 to 14. Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall, geology and irrigation. This is indicated by the comparing maps from September to March for each reporting year, which identify a marginal rise in groundwater levels. This is particularly evident when comparing Figure 6 and Figure 5, with an increase in groundwater level and reduction of salinity exhibited in March 2017 (Figure 5). This is likely the lag effect following high rainfall experienced towards the end of 2016.

General salinity changes in the Shallow Shepparton Formation from September to March for each reporting year show decreases in EC values across the MIA. These areas of reduced salinity correlate with an increase in groundwater levels, highlighting potential recharge areas.

When compared to recent years, 2005/06 groundwater levels (Figure 11 and 12) appear to be deeper across the MIA, with fewer piezometers within 2m from surface level. This is likely a result of reduced recharge from rainfall, as a result of drought conditions.

2016/17

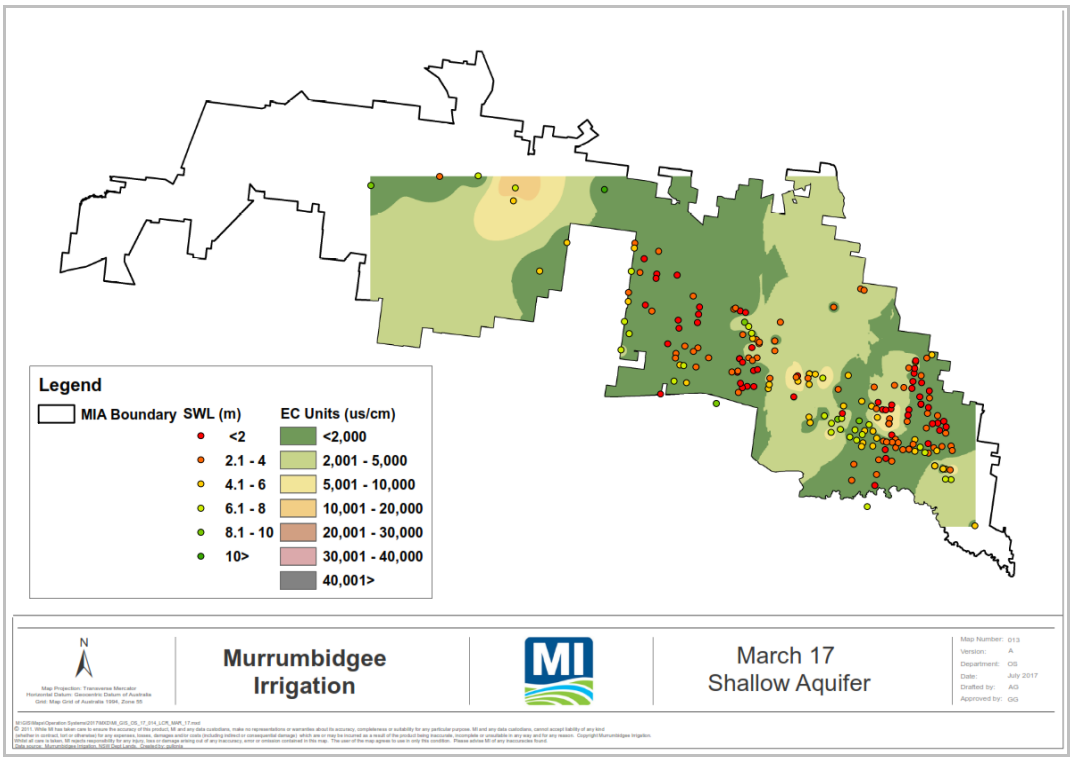


Figure 5 Shallow Shepparton Formation- depth to water table and salinity, March 2017

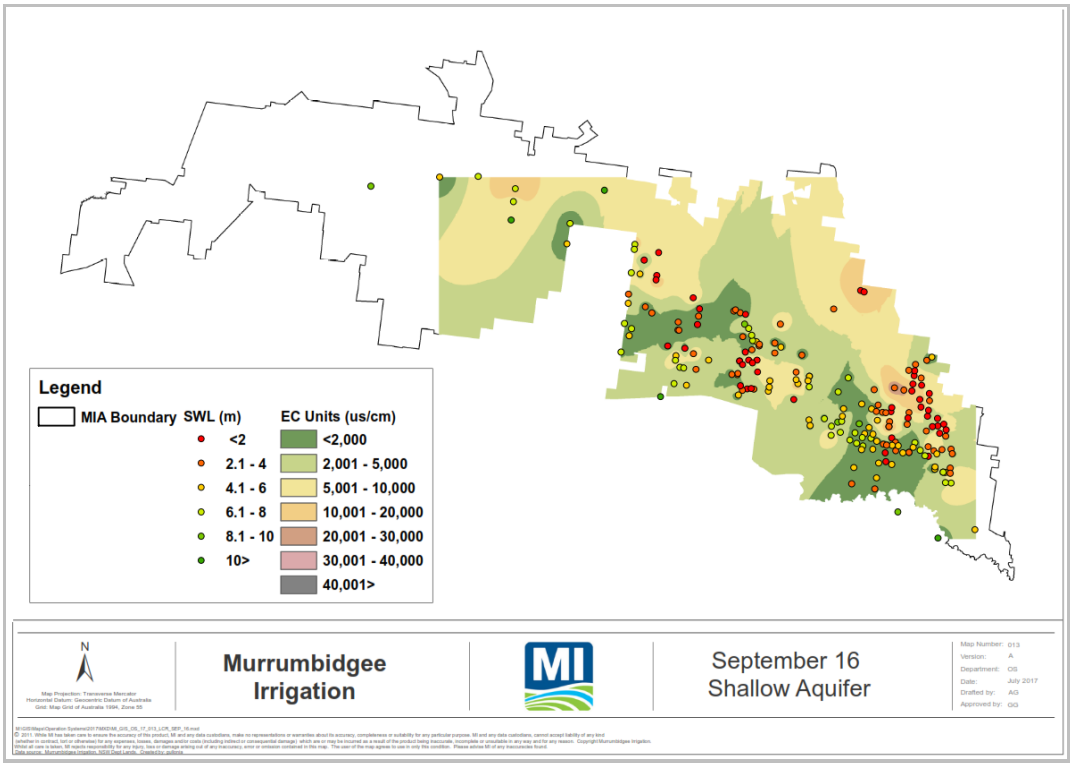


Figure 6 Shallow Shepparton Formation- depth to water table and salinity, Sep 2016

2015/16

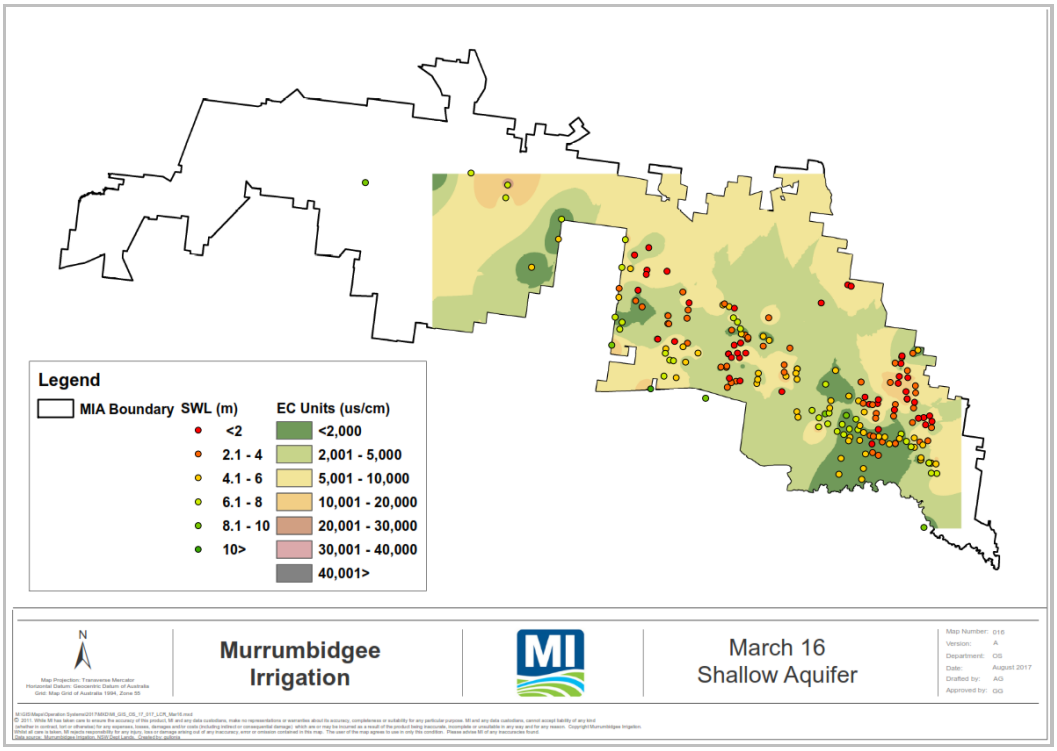


Figure 7 Shallow Shepparton Formation- depth to water table and salinity, March 2016

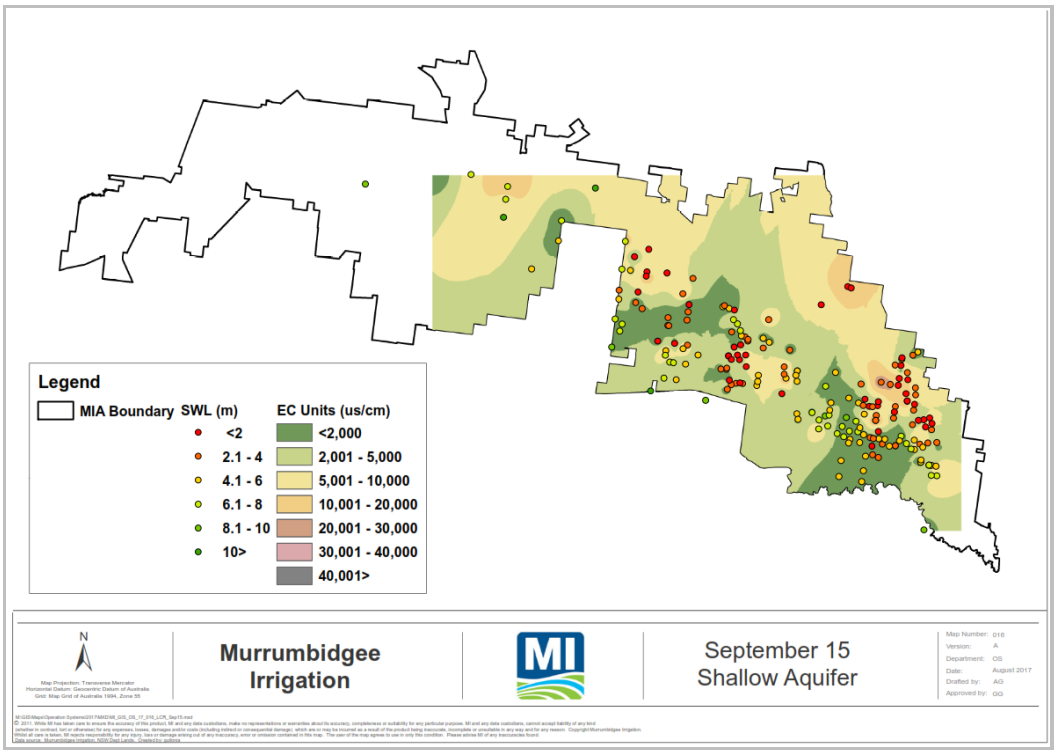


Figure 8 Shallow Shepparton Formation- depth to water table and salinity, Sep 2015

2014/15

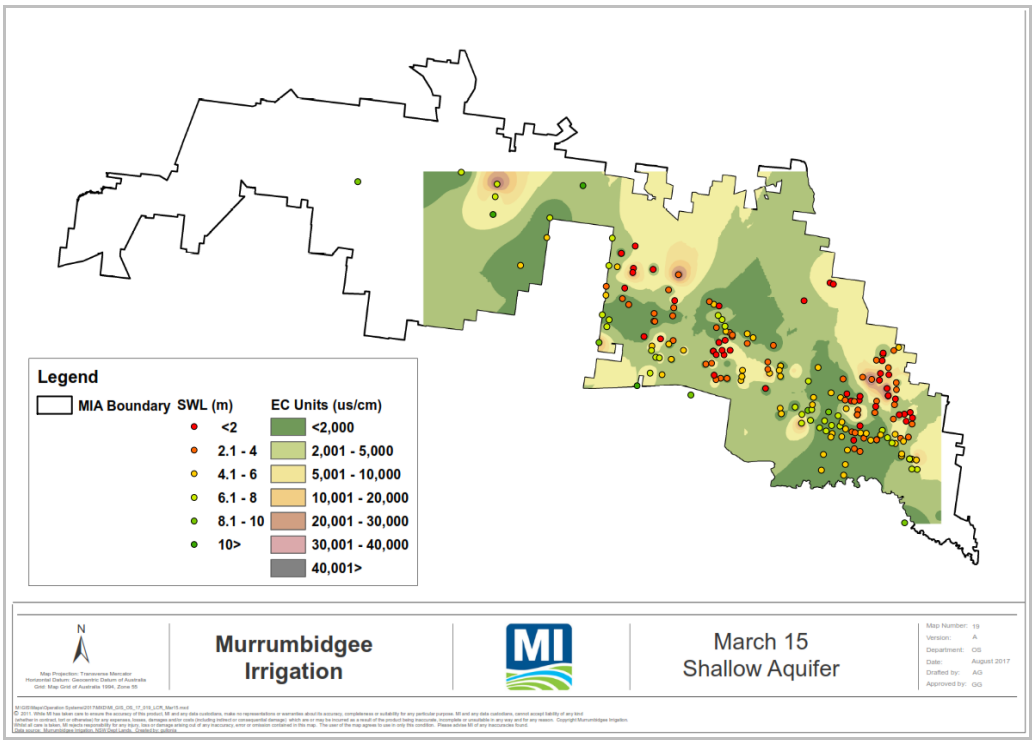


Figure 9 Shallow Shepparton Formation- depth to water table and salinity, March 2015

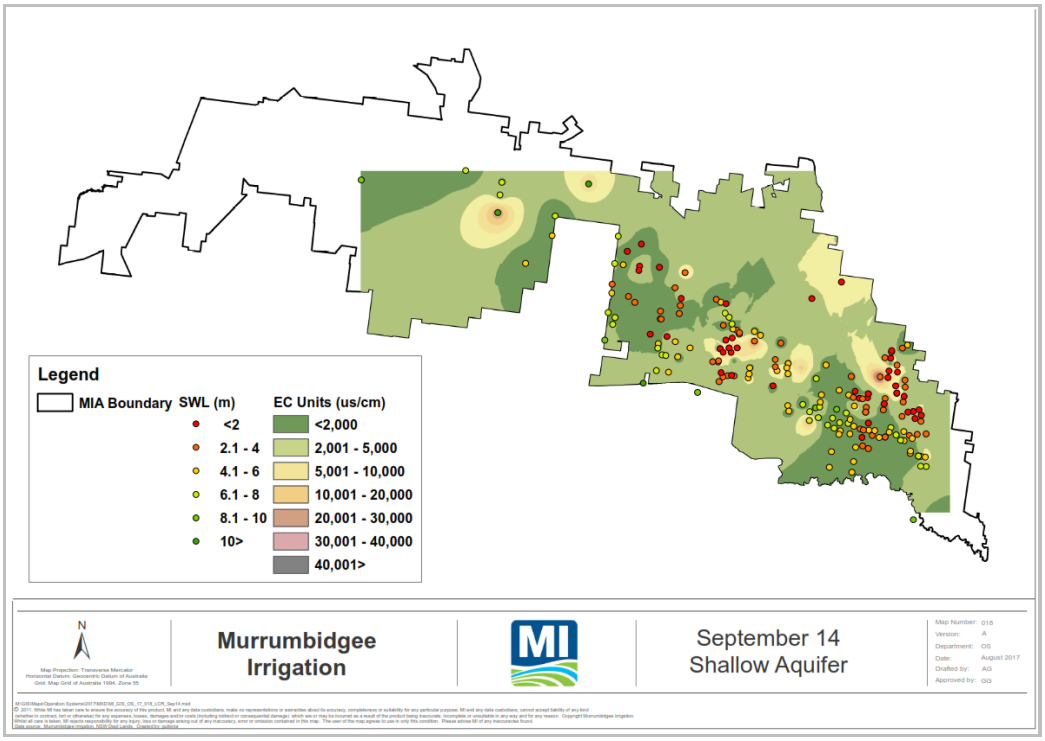


Figure 10 Shallow Shepparton Formation- depth to water table and salinity, Sep 2014

2005/06

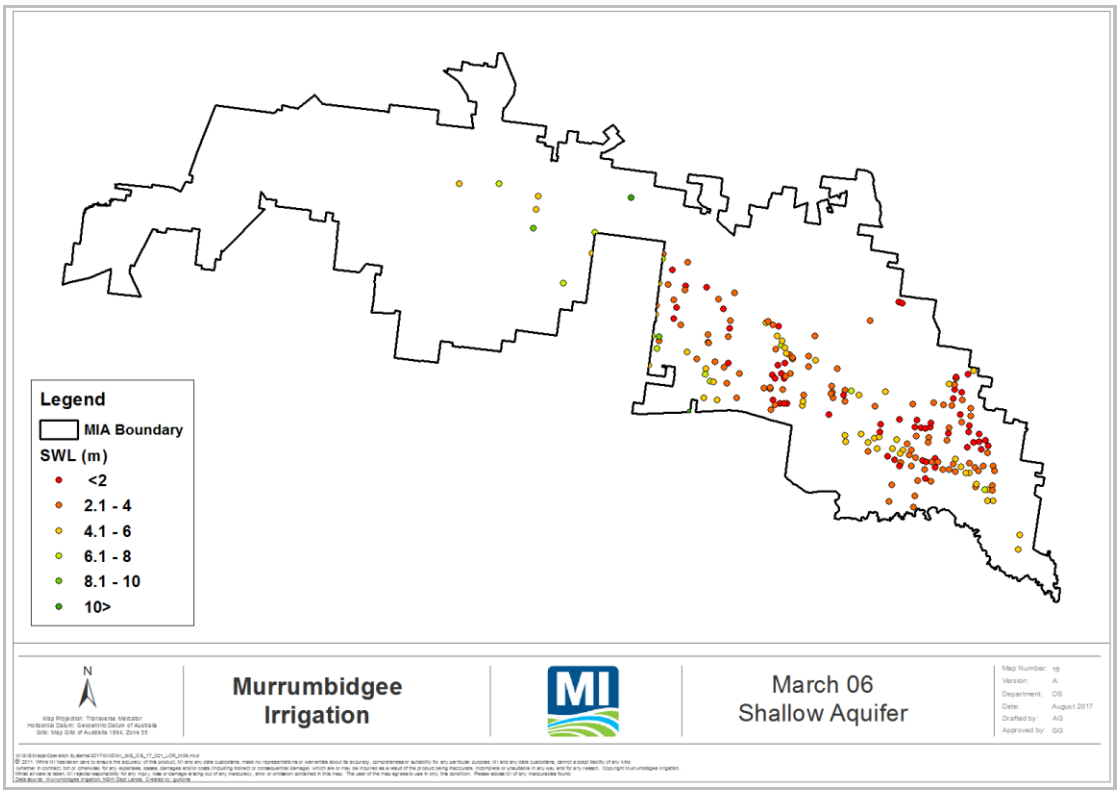


Figure 11 Shallow Shepparton Formation - depth to water table, March 2006

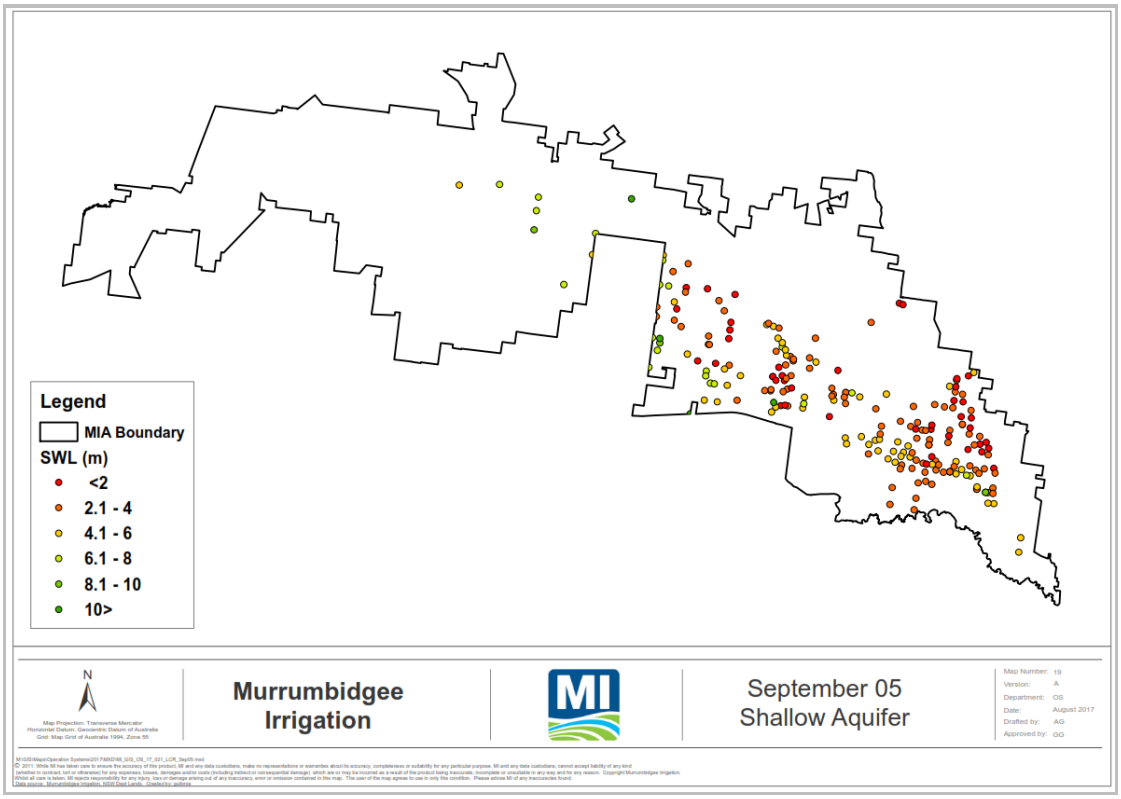


Figure 12 Shallow Shepparton Formation - depth to water table, Sep 2005

1980/2002

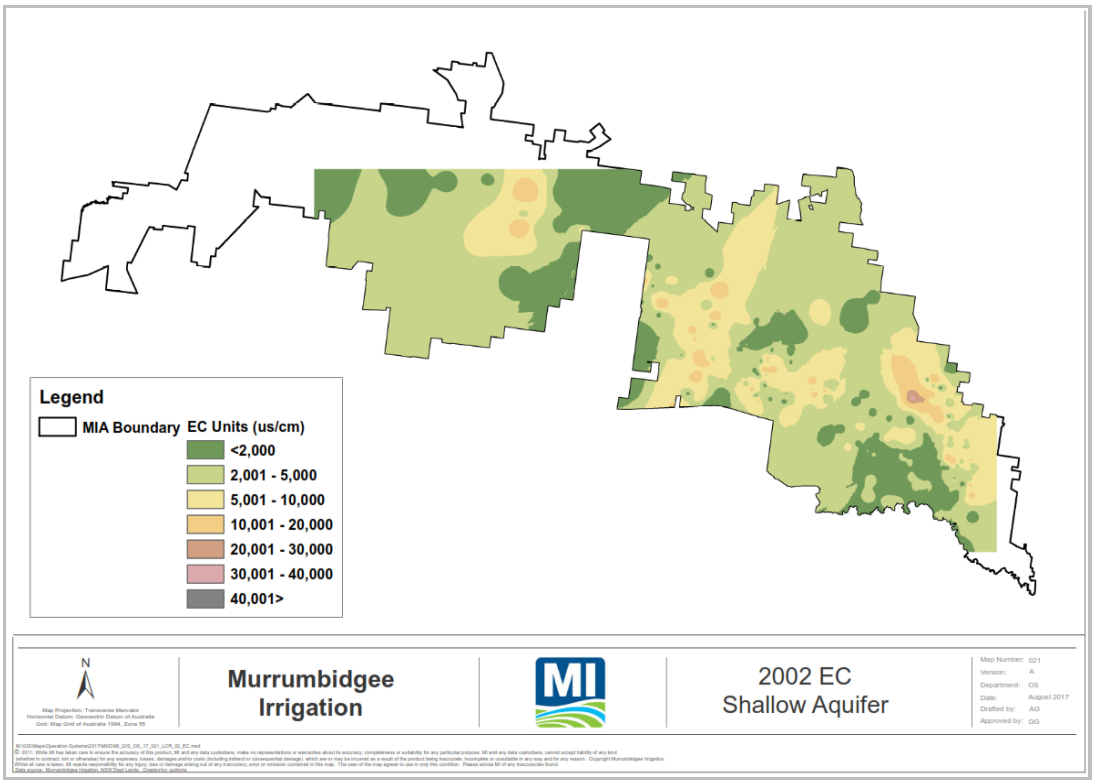


Figure 13 Shallow Shepparton Formation, groundwater salinity, Sep 2002

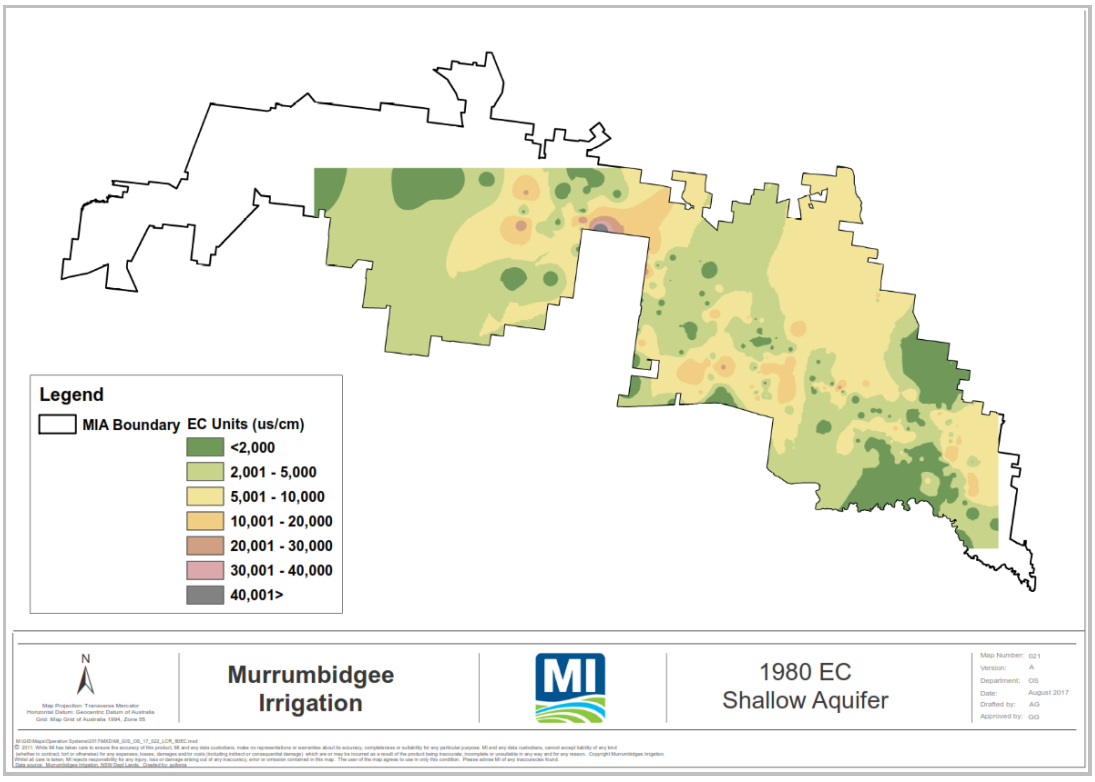


Figure 14 Shallow Shepparton Formation – groundwater salinity, Sep 1980

6.4 Deep Shepparton Formation

Depth to water table and salinity maps for piezometers in the deep Shepparton Formation are presented in Figures 15 to 24. Groundwater levels and salinity trends in the deep Shepparton Formation can be influenced by connectivity with the shallow Shepparton Formation, therefore the trends observed in the shallow Shepparton Formation also evident in the deep Formation.

Due to the attenuation time for groundwater to infiltrate through layers or for gradient movement across the MIA, groundwater changes can be seen long after a flood event has occurred. This can be seen with decrease in groundwater salinity in March 2017 (Figure 15) compared to September 2016 (Figure 16), which is likely attributed to the high rainfall received at the end of 2016.

2016/17

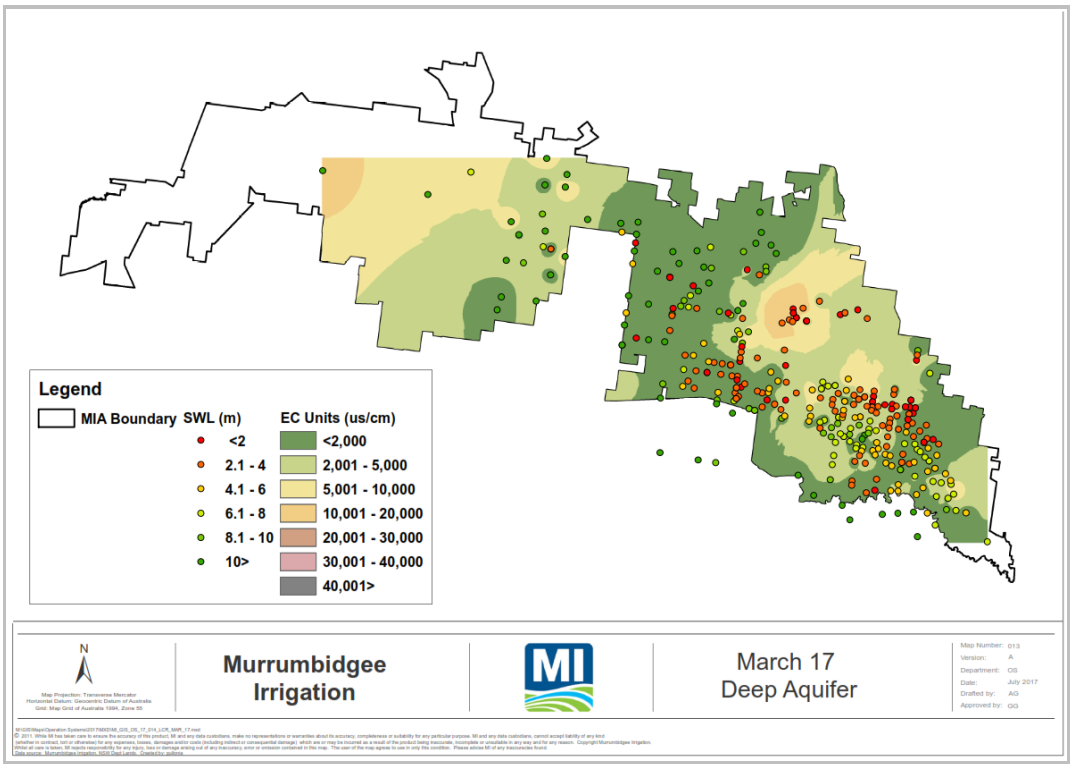


Figure 15 Deep Shepparton Formation- depth to water table and salinity, March 2017

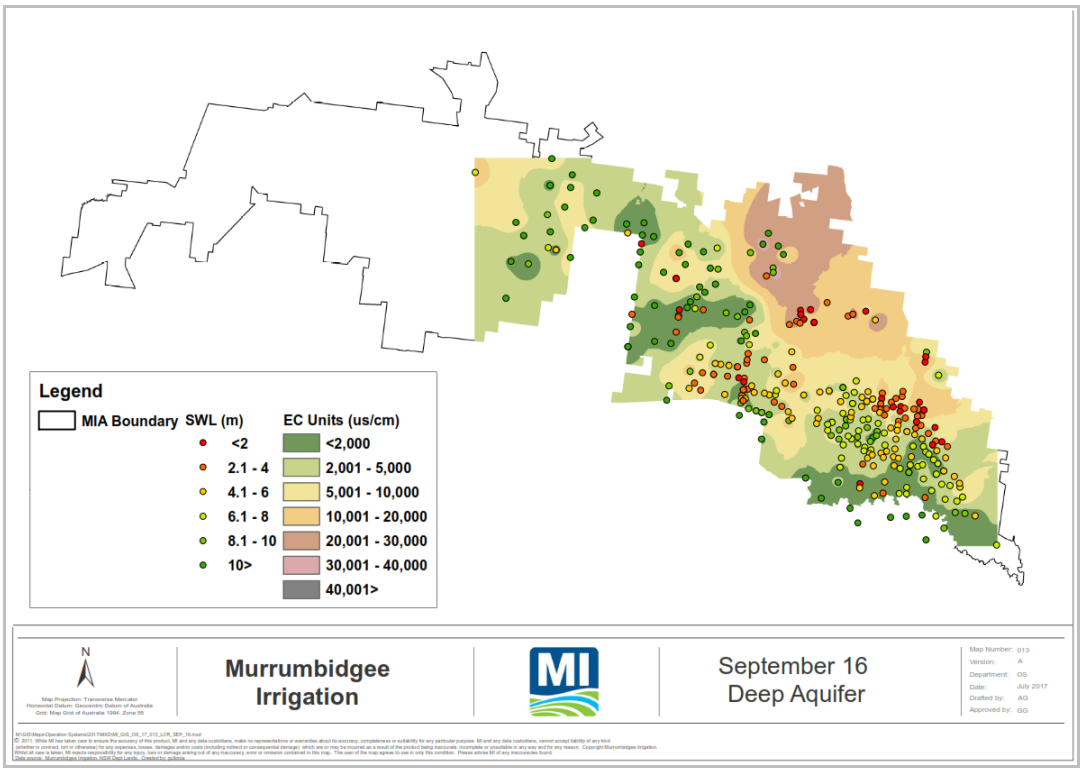


Figure 16 Deep Shepparton Formation- depth to water table and salinity, September 2016

2015/16

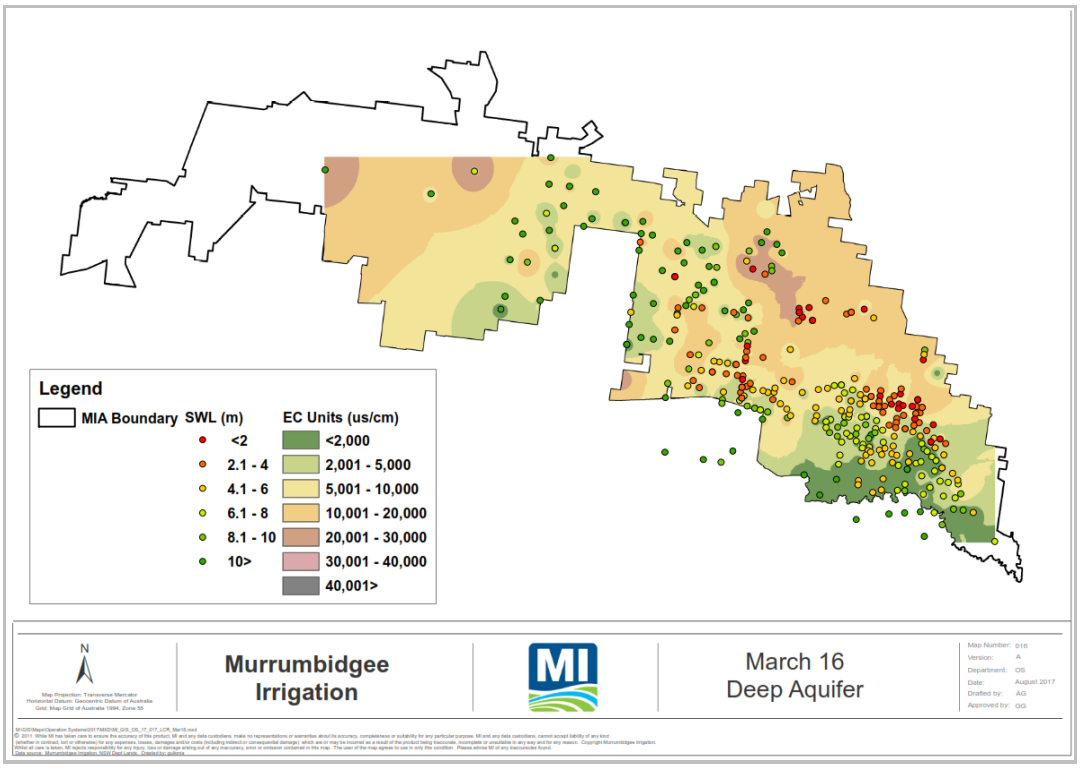


Figure 13 Deep Shepparton Formation- depth to water table and salinity, March 2016

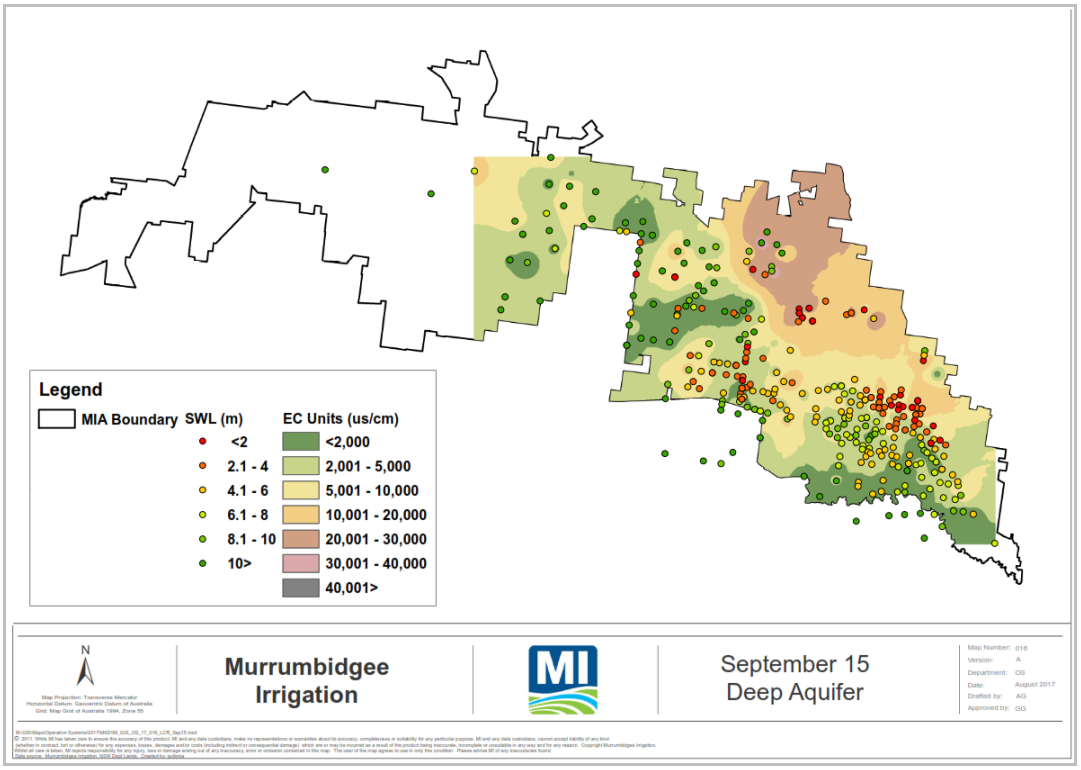


Figure 18 Deep Shepparton Formation- depth to water table and salinity, September 2015

2014/15

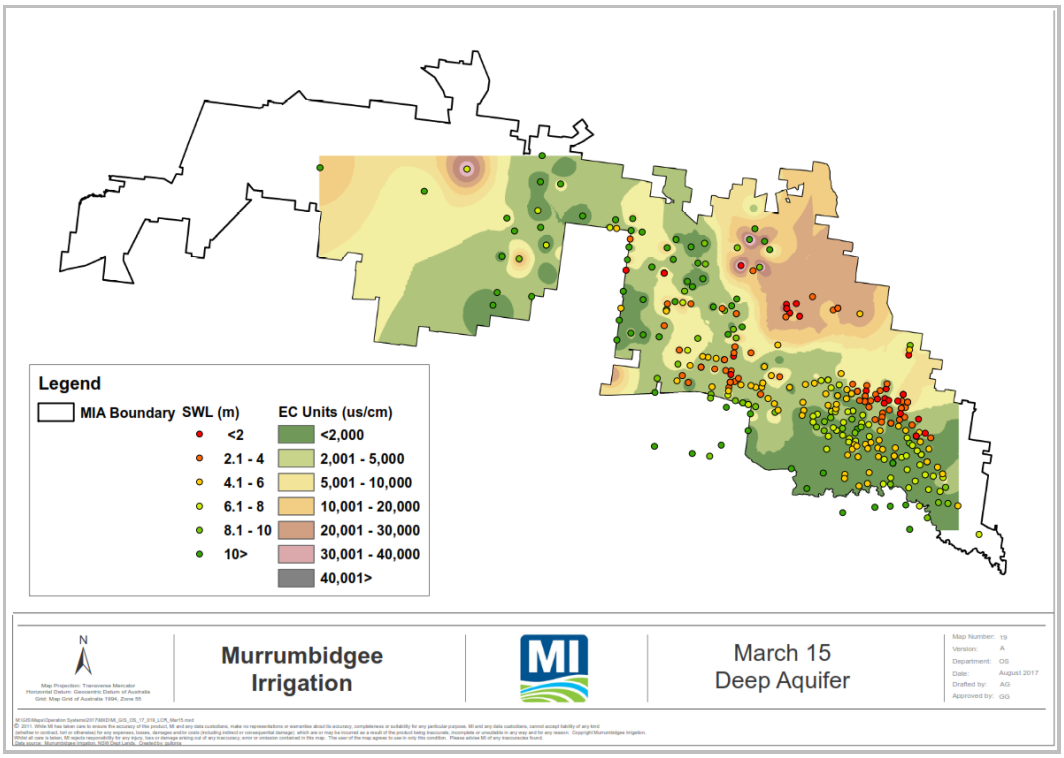


Figure 19 Deep Shepparton Formation- depth to water table and salinity, March 2015

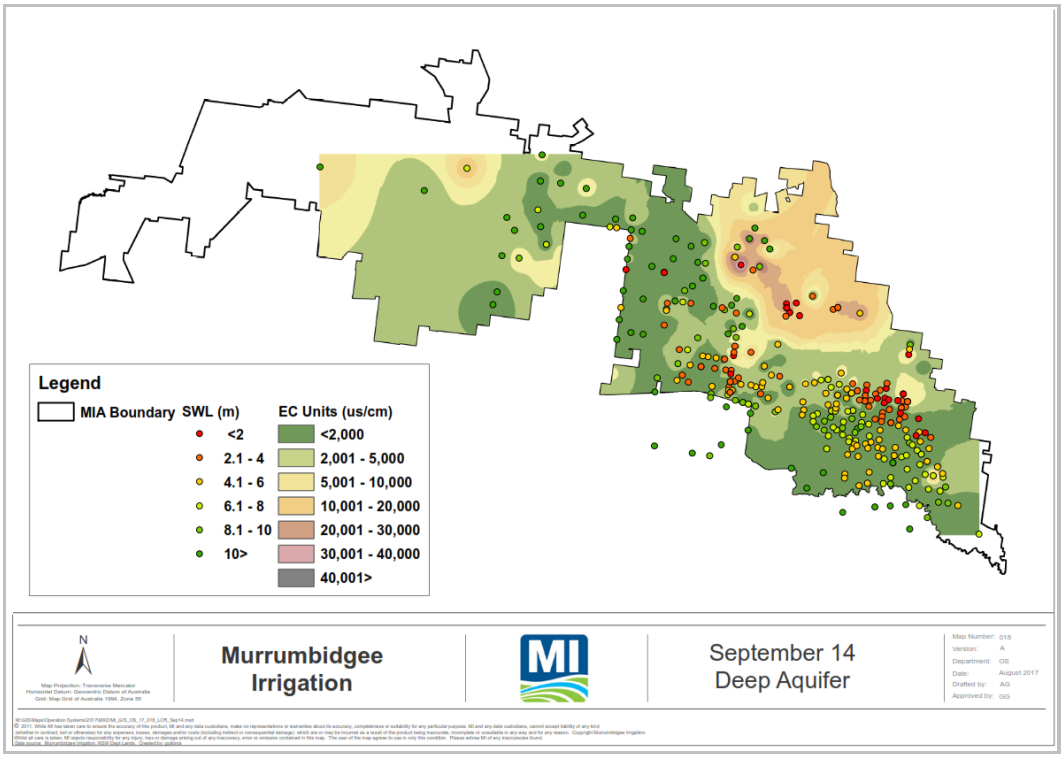


Figure 20 Deep Shepparton Formation- depth to water table and salinity, September 2014

2005/06

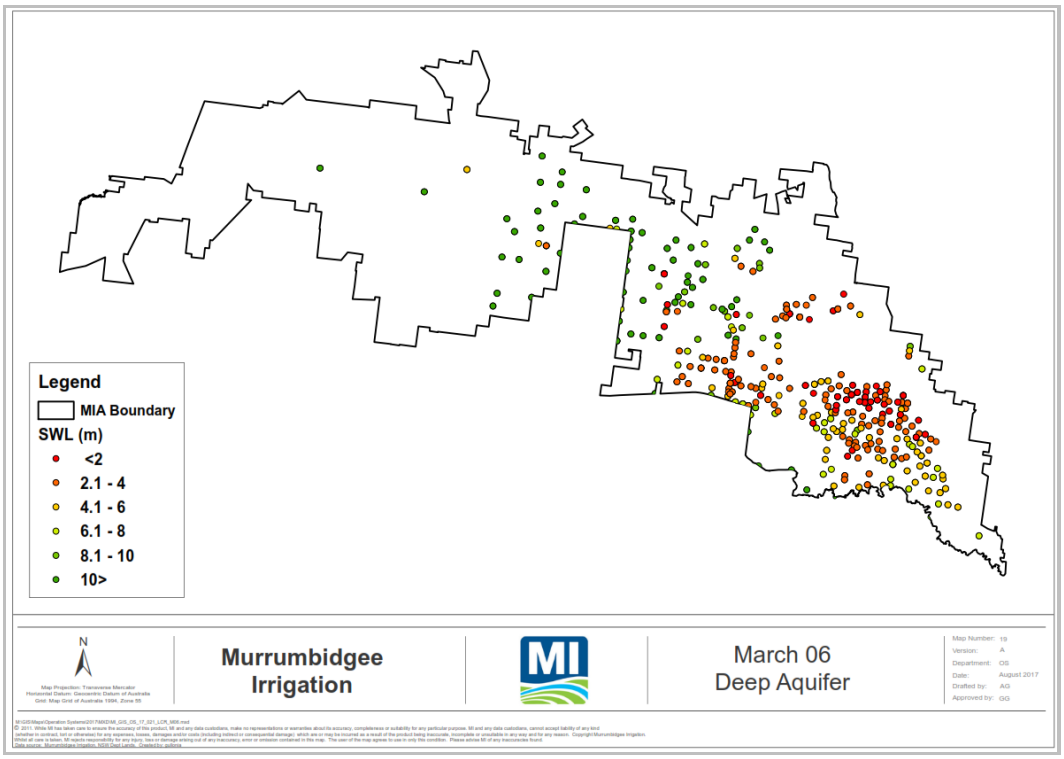


Figure 21 Depth (m) to water table and groundwater salinity (µS/cm) in the Deep Shepparton Formation, March 2006

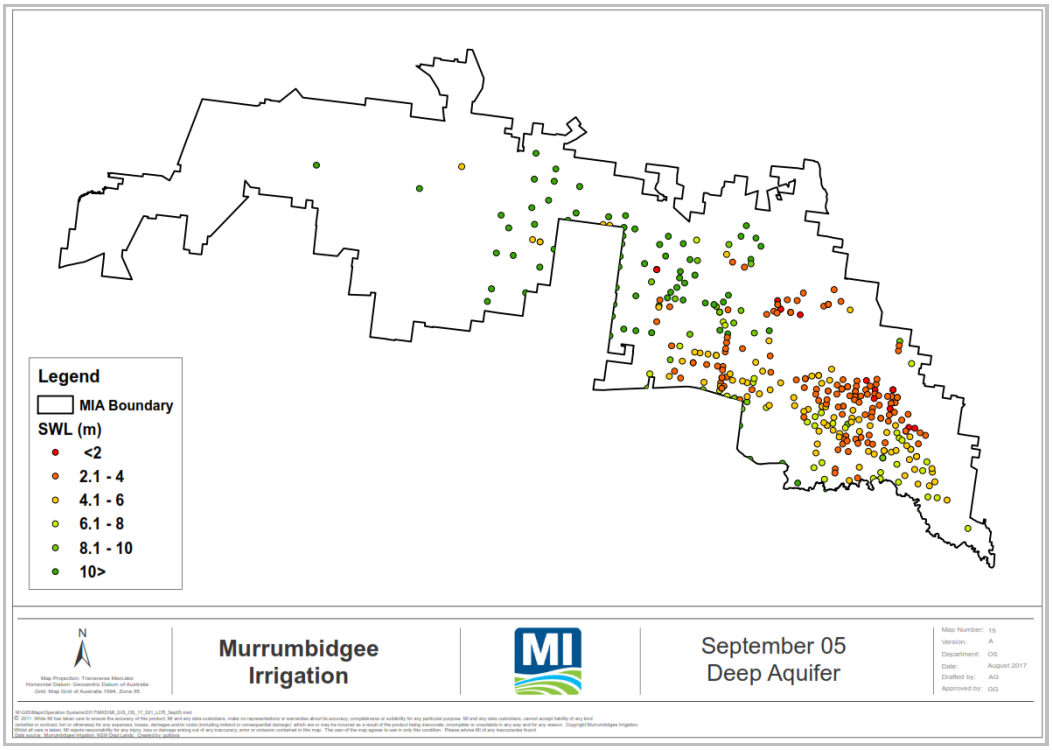


Figure 22 Depth (m) to water table and groundwater salinity (µS/cm) in the Deep Shepparton Formation, September 2005

1980/2002

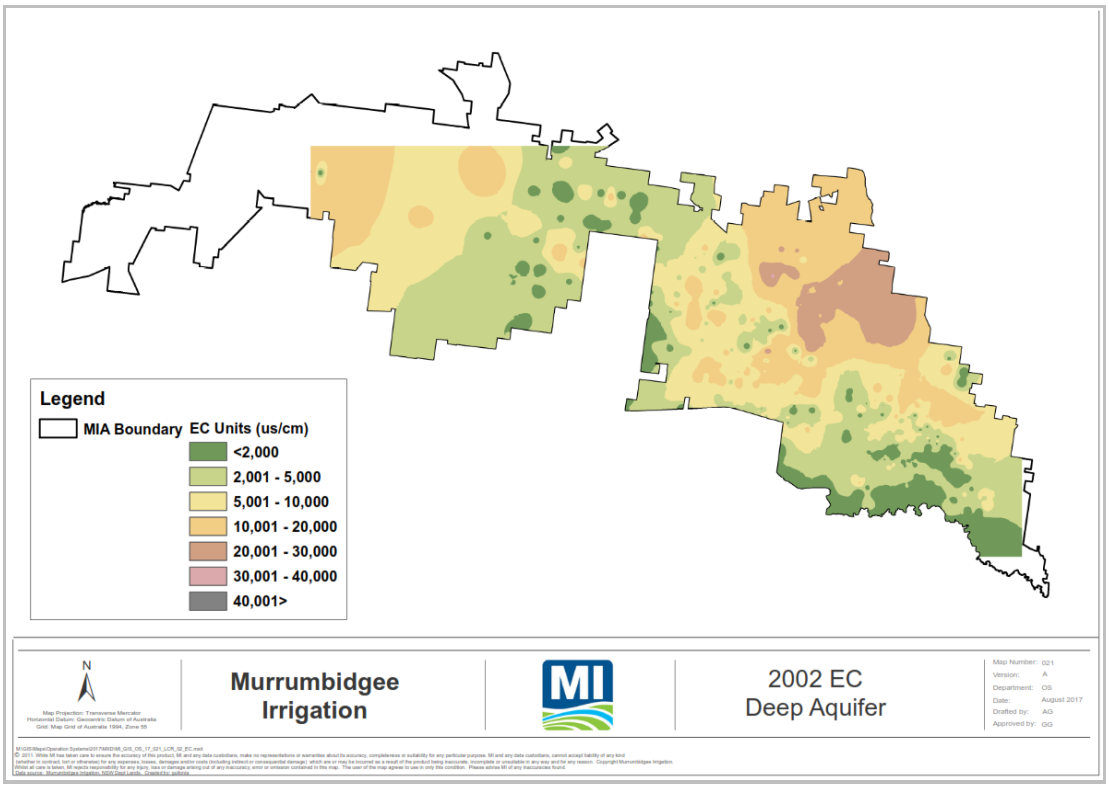


Figure 23 Deep Shepparton Formation - groundwater salinity, September 2002

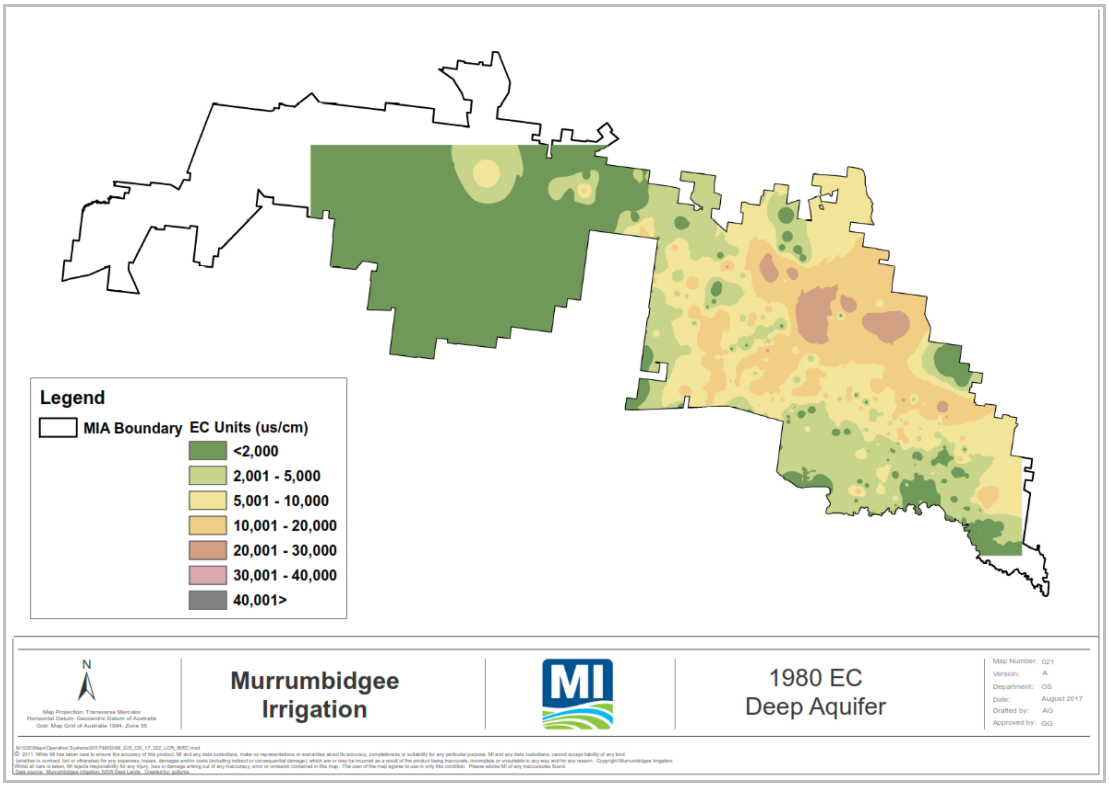


Figure 24 Deep Shepparton Formation - groundwater salinity, September 1980

6.5 Calivil Formation

Depth to water table and salinity maps for piezometers in the Calivil Formation are presented in Figures 25 to 34. Level trends in this formation generally represent drawdown from shallow aquifers. As seen in the upper formations, piezometers measured in the deep formation March 2017 (Figure 25) exhibit low salinity. This suggests that the Calivil Formation may be influenced by large flooding events, either through direct recharge, aquifer exchange or, to a lesser degree, vertical seepage from the above Shepparton Formation. However, due to the dynamic nature of groundwater aquifers, it is difficult to ascertain the true origin and significance of level changes with any confidence. Levels in this aquifer remain consistent for all reporting years, with the majority with a depth of more than 10m.

2016/17

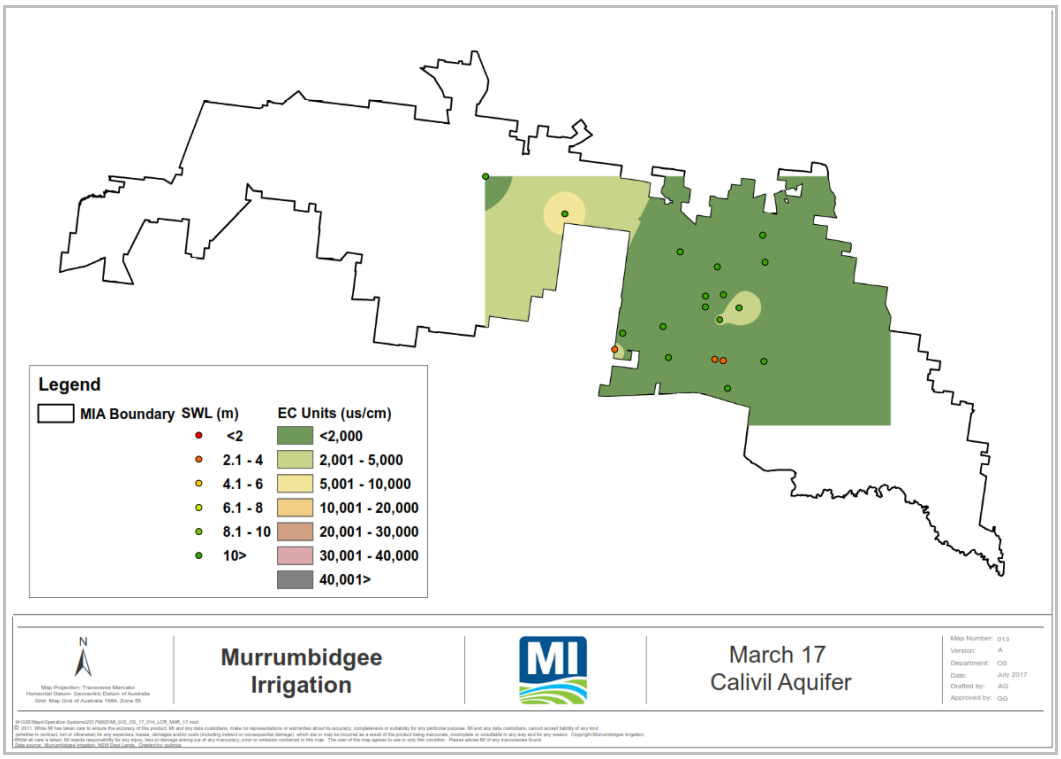


Figure 25 Calivil Formation - depth to water table and salinity, March 2017

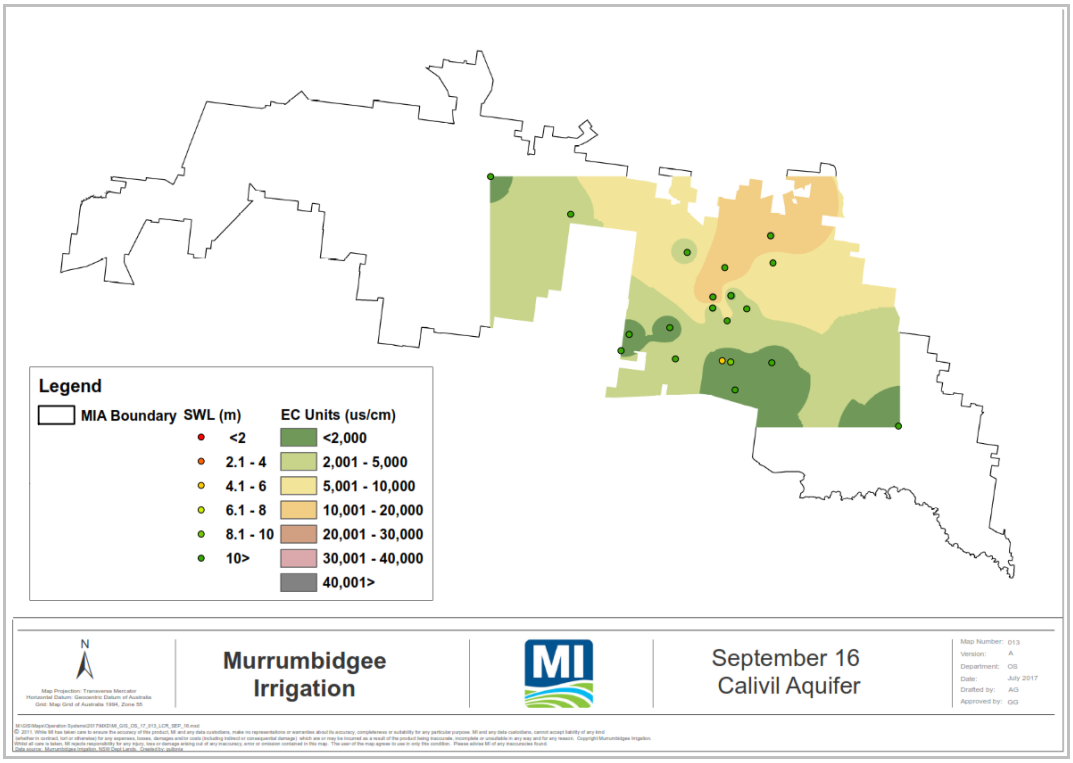


Figure 26 Calivil Formation - depth to water table and salinity, September 2016

2015/16

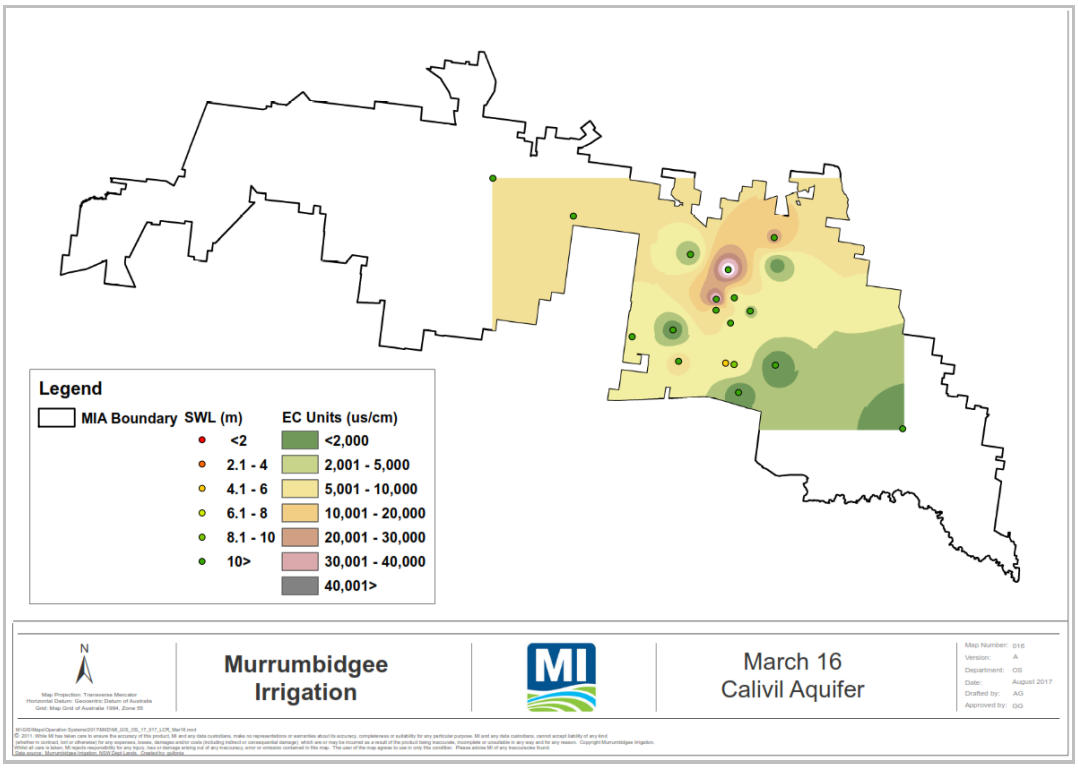


Figure 27 Calivil Formation - depth to water table and salinity, March 2016

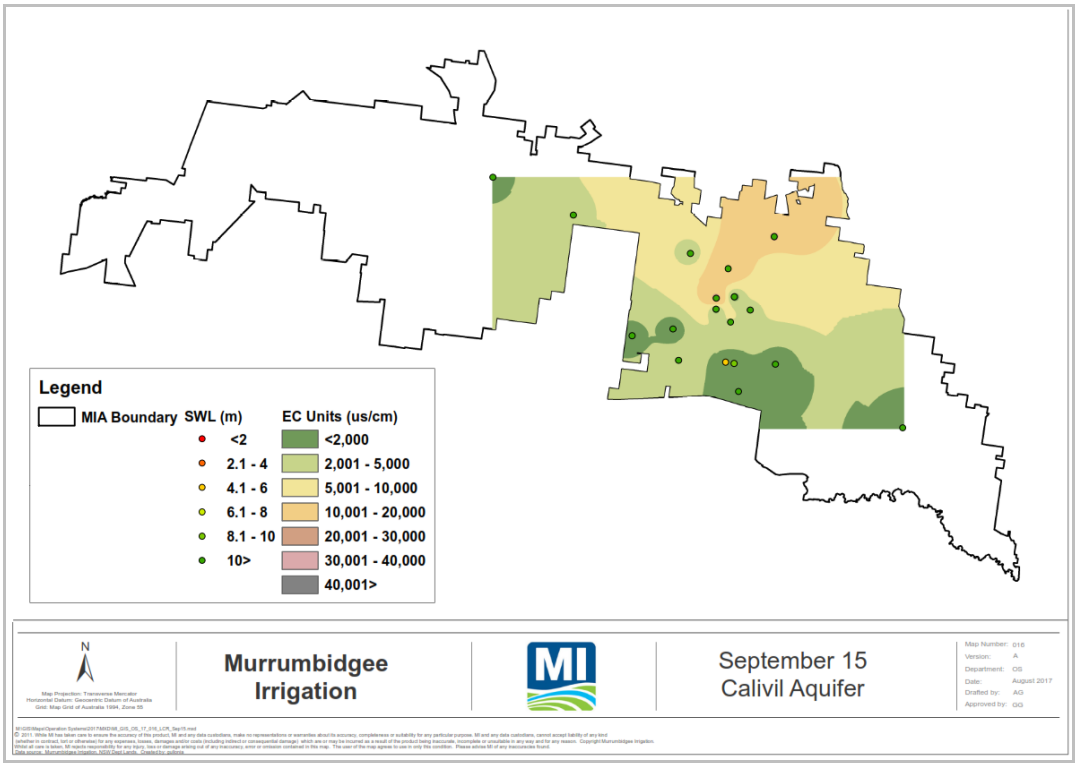


Figure 28 Calivil Formation - depth to water table and salinity, September 2015

2014/15

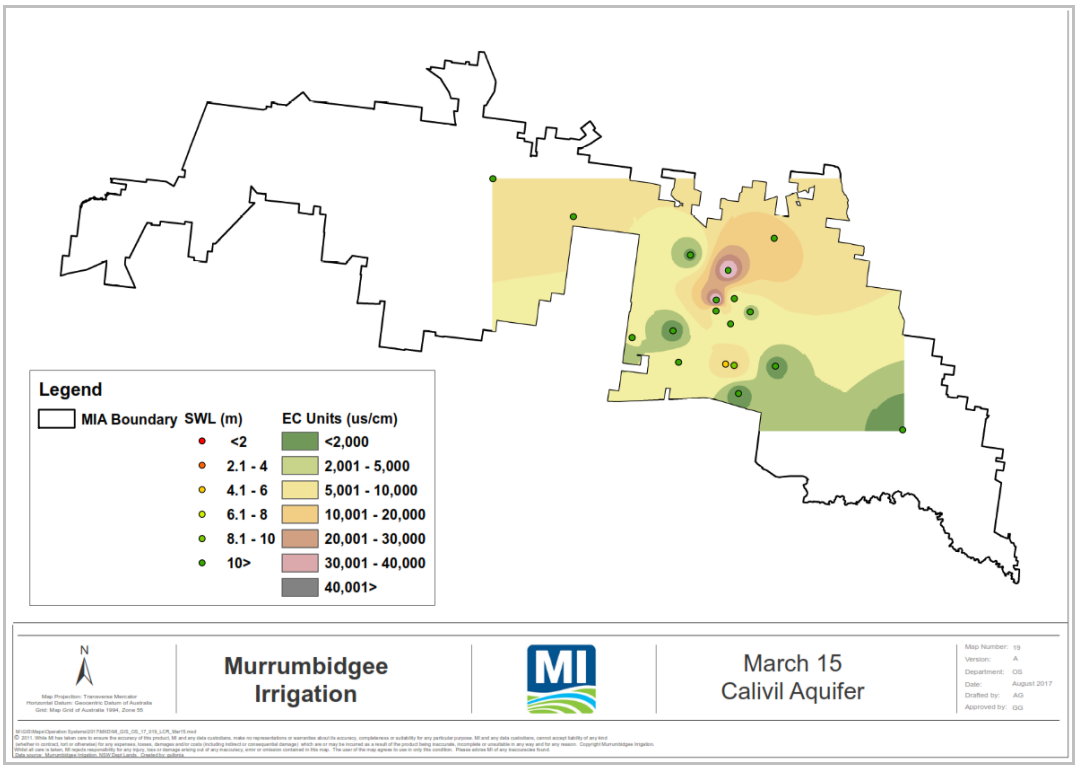


Figure 29 Calivil Formation - depth to water table and salinity, March 2015

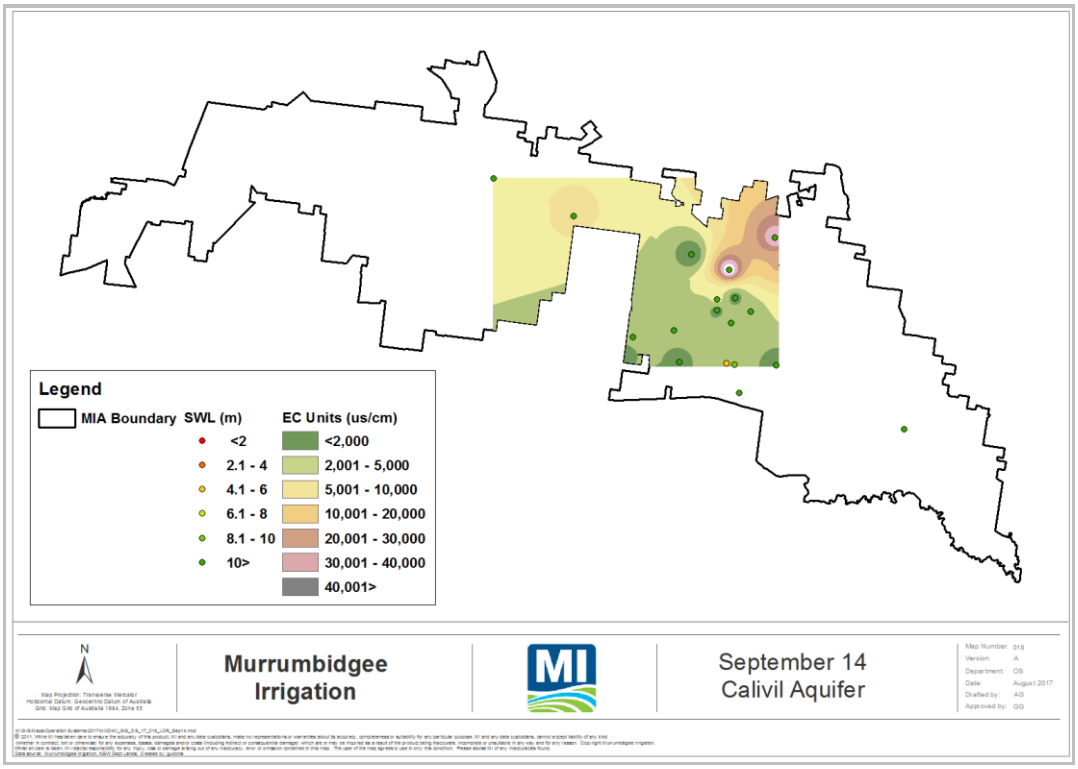


Figure 30 Calivil Formation - depth to water table and salinity, September 2014

2005/06

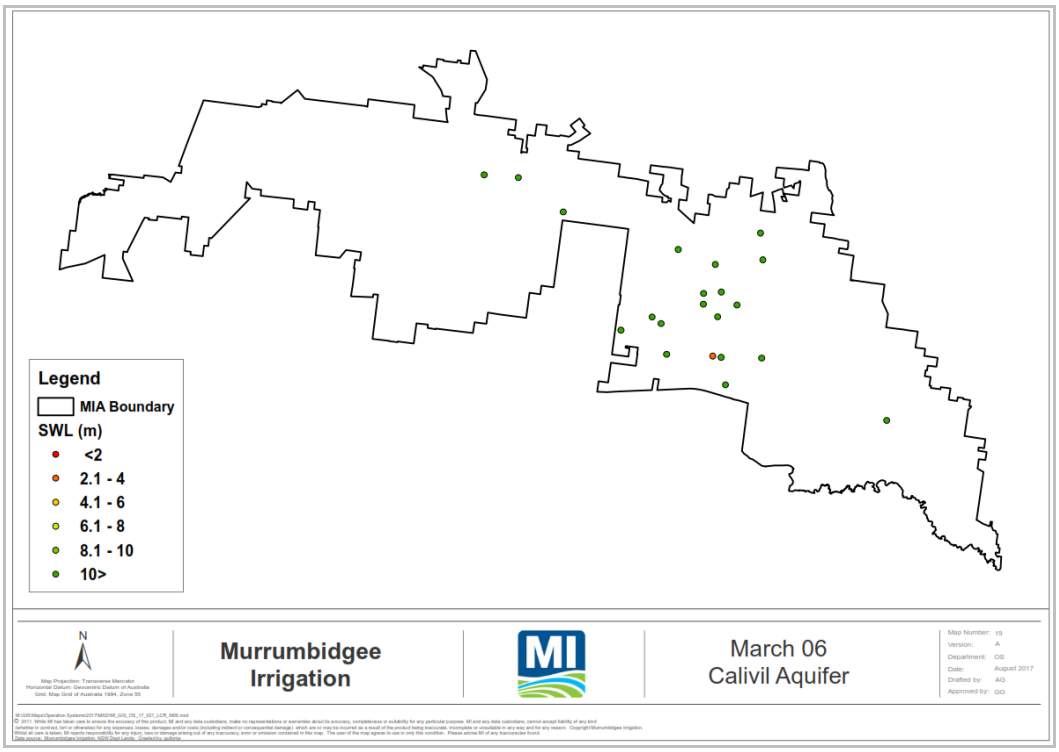


Figure 14 Calivil Formation - depth to water table and salinity, March 2006

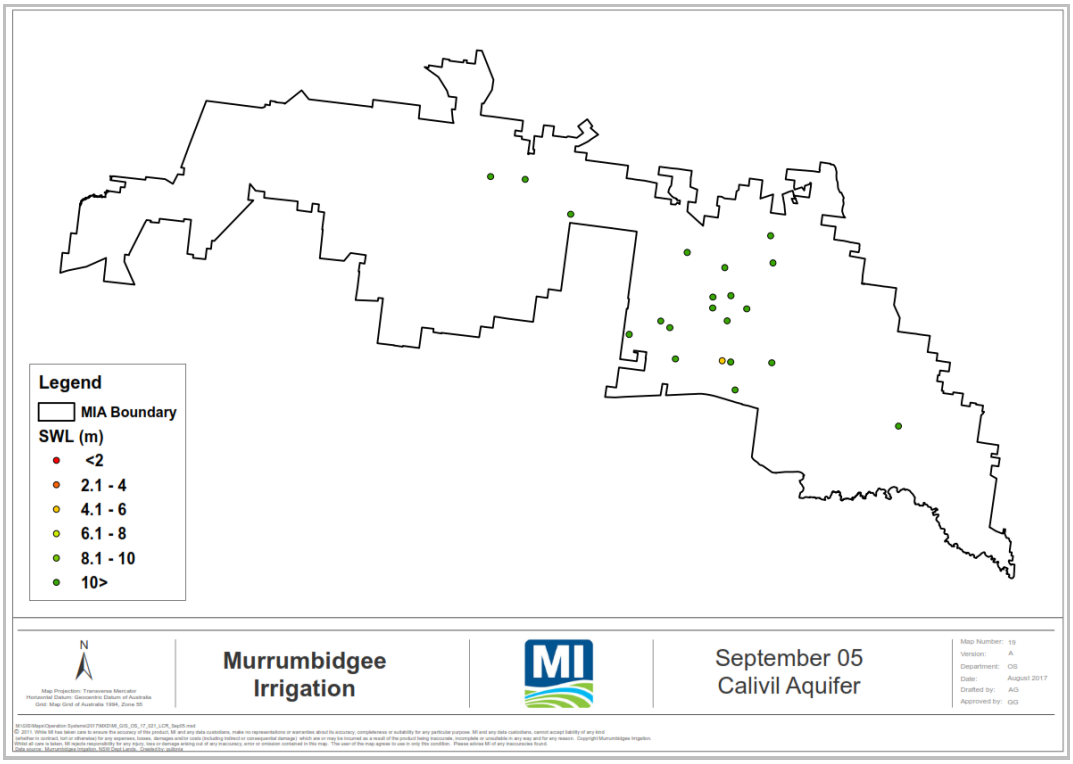


Figure 15 Calivil Formation - depth to water table and salinity, September 2005

1980/2002

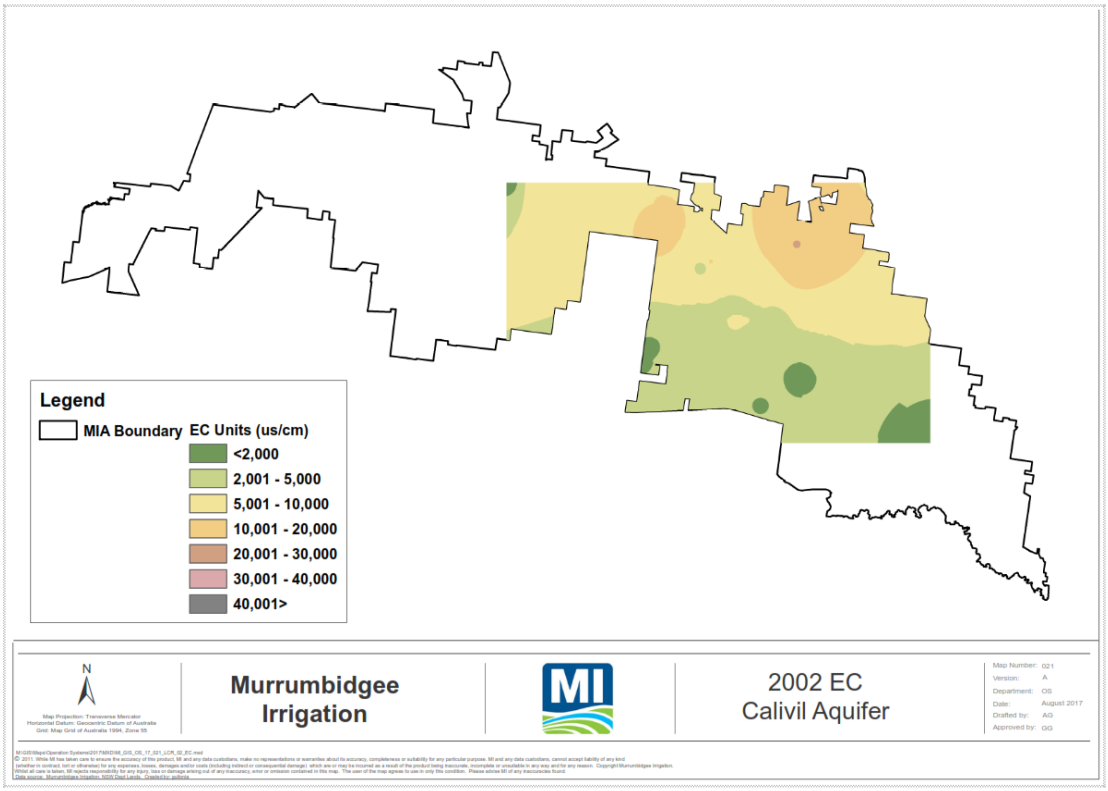


Figure 16 Calivil Formation - groundwater salinity, September 2002

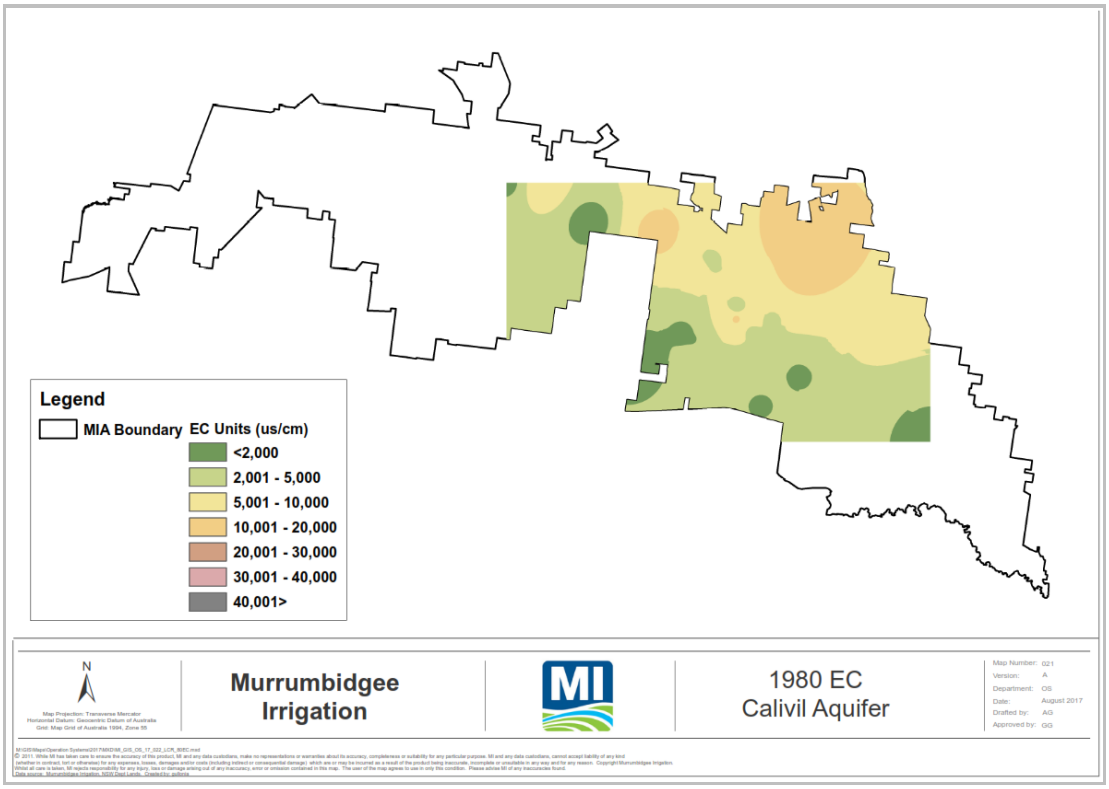


Figure 17 Calivil Formation - groundwater salinity, September 1980

7 Tubewells

MI monitors the volume of water and salt load pumped from seven tubewells within the MIA. The location of the tubewells are shown in Figure 4. Table 24 shows the total volumes and salt discharged from tubewells for 2016/17 and previous years. EC was measured in July 2017 and used to calculate salt loads. EC measurements were unable to be measured at Five Bridges and South Leeton tubewells in 2016/17 due to mechanical failure and therefore the inability to access a water sample. To allow the data to be comparable to other years reported in this table, a three year average EC reading was used to calculate saltload for 2016/17. A total volume of 1,816 ML and 2829 tonnes of salt was discharged from tubewells for 2016/17. The tubewell located at Baulch's has not been operational since 2010.

Table 24 Tubewell monitoring data 2016/17 compared to previous years

2016/17			2015/16		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	324	180*	Five Bridges	658	357
Gil Gil	518	1061	Gil Gil	412	755
Yanco West	284	513	Yanco West	274	680
South Leeton	191	816*	South Leeton	261	1,090
Baulch's	0	0	Baulch's	0	0
Wamoon	238	128	Wamoon	175	88
East Wamoon	261	129	East Wamoon	93	40
Total	**1816**	**2829**	**Total**	**1,873**	**3,012**
2014/15			**2006/07**		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	777	394	Five Bridges	707	489
Gil Gil	585	1088	Gil Gil	266	353
Yanco West	262	411	Yanco West	305	404
South Leeton	0	0	South Leeton	76	118
Baulch's	0	0	Baulch's	137	52
Wamoon	351	166	Wamoon	384	200
East Wamoon	97	43	East Wamoon	778	454
Total	**2,072**	**2,102**	**Total**	**2,653**	**2,070**

*no EC data available. Three year average used to calculate saltload

8 New Measures to Limit Groundwater Recharge and Discharge of Salt

MI continues to deliver water saving projects through automation, gravity piping, conversion to pressurised pipeline and the channel lining of sections of the supply system under the Private Irrigation Infrastructure Operations Program (PIIOP). The modernisation programs implemented over the 2016/17 year include refurbishment and automation of MI's Main Canal, Division 3 (Whitton), Yenda, Widgelli, Benerembah and Bilbul systems, increasing operational efficiency and reducing groundwater recharge.

The PIIOP works have also helped reduce impacts of losses through channel seepage to groundwater systems at Lake Wyangan, Hanwood, Yenda and Tharbogang which has included the replacement of ageing earthen channels with channel lining or gravity pipelines as well as channel automation and on-farm water saving initiatives.

9 Environmental Protection and Management

9.1 Discharge of noxious aquatic weeds

During 2016/17 irrigation year, there was no known potential or actual discharge of Class 1, 2 or 3 declared noxious aquatic weeds from MI's Area of Operation.

9.2 Discharge of Blue-Green Algae

All Blue Green Algae results from water sampled during discharge from MI's area of operation were reported to the Minister's nominated contact officer within 24 hours of receiving results.

ENVIRONMENTAL PROTECTION LICENCE 4651

10 Statement of Compliance

MI has fulfilled the compliance requirements as set out in EPL 4651 for 2016/17. A summary of the compliance requirements is cross referenced to this report and listed in Table 25.

Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations. Internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

MI is able to receive complaints from members of the public in relation to MI's activities via the business telephone number. Direction on how to make a complaint can be found on MI's website (www.mirrigation.com.au/Contact-Us).

Table 25 Environmental Protection Licence (EPL 4651) Monitoring and Reporting Requirements

Licence section	Requirement	Compliant	Report Section
Administrative Conditions	1	Yes	N/A
Discharges to Air and Water and Applications to Land	2	Yes	N/A
Limit Conditions	3	Yes	N/A
Operating Conditions	4	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	www.mirrigation.com.au/Environment/Water-Quality
Maintain a Chemical Control Plan	O3.5	Yes	
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	
Monitoring and Recording Conditions	5	Yes	
Monitoring Records	M1	Yes	Available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	Internal documents
Recording of pollution complaints	M4	Yes	Available upon request from EPA
Telephone complaints line	M5	Yes	1. Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11. EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	8.1. Noxious Weed Management
Annual return documents	R1		Submitted August 2017
Notification of environmental harm	R2	Yes	N/A
Written Report (of an event)	R3	Yes	N/A
Annual system performance report	R4	Yes	Full Report
Other reporting conditions	R5	Yes	Section 10

11 EPL Monitoring and Reporting

Under MI's EPL 4651, five points (Figure 3) are licenced to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded and specified water quality parameters are measured during flow or rainfall events. These monitoring points are referred to throughout this section.

11.1 System performance

Table 26 presents total diversions into the MIA and total water discharged from the MIA for 2016/17 compared to previous years. In 2016/17, 122,092 ML was discharged, which included 121,363 ML that was diverted to Mirrool Creek Floodway in response to well above average rainfall and subsequent floodwater entering MI drainage networks from catchments in and outside of the MIA.

In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in this year. MI does not discharge irrigation waste water directly to ground waters in or outside the area of operations.

Table 26 Total water volumes (ML)

Year	Diversions	Discharged
2016/17	780,083	122,092
2015/16	643,957	1,079
2014/15	878,614	671
2005/06	1,036,519	8,570

11.2 Water Quality Monitoring

Monthly summaries for each monitoring point are presented in Table 27 - 31. Monitoring consisted of 38 sampling events, with 24 notification or action level detections, all of which were reported to the EPA in accordance with R5.1. The results were also made available on MI's website in line with legislative requirements.

Chemical detections were found at all sites except for Point 6 - YMS where all flow was diverted to MI's internal reuse system. High rainfall in the catchment from July to September 2016 caused the release of drainage water from farms into MI works that would normally be retained and recycled on farm. This had the greatest impact at Point 4 – LAG (Table 27), with 21 sampling events and 17 detections. Diuron, Simazine and Metolachlor were the only chemicals detected in 2016/17.

Table 27 Monitoring results for Point 4 - LAG

Point 4 – LAG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-16	65.1	3	4	6/7/16 Action level Diuron (8.57µg/L), 18/7/16 Action level Diuron (25.0µg/L) and Notification level Simazine (3.38µg/L), 20/7/16 Action level Diuron (22.4µg/L)
Aug-16	11.5	2	2	1/8/16 Action level Diuron (8.51µg/L), 2/8/16 Notification level Diuron (4.46µg/L)
Sep-16	66.7	3	7	1/9/16 Action level Diuron (7.47µg/L) and Notification level Metolachlor (0.021µg/L), 5/9/16 Notification level Diuron (2.2µg/L), Notification level Metolachlor (0.032µg/L), Notification level Simazine (5.68µg/L), 12/9/16 Notification level Diuron (1.3µg/L), Notification level Metolachlor (0.02µg/L),
Oct-16	0.0	0	0	-
Nov-16	28.6	2	0	-
Dec-16	50.6	2	0	-
Jan-17	6.7	1	0	-
Feb-17	8.4	0	0	-
Mar-17	34.6	2	0	-
Apr-17	31.4	1	0	-
May-17	85.8	5	4	12/5/17 Notification level Diuron (3.11µg/L), 18/5/17 Action level Diuron (5.16µg/L), 19/5/17 Notification level Diuron (1.42µg/L), 31/5/17 Action level Diuron (24.4µg/L)
Jun-17	14.4	0	0	-
Total	403.9	21	17	

Table 28 Monitoring results for Point 5 - GMSRR

Point 5 – GMSRR				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-16	11.8	2	4	6/7/16 Action level Simazine (25.1µg/L) and Notification level Diuron (3.63µg/L), 11/7/16 Notification level Simazine (4.86µg/L) and Notification level Diuron (3.58µg/L)
Aug-16	0.01	0	0	-
Sep-16	0.03	1	0	-
Oct-16	2.4	0	0	-
Nov-16	6.2	0	0	-
Dec-16	12.5	1	0	-
Jan-17	15.1	0	0	-
Feb-17	10.1	0	0	-
Mar-17	9.2	1	0	-
Apr-17	8.3	1	0	-
May-17	1.2	0	0	-
Jun-17	0.0	0	0	-
Total	76.8	6	4	

Table 29 Monitoring results for Point 6 - YMS

Point 6 – YMS				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-16	0.0	0	0	-
Aug-16	0.0	0	0	-
Sep-16	0.0	0	0	-
Oct-16	0.0	0	0	-
Nov-16	0.0	0	0	-
Dec-16	0.0	0	0	-
Jan-17	0.0	0	0	-
Feb-17	0.0	0	0	-
Mar-17	0.0	0	0	-
Apr-17	0.0	0	0	-
May-17	0.0	0	0	-
Jun-17	0.0	0	0	-
Total	0.0	0	0	

Table 30 Monitoring results for Point 7 - ROCUDG

Point 7 – ROCUDG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-16	0.0	2	0	-
Aug-16	73.7	2	1	12/8/16 Notification level Metolachlor (0.046µg/L)
Sep-16	5.1	0	0	-
Oct-16	0.0	0	0	-
Nov-16	11.8	0	0	-
Dec-16	58.6	1	0	-
Jan-17	13.1	0	0	-
Feb-17	0.0	0	0	-
Mar-17	0.0	0	0	-
Apr-17	13.4	0	0	-
May-17	60.3	2	0	-
Jun-17	12.3	0	0	-
Total	248.1	7	1	

Water was released to Point 15 – MIRFLD in September and October during flood conditions. During these conditions, access to this point was limited due to safety risks and samples were collected at a number of sites upstream. These results are available if requested by the EPA or DPI Water.

Table 31 Monitoring results for Point 15 - MIRFLD

Point 15 – MIRFLD				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-16	640	1	1	10/7/16 Action level Metolachlor (0.132µg/L)
Aug-16	0.0	0	0	-
Sep-16	57,180	2	1	12/9/16 Notification level Metolachlor (0.029µg/L)
Oct-16	63,543	1	0	-
Nov-16	0.0	0	0	-
Dec-16	0.0	0	0	-
Jan-17	0.0	0	0	-
Feb-17	0.0	0	0	-
Mar-17	0.0	0	0	-
Apr-17	0.0	0	0	-
May-17	0.0	0	0	-
Jun-17	0.0	0	0	-
Total	121,363	4	2	

Murrumbidgee Irrigation

2018 ANNUAL COMPLIANCE REPORT



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Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
BBSW	Barren Box Storage and Wetland
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DOI Water	Department of Industry, Water
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Reference crop evapotranspiration
GIS	Geographic Information System
ha	Hectare(s)
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	Micro Siemens per centimetre
µg/L	Micrograms per litre
ML	Megalitre
NRAR	Natural Resources Access Regulator
OEH	Office of Environment and Heritage
SOP	Standard Operating Procedure
t	Tonnes
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
YMS	EPL Point 6 - Yanco Main Southern Drain
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station

Preface

The Annual Compliance Report 2016/17 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation (MI) with the Department of Industry, Water (DoI Water) and the NSW Environment Protection Authority (EPA). MI operates under a Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) issued by DoI Water, and an Environment Protection Licence (EPL) 4651 issued by the EPA in accordance with the Protection of the Environment Operations Act 1997.

MI is committed to achieving organisational excellence through operating safely, efficiently and effectively, all of which contribute towards the measure of MI's environmental and compliance performance.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of Compliance

Murrumbidgee Irrigation (MI) has met the conditions of the Monitoring and Reporting Plan for our Combined Approval in 2017/18. The compliance requirements are cross referenced within this report and listed in Table 1. MI has quality assurance and control procedures to guarantee data integrity and to ensure that all compliance obligations are met. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations.

There were no significant events in 2017/18 that required notification to the Minister.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2017/18. MI did not construct new works that would allow further discharge from the Area of Operations. In 2017/18, the boundary of MI's Area of Operations increased by 2,717 hectares, which is identified in Figure 1.

Table 1 Combined Water Supply Work Approval and Water Use Approval (40CA403245) reporting summary

Licence section	Condition	Report Section
Notification of events	10	1. Statement of Compliance
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1	2. Plan of Operations and Works
	12.2	
Statement of Compliance	12.3	1. Statement of Compliance
Presentation of Data and Analyses	12.4	Section 1 - 6
	12.5	
	12.6	
	12.7	Provided on USB
	12.8	1. Statement of Compliance
New Measures to Limit Groundwater Recharge and Discharge of Salt	12.9	8. New Measures to Limit Groundwater Recharge and Discharge of Salt
Reporting on Water Management	12.10	3.3 Diversions and Water Allocation
	12.11	3.5 Water discharged from Area of Operation
	12.12	3.9 Water Balance
	12.13 (a) (b)	3.1 Climate Conditions
	(c) – (j)	4. Water Use
Reporting on Salinity and Salt load	12.14	5. Salinity and Salt load
	12.15	
	12.16	
Reporting on Groundwater Conditions	12.17	6. Groundwater Conditions

2 Plan of Operations and Works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. The Murrumbidgee Irrigation Area (MIA) is supplied by water stored in Burrinjuck and Blowering dams and released to the Murrumbidgee River. Water is diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval, via two authorised supply works (Figure 2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STURT - Sturt Regulator (after diversion from Gogeldrie Weir)

There are five (5) sites which have the potential to discharge water outside MI's area of operations, which are presented in Figure 2. These sites are monitored in accordance with MI's Combined Approval and Environmental Protection Licence (EPL) 4651.

MI's five discharge monitoring points are:

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDG – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain River Road
- MIRFLD – Mirrool Creek Floodway Wyvern Station

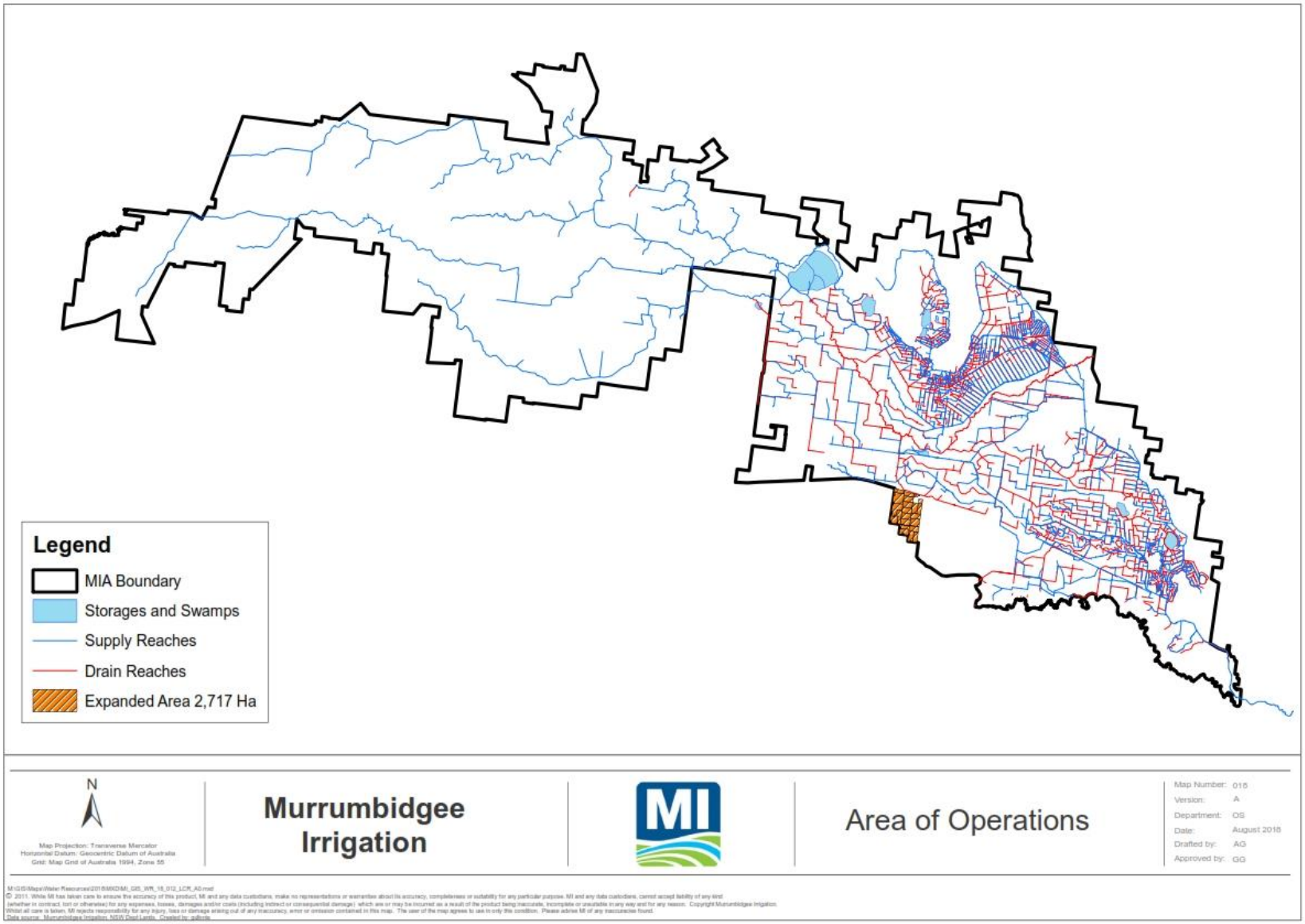


Figure 1 Murrumbidgee Irrigation's Area of Operation, identifying areas of expansion

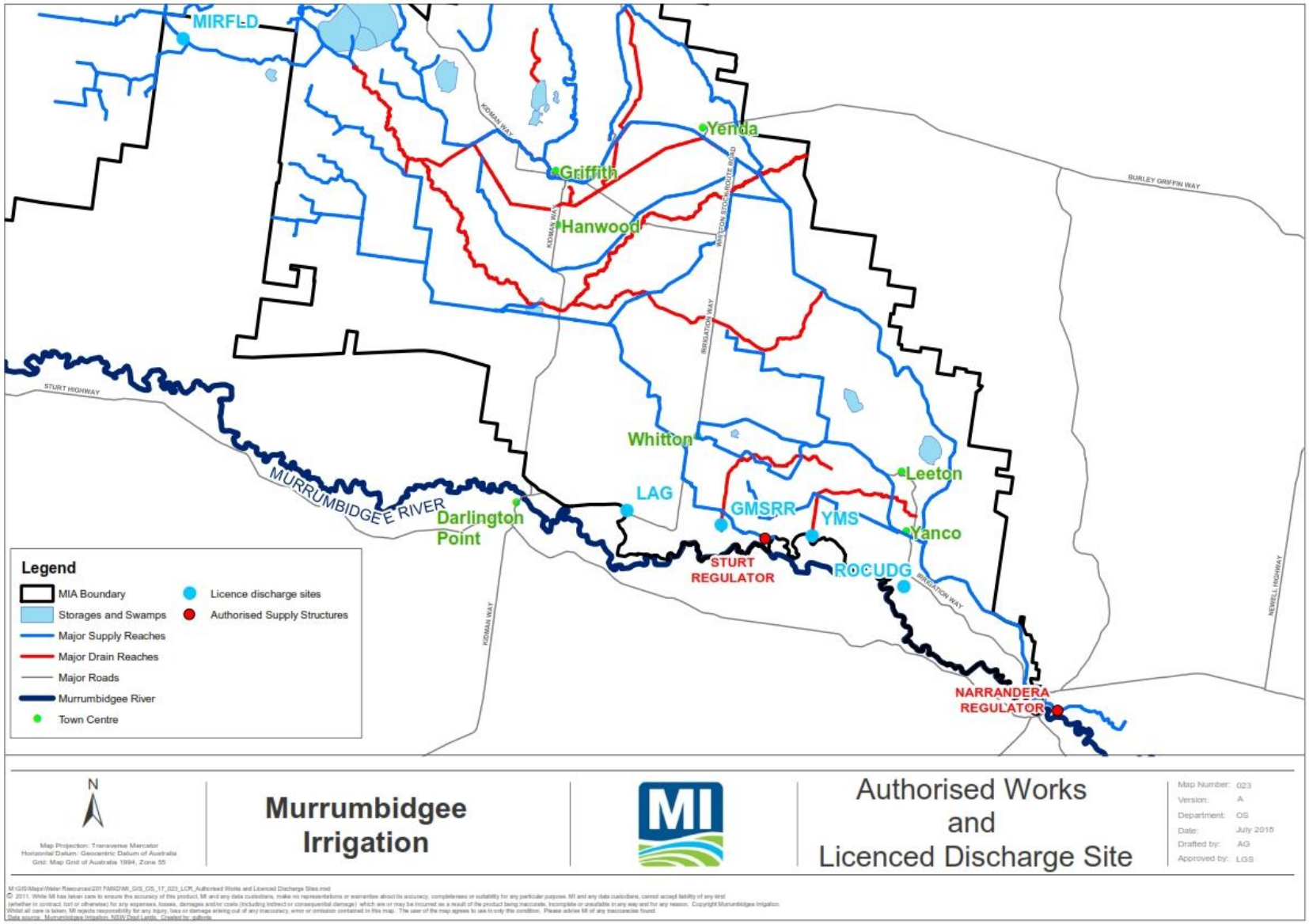


Figure 2 Location of authorised supply works and licence discharge points

3 Reporting on Water Management

MI's water management information is presented below. There are no internal benchmarks or targets that are relevant to this report.

3.1 Climate conditions

Rainfall and evapotranspiration (ETo) data recorded at the Griffith CSIRO weather station is presented in Table 2. Below average rainfall was recorded during the 2017/18 reporting period, in contrast to 2016/17 that included above average rainfall and a 1/150-year flood event.

Table 2 Griffith CSIRO weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2017/18	315	1894
2016/17	556	1593
2015/16	529	1712
2005/06	357	1935

3.2 Calibration Report for Main Canal and Sturt Canal AFFRA Units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of the contract with MI to ensure flow measurements meet the conditions of Combined Approval 40CA403245. The calibration report summary for the NARREG AFFRA is presented in Table 3 and the STURT AFFRA presented in Table 4. The full calibration report is included with the submission of this report. The STURT AFFRA unit was repaired in September 2017.

Table 3 Main Canal at NARREG (410127) calibration report

Date	Time	Calibration Measurements:	AFFRA Sensor:	Deviation
12/09/2017	13:29	1225	1278	-4.12%
11/10/2017	12:40	1715	1680	2.07%
21/11/2017	10:03	2956	2926	1.01%
14/03/2018	12:29	2327	2340	-0.54%

Table 4 Sturt Canal at STURT (410129) calibration report

Date	Time	Calibration	AFFRA Sensor:	Deviation
25/08/2017	14:02	796	745	6.82%*
25/08/2017	14:41	722	719	0.37%
13/09/2017	12:48	766	778	-1.45%
12/10/2017	9:06	985	895	10.07%**
12/10/2017	12:28	769	741	3.75%
3/11/2017	11:28	686	671	2.26%
16/05/2018	15:34	292	295	-0.82%

* Gauging was performed during a steep fall with the old Affra unit in place. The site was re-measured later in the day after the new instrument installed. This second measurement was relied upon.

** Conditions were windy during this measurement with predominantly upstream winds. A second measurement was done later in the day when the wind had subsided, and this measurement should be relied upon.

3.3 Diversions and Water Allocation

A monthly summary of gross water diverted from the Murrumbidgee River is presented in Table 5. These volumes represent gross diversions entering the supply system via MI's two authorised water supply works at NARREG and STURT. The total diversion volume of 945,805 ML includes an environmental water diversion volume of 600 ML diverted for the Office of Environment and Heritage (OEH). Total deliveries to customers includes 1,602 ML of captured water delivered following rainfall (estimation), which is further outlined in Section 3.7 of this report.

Table 5 Monthly summaries of water diversions (ML) deliveries to customers (ML), 2017/18

Month	STURT	NARREG	Total diversion	Deliveries to customers
Jul-17	3,544	6,071	9,615	2,902
Aug-17	13,419	28,479	41,898	34,004
Sep-17	22,757	54,688	77,445	70,488
Oct-17	30,123	69,002	99,125	90,525
Nov-17	22,520	78,442	100,962	89,569
Dec-17	29,325	94,287	123,612	108,606
Jan-18	46,609	134,530	181,139	158,777
Feb-18	33,709	93,564	127,273	118,191
Mar-18	15,544	63,140	78,684	63,389
Apr-18	9,965	36,033	45,998	31,699
May-18	10,047	29,160	39,207	29,274
Jun-18	0	20,847	20,847	3,539
Total	**237,562**	**708,243**	**945,805**	**800,963**
Deliveries resulting from rainfall				1,602
Total Deliveries to customers				**802,565**

Table 6 compares water allocations, diversions, total deliveries and climate data from the 2017/18 reporting year to previous years. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year. Below average rainfall was recorded throughout the catchment in 2017/18, resulting in 45% allocation for General Security and 95% allocation for High Security allocation announcement. Total diversions and deliveries to customers increased compared to the previous reporting year, due in part to customer entitlement carry over, inter valley water trades into the MIA, forward water sale initiatives and company enhancement to eligible customers.

When low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. However, it must be noted flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

Table 6 Water allocation, total diversions and deliveries 2017/18 compared to previous years

Year	Announced Allocation (%) General / High	Diversions (ML)	Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2017/18	45/95	945,805	800,963	315	1,894
2016/17	100/100	780,083	621,094	556	1,593
2015/16	37/95	643,957	526,278	529	1,712
2005/06	54/95	1,036,519	829,990	367	1,935

3.4 Environmental diversions

At the request of OEH, 600 ML (including 20% conveyance) of environmental water was delivered in March and April 2017 to Tuckerbill Swamp as shown in Table 7. This volume is accounted for in total Diversions and Deliveries.

Table 7 Environmental water diversions for 2017/18

Month	Tuckerbill Swamp (ML)
Mar-17	186
Apr-17	414
Total	**600**

3.5 Water discharged from Area of Operations

Monthly discharge volumes for each discharge monitoring point are shown in Table 8. A total of 4,471 ML was discharged from MI's area of operations in 2017/18 with 3,405 ML of this total released to the Mirrool Creek Floodway (MIRFLD) to mitigate localised flooding.

Table 8 Monthly discharge volumes (ML) recorded at monitoring points

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-17	0	0	0	0	0
Aug-17	1.5	33.4	0	1.3	0
Sep-17	25.0	1.1	0	2.5	0
Oct-17	27.9	8.1	0	10.7	0
Nov-17	20.6	0	0	0.1	100
Dec-17	111.6	108.8	0	56.5	3,305
Jan-18	17.7	59.0	0	0	0
Feb-18	21.4	22.5	0	0	0
Mar-18	9.0	33.9	0	0	0
Apr-18	0.9	44.0	0	0	0
May-18	0	64.8	0	28.2	0
Jun-18	6.3	107.1	195.0	47.1	0
Total	**241.9**	**482.4**	**195.0**	**146.3**	**3,405**

Table 9 shows total discharge volumes from MI's Area of Operation compared to previous years. The total volume discharged in 2017/18 included 3,405ML diverted to MIRFLD to mitigate localised flooding. However, this was significantly lower when compared to 2016/17 where 121,363 ML of floodwater was diverted to the MIRFLD after a major flood event. Except for flood mitigation releases, increased efficiency of MI's drainage reuse system is exhibited in the reduction of discharge volumes from 2005/06.

Table 9 Annual water volumes (ML) discharged from the MIA

Year	Total discharged (ML)
2017/18	4,471
2016/17	122,092
2015/16	1,079
2005/06	8,570

3.6 Supply efficiency

Table 10 illustrates the simple efficiency of MI's supply system to be at 85% for 2017/18. The simple efficiency provides insight into how the supply system is managed under the season's climatic conditions, whilst balancing irrigation demand and minimising system losses.

Table 10 Supply efficiency from 2017/18 and previous years

Year	Sturt Canal	Main Canal	Environment Diversions	NET TOTAL Irrigation Diversions	Deliveries (ML)	Conveyance (ML)	Simple Efficiency (%)
2017/18	237,56	708,243	600	945,805	800,963	144,842	85%
2016/17	196,23	583,849	986	779,097	621,094	158,003	80%
2015/16	141,08	505,845	2,977	643,957	526,278	117,679	82%
2005/06	233,38	805,277	2,146	1,036,519	829,990	206,529	80%

3.7 Water balance

The annual water balance in Table 11 has been produced to meet condition 2.12 of MI's Combined Approval. For the 2017/18 reporting year, the annual water balance has been refined to provide a clearer representation of system operations. To assist with interpretation of this water balance, each line has been referenced to the specific requirements of Condition 2.12.

Total deliveries to customers includes environmental water deliveries. Overland flood losses in 2016/17 refer to overland flows from bank cuts or breaches during peak flood periods. With reference to Condition 2.10 (c) and 2.11(b), no water was extracted or discharged for environmental or river operational purposes. The conveyance volumes represented in this water balance account for seepage, evaporated water and general conveyance required to deliver water to customers.

Total gross diversions of 945,805 ML for 2017/18 were used to generate water deliveries of 802,566 ML A large rainfall event in December 2017 created localised flooding, requiring water to be discharged to the Mirrool Creek Floodway. 3,405ML was released to the floodway to mitigate the flood impacts, with 1,602ML captured and delivered to customers. Therefore, the total volume of water delivered to customers for 2017/18 was 802,565 ML.

Table 11 Annual Water Balance (ML)

Condition	Sources	2017/18	2016/17*	2015/16*	2005/06
2.10 (a) (b)	River diversions	945,805	780,083	643,957	1,036,519
2.12 (c)	Internal storage volume (July 1, 2017)	32,318	29,042	15,621	N/A
2.12 (b)	Water captured (measured)	5,007	171,376		0
	Total	**983,131**	**980,501**	**659,578**	**1,036,519**
	Applications				
2.10 (d)	Deliveries to customers (river and storages)	800,963	621,094	526,278	829,990
2.10 (d)	Deliveries to customers (captured flood water)	1,602	49,225	0	0
2.12 (b) delivered	Environmental water diversions	600	986	2,629	N/A
2.12 (b) loss	Conveyance	151,904	127,960	101,629	206,518
2.12 (c)	Internal storage volume (June 30, 2018)	25,256	32,318	29,042	N/A
2.11 (a)	Discharges out of area of operation	4,471	121,363		11
2.12 (b) loss	Overland flood discharge	0	25,600		0
2.12 (b) loss	Customer flood discharge	0	1,955		0
	Total	**983,131**	**980,501**	**659,578**	**1,036,519**

*Presentation of data from these reporting years has changed from previous reports to better align with reporting conditions

4 Water Use

4.1 Crop statistics

For each water order customers are required to nominate their water use to a crop or use. This data is not validated at the farm level and is therefore an estimate only. Table 12 shows water deliveries and estimated crop water use for 2017/18. It is important to note the water use data presented for the total area of crop are also influenced by rainfall, ETo and irrigation practices, which are not considered in these figures.

The 'Not Defined' category refers to water taken by MI customers without placing an order. This is only discovered once the meter is read and does not provide opportunity to allocate the water to a use.

Table 12 Summary of water deliveries for major crop groupings 2017/18

Crop/Purpose	Area (ha)	Volume Delivered(ML)	Crop Water Use (ML/ha)
Citrus	7,942	48,260	6.1
Cotton	21,861	174,778	8.0
Industrial	29	6,385	218.7
Other crops	327	2,733	8.4
Other fruits	1,231	5,682	4.6
Plantation	68	542	8.0
Rice	20,588	220,423	10.7
Stock & domestic	257	5,720	22.3
Summer cereals	2,736	22,462	8.2
Summer oilseeds	464	2,271	4.9
Summer pasture	2,483	15,614	6.3
Town supplies	-	12,019	-
Vegetables	1,897	10,940	5.8
Vines	18,187	80,105	4.4
Winter cereals	46,595	91,335	2.0
Winter oilseeds	3,024	7,371	2.4
Winter pasture	8,080	22,338	2.8
Not Defined*	-	73,590	-
Total	**135,770**	**802,566**	**-**

*No crop type assigned by customer at time of use

A comparison of crop water use for 2017/18 with previous years is presented in Table 13. Cotton accounted for the largest area grown (21,861 ha), marginally higher than rice (20,588 ha). However, rice accounted for the highest volume of water deliveries in the MIA. Although allocations were lower compared to the previous season, increased customer allocation carry over, inter valley water trades into the MIA, forward water sale initiatives and company enhancement to eligible customers in 2017/18 provided opportunity for customers to increase their area of non-permanent plantings.

Table 13 Total deliveries to major crop types 2017/18 compared to previous years (ML)

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines + Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial	Cotton
2017/18	220,423	37,952	123,439	10,940	134,046	76,864	24,123	174,778
2016/17	304,200	26,030	57,479	10,129	109,257	71,376	9,844	82,004
2015/16	136,805	19,449	96,851	10,011	128,789	22,729	31,832	79,812
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

Note: Cotton was included in 'other crops and plantations' for 2005/06

4.2 Irrigation intensity

Irrigation intensity is displayed in Figure 3 by water use (ML/ha) at a property level. This map identifies locations of landholdings using between 0 and 4 ML/ha, 4 and 4.1-8 ML/ha and above 8.1 ML/ha.

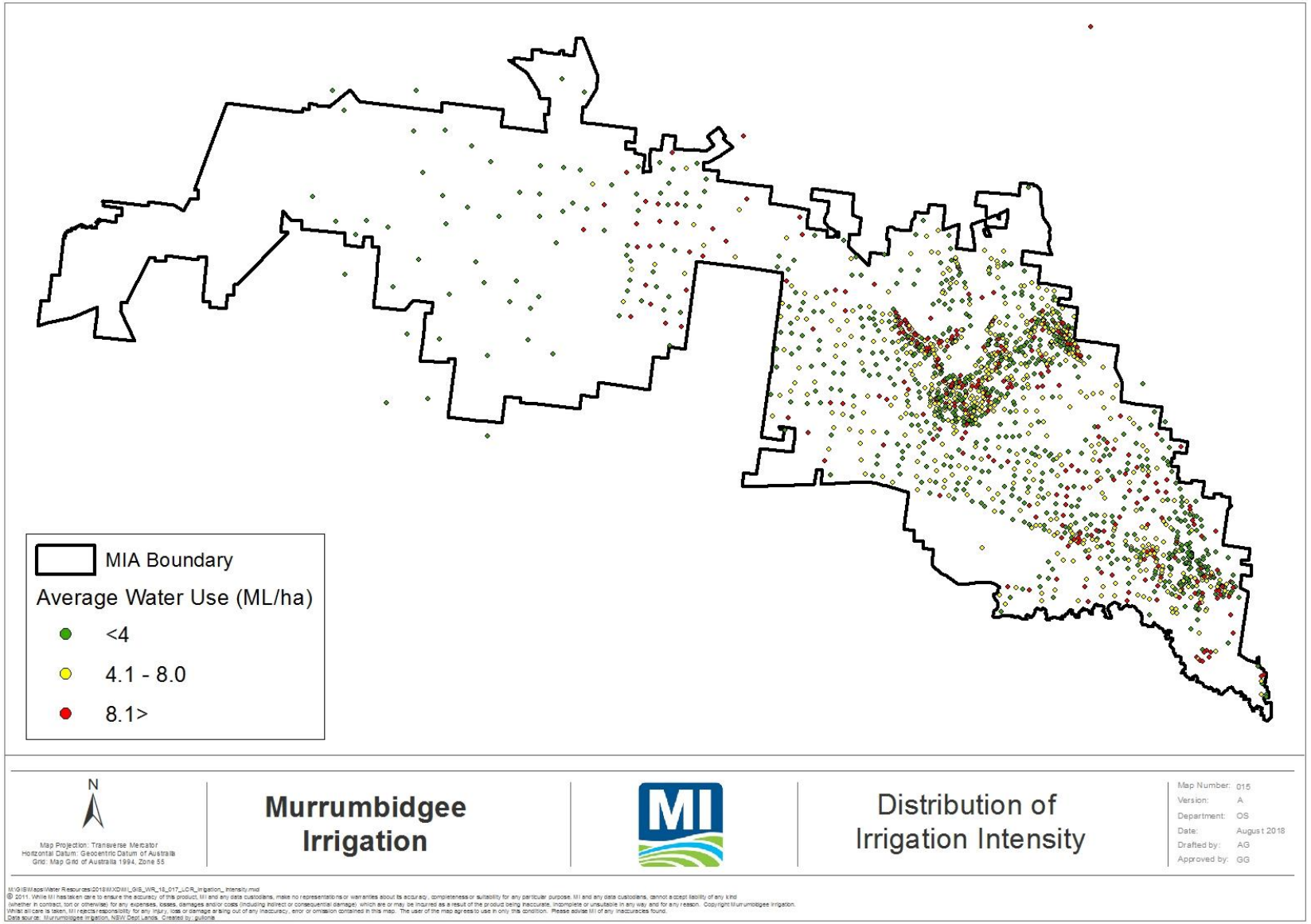


Figure 3 Distribution of irrigation intensity across the MIA

5 Salinity and Salt Load

5.1 Extracted salt load

Electrical conductivity (EC) sensors were installed at NARREG and STURT in September 2017. The salt loads for NARREG and STUR are calculated using Water NSW monitoring site 410001 on the Murrumbidgee River for July, August and September and data reported from EC sensors installed at the offtakes for the remaining months. The monthly mean EC values and extracted salt loads are presented in Table 14.

Table 14 Total extracted salt load for 2017/18

Month	STUR			NARREG		
	Flow (ML)	mean EC (µS/cm)	STUR Salt (t)	Flow (ML)	Mean EC (µS/cm)	NARREG Salt (t)
Jul-17	3,758	177	400	5,426	177	686
Aug-17	13,990	81	699	31,440	81	1,483
Sep-17	22,630	140	2,037	54,400	140	4,895
Oct-17	30,390	101	1,871	69,130	104	4,258
Nov-17	22,760	103	1,397	81,010	99	4,657
Dec-17	29,350	145	2,521	93,470	139	8,061
Jan-18	46630	78	2,168	134,800	85	6,867
Feb-18	33,790	117	1,084	93,840	120	6,799
Mar-18	15,790	144	1,329	63,530	153	5,789
Apr-18	9,903	121	660	36,090	122	2,637
May-18	10,190	115	752	29,090	133	2,263
Jun-18	17	184	2	21,110	136	1,635
Total	**239,200**	**-**	**14,920**	**713,300**	**-**	**50,030**

Table 15 presents the total extracted salt loads for 2017/18 and previous years. During 2017/18, an estimated 64,950 tonnes of salt was imported into MI's area of operation from the Murrumbidgee River. Generally, the amount of salt is relative to the volume of water diverted from the river, which is evident for all reporting years.

Table 15 Extracted salt-load (t) for 2017/18 compared to previous years

Year	Diversions (ML)	Extracted salt load (t)		
		STUR	NARREG	Total
2017/18	945,805	14,920	50,030	64,950
2016/17	780,083	11,722	32,903	44,625
2015/16	643,957	10,939	39,758	50,696
2007/08	393,973	1,778	26,816	28,594

5.2 Discharged salt load

There are five discharge monitoring points that can discharge water out of MI's area of operation. The locations of these sites are shown in Figure 2 of this report. Flow, EC and salt load data for these sites is presented in Table 17 and totals from previous years are compared in Table 16.

An estimated 854 tonnes was discharged from MI's Area of Operation in 2017/18. The majority of salt was discharged to the MIRFLD, which corresponds with the volume of water discharged at this site.

Table 16 Discharged salt load 2017/18 compared to previous years

Year	Water discharged (ML)	Discharged Salt load (t)
2017/18	4,471	854
2016/17	122,092	34,230
2015/16	1,620	201
2005/06	8,570	1,887

Table 17 Monthly summary of flow, EC and salt loads at monitoring points for 2017/18

Month	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)	Flow (ML)	Mean EC (µS/cm)	Min.EC (µS/cm)	Max. EC (µS/cm)	Salt load (t)
	Yanco Main Southern Escape (YMS) 410083					Gooragool Lagoon Escape (LAG) 41010940				
Jul-17	0.0	-	-	-	0.0	0.0	-	-	-	0.0
Aug-17	0.0	-	-	-	0.0	1.5	363	332	392	0.0
Sep-17	0.0	-	-	-	0.0	25.0	370	118	1190	4.0
Oct-17	0.0	-	-	-	0.0	27.9	265	77.2	694	4.0
Nov-17	0.0	-	-	-	0.0	20.6	218	89.4	725	3.0
Dec-17	0.0	-	-	-	0.0	111.6	235	92	1150	17.0
Jan-18	0.0	-	-	-	0.0	17.7	356	0.4	612	4.0
Feb-18	0.0	-	-	-	0.0	21.4	234	120	355	3.0
Mar-18	0.0	-	-	-	0.0	9.0	269	199	355	1.0
Apr-18	0.0	-	-	-	0.0	0.9	303	277	327	0.0
May-18	0.0	-	-	-	0.0	0.0	-	-	-	0.0
Jun-18	195.0	1330	882	1760	166.0	6.3	564	541	588	2.0
Total	**195.0**				**166.0**	241.9				**40**
	Gogeldrie Main Southern Escape (GMSRR) 41010921					Cudgel Creek Escape (ROCUDG) 41010005				
Jul-17	0.0	-	-	-	0.0	0.0	-	-	-	0.0
Aug-17	1.3	261	162	352	0.0	33.4	149	125	177	3.0
Sep-17	2.5	306	129	417	0.0	1.1	158	132	222	0.0
Oct-17	10.7	153	99.9	235	1.0	8.1	206	179	257	1.0
Nov-17	0.1	143	121	188	0.0	0.0	-	-	-	0.0
Dec-17	56.5	248	159	340	7.0	108.8	213	182	255	13.0
Jan-18	0.0	-	-	-	0.0	59.0	221	186	247	8.0
Feb-18	0.0	-	-	-	0.0	22.5	254	203	307	3.0
Mar-18	0.0	-	-	-	0.0	33.9	276	169	328	5.0
Apr-18	0.0	-	-	-	0.0	44.0	174	154	201	5.0
May-18	28.2	176	159	193	3.0	64.8	151	117	199	6.0
Jun-18	47.1	117	30.4	195	3.0	107.1	123	100	145	8.0
Total	**146.3**				**14**	**482.4**				**52**
	Mirrool Creek Floodway (MIRFLD) 41010163									
Nov-17	100	237.3	219.3	255.3	17.1					
Dec-17	3,305	297.2	294.1	300.3	565.3					
Total	**3,405**				582					

5.3 Salt load summary

The salt loads presented in Table 18 show that of the 64,952 tonnes of salt received through diversions recorded at MI's authorised supply works (NARREG and STURT), 852 tonnes was discharged from the area of operations and an estimated 64,096 tonnes was retained within the MIA. It is important to note that this is a simple annual salt balance that considers salt loads entering and leaving via authorised works and does not consider other factors that impact total salt loads in the MIA.

No additional data is held by MI that is relevant to the assessment of salinity impacts under the Murray Darling Basin Salinity Management Strategy.

Table 18 Salt load summary for 2017/18

Extracted	**Salt load (t)**
STUR	14,920
NARREG	50,030
Total extracted	**64,950**
Discharged	**Salt load (t)**
YMS	166
GMSRR	14
LAG	40
ROCUDG	52
MIRFLD	582
Total discharged	**854**
Retained	**64,096**

6 Groundwater Conditions

6.1 Groundwater Monitoring and Reporting

A total of 641 piezometers are listed in Schedule 2 of the Combined Approval and the locations of these bores are displayed in Figure 4. In September 2017/18, 587 piezometers were monitored, which equates to 91.5% of the total piezometer network.

Table 19 Groundwater piezometer status summary (September 2017)

Total bores	Total destroyed	Dry, Flooded or Blocked	Total read
641	54	20	587

Groundwater levels and salinity (reported as EC) are measured in September to give insight into groundwater levels prior to the irrigation season and again in March to identify regional groundwater trends. The network consists of piezometers in the shallow and deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

Depth to water table data is reported for 2017/18, 2016/17, 2015/16, and 2005/2006. The 2005/06 reporting year was chosen for reference for depth to water table to coincide with the peak of the millennium drought for the MIA. Groundwater salinity is reported for 2017/18, 2016/17, 2015/16, 2002 and 1980. Due to the limited data sets from 2005/06, data from 2002 and 1980 was chosen to represent suitable comparisons for salinity changes from a historical perspective.

The number of piezometers read within depth ranges for September are shown in Table 20.

Table 20 Number and percent of total piezometers read within each depth range

Year	Number <2M of surface	Number 2-4M of surface	Number >4M of surface	% <2M of surface	% 2-4M of surface	% >4M of surface	Total
2017	65	163	339	11%	29%	60%	567
2016	78	123	363	14%	22%	64%	564
2015	76	121	368	13%	21%	65%	565
2005	55	225	342	9%	36%	55%	622

6.2 Groundwater salinity

The number of piezometers read within salinity ranges for September is shown in Table 21 and the percentage of total piezometers measured within each range is presented in Table 22. The data identifies similar groundwater salinity trends throughout years reported for the Shallow Shepparton, Deep Shepparton and Calivil formations, including benchmark year 1980. In 2015, the lower number of total piezometers monitored for EC was a result of equipment failure during the monitoring program. DPI Water was notified, and additional equipment was purchased.

Discussions between DPI Water and MI in 2017/18 identified the need for an extensive review of the groundwater monitoring and reporting requirements within the Combined Approval. It is expected that this will be finalised this year, and the changes included in MI's ACR 2018/19.

Table 21 Number of piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2017	287	157	85	34	4	0	0	567
2016	247	126	86	57	19	5	1	541
2015	165	92	65	48	16	7	3	396
1980	250	211	180	152	47	2	1	843

Table 22 Percentage of total piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2017	51%	28%	15%	6%	1%	0%	0%	567
2016	46%	23%	16%	11%	4%	1%	0%	541
2015	42%	23%	16%	12%	4%	2%	1%	396
1980	30%	25%	21%	18%	6%	0%	0%	843

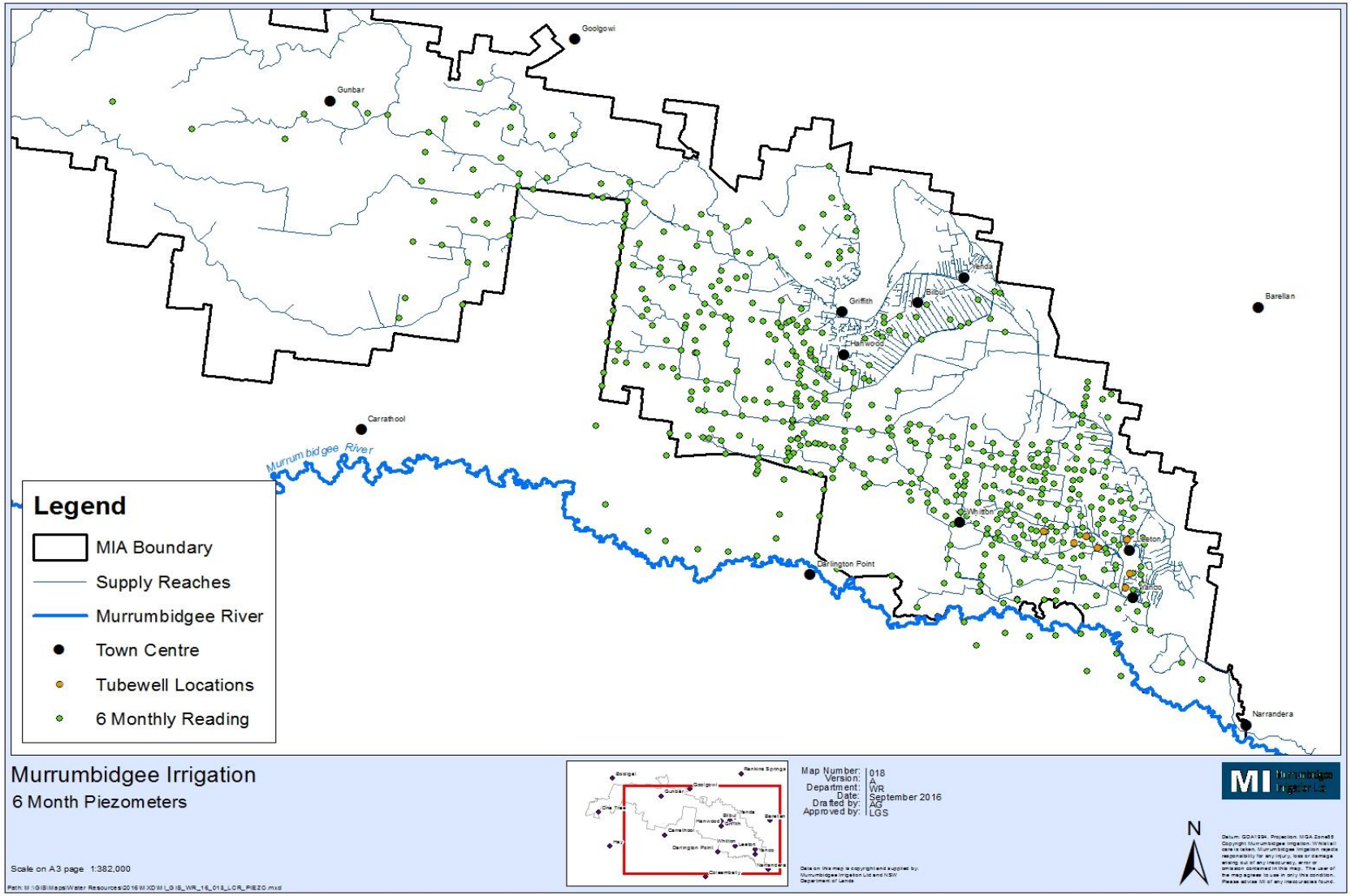


Figure 4 Location of piezometers and tubewells in the MIA 2017/18

6.3 Shallow Shepparton Formation

September and March depth to water table and salinity maps for piezometers in the shallow Shepparton Formation are presented in Figures 5 to 20. Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall, geology and irrigation. This is indicated by the comparing maps from September to March for each reporting year, which identify a marginal rise in groundwater levels. This is particularly evident when comparing Figure 5 and Figure 6, with an increase in groundwater level exhibited in March 2018 (Figure 5).

General salinity changes in the Shallow Shepparton Formation from September to March for each reporting year show decreases in EC values across the MIA. These areas of reduced salinity correlate with an increase in groundwater levels, highlighting potential recharge areas.

When compared to recent years, 2005/06 groundwater levels (Figure 17 and 18) appear to be deeper across the MIA, with fewer piezometers within 2m from surface level. This is likely a result of reduced recharge from rainfall, as a result of drought conditions.

2017/18

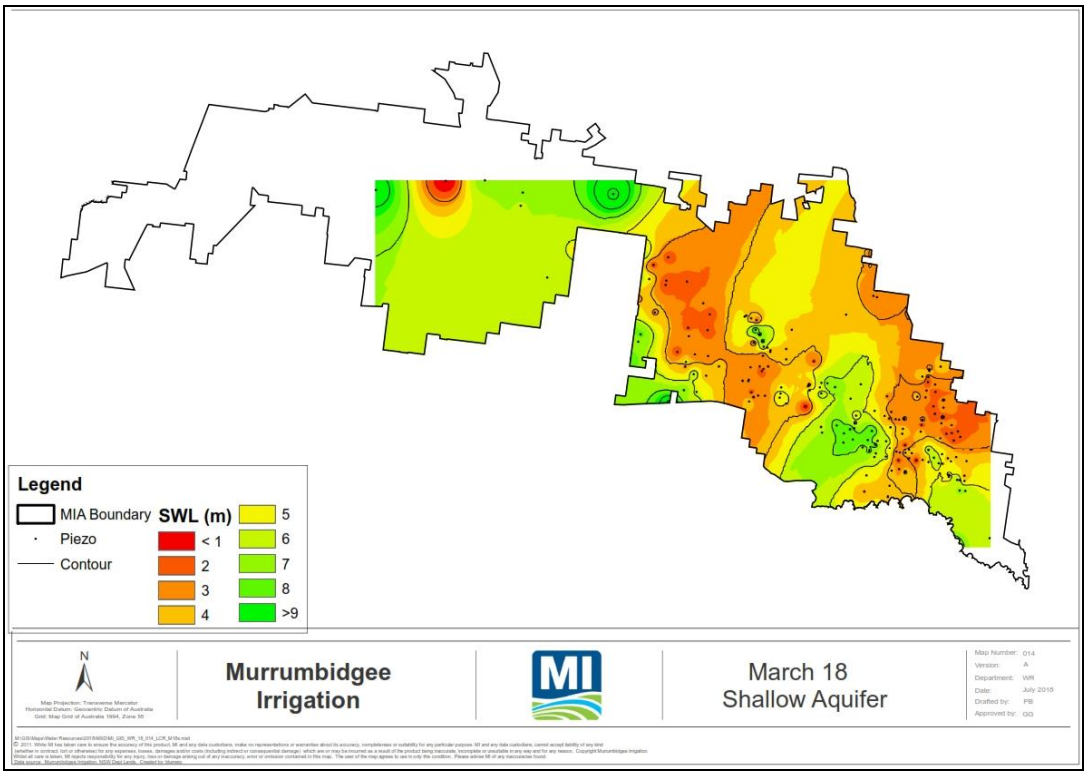


Figure 5 Shallow Shepparton Formation- depth to water table, March 2018

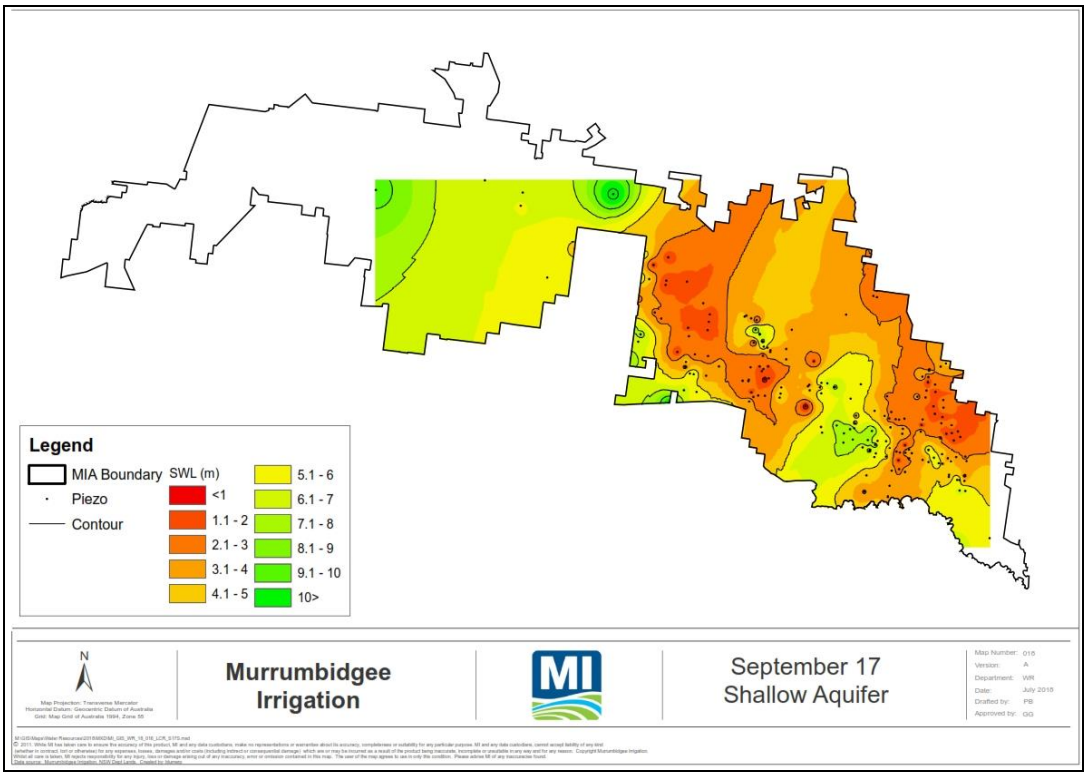


Figure 6 Shallow Shepparton Formation- depth to water table, Sep 2017

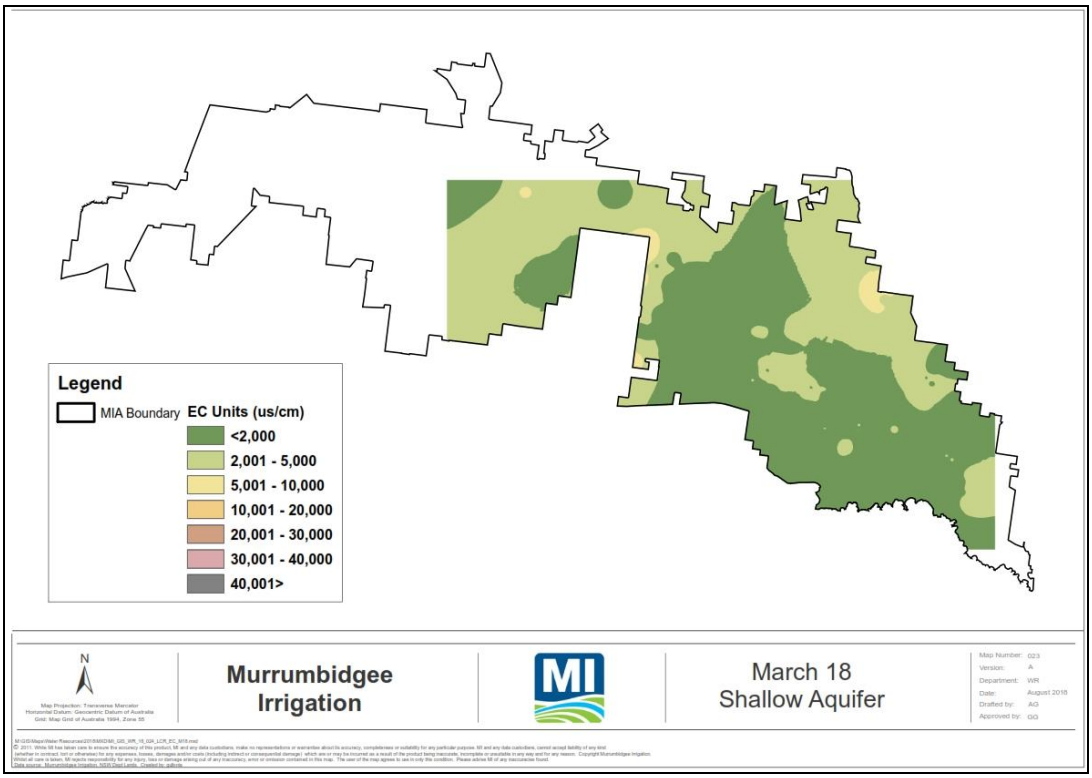


Figure 7 Shallow Shepparton Formation- Groundwater Salinity, March 2018

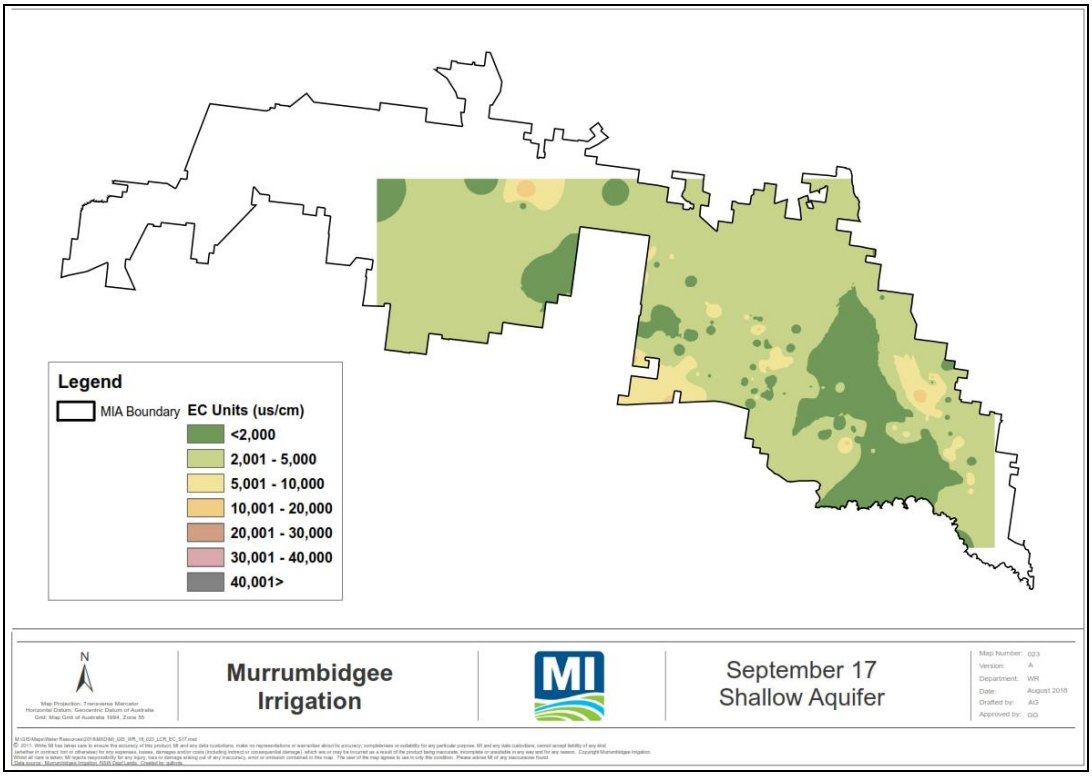


Figure 8 Shallow Shepparton Formation- Groundwater Salinity, Sep 2017

2016/17

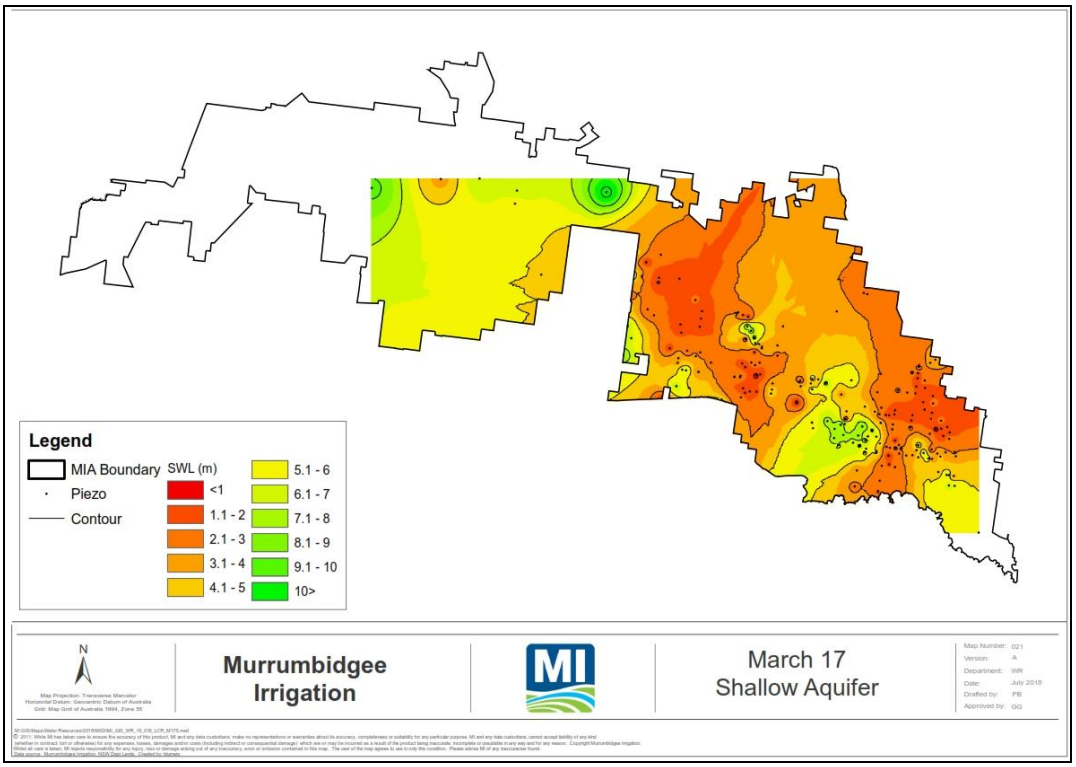


Figure 9 Shallow Shepparton Formation- depth to water table, March 2017

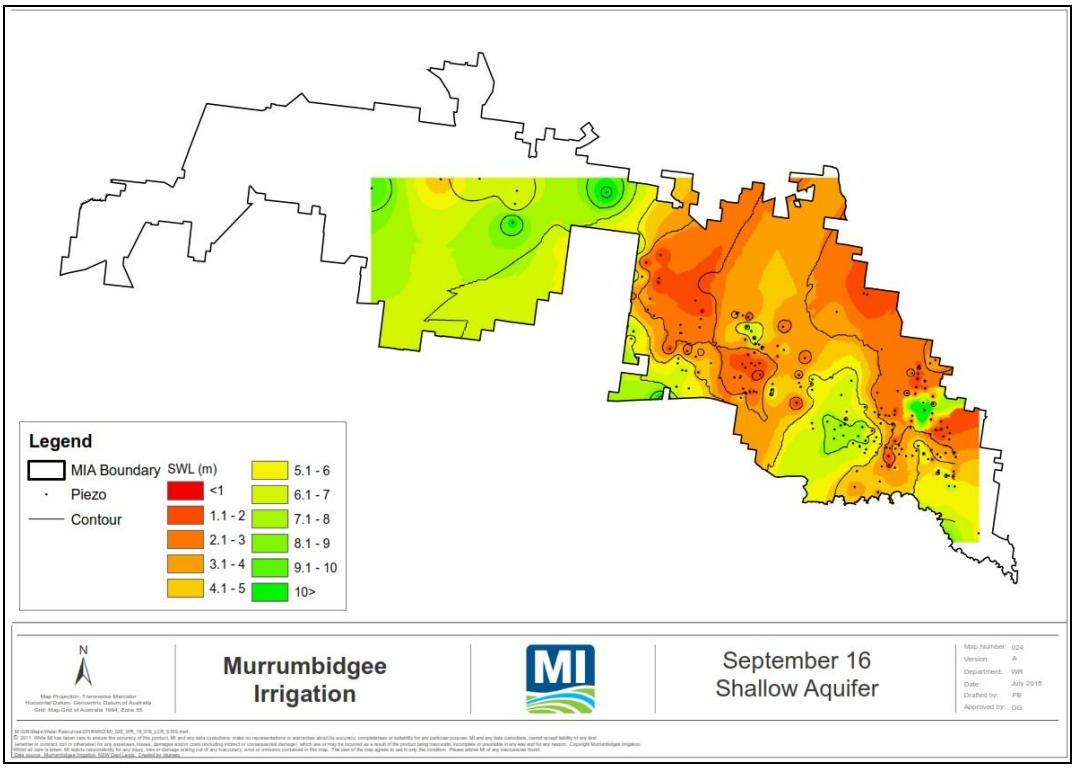


Figure 10 Shallow Shepparton Formation- depth to water table, Sep 2016

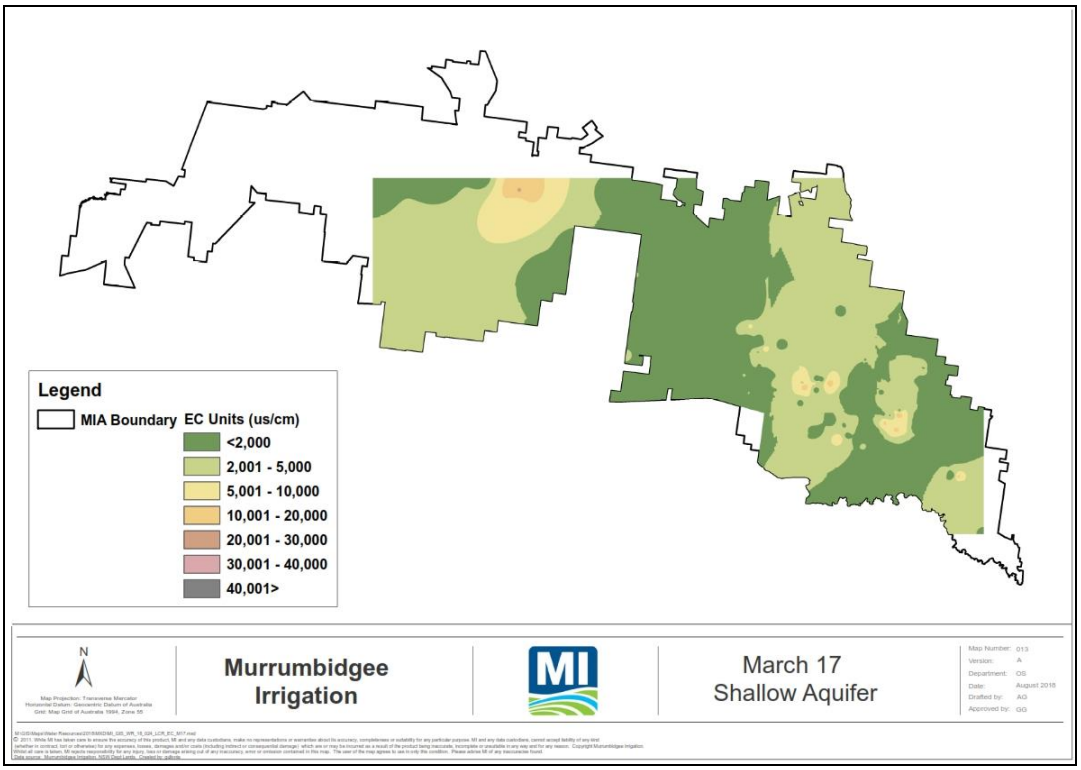


Figure 11 Shallow Shepparton Formation- Groundwater Salinity, March 2017

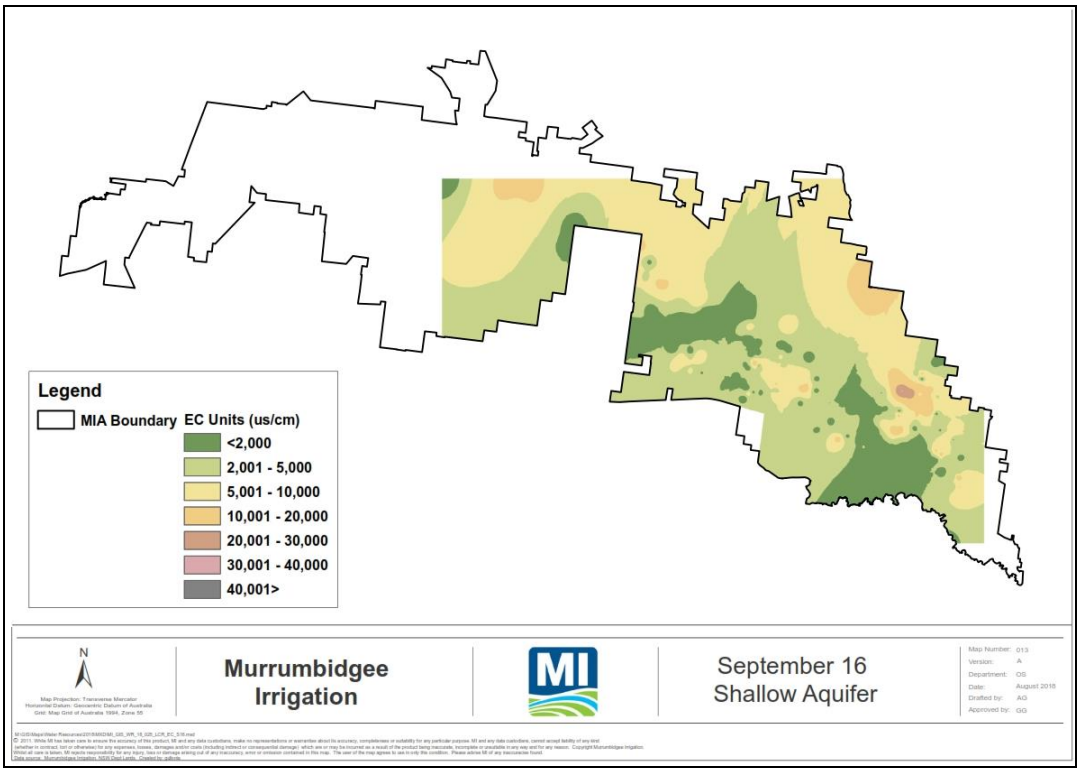


Figure 12 Shallow Shepparton Formation- Groundwater Salinity, Sep 2016

2015/16

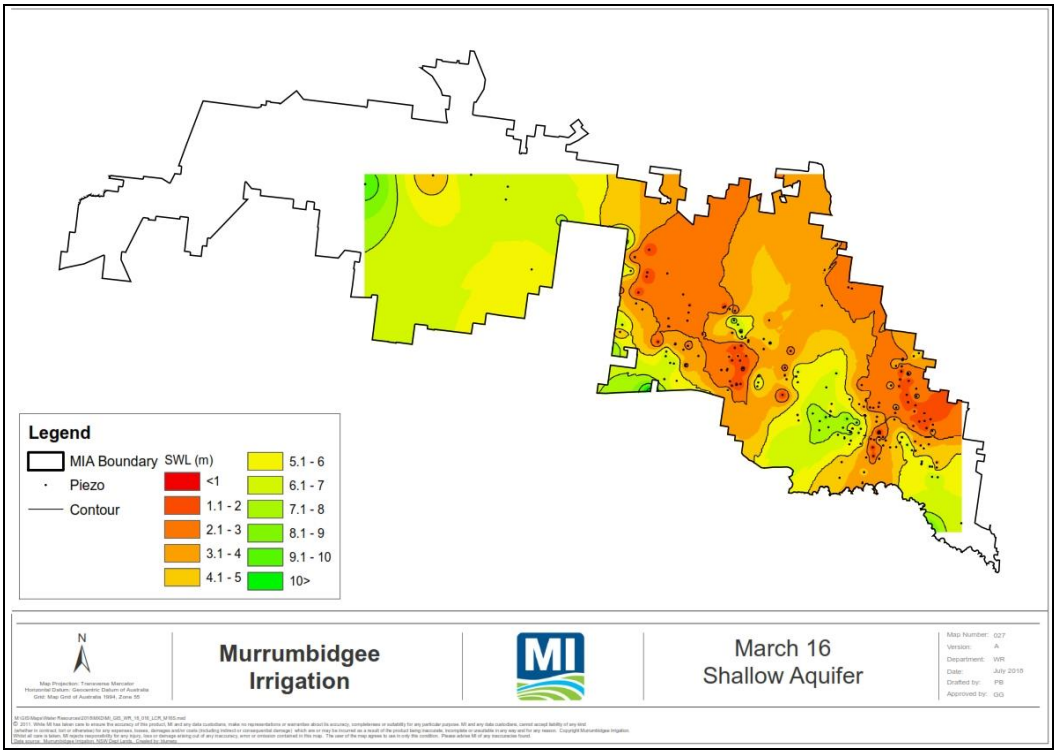


Figure 13 Shallow Shepparton Formation- depth to water table, March 2016

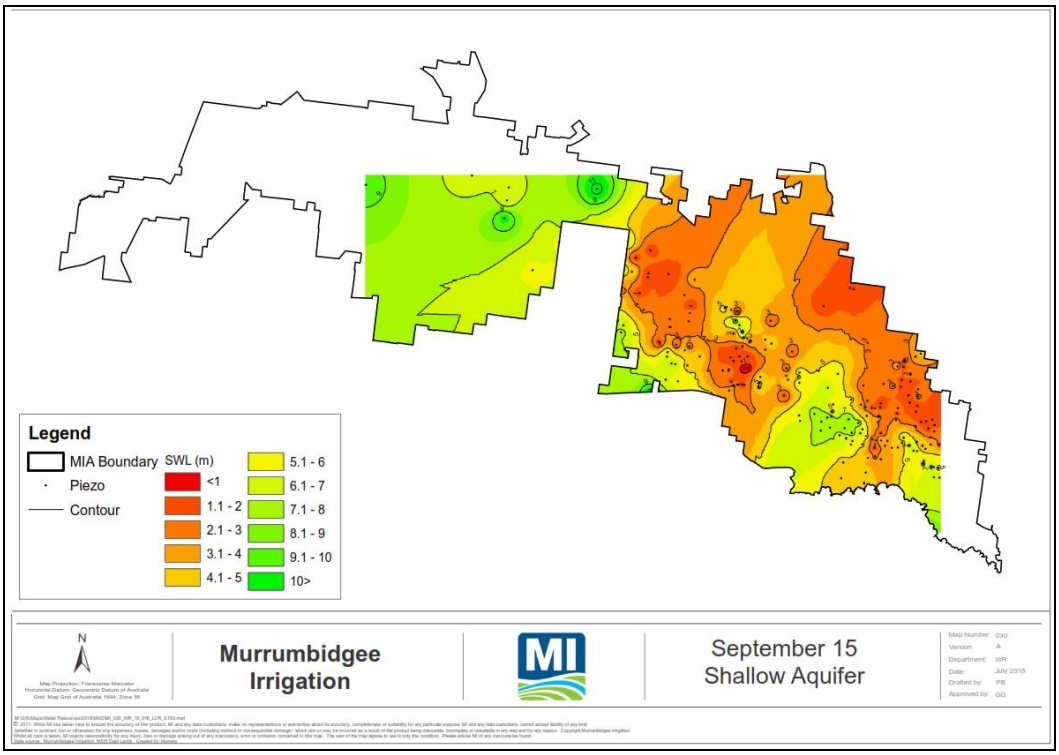


Figure 14 Shallow Shepparton Formation- depth to water table, March 2016

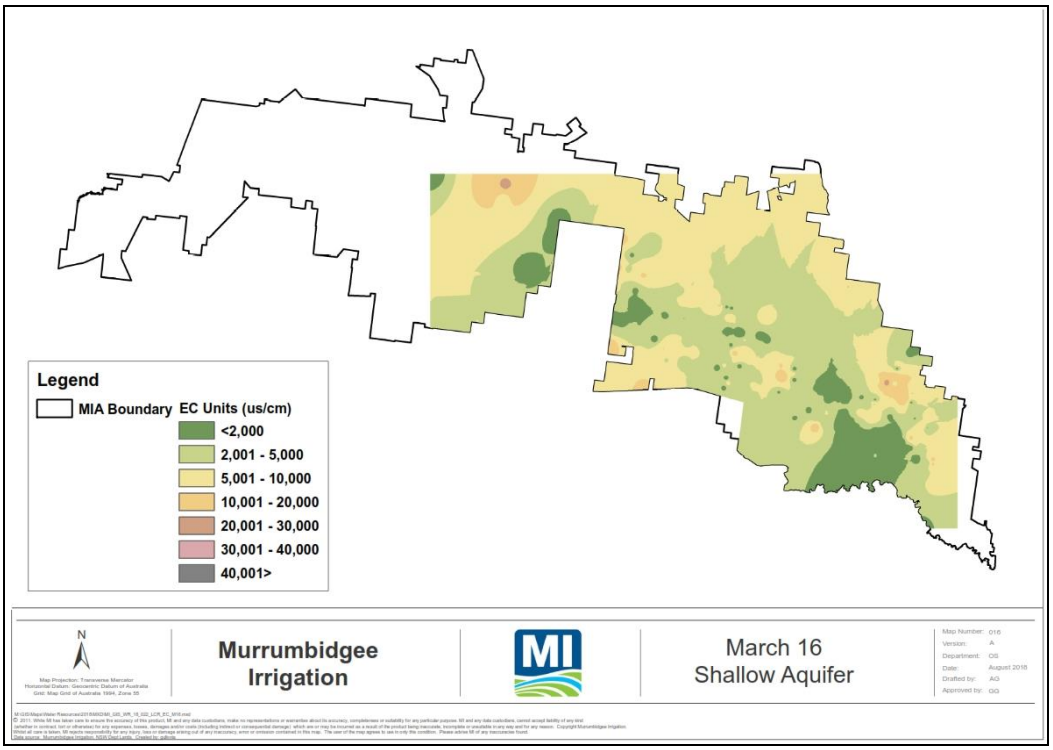


Figure 15 Shallow Shepparton Formation- Groundwater Salinity, March 2016

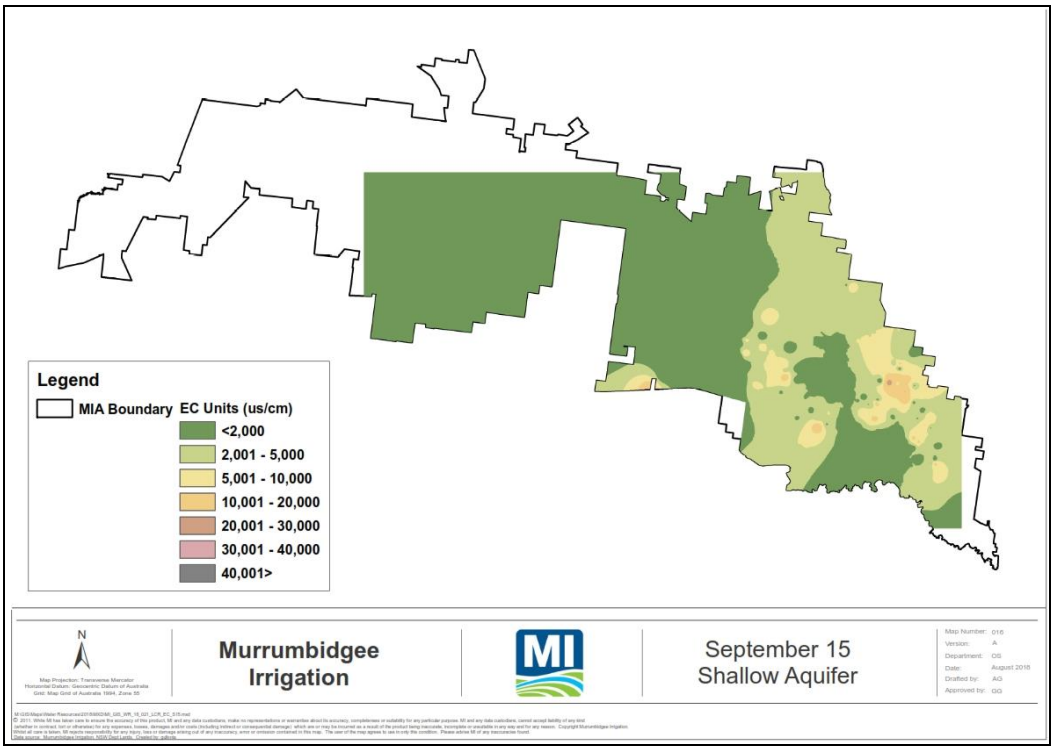


Figure 16 Shallow Shepparton Formation- Groundwater Salinity, Sep 2015

2005/06

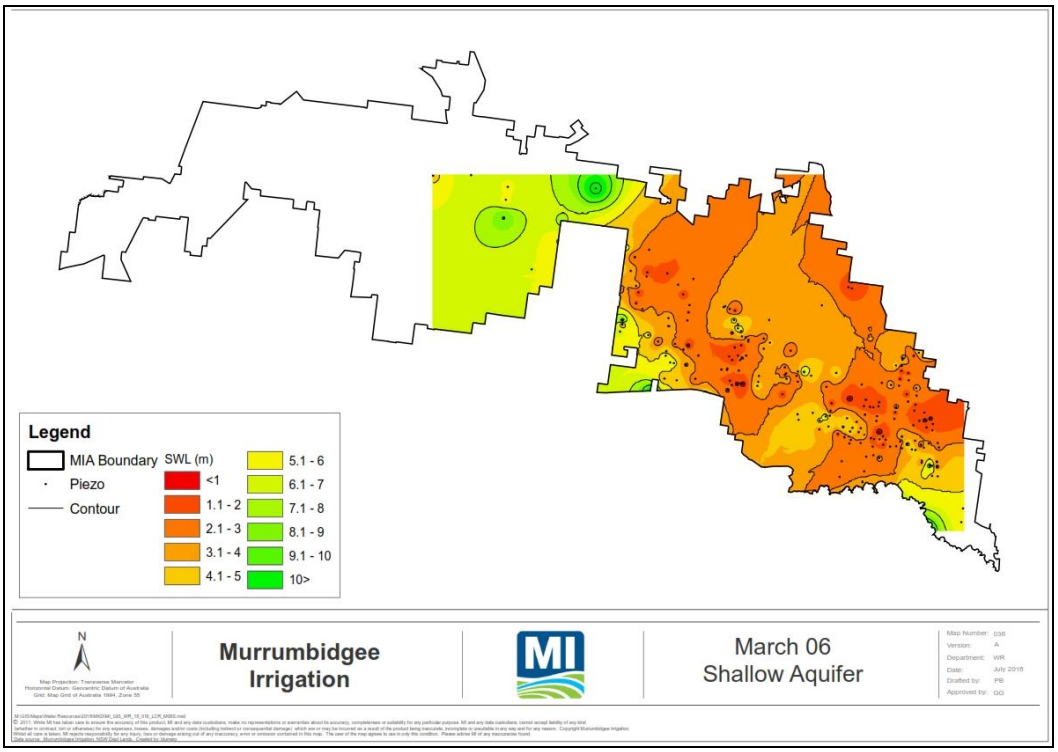


Figure 17 Shallow Shepparton Formation - depth to water table, March 2006

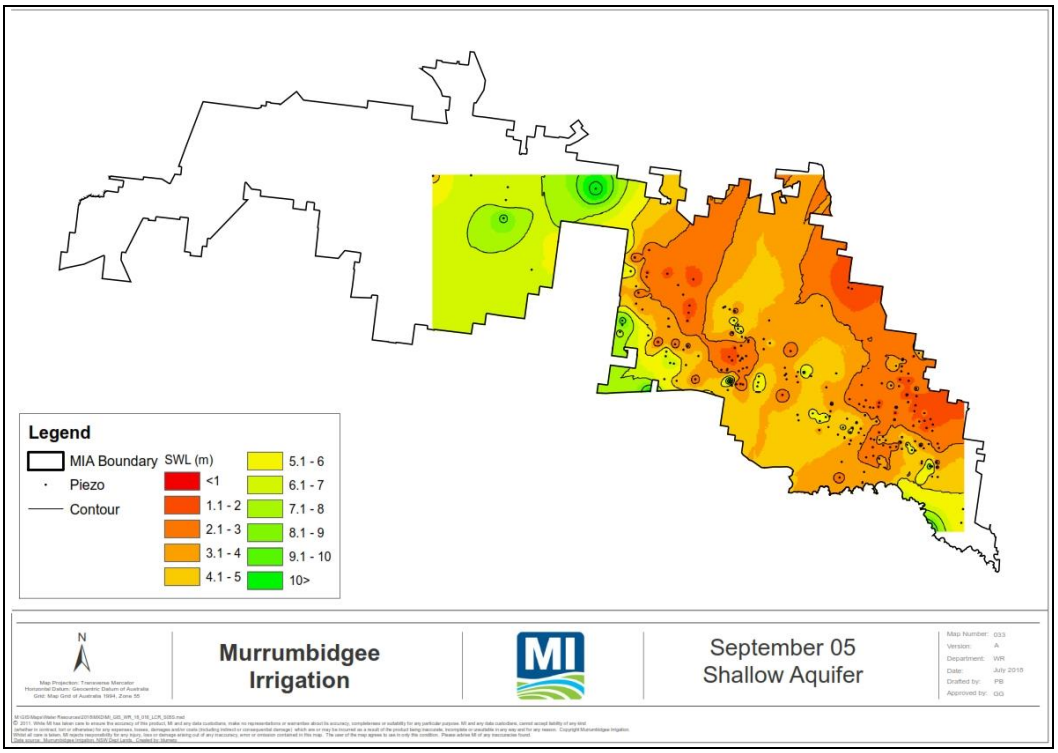


Figure 18 Shallow Shepparton Formation - depth to water table, Sep 2005

1980/2002

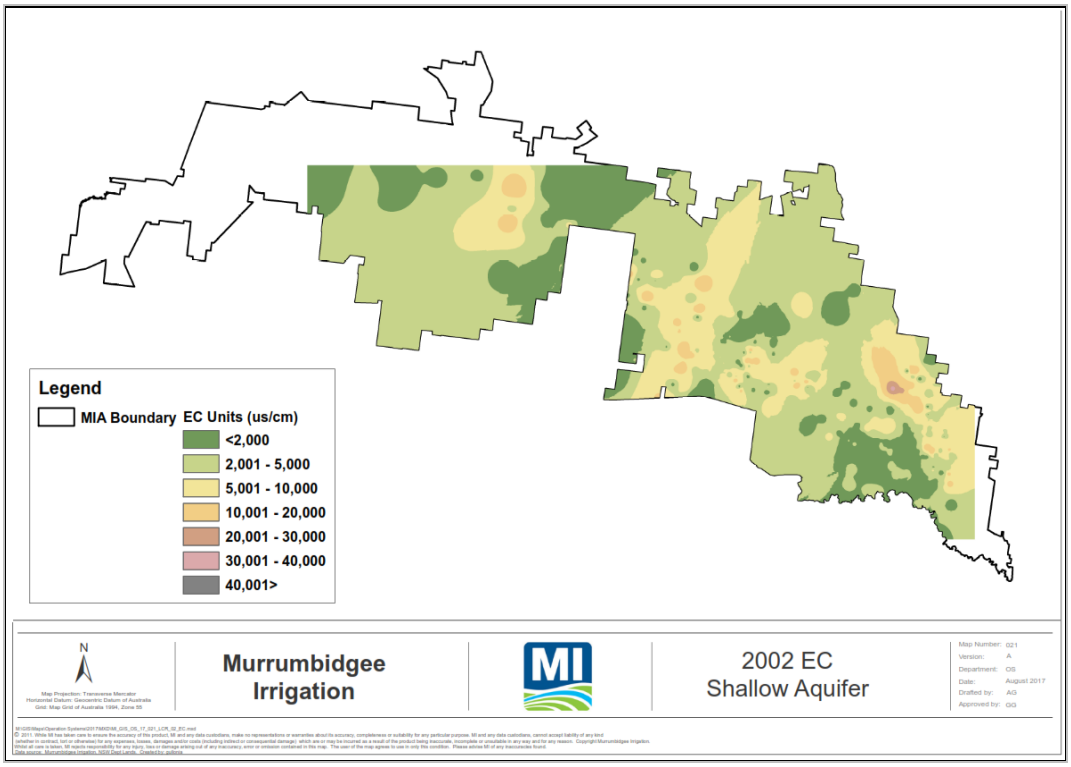


Figure 19 Shallow Shepparton Formation, groundwater salinity, Sep 2002

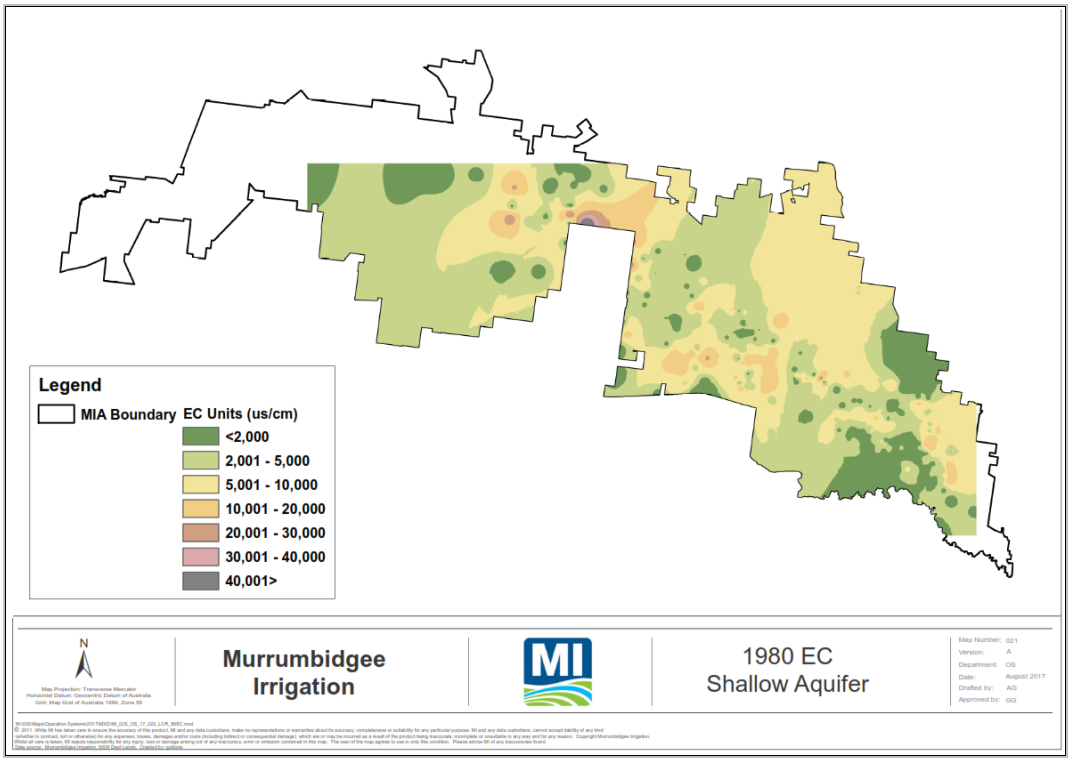


Figure 20 Shallow Shepparton Formation – groundwater salinity, Sep 1980

6.4 Deep Shepparton Formation

Depth to water table and salinity maps for piezometers in the deep Shepparton Formation are presented in Figures 21 to 36. Groundwater levels and salinity trends in the deep Shepparton Formation can be influenced by connectivity with the shallow Shepparton Formation, therefore the trends observed in the shallow Shepparton Formation also evident in the deep Formation.

Groundwater levels and salinity appear to have remained relatively constant from September 2017 to March 2018, with irrigation applied during the season potentially offsetting the below average rainfall experienced.

2017/18

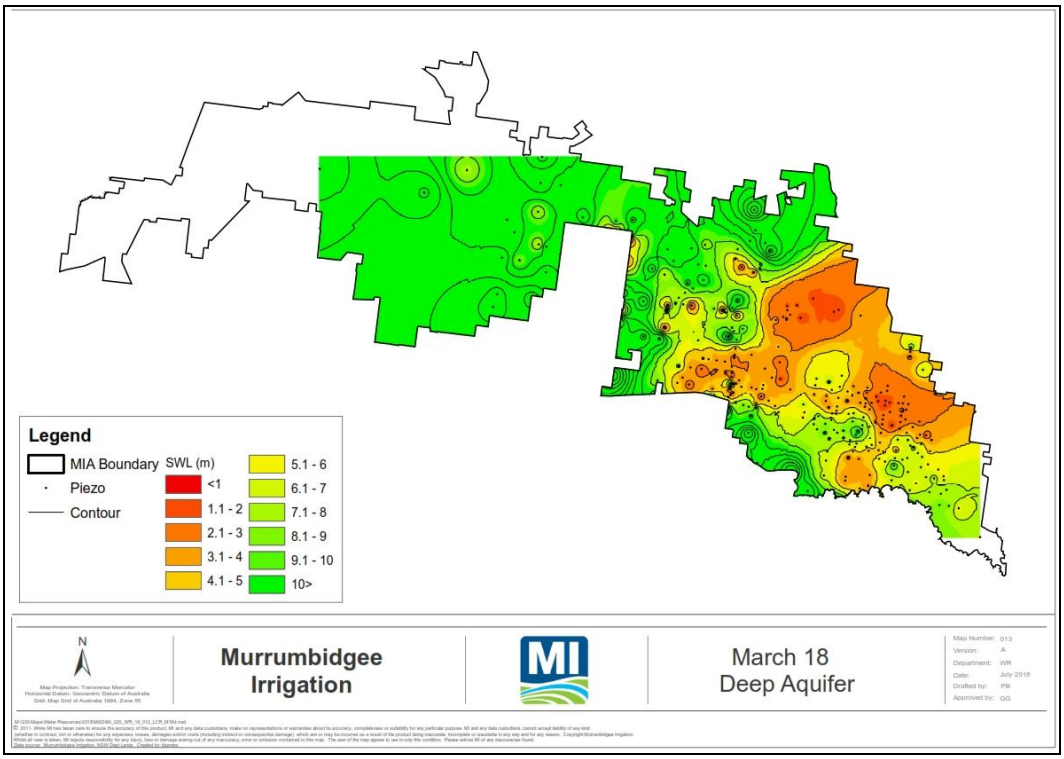


Figure 21 Deep Shepparton Formation- depth to water table, March 2018

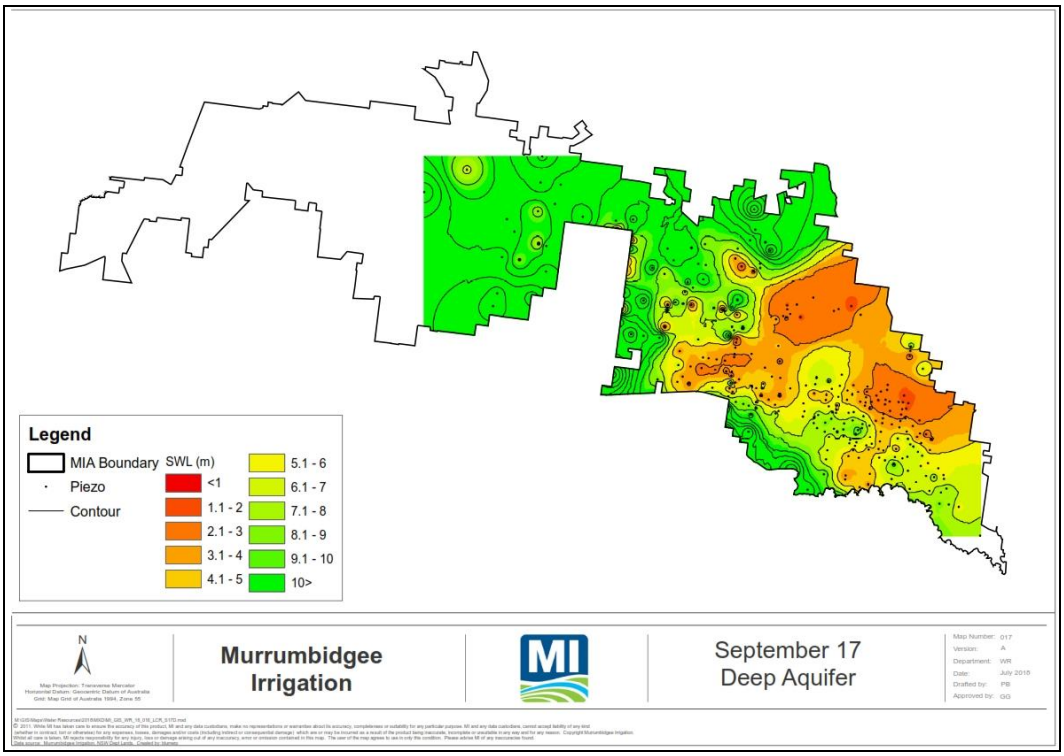


Figure 22 Deep Shepparton Formation- depth to water table, Sep 2017

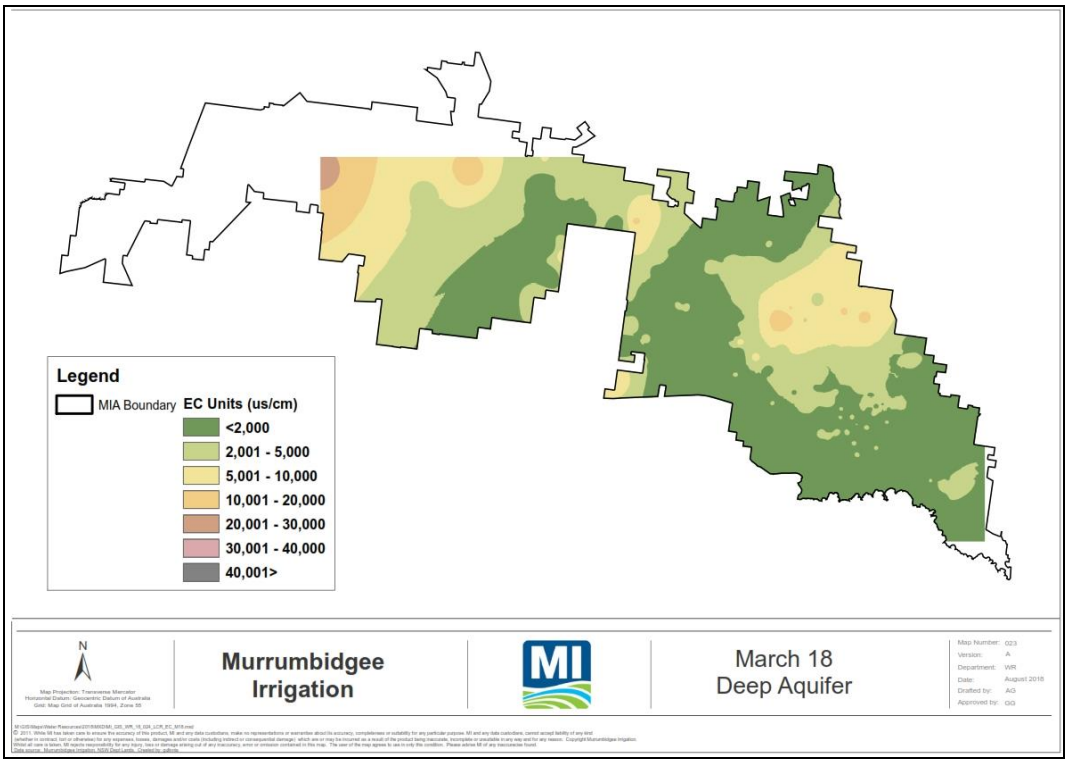


Figure 23 Deep Shepparton Formation- depth to water table, Sep 2017

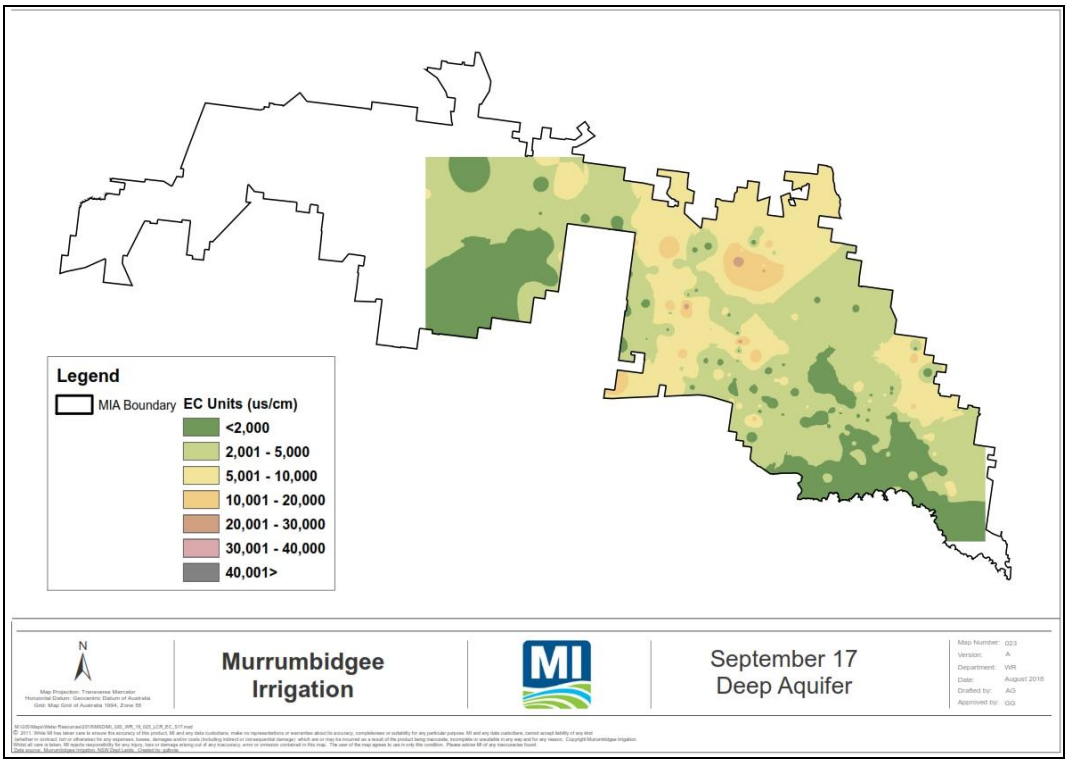


Figure 24 Deep Shepparton Formation- Groundwater Salinity, Sep 2017

2016/17

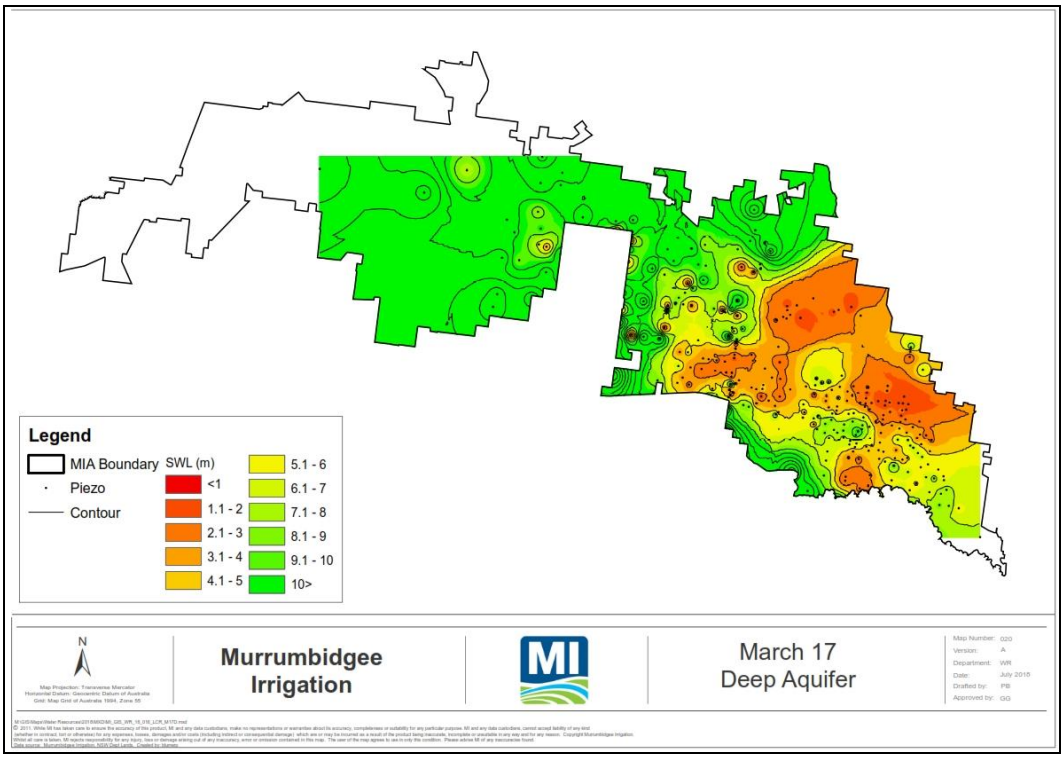


Figure 25 Deep Shepparton Formation- depth to water table, March 2017

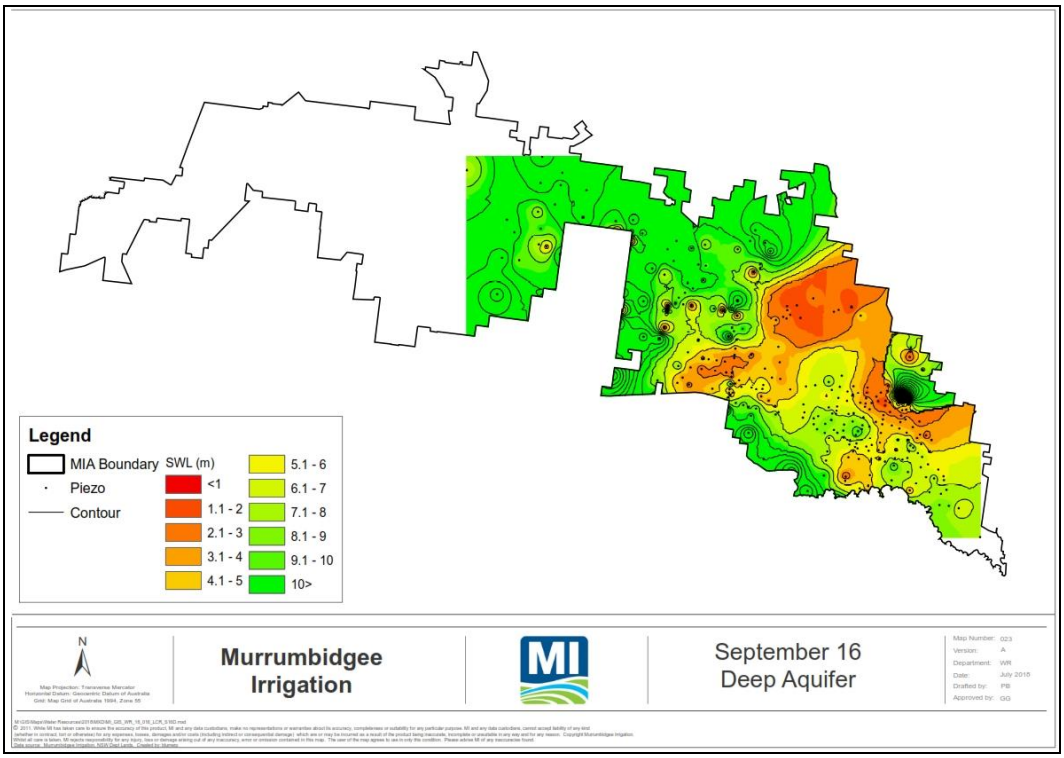


Figure 26 Deep Shepparton Formation- depth to water table, Sep 2016

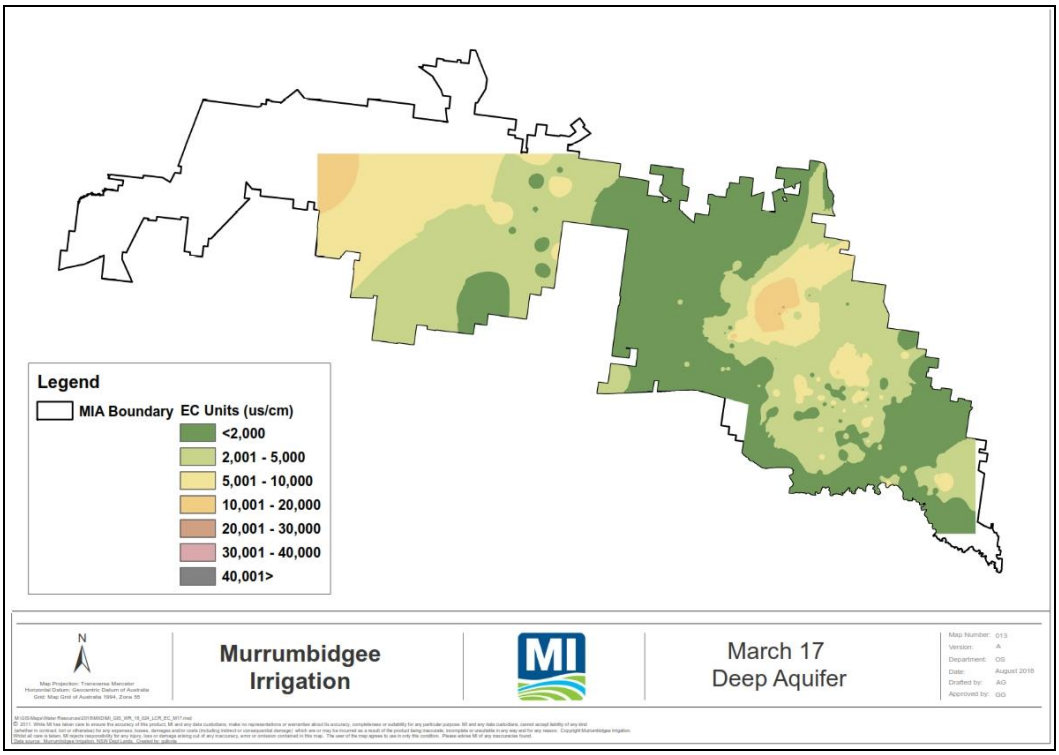


Figure 27 Deep Shepparton Formation- Groundwater Salinity, March 2017

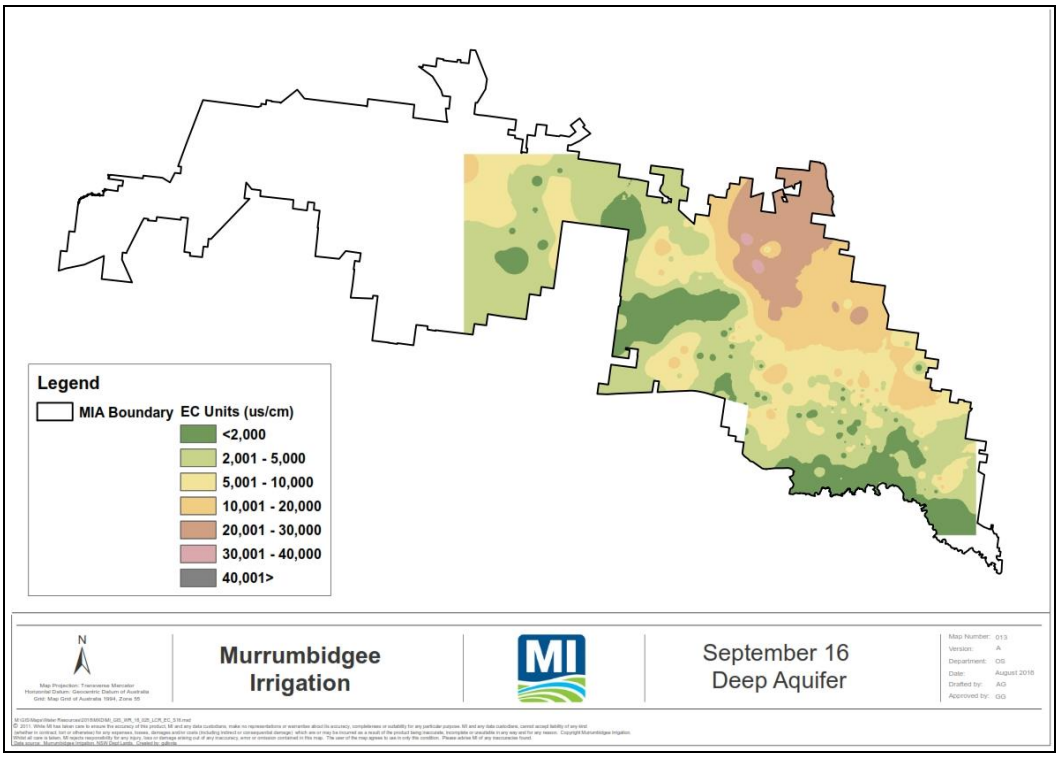


Figure 28 Deep Shepparton Formation- Groundwater Salinity, Sep 2016

2015/16

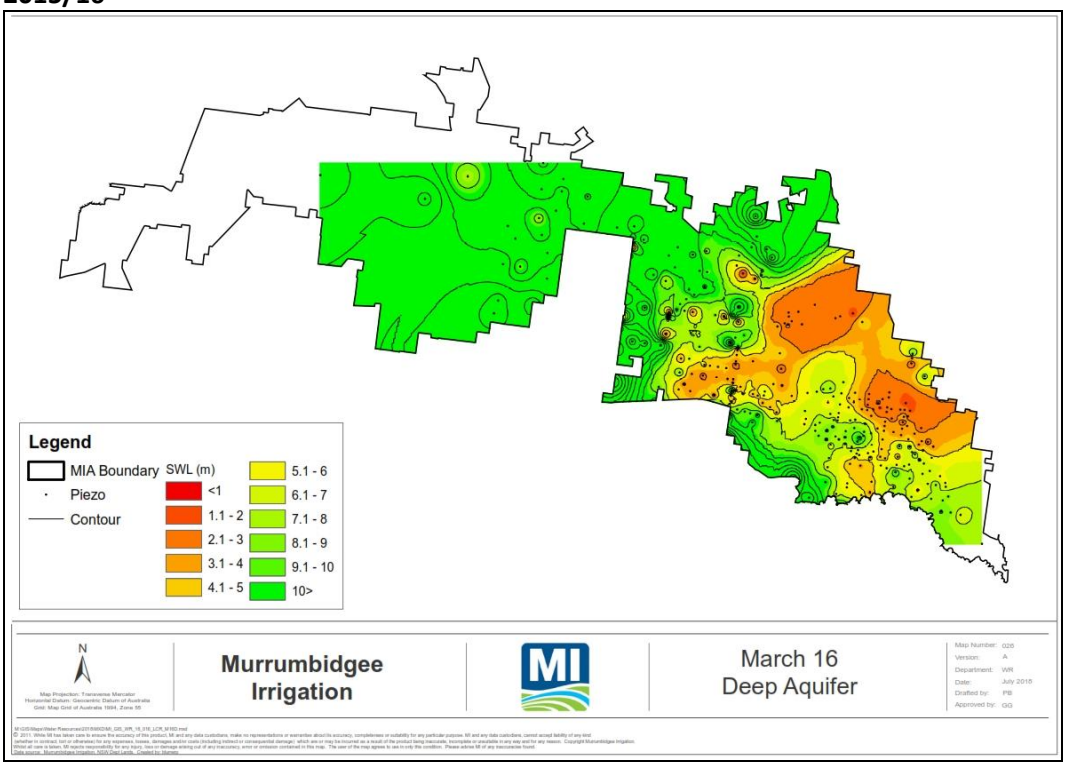


Figure 29 Deep Shepparton Formation- depth to water table, March 2016

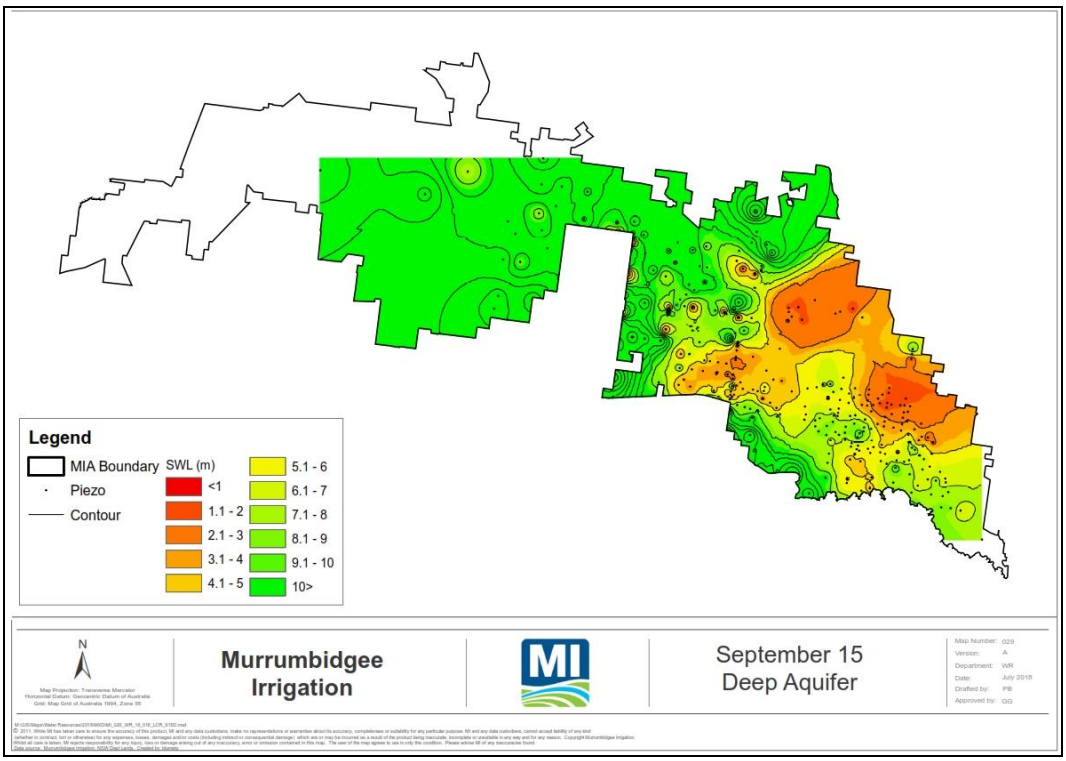


Figure 30 Deep Shepparton Formation- depth to water table, September 2015

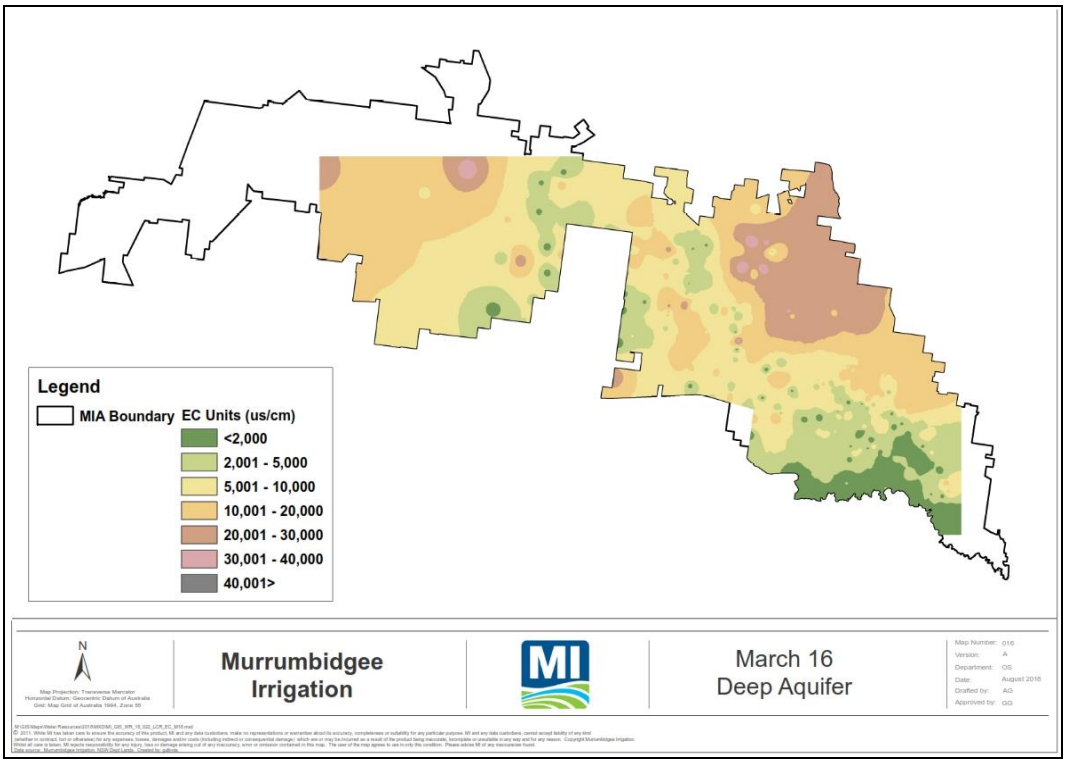


Figure 31 Deep Shepparton Formation- Groundwater Salinity, March 2016

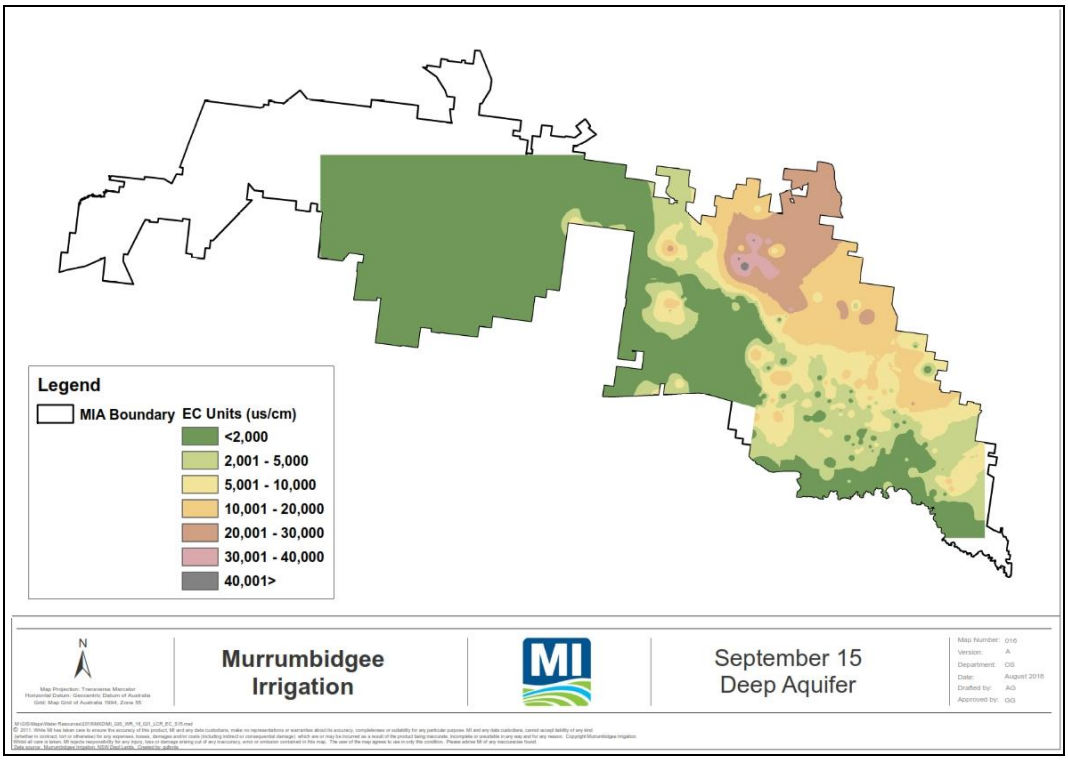


Figure 32 Deep Shepparton Formation- groundwater Salinity, Sep 2015

2005/06

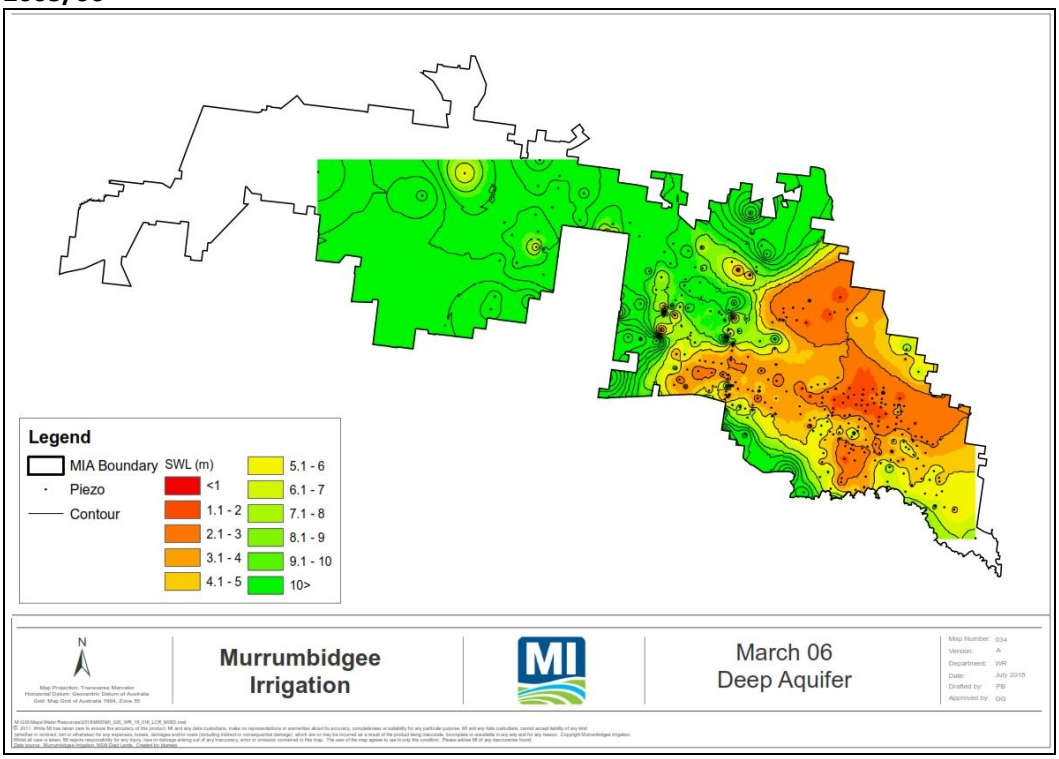


Figure 33 Deep Shepparton Formation – Depth to water table, March 2006

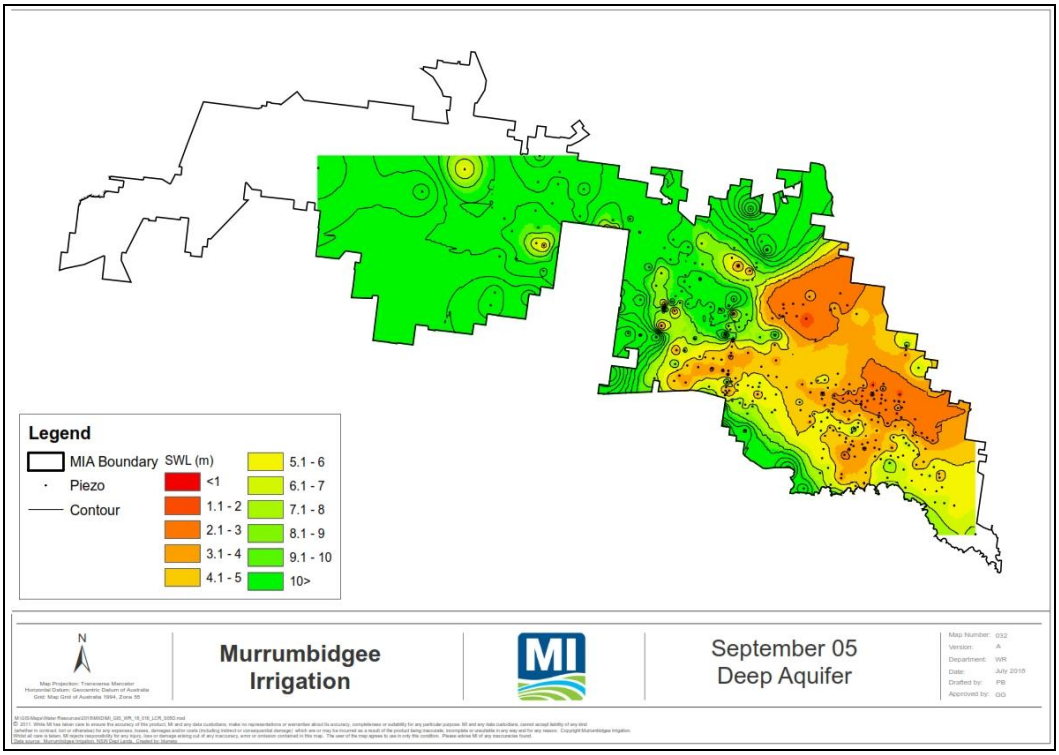


Figure 34 Deep Shepparton Formation – Depth to water table, September 2005

1980/2002

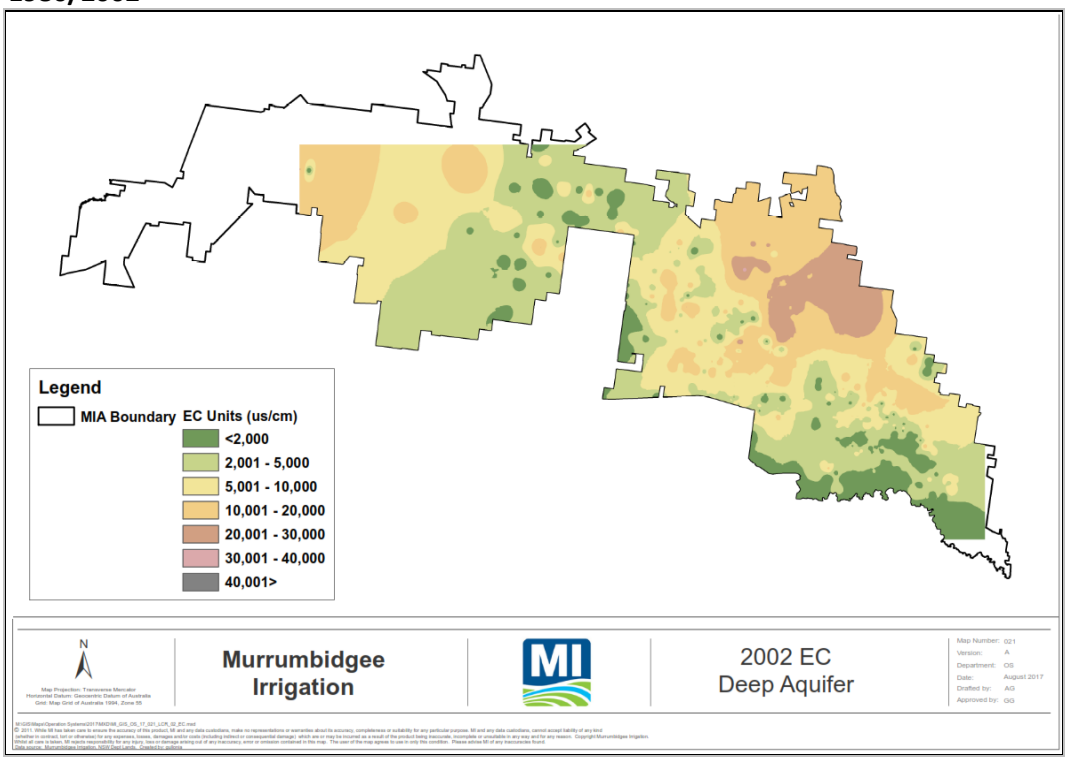


Figure 35 Deep Shepparton Formation - groundwater salinity, 2002

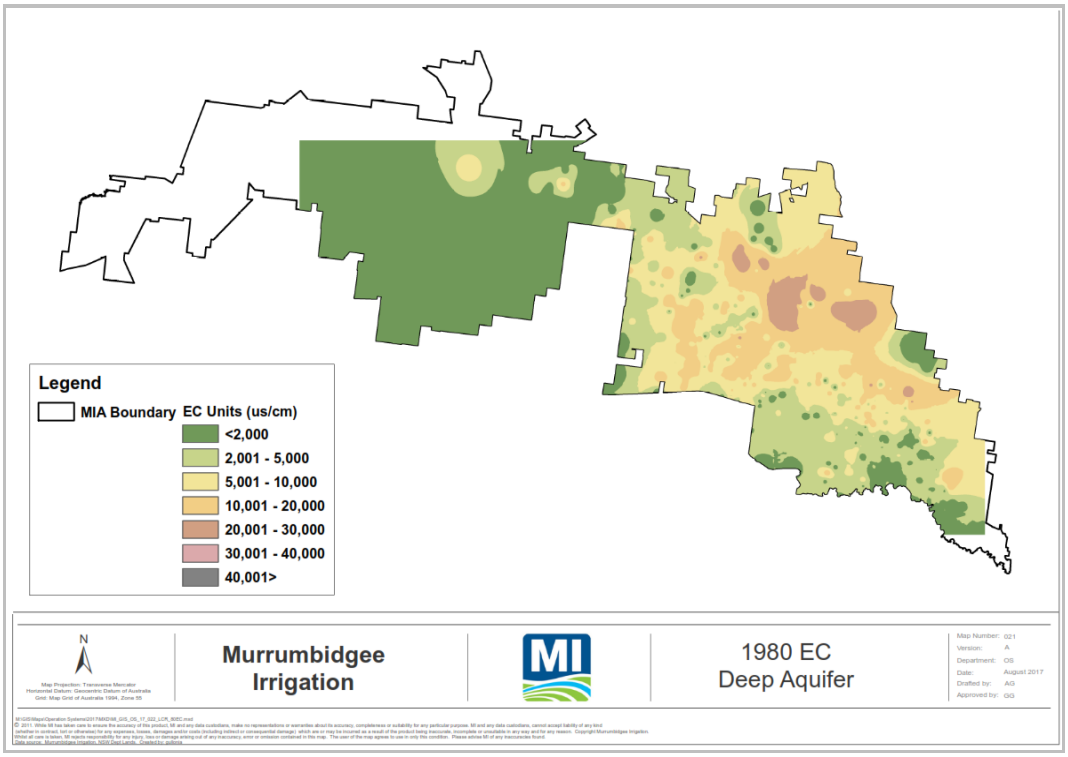


Figure 36 Deep Shepparton Formation - groundwater salinity, September 1980

6.5 Calivil Formation

Depth to water table and salinity maps for piezometers in the Calivil Formation are presented in Figures 37 to 52. Level trends in this formation generally represent drawdown from shallow aquifers. As seen in the upper formations, piezometers measured in the deep formation March 2018 (Figure 39) exhibit low salinity. This suggests that the Calivil Formation may be influenced by large flooding events, either through direct recharge, aquifer exchange or, to a lesser degree, vertical seepage from the above Shepparton Formation. However, due to the dynamic nature of groundwater aquifers, it is difficult to ascertain the true origin and significance of level changes with any confidence. Levels in this aquifer remain consistent for all reporting years, with the majority with a depth of more than 10m.

2017/18

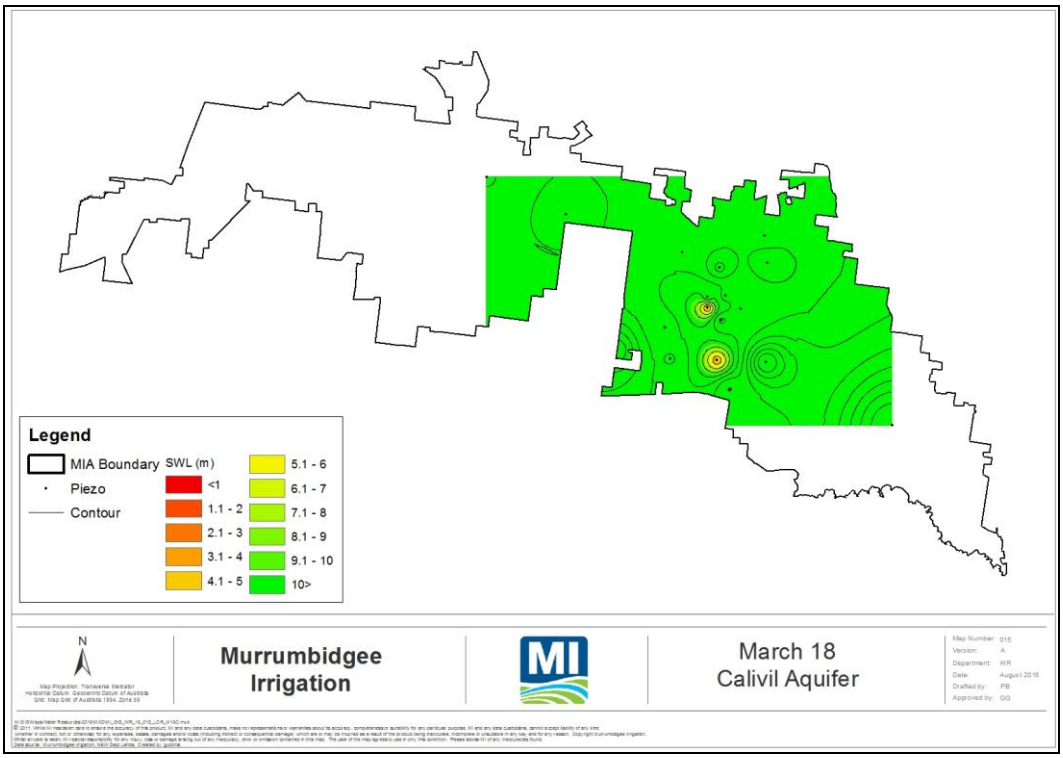


Figure 37 Calivil Formation - depth to water table, March 2018

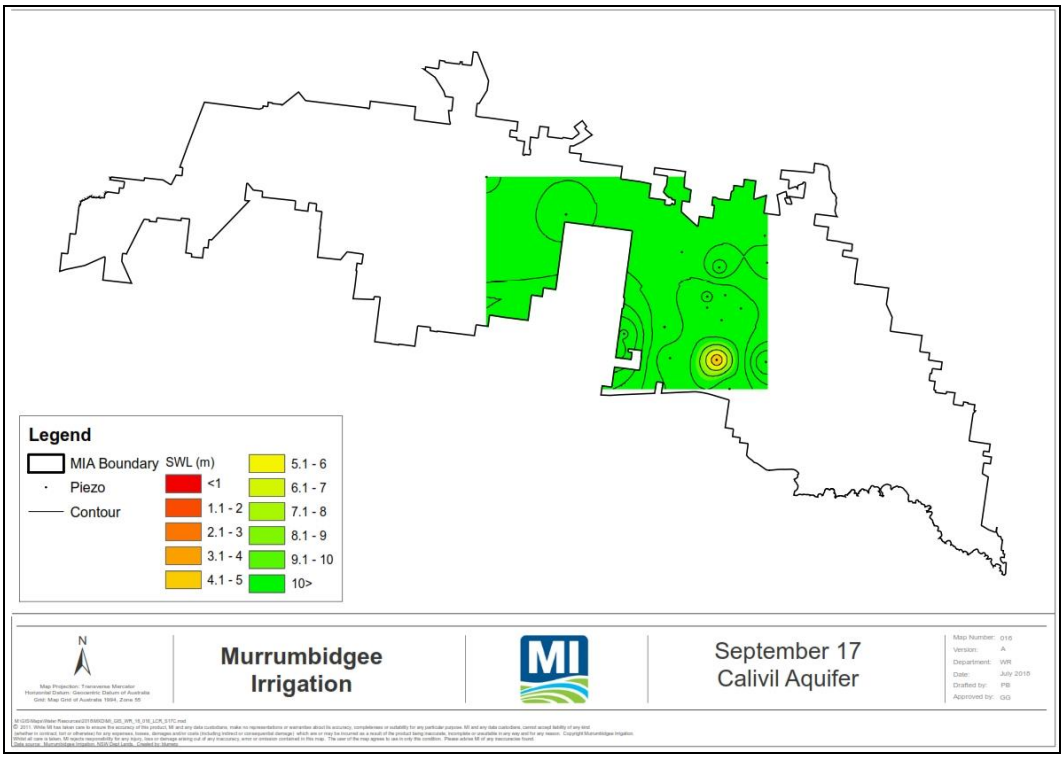


Figure 38 Calivil Formation - depth to water table, Sep 2017

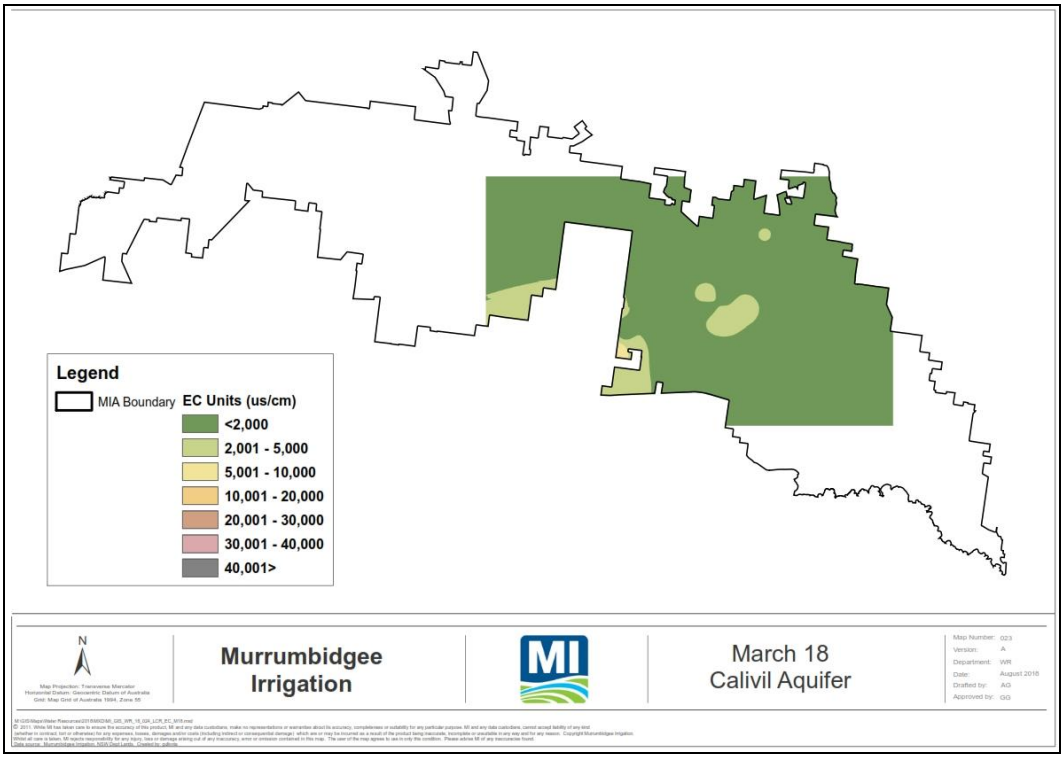


Figure 39 Calivil Formation- groundwater salinity, March 2018

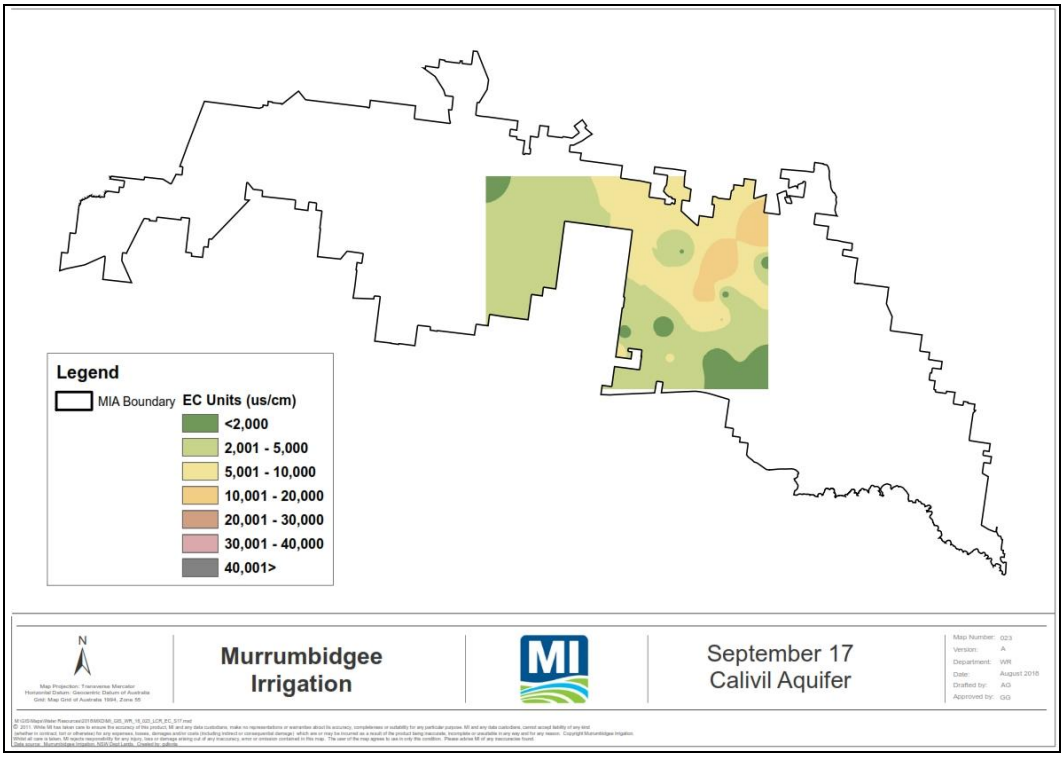


Figure 40 Calivil Shepparton Formation- groundwater salinity, Sep 2017

2016/17

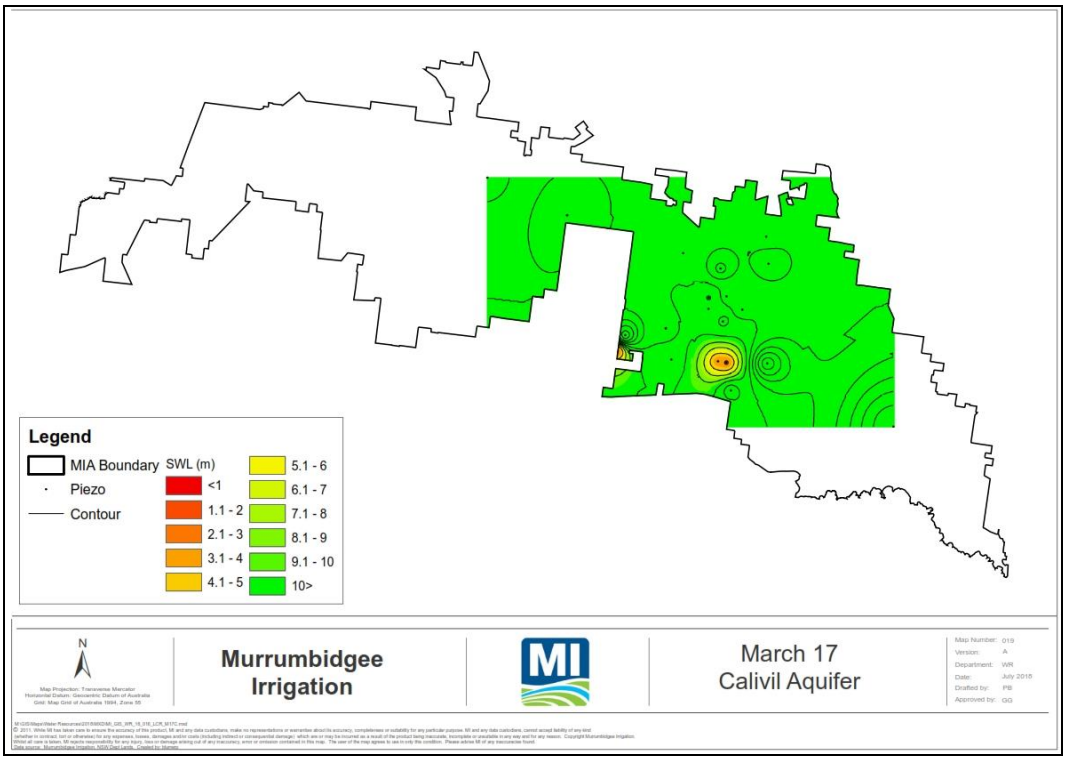


Figure 41 Calivil Formation - depth to water table, March 2017

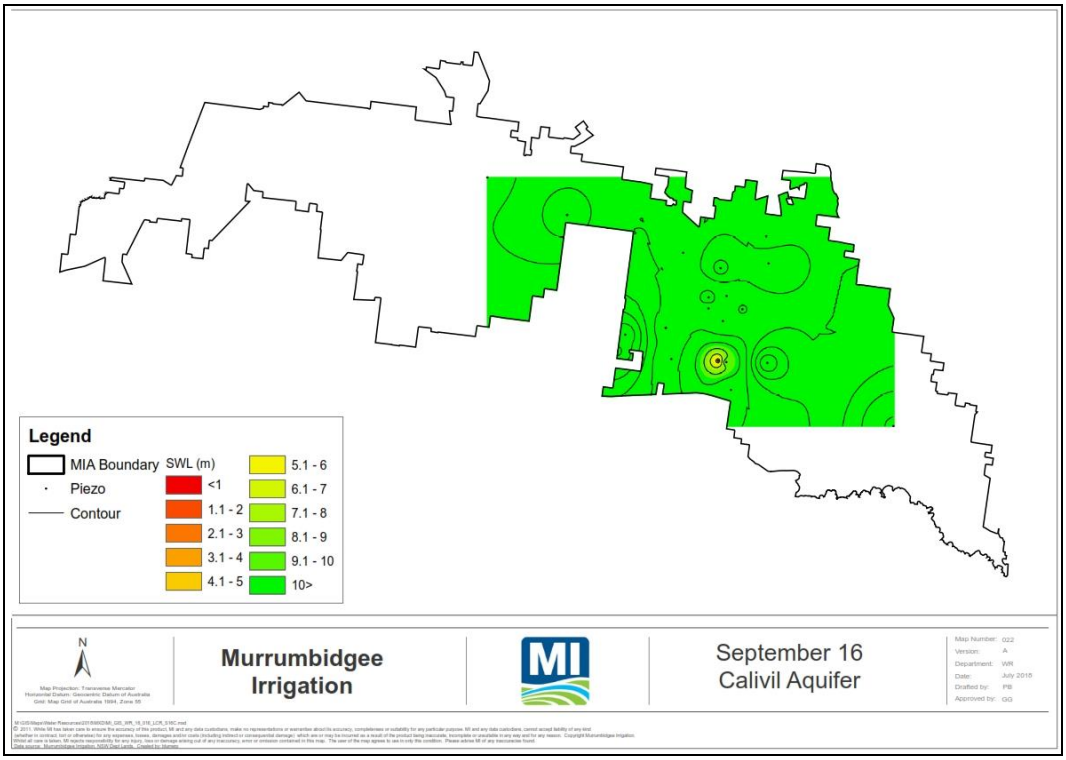


Figure 42 Calivil Formation - depth to water table, September 2016

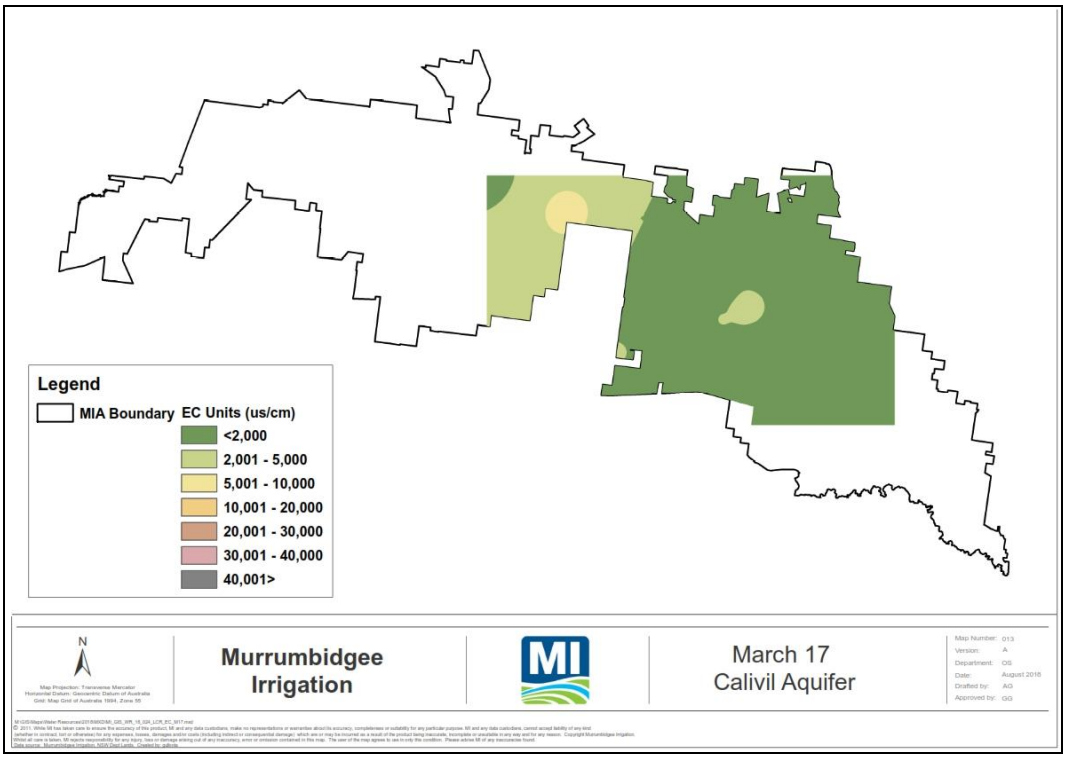


Figure 43 Calivil Formation- groundwater salinity, March 2017

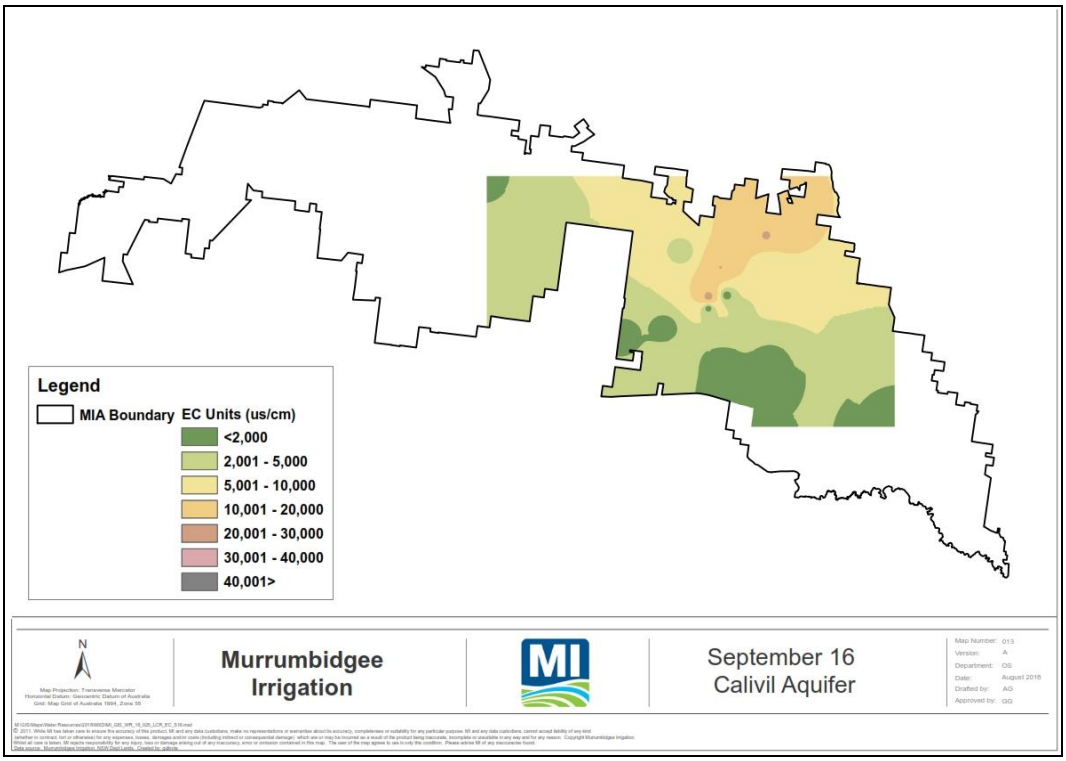


Figure 44 Calivil Formation- groundwater salinity, Sep 2016

2015/16

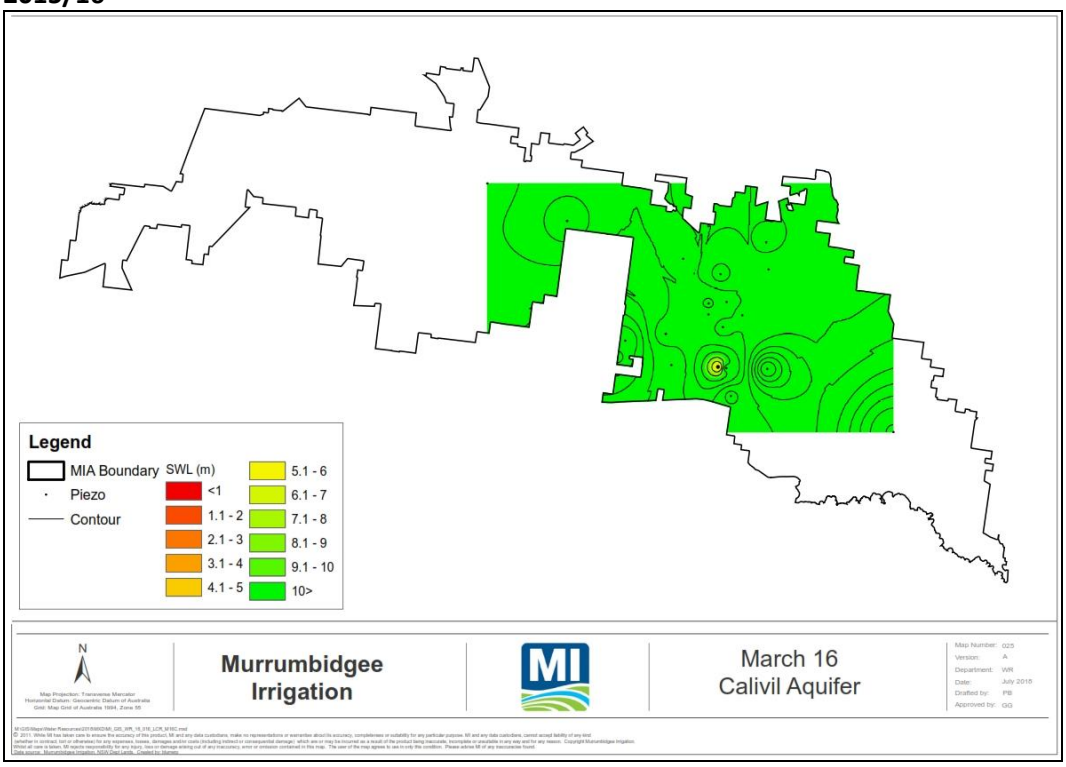


Figure 45 Calivil Formation - depth to water table, March 2016

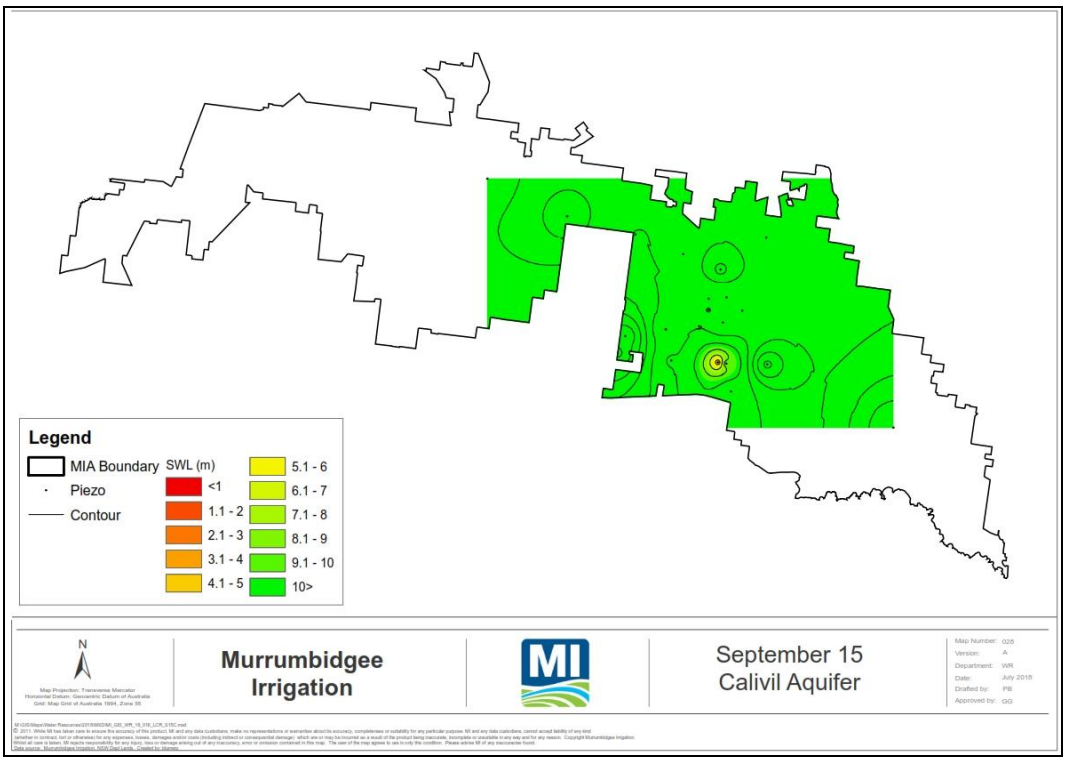


Figure 46 Calivil Formation - depth to water table, September 2015

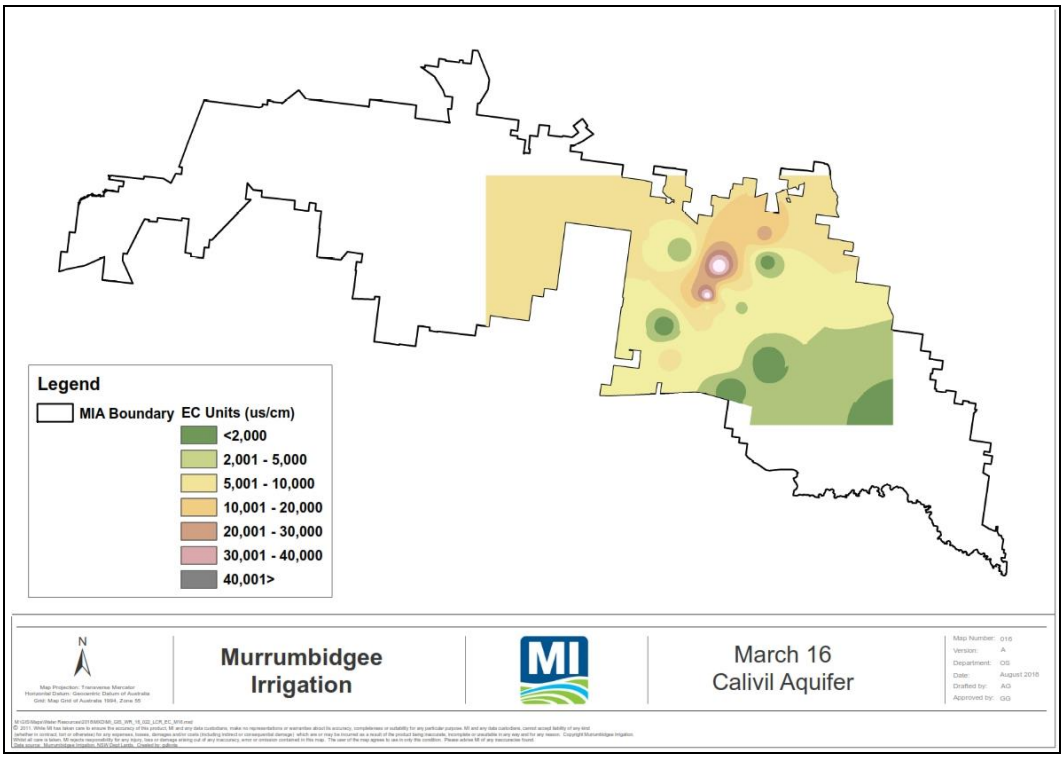


Figure 47 Calivil Formation- groundwater salinity, March 2016

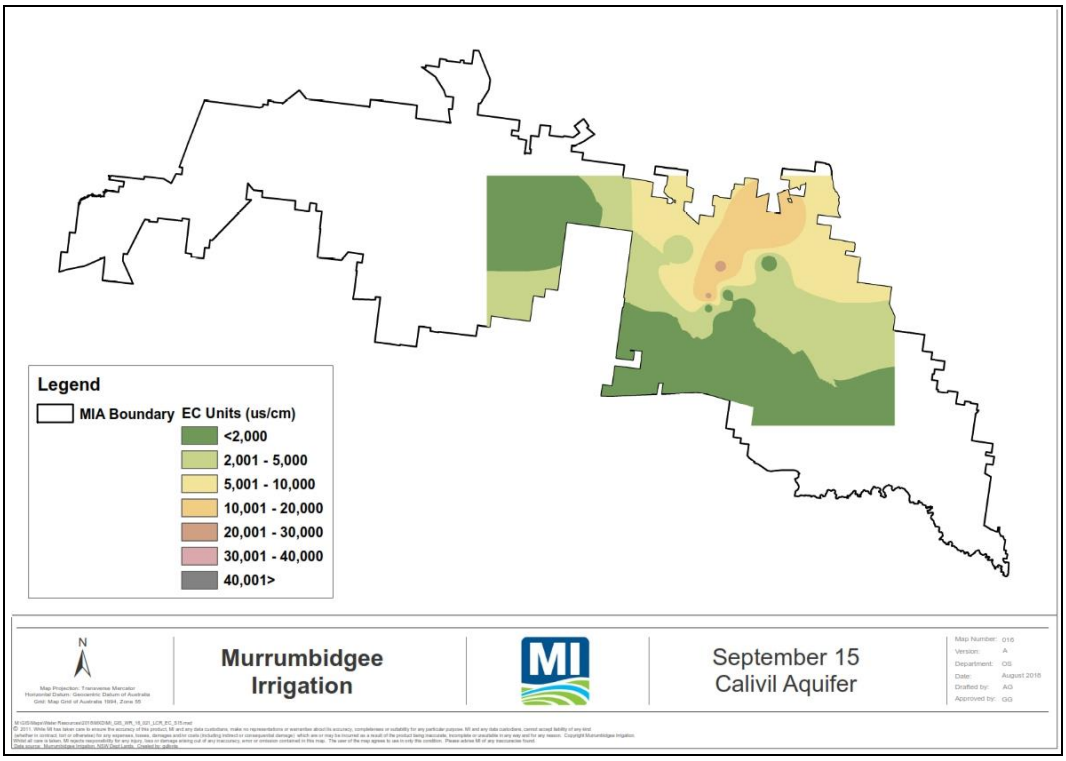


Figure 48 Calivil Formation- groundwater salinity, Sep 2015

2005/06

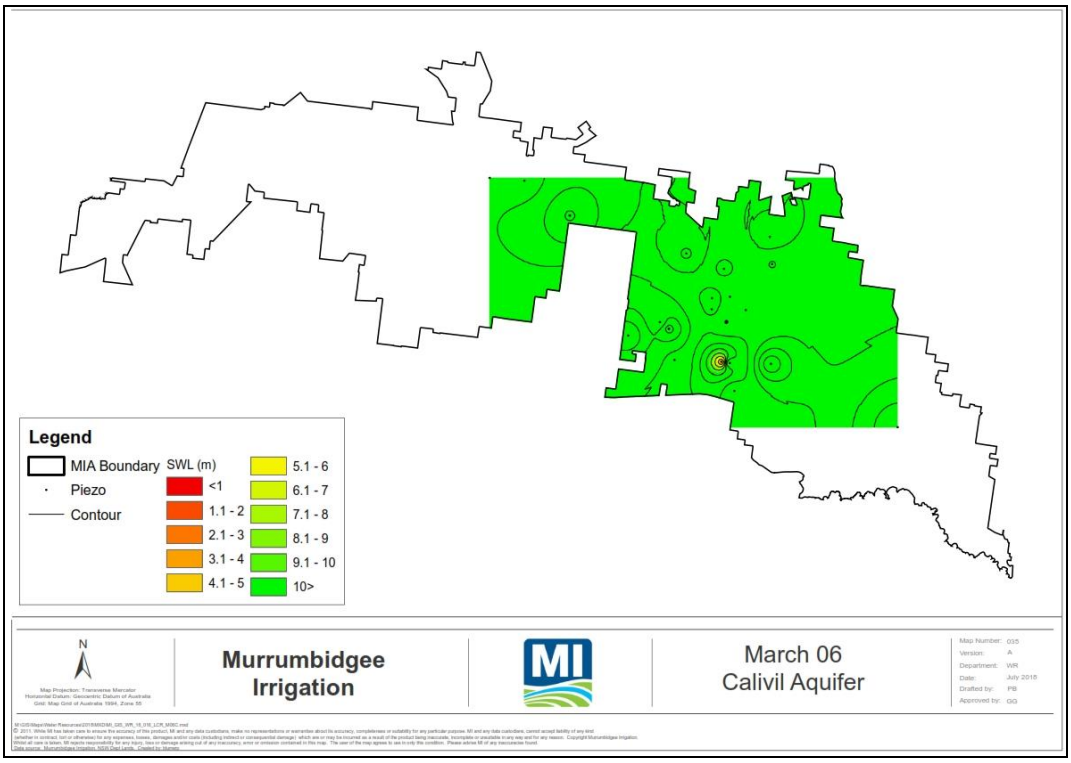


Figure 49 Calivil Formation - depth to water table, March 2006

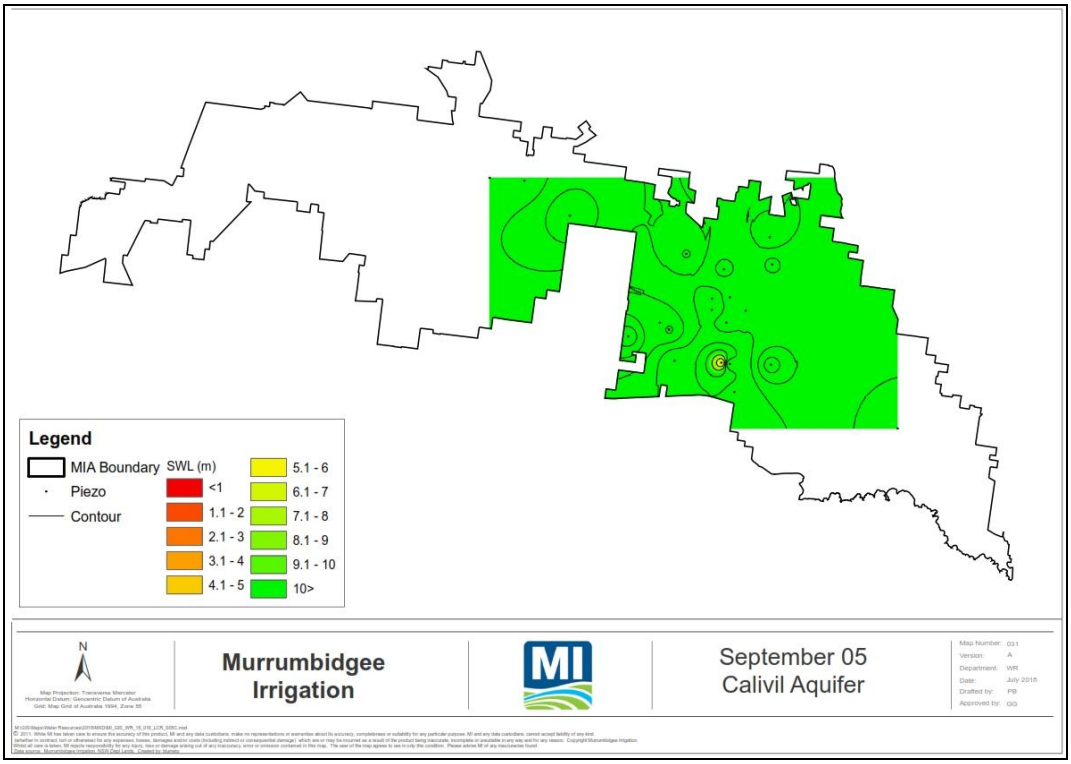


Figure 50 Calivil Formation - depth to water table, Sep 2005

1980/2002

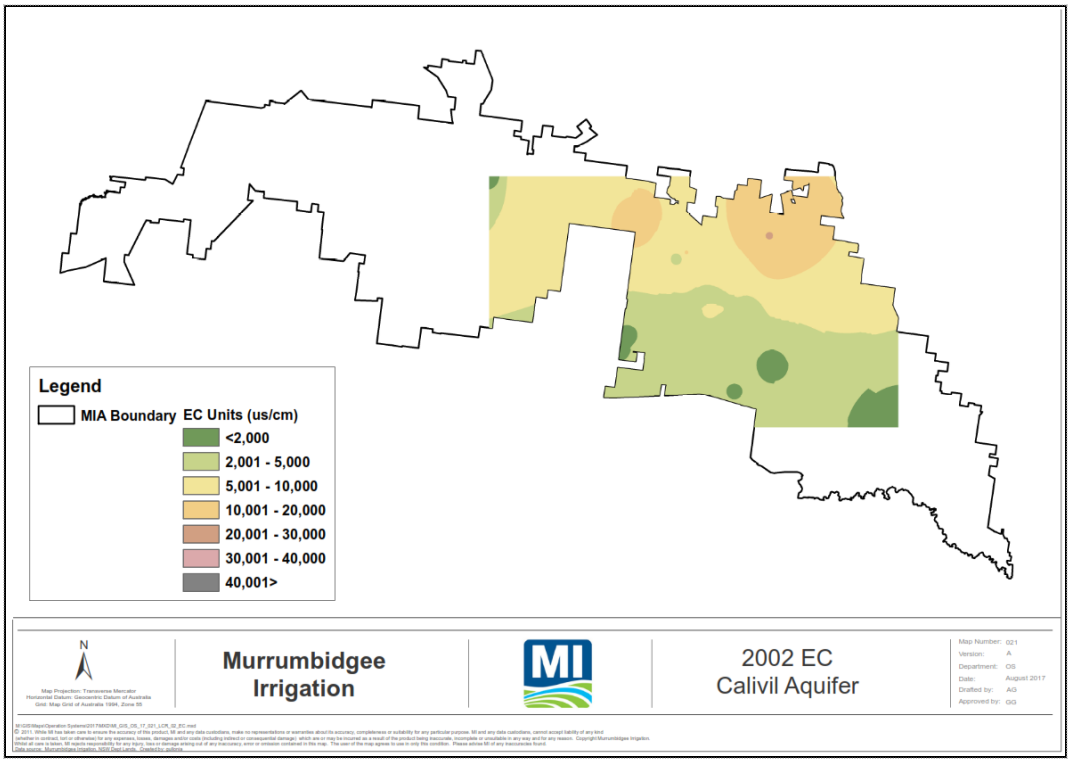


Figure 51 Calivil Formation - groundwater salinity, September 2002

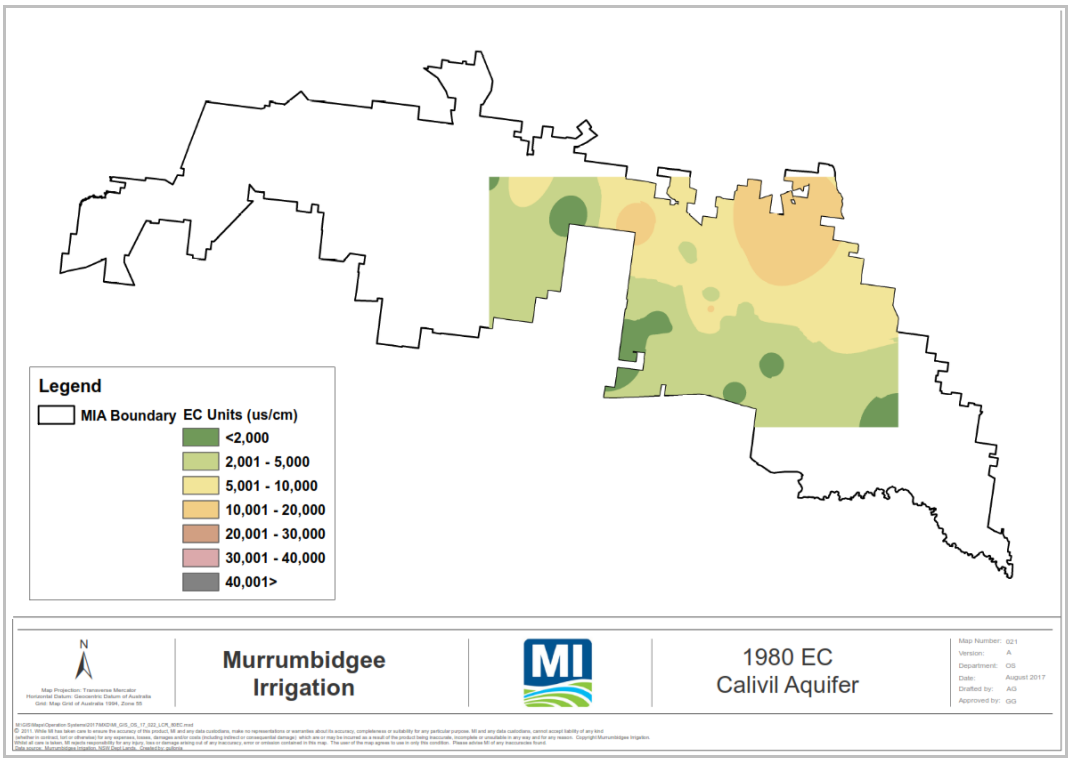


Figure 52 Calivil Formation - groundwater salinity, September 1980

7 Tubewells

MI monitors the volume of water and salt load pumped from seven tubewells within the MIA. The location of the tubewells is shown in Figure 4. Table 23 shows the total volumes and salt discharged from tubewells for 2017/18 and previous years. EC was measured in July 2018 and used to calculate salt loads. A total volume of 906 ML and 1313 tonnes of salt was discharged from tubewells for 2017/18.

Table 23 Tubewell monitoring data 2017/18 compared to previous years

2017/18			2016/17		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	0	0	Five Bridges	324	180*
Gil Gil	378	696	Gil Gil	518	1,061
Yanco West	321	528	Yanco West	284	513
South Leeton	0	0	South Leeton	191	816*
Baulch's	0	0	Baulch's	0	0
Wamoon	111	50	Wamoon	238	128
East Wamoon	96	39	East Wamoon	261	129
Total	**906**	**1313**	**Total**	**1816**	**2829**
2015/16			**2006/07**		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	658	357	Five Bridges	707	489
Gil Gil	412	755	Gil Gil	266	353
Yanco West	274	680	Yanco West	305	404
South Leeton	261	1,090	South Leeton	76	118
Baulch's	0	0	Baulch's	137	52
Wamoon	175	88	Wamoon	384	200
East Wamoon	93	40	East Wamoon	778	454
Total	**1,873**	**3,012**	**Total**	**2,653**	**2,070**

*no EC data available. Three year average used to calculate salt load

8 New Measures to Limit Groundwater Recharge and Discharge of Salt

No new measures were implemented for 2017/18.

9 Environmental Protection and Management

9.1 Discharge of noxious aquatic weeds

During 2017/18 irrigation year, there was no known potential or actual discharge of Class 1, 2 or 3 declared noxious aquatic weeds from MI's Area of Operation.

9.2 Discharge of Blue-Green Algae

No Red alert level Blue Green Algae was detected from water sampled during discharge from MI's area of operation.

ENVIRONMENTAL PROTECTION LICENCE 4651

10 Statement of Compliance

MI has fulfilled the compliance requirements as set out in EPL 4651 for 2017/18, aside from one occasion where reporting of monitoring results did not take place within required timeframes, due to an internal process failure that has since been addressed and detailed in MI's Annual Return. A summary of the compliance requirements is cross referenced to this report and listed in Table 24.

Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations at discharge points. Internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

MI has in place a process to receive complaints from members of the public in relation to MI's activities via the business telephone number. Direction on how to make a complaint can be found on MI's website (www.mirrigation.com.au/Contact-Us).

Table 24 Environmental Protection Licence (EPL 4651) Monitoring and Reporting Requirements

Licence section	Requirement	Compliant	Report Section
Administrative Conditions	1	Yes	N/A
Discharges to Air and Water and Applications to Land	2	Yes	N/A
Limit Conditions	3	Yes	N/A
Operating Conditions	4	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	www.mirrigation.com.au/Environment/Water-Quality
Maintain a Chemical Control Plan	O3.5	Yes	
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	
Monitoring and Recording Conditions	5	No	1. Statement of Compliance
Monitoring Records	M1	Yes	Available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	Internal documents
Recording of pollution complaints	M4	Yes	Available upon request from EPA
Telephone complaints line	M5	Yes	1. Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11. EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	8.1. Noxious Weed Management
Annual return documents	R1		Submitted August 2017
Notification of environmental harm	R2	Yes	N/A
Written Report (of an event)	R3	Yes	N/A
Annual system performance report	R4	Yes	Full Report
Other reporting conditions	R5	Yes	Section 10

11 EPL Monitoring and Reporting

Under MI's EPL 4651, five points (Figure 2) are licenced to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded, and specified water quality parameters are measured during flow or rainfall events. These monitoring points are referred to throughout this section.

11.1 System performance

Table 25 presents total diversions into the MIA and total water discharged from the MIA for 2017/18 compared to previous years. In 2017/18, 4,471 ML was discharged and included 3,405ML discharged to Mirrool Creek Floodway to mitigate localised flooding. The large volume discharged in the 2016/17 season included 121,363 ML that was diverted to Mirrool Creek Floodway in response to well above average rainfall and subsequent floodwater entering MI drainage networks from catchments in and outside of the MIA.

In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in that year. MI does not discharge irrigation waste water directly to groundwaters inside or outside the area of operations.

Table 25 Total water volumes (ML)

Year	Diversions	Discharged
2017/18	945,805	4,471
2016/17	780,083	122,092
2015/16	643,957	1,079
2005/06	1,036,519	8,570

11.2 Water Quality Monitoring

Monthly summaries for each monitoring point are presented in Table 26 - 30. Monitoring consisted of 44 sampling events, with 5 action level and 15 notification level detections. Action level detections. consisted of 3 Metolachlor, 1 Chlorpyrifos and 1 Thiobencarb. The number of Action level detections was lower compared to last reporting year where 9 Action levels were detected.

Diuron, Metolachlor, Chlorpyrifos and Thiobencarb were the four chemicals detected in 2017/18. Chemical detections were found at 3 of the 5 Licenced sites, Point 4 – LAG, Point 5 – GMSRR and Point 15 – MIRFLD.

Table 26 Monitoring results for Point 4 - LAG

Point 4 – LAG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-17	0.0	0	0	-
Aug-17	1.5	0	0	-
Sep-17	25.0	2	0	-
Oct-17	27.9	4	3	3/10/2017 Notification level Diuron (1.17µg/L) 10/10/2017 Notification level Diuron (4.81 µg/L) Notification level Simazine (4.82 µg/L)
Nov-17	20.6	3	1	3/11/2017 Notification level Diuron (1.39 µg/L)
Dec-17	111.6	3	1	3/12/2017 Action level Metolachlor (1.33 µg/L)
Jan-18	17.7	4	1	8/1/2018 Notification level Metolachlor (0.059 µg/L)
Feb-18	21.4	1	0	-
Mar-18	9.0	2	1	27/3/2018 Action level Chlorpyrifos (0.266 µg/L)
Apr-18	0.9	0	0	--
May-18	0.0	0	0	-
Jun-18	6.3	0	0	-
Total	241.9	19	7	-

Table 27 Monitoring results for Point 5 - GMSRR

Point 5 – GMSRR				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-17	0.0	0	0	-
Aug-17	1.3	0	0	-
Sep-17	2.5	1	0	-
Oct-17	10.7	2	0	-
Nov-17	0.1	0	0	-
Dec-17	56.5	3	2	4/12/2017 Notification level Diuron (1.2 µg/L) Notification level Metolachlor (0.025 µg/L)
Jan-18	0.0	0	0	-
Feb-18	0.0	0	0	-
Mar-18	0.0	0	0	
Apr-18	0.0	0	0	
May-18	28.2	1	0	
Jun-18	47.1	2	1	19/6/2018 Notification level Chlorpyrifos (0.087 µg/L)
Total	146.3	9	3	

Table 28 Monitoring results for Point 6 - YMS

Point 6 – YMS				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-17	0.0	0	0	-
Aug-17	0.0	0	0	-
Sep-17	0.0	0	0	-
Oct-17	0.0	0	0	-
Nov-17	0.0	0	0	-
Dec-17	0.0	0	0	-
Jan-18	0.0	0	0	-
Feb-18	0.0	0	0	-
Mar-18	0.0	0	0	-
Apr-18	0.0	0	0	-
May-18	0.0	1	0	-
Jun-18	195	1	0	-
Total	195	2	0	-

Table 29 Monitoring results for Point 7 - ROCUDG

Point 7 – ROCUDG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-17	0.0	0	0	-
Aug-17	33.4	1	0	-
Sep-17	1.1	0	0	-
Oct-17	8.1	1	0	-
Nov-17	0.0	0	0	-
Dec-17	108.8	2	0	-
Jan-18	59.0	2	0	-
Feb-18	22.5	0	0	-
Mar-18	33.9	1	0	-
Apr-18	44.0	1	0	-
May-17	64.8	2	0	-
Jun-17	107.1	0	0	-
Total	482.4	10	0	-

Table 30 Monitoring results for Point 15 - MIRFLD

Point 15 – MIRFLD				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-17	0.0	0	0	-
Aug-17	0.0	0	0	-
Sep-17	0.0	0	0	-
Oct-17	0.0	0	0	-
Nov-17	100	2	6	20/11/2017 Notification level Chlorpyrifos (0.064 µg/L) Action level Metolachlor (0.216 µg/L). 22/11/2017 Notification level Chlorpyrifos (0.083 µg/L) Notification level Diuron (2.5 µg/L) Action level Metolachlor 0.434 µg/L) Action level Thiobencarb (4.79 µg/L)
Dec-17	3305	2	4	1/12/2017 Notification level Chlorpyrifos (0.015 µg/L) Notification level Metolachlor (0.045 µg/L) 10/12/2017 Notification level Chlorpyrifos (0.029 µg/L) Notification level Metolachlor (0.039 µg/L)
Jan-18	0.0	0	0	-
Feb-18	0.0	0	0	-
Mar-18	0.0	0	0	-
Apr-18	0.0	0	0	-
May-18	0.0	0	0	-
Jun-18	0.0	0	0	-
Total	3405	4	10	-

END

Murrumbidgee Irrigation



2019 ANNUAL COMPLIANCE REPORT

This document is the property of Murrumbidgee Irrigation Limited. The data contained in this Annual Compliance Report is for the sole purpose of meeting MI's licence compliance reporting requirements. MI does not guarantee the accuracy, reliability or suitability of excerpts of this data for any other purpose.

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Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
BBS	Barren Box Storage
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Evapotranspiration (crop reference)
GIS	Geographic Information System
ha	Hectare(s)
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
µS/cm	Micro Siemens per centimetre
µg/L	Micrograms per litre
ML	Megalitre
NRAR	Natural Resources Access Regulator
OEH	Office of Environment and Heritage
SOP	Standard Operating Procedure
t	Tonnes
WAL	Water Access Licence
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
YMS	EPL Point 6 - Yanco Main Southern Drain
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station

Preface

The Annual Compliance Report 2018/19 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation (MI). MI operates under a Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) issued by the NSW Department of Planning, Industry and Environment (DPIE) and regulated by the Natural Resources Access Regulator (NRAR). MI also holds an Environment Protection Licence (EPL) 4651 issued by the NSW Environment Protection Authority (EPA).

MI is committed to achieving organisational excellence through operating safely, efficiently and effectively, all of which contribute towards the measure of MI's compliance performance.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of Compliance

Murrumbidgee Irrigation (MI) has met the conditions of the Monitoring and Reporting Plan for our Combined Approval in 2018/19. The compliance requirements are cross referenced within this report and listed in Table 1. MI has quality assurance and control procedures to guarantee data integrity and to ensure that all compliance obligations are met. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain our licensed supply and discharge points.

There were no significant events in 2018/19 that required notification to the Minister.

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2018/19. MI did not construct new works that would allow further discharge from the Area of Operations. In 2018/19, the boundary of MI's Area of Operations decreased by 192,202 hectares (Figure 1), with the project finalisation and handover of the Gunbar Private Water Supply District.

Table 1 Combined Approval (40CA403245) reporting summary

Licence section	Condition	Report Section
Notification of events	10	1. Statement of Compliance
Plans of the Area of Operations, Authorised Works, Monitoring Sites and Water Management Infrastructure	12.1	2. Plan of Operations and Works
	12.2	
Statement of Compliance	12.3	1. Statement of Compliance
Presentation of Data and Analyses	12.4	Sections 1 - 6
	12.5	
	12.6	
	12.7	Provided on USB
	12.8	1. Statement of Compliance
New Measures to Limit Groundwater Recharge and Discharge of Salt	12.9	8. New Measures to Limit Groundwater Recharge and Discharge of Salt
Reporting on Water Management	12.10	3.3 Diversions and Water Allocation
	12.11	3.5 Water discharged from Area of Operation
	12.12	3.9 Water Balance
	12.13 (a) (b)	3.1 Climate Conditions
	(c) – (j)	4. Water Use
Reporting on Salinity and Salt load	12.14	5. Salinity and Salt load
	12.15	
	12.16	
Reporting on Groundwater Conditions	12.17	6. Groundwater Conditions

2 Plan of Operations and Works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. The Murrumbidgee Irrigation Area (MIA) is supplied by water stored in Burrinjuck and Blowering dams and released to the Murrumbidgee River. Water is diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval, via two authorised supply works (Figure 2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STURT - Sturt Regulator (after diversion from Gogeldrie Weir)

There are five (5) sites which have the potential to discharge water outside MI's area of operations, which are presented in Figure 2. These sites are monitored in accordance with MI's Combined Approval and Environmental Protection Licence (EPL) 4651.

MI's five discharge monitoring points are:

- LAG – Gogeldrie Main Drain at Gooragool Lagoon
- ROCUDG – Cudgel Creek Roaches Escape
- YMS – Yanco Main Southern Drain
- GMSRR – Gogeldrie Main Southern Drain River Road
- MIRFLD – Mirrool Creek Floodway Wyvern Station

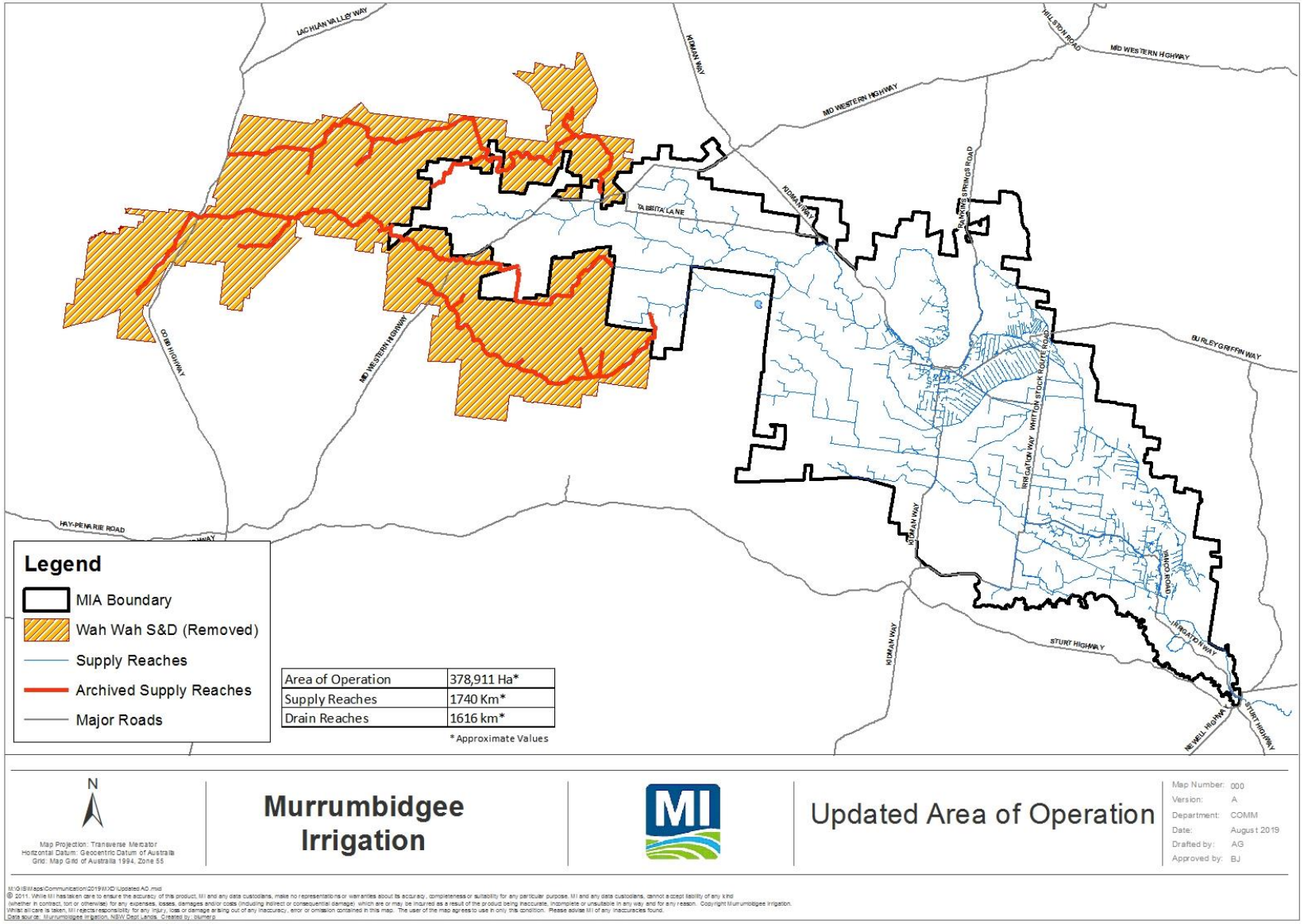


Figure 1 Murrumbidgee Irrigation's Area of Operation, identifying MI's area of exclusion

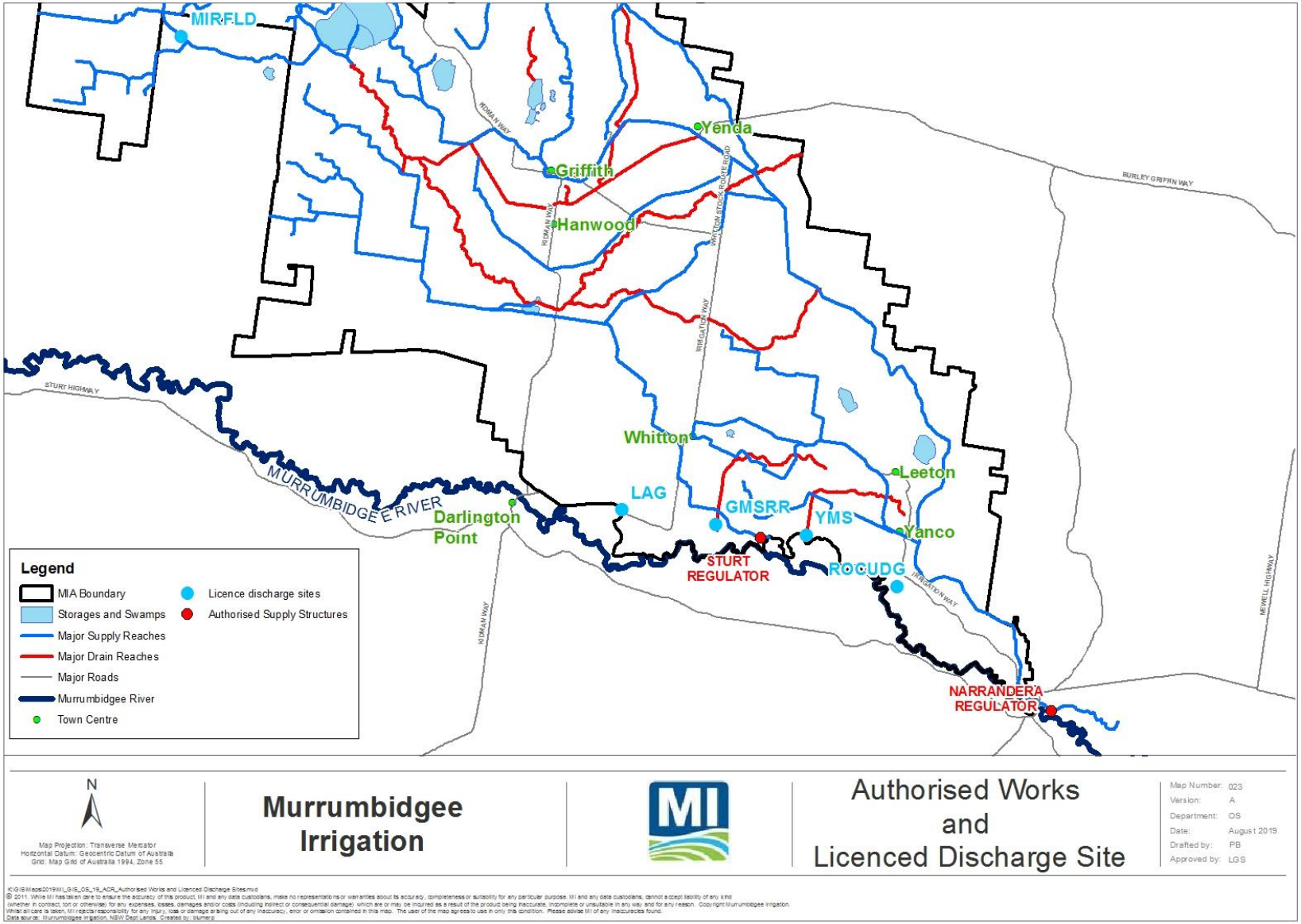


Figure 2 Location of authorised supply works and licence discharge points

3 Reporting on Water Management

MI's water management information is presented below. There are no internal benchmarks or targets that are relevant to this report.

3.1 Climate conditions

Rainfall and evapotranspiration (ETo) data recorded at the Griffith CSIRO weather station is presented in Table 2. Below average rainfall was recorded in 2018/19, comparable to rainfall recorded during the millennium drought in 2005/06. The high rainfall recorded in 2016/17 was the result of a 1/150-year flood event.

Table 2 Griffith CSIRO weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2018/19	337	1,914
2017/18	315	1,894
2016/17	556	1,593
2005/06	357	1,935

3.2 Calibration Report for Main Canal and Sturt Canal AFFRA Units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of the contract with MI to ensure flow measurements meet the conditions of Combined Approval 40CA403245. The calibration report summary for the NARREG AFFRA unit is presented in Table 3 and the STURT AFFRA unit presented in Table 4. The full calibration report is included with the submission of this report.

Table 3 Main Canal at NARREG (410127) calibration report

Date	Time	Calibration	AFFRA Sensor:	Deviation
15/08/2018	1439	1459	1407	3.73%
16/09/2018	1641	1666	1715	-2.86%
16/09/2018	1607	1703	1713	-0.60%
17/10/2018	1048	1255	1265	-0.79%
20/11/2018	728	1060	1041	1.89%
26/01/2019	636	3556	3582	-0.73%
20/02/2019	853	1970	1946	1.23%

Table 4 Sturt Canal at STURT (410129) calibration report

Date	Time	Calibration	AFFRA Sensor:	Deviation
13/08/2018	1544	479	482	-0.57%
17/09/2018	1614	685	698	-1.81%
15/10/2018	1317	855	891	-4.01%
25/01/2019	837	830	856	-3.04%
19/02/2019	1137	389	392	-0.77%

3.3 Diversions and Water Allocation

A monthly summary of gross water diverted from the Murrumbidgee River is presented in Table 5. These volumes represent diversions entering the supply system via MI's two authorised water supply works at NARREG and STURT. The total diversion volume of 586,752 ML includes an environmental water diversion volume of 2,996 ML diverted on behalf of the Office of Environment and Heritage (OEH).

Table 5 Monthly summaries of water diversions (ML) deliveries to customers (ML), 2018/19

Month	STURT	NARREG	Total diversion	Deliveries to customers
Jul-18	0	4,547	4,547	2,859
Aug-18	14,306	37,013	51,319	38,276
Sep-18	15,925	43,275	59,200	52,313
Oct-18	16,866	49,370	66,236	59,012
Nov-18	5,939	35,179	41,118	32,242
Dec-18	19,580	80,876	100,456	81,318
Jan-19	26,652	100,853	127,505	105,604
Feb-19	10,618	53,581	64,199	56,541
Mar-19	6,822	39,046	45,868	38,171
Apr-19	755	17,797	18,572	12,129
May-19	0	4,303	4,303	6,234
Jun-19	0	3,429	3,429	2,505
Total	**117,483**	**469,269**	**586,752**	**487,204**

Table 6 compares water allocations, diversions, total deliveries and climate data from the 2018/19 reporting year to previous years. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year. Below average rainfall was recorded throughout the catchment in 2018/19, resulting in 7% allocation for General Security and 95% allocation for High Security allocation announcement. Total diversions and deliveries to customers were reduced compared to the previous reporting year in line with reduced allocations. However, 487,204ML delivered is higher than would be expected in a 7% General Security allocation season, with customers utilising substantial carry over from the previous 2017/18 season allocation.

When low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. However, it must be noted flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

The volume of water extracted under each of MI's Water Access Licences are shown in Table 7.

Table 6 Water allocation, total diversions and deliveries 2018/19 compared to previous years

Year	Announced Allocation (%) General / High	Diversions (ML)	Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2018/19	7/95	586,752	487,204	337	1,914
2017/18	45/95	945,805	800,963	315	1,894
2016/17	100/100	780,083	621,094	556	1,593
2005/06	54/95	1,036,519	829,990	367	1,935

Table 7 Diversions - Water Access Licences (WALs)

Year	WAL 1 HS	WAL 2 GS	WAL 3 Towns	WAL 4 S&D	WAL 5 Other
2018/19	269,817	161,433	19,699	7,345	128,458

3.4 Environmental diversions

At the request of OEH, 2,996ML (including 20% conveyance) of environmental water was delivered in 2018/19 as shown in Table 8. This volume is accounted for in total Diversions and Deliveries.

Table 8 Environmental water diversions for 2018/19

Month	Gooragool Lagoon	Tuckerbill Swamp	Fivebough Swamp	Turkey Flats	Yanco Ag	Nericon Swamp	Campbell's Swamp	30 Mile	BBS Wetlands	Total
Jul-18	0	0	0	0	0	0	0	0	0	**0**
Aug-18	0	0	0	0	0	0	0	0	0	**0**
Sep-18	0	0	0	0	0	0	0	0	0	**0**
Oct-18	0	410	252	17	470	0	263	0	0	**1,412**
Nov-18	0	0	27	104	55	0	136	0	0	**322**
Dec-18	0	0	257	64	178	0	0	0	0	**499**
Jan-19	0	0	0	60	187	0	0	0	0	**247**
Feb-19	0	133	0	60	0	0	0	0	0	**193**
Mar-19	0	0	256	0	0	0	0	0	0	**256**
Apr-19	0	0	0	0	0	0	0	0	0	**0**
May-19	0	66	0	0	0	0	0	0	0	**66**
Jun-19	0	0	0	0	0	0	0	0	0	**0**
Total (ML)	**0**	**610**	**792**	**305**	**891**	**0**	**398**	**0**	**0**	**2,996**

3.5 Water discharged from Area of Operations

Monthly discharge volumes for each discharge monitoring point are shown in Table 9. A total of 642 ML was discharged from MI's Area of Operations in 2018/19 with 150 ML of this total released to the Mirrool Creek Floodway (MIRFLD) to facilitate required operational works.

Table 9 Monthly discharge volumes (ML) recorded at monitoring points

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-18	16.8	16.6	102	104.6	150
Aug-18	19.5	66.1	0	67.5	0
Sep-18	11.9	7.6	0	0.0	0
Oct-18	24.1	6.9	0.3	0.0	0
Nov-18	5.9	0.0	0	0.0	0
Dec-18	28.3	0.0	0	0.0	0
Jan-19	4.6	1.8	0	0.0	0
Feb-19	0.0	0.2	0	0.0	0
Mar-19	0.0	0.0	0	0.0	0
Apr-19	0.0	0.0	0	0.0	0
May-19	7.5	0.0	0	0.0	0
Jun-19	0.0	0.0	0	0.0	0
Total	**118.6**	**99.20**	**102.3**	**172.1**	**150**

Table 10 shows total discharge volumes from MI's Area of Operation compared to previous years. The total volume discharged in 2018/19 was significantly lower compared to previous years. It must be noted that in 2016/17 121,363ML was diverted to the MIRFLD as a means of flood risk mitigation.

Table 10 Total volumes discharged from the MIA

Year	Total discharged (ML)
2018/19	642
2017/18	4,471
2016/17	122,092
2005/06	8,570

3.6 Supply efficiency

Table 11 illustrates the simple efficiency of MI's supply system to be at 83% for 2018/19. The simple efficiency provides insight into how the supply system is managed under the season's climatic conditions, whilst balancing irrigation demand and minimising system losses.

Table 11 Supply efficiency from 2018/19 and previous years

Year	Diversions (ML)	Deliveries (ML)	Conveyance (ML)	Simple Efficiency (%)
2018/19	586,752	487,204	99,548	83%
2017/18	945,805	800,963	144,842	85%
2016/17	780,083	621,094	158,003	80%
2005/06	1,036,519	829,990	206,529	80%

3.7 Water balance

The annual water balance in Table 12 has been produced to meet condition 2.12 of the Combined Approval Monitoring and Reporting Plan. To assist with interpretation of this water balance, each line has been referenced to the specific requirements of Condition 2.12.

The conveyance volumes represented in this water balance account for seepage, evaporated water (in channel and storage) and general conveyance required to deliver water to customers. With reference to Condition 2.10 (c) and 2.11(b), no water was extracted or discharged for environmental or river operational purposes as directed by Water NSW or the Minister. Overland flood losses in 2016/17 refers to overland flows from bank cuts or breaches during peak flood periods.

Total gross diversions of 586,752 ML for 2018/19 were used to generate water deliveries of 487,204 ML including 2,996 ML Environmental water diversions. There were no flood events resulting in captured flood water deliveries during 2018/19, therefore the total volume of water delivered to customers for 2018/19 was sourced from river diversions and internal storage.

Table 12 Annual Water Balance (ML)

Condition	Sources	2018/19	2017/18	2016/17	2015/16	2005/06
2.10 (a) (b)	River diversions	586,752	945,805	780,083	643,957	1,036,519
2.12 (c)	Internal storage volume (July 1)	25,256	32,318	29,042	15,621	N/A
2.12 (b)	Water captured (measured)	0	5,007	171,376		0
	Total	**612,008**	**983,131**	**980,501**	**659,578**	**1,036,519**
	Applications					
2.10 (d)	Deliveries to customers (river and storages)	484,208	800,963	621,094	526,278	829,990
2.10 (d)	Deliveries to customers (captured flood water)	0	1,602	49,225	0	0
2.12 (b) delivered	Environmental water diversions	2,996	600	986	2,629	N/A
2.12 (b) loss	Conveyance	121,728	151,904	127,960	101,629	206,518
2.12 (c)	Internal storage volume (June 30)	2,434	25,256	32,318	29,042	N/A
2.11 (a)	Discharges out of area of operation	642	4,471	121,363		11
2.12 (b) loss	Overland flood discharge	0	0	25,600		0
2.12 (b) loss	Customer flood discharge	0	0	1,955		0
	Total	**612,008**	**983,131**	**980,501**	**659,578**	**1,036,519**

4 Water Use

4.1 Crop statistics

Customers are required to nominate the intended water use to a crop or purpose when placing water orders. This data is not validated at the farm level and is therefore an estimate only. Table 13 shows water deliveries and estimated crop water use for 2018/19. It is important to note the water use data presented for the total area of crop is influenced by seasonal rainfall, ETo and irrigation practices.

The 'Not Defined' category refers to water taken by MI customers without placing an order. This information is obtained after the meter is read and does not provide opportunity to allocate the water to a use.

Table 13 Summary of water deliveries for major crop groupings 2018/19

Crop/Purpose	Area (ha)	Volume Delivered (ML)	Crop Water Use (ML/ha)
Citrus	8,301	42,664	5.1
Cotton	12,319	113,443	9.2
Industrial	-	6,006	-
Other crops	186	1,967	10.6
Other fruits	1,327	6,150	4.6
Plantation	97	365	3.8
Rice	2,783	37,171	13.4
Stock & domestic	257	3,862	15.0
Summer cereals	2,384	22,928	9.6
Summer oilseeds	190	618	3.3
Summer pasture	1,476	5,851	4.0
Town supplies	-	12,306	-
Vegetables	1,914	10,518	5.5
Vines	17,887	81,903	4.6
Winter cereals	27,817	63,722	2.3
Winter oilseeds	670	1,700	2.5
Winter pasture	3,291	6,902	2.1
Not Defined*	-	69,128	-
Total	**80,898**	**487,204**	**-**

*No crop type assigned by customer at time of use

A comparison of crop water use for 2018/19 with previous years is presented in Table 14. Reduced general security allocation dramatically reduced seasonal summer cropping deliveries in 2018/19. As a result, the combined permanent plantings of citrus, vines and other fruits accounted for the highest volume of water deliveries in the MIA, otherwise cotton was the highest user.

Table 14 Total deliveries to major crop types 2018/19 compared to previous years (ML)

Year	Rice	Pasture	Cereal and Oil Seeds	Vegetables	Citrus + Vines + Other Fruits	Other Crops + Plantations	S&D + Towns + Industrial	Cotton
2018/19	37,171	12,753	88,968	10,518	130,716	71,460	22,174	113,443
2017/18	220,423	37,952	123,439	10,940	134,046	76,864	24,123	174,778
2016/17	304,200	26,030	57,479	10,129	109,257	71,376	9,844	82,004
2005/06	355,254	65,878	181,641	27,588	142,025	9,481	48,123	n/a

Note: Cotton was included in 'other crops and plantations' for 2005/06

4.2 Irrigation intensity

Irrigation intensity is displayed in Figure 3 by water use (ML/ha) at a property level. This map identifies locations of landholdings using between 0 and 4 ML/ha, 4 and 4.1-8 ML/ha and above 8.1 ML/ha.

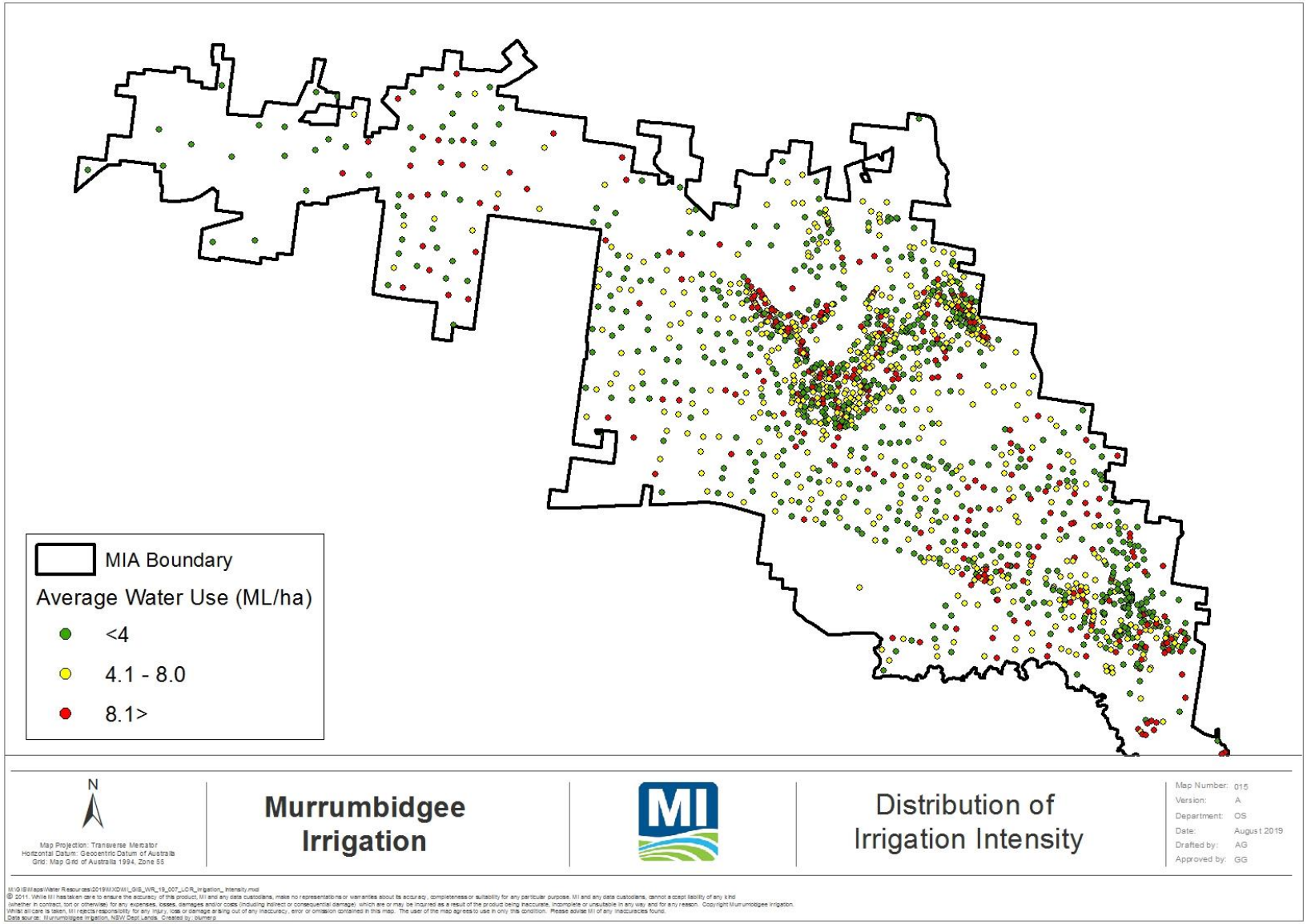


Figure 3 Distribution of irrigation intensity across the MIA

5 Salinity and Salt Load

5.1 Extracted salt load

The monthly mean EC values and extracted salt loads are calculated using electrical conductivity (EC) sensors at MI's two river offtake sites NARREG and Sturt and presented in Table 15.

Table 15 Total extracted salt load for 2018/19

Month	STUR			NARREG		
	Flow (ML)	mean EC (µS/cm)	STUR Salt (t)	Flow (ML)	Mean EC (µS/cm)	NARREG Salt (t)
Jul-18	0	222	0	4,547	159	424
Aug-18	14,306	149	1,083	37,013	125	2,620
Sep-18	15,925	100	965	43,275	81	2,087
Oct-18	16,866	76	717	49,370	67	2,000
Nov-18	5,939	76	291	35,179	76	1,591
Dec-18	19,580	83	1,022	80,876	76	3,836
Jan-19	26,652	84	1,306	100,853	81	4,861
Feb-19	10,618	161	1,001	53,581	152	4,846
Mar-19	6,822	123	547	39,046	104	2,462
Apr-19	755	116	20	17,797	182	1,748
May-19	0	173	0	4,303	214	678
Jun-19	0	201	0	3,429	207	415
Total	**117,483**	**-**	**6,952**	**469,269**	**-**	**27,570**

Table 16 presents the total extracted salt loads for 2018/19 and previous years. During 2018/19, an estimated 34,522 tonnes of salt was imported into MI's area of operation from the Murrumbidgee River. Generally, the amount of salt is relative to the volume of water diverted from the river, which is evident for all reporting years.

Table 16 Extracted salt-load (t) for 2018/19 compared to previous years

Year	Diversions (ML)	Extracted salt load (t)		
		STUR	NARREG	Total
2018/19	586,752	6,952	27,570	34,522
2017/18	945,805	14,920	50,030	64,950
2016/17	780,083	11,722	32,903	44,625
2007/08	393,973	1,778	26,816	28,594

5.2 Discharged salt load

There are five discharge monitoring points that can discharge water out of MI's area of operation. The locations of these sites are shown in Figure 2 of this report. Flow, EC and salt load data for these sites is presented in Table 18 and totals from previous years are compared in Table 17.

An estimated 98 tonnes was discharged from MI's Area of Operation through the five discharge monitoring points in 2018/19.

Table 17 Discharged salt load 2018/19 compared to previous years

Year	Water discharged (ML)	Discharged Salt load (t)
2018/19	642	98
2017/18	4,471	854
2016/17	122,092	34,230
2005/06	8,570	1,887

Table 18 Monthly summary of flow, EC and salt loads at monitoring points for 2018/19

Month	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)
	Yanco Main Southern Escape (YMS) 410083					Gooragool Lagoon Escape (LAG) 41010940				
Jul-18	102	985.8	985.8	985.8	38.6	16.8	403.0	234.0	572.0	3.0
Aug-18	-	-	-	-	-	19.5	299.0	68.0	418.0	3.0
Sep-18	-	-	-	-	-	11.9	251.0	204.0	332.0	2.0
Oct-18	0.3	192.7	192.7	192.7	0.0	24.1	247.0	154.0	660.0	4.0
Nov-18	-	-	-	-	-	5.9	292.0	8.0	345.0	1.0
Dec-18	-	-	-	-	-	28.3	375.0	242.0	449.0	6.0
Jan-19	-	-	-	-	-	4.6	386.0	258.0	528.0	1.0
Feb-19	-	-	-	-	-	0.0	-	-	-	0.0
Mar-19	-	-	-	-	-	0.0	-	-	-	0.0
Apr-19	-	-	-	-	-	0.0	-	-	-	0.0
May-19	-	-	-	-	-	7.5	211.0	6.0	262.0	1.0
Jun-19	-	-	-	-	-	0.0	-	-	-	0.0
Total	**102.3**				**38.6**	**118.6**				**21.0**
	Gogeldrie Main Southern Escape (GMSRR) 41010921					Cudgel Creek Escape (ROCUDG) 41010005				
Jul-18	104.6	121.0	71.0	170.0	8.0	16.6	139.0	114.0	179.0	1.0
Aug-18	67.5	175.0	0.0	216.0	7.0	66.1	141.0	115.0	173.0	5.0
Sep-18	0.0	-	-	-	-	7.6	167.0	131.0	205.0	1.0
Oct-18	0.0	-	-	-	-	6.9	142.0	109.0	218.0	1.0
Nov-18	0.0	-	-	-	-	0.0	-	-	-	0.0
Dec-18	0.0	-	-	-	-	0.0	-	-	-	0.0
Jan-19	0.0	-	-	-	-	1.8	241.0	215.0	281.0	0.0
Feb-19	0.0	-	-	-	-	0.2	232.0	200.0	262.0	0.0
Mar-19	0.0	-	-	-	-	0.0	-	-	-	0.0
Apr-19	0.0	-	-	-	-	0.0	-	-	-	0.0
May-19	0.0	-	-	-	-	0.0	-	-	-	0.0
Jun-19	0.0	-	-	-	-	0.0	-	-	-	0.0
Total	**172.1**				**15.0**	**99.20**				**8.0**
	Mirrool Creek Floodway (MIRFLD) 41010163									
Jul-18	150	163.8	163.8	163.8	15.7					
Total	**150**				**15.7**					

5.3 Salt load summary

The salt loads presented in Table 19 show that of the 34,522 tonnes of salt received through diversions recorded at MI's authorised supply works (NARREG and STURT), 98 tonnes was discharged from the Area of Operations and an estimated 34,424 tonnes was retained within the MIA. It is important to note that this is a simple annual salt balance that considers salt loads entering and leaving via authorised works and does not consider other factors that impact total salt loads in the MIA.

No additional data is held by MI that is relevant to the assessment of salinity impacts under the Murray Darling Basin Salinity Management Strategy. There are no benchmarks, management plans or strategies relevant to MI's salinity or salt load monitoring data.

Table 19 Salt load summary for 2018/19

Extracted	**Salt load (t)**
STUR	6,952
NARREG	27,570
Total extracted	**34,522**
Discharged	**Salt load (t)**
YMS	39
GMSRR	15
LAG	21
ROCUDG	8
MIRFLD	16
Total discharged	**98**
Retained	**34,424**

6 Groundwater Conditions

6.1 Groundwater Monitoring and Reporting

A total of 641 piezometers are monitored and reported as per Attachment 2 of the Monitoring and Reporting Plan. The locations of these bores are displayed in Figure 4. In September 2018/19, 595 piezometers were monitored, which equates to 93% of the total piezometer network.

Table 20 Groundwater piezometer status summary (September 2018)

Total bores	Total destroyed	Dry, Flooded or Blocked	Total read
641	45	55	596

Groundwater levels and salinity (reported as EC) monitoring occurs in September to give insight into groundwater levels prior to the irrigation season. The network consists of piezometers in the shallow and deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

Depth to water table data is reported for 2018/19, 2017/18, 2016/17 and 2005/2006. The 2005/06 reporting year was chosen for reference as it represents a time period that includes the millennium drought in the MIA. Groundwater salinity is reported for 2018/19, 2017/18, 2016/17, 2002 and 1980. Due to the limited data sets from 2005/06, data from 2002 and 1980 was chosen to represent suitable comparisons for salinity changes from a historical perspective.

The number of piezometers read within depth ranges for September are shown in Table 21.

Table 21 Number and percent of total piezometers read within each depth range

Year	Number <2M of surface	Number 2-4M of surface	Number >4M of surface	% <2M of surface	% 2-4M of surface	% >4M of surface	Total
2018	23	151	367	4%	28%	68%	541
2017	65	163	339	11%	29%	60%	567
2016	78	123	363	14%	22%	64%	564
2005	55	225	342	9%	36%	55%	622

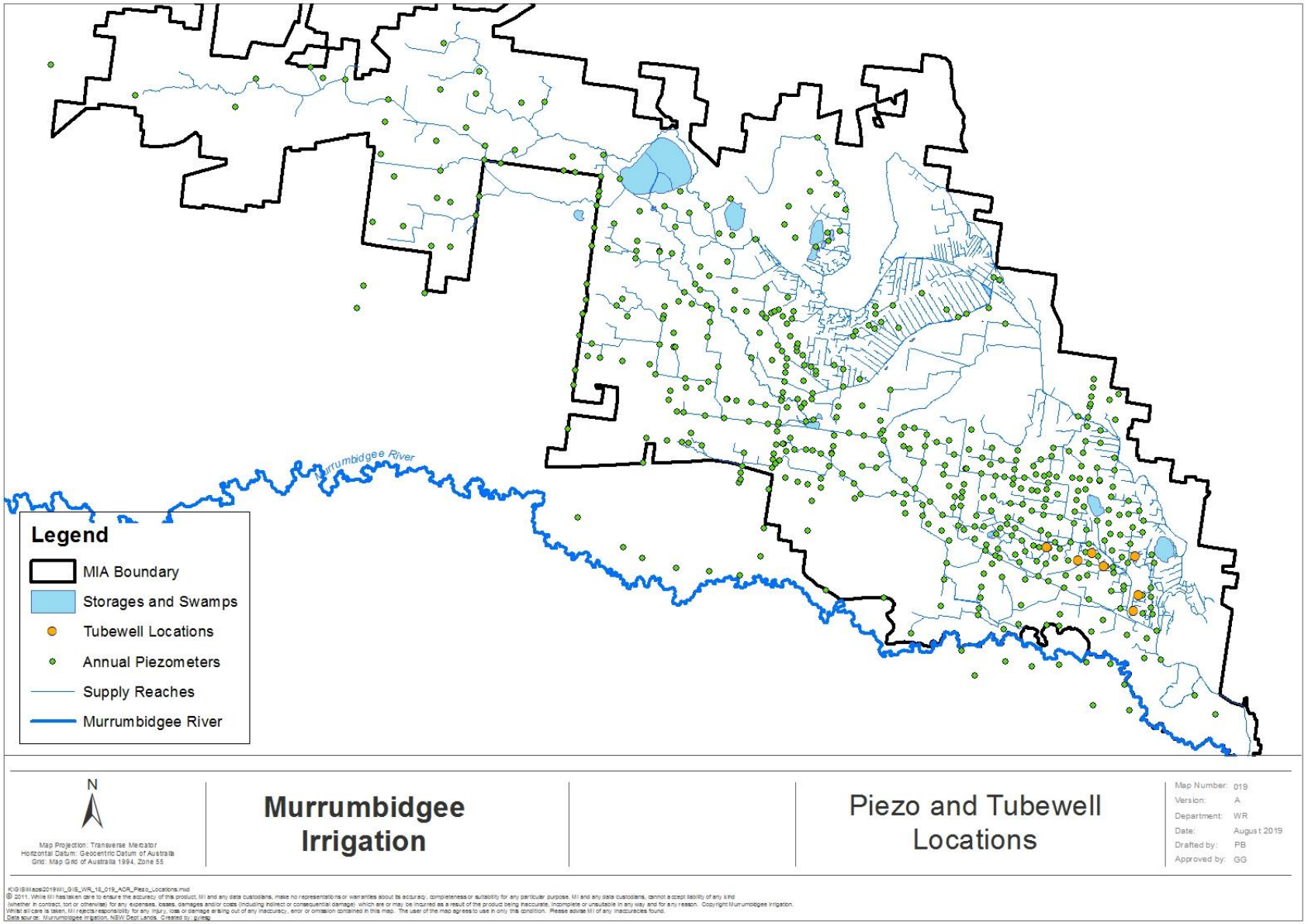


Figure 4 **Location of piezometers and tubewells in the MIA 2018/19**

6.2 Groundwater salinity

The number of piezometers read within salinity ranges for September is shown in Table 22 and the percentage of total piezometers measured within each range is presented in Table 23. The data identifies similar groundwater salinity trends throughout years reported for the Shallow Shepparton, Deep Shepparton and Calivil formations, including benchmark year 1980.

Table 22 Number of piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2018	481	49	11	0	0	0	0	541
2017	287	157	85	34	4	0	0	567
2016	247	126	86	57	19	5	1	541
1980	250	211	180	152	47	2	1	843

Table 23 Percentage of total piezometers read within each salinity range

Year	0-2000 (µS/cm)	2001-5000 (µS/cm)	5001-10000 (µS/cm)	10001-20000 (µS/cm)	20001-30000 (µS/cm)	30001-40000 (µS/cm)	>40000 (µS/cm)	Total
2018	89%	9%	2%	0%	0%	0%	0%	541
2017	51%	28%	15%	6%	1%	0%	0%	567
2016	46%	23%	16%	11%	4%	1%	0%	541
1980	30%	25%	21%	18%	6%	0%	0%	843

6.3 Shallow Shepparton Formation

September 2018 depth to water table and salinity maps for piezometers in the shallow Shepparton Formation are presented in Figures 5 to 10. Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall, geology and irrigation. Ongoing drought conditions have resulted in groundwater levels in the Shallow Shepparton formation deeper in comparison with the previous years. This relates to well below average rainfall and associated reduced recharge, along with reduced allocations and water availability.

General salinity changes in the Shallow Shepparton Formation show progressive decreases in EC values across the MIA from the benchmark year 1980.

When compared to 2005/06 (Figure 17 and 18), recent groundwater levels appear to be deeper across the MIA, with fewer piezometers within 2m from surface level. An indication of the severity and influence of the ongoing drought conditions.

2018/19

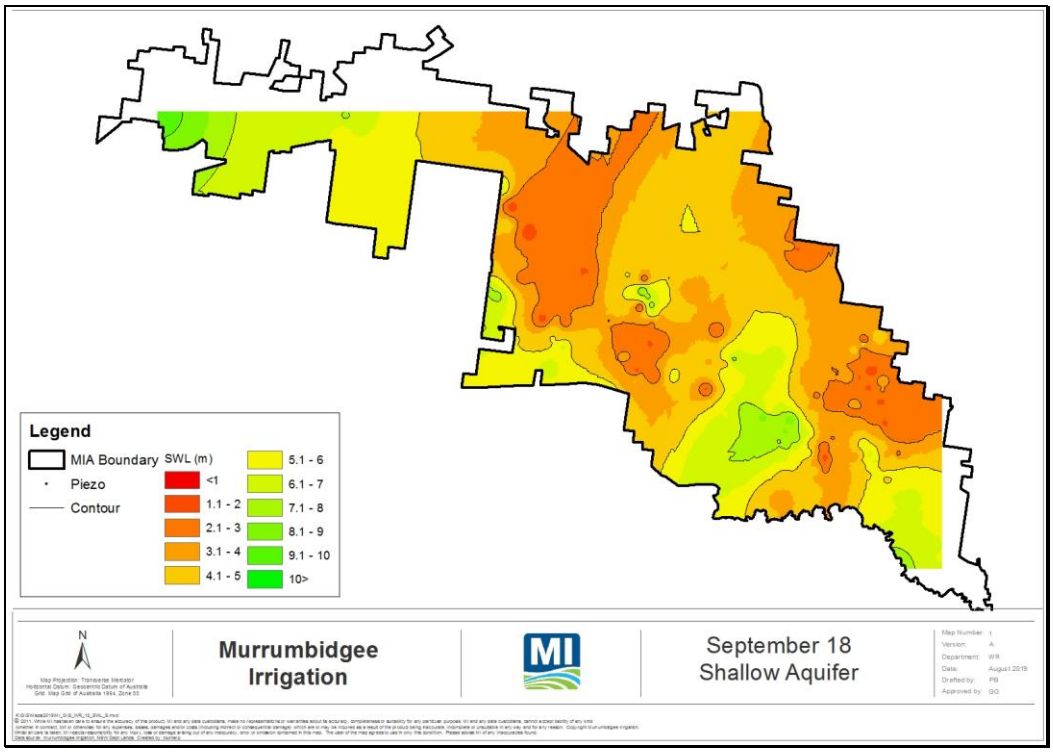


Figure 5 Shallow Shepparton Formation- depth to water table, Sep 2018

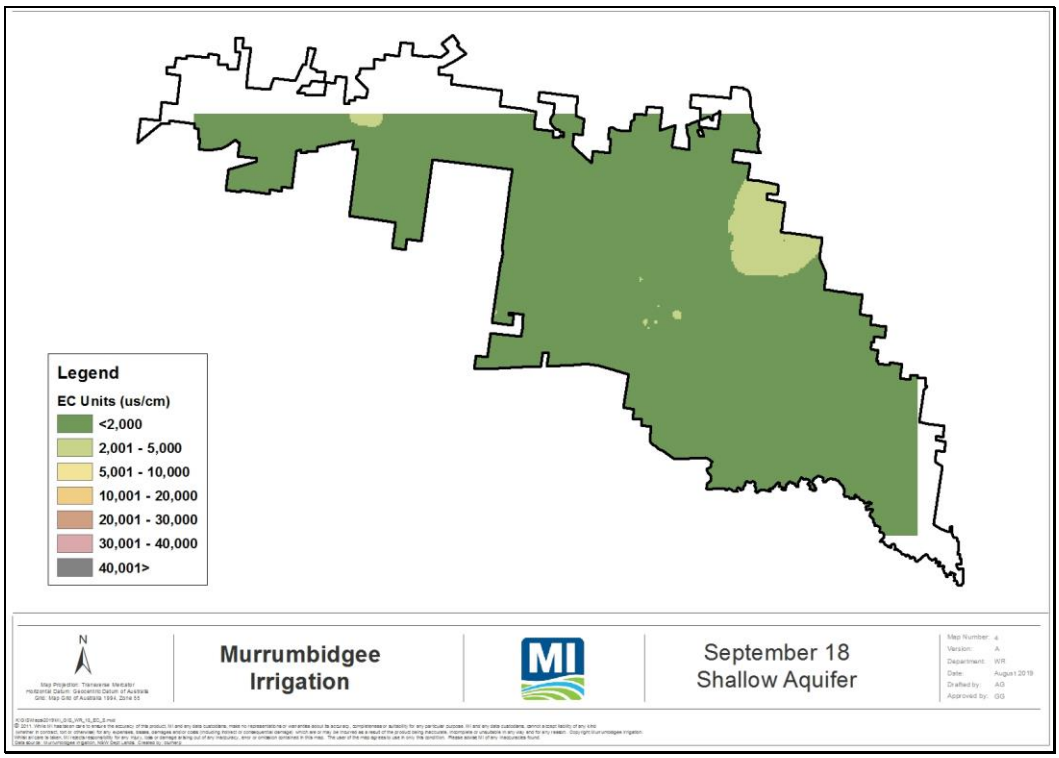


Figure 6 Shallow Shepparton Formation- Groundwater Salinity, Sep 2018

2017/18

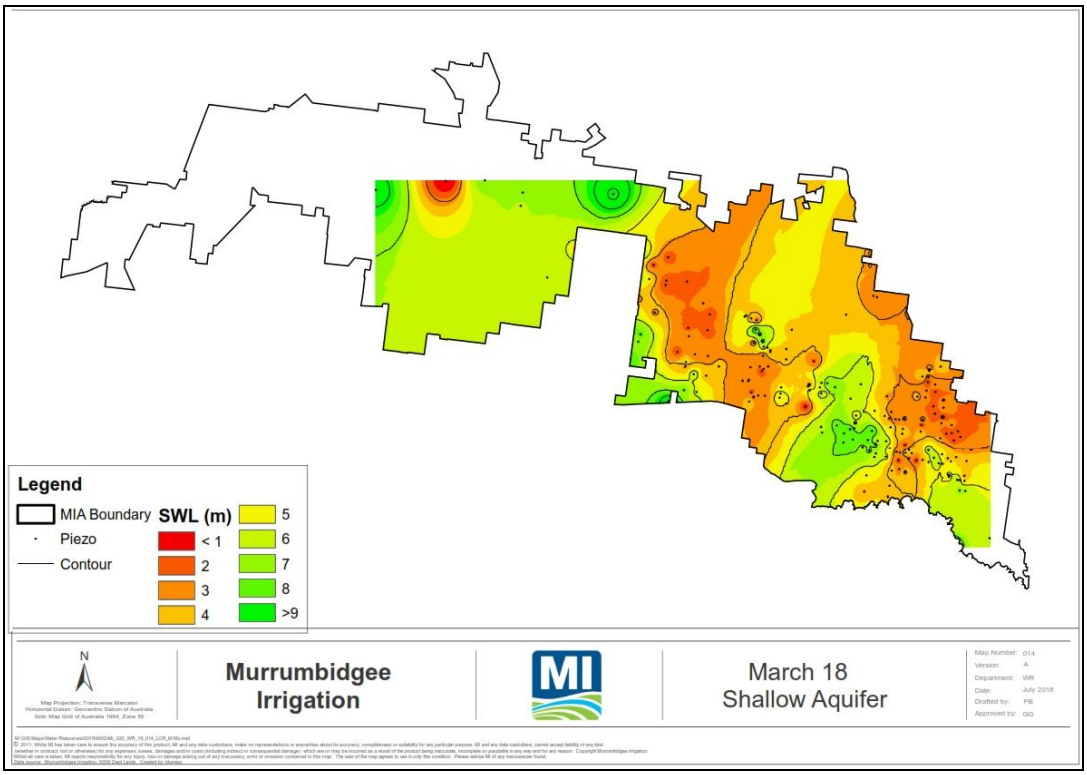


Figure 7 Shallow Shepparton Formation- depth to water table, March 2018

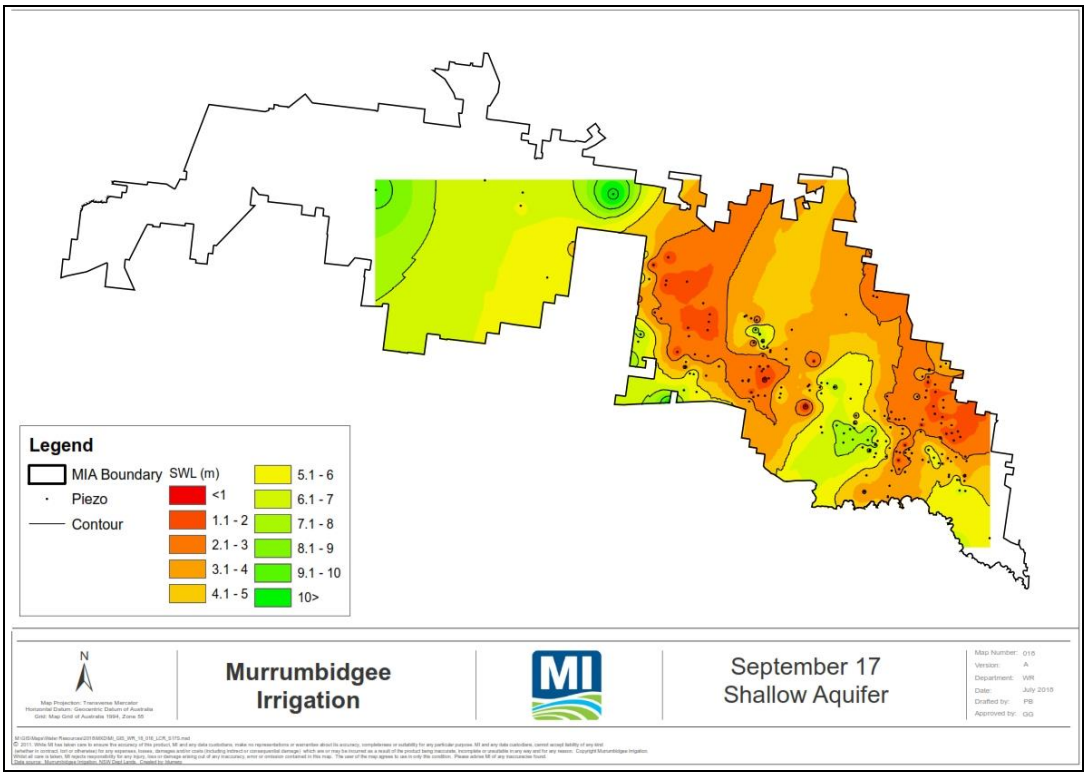


Figure 8 Shallow Shepparton Formation- depth to water table, Sep 2017

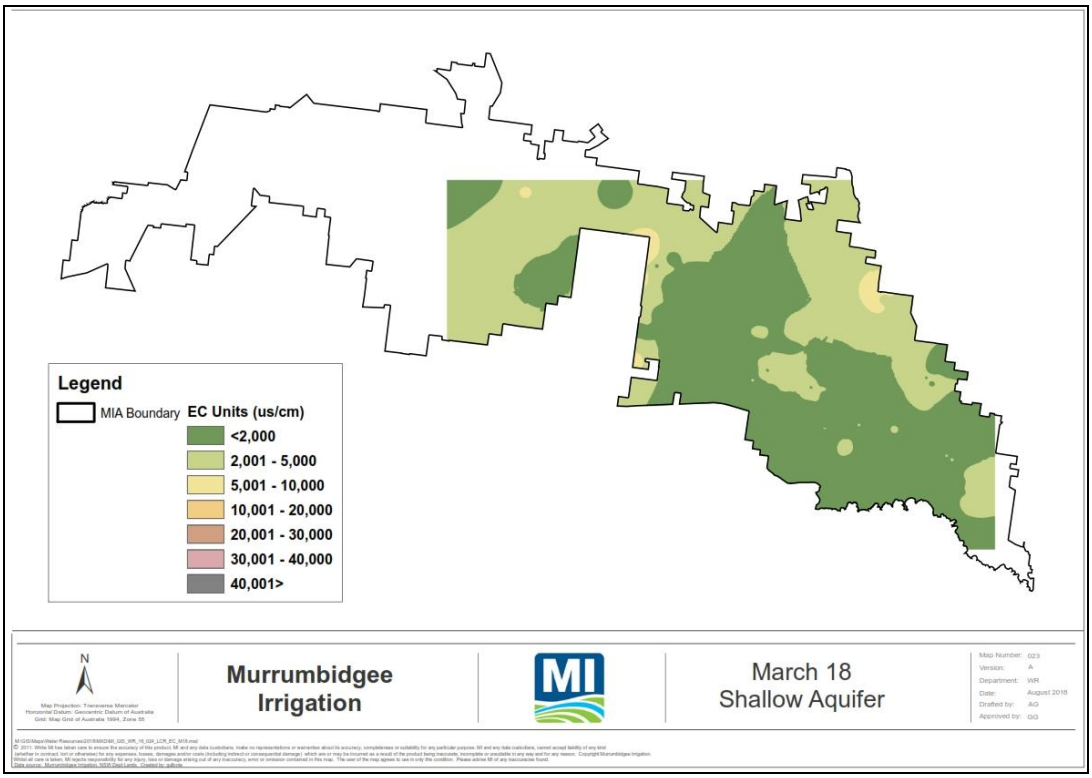


Figure 9 Shallow Shepparton Formation- Groundwater Salinity, March 2018

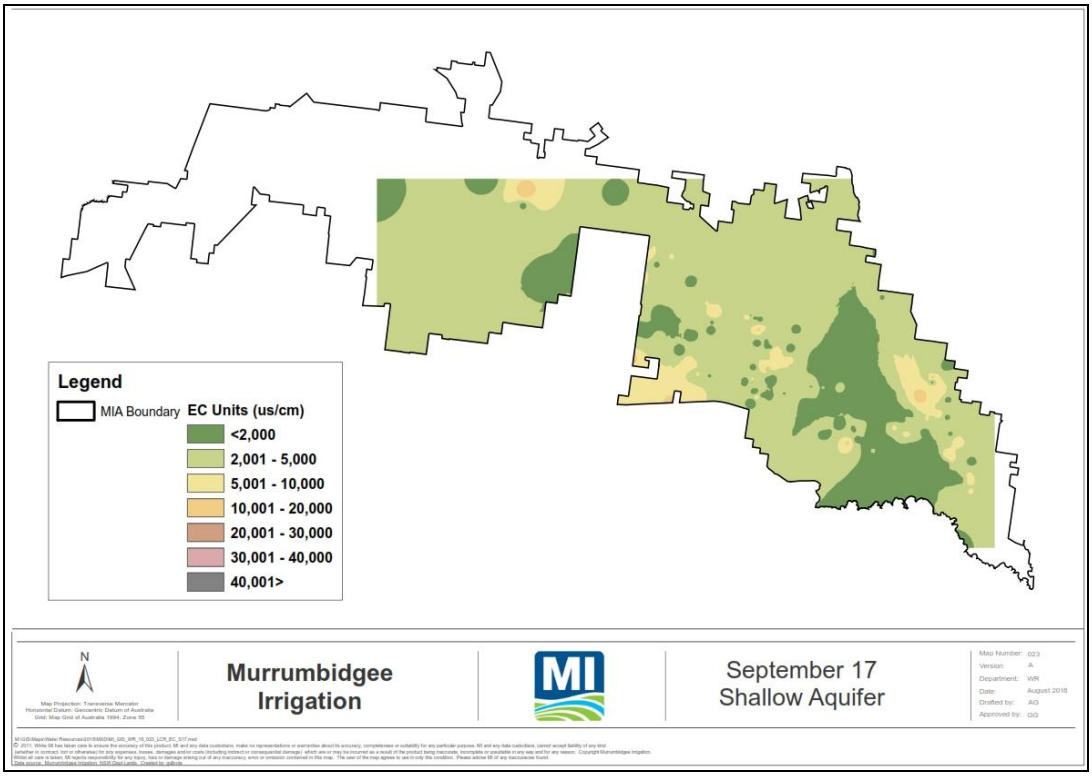


Figure 10 Shallow Shepparton Formation- Groundwater Salinity, Sep 2017

2016/17

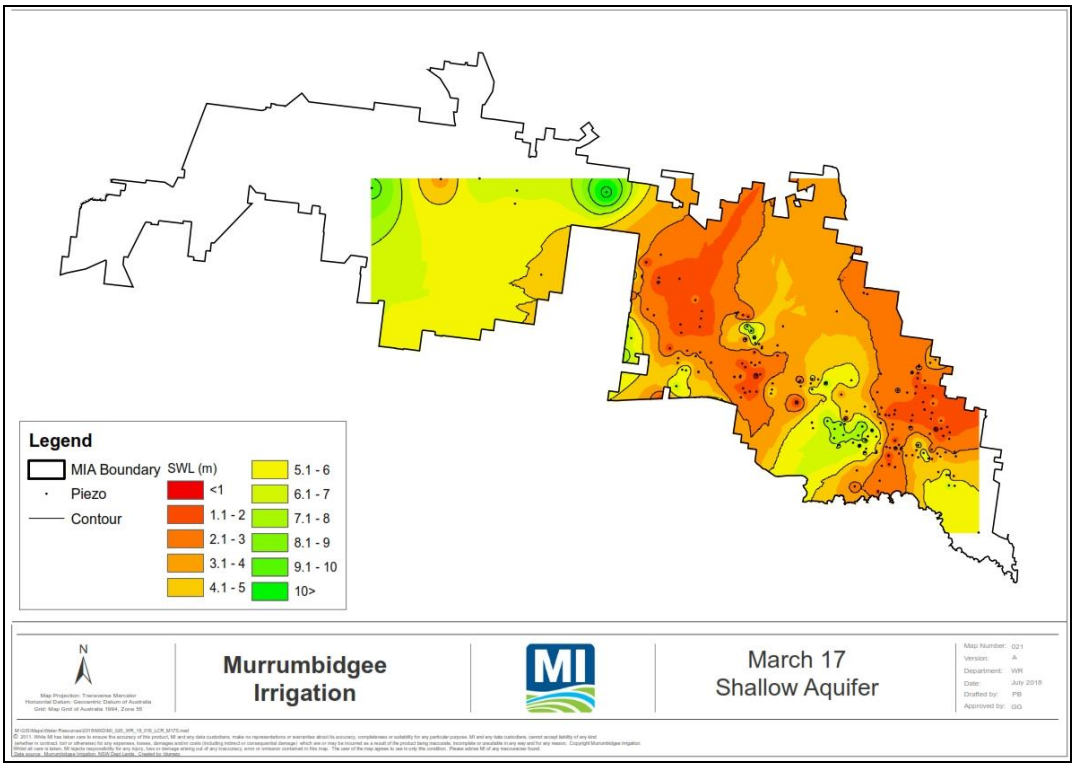


Figure 11 Shallow Shepparton Formation- depth to water table, March 2017

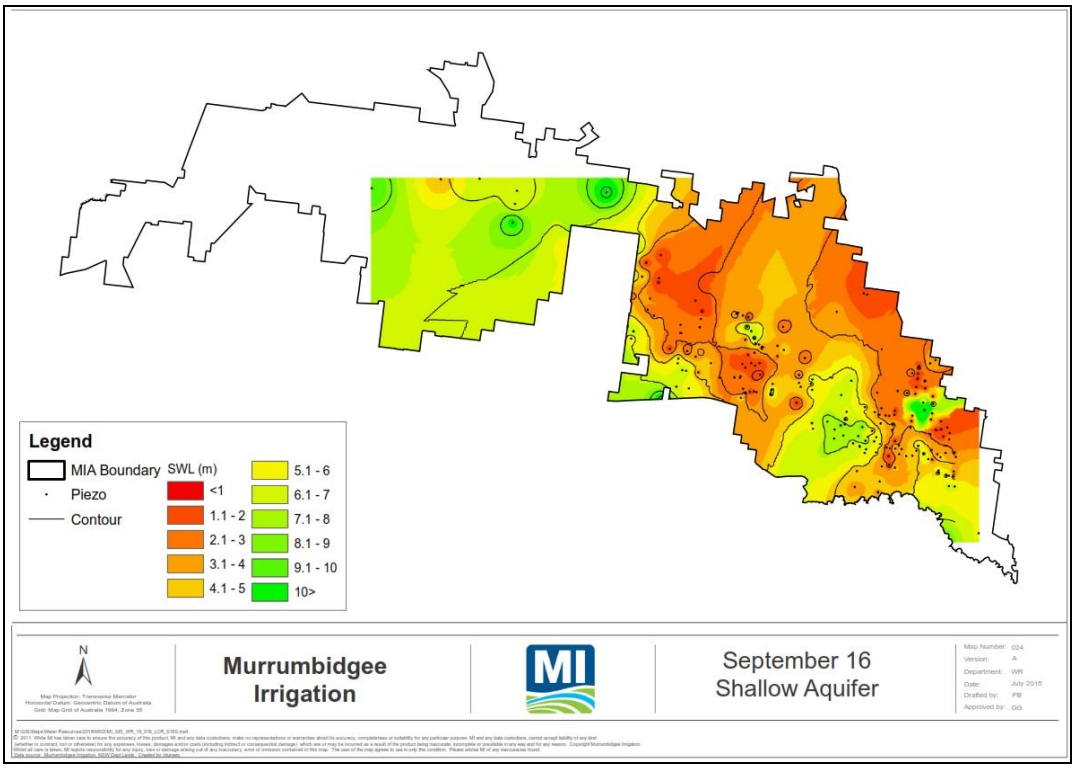


Figure 12 Shallow Shepparton Formation- depth to water table, Sep 2016

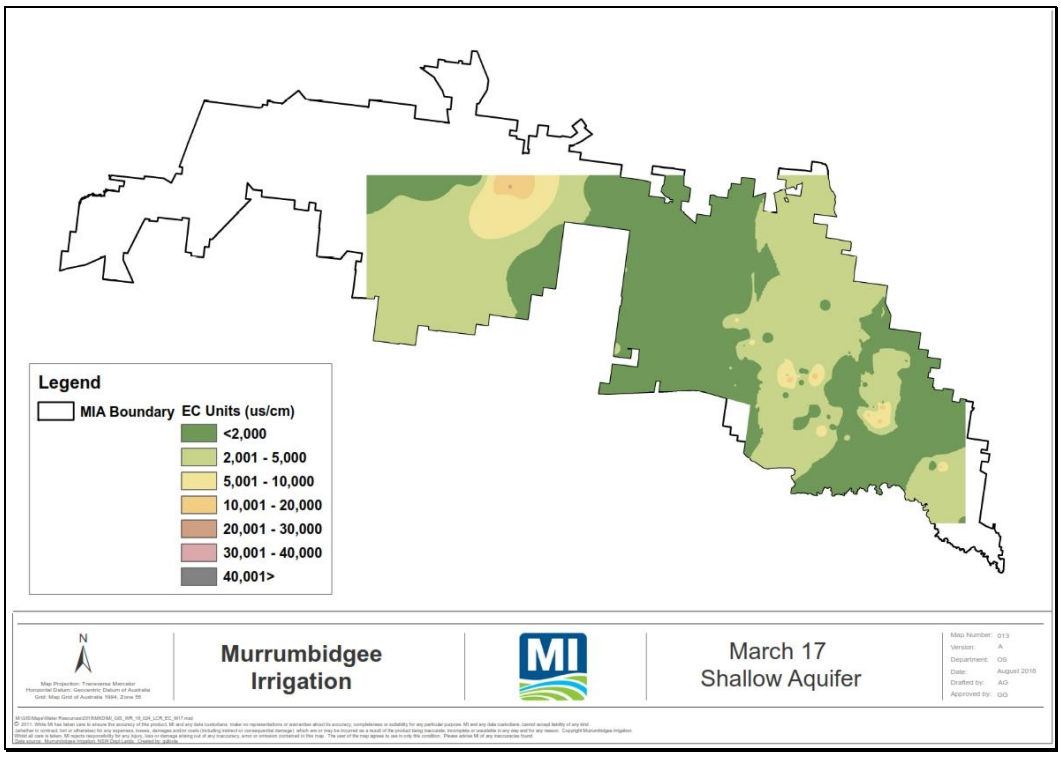


Figure 13 Shallow Shepparton Formation- Groundwater Salinity, March 2017

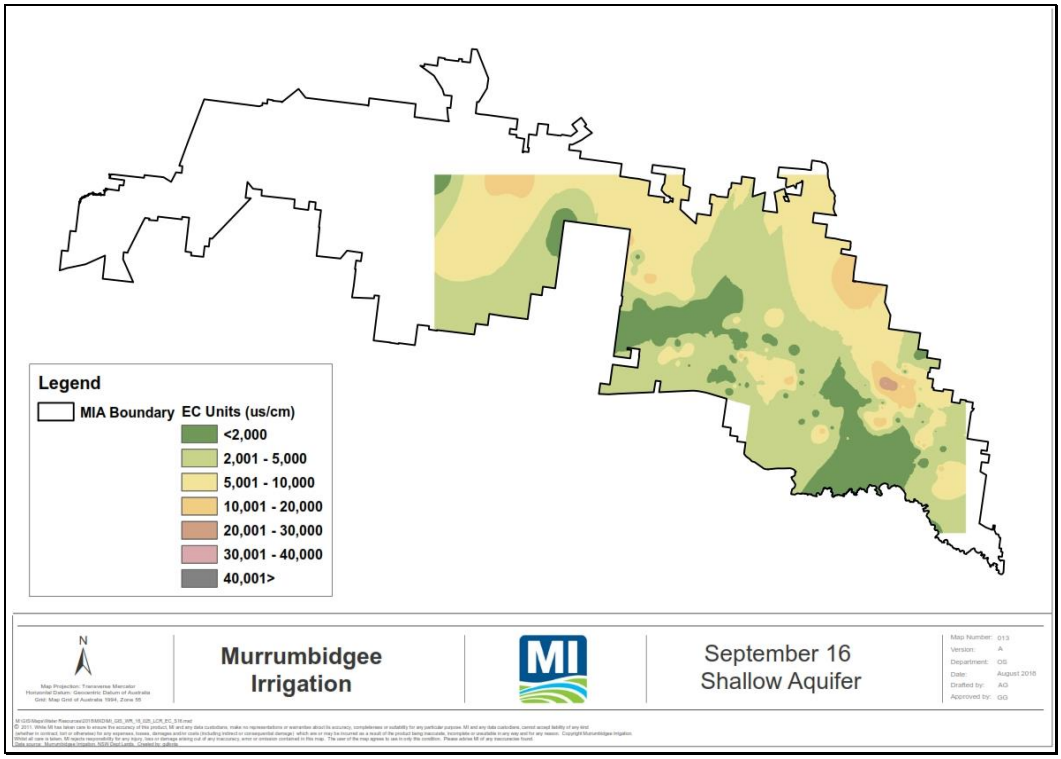


Figure 14 Shallow Shepparton Formation- Groundwater Salinity, Sep 2016

2005/06

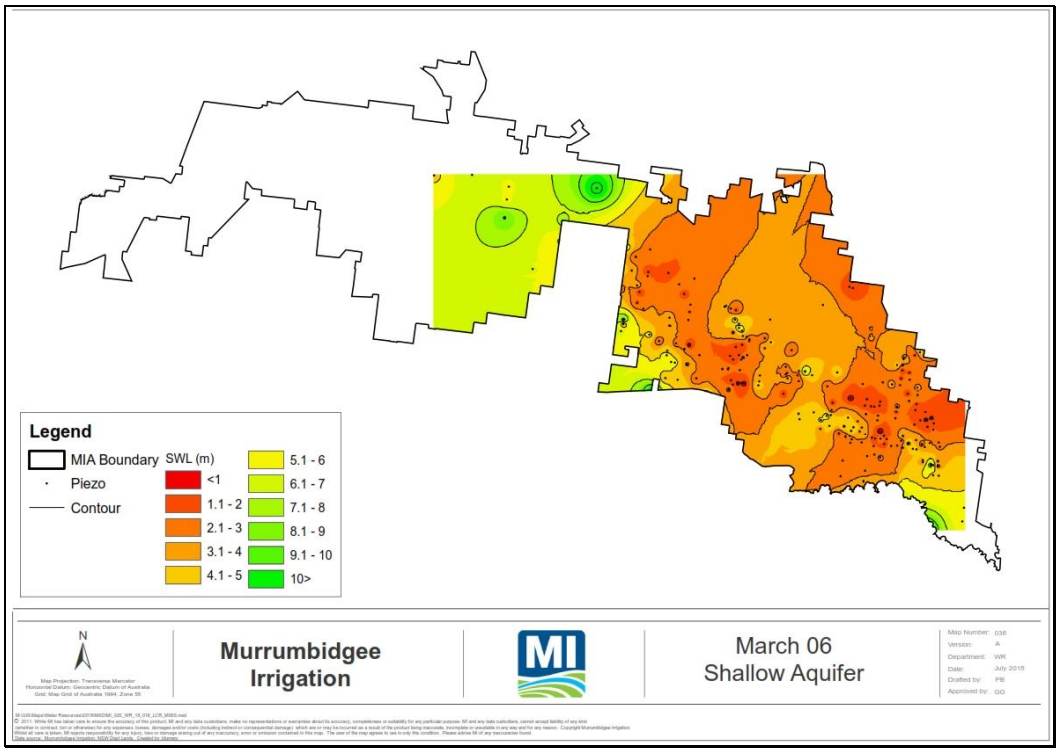


Figure 15 Shallow Shepparton Formation - depth to water table, March 2006

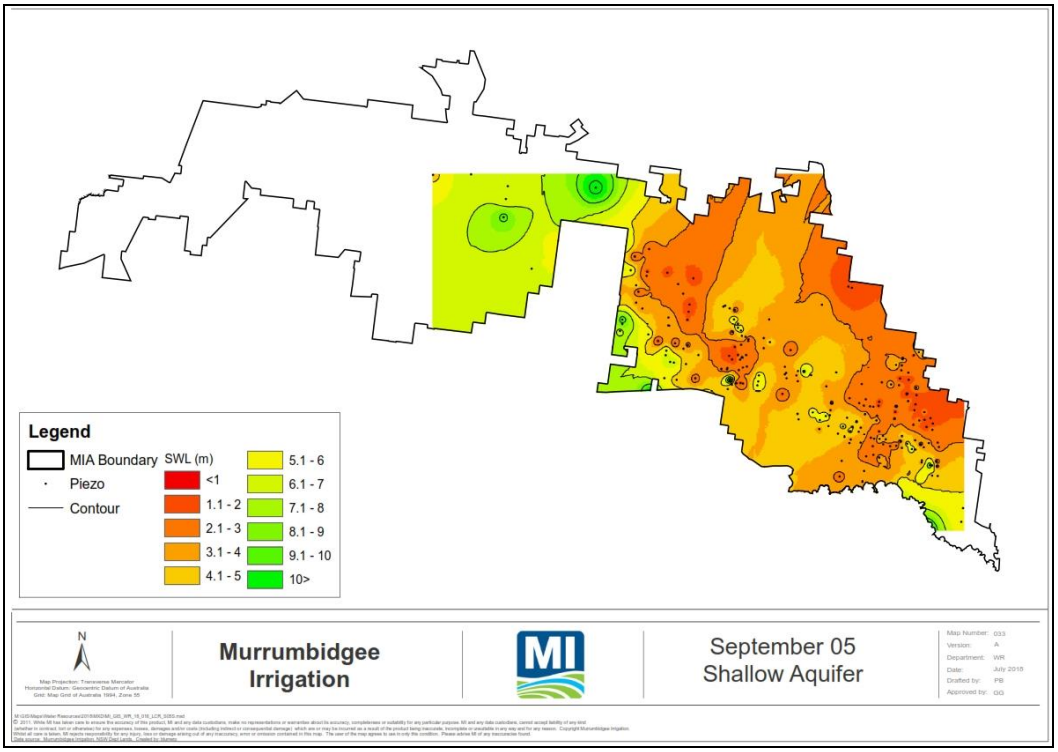


Figure 16 Shallow Shepparton Formation - depth to water table, Sep 2005

1980/2002

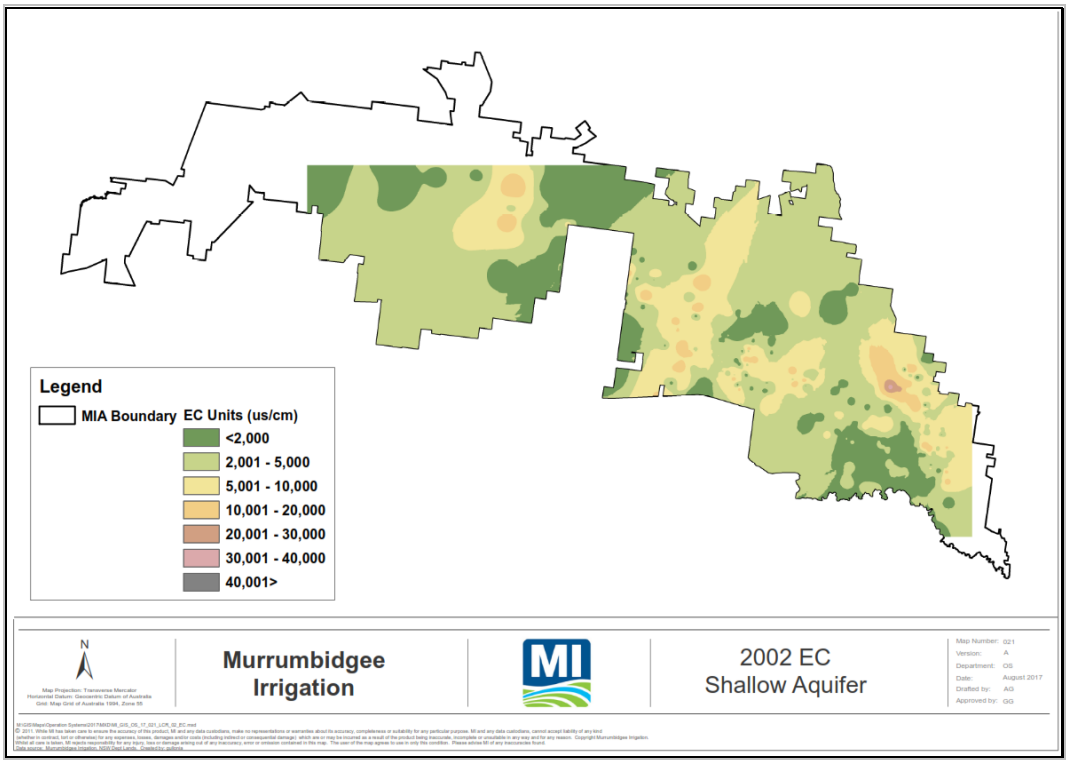


Figure 17 Shallow Shepparton Formation, groundwater salinity, Sep 2002

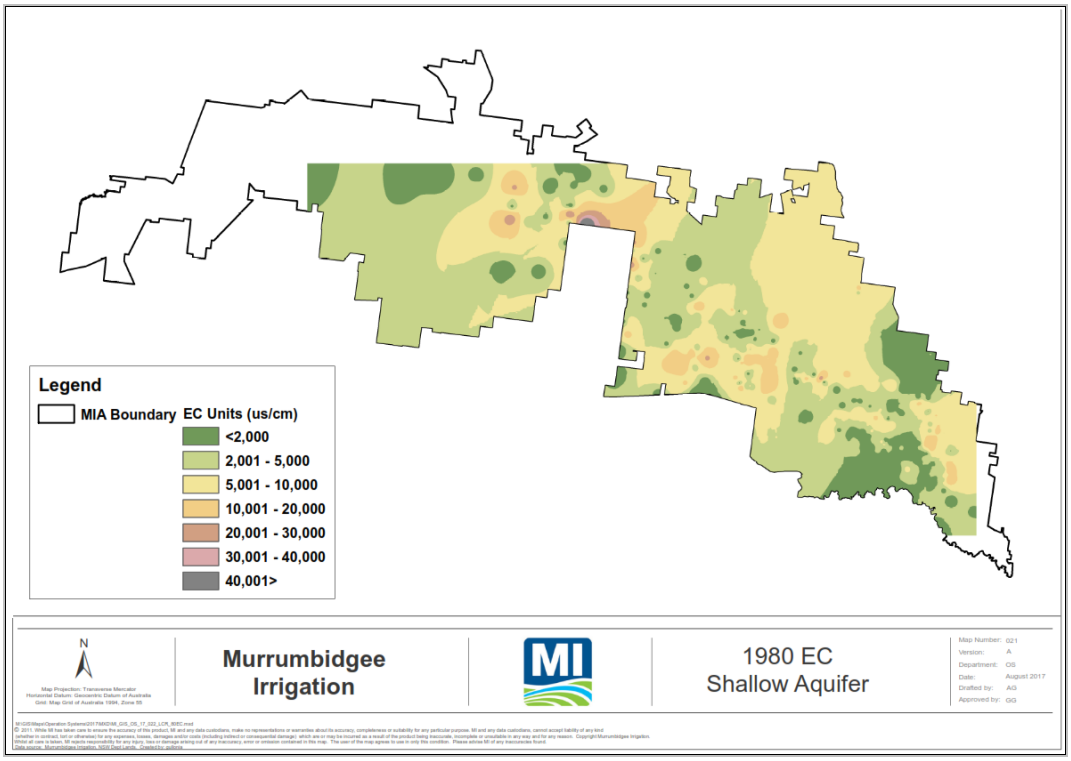


Figure 18 Shallow Shepparton Formation – groundwater salinity, Sep 1980

6.4 Deep Shepparton Formation

Depth to water table and salinity maps for piezometers in the deep Shepparton Formation are presented in Figures 19 to 32. Groundwater levels and salinity trends in the deep Shepparton Formation can be influenced by connectivity with the shallow Shepparton Formation, therefore the trends observed in the shallow Shepparton Formation also evident in the deep Formation.

Groundwater levels and salinity appear to have decreased in the deep Shepparton Formation influenced by the ongoing below average rainfall drought conditions, resulting low allocations and reduced water availability.

2018/19

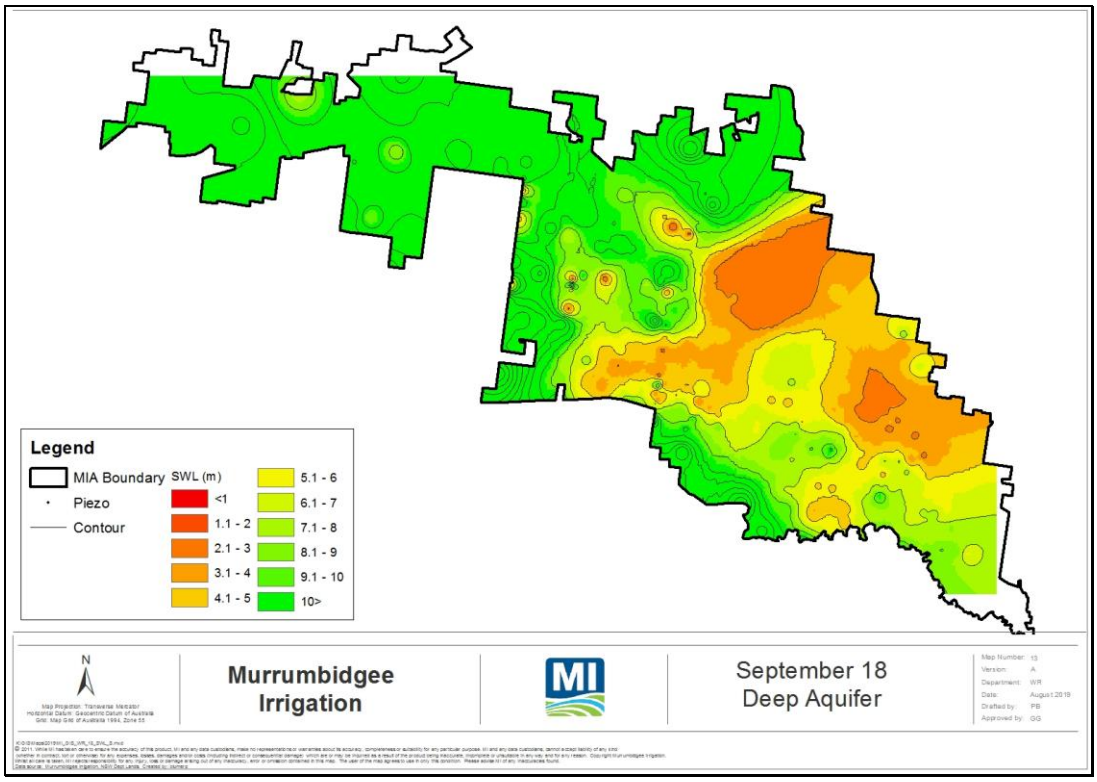


Figure 19 Deep Shepparton Formation- depth to water table, Sept 2018

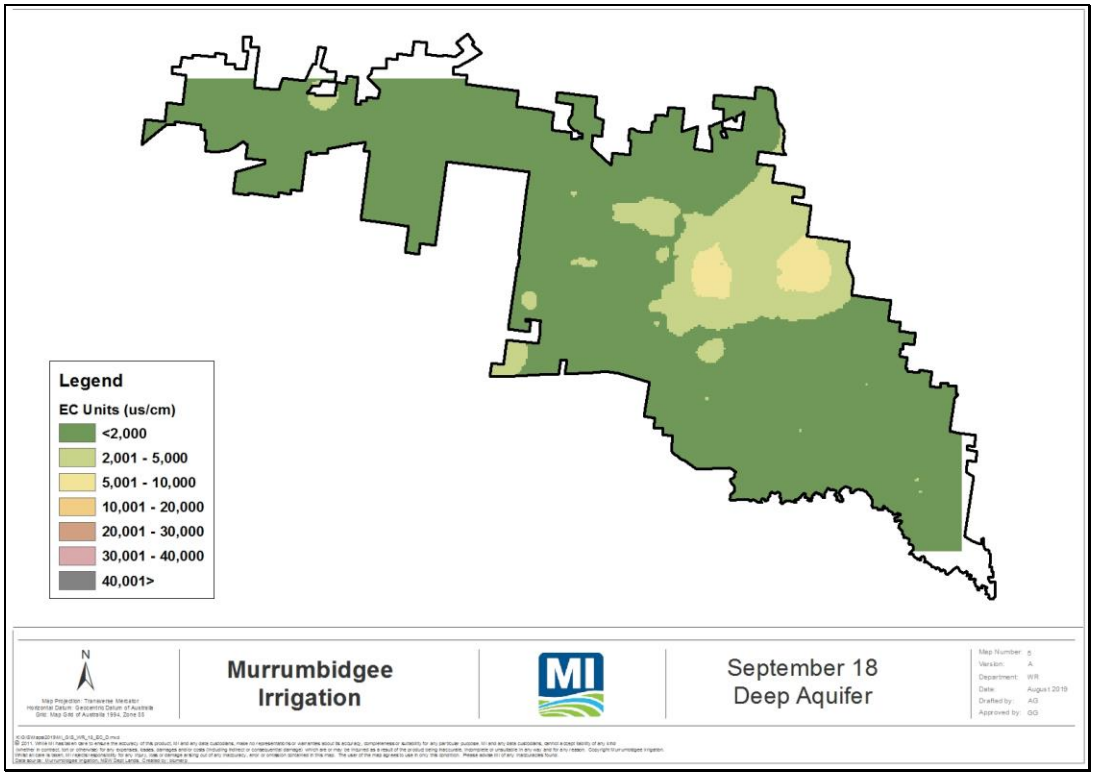


Figure 20 Deep Shepparton Formation- Groundwater Salinity, Sep 2018

2017/18

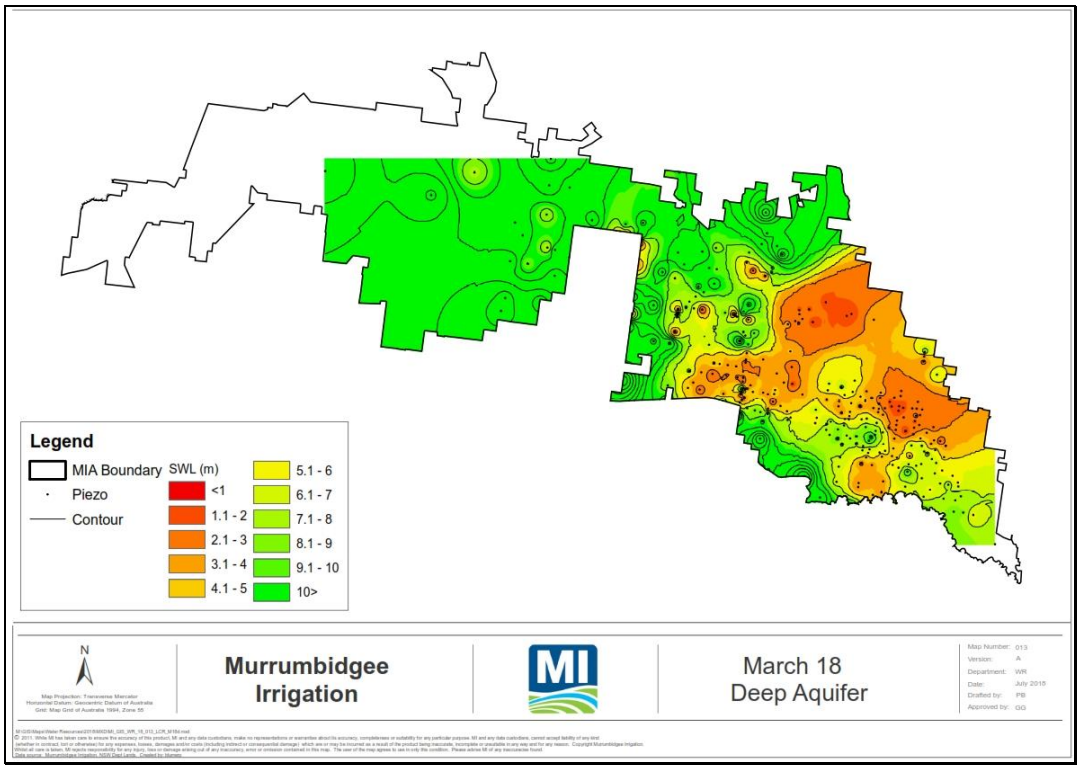


Figure 21 Deep Shepparton Formation- depth to water table, March 2018

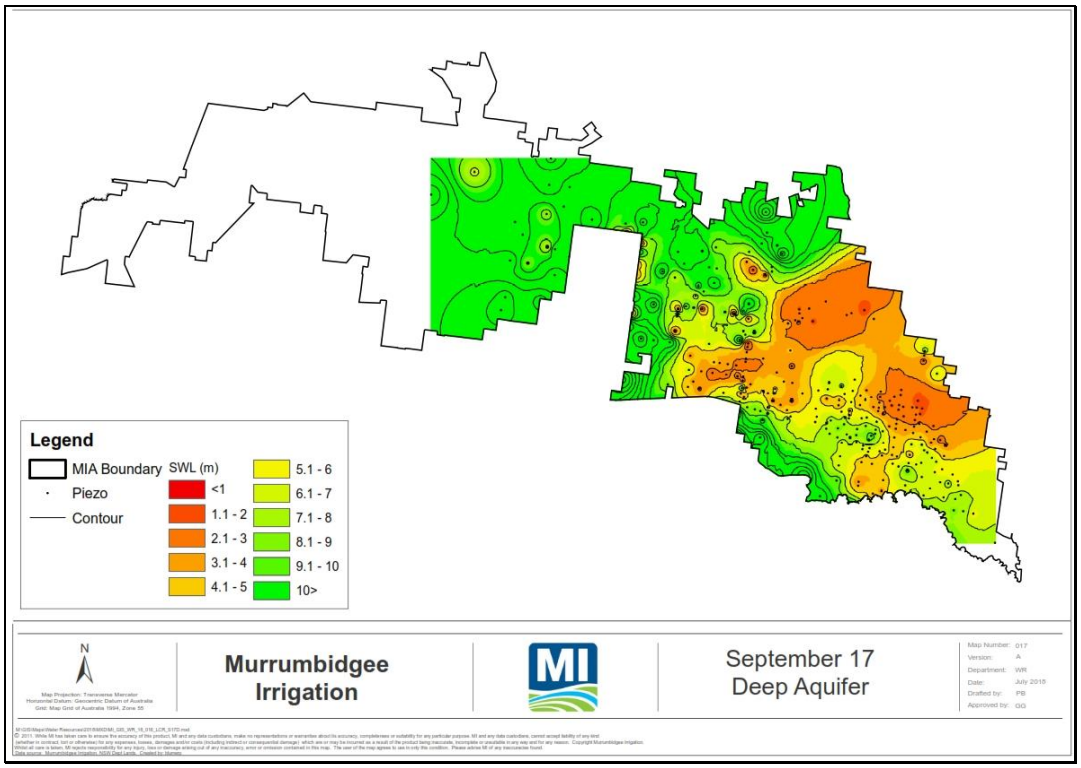


Figure 22 Deep Shepparton Formation- depth to water table, Sep 2017

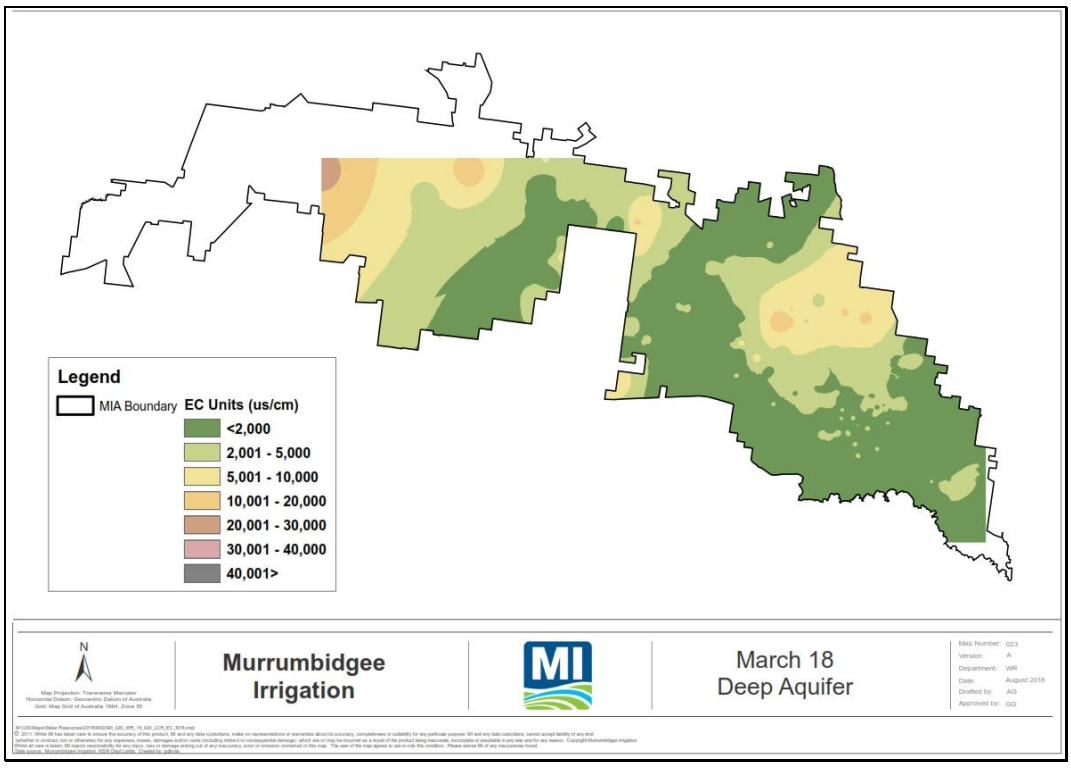


Figure 23 Deep Shepparton Formation- depth to water table, Mar 2018

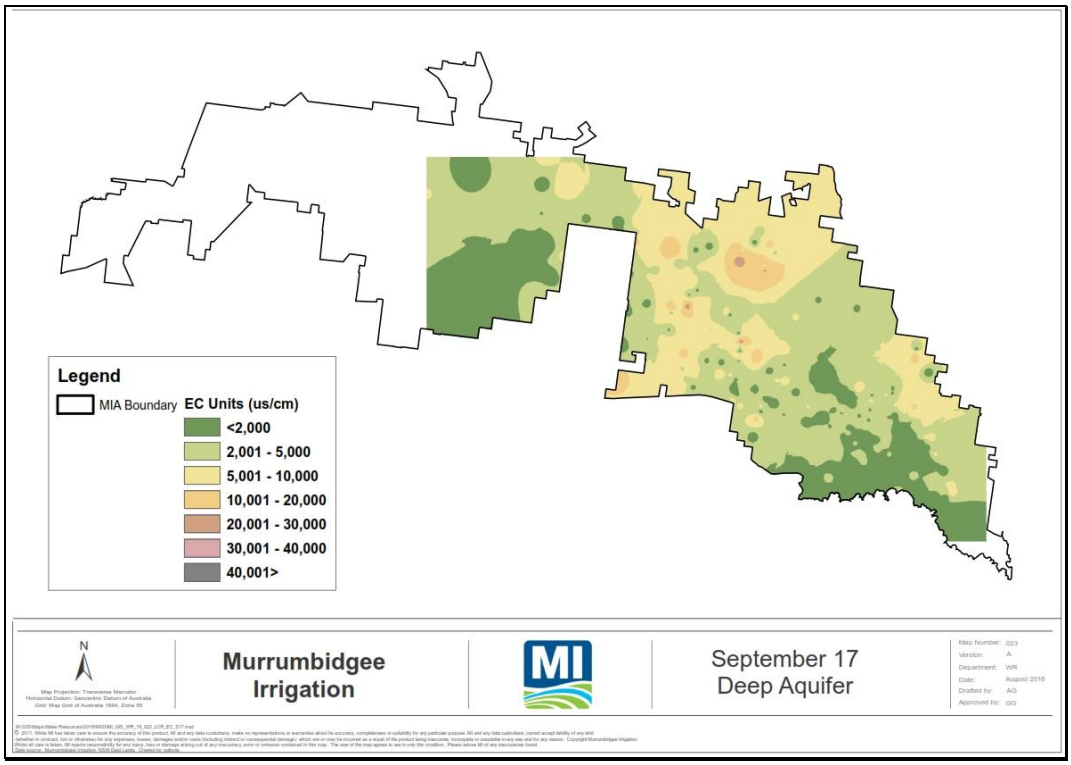


Figure 24 Deep Shepparton Formation- Groundwater Salinity, Sep 2017

2016/17

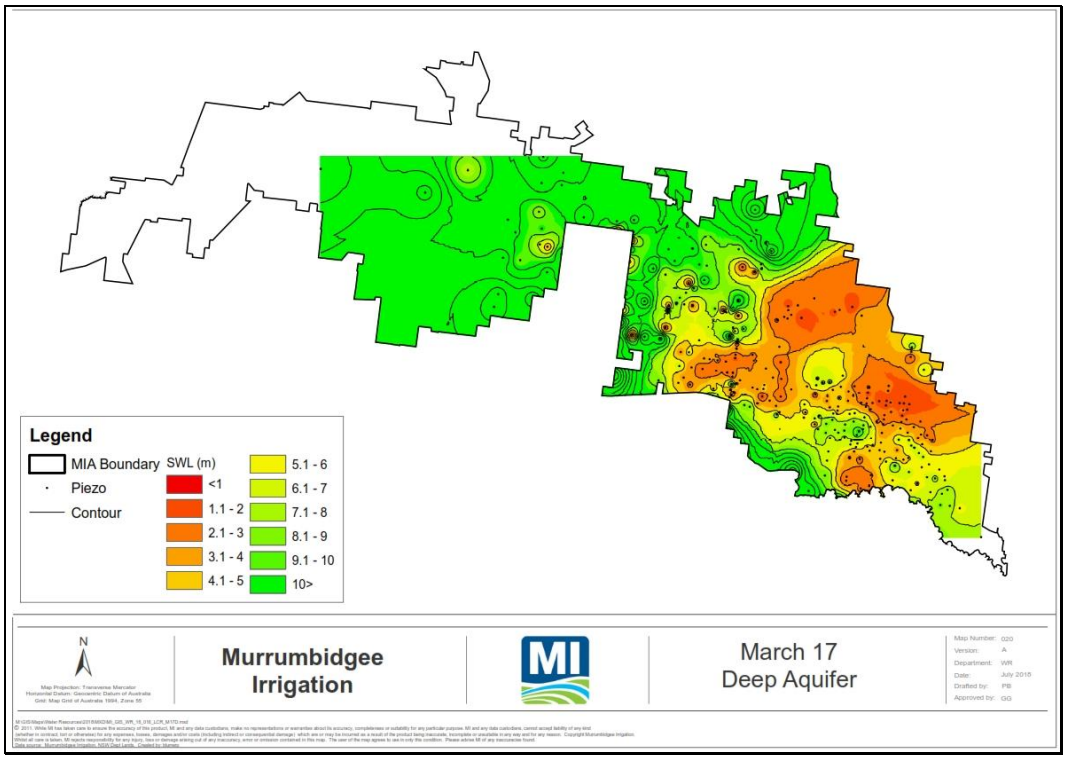


Figure 25 Deep Shepparton Formation- depth to water table, March 2017

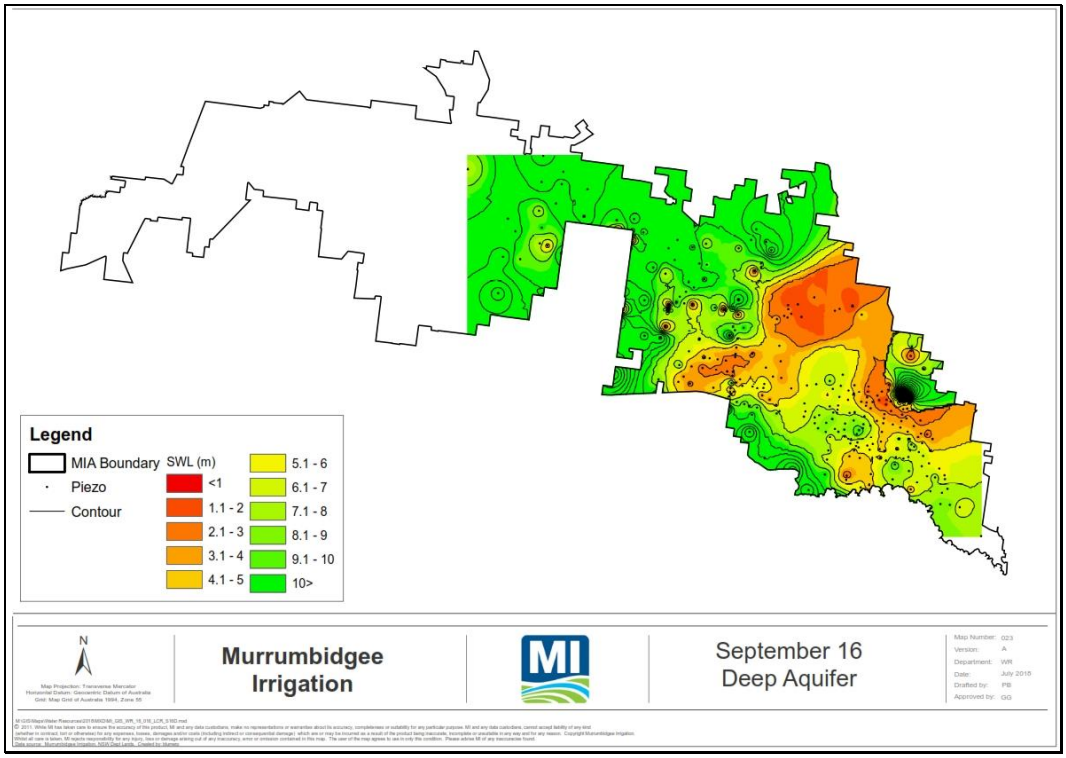


Figure 26 Deep Shepparton Formation- depth to water table, Sep 2016

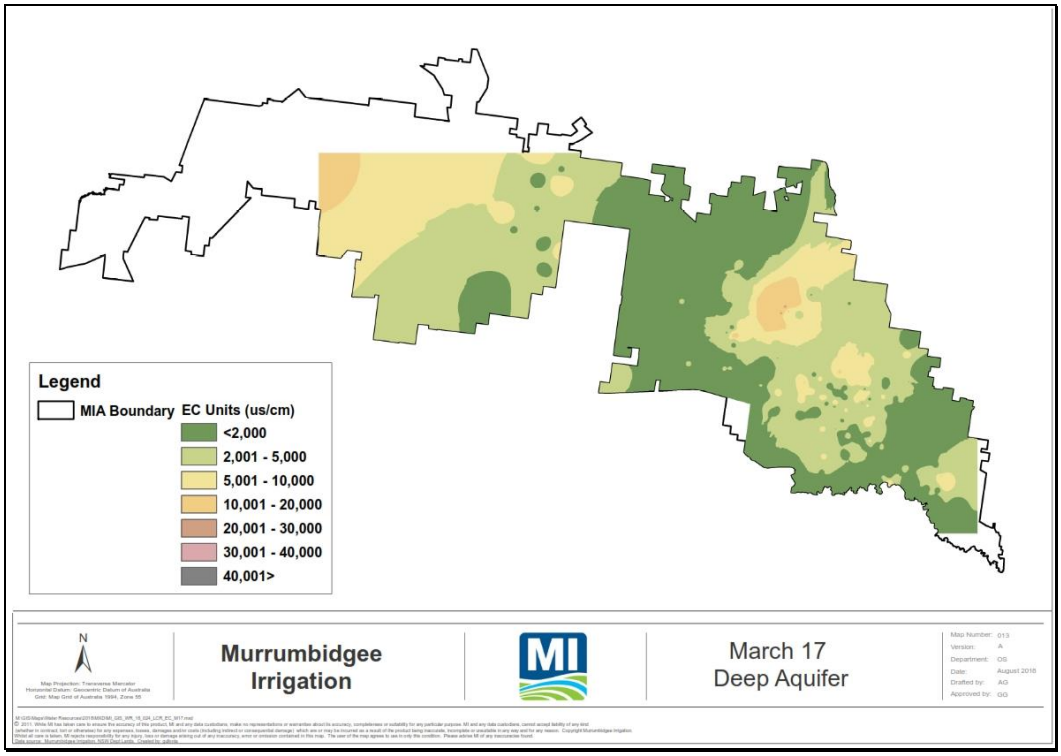


Figure 27 Deep Shepparton Formation- Groundwater Salinity, March 2017

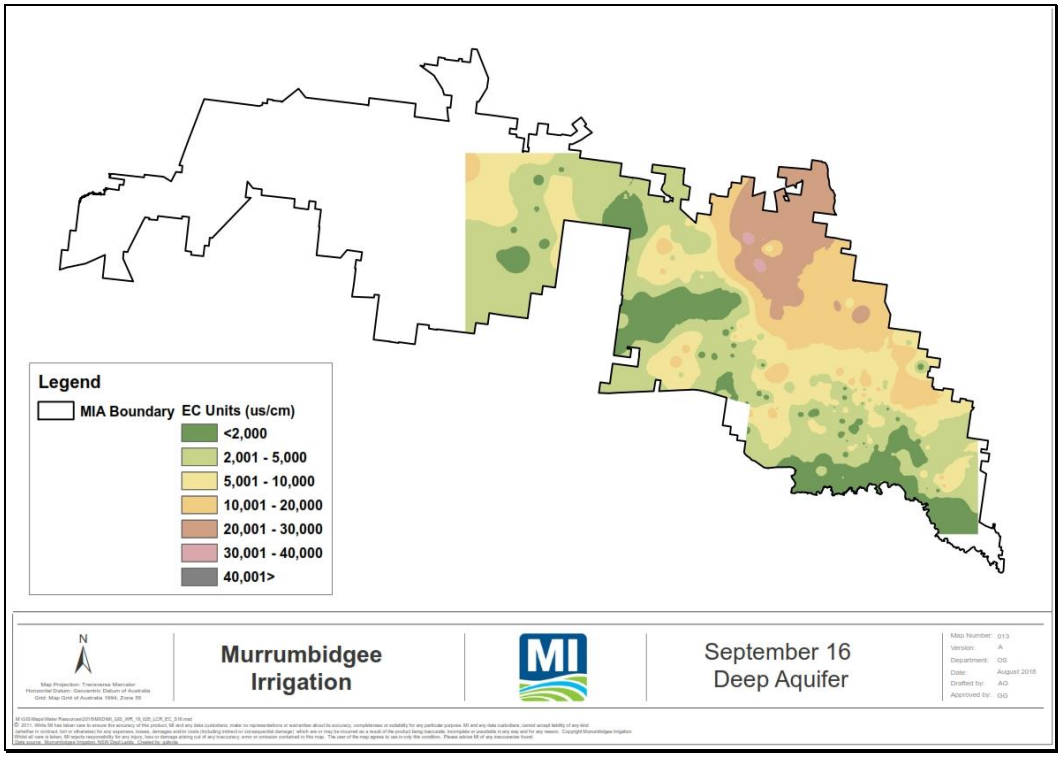


Figure 28 Deep Shepparton Formation- Groundwater Salinity, Sep 2016

2005/06

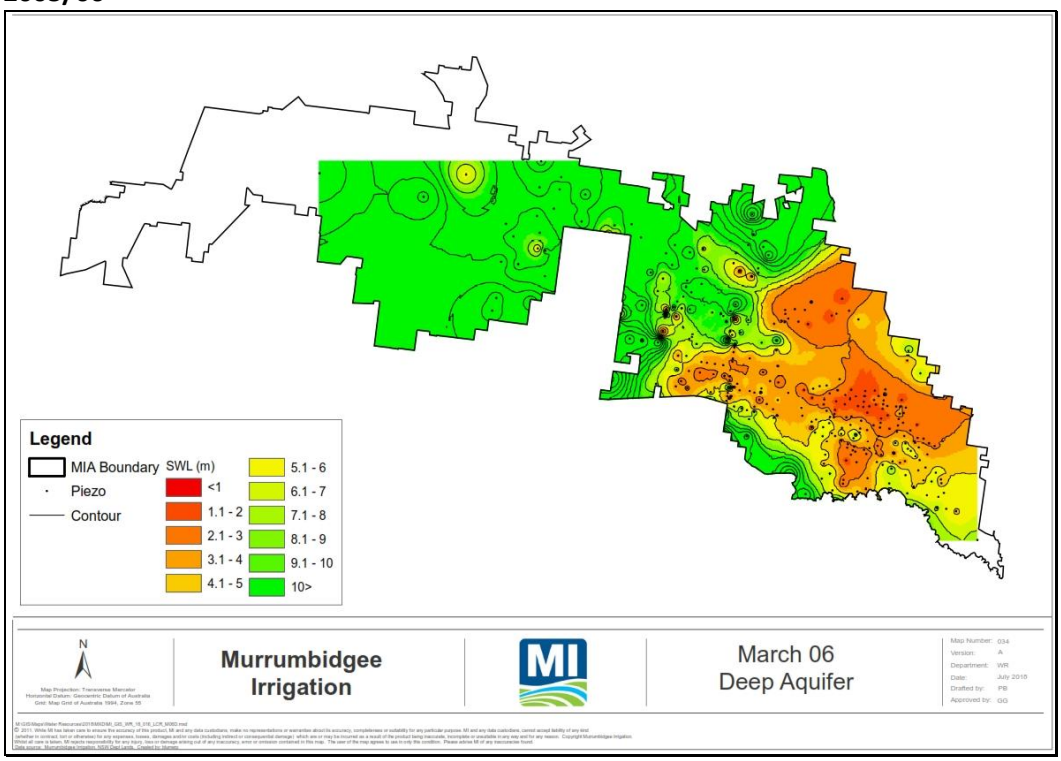


Figure 29 Deep Shepparton Formation – Depth to water table, March 2006

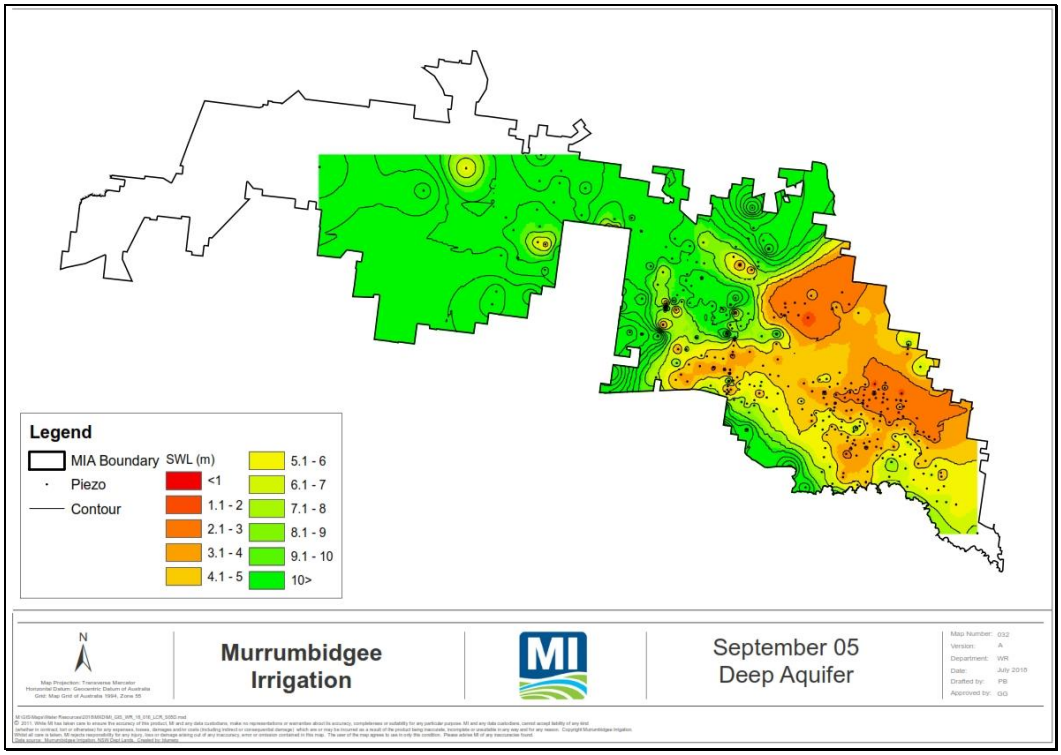


Figure 30 Deep Shepparton Formation – Depth to water table, September 2005

1980/2002

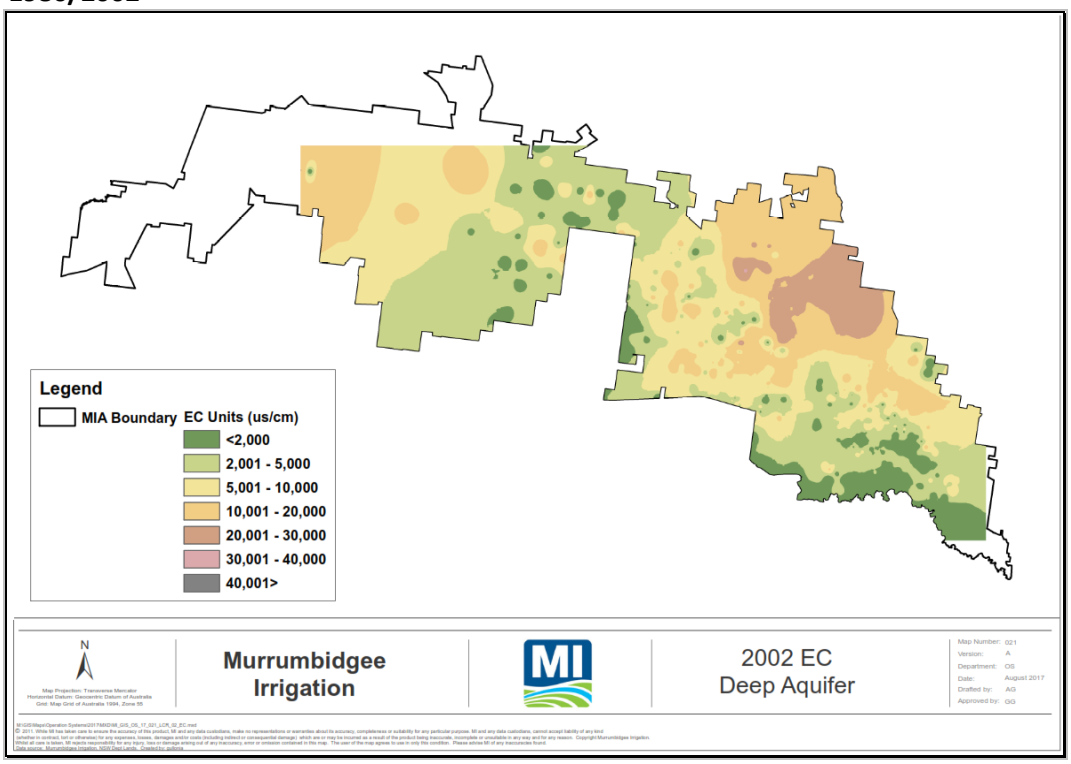


Figure 31 Deep Shepparton Formation - groundwater salinity, 2002

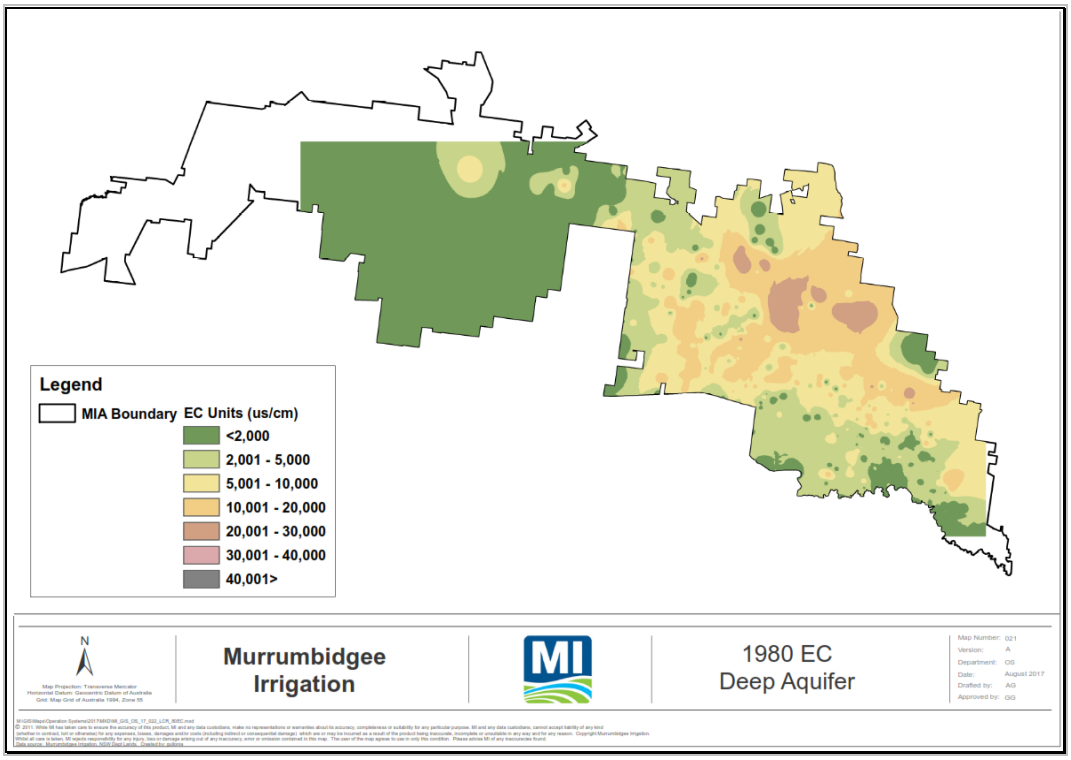


Figure 32 Deep Shepparton Formation - groundwater salinity, September 1980

6.5 Calivil Formation

Depth to water table and salinity maps for piezometers in the Calivil Formation are presented in Figures 33 to 46. Level trends in this formation generally represent drawdown from the shallow and deep Shepparton aquifers. As seen in the upper formations, piezometers measured in the deep formation September 2018 (Figure 34) exhibit low salinity. This suggests that the Calivil Formation may be influenced by previous years' large flooding events, either through direct recharge, aquifer exchange or, to a lesser degree, vertical seepage from the above Shepparton Formation. However, due to the dynamic nature of groundwater aquifers, it is difficult to ascertain the true origin and significance of level changes with any confidence. Levels in this aquifer remain consistent for all reporting years, with the majority with a depth of more than 10m.

2018/19

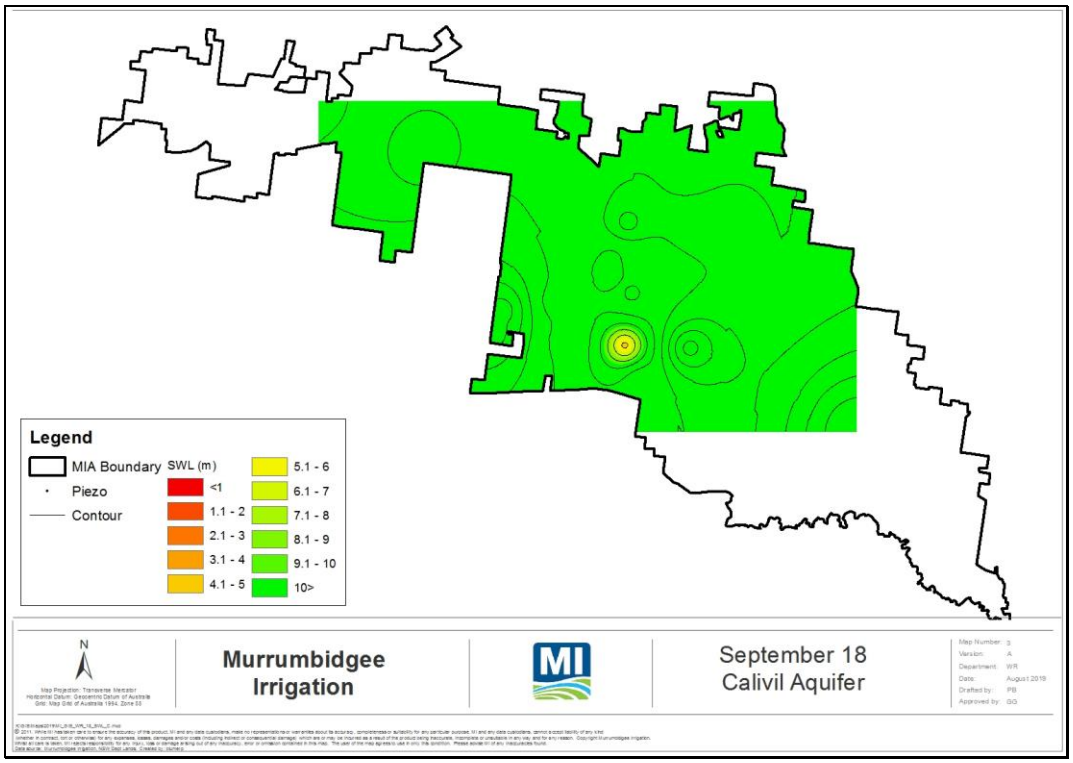


Figure 33 Calivil Formation - depth to water table, Sep 2018

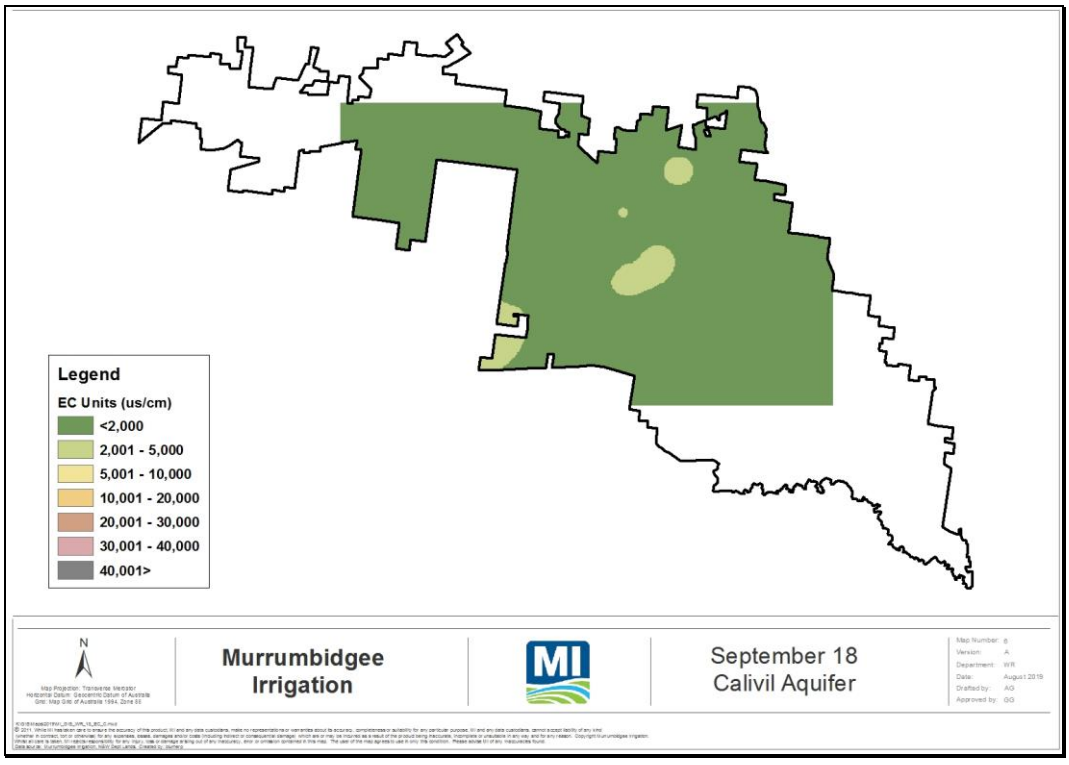


Figure 34 Calivil Shepparton Formation- groundwater salinity, Sep 2018

2017/18

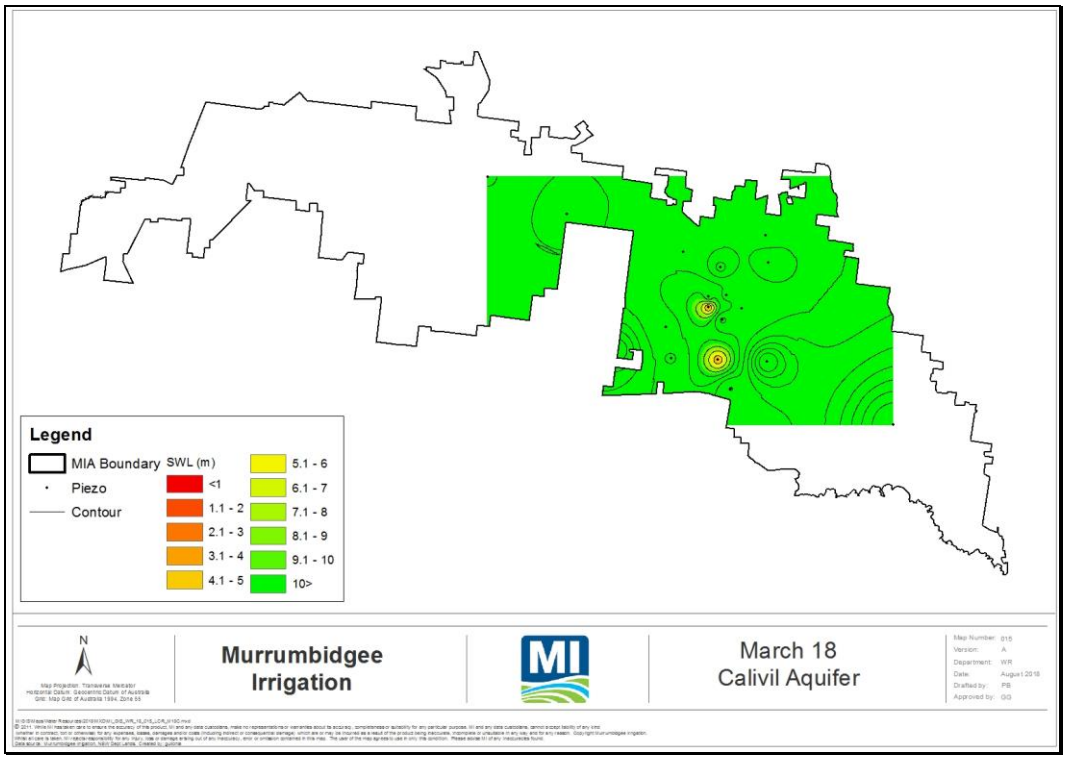


Figure 35 Calivil Formation - depth to water table, March 2018

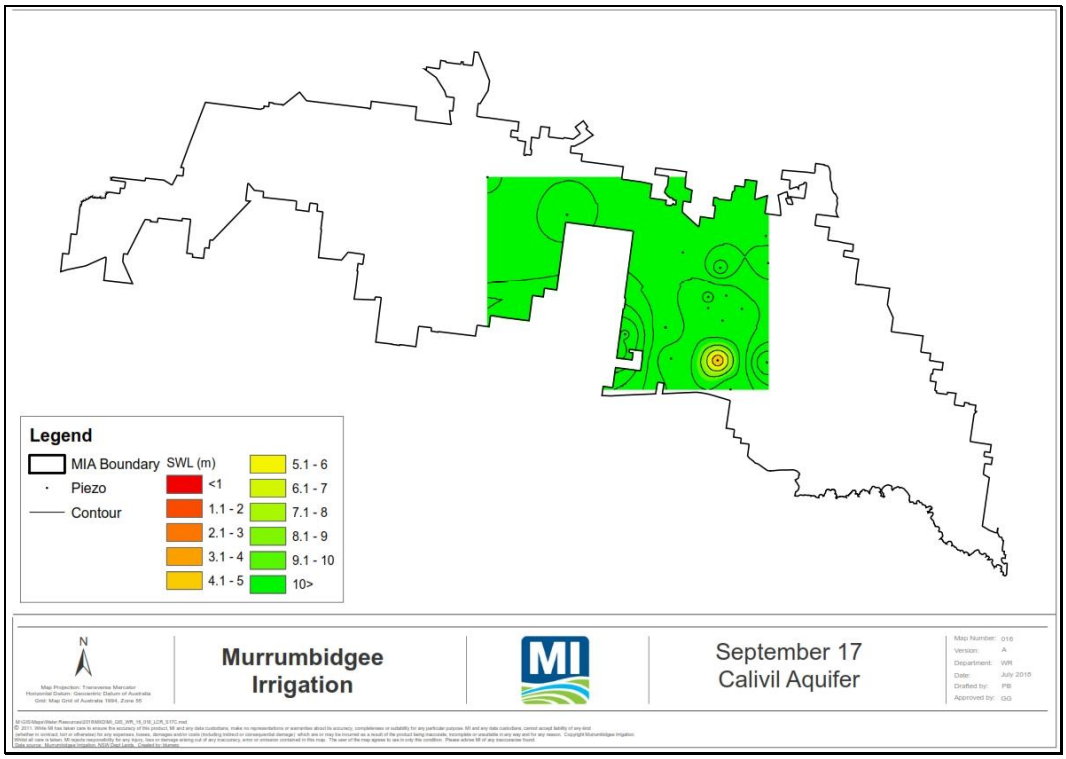


Figure 36 Calivil Formation - depth to water table, Sep 2017

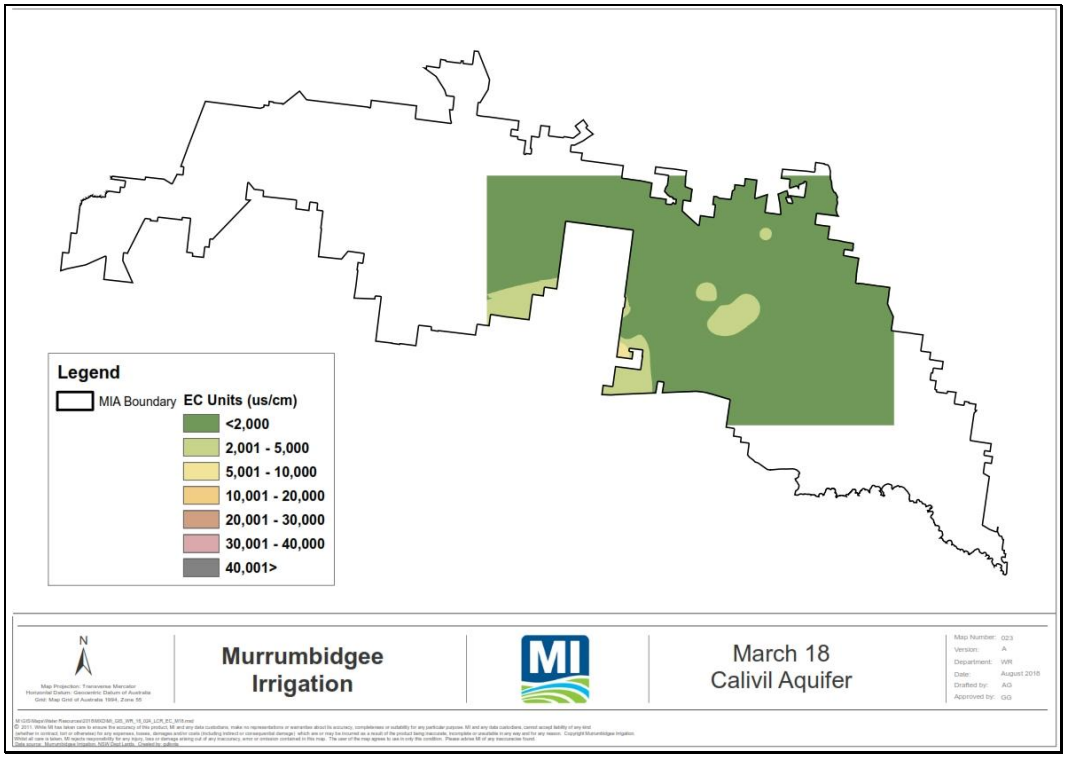


Figure 37 Calivil Formation- groundwater salinity, March 2018

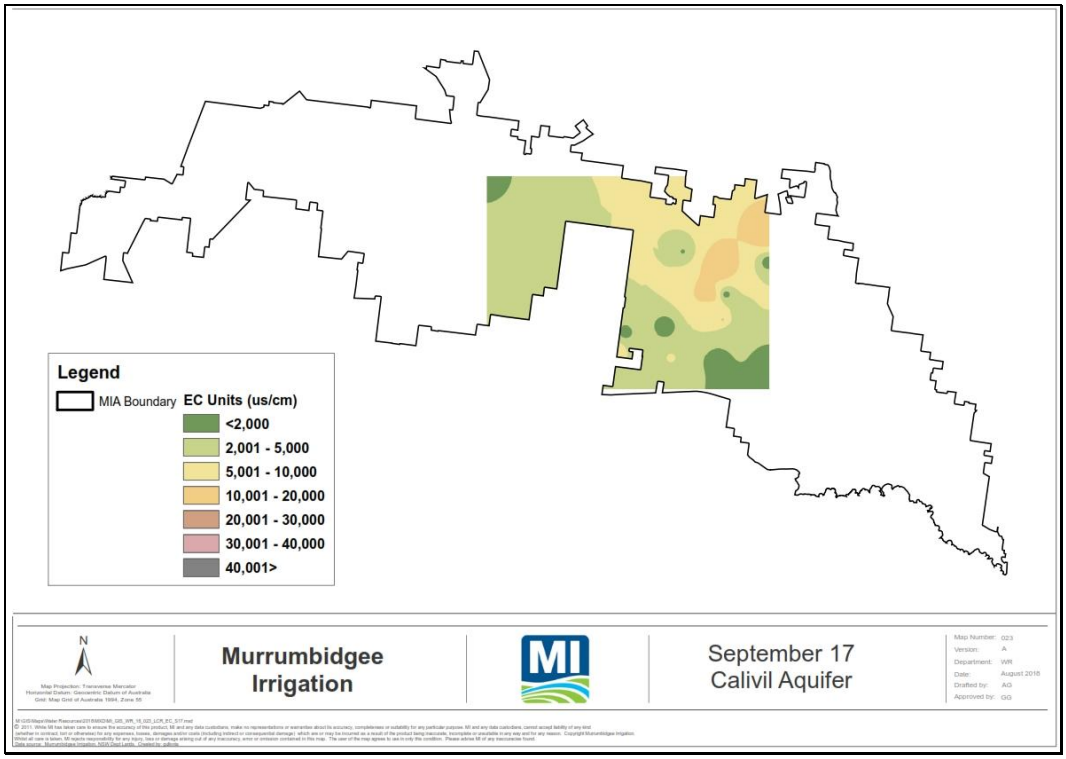


Figure 38 Calivil Shepparton Formation- groundwater salinity, Sep 2017

2016/17

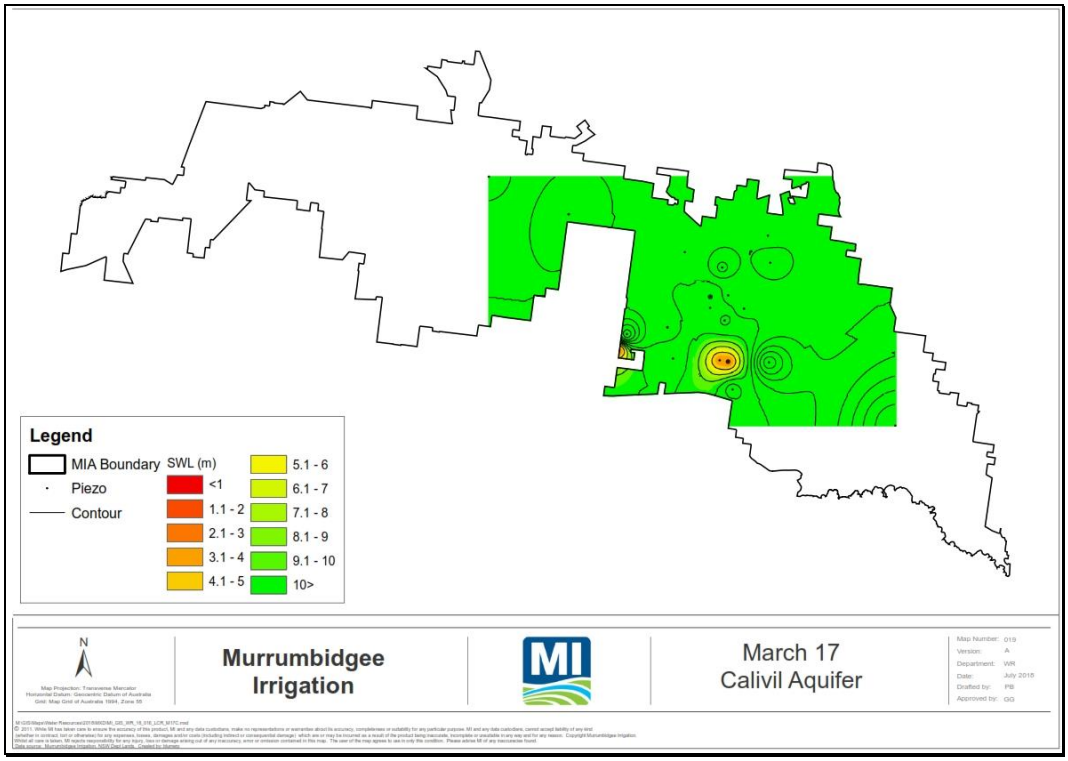


Figure 39 Calivil Formation - depth to water table, March 2017

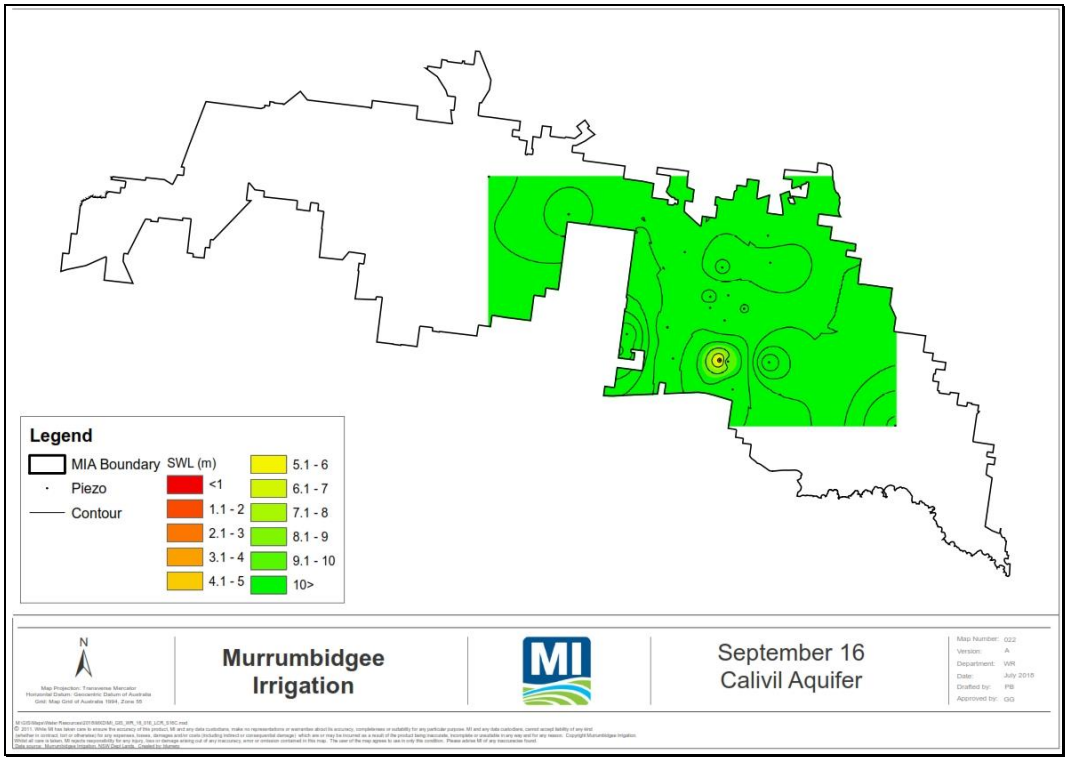


Figure 40 Calivil Formation - depth to water table, September 2016

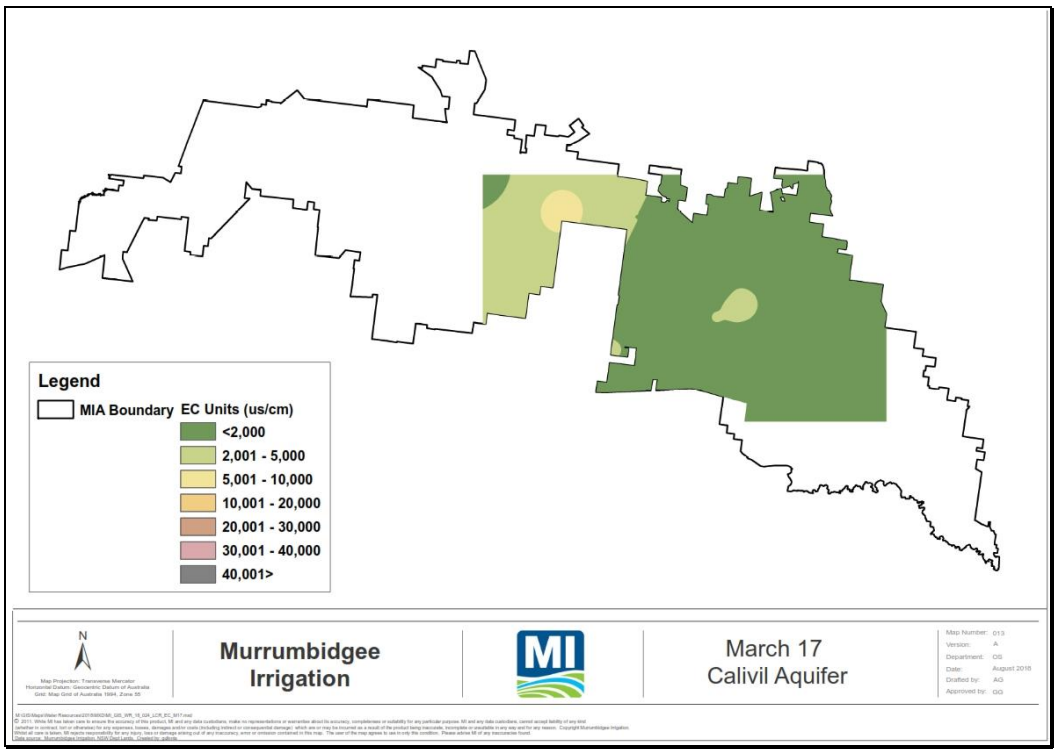


Figure 41 Calivil Formation- groundwater salinity, March 2017

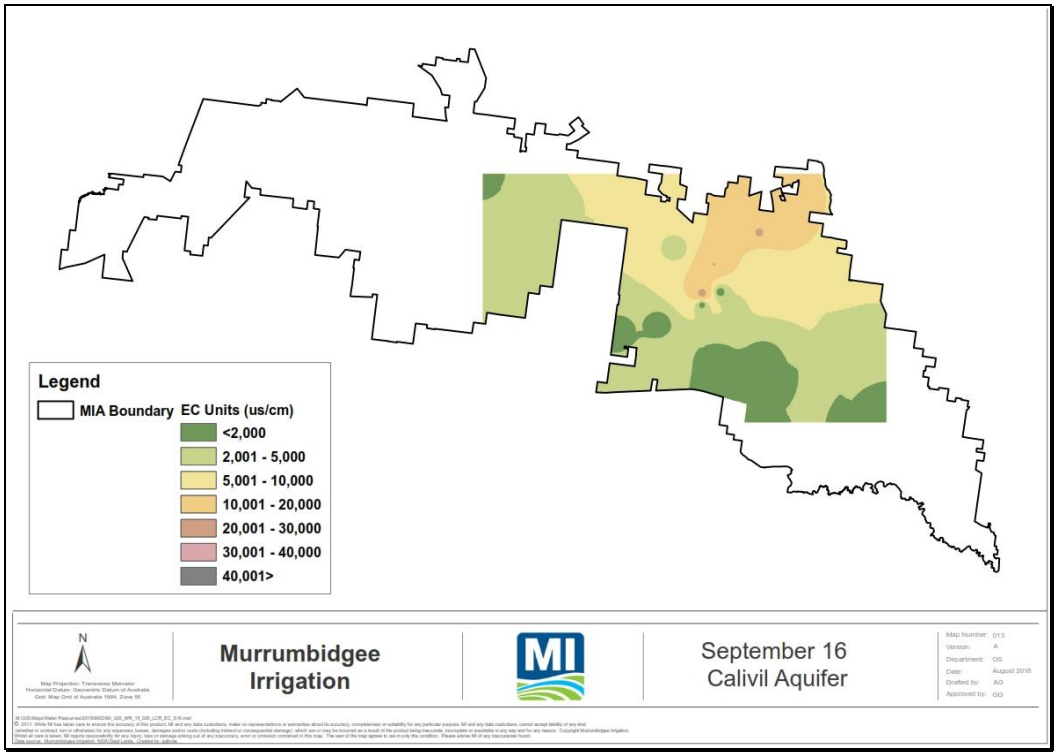


Figure 42 Calivil Formation- groundwater salinity, Sep 2016

2005/06

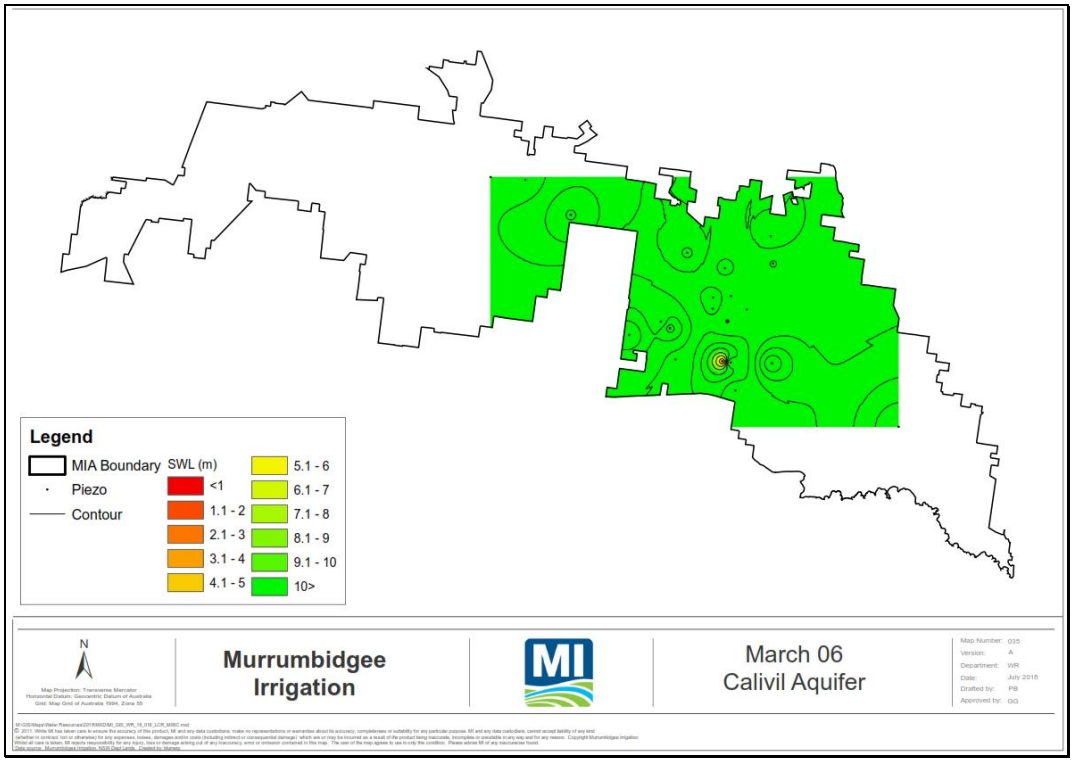


Figure 43 Calivil Formation - depth to water table, March 2006

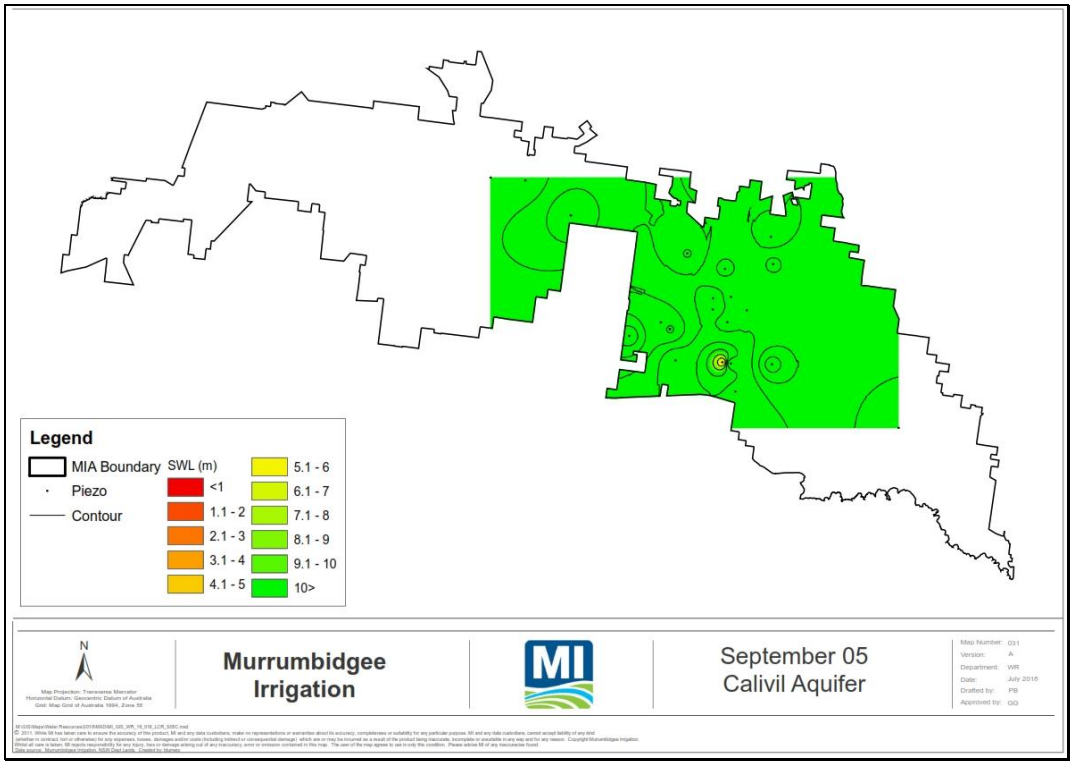


Figure 44 Calivil Formation - depth to water table, Sep 2005

1980/2002

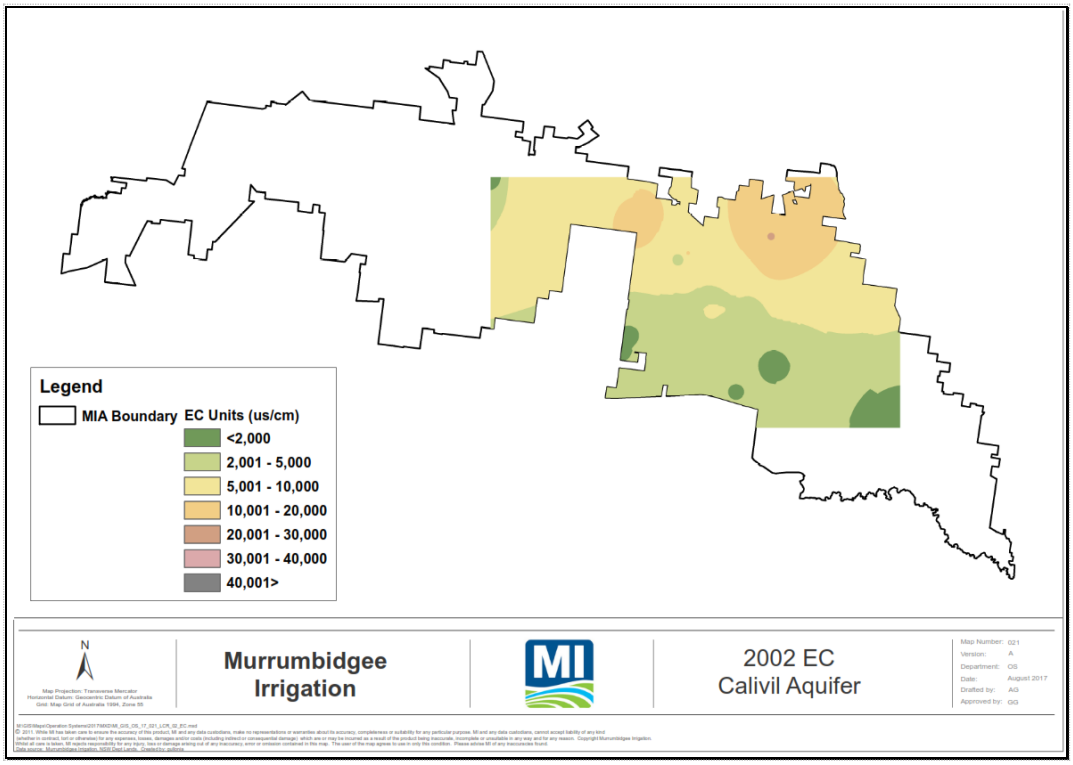


Figure 45 Calivil Formation - groundwater salinity, September 2002

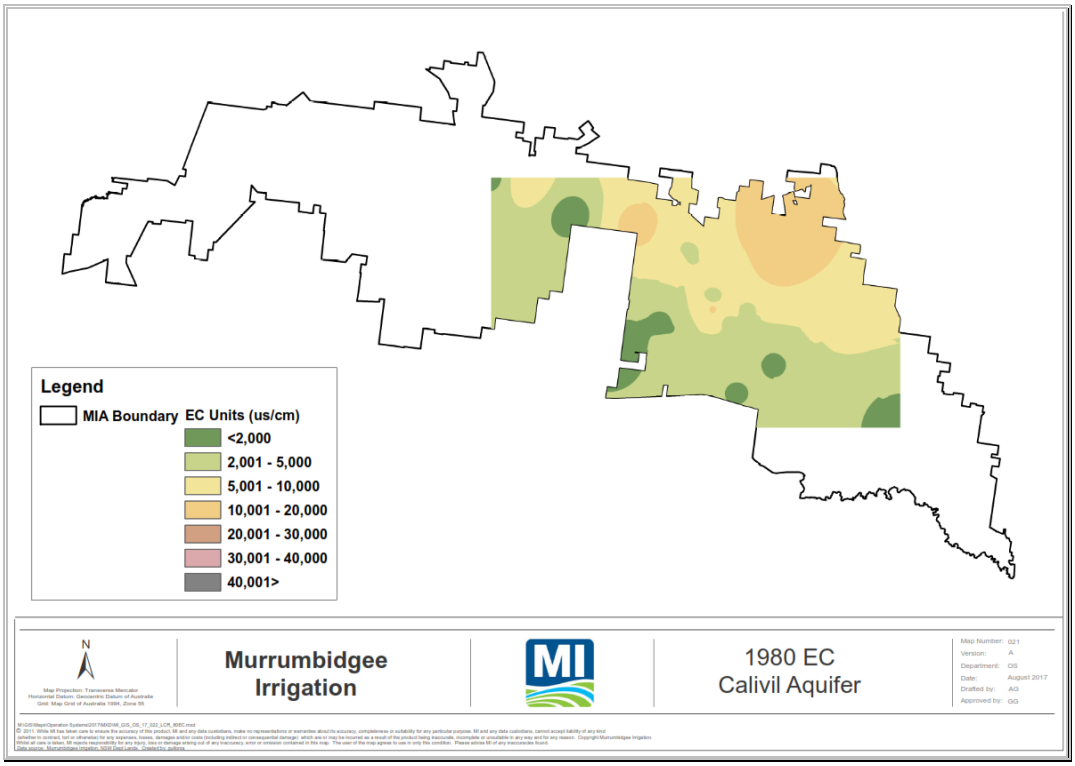


Figure 46 Calivil Formation - groundwater salinity, September 1980

7 Tubewells

MI monitors the volume of water and salt load pumped from seven tubewells within the MIA. The location of the tubewells is shown in Figure 4. Table 24 shows the total volumes and salt discharged from tubewells for 2018/19 and previous years. Only three tubewells operated, intermittently during 2018/19 and therefore, EC field measurements could not be measured at these sites. Salt loads for 2018/19 have been calculated using a three year EC average for each site. A total volume of 376 ML and 574 tonnes of salt was discharged from tubewells for 2018/19.

Table 24 Tubewell monitoring data 2018/19 compared to previous years

2018/19			2017/18		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	0	0	Five Bridges	0	0
Gil Gil	213	406	Gil Gil	378	696
Yanco West	63	122	Yanco West	321	528
South Leeton	0	0	South Leeton	0	0
Baulch's	0	0	Baulch's	0	0
Wamoon	0	0	Wamoon	111	50
East Wamoon	101	45	East Wamoon	96	39
Total	**376**	**574**	**Total**	**906**	**1313**
2016/17			**2006/07**		
Location	**Volume (ML)**	**Salt load (t)**	**Location**	**Volume (ML)**	**Salt load (t)**
Five Bridges	324	180	Five Bridges	707	489
Gil Gil	518	1,061	Gil Gil	266	353
Yanco West	284	513	Yanco West	305	404
South Leeton	191	816	South Leeton	76	118
Baulch's	0	0	Baulch's	137	52
Wamoon	238	128	Wamoon	384	200
East Wamoon	261	129	East Wamoon	778	454
Total	**1816**	**2829**	**Total**	**2,653**	**2,070**

8 New Measures to Limit Groundwater Recharge and Discharge of Salt

No new measures were implemented for 2018/19.

9 Environmental Protection and Management

9.1 Discharge of noxious aquatic weeds

During 2018/19 irrigation year, there was no known potential or actual discharge of Class 1, 2 or 3 declared noxious aquatic weeds from MI's Area of Operation.

9.2 Discharge of Blue-Green Algae

No Red alert level Blue Green Algae was detected from water sampled during discharge from MI's area of operation.

ENVIRONMENTAL PROTECTION LICENCE 4651

10 Statement of Compliance

MI has fulfilled the compliance requirements as set out in EPL 4651 for 2018/19A summary of the compliance requirements is cross referenced to this report and listed in Table 25.

Quality assurance and control procedures are in place to guarantee data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations at discharge points. Internal Standard Operating Procedures (SOPs) are reviewed and updated regularly.

MI has in place a process to receive complaints from members of the public in relation to MI's activities via the business telephone number. Direction on how to make a complaint can be found on MI's website (www.mirrigation.com.au/Contact-Us).

Table 25 Environmental Protection Licence (EPL 4651) Monitoring and Reporting Requirements

Licence section	Requirement	Compliant	Report Section
Administrative Conditions	1	Yes	N/A
Discharges to Air and Water and Applications to Land	2	Yes	N/A
Limit Conditions	3	Yes	N/A
Operating Conditions	4	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	www.mirrigation.com.au/Environment/Water-Quality
Maintain a Chemical Control Plan	O3.5	Yes	
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	
Monitoring and Recording Conditions	5	No	1. Statement of Compliance
Monitoring Records	M1	Yes	Available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	Internal documents
Recording of pollution complaints	M4	Yes	Available upon request from EPA
Telephone complaints line	M5	Yes	1. Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11. EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	8.1. Noxious Weed Management
Annual return documents	R1		Submitted August 2017
Notification of environmental harm	R2	Yes	N/A
Written Report (of an event)	R3	Yes	N/A
Annual system performance report	R4	Yes	Full Report
Other reporting conditions	R5	Yes	Section 10

11 EPL Monitoring and Reporting

Under MI's EPL 4651, five points (Figure 2) are licensed to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded, and specified water quality parameters are monitored. These discharge points are listed below:

- POINT 4 LAG - Gogeldrie Main Drain at Gooragool Lagoon
- POINT 5 GMSRR – Gogeldrie Main Southern Drain River Road
- POINT 6 YMS – Yanco Main Southern Drain
- POINT 7 ROCUDG – Cudgel Creek Roaches Escape
- POINT 15 MIRFLD – Mirrool Creek Floodway Wyvern Station

11.1 System performance

Table 26 presents total diversions into the MIA and total water discharged from the MIA for 2018/19 compared to previous years. In 2018/19, 642 ML was discharged and included 150ML discharged to Mirrool Creek Floodway to facilitate necessary operational works. The large volume discharged in the 2016/17 season included 121,363 ML that was diverted to Mirrool Creek Floodway as a means of flood risk mitigation during a 1/150-year flood event.

In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in that year. MI does not discharge irrigation waste water directly to groundwaters inside or outside the area of operations.

Table 26 Total water volumes (ML)

Year	Diversions	Discharged
2018/19	586,752	642
2017/18	945,805	4,471
2016/17	780,083	122,092
2005/06	1,036,519	8,570

11.2 Water Quality Monitoring

Monthly summaries for each monitoring point are presented in Tables 27 - 31. Monitoring consisted of 11 sampling events, with 2 Action level detections and 1 Notification level detection. Metolachlor and Diuron were detected at Action levels, at Point 15 and Point 5 respectively. The number of Action level detections was lower compared to last reporting year where 5 Action levels were detected.

Diuron, Metolachlor and Chlorpyrifos were the three chemical types detected in 2018/19. Chemical detections were found at 3 of the 5 Licenced sites, Point 5 – GMSRR, Point 6 -YMS and Point 15 – MIRFLD.

Table 27 Monitoring results for Point 4 - LAG

Point 4 – LAG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-18	16.8	0	0	-
Aug-18	19.5	0	0	-
Sep-18	11.9	0	0	-
Oct-18	24.1	1	0	-
Nov-18	5.9	1	0	-
Dec-18	28.3	1	0	-
Jan-19	4.6	0	0	-
Feb-19	0	0	0	-
Mar-19	0	0	0	-
Apr-19	0	0	0	-
May-19	7.5	1	0	-
Jun-19	0	0	0	-
Total	**118.6**	4	0	-

Table 28 Monitoring results for Point 5 - GMSRR

Point 5 – GMSRR				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-18	104.6	1	0	-
Aug-18	67.5	1	1	9/8/2018 Action level Diuron (9.8 µg/L)
Sep-18	0	0	0	-
Oct-18	0	0	0	-
Nov-18	0	0	0	-
Dec-18	0	0	0	-
Jan-19	0	0	0	-
Feb-19	0	0	0	-
Mar-19	0	0	0	-
Apr-19	0	0	0	-
May-19	0	0	0	-
Jun-19	0	0	0	-
Total	**172.1**	2	1	-

Table 29 Monitoring results for Point 6 - YMS

Point 6 – YMS				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-18	102	1	0	-
Aug-18	-	0	0	-
Sep-18	-	0	0	-
Oct-18	0.3	1	1	19/10/2018 Notification level Chlorpyrifos (0.027 µg/L)
Nov-18	-	0	0	-
Dec-18	-	0	0	-
Jan-19	-	0	0	-
Feb-19	-	0	0	-
Mar-19	-	0	0	-
Apr-19	-	0	0	-
May-19	-	0	0	-
Jun-19	-	0	0	-
Total	**102.3**	2	1	-

Table 30 Monitoring results for Point 7 - ROCUDG

Point 7 – ROCUDG				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-18	16.6	0	0	-
Aug-18	66.1	1	0	-
Sep-18	7.6	0	0	-
Oct-18	6.9	1	0	-
Nov-18	0	0	0	-
Dec-18	0	0	0	-
Jan-19	1.8	0	0	-
Feb-19	0.2	0	0	-
Mar-19	0	0	0	-
Apr-19	0	0	0	-
May-19	0	0	0	-
Jun-19	0	0	0	-
Total	**99.2**	2	0	-

Table 31 Monitoring results for Point 15 - MIRFLD

Point 15 – MIRFLD				
Month	**Discharge Volumes (ML)**	**No. of sampling events**	**No. of detections**	**Chemical detection details**
Jul-18	150	1	1	2/7/2018 Action level Metolachlor (0.12 µg/L)
Aug-18	0	0	0	-
Sep-18	0	0	0	-
Oct-18	0	0	0	-
Nov-18	0	0	0	-
Dec-18	0	0	0	-
Jan-19	0	0	0	-
Feb-19	0	0	0	-
Mar-19	0	0	0	-
Apr-19	0	0	0	-
May-19	0	0	0	-
Jun-19	0	0	0	-
Total	150	1	1	-

Murrumbidgee Irrigation



2020 Annual Compliance Report

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Abbreviations

AFFRA	Acoustic Flowmeter For Remote Areas
ANZECC	Australian and New Zealand Environment and Conservation Council
BBS	Barren Box Storage
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Evapotranspiration (crop reference)
GIS	Geographic Information System
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
ha	Hectare(s)
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station
ML	Megalitre
NARREG	Narrandera Regular
NRAR	Natural Resources Access Regulator
OEH	Office of Environment and Heritage
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
SOP	Standard Operating Procedure
t	tonnes
µS/cm	micro siemens per centimetre
µg/L	micrograms per litre
WAL	Water Access Licence
YMS	EPL Point 6 - Yanco Main Southern Drain

Preface

The Annual Compliance Report 2019/20 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation (MI).

MI operates under a Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) issued by the NSW Department of Primary Industry – Water and regulated by the Natural Resources Access Regulator (NRAR). MI also holds an Environment Protection Licence (EPL) 4651 issued by the NSW Environment Protection Authority (EPA).

MI is committed to achieving organisational excellence through operating safely, efficiently and effectively, all of which contribute towards the measure of MI's compliance performance.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of compliance

Murrumbidgee Irrigation (MI) has met the conditions of the Monitoring and Reporting Plan dated 16 March 2018 for our Combined Approval in 2019/20. The compliance requirements are cross referenced within this report and listed in Table 1.

MI has quality assurance and control procedures to guarantee data integrity and to ensure that all compliance obligations are met. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain our licensed supply and discharge points.

Table 1 Combined Approval (40CA403245) reporting summary

Approval section	Condition	Report section
Submission of annual compliance report	1	This report
Plans of the area of operations, authorised works, monitoring sites and water management infrastructure	2.1	2. Plan of operations and works
	2.2	
Statement of compliance	2.3	1. Statement of compliance
Presentation of data and analyses	2.4	Sections 3 - 7
	2.5	
	2.6	
	2.7	Provided via email with report
	2.8	1. Statement of Compliance
New measures to limit groundwater recharge and discharge of salt	2.9	8. New measures to limit groundwater recharge and discharge of salt
Reporting on water management	2.10	3.3 Diversions and water allocation
	2.11	3.5 Water discharged from area of operation
	2.12	3.6 Water balance
	2.13 (a) (b)	3.1 Climate conditions
	(c) – (i)	4. Water use
Reporting on salinity and salt load	2.14	5. Salinity and salt load
	2.15	
	2.16	
Reporting on groundwater conditions	2.17	6. Groundwater conditions

Approval section	Condition	Report section
Discharge of noxious aquatic weeds	5	9.1 Discharge of noxious aquatic weeds
Discharge of blue green algae	6	9.2 Discharge of blue-green algae

There was one significant event in 2019/20 that required notification to the Minister, which is detailed in Table 2.

Table 2 Significant event notifications

Date	Reference	Event	Notification Method
07/05/2020	385359	Meter algorithm improvements identified	S91i Self Reporting Form
Actions, steps or procedures taken by MI to remedy: S91i process followed and certificate of validation completed and submitted by 2 June 2020.			

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2019/20. MI did not construct new works that would allow further discharge from the Area of Operations.

2 Plan of operations and works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. The Murrumbidgee Irrigation Area (MIA) is supplied by water stored in Burrinjuck and Blowering dams and released to the Murrumbidgee River. Water is diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval, via two authorised supply works (Figure 2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STURT - Sturt Regulator (after diversion from Gogeldrie Weir)

There are five (5) sites which have the potential to discharge water outside MI's area of operations, which are presented in Figure 2. These sites are monitored in accordance with MI's Combined Approval and Environmental Protection Licence (EPL) 4651.

MI's five discharge monitoring points are:

- EPL Point 4 - LAG – Gogeldrie Main Drain at Gooragool Lagoon
- EPL Point 7 - ROCUDG – Cudgel Creek Roaches Escape
- EPL Point 6- YMS – Yanco Main Southern Drain
- EPL Point 5 - GMSRR – Gogeldrie Main Southern Drain River Road
- EPL Point 15 - MIRFLD – Mirrool Creek Floodway Wyvern Station

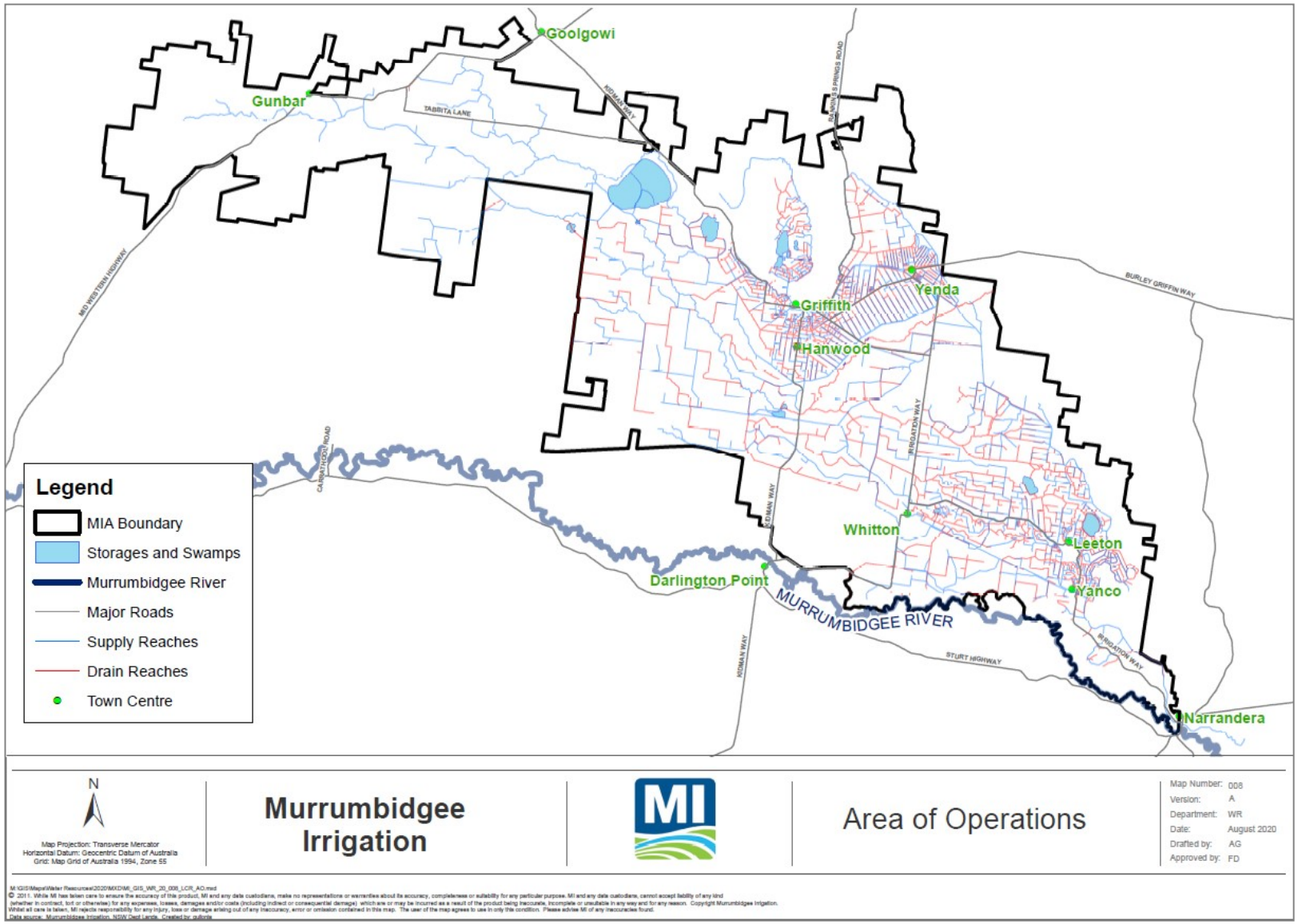


Figure 1 Murrumbidgee Irrigation's Area of Operation

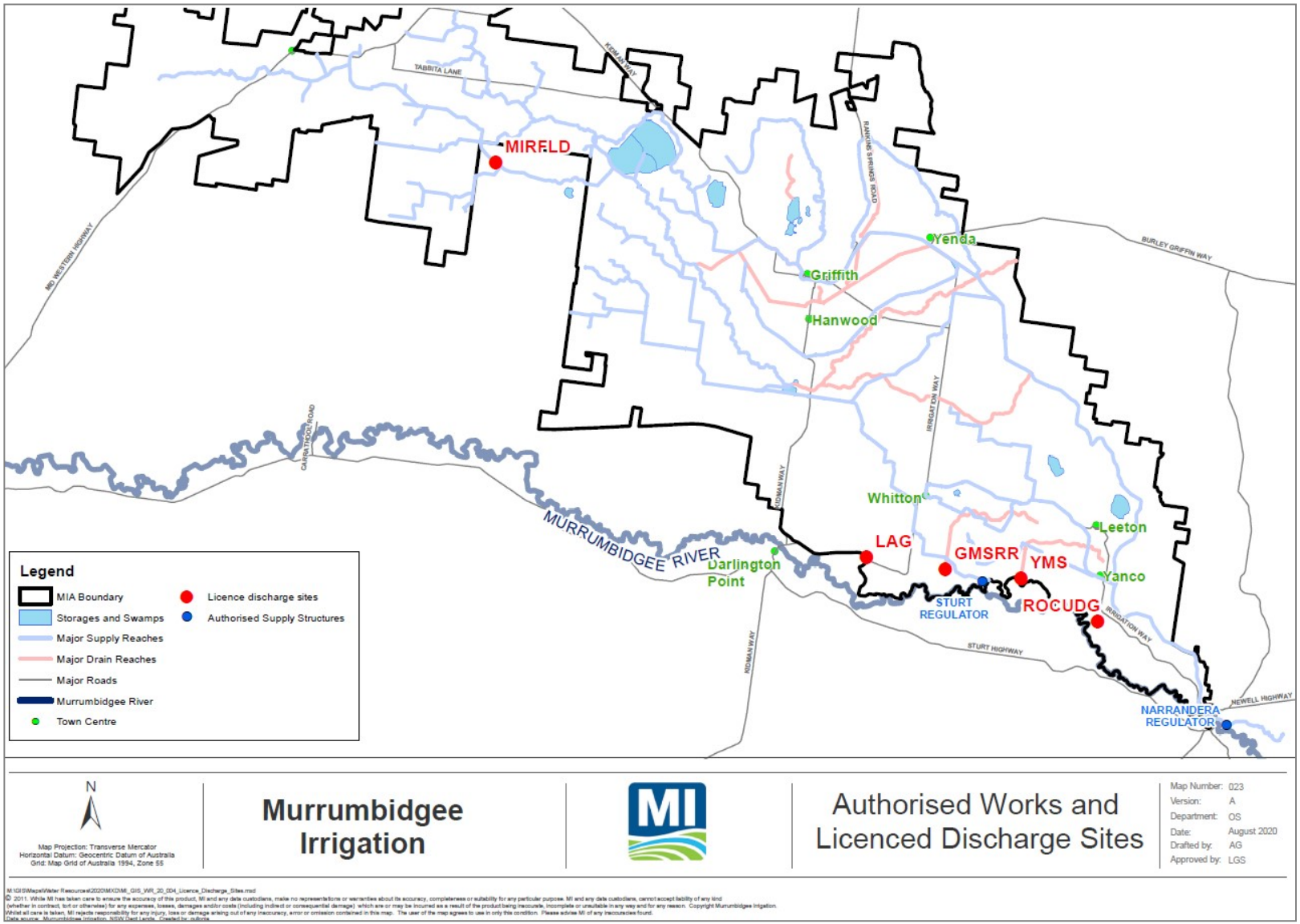


Figure 2 Location of authorised supply works and licence discharge points

3 Reporting on water management

MI's water management information is presented below. There are no internal benchmarks or targets that are relevant to this report.

3.1 Climate conditions

Rainfall and evapotranspiration (ETo) data recorded at the Griffith CSIRO weather station is presented in Table 3. Below average rainfall was recorded in 2019/20 reporting period, with an increase of 27mm from the prior reporting period. The rainfall recorded in 2019/20 is very similar to the rainfall recorded during 2005/06 which fell during the millennium drought.

Table 3 Griffith CSIRO weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2019/20	364	1,784
2018/19	337	1,914
2017/18	315	1,894
2016/17 (includes flood Sept 2016)	556	1,593
2005/06	357	1,935

*Note: *1 and 2 February 2020 data were not recorded in Griffith due to Telstra communications issues as a result of high temperatures during this period. The data for the two days has been patched with data from the Griffith airport site by CSIRO.*

3.2 Calibration report for Main Canal and Sturt Canal AFFRA units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of a contract with MI to ensure flow measurements meet the conditions of Combined Approval 40CA403245. The calibration report summary for the NARREG AFFRA unit is presented in Table 4 and the STURT AFFRA unit presented in Table 5. The VENTIA flow, EC, and salt load monitoring financial year report is included as Attachment A.

Table 4 Main Canal at NARREG (410127) calibration report

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
25/09/2019	1404	838	850	-1.30%
30/10/2019	1542	1132	1140	-0.72%
27/11/2019	1141	1351	1400	-3.47%
30/01/2020	0728	1911	1911	-0.03%
26/02/2020	0755	1182	1170	1.07%
27/05/2020	1141	138	138	0.55%

Table 5 Sturt Canal at STURT (410129) calibration report

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
25/09/2019	1639	101.375	101	0.37%
30/10/2019	0933	444.273	446	-0.33%
30/10/2019	1018	425.894	426	-0.02%
27/11/2019	0826	76.034	75	1.46%

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
17/12/2019	1144	126.642	95	33.94%*
17/12/2019	1236	128.518	101	27.90%*
17/12/2019	1405	129.598	148	-12.33%*
29/01/2020	1121	122.302	147	-16.80%**

* Gaugings conducted when gates were being tested. As such, the measurement may be in error.
** The measurement was conducted with a moderate wind blowing directly upstream and has been discounted for use with the index table.

3.3 Diversions and water allocation

A monthly summary of gross water diverted from the Murrumbidgee River is presented in Table 6. These volumes represent diversions entering the supply system via MI's two authorised water supply works at NARREG and STURT. The total diversion volume of 349,523 ML includes an environmental water diversion volume of 3,612 ML diverted on behalf of the Office of Environment and Heritage (OEH).

Table 6 Monthly summaries of water diversions delivered to customers, 2019/20

Month	STURT	NARREG	Total diversion	Delivered to customers
Jul-19	92	2,469	2,561	1,514
Aug-19	1,590	10,819	12,409	7,620
Sep-19	3,284	26,244	29,528	23,095
Oct-19	6,030	39,777	45,807	35,571
Nov-19	4,901	35,662	40,563	33,031
Dec-19	9,140	64,600	73,740	59,649
Jan-20	6,664	59,533	66,197	55,102
Feb-20	2,710	31,586	34,296	31,594
Mar-20	331	17,179	17,510	15,915
Apr-20	218	7,165	7,383	6,553
May-20	1,491	10,243	11,734	9,649
Jun-20	0	7,795	7,795	5,978
Total	**36,451**	**313,072**	**349,523**	**285,270**

Note: All figures in ML

Table 7 compares water allocations, diversions, total deliveries and climate data from the 2019/20 reporting year to prior years. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year.

Table 7 Water allocation, total diversions and deliveries 2018/19 compared to previous years

Year	Announced allocation (%) general / high	Diversions (ML)	Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2019/20	11/95	349,523	285,270	364	1,784
2018/19	7/95	586,752	487,204	337	1,914
2017/18	45/95	945,805	800,963	315	1,894
2016/17	100/100	780,083	621,094	556	1,593
2005/06	54/95	1,036,519	829,990	367	1,935

Note: All figures in ML

Below average rainfall was recorded throughout the catchment in 2019/20, resulting in 11% allocation for General Security and 95% allocation for High Security allocation.

When low rainfall years are coupled with high ETo rates, as seen in 2005/06, water supply demand increases dramatically. However, it must be noted flows for that year were supplemented by the Snowy Hydro borrows, which added just over 100,000ML of water to the available water pool.

The volume of water diversions debited to each grouping of MI's Water Access Licences are shown in Table 8.

Table 8 Diversions debited to Water Access Licences groups

Year	WAL 1 High Security	WAL 2 General Security	WAL 3 Towns	WAL 4 Stock & Domestic	WAL 5 Other
2019/20	212,062	50,985	19,699	7,263	59,514
2018/19	269,817	161,433	19,699	7,345	128,458
2017/18	265,936	495,573	19,699	7,345	157,252

Note: All figures in ML

3.4 Environmental diversions

At the request of OEH, 3,612 ML of environmental water was delivered in 2019/20 as shown in Table 9. This volume is accounted for in total diversions and deliveries shown in Table 8.

Table 9 Environmental water diversions for 2019/20

Month	Tuckerbill Swamp	Turkey Flats	Yanco Ag	Campbell's Swamp	Total
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	99	173	982	345	1598
Nov-19	36	165	0	0	201
Dec-19	98	236	240	0	574
Jan-20	0	189	0	128	316
Feb-20	66	36	484	96	682
Mar-20	0	0	0	0	0
Apr-20	240	0	0	0	240
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Total (ML)	**539**	**798**	**1,706**	**569**	**3612**

3.5 Water discharged from area of operations

Monthly discharge volumes for each discharge monitoring point are shown in Table 10.

A total of 127 ML was discharged from MI's Area of Operations during 2019/20.

Table 10 Monthly discharge volumes (ML) recorded at monitoring points

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	22	0	0	3.2	0
Oct-19	0	0.3	0	0	0
Nov-19	0	3.4	0	0	0
Dec-19	0	0.1	0	0	0

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jan-20	0	0	0	0	0
Feb-20	0.7	0	0	0	0
Mar-20	16.1	0	41.5	0	0
Apr-20	2.3	0	0	0	0
May-20	26.3	8.8	0	0	0
Jun-20	2.1	0	0	0	0
Total	**69.5**	**12.6**	**41.5**	**3.2**	**0**

Note: All figures in ML

Table 11 shows total discharge volumes from MI's Area of Operation compared to prior years.

The total volume discharged in 2019/20 was significantly lower compared to prior years. This was a result of several factors including:

- Customer on-farm efficiencies and recycling reducing drainage discharge volumes
- Recycling of drainage waters within the MIA
- Improved water ordering efficiencies

We note in 2016/17 121,363 ML was diverted to the MIRFLD as a means of flood risk mitigation as a result of the September 2016 flood event.

Table 11 Total volumes discharged from the MIA

Year	Total discharged (ML)
2019/20	127
2018/19	642
2017/18	4,471
2016/17	122,092
2005/06	8,570

3.6 Water balance

The annual water balance in Table 12 has been produced to meet condition 2.12 of the Combined Approval Monitoring and Reporting Plan. To assist with interpretation of this water balance, each line has been referenced to the specific requirements of Condition 2.12.

The conveyance volumes represented in this water balance account for seepage, evaporated water from in channel and storage, and general conveyance required to deliver water to customers. Overland flood losses in 2016/17 refers to overland flows from bank cuts or breaches during peak flood periods.

Total gross diversions of 349,523 ML for 2019/20 were used to generate water deliveries of 281,658 ML to customers and 3,612 ML for environmental water diversions.

There were no flood events resulting in captured flood water deliveries during 2019/20, therefore the total volume of water delivered to customers for 2019/20 was sourced from river diversions and internal storage.

Table 12 Annual water balance as at 1 July 2020 and prior years

Condition	Sources	2019/20	2018/19	2017/18	2016/17	2005/06
2.10 (a) (b)	River diversions	349,523	586,752	945,805	780,083	1,036,519
2.12 (c)	Internal storage (July 1)	2,434	25,256	32,318	29,042	N/A
2.12 (b)	Water captured (measured)	0	0	5,007	171,376	0
	Total	**351,957**	**612,008**	**983,131**	**980,501**	**1,036,519**
	Applications					
2.10 (d)	Deliveries to customers (river and storages)	281,658	484,208	800,963	621,094	829,990
2.10 (d)	Deliveries to customers (captured flood water)	0	0	1,602	49,225	0
2.12 (b) delivered	Environmental water diversions	3,612	2,996	600	986	N/A
2.12 (b) loss	Conveyance	61,836	121,728	151,904	127,960	206,518
2.12 (c)	Internal storage (June 30)	4,724	2,434	25,256	32,318	N/A
2.11 (a)	Discharges out of area of operation	127	642	4,471	121,363	11
2.12 (b) loss	Overland flood discharge	0	0	0	25,600	0
2.12 (b) loss	Customer flood discharge	0	0	0	1,955	0
	Total	**351,957**	**612,008**	**983,131**	**980,501**	**1,036,519**

Note: All figures in ML

4 Water use

4.1 Crop statistics

Customers are required to nominate the intended water use to a crop or purpose when placing water orders. This data is not validated at the farm level and is therefore an estimate only. Table 13 shows water deliveries and estimated crop water use for 2019/20. It is important to note the water use data presented for the total area of crop is influenced by seasonal rainfall, ETo and irrigation practices.

The 'Not Defined' category refers to water taken by MI customers without placing an order. This information is obtained after the meter is read and does not provide opportunity to allocate the water to a use.

Table 13 Summary of water deliveries for major crop groupings 2019/20

Crop/ purpose	Area (ha)	Volume delivered (ML)	Crop water use (ML/ha)
Citrus	7,995	34,995	4.4
Cotton	392	1,170	3
Nuts	5,687	47,258	8.3
Other crops	228	1,588	7
Other fruits	1,097	4,352	4
Plantation	195	380	1.9
Rice	2,213	27,302	12.3
Stock & domestic	341	3,854	11.3
Summer cereals	1,314	9,996	7.6
Summer oilseeds	40	403	10.1
Summer pasture	347	1,626	4.7
Vegetables	2,009	10,655	5.3
Vines	17,808	74,881	4.2
Winter cereals	6,943	18,650	2.7
Winter oilseeds	167	1,057	6.3

Crop/ purpose	Area (ha)	Volume delivered (ML)	Crop water use (ML/ha)
Winter pasture	397	2,721	6.9
Not defined*	-	22,002	-
Total	**47,173**	**262,890**	

*No crop type assigned by customer at time of use

A comparison of crop water use for 2019/20 with prior years is presented in Table 14. Reduced general security allocation dramatically reduced seasonal summer cropping deliveries in 2019/20. As a result, the combined permanent plantings of citrus, vines and other fruits accounted for the highest volume of water deliveries in the MIA.

Table 14 Total deliveries to major crop types 2019/20 compared to previous years

Year	Rice	Pasture	Cereal and oil seeds	Vegetables	Citrus, vines, other fruits	S&D, towns, industrial	Other crops, plantations	Cotton
2019/20	27,302	4,346	30,105	10,655	114,229	22,216	23,969	1,170
2018/19	37,171	12,753	88,968	10,518	130,716	22,174	71,460	113,443
2017/18	220,423	37,952	123,439	10,940	134,046	24,123	76,864	174,778
2016/17	304,200	26,030	57,479	10,129	109,257	9,844	71,376	82,004
2005/06	355,254	65,878	181,641	27,588	142,025	48,123	9,481	

Note: Cotton was included in 'other crops and plantations' for 2005/06. All figures in ML

4.2 Irrigation intensity

Irrigation intensity is displayed in Figure 3 by water use (ML/ha) at a property level.

This map identifies locations of landholdings using between >0 to 4; >4 to 8; and above 8 ML/ha.

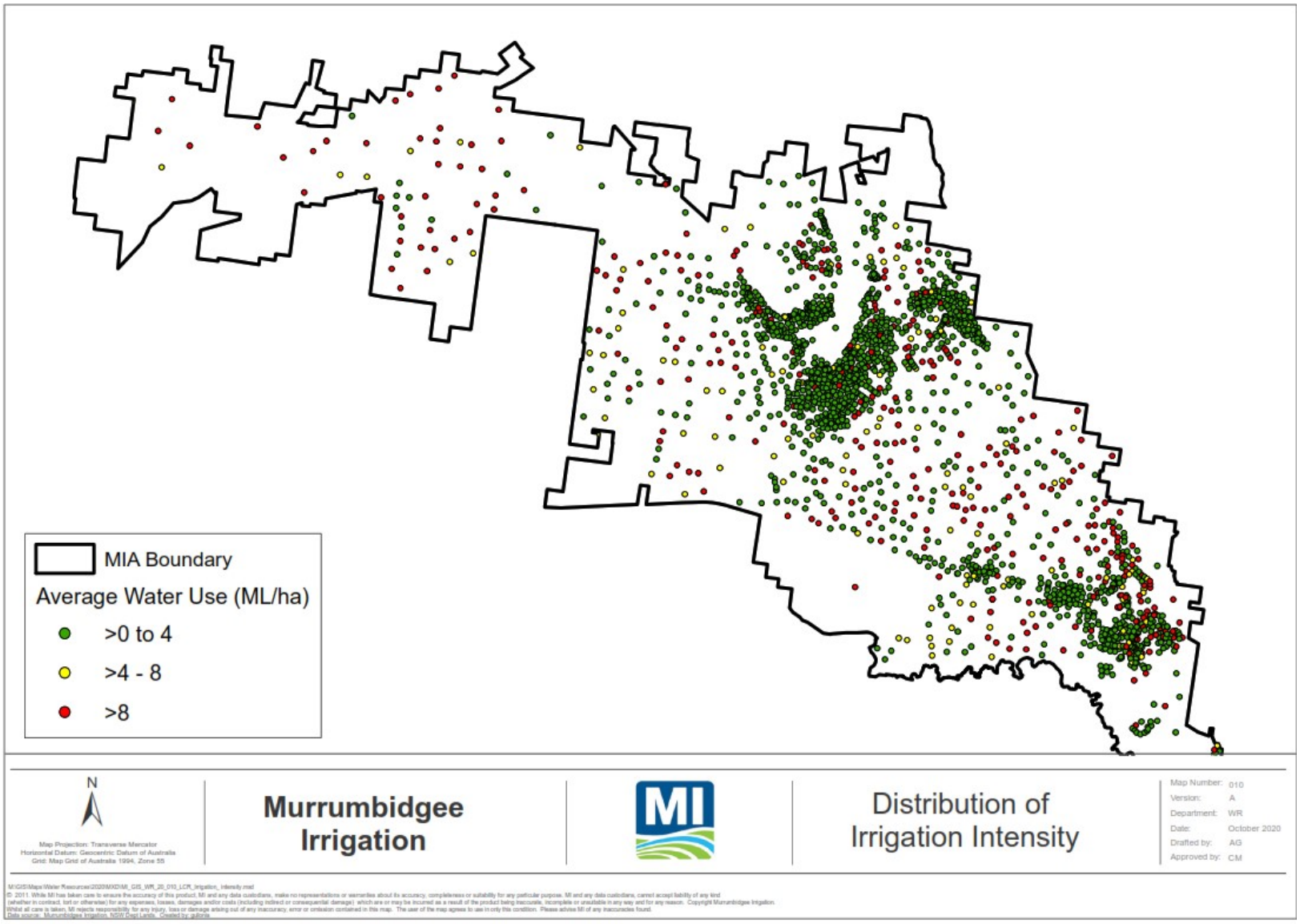


Figure 3 Distribution of irrigation intensity across the MIA

5 Salinity and salt load

5.1 Extracted salt load

The monthly mean electrical conductivity (EC) values and extracted salt loads are calculated using EC sensors at MI's two river offtake sites NARREG and Sturt and presented in Table 15.

Table 15 Total extracted salt load for 2019/20

Month	STURT			NARREG		
	Flow (ML)	Mean EC (µS/cm)	Salt (t)	Flow (ML)	Mean EC (µS/cm)	Salt (t)
Jul-19	92	208	15	2,469	195	235
Aug-19	1,590	170	171	10,819	187	1,165
Sep-19	3,284	129	256	26,244	121	1,917
Oct-19	6,030	80.1	268	39,777	72.9	1,728
Nov-19	4,901	70.0	213	35,662	81.5	1,775
Dec-19	9,140	52.1	272	64,600	55.9	2,110
Jan-20	6,664	55.2	205	59,533	55.7	1,942
Feb-20	2,710	70.4	109	31,586	78.3	1,563
Mar-20	331	111	39	17,179	122	1,328
Apr-20	218	158	27	7,165	185	811
May-20	1,491	156	211	10,243	184	1,284
Jun-20	0	0	0	7,795	198	1,170
Total	**36,451**		**1,787**	**313,072**		**17,030**

Table 16 presents the total extracted salt loads for 2019/20 and prior years.

During 2019/20, an estimated 18,817 tonnes of salt was imported into MI's area of operation from the Murrumbidgee River. Generally, the amount of salt is relative to the volume of water diverted from the river, which is evident for all reporting years.

Table 16 Extracted salt-load (t) for 2019/20 compared to prior years

Year	Diversions (ML)	Extracted salt load (t)		
		STURT	NARREG	Total
2019/20	349,523	1,787	17,030	18,817
2018/19	586,752	6,952	27,570	34,522
2017/18	945,805	14,920	50,030	64,950
2016/17	780,083	11,722	32,903	44,625
2007/08	393,973	1,778	26,816	28,594

5.2 Discharged salt load

There are five discharge monitoring points that can discharge water from MI's area of operation. The locations of these sites are shown in Figure 2 of this report.

Flow, EC and salt load data for these sites is presented in Table 17. When standing water is held at a discharge location, while EC measurements are taken, no flow occurs. Alternatively, minor flows do not trigger accurate measurements to enable salt load calculations.

An estimated 25 tonnes were discharged from MI's Area of Operation through the five discharge monitoring points in 2019/20.

Table 17 Monthly summary of flow, EC and salt loads at monitoring points for 2019/20

Month	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)
Yanco Main Southern Escape (YMS) 410083					
Jul-19	-	-	-	-	-
Aug-19	-	-	-	-	-
Sep-19	-	-	-	-	-
Oct-19	-	-	-	-	-
Nov-19	-	-	-	-	-
Dec-19	-	-	-	-	-
Jan-20	-	-	-	-	-
Feb-20	-	-	-	-	-
Mar-20	41.5	121	74.8	192	3.2
Apr-20	-	-	-	-	-
May-20	-	605	427	650	-
Jun-20	-	-	-	-	-
Total	**41.5**				**3.2**
Gooragool Lagoon Escape (LAG) 41010940					
Jul-19	-				-
Aug-19	-				-
Sep-19	22	671.0	41.8	814.0	9.0
Oct-19	-				-
Nov-19	-				-
Dec-19	-				-
Jan-20	-				-
Feb-20	0.7	60.0	1.1	158.0	-
Mar-20	16.1	636.0	198.0	798.0	5.0
Apr-20	2.3	240.0	11.9	691.0	-
May-20	26.3	424.0	157.0	758.0	6.0
Jun-20	2.1	551.0	472.0	749.0	1.0
Total	**69.5**				**21**
Gogeldrie Main Southern Escape (GMSRR) 41010921					
Jul-19	-	-	-	-	-
Aug-19	-	-	-	-	-
Sep-19	3.2	245	227	259	-
Oct-19	-	-	-	-	-
Nov-19	-	-	-	-	-
Dec-19	-	-	-	-	-
Jan-20	-	-	-	-	-
Feb-20	-	-	-	-	-
Mar-20	-	-	-	-	-
Apr-20	-	-	-	-	-
May-20	-	-	-	-	-
Jun-20	-	-	-	-	-

Month	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)
Total	**3.2**				
Cudgel Creek Escape (ROCUDG) 41010005					
Jul-19	-	-	-	-	-
Aug-19	-	-	-	-	-
Sep-19	-	-	-	-	-
Oct-19	0.3	75.4	55.7	104.0	-
Nov-19	3.4	87.6	52.5	124.0	-
Dec-19	0.1	88.3	75.2	109.0	-
Jan-20	-	108.0	97.0	130.0	-
Feb-20	-	85.1	64.6	109.0	-
Mar-20	-	66.7	59.9	75.5	-
Apr-20	-	-	-	-	-
May-20	8.8	134.0	114.0	177.0	1.0
Jun-20	-	124.0	41.4	146.0	-
Total	**12.6**				**1.0**
Mirrool Creek Floodway (MIRFLD) 41010163					
	-	-	-	-	-
Total	**-**				**-**

Table 18 details the discharged salt load for the current reporting year and prior years, including the benchmark year.

The salt load is fully dependent on the volume discharged, however the reduction in salt can also be attributed to MI's efforts to recycle irrigation discharge water within the MIA and our customers' efforts to improve water efficiency and recycle irrigation waters on-farm.

Table 18 Discharged salt load 2019/20 compared to prior years

Year	Water discharged (ML)	Discharged Salt load (t)
2019/20	127	25
2018/19	642	98
2017/18	4,471	854
2016/17	122,092	34,230
2005/06	8,570	1,887

5.3 Salt load summary

The salt loads presented in Table 19 show 18,817 tonnes of salt was received through diversions recorded at MI's authorised supply works (NARREG and STURT). A total of 25 tonnes was discharged from the Area of Operations and an estimated 18,792 tonnes was retained within the MIA.

Table 19 Salt load summary for 2019/20

Extracted	Salt load (t)
STUR	1,787
NARREG	17,030
Total extracted	**18,817**

Discharged	Salt load (t)
YMS	3
GMSRR	0
LAG	21
ROCUDG	1
MIRFLD	0
Total discharged	**25**
Retained	**18,792**

It is important to note that this is a simple annual salt balance that considers salt loads entering via authorised works and leaving via approved discharge locations. The balance does not consider other factors that impact total salt loads in the MIA.

No additional data is held by MI that is relevant to the assessment of salinity impacts under the Murray Darling Basin – Basin Salinity Management 2030.

6 Groundwater conditions

The following information is provided from MI's groundwater network monitoring only. MI cannot comment on influences on groundwater from other sources, including groundwater extraction by private owners or other entities and any recharge or disturbance from other developments or activities.

6.1 Groundwater monitoring and reporting

Groundwater monitoring was completed in the last quarter of 2019. The network consists of piezometers in the Shallow and Deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

A total of 641 piezometers are required to be monitored and reported on as per Attachment 2 of the Monitoring and Reporting Plan. The locations of these bores are displayed in Figure 4.

Table 20 provides a status summary of the groundwater piezometers monitored in 2019.

A total of 534 piezometers were read during the monitoring, which equates to 83% of the network and 89% of the network which has not been destroyed. A total of 94% of the MI piezometer network was still in place, with only 39 piezometers noted as destroyed.

During the monitoring, 68 piezometers could not be found in the field. It is believed this was due to a combination of factors, including altered site access, site redevelopment, removal of marker stakes, ground conditions and staff unfamiliar with the area. A concerted effort is being made in 2020 to ensure all locations are inspected and site identification is improved.

Table 20 Groundwater piezometer status summary 2019

Total bores	Total destroyed+	Dry, flooded or blocked	Not found	Total read
641	39	47	68	534

Note: + piezometers damaged or destroyed in the field due to land development or other uses or actions.

Depth to water table data is reported for 2019/20, 2018/19, 2017/18 and 2005/2006. The 2005/06 reporting year was chosen for reference as it represents a time period that includes the millennium drought in the MIA.

The number of piezometers read within depth ranges for 2019 are shown in Table 21.

Table 21 Number and percent of total piezometers readings within each depth range

Year	<2M of surface	2-4M of surface	>4M of surface	% <2M of surface	% 2-4M of surface	% >4M of surface	Total
2019	5	96	386	1%	20%	79%	487
2018	23	151	367	4%	28%	68%	541
2017	65	163	339	11%	29%	60%	567
2005	55	225	342	9%	36%	55%	622

Table 21 shows that the trend in groundwater depth at each piezometer is trending downward, with 79% of piezometers reading at a depth greater than four metres below the ground surface.

Table 22 provides a comparison of the three depth class areas relative to the previous two years and historical reference year. The area for each class is estimated using the depth measurement from each piezometer and its known location. The value for an area is interpolated from the point measurement using Nearest Neighbour Resampling method. This information can change if certain piezometers are not read due to being blocked, flooded, destroyed or lack of access.

In 2019 when compared to 2017 there has been an overall reduction of hectares in the shallow depth range, including when compared to the 2005 figures. The small rise in hectares from 2018 to 2019 for shallow groundwater levels may not be significant, given the inherent uncertainties in the area calculations.

The overall trend in groundwater levels using both point data from Table 21 and area data from Table 22 shows groundwater levels are at a deeper level when compared to both recent years and the benchmark year of 2005.

The area of operations has decreased between 2005 and 2019 and approval granted in 2015 to reduce the groundwater piezometer network.

Table 22 Change in groundwater depth

Groundwater depth range (m)	Depth to water table area (ha)				Change in depth [+ = rising] [- = falling]		
	2019	2018	2017	2005	2019 vs 2018	2019 vs 2017	2019 vs 2005
<2M	161	0	1,829	996	+161	-1,668	-835
2-4M	32,310	76,393	120,189	109,772	-44,083	-87,879	-77,462
>4M	892,237	848,315	658,149	815,545	+43,922	+234,088	+76,692
Total	924,708	924,708	780,168	926,313			

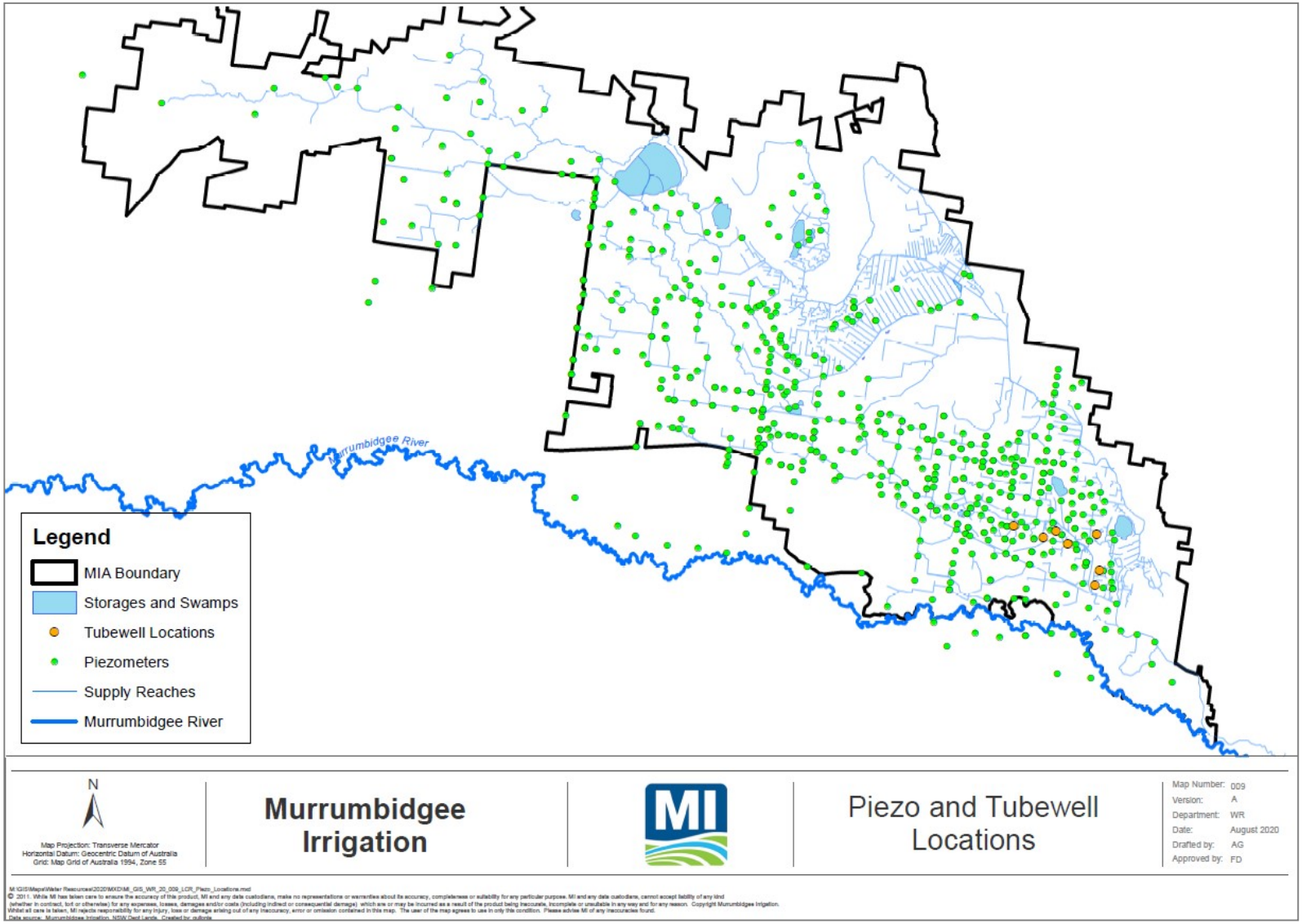


Figure 4 Location of piezometers and tubewells in the MIA 2019/20

6.2 Groundwater salinity

Groundwater salinity was not requested by the Minister for 2019/2020 reporting year.

6.3 Shallow Shepparton Formation

The depth to water table in 2019 for piezometers in the shallow Shepparton Formation are presented in Figure 5 to Figure 9.

Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall, geology and irrigation. A comparison between Figure 5 and Figure 6 demonstrates that the majority of groundwater levels have lowered in comparison with prior years. Below average rainfall combined with less diversions and deliveries to customers would have impacted the aquifers ability to recharge.

When compared to 2005/06 (Figure 9), recent groundwater levels appear to have mainly lowered across the MIA, with fewer piezometers reading standing water levels within 2 m from surface level. While groundwater levels can be influenced by ongoing drought conditions and below average rainfall, it is likely that groundwater levels have lowered due to the following:

- Reduction in flood irrigation practices
- Improved water efficiency on farm, including water retention and recycling
- Seepage reduction works across the MIA network

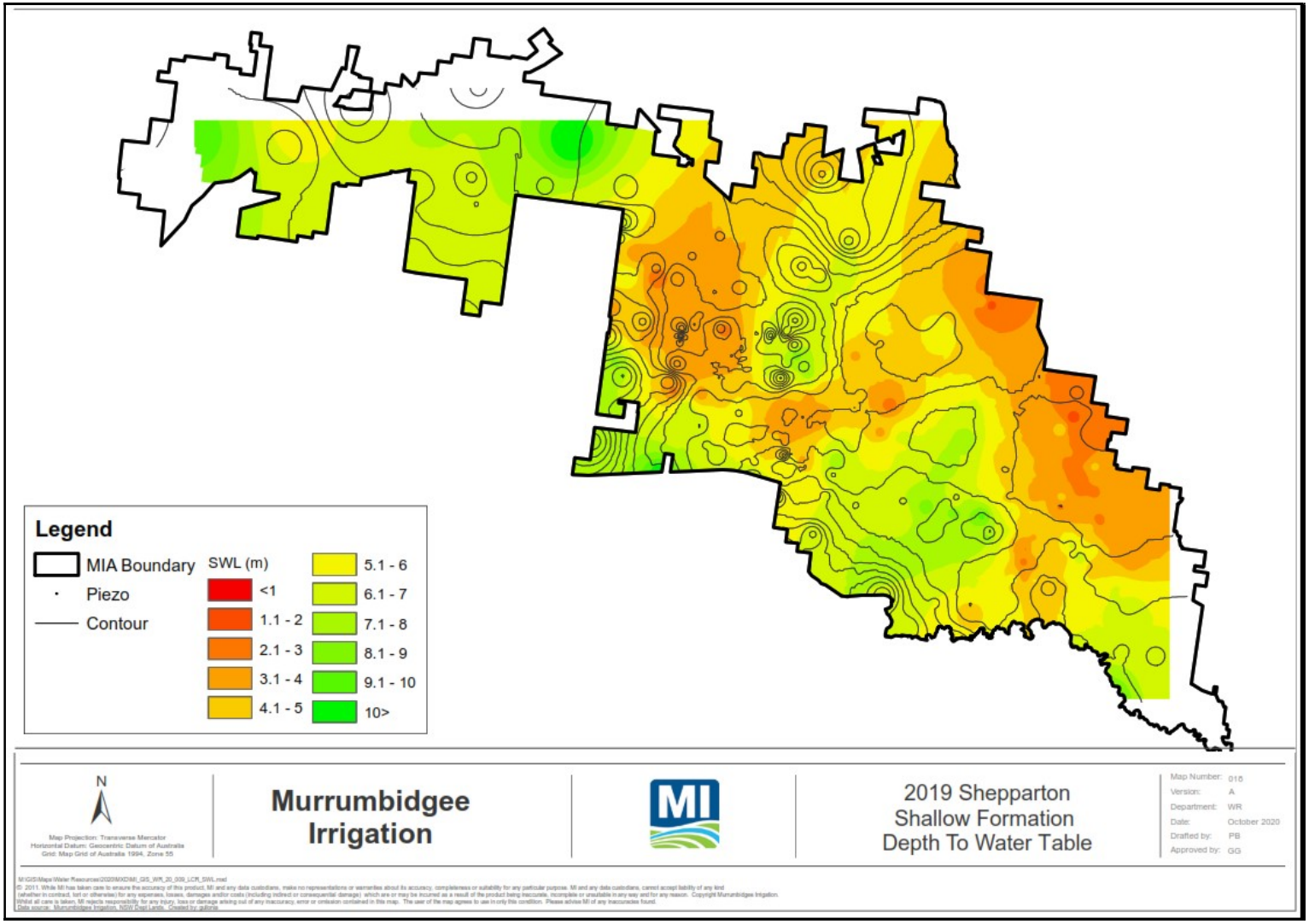


Figure 5 Shallow Shepparton Formation – depth to water table 2019

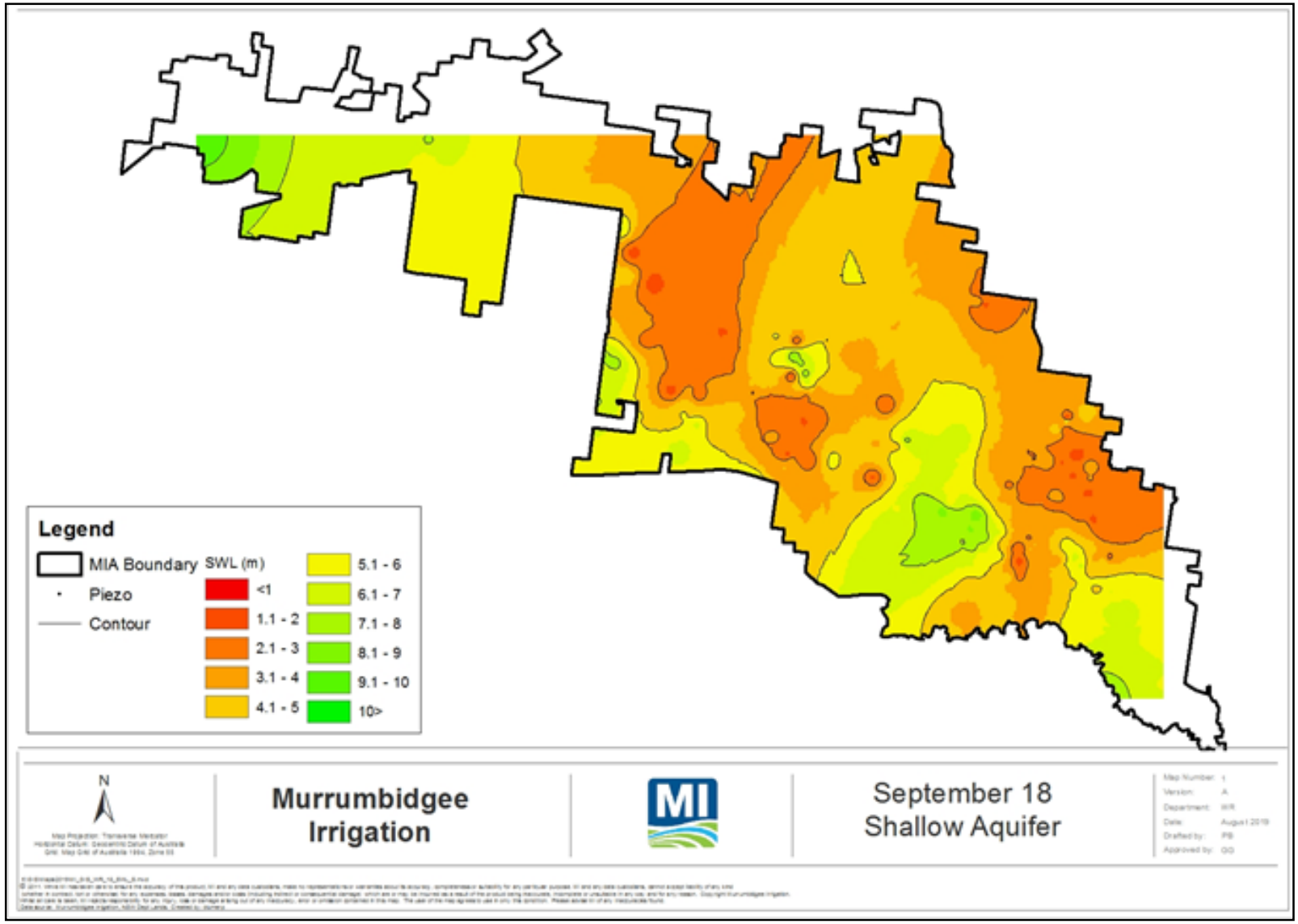


Figure 6 Shallow Shepparton Formation – depth to water table September 2018

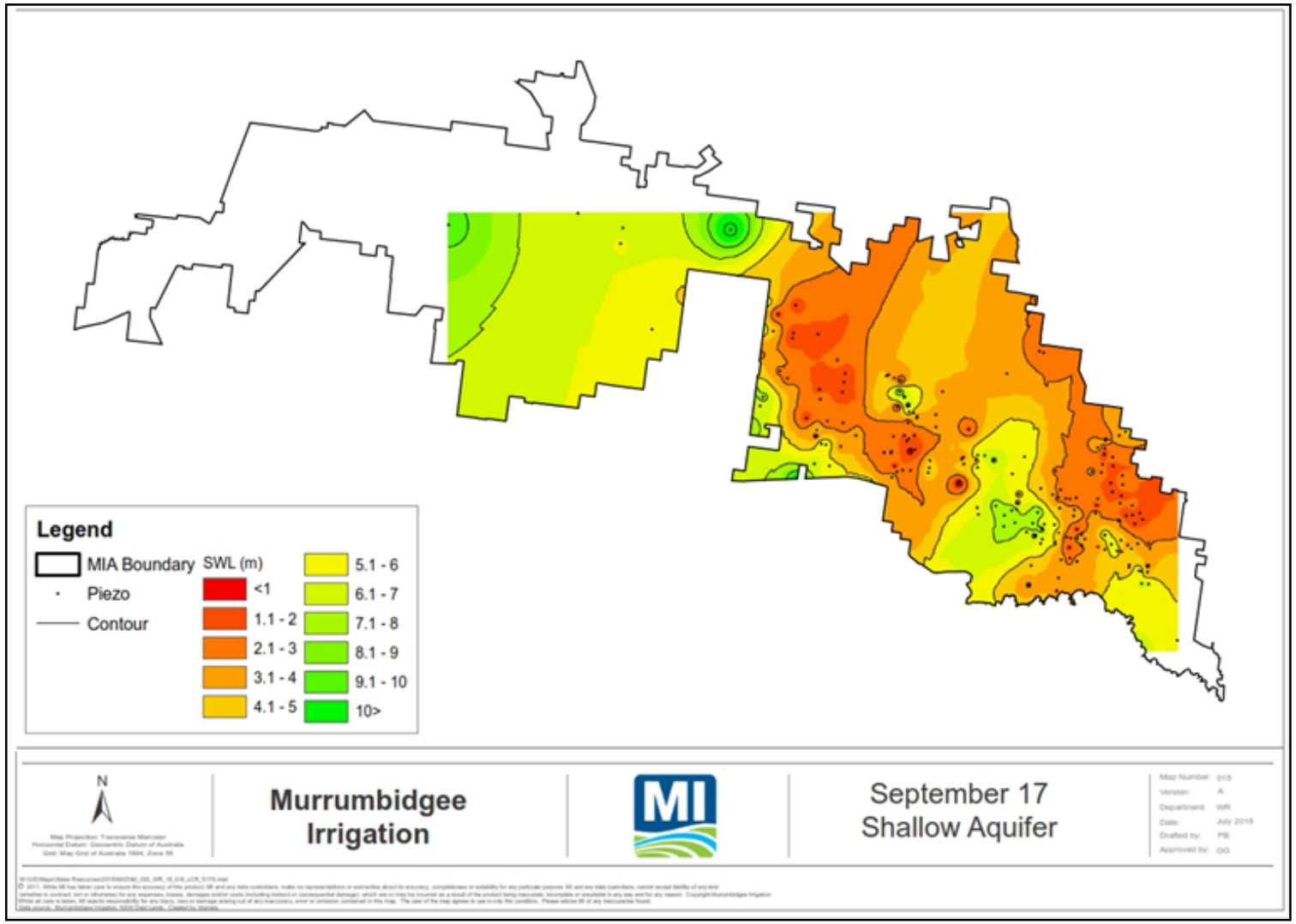


Figure 7 Shallow Shepparton Formation - depth to water table, September 2017

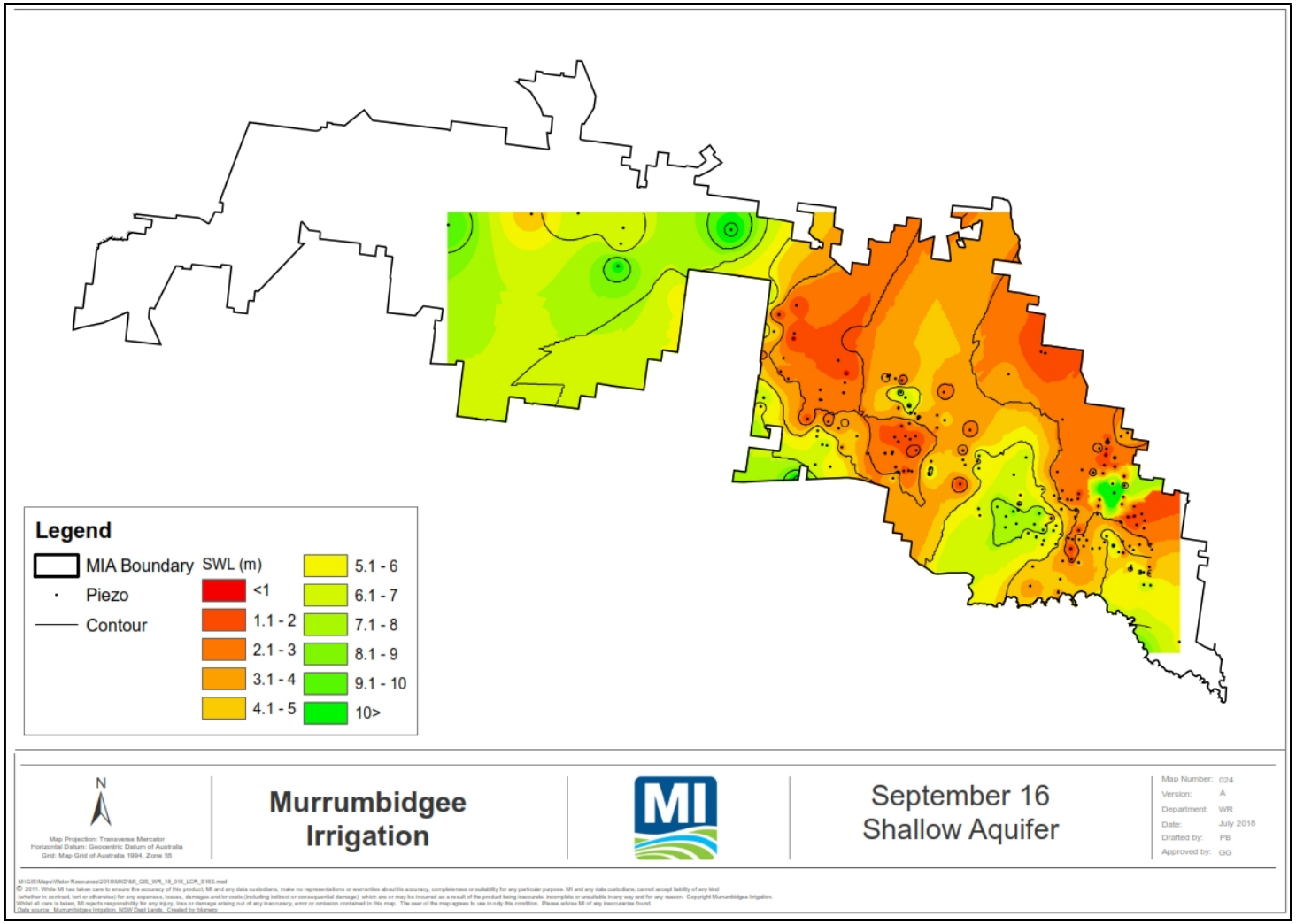


Figure 8 Shallow Shepparton Formation - depth to water table, September 2016

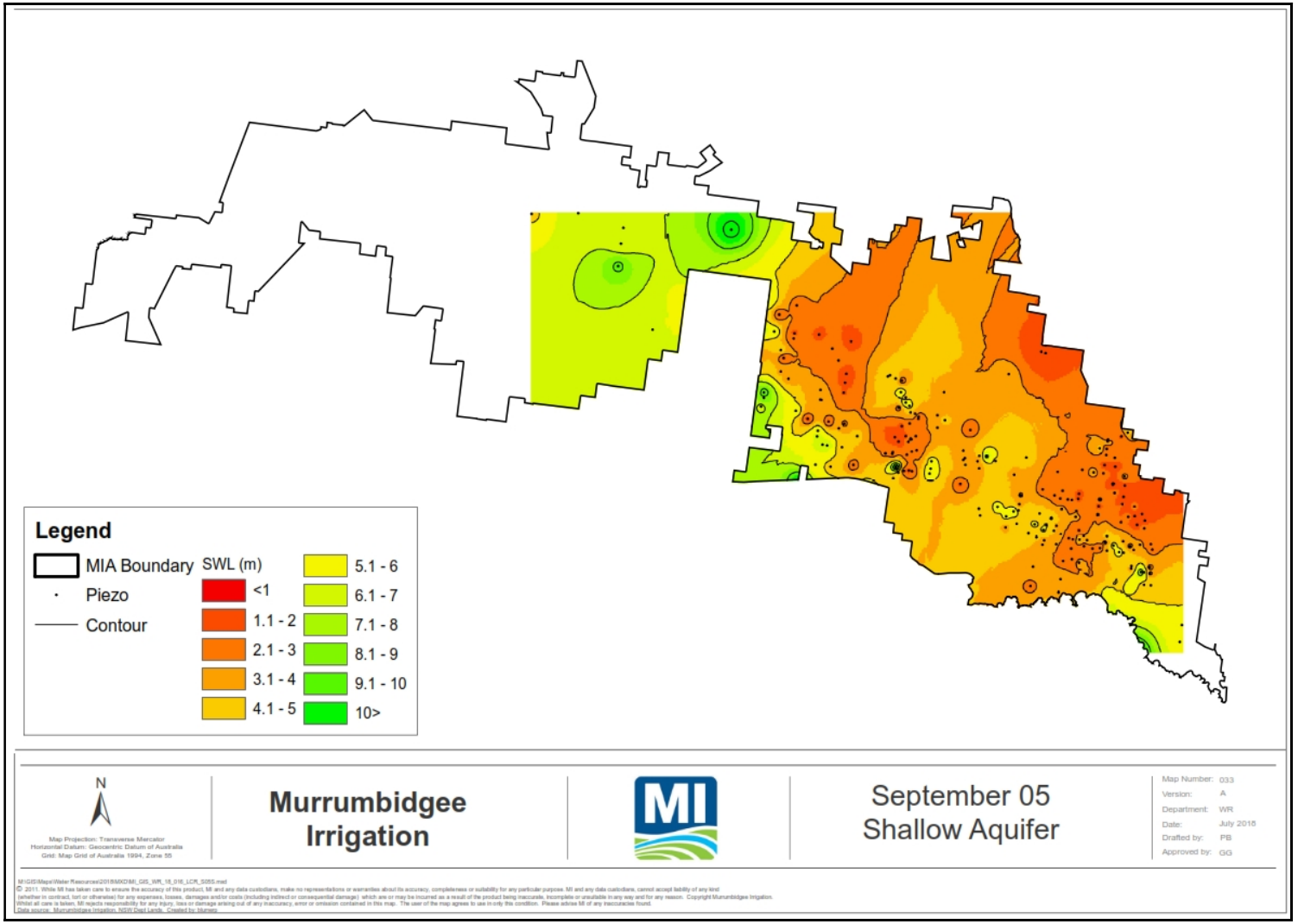


Figure 9 Shallow Shepparton Formation - depth to water table, September 2005

6.4 Deep Shepparton Formation

Depth to water table for piezometers in the deep Shepparton Formation are presented in Figure 10 to Figure 14.

Groundwater levels in the deep Shepparton Formation can be influenced by connectivity with the shallow Shepparton Formation. Therefore, a comparison between Figure 10 and Figure 11 also demonstrates that the groundwater levels have lowered in comparison with prior years.

Groundwater levels appear to have lowered in the deep Shepparton formation. This deep formation is potentially influenced by the reduced number of flood irrigated fields and below average rainfall.

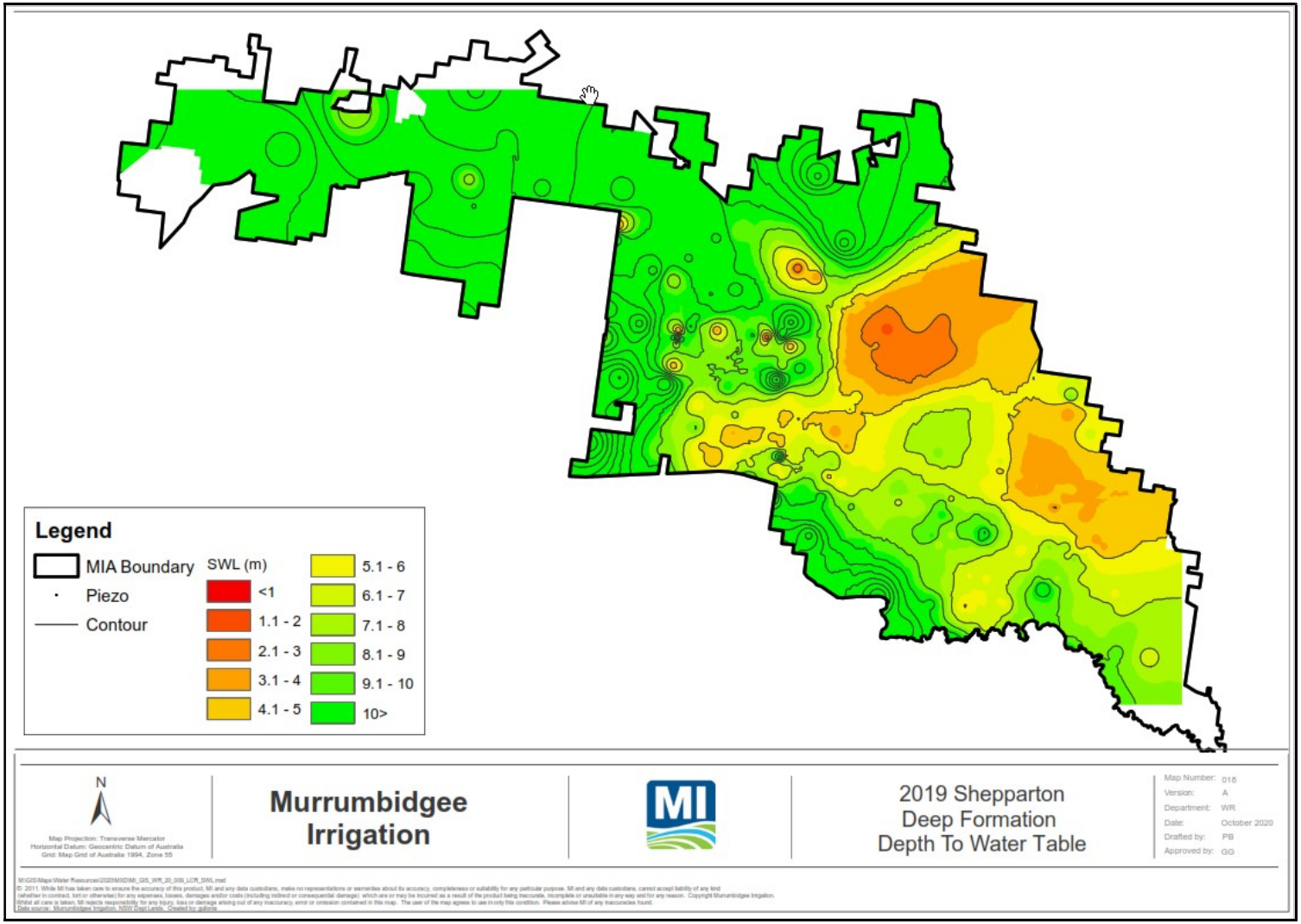


Figure 10 Deep Shepparton Formation - depth to water table, 2019

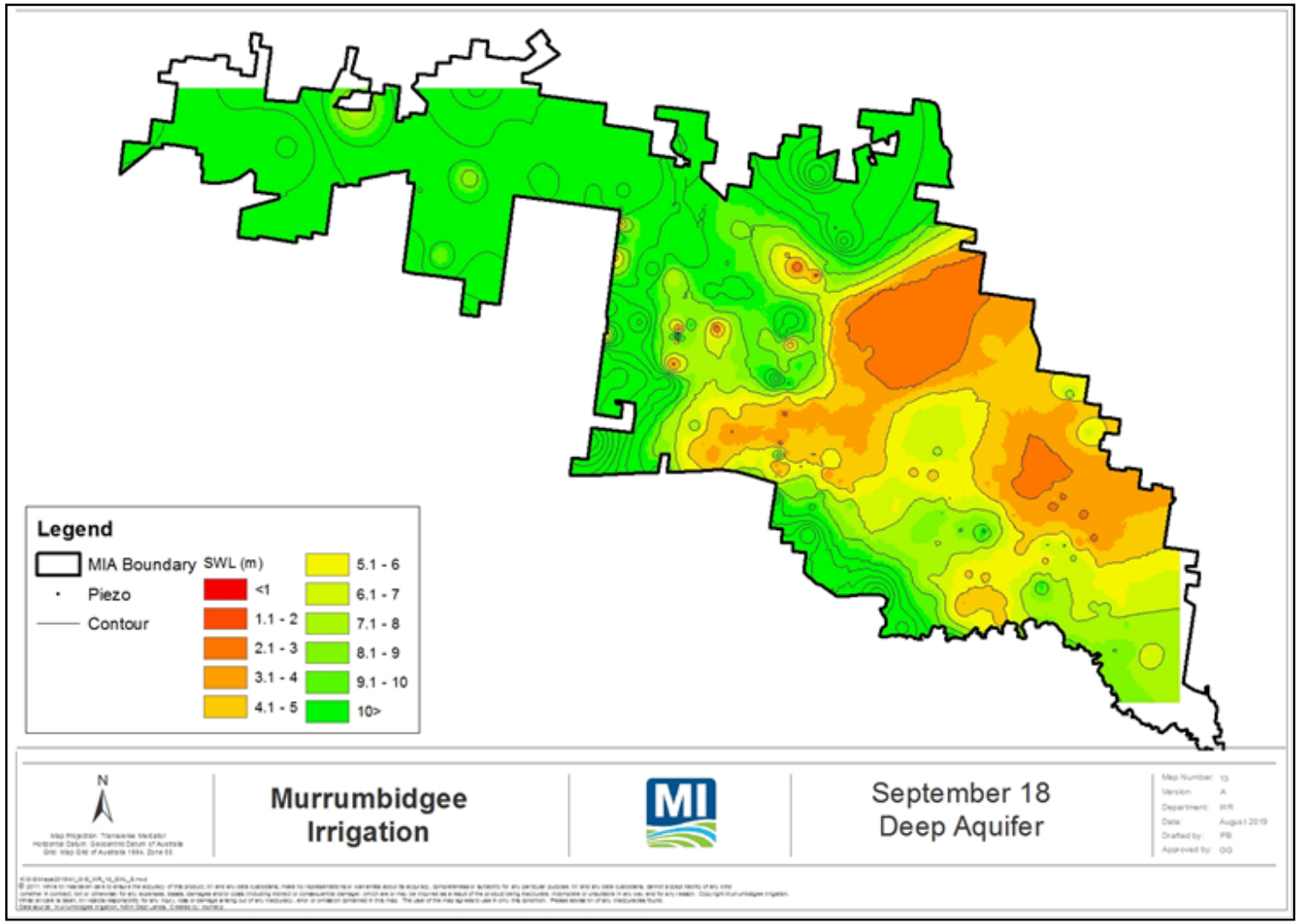


Figure 11 Deep Shepparton Formation - depth to water table, September 2018

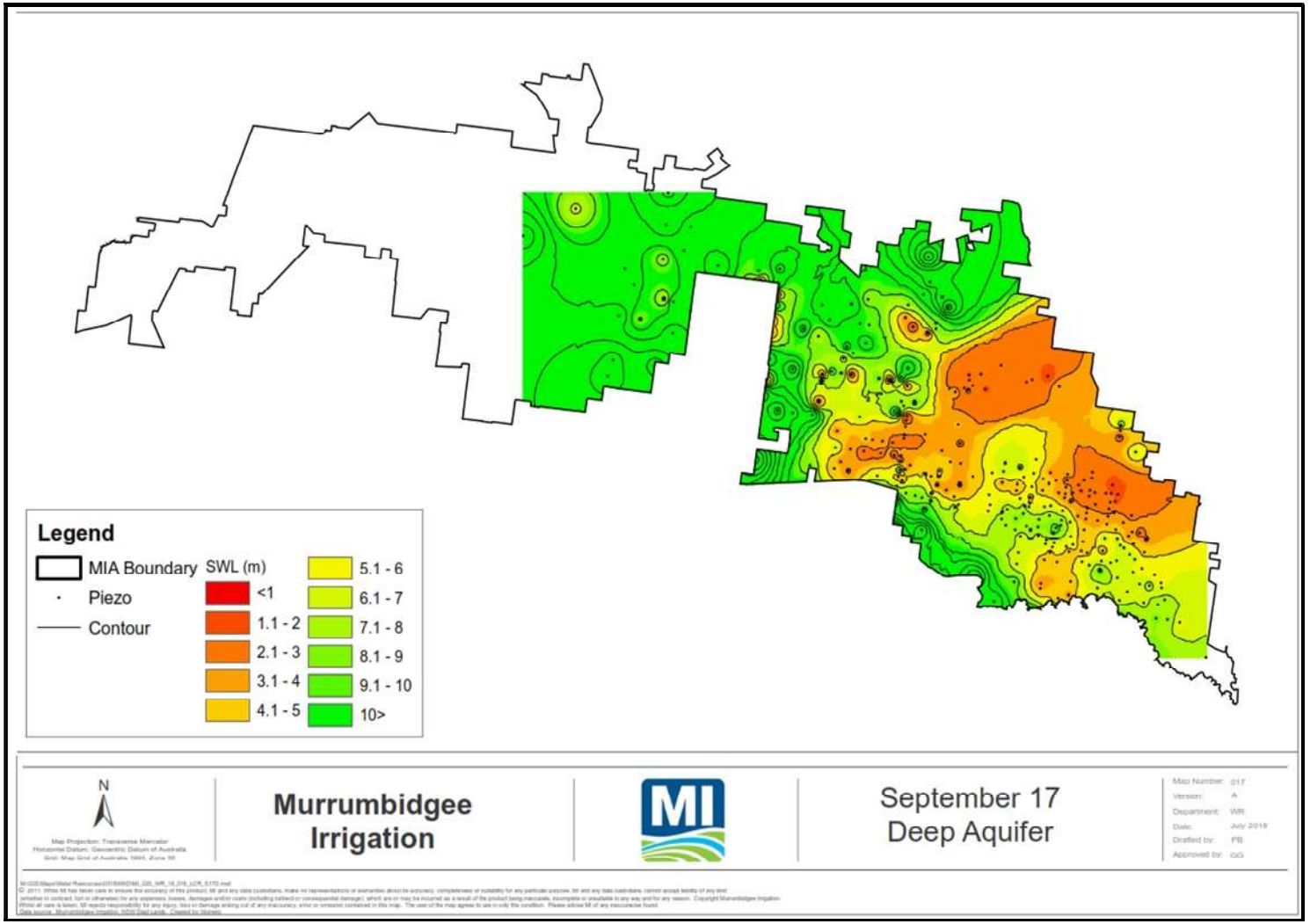


Figure 12 Deep Shepparton Formation - depth to water table, September 2017

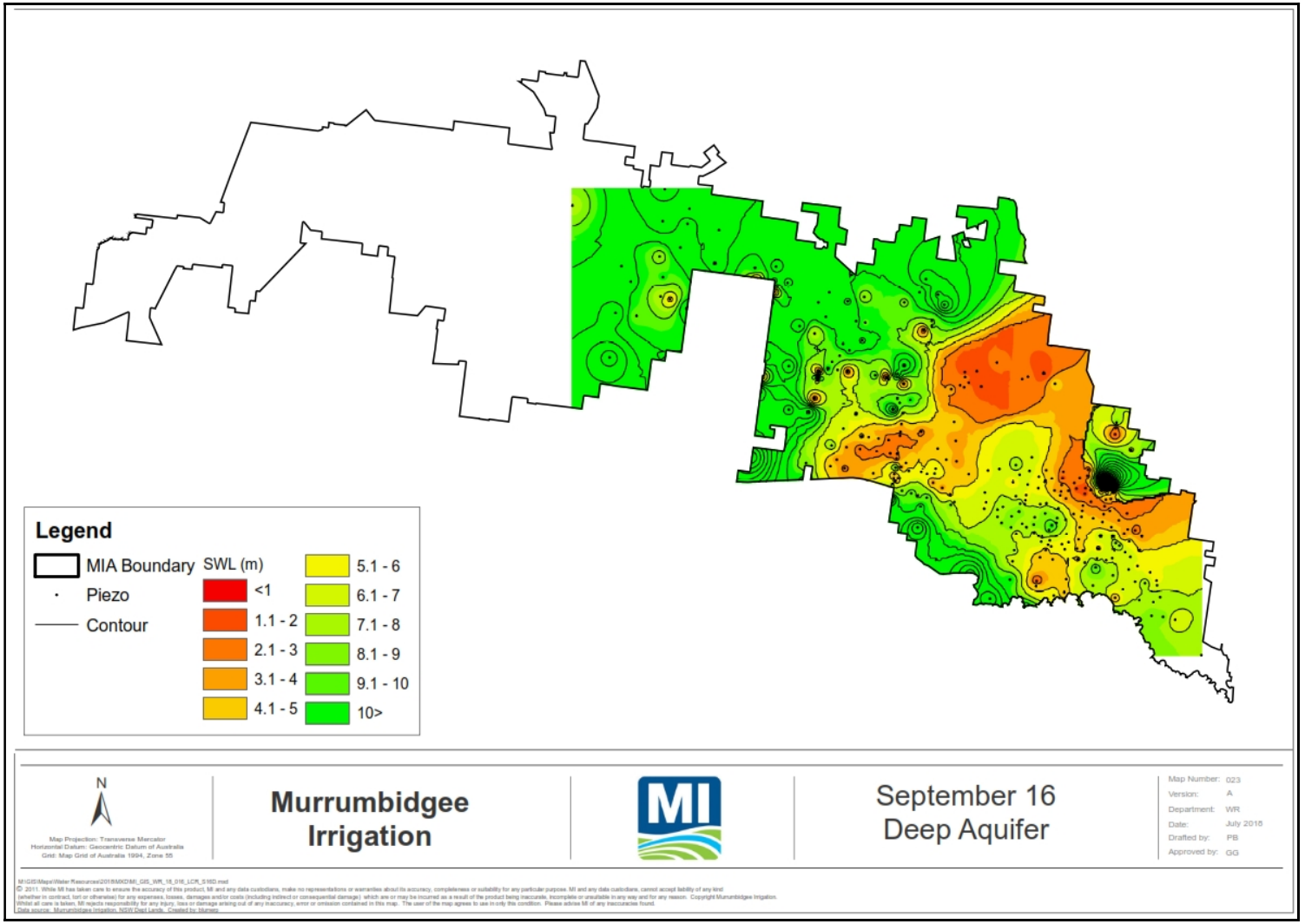


Figure 13 Deep Shepparton Formation - depth to water table, September 2016

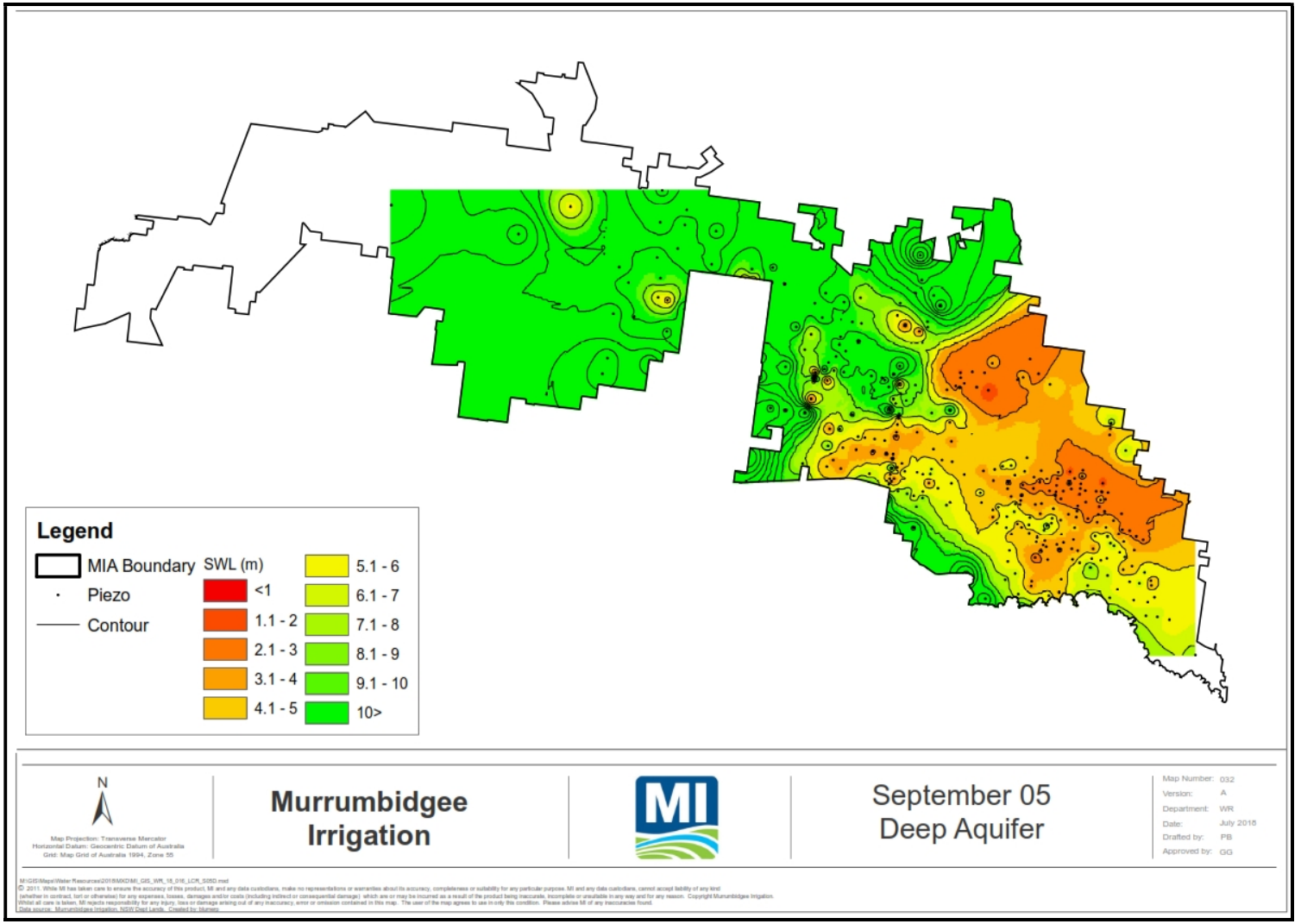


Figure 14 Deep Shepparton Formation – Depth to water table, September 2005

6.5 Calivil Formation

Depth to water table for piezometers in the Calivil Formation are presented in Figure 15 to Figure 19.

Level trends in this formation generally represent drawdown from the shallow and deep Shepparton aquifers. When comparing Figure 15 and Figure 16 the depth to water table has lowered. Overall, the levels in this aquifer remain consistent for all reporting years, with most piezometers reading a depth to water table of more than 10 metres.

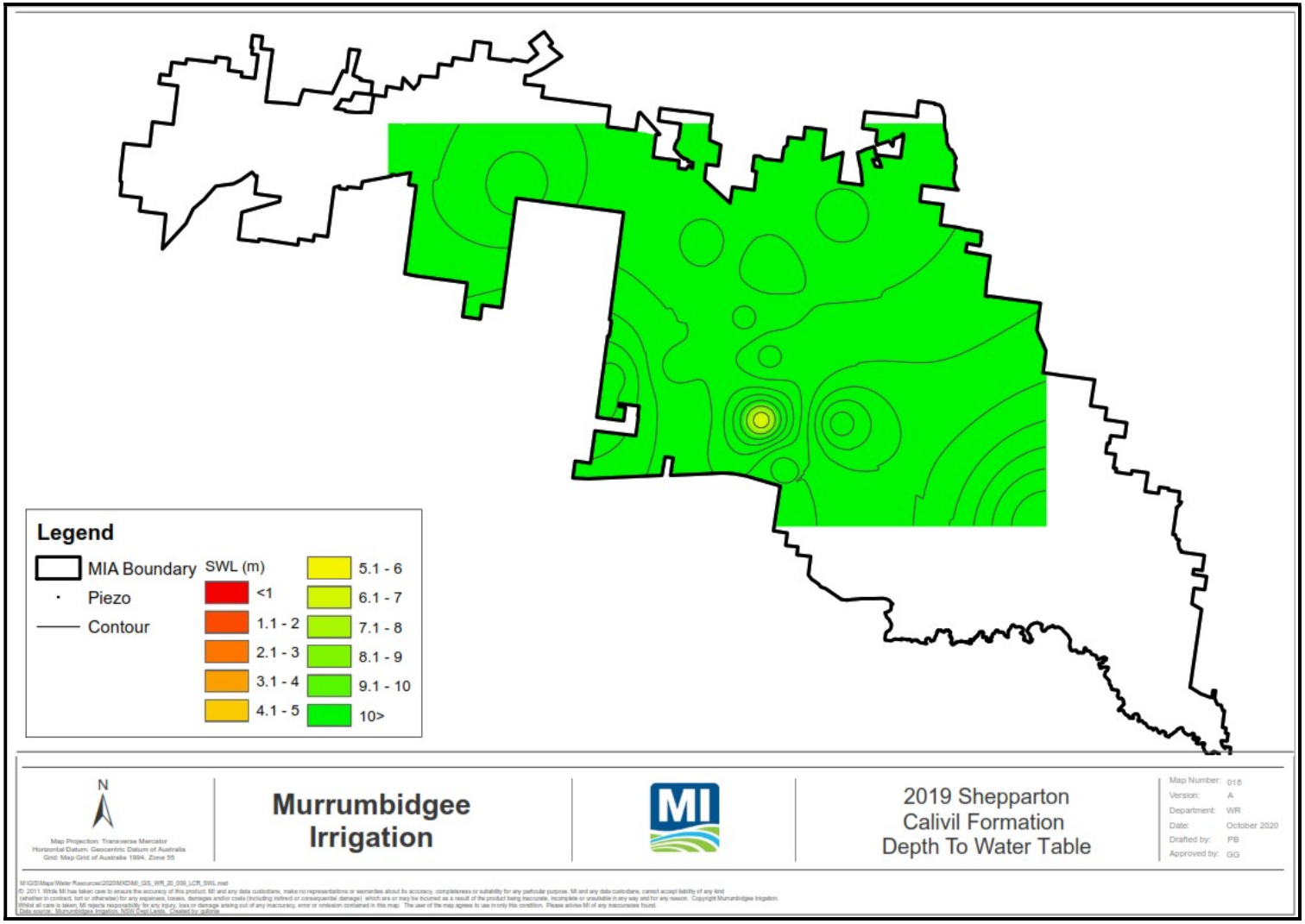


Figure 15 Calivil Formation – depth to water table, 2019

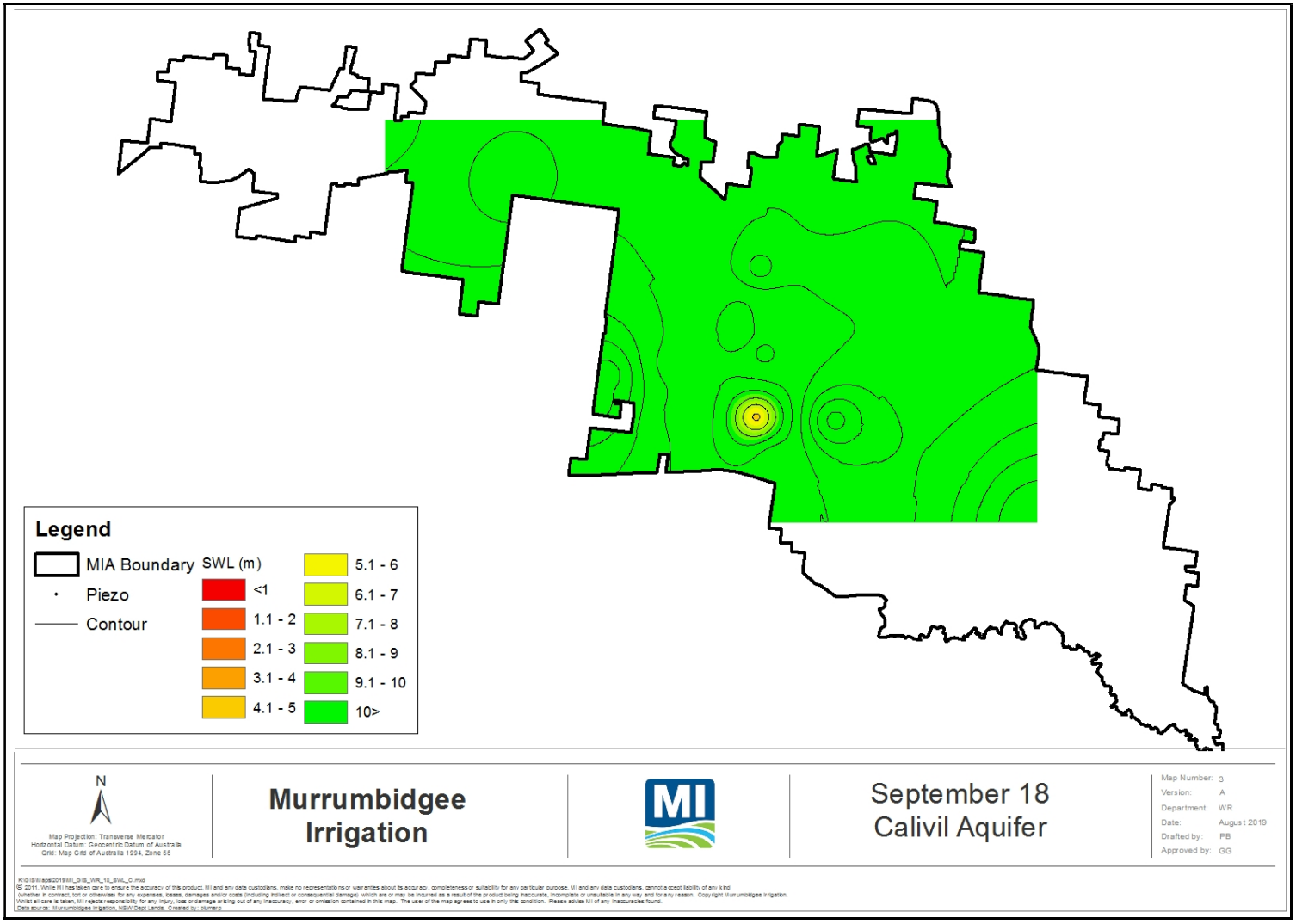


Figure 16 Calivil Formation - depth to water table, September 2018

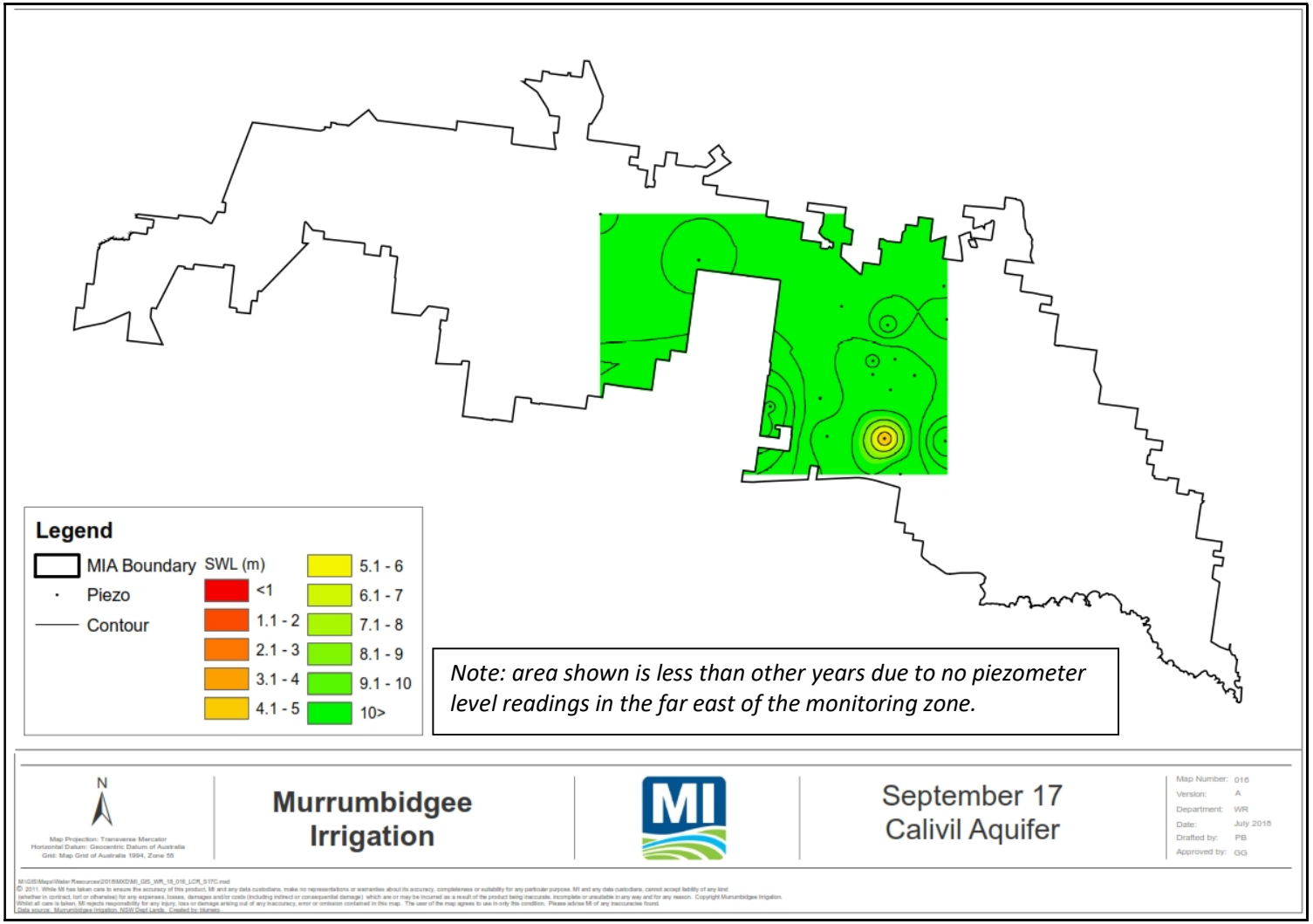


Figure 17 Calivil Formation - depth to water table, September 2017

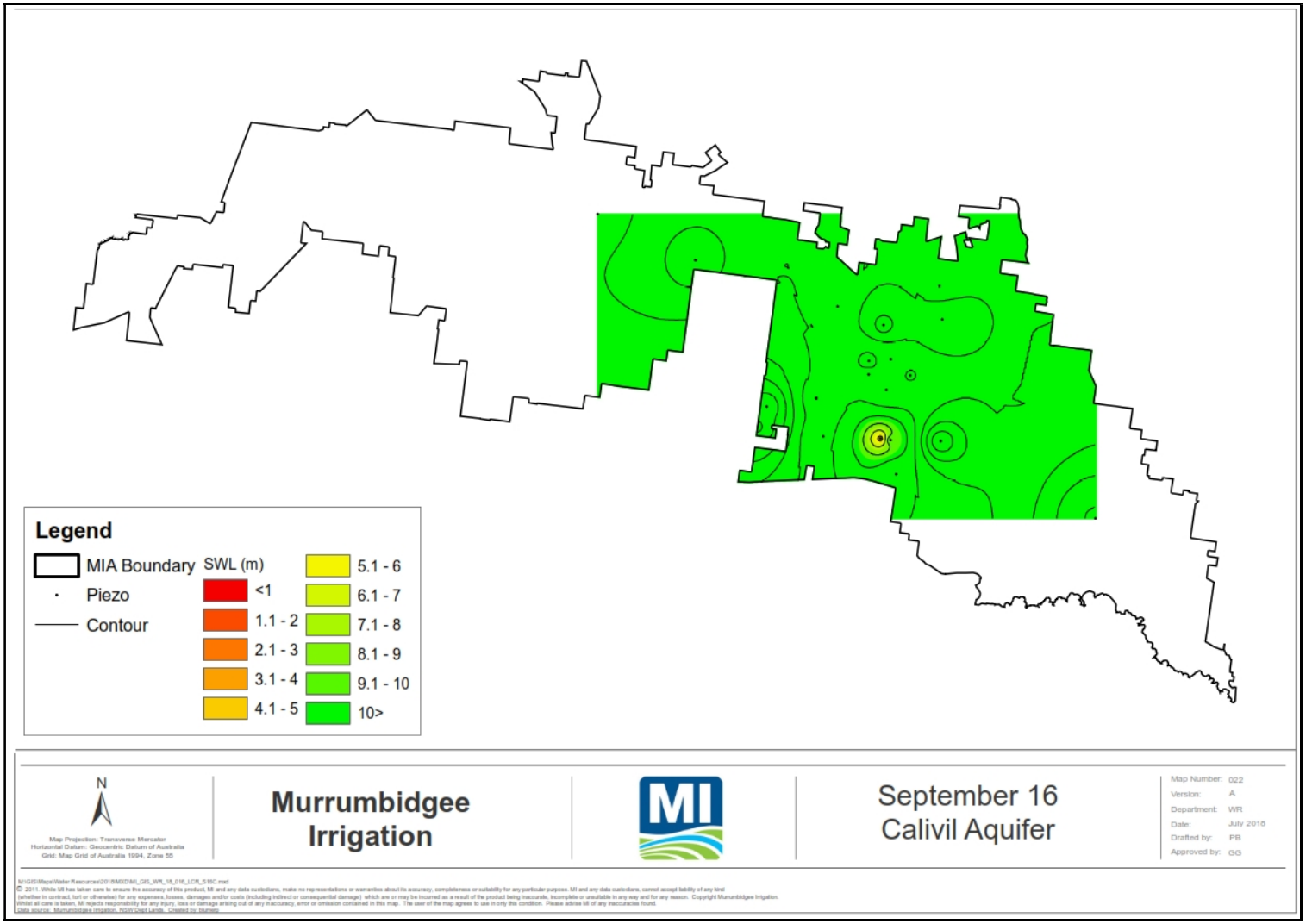


Figure 18 Calivil Formation - depth to water table, September 2016

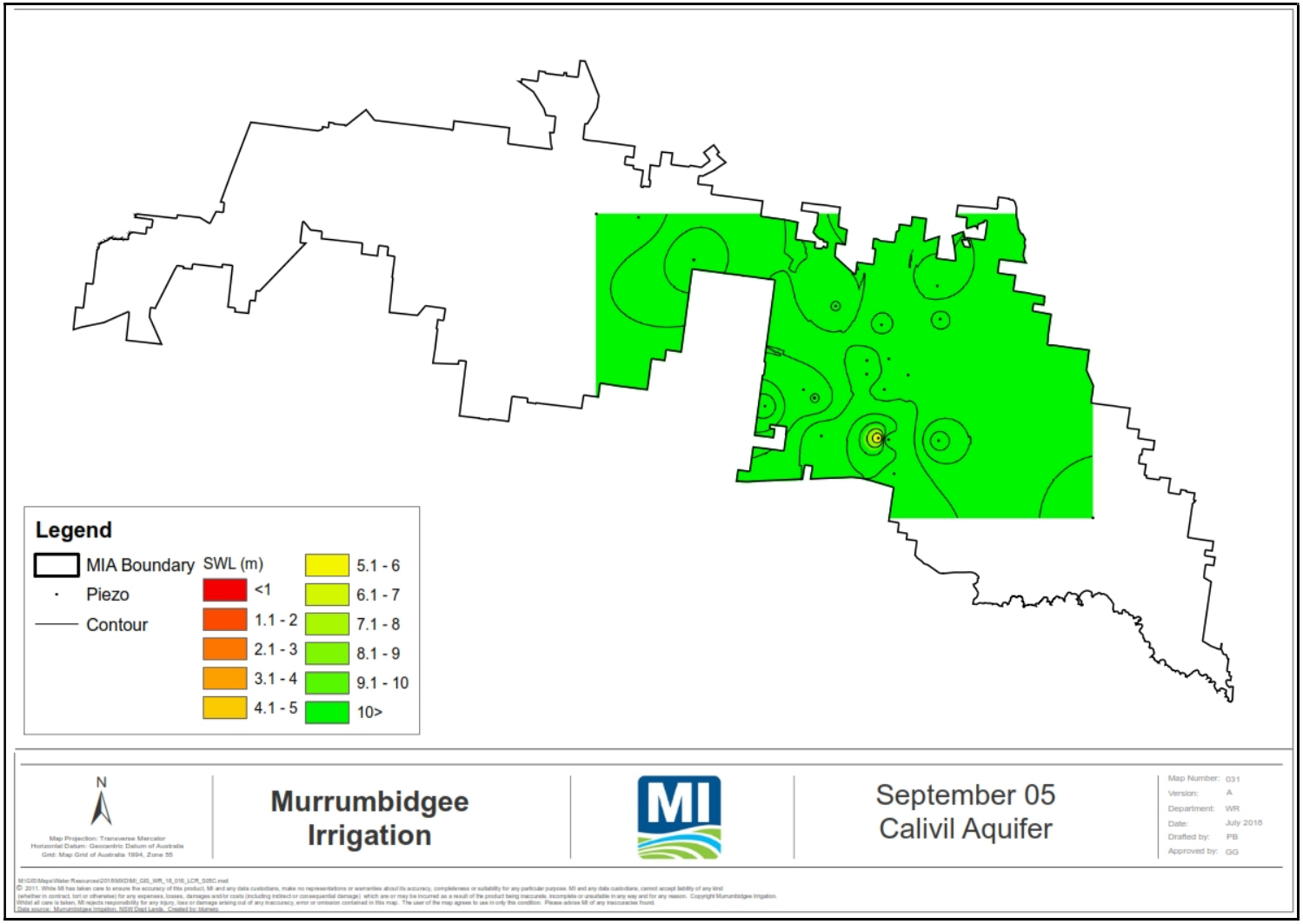


Figure 19 Calivil Formation - depth to water table, September 2005

7 Tubewells

MI monitors the volume of water and salt load pumped from seven tubewells within the MIA. The locations of the tubewells are shown in Figure 4.

No tubewells were operated during the 2019/20 reporting period. MI are in consultation with the relevant authority as to their future operation.

8 New measures to limit groundwater recharge and discharge of salt

No new measures were implemented for 2019/20.

9 Environmental protection and management

9.1 Discharge of noxious aquatic weeds

During 2019/20 irrigation year, there was no known actual or potential discharge of Class 1, 2 or 3 declared aquatic weeds from MI's Area of Operation.

9.2 Discharge of blue-green algae

No Red alert levels of blue-green algae were detected from any water sampled during discharge from MI's area of operation.

ENVIRONMENTAL PROTECTION LICENCE 4651

10 Statement of compliance

MI has fulfilled the compliance requirements as set out in EPL 4651 for 2019/20. A summary of the compliance requirements is cross referenced to this report and listed in Table 23.

One non-compliance was recorded and reported on during 2019/20 and was detailed in MI's Annual Return.

Quality assurance and control procedures are in place to ensure data integrity and to ensure that all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations at discharge points. Internal Standard Operating Procedures (SOPs) for monitoring and reporting are reviewed and updated regularly.

MI has in place a process to receive complaints from members of the public in relation to MI's activities via the business telephone number. Contact information for complaints can be found on MI's website (https://www.mirrigation.com.au/company/contact).

Table 23 EPL 4651 monitoring and reporting requirements

Licence section	Requirement	Compliant	Included in this report
Administrative Conditions	1	Yes	No, not applicable
Discharges to Air and Water and Applications to Land	2	Yes	N/A
Limit Conditions	3	Yes	N/A
Operating Conditions	4	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	No, see: https://www.mirrigation.com.au/water/water-quality
Maintain a Chemical Control Plan	O3.5	Yes	
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	
Monitoring and Recording Conditions	5	Yes	10. Statement of Compliance
Monitoring Records	M1	Yes	No - available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	No - Internal documents
Recording of pollution complaints	M4	Yes	No - available upon request from EPA
Telephone complaints line	M5	Yes	10. Statement of Compliance
Requirement to monitor volume or	M6	Yes	11. EPL Monitoring and

Licence section	Requirement	Compliant	Included in this report
mass			Reporting
Other Monitoring and recording conditions	M7	Yes	9.1. Noxious Weed Management
Annual return documents	R1	Yes	Submitted 25 August 2020
Annual system performance report	R4 Summary R2, R3 & R5	Yes	a) 3. Reporting on water management b) 11. EPL monitoring and reporting & 11.2 Water quality monitoring c) 11.3. Summary of events d) 12. Proposed changes

11 EPL monitoring and reporting

Under MI's EPL 4651, five locations (Figure 2) are licensed to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded, and specified water quality parameters are monitored. These discharge points are listed below:

- POINT 4 LAG - Gogeldrie Main Drain at Gooragool Lagoon
- POINT 5 GMSRR – Gogeldrie Main Southern Drain River Road
- POINT 6 YMS – Yanco Main Southern Drain
- POINT 7 ROCUDG – Cudgel Creek Roaches Escape
- POINT 15 MIRFLD – Mirrool Creek Floodway Wyvern Station

11.1 System performance

Table 24 presents total diversions into the MIA and total water discharged from the MIA for 2019/20 compared to previous years. In 2019/20, 127 ML was discharged. The large volume discharged in the 2016/17 season included 121,363 ML that was diverted to Mirrool Creek Floodway as a means of flood risk mitigation during a 1/150-year flood event.

In 2005/06 MI's drainage reuse system was not complete, which explains the high discharge volumes recorded in that year. MI does not discharge irrigation wastewater directly to groundwaters inside or outside the area of operations.

Table 24 Total water volumes

Year	Diversions (ML)	Discharged (ML)
2019/20	349,523	127
2018/19	586,752	642
2017/18	945,805	4,471
2016/17	780,083	122,092
2005/06	1,036,519	8,570

11.2 Water quality monitoring

Monthly summaries for each monitoring point are presented in Table 25 to Table 29. Monitoring consisted of five sampling events, with five Notification level detections. No Action levels were detected during the reporting period, compared to the prior reporting year where two Action levels were detected.

Diuron, metolachlor and chlorpyrifos were the three chemicals detected in 2019/20. Chemical detections were found at two of the five licenced sites, Point 4 - LAG and, Point 6 - YMS.

Table 25 Monitoring results for Point 4 - LAG

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-19	0	0	0	-
Aug-19	0	0	0	-
Sep-19	22	1	2	04/09/19 Notification level Chlorpyrifos (0.104µg/L) 04/09/19 Notification level Metolachlor (0.025µg/L)
Oct-19	0	0	0	-
Nov-19	0	0	0	-
Dec-19	0	0	0	-
Jan-20	0	0	0	-
Feb-20	0.7	1	1	12/02/20 Notification level Chlorpyrifos (0.043µg/L)
Mar-20	16.1	1	1	06/03/20 Notification level Metolachlor (0.063µg/L)
Apr-20	2.3	0	0	-
May-20	26.3	0	0	Supply water release via escape. No sample taken. See Annual Return
Jun-20	2.1	0	0	-
Total	**69.5**	**3**	**4**	

Table 26 Monitoring results for Point 5 - GMSRR

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-19	0	0	0	-
Aug-19	0	0	0	-
Sep-19	3.2	0	0	Supply water release (via breach of regulator). No sample taken
Oct-19	0	0	0	-
Nov-19	0	0	0	-
Dec-19	0	0	0	-
Jan-20	0	0	0	-
Feb-20	0	0	0	-
Mar-20	0	0	0	-
Apr-20	0	0	0	-
May-20	0	0	0	-
Jun-20	0	0	0	-
Total	**3.2**	**0**	**0**	-

Table 27 Monitoring results for Point 6 - YMS

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-19	0	0	0	-
Aug-19	0	0	0	-
Sep-19	0	0	0	-
Oct-19	0	0	0	-
Nov-19	0	0	0	-
Dec-19	0	0	0	-
Jan-20	0	0	0	-
Feb-20	0	0	0	-
Mar-20	41.5	1	1	06/03/20 Notification level Diuron (0.313µg/L)
Apr-20	0	0	0	-
May-20	0	0	0	-
Jun-20	0	0	0	-
Total	**41.5**	**1**	**1**	

Table 28 Monitoring results for Point 7 - ROCUDG

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-19	0	0	0	-
Aug-19	0	0	0	-
Sep-19	0	0	0	-
Oct-19	0.3	0	0	-
Nov-19	3.4	1	0	No sample taken. Low flows didn't trigger alarm
Dec-19	0.1	0	0	-
Jan-20	0	0	0	-
Feb-20	0	0	0	-
Mar-20	0	0	0	-
Apr-20	0	0	0	-
May-20	8.8	0	0	No sample taken. Low flows over 19 days did not trigger alarm
Jun-20	0	0	0	-
Total	**12.6**	**1**	**0**	-

Table 29 Monitoring results for Point 15 - MIRFLD

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-19	0	0	0	-
Aug-19	0	0	0	-
Sep-19	0	0	0	-
Oct-19	0	0	0	-

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Nov-19	0	0	0	-
Dec-19	0	0	0	-
Jan-20	0	0	0	-
Feb-20	0	0	0	-
Mar-20	0	0	0	-
Apr-20	0	0	0	-
May-20	0	0	0	-
Jun-20	0	0	0	-
Total	**0**	**0**	**0**	**-**

Figure 20 provides a comparison of annual rainfall received, compared to the number of chemical detections for the last four years.

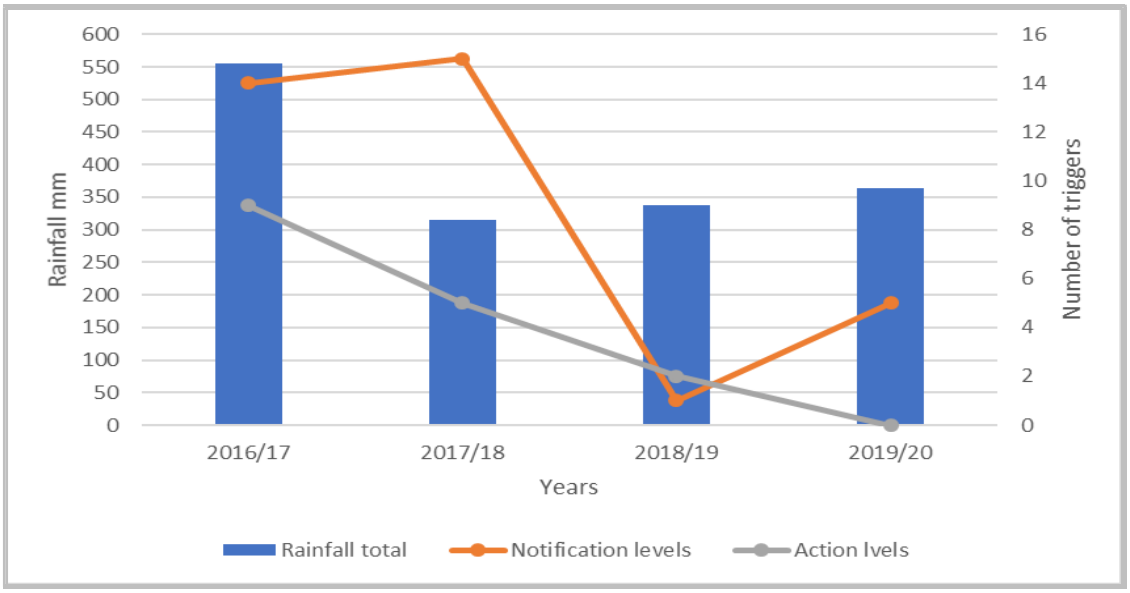


Figure 20: Comparison of irrigation drainage water notification trends

Drought conditions have occurred throughout the last three years which has led to water being retained and recycled on farms and within the MIA wherever possible. The year following the 2016 floods, saw the MIA catchment saturated and most storages full.

While the development of drought conditions following the floods, is likely to have influenced the decrease in chemical detections from 2018/19 onwards. The notification levels triggered in 2017/18, was due to the Mirrool Creek Floodway being operated on a number of occasions to reduce local flood risks, therefore the additional sampling effort resulted in chemical detections above notification levels.

Overall EPL-listed chemical levels within irrigation drainage water leaving the MIA has decreased throughout the last four years, with no above Action level detections in 2019/20.

MI is continuing to work with our customers to advise when exceedances have been recorded and encourage them to seek advice on appropriate chemical use for their businesses.

11.3 Summary of events

Table 30 contains a summary of all events that have been reported on during 2019/20. No events occurred that triggered notification of environmental harm or a written report to the EPA. A total of five exceedances were recorded throughout 2019/20 reporting period.

Table 30 Summary of events 2019/20

Year	Notification of environmental harm	Written report (of an event)	Exceedances
2019/20	0	1 (non-conformance, no env harm)	5

12 Proposed changes

MI propose no changes to the EPL conditions at this time.

Attachment A: VENTIA flow, EC, and salt load monitoring financial year report

MURRUMBIDGEE IRRIGATION LIMITED

FLOW, EC & SALT LOAD MONITORING FINANCIAL YEAR REPORT, AUGUST 2020

Issue To Lindsay Golsby-Smith

Issued Date 31/07/2020

Prepared: Ventia Utility Services
Envirnmental Monitoring
Hussain Morssi – Data Analyst

Reviewed: Ventia Utility Services
Seamus Ferry – Area Manager
Rebekah Webb– Hydrology Manager

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Document Control

Amendment	Date	Page	Description	Authorised
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Ventia Utility Services	Seamus Ferry
Ventia Utility Services	Rebekah Webb

The above notification list is a minimum controlled distribution and it is the responsibility of the persons receiving the notification to further notify other Ventia personnel within their area if required.

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1.0 Introduction

Ventia Utility Services is contracted by Murrumbidgee Irrigation Limited (MIA) to conduct continuous level/flow and salinity monitoring at a range of locations distributed across their area of operations.

This report presents monthly statistics and annual summaries of total flow and salt loads derived from the monitoring at Drain sites for the 2019 - 2020 financial year. Site 410083 contains no flow or salt load data as the rating table was suspended as of the 01/06/2010 to present due to the installation of new gates.

This report contains information relating to Murrumbidgee Irrigation Limited Compliance sites, 410083, 41010005, 41010921 and 41010940. Also reported on are the two offtake sites being 410127 and 410129. An annual site summary can be found in this report on all sites maintained by Ventia field staff.

All data reported is extracted from the Ventia Hydstra software archive to an accuracy of three (3) significant figures.

A data extraction process called HYTAB is used when extracting the data. HYTAB utilises a configuration file provided by MIA to format the data. This file stipulates reporting to four (4) significant figures. Using four significant figures implies an unrealistic level of accuracy for the data collection processes undertaken. Ventia data reporting standards recommend a maximum of three (3) significant figures.

2.0 Annual Flow Summaries

2.1 Compliance Sites

Please note that [#] implies that although a mean monthly flow figure has been given, this flow figure is only the mean based off data capture and does not include data on days in the monthly period where a flow could not be determined. [V] denotes that the data is operational only data, the data was unable to be validated during the field visit.

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)																				Site	410083
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release																				Year	2019/20
Year	2019/20																						
Day	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Day
Mean	[ ]U		[ ]M		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]		
Median	[ ]U		[ ]M		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]		
Inst.Max	[ ]U		[ ]M		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]		
Inst.Min	[ ]U		[ ]M		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]		
Total	[ ]U		[ ]M		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]S		[ ]		

Annual Mean	[ ]	M ...	Equipment malfunction
Ann. Median	[ ]	S ...	Rating table suspended
Annual Total	[ ]	U ...	Lost data (NRE approved)

The rating table for this site was suspended by Ventia on the 01/06/2010 as new gates were installed by Murrumbidgee Irrigation. Ventia does not currently supply flow data for this site.

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)										Site	41010005
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.0R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3R	[0.0]	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.2R	[0.0]	
Inst.Max	0.0R	0.0R	0.0R	0.6R	3.1R	0.1R	0.0R	0.0R	0.0R	0.0R	1.8R	[0.0]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0.000R	0.000R	0.000R	0.299R	3.385R	0.034R	0.000R	0.000R	0.000R	0.000R	8.832R	[0.000]	

Annual Mean [0.0]
Ann. Median [0.0]
Annual Total [12.55]

? ... Irregular data use with caution
R ... Rating table extrapolated
All Totals are in megalitres

41010005 experienced its highest flows in May 2020.

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)										Site	41010921
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Inst.Max	0.0R	0.0R	11.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0.000R	0.000R	3.199R	0.000R	0.000R	0.000R	0.000R	0.000R	0.000R	0.000R	0.000R	[0.000]	

Annual Mean [0.0]
Ann. Median [0.0]
Annual Total [3.199]

R ... Rating table extrapolated
All Totals are in megalitres
Figures refer to period ending 2400 hours.

41010921 experienced its highest flows in September 2019.

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)										Site	41010940
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.7R	0.0R	0.0R	0.0R	0.0R	0.0R	0.5R	0.1R	0.8R	[0.1]	
Median	0.0R	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.3R	[0.0]	
Inst.Max	0.0R	0.0R	10.3R	0.0R	0.0R	0.0R	0.0R	3.8R	4.9R	0.9R	14.2R	[0.9]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0.000R	0.000R	21.98 R	0.000R	0.000R	0.000R	0.000R	0.690R	16.11 R	2.286R	26.32 R	[2.139]	

Annual Mean [0.2]
Ann. Median [0.0]
Annual Total [69.52]

R ... Rating table extrapolated
V ... Operational Data
All Totals are in megalitres

41010940 experienced its highest flows in September 2019.

2.2 Offtake Sites

Site	410127	MAIN CANAL AT NARRANDERA REGULATOR										Site	410127
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	70.6K	342 V	877	1290	1190	2080	1930	1100	559	243	330 V	[350]	
Median	16.1K	270 V	830	1270	1350	2170	2070	1150	618	233	162 V	[207]	
Inst.Max	975 K	1540 V	2090	2750	2460	4430	3670	3250	1430	665	3540 V	[4880]	
Inst.Min	0.0K	0.0V	420	598	-36.5	545	-21.6	48.2	0.0	0.0	0.0V	[43.5]	
Total	2188K	10610V	26310	39850	35620	64510	59690	31780	17340	7287	10240V	[10160]	

Annual Mean	[865]	K ...	Minor editing
Ann. Median	[694]	V ...	Operational Data
Annual Total	[315600]	All Totals are in megalitres	

410127 experienced minor periods of negative flow due to seiching at the site

Site	410129	STURT CANAL AT OFFTAKE										Site	410129
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	4.5V	55.7V	105 V	190 K	169 V	281 V	205 V	88.6K	20.1V	8.9K	82.4V	0.0	
Median	0.0V	60.9V	108 V	175 K	166 V	297 V	224 V	81.2K	0.0V	0.0K	0.0V	0.0	
Inst.Max	147 V	152 V	258 V	641 K	671 V	431 V	392 V	333 K	275 V	819 K	2460 V	0.0	
Inst.Min	0.0V	1.0V	0.0V	10.0K	1.0V	54.0V	40.0V	0.0K	0.0V	0.0K	0.0V	0.0	
Total	138V	1727V	3158V	5899K	5071V	8721V	6355V	2570K	622V	268K	2553V	0	

Annual Mean	101 K	K ...	Minor editing
Ann. Median	69.8K	V ...	Operational Data
Annual Total	37080K	All Totals are in megalitres	

410129 experienced its highest flows in December 2019.

3.0 Annual Salt Load Summaries

3.1 Compliance Sites

Please note that [#] implies that although a mean monthly flow figure has been given, this flow figure is only the mean based off data capture and does not include data on days in the monthly period where a flow could not be determined. [V] denotes that the data is operational only data, the data was unable to be validated during the field visit.

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)											Site	410083
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release											Year	2019/20
Year	2019/20													
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day	
Mean	[ ]U	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]		
Median	[ ]U	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]		
Inst.Max	[ ]U	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]		
Inst.Min	[ ]U	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]		
Total	[ ]U	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]		

Annual Mean [ ]
Ann. Median [ ]
Annual Total [ ]

M ... Equipment malfunction
S ... Rating table suspended
U ... Lost data (NRE approved)

No salt loads can be produced for site 410083 as no flows are calculated by Ventia.

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)										Site	41010005
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Inst.Max	0.0R	0.0R	0.0R	0.0R	0.2R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R	[0.0]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	1R	[0]	

Annual Mean	[0.0]	? ...	Irregular data use with caution
Ann. Median	[0.0]	R ...	Rating table extrapolated
Annual Total	[1]	V ...	Operational Data

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)										Site	41010921
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Inst.Max	0.0R	0.0R	1.4R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	0R	[0]	

Annual Mean	[0.0]	R ...	Rating table extrapolated
Ann. Median	[0.0]	All Totals are in tonnes	
Annual Total	[0]	Figures refer to period ending 2400 hours.	

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)										Site	41010940
Variable	804.00	Salt Transport (t/d) in tonnes/day, 6th sensor avail release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	0.0R	0.3R	0.0R	0.0R	0.0R	0.0R	0.0R	0.2R	0.0R	0.2R	[0.0]	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.1R	[0.0]	
Inst.Max	0.0R	0.0R	4.4R	0.0R	0.0R	0.0R	0.0R	0.3R	1.1R	0.2R	4.7R	[0.3]	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	[0.0]	
Total	0R	0R	9R	0R	0R	0R	0R	0R	5R	0R	6R	[1]	

Annual Mean	[0.1]	R ...	Rating table extrapolated
Ann. Median	[0.0]	V ...	Operational Data
Annual Total	[21]	All Totals are in tonnes	

3.2 Offtake Sites

Site	410127	MAIN CANAL AT NARRANDERA REGULATOR										Site	410127
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, 6th sensor avail release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	7.6K	37.6V	63.9	55.7	59.2	68.1	62.6	53.9	42.8	27.1	41.4V	[40.3]	
Median	2.0K	30.5V	58.6	54.3	62.8	67.5	63.0	51.5	45.5	25.1	18.1V	[24.8]	
Inst.Max	102 K	170 V	158	132	190	122	141	134	120	71.7	482 V	[537]	
Inst.Min	0.0K	0.0V	23.7	23.9	-1.5	20.5	-0.9	1.9	0.0	0.0	0.0V	[5.4]	
Total	235K	1165V	1917	1728	1775	2110	1942	1563	1328	811	1284V	[1170]	

Annual Mean	[46.7]	K ...	Minor editing
Ann. Median	[45.2]	V ...	Operational Data
Annual Total	[17030]	All Totals are in tonnes	

410127 has periods of negative salt loads due to negative flow caused by seiching at the site

Site	410129	STURT CANAL AT OFFTAKE										Site	410129
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, 6th sensor avail release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.5V	5.5V	8.5V	8.7K	7.1V	8.8V	6.6V	3.7K	1.3V	0.9K	6.8V	0.0	
Median	0.0V	5.5V	6.1V	8.4K	7.0V	9.0V	6.4V	3.6K	0.0V	0.0K	0.0V	0.0	
Inst.Max	15.1V	15.7V	22.5V	24.9K	24.3V	14.8V	13.9V	16.5K	17.3V	90.4K	214 V	0.0	
Inst.Min	0.0V	0.1V	0.0V	0.5K	0.0V	1.6V	1.6V	0.0K	0.0V	0.0K	0.0V	0.0	
Total	15V	171V	256V	268K	213V	272V	205V	109K	39V	27K	211V	0	

Annual Mean	4.9K	K ...	Minor editing
Ann. Median	4.0K	V ...	Operational Data
Annual Total	1787K	All Totals are in tonnes	

4.0 Annual EC Summaries

4.1 Compliance Sites

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)																				Site	410083
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release																				Year	2019/20
Year	2019/20																						
Day	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun	Day
Mean	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[121	]	[	]T	[605	]	[	]
Median	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[121	]	[	]T	[614	]	[	]
Max.Daily	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[146	]	[	]T	[616	]	[	]
Min.Daily	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[95.6]		[	]T	[568	]	[	]
Inst.Max	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[192	]	[	]T	[650	]	[	]
Inst.Min	[	]T	[	]U	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[	]T	[74.8]		[	]T	[427	]	[	]

Annual Mean [467]
Ann. Median [614]

T ... Probe out of water/below instrument threshold
U ... Lost data (NRE approved)

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)																				Site	41010005
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release																				Year	2019/20
Year	2019/20																						
Day	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun	Day
Mean	[	]T	[	]T	[	]T	[75.4]		[87.6]		[88.3]		[108	]	[85.1]		[66.7]		[	]T	[134	]	[124	]	
Median	[	]T	[	]T	[	]T	[73.8]		[86.6]		[87.2]		[107	]	[85.5]		[66.7]		[	]T	[135	]	[126	]	
Max.Daily	[	]T	[	]T	[	]T	[88.7]		[111	]	[98.8]		[113	]	[99.5]		[66.7]		[	]T	[158	]	[141	]	
Min.Daily	[	]T	[	]T	[	]T	[65.2]		[64.4]		[80.2]		[105	]	[70.1]		[66.7]		[	]T	[121	]	[92.7]		
Inst.Max	[	]T	[	]T	[	]T	[104	]	[124	]	[109	]	[130	]	[109	]	[75.5]		[	]T	[177	]	[146	]	
Inst.Min	[	]T	[	]T	[	]T	[55.7]		[52.5]		[75.2]		[97.0]		[64.6]		[59.9]		[	]T	[114	]	[41.4]		

Annual Mean [108]
Ann. Median [110]

? ... Irregular data use with caution
T ... Probe out of water/below instrument threshold

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)										Site	41010921	
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2019/20	
Year	2019/20													
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day	
Mean	[ ]T	[ ]T	[245]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		
Median	[ ]T	[ ]T	[245]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		
Max.Daily	[ ]T	[ ]T	[245]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		
Min.Daily	[ ]T	[ ]T	[245]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		
Inst.Max	[ ]T	[ ]T	[259]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		
Inst.Min	[ ]T	[ ]T	[227]	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]		

Annual Mean [245]
Ann. Median [245]

T ... Probe out of water/below instrument threshold
V ... Operational Data

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)										Site	41010940	
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2019/20	
Year	2019/20													
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day	
Mean	[ ]T	[ ]T	[671]	[ ]T	[ ]T	[ ]T	[ ]T	[60.0]	[636]	[240]	[424]	[551]		
Median	[ ]T	[ ]T	[742]	[ ]T	[ ]T	[ ]T	[ ]T	[60.0]	[687]	[190]	[443]	[540]		
Max.Daily	[ ]T	[ ]T	[792]	[ ]T	[ ]T	[ ]T	[ ]T	[60.0]	[766]	[519]	[570]	[680]		
Min.Daily	[ ]T	[ ]T	[109]	[ ]T	[ ]T	[ ]T	[ ]T	[60.0]	[365]	[16.9]	[164]	[484]		
Inst.Max	[ ]T	[ ]T	[814]	[ ]T	[ ]T	[ ]T	[ ]T	[158]	[798]	[691]	[758]	[749]		
Inst.Min	[ ]T	[ ]T	[41.8]	[ ]T	[ ]T	[ ]T	[ ]T	[1.1]	[198]	[11.9]	[157]	[472]		

Annual Mean [499]
Ann. Median [520]

T ... Probe out of water/below instrument threshold
V ... Operational Data

4.2 Offtake Sites

Site	410127	MAIN CANAL AT NARRANDERA REGULATOR										Site	410127
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	195	187	121	72.9	81.5	55.9	55.7	78.3	122	185	184	[198]	
Median	201	189	97.2	68.5	74.7	55.3	48.3	66.8	110	185	192	[201]	
Max.Daily	209	219	194	94.1	137	72.0	82.0	140	166	197	249	[212]	
Min.Daily	173	155	75.4	62.5	64.9	45.8	44.8	52.3	92.7	174	146	[171]	
Inst.Max	219	224	198	97.4	142	73.7	87.5	144	173	202	265	[216]	
Inst.Min	172	152	72.6	58.4	61.5	43.4	42.6	50.1	91.6	163	145	[170]	

Annual Mean [128]
Ann. Median [118]

Figures refer to period ending 2400 hours.

Site	410129	STURT CANAL AT OFFTAKE										Site	410129
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2019/20
Year	2019/20												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	[208]	170	129	80.1	70.0	52.1	55.2	70.4	111	158 V	[156]	[ ]T	
Median	[207]	175	102	74.6	63.4	51.2	51.5	64.4	111	158 V	[141]	[ ]T	
Max.Daily	[232]	188	188	107	128	59.3	72.8	95.6	119	182 V	[216]	[ ]T	
Min.Daily	[170]	141	84.3	62.8	55.5	47.3	47.1	54.4	101	131 V	[130]	[ ]T	
Inst.Max	[246]	193	192	113	131	73.2	85.0	98.5	123	185 V	[224]	[ ]T	
Inst.Min	[157]	140	81.0	59.7	52.6	45.8	44.2	53.8	96.4	117 V	[126]	[ ]T	

Annual Mean [106]
Ann. Median [95.6]

T ... Probe out of water/below instrument threshold
V ... Operational Data

5.0 Annual Site Summaries for sites affected by back-up

There were no compliance or offtake sites affected by backup during the 2019/2020 reporting time.

6.0 Annual Site Visit Summary

SI No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
410083	YMS	12	10	0	No flow conditions.		Block bank remains in position following a leakage at the gate structure in November 2018. Battery stolen at site; no data collected from July 2019 download until replacement battery was re-installed in September 2019.
410085	LMC	12	12	4			Stock access to drain has caused some damage to banks of control.
410164	BOD1	0	0	-	No data		Site discontinued 2017-18.
410167	BBOW	0	0	-	No data		Site decommissioned at end of 2018-19 season.
410174	MDJWE	12	12	4			Water pumped from drain into Warburton escape at times as part of MI initiative.
41010005	ROCUDG	12	12	0			Limited flow conditions throughout season.
41010921	GMSRR	12	12	0			Limited flow conditions throughout season.
41010940	LAG	12	12	0			Limited flow conditions throughout season.
41010955	MIRMCN	12	12	4			Debris on bridge pylon has been affecting operational data following high flows.
410127	Main Canal	12	12	6			
410129	Sturt Canal	12	12	8			New programs loaded and indexing equation adjusted during season. Cross path velocity sensors being installed.
CD-2-1922	CD-2-1922	12	12	0			Monthly site visits added to contract extension. Limited flow conditions throughout season.
MS-2MDJY-01	MDJY	12	12	5			
Yoogali	MDJ_Yoogali	0	0	-	No data.		Site decommissioned in November 2018.
			TOTALS	**31**			
General Comments							

7.0 EWAs 2020

W	= EWA submitted, waiting on approval
A	= EWA approved, works right to proceed
C	= EWA completed, ready to be invoiced
I	= EWA invoiced, closed out
N	= EWA cancelled, will not be approved

EWA REF		Site ID	Name	EXTRA WORKS DESCRIPTION	Issued by	Total Value (ex GST)	Status
MI	54	410129	Sturt Offtake	Supply of posts and instrumentation to upgrade deltaflex sensors and posts at Sturt offtake.	SF	$ 50,150	A
MI	55	Various	Offtake sites	Repair and installation of multiprobes at offtake sites for turbidity and pH monitoring.	SF	$ 12,469	A

8.0 410127 MAIN CANAL @ NARRANDERA REGULATOR

8.1 Measurement Summary

Date	Time	Q Measured	Q Recorded	Deviation
25/09/2019	1404	838	850	-1.30%
30/10/2019	1542	1132	1140	-0.72%
27/11/2019	1141	1351	1400	-3.47%
30/01/2020	728	1911	1911	-0.03%
26/02/2020	755	1182	1170	1.07%
27/05/2020	1141	138	138	-0.55%

Discharge Measurement Summary

Date Measured: Wednesday, September 25, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information

Site Name	Narrandera OT
Station Number	410127
Location	50m US of gates.

Measurement Information

Party	SF
Boat/Motor	SU
Meas. Number	99

System Information

System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup

Tagline Azimuth (deg)	354.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	9.77
Discharge Method	Mid-Section
Measurement Quality	--

Units

Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings

Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty

Category	ISO	Stats
Depth	0.11%	0.46%
Velocity	0.08%	1.15%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.88%	--
Instrument	0.25%	0.25%
Overall	1.91%	1.27%

Discharge Results

Total Area	75.560
Mean Velocity	0.128
Total Width	29.500
Total Q	9.703
Maximum Measured Depth(m)	3.419
Maximum Measured Velocity(m/s)	0.202
Mean Flow Angle	-2.788
Rated Discharge	9.766
% difference Q	-0.639
Water Temperature (Independent)	17.000
Mean Water Temperature	17.223
Mean Weighted Gauge Height	5.230

Discharge Measurement Summary

Date Measured: Wednesday, October 30, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera OT
Station Number	410127
Location	70m Upstream of gates.

Measurement Information	
Party	SF/GR
Boat/Motor	SU
Meas. Number	100

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	350.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	13.18
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.45%
Velocity	0.08%	0.74%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	0.90%

Discharge Results	
Total Area	76.350
Mean Velocity	0.172
Total Width	29.500
Total Q	13.101
Maximum Measured Depth(m)	3.462
Maximum Measured Velocity(m/s)	0.234
Mean Flow Angle	-3.395
Rated Discharge	13.180
% difference Q	-0.602
Water Temperature (Independent)	21.000
Mean Water Temperature	22.938
Mean Weighted Gauge Height	5.250

Discharge Measurement Summary

Date Measured: Wednesday, November 27, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera O/T
Station Number	410127
Location	70m US of gates.

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	101

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	16.21
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.63%
Velocity	0.09%	0.67%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.88%	--
Instrument	0.25%	0.25%
Overall	1.91%	0.96%

Discharge Results	
Total Area	75.397
Mean Velocity	0.208
Total Width	29.200
Total Q	15.650
Maximum Measured Depth(m)	3.423
Maximum Measured Velocity(m/s)	0.309
Mean Flow Angle	0.537
Rated Discharge	16.210
% difference Q	-3.456
Water Temperature (Independent)	23.500
Mean Water Temperature	22.302
Mean Weighted Gauge Height	5.249

Discharge Measurement Summary

Date Measured: Thursday, January 30, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera OT
Station Number	410127
Location	Between Affra posts

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	102

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	22.07
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.38%
Velocity	0.09%	1.28%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	1.36%

Discharge Results	
Total Area	73.729
Mean Velocity	0.300
Total Width	28.700
Total Q	22.104
Maximum Measured Depth(m)	3.417
Maximum Measured Velocity(m/s)	0.400
Mean Flow Angle	0.672
Rated Discharge	22.070
% difference Q	0.153
Water Temperature (Independent)	26.000
Mean Water Temperature	25.484
Mean Weighted Gauge Height	5.220

Discharge Measurement Summary

Date Measured: Wednesday, February 26, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera O/T
Station Number	410127
Location	Gauging completed between affra posts.

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	103

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	13.54
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.43%
Velocity	0.08%	1.51%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	1.60%

Discharge Results	
Total Area	74.726
Mean Velocity	0.183
Total Width	29.400
Total Q	13.689
Maximum Measured Depth(m)	3.388
Maximum Measured Velocity(m/s)	0.249
Mean Flow Angle	4.004
Rated Discharge	13.539
% difference Q	1.103
Water Temperature (Independent)	25.000
Mean Water Temperature	25.026
Mean Weighted Gauge Height	5.218

Discharge Measurement Summary

Date Measured: Wednesday, May 27, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera OT
Station Number	410127
Location	

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	104

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.51
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.60%
Velocity	0.39%	1.72%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.88%	--
Instrument	0.25%	0.25%
Overall	1.95%	1.85%

Discharge Results	
Total Area	71.826
Mean Velocity	0.022
Total Width	28.400
Total Q	1.594
Maximum Measured Depth(m)	3.318
Maximum Measured Velocity(m/s)	0.047
Mean Flow Angle	2.453
Rated Discharge	1.510
% difference Q	5.594
Water Temperature (Independent)	12.300
Mean Water Temperature	12.758
Mean Weighted Gauge Height	5.216

9.0 410129 STURT CANAL @ OFFTAKE

9.1 Measurement Summary

Date	Time	Q Measured	Q Recorded	Deviation
25/09/2019	1639	101.375	101	0.37%
30/10/2019	933	444.273	446	-0.33%
30/10/2019	1018	425.894	426	-0.02%
27/11/2019	826	76.034	75	1.46%
17/12/2019	1144	126.642	95	33.94%*
17/12/2019	1236	128.518	101	27.9%*
17/12/2019	1405	129.598	148	-12.33%*
29/01/2020	1121	122.302	147	-16.80%**

The measurement results have been compiled using the new index table.
* Gaugings were conducted alongside Murrumbidgee Irrigation, during a time when the gates were being tested. As such, the measurement results may be in error. Additionally, during this time period, the level was only high enough for the to utilise the velocity table using Path 1, Path 2, and Path 3 and the deviation from this table is higher than the velocity table using all Affra paths.
** The measurement was conducted with a moderate wind blowing directly upstream and has been discounted for use with the index table.

In the 2018/2019 irrigation season, the measurements displayed a persistent negative trend. With the 2019/2020 season, while some gaugings have been discounted, the measurements early in the season display a more balance trend. The new index table has been successful there but will need to be checked when the flows resume at higher levels.

Discharge Measurement Summary

Date Measured: Wednesday, September 25, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	10m US of affra posts

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	111

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	331.4
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.14
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Results	
Total Area	56.162
Mean Velocity	0.021
Total Width	27.500
Total Q	1.172
Maximum Measured Depth(m)	2.819
Maximum Measured Velocity(m/s)	0.043
Mean Flow Angle	-1.492
Rated Discharge	1.140
% difference Q	2.818
Water Temperature (Independent)	17.000
Mean Water Temperature	17.595
Mean Weighted Gauge Height	2.522

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	1.02%
Velocity	0.35%	3.27%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.95%	--
Instrument	0.25%	0.25%
Overall	2.01%	3.44%

Discharge Measurement Summary

Date Measured: Wednesday, October 30, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt O/T
Station Number	410129
Location	10m US of Affra post.

Measurement Information	
Party	SF/GR
Boat/Motor	SU
Meas. Number	112

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	324.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	5.44
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.78%
Velocity	0.11%	1.50%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.95%	--
Instrument	0.25%	0.25%
Overall	1.98%	1.71%

Discharge Results	
Total Area	51.246
Mean Velocity	0.100
Total Width	27.500
Total Q	5.140
Maximum Measured Depth(m)	2.620
Maximum Measured Velocity(m/s)	0.147
Mean Flow Angle	0.667
Rated Discharge	5.440
% difference Q	-5.521
Water Temperature (Independent)	21.400
Mean Water Temperature	20.868
Mean Weighted Gauge Height	2.339

Discharge Measurement Summary

Date Measured: Wednesday, October 30, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	

Measurement Information	
Party	SF/GR
Boat/Motor	SU
Meas. Number	113

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	324.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	5.16
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.60%
Velocity	0.18%	1.17%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.82%	--
Instrument	0.25%	0.25%
Overall	1.85%	1.34%

Discharge Results	
Total Area	51.288
Mean Velocity	0.096
Total Width	27.500
Total Q	4.930
Maximum Measured Depth(m)	2.616
Maximum Measured Velocity(m/s)	0.153
Mean Flow Angle	0.081
Rated Discharge	5.160
% difference Q	-4.453
Water Temperature (Independent)	21.400
Mean Water Temperature	20.635
Mean Weighted Gauge Height	2.332

Discharge Measurement Summary

Date Measured: Monday, January 1, 2018

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information

Site Name	Sturt O/T
Station Number	410129
Location	30m upstream of Affra posts

Measurement Information

Party	SF
Boat/Motor	SU
Meas. Number	114

System Information

System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup

Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	0.91
Discharge Method	Mid-Section
Measurement Quality	--

Units

Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings

Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty

Category	ISO	Stats
Depth	0.11%	0.91%
Velocity	0.60%	2.76%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.88%	--
Instrument	0.25%	0.25%
Overall	2.00%	2.92%

Discharge Results

Total Area	65.504
Mean Velocity	0.014
Total Width	28.000
Total Q	0.884
Maximum Measured Depth(m)	3.173
Maximum Measured Velocity(m/s)	0.034
Mean Flow Angle	2.765
Rated Discharge	0.910
% difference Q	-2.815
Water Temperature (Independent)	23.800
Mean Water Temperature	21.244
Mean Weighted Gauge Height	2.900

Discharge Measurement Summary

Date Measured: Tuesday, December 17, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt O/T
Station Number	410129
Location	

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	115

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.61
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.39%
Velocity	0.31%	4.06%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.76%	4.09%

Discharge Results	
Total Area	48.426
Mean Velocity	0.030
Total Width	25.500
Total Q	1.465
Maximum Measured Depth(m)	2.558
Maximum Measured Velocity(m/s)	0.076
Mean Flow Angle	-5.212
Rated Discharge	1.612
% difference Q	-9.091
Water Temperature (Independent)	24.200
Mean Water Temperature	27.000
Mean Weighted Gauge Height	2.254

Discharge Measurement Summary

Date Measured: Tuesday, December 17, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	116

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.40
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.43%
Velocity	0.21%	2.71%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.75%	2.76%

Discharge Results	
Total Area	48.831
Mean Velocity	0.030
Total Width	25.500
Total Q	1.483
Maximum Measured Depth(m)	2.577
Maximum Measured Velocity(m/s)	0.076
Mean Flow Angle	-4.308
Rated Discharge	1.401
% difference Q	5.866
Water Temperature (Independent)	24.200
Mean Water Temperature	27.480
Mean Weighted Gauge Height	2.262

Discharge Measurement Summary

Date Measured: Tuesday, December 17, 2019

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	

Measurement Information	
Party	SF
Boat/Motor	SU
Meas. Number	117

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.59
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.61%
Velocity	0.24%	2.70%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.75%	2.78%

Discharge Results	
Total Area	49.228
Mean Velocity	0.030
Total Width	25.500
Total Q	1.500
Maximum Measured Depth(m)	2.605
Maximum Measured Velocity(m/s)	0.070
Mean Flow Angle	-1.976
Rated Discharge	1.588
% difference Q	-5.515
Water Temperature (Independent)	24.200
Mean Water Temperature	28.650
Mean Weighted Gauge Height	2.280

Discharge Measurement Summary

Date Measured: Wednesday, January 29, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt O/T
Station Number	410129
Location	Endless Wire

Measurement Information	
Party	SF/MS
Boat/Motor	SU
Meas. Number	118

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	326.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.81
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.39%
Velocity	0.40%	2.28%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.56%	--
Instrument	0.25%	0.25%
Overall	1.64%	2.33%

Discharge Results	
Total Area	64.903
Mean Velocity	0.022
Total Width	27.500
Total Q	1.418
Maximum Measured Depth(m)	3.142
Maximum Measured Velocity(m/s)	0.054
Mean Flow Angle	-3.092
Rated Discharge	1.810
% difference Q	-21.655
Water Temperature (Independent)	27.600
Mean Water Temperature	27.268
Mean Weighted Gauge Height	2.870

Murrumbidgee Irrigation



2021 Annual Compliance Report

This document is the property of Murrumbidgee Irrigation Limited. The data contained in this Annual Compliance Report is for the sole purpose of meeting MI's licence compliance reporting requirements. MI does not guarantee the accuracy, reliability or suitability of excerpts of this data for any other purpose.

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Abbreviations

AFFRA	Acoustic Flowmeter For Remote Areas
ANZECC	Australian and New Zealand Environment and Conservation Council
BBS	Barren Box Storage
CSIRO	Commonwealth Scientific Investigation and Research Organisation
DPIE	NSW Department of Planning, Industry and Environment
EC	Electrical Conductivity
EES	Environment, Energy and Science
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ETo	Evapotranspiration (crop reference)
GIS	Geographic Information System
GMSRR	EPL Point 5 - Gogeldrie Main Southern Drain River Road
ha	Hectare(s)
LAG	EPL Point 4 - Gogeldrie Main Drain at Gooragool Lagoon
LTA	Long-term average
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
MIRFLD	EPL Point 15 - Mirrool Creek Floodway Wyvern Station
ML	Megalitre
NARREG	Narrandera Regular
NRAR	Natural Resources Access Regulator
ROCUDG	EPL Point 7 - Point Cudgel Creek Roaches Escape
SOP	Standard Operating Procedure
t	tonnes
µS/cm	micro siemens per centimetre
µg/L	micrograms per litre
WAL	Water Access Licence
YMS	EPL Point 6 - Yanco Main Southern Drain

Preface

The Annual Compliance Report for the financial year 2020/21 has been prepared to meet the reporting requirements of the licences held by Murrumbidgee Irrigation (MI).

MI operates under a Combined Water Supply Work Approval and Water Use Approval 40CA403245 (Combined Approval) issued by the NSW Department of Primary Industry – Water and regulated by the Natural Resources Access Regulator (NRAR). MI also holds an Environment Protection Licence (EPL) 4651 issued by the NSW Environment Protection Authority (EPA).

MI is committed to achieving organisational excellence through operating safely, efficiently and effectively, all of which contribute towards the measure of MI's compliance performance.

COMBINED WATER SUPPLY WORK APPROVAL AND WATER USE APPROVAL

1 Statement of compliance

MI has met the conditions of the Monitoring and Reporting Plan dated 16 March 2018 for our Combined Approval in 2020/21. The compliance requirements are cross referenced within this report and listed in Table 1.

MI has quality assurance and control procedures for data integrity and to ensure that all compliance obligations are met. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain our licensed supply and discharge points.

Table 1 Combined Approval (40CA403245) reporting summary

Approval section	Condition	Report section
Submission of annual compliance report	1	This report
Plans of the area of operations, authorised works, monitoring sites and water management infrastructure	2.1	2. Plan of operations and works
	2.2	
Statement of compliance	2.3	1. Statement of compliance
Presentation of data and analyses	2.4	Sections 3 - 7
	2.5	
	2.6	
	2.7	Provided via email with report
	2.8	1. Statement of Compliance
New measures to limit groundwater recharge and discharge of salt	2.9	8. New measures to limit groundwater recharge and discharge of salt
Reporting on water management	2.10	3.3 Diversions and water allocation
	2.11	0 Water discharged from area of operation
	2.12	3.6 Water balance
	2.13 (a) (b)	3.1 Climate conditions
	(c) – (i)	4. Water use
Reporting on salinity and salt load	2.14	5. Salinity and salt load
	2.15	
	2.16	

Approval section	Condition	Report section
Reporting on groundwater conditions	2.17	6. Groundwater conditions
Discharge of noxious aquatic weeds	5	9.1 Discharge of noxious aquatic weeds
Discharge of blue green algae	6	9.2 Discharge of blue-green algae

Table 2 outlines the number of significant events that occurred in 2020/21 that required notification to the Minister. The significant events are detailed in Attachment A.

When a significant event occurs MI lodge an S91i -self reporting form, MI engage a Duly Qualified Person (DQP) to rectify the issue. A Certification of Validation is completed and an S91 completion form is lodged with the relevant supporting documentation.

Table 2 Significant event notifications (S91i events)

Year	Number of significant events
2020/21	7

MI did not change or modify the condition of the existing authorised water supply works or authorised discharge works listed in the Combined Approval during 2020/21. MI did not construct new works that would allow further discharge from the Area of Operations.

2 Plan of operations and works

MI's area of operations, storages and major supply and drainage channels are presented in Figure 1. There were no changes from the prior financial year. Figures 1 and 2 have also not changed from the prior financial year report.

The Murrumbidgee Irrigation Area (MIA) is supplied by water stored in Burrinjuck and Blowering dams and released to the Murrumbidgee River. Water is diverted from the Murrumbidgee River in accordance with the conditions of the Combined Approval via two authorised supply works (Figure 2):

- NARREG - Narrandera Regulator (after diversion from Berembed Weir via Bundidgerry Creek and regulator)
- STURT - Sturt Regulator (after diversion from Gogeldrie Weir)

There are five (5) sites which have the potential to discharge water outside MI's area of operations, which are presented in Figure 2. These sites are monitored in accordance with MI's Combined Approval and Environmental Protection Licence (EPL) 4651.

MI's five discharge monitoring points are:

- EPL Point 4 - LAG – Gogeldrie Main Drain at Gooragool Lagoon
- EPL Point 7 - ROCUDG – Cudgel Creek Roaches Escape
- EPL Point 6- YMS – Yanco Main Southern Drain
- EPL Point 5 - GMSRR – Gogeldrie Main Southern Drain River Road
- EPL Point 15 - MIRFLD – Mirrool Creek Floodway Wyvern Station

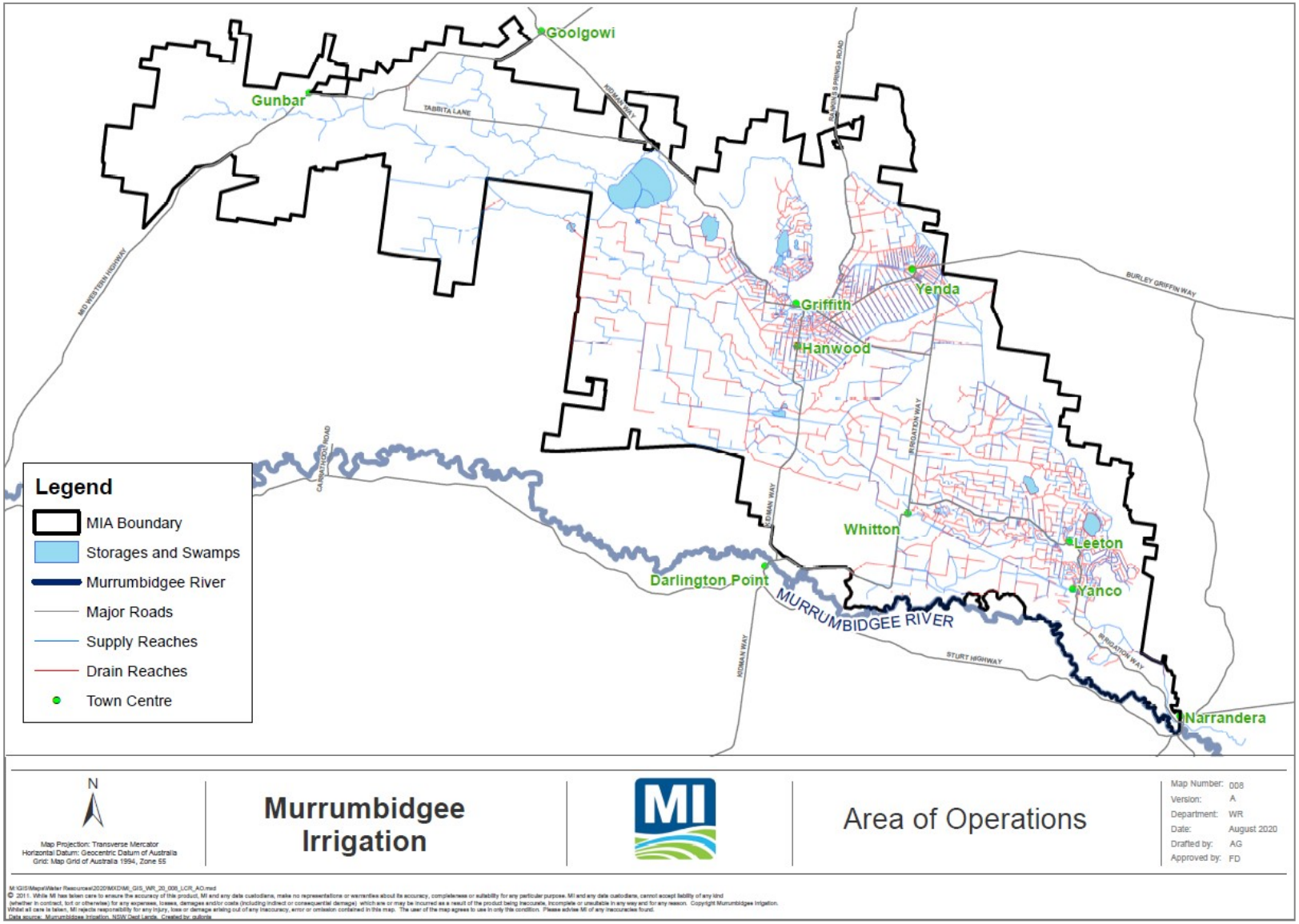


Figure 1 Murrumbidgee Irrigation's Area of Operations

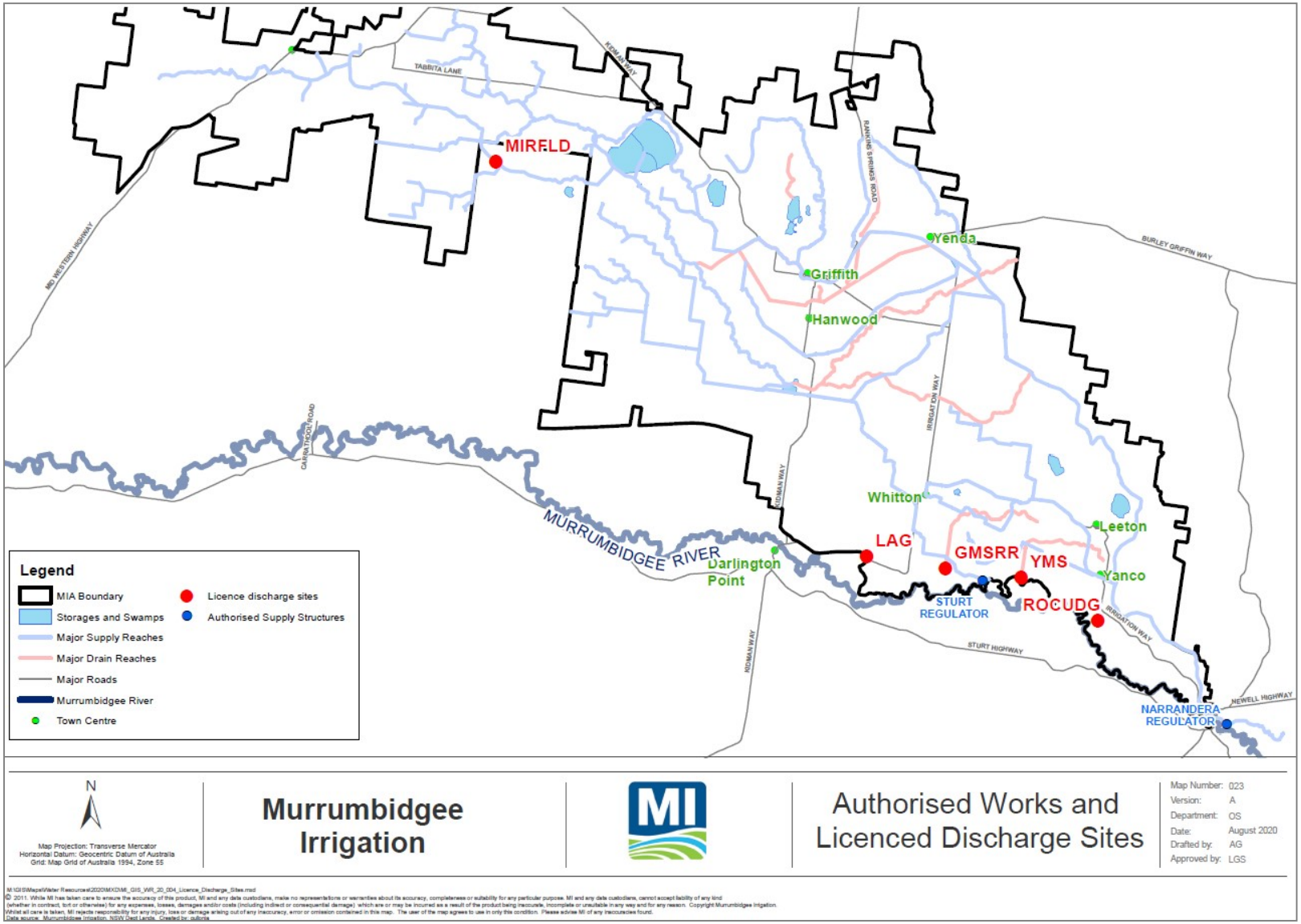


Figure 2 Location of authorised supply works and licence discharge points

3 Reporting on water management

MI's water management information is presented below. There are no internal benchmarks or targets that are relevant to this report.

The reference year of 2014-15 was chosen for this year's report. The reference year has comparable rainfall and evapotranspiration (ETo) levels with the past few years, as well as very similar diversion and delivery volumes.

3.1 Climate conditions

Rainfall and ETo data recorded at the Griffith CSIRO weather station is presented in Table 3.

Above average rainfall was recorded in 2020/21 reporting period, with an increase of 77mm from the prior reporting period. The rainfall recorded in 2020/21 is the highest received throughout the last four years, however ETo was lower, likely due to lower temperatures and a higher number of rain days.

Table 3 Griffith CSIRO weather station rainfall and ETo

Year	Total rainfall (mm)	Total ETo (mm)
2020/21	441	1,646
2019/20	364	1,784
2018/19	337	1,914
2017/18	315	1,894
2014/15	348	1,776

3.2 Calibration report for Main Canal and Sturt Canal AFFRA units

The calibration reports for Narrandera Regulator (NARREG) and Sturt Canal offtake (STURT) AFFRA units have been provided by Ventia as part of a contract with MI to ensure flow measurements meet the conditions of Combined Approval 40CA403245.

The calibration report summary for the NARREG AFFRA unit is presented in Table 4 and the STURT AFFRA unit presented in Table 5. The VENTIA flow, EC, and salt load monitoring financial year report is included as Attachment B.

Table 4 Main Canal at NARREG (410127) calibration report

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
28/08/2020	11:26	3945.9	3902.5	1.11%
30/09/2020	15:37	1380.84	1320	4.61%
28/10/2020	12:54	558.3	515.75	8.25%*
28/10/2020	13:40	564.43	575.75	-1.97%
26/11/2020	9:28	3496.5	3516	-0.55%^
29/01/2021	9:32	1577.77	1506.92	4.70%
25/02/2021	11:56	3355.81	3312.31	1.31%

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
31/03/2021	13:37	536.24	410.89	30.51%#
29/04/2021	12:43	1554.95	1539.33	1.01%

Table 5 Sturt Canal at STURT (410129) calibration report

Date	Time (24hr)	Calibration measurements: Q measured discharge ML/day	AFFRA sensor: Q recorded mean ML/day	Deviation (%)
29/08/2020	07:23	1715.00	1647.5	4.10%
30/09/2020	10:15	796.01	816.75	-2.54%
30/09/2020	11:14	809.77	832.25	-2.70%
11/12/2020	13:43	1434.41	1484.00	-3.34%!
15/12/2020	13:02	1025.00	1042.73	-1.7%!
16/12/2020	13:29	1497.59	1570.77	-4.66%
16/12/2020	14:23	1515.31	1572.86	-3.66%
24/02/2021	15:39	1092.84	1073.85	1.77%
30/03/2021	16:02	77.181	94.46	-18.3%#
28/04/2021	15:31	696.62	713.43	-2.36%

*Flows were not kept stable by MI operators during gauging.
Very low flow with strong winds.
^ Documentation misplaced – gauging start and end times estimated based on field sheets from the visit.
! Gaugings conducted by MI. The measurement was conducted with a moderate wind blowing directly upstream and has been discounted for use with the index table.

3.3 Diversions and water allocation

A monthly summary of gross water diverted from the Murrumbidgee River is presented in Table 6. These volumes represent diversions entering the supply system via MI's two authorised water supply works at NARREG and STURT.

The total diversion volume of 880,456 ML includes an environmental water diversion volume of 3,482.5 ML diverted on behalf of Department of Planning, Industry and Environment–Environment, Energy and Science (DPIE-EES).

Table 6 Monthly summaries of water diversions delivered to customers, 2020/21

Month	STURT	NARREG	Total diversion	Delivered to customers
Jul-20	368	3,650	4,018	2,024
Aug-20	15,420	40,600	56,020	39,938
Sep-20	22,616	47,450	70,066	44,931
Oct-20	23,444	50,700	74,144	57,309
Nov-20	29,454	90,300	119,754	105,422
Dec-20	35,577	113,550	149,127	134,312
Jan-21	35,302	116,050	151,352	136,600
Feb-21	29,119	76,850	105,969	84,952

Month	STURT	NARREG	Total diversion	Delivered to customers
Mar-21	13,699	30,299	43,998	53,859
Apr-21	9,199	31,011	40,210	33,945
May-21	15,066	35,274	50,340	39,036
Jun-21	2,264	13,194	15,458	16,660
Total	**231,528**	**648,928**	**880,456**	**748,988**

Note: All figures in ML

Table 7 compares water allocations, diversions, total deliveries and climate data from the 2020/21 reporting year to prior years. Although announced allocations determine much of the irrigation demand, rainfall and ETo can significantly affect the total diversions for the year.

Table 7 Water allocation, total diversions and deliveries 2020/21 compared to previous years

Year	Announced allocation (%) general / high	Diversions (ML)	Deliveries (ML)	Rainfall (mm) Griffith AWS	ETo (mm) Griffith AWS
2020/21	100/100	880,456	748,988	441	1,646
2019/20	11/95	349,523	285,270	364	1,784
2018/19	7/95	586,752	487,204	337	1,914
2017/18	45/95	945,805	800,963	315	1,894
2014/15	53/95	878,614	730,016	349	1,776

Note: All figures in ML

Above average rainfall was recorded throughout local and upriver catchments in 2020/21, resulting in 100% allocation for General Security and 100% allocation for High Security allocation. An increase of 530,933ML diversions and 463,718ML of deliveries occurred from 2019/20. The diversions and deliveries supplied in 2017/18 and the 2014/15 reference year are very similar to those in 2020/21.

The volume of water diversions debited to each grouping of MI's Water Access Licences are shown in Table 8.

Table 8 Diversions debited to Water Access Licences groups

Year	WAL 1 High Security	WAL 2 General Security	WAL 3 Towns	WAL 4 Stock & Domestic	WAL 5 Other
2020/21	231,450	404,808	19,699	6,384	218,115
2019/20	212,062	50,985	19,699	7,263	59,514
2018/19	269,817	161,433	19,699	7,345	128,458
2017/18	265,936	495,573	19,699	7,345	157,252

Note: All figures in ML. WAL 5 Other includes Supplementary Water Access and Conveyance licences

3.4 Environmental diversions

At the request of DPIE-EES, 3,482.5 ML of environmental water was delivered in 2020/21 as shown in Table 9. This volume is accounted for in total diversions and deliveries shown in Table 7.

Table 9 Environmental water diversions for 2020/21

Month	Tuckerbill Swamp	Turkey Flats	Yanco Ag	Campbell's Swamp	Fivebough Swamp	Coononcabil Lagoon	Total
Jul-20	0	0	0	0	0	0	0
Aug-20	0	0	0	0	0	0	0
Sep-20	0	0	0	0	0	0	0
Oct-20	104.3	0	0	0	0	504.2	608.5
Nov-20	246	25	433	13.6	0	547.8	1,265.4

Month	Tuckerbill Swamp	Turkey Flats	Yanco Ag	Campbell's Swamp	Fivebough Swamp	Coononcabil Lagoon	Total
Dec-20	207	0	0	178.8	216.4	0	602.2
Jan-21	0	78	0	0	0	349.4	427.4
Feb-21	50	311.3	0	0	0	0	361.3
Mar-21	0	117.2	0	100.5	0	0	217.7
Apr-21	0	0	0	0	0	0	0
May-21	0	0	0	0	0	0	0
Jun-21	0	0	0	0	0	0	0
Total (ML)	**607.3**	**531.5**	**433**	**292.9**	**216.4**	**1,401.4**	**3,482.5**

A total of 3922 ML was diverted into the Barren Box Wetland cell as a means of flood mitigation from floodwater entering Mirrool Creek during June 2021. The water diverted is unable to be recovered or diverted to customers for use. The diversion is accounted for as a diversion under MI's BBS management plan as wetland watering.

3.5 Water discharged from area of operations

Monthly discharge volumes for each discharge monitoring point are shown in Table 10. A total of 900 ML was discharged from MI's Area of Operations during 2020/21.

Table 10 Monthly discharge volumes (ML) recorded at monitoring points

Month	LAG (41010940)	ROCUDG (41010005)	YMS (410083)	GMSRR (41010921)	MIRFLD (41010163)
Jul-20	0	0	0	0	0
Aug-20	34[R]	1.7[B]	0	2.1[R]	0
Sep-20	59.8[R]	12.1[R]	0	0	0
Oct-20	4.7[R]	13.7[R]	1.2	0	0
Nov-20	13.9[R]	85[R]	2.2	0	0
Dec-21	23[R]	0	0	0	0
Jan-21	58[B]	0	0	0	0
Feb-21	35[B]	0	0	0	0
Mar-21	143.7	102[*]	102	133[R]	0
Apr-21	9.8[R]	4[R]	0	0	0
May-21	1[R]	10.4[R]	0	0	0
Jun-21	8.5[R]	23	15.8	0	0
Total	**391.4**	**251.9**	**121.2**	**135.1**	**0**

Note: All figures in ML
*Debris effecting sensor
R Rating table extrapolated
B Backed-up stage

Table 11 shows total discharge volumes from MI's Area of Operations compared to prior years.

The total volume discharged in 2020/21 was notably higher compared to prior years. This was a result of several factors including:

- Above average rainfall
- Increased announced allocation 100%
- Saturated catchments
- Increase in diversions and deliveries
- Increase in winter cropping

Table 11 Total volumes discharged from the MIA

Year	Total discharged (ML)
2020/21	900
2019/20	127
2018/19	642
2017/18	4,471
2014/15	675

3.6 Water balance

The annual water balance in Table 12 has been produced to meet condition 2.12 of the Combined Approval Monitoring and Reporting Plan. To assist with interpretation of this water balance, each line has been referenced to the specific requirements of Condition 2.12.
The conveyance volumes represented in this water balance account for seepage, evaporated water from in channel and storage, and general conveyance required to deliver water to customers.

Total gross diversions of 880,456 ML for 2020/21 were used to generate water deliveries of 748,988 ML to customers and 7,405 ML for environmental water diversions including 3,922 ML into Barren Box Wetland.

There were no flood events resulting in captured flood water deliveries during 2020/21, therefore the total volume of water delivered to customers for 2020/21 was sourced from river diversions and internal storage.

Table 12 Annual water balance as at 1 July 2021 and prior years

Condition	Sources	2020/21	2019/20	2018/19	2017/18	2014/15
2.10 (a) (b) (c)	River diversions	880,456	349,523	586,752	945,805	878,614
2.12 (c)	Internal storage (July 1)	4,724	2,434	25,256	32,318	19,119
2.12 (b)	Water captured (estimate)	5,870	0	0	5,007	0
	Total	**891,050**	**351,957**	**612,008**	**983,131**	**897,733**
	Applications					
2.10 (d)	Deliveries to customers (river and storages)	748,988	281,658	484,208	800,963	730,016
2.11 (a)	Discharges (without credit)	4,822+	127	642	4,471	671
2.11 (b)	Environmental water diversions	3,483	3,612	2,996	600	2,472
2.12 (b) loss	Overland flood discharge	0	0	0	0	0
2.12 (b) loss	Conveyance	98,355	61,836	121,728	151,904	148,850
2.12 (c)	Internal storage (June 30)	35,402	4,724	2,434	25,256	15,724
	Total	**891,050**	**351,957**	**612,008**	**983,131**	**897,733**

Note: All figures in ML.
+ includes 3922ML of wetland watering for BBS wetland

4 Water use

4.1 Crop statistics

Customers are required to nominate the intended water use to a crop or purpose when placing water orders. This data is not validated at the farm level and is therefore an estimate only. Table 13 shows water deliveries and estimated crop water use for 2020/21. It is important to note the water use data presented for the total area of crop is influenced by seasonal rainfall, ETo and irrigation practices.

The 'Not Defined' category refers to water taken by MI customers without placing an order. This information is obtained after the meter is read and does not provide opportunity to allocate the water to a use.

Table 13 Summary of water deliveries for major crop groupings 2020/21

Crop/ purpose	Area (ha)	Volume delivered (ML)	Crop water use (ML/ha)
Citrus	7,733	34,674	4.5
Cotton	7,931	62,778	7.9
Environment	-	3,251	-
Industrial	27.2	6,531	-
Nuts	7,210	55,309	7.7
Other crops	182.8	1,033.2	5.7
Other fruits	1,042	4,733	4.5
Plantation	93	269	2.9
Rice	19,166	250,516	13.1
Stock & Domestic	263.7	6,692.6	-
Summer cereals	1,741	20,425	11.7
Summer oilseeds	476	3,361	7.1
Summer pasture	1,095	8,426	7.7
Town supply	4	13,868	-
Vegetables	1,388.4	11,587	8.3
Vines	17,551.8	82,172	4.7
Winter cereals	62,609.1	120,674	1.9
Winter oilseeds	2,406	6,786	2.8
Winter pasture	4,995	17,316	3.5
Not defined*	-	34,587	-
Total	**135,914**	**744,988**	

*No crop type assigned

A comparison of crop water use for 2020/21 with prior years is presented in Table 14 and Figure 3.

Increased general security allocation saw significant increases in seasonal summer cropping deliveries in 2020/21. Rice crops accounted for the highest volume of water deliveries in the MIA. In previous years permanent plantings of citrus, vines and other fruits were the main crop type to receive the highest proportion of water delivery volumes.

Figure 3 shows the past financial year water deliveries correlate strongly with the 2014/15 comparison year. This is likely due to the seasonal outlook and allocations being very similar. The differences in the two prior years strongly reflect the lower allocations and watering of permanent plantings over seasonal crops. In addition, 'Other crops and plantations' has been influenced over the past two years due to the increase in nut plantations in the MIA, requiring watering across the year.

Table 14 Total deliveries to major crop types 2020/21 compared to previous years

Year	Rice	Pasture	Cereal and oil seeds	Vegetables	Citrus, vines, other fruits	S&D, towns, industrial	Other crops, plantations	Cotton
2020/21	250,516	25,742	151,247	11,587	121,579	27,092	56,611	62,778
2019/20	27,302	4,346	30,105	10,655	114,229	22,216	23,969	1,170
2018/19	37,171	12,753	88,968	10,518	130,716	22,174	71,460	113,443
2017/18	220,423	37,952	123,439	10,940	134,046	24,123	76,864	174,778
2014/15	255,384	32,206	171,645	12,216	149,045	20,547	28,295	60,678

Note: All figures in ML

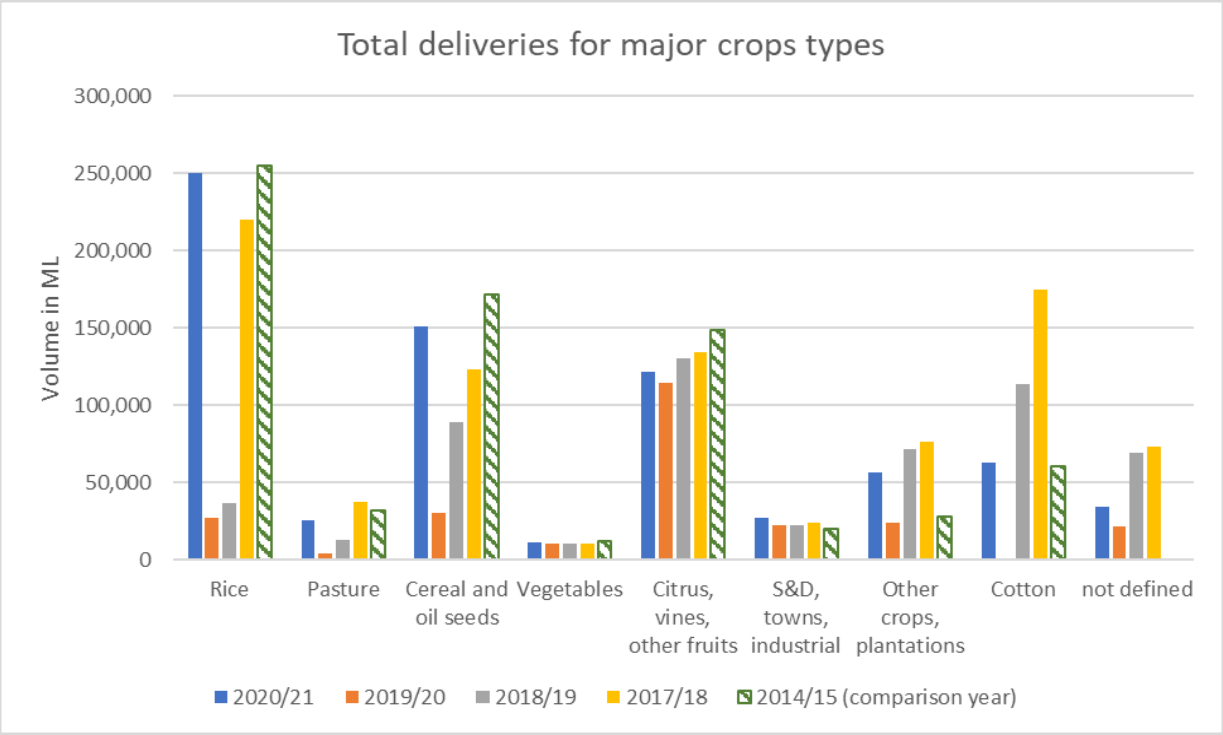


Figure 3 Comparison of total water deliveries to major crop types

4.2 Irrigation intensity

Irrigation intensity is displayed in Figure 4 by water use (ML/ha) at a property level.

This map identifies locations of landholdings using between >0 to 4; >4 to 8; and above 8 ML/ha of irrigation water.

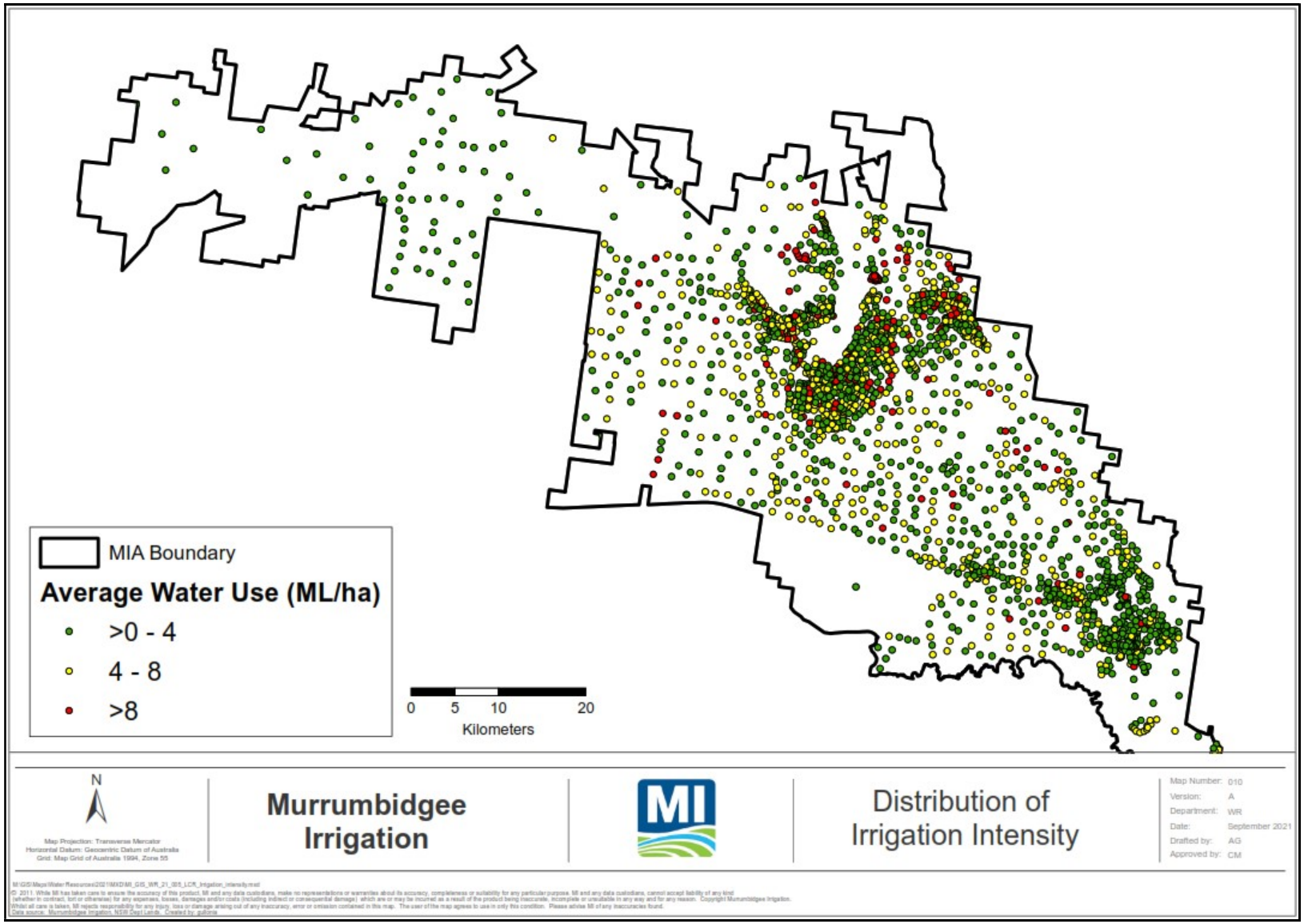


Figure 4 Distribution of irrigation intensity across the MIA

5 Salinity and salt load

5.1 Extracted salt load

The monthly mean electrical conductivity (EC) values and extracted salt loads are calculated using EC sensors at MI's two river offtake sites NARREG and Sturt and presented in Table 15. Attachment B contains Ventia's report which outlines the data and quality assurance information.

Table 15 Total extracted salt load for 2020/21

Month	STURT			NARREG		
	Flow (ML)	Mean EC (µS/cm)	Salt (t)	Flow (ML)	Mean EC (µS/cm)	Salt (t)
Jul-20	368	227	16	3,650	172	307
Aug-20	15,420	229	1914	40,600	219	4,670
Sep-20	22,616	194	2235	47,450	194	5,458
Oct-20	23,444	183	2651	50,700	160	4,584
Nov-20	29,454	184	3207	90,300	185	9,128
Dec-20	35,577	109	2606	113,550	103	6,696
Jan-21	35,302	102	2121	116,050	93.8	6,247
Feb-21	29,119	134	1803	76,850	135	6386
Mar-21	13,699	113	923	30,299	118	3711
Apr-21	9,199	198	1058	31,011	203	3682
May-21	15,066	138	1221	35,274	125	2565
Jun-21	2,264	165	220	13,194	124	923
Total	**231,528**		**19,975**	**648,928**		**53,357**

Note:
See Ventia's report in Attachment B for further details.

Table 16 presents the total extracted salt loads for 2020/21 and prior years.

During 2020/21, an estimated 73,332 tonnes of salt was imported into MI's area of operations from the Murrumbidgee River. An increase of 54,515 tonnes of salt was imported into MI's area of operations compared to 2019/20.

In 2014/15 MI received similar diversions to 2020/21 (within 1%) however, in 2020/21 an increase of over 24% by volume of salt was imported into MI's area of operation.

Table 16 Extracted salt-load (t) for 2020/21 compared to prior years

Year	Diversions (ML)	Extracted salt load (t)		
		STURT	NARREG	Total
2020/21	880,456	19,975	53,357	73,332
2019/20	349,523	1,787	17,030	18,817
2018/19	586,752	6,952	27,570	34,522
2017/18	945,805	14,920	50,030	64,950
2014/15	878,614	14,587	44,270	58,858

5.2 Discharged salt load

There are five licensed locations where discharge water from MI's area of operations is monitored. The locations of these sites are shown in Figure 2.

Flow, EC and salt load data for these sites is presented in Table 17. When standing water is held at a discharge location, while EC measurements are taken, no discharge occurs. Alternatively, minor flows do not trigger accurate measurements to enable robust salt load calculations.

An estimated 88.5 tonnes were discharged from MI's area of operations through the five discharge monitoring points in 2020/21.

Table 17 Monthly summary of flow, EC and salt loads at monitoring points for 2020/21

Month	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)
Yanco Main Southern Escape (YMS) 410083					
Jul-20	-	-	-	-	-
Aug-20	-	-	-	-	-
Sep-20	-	48.5	0	559	-
Oct-20	1.2	83	0	310	0.1
Nov-20	2.2	204	0	435	0.3
Dec-20	-	195	146	270	-
Jan-21	-	181	130	297	-
Feb-21	-	220	148	384	-
Mar-21	102	295	181	973	19.3
Apr-21	-	185	0	469	-
May-21	-	-	-	-	-
Jun-21	15.8	75.1	0	425	0.8
Total	**121.2**				**20.5**
Gooragool Lagoon Escape (LAG) 41010940					
Jul-20	-	-	-	-	-
Aug-20	34	138	0	609	5
Sep-20	59.8	277	0	495	11
Oct-20	4.7	161	0	515	1
Nov-20	13.9	166	0	706	2
Dec-20	23	181	0	611	3
Jan-21	58	53.1	0	343	-
Feb-21	35	287	0	740	-
Mar-21	143.7	77.6	0	828	17
Apr-21	9.8	52.7	0	254	1
May-21	1	214	0	507	-
Jun-21	8.5	232	0	986	-
Total	**391.4**				**40**
Gogeldrie Main Southern Escape (GMSRR) 41010921					
Jul-20	-	-	-	-	-
Aug-20	2.1	2.9	0	167	-

Month	Flow (ML)	Mean EC (µS/cm)	Min EC (µS/cm)	Max EC (µS/cm)	Salt load (t)
Sep-20	-	5.3	0	167	-
Oct-20	-	-	-	-	-
Nov-20	-	-	-	-	-
Dec-20	-	-	-	-	-
Jan-21	-	-	-	-	-
Feb-21	-	-	-	-	-
Mar-21	133	35.4	0	252	15
Apr-21	-	-	-	-	-
May-21	-	-	-	-	-
Jun-21	-	-	-	-	-
Total	**135.1**				**15**
Cudgel Creek Escape (ROCUDG) 41010005					
Jul-20	-	-	-	-	-
Aug-20	1.7	215	203	227	-
Sep-20	12.1	171	97.6	256	1
Oct-20	13.7	160	110	203	1
Nov-20	85	212	179	322	10
Dec-20	-	201	12.3	234	-
Jan-21	-	-	-	-	-
Feb-21	-	-	-	-	-
Mar-21	102	-	-	-	-
Apr-21	4	187	156	204	-
May-21	10.4	111	98.1	139	1
Jun-21	23	139	97.6	206	-
Total	**251.9**				**13**
Mirrool Creek Floodway (MIRFLD) 41010163					
	-	-	-	-	-
Total	**-**				**-**

Note:
See Ventia's report in Attachment B for further details

Table 18 details the discharged salt load for the current reporting year and prior years, including the reference year.

While the salt load in tonnes increased, as expected with the higher volume discharged, overall the percentage of salt load per megalitre reduced compared to both the prior year and the reference year. These percentages are 0.098 t/ML; 0.197 t/ML and 0.142 t/ML respectively.

The reduction in salt can be attributed to MI's efforts to recycle irrigation discharge water within the MIA and our customers' efforts to improve water efficiency and recycle irrigation waters on-farm.

Table 18 Discharged salt load 2020/21 compared to prior years

Year	Water discharged (ML)	Discharged Salt load (t)
2020/21	900	88.5
2019/20	127	25

Year	Water discharged (ML)	Discharged Salt load (t)
2018/19	642	98
2017/18	4,471	854
2014/15	675	96

5.3 Salt load summary

The salt loads presented in Table 19 show 73,332 tonnes of salt was received through diversions recorded at MI's authorised supply works (NARREG and STURT). A total of 88.5 tonnes was discharged from the area of operations and an estimated 73,243.5 tonnes was retained within the MIA.

Table 19 Salt load summary for 2020/21

Extracted	**Salt load (t)**
STURT	19,975
NARREG	53,357
Total extracted	**73,332**
Discharged	**Salt load (t)**
YMS	20.5
GMSRR	15
LAG	40
ROCUDG	13
MIRFLD	0
Total discharged	**88.5**
Retained	**Salt load (t)**
MIA	**73,243.5**

It is important to note that this is a simple annual salt balance that considers salt loads entering via authorised works and leaving via approved discharge locations. The balance does not consider other factors that impact total salt loads in the MIA.

No additional data is held by MI that is relevant to the assessment of salinity impacts under the Murray Darling Basin – Basin Salinity Management 2030.

6 Groundwater conditions

The following information is provided from MI's groundwater network monitoring only. MI cannot comment on influences on groundwater from other sources, including groundwater extraction by private owners or other entities and any recharge or disturbance from other developments or activities.

6.1 Groundwater monitoring and reporting

Groundwater monitoring was completed in the last quarter of 2020. The network consists of piezometers in the Shallow and Deep Shepparton Formation and a smaller monitoring network in the Calivil Formation.

A total of 641 piezometers are required to be monitored and reported on as per Attachment 2 of the Monitoring and Reporting Plan. The locations of these bores are displayed in Figure 5. Figure 4 locations have not changed from the prior reporting year.

Table 20 provides a status summary of the groundwater piezometers monitored in 2020.

A total of 545 piezometers were read during the monitoring, an increase of 11 from the prior year. The total piezometers read equates to 85% of the network.

Factors affecting the percentage read includes an increasing number of piezometers found to be destroyed by land development or other activities outside of MI's control. During the 2020 and 2021 monitoring rounds, a concerted effort was made to validate where piezometers were destroyed or not found. The 2020 monitoring therefore read 98.2% of the piezometers still available to be read.

Table 20 Groundwater piezometer status summary 2020

Total bores	Total destroyed+	Dry, flooded or blocked	Not found	Total read
641	86	50	10	545

Note: + piezometers damaged or destroyed in the field due to land development or other uses or actions.

Depth to water table data is reported for 2020/21, 2019/20, 2018/19 and 2007/08. Groundwater data was read in August 2020 and therefore more likely to be influenced by the prior year. The 2007/08 year was chosen as the historical reference year for groundwater. That year had climatic conditions such as rainfall and evapotranspiration, along with announced allocation in the MIA comparable to the 2019/20 year.

The number of piezometers read within depth ranges for 2020 are shown in Table 21.

Table 21 Number and percent of total piezometers readings within each depth range

Year	<2M of surface	2-4M of surface	>4M of surface	% <2M of surface	% 2-4M of surface	% >4M of surface	Total
2020	12	86	437	2%	16%	82%	535
2019	5	96	386	1%	20%	79%	487
2018	23	151	367	4%	28%	68%	541
2007	11	207	609	1%	25%	74%	827

Table 21 shows groundwater depth at each piezometer is increasing, with 82% of piezometers reading at a depth greater than four metres below the ground surface.

Table 22 provides a comparison of the three depth class areas relative to the prior three years and a historical reference year. The standing water levels measured by the piezometers at known points are interpolated to each pixel within MI's area of operations using the nearest neighbour resampling method. The area for each depth class equals the count of pixels within the depth class * pixel size. Data for each year in the table was cropped to the extent of MI's area of operations for comparison. This information can change if certain piezometers are not read due to being blocked, flooded, destroyed or lack of access.

In 2020 when compared to 2019 there has been a minor increase of hectares in the shallow depth range, including when compared to the 2007 figures. The small rise in hectares from 2020 to 2019 for shallow groundwater levels may not be significant, given the inherent uncertainties in the area calculations.

The overall trend in groundwater levels using both point data from Table 21 and area data from Table 22 shows groundwater levels are at a deeper level when compared to both recent years and the benchmark year of 2007.

The area of operations has decreased between 2007 and 2020 and approval granted in 2015 to reduce the groundwater piezometer network.

Table 22 Change in groundwater depth

Groundwater	Depth to water table area (ha)	Change in depth

depth range (m)						[+ = rising] [- = falling]			
	2020	2019	2018	2017	2007	2020 vs 2019	2020 vs 2018	2020 vs 2017	2020 vs 2007
<2M	178	161	0	1,821	280	+17	+178	-1,643	-102
2-4M	24,392	26,924	52,383	71,558	56,127	-2,532	-27,991	-47,166	-31,735
>4M	336,117	343,045	317,747	272,639	313,690	-6,928	+18,370	+63,478	+22,427
Total	360,687	370,130	370,130	346,018	370,097				

Note: Previous years data was cropped to match MI's area of operations for comparison

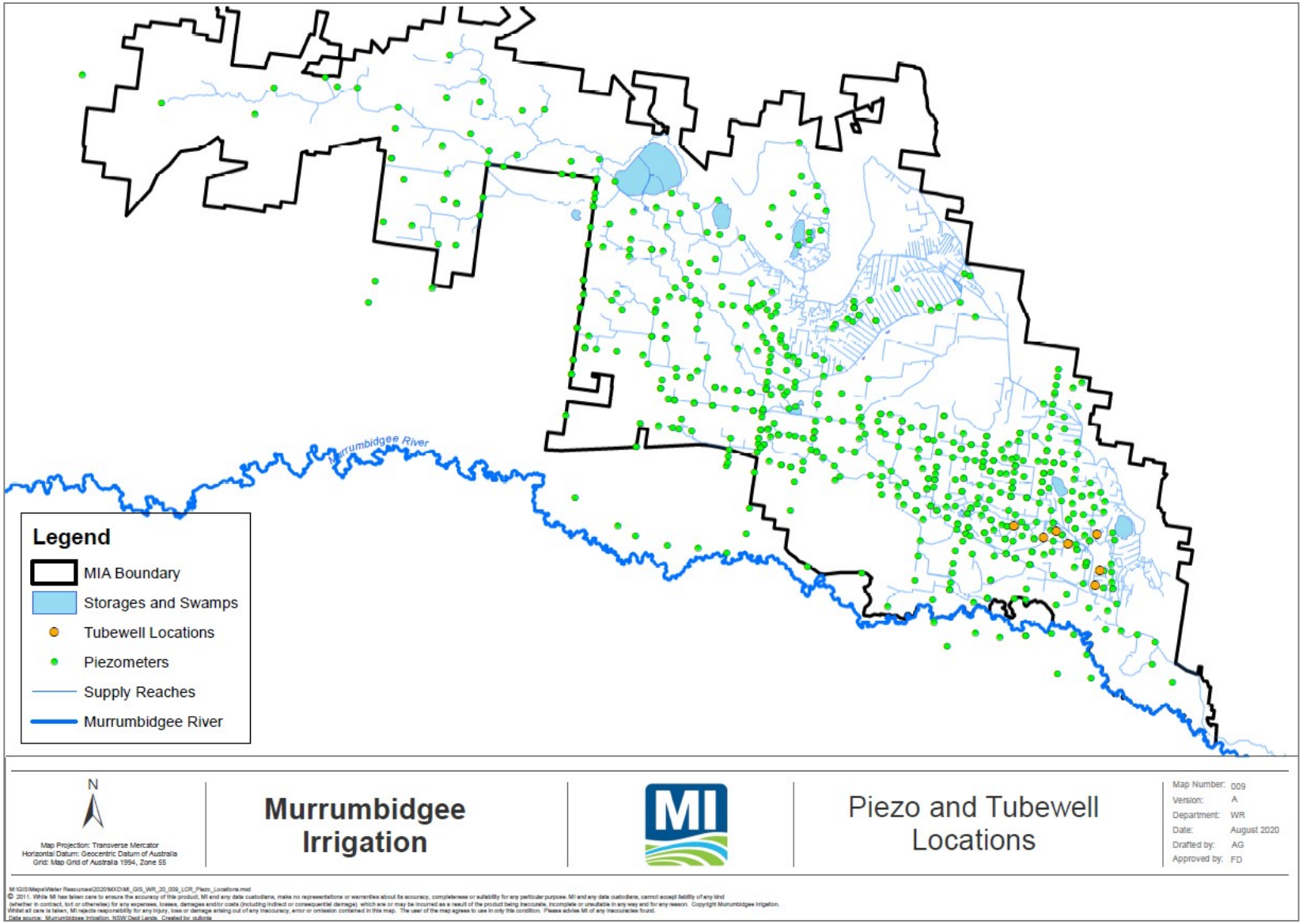


Figure 5 Location of piezometers and tubewells in the MIA 2020/21

6.2 Groundwater salinity

Groundwater salinity was not requested by the Minister for 2020/2021 reporting year.

6.3 Shallow Shepparton Formation

The depth to water table in 2020 for piezometers in the shallow Shepparton Formation are presented in Figure 6 to Figure 10.

Groundwater levels in this formation are expected to be highly influenced by seasonal rainfall, geology, and irrigation. A comparison between Figure 6 and Figure 7 demonstrates that the overall groundwater levels have lowered in comparison with prior years.

When compared to 2007/08 (Figure 9), recent groundwater levels have mainly lowered across the MIA, with more piezometers reading standing water levels greater than 4 m from surface level. Groundwater levels have likely lowered due to a reduction in flood irrigation practices and improved water efficiency on farms.

In 2020 six piezometers experienced a greater than 1 m rise in standing water level. The piezometers are positioned in crop areas that contain significant watering such as rice and cotton. In 2019/20 MIA experienced above average rainfall, periods of saturated catchments, higher diversions, and allocations. In addition, more cropping occurred over winter than in previous years likely due to a combination water availability, seasonal outlook and commodity prices.

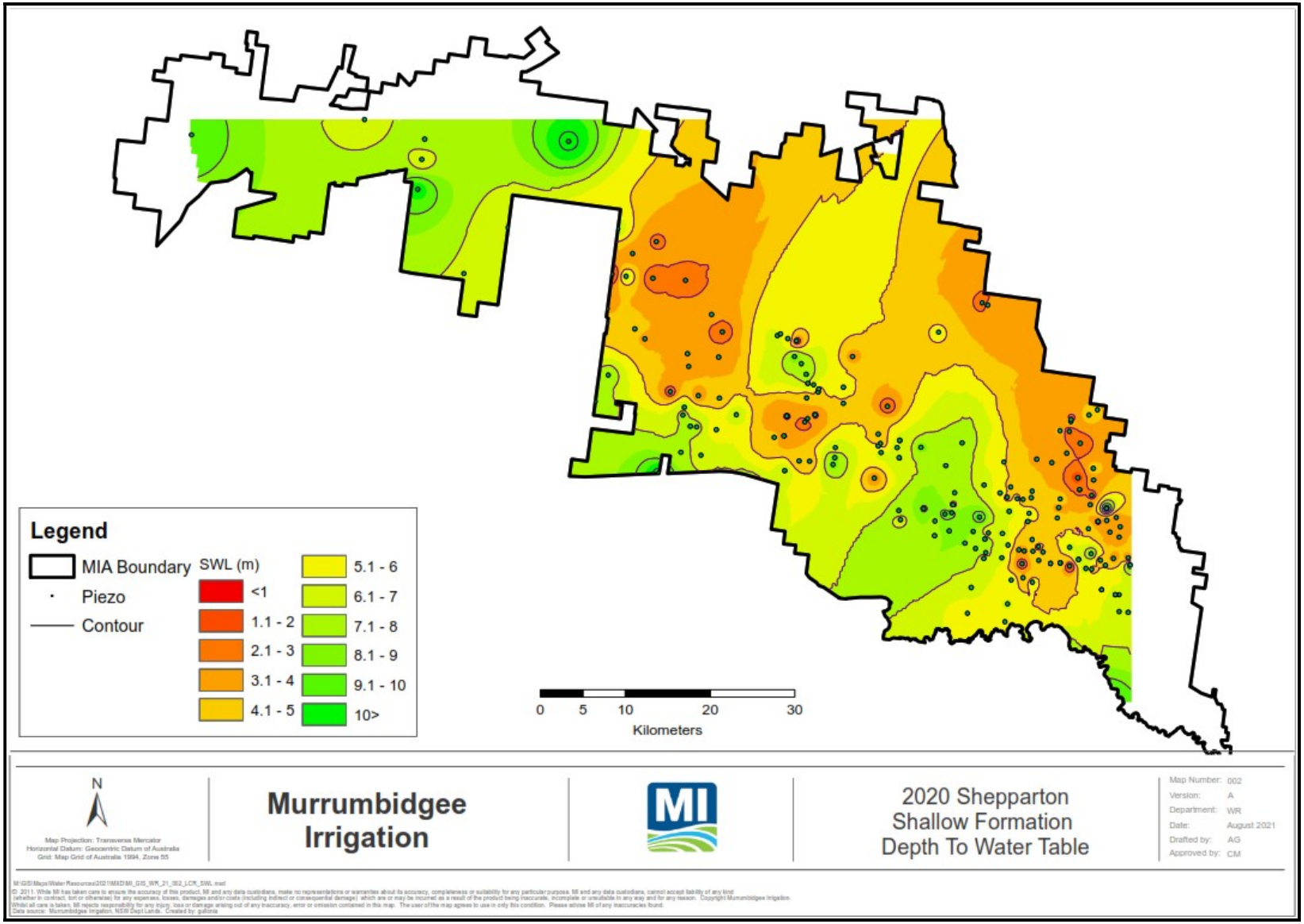


Figure 6 Shallow Shepparton Formation – depth to water table 2020

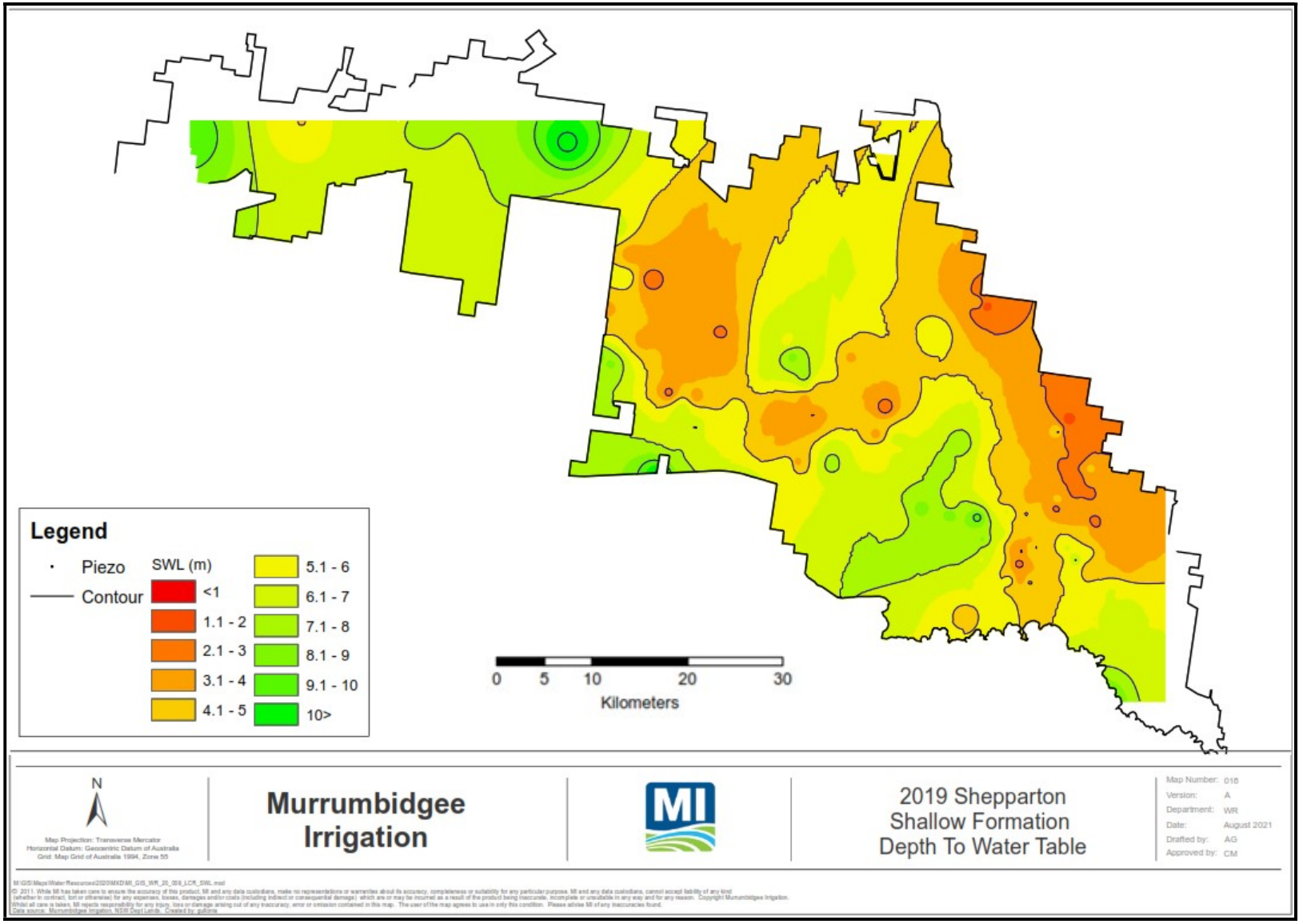


Figure 7 Shallow Shepparton Formation – depth to water table September 2019
(Note: A data error occurred in last FY report and Figure 6 has been updated to address)

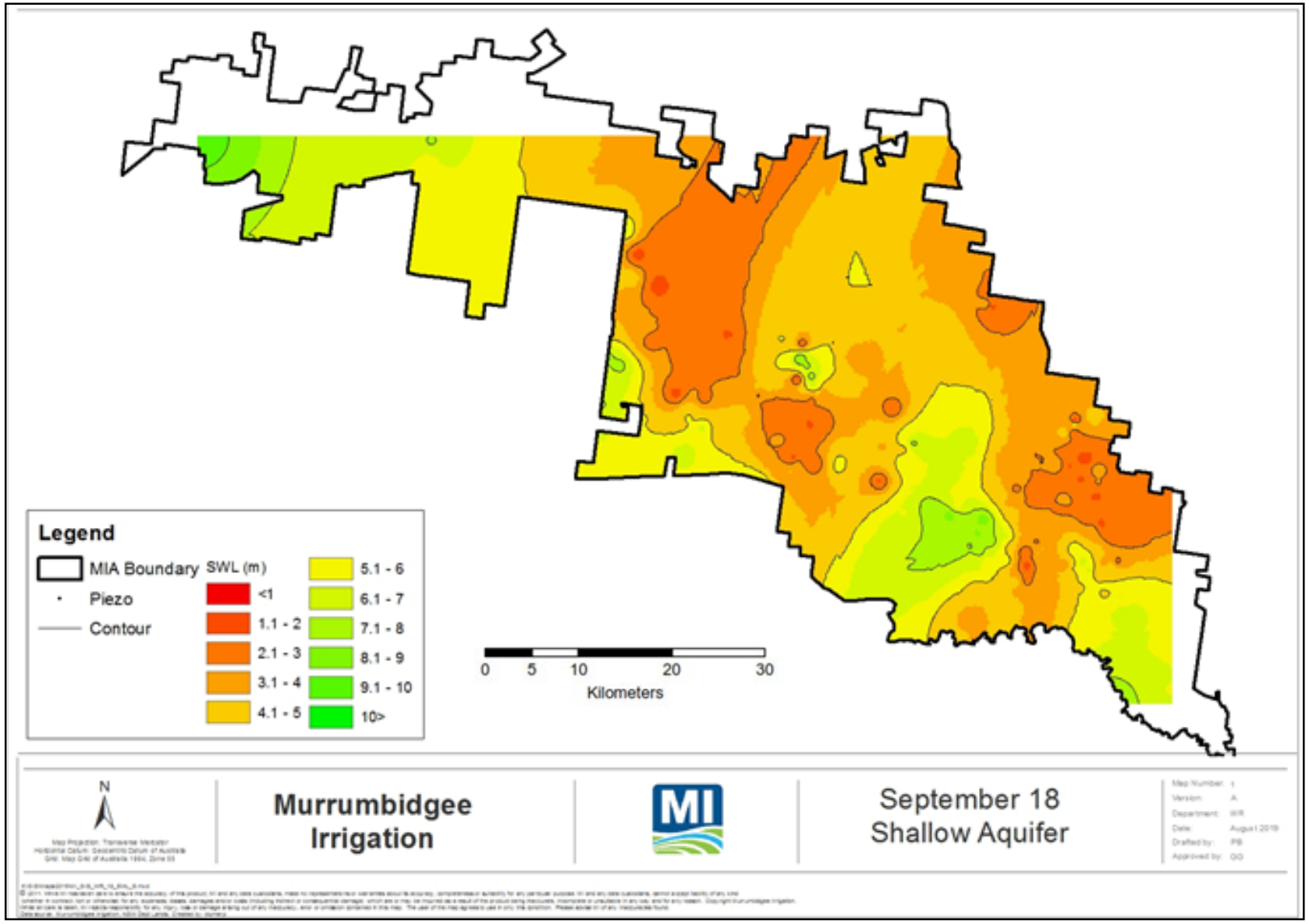


Figure 8 Shallow Shepparton Formation - depth to water table, September 2018

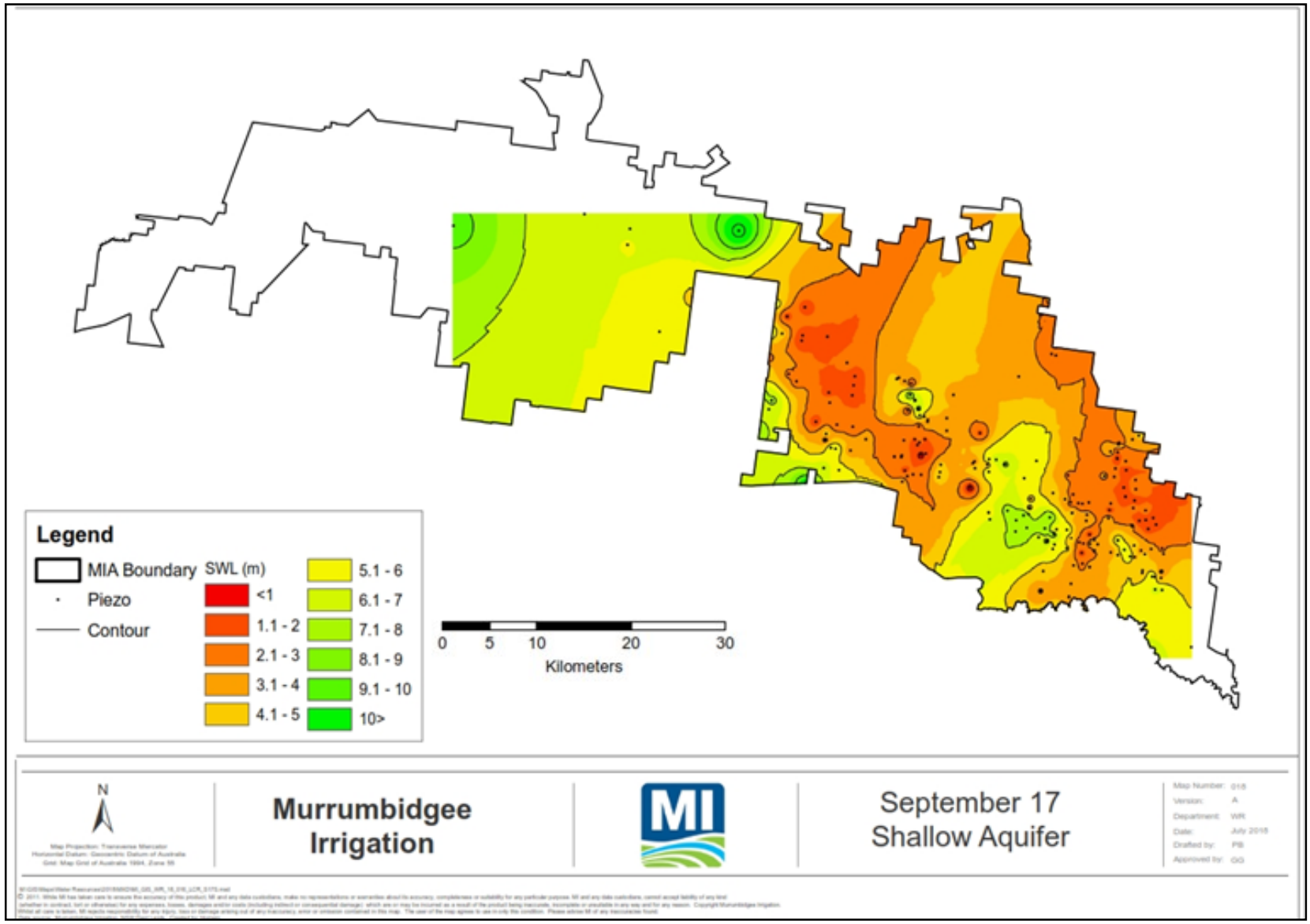


Figure 9 Shallow Shepparton Formation - depth to water table, September 2017

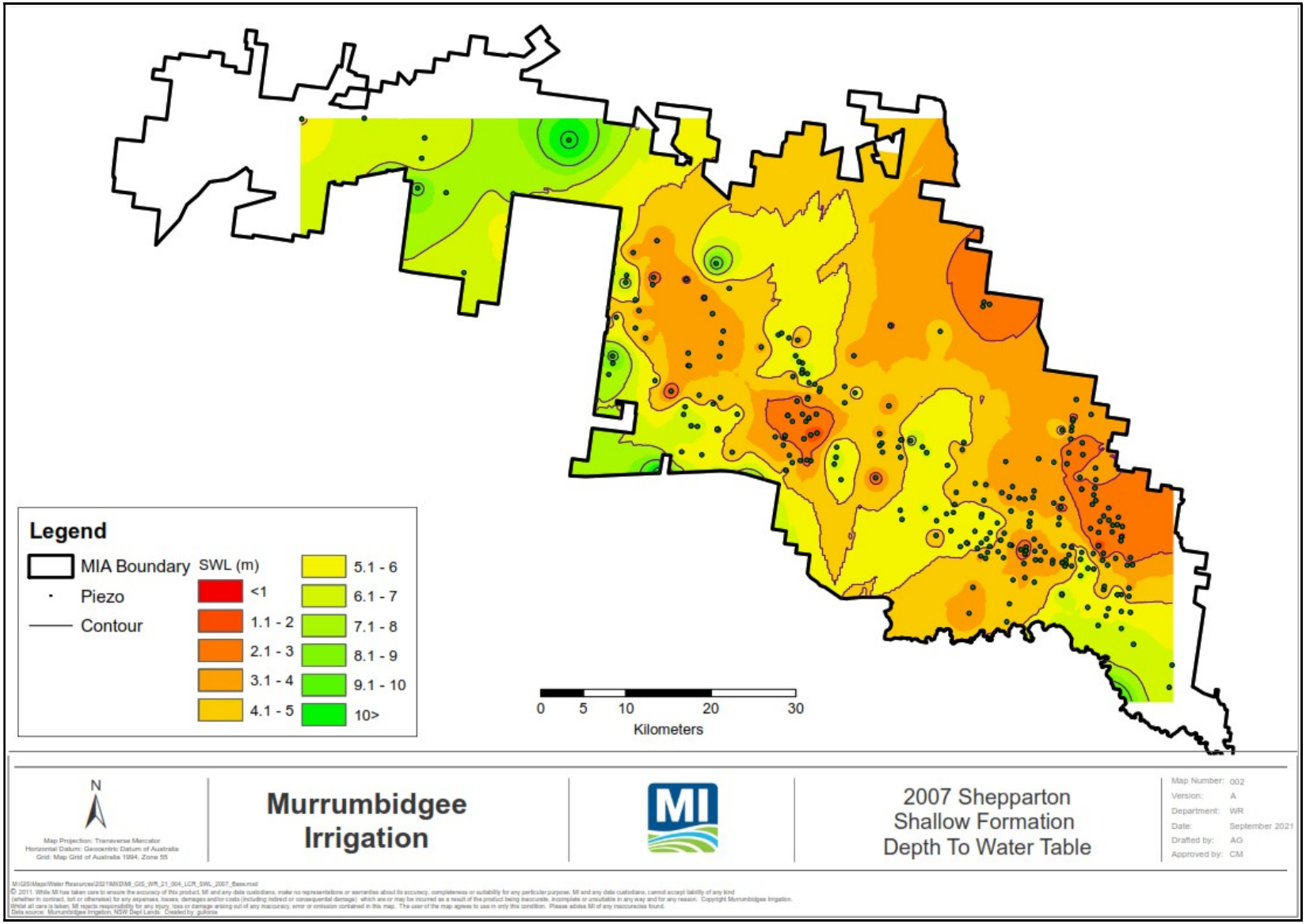


Figure 10 Shallow Shepparton Formation - depth to water table, September 2007

6.4 Deep Shepparton Formation

Depth to water table for piezometers in the deep Shepparton Formation are presented in Figure 11 to Figure 15.

Groundwater levels in the deep Shepparton Formation, in the longer term, are also influenced by rainfall and irrigation practices along with the connectivity with the shallow Shepparton Formation. Therefore, the trends observed in the shallow Shepparton Formation are also often seen in the deep Shepparton Formation. Groundwater extraction may also influence these levels, however MI does not have access to this data.

A comparison between Figure 11 and Figure 12 also demonstrates groundwater levels deepening across MIA for previous reporting years, including the historical reference year 2007/08, Figure 14.

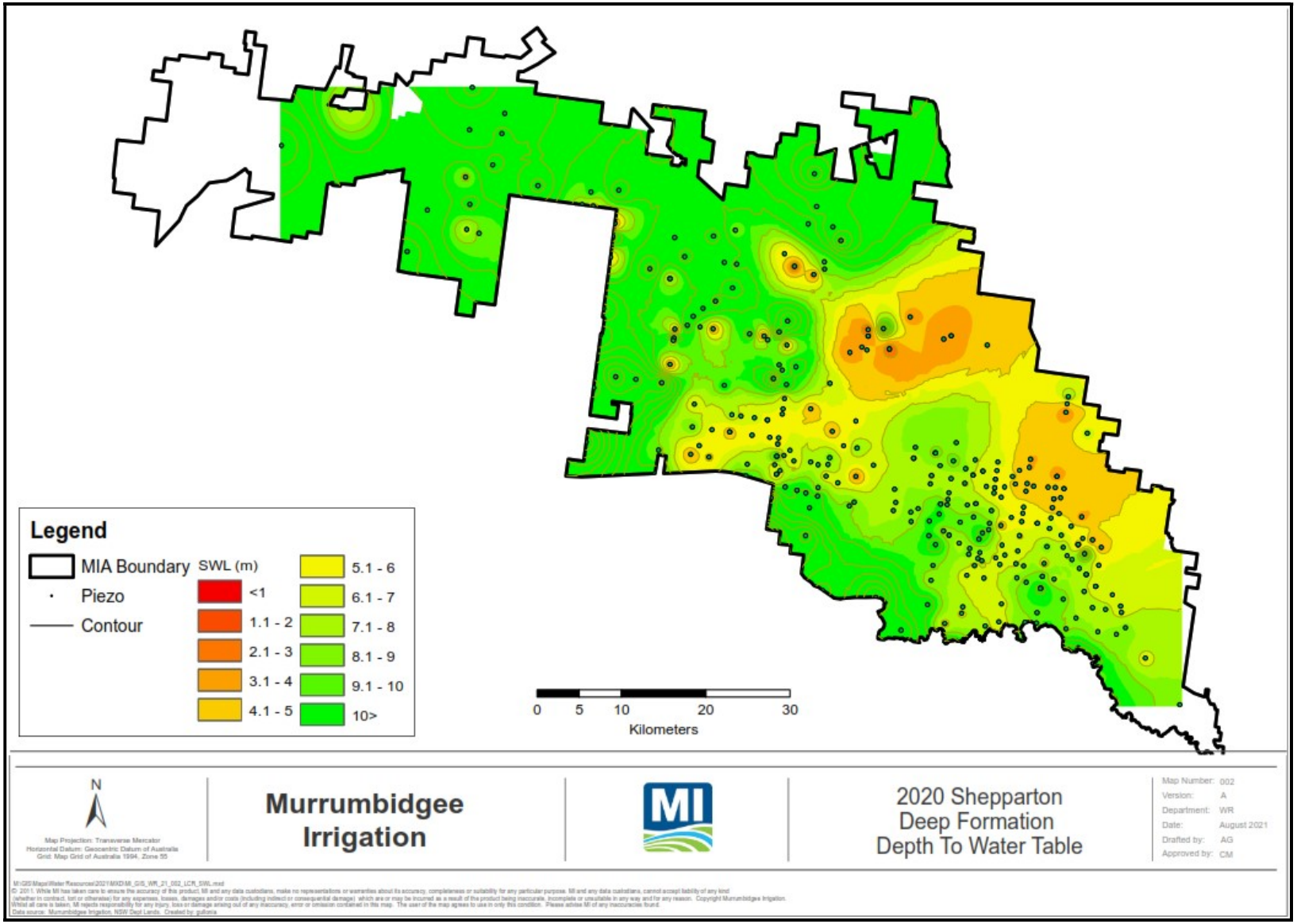


Figure 11 Deep Shepparton Formation - depth to water table, 2020

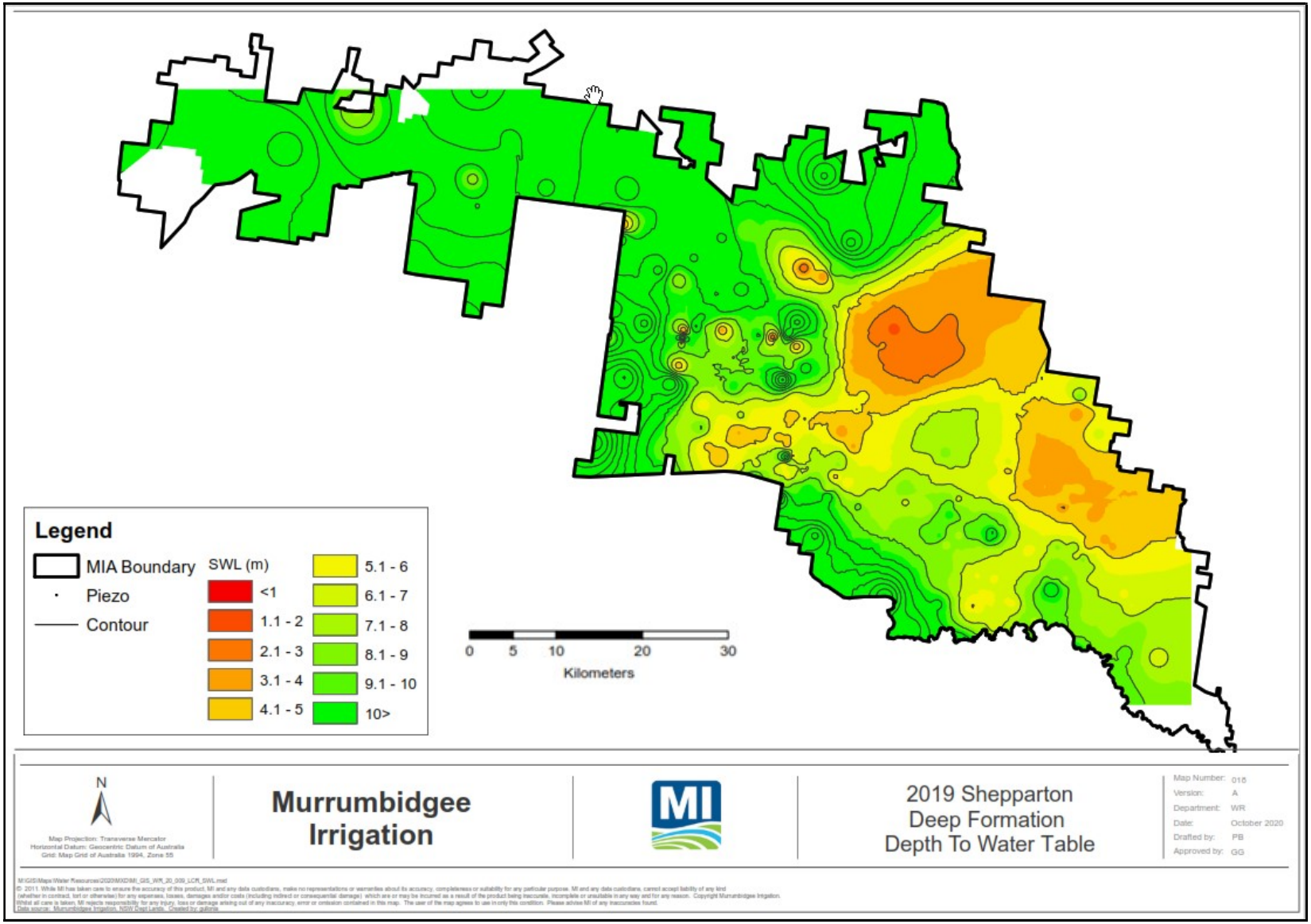


Figure 12 Deep Shepparton Formation - depth to water table, September 2019

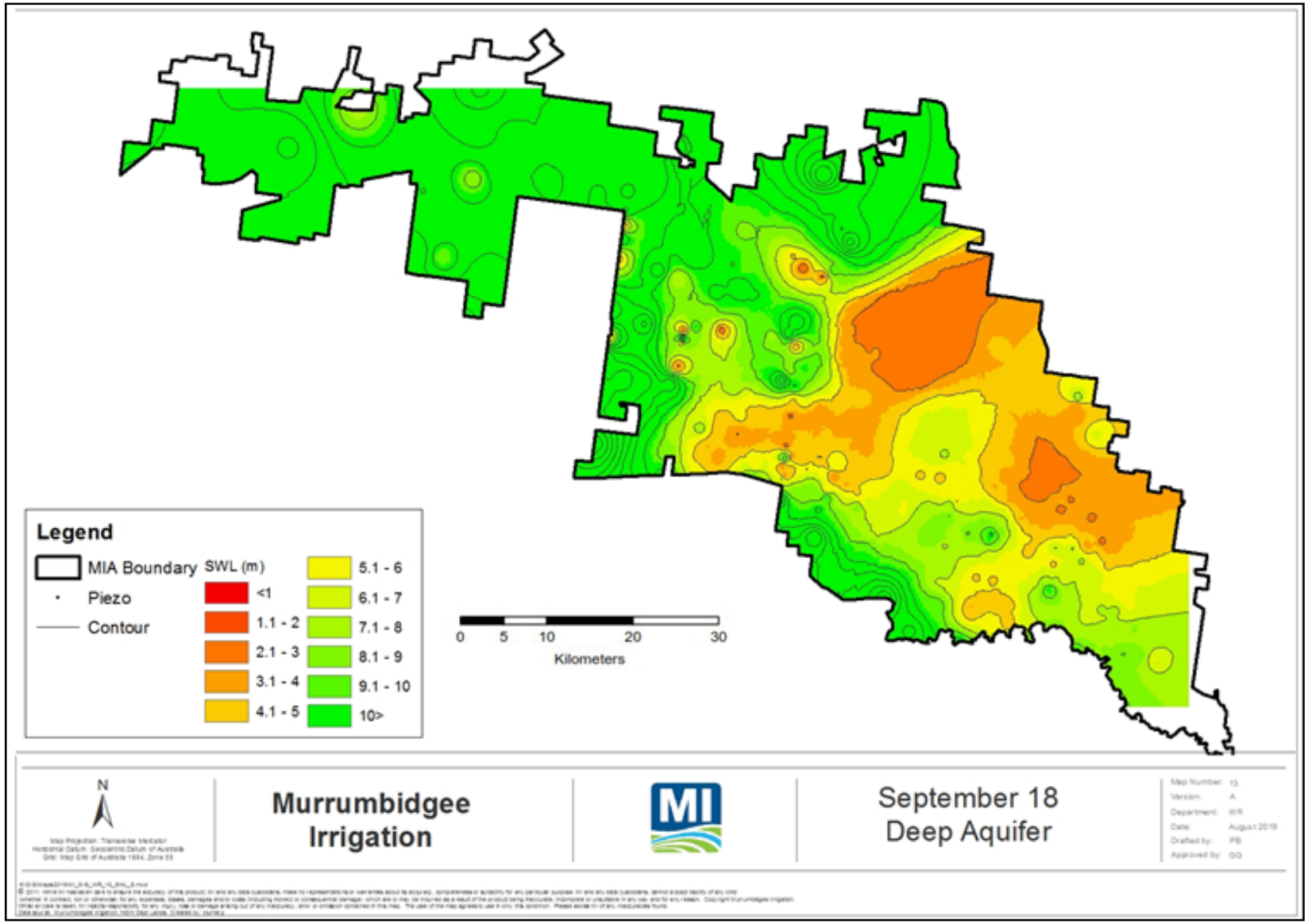


Figure 13 Deep Shepparton Formation - depth to water table, September 2018

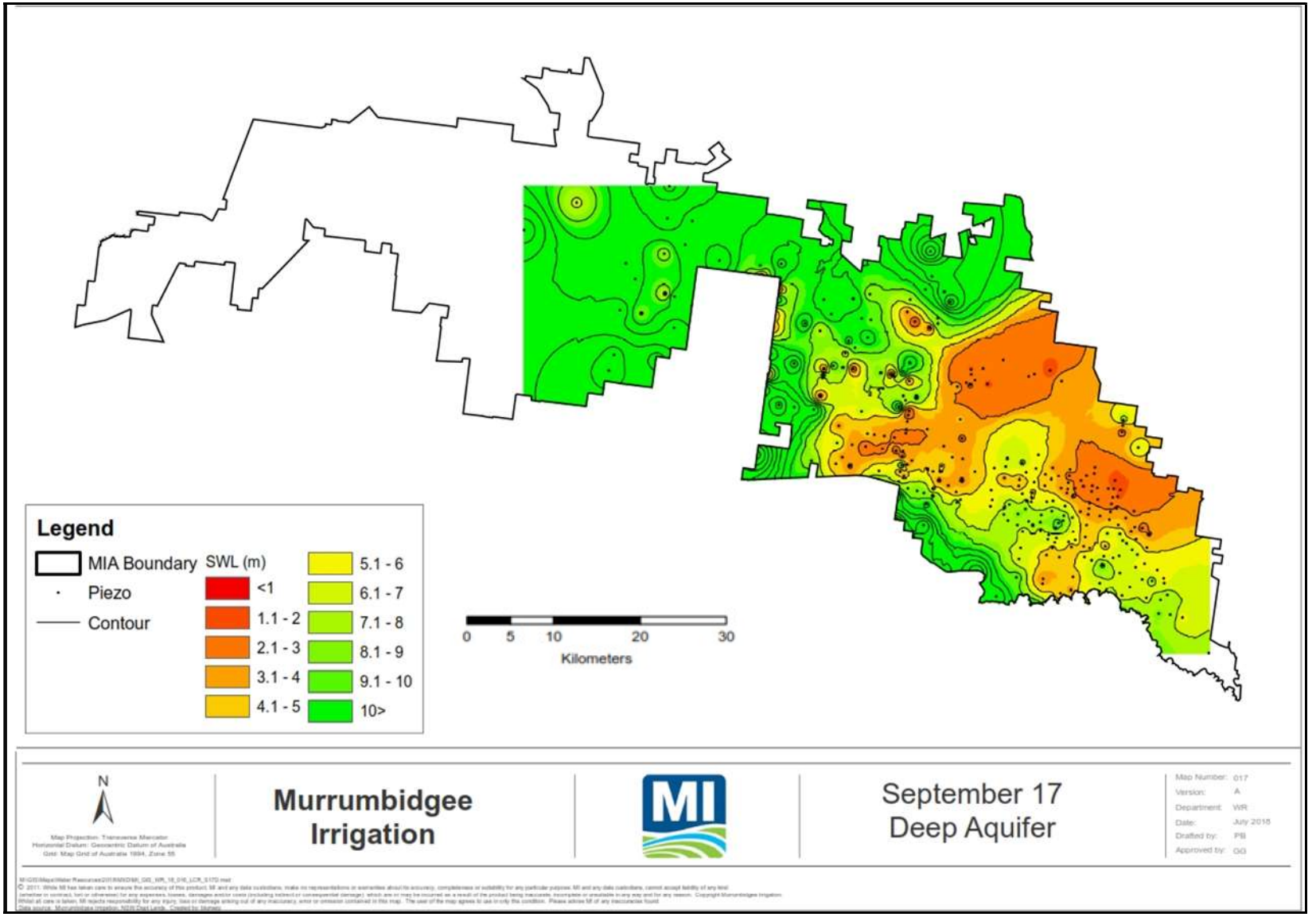


Figure 14 Deep Shepparton Formation - depth to water table, September 2017

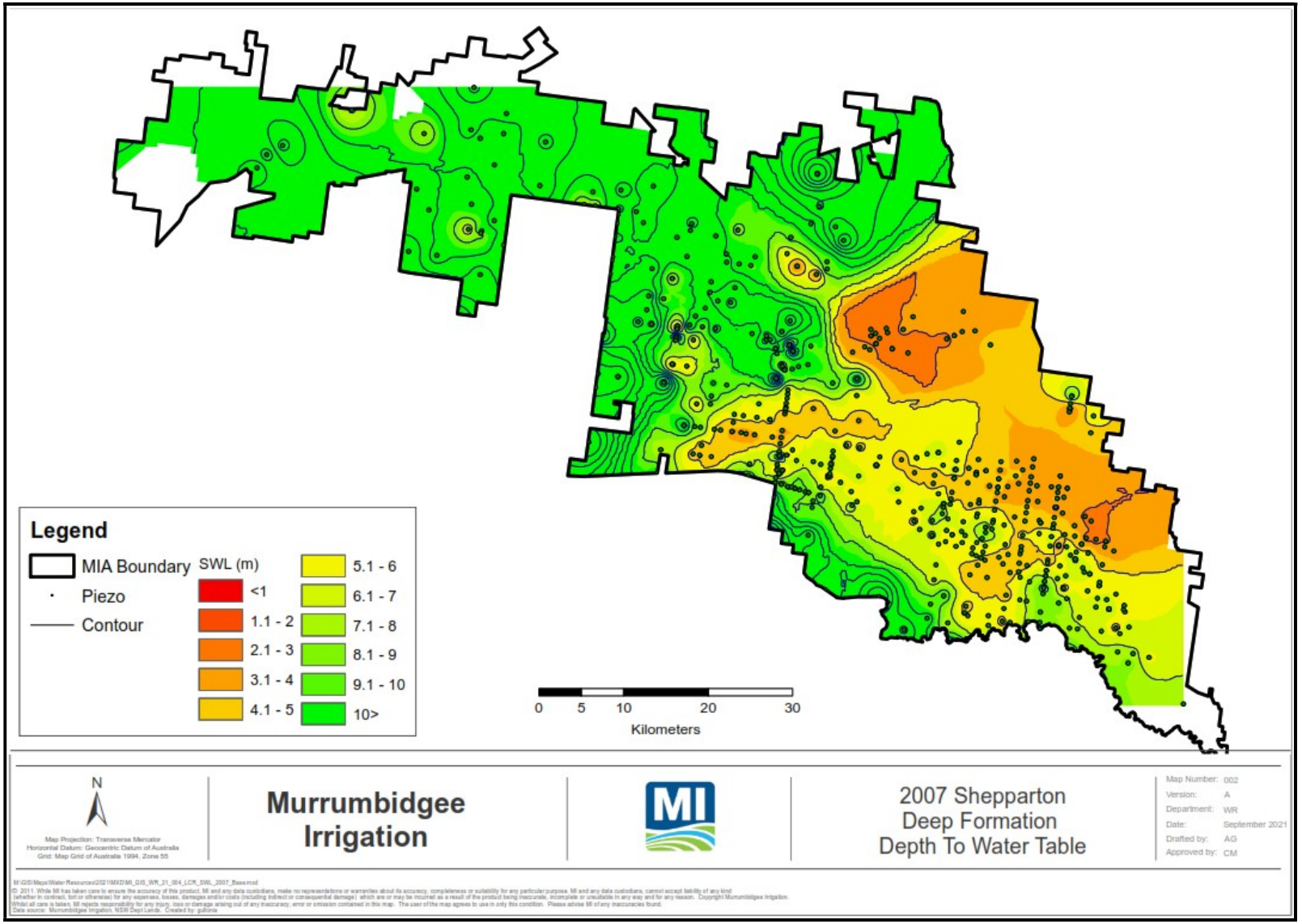


Figure 15 Deep Shepparton Formation – depth to water table, September 2007

6.5 Calivil Formation

Depth to water table for piezometers in the Calivil Formation are presented in Figure 16 to Figure 20.

Level trend in this formation generally represent drawdown from the shallow and deep Shepparton aquifers. Therefore, when comparing Figure 16 and Figure 17 the depth to water table has lowered. Overall, the levels in this aquifer remain consistent for all reporting years, with majority of piezometers reading a depth to water table of more than 10 metres.

The depth to water table area (Table 22) represents that the groundwater range greater than 4 metres continues to contain the largest area. Throughout the last three years there has been a gradual increase in piezometers reading standing water levels greater than 4 metres from the surface.

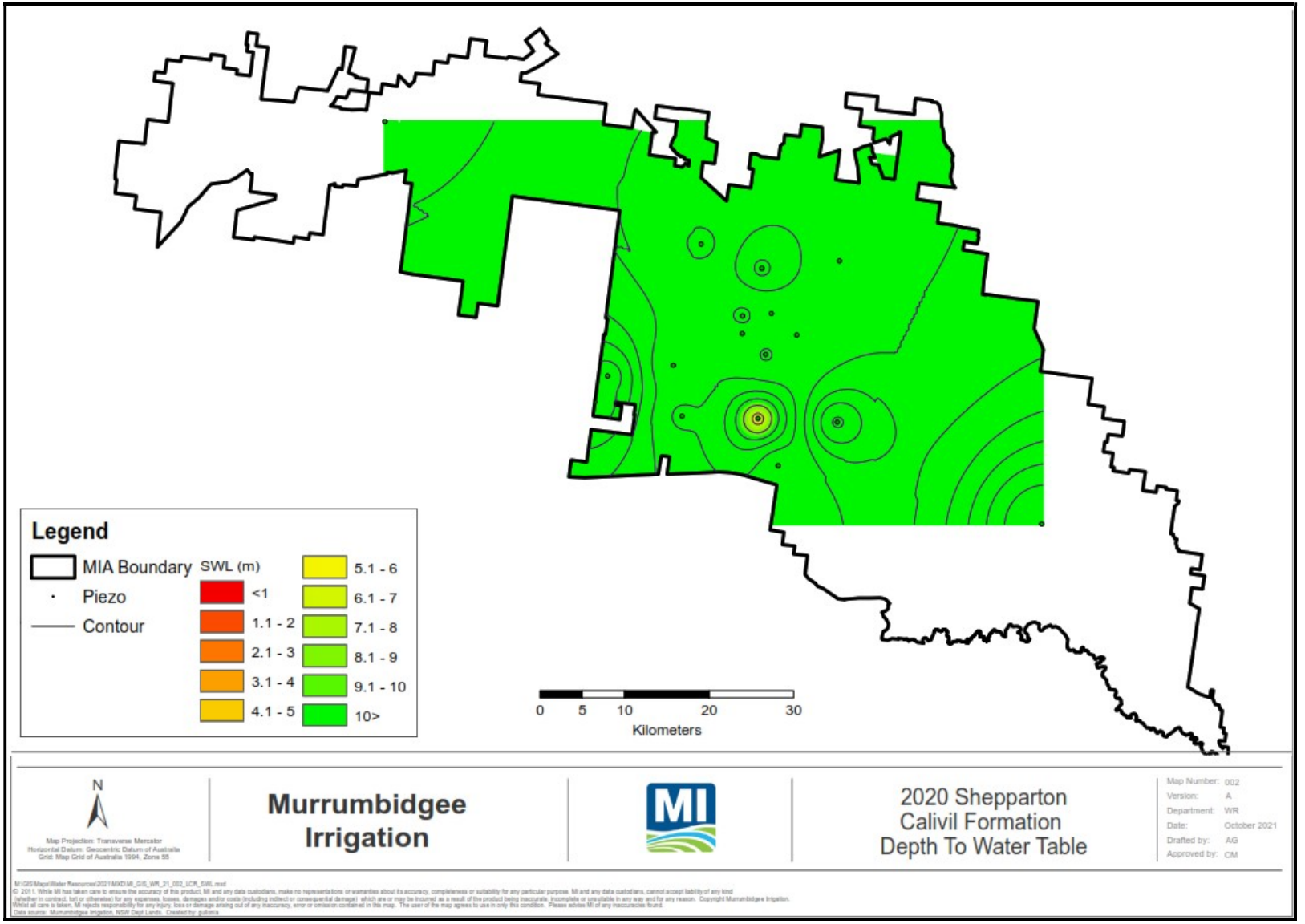


Figure 16 Calivil Formation – depth to water table, 2020

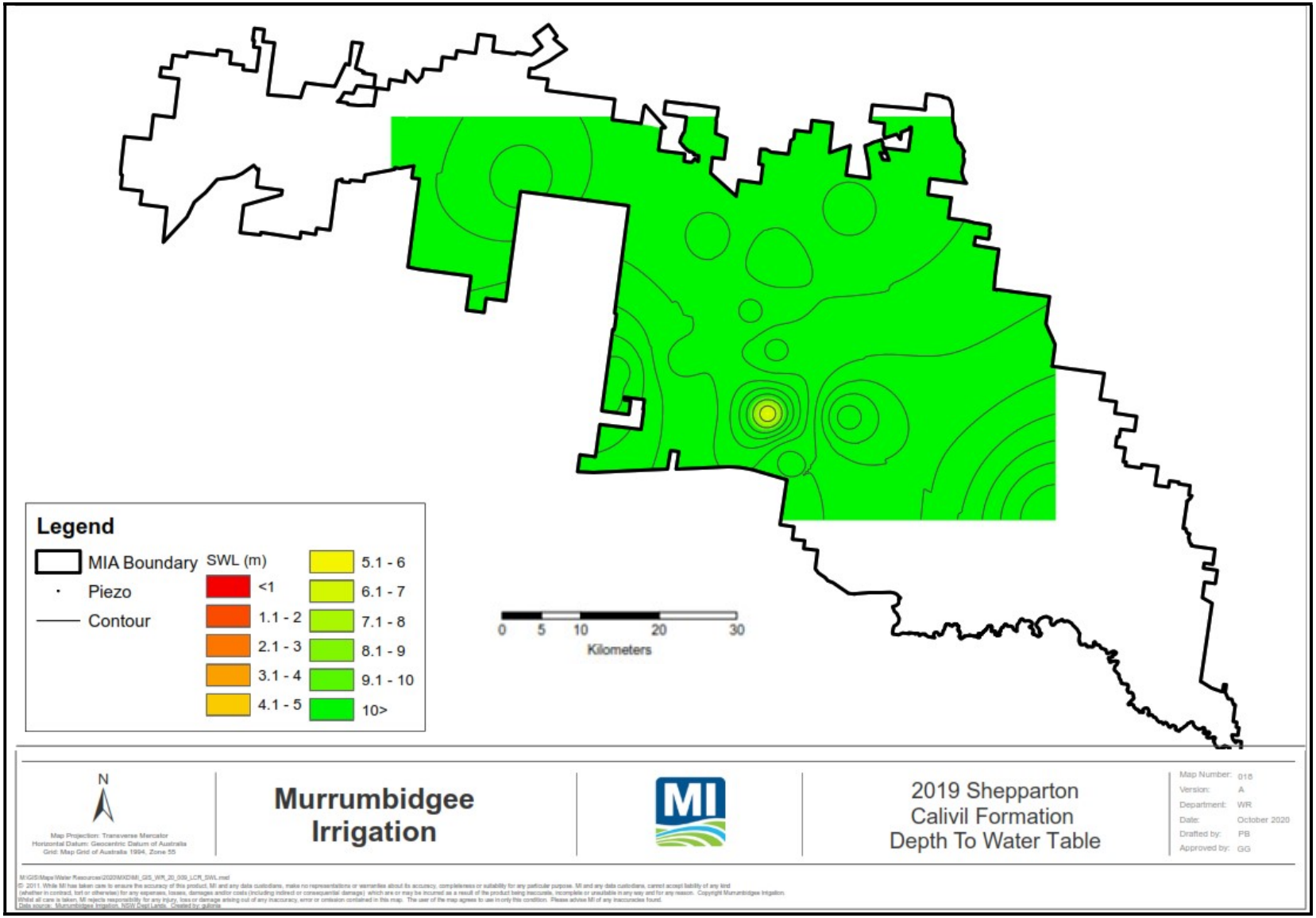


Figure 17 Calivil Formation - depth to water table, September 2019

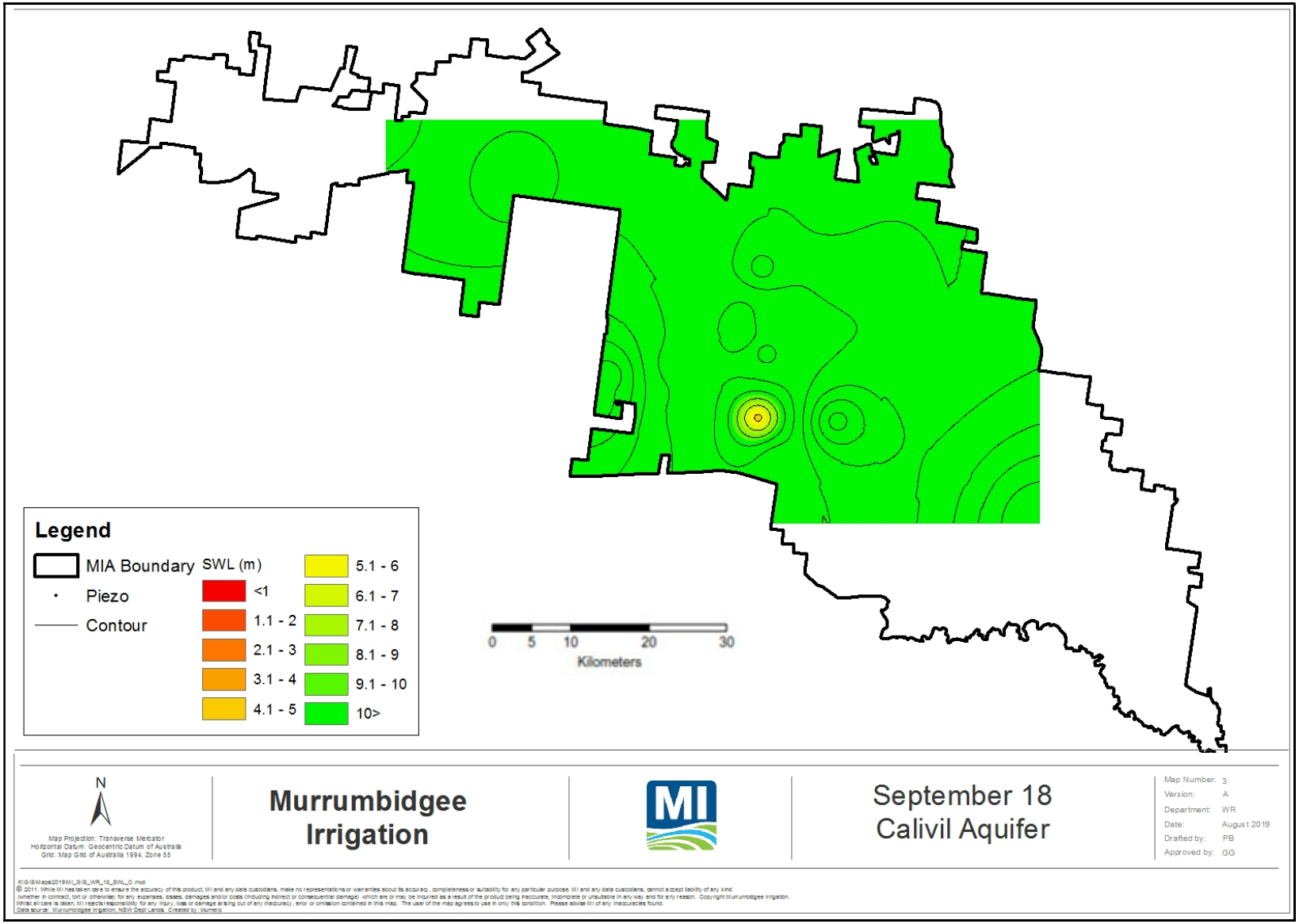


Figure 18 Calivil Formation - depth to water table, September 2018

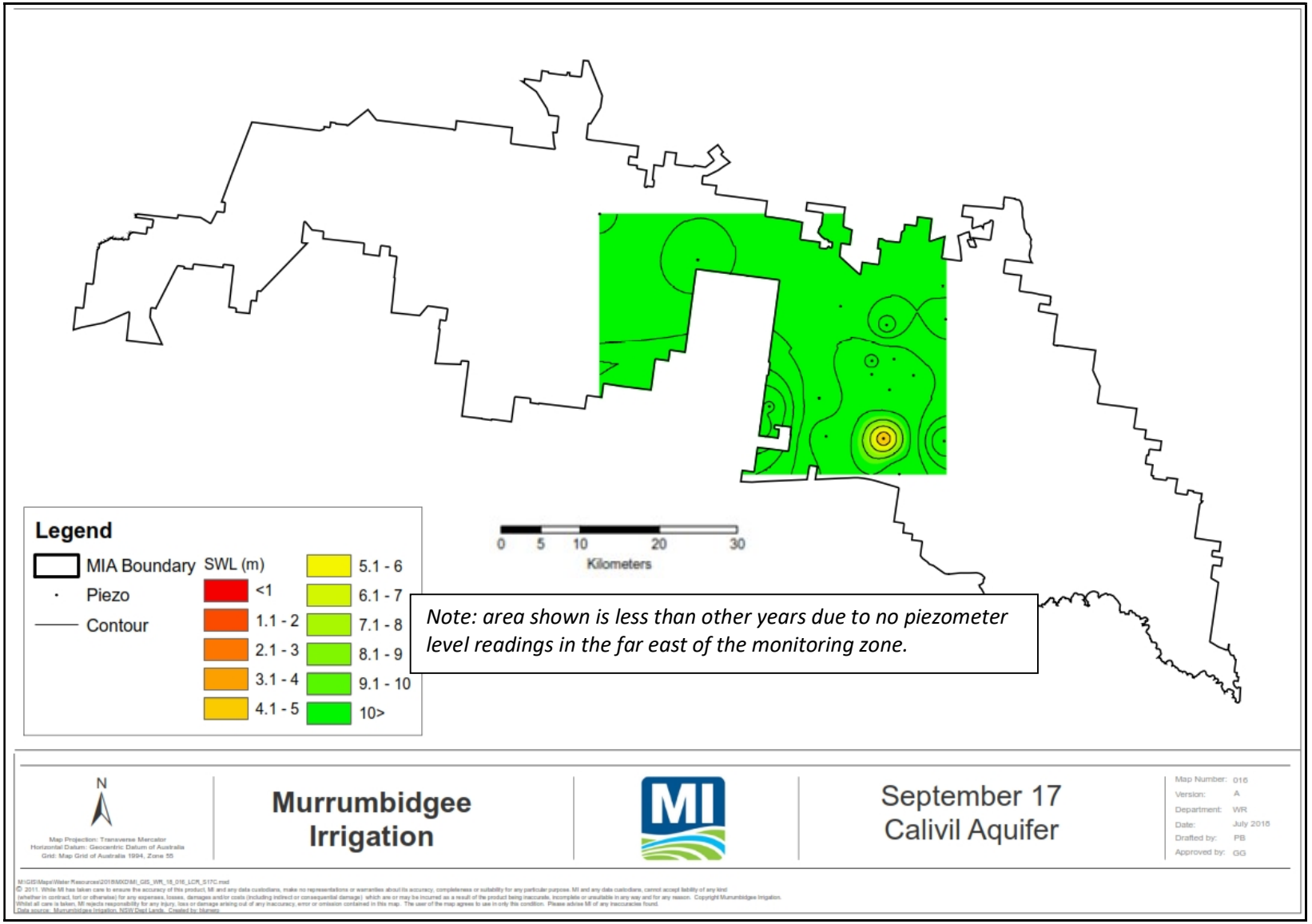


Figure 19 Calivil Formation - depth to water table, September 2017

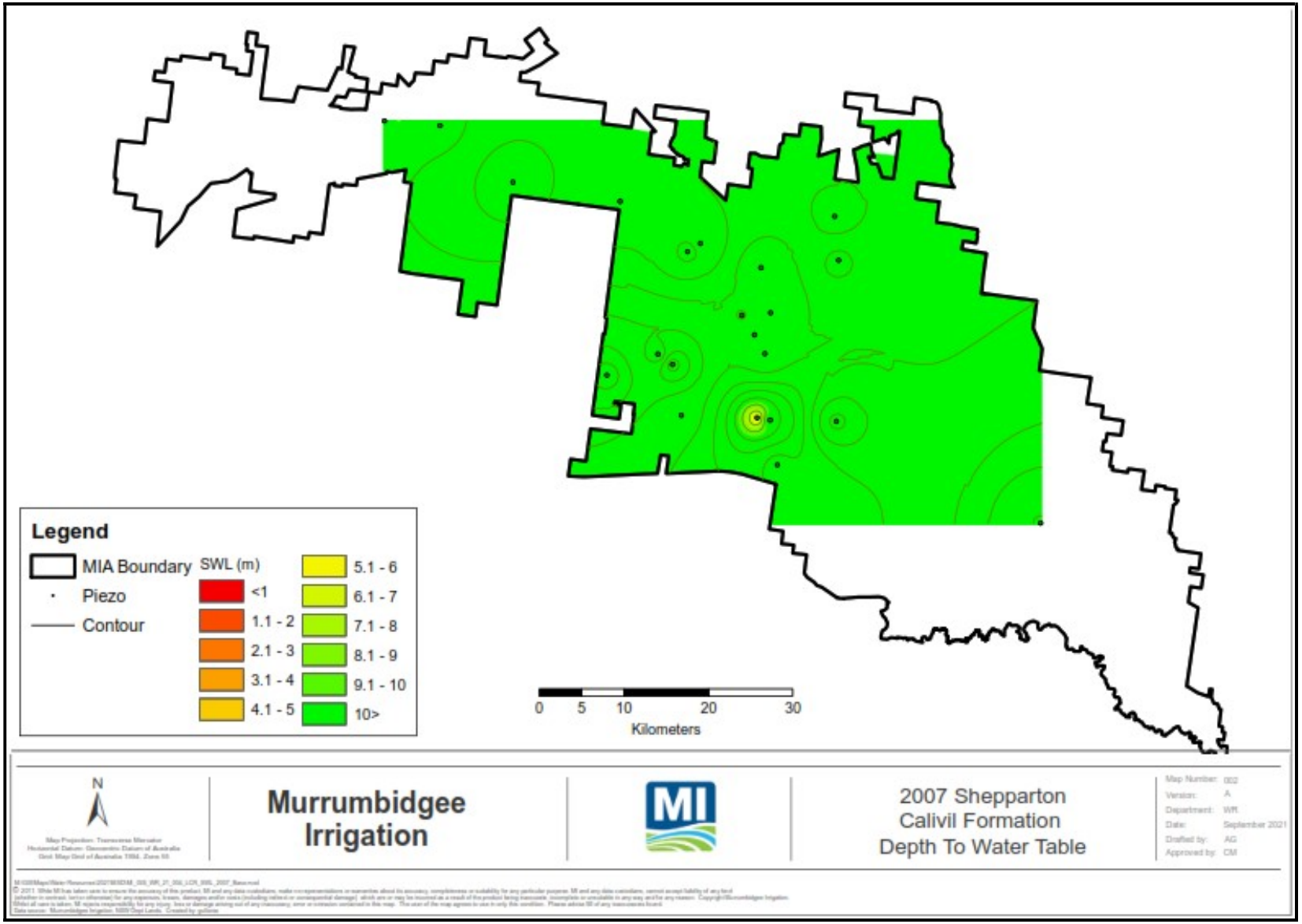


Figure 20 Calivil Formation - depth to water table, September 2007

7 Tubewells

MI monitors the volume of water and salt load pumped from seven tubewells within the MIA when operational. The locations of the tubewells are shown in Figure 5.

No tubewells were operated during the 2020/21 reporting period. MI will consult with the relevant authority as to their future operation.

8 New measures to limit groundwater recharge and discharge of salt

No new measures were implemented for 2020/21.

9 Environmental protection and management

9.1 Discharge of noxious aquatic weeds

During 2020/21 irrigation year, there was no known actual or potential discharge of Class 1, 2 or 3 declared aquatic weeds from MI's Area of Operation.

One potential notification was provided to NRAR on 16 December 2020, based on a third party notification. Upon further investigations it was determined the plant was not a Weed of National Significance.

9.2 Discharge of blue-green algae

No Red alert levels of blue-green algae were detected from any water sampled during discharge from MI's area of operation.

ENVIRONMENTAL PROTECTION LICENCE 4651

10 Statement of compliance

MI has fulfilled the compliance requirements as set out in EPL 4651 for 2020/21. A summary of the compliance requirements is cross referenced to this report and listed in Table 23.

No non-compliances were recorded and reported on during 2020/21.

Quality assurance and control procedures are in place to ensure data integrity and all compliance obligations are fulfilled. This includes using a NATA accredited laboratory for water sample analysis and contracting an external hydrological service provider to manage and maintain automated monitoring stations at discharge points. Internal Standard Operating Procedures (SOPs) for monitoring and reporting are reviewed and updated regularly.

MI has in place a process to receive complaints from members of the public in relation to MI's activities via the business telephone number. Contact information for complaints can be found on MI's website (https://www.mirrigation.com.au/company/contact).

Table 23 EPL 4651 monitoring and reporting requirements

Licence section	Requirement	Compliant	Included in this report
Administrative Conditions	1	Yes	No, not applicable
Discharges to Air and Water and Applications to Land	2	Yes	N/A
Limit Conditions	3	Yes	N/A
Operating Conditions	4	Yes	N/A
Maintain a Chemical Contingency Plan	O3.1	Yes	No, see: https://www.mirrigation.com.au/water/water-quality
Maintain a Chemical Control Plan	O3.5	Yes	
Maintain Pollution Incident Response Management Plan	Required for all EPL holders under the *Protection of Environment Operations Act 1997*	Yes	
Monitoring and Recording Conditions	5	Yes	10. Statement of Compliance
Monitoring Records	M1	Yes	No - available upon request from EPA
Requirement to monitor concentration of pollutants discharged	M2	Yes	11. EPL Monitoring and Reporting
Testing Methods	M3	Yes	No - Internal documents
Recording of pollution complaints	M4	Yes	No - available upon request from EPA
Telephone complaints line	M5	Yes	10. Statement of Compliance
Requirement to monitor volume or mass	M6	Yes	11. EPL Monitoring and Reporting
Other Monitoring and recording conditions	M7	Yes	9.1. Noxious Weed Management

Licence section	Requirement	Compliant	Included in this report
Annual return documents	R1	Yes	Submitted 23 August 2021
Annual system performance report	R4 Summary R2, R3 & R5	Yes	a) 3. Reporting on water management b) 11. EPL monitoring and reporting & 11.2 Water quality monitoring c) 11.3. Summary of events d) 12. Proposed changes

11 EPL monitoring and reporting

Under MI's EPL 4651, five locations (Figure 2) are licensed to allow water to be discharged outside MI's Area of Operation, with the condition that all flows are recorded, and specified water quality parameters are monitored. These discharge points are listed below:

- POINT 4 LAG - Gogeldrie Main Drain at Gooragool Lagoon
- POINT 5 GMSRR – Gogeldrie Main Southern Drain River Road
- POINT 6 YMS – Yanco Main Southern Drain
- POINT 7 ROCUDG – Cudgel Creek Roaches Escape
- POINT 15 MIRFLD – Mirrool Creek Floodway Wyvern Station

11.1 System performance

Table 24 presents total diversions into the MIA and total water discharged from the MIA for 2020/21 compared to previous years. In 2020/21, 900 ML was discharged, an increase of 773 ML compared to last reporting period 2019/20.

The diversions for 2020/21 are comparable to 2014/15, however 2020/21 discharged 229 ML more than 2014/15. This is due to 100% allocations and above average rainfall received for 2020/21.

Table 24 Total water volumes

Year	Diversions (ML)	Discharged (ML)
2020/21	880,456	900
2019/20	349,523	127
2018/19	586,752	642
2017/18	945,805	4,471
2014/15	878,614	671

11.2 Water quality monitoring

Monthly summaries for each monitoring point are presented in Table 25 to Table 29. Monitoring consisted of thirty sampling events, with twelve Notification level detections and five Action level detections.

Diuron and metolachlor were the two chemicals detected above licence limits in 2020/21. Chemical detections were found at three of the five licenced sites, Point 4 – LAG, Point 5 - GMSRR and, Point 7 - ROCUDG.

Table 25 Monitoring results for Point 4 - LAG

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-20	0	0	0	-
Aug-20	34	2	2	17/08/2020 Notification level Diuron (0.406µg/L) 31/08/2020 Action level Diuron (1.15µg/L)
Sep-20	59.8	2	0	-
Oct-20	4.7	0	0	No sample taken. Low flows didn't trigger alarm
Nov-20	13.9	3	2	10/11/2020 Notification level Diuron (0.286µg/L) 10/11/2020 Action level Metolachlor (0.104µg/L)
Dec-20	23	3	1	19/12/2020 Notification level Metolachlor (0.083µg/L)
Jan-21	58	2	0	-
Feb-21	35	3	3	05/02/2021 Notification level Metolachlor (0.052µg/L) 12/02/2021 Action level Metolachlor (0.475µg/L) 15/02/2021 Action level Metolachlor (0.813µg/L)
Mar-21	143.7	1	2	22/03/2021 Notification level Diuron (0.552µg/L) 22/03/2021 Notification level Metolachlor (0.071µg/L)
Apr-21	9.8	1	0	-
May-21	1	0	0	-
Jun-21	8.5	1	2	25/06/2021 Notification level Diuron (0.443µg/L) 25/06/2021 Notification level Metolachlor (0.089µg/L)
Total	**391.4**	**18**	**12**	

Table 26 Monitoring results for Point 5 - GMSRR

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-20	0	0	0	-
Aug-20	2.1	0	0	Supply water release (overtopped structure) No sample taken
Sep-20	0	0	0	-
Oct-20	0	0	0	-
Nov-20	0	0	0	-
Dec-20	0	0	0	-
Jan-21	0	0	0	-
Feb-21	0	0	0	-
Mar-21	133	1	1	24/03/2021 Notification level Diuron (0.644µg/L)
Apr-21	0	0	0	-
May-21	0	0	0	-
Jun-21	0	0	0	-
Total	**135.1**	1	1	

Table 27 Monitoring results for Point 6 - YMS

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-20	0	0	0	-
Aug-20	0	0	0	-
Sep-20	0	0	0	-
Oct-20	1.2	0	0	-
Nov-20	2.2	1	0	-
Dec-20	0	0	0	-
Jan-21	0	0	0	-
Feb-21	0	0	0	-
Mar-21	102	1	0	-
Apr-21	0	0	0	-
May-21	0	0	0	-
Jun-21	15.8	1	0	-
Total	**121.2**	**3**	**0**	

Table 28 Monitoring results for Point 7 - ROCUDG

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-20	0	0	0	-
Aug-20	1.7	0	0	-
Sep-20	12.1	1	0	-
Oct-20	13.7	0	0	No sample taken. Low flows throughout the month due to rainfall, didn't trigger an alarm.
Nov-20	85	2	0	-
Dec-20	0	0	0	-
Jan-21	0	0	0	-
Feb-21	0	0	0	-
Mar-21	102	2	2	25/03/2021 Notification level Metolachlor (0.047µg/L) 31/03/2021 Notification level Metolachlor (0.08µg/L)
Apr-21	4	0	0	No sample taken. Low flows didn't trigger alarm
May-21	10.4	1	1	27/05/2021 Notification level Metolachlor (0.041µg/L)
Jun-21	23	2	1	06/06/2021 Action level Metolachlor (0.115µg/L)
Total	**251.9**	**8**	**4**	

Table 29 Monitoring results for Point 15 - MIRFLD

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Jul-20	0	0	0	-
Aug-20	0	0	0	-
Sep-20	0	0	0	-

Month	Discharged (ML)	Sampling events	Detections	Chemical detection details
Oct-20	0	0	0	-
Nov-20	0	0	0	-
Dec-20	0	0	0	-
Jan-21	0	0	0	-
Feb-21	0	0	0	-
Mar-21	0	0	0	-
Apr-21	0	0	0	-
May-21	0	0	0	-
Jun-21	0	0	0	-
Total	**0**	**0**	**0**	**-**

Figure 21 provides a comparison of annual rainfall received, compared to the number of chemical detections for the last four years.

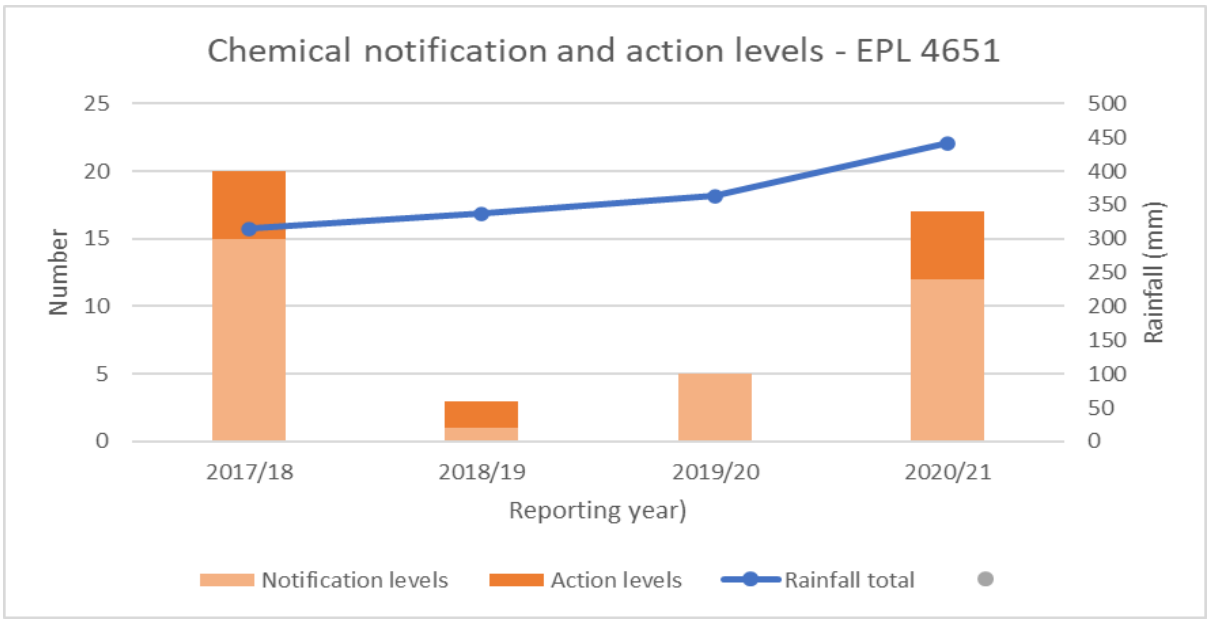


Figure 21: Comparison of irrigation drainage water notification trends

The number of Notification and Action level detections has increased compared to the prior reporting year where no Action levels were detected. This correlates with increased water deliveries to customers, increased cropping and local rainfalls yielding increased drainage water discharges.

Another influence on the results is a change in March 2020 to Diuron notification and action levels under MI's EPL4651. These levels were decreased, leading to increased instances where notification to EPA is required.

Overall, in the 2020-21 year Diuron accounted for five reports to the EPA and Metolachlor accounted for twelve. MI has provided information to our customers via our Customer Newsletters and Chemical Fact Sheets via our website to raise awareness in the MIA on the risks of chemical use and the need to comply with MI's Drainage Use Rules. Where investigations have been undertaken, direct contact with customers occurs via phone calls, letters, emails and in-field meetings to raise awareness on MI's EPL

requirements, Drainage Use Rules and the need for customers to comply with all pesticide legislative requirements, included using chemicals in accordance with their approved labels.

11.3 Summary of events

Table 30 contains a summary of all events that have been reported on during 2020/21. No events occurred that triggered notification of environmental harm or a written report to the EPA under the EPL. A total of 17 exceedances were recorded during 2020/21 reporting period.

Table 30 Summary of events 2020/21

Year	Notification of environmental harm	Written report (of an event)	Exceedances
2020/21	0	0	17

12 Proposed changes

MI propose no changes to the EPL conditions at this time.

Attachment A: Significant events for 2020/21

Murrumbidgee Irrigation notified the minister of seven significant events during 2020/21 reporting year. Each significant event details are outlined below in below Table 31. Each significant event was notified to the minister using the S91i process.

Table 31 Summary of significant events 2020/21

Date lodged	Reference	Site	Event details	Occurrence	Corrected by	Date closed
7/06/2021	CS0352556	Sturt Offtake	low river levels	Low river levels with potential for inaccurate flow measurements	Certificate of Validation provided	27/06/2021
23/02/2021	CS0321512	Sturt Offtake	Single door operation	Single gate operation at low flows	Updated site operating protocols. Introduced gate operation interlocks below a low flow threshold.	16/03/2021
2/12/2020	CS0296001	Sturt Offtake	Mechanical Fault	Component failure	Component repaired	30/01/2021
28/08/2020	CS0002573	Sturt Offtake	Component failure	Component failure	Component repaired	10/10/2020
30/07/2020	CS0002427	Sturt Offtake	low flow conditions	Site operating at low flow conditions	Updated site operating protocols	4/10/2020
27/07/2020	CS0002420	Narrandera Offtake	low levels	Low river levels with potential for inaccurate flow measurements	Updated site operating protocols	4/10/2020
1/06/2020	CS0002332	Sturt Offtake	Meter algorithm updated	Identified opportunity to increase accuracy of meter	Updated flow measurement algorithm in Affra Unit	10/10/2020

Attachment B: VENTIA flow, EC, and salt load monitoring financial year report

MURRUMBIDGEE IRRIGATION LIMITED - FLOW, EC & SALT LOAD MONITORING FINANCIAL YEAR 2020/2021 REPORT

Issue	**04**
Issued Date	**22/10/2021**

Prepared	Hussain Morssi (*Data Analyst*)
Reviewed	Matthew Bamford (*Area Manager*)
Approved	Rebekah Webb (*Hydrology Manager*)

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Report No.	RPT0555

Contact for Enquiries and Proposed Changes

If you have any questions regarding this document, please contact:

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Document Control

Amendment	Date	Page	Description	Authorised
02	03/08/2021	-	-	Matthew Bamford
03	26/08/2021	-	New data received	Matthew Bamford
04	22/10/2021	-	Updated Sections 3.2 & 4.2	Matthew Bamford

Notification / Distribution List

Section/Group	Contact
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Murrumbidgee Irrigation Limited	Sam Yenamandra
Murrumbidgee Irrigation Limited	Fern Dorricott
Murrumbidgee Irrigation Limited	Cindy McGrath
Ventia Utility Services	Matthew Bamford
Ventia Utility Services	Rebekah Webb

The above notification list is a minimum controlled distribution and it is the responsibility of the persons receiving the notification to further notify other Ventia personnel within their area if required.

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1.0 Introduction

Ventia Utility Services is contracted by Murrumbidgee Irrigation Limited (MIA) to conduct continuous level/flow and salinity monitoring at a range of locations distributed across their area of operations.

This report presents monthly statistics and annual summaries of total flow and salt loads derived from the monitoring at drain sites for the 2020/2021 financial year. Site 410083 contains no flow or salt load data as the rating table was suspended as of the 01/06/2010 to present due to the installation of new gates.

This report contains information relating to Murrumbidgee Irrigation Limited Compliance sites, 410083, 41010005, 41010921 and 41010940. Also reported on are the two offtake sites being 410127 and 410129. An annual site summary can be found in this report on all sites maintained by Ventia field staff.

All data reported is extracted from the Ventia Hydstra software archive to an accuracy of three (3) significant figures.

A data extraction process called HYTAB is used when extracting the data. HYTAB utilises a configuration file provided by MIA to format the data. This file stipulates reporting to four (4) significant figures. Using four significant figures implies an unrealistic level of accuracy for the data collection processes undertaken. Ventia data reporting standards recommend a maximum of three (3) significant figures.

2.0 Annual Flow Summaries

2.1 Compliance Sites

Please note that [#] implies that although a mean monthly flow figure has been given, this flow figure is only the mean based off data capture and does not include data on days in the monthly period where a flow could not be determined. [V] denotes that the data is operational only data, the data was unable to be validated during the field visit.

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)										Site	410083
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]
Median	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]
Inst.Max	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]
Inst.Min	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]
Total	[ ]M	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]

Annual Mean	[ ]	M ...	Equipment malfunction
Ann. Median	[ ]	S ...	Rating table suspended
Annual Total	[ ]	All Totals are in megalitres	

The rating table for this site was suspended by Ventia on the 01/06/2010 as new gates were installed by Murrumbidgee Irrigation. Ventia does not currently supply flow data for this site.

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)										Site	41010005
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	0.0R	0.1B	0.4R	0.4R	2.8R	0.0R	0.0R	0.0R	3.3*	0.1R	0.3R	[0.8]	
Median	0.0R	0.0B	0.0R	0.3R	0.1R	0.0R	0.0R	0.0R	0.0*	0.0R	0.0R	[0.1]	
Inst.Max	0.0R	5.3B	2.9R	2.0R	23.0R	0.0R	0.0R	0.0R	34.3*	1.7R	3.1R	[17.6]	
Inst.Min	0.0R	0.0B	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0*	0.0R	0.0R	[0.0]	
Total	0.000R	1.666B	12.07 R	13.70 R	85.04 R	0.000R	0.000R	0.000R	101.8 *	4.038R	10.35 R	[22.89]	

Annual Mean	[0.7]	# ...	Other authorities data (MW)
Ann. Median	[0.0]	* ...	Debris Effecting Sensor
Annual Total	[251.5]	? ...	Irregular data use with caution

41010005 experienced its highest flows in November 2020.

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)										Site	41010921
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	0.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	4.3R	0.0R	0.0R	0.0R	
Median	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
Inst.Max	0.0R	16.0R	0.1R	0.0R	0.0R	0.0R	0.0R	0.0R	123 R	0.0R	0.0R	0.0R	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	
Total	0.000R	2.058R	0.004R	0.000R	0.000R	0.000R	0.000R	0.000R	132.6 R	0.000R	0.000R	0.000R	

Annual Mean	0.4R	N ...	Rating Extrapol. within x1.5 max flow
Ann. Median	0.0R	R ...	Rating table extrapolated
Annual Total	134.7 R	All Totals are in megalitres	

41010921 experienced its highest flows in March 2021.

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)										Site	41010940
Variable	141.00	Stream Discharge (Ml/d) in megalitres/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
Mean	0.0R	1.1R	2.0R	0.2R	0.5R	0.7R	1.9B	1.3B	4.6R	0.3R	0.0R	0.3R	
Median	0.0R	0.0R	1.0R	0.0R	0.0R	0.2R	0.0B	0.8B	0.0R	0.0R	0.0R	0.0R	
Inst.Max	0.0R	8.2R	16.5R	1.5R	7.7R	6.9R	28.9B	6.9B	71.2R	4.2R	1.2R	9.7R	
Inst.Min	0.0R	0.0R	0.0R	0.0R	0.0R	0.0R	0.0B	0.0B	0.0R	0.0R	0.0R	0.0R	
Total	0.000R	34.01 R	59.79 R	4.651R	13.87 R	22.96 R	58.14 B	35.34 B	143.7 R	9.807R	0.986R	8.543R	

Annual Mean	1.1B	# ...	Other authorities data (MW)
Ann. Median	0.0B	B ...	Backed-up stage
Annual Total	391.8 B	R ...	Rating table extrapolated

41010940 experienced its highest flows in March 2021.

2.2 Offtake Sites

Site	410127			MAIN CANAL AT NARRANDERA REGULATOR																	Site	410127	
Variable	141.00			Stream Discharge (Ml/d) in megalitres/day, Available for release																	Year	2020/21	
Year	2020/21																						
Day	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun	
Mean	97.6	?	1160	?	1530	V	1560	V	2880		3510	V	3630	V	2670		1700		1030	V	1140	V	443	V
Median	69.3	?	479	?	1460	V	1680	V	2800		3570	V	4050	V	3230		1870		968	V	1220	V	455	V
Inst.Max	910	?	5860	?	3120	V	3990	V	5470		5060	V	5790	V	5620		3890		1770	V	2030	V	1220	V
Inst.Min	-58.3	?	-31.3	?	317	V	233	V	308		1270	V	479	V	278		0.0		244	V	154	V	-19.9	V
Total	3026	?	36090	?	45770	V	48400	V	86510		109000	V	112400	V	74840		52660		30950	V	35310	V	13290	V

Annual Mean	1780	?	? ... Irregular data use with caution
Ann. Median	1400	?	C ... Correlated data
Annual Total	648200	?	V ... Operational Data

410127 experienced minor periods of negative flow due to seiching at the site.

Site	410129			STURT CANAL AT OFFTAKE																	Site	410129	
Variable	141.00			Stream Discharge (Ml/d) in megalitres/day, Available for release																	Year	2020/21	
Year	2020/21																						
Day	Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun	
Mean	4.3	V	470	#	751	E	810	E	981	V	1270	E	1150	E	898	V	448	V	303	V	489	V	73.3	V
Median	0.0	V	162	#	714	E	843	E	871	V	1280	E	1290	E	955	V	395	V	258	V	495	V	0.0	V
Inst.Max	127	V	2560	#	3140	E	2260	E	3430	V	2190	E	2330	E	2940	V	1550	V	922	V	1150	V	905	V
Inst.Min	0.0	V	0.0	#	0.0	E	0.0	E	84.9	V	205	E	181	E	51.4	V	0.0	V	0.0	V	48.2	V	0.0	V
Total	132	V	14580	#	22520	E	25110	E	29440	V	39250	E	35510	E	25150	V	13900	V	9094	V	15140	V	2200	V

Annual Mean	636	E	# ... Other authorities data (MW)
Ann. Median	528	E	E ... Estimated
Annual Total	232000	E	K ... Minor editing

410129 experienced its highest flows in December 2020.

3.0 Annual Salt Load Summaries

3.1 Compliance Sites

Please note that [#] implies that although a mean monthly flow figure has been given, this flow figure is only the mean based off data capture and does not include data on days in the monthly period where a flow could not be determined. [V] denotes that the data is operational only data, the data was unable to be validated during the field visit.

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)										Site	410083
Variable	804.00	Salt Transport (t/d) in tonnes/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]T	[ ]T	[ ]T	[ ]T	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]T	[ ]T	[ ]	
Median	[ ]T	[ ]T	[ ]T	[ ]T	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]T	[ ]T	[ ]	
Inst.Max	[ ]T	[ ]T	[ ]T	[ ]T	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]T	[ ]T	[ ]	
Inst.Min	[ ]T	[ ]T	[ ]T	[ ]T	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]T	[ ]T	[ ]	
Total	[ ]T	[ ]T	[ ]T	[ ]T	[ ]S	[ ]S	[ ]S	[ ]S	[ ]S	[ ]T	[ ]T	[ ]	

Annual Mean	[ ]	S ...	Rating table suspended
Ann. Median	[ ]	T ...	Probe out of water/below instrument threshold
Annual Total	[ ]	All Totals are in tonnes	

No salt loads can be produced for site 410083 as no flows are calculated by Ventia.

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)										Site	41010005
Variable	804.00	Salt Transport (t/d) in tonnes/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]T	[0.0]	[0.0]	0.0R	0.3R	[0.0]	[ ]T	[ ]T	[ ]*	[0.0]	[0.1]	[0.0]	
Median	[ ]T	[0.0]	[0.0]	0.0R	0.0R	[0.0]	[ ]T	[ ]T	[ ]*	[0.0]	[0.1]	[0.0]	
Inst.Max	[ ]T	[0.0]	[0.2]	0.2R	2.8R	[0.0]	[ ]T	[ ]T	[ ]*	[0.2]	[0.2]	[0.1]	
Inst.Min	[ ]T	[0.0]	[0.0]	0.0R	0.0R	[0.0]	[ ]T	[ ]T	[ ]*	[0.0]	[0.1]	[0.0]	
Total	[ ]T	[0]	[1]	1R	10R	[0]	[ ]T	[ ]T	[ ]*	[0]	[1]	[0]	

Annual Mean	[0.1]
Ann. Median	[0.0]
Annual Total	[14]

* ... Debris Effecting Sensor
? ... Irregular data use with caution
B ... Backed-up stage

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)										Site	41010921
Variable	804.00	Salt Transport (t/d) in tonnes/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[2.6]	[ ]T	[ ]T	[ ]T	
Median	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[1.1]	[ ]T	[ ]T	[ ]T	
Inst.Max	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[16.4]	[ ]T	[ ]T	[ ]T	
Inst.Min	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[0.0]	[ ]T	[ ]T	[ ]T	
Total	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[ ]T	[15]	[ ]T	[ ]T	[ ]T	

Annual Mean	[2.6]
Ann. Median	[1.1]
Annual Total	[15]

N ... Rating Extrapol. within x1.5 max flow
R ... Rating table extrapolated
T ... Probe out of water/below instrument threshold

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)										Site	41010940
Variable	804.00	Salt Transport (t/d) in tonnes/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]T	[0.4]	[0.4]	0.0R	[0.2]	[0.1]	[ ]B	[ ]T	[1.7]	[0.1]	[0.0]	[0.0]	
Median	[ ]T	[0.2]	[0.3]	0.0R	[0.2]	[0.1]	[ ]B	[ ]T	[0.4]	[0.0]	[0.0]	[0.0]	
Inst.Max	[ ]T	[1.3]	[3.0]	0.3R	[1.3]	[0.9]	[ ]B	[ ]T	[13.8]	[0.3]	[0.2]	[0.0]	
Inst.Min	[ ]T	[0.0]	[0.0]	0.0R	[0.0]	[0.0]	[ ]B	[ ]T	[0.0]	[0.0]	[0.0]	[0.0]	
Total	[ ]T	[5]	[11]	1R	[2]	[3]	[ ]B	[ ]T	[17]	[1]	[0]	[0]	

Annual Mean	[0.3]
Ann. Median	[0.0]
Annual Total	[39]

B ... Backed-up stage
R ... Rating table extrapolated
T ... Probe out of water/below instrument threshold

3.2 Offtake Sites

Site	410127	MAIN CANAL AT NARRANDERA REGULATOR										Site	410127
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	9.9?	151 ?	182 V	148 V	[315]	216 K	202 K	228	120	123 V	82.7K	[33.0]	
Median	6.9?	64.6?	181 V	157 V	[317]	220 K	196 K	260	134	123 V	75.4K	[35.5]	
Inst.Max	85.2?	987 ?	387 V	375 V	[671]	340 K	377 K	540	286	217 V	153 K	[88.9]	
Inst.Min	-6.1?	-4.4?	37.9V	19.7V	[32.1]	75.5K	28.3K	19.0	0.0	17.6V	14.5K	[-1.0]	
Total	307?	4670?	5458V	4584V	[9128]	6696K	6247K	6386	3711	3682V	2565K	[923]	

Annual Mean	[150]	? ...	Irregular data use with caution
Ann. Median	[134]	C ...	Correlated data
Annual Total	[54360]	K ...	Minor editing

410127 has periods of negative salt loads due to negative flow caused by seiching at the site.

Site	410129	STURT CANAL AT OFFTAKE										Site	410129	
Variable	803.00	Salt Transport (calc from MDFs) (t/d) in tonnes/day, Available for release										Year	2020/21	
Year	2020/21													
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		Day
Mean	[1.0]	61.8?	[93.1]	[88.4]	107	84.1E	68.4E	[75.1]	29.8V	35.3	39.4	[27.5]		
Median	[0.0]	27.1?	[76.6]	[97.2]	103	74.5E	72.5E	[70.0]	25.0V	39.0	38.9	[32.3]		
Inst.Max	[16.0]	384 ?	[387]	[243]	390	182 E	147 E	[234]	102 V	96.5	108	[83.3]		
Inst.Min	[0.0]	0.0?	[0.0]	[0.0]	11.0	11.2E	10.6E	[3.3]	0.0V	0.0	4.7	[0.0]		
Total	[16]	1914?	[2235]	[2651]	3207	2606E	2121E	[1803]	923V	1058	1221	[220]		

Annual Mean	[62.8]	# ...	Other authorities data (MW)
Ann. Median	[51.3]	? ...	Irregular data use with caution
Annual Total	[19980]	E ...	Estimated

410129 has periods of negative salt loads due to negative flow caused by seiching at the site.

4.0 Annual EC Summaries

4.1 Compliance Sites

Site	410083	YANKO MAIN SOUTHERN DRAIN AT OUTFALL (YMS)										Site	410083
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	0.0T	0.0T	48.5T	83.0T	204 T	195	181	220	295	185 T	0.0T	75.1T	
Median	0.0T	0.0T	0.0T	0.0T	247 T	182	175	204	211	196 T	0.0T	0.0T	
Inst.Max	0.0T	0.0T	559 T	310 T	435 T	270	297	384	973	469 T	0.0T	425 T	
Inst.Min	0.0T	0.0T	0.0T	0.0T	0.0T	146	130	148	181	0.0T	0.0T	0.0T	

Annual Mean	123 T	T ...	Probe out of water/below instrument th
Ann. Median	157 T	V ...	Operational Data

Site	41010005	CUDGEL CREEK AT ROACHES OUTFALL (ROCUDG)										Site	41010005
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[ ]T	[215]	[171]	160	212	[201]	[ ]T	[ ]T	[ ]*	[187]	[111]	139 #	
Median	[ ]T	[215]	[166]	164	213	[219]	[ ]T	[ ]T	[ ]*	[189]	[110]	141 #	
Inst.Max	[ ]T	[227]	[256]	203	322	[234]	[ ]T	[ ]T	[ ]*	[204]	[139]	206 #	
Inst.Min	[ ]T	[203]	[97.6]	110	179	[12.3]	[ ]T	[ ]T	[ ]*	[156]	[98.1]	97.6#	

Annual Mean	[173]	# ...	Other authorities data (MW)
Ann. Median	[179]	* ...	Debris Effecting Sensor

Site	41010921	GOGELDRIE MAIN SOUTHERN DRAIN AT RIVER ROAD (GMSRR)									Site	41010921
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release									Year	2020/21
Year	2020/21											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.0T	2.9T	5.3T	0.0T	0.0T	0.0T	0.0T	0.0T	35.4T	0.0T	0.0T	0.0T
Median	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T
Inst.Max	0.0T	167 T	167 T	0.0T	0.0T	0.0T	0.0T	0.0T	252 T	0.0T	0.0T	0.0T
Inst.Min	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T

Annual Mean	3.7T	T ...	Probe out of water/below instrument th
Ann. Median	0.0T	V ...	Operational Data

Site	41010940	LAGOON DRAIN @ GOORAGOOL LAGOON (LAG)									Site	41010940
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release									Year	2020/21
Year	2020/21											
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean	0.0T	138 T	277 T	161 K	166 T	181 T	53.1T	287 T	77.6T	52.7T	214 T	232 T
Median	0.0T	0.0T	287 T	11.9K	8.0T	206 T	0.0T	278 T	0.0T	0.0T	262 T	231 T
Inst.Max	0.0T	609 T	495 T	515 K	706 T	611 T	343 T	740 T	828 T	254 T	507 T	986 T
Inst.Min	0.0T	0.0T	0.0T	0.0K	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T	0.0T

Annual Mean	152 T	# ...	Other authorities data (MW)
Ann. Median	118 T	K ...	Minor editing

4.2 Offtake Sites

Site	410127	MAIN CANAL AT NARRANDERA REGULATOR										Site	410127
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	172 V	219	194	160	[185]	103 K	93.8K	135	118	203	125 K	[124]	
Median	176 V	219	205	154	[192]	100 K	98.0K	124	118	185	131 K	[128]	
Inst.Max	185 V	286	223	219	[233]	137 K	118 K	254	132	310	173 K	[157]	
Inst.Min	150 V	156	152	139	[123]	82.9K	67.7K	94.6	107	105	74.8K	[77.9]	

Annual Mean	[153]	K ...	Minor editing
Ann. Median	[153]	M ...	Equipment malfunction

Site	410129	STURT CANAL AT OFFTAKE										Site	410129
Variable	820.00	Conductivity (µS/cm) in µS/cm@25°C, Available for release										Year	2020/21
Year	2020/21												
Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Mean	[227]	229 ?	[194]	[183]	184	109	102	[134]	113 V	198	138	[165]	
Median	[231]	227 ?	[206]	[180]	188	99.1	98.9	[130]	114 V	184	133	[166]	
Inst.Max	[242]	303 ?	[229]	[242]	232	150	128	[216]	125 V	297	190	[178]	
Inst.Min	[204]	168 ?	[152]	[162]	118	86.7	78.0	[96.5]	98.6V	120	91.4	[151]	

Annual Mean	[162]	# ...	Other authorities data (MW)
Ann. Median	[161]	? ...	Irregular data use with caution

5.0 Annual Site Summaries for sites affected by back-up

5.1 Compliance Sites:

- 41010005 was affected by backup during the period between 27/08/2020 and 29/08/2020.
- 41010940 was affected by backup during the period between 24/01/2021 and 21/02/2021.
- The remaining sites were not affected by backup during the report period of 2020/2021.

5.2 Offtake Sites:

No offtake sites were affected by backup during the reporting period of 2020/2021.

SIte No.	Site Acronym	No. of Visits	No. of Data Downloads	Discharge Measurements		Sensor Changes	General Comments
				No. of Meas.	Comments		
410083	YMS	10	12	0	No flow conditions.		Block bank removed in November 2020 and built on again in April 2021. During this time water was leaking from the regulator. Battery was stolen at site; no data collected from 19th July 2020 to 28th July 2020.
410085	LMC	12	12	4			Stock access to drain has caused some damage to banks of control.
410164	BOD1	0	0	-	No data		Site discontinued 2017-18.
410167	BBOW	0	0	-	No data		Site decommissioned at end of 2018-19 season.
410174	MDJWE	12	12	4			Water flowing into drain from Warburton escape. Mice chewed through the orifice line, causing level data to be unreliable from 19th May 2021 till 22nd June 2021. New Orifice line installed on 22nd June 2021.
41010005	ROCUDG	11	12	4			Limited flow conditions throughout season.
41010921	GMSRR	12	12	0			Limited flow conditions throughout season.
41010940	LAG	12	12	2			Limited flow conditions throughout season.
41010955	MIRMCN	12	12	4			Debris on bridge pylon following high flows has been affecting operational data.
410127	Main Canal	12	12	9			410127B water quality site established on 25th February 2021. Hydrolab sensor and CR800 logger installed.
410129	Sturt Canal	12	12	10			410129B water quality site established on 23rd February 2021. Hydrolab sensor and CR800 logger installed.
CD-2-1922	CD-2-1922	12	12	0			Updated program on 15th June 2021. Limited flow conditions throughout season.
MS-2MDJY-01	MDJY	12	12	5			New rating updated on 24th Feb 2021
Yoogali	MDJ_Yoogali	0	0	-	No data.		Site decommissioned in November 2018.
			TOTALS	42			
General Comments							

6.0 EWA's 2020/2021

W	= EWA submitted, waiting on approval
A	= EWA approved, works right to proceed
C	= EWA completed, ready to be invoiced
I	= EWA invoiced, closed out
N	= EWA cancelled, will not be approved

EWA REF		Site ID	Name	EXTRA WORKS DESCRIPTION	Issued by	Total Value (ex GST)	Status
MI	56	410129	Sturt Offtake	Assessment of AFFRA Unit SN: 1018412 - Delivery to Kern Elektronik in Switzerland from Shepparton. - Assessment of AFFRA head unit by Kern technician. - Quote provided for repair or replacement of unit.	SF	$ 740	I
MI	57	Various	-	AWS Data Retrieval	SF	$ 1669.40	I
MI	58	Various	-	Supply and installation of multiprobes.	SF	$ 13,091	I
MI	59	Various	-	Supply and installation of dataflex sensors.	SF	$ 46,650	I
MI	60	CD-2-1922	CD-2-1922	Remote program CD21922_2018-02-23.CR8 to output SCADA parameters.	SF	$ 274.16	I
MI	61	410167	BBOW	Removal of all instrumentation from site (to be allocated as MIA spares)	SF	$ 400.72	I
MI	62	41010955	MIRMCN	Orifice line replacement.	MB	$ 273.22	I
MI	63	Various	-	Campbell's program to test Modbus outputs for Rubicon water	MB	$ 274.16	I

7.0 410127 MAIN CANAL @ NARRANDERA REGULATOR

7.1 Measurement Summary

Date	Time	Calibration Measurements Q, Measured Discharge (Ml/day)	AFFRA Sensor Q, (Ml/day)	Deviation
28/08/2020	11:26	3945.90	3902.50	1.11%
30/09/2020	15:37	1380.84	1320.00	4.61%
28/10/2020	12:54	558.30	515.75	8.25% *
28/10/2020	13:40	564.43	575.75	-1.97%
26/11/2020	09:28	3496.50	3516.00	-0.55% ^
29/01/2021	09:32	1577.77	1506.92	4.70%
25/02/2021	11:56	3355.81	3312.31	1.31%
31/03/2021	13:37	536.24	410.89	30.51% #
29/04/2021	12:43	1554.95	1539.33	1.01%

* Flows were not kept stable by MI operators during gauging.
# Very low flow with strong winds.
^ Documentation misplaced – gauging start and end times estimated based on field sheets from the visit.

Discharge Measurement Summary

Date Measured: Friday, August 28, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera OT
Station Number	410127
Location	Between AFFRA posts

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	105

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	45.12
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.51%
Velocity	0.19%	1.15%
Width	0.10%	0.10%
# Cells	0.11%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.74%	1.29%

Discharge Results	
Total Area	72.469
Mean Velocity	0.630
Total Width	29.000
Total Q	45.664
Maximum Measured Depth(m)	3.282
Maximum Measured Velocity(m/s)	0.872
Mean Flow Angle	2.614
Rated Discharge	45.120
% difference Q	1.205
Water Temperature (Independent)	10.800
Mean Water Temperature	10.472
Mean Weighted Gauge Height	5.115

Discharge Measurement Summary

Date Measured: Wednesday, September 30, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Nar
Station Number	410127
Location	Between affra posts

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	106

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	15.29
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.47%
Velocity	0.07%	0.98%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.82%	--
Instrument	0.25%	0.25%
Overall	1.85%	1.12%

Discharge Results	
Total Area	76.905
Mean Velocity	0.208
Total Width	31.500
Total Q	15.987
Maximum Measured Depth(m)	3.408
Maximum Measured Velocity(m/s)	0.284
Mean Flow Angle	3.023
Rated Discharge	15.290
% difference Q	4.561
Water Temperature (Independent)	16.600
Mean Water Temperature	16.679
Mean Weighted Gauge Height	5.221

Discharge Measurement Summary

Date Measured: Wednesday, October 28, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Naranderra OT
Station Number	410127
Location	30m DS of footbridge.

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	107

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	5.97
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.47%
Velocity	0.08%	1.22%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.73%	1.33%

Discharge Results	
Total Area	74.782
Mean Velocity	0.086
Total Width	30.500
Total Q	6.463
Maximum Measured Depth(m)	3.135
Maximum Measured Velocity(m/s)	0.158
Mean Flow Angle	0.418
Rated Discharge	5.970
% difference Q	8.250
Water Temperature (Independent)	22.000
Mean Water Temperature	22.615
Mean Weighted Gauge Height	5.218

Discharge Measurement Summary

Date Measured: Wednesday, October 28, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Naranderra
Station Number	410127
Location	

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	108

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	349.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	7.21
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.70%
Velocity	0.10%	1.78%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	1.93%

Discharge Results	
Total Area	74.762
Mean Velocity	0.087
Total Width	30.500
Total Q	6.537
Maximum Measured Depth(m)	3.124
Maximum Measured Velocity(m/s)	0.172
Mean Flow Angle	-2.890
Rated Discharge	7.210
% difference Q	-9.341
Water Temperature (Independent)	21.000
Mean Water Temperature	22.994
Mean Weighted Gauge Height	0.000

Discharge Measurement Summary

Date Measured: Friday, January 29, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera OT
Station Number	410127
Location	Temporary endless wire.

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	110

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	355.6
Salinity (ppt)	0.0
Rated Discharge (m3/s)	17.41
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.61%
Velocity	0.27%	2.17%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.81%	2.28%

Discharge Results	
Total Area	74.568
Mean Velocity	0.245
Total Width	29.000
Total Q	18.266
Maximum Measured Depth(m)	3.128
Maximum Measured Velocity(m/s)	0.339
Mean Flow Angle	-0.014
Rated Discharge	17.410
% difference Q	4.915
Water Temperature (Independent)	21.000
Mean Water Temperature	20.902
Mean Weighted Gauge Height	0.000

Discharge Measurement Summary

Date Measured: Thursday, February 25, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera Offtake
Station Number	410127
Location	80m US of regulator.

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	111

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	355.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	38.33
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.58%
Velocity	0.09%	0.64%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	0.91%

Discharge Results	
Total Area	75.187
Mean Velocity	0.516
Total Width	30.000
Total Q	38.824
Maximum Measured Depth(m)	3.129
Maximum Measured Velocity(m/s)	0.682
Mean Flow Angle	-5.166
Rated Discharge	38.328
% difference Q	1.295
Water Temperature (Independent)	24.400
Mean Water Temperature	23.796
Mean Weighted Gauge Height	5.230

Discharge Measurement Summary

Date Measured: Wednesday, March 31, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrendra OT
Station Number	410127
Location	80m U/S from regulator

Measurement Information	
Party	MS
Boat/Motor	
Meas. Number	112

System Information	
System Type	RS-M9
Serial Number	2457
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	352.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	5.27
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.49%
Velocity	0.26%	1.35%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.60%	--
Instrument	0.25%	0.25%
Overall	1.65%	1.46%

Discharge Results	
Total Area	72.761
Mean Velocity	0.083
Total Width	30.500
Total Q	6.022
Maximum Measured Depth(m)	3.043
Maximum Measured Velocity(m/s)	0.143
Mean Flow Angle	3.443
Rated Discharge	5.270
% difference Q	14.276
Water Temperature (Independent)	0.000
Mean Water Temperature	23.079
Mean Weighted Gauge Height	5.216

Discharge Measurement Summary

Date Measured: Thursday, April 29, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Narrandera Offtake
Station Number	410127
Location	Cableway

Measurement Information	
Party	MS
Boat/Motor	
Meas. Number	113

System Information	
System Type	RS-M9
Serial Number	2457
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	355.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	17.82
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.41%
Velocity	0.09%	0.61%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.65%	--
Instrument	0.25%	0.25%
Overall	1.68%	0.78%

Discharge Results	
Total Area	75.104
Mean Velocity	0.240
Total Width	30.500
Total Q	17.995
Maximum Measured Depth(m)	3.105
Maximum Measured Velocity(m/s)	0.330
Mean Flow Angle	-2.752
Rated Discharge	17.820
% difference Q	0.980
Water Temperature (Independent)	15.400
Mean Water Temperature	15.495
Mean Weighted Gauge Height	5.222

8.0 410129 STURT CANAL @ OFFTAKE

8.1 Measurement Summary

Date	Time	Calibration Measurements Q, Measured Discharge (Ml/day)	AFFRA Sensor Q, (Ml/day)	Deviation
29/08/2020	07:23	1715.00	1647.50	4.10%
30/09/2020	10:15	796.01	816.75	-2.54%
30/09/2020	11:14	809.77	832.25	-2.70%
11/12/2020	13:43	1434.41	1484.00	-3.34% !
15/12/2020	13:02	1025.00	1042.73	-1.70% !
16/12/2020	13:29	1497.59	1570.77	-4.66%
16/12/2020	14:23	1515.31	1572.86	-3.66%
24/02/2021	15:39	1092.84	1073.85	1.77%
30/03/2021	16:02	77.181	94.46	-18.30% #
28/04/2021	15:31	696.62	713.43	-2.36%

Very low flow with strong winds.
! Gaugings conducted by MIA.

Discharge Measurement Summary

Date Measured: Saturday, August 29, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	Cableway

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	119

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	326.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	19.19
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.51%
Velocity	0.13%	3.37%
Width	0.10%	0.10%
# Cells	0.12%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	3.42%

Discharge Results	
Total Area	61.351
Mean Velocity	0.330
Total Width	28.500
Total Q	20.254
Maximum Measured Depth(m)	2.926
Maximum Measured Velocity(m/s)	0.569
Mean Flow Angle	4.161
Rated Discharge	19.190
% difference Q	5.547
Water Temperature (Independent)	9.500
Mean Water Temperature	8.853
Mean Weighted Gauge Height	2.664

Discharge Measurement Summary

Date Measured: Wednesday, September 30, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	Cableway

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	120

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	9.77
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.11%	0.55%
Velocity	0.09%	1.71%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	1.81%

Discharge Results	
Total Area	63.111
Mean Velocity	0.146
Total Width	28.500
Total Q	9.220
Maximum Measured Depth(m)	3.066
Maximum Measured Velocity(m/s)	0.203
Mean Flow Angle	0.278
Rated Discharge	9.770
% difference Q	-5.626
Water Temperature (Independent)	15.200
Mean Water Temperature	15.282
Mean Weighted Gauge Height	2.750

Discharge Measurement Summary

Date Measured: Wednesday, September 30, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	Cableway

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	121

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	9.78
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty	ISO	Stats
Depth	0.11%	0.68%
Velocity	0.09%	1.04%
Width	0.11%	0.11%
# Cells	0.11%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.74%	1.27%

Discharge Results	
Total Area	63.257
Mean Velocity	0.148
Total Width	28.500
Total Q	9.375
Maximum Measured Depth(m)	3.068
Maximum Measured Velocity(m/s)	0.211
Mean Flow Angle	-1.646
Rated Discharge	9.780
% difference Q	-4.138
Water Temperature (Independent)	15.200
Mean Water Temperature	15.671
Mean Weighted Gauge Height	2.745

Discharge Measurement Summary

Date Measured: Wednesday, December 16, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt Offtake
Station Number	410129
Location	Endless Wire

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	124

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	15.55
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty	ISO	Stats
Depth	0.10%	0.56%
Velocity	0.08%	1.73%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.70%	--
Instrument	0.25%	0.25%
Overall	1.73%	1.84%

Discharge Results	
Total Area	61.267
Mean Velocity	0.283
Total Width	28.000
Total Q	17.330
Maximum Measured Depth(m)	2.986
Maximum Measured Velocity(m/s)	0.409
Mean Flow Angle	-2.434
Rated Discharge	15.550
% difference Q	11.446
Water Temperature (Independent)	24.000
Mean Water Temperature	26.591
Mean Weighted Gauge Height	0.000

Discharge Measurement Summary

Date Measured: Wednesday, December 16, 2020

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt OT
Station Number	410129
Location	Cableway

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	125

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	329.0
Salinity (ppt)	0.0
Rated Discharge (m3/s)	15.49
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.72%
Velocity	0.08%	1.06%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.76%	--
Instrument	0.25%	0.25%
Overall	1.79%	1.31%

Discharge Results	
Total Area	61.534
Mean Velocity	0.285
Total Width	28.000
Total Q	17.536
Maximum Measured Depth(m)	2.996
Maximum Measured Velocity(m/s)	0.410
Mean Flow Angle	-1.418
Rated Discharge	15.490
% difference Q	13.207
Water Temperature (Independent)	24.000
Mean Water Temperature	24.883
Mean Weighted Gauge Height	2.670

Discharge Measurement Summary

Date Measured: Wednesday, February 24, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt Offtake
Station Number	410129
Location	Cableway

Measurement Information	
Party	SF
Boat/Motor	
Meas. Number	126

System Information	
System Type	RS-M9
Serial Number	2169
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	328.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	12.49
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.53%
Velocity	0.11%	1.18%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.65%	--
Instrument	0.25%	0.25%
Overall	1.68%	1.32%

Discharge Results	
Total Area	63.262
Mean Velocity	0.200
Total Width	27.500
Total Q	12.650
Maximum Measured Depth(m)	3.070
Maximum Measured Velocity(m/s)	0.274
Mean Flow Angle	-2.444
Rated Discharge	12.495
% difference Q	1.243
Water Temperature (Independent)	24.900
Mean Water Temperature	25.649
Mean Weighted Gauge Height	2.705

Discharge Measurement Summary

Date Measured: Tuesday, March 30, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt Offtake
Station Number	4101029
Location	Cableway

Measurement Information	
Party	MS
Boat/Motor	
Meas. Number	127

System Information	
System Type	RS-M9
Serial Number	2457
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	328.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	1.16
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.14%	1.70%
Velocity	1.05%	14.75%
Width	0.14%	0.14%
# Cells	0.14%	--
# Stations	2.11%	--
Instrument	0.25%	0.25%
Overall	2.38%	14.85%

Discharge Results	
Total Area	64.246
Mean Velocity	0.014
Total Width	28.500
Total Q	0.892
Maximum Measured Depth(m)	3.144
Maximum Measured Velocity(m/s)	0.057
Mean Flow Angle	-5.748
Rated Discharge	1.157
% difference Q	-22.899
Water Temperature (Independent)	21.100
Mean Water Temperature	21.149
Mean Weighted Gauge Height	2.775

Discharge Measurement Summary

Date Measured: Wednesday, April 28, 2021

Recorded file is located under My Documents|SonTek Data|YYYY_MM_DD|StationaryDataFiles

Site Information	
Site Name	Sturt Offtake
Station Number	410129
Location	Cableway

Measurement Information	
Party	MS
Boat/Motor	
Meas. Number	128

System Information	
System Type	RS-M9
Serial Number	2457
Firmware Version	4.10

System Setup	
Tagline Azimuth (deg)	328.7
Salinity (ppt)	0.0
Rated Discharge (m3/s)	8.28
Discharge Method	Mid-Section
Measurement Quality	--

Units	
Distance	m
Velocity	m/s
Area	m2
Discharge	m3/s
Temperature	degC

Discharge Calculation Settings	
Track Reference	System (default)
Depth Reference	Vertical Beam

Discharge Uncertainty		
Category	ISO	Stats
Depth	0.10%	0.46%
Velocity	0.07%	1.21%
Width	0.10%	0.10%
# Cells	0.10%	--
# Stations	1.65%	--
Instrument	0.25%	0.25%
Overall	1.68%	1.32%

Discharge Results	
Total Area	59.090
Mean Velocity	0.136
Total Width	27.900
Total Q	8.062
Maximum Measured Depth(m)	2.929
Maximum Measured Velocity(m/s)	0.194
Mean Flow Angle	1.225
Rated Discharge	8.280
% difference Q	-2.630
Water Temperature (Independent)	15.600
Mean Water Temperature	16.006
Mean Weighted Gauge Height	2.600