ORANGE
Australia's Colour City

Macquarie River to Orange pipeline project

Preferred project report

Volume 1 • Main report

February 2013

GHD

Cover photo shows the Macquarie River at Cobbs Hut Hole, with an estimated flow rate of 33 ML/day.
Source: Orange City Council.

Orange City Council

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Glossary of terms and abbreviations

Term	Definition
aquifer	Rock or soil formation containing groundwater in recoverable quantities.
AS/NZS	Australian Standard/New Zealand Standard
biodiversity offset/s	An action that compensates for impacts caused by development related impacts upon biodiversity.
break tank	A break tank is a water tank apparatus that uses an air gap to stop reflux (backflow) into the system.
catchment	The area drained by a stream, lake or other body of water.
cease to pump threshold	The cease to pump threshold establishes the river flow at which licensed pumping must stop.
chainage	A term for distance or length along a project extent as measured by a surveyor's chain, tape or wheel.
discharge structure	Water is discharged from the pipeline to the Suma Park reservoir via the discharge structure.
Director-General's requirements	Outlines the requirements for an environmental impact assessment in accordance with the EP&A Act.
DSEWPaC	(Commonwealth) Department of Sustainability, Environment, Water, Population and Communities
CSIRO	Commonwealth Scientific and Industrial Research Organisation
easement	An easement is a legal right to use land for a particular purpose. Ownership of the land remains with the landowner, however the use of the land would be subject to certain conditions.
EEC	endangered ecological community
effluent	Liquid waste or wastewater, which may or may not have been passed through a purification process.
EP&A Act	*Environmental Planning and Assessment Act 1979*
environmental flow	The amount of water needed in a watercourse to maintain a healthy, natural ecosystem.
environmental management plan	A document setting out the management, control and monitoring measures to be implemented during construction (a construction environmental management plan) and /or operation (operational environmental management plan) of a development, to avoid or minimise the potential environmental impacts identified during an environmental assessment process.
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
flora and fauna	Plants and animals
flow classes	The daily extraction management in unregulated rivers policy advisory note defines three flow classes or daily flow extraction classes (Government of New South Wales, 2002): ◗ Class A (low flows): generally from the 80th to the 95th percentile flow ◗ Class B (low to moderate flows): generally from the 50th to the 80th percentile flow ◗ Class C (moderate to high flows, freshes and floods): generally from 0 to the 50th percentile flow.
GHD	GHD Pty Ltd

Term	Definition
geomorphology	The study of the physical features of the surface of the earth and their relation to its geological structures.
GL	gigalitre
ha	hectare
hydrology	The science dealing with water on the land or under the surface, its properties and distribution.
inflow	The act or process of water flowing into a water body.
ISO	International Standards Organisation
IQQM	Integrated Quantity and Quality Model (or Modelling). River system model that has been widely applied in Qld and NSW for the development of water sharing and water resources plans.
IWCM	Integrated water cycle management – management process undertaken by local water utilities (councils or utilities covering several councils) to manage their water systems by integrating the utility's three main services – water supply, sewerage and stormwater.
kg	kilograms
km	kilometres
km/hr	Kilometres per hour
L	litres
L/p/d	litres per person per day
local water utility	Local water utilities (councils) are responsible for providing water supply and sewerage services to NSW non-metropolitan urban communities. The majority of councils exercise their water supply functions under Division 2 Part 3 Chapter 6 of the *Local Government Act 1993*.
m	metres
m^2	square metres
m^3	cubic metres
m/s	metres per second
Macquarie Bogan WSP	Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012
ML	megalitres
ML/day	megalitres per day
mm	millimetres
MR5a	The refined section of the project, located between Long Point Road and the Macquarie River, including the proposed new location for the offtake structure.
MR5a project corridor	The project corridor (refer definition below) for MR5a.
MR5a study area	The study area (refer definition below) for MR5a.
NSW	New South Wales
OCC	Orange City Council
offset/s	See biodiversity offsets
offtake structure	Water is drawn out of the Macquarie River by means of the pumping infrastructure contained in the offtake structure.

Term	Definition
original section	The original 4 km section of project, located between Long Point Road and the river (as per the project described in the exhibited environmental assessment).
PAD	Potential archaeological deposit
PASA	Potentially archaeologically sensitive area
pH	Measure of acidity (or alkalinity)
pipeline corridor	The corridor in which the pipeline would be located and within which construction would be undertaken.
pipeline easement	The land under which the pipeline is located would be subject to an easement.
project	The project for the purposes of this assessment is the proposal to construct and operate a water pipeline and associated infrastructure, to transfer water from the Macquarie River to the Suma Park Reservoir in Orange.
project corridor	The corridor in which the project (including the pipeline and associated infrastructure such as the power supply) would be located and within which construction would be undertaken.
proponent	Orange City Council
pump/ing station	A combination of pumps, electrical control equipment, with piping, valves and sensors, usually contained within a building or structure, used to transfer fluid (generally water) from one point to another.
refined project	The project incorporating the proposed refinements. The preferred project.
reservoir	A natural or artificial pond or lake used for the storage and regulation of water.
residential receiver	A dwelling potentially affected by noise or vibration.
rip rap	Also known as rock armour – consists of rock or other material used to protect shorelines, streambeds, abutments, banks etc against scour/erosion.
rock hammering	Construction equipment used to split and/or break rocks.
scour valves	Scour valves are installed at low points to permit water to be drained from the pipeline to allow maintenance. Scour valves are also used to flush dirty water and suspended solids from the pipeline.
sleeper licence	A licence that has been issued but does not have history of water usage.
spoil	Material removed from and under the ground during construction, usually as a result of excavation.
study area	The project corridor/construction area and any additional areas likely to be affected, either directly or indirectly, by the project.
the project	The Macquarie River to Orange water pipeline project.
threatened species	Species of animals or plants that are at risk of extinction (also known as 'endangered species') or becoming endangered within the next 25 years ('vulnerable species'), defined by the *Threatened Species Conservation Act 1995.*
TSC Act	*Threatened Species Conservation Act 1995*
watercourse	A river, creek or other natural watercourse (whether modified or not) in which water is contained or flows (whether permanently or from time to time).
WSP	Water sharing plan

1. Introduction

1.1 Background to the preferred project report

The proponent, Orange City Council (Council), is seeking approval to construct and operate the Macquarie River to Orange pipeline project (the project). The project requires approval under (the now repealed) Part 3A of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act). The Minister for Planning and Infrastructure is the approval authority for the project.

The project is needed to address the existing shortfall in water supply in the Orange area and to provide certainty about future supply. The design and development of the project has taken into account the existing and future water needs of the Orange community; projected population growth; secure water yields with demand management measures in place; and potential environmental, economic, community and climate change impacts. Once it is fully operational, the project would provide for the water supply needs of the Orange community until at least 2050 under a high population growth scenario, and beyond 2060 under a medium growth scenario.

On 13 January 2011 the (then) Minister for Planning declared the project to be a project to which Part 3A of the EP&A Act applies. An environmental assessment was prepared to consider the potential impacts of the project and support the application for approval. The assessment was prepared in accordance with the provisions of Part 3A and the requirements of the Director General of the Department of Planning and Infrastructure, dated 24 March 2011 and 27 February 2012.

The environmental assessment was placed on public exhibition by the Department of Planning and Infrastructure on 29 August 2012. Written submissions were invited and received during this period. On 30 October 2012, the Director General of the Department of Planning and Infrastructure advised Council that, in accordance with section 75H of the EP&A Act, Council was required to respond to the issues raised in the submissions received.

Council has refined and changed the project following consideration of issues raised in submissions and additional environmental and engineering investigations. As modifications have been made to the project described in the environmental assessment, a preferred project report has been prepared to respond to the issues raised in submissions, outline the proposed changes to the project, and consider the potential impacts of these changes.

1.2 The project

1.2.1 The project as exhibited

The project involves construction and operation of the infrastructure required to transfer, on average, 1,616 mega litres (ML) of water per year from the Macquarie River to the Suma Park Reservoir at Orange. On average, pumping would occur 135 days per year (when the operating rules are met), transferring approximately 12 ML per day over a 19 hour period.

The infrastructure required to transfer the water includes an offtake (inlet) structure and pump stations, an underground pipeline, a discharge (outlet) structure, and ancillary infrastructure. The project is described in chapters 6 (operation) and 7 (construction) of the environmental assessment.

In summary, the key features of the exhibited project include:

- an offtake structure and pump station located at the upper Macquarie River on the south side of the river
- a pipeline approximately 37 km in length and 375 mm in diameter, between the Macquarie River and Suma Park Dam
- two booster pump stations and break tanks along the pipeline corridor
- a water discharge structure at the Suma Park Dam located approximately 10 m east of the existing saddle dam (at the north-west corner of the dam wall)
- a power supply to the pumps and other infrastructure, including approximately 4.1 km of new power lines and 22.5 km of upgraded lines
- telemetry controls to enable remote operation of the infrastructure, including the pumps and valves.

1.2.2 Summary of refinements to the project since exhibition

Allowance for design refinements

Section 1.2 of the environmental assessment noted that the route and project components described in the environmental assessment are indicative and conceptual, and that Council may refine the design during the detailed design phase. The environmental assessment noted that refinements may occur due to the need to:

- avoid ground conditions or services that present significant construction difficulties in terms of logistics, time and/or cost
- reduce the construction timeframe
- avoid areas of environmental sensitivity identified following approval
- reduce impacts on local residents
- improve the operation of the project without increasing the potential environmental impacts.

Refinements made

Refinements have been made to part of the project. These refinements have been made as a result of:

- consideration of the issues raised in submissions
- changes in land availability
- further information provided by the environmental assessment and engineering design process.

The main change affects the section of the project between Long Point Road and the offtake point at the Macquarie River (the section located between original chainages 0 and 4100 in the exhibited project). The changes to the project as exhibited are as follows:

- relocation of the offtake structure and pump station to a location known as Cobbs Hut Hole (located approximately 3.8 km to the east of the original proposed location)
- provision of an access road (approximately 1.4 km in length) from Long Point Road to the offtake structure
- a new section of pipeline (approximately 6.5 km in length) between (new) chainage 6480 (near Long Point Road) and the offtake structure

- associated changes to the proposed power supply arrangements.

In summary, the refined project would involve (changes in bold):

Construction and operation of the infrastructure required to transfer, on average, 1,616 mega litres (ML) of water per year a distance of approximately **39 km** from the Macquarie River to the Suma Park Reservoir at Orange. On average pumping would occur 135 days per year (when the operating rules are met), transferring 12 ML per day (ML/day) over a 19 hour period.

Key features of the refined project include:

- an offtake structure and pump station located **at Cobbs Hut Hole**
- a pipeline approximately **39 km in length** and 375 mm in diameter, between the Macquarie River and Suma Park Dam
- two booster pump stations and break tanks along the pipeline corridor
- a water discharge structure at the Suma Park Dam located approximately 10 m east of the existing saddle dam (at the north-west corner of the dam wall)
- a power supply to the pumps and other infrastructure, including approximately **3.15 km of new** power lines and **25 km of upgraded** lines
- telemetry controls to enable remote operation of the infrastructure, including the pumps and valves.

The refinements to the project between Long Point Road and the offtake point are also known as MR5a, which was the code for the preferred route location option in this area. A summary of the changes to the project is provided in Table 1.1.

Table 1.1 Changes to project

Key feature of the project	Original project as exhibited	Refined project	Change?
Offtake structure and pump station location	Immediately upstream of the confluence with Boshes Creek	Cobbs Hut Hole	Yes
Pipeline location	Between the Macquarie River and Suma Park Dam	Between the Macquarie River and Suma Park Dam	Change to a section of the route between Long Point Road and the river
Pipeline diameter	375 mm	375 mm	No
Pipeline length	37 km	39 km	Yes – approx. 2 km longer
Booster pump stations/break tanks	Two	Two	No
Water discharge structure	Suma Park Dam	Suma Park Dam	No
Power supply – new power lines	4.1 km	4.3 km (1.2 km underground)	Change in the vicinity of the refined section of route
Power supply – upgraded power lines	22.5 km	25 km	Change in the vicinity of the refined section of route
Access road to offtake structure	4 km	1.4 km	Yes – shorter and in a different location
Telemetry controls	Provided	Provided	No

Further information on the proposed refinements is provided in section 9. The location of the project as a whole and the proposed refinements are shown in Figure 1.1.

1.3 Summary of project need

As Orange has grown, so has the demand for water. Orange has experienced severe drought conditions. The most recent drought, together with predicted climate change and long term population growth, has widened the gap between the level of demand for water and the ability to maintain a secure source of supply. Orange has experienced water shortages for some time. In 2010, the city was on the brink of level six water restrictions, which would have severely restricted business and industry activity within the city. To provide for the expected level of population growth and provide certainty for the future, Council needs to develop additional water supply sources for the Orange community.

Extensive consideration of the need and options for securing the water supply for the existing and future community of Orange has been undertaken. Council's Comprehensive Water Management Strategy identifies the approach for modelling of future demands and the strategic principles upon which future supply options should be considered. In particular, it recognises the need *'to establish a broad-based water supply strategy for the next 50 years and beyond which focuses on ongoing water conservation, quality and demand management and the provision of key water supply infrastructure at least 10 years in advance of projected demand'.*

Since 2002, Council has applied a water conservation and demand management program. As a result of this program, water consumption by the Orange community has reduced from a high of 7,120 ML per year in 2002, to 3,708 ML per year in 2010 under level 5a restrictions. In addition to this, Council has recently been granted a licence to extract groundwater from water bores and has developed innovative stormwater harvesting techniques to enhance supply.

However, the studies undertaken have identified that, even with these initiatives in place, the demand for water would continue to exceed the secure yield of the city's water supplies. Therefore, an additional water supply option is needed in the short term to reduce the current and immediate shortfall, as well as to provide additional supply to meet the needs of future growth.

The project was identified as an outcome of a regional Water Security Study, undertaken by the Central NSW regional organisation of councils (Centroc). It was further developed by Council, overseen by a NSW Government taskforce, chaired by the Department of Premier and Cabinet. The project forms a key component of Orange's water security enhancement program.

Council has an existing surface water entitlement to extract up to 7,800 ML/year from the Macquarie River system for the purpose of town water supply. This is in the form of a water access licence under the *Water Act 1912.* The full town water entitlement is included in the *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012*, made under the *Water Management Act 2000*. However, although Council has approval to take this amount of water out of the system, Orange's existing water supply system cannot currently deliver this supply with security. Adding independent water sources to the system increases security. The addition of the project would provide a diversified system which would contribute to Orange's water security.

While the recent rains have reduced the urgency of the situation, the fact remains that Orange is regularly under threat from drought conditions. A long term solution is needed.

1.4 Submissions received

1.4.1 Number of submissions

The environmental assessment was publicly exhibited from 29 August to 15 October 2012. During this time, submissions were invited from the community and other stakeholders. The receipt of submissions was coordinated and managed by the Department of Planning and Infrastructure. Submissions were received and registered by the Department, and uploaded onto the Department's website. Each submission was assigned a submission number. Some individuals/groups made multiple submissions.

A total of 144 formal submissions and 48 postcards were received during the exhibition period. An approximate breakdown of submissions by type of stakeholder is provided in Table 1.2.

Table 1.2 Approximate breakdown of submissions by type of stakeholder

Submitter type	Number of submissions received
Individuals	104
Community groups/organisations	17
Government departments and agencies	4[1]
Local members and Councillors	7
Name withheld	12
TOTAL	**144**

Note 1: The submission from the Department of Primary Industries incorporated the input of four agencies

Although not considered formal submissions, a number of letters providing comment on the project and the environmental assessment were also received by Council and the Department outside the exhibition period. The issues raised in this correspondence have been considered in this report.

1.4.2 Main issues raised

The main issues (those issues raised by 50 or more submissions) related to:

- project justification
- objection to the project
- alternatives to the project
- adequacy of the aquatic ecology assessment
- impacts on threatened aquatic species, particularly the Trout Cod
- impacts on the ecology of the Macquarie River.

Issues raised by between 10 and 50 submissions included:

- design and features of the project
- impacts on terrestrial ecology - general
- impacts on threatened terrestrial species
- offsetting
- contamination and soils

- community involvement in the design process
- assessment of the application.

1.5 The preferred project report

1.5.1 Scope and methodology

The preferred project report:

- summarises and responds to issues raised in the submissions made during the exhibition period
- identifies and considers refinements to the project
- summarises the results of the assessment of these refinements
- describes the preferred project for which approval is sought
- provides a final statement of commitments.

The preferred project report consists of two volumes. It incorporates a submissions report by providing Council's responses to issues raised in the submissions (contained in this report – volume 1). It also provides details of the proposed changes to the project described in the environmental assessment (volume 1) and describes the results of additional studies undertaken since the environmental assessment was placed on public exhibition (volume 2).

1.5.2 Methodology for reviewing submissions

Each submission recorded on the Department's website was assigned a submission number. An assessment of each submission was undertaken. This involved identifying the issues raised and coding the issues into the key issue categories. There were 44 key issue categories identified and coded during the submission review process. Table A.1 in Appendix A identifies the issue categories identified, and where these are addressed in this report. Tables A.2 and A.3 identify the key issues raised by community and government submissions, according to the submission number (for community submissions) and submitter/agency and submission number (for government submissions).

The issues raised were summarised and grouped according to the key issue categories. Responses to these issues were sought where relevant from the specialists who assisted with preparation of the environmental assessment. The key issues raised are provided in sections 3 to 8, together with responses to the issues. Issues raised in government submissions are provided in **blue text** and shading, community issues are provided in **red text** and shading.

1.5.3 Assessing the impacts of the proposed refinements to the project

An assessment of the potential impacts of the proposed refinements to the project has been undertaken. Input to this assessment was provided by various technical specialists. The results of this assessment are summarised in section 10 of this report. Further information is provided in volume 2.

1.5.4 Structure of the preferred project report

Volume 1 – Main report

The report includes:

- Section 1 – introduction and context
- Section 2 – a description of the communication activities undertaken in association with exhibition of the environmental assessment
- Sections 3 to 8 – responses to the issues raised in the submissions:
  - section 3 responds to issues relating to **the project**, including the justification, design and project alternatives
  - sections 4 to 7 respond to issues relating to the **potential environmental impacts** of the project
  - section 8 responds to issues relating to the **assessment and consultation process**
- Section 9 – describes the proposed modifications to the project as exhibited
- Section 10 – provides a summary of the environmental assessment of the changes and the refined project in terms of the results of the preliminary environmental risk assessment of MR5a. Further information on the results of the environmental assessment is provided in volume 2
- Section 11 – describes the preferred project that Council is seeking approval for
- Section 12 – provides the final statement of commitments including the mitigation and management measures that would be implemented
- Section 13 – reference list

Volume 2 - Environmental assessment of proposed refinements

- Section 1 – introduction and context
- Section 2 – a description of the existing environment of MR5a
- Section 3 – identification of the priority environmental issues for detailed assessment and consideration by means of a preliminary environmental risk assessment
- Sections 4 to 6 – a summary of the results of the assessment of priority environmental issues (hydrology and water security, terrestrial ecology and aquatic ecology)

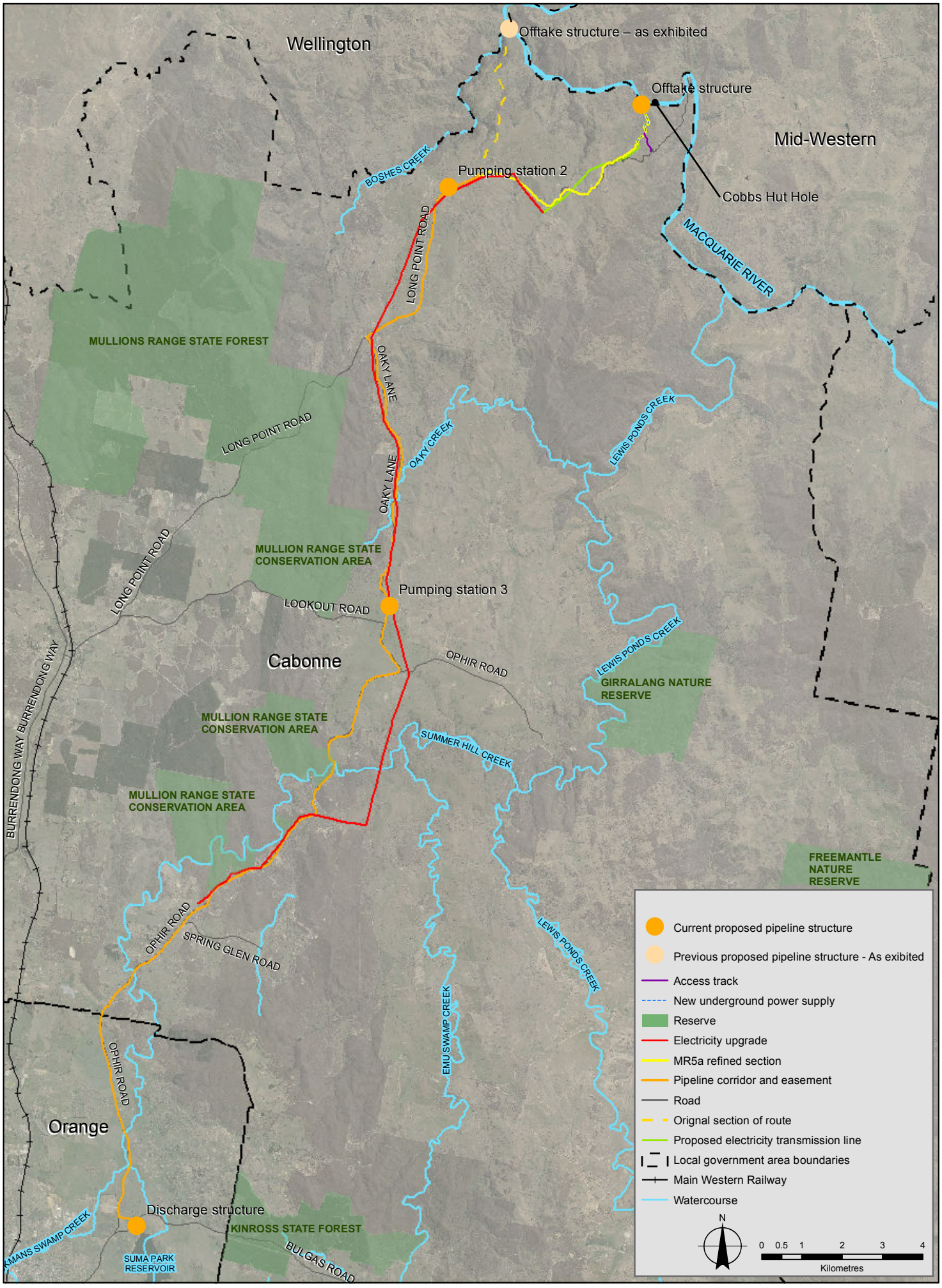


Figure 1.1
Location of the project

2. Community involvement

2.1 Overview

This section provides a description of the consultation undertaken with stakeholders following completion and during exhibition of the environmental assessment. Consultation during the project development, concept design and assessment stages was summarised in chapter 4 of the environmental assessment.

The main focus of community input during this stage of consultation were the submissions provided in response to public exhibition. A summary of the submissions received is provided in section 1.4 of this report. The responses to issues raised in submissions are provided in sections 3 to 8.

2.2 Consultation associated with exhibition of the environmental assessment

Activities undertaken by Council following completion of the environmental assessment and in conjunction with public exhibition are summarised in Table 2.1.

Table 2.1 Consultation following environmental assessment completion

Tool	Description	Activity following environmental assessment completion
Project website	Information on the overall water security strategy for Orange, including this project, is provided on www.watersecurity.orange.nsw.gov.au.	Website updated
Pipeline newsletter	Bi-monthly newsletter distributed by Council to keep affected landholders up to date with the pipeline project.	Continued distribution on a bi-monthly basis
Information mail outs	Council has been sending letters to stakeholders from March 2011. Letters provided an outline of Council's progress and information on the project. The letters have been sent out periodically as updates became available. As the project design has developed, Council has corresponded with landowners to advise how their property could potentially be affected, and to request individual meetings. Letters have been sent to landowners regarding the valuation process and the property management planning course. The first edition of the pipeline newsletter was sent to landholders in October. This will be sent out each month to keep landholders informed about the project.	Since the environmental assessment has been completed, Council sent two letters to all landholders Council has also sent out one landholder newsletter
Media updates	Council has issued regular media updates to report on project progress. These updates are available on Council's website and are circulated to local media in Bathurst, Dubbo, Molong, Orange and Wellington.	Since the environmental assessment has been completed, Council issued eight media updates.
Community information session	Community information sessions have been held during the project to present information on the project and listen to feedback. In association with public exhibition, a	Session held on 18 September 2012, 10 people attended

Tool	Description	Activity following environmental assessment completion
	community drop-in/Q&A session was held.	Session held on 26 June 2012, 60 people attended
Consultation with State and Commonwealth Government	A project updates was sent to government representatives.	Update sent on 9 May, 27 August, 24 October and 25 October
Consultation with local government	Project updates are regularly sent to Cabonne Council.	Two letters have been sent to Cabonne Council since completion of the environmental assessment
Consultation groups	A project taskforce was established at the beginning of the project.	The taskforce has held five meetings

3. Issues relating to project justification, design and alternatives

3.1 Summary of issues raised

Issues and queries relating to the need for and justification of the project, and the options that were considered as part of the project development, were raised in a number of submissions. Submissions raised objections to, and support for, the project. Common issues and concerns raised included:

- the reasons for undertaking the project
- a perception that the reported benefits of the project are overstated
- the stated levels of water demand/use in Orange, which form the basis for the justification, are incorrect and/or are overestimated
- that the figures presented on water supply, including water levels and flow etc, are incorrect, and a concern that there will not be enough water in the river to supply the project
- there is adequate water in Orange's water supply system so the project is no longer needed
- the project is not adequately justified in comparison to other water supply options
- other options were not adequately considered
- there should be a regional approach to water planning
- the proposed operation of the project.

These issues, and other key issues raised in relation to the project need and justification, are considered in the following sections.

3.2 Project justification

3.2.1 Concerns with the overall justification and reasons for undertaking the project

Concerns with the efficiency and sustainability of the project

- The project is at odds with the requirements of the National Water Initiative. Concerns with the efficiency and sustainability of the project. Water will spill or evaporate from Suma Park Reservoir.
- Is proceeding with the project in the best interest of all Macquarie River users?

Response:

National Water Initiative

The National Water Initiative is an intergovernmental agreement called into effect by state and territory legislation and regulation. Therefore, the initiative itself does not place specific requirements on projects. This has been confirmed by discussions with relevant officers of the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

The NSW Government developed the 'NSW Implementation Plan for the National Water Initiative' (NSW Government, 2006) which sets out the actions the government has taken, and committed to undertake, to meet the eight key elements of the National Water Initiative. A key component of the NSW implementation plan is the establishment of water sharing plans. Therefore, the most relevant requirement for the project is the *Water Sharing Plan for* the *Macquarie Bogan Unregulated and Alluvial Water Sources 2012* (the Macquarie Bogan WSP) which commenced on 4 October 2012.

The water sharing plan was considered (in its draft form) during preparation of the environmental assessment. Comments on how the recently gazetted water sharing plan may impact on the project are provided in section 3.2.8 and Table 3.2.

A discussion of issues related to spill and evaporation loss from Suma Park Dam is provided in section 3.4.6.

Macquarie River users

As noted in section 1.3**, Council has an *existing* surface water entitlement to extract up to 7,800 ML/year from the Macquarie River system for the purpose of town water supply.** This is in the form of a water access licence (licence no. 80SL046857) under the *Water Act 1912.* The full town water entitlement is included in the Macquarie Bogan WSP (clause 23(x)). However, although Council has approval to take this amount of water from the system, Orange's existing water supply system cannot currently deliver this supply with security. Adding independent water sources to a system increases security. The addition of the project to the system would provide a diversified system which would contribute to Orange's water security.

Council is not seeking access to water in excess of its current water supply entitlement. Council is seeking to *diversify* the existing water supply system to improve the security of supply of this water.

Further comment in relation to potential impacts to river users is provided in section 4.6.1.

Concerns with the reasons for undertaking the project

- The project is being proposed to supply water to the mines, or because Council already provides water to the mines rather than uses it for drinking.
- The project is being proposed to spend a government funding grant.
- The environmental assessment claims that water will be used by the rural fire service. We can see no use for this possible supply, as we already have plans to supply water for brigade needs.

Response:

Use of water and project funding

The project would not be used to supply raw or potable water to the mines. A detailed assessment of indirect potable reuse that was undertaken as part of Council's Integrated Water Cycle Management Evaluation Study demonstrated that this option would be more expensive than the project.

A detailed consideration of viable options indicates that the project is cost effective even without the available government grants.

Rural fires use

Council received correspondence from the NSW Rural Fire Service – Canobolas Zone (dated 12 June 2012) who requested that provision be made for water points along the pipeline route to

facilitate water supply for fire fighting purposes. As noted in section 6.3 of the environmental assessment, Council would address this request by providing access points at the pumping stations.

Concerns with the water security claims made by Council

- The claim that Orange lacks water security contradicts factual information to the contrary.
- The project will not deliver water security to Orange.

Response:

As noted in section 3.2.2, Council uses 'secure yield' as the measure of water security. Orange's existing water supply system has a secure yield of 4,750 ML/year. The current unrestricted water demand for Orange is 5,400 ML/year. As can be seen by these figures, **the current unrestricted demand in Orange exceeds the system's existing secure yield**, which means that the existing water supply system is not secure for the current population. As the population of Orange grows, as it is predicted to do, the gap between demand and secure yield would continue to increase. This situation is exacerbated under the impacts of climate change. This information indicates that **Orange's water supply system is currently not secure, and will continue to be not secure into the future, without some form of augmentation.**

Secure yield modelling undertaken for the project demonstrates that it can provide water security for Orange (refer chapter 10 and Appendix D of the environmental assessment). The estimated secure yield that would be provided by the project is 2,700 ML/year, when operated according to the proposed operating rules as assessed by the environmental assessment. **This would provide a total system secure yield of 7,450 ML/year, which would provide water security for Orange for the next 39 to 58 years under high and medium population growth projections respectively.**

3.2.2 Concerns with the reported benefits and yields of the project

Concerns about the reported benefits and yields of the project

- The pipeline will only yield a net 300 ML/year to Orange's water supply.
- The pipeline will provide an average of 1,616 ML/year to Suma Park Dam. On average, 1,300 ML/year of this spills back into the Macquarie River upstream of the pump site.

Response:

As explained below, the conclusions reached by these submissions are incorrect.

Council has adopted the concept of secure yield to compare water supply options. As noted in chapter 8 of the environmental assessment, secure yield is the annual demand that can be supplied from a water supply system while satisfying the following conditions (also known as the NSW security of supply basis):

- Duration of restrictions does not exceed 5% of the time.
- Frequency of restrictions does not exceed 10% of years.
- Severity of restrictions does not exceed 10%. Systems must be able to meet 90% of the unrestricted water demand (that is, 10% average reduction in consumption due to water restrictions) through a repeat of the worst recorded drought, commencing with storage drawn down to the level at which restrictions need to be imposed to satisfy the first two requirements.

This measure determines how much water can be supplied by a system during a drought worse than the worse recorded drought.

Secure yield is different to average annual values - it is measuring a different thing. Secure yield measures the amount of water supplied by a system through a drought period, which may be a period of several years. By definition, this is a period when system storage/s are drawn down and therefore not spilling. Therefore, all water added to storages during the critical drought period is not lost during the drought period, and it contributes to improved water security.

The average annual values are derived from the entire 118 year model period, not just the critical drought period. In terms of the long term averages, the correct numbers are:

- The **average annual transfer** to Suma Park Reservoir as a result of the operation of the project is **1,616 ML/year.**
- The increase in **average annual spill** from Suma Park Dam is **1,078 ML/year**.

Therefore, with the project, the difference between the average annual transfer (1,616 ML/year) and the increase in average annual spill (1,078 ML/year) would be 538 ML/year.

Additional flow occurs downstream of the confluence of Blackmans Swamp Creek and Summer Hill Creek as a result of slightly reduced stormwater harvesting and additional water demand. This leads to additional discharge of treated effluent. These add to the increased spill from the dam, resulting in an increase in average annual flow in Summer Hill Creek of 1,298 ML/year (without raising Suma Park Dam).

The additional spill from Suma Park Dam occurs due to the fact that the storage would be kept fuller by adding water from external sources. When catchment runoff is received, less volume is required to fill the storage, resulting in a greater spill volume in that event. However, this does not occur when the storage is less than full. Adding water to Suma Park Reservoir when it is less than full would improve the security of supply.

In those years when the storage is not full, all water transferred from the Macquarie River (and other external sources) would be available to meet demand. Therefore, it is incorrect to suggest that a portion of the water transferred from the Macquarie River would be lost to spill each year, resulting in a net increase of only 300 ML/year (or 538 ML/year) for Orange.

Further discussion of the water balance results, including spill and evaporation losses from Suma Park Dam, is provided in section 3.4.6.

3.2.3 Concerns relating to the reported demand for water

Demand assumptions and scenarios

- Please clarify the assumptions for unrestricted water demand. It would help if this could be considered against the pre-BASIX water demand for Orange. Submissions also raised comparisons of water demand with Canberra and Goulburn, and this should also be considered.
- Further explanation about how a scenario based on the last 10 years is appropriate given that these were dry years.

Response:

Unrestricted demand assumptions and derivation of the baseline per capita water demand

The unrestricted demand was determined using historical water production records from 1 January 1992 to 31 December 2010, supplied as bulk raw water to the water treatment plants. The DEUS Water Demand Trend Tracking and Climate Correction software (v10) (DEUS, 2002) was used to assess historical water production data. The results of this assessment were used to estimate the current unrestricted water demand. This assessment is detailed in Technical Note 3 of Council's

Integrated Water Cycle Management (IWCM) Evaluation Study (Geolyse, 2012b). Relevant findings are provided below.

The observed and climate corrected daily production from January 1993 to December 2010 is shown in Figure 3.1. The water restriction regime which has operated since January 2003 and the implementation of user pay water pricing are shown. The daily production data provided by this figure is the total water demand, divided by the population served by the water. It includes all water (residential, industrial, commercial, non-revenue water and losses).

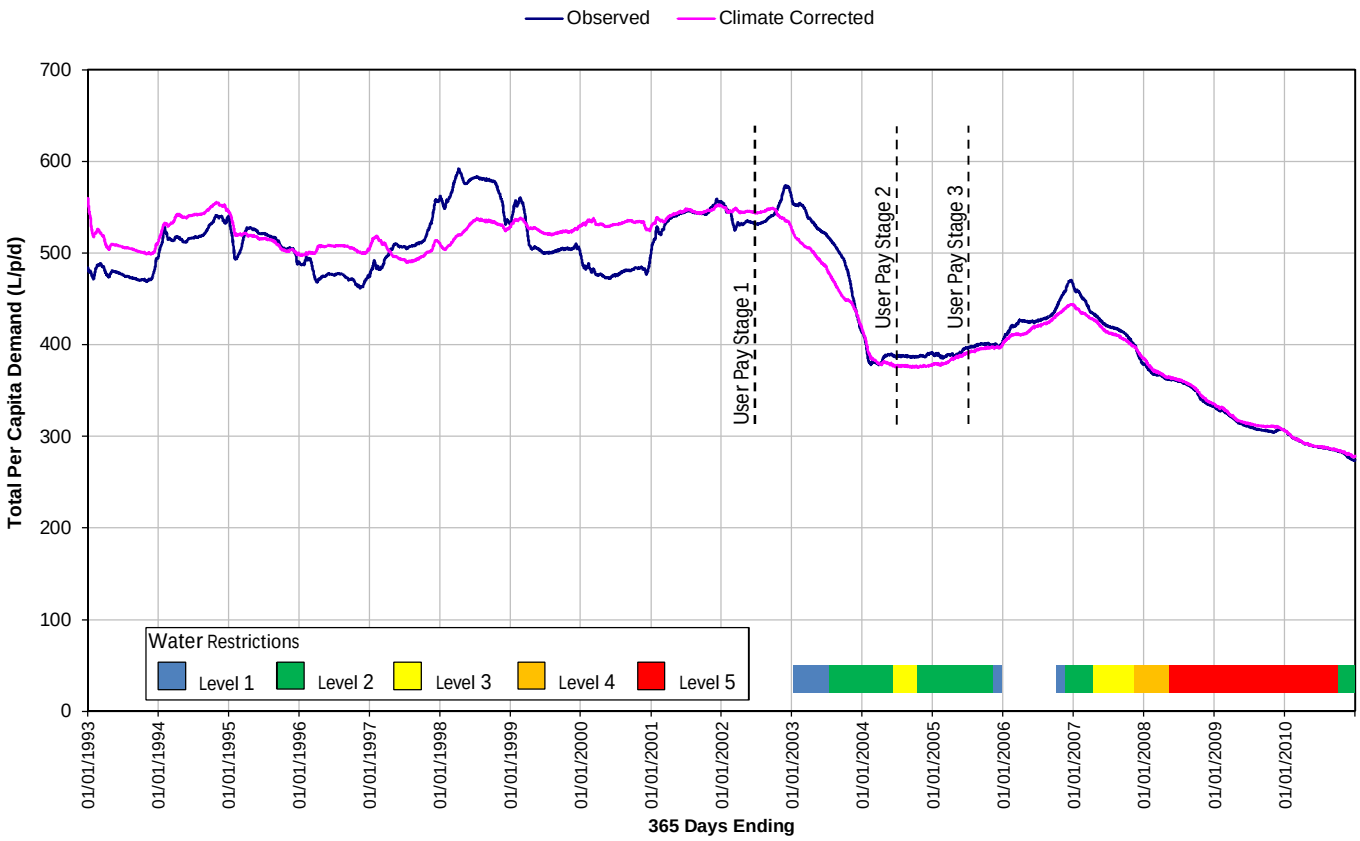


Figure 3.1 Observed and climate corrected demand for Orange

Prior to the introduction of user pay pricing, the climate corrected per capita water production ranged from 490 litres per person per day (L/p/d) to 555 L/p/d. This dropped markedly following the introduction of Stage 1 user pays in July 2002, falling to around 380 L/p/d just prior to the introduction of Stage 2 of the user pays system in July 2004. However, water demand during this period was also reduced by the introduction of the water restriction regime, which commenced with Level 1 in January 2003 and gradually increased to Level 3 in June 2004.

The climate corrected water demand remained at around 380 L/p/d to the end of 2005, before starting to increase as water restrictions were eased, lifting at the start of December 2005. The climate corrected daily production increased to 445 L/p/d. A new water restriction regime commenced in October 2006, increasing to Level 5 restrictions in May 2008. This reduced demand to 278 L/p/d by the end of 2010.

A climate corrected current per capita demand level is required as the starting point for baseline demand estimates. The IWCM Concept Study (MWH, 2007) adopted a baseline per capita demand

of 467 L/p/d, using data to December 2006. This was based on the climate corrected average for the 12 months after Stage 1 user pay system was introduced. Level 1 water restrictions were in place for half of this period.

The regional water security study undertaken by Centroc extended the analysis for Orange to include water production data to the end of 2008, adopting a baseline demand of 435 L/p/d. This represented the per capita climate corrected demand at the end of 2006, following a period with no water restrictions and with Stage 3 user pays. The total annual demand, from this per capita daily demand and the population served with water at the time, was 5,590 ML/year.

In 2009, Council undertook a major leak and pressure reduction program. These works were audited and found to have saved 500 ML/year of unaccounted for water. Applying this annual water saving to the water consumption at the end of 2006 resulted in a per capita daily demand of 404 L/p/d.

The period from **December 2005 to October 2006** is the only period not restricted under the user pays water pricing system. Therefore, dat**a from this period is considered to be the best estimate of current unrestricted demand.** Prior to the leak and pressure reduction program, the per capita demand was 435 L/p/d. This reduces to 404 L/p/d once the water savings from the leak and pressure reduction program are accounted for. **Therefore, the baseline per capita water demand was set at 404 L/p/d in 2010, which equates to an annual demand of 5,403 ML/year**.

Pre BASIX demand

The NSW Government introduced the Building Sustainability Index (BASIX) in July 2004. At this time, the climate corrected per capita water demand was around 380 L/p/d. However, this period also coincided with a period of Level 3 water restrictions, so it cannot be used as a reliable estimate of pre-BASIX demand.

Prior to 2004, the climate corrected per capita water production ranged from 490 to 555 L/p/d. It is considered that the user pay pricing system had the biggest effect on water consumption.

The potential water savings achieved by BASIX compliance with new residential accounts is included in the demand modelling. This includes the provision of an alternative water supply to the Ploughmans Valley and North Orange development areas. This alternative water supply is included in the BASIX tool.

Water consumption - comparison

A comparison of annual residential water consumption for a range of inland water utilities is presented in Table 3.1. This data has been collated from the NSW Water Supply and Sewerage Performance Monitoring Reports for the years 2005/06 to 2010/11. Annual residential water consumption data for Canberra is also included. In Orange, the residential sector dominates water consumption with an average of 73% of total annual water consumption.

Table 3.1 Annual residential water consumption for various water utilities

	Reported annual residential water consumption (kL/property/year)					
Utility	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**
Orange City Council	230	323	177	259	148	158
Goulburn-Mulwaree	143	135	147	134	136	133
Bathurst Regional Council	267	291	241	240	252	182
Dubbo City Council	385	431	322	331	329	263

	Reported annual residential water consumption (kL/property/year)					
Utility	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**
Tamworth Regional Council	319	229	192	226	256	216
Central Tablelands Water	241	204	190	196	201	158
Parkes Shire Council	368	239	212	315	344	215
Wellington	233	279	304	202	209	234
Mid-Western Regional Council	286	316	199	158	205	165
ACT[1]	260	240	190	199	199	na

Note 1: Source - http://www.measuringourprogress.act.gov.au/a_sustainable_act/a_sustainable_indicator**.** No value available for 2010-11. Canberra has been on water restrictions since December 2002.

This data shows that:

- residential water consumption is lowest in Goulburn-Mulwaree
- apart from two years (2006/07 and 2008/09), residential water consumption in Orange is in the bottom two or three
- residential water consumption in Orange is lower than Dubbo and generally lower than Bathurst
- residential water consumption in Orange is reasonably consistent with that of the ACT - the average for Orange over the five years 2005/06 to 2009/10 is 227 kL per property per year, compared with 218 for the ACT.

As shown in Figure 3.1, apart from the first part of 2006, water restrictions have applied in Orange from 2005/06 to 2010/11. These restrictions reached Level 5 in May 2008, which continued to apply through 2009 and part of 2010. **Therefore, these numbers would represent a restricted demand period**. The average residential consumption for Orange over this six year period is 216 kL/property/year.

The residential component of the total unrestricted demand, which is used as the starting point for future demand projections, equates to **234 kL/property/year**. This is only 18 kL/property/year (18,000 litres) more than the average over the past six years, which have included severe restrictions. Furthermore, the demand forecasting assumes that further water savings will be achieved such that residential demand in 2040 would be equivalent to 206 kL/property/year now. This is less than the average residential consumption for Orange over the six year period 2005/06 to 2010/11.

Catchment modelling scenario (using the Scenario B flow series)

The Scenario B flow series was adopted for modelling purposes as it:

- provides a conservative basis for the impact assessment
- examines how the system could operate if reduced runoff catchment conditions prevail.

The assessment, based on the proposed operating rules and the assumption of a reduced river flow series, demonstrated that the project could provide water security for Orange (refer section 3.2.1 above). The long term extraction volumes are also based on the assumption of a continued growth in the demand for water for the next 118 years. All of these assumptions, used in the environmental assessment, provided a conservative basis for the assessment and, in effect, presented a worst case scenario.

Council has committed to developing a decision support tool, which would include a set of integrated operating rules, to guide the management of all its water supply sources. These rules would form part of the overall decision support tool (referred to in chapter 26 of the environmental assessment), which would allow variable operation based on demand levels and climatic considerations. Further discussion of this is provided in section 3.7.

The main issue with using the Scenario B flow series is that compared to the historical flow series, the 80th flow percentile is less at 22 ML/day compared to 90 ML/day. There is a lack of long term actual flow data at the proposed offtake point, hence modelling was used to inform and assist the impact assessment. The river flow series may be more similar to the historical series. If this was the case, and the 38 ML/day operating trigger remained, the environmental assessment demonstrated that this would not fall below the recommended '**cease to pump' threshold**, and would still protect low flows in the river. This still exceeds the access rules in the Macquarie Bogan WSP, which sets a visible flow criterion as the cease to pump threshold.

In their submission to the environmental assessment, the NSW Office of Water noted that there has not been stream gaugings at lows flows to provide confidence with the rating curve. The Office of Water suggested that further data should be obtained at low flows, and in the interim, a higher pump trigger should be adopted. This can be adopted in the short term, as the trigger points (in terms of river flow and volume in Suma Park Reservoir) can be adjusted to match demand as it increases.

As specified by the final statement of commitments for the project, Council is committed to obtaining the additional data required to improve the rating curve for the low flow range.

Concerns that the stated levels of water demand/use in Orange, which form the basis for the justification, are incorrect and/or are overestimated

- The figures on which the justification is based are incorrect and exaggerated.
- The project has been designed to supply an artificially high water demand, based on 'unrestricted' average daily use of 404 litres per person per day which is much higher than usage in recent years (225 per day) and that for other towns/cities.
- A more realistic water demand target, inclusive of business and industry use, would be between 300 to 350 litres per person per day. Similar to the targets of Goulburn (337) and Canberra (302) which have on average 30% less rainfall then Orange.
- The high consumption model is unethical and strategically risky. Establishing an unrestricted supply model will lead to unrestricted consumption.
- Council has used the 2006 water consumption 'baseline' for the water demand, it has not identified what the 'baseline' cost was for water at that time.

Response:

A description of how the baseline level of demand (404 L/p/day) was derived is provided above. Historical data indicates that level of demand is not much higher than recent years (refer Figure 3.1). The data presented in Table 3.1 shows that the residential component of this demand is typically lower than most other comparable regional centres.

The historical data does not support the assertion that this level of water demand is unrealistic. Residential water consumption in Orange is reasonably consistent with that of the ACT (refer Table 3.1). The source of the targets for Goulburn and Canberra stated by a submission are unknown.

Prudent **strategic water planning should be based on unrestricted demand forecasting**. The frequency, duration and severity of restrictions are accounted for by the secure yield analysis. Use of secure yield modelling and demand forecasting is consistent with NSW Government best practice.

In terms of costs, the typical residential bill for water in 2006 is estimated as $455 per assessment in 2006/07 dollars ($527 per assessment in 2010/11 dollars). This is based on a residential consumption of 250 kL/property/year, and the applicable water charges for that year. The typical residential bill for 2010/11 is $570 per assessment, based on a residential consumption of 250 kL/property/year.

Justification for the continued growth of Orange

- Council has not considered sustainable city size. It assumes that Orange should continue to grow indefinably, as fast as possible. The question of growth should be considered.

Response:

The growth projections used in the assessment are consistent with Council's strategic land use planning, specifically the 'Orange Sustainable Settlement Strategy Update' (Newplan, 2010).

Council has undertaken, and is currently undertaking, a number of strategic land use planning exercises which involve consideration of the future growth and development of the Orange local government area. These include the Orange Sustainable Settlement Strategy and Local Environmental Study (2004), the Sub-Regional Rural and Industrial Land Use Strategy (2008) and the Sustainable Settlement Strategy update (2010). Community involvement has formed part of these studies.

Mechanisms for ongoing community involvement in Council's strategic planning processes include the Strategic Planning and Land Use Community Committee. This committee advises Council (by recommendation via the Sustainable Development Policy Committee) on policy relating to strategic land use planning; urban design (including issues relating to built environment and heritage); and community land planning. The committee includes an allowance for the involvement of up to five community members.

Council also provides opportunities for the broader community to engage with planning initiatives such as LEP and DCP amendments and significant development applications.

The construction and development sectors are significant sectors for the local economy. Council considers that a policy of population stabilisation would result in a local contraction of these sectors, which would have a flow on effect to the remainder of the local economy. Stabilisation of population would therefore also involve stabilisation of the local economy. This would require fostering alternative sectors of the economy to take up the capacity released from a diminished construction sector.

Council considers that population stabilisation would be at odds with the positioning of the city as an important regional centre in terms of (amongst other sectors):

- Health – The state government has invested $290 million in a new base hospital, the Careflight helicopter service is situated in Orange and provides emergency transport for the whole region.
- Education – The Charles Sturt University campus provides medical and dental courses aimed at redressing rural skills shortages. The campus is currently investing in further student accommodation as part of long term expansion plans.
- Mining – Newcrest Mining has committed to establishing an operational hub in Orange, which will ultimately be used to remotely operate heavy machinery and equipment in mines across the world.
- Transport – Orange airport is being expanded to cater for increasing demand and the need for larger aircrafts to service the region's transport needs. Additionally, the airport is situated in close

proximity to the rail line. This allows for the development of future intermodal opportunities, which may not be readily available in other centres.

- Governance and administration – Orange is home to the regional offices of a range of government departments and agencies.

More broadly, the central west region of NSW provides a substantial contribution to the state and national economies, particularly the agriculture, mining, tourism and education sectors. The effective and efficient operation of these sectors relies upon the existence of significant regional centres to provide a range of supporting services and facilities, and to accommodate and provide for the day to day needs of the workforce. The central west also comprises a range of smaller communities, towns and villages, which also rely on major regional centres to provide higher order services and facilities within a reasonable distance.

Orange's role as a major regional centre therefore allows for the effective delivery of a range of services throughout the region, as well as reducing dependency on centralised facilities and services in Sydney. This is consistent with the NSW Government's adopted policy of encouraging Sydney metropolitan region residents to relocate to the regions under the EvoCities program. It is assumed that this policy has two aspects, firstly reducing congestion in the metropolitan areas, and secondly increasing population in the regions to make more efficient and rational use of local infrastructure and services, which have been successively built up over many decades.

The continued success of Orange is therefore considered to be in the national, state, regional and local interest. This depends on a sustainable rate of growth being achieved, which in turn requires a secure water supply.

3.2.4 Concerns relating to the supply of water

The current water supply reserves available to Orange are not at critical levels and the urgent need to address the problem has dissipated to some extent.

Response:

While the storage reservoirs are currently full (or nearly full), the fact remains that the existing water supply system is not secure. In other words, the system's secure yield (which is a measure of how much water can be supplied during a drought period) is less than the demand. This lack of security was evident during the last drought period.

Council adopted a strategic water security strategy in 2009 which, amongst other things, included a key strategy of delivering water supply infrastructure up to 10 years in advance of demand. This responsible strategic approach to water supply planning avoids the short term and often costly decisions which are made under emergency conditions.

Concerns that there will not be enough water in the river to supply the project

- The data used is calculations not actual figures.
- There are no gauging stations below Suma Park Dam to get exact figures.
- The river historically is reduced to a series of water holes in times of drought, thus producing no viable water for the city.
- During the recent drought the flow in the river reduced to insignificant levels and even stopped completely. Not a viable source of water for drought protection when it does not have guaranteed flow.

- Project reduces the dam's ability to capture the free natural runoff inflows to the dam, therefore driving up the cost of Orange's water supply to residents.
- The photo shows the river as a significant water resource, and is not typical of the Macquarie River above Burrendong Dam.
- If the river does not flow for 100 days of the year, how does this impact on the ability of pumps to inject water into a storage area?

Response:

Modelling is necessary to obtain a long term time series to enable assessment of the operation of the project. The modelling is based on calibrated catchment models. The assessment of the 2000 to 2010 period was based on actual river flow data from the Bruinbun and Sofala stream flow gauging stations, and actual water consumption and dam storage data.

Council has a stream gauging station located upstream of Suma Park Dam (near Icely Road) that is used to monitor dam inflows. This station is currently undergoing minor works to ensure that it is accurate in the low flow range. Environmental flow release is measured via a v-notch weir downstream of the dam. Council is currently reviewing options to upgrade this to a flow meter. There are also stream flow gauging stations on Blackmans Swamp Creek (upstream of its confluence with Summer Hill Creek) and on Summer Hill Creek near the third crossing. Council is currently considering relocating the third crossing gauging site to a more suitable location.

Operation of the project would *not* involve waiting until severe drought conditions occur before transfers commence. Instead, it would involve using water when it is available to keep the storages fuller. This would improve the security of Orange's water supply system. That way, when drought conditions cause the river to stop flowing, there would be enough water stored.

The 2000 to 2010 assessment demonstrated that, despite the river being dry at times, operation of the project would still have been viable and would have improved water security during this period.

The natural catchment and existing storages do not currently provide water security. The system needs to be supplemented with external sources. As noted above, operation of all external water supply sources would be subject to a decision support tool, including a set of integrated operating rules (refer section 3.7).

The results of modelling undertaken indicate that the Macquarie River provides a viable water source that could help contribute to Orange's water security. The reliability of this water resource is confirmed by the upstream streamflow data, which indicates there is some flow in the river at least 99% of the time, and in the Turon River at least 91% of the time. Sensitivity analysis, which assumed no flow in the river for 91 days each year, demonstrated that the project is a robust water supply option, which is not significantly impacted by assumptions relating to low river flow.

Concerns that the project is no longer needed, as there is adequate water in Orange's water supply system

- Orange water storage dams have been full, or near full, since August 2010. There are five years of water available based on its current consumption rates.
- Nowhere near enough emergency to warrant the project.
- After good rainfall the Orange's water storage is full. The river flows as well. No need for extra water.

Response:

As noted above (including section 3.2.1 and 3.2.2), **the project is needed because Orange's existing water supply system is not secure**, **regardless of existing storage levels.** In addition, as noted above, in 2009 Council adopted a strategic water security strategy which, amongst other things, included a strategy of delivering water supply infrastructure up to 10 years in advance of demand.

Under the proposed operating rules, water would not be transferred if the volume in Suma Park Reservoir was above 90% of capacity. So when the storage is full, no water would be transferred.

What if the climate change estimates are incorrect?

- Is it possible that climate change and other factors could decrease the future flow in the river by a greater percentage than 26%? This may impact on the viability of the project.

Response:

Climate change modelling was based on data from the NSW Office of water's data set for a one degree warming scenario. The reported 26% reduction refers to the reduction in secure yield for the Orange water supply system, using dams and catchments only. It does not refer to potential changes in the Macquarie River.

The modelled climate change reduction factor for the augmented system (that is, existing catchments and dams, stormwater harvesting, bores and the Macquarie River to Orange pipeline) was 6% to 8%. This indicates that, by diversifying and augmenting water sources, the water supply system has become more resilient to the potential impacts of climate change.

3.2.5 Expenditure and funding, costs of the project

Are the timeframes and cost estimates of the project realistic for both engineering and construction to take place?

The project is considered to be too expensive, not enough detail has been factored into the cost

- The pipeline is too expensive, too far away and will cost a fortune to pump the water to Suma Park (electricity etc). If we are in drought we could not pump water.
- The ongoing costs are not justified. The costs of this project will escalate.
- The geological conditions have not been factored into the cost.
- A firm updated cost analysis is required.

Response:

Council considers that the timeframes and estimates are realistic. The financial analysis of the cost of the Macquarie River pipeline option included all capital, fixed and variable operating costs. The analysis demonstrated that the project would be a cost effective option compared to other options. As noted in section 3.2.4, the project has been designed to operate when sufficient water is available in the river, not necessarily during drought periods.

A number of estimates have been prepared, which included consideration of issues such as the geotechnical conditions likely to be encountered along the route. Each estimate, including independent estimates, provides a high degree of confidence that the project could be delivered within the budget. Prior to construction, tenders would be called and these would provide further confidence in relation to the final project cost.

Operation and maintenance costs were included when reviewing alternative options and comparing net present value calculations. Such costs were also included when the increase in the typical residential bill was calculated.

Concerns relating to how the project is funded

- Concerned with Council transferring money by a loan arrangement from the Sewer Fund, then combining the Sewer and Water Fund and later forgiving the loan.

Response:

Council has adopted an integrated water management approach for the management of water and sewer resources. Council received approval from the Department of Local Government in October 2010 for an interest only loan for the project from Sewer Fund to Water Fund. The internal loan mechanism is required due to the existence of the two separate funds. The Instrument of Approval for this loan identifies that, should Council pursue its intention to merge the water and sewer funds into one water management fund aligned with the integrated management principles, the loan could be forgiven as there would no longer be a distinction between the two funds. The purpose of the loan would remain the same, but with amalgamation of the two funds under the integrated water management approach, Council is able to use the combined funds without the loan being required.

3.2.6 Consideration of other options

Further detail on demand management measures should be provided

- Include water conservation measures and community education/public awareness.
- Have all of these measures been included in the modelling assumptions?
- If so, would the further reductions referred to eventuate, irrespective of the size of any reduction?

Response:

Section 5.5.4 of the environmental assessment noted that Council has already implemented several measures to further reduce per capita water demand, including:

- permanent water conservation measures to prevent excessive outdoor water usage
- community education/public awareness campaigns to eliminate water wastage
- National Water Efficiency Labelling scheme to encourage purchase of more water efficient appliances
- a showerhead exchange program to make internal water use more efficient
- water audits to help businesses identify ways to reduce water consumption.

Council's Water Demand and Conservation Management Plan (Geolyse, 2012c) provides the following information on adopted demand management measures.

Permanent water conservation measures

Potential savings can be reinforced by adopting permanent water conservation measures. The aim is for continued best practice water efficiency, through community awareness of the need to reduce consumption and eliminate inefficient uses of water. Water use efficiency should be encouraged when staged water restrictions are not in place. This includes education in relation to:

- not irrigating during times of the day when there is high evaporation
- the use of trigger hoses when washing cars or watering lawns with hand held hoses

- preventing irrigation falling on hard surfaces
- not using hoses to wash down footpaths, driveways and other hard surfaces.

Community education

Effective education and communication with the community is imperative for strategies to be effective. Council is developing a range of water saving rules that will be incorporated into community education programs. The media strategy includes:

- Electronic - Council has established a website to provide information on water security, capital works projects planned, and how demand management is being handled. The website is also used to provide information on ways to efficiently use water, rebates and links to other websites.
- Print - direct mail with newsletters, flyers, notices with rates, and general media releases. Includes provision of information with water accounts in relation to Council's water charging policy and measures to conserve water.
- Radio - Broadcasts are presented on local radio stations 105.9 Star FM and 105.1 2GZ.

Water efficient fixtures

The Water Efficiency Labelling Scheme (WELS) was introduced in 2005. Council recommends that customers install AAA rated appliances (toilets, washing machines, dishwashers, shower roses, taps and urinals) and all kitchen and hand basin taps be fitted with flow restrictors.

Showerhead exchange program

Council invites residential customers to exchange existing showerheads for water efficient ones. The showerhead exchange program provided 102 showerheads in 2011/2012.

Water audits

Council offers residential and non-residential water audits. The residential audit includes an audit of the property as well as the installation of water efficient showerheads, tap aerators and cistern weights for toilets. These are free for residents. The non-residential water audit varies according to each business or commercial activity type. The audit may include, but is not limited to, review, evaluation of water use and identification of ways to save water.

Council has worked with the top 20 non-residential water users to reduce their water consumption through the preparation of a Water Saving Action Plan.

BASIX

The following measures are used to achieve the required 40% water saving:

- use of water efficient fixtures
- installing a rainwater tank
- connecting to an alternative water supply (if available)
- low water use gardens.

Council has a dual water supply system for the Ploughmans Valley and North Orange development areas. This system will ultimately supply non-potable water to 4,500 homes in the north and west of the city. The original intent of the system, which has been partially constructed, was to supply treated sewage effluent to residential properties for toilet flushing and outdoor use. By the start of 2011, around 1,000 properties had been connected. Connection to this system for toilet and outdoor water

use was deemed to satisfy the criteria as a reticulated alternative water supply under BASIX by the Department of Planning.

Currently, this system is charged with potable water as treated effluent is not available due to the existing treated effluent supply agreement with Cadia Holdings.

Council undertook a review of this system in early 2011 and considered a range of alternate water sources for the dual water system to ensure ongoing compliance with BASIX requirements in this area. As a result of this review, it was recommended that the system be supplied with harvested stormwater. The required capital works for this supply are underway and scheduled for completion in the first quarter of 2013.

Other demand management measures

These include:

- user pay pricing structure
- conducting regular attitude surveys
- development of a system wide water model
- ongoing meter replacement program
- consideration of a smart metering program
- leak detection and water loss management
- pressure reduction through the system
- rainwater tank rebates
- Council water efficiency.

Water savings and the impact of demand management

The impact of the existing demand management measures described above has been included in the demand forecast model for Orange. Modelling for the medium population growth rate (0.8% per year) shows annual water savings of between 260 ML/year (in year 2) and 860 ML/year (in year 30). This saving represents up to 16% of the current estimated unrestricted annual demand. The average annual water saving over 30 years is 560 ML/year (about 10% of the current estimated unrestricted annual demand).

The total annual demand includes both residential and non-residential use (commercial, industrial, public and open space, losses and non-revenue water). When the total annual values are reduced to the residential component, the demand forecast indicates that demand management measures would reduce the estimated residential consumption to 228 L/p/d in 2040. This sits between the current target for Level 2 and 3 water restrictions.

This comparison indicates that the forecast water demand will require a change in community water consumption and, in the longer term, a revision of the restriction targets. Such a change is evident already, as the community has not significantly increased water consumption following easing of water restrictions in August 2010, although recent warm weather has seen residential consumption increase to 280 and 306 litres per person per day.

Council is expecting to realise the savings assessed by the modelling. If they are not realised, the water supply system will be less secure.

3.2.7 Justification of the project compared to the other options considered

The project is not adequately justified in comparison to other water supply options

- The money would be better spent on more sustainable options.
- Orange does not need a pipeline - it needs more water catchment and more storage.
- Orange currently has substantial infrastructure in place with the stormwater harvesting scheme.

Response:

Options evaluation process

A summary of the option evaluation process is provided in chapter 8 of the environmental assessment. The project was one of 35 potential water supply options considered by a review of available water resources, undertaken as part of Council's IWCM Evaluation Study (Geolyse, 2012a). The long list of options was screened by considering the potential secure yield, capital and operating costs, and issues associated with gaining approval, including consideration of environmental impacts and timing.

Six of the 35 long listed options were already part of Council's 'business as usual' scenario. These six options depend on gaining appropriate approvals and licences. Seven options were short listed as preferred options, to be considered if elements of the business as usual scenario do not eventuate.

The Macquarie River pipeline option was considered against other options using a multi-criteria analysis. It was identified as the preferred option as an outcome of this analysis.

Increasing the water catchment/storage

It is not possible to increase the water catchment area without constructing a new dam. Likewise, the provision of significant additional storage is not possible without a new dam or managed aquifer recharge. A new dam would be significantly more expensive than the project.

Managed aquifer recharge was examined as a means of increasing storage. However, this option would not work unless there is additional water to inject into the groundwater for later use. As more water cannot be generated from the catchment, external supply sources are required.

Structural analysis of Suma Park Dam shows that it cannot be raised by more than 1.0 m without exceeding the allowable stress limits of the existing concrete arch wall. This rise would provide an additional 1,680 ML of storage. Whilst this would improve water security, it is not significant and would not meet the current unrestricted demand of 5,400 ML/year.

Assessment of the existing surface water catchment and storage system, including inflow from the stormwater harvesting schemes, shows that Suma Park Reservoir would need to have a volume of 24,000 ML to provide a secure yield that would meet the current unrestricted demand. This would involve a 3.6 m increase in the full supply level of the dam, which is not technically feasible.

Further information on the Suma Park Dam option is provided in section 3.4.3.

Adding external water sources to the existing system, such as harvesting schemes (stormwater harvesting and the Macquarie River to Orange pipeline) actually **does effectively increase the catchment area for Orange and diversify its water sources.**

Stormwater harvesting

Council does have significant and innovative stormwater harvesting infrastructure in place, which supplements the city's raw water supply. The current approved schemes add 900 ML/year to the secure yield. This amount is included in the current secure yield value.

Full approval of the Blackmans Swamp Creek stormwater harvesting scheme would add a further 200 ML/year to the secure yield. However, the existing stormwater harvesting schemes (including full approval of the Blackmans Swamp Creek scheme) do not provide the secure yield necessary to meet demand.

Further discussion on issues relating to possible expansion of the Blackmans Swamp Creek stormwater harvesting scheme is provided in section 3.5.4.

3.2.8 The relationship between the strategic planning context (other studies) and the project justification

Relationship to planning studies

- How does the project fit within the overall Water Management Plan for NSW. Does the NSW Government have a Catchment Management Plan to secure, not only Oranges' water supply but other regions and other major Centres?
- P 5.3 Draft Central West Catchment Action Plan 2011-2021 – it is not clear how OCC is addressing the actions identified or how the project in particular addresses them (and some of them aren't actions but statements).
- p. 5.4 Address the implications of the finalisation of the Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources (gazetted in early October).
- s5.2.4 p. 5.6 - Comprehensive Water Supply Management Strategy 2009 – what is meant by "very significant levels" in relation to demand management, user education and water system efficiency in the context of this project?

Response:

Water Management Plan for NSW

Water sharing plans are being progressively developed for rivers and groundwater systems across NSW following the commencement of the *Water Management Act 2000*. Water sharing plans establish rules for sharing water between the environmental needs of the river or aquifer and water users, and also between different types of water use such as town supply, rural domestic supply, stock watering, industry and irrigation.

The most relevant water management plan for the project is the Macquarie Bogan WSP, which commenced on 4 October 2012. The Macquarie Bogan WSP establishes the Macquarie Bogan Unregulated Rivers Extraction Management Unit, which has 30 water sources. The Orange catchment sits in the Summer Hill Creek water source. The proposed offtake point is located in the Macquarie River above Burrendong water source.

The WSP establishes a long term extraction limit for the Extraction Management Unit. **The existing full town water entitlement held by Orange City Council (that is, 7,800 ML/year) is included in the long term extraction limit** (Clause 23(x)). Town water entitlements for other centres upstream of Burrendong Dam are also included in the plan.

The project provides the means by which Council can access this water supply entitlement with security, **and it is therefore consistent with the requirements of the Macquarie Bogan WSP**.

Draft Central West Catchment Action Plan 2011-2021

The Draft Central West Catchment Action Plan 2011-2021 has four water theme targets supported by 13 priority actions. Actions which are relevant to strategic water supply options and how they relate to the project are discussed below:

All water sharing plans contributing to management of priority river reaches, groundwater dependent ecosystems

This action relates to ensuring that priority river reaches and groundwater dependent ecosystems are considered during the formulation of water sharing plans. One of the objectives of the Macquarie Bogan WSP is to 'protect, preserve, maintain and enhance the important river flow dependent and high priority groundwater dependent ecosystems'. This is achieved by a commitment to planned environmental water, which in terms of surface water (amongst other things) is the water remaining after extraction in accordance with the access rules. The project can be operated in accordance with this plan. The proposed 38 ML/day flow trigger is above the level below which the taking of water is not permitted.

Manage hydrological regimes for ecological outcomes

Adopting the pump trigger level based on the 80th flow percentile, which is above the visible flow criteria set by the Macquarie Bogan WSP, is aimed at protecting low flows in the river system.

Multiple beneficial use including water reuse and recycling

This action relates more to integrated water cycle management. Council's water system includes various reuse and recycling systems. These actions are delivering multiple beneficial use of water:

- treated effluent is reused for industrial purposes at Cadia mine
- stormwater is captured and recycled for potable use through two systems
- treated stormwater will be used to supply the dual water reticulation area (to be commissioned in 2013)
- backwash water from the Icely Road water treatment plant is added back to the raw water system.

Improve connectivity of water flow laterally, longitudinally and vertically

This relates to physical barriers that may inhibit fish passage. The project has been designed and would be operated to minimise impacts to fish passage.

Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012

As the Macquarie Bogan WSP commenced on 4 October 2012, the environmental assessment referred to the draft version of this plan. A summary of those elements of the plan that are relevant to the project, and how they changed in the final plan, is provided in Table 3.2. The first column provides wording from the environmental assessment (refer section 2.2.1 of Appendix D).

Table 3.2 Implications of the water sharing plan

Implications of the draft plan – as noted by the environmental assessment	Implications of the final plan
The proposed offtake structure is located in the Macquarie Bogan Unregulated Rivers Extraction Management Unit.	This is unchanged.
The proposed offtake structure is located in the Macquarie River above Burrendong Water Source which forms part of the Macquarie Bogan Unregulated Rivers Extraction Management Unit.	This is unchanged.
The plan establishes a long term extraction limit for the Macquarie Bogan Unregulated Rivers Extraction Management Unit. In establishing this limit the full town water entitlement held by Orange City Council (that is, 7,800 ML/year) was included (Clause 23(x)).	This is unchanged.
Trading of access licences is permitted within the Macquarie River above Burrendong Water Source subject to assessment	This is unchanged.
Access rules for the taking of surface water state that water must not be taken if there is no visible flow in the water source (Clause 50(2)) or from a natural pool, lagoon or lake when that source is at less than 100% capacity after visible flow has ceased (Clause 50(4)). It is noted that this access rule does not apply for the licence category of town water supply (Clause 50(18)(e)). However, if a works approval is granted for the project, extraction would be subject to the conditions attached to that works approval.	Access rules for the taking of surface water are now defined in Clause 53. Whilst some wording has changed, the intent of the rule remains the same, that is, water must not be taken if there is no visible flow in the water source (Clause 53(2)) or from an in-river pool or off-river pool when that source is at less than full capacity of the pool (Clause 53(3)). Access rules does not apply for the licence category of town water supply (Clause 53(32)(e)).
There are two licences in the system upstream of the proposed offtake point with pre-existing cease to pump thresholds that are higher than the cease to pump thresholds specified in (Clause 50(2)).	Apart from clause numbering changes, this is unchanged.
The draft plan does not establish total daily extraction limits.	This is unchanged (now clause 54).
The draft plan does not establish individual daily extraction limits.	This is unchanged (now clause 55).
Transfer (temporary or permanent) of a portion of Orange City Council's existing town water access entitlement is permissible under the draft plan.	This is unchanged.

Comprehensive Water Supply Management Strategy 2009

Council's Comprehensive Water Supply Management Strategy 2009 refers to achievable and very significant levels of:

- demand management
- user education
- water system efficiency.

These are demand side management measures, which are factored into the demand forecast that forms part of the water security context for Orange. Further information on demand management and education measures is provided in section 3.2.5.

Water system efficiency refers to management of the water supply and delivery system to ensure its efficiency. Council's current and ongoing actions to ensure water system efficiency include:

- Development of a system wide water model that will be used to identify any areas of the system that do not meet the agreed level of service; assess capital works required for system expansions; and guide development and installation of additional system meters to improve water consumption monitoring.
- Ongoing meter replacement program to ensure all meters are replaced on a 10 year cycle.
- Consideration of the installation of Automated Meter Reading (AMR) systems that allow water meters to be read remotely. Areas identified for the trial of smart metering will be identified using the water model.
- Leak detection and loss management. In 2009, Council undertook a major leak reduction program. These works have been audited and found to have saved 500 ML/year of previously unaccounted for water.
- Establishment of District Metering Areas that will assist with analysis of water consumption and losses.
- Ongoing pressure reduction program that helps reduce water losses due to main breaks and for reducing the volume of water used through showers and other fixtures such as garden hoses.
- Council water use efficiency. Water meters are being installed on all of Council facilities (parks and gardens, pools etc) so water consumption can be measured and conservation initiatives developed. The installation of meters will act as an incentive to reduce consumption. Water conservation and management practices will be reviewed and appropriate initiatives will be progressively introduced to all Council properties where practical.

Concerns with how the strategic and policy context for the project has been used and whether the information is correct and up to date

- Council has used out of date advice on protecting unregulated river environments and has ignored others.
- Has not met urban water management principles adopted in 2008, particularly principle 3.
- The environmental assessment has ignored the 2011 policy requirements of the Office of Water for determining low flows and ecological requirements.

Response:

The 'Advice to water management committees - No. 6 daily extraction management in unregulated rivers' (NSW Government, 2002) was used to guide the definition of flow classes and operating rules for the project. This policy advisory note defines cease to pump thresholds, daily flow extraction classes, daily extraction limits and management options for daily extraction management. Further information on these terms is provided in section 2.2.2 of Appendix D to the environmental assessment. Flow classes are defined in the glossary at the front of this report.

This policy advisory note remains relevant and has not been superseded by the Office of Water unregulated river policy in 2010 or the publication 'Macro water sharing plans – the approach for unregulated rivers: A report to assist community consultation' (NSW Office of Water, 2011). Review of the 2011 document does not indicate that it supersedes the policy advisory note. The policy advisory note is listed (along with 13 others) in Appendix 8, which states that the policy notes were used to guide the assessments that underpin the macro water sharing plans.

Furthermore, during preparation of the environmental assessment, the Office of Water advised that the policy note was still relevant.

In November 2008 the Council of Australian Governments (COAG) agreed to a range of actions to progress urban water reforms. This included adopting National Urban Water Planning Principles (http://www.environment.gov.au/water/policy-programs/urban-reform/index.html). Many of these principles are reflected in the 'Best-practice management of water supply and sewerage guidelines' (NSW Government, 2007) which have the following six criteria for best-practice management of water supply and sewerage:

1. Strategic business planning
2. Pricing
3. Water conservation
4. Drought management
5. Performance reporting
6. Integrated Water Cycle Management

Utilities that achieve outcomes required by the best-practice guidelines will have effective and sustainable water and sewerage businesses, and demonstrate compliance with the National Competition Policy and National Water Initiative (NSW Government, 2007).

Principle 3 of the National Urban Water Planning Principles is to 'Adopt a partnership approach so that stakeholders are able to make an informed contribution to urban water planning, including consideration of the appropriate supply/demand balance.'

Council completed its strategic business plans for water supply and sewerage in 2009 (Worley Parsons, 2009) and commenced the IWCM planning process in 2006. This resulted in preparation of the IWCM Evaluation Study in 2012 (Geolyse, 2012a). This latter document is currently being reviewed by the Office of Water. Both of these strategic planning processes included consultation with stakeholder groups. Specific consultation was undertaken during preparation of the strategic business plans to identify agreed levels of service. The agreed levels of service form a key component of the IWCM process. A project reference group, consisting of community and industry stakeholders, contributed to the IWCM process. Community attitudes regarding water knowledge, attitudes and behaviour are regularly reviewed through community attitude surveys.

As a result, consultation undertaken by Council over the past four to five years is considered to be consistent with the intent of principle 3 of the National Urban Water Planning Principles. Further comment is provided in section 8.2.

The 2011 publication 'Macro water sharing plans – the approach for unregulated rivers: A report to assist community consultation' (NSW Office of Water, 2011) noted by this submission was reviewed, and it was not possible to identify the specific policy requirements referred to. As noted above, the NSW Government policy advisory note was used to define flow classes and daily extraction management measures. These remain valid and appropriate for the project.

3.2.9 Regional approach to water planning

A number of submissions stated that there should be a regional approach to water planning, and that the project is not justified because there has not been a regional approach

- There should be a properly planned regional scheme. Towns should stop competing and work together.
- Considering the large amount of funding that is being provided a regional approach to water supply would be more sensible. A plan that guarantees the water security of the region would secure further investment throughout the area.
- The project does not fit with the broader regional water issues and needs. Is at odds with Centroc strategies.

Response:

The project is an outcome of a regional approach to planning, and is supported by Centroc. As noted in section 5.2.2 of the environmental assessment, Centroc undertook a Water Security Study in 2008/09 to investigate and recommend solutions to improve water security across 17 local government areas. The study identified that 29 towns (including Orange) were at risk, and that these towns required substantial improvements to water security.

It was determined that an integrated program of water conservation and demand management measures, coupled with new and upgraded water supply and storage infrastructure was required. The recommended regional town water security strategy centred on augmenting Lake Rowlands with various other infrastructure to provide strategic regional connections. The study also recommended contingency actions for emergency situations, which included a water pipeline connection between Orange and the Macquarie River.

Council investigated the proposed recommendations of this study and progressed development of the water supply augmentation options through various project specific studies (refer section 3.4).

Centroc provided, by letter dated 26 October 2012, confirmation of its role in the planning process and the organisation's support for the project. Centroc's letter indicated that:

- Centroc has two objectives – regional sustainability and regional cooperation and resource sharing.
- The Centroc Board is made up of the 34 Mayors and General Managers of its 17 member Council who determine the priorities for the region, these priorities are then progressed via sponsoring Councils.
- In 2008, Centroc received funding from the NSW Department of Water and Energy for a water security study to investigate potential solutions to improve water supply security across the region. The study had two components:
  - Component 1 – an audit of existing infrastructure for bulk water supply
  - Component 2 – an options paper for improving water supply security.
- The study assessed the feasibility of water supply security options, considering environmental, social and economic objectives.
- In relation to Orange, the study identified significant shortcomings in the city's water supply and identified the Macquarie River to Orange Pipeline Project as a solution to these shortcomings.

The letter noted that 'At a Centroc meeting in 2009 the above mentioned Councils unanimously endorsed the Centroc Water Security Study and its findings. Centroc continues to work through the

options in the study to deliver water security across the region. **The Macquarie River to Orange Pipeline Project is a critical step in delivering that regional water security**.' *(emphasis added)*

A regional option involving Lake Rowlands should be considered

Response:

Considered below in section 3.4.6.

3.3 Objections to the project – the project is not needed

A number of submissions expressed objections to the project. The stated reasons for the objections, and where these are considered in this report, are outlined in Table 3.3.

Table 3.3 Consideration of objections

Reason for objection	Where considered in report
The project is not justified, it is too costly, Orange has plenty of water, will destroy the river for a mine	Section 3.2
Other options should be considered	Sections 3.4, 4.3.1
The project will impact on the river	Section 4.5
The project will impact on the aquatic ecology of the river, including fish, all the fish will go, fishing will be impacted	Section 6
It is not a regional solution, not in the best interests of the region	Section 3.2.9
Does not supply enough water or fix the problems	Sections 3.2, 3.3
Impacts to the environment (including biodiversity, heritage) are unacceptable, does not meet ESD principles	Section 5 to 7
Our group's representatives were not involved in the survey work	Section 7.5.1
Don't want it to traverse my property	Sections 7.10.1, 9
Does not consider other water users	Section 4.6, 4.7
Information used is out of date	Sections 3.2.8, 4.2, 4.8

3.4 Alternatives to the project

3.4.1 Options considered as part of project development

Other options considered

- What other options has Council considered to secure future water supply needs? Why is the pipeline considered to be the best option?
- Has the project explored all possible options?

Council did not consider other possible options adequately as part of project development, and options were dismissed for no reason.

- The easiest and cheapest option is the preferred one, regardless of impacts on the environment and generally ends up costing much more money in long term.

- The original Centroc report did not recommend the Macquarie River pipeline option as a water security option for the region.
- Council has selectively and unfairly dismissed other better options.

Response:

Refer to section 3.2.7 regarding the consideration of other options.

The environmental assessment evaluates the environmental impacts of a preferred project. It is not an options development and assessment process. This process was undertaken prior to preparation of the environmental assessment, and the results of the options evaluation and assessment process are presented in other reports (summarised below).

As noted in section 5.2.4 of the environmental assessment, Council adopted a 'Comprehensive Water Supply Management Strategy' in November 2009. The strategic objective of the strategy is to establish a broad-based water supply strategy for the next 50 years and beyond, which focuses on ongoing water conservation, quality and demand management and the provision of key water supply infrastructure at least 10 years in advance of projected demand. The aim of the strategy is to be able to deliver fewer restrictions, improved security and additional capacity to facilitate ongoing growth based on:

- a holistic/integrated approach which meets national water initiative requirements (essentially a balanced portfolio of realistic demand and supply options)
- achievable and very significant levels of demand management
- achievable and very significant levels of user education
- achievable and very significant levels of water system efficiency
- proper inclusion of climate change and climate correction
- proper analysis of yield, reliability and security compared to population and growth
- after consideration of the above, the identification of the need for further supply sources to meet growth and improve yield, reliability and security
- identification of local and regional sources to serve the city into the future with an appropriate cushion/contingency.

The strategy outlined a number of actions aimed at meeting its strategic objective. These actions addressed the following elements:

- water conservation and quality and demand management
- provision of infrastructure – priority local options, priority regional options and alternative options
- management, promotion and lobbying
- available funding.

As noted above in section 3.2.6, demand management, water efficiency and community education actions have also been undertaken in addition to the significant advances that have been made in investigating and implementing structural options.

Further to this study, Council undertook the following:

Orange Emergency Water Supply Further Feasibility Assessment, 2010

In October 2009, Orange had less than two years water supply available and the city was on level 5 water restrictions. To provide water security to the city, as part of an overall strategy to diversify the city's water sources, Council commissioned a feasibility study into the possibility of connecting the

city via a pipeline to one of two water sources: either Lake Rowlands or the Macquarie River (MWH, 2010).

In the feasibility study, several potential pipe corridors to Orange were investigated. Two of these were from Lake Rowlands and seven from the Macquarie River. The study concluded that the most feasible solution was to bring water to Orange from the Macquarie River via one of two broad potential pipeline corridors. The report found that additional engineering and environmental investigations were required to recommend a preferred corridor.

Orange Drought Relief Connection Concept Investigation Report, 2011

Following the feasibility assessment, the concept investigation study (MWH, 2011) compared and evaluated the two pipeline corridor options. A multi-criteria analysis was undertaken and the preferred corridor was recommended. The report also provided a number of recommendations for detailed design.

Further information on the option assessment process for the project and the alternatives considered are provided in chapter 8 of the environmental assessment.

Centroc water security study report

The Macquarie River to Orange pipeline option was identified in Centroc's water security study report, but was not short listed at that stage as further information or investigation was required. It was recommended that this option should be considered as a contingency action for emergency measures (MWH, 2009). However, since that time, and as noted above, further investigations were undertaken, and these identified that the Macquarie River is a viable water source.

Further information on the regional approach to water security planning is provided in section 3.2.9.

A response in terms of other options identified by submissions to the environmental assessment is provided in the following sections.

3.4.2 Groundwater options

The proponent should assess the availability of additional groundwater reserves

Groundwater options should be considered

- Groundwater to the south of Orange should be used.
- Water is available from aquifers (basalt and limestone) to the South of Orange. Their altitude, distance from Orange's water storage, quality of water and existing infrastructure (power, bores) make this water more economically feasible and environmentally sustainable than the Macquarie River Pipeline.

Response:

Council and Centroc commissioned various studies to identify potential groundwater resources in the Orange area. Three possible areas of groundwater were investigated:

- The Orange basalt areas to the south of the town – *see discussion below*.
- Possible bore locations in north Orange along the north Orange bypass and harvesting pipeline route and possible bore locations in or nearby parks and reserves in Orange. These areas show some potential. However, the typical groundwater yields are very low (usually no more than 1.0 L/s) and these do not offer substantial potential to supplement town water supplies.

- Managed aquifer recharge - this was examined as a means of increasing storage but was not considered viable (refer section 3.2.7).

Another possible groundwater source is Browns Creek Mine, which is discussed further below.

Potential groundwater resources are identified in Council's IWCM Evaluation Study (Geolyse, 2012a). Council recently commissioned a review of groundwater resources. The review, which focuses on the Orange Basalts and Browns Creek mine, was undertaken by C M Jewell & Associates and is included in Appendix B. The results of the review are summarised below.

Orange Basalts

The Orange Basalt aquifer is an established and locally very important source of generally good quality groundwater. However, the hydrogeology of the aquifer is complex and not fully understood, or mapped in detail. Yields are very variable and are controlled by factors that are difficult to map or predict at a local scale. There is no reliable estimate of the available groundwater storage.

On a source-wide basis, the long term extraction limit nominated in the WSP exceeds current and share components by a factor of more than two. The review concluded that, at a local level, establishing significant new supplies from the aquifer is likely to prove difficult. Unless sited with great care, and at a substantial distance from existing bores, new bores are likely to have an impact on existing users.

Browns Creek Mine

Although there is a potentially significant groundwater resource at Browns Creek, the sustainable yield of the local aquifer system, which may include the Cowriga Limestone and part of the Blayney Volcanics, has not been established. There are also significant water quality issues. A detailed local hydrogeological study would be required to justify the costs of development, and as a prerequisite to obtaining an access licence and works approval.

In 2008, the Department of Commerce completed a desktop study of the feasibility of transferring water from the abandoned Browns Creek Mine at Blayney to Orange (Department of Commerce, 2008). The study included capital cost estimates of the transfer and water treatment systems. This data was used by Council's IWCM Evaluation Study, with the results of financial analysis concluding that using water from Browns Creek mine would cost $3,009 for each ML increase in secure yield. This compares to a cost of $408 per ML increase in secure yield for project (or $1,232 per ML increase excluding grants).

Using water from the Browns Creek mine only in drought periods would reduce the annual operating costs. However, the capital costs of this option would be $1,900 per ML increase in secure yield. Therefore, this option would still be more expensive than the project.

3.4.3 Suma Park Dam option

Raising the Suma Park dam wall may be a better option

- Raising the dam wall at Suma Park may be a better option.
- Further investigation of the raising of the wall at Suma Park Dam could be given greater assessment before installation of the pipeline is contemplated.

Options relating to Suma Park Dam should be considered

- Works to Suma Park Dam should be implemented as the highest priority.
- The height of the dam wall should be increased and the reservoir should be expanded.

- Increasing the height to 1.8 m as was approved back in 2005 and construction was meant to begin in 2006.
- Dam requires an urgent safety upgrade.

Response:

Raising Suma Park Dam

A detailed assessment of the secure yield benefits of raising Suma Park Dam were undertaken as part of Council's IWCM Evaluation Study (Geolyse, 2012a). This assessment followed the detailed engineering investigations, which determined the dam wall could only be raised by 1.0 m (refer above section 3.2.7).

A 1.0 m rise in the full supply level of **Suma Park Dam would only provide an increase of 100 to 200 ML/year in secure yield**. The reason for this small increase is illustrated in Figure 3.2 for the critical drought period. Raising the dam by 1.0 m increases the storage volume by 1,680 ML. This amount of additional supply is available at the start of the drought period. Inflow to the storage would not change through the drought period. Therefore, the additional volume provided by raising the dam, which is available at the start of a drought period, is 'used up' during the drought by increased annual demand and additional evaporation losses. This is shown in Figure 3.2 as the two storage lines gradually converge. Therefore, the additional volume is not available every year as it is used over the drought period when the storage is less than full.

Secure yield is a function of inflow, storage volume and demand. Increasing the storage volume does not increase the inflow. Therefore, the system responds better to additional inflow rather than additional storage. **Options that increase inflow to the system provide a much greater improvement to the secure yield.**

Council has recently resolved to increase the full supply level of the dam by 1.0 m in conjunction with dam safety works. The required dam safety works and raising are scheduled for design, approvals and construction in 2012/13 and 2013/14, pending approvals and licensing.

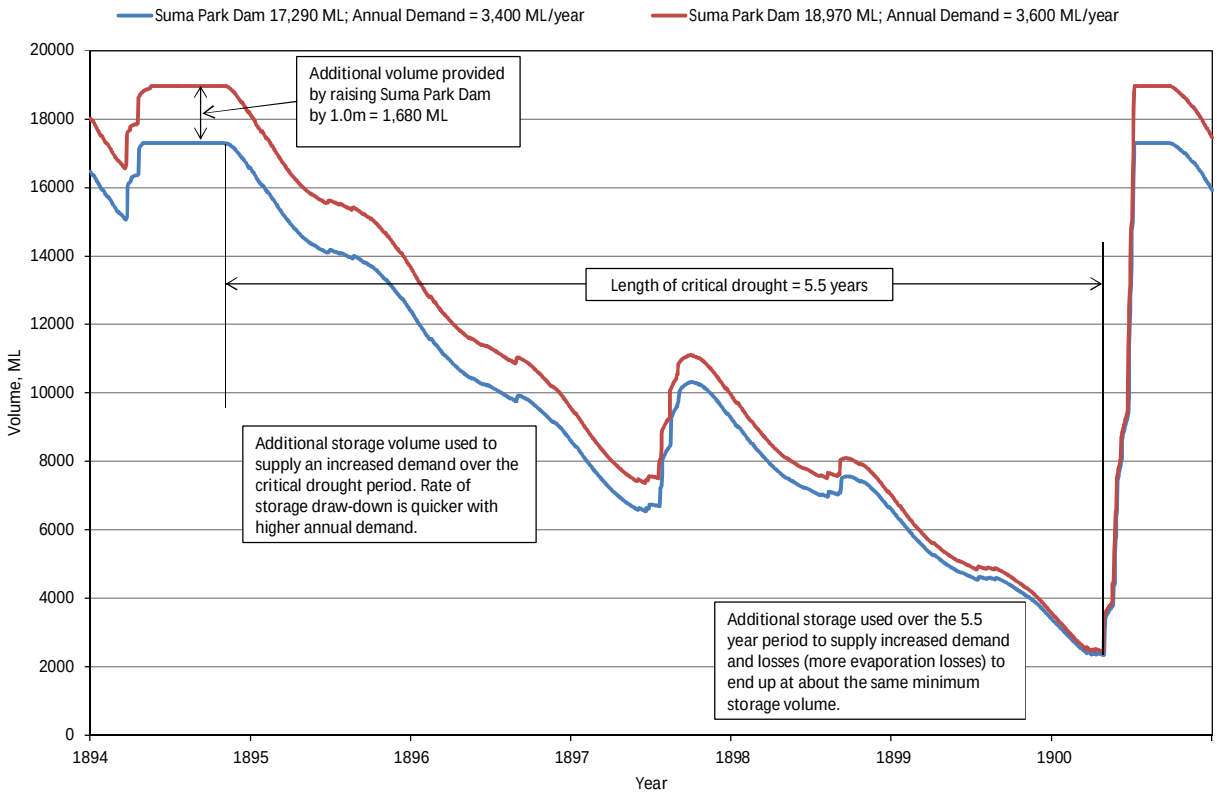


Figure 3.2 Modelled additional Suma Park Dam storage during critical drought period

3.4.4 Stormwater harvesting and reuse options

More detail/clarification should be included about why the stormwater harvesting scheme is limited

Stormwater harvesting, water recycling and conservation are better options. Can the stormwater harvesting scheme be expanded?

- More emphasis should be placed on conserving and recycling water.
- Stormwater harvesting scheme should be explored as it is an available resource that needs to be used to its full capacity.
- Stormwater harvesting is not at a full capability. This option appears to have been dismissed.
- Harvesting is capped for no reason

Response:

Council has significant and innovative stormwater harvesting infrastructure that supplements the city's raw water supply. The current approved schemes add 900 ML/year to the secure yield. This amount is included in the current secure yield value. Full approval of the existing Blackmans Swamp Creek stormwater harvesting scheme would add a further 200 ML/year to the secure yield. Stage 2 of this scheme could add 900 ML/year and Stage 3 a further 1,000 ML/year to the secure yield, if approved.

Council has demonstrated innovation by developing the existing stormwater harvesting scheme to supplement the city's water supplies. However, there are a number of issues that need to be resolved before stormwater harvesting can be considered as a permanent part of the long term water solution. These are discussed in Council's IWCM Evaluation Study (Geolyse, 2012a) and are summarised below.

Representatives of the Office of Water stated that they consider stormwater harvesting not to be a long term option. This concern is based on water quality considerations. It was these concerns that lead to development of a staged water quality approval process. This process must be completed before consideration would be given to expansion of the scheme. This process is likely to take three to five years to complete for the existing stormwater harvesting schemes, before any further stages could be contemplated.

Licensing of the Blackmans Swamp Creek scheme has been a protracted process and is still not resolved. Concerns relate to the flow regime in the Summer Hill Creek system. While it has been demonstrated that the harvesting scheme does not impact on low flows, downstream licence holders have raised concerns about their ability to access their water entitlement. There is also an environmental concern relating to changes in the flow regime associated with harvesting, the removal of treated effluent from the system, and the impact of Suma Park Dam. All of these aspects are related and Council has commissioned a detailed environmental flow study to determine the most appropriate management strategy for the Summer Hill Creek system. This study will assist in identifying the level to which stormwater harvesting can occur.

Informal discussions with the Office of Water licensing section indicates that it may be possible to gain approval for Stage 2, however approval of Stage 3 and future stages is unlikely. Concerns are based on the potential impact on the creek system (Stage 3 harvesting would increase extraction from Blackmans Swamp Creek to 27% of the average annual flow) and the large proportion that stormwater harvesting would contribute in terms of raw water supply (an average of 55% of the unrestricted water demand).

The Macquarie Bogan Water Sharing Plan applies to the Summer Hill Creek water source. Clause 57(2) states that

> 'A water supply work approval must not be granted or amended to authorise the construction and use of a new in-river dam which, in the Minister's opinion, is being used or is proposed to be used to take water from the following water sources: …. (u) Summerhill Creek Water Source'.

This means that the proposed larger harvesting weir for Stage 3 would require Ministerial approval. Other advice is that it would require amendment to the WSP. This would make the approval process for Stage 3 difficult, contributing to the above conclusion that future stages are unlikely to be approved.

Tanks/reuse

- There are many ways Council can save water such as the mass installation of tanks and reusing water after it has been through the sewer treatment works.
- Other viable alternatives such as reusing waste water for non-potable use appear to have been dismissed.

Response:

Reusing waste water for non-potable and potable uses was considered by the IWCM Evaluation Study (Geolyse, 2012a). Supplying treated effluent for non-potable use was not short listed, as a result of the cost and limited potable water savings. Although the majority of treated effluent is supplied under agreement to Cadia Valley Operations (and is expected to be until 2030), an option for using treated effluent in an indirect potable reuse scheme was short listed and was noted in the environmental assessment as one of the alternatives. It was a low ranking option, particularly when economic criteria were included.

In relation to demand management options (including conservation), these options already form part of Council's Comprehensive Water Supply Management Strategy. Further consideration of these options is outside the scope of the environmental assessment.

The mass installation of rainwater tanks was considered in the IWCM Evaluation Study and considered as one of the alternatives. It is a very expensive option and does not result in a significant increase in secure yield.

3.4.5 An integrated regional solution

A regional solution should be adopted as the preferred option, rather than the pipeline which is a local solution.

- A regional water supply solution which services all the localities in the Central West should be developed instead of a project which ignores all localities except Orange.
- A new dam to service the region should be provided.

Response:

As noted in section 3.2.9, the project is an outcome of a regional approach to planning, and is supported by Centroc. The existing water supply system for Orange is not secure. An increase in supply is required immediately. A new dam to service the region may be a solution. However, it would come at a much greater cost than the pipeline project and would take considerably longer to develop (most likely at least a 10 to 15 year time frame). An option of constructing a new dam at Mulyan Creek was considered as one of the alternatives. This option ranked low due to the low yield and high cost.

3.4.6 Pumping water directly to the water treatment plant

The proponent should assess the option of storing water in a closed reservoir or pumping directly to treatment and reticulation as an alternative to pumping to Suma Park Dam.

- It is understood that Browns Creek, or Lake Rowlands may be better options.
- A more appropriate means of securing Orange's water supply would be an expansion of the capacity of the dam at Lake Rowlands.

Response:

Using a closed reservoir or pumping direct to treatment

Successful operation of the system would involve transferring water to Suma Park Reservoir when water is available in the river, to keep the reservoir fuller. Hence an operating rule involving a reservoir trigger point of 90% was set for the environmental assessment. This avoids entering a drought with the reservoir drawn down, when the water availability in the river becomes more limited.

The trade off with this method of operation is that the reservoir is kept fuller, which increases the average annual net evaporation loss and reduces the amount of the catchment runoff that can be captured. This latter effect therefore increases spill. The water balance results presented in the environmental assessment demonstrated that with the addition of water from the Macquarie River:

- the average annual net evaporation loss from Suma Park Reservoir increased by 54 ML/year
- the average annual spill increased by 1,078 ML/year.

To minimise evaporation loss, it has been suggested that water could be pumped from the river directly to the Icely Road Water Treatment Plant, or to a covered reservoir. However, the system

water balance shows that this would not change evaporation loss or spill from Suma Park Reservoir. This is because delivering water directly to the water treatment plant or to a covered storage would mean that the reservoir would be kept fuller. This is the same result as pumping water to the reservoir.

Several examples demonstrating this are provided in Figure 3.3. The top half of this figure shows the water balance if water from the river was pumped directly to the treatment plant for daily demands of 8, 12 and 18 ML/day. The bottom half shows the water balance with water from the river pumped to the reservoir for the same daily demands. **The change in storage (and hence surface area) remains the same for each case, which indicates that pumping directly to the treatment plant (or another reservoir) would provide no benefit in terms of evaporation loss or reduced spill.**

A slight variation would be to pump only the daily demand from the river up to a maximum of 12 ML/day. For example, on the day when the daily demand is 8 ML/day, only 8 ML could be pumped from the river directly to the treatment plant without the remaining 4 ML going to Suma Park Reservoir. This would therefore not increase the storage volume or surface area. This operating protocol was modelled and found to save an average of only 1 ML/year in evaporation and 3 ML/year in spill. However, operating the project in this manner would reduce the secure yield by 100 ML/year.

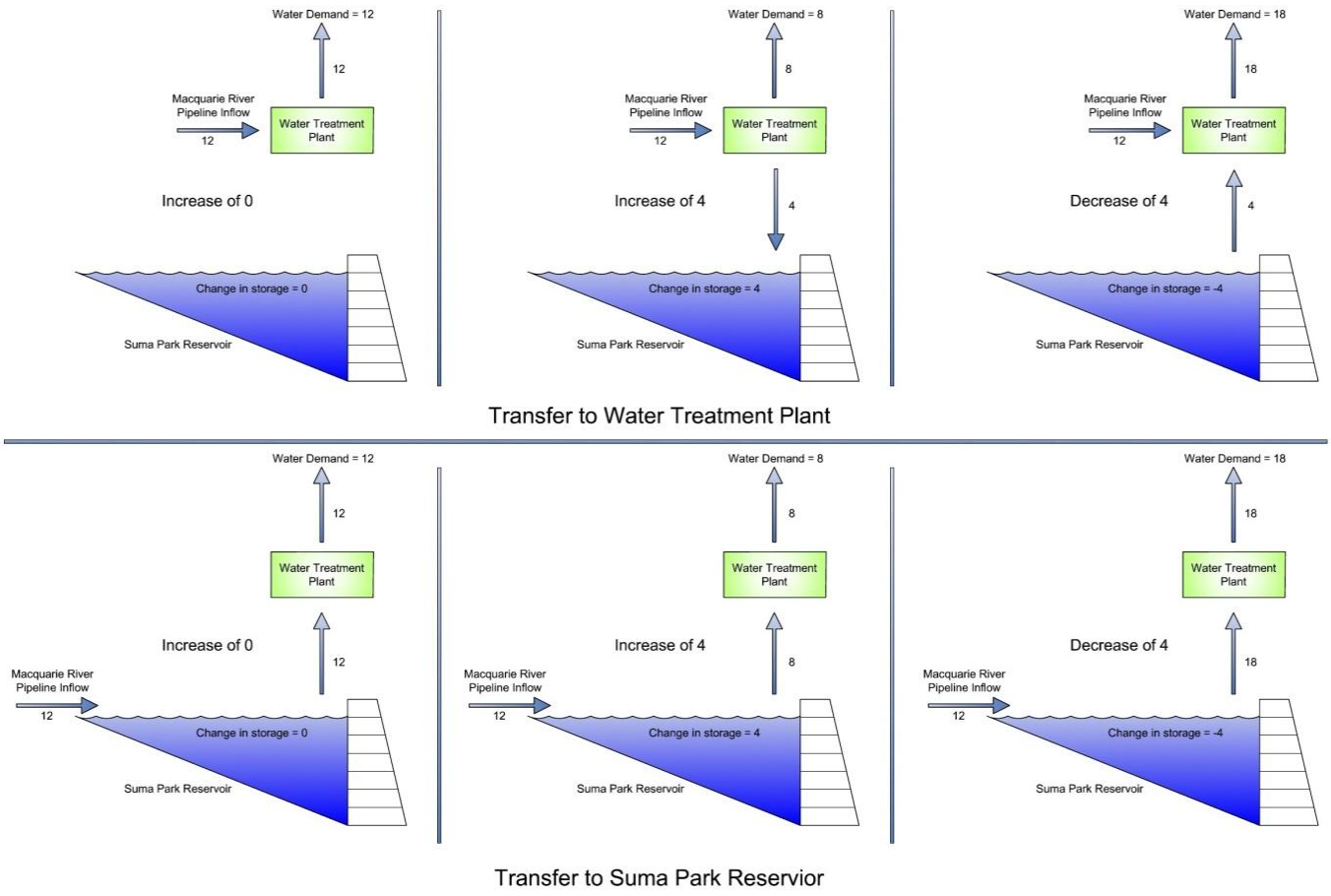


Figure 3.3 Suma Park Reservoir water balance comparing direct transfer option

3.4.7 The Browns Creek mine and Lake Rowlands options

- Browns Creek, or Lake Rowlands may be better options.
- A more appropriate means of securing Orange's water supply would be an expansion of the capacity of the dam at Lake Rowlands.

Browns Creek mine

The mine was closed after major water ingress from an underlying aquifer occurred in December 1999. The mine pit now contains an estimated 4,700 ML of water, with groundwater inflow causing a constant overflow into Cowriga Creek at a rate of between 0.4 to 1.0 ML/day. The option of using water from Browns Creek mine was assessed by the IWCM Evaluation Study (Geolyse, 2012a). The Office of Water advised that the most likely allowable maximum long term pumping rate of water from the mine would be around 2.2 ML/day. It was estimated that this would equate to a secure yield of around 1,000 ML/year.

As noted in section 3.4.2, there is water quality issues associated with water in the mine. Arsenic and antimony have been consistently detected in the mine water at levels above relevant health related drinking water guideline levels. Cyanide has also been detected, but has not been present in the mine water since 2002. A treatment system would be required, consisting of oxidation, chemical coagulation and filtration. A reverse osmosis treatment system would be required to remove cyanide.

This option was not short listed as the capital and treatment costs would be very high relative to other options. Further work and discussions with the Office of Water would be required to establish a sustainable extraction rate. Other issues include potential impacts on groundwater as a result of draw-down of water in the mining void.

Lake Rowlands

An augmented Lake Rowlands was a key recommended regional option of the Centroc water security strategy. In the short term, there is insufficient capacity in Lake Rowlands for it to play a significant regional water security role. Enlarging the dam to a capacity of 26,500 ML would increase the secure yield and provide additional water to a regional network.

In early 2012 the Minister for Primary Industries instructed the Office of Water to undertake an independent review of the secure yield analysis of the augmented Lake Rowlands. The results of the study indicated that under a climate change scenario, the secure yield from Lake Rowlands would be 3,150 ML/year, which is lower than the previous estimate of 4,600 ML/year. Central Tablelands Water has a baseline demand of 2,350 ML/year (excluding bores) and a commitment to supply Cowra with 1,278 ML/year in drought periods. These amounts equal 3,628 ML/year, which is greater than the secure yield of an augmented Lake Rowlands.

The results of this assessment indicate that there is unlikely to be significant 'spare' secure yield from an augmented Lake Rowlands to supply Orange, particularly when climate change is considered. In addition, the draft Water Sharing Plan for Lachlan Unregulated and Alluvial Water Sources places limitations on water access entitlements.

3.4.8 The Burrendong Dam option

Burrendong Dam would be a better solution, and would be a regional solution

- Consider options using Burrendong Dam – this would provide greater security.
- Installing a water pipeline section from Burrendong Dam to a railhead at Mumbil has not been explored in depth.
- A regional pipeline from secure water storage such as Burrendong Dam would be a better option.

Response:

The option of using a pipeline from Burrendong Dam was assessed by the IWCM Evaluation Study (Geolyse, 2012a) and was listed in chapter 8 of the environmental assessment as one of the options assessed by Council.

To ensure security the offtake point would need to be located on the downstream side of the dam, which would then make it part of the regulated supply. An access licence would be required to extract water for town water supply. If this option was pursued, it would be preferable to obtain a high security licence rather than a general security licence, which would be subject to allocation limitations. A high security allocation would need to be purchased on the open market. It is estimated that this could cost approximately $3,000 per ML increase.

A pipeline from Burrendong Dam to Orange would have significant capital costs. It would be around 78 km in length (compared to 39 km for the project), and would require four pump stations. For this option, sufficient licence allocation would be required to allow it to provide a secure yield increase similar to the project. It was assumed that this option could attract the same State Government grant ($18.2 million) as the project. The modelling undertaken determined that a 12.3 ML/day system transferring water whenever Suma Park Reservoir was less than 70% full could provide an increase in secure yield for Orange of 2,800 ML/year. The system was used in 82 years of the 118 years modelled. The long term average transfer for this system was 1,260 ML/year.

In summary, it was estimated that the cost of the Burrendong Dam to Orange pipeline option would be $1,681 per ML increase in secure yield. This compares to a cost of $408 per ML increase for the project. Both options would provide the same level of water security for Orange.

The Burrendong Dam pipeline option was considered by the Centroc water security study. It was not included in the short list as it was not considered to be feasible, and better options were available.

The option of a shorter pipeline to a railhead at Mumbil was not considered. Presumably this option would then transfer water to Orange in rail tankers. While this option would have lower capital costs, other studies suggest that it would have significant operating costs. For example, the water carting investigation completed for Council by NSW Water Solutions (2009) had daily operating costs of $153,983 to transport 3 ML/day by rail from Blayney to Orange. This would only supply around 1,100 ML/year and would have an annual cost of around $56 million.

Other options should be considered

- Need to more thoroughly investigate all options.
- There are cheaper viable alternative water sources such as Brown's Creek.
- Use existing water supplies in and around Orange.

- All the stated options (eg stormwater harvesting, bores, water reuse, Suma Park Dam etc) together would be a better option. If these were implemented, the project would not be needed.
- Council should redo its integrated water cycle management plan and take into account other sources of water. It should not assume that this pipeline or the stormwater harvesting stage II is 'business as usual'.

Response:

As noted in section 3.2.7, the project was one of 35 potential water supply options considered by a review of available water resources, undertaken as part of Council's IWCM Evaluation Study. Short listed options (including the project) were assessed against other options. As an outcome of this process, the project was identified to be the preferred option. It has the flexibility to operate at a rate that would meet both current and future demands.

Comment regarding the Browns Creek mine option is provided in previous sections. It is a more expensive option than the project.

As noted previously, the majority of treated effluent is supplied under agreement to Cadia Valley Operations. This is expected to continue until 2030 (the current estimated life of the mining operations). As a result, water reuse is not a feasible option at this time.

Council's 'business as usual' scenario includes obtaining full licensing of the existing stormwater harvesting schemes; Stage 2 of the Blackmans Swamp Creek stormwater harvesting scheme; bores; and raising Suma Park Dam. These options alone do not provide security for the 50 year strategic planning period.

In 2009 Council resolved to investigate several water supply infrastructure options to provide water security for Orange. The Macquarie River to Orange pipeline and Blackmans Swamp Creek stormwater harvesting Stage 2 were included in the options to be considered. According to the IWCM process, investigation of these options is part of Council's business as usual scenario, as they are actions that have been formally committed to through Council resolution.

Alternative locations for the pipeline should be considered.

- Landowners along Oaky lane have suggested that the pipeline would have less impact if the route was to traverse under the carriageway of Oaky lane.

Response:

Oaky Lane is heavily wooded with large mature trees and significant root/habitat damage could occur if the pipeline was located in the road reserve. The selected route minimises the potential for these impacts. Input to selection of this section of the proposed route was provided by ecologists on the project team.

3.5 Design and features of the project

3.5.1 Physical features of the project, offtake, pumping stations etc

What is meant in regards to minimum cover of 600 mm over pipeline – this implies that a potential final trench of up to 1,400 mm would remain (where the pipeline is laid at 1.2 to 2 m)? Presumably this is not the case or alternatively would create a hazard if not fenced off.

Response:

The trench would be reinstated back to natural ground surface level.

Graphic representations, such as an aerial view/indicative layout of the structures identified would be useful, particularly at the offtake site.

Response:

Refer Figure 11.10.

3.5.2 Project route

The exact route to the river has not been fully determined. The assessment is not valid because changes are proposed.

- A final route and pump site has not been fully identified. Full assessment of the impacts of all project sites must be conducted before the project can be considered.
- There is considerable uncertainty surrounding the route and off-take point, which is contrary to the Director-General's requirements.
- The assessment should be delayed until the preferred option is determined.

Response:

The environmental assessment assessed the concept design for the project as proposed at the time of preparation. As noted in section 1.2.2 of the environmental assessment, the route and project components described in the environmental assessment are indicative and conceptual, and Council may refine the design during the detailed design phase. Refinements have been made to part of the project. These refinements have been made as a result of:

- consideration of the issues raised in submissions
- changes in land availability
- further information provided by the environmental assessment and engineering design process.

The preferred project report considers the project with the proposed refinements (that is, the 'preferred project') and provides an assessment of the potential impacts of these refinements.

Lack of detail

- Lack of detail regarding where the project easement would be narrowed to retain biodiversity.
- The proponent states that the easement will be as wide as 60 m in the area close to the off-take point of the Macquarie River. This is unsuitable due to the native vegetation that would have to be cleared in this area
- No detail on creek crossings, depths etc.
- No design or location details of access road.

Response:

The environmental assessment assessed the concept design for the project proposed at the time of preparation. Assuming that the project is approved, the detailed design phase would involve further development of the design for the project, including project footprints, creek crossings and detailed design of the access road.

3.6 Operation of the project

3.6.1 Operating rules

Queries regarding the proposed operating rules

- There is a lack of flow data for the flow ranges related to the proposed commence to pump trigger. The rating curve needs to be improved prior to commencement of operations and/or a higher flow trigger adopted to protect low flows until sufficient data has been obtained.
- s. 6.3 - It is noted that the description of the project is largely on the basis of the average operation of the project (1,616 ML/yr, extracted over 135 days, at max. rate of 12 ML/day for up to 19 hours per day) however the environmental assessment should assess the "worst case scenario" (up to approx. 3804 ML/yr?). This should be defined and confirmation that the assessment has been undertaken on this scenario should be provided.
- Table 6.2 - There appears to be an error in table in relation to (if nothing else) pH and turbidity. Please confirm whether figures quoted are correct or if only the units are incorrect. What happens if trigger levels are not met?
- Need to provide greater details on how the 38 ML/day figure was calculated

Response:

Rating curve and low flow data

The gauging station 421192 - Macquarie River downstream of Long Point, was installed and commissioned in June 2011. Sixteen stream gaugings have been completed to date, with the lowest gauging at a flow of 7.99 ML/day. The rating curve was updated on 15 January 2013 taking into account this lowest stream gauging. The current rating table (RT 115.03) is showing good agreement with the river gaugings in the low flow range. Further data needs to be obtained across the flow regime, to confirm the accuracy of the rating curve.

There is likely to be the opportunity to obtain more stream flow data during the construction period. This data would improve the rating curve and level controls for the system, and would provide an input to the development of the decision support tool for Council's water supply, as discussed in section 3.7.

Further information on the catchment modelling scenario is provided in section 3.2.3.

Defining a 'worst case' scenario

The potential impact of the project on river hydrology was assessed for long term averages as well as dry and wet periods (refer chapter 10 and Appendix D of the environmental assessment). One of the dry periods assessed (the Federation Drought) included the maximum extraction year. This year did not represent the maximum extraction in terms of the proportion of river flow extracted. This occurred in 'model year' 1944, when 5.96% of the annual river flow (1,092 ML) was transferred. A similar proportion (5.94%) was transferred in model year 1982, when 1,248 ML was transferred. This was assessed as one of the dry periods.

It is difficult to define what a 'worst case' scenario - is it based on the maximum annual transfer (which could occur in years when there is a large volume in the river) or the maximum proportion extracted? In either case, any 'maximum' is only a transient occurrence. Both of these types of worst case scenarios were considered in the assessment of dry periods by considering daily flow duration curves and daily flow series.

Clarification of Table 6.2

The units shown for pH should be pH units. The units shown for turbidity should be NTU. This table shows water quality targets for drinking water supply and does not relate to the targets for the river water.

Derivation of the 38 ML/day pumping threshold

Initially, the assessment of the project used a 'cease to pump' threshold of 34 ML/day (also called the '12/34 operating rule'). This was based on the 80th percentile flow for the Scenario B flow series plus the proposed 12 ML/day daily extraction rate (that is, 22 plus 12 ML/day equals 34 ML/day). However, as the pumps would only operate for 19 hours per day, the 'equivalent' daily flow during pump operation is less than 22 ML/day, or 18.8 ML/day when considered on an hourly basis. Therefore, a 38 ML/day flow threshold was adopted (the 12/38 operating rule). **Using the 38 ML cease to pump threshold means that during operation, the downstream river flow would reduce to the equivalent of 22.8 ML/day. Adopting this higher cease to pump threshold ensures that equivalent daily river flow is not reduced to below the 80th percentile flow (that is, low flows).**

3.6.2 Pumping operation and flow rates

Pumping during high/low flows

- The pipeline will only extract water in periods of high flows above 30 ML. The Office of Water has a flow chart that shows low flows in an unregulated river as is the Macquarie River end at 200 ML before being classified as a moderate flow.
- Pumping would mostly occur at lower flow rates when rain events were below average thus placing extra stress on the aquatic ecological communities in the Macquarie river

Response:

The modelled data for the river at the offtake point shows that the 80th flow percentile is 22 ML/day. This was used to determine the 'cease to pump' trigger, as described above. The chart referred to in this submission is likely to be a typical flow duration curve for an unregulated river, not a flow duration curve specific to the Macquarie River at the proposed offtake point.

Pumping for the project *would not* occur during low flows. By adopting the proposed 38 ML/day pumping trigger, pumping would only occur during Class B (that is, low to moderate) and Class C (moderate to high) flows. There would be no pumping during Class A (low flows). The flow classes are defined in the glossary at the beginning of this report. Further information on flow classes is provided in section 2.2.2 of Appendix D to the environmental assessment.

Starting/stopping, rates

- Please clarify when pumping is proposed to start and stop. It commences at what level below 90% and stops at what level above 90%?
- At what point below 90% and above does extraction start/stop? Once it commences does it continue to FSL? Presumably this would be addressed in the operating rules.
- Clarify the maximum daily pumping rate. It is mostly stated as 12 ML/day however Table 6.1 implies it could be up to 15 ML/day.

Response:

Starting/stopping and the Suma Park Reservoir trigger

The operation of the project was assessed based on the operating rules defined in section 6.3.2 of the environmental assessment (refer section 3.7 below). These include pumping when the storage level in the Suma Park Reservoir is less than 90% full. In relation to this trigger, the model algorithm only allowed transfer if the volume in storage was less than 90%. Therefore pumping could occur whenever the storage was less than 90% full (and the river flow conditions are met). The pumps would stop at 90% full.

This rule was adopted for the purposes of impact assessment. Council would develop a decision support tool that would include overall system operating rules to optimise how the entire water supply system is operated. This may involve adjusting the Suma Park Reservoir trigger in response to climatic indicators or lower demand. In any case, the adopted trigger level would represent the start and stop for the transfer. Further information is provided in section 3.7.

Maximum daily pumping rate

The maximum daily transfer is 12 ML/day. The data presented in Table 6.1 for the dry periods shows an average of the transfer volume over the three periods assessed of 2,300 ML/year (noted as approximate). The volume transferred ranges from 1,782 to 2,838 ML/year, which when divided by the number of pump days per year, gives a daily transfer of around 12 ML/day.

How to ensure that pumping stops

- To ensure that pumping stops at the flow rate stated, a continuous real-time flow monitor would be needed immediately below the offtake pump. The proponent stated that the flow rate of the River will be checked every 15 minutes, however I cannot see any mention of this in the environmental assessment.

Response:

The river gauging station (Macquarie River downstream of Long Point, Station 421192) would provide information to control the pump operation. This gauging station logs the river height every 15 minutes, with the information on the Office of Water's website updated every hour. The pump control system would be linked to the gauge and would receive river level information every 15 minutes. Therefore, if the river level falls below the cease to pump threshold at any time, the pumps would turn off.

3.6.3 Water quality triggers for operation

Water quality triggers

- Need to consider water quality and ecological considerations in the low flow regime as low flows and high temperatures can lead to potentially anoxic conditions and blue-green algae blooms. Monitoring needs to be included in the OEMP and pumping strategies should be developed to minimise exacerbation of these issues.
- Water quality pumping rules are not indicated in the environmental assessment. What are these likely to entail? What are the water quality measures for extraction that is, parameters and trigger levels or at what point is water quality not appropriate for extraction? If only one parameter is not met does that mean that water would not be extracted or does it need to be a combination of parameters?

Response:

The system would not operate during low flows. The water quality triggers would be determined during development of the decision support tool for the project (refer section 3.7).

3.6.4 Interactions between operation of this project and other water supply infrastructure

How will the proposed raising of Suma Park Dam affect the operation of this project?

- Particularly with respect to the pumping rules and spills from Suma Park Dam, any reduction in flows below Summer Hill Creek or increased pumping.

Response:

The assessment of the potential impacts of the project included operation with and without the raising of Suma Park Dam. The water balance results are presented and discussed in Appendix D of the environmental assessment. In this assessment, 'Run 3' is the transfer and the existing Suma Park Dam, and 'Run 4' is the transfer with the dam raised by 1.0 m. A summary of the results of Run 4 (compared to Run 3) is as follows:

- larger net losses due to a larger storage surface area
- slight increase in the stormwater harvesting input due to the larger storage volume
- average annual spill volume is less, as the larger storage captures more of the catchment inflow
- greater water demand is supplied
- increased average annual flow in Blackmans Swamp Creek - a balance of additional treated effluent discharge less the additional stormwater harvesting
- slight reduction in the average annual flow in Summer Hill Creek due to the reduced spill volume.

Is additional water likely to be provided to or be committed to Cadia Mine?

- The Mine's assessment does not indicate increasing the amount of water from Orange despite the expansion.

Response:

The project would not be used to supply raw or potable water to the mines. Refer section 3.2.1 for further information on the supply of water to Cadia Holdings.

Would operating the project result in over reliance on this scheme as compared to others?

- Would it result in the stormwater harvesting scheme not being used, as pumping is proposed when dam levels are less than 90% rather than using the stormwater harvesting scheme when dam levels are less than 50%.

Response:

Council has two stormwater harvesting schemes. The modelling was based on the assumption that both would be operating on a 100% trigger; that is, used whenever Suma Park Reservoir is less than 100% capacity (compared to a 90% trigger for the project). This means that the stormwater harvesting schemes would operate in the first instance. The water balance result shows only a small reduction in the input from the stormwater harvesting schemes with the addition of the project.

3.7 Decision support tool and integrated operating rules for the Orange Water Supply System

As noted in previous sections, Council is developing a decision support tool that would include a set of integrated operating rules to optimise the use of the various external water sources. The project operating rules used to assess the impacts of the project were defined in section 6.3.2 of the environmental assessment. The rules stated that the project would extract up to 12 ML/day when the following conditions are met:

- the storage level in the Suma Park Reservoir is less than 90% full
- the flow in the Macquarie River exceeds 38 ML/day
- the water quality within the Macquarie River is acceptable for extraction purposes.

These were considered to provide a conservative basis for impact assessment purposes. Other model assumptions that resulted in a conservative basis for the assessment included:

- using the Scenario B river flow series which reflect a river system with less water in the future
- continued population growth (and hence water demand growth) beyond 50 years, which increases the long term annual averages derived from the modelling.

In effect, these allowed for a 'worst case scenario' in terms of the amount of water transferred from the river. If approved, the project would form part of Orange's overall water supply system, and function as an additional source of water supply. The assessment has demonstrated that the addition of the project would provide long term security for Orange's water supply. In the shorter term, to provide an adequate secure yield buffer above the level of demand, it does not need to be operated to the maximum amount assessed. The project was developed for a 50 year planning period. However, it can be implemented in stages as demand grows with population growth. Operating the pipeline at a lower secure yield level would reduce the volume transferred from the river and provide more storage space to capture catchment runoff. Reducing the yield from the project could be achieved by one or a combination of the following:

- lowering the trigger level in Suma Park Reservoir
- increasing the river flow trigger
- reducing the daily volume transferred from the river (by reducing the pump time)
- adopting a percentage of river extraction to limit the extraction around the river trigger flow.

One of the commitments included in the draft (and final) statement of commitments is that Council's approach to management of the project would involve developing and implementing a decision support tool to manage the operation of the water supply system as a whole (including the project). The decision support tool would include a set of integrated operating rules for management of the overall Orange water supply system, which would aim to:

- minimise raw water costs
- assist with the sustainable management of water drawn from the bores, Blackmans Swamp Creek, Ploughmans Creek and the Macquarie River
- maximise use of the existing surface water systems through consideration of existing inflow patterns and long term weather outlooks
- provide a means of accounting for environmental flow releases from Suma Park Dam.

The operating rules would apply to the Orange city water supply system only. A framework for developing these rules, including the scope and suggested approach, is provided in Appendix C.

4. Issues relating to hydrology and water security

4.1 Summary of issues raised

Issues and queries relating to the potential impacts of the project on the Macquarie River, other users and the downstream river flow environment, were raised in a number of submissions. Common issues, concerns and queries included:

- how potential impacts were assessed, the validity of the model, data and figures used
- the water licensing arrangements that would apply
- the impacts on water levels and flows in the river, and the potential for significant impacts during periods of low flows, and impacts on the downstream environment
- impacts on existing downstream water users
- impacts on future water security for other users/communities
- supply of water during droughts when flows in the river are low.

These issues, and other key issues raised in relation to the impacts of the project on hydrology and water security, are considered in the following sections.

4.2 Assessment queries

4.2.1 DP&I questions

In figure 10.7, why does it show a drop after October 10 compared to actual data?

The model used for this assessment has inbuilt rules for water restrictions that are linked to the total combined storage volume. The combined storage reached 100% in August 2010. At this level of combined storage there would be no water restrictions. However, Council resolved to keep the Level 2 water restrictions in place. This maintained the storage levels at or around 100% at the end of 2010. The model algorithm determines that there would be no water restrictions and therefore a higher demand. Hence the higher demand in the modelled case draws down the combined water storage.

Why is the modelled max extraction in 1896 3,876 ML/year but the average 1,616 (0-3,804) ML/year?

The modelled maximum extraction used in the Integrated Quantity and Quality Model (IQQM) was 3,876 ML/year in model year 1896. This extraction was determined using the original 12/34 operating rule (that is, extraction of up to 12 ML/day when the flow in the river exceeds 34 ML/day[1]). A footnote in section 4.6.2.2 of Appendix D of the environmental assessment explains that the IQQM assessment was undertaken using data for the 12/34 operating rule and was not re-visited for the 12/38 operating rule.

Under the 12/34 rule, the long term average annual extraction was determined to be 1,665 ML/year. As this is more than that under the proposed 12/38 operating rule (that is, 1,616 ML/year), it was

[1] The change from the original 34 ML/day threshold to the 38 ML/day threshold is explained in section 3.6.1.

considered that the 12/34 IQQM assessment would provide a conservative assessment of the potential impacts of the project. Furthermore, the different in average annual extraction between these two values (49 ML/year) is well within the error range of the models used. Therefore, the IQQM assessment was not updated for the 12/38 operating rule. All results presented and discussed in this section were based on the higher average annual extraction derived for the 12/34 operating rule.

Groundwater decrease in Macquarie River is calculated to be 19 mm but elsewhere in the report its 23 mm – what is the correct value?

The environmental assessment notes in relation to water level decreases in the Macquarie River (pg 10.8):

> Computed changes in water level at Gardiners Hole (at the offtake point) during operation of the project were modelled. The maximum water level reduction in Gardiners Hole would occur when the pump triggers at a flow of 38 ML/day and reduces the flow to the equivalent of 22.8 ML/day. In this instance, the reduction in water level would be 23 mm. This would only occur on only 0.11% of the total pump days over the 118 years modelled.

The 23 mm decrease refers to the maximum water level decrease in Gardiners Hole (that is, a surface water decrease). The figure of 19 mm was an original figure derived for the 12/34 operating rule, when it was incorrectly assumed the river flow would drop from 34 to 22 ML/day (the instantaneous flow would in fact drop to 18.8 ML/day). This was revised during the assessment of the 12/38 operating rule and the correct maximum drop is 23 mm. It was incorrectly transcribed to the environmental assessment.

Clarify what annual volume of extraction has been assessed or what annual or average volumes are used in each part of the assessment. Most figures refer to average extraction of 1,020 ML.

On average the project would deliver 1,616 ML/year of water to Suma Park Reservoir.

p. 10.12 – The location of Marebone Weir is not clearly shown. Can a figure be provided showing this?

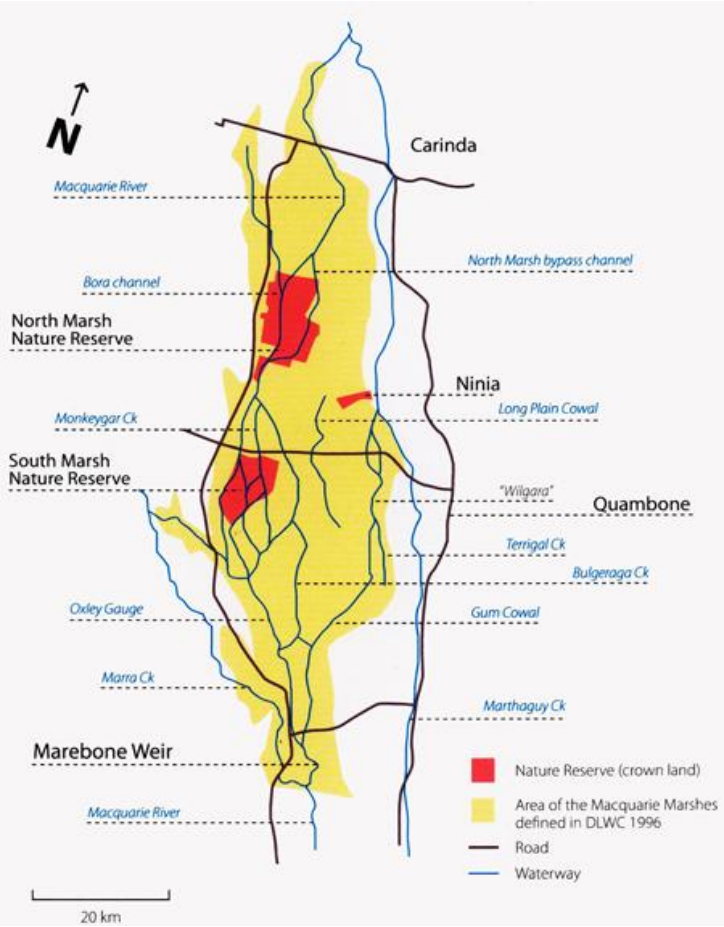
Refer to Figure 4.1.

p. 10.17 - Reference to the environmental flow study for Summer Hill Creek. When will it be complete and a copy provided?

The Stage 2 draft report 'Summer Hill Creek environmental flow determination' (Entura, November 2012) has been provided to Council. This report proposes four environmental flow rules aimed at improving conditions in the Summer Hill Creek system. A key conclusion of this report is that operation of proposed future harvesting schemes (Blackmans Swamp Creek stormwater harvesting and the project) will reduce the frequency that the proposed dry condition base flow and annual fresh rules (proposed Rules 2 and 3) will be enacted. Also, the addition of water from other sources will also increase the likelihood that water will be reserved in any one year for the dry period water reserve (Rule 4) (Entura, 2012).

p. 10.18 - Decision support tool – the information provided is quite generic and non-committal. Confirmation is required.

Further information on the integrated operating rules for the Orange water supply system, which forms the basis of the decision support tool, is provided in section 3.7.



Source: http://www.macquariemarshes.org.au

Figure 4.1 Location of Marebone Weir in relation to the Macquarie Marshes

Note reference to permanent transfer of 640 ML from unregulated licence. What is the likelihood that this would occur and what are the implications if it is not?

Council holds an option for the purchase of a 640 ML/year unregulated water access licence. This would be transferred from an upstream location on the Macquarie River to the proposed offtake point if the project is approved. Council is committed to purchasing this licence if the project obtains approval.

The transfer is permitted under the Macquarie Bogan WSP.

In the very unlikely event that the transfer is not completed, Council would use a temporary transfer of a portion of its town water supply access entitlement to cover extraction from the river (as described in section 6.3 of the environmental assessment).

4.3 Use of modelling by the impact assessment

4.3.1 Concerns about the model used

Modelling concerns

- The IQQM model has not been used appropriately.
- Greater effort is required to improve the modelling in relation to the proposal's potential impact on the Macquarie Marshes and water users within the regulated system.
- Questions the use of a modelled flow duration curve to assess the impacts of the proposed extraction.

Response:

The Office of Water's IQQM is a hydrologic modelling tool developed by the NSW Government for use in planning and evaluating water resource management policies[2]:

> The main surface water model used for water sharing and management is the Integrated Quantity and Quality Model (IQQM). IQQM has been developed to assess the impacts of different management strategies on all water users. The models have been developed to simulate the major hydrological processes in river valleys along with relevant management rules. These models have been calibrated to match reservoir levels, diversions and flows over the calibration periods. The models are set up in such a way as to reproduce the average long term behaviour of the river system for planning purposes and not specifically to reproduce individual daily flow behaviour in any particular year, or to forecast any future year.
>
> IQQM models have been developed for most inland river basins and some coastal river valleys. The models can be used to obtain a range of information on simulated river system behaviour ranging from average summary statistics to specific event or sequence details.
>
> These models are used in different water management areas such as:
>
> - Water sharing plans
> - Auditing NSW compliance with the Murray-Darling Ministerial Council Cap
> - Estimating the baseline salinity condition of NSW rivers in the Murray-Darling Basin
> - Strategic and operational hydrologic matters

Examples of the application of IQQM in the Macquarie River basin include:

- Assessment of the average long term extraction limits for the Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2003 (Government of NSW, 2006) – this plan applies to the Macquarie River downstream of Burrendong Dam and the Cudgegong River downstream of Windamere Dam.
- Assessment of water availability in the Macquarie-Castlereagh system including an assessment of the impact on the Macquarie Marshes under different climate and development scenarios (CSIRO, 2008).

In terms of the Macquarie Marshes, IQQM has in-built rules for environmental water management that meet the requirements of the Macquarie-Cudgegong WSP. Water managers may at any time choose not to follow these rules; however IQQM cannot be used to predict how these individual decisions may impact on environmental water availability.

The application of the IQQM model to the assessment of the project was based on the following question: *If the rules remain the same, how would the extraction of water upstream of Burrendong Dam change the volume of water available for the Macquarie Marshes?*

[2] http://www.water.nsw.gov.au/Water-Management/Modelling/default.aspx

The only change between the two model runs was the extraction upstream of Burrendong Dam. This is the most appropriate means of defining the potential impacts of the project.

Concerns about the type of model and figures used to assess the potential impacts on the river were raised

- Use of statistically inappropriate strategies for evaluation of flows in the Macquarie River.
- Low flow modelling using the IQQM and other models have major limitations.
- Some important, inconsistent results are identifiable, particularly for alternative water sources. A key source document for the modelling results is not provided in the environmental assessment.
- Use of annual average figures is inappropriate because it hides the data extremes and frequency distributions that are environmentally critical.
- The river system modelling is unsatisfactory because it uses a hypothetical, ten year calibration period. Evidence should be provided of the results of rigorous performance testing of predictive river flow modelling.
- The hydrology model does not represent how environmental water is managed from Burrendong Dam.

Response:

Evaluation of flows in the Macquarie River

Assessment of the project used 118 years of modelled daily river flow data. This data was assessed in several ways:

- The daily flow data was used to derive flow duration curves. These are a common means of representing long term river flow information, as they show how often a flow of a particular size is likely to occur. Changes resulting from the project can then be seen through changes in the flow duration curves with and without the project operating.
- Impacts of the project were assessed for each flow decile, including changes in flow and changes in river flow depth.
- The 118 years of daily data were used to derive measures such as averages (volumes, days pumped etc) and ranges to establish and describe long term changes.
- Daily data through wet and dry periods was assessed using daily flow series and flow duration curve analysis.

This level of assessment is considered to be appropriate for the project.

Low flow modelling using IQQM

IQQM was not used to define low flows through the Macquarie-Cudgegong river system. Instead, as described above, it was used to determine if the extraction of water upstream of Burrendong Dam would impact on the ability to operate the regulated section of the river system in accordance with the Macquarie-Cudgegong WSP.

It is noted that the project has been designed *not* to operate in low flows.

Inconsistent results

This submission makes reference to Table 4.4 and 4.23 of Appendix D of the environmental assessment for the Federation Drought period, stating that they show different results for the inflow to Burrendong Dam over this period. It should be noted that Table 4.4 shows the annual river

volumes for the Macquarie River at the proposed offtake point whereas Table 4.23 shows the inflow to Burrendong Dam, which includes the river system downstream of the proposed offtake point, including the Cudgegong River system and releases from Windamere Dam. The annual totals in these tables therefore cannot be compared.

A summary of the alternative water sources and explanation of some of the perceived inconsistencies/issues raised by submissions is provided in Table 4.1.

Table 4.1 Alternate water sources and issue responses

Option	Secure yield (ML/year)	Issue raised	Response
Option SW3: Macquarie River pipeline	2,700	The data source (Geolyse 2012a in Appendix D) for the 2700 ML is not available in the environmental assessment.	Derivation of the secure yield result for the project (2,700 ML/year) is described in section 4.4.1.2 of Appendix D of the environmental assessment. The secure yield results presented in the environmental assessment for alternatives were sourced from the work undertaken for Council's IWCM Evaluation Study.
Option SW1: Suma Park Dam raising	100 - 200	This secure yield is approximate and within 100% variation, which does not apply to other secure yield estimates. The dam security works should be completed before any additional water source is added to the storage.	Section 3.4.3 describes how the additional storage volume does not translate to additional secure yield. The secure yield range provided in the environmental assessment of 100 to 200 ML/year are the results for various model runs for a 1 m raise of the dam wall and assumptions relating to the addition of external water sources. Furthermore, at the time of undertaking the assessment, the impact of potential changes in environmental flow rules was not known. Therefore, the potential secure yield increase is presented as a range. Council has recently resolved to increase the full supply level of the dam by 1.0 m in conjunction with dam safety works.
Option GW1: bores	350	This source is part of the water security strategy. It is unclear why there is a reduction from the average yield and the secure yield. These are fractured rock bores near Orange.	This represents supply from four existing bores that are connected to the raw water supply. At the time of the assessment, Council held a licence to extract 75 ML/year, which equated to a secure yield of 100 ML/year. Council had made application to the Office of Water for additional licences to increase the average yield to 462 ML/year. Therefore, getting approval of the licences would add an additional 350 ML/year of secure yield.
Option SH0: Blackmans Swamp Stage 1	900; 200	This source is part of the water security strategy. It is unclear why there is a reduction from the average yield to the secure yield for Stage 1b and especially when Stage 1a has a significant increase to the secure yield.	With regard to Stage 1a, the secure yield figure is the combined secure yield from Blackmans Swamp Creek Stage 1a and the Ploughmans Creek stormwater harvesting schemes. As described in section 3.2.2, secure yield is different to long term averages. With regard to Stage 1b, the long term average extraction from Blackmans Swamp Creek increases to 848 ML/year as the system is used at all times when Suma Park Reservoir is less than 100%. However the additional secure yield supplied during the critical drought period (which defines secure yield) by moving from a 50% to 100% trigger is only around 200 ML/year.

Option	Secure yield (ML/year)	Issue raised	Response
Option SH1: Blackmans Swamp Stage 2	900	Council has rejected this source due to (solvable) issues regarding environmental flows in Summer Hill Creek. It is unclear why there is a reduction from the average yield to the secure yield.	Issues relating to existing and expanded stormwater harvesting are described in section 3.4.4, and relate to more than environmental flows in Summer Hill Creek. It is noted that secure yield is a different measure to long term averages. It is the amount supplied by the harvesting scheme through the critical drought period.
Option SH2: Blackmans Swamp Stage 3	1,000		
Option SW4: Burrendong Pipeline	2,800	Council has rejected this option on cost grounds. The average yield and secure yield is based on a 12.3 ML/day pipeline to Orange. This source could provide water to a wider regional area.	Comments on the Burrendong Dam pipeline option are provided in section 3.4.8.
Option RW1: Rainwater Tanks	300	Counil has rejected this option on cost grounds. Council's costing for this option was challenged.	The costing used in the IWCM Evaluation Study was supported by independent quotations received from licenced installers. In addition, this option provides limited secure yield as the volume supplied by rainwater tanks is less in dry years (i.e. through the critical drought period).
Option E2: IPR (indirect potable reuse)	3,330	Council has rejected this option on cost grounds. This option ignores use of any of the 3,000 ML/yr of wastewater reuse for non-potable purposes.	Despite treated effluent not being available due to the existing supply agreement with Cadia Valley Operations, an option for using treated effluent in an indirect potable reuse scheme was short listed and considered as one of the alternatives in the environmental assessment. It was a low ranking option, particularly when economic criteria were included.
Option SW5: Mulyan Creek Dam	430	Council has rejected this option on cost grounds.	This option was considered. It is a low ranking option due to cost and low secure yield.
Wastewater reuse for non-potable purposes Not assessed by OCC	At least 3,000	Council has refused to consider any use of this water, for a period of time, because of a contractual arrangement with the Cadia mine which is to cease operation in 2030. Some of this water could be used in the dual water supply in new residential developments in Orange or to provide environmental flows for Summer Hill Creek and thus permit more stormwater harvesting.	Currently, and until 2030, the majority of treated effluent is supplied to Cadia Valley Operation under the existing supply agreement. It is simply not a consistent source available to Council. Despite this, Council's IWCM Evaluation Study considered options for non-potable reuse. The dual reticulation area, once fully developed, is expected to save an average about 600 ML/year of potable water.
Browns Creek groundwater source Not assessed	Not assessed	This is a very viable source for town water supply.	The Browns Creek Mine option was assessed as part of Council's IWCM Evaluation Study. Refer to comments in section 3.4.2 and 3.4.7.

Average annual figures

As discussed above, the assessment of hydrological impacts did not rely solely on long term averages. Flow duration curves represent the river variability and define low and high flows across the entire flow regime.

Model calibration period

The catchment models were calibrated using all available data at the time of the study. The data and how it was used is described in Table 2.5 in Appendix D of the environmental assessment and included:

- 24 years for the Campbells River upstream of Chifley
- 24 years for the Macquarie River at Bathurst
- 19 years for Emu Swamp Creek at Llewellyn
- 56 years for the Macquarie River at Bruinbun
- 64 years for the Turon River at Sofala.

Calibration of the models showed good agreement with the historical data and with the NSW Office of Water's streamflow data set. The use of additional catchment losses to derive the Scenario B dataset was based on observed river flow data which is described in the environmental assessment. The Scenario B dataset was derived to provide a conservative basis for the impact assessment.

Management of environmental water from Burrendong Dam

Refer to response in section 4.3.1.

Concerns about the scenario used.

- Concerns with using the Scenario B model.
- If Geolyse had based their model on all the historical flow data (Scenario A) the 80th percentile flow would have been 90 ML/day (p 51/139 3.3.2.1 Figure 25). The advantage for the proponent is that by basing the operating rules on Scenario B pumping can continue until the flow is 22 ML/day. Based on Scenario A, pumping would have to stop at a flow of 90 ML/day.

Response:

Refer to section 3.2.3.

4.4 Water access licences

Licences

- The proponent could consider the purchase of regulated licences to be made available to the environment as an offset, given the uncertainty around the impact of the proposal on downstream flows to the Macquarie Marshes because of the inadequacy of the modelling.
- The Macquarie-Bogan Unregulated and Alluvial Water Sharing Plan commenced on 4 Oct 2012. The gazetted version has some minor amendments to the draft considered in the environmental assessment, including the enabling of specific access rules for any access licence used for the project. Attention is also draft to new clauses 53(2) and 53(3).
- The proponent will be required to transfer the required Water Access Licences.

Response:

Refer to section 4.3.1 and 4.6.2 in relation to the potential for impacts on the Macquarie Marshes. As noted in the environmental assessment, the assessment of the potential for the extraction of water for the project to impact on the Macquarie Marshes concluded that the impacts would be:

- negligible in terms of the entire system flows and potential changes

- within the uncertainties of the models used for river planning (refer section 4.6.2.2 of Appendix D to the environmental assessment).

As noted in section 3 above, the impact assessment was based on a worst case scenario, which means that the actual impacts are likely to be a lot less. An appropriate assessment method was used, and given the very minor changes predicted, the purchase of unregulated licences to provide offsets is not considered to be warranted.

Council would transfer the 640 ML unregulated licence and make annual transfers from the existing 7,800 ML/year town water entitlement as required to ensure it holds proper access rights for the water extracted by the project. This has been reinforced in the final statement of commitments for the project.

Further discussion about the water licence required

- Is it a sleeper licence?
- If it is currently not is use now how will this affect the water extraction from the upper Macquarie River compared to what is currently being extracted?
- How is this considered in the Water Sharing plan?

Concerns about the use of sleeper licences

- Concerned about activating of sleeper licences to provide the water to the orange pipeline. If the water was purchased from existing active entitlements we could have a different view on this matter.
- The purchase of an option on an upstream (of the proposed take off point) irrigation licence may require some further investigation because of the possibility that it may be a “sleeper” licence.

Response:

As noted in section 4.2, Council holds an option for the purchase of a 640 ML/year unregulated water access licence. The 640 ML/year licence is included in the Macquarie Bogan WSP and its transfer is permissible under this plan. It is understood that this licence is a sleeper licence. The fact that it is a sleeper licence is irrelevant, as it could be used at any time either by the existing licence holder or by any person who purchases and transfers the licence. If Council transfers this licence, it would avoid a double up effect, that is, the proposed extraction by Council plus the extraction under the 640 ML/year licence if held by another party.

A few submissions queried how the project would be licensed, impacts on other licensees, and general security entitlements

- The reliability of all general security water in the Macquarie is only 51%. This means that twice the average annual flow of the river is issued in general security entitlements.
- In the long term Council will need more than Suma Park dam licence entitlement to meet a growing demand with future population growth, and the availability of infrastructure storage capacity has a direct impact on system secure yield.
- Concerns with water licence entitlements for irrigators downstream.

Response:

It is assumed that this comment refers to the regulated river general security and the available water determination announcements (previously referred to as allocation announcements). The proposed offtake point is in the unregulated section of the Macquarie River and therefore has not been the subject of any available water determinations.

As noted in section 3.2.1, Council holds a town water access entitlement of 7,800 ML/year, which is sufficient to meet the projected water demand to around 2055 to 2060.

There are no irrigators downstream of the proposed offtake point in the unregulated section of the river. **The results of the assessment of the regulated section demonstrated that the modelled changes in river flow would not detrimentally impact on the ability of the regulated system to operate in accordance with the Macquarie-Cudgegong Water Sharing Plan, including supply of water to general and high security users.**

4.5 Impacts on Macquarie River flows, heights, riffles etc

The proponent should provide further detail on the impacts of pumping on flows through riffles

- Expected to have an impact on any day the pump is in use not only on the days when minimum pumping conditions are experienced.

Response:

Potential changes in riffle sections downstream of the proposed offtake point were assessed by approximating the riffle sections as a trapezoidal channel with a flat bottom and uniform side slopes. Each riffle would be different in terms of its shape, including width, side slopes, longitudinal slope etc. Furthermore, along each riffle there would be deeper and shallower sections/channels as water moves in and around rocks. Therefore, the approximation approach was adopted to assess the potential impacts.

Hydraulic calculations were based on Mannings equation for open channel flow using the following parameters:

- trapezoidal channel shape
- base width – varies from 5 to 20 m
- side slopes – 2:1 (horizontal to vertical)
- Mannings n = 0.04 (bottom: gravels, cobbles, and few boulders)

The assessment considered changes in:

- hydraulic measures riffle sections when the project operates at a river flow of 38 ML/day
- number of days that depths of 0.2 and 0.3 m would occur through riffles sections – this is the minimum depth of water required for large bodied fish to navigate riffle sections.

The results of this assessment were used by the aquatic ecology assessment which formed part of the environmental assessment. Further discussion is provided in section 6.

Impacts on the river

- What are the real impacts on the Macquarie River environmentally by taking this water out? Will it create another debacle such as we have with the Murray/ Darling system?
- Will the operation of the project result in longer periods of low flows?

Response:

The results of the assessment of impacts of the proposed extraction are presented in the environmental assessment. The extraction of up to 7,800 ML/year for the Orange town water supply is allowed for in the Macquarie Bogan Water Sharing Plan.

As the project would not operate during low flows, operation would not result in longer periods of low flow.

How would the project affect the flow and amount of water in the river system?

- Concerns included that the project would impact on water levels and flows, and that there would be significant impacts during periods of low flows.
- The river needs all its water in times of low flows.
- The water requirements of the river should be considered.

Response:

The project can be operated consistent with the NSW River Flow Objectives, with particular emphasis on protecting low river flows by adopting the proposed cease to pump threshold (refer section 3.2.3 and 3.2.8). This protects basic stock and domestic rights and environmental flow along the unregulated section of the Macquarie River through to Burrendong Dam. The project would not operate during low flows.

Some submissions noted that, contrary to the conclusions of the environmental assessment, the impacts of the project on river flows would be significant

- The impact is significant (one-third of flow extracted during periods of extraction around the trigger flow rate).
- To pump 38 ML/day from the Macquarie River at a very low flow rate would do serious harm to the river.
- Serious permanent environmental harm will be caused if almost one third of the total river flow is extracted in low flow periods.

Response:

The number of days when the extraction is 31.5% of the river flow is 17 for the entire model period of 43,099 days (that is, less than 0.04% of the time). This infrequent occurrence was not considered to result in any significant impacts on the river system.

The pumps would only extract up to 12 ML/day, not 38 ML/day. As noted in the environmental assessment and confirmed in section 3 of this report, the project would not operate during low flow periods.

Further information on the operation of the project, including the derivation of pumping triggers, is provided in section 3.6.

4.6 Impacts on existing water users and the downstream river environment

4.6.1 Impacts on downstream users

Concerns were raised about the impacts of the project on existing water users downstream of the project

- The project would be detrimental to the communities down river. Many communities rely on the Macquarie as their only source of water.

- The project would impact directly on downstream users – most significantly and immediately the residents of Wellington. The rights to a secure water supply for downstream residents are being trampled on.
- No certainty is provided in terms of impacts to downstream users.

Response:

As noted in section 3.2.1, under the *Water Act 1912,* Council has an existing surface water entitlement to extract up to 7,800 ML/year from the Macquarie River system for the purpose of town water supply. However, Orange's existing water supply system cannot currently deliver this supply with security. Council is not seeking access to water in excess of its current water supply entitlement. Council is seeking to *diversify* the existing water supply system to improve the security of supply.

The project can be operated consistent with the NSW River Flow Objectives, including protecting low river flows. This would be achieved by adopting the proposed 'cease to pump' threshold (that is, the river flow at which licensed pumping must stop), which is above the requirements of the water sharing plan for this section of the Macquarie River. This would protect basic stock and domestic rights, and environmental flows, along the unregulated section of the river downstream of the proposed offtake point through to Burrendong Dam.

The detailed assessment of the potential impacts of the project that was undertaken as part of the environmental assessment indicated that it would:

- have a negligible impact on system flows downstream of Burrendong Dam
- not impact on the ability to operate the regulated system in accordance with the Macquarie-Cudgegong water sharing plan.

Therefore, it is considered that the project can operate without impacting on other Macquarie River users.

4.6.2 Impacts on the downstream environment

What is the impact of such a project on the contribution of Macquarie River to the Murray-Darling system?

Response:

The proposed average annual extraction represents 0.11% of the average annual inflow to the Macquarie-Cudgegong system. As a result, it can be reasonably concluded that the impact on the Murray-Darling system is negligible.

Impact on the downstream environment of the river, particularly impacts on the Macquarie Marshes

- What of the needs of riparian water users downstream? Conservationists were alarmed during the last drought regarding the minimal flow to the Macquarie Marshes.
- Insufficient information about the environmental impacts of removing water from the river.

Response:

Riparian flow in the **unregulated** section of the river would be protected by adopting the 38 ML/day pump trigger, which prevents pumping when river flows are in the low flow range.

The assessment of potential changes in flows through the **regulated** section of the Macquarie River, which included assessment of dry periods, indicated that the impact on regulated water users and the flow regimes at the Macquarie Marshes is likely to be negligible.

As noted in section 4.3.1, the assessment of the potential impact of the extraction on the Macquarie Marshes concluded that the impacts would be negligible in terms of the entire system flows and potential changes, and within the uncertainties of the models used for river planning (refer section 4.6.2.2 of Appendix D to the environmental assessment). As noted in section 3 above, the impact assessment was based on a worst case scenario, which means that the actual impacts are likely to be a lot less.

The information relating to the potential changes in river hydrology was provided to the specialists undertaking the assessment of impacts on terrestrial and aquatic ecology, geomorphology and groundwater. The results of the assessment of these potential environmental impacts are presented in chapters 11 to 13 of the environmental assessment.

4.6.3 Impacts on Summer Hill Creek

p. 10.19 Clarify what is meant by the increased flow in Summer Hill Creek would have an insignificant impact as hydraulic changes are minimal and would be dampened by inflow from downstream tributaries.

Response:

Modelled increases in flow depth for the two reaches assessed in the Summer Hill/Lewis Ponds Creek system ranged from 30 to 36 mm. Velocity changes ranged from a reduction of 0.28 m/s to an increase of 0.25 m/s. These results indicate there would be insignificant changes in hydraulic characteristics.

The assessment was based on the modelled flows from Suma Park Dam and Blackmans Swamp Creek, and did not include the influence of tributary inflow downstream of the confluence of these two creeks. Inflow from downstream tributaries would reduce the modelled changes as additional water is added to the system. That is, changes in hydraulics become less in a relative sense as the flow increases. This is why the impacts were described as being dampened by inflow from downstream tributaries.

4.6.4 Impacts on Suma Park Dam

The project reduces the dam's ability to capture the free natural runoff inflows to the dam, therefore driving up the cost of Orange's water supply to residents. This strategy is a trade-off between the high cost of residential water supply and wasted energy.

Response:

The project would improve water security. It is required when the existing dams are below capacity, and during these periods it would improve the security of Orange's water supply system. The critical drought period that defines the secure yield for the Orange water supply system lasts for around six years. During this time, the existing storages are below capacity and the addition of water from external sources improves water security.

Council is developing a decision support tool that would include the objective of minimising raw water costs through appropriate system operating rules and consideration of demand and forecast indicators. Further details are provided in section 3.7.

4.7 Impacts on future water security for other users/communities

4.7.1 General impacts

Does not favour a proposal that facilitates the growth and expansion of Orange at the expense of other communities

Response:

A summary of the need for the project is provided above in section 1.3. Further information in relation to project need is provided in chapter 5 of the environmental assessment.

Responses to issues raised in relation to demand, including a response to the issue relating to the continued growth of Orange, is provided in section 3.2.3.

Other communities have not suffered the debilitating effects of water shortages in the manner that Orange has. There is no evidence to suggest it would have any detrimental economic impacts on neighbouring cities.

Response:

This has been considered as part of the need for the project. A summary of the need for the project is provided in section 1.3. Further information is provided in chapter 5 of the environmental assessment.

Responses to issues raised in relation to the justification of the project are provided in section 3.2.

4.7.2 Water security

The reliability of all general security water in the Macquarie is only 51%. This means that twice the average annual flow of the river is issued in general security entitlements.

Response:

It is assumed that this issue refers to the regulated river general security and the available water determination announcements (previously referred to as allocation announcements). The proposed offtake point is in the **unregulated** section of the Macquarie River and therefore has not been the subject of any available water determinations.

4.7.3 Impacts on Bathurst

Concerned with the potential impacts on water supply to Bathurst

- Council needs to take into account the impacts in terms of future restrictions to the water security of Bathurst. Need to ensure that Bathurst is not placed in a situation where future growth can't proceed.
- What security is given to ensure that Bathurst will not have to release additional water into the Macquarie River to feed the pipeline. Whilst Bathurst has invested in water security, the growth and expansion of the city will mean other water measures need to be taken into the future.

Response:

The proposed offtake point is located well downstream of Bathurst. The assessment of the potential impacts of the project does not rely on, or account for, any changed operation of the Bathurst water

supply system. Extracting water from the river at a location well downstream of Bathurst would not impact on the ability of Bathurst Regional Council to operate its own water supply system.

4.8 Assessment concerns

4.8.1 Adequacy of assessment

Accuracy of the water security assessment

- The project's water security assessment is inaccurate and does not justify the project as currently proposed.
- The stated intent to pump water into Suma Park Dam up to and to maintain a capacity of 90% does not allow for capture of significant rainfall runoff into the dam.

Response:

Council is using secure yield as a quantitative measure for comparing various water supply options. The secure yield assessments are undertaken by NSW Water Solutions. The water security assessment is based on secure yield modelling of the entire water supply system, with the addition of various external sources as required. The modelling demonstrated that operating the project would increase the secure yield of Orange's water supply system by 2,700 ML/year.

Operation of the project would not involve maintaining Suma Park Reservoir at a capacity of 90%. The value of 90% refers to one of the operating rules for the project, which means that operation is triggered when certain criteria are satisfied (including when the storage level in the reservoir is less than 90% full). The assessment of the 2000 to 2010 period demonstrated that transfer does not maintain the storage at 90%.

Assessment of impact based on change in discharge volume does not indicate the likely aquatic ecological impacts of the extraction. This is better assessed by consideration of the change in stage or stream level in the effected reach.

Response:

The modelled changes in river hydrology were used to inform the aquatic ecology impact assessment. This included changes in river stage.

Further assessment of the potential impact through riffles has been undertaken and the results are presented in section 6 of this report.

Concerns were raised about the adequacy and independence of the hydrological assessment

- Significant shortcomings in the assessment and risks have been ignored.
- An independent assessment of the impacts should be undertaken.

Response:

The assessment of potential hydrology and water security impacts was based on 118 years of daily modelling using the proposed set of operating rules, which allowed for a conservative assessment of the potential impacts of the project on the river system. Sensitivity analysis was used to demonstrate that the project is a robust water supply option that is not significantly impacted by assumptions relating to low river flow. It is considered that this level of assessment is adequate for the project.

Modelling of the Macquarie River catchment was undertaken by Kozarovski and Partners. Secure yield modelling was undertaken by NSW Water Solutions. Macquarie River IQQM modelling was

undertaken by the Office of Water, Water Resources Management and Modelling Unit. Geolyse Pty Ltd was responsible for data collation, post modelling data processing, water balance modelling and hydraulic modelling. All organisations are independent professional consulting companies that have no vested interest in the outcomes of the project.

4.8.2 Queries about data used

Concerns were raised about the accuracy of data used to undertake the modelling, and whether it was adequate for the purposes for which it was used.

- The use of average annual flows is misleading. Establish the impacts of extracting water on the actual flow at the time of extraction.
- Pumping at this discharge cannot be achieved based on the current gauge rating and there are major issues with the accuracy with the gauging at these low flows.

Response:

Refer to comment in section 4.3.1.

Modelling was based on 118 years of daily data. To assess the potential impact of the project, the daily flow series was determined with and without the pumps operating. This established the impact on each day in the model (over 43,099 days). Flow duration curves were used to present a large amount of data in a simple format. Other measures such as averages (volumes, days pumped etc) and ranges were used to establish long term changes. Daily data through wet and dry periods was assessed using daily flow series and flow duration curve analysis. Hydraulic changes (changes the river levels due to extraction) were determined for the computed flow deciles with and without the project as to do this for each day of the pump operation would be excessive for the impacts being considered.

Further assessment of the potential impact through riffles has been undertaken and the results are presented in section 6 of this report. This includes impacts on the days of pump operation.

4.8.3 Issues with the assessment conclusions

Some submissions expressed their disagreement with the conclusions of the assessment

- The project would not provide adequate water during the period it is most needed, ie during droughts when flows in the river are low.
- The project will not drought proof Orange as the river ceases to flow, or is reduced to a negligible flow. The statement, “During the three dry (drought) periods modelled, the average annual extraction was 1.0% to 2.4% of the total river flow,” defies logic, as there will be no pumping. At the very time that water is needed for Orange’s security there will be none to pump.
- As it is proposed to extract almost one-third of the total river flow in low-flow periods, cannot say that the impacts are insignificant.

Response:

The daily river flow series indicated that there was sufficient flow during drought periods to allow some pumping. As described in section 3.2.4, **operation of the project is not based on waiting until severe drought conditions before transfers commence. Instead, it is based on using water when it is available to keep storages fuller.** This improves the security of the system. That way, when drought conditions cause the river to stop flowing, there would be additional water in storage to manage through the drought period.

The proposed pump trigger level (38 ML/day) is not in the low flow range. Water would not be extracted during low flow periods. As noted in section 4.5, the number of days when the extraction is 31.5% of the river flow is 17 for the entire model period of 43,099 days (that is, less than 0.04% of the time). This infrequent occurrence was not considered to result in any significant impacts on the river system.