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resources & energy

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Ref: 301015-02980
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Mr Alexander Scott
Planning Officer
Infrastructure Projects
Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2000

31 May 2013

Dear Alexander,

CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE PROJECT (SSI 5039)

This letter has been prepared to respond to Commonwealth and State Government Agencies' comments on the Preferred Infrastructure Report (PIR) for the abovementioned project. The letter is accompanied by:

- Revised Figures
  - Figure 1 - Revised dam wall works area
  - Figure 2 - Project Layout, incorporating revised dam wall works area
  - Figure 3 - Dam wall raising cross-section, showing existing and new crest elevations
- Revised Addendum Flora and Fauna Impact Assessment
- Revised Offset Plan
- Letter from State Water regarding the proposed payment framework and funding contribution for the Booroolong Frog Offset.

1. BACKGROUND

On 15 March 2013, the Chaffey Dam Augmentation and Safety Upgrade PIR was submitted to the Department of Planning and Infrastructure (the Department) by WorleyParsons, on behalf of State Water. An Addendum Flora and Fauna Impact Assessment, including an Offset Plan, was provided as an appendix to the PIR.

The PIR was subsequently referred by the Department to relevant State Government agencies. The PIR was also referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) as the Project has previously been declared a controlled action under the *Environment Protection and Biodiversity Act, 1999 (EPBC Act).*

Comments on the PIR were received from the following State agencies:

- Heritage Council of NSW, dated 26 March 2013
- Trade and Investment, Crown Lands, dated 2 April 2013
- Namoi Catchment Management Authority (CMA), dated 5 April 2013
- Office of Environment and Heritage (OEH), dated 5 April 2013
- Department of Primary Industries, Fisheries NSW and NSW Office of Water, dated 17 April 2013
- Department of Planning and Infrastructure, dated 19 April 2013

SEWPaC provided comments to the Department in a letter dated 12 April 2013.

2. RESPONSE TO PIR COMMENTS

2.1 Flora and Fauna

A Revised Addendum Flora and Fauna Impact Assessment and a Revised Offset Plan have been prepared by nghenvironmental to incorporate additional information, maps and graphs to address the biodiversity comments raised by SEWPaC, the Department, OEH and Namoi CMA. A Response to Submissions Table forms Appendix B of the Revised Addendum Report and contains a summary of the response to each agency's comment. Detailed information in relation to each comment is contained in the Revised Addendum Report or the Revised Offset Plan, where relevant.

The Revised Addendum Flora and Fauna Impact Assessment and the Revised Offset Plan **replace** the Addendum Flora and Fauna Impact Assessment and Offset Plan submitted with the PIR.

The Revised Addendum Flora and Fauna Impact Assessment, incorporating the Revised Offset Plan, is provided as **Attachment A**.

A letter from State Water regarding the proposed payment framework and funding contribution for the Booroolong Frog Offset is provided as **Attachment B**.

2.2 Modification to Works at the Dam Wall and Construction Method

Subsequent to submission of the PIR, progression of detailed design and discussions with contractors has resulted in two proposed minor amendments to the Project, namely to the dam wall works area and to the dam wall construction method.

The southern extent of the dam wall works area, as presented in the Project Environmental Impact Statement (EIS) and PIR, is proposed to be increased in size by 1.5 ha which would increase the overall works area from 33.6 ha to 35.1 ha. The additional area is currently occupied by cleared land and exotic vegetation. No environmental impacts additional to those assessed in the EIS and PIR are anticipated to occur.

The revised dam wall works area is shown in **Figure 1**. The Project Layout, incorporating the revised dam wall works area, is shown in **Figure 2**.

The dam wall construction method is also proposed to be modified. The dam wall raising will now be achieved by the construction of a vertical reinforced earth wall that is to be constructed on the crest of the existing dam wall. The construction of the reinforced earth wall will not require any excavation of the dam wall toe or any placement of rocks on the downstream embankment. The wall raising and access will be limited to the crest of the dam wall.

In addition, the revised construction approach will mean that there is no longer any requirement to raise the morning glory spillway access bridge and piered platform.

A cross-section of the revised design for the dam wall raising, showing the existing and new crest elevations, is presented in **Figure 3**.

Changes to the Project construction methodology, facilities and anticipated equipment, as presented in Table 4-1 of the EIS, are shown below in **Table 1**. Items shown in strikethrough (~~strikethrough~~) are no longer required. Items shown in bold are additional to the information presented in the EIS.

Table 1: Revised Project Construction Methodology, Facilities and anticipated Equipment for raising of the Dam Wall

Methodology	Volume	Anticipated Equipment	Facilities
Raising the Dam Wall			
Remove and stockpile parapet wall for reuse. Some wall units will require excavation for removal.	380 pre-cast concrete units	20 tonne (t) rough terrain crane 10 t flatbed truck 5 t backhoe	Works Area located downstream of dam wall with direct access from Tamworth-Nundle Road (refer Figure 1 and Figure 2)
~~Excavate and stockpile deposited material at toe of dam wall for reuse at toe of new embankment.~~	~~160,000 m^3~~	~~80 t excavator~~ ~~45 t articulated dump trucks (12 loads per hour)~~ ~~D10 dozer~~	
Excavation of dam crest to expose existing **clay core** ~~crest embankment zones.~~	~~30,000~~ , **2,000 m^3**	30 t excavator 30 t dump trucks (12 loads per hour) Water cart Cat 140H grader	
Haul and place rock from existing stockpile and clay from borrow areas for dam wall raising.	~~200,000~~ **30,000 m^3**	80 t excavators 50 t dump trucks (assume 9 loads per hour) 20 t vibrating roller 25 t compactor Water cart Cat 140H grader ~~Cat D10N dozer~~	
Installation of precast wall panels for reinforced earth wall	**7,000 m^2**	**20 t Excavator** **20 t Crane** **10 t Flatbed truck**	
Construction of road pavement and reinstalling the parapet wall.	3,740 m^2 380 pre-cast concrete units	30 t articulated dump trucks 16 t vibrating roller Water Cart Truck (8 m^3 body) (assume 94 loads at one hour per round trip) Cat 140H grader	

The revised design and construction methodology for upgrade of the dam wall will continue to deliver the key Project outcomes in terms of meeting dam safety requirements and augmentation of storage capacity to 100 gigalitres (GL). The revised design and construction methodology also has the added benefit of a lower capital works cost and lesser environmental impacts.

The revised design and construction methodology for upgrade of the dam wall has been taken into consideration in the Revised Addendum Flora and Fauna Impact Assessment. Significant impacts to the Border Thick-tailed Gecko on the downstream face of the wall will now be avoided.

It is considered that the EIS, PIR and the supplementary information contained within this response provide the information required to address all Commonwealth and State Agencies' comments.

Should you have any questions regarding this information, please contact Nicole Cowlishaw on (02) 8456 7209.

Kind regards,

Sofie Mason-Jones
Principal Environmental Planner
WorleyParsons

Enclosed:

Figure 1:	**Revised dam wall works area**
Figure 2:	**Project Layout, incorporating revised dam wall works area**
Figure 3:	**Dam wall raising cross-section, showing existing and new crest elevations**
Attachment A:	**Revised Addendum Flora and Fauna Impact Assessment, incorporating the Revised Offset Plan**
Attachment B:	**State Water Letter**

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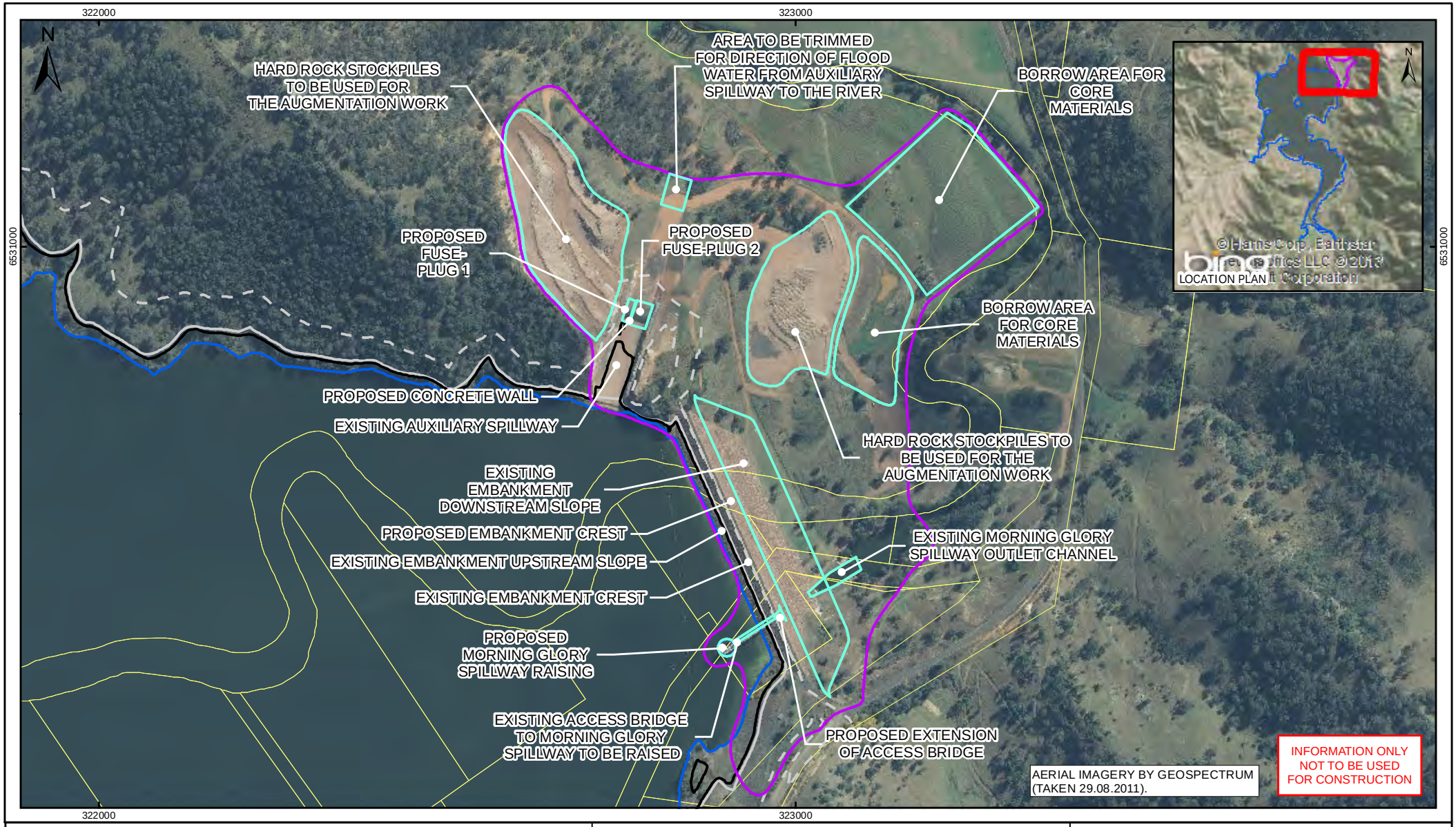
FIGURE 1

Revised dam wall works area



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State water

0 0.1 0.2 0.4
Kilometres @ A4

Datum : GDA94
Map Grid of Australia Zone 56

LEGEND

- **DAM WALL SITE LAYOUT AREAS**
- WORKS AREA
- EXISTING FULL SUPPLY LEVEL
- NEW FULL SUPPLY LEVEL
- NEW 1 IN 100 YEAR FLOOD LEVEL
- NEW PROBABLE MAX FLOOD LEVEL
- **CADASTRE (05.07.2012)**

CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

DAM WALL CONSTRUCTION AREA

DATE : 21 May 2013
SCALE : 1:7,500
CUSTOMER : STATE WATER
AUTHOR : RW
REF : 301015-02980-GIS-SKT-006.mxd
REV : A2

Produced By: ryan.wright@worleyparsons.com - Geomatics

Location: ..\301015-02980 CHAFFEY DAM\03Project\Workspace_SKT\301015-02980-GIS-SKT-006

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FIGURE 2

Project Layout, incorporating revised dam wall works area

320000

325000

6530000

6525000

N

LEGEND

- WORKS AREA
- REVISED WORKS AREAS
- EXISTING FULL SUPPLY LEVEL
- NEW FULL SUPPLY LEVEL
- NEW 1 IN 100 YEAR FLOOD LEVEL
- NEW PROBABLE MAX FLOOD LEVEL

INFORMATION ONLY
NOT TO BE USED
FOR CONSTRUCTION

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AE
the GIS User Community

AERIAL IMAGERY BY GEOSPECTRUM (TAKEN 29.08.2011). ALTERNATE IMAGERY BY ESRI

320000

325000

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N

0 0.25 0.5 1 1.5 2

Kilometres @ A3

Datum : GDA94
Map Grid of Australia
Zone 56

LOCATION PLAN

CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

REVISED PROJECT LAYOUT

DATE : 21 May 2013
SCALE : 1:30,000
CUSTOMER : STATE WATER
AUTHOR : RW
REF : 301015-02980-GIS-SKT-012.mxd
REV : A2

Produced By: ryan.wright@worleyparsons.com - Geomatics

Location: \301015-02980 CHAFFEY DAM\03Project\Workspace_SKT\301015-02980-GIS-SKT-012

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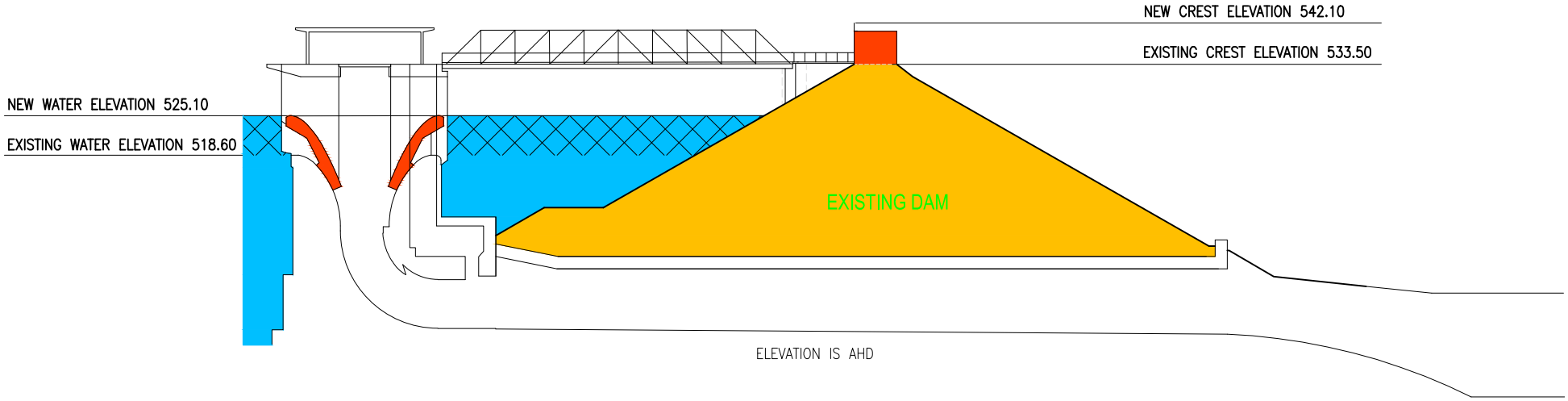
FIGURE 3

Dam wall raising cross-section, showing existing and new crest elevations


NEW CREST ELEVATION 542.10
EXISTING CREST ELEVATION 533.50
NEW WATER ELEVATION 525.10
EXISTING WATER ELEVATION 518.60
EXISTING DAM
ELEVATION IS AHD

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ATTACHMENT A

Revised Addendum Flora and Fauna Impact Assessment, incorporating the Revised Offset Plan

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Revised Addendum Report

TERRESTRIAL AND AQUATIC FLORA AND FAUNA IMPACT ASSESSMENT ADDENDUM REPORT CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

MAY 2013

ngh environmental

Document Verification

Project Title: TERRESTRIAL AND AQUATIC FLORA AND FAUNA IMPACT ASSESSMENT ADDENDUM REPORT CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

Project Number: 2400

Project File Name: Revised Addendum Report Chaffey Dam Augmentation and Safety Upgrade 300513 Final

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Revised Addendum Report Final	30/05/13	Freya Gordon Dave Maynard Raphael Morgan	Jacqui Coughlan	Nick Graham-Higgs

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TABLES

FIGURES

1 INTRODUCTION

1.1 BACKGROUND

This Revised Addendum Report - Terrestrial and Aquatic Flora and Fauna Impact Assessment (Flora and Fauna Addendum Report) has been prepared to address the additional survey requirements and State and Commonwealth assessment provisions identified in the Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement (EIS) (WorleyParsons 2012) submitted in December 2012, and the Preferred Infrastructure Report (PIR) submitted on 15 March 2013. It also aims to respond to the comments raised by Agencies in April 2013 following their review of the PIR.

In 2012 **ngh**environmental were engaged by WorleyParsons Services Pty Ltd (WorleyParsons) to undertake a terrestrial and aquatic flora and fauna assessment of the potential impacts associated with the augmentation and safety upgrade of Chaffey Dam (the Project), proposed to be carried out by State Water Corporation (State Water).

Chaffey Dam is located on the Peel River approximately 30 km south-east of Tamworth. Chaffey Dam is ranked by the NSW Dams Safety Committee as being in the "extreme" hazard category. This represents an inadequate flood capacity and is based on the population at risk and the severity of damage and loss that would result from dam failure (Dams Safety Committee 2008/2009). In terms of the Australian National Committee on Large Dams (ANCOLD) guidelines and NSW Dams Safety Committee risk framework, the dam failure risks at Chaffey Dam are considered to be intolerable.

The current storage capacity of the dam is 62 GL. Three alternative scenarios were initially considered by State Water – raising the dam to a permanent storage capacity of 80, 100 or 120 GL, as documented in the EIS (WorleyParsons 2012). The preferred option assessed in the EIS is to raise the capacity to 100 GL, increasing the Full Supply Level (FSL) by 6.5m. Since the 80 and 120 GL augmentation options were ruled out, only the 100 GL scenario was assessed in detail in the ecological impact assessments for the project. The comparative ecological impacts of the three scenarios are considered in Section 1.4 of this Addendum report.

1.1.1 History of the Project

The Project has been classified by the NSW Minister for Planning and Infrastructure as State Significant Infrastructure and is subject to the provisions of Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). On 23 January 2012, Director-General's Requirements (DGRs) were issued for the Project.

On 29 August 2012, State Water referred the Project to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 28 September 2012 the Minister for SEWPaC declared the project a controlled action, therefore the Project requires assessment and approval under the EPBC Act. SEWPaC advised that the Project would be assessed through an accredited assessment under Part 5.1 of the EP&A Act. On 19 October 2012, Supplementary DGRs were issued for the Project in relation to assessment of impacts to threatened species and communities listed under the EPBC Act.

The EIS was placed on public exhibition by the NSW Department of Planning and Infrastructure from 12 December 2012 until 31 January 2013. Section 8.2.5 of the EIS committed State Water to undertake

additional surveys during summer 2012/2013 to further inform the flora and fauna impact assessment for the Project in relation to Queensland Bluegrass (*Dichanthium setosum*) and the Booroolong Frog (*Litoria booroolongensis)*.

Submissions on the EIS, relevant to the flora and fauna impact assessment for the Project, were received from the Namoi Catchment Management Authority (Namoi CMA), the NSW Office of Environment and Heritage (OEH) and the Department of Planning and Infrastructure.

Section 8.2.6 of the EIS committed State Water to prepare and submit an Offset Plan with the Preferred Infrastructure Report or Response to Submissions report. Following agency comments in April 2013, a revised Offset Plan has been provided in Appendix D.

A response to submissions made on the PIR in relation to flora and fauna is provided at Appendix B. The response references relevant sections of this revised Flora and Fauna Addendum Report where additional information is provided. Substantial detailed information is contained within the Terrestrial and Aquatic Flora and Fauna Assessment prepared by **ngh**environmental (2012) and contained in the EIS as Appendix 8. These documents are referred to within this report as follows:

1. WorleyParsons (2012). Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement State Significant Infrastructure. Report prepared for State Water.
2. **ngh**environmental (2012). Terrestrial and Aquatic Flora and Fauna Impact Assessment. Appendix 8 of WorleyParsons (2012).

Following submission of the EIS and PIR, some modifications have been made to the Project to reduce its environmental impact.

1.1.2 Project Location and Layout

The Project comprises the augmentation and safety upgrade of the existing Chaffey Dam (

Figure 1-1). The proposed works will result in an increase in the FSL of 6.5 m and an increase in the permanent storage capacity from 62 GL to 100 GL.

The Project is proposed to be carried out by State Water and includes the following components:

- Augmentation of the dam to 100 GL at FSL and safety upgrade, through raising of the dam wall and modification of the existing spillways. The safety upgrade works will involve raising the dam wall by 8.4 m to increase the flood storage capacity of the reservoir. Reconfiguration of the auxiliary spillway fuseplug is also proposed to enable staged discharge of floodwaters. Raising the morning glory spillway by 6.5 m will enable augmentation to 100 GL.
- Realignment of roads will be required due to the increased FSL, but will be limited to parts of Tamworth-Nundle Road, Rivers Road, Western Foreshore Road and bridges, limited to Bowling Alley Point Bridge, Hydes Creek Bridge and a culvert crossing at Silver Gully.
- Relocation of some facilities at the Bowling Alley Point Recreation Area and the South Bowlo Fishing Club is also required due to the increased FSL. As part of the Project, the South Bowlo Fishing Club facilities will be relocated to higher ground, proximate to their existing locations.
- The Project will result in an increase to the FSL of approximately 185 ha surrounding the existing reservoir and an additional footprint of up to 38 ha for development of new roads and bridges.

1.2 STUDY SITE AND STUDY AREA DESCRIPTION

Chaffey Dam is located on the Peel River within the upper Namoi River catchment in north-east NSW. The dam is approximately 6 km south of the town of Woolomin, and approximately 13 km north of the town of Nundle.

The study site is defined as the areas directly affected by the Project, and includes those areas within the augmented FSL and works areas (

Figure 1-1). The works areas include the roads and bridges to be realigned or relocated along Western Foreshore Road, Tamworth-Nundle Road and Rivers Road, as well as the area impacted by works to the dam wall, morning glory spillway and auxiliary spillway.

The study area centres on Chaffey Dam (

Figure 1-1) and is defined as the study site plus surrounding areas which were investigated in order to undertake the impact assessment. The study area encompassed a 1 km buffer from the new FSL.

The Project is located on land comprising Crown land, freehold, leasehold, road reserve and State Water acquired land. Existing land uses around Chaffey Dam include:

- The existing dam and reservoir
- Recreational and open space land uses, including:
    - Bowling Alley Point Recreation Area (managed by the Bowling Alley Point Recreation Reserve Trust)
    - South Bowlo Fishing Club
    - Nundle Fishing Club
    - Dulegal Arboretum (established by the now dissolved Dulegal Arboretum Association and opened in 1982, this area is noted for its scientific and recreational value, however it is no longer being maintained)
- Land under private ownership and leasehold, including rural residential properties and land used for grazing and dairy farming
- Roads and bridges
- State Water administration and maintenance facilities and Storage Custodian's residence

1.3 SCOPE OF THIS REPORT

At the time of writing the Terrestrial and Aquatic Flora and Fauna Impact Assessment and the EIS, the likely level of impact on two threatened species (Booroolong Frog and Queensland Bluegrass) was uncertain due to a lack of data that was based on recent surveys conducted in an appropriate season. The EIS committed to undertaking additional surveys to clarify the extent of likely impact based on current data, and the offsetting requirements for these species. The PIR with the Flora and Fauna Addendum report was submitted to the Department of Planning and Infrastructure in February 2013, and submissions in relation to biodiversity were received from Namoi CMA, OEH and the Department of Planning and Infrastructure in April 2013.

This report provides an analysis of the updated survey data and a revised and complete assessment of potential impact. It also addresses the biodiversity comments raised from the Agency review of the PIR.

In addition, further information is provided on the level of impact and proposed mitigation for the threatened Border Thick-tailed Gecko (*Uvidicolus sphyrurus*) and Murray Cod (*Maccullochella peelii peelii*). The Border Thick-tailed Gecko inhabits the dam wall, and due to a change in Project methodology, impacts to the Border Thick-tailed Gecko have been greatly reduced, therefore a revised impact assessment for this species has been provided.

These four species (Booroolong Frog, Queensland Bluegrass, Border Thick-tailed Gecko and Murray Cod) are referred to in this report as the Subject Species.

Therefore the primary aims of this Flora and Fauna Addendum Report are to:

- Provide updated data on the abundance and distribution of the Booroolong Frog within the study area, listed as Endangered under both the *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act
- Determine the likelihood of occurrence of Queensland Bluegrass within the study site, listed as Vulnerable under both the TSC Act and EPBC Act
- Determine the potential impacts of the Project on the Booroolong Frog and Queensland Bluegrass
- Reassess the impacts of the Project on the Border Thick-tailed Gecko, listed as vulnerable under both the TSC Act and EPBC Act
- Provide a more detailed impact assessment of the Murray Cod, listed as vulnerable under the EPBC Act.
- Provide an Offset Plan that meets the requirements of State and Commonwealth Government offset policies
- Provide a response to submissions received on the EIS and PIR in relation to flora and fauna

Furthermore, the assessment of impact to vegetation communities in the EIS was based on a worst case scenario estimation of the road and bridge construction footprints (works areas). A revised assessment is provided based on the detailed design of these areas and more accurate calculations of the extent of impact as a result of road and bridge construction activities.

This Addendum Flora and Fauna Assessment Report is accompanied by four appendices:

1. Appendix A – Revised threatened species impact assessment
2. Appendix B - Response to submissions on PIR
3. Appendix C - Booroolong Frog Distribution on the Peel River (2013 data)
4. Appendix D - Offset Plan

State and commonwealth policies and guidelines that have been consulted in the preparation of this report include:

- Biobanking Assessment Methodology (DECC 2009a)
- EPBC Act Environmental Offsets Policy (SEWPaC 2012)
- Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DEWHA 2009)
- Namoi CMA Biodiversity Offsets Policy (Namoi CMA 2011)
- NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects (NSW OEH 2011)
- Threatened species assessment guidelines (DECC 2007)

Following submission of the EIS for exhibition, some modifications have been made to the Project to reduce its environmental impact.

1.4 REDUCTION IN WORKS AREAS

To decrease the environmental impact of the Project on biodiversity, the Works Areas for the realignment of Tamworth-Nundle Road, Rivers Road and Western Foreshore Road have been reduced in size. This has been achieved through refinement of the road design and selection of specific stockpiling and equipment laydown areas.

The original size of each Works Area, the revised size of each Works Area and the subsequent reduction in the size of the Works Areas is in shown in Table 1-1.

The dam wall raising will now be achieved by the construction of a 6.5 m vertical reinforced earth wall on the crest of the dam wall. The construction of the reinforced earth wall will not require any excavation of the dam wall toe and placing of rocks on the downstream embankment. The wall raising and access will be limited to the crest of the dam wall. Excavation on the crest of the dam wall will be up to 1 metre deep and will require removal of the parapet wall.

Table 1-1 Change to the size of the Project Works Areas

Works Area	Original Size (as described in EIS)	Revised Size (as described in PIR)	Reduction in Size of impact
Tamworth-Nundle Road and Rivers Road (including Bowling Alley Point Bridge)	41.1 ha	23.9 ha	17.2 ha
Western Foreshore Road (including Hydes Creek and culvert crossing at Silver Gully)	86.7 ha	25.0 ha	61.7 ha
Dam wall upstream and downstream embankment	52,600 m^2	4,600 m^2	48,000 m^2

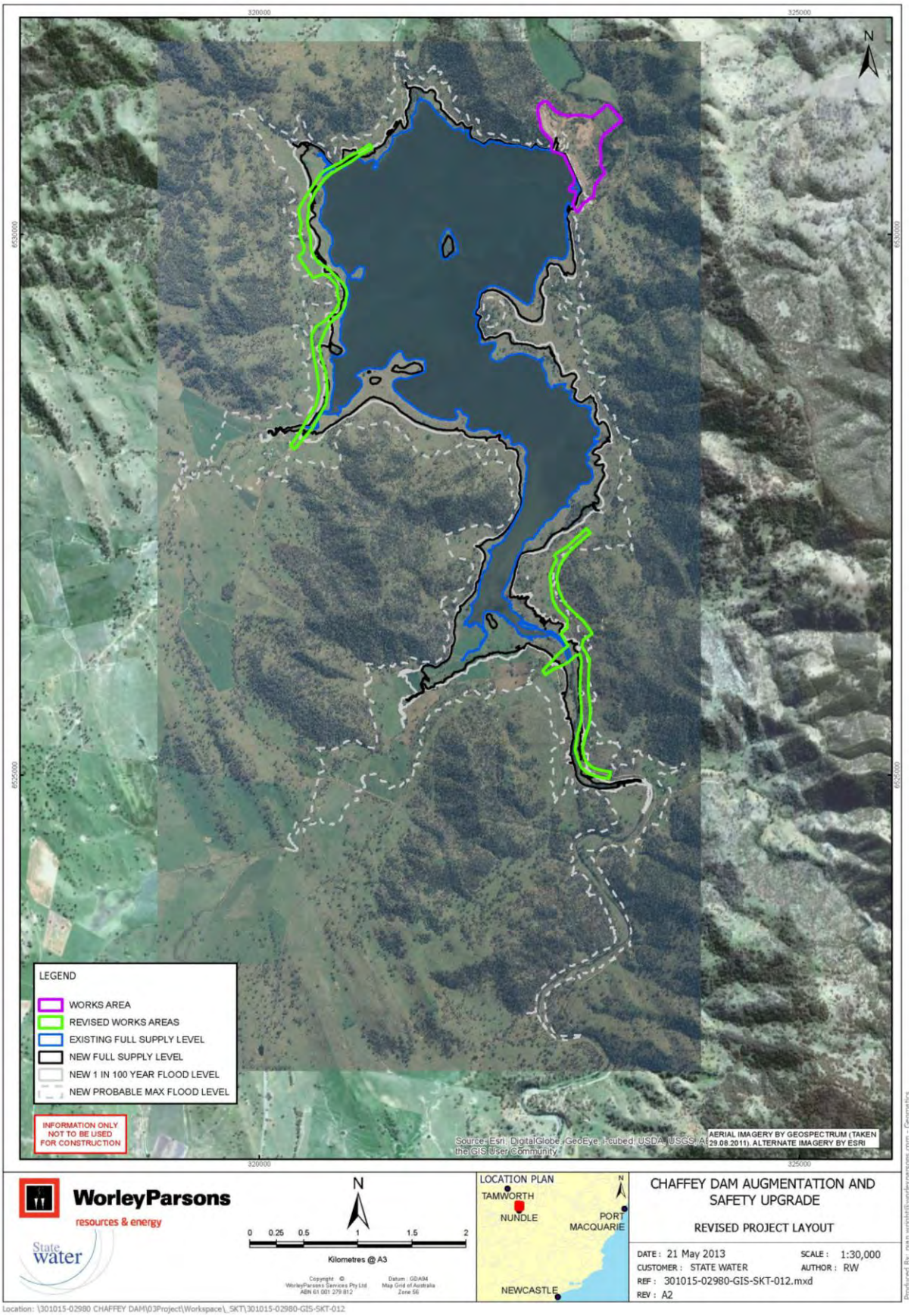

Figure 1-1. Project layout

1.5 ASSESSMENT OF ALTERNATIVES

The Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012) assessed the ecological impacts in relation to threatened species of the proposed safety upgrade and augmentation to increase the dam capacity to 100 GL. Below is a comparison of ecological impacts under two alternative scenarios; a lower capacity of 80 GL; and a higher capacity of 120 GL. A comprehensive comparison of impacts of the alternative on vegetation communities is illustrated in Table 1-1.

As described in Section 2.1.9, augmentation of Chaffey Dam to 100 GL is expected to impact on approximately 1.6 km of Booroolong Frog habitat. According to the channel width of the Peel River, this equates to an area of approximately 4.77 ha.

In comparison to the proposed 100 GL capacity, an additional 600 m, or 0.87 ha of Booroolong Frog habitat on the Peel River would be lost under the 120 GL capacity. Approximately 760 m, or 1.1 ha less of Booroolong Frog habitat would be lost under the 80 GL capacity. Under all scenarios this would be considered a significant loss of habitat. The National Recovery Plan for Booroolong Frog (NSW OEH 2012a) states that "habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency or results in loss of rock crevices is likely to threaten the persistence of local populations of this species."

Impacts to the Border Thick-tailed Gecko are not expected to differ between the different augmentation scenarios. All scenarios would require construction works to the dam wall. Impacts associated with construction will only occur on the crest of the dam wall during construction of the vertical wall, and along the upstream face of the wall between the left bank and the morning glory spillway (a total of 2000 m^2). Any loss of habitat on the upstream side of the dam wall through increased inundation would be replaced through the increased dam wall height.

As described in the Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012) and shown in Table 1-2, the proposed augmentation to 100 GL is expected to result in the inundation of approximately 180 ha native and non-native vegetation. Comparatively, augmentation to 80 GL would result in the inundation of 67 ha of vegetation (38 ha listed under the TSC and EPBC Acts), while augmentation to 120 GL would result in the inundation of approximately 250 ha of vegetation (164 ha listed under the TSC and EPBC Acts), including native and exotic non-native vegetation (Table 1-2).

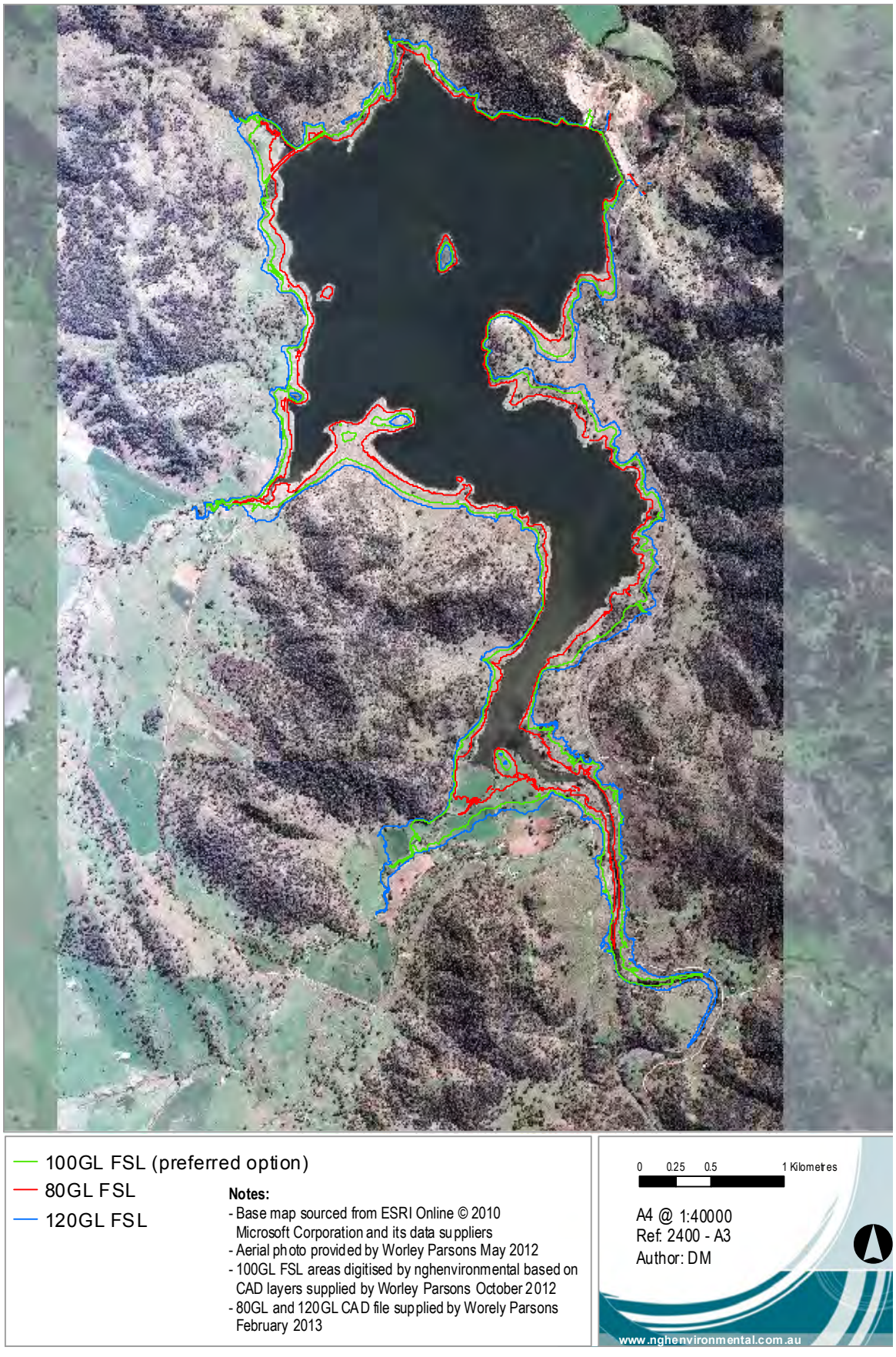

Figure 1-2 Comparison of Full Supply Level under the three storage capacity scenarios of 80 GL, 100 GL and 120 GL.

Table 1-2 Comparison of area of vegetation to be inundated under alternative scenarios of storage capacity

Vegetation Communities	Area to be inundated 100 GL (ha)	Area to be inundated 80 GL (ha)	Area to be inundated 120 GL (ha)
Regional Vegetation Community (RVC)			
Box–gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17)	30	7	46
Derived grasslands, Brigalow Belt South and Nandewar (RVC 28)	87	31	118
Silvertop Stringybark grassy open forests, eastern Nandewar and New England Tablelands (RVC 39)	3	1	4
River Oak Riparian Woodland, eastern NSW (RVC 71)	6	3	6
Wetlands and marshes, inland NSW (RVC 70)	0.24	0	0.24
Planted non-indigenous native vegetation (no RVC)	9	4	13
Exotic non-native vegetation	45	21	62
TOTAL RVC	**180.24**	**67**	**249.24**
White Box - Yellow Box - Blakely's Red Gum woodland and derived native grasslands			
Endangered Ecological Community (TSC)	117	38	164
Critically Endangered Ecological Community (EPBC)	6	1	10
Hollow-bearing trees to be lost	**41**	**3**	**51**

2 SUBJECT SPECIES

2.1 BOOROOLONG FROG

Surveys conducted by **ngh**environmental and North West Ecological Services (NWES) in January and February 2013 were designed specifically to detect threatened species that were not detectable during surveys carried out for the Project in 2012. Survey effort was guided by previous desktop investigations and field surveys in areas of known or potential habitat.

Specifically, surveys for the Booroolong Frog were carried out by NWES during the species peak activity period, both inside and outside the new FSL, as requested by Department of Planning and Infrastructure (DP&I). Detailed survey data has been provided within this report.

2.1.1 Conservation Status

National

The Booroolong Frog is restricted to NSW and north-eastern Victoria tablelands and slopes from 200 m to 1300 m above sea level. The species is predominantly found along the western-flowing streams and their headwaters of the Great Dividing Range, although a small number of animals have been recorded in eastern-flowing streams (SEWPaC 2012; DECC 2005).

In early 1999, Booroolong Frogs were located along three small creeks, several kilometres north of the Murray River, near Jingellic, southern NSW. A subsequent survey was undertaken, searching for the frogs in four creeks (Burrowye, Walwa, Sandy, and Cudgewa Creeks) and the Murray River. Booroolong Frogs were found on Burrowye Creek at Burrowye, and on the banks of the Murray River near Jingellic, confirming the occurrence of the species in Victoria (The Victorian Frog Group 1999).

Within Victoria there are only two known locations for the Booroolong Frog in the north-east of the state; Burrowye/Guys Forest Creek at Burrowye and Koetong Creek within Mount Lawson State National Park (DSE 2013).

Overall, survey information indicates that the Booroolong Frog has undergone a severe decline and is no longer present across more than 50% of the species' former range (NSW OEH 2012a). Since 1998, surveys have been undertaken to determine the extent and cause of decline in the species.

The current geographic distribution of the Booroolong Frog extends from two streams near Tamworth in northern NSW to the Southern Highlands in Victoria. The Booroolong Frog is known to occupy 30 separate locations, being a stream or group of streams which supports a population of Booroolong Frogs connected by suitable habitat (Hunter 2013). An estimate of the area of occupancy for the Booroolong Frog across its range is 520 km of stream across 56 streams. This estimate is based on targeted surveys for this species, and extent of suitable habitat along occupied streams (Hunter 2013). Some areas of this species historic known distribution on the New England Tablelands has not been the focus of targeted surveys, therefore it is likely that this estimate of area of occupancy is an underestimate (Hunter 2013).

The most pronounced decline in the species' range has been across the Northern Tablelands where it was once common but has not been located in recent years despite extensive fauna surveys undertaken by the North-east Forest Biodiversity Study (NSW NPWS 1994), Regional Forests Assessment Program and others (NSW NPWS 2004). Specific surveys in the Northern Tablelands for the Booroolong Frog

conducted in 1999 and 2000 failed to locate the species from a number of historic locations and other potentially suitable habitat (Gillespie 2000).

Regional (NSW)

The Booroolong Frog has disappeared from the Northern Tablelands of NSW and is now rare throughout most of the remainder of its range. Previously known populations within the Blue Mountains are no longer able to be located.

The Booroolong Frog is now known from a single catchment in northern NSW - the Peel River catchment, of which the Cockburn River is a sub-catchment (Anna Cronin *pers comm.* 2013).

The only records of the species in northern NSW outside the Northern Tablelands are from two streams near Tamworth, NSW. These populations appear to be highly restricted and surveys of other previous known localities and streams with potentially suitable habitat in the Tamworth-Murrurundi area failed to locate additional populations of the Booroolong Frog (Gillespie 2000).

The Booroolong Frog was historically widespread throughout the Central Tablelands, having been recorded from locations within and between tributaries of the Macquarie and Lachlan Rivers. Surveys throughout this region have failed to locate the species along many of these streams, suggesting it is now rare in the Central Tablelands region (Gillespie 1999; Gillespie 2000). The species persists in this region along the Turon River and Winburndale Creek in the Winburndale Nature Reserve (NSW NPWS 2004) and within the Abercrombie River Catchment (Gillespie 2000).

This report presents the most recent available survey data for the species in NSW.

Local (upper Peel River and Cockburn River within the Peel River Catchment).

Surveys by NWES (2009b) in 2008/2009 found the Booroolong Frog occurring in the headwater streams of the Namoi Catchment between 400 to 700 metres above sea level. NWES located a large population of this species upstream of Chaffey Dam on the Peel River (NWES 2009b). The population at that time was conservatively estimated to be between 600 and 800 frogs (NWES 2009a). The area was again surveyed in January and February 2013 by experienced herpetologists Phil Spark and Dr Andrew Stauber and the species was found to be distributed along the Peel River from upstream of Chaffey Dam (within the current FSL) to Pearly Gates Bridge, Wombramurra Creek, and further upstream on the Peel River over a total distance of 25 km. The area surveyed and recorded locations of frogs are shown in Figure 2-3. A total of 2289 Booroolong frogs were recorded over 25 km of surveyed Peel River and Wombramurra Creek. Note, there is still a section of the Peel River upstream of Pearly Gates Bridge that has not been surveyed. However it is considered likely that the frogs would occur here (Phil Spark *pers comm.* 2013).

A population of this size is presently unknown from anywhere else in the current distribution of the species (P. Spark, *pers. comm.).*

2.1.2 Degree of Protection in Reserves

The majority of extant populations of the Booroolong Frog occur along streams that are not within nature reserves and are continuing to be modified, primarily through cattle grazing and weed invasion, in a manner that is likely to continue to contribute to the decline of this species. Habitat modification will undoubtedly contribute to the continued decline of the Booroolong Frog in the short term and increase

the susceptibility of the species to other factors likely to be impacting on the species (for example the disease chytridiomycosis and exotic fish).

2.1.3 Revised impact assessment

The large population of Booroolong Frogs approximately 1 km upstream of Chaffey Dam (634 individuals) that was documented in NWES (2009b) had fallen to 50 individuals in the 2013 surveys at that location. This supports the previous assertion of NWES (2009b) that such a large number of frogs at one location was an anomaly and not representative of the distribution along the rest of the Peel River. Furthermore, the summer 2013 surveys found that the Booroolong Frog was well distributed along the Peel River, upstream of Chaffey Dam for a distance of approximately 25 km.

As discussed in **ngh**environmental (2012), the high density of metamorph and juvenile Booroolong Frogs found at the junction of the Peel River with Chaffey Dam in 2008/2009 may have been a result of two floods that occurred in November and December 2008, washing eggs and possibly young tadpoles downstream (NWES 2009b). The summer 2013 surveys support this hypothesis, as this site does not currently support such a high abundance of individuals and the frog is well distributed upstream along the Peel River. It is likely that after the floods individual Booroolong Frogs migrated from Chaffey Dam upstream, and since that time there has been a spread in their distribution along the Peel River (Phil Spark, *pers. comm*.). According to NWES (2009b) there is approximately 99 km of potential Booroolong Frog habitat in the Namoi Catchment.

A very rough (and conservative) estimate of the Booroolong Frog population in the Namoi catchment was made, based on the number of Booroolong Frogs recorded from the 66 x 500 metre survey transects over 99 km of stream. On average, three to four frogs were recorded per 500 m, equating to a total population of between 594 and 792 frogs. This calculation excluded the 634 individuals recorded immediately upstream of Chaffey Dam, because it was considered atypical. The calculation also assumes that frogs occur along the length of the stream, which was not known at the time of writing (NWES 2009b).

Given the potential for 600 individual frogs to be impacted by inundation to the new FSL, the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) concluded that:

"*the Project is likely to have a significant impact on the population of the endangered Booroolong Frog that occurs immediately upstream of Chaffey Dam on the Peel River. However, this impact will be localised and the impact to the species across its range is unlikely to be significant.*"

It was recommended that surveys be undertaken in coordination with Namoi CMA during summer 2012/2013 to provide an updated estimate of the number of frogs both at the Chaffey Dam site and further upstream on the Peel River, in order to more accurately assess potential impacts on the species.

2.1.4 Current Surveys

Targeted surveys for Booroolong Frogs and their habitat were undertaken by Phil Spark and Dr Andrew Stauber over 21 nights between 17 January and 21 February 2013. These surveys comprised a follow-up study for surveys undertaken in 2008/2009 by Phil Spark (NWES 2009b), and are therefore considered a suitable comparison. The timing and methodology of these surveys were undertaken in accordance with the Survey guidelines for Australia's threatened frogs (DEWHA 2010), the Threatened species survey and assessment guidelines: field survey methods for fauna (DECC 2009b) and the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008). The supplementary DGR's requested that surveys be

undertaken during the breeding period (mid-November to mid-December), however the activity period extends until February (as stated in DEWHA 2010) and is dependent on local climatic conditions. Phil Spark conducted the surveys in January and February 2013 in response to local conditions and his knowledge of the population. The commencement of surveys in January 2013 is not considered to be a limitation due to the high activity levels observed during this period.

2.1.5 Methods

Night surveys were undertaken over the full width of the Peel River, commencing at the southern end of Chaffey Dam and working upstream. Handheld spotlights were used to survey the ground along the water's edge, and under emerging rocks and logs. Booroolong Frogs were captured where necessary to determine gender, and subsequently released.

A GPS location was recorded for each sighting, using Garmin hand-held units. For each individual, gender or developmental status was recorded, along with microhabitat details. Notes were also taken on the presence of other frog species, turtles and eastern water dragons.

2.1.6 Results

A distance of 21.3 km of the Peel River, immediately upstream of Chaffey Dam to Pearly Gates Bridge, was sampled during the 2013 summer surveys. Two areas were also sampled further upstream; 0.5 km of the Peel River approximately 11 km upstream of Pearly Gates Bridge, and 3.2 km of Wombramurra Creek, a tributary of the Peel River approximately 8.8 km upstream of Pearly Gates Bridge (south) (Figure 2-3). Thus a total distance of approximately 25 km of the Peel River and one of its tributaries was sampled in summer 2013. To date, 2289 Booroolong Frogs have been recorded over 21 nights of survey.

A total of 50 individuals were recorded over the 1.6 km of Peel River inside the new FSL (excluding four individuals within a 200 m section of the existing FSL) and 2235 individuals along the Peel River and its tributaries outside the new FSL.

Of the frogs recorded outside the new FSL, 2037 individuals were recorded over a 19.5 km stretch of the Peel River upstream of the new FSL, 118 individuals were recorded within a 1.5 km stretch of Wombramurra Creek, and a further 80 individuals were recorded within a 0.5 km stretch of the Peel River further upstream. The majority of Booroolong Frogs were confined to stream sections where large rocks were abundant.

This information is summarised in Table 2-1.

Table 2-1 Booroolong Frog survey results, summer 2013

Location	Number of frogs	Description	Distance surveyed
Immediately upstream of Chaffey Dam			
Inside existing FSL	4	From 100 m north of Bowling Alley Point Bridge to southern boundary of existing FSL	0.2 km
Inside new FSL	50	From southern boundary of existing FSL to boundary of new FSL on Peel River	1.6 km
Outside new FSL	2037	From boundary of new FSL upstream on Peel River to Pearly Gates Bridge	19.5 km
Survey locations at upstream extent of survey area			
Outside new FSL	118	Wombramurra Creek, 8.8 km upstream of Pearly Gates Bridge	3.2 km
Outside new FSL	80	Peel River, 11 km upstream of Pearly Gates Bridge	0.5 km
Total	2289		25.0 km

2.1.7 Current Population Status

Prior to the summer surveys being undertaken in January 2013, the most recent data on the population status of the Booroolong Frog upstream of Chaffey Dam was recorded in 2008/2009 (NWES 2009b). The recent surveys (January 2013) aimed to estimate the current population of Booroolong Frogs on the Peel River, both inside and outside the new FSL, to allow for a more informed assessment of impacts associated with the Project. These surveys have also assisted with the first recovery objective of the National Booroolong Frog Recovery Plan; to determine the distribution in areas that have not been the focus of targeted surveys (NSW OEH 2012a).

The surveys conducted in summer 2013 recorded a total of 2289 Booroolong Frogs along the Peel River and Wombramurra Creek. Results showing the distribution of individuals are provided in Figure 2-3. A more detailed breakdown of the population data along the sampled sections of the Peel River has been supplied as a map series in Appendix C. Of these 616 were males, 510 females, 339 metamorphs and 824 sub-adults. These maps and associated graphs (Figure 2-1 and Figure 2-2) give a clear indication that Booroolong Frogs at all life stages are present along the length of the river surveyed (25 km). From this representation of the data it is evident that suitable breeding habitat for the Booroolong Frog is present both within the new FSL and upstream, along the 25 km stretch of the Peel River and Wombramurra Creek surveyed.

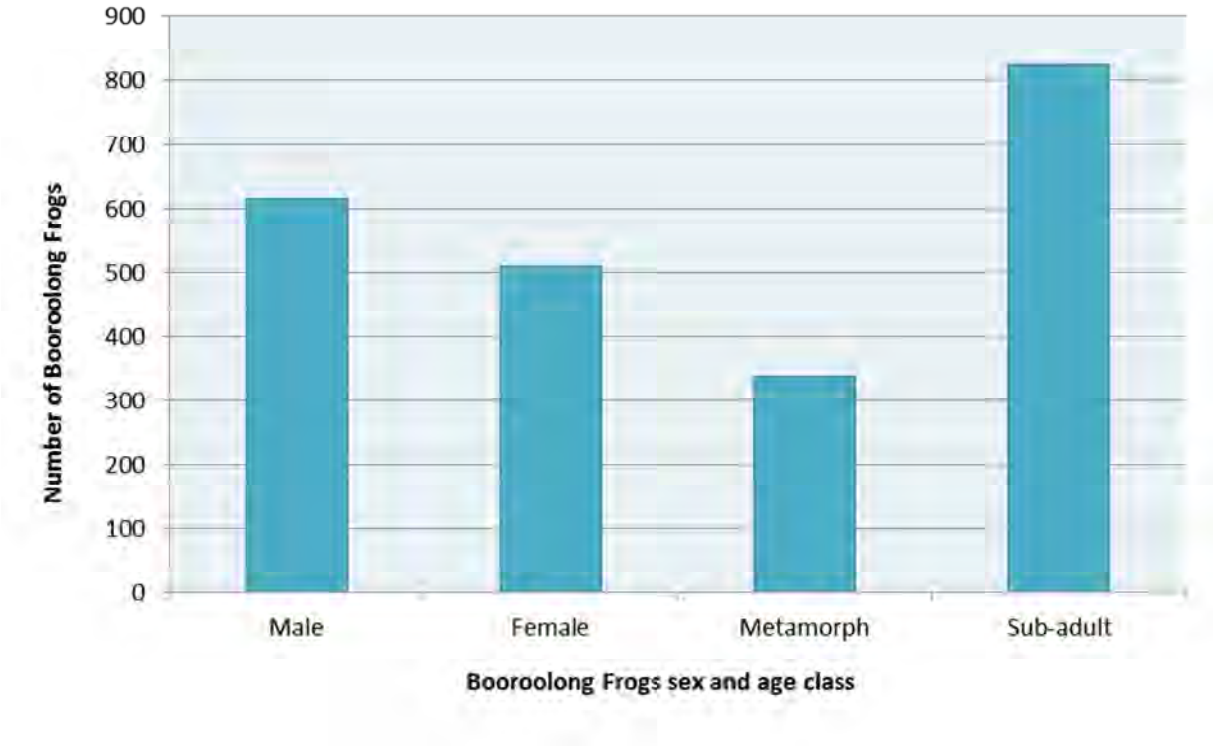

Figure 2-1 Sex and age class of Booroolong Frogs recorded in summer 2013 (NWES, 2013)

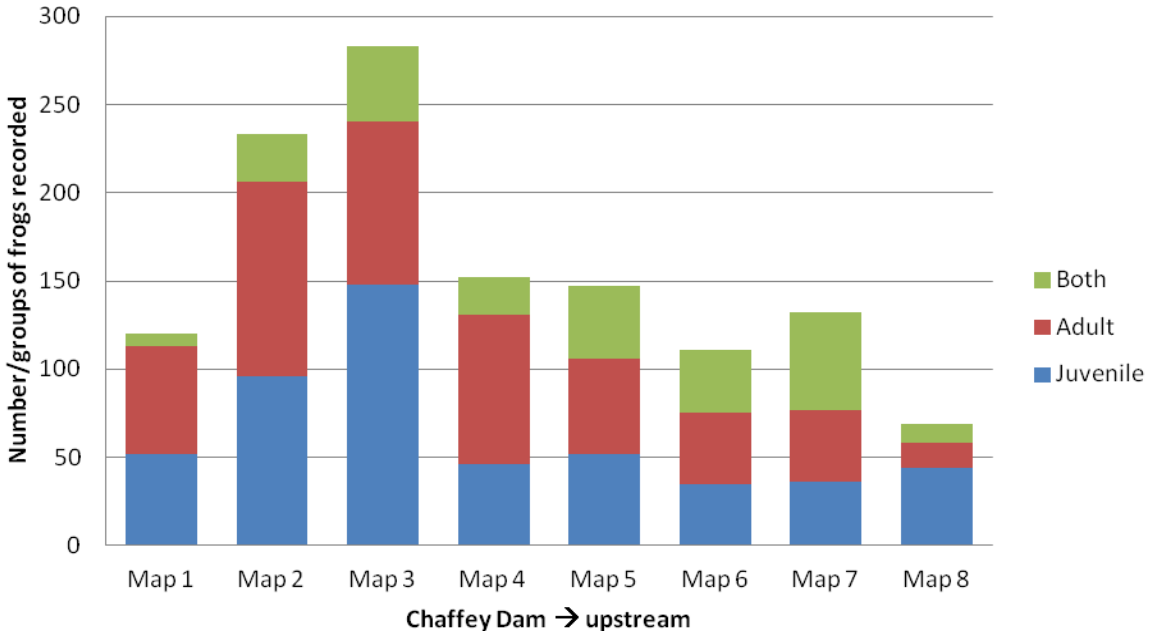

Figure 2-2 Booroolong Frog life stages from Chaffey Dam (Map 1) upstream (to Map 8) (NWES, 2013)

The summer 2013 surveys indicate that the Booroolong Frog population in the Peel River, immediately upstream of Chaffey Dam, currently comprises in the order of 2000 individuals, with a broad distribution along the length of the river surveyed (21.3 km). Fifty individuals were recorded within the new FSL, representing approximately 2.2% of the current known population of the Peel River (excluding the four individuals within the current FSL) surveyed in a 25 km stretch upstream of Chaffey Dam.

This suggests that the current impacts to the Booroolong Frog as a result of the Project are not as severe as initially assessed based on surveys undertaken in 2008/2009. However, as the Booroolong Frog is known to exhibit large fluctuations in abundance from one year to the next, as occurred when 634 individuals were observed within 1 km of Chaffey Dam, population abundance is not an accurate indicator of population resilience (NSW OEH 2012a). Therefore a more accurate reflection of impact to this species is to assess impact in relation to Booroolong Frog habitat.

2.1.8 Habitat

Surveys in summer 2013 found the Booroolong Frog to be well distributed along the Peel River, upstream of Chaffey Dam. As discussed previously, the Booroolong Frog occupies a linear habitat, therefore area of occupancy is best considered in terms of length of stream occupied (Hunter, 2013). These surveys showed that the entire 25 km of Peel River and Wombramurra Creek surveyed was occupied by Booroolong Frogs and is therefore considered to provide suitable habitat for the species. The presence of metamorph and sub-adult (juvenile) life stages in the area surveyed confirms all 25 km is suitable breeding habitat for the species (Figure 2-1, Figure 2-2 and Appendix C). The as yet unsurveyed section of the Peel River as shown in Figure 2-3 is considered likely to be occupied by Booroolong Frogs (Phil Spark *pers. comm.).*

The current data indicates that the Booroolong Frog is utilising the majority of habitat along the 25 km stretch of the Peel River immediately upstream of Chaffey Dam. Furthermore, it is known that the species uses a range of habitats at different life stages, with tadpoles developing in slow-flowing connected or isolated pools (Anstis 2002). It is therefore evident that the Booroolong Frog has a reliance on both riffle and pool habitats, which are the features that comprise the surveyed sections of the Peel River.

The extent of shading along the Peel River was not taken into account during the summer 2013 surveys by Phil Spark (NWES), however observations pertaining to depth and substrate were made at every location where a Booroolong Frog was located. This gives an indication of preferred habitat by the Booroolong Frog and indicates that the Booroolong Frog has a microhabitat preference for riffles with large rocks (33%) followed by rapids with large rocks (26%) (Figure 2-4). Detailed maps showing the distribution of the Booroolong Frog population on the Peel River, upstream of Chaffey Dam is provided in Appendix C. It is clear from these maps that Booroolong Frogs are well distributed upstream of Chaffey Dam, as are the habitat features utilised by the species at each of those locations. This is further supported by the graph in Figure 2-4 which portrays the proportion of each habitat type within each of the maps (stream sections surveyed). Overall, the most common habitat components across the entire area surveyed (25 km) were rapid or riffle zones with large rocks. Booroolong Frogs, both adults and juveniles, were also found in areas described as 'hole, still – gravel bank'. It is also evident that the species is less reliant on areas with small rocks. Furthermore, there were very few (if any) individuals found in areas of 'hole, still – dirt bank', otherwise known as the edges of deep pools. Nonetheless, the trend in habitat preferences is very similar across the 25 km surveyed in summer 2013. From the maps provided in Appendix C it is evident that there is no gap in Booroolong Frog occupation along the Peel River greater than 200 m (with most gaps much less than this). Therefore, it seems reasonable to assume

that the ratio of suitable versus unsuitable habitat is relatively even. As a mobile species, the Booroolong Frog is likely to range outside of the locations identified by Phil Spark in summer 2012/2013. As such, we have assumed that the entire length of river both within the new FSL and outside the new FSL provided a similar proportion of suitable habitat for the Booroolong Frog.

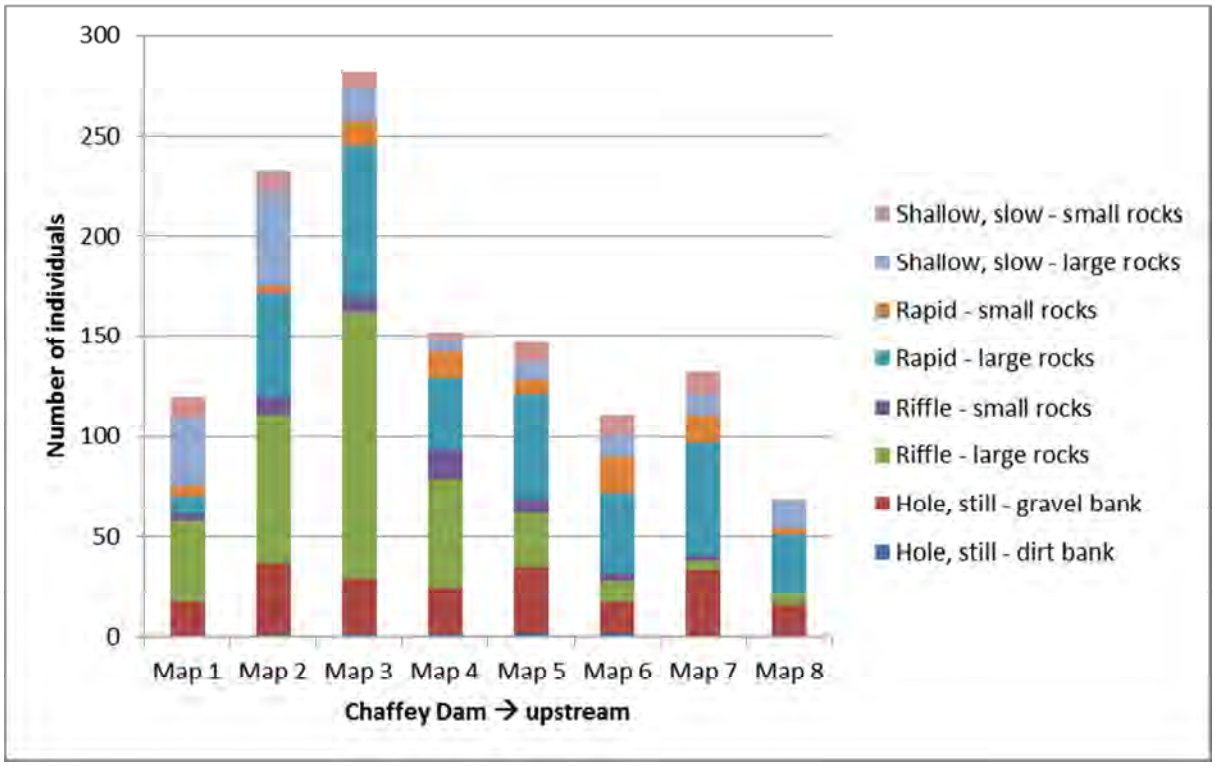

Figure 2-4 Microhabitat selection by Booroolong Frogs surveyed in summer 2013 in the Peel River and Wombramurra Creek, from Chaffey Dam (Map 1) upstream (to Map 8) (source NWES 2013).

In the 2012 Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), riffle habitats were assessed as optimal Booroolong Frog habitat both within the new FSL and outside of the new FSL. Given the outcomes of the summer 2013 surveys, the loss of habitat as a result of inundation to the new FSL has been re-assessed to include the entire length of the river between the existing FSL and the new FSL for a distance of 1.6 km. The Peel River is a dynamic system; areas of suitable Booroolong Frog habitat will change in response to rainfall or lack thereof. Therefore, the total river channel width (calculated using ArcGIS) has been used to calculate the area of Booroolong Frog habitat within the 1.6 km stretch of stream to be impacted by the Project. This method gives an area of 4.77 ha of Booroolong Frog habitat on the Peel River that will be impacted as a result of inundation. This calculation of area has been used in order to utilise the BioBanking Credit Calculator and the EPBC Offsets Calculator. However, as the Booroolong Frog occupies a linear habitat, area of occupancy is best considered in terms of length of stream occupied (Hunter, 2013). The length of 1.6 km equates to approximately 6.4% of the known Booroolong Frog habitat on the Peel River. This is a conservative estimate. The impact of 6.4% is calculated according to the area of stream over which Booroolong Frogs were recorded during the summer 2013 surveys. There is a high probability that Booroolong Frogs would also occupy the 15 km section not surveyed between Pearly Gates Bridge and Wombramurra Creek, and further upstream along the Peel River (Phil Spark, *pers. comm.*) (Figure 2-3). The presence of Booroolong Frogs at the upstream and downstream extent of the survey area, strongly suggests they would also be present in the un-surveyed section. This would mean a total occupied area of more than 40 km and an impact area

therefore of less than 4%. However, with the aim of quantifying the impact of the Project on *known* Booroolong Frog habitat as opposed to potential habitat, a conservative calculation of 6.4% has been provided (not 4%).

2.1.9 Potential Impacts

It is estimated that the area of Booroolong Frog habitat to be impacted by inundation to the new FSL is 4.77 ha. This is based on the actual channel width of the Peel River within the distance between the existing FSL and the new FSL (1.6 km), and has been calculated using ArcGIS. Fifty Booroolong Frogs were recorded within this area during surveys in summer 2013. Suitable breeding habitat for the Booroolong Frog is present along the 25 km stretch of the Peel River and Wombramurra Creek surveyed. The loss of habitat within the impact site (1.6 km) will not remove important breeding habitat over and above breeding habitat present upstream of the new FSL.

Based on simulated 100 year dam volumes, the minimum duration over which the additional inundation will occur is expected to be between eight and 21 weeks, although inundation to the new FSL could take up to several years. Thus the magnitude of the impact on the individuals recorded within the FSL will initially be low and gradual. Given the proven ability of the frogs to move according to changed conditions evidenced by the four individuals recorded within the existing FSL, this may mitigate (slow) the rate of habitat loss and provide an opportunity for the natural migration of individuals upstream, thereby reducing the impact to the species.

Water levels in the reservoir fluctuate with corresponding rainfall, inflow and drought events. Following implementation of the Project, the reservoir water level will not always be at the new FSL. According to simulated 100 year dam volumes, following augmentation to 100 GL the reservoir will only be at FSL 24% of the time. Further, the reservoir will be at or below the existing FSL around 21% of the time.

The changes in the reservoir storage level means that 100% of the 1.6 km of Booroolong Frog habitat is only inundated when the reservoir is at 100% capacity (i.e. 24% of the time). While the suitability of habitat for the frogs once it has been inundated and the water level has dropped is unknown, for all storage levels below 100% the impact is less, to the point where the storage reduces to the existing FSL (or below) and the impact is zero.

The distribution of Booroolong Frog along the Peel River recorded in the summer 2013 surveys compared to the recorded distribution and abundance in 2009 (NWES 2009b) suggests that the Booroolong Frog is capable of migrating upstream and downstream and is resilient to a wetting and drying cycle. Thus, habitat currently occupied by the Booroolong Frog inside the new FSL may intermittently provide habitat for the Booroolong Frog following implementation of the Project, when reservoir levels are below the new FSL.

Due to uncertainties regarding the timing of initial inundation and the quality of the habitat post-inundation, the permanent loss of habitat inside the new FSL has been assessed. The National Recovery Plan for the Booroolong Frog states that "*any action that reduces stream permanency or results in loss of rock crevices, is likely to threaten the persistence of local populations of this species*". Therefore, despite the current abundance of the Booroolong Frog along the Peel River, the loss of 1.6 km (6.4%) of known Booroolong Frog habitat is considered to have a significant impact at a local and regional level. This population immediately upstream of Chaffey Dam forms the largest and most continuous distribution of the species known in northern NSW, and potentially Australia. As such, an Offset Plan has been prepared to satisfy the legislative requirements with the aim of reducing known threatening processes occurring

along the Peel River, thereby contributing to the recovery of the Booroolong Frog in the Namoi catchment (Appendix D).

An Assessment of Significance in accordance with the EPBC Act *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* is provided in Appendix A.3.

2.1.10 Management measures for Booroolong Frog

Due to the nature of the Project, impacts to the Booroolong Frog through inundation to the new FSL are unavoidable and cannot be mitigated. Accordingly, management measures are outlined below.

Major factors contributing to the decline of the Booroolong Frog within the Namoi catchment include disease (Chytridiomycosis) and habitat degradation (e.g. erosion due to vegetation clearing, stock grazing, and fossicking; weed invasion; sedimentation) (NSW OEH 2012a). As such, recommendations and management measures for the Booroolong Frog have been proposed in order to respond to these factors and contribute to the recovery of this species along the Peel River.

The following mitigation measures will be incorporated into the Project to limit impacts to the Booroolong Frog during construction:

- Strict hygiene protocols (Weeks 1 to 104)
- Sediment and erosion controls (Weeks 1 to 104)
- An ecologist will be engaged to prepare induction material to outline the species profile, hygiene protocols and maps of sensitive areas in relation to the Booroolong Frog. Induction of all contractors will be carried out at the commencement of onsite activities specifically at Bowling Alley Point Bridge. Additional inductions will be carried out periodically as new contractors enter the site. (Weeks 13 to 60 where appropriate)

As part of these management measures an Offset Plan which will strive to "improve or maintain" the existing population has been proposed and is included in Appendix D.

- A management plan will be developed and implemented for the Booroolong Frog that will include provision for:
    - Remediation and threat mitigation as required at offset sites (e.g. stock exclusion, weed removal, removal of exotic shading vegetation, protection from fossicking).
    - Post-construction monitoring for a minimum of two years to monitor the success of remediation and threat mitigation measures outside of the FSL, and to monitor the impacts of inundation on Booroolong Frog populations located within the FSL. This will be dependent on the rate of inundation and consultation with the relevant parties (e.g. Namoi CMA). Annual auditing and reporting would be required in order to detect potential problems associated with implementing mitigation measures (e.g. landholder compliance) as well as annual monitoring during the summer breeding season to assess the success of those measures and response of the Booroolong Frog population.
    - Following further consideration of mitigation strategies and consultation with OEH and Namoi CMA, relocation is no longer proposed for the Booroolong Frog.
    - Any monitoring undertaken must comply with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008) in order to prevent the spread of Chytridiomycosis.
- Riparian restoration and protection program. This will include:

- Rehabilitation of the riparian zone to promote regeneration of native riparian vegetation
- Weed control with a focus on woody weeds such as willows and Blackberry.
- Signage to reduce human access.

These management measures have been designed in consultation with OEH, Namoi CMA and relevant experts. These management plans will form part of the approved Offset Management Plan.

2.1.11 Expected or Predicted Effectiveness of proposed mitigation

Threats to the Booroolong Frog are relatively well known and documented. Primary threats include disturbance and siltation impacts from fossicking and stock trampling, weed infestation, shading from exotic vegetation, chytrid, predation on adults frogs by foxes and predation on tadpoles by exotic fish such as European Carp.

The Offset Plan and management measures therein aim to address as many of these threats as possible by implementing private conservation agreements with landholders that ensure the management of riparian habitats along the Peel River with the aim of reducing the operation of these threats. The details of the implementation, timing, duration and nature of management activities will be finalised in consultation with Namoi CMA, OEH, SEWPaC and other relevant species experts.

2.2 QUEENSLAND BLUEGRASS

An historical record exists for Queensland Bluegrass in the Bowling Alley Point cemetery from early February 2003 (Appendix A). The cemetery is located in close proximity (approximately 500m east) to the Chaffey Dam reservoir and the habitat that occurs within the cemetery is similar to that which occurs within the area to be inundated by the proposed augmentation.

Targeted surveys carried out by **ngh**environmental in October 2012 did not locate Queensland Bluegrass at the location of the previous recording or elsewhere in the study area. However, as the species is more likely to be flowering (and thus identifiable) in summer, it was determined that summer surveys were necessary to determine whether it is present or absent in the study area. Without these surveys the employment of the precautionary principle assumed that there was the potential for a significant impact to Queensland Bluegrass as a result of the Project. It was estimated that approximately 10 ha of high quality box gum woodland providing suitable habitat for Queensland Bluegrass, would be impacted by the Project as a result of both inundation and construction (**ngh**environmental 2012).

2.2.1 Survey Methods

A targeted summer survey for Queensland Bluegrass was undertaken from the 31 January to 1 February 2013 by two experienced botanists. This survey timing was considered suitable for detecting the species as the survey was carried out in the known flowering period for the species (NSW OEH 2012b) and the previous record was recorded on the 10 February 2003. A total of 13 person hours was dedicated to Queensland Bluegrass surveys (Table 2-2). The timing and effort devoted to this survey is considered to be adequate to confidently assess the presence or absence of this species.

Foot based surveys were conducted employing parallel transects spaced approximately 5 m to 10 m apart through areas of suitable habitat. A total of five foot based transect surveys were conducted, one at the location of the previous record (outside of the area of impact) and four within the area to be impacted by

the Project, focusing on areas of better quality habitat. Areas immediately adjacent to the area to be impacted where also included.

A single driving transect was also conducted through lower quality habitat while moving between foot based survey locations. This consisted of observing from both sides of a slow moving vehicle, stopping when required to confirm species identifications.

The locations of transects and associated survey effort are described in Table 2-2. A map of survey effort is presented in Figure 2-5.

Table 2-2 Queensland Bluegrass targeted survey locations and effort

Transect No.	Targeted survey location description	Survey effort (person hours)
1	Bowling Alley Point cemetery	2.0
2	Box-Gum Woodland, eastern foreshore, north of Bowling Alley Point Recreation Area	3.5
3	Box-Gum Woodland derived grassland, eastern foreshore, between transect 2 and 4 (driving)	1.0
4	Box-Gum Woodland, eastern foreshore, opposite access road to cemetery	3.0
5	Box-Gum Woodland, eastern foreshore, north of Bowling Alley Point Bridge	2.0
6	Box-Gum Woodland derived grassland along northern verge of the Tamworth – Nundle Road within proposed road works area	1.5
Total		13.0

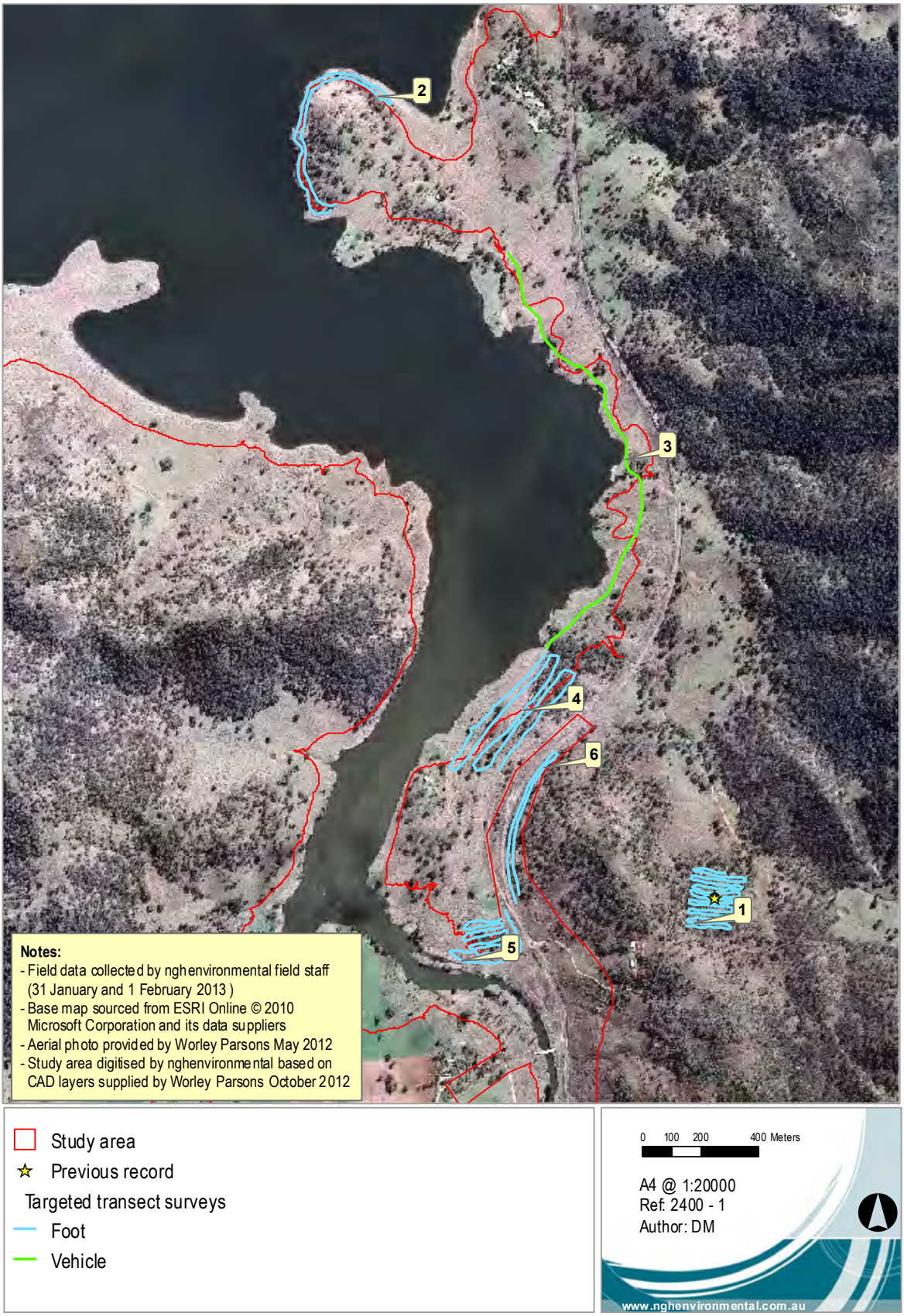

Figure 2-5 Queensland Bluegrass targeted survey locations

2.2.2 Results

From the six transect surveys conducted, no Queensland Bluegrass individuals were identified and it is considered unlikely that any would have been overlooked. Despite extensive searches, the previous record of this species within the Bowling Alley Point cemetery was not detected and thus not able to be verified.

The more common species of Bluegrass (*Dichanthium sericeum*), which is not listed as threatened under Commonwealth or State legislation, was identified along all transects within the areas to be impacted (being particularly abundant at transect 4) however, it was not detected within the cemetery. Considering that species of *Dichanthium* are generally shade intolerant it is possible that the overstorey within the cemetery has developed to the extent as to render the habitat unsuitable for either *D. sericeum* or *D. setosum* and that the threatened species no longer persists at this location.

2.2.3 Potential impacts and mitigation

The Terrestrial and Aquatic Flora and Fauna Impact Assessment conducted by **ngh**environmental in 2012 concluded that due to a previous record of the species (from 2003) in close proximity to the study area and that similar habitat occurred within the area to be impacted, a population of Queensland Bluegrass could exist and be impacted by the Project. As such, further surveys were recommended during the peak flowering period of Queensland Bluegrass in order to detect the species if it occurs, and accurately assess the impact of the Project on Queensland Bluegrass.

Targeted searches conducted on the 31 January and 1 February 2013 did not detect Queensland Bluegrass, either at Bowling Alley Point cemetery where it had previously been recorded, or in optimal habitat within the study area.

Given the suitability of the timing of the surveys and that all areas of better quality habitat within the area to be impacted were searched and the species not detected, it is considered that the species does not occur on the site and will not be impacted by the Project. No further recommendations are considered to be required for this species.

2.3 BORDER THICK-TAILED GECKO

The Border Thick-tailed Gecko is listed as vulnerable under the TSC Act and the EPBC Act. This species is patchily distributed on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree (NSW OEH 2012c). It is most common in the granite country of the New England Tablelands, occurring at sites ranging from 500 to 1100 m elevation. Populations are mostly fragmented, with over 50 discrete sites currently known that are separated by at least 2 km (NSW OEH 2012c).

There are 11 records in six locations of the Border Thick-tailed Gecko within 10 km of the dam wall, from between 1993 and 2008 (Appendix A). Most recently, this species has been recorded on the dam wall and in the remnant vegetation of Goat Mountain, adjacent to the dam wall (NWES 2009a and **ngh**environmental 2012).

The artificial rocky surface area of the downstream dam wall currently provides approximately 50,000 m^2 of Border Thick-tailed Gecko habitat. The upstream face of the dam wall above the existing FSL provides an additional 6,000 m^2 of suitable rocky habitat (of which 2,600 m^2 will be impacted by inundation). A change to the scope of works since submission of the PIR means that the total area of Border Thick-tailed Gecko habitat on the downstream face of the wall (50,000 m^2) will no longer be impacted by

construction. Impacts associated with the revised construction methodology will occur along the upstream face of the wall between the left bank and the morning glory spillway. This constitutes a total impact area of 2,000 m^2 during construction and 2,600 m^2 from inundation (a total of 4,600 m^2). Given the substantial reduction in the area of impact on the dam wall, significant impacts to the gecko during construction have been avoided.

Surveys carried out by **ngh**environmental in October 2012, in a total survey effort time of 240 person minutes, confirmed the presence of the Border Thick-tailed Gecko on the dam wall and on Goat Mountain to the immediate north of the dam (**ngh**environmental 2012). The recommended survey period is November to February (SEWPaC 2011), however confirmation of the species presence on the dam wall was achieved in October, therefore no further surveys were considered to be required.

The proposed mitigation measures set out in Section 4 aim to avoid impacts to the Border Thick-tailed Geckos that occur within the impact zone during construction on the dam wall.

2.3.1 Habitat and Population at Chaffey Dam

Artificial habitat for the Border Thick-tailed Gecko is provided by the large rocks that form the existing dam wall. In 2008 and 2009 NWES conducted targeted searches for the Border Thick-tailed Gecko, and found it to be relatively common on the dam wall, as well as in shrubby rocky remnants around Woolomin, including Goat Mountain, to the immediate northwest of the dam wall.

The Border Thick-tailed Gecko was observed by NWES in 2008 on the dam wall (NWES 2009a). The species was also found to be relatively common within the locality and the region, recorded many times in shrubby rocky remnants around Woolomin, including Goat Mountain, to the immediate northwest of the dam wall. Geckos were also found to be relatively common within woodland remnants, dry open forests with a patchy and continuous shrub layer (NWES 2009a). NWES (2009a) concluded that the geckos on the dam wall are likely to be part of a much larger population in the remnant habitat of Goat Mountain.

One individual was found on Goat Mountain during surveys by **ngh**environmental in October 2012. A further three individuals were found on the top of the downstream face of the dam wall in October 2012. However, due to access and safety issues, it was not possible to survey the whole of the artificial rock pile of the dam wall.

Construction associated with the raising of the dam wall has been designed to avoid impacts to the Border Thick-tailed Gecko. Provided that the proposed mitigation measures are carried out, the Project is not considered to have an impact on this species at a local, regional or national scale. No natural habitat for the species will be removed. An offset is not required for this species in accordance with the EPBC Act Environmental Offsets Policy and the NSW BioBanking Assessment Methodology, however habitat on Goat Mountain where the Border Thick-tailed Gecko is present will be offset as part of the proposed Offset Plan (Appendix D).

2.3.2 Potential Impacts

Surveys by **ngh**environmental in October 2012 confirmed the presence of the Border Thick-tailed Gecko on the dam wall (three individuals). The Gecko is known to currently inhabit the dam wall but due to the access and safety issues in surveying such a habitat the number of individuals is unknown.

Due to a change in the Project methodology, there has been a substantial reduction in the level of impact to the Border Thick-tailed Geckos inhabiting the dam wall. The raising of the morning glory spillway

access bridge and platform on the piers, and changes to the auxiliary spillway and fuse plug will no longer proceed as part of the proposed works. Raising of the dam wall by placement of rock on the downstream face is no longer required. As an alternative, a vertical reinforced earth embankment for wall raising will be constructed on the crest of the dam wall (Figure 2-6). As a result, the 50,000 m^2 of Border Thick-tailed Gecko habitat on the downstream face of the wall will no longer be impacted. Impacts to Border Thick-tailed Gecko habitat associated with the revised construction methodology will only occur along the upstream face of the wall between the left bank and the morning glory spillway. This constitutes an impact area of 2,000 m^2as a result of construction. As such, relocation of geckos to an area of artificial habitat will no longer be required. Revised mitigation and management measures are detailed below.

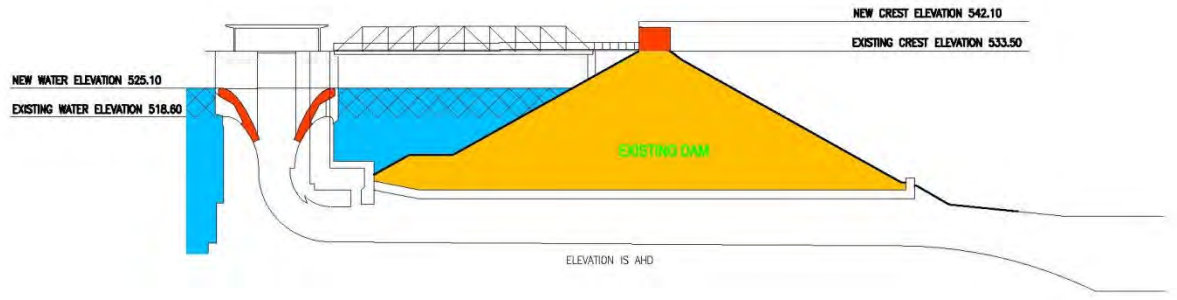

Figure 2-6 Revised construction methodology on the Chaffey Dam wall

Overall, it has been estimated that approximately 4,600 m^2 of the upstream dam wall habitat will be impacted by both inundation (2,600 m^2) and construction (2,000 m^2). The remaining 1,400m^2 on the upstream face of the wall will continue to provide suitable habitat for the Border Thick-tailed Gecko throughout the construction phase. The 50,000 m^2 of Border Thick-tailed Gecko habitat on the downstream face of the dam wall will not be impacted by the Project and will continue to provide the species with suitable habitat during and post-construction. Post-construction, the Border Thick-tailed Gecko will have access to the entire upstream and downstream face of the dam wall. There will be no operational phase impacts on the species.

No other Border Thick-tailed Gecko habitat will be impacted as a result of the Project. Mitigation measures have been designed to avoid impacts to Border Thick-tailed Gecko individuals inhabiting the works areas on the dam wall throughout the construction process, and are detailed in Section 2.3.3.

The Gecko occurs naturally on Goat Mountain to the immediate north of the dam wall and this population will not be impacted by the Project. Given it's occurrence in surrounding areas and that only a small proportion (8.7%) of artificial habitat will be impacted by the Project, it is likely that the species will recolonise the works areas on the dam wall post-construction, therefore the impact is unlikely to be significant.

No naturally occurring population of the species will be impacted by the Project. Furthermore the proposed offset location northwest of the dam encompasses Goat Mountain which supports a known population of the species. There will be no translocation of individuals from the dam wall into already occupied habitats.

An Assessment of Significance in accordance with the EPBC Act *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* is provided in Appendix A.3.

2.3.3 Mitigation and management measures for the Border Thick-tailed Gecko

To avoid impacts to the Border Thick-tailed Gecko during the construction phase, works will follow a staged and strategic plan for the clearing and excavation. The entire wall will not be impacted, therefore the geckos will be able to continue to utilise areas of the wall during construction. A Fauna Management Plan will be prepared and implemented to guide the construction phase activities including the following considerations:

- Disturbance to any area of Border Thick-tailed Gecko habitat on the dam wall will only take place between the months of September and April.
- Three nights of pre-clearing surveys will be undertaken prior to construction to relocate individuals from the crest of the dam wall to adjacent areas of the wall which will not be impacted.
- A Fauna Management Plan will be prepared and implemented to guide the construction phase activities including the following considerations:
    - A Construction Environmental Management Plan (EMP) will provide employees on the construction site with detailed information on the Border Thick-tailed Gecko relating to its identification, habitat preferences, time of activity, and the appropriate procedures upon encountering individuals.
    - An ecologist will be on site during construction to ensure the safe relocation of all fauna species encountered, to other areas of the wall not to be impacted by construction.
    - If many (>5) individuals are encountered during construction, activities will stop, and an additional night survey will be conducted in order to relocate individuals to adjacent areas of the wall that will not be impacted by construction. Construction may recommence.

The wildlife corridor created in late 2011 and early 2012 linking Goat Mountain with the Peel River and habitat areas to the east was designed as a movement corridor for fauna, but is currently adversely impacted by stock and weeds.

- Weed management would be ongoing as per the Vegetation Management Plan particularly focusing on Coolatai Grass infested areas around the dam wall and planted wildlife corridor. Coolatai grass has been identified as a key threatening process for the Border Thick-tailed Gecko.

2.3.4 Expected or Predicted Effectiveness of proposed mitigation

Due to significant changes in the proposed construction methodology on the dam wall, impacts to the Border Thick-tailed Gecko have been substantially reduced. The Project will now only affect approximately 4,600 m^2 of Border Thick-tailed Gecko artificial habitat as a result of inundation and construction, as opposed to the 52,600 m^2 originally assessed (**ngh**environmental 2012; **ngh**environmental 2013). While the majority of works have avoided known habitat for the species, adverse impacts on individuals within the revised impact area will be avoided through the mitigation measures proposed.

The mitigation measures proposed for the Border thick-tailed Gecko have been developed in consultation with State Water and OEH to provide certainty of practicality and acceptability. Assumptions have been based on available data on the distribution of the species locally, elsewhere in the study area and within the artificial habitat of the dam wall. Adverse impact on the species will be avoided through the staged approach to construction that State Water has committed to.

2.4 MURRAY COD

2.4.1 Populations and Habitat

The Murray Cod occurs in a range of flowing and standing waters, from small, clear, rocky streams on the inland slopes and uplands of the Great Diving Range, to the large, turbid, meandering slow-flowing rivers, creeks, anabranches, and lakes and larger billabongs, of the inland plains of the Murray Darling Basin. Within these broad habitat types, Murray Cod are usually found associated with complex structural cover such as large rocks, large snags and smaller structural woody habitat, undercut banks and over-hanging vegetation (Dakin and Kesteven 1938; Lake 1967b; Langtry in Cadwallader 1977; Cadwallader 1979; Cadwallader and Backhouse 1983; Harris and Rowland 1996; Koehn 1996, 2006; Rowland 1988a, 2005). The length of the Peel River and Chaffey Dam provides habitat for this species. Habitat critical for the species has not been identified in the National Recovery Plan for the Murray Cod (National Murray Cod Recovery Team 2010) or the Register of Critical Habitat maintained by the minister under the EPBC Act.

Figure 2-7 maps the known records of Murray Cod within Chaffey Dam and the Peel River, habitat for the Murray Cod and indicates the extent of the potential downstream and upstream impacts. Known records were sourced data provided by DPI (fisheries) on 30 April 2013. Minor watercourses indicated on Figure 2-7, tributaries to the Peel River, are also potential habitat for the species.

A search of the Atlas of Living Australia and the NSW Bionet Atlas on 2 May 2013 did not identify any previous records of the Murray Cod in Chaffey Dam or along the Peel River.

It should be noted that known records do not provide an accurate indication of the prevalence of the species within the Peel River and Chaffey Dam. As discussed below, Peel River and Chaffey dam are an important recreational fishing area and the Murray Cod is regularly stocked within these areas (Table 2-3).

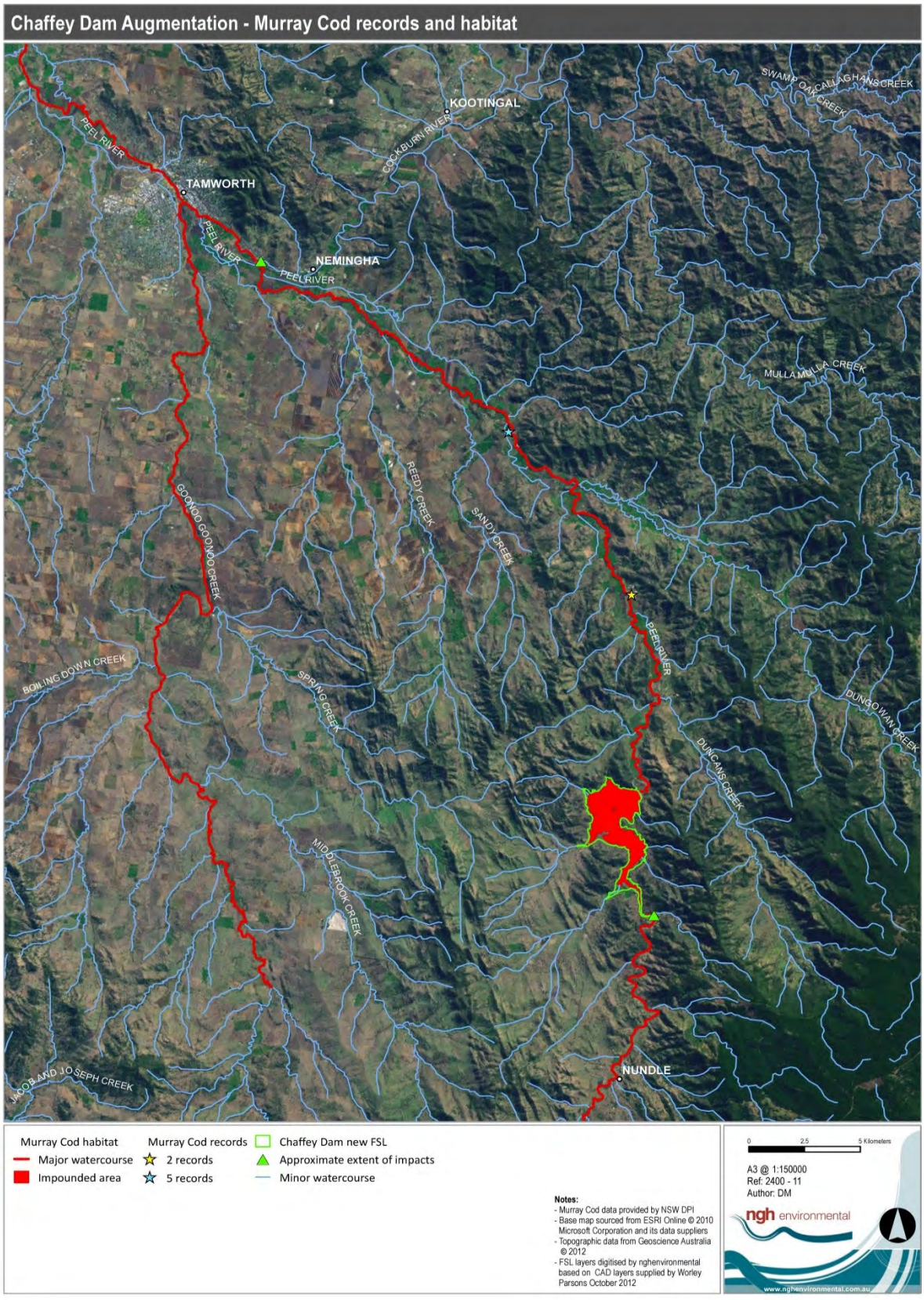

Figure 2-7 Location of previous Murray Cod records, extent of downstream and upstream impacts and habitat of Murray Cod

Murray Cod stocking

Murray Cod are stocked annually into a range of impoundments and streams in NSW in order to enhance the recreational fishery. All stocking activities are required to comply with the NSW Freshwater Fish Stocking Fishery Management Strategy (NSW DPI 2005) which includes consideration of issues such as genetic management, biosecurity, impact on other species including threatened species, natural range, fish welfare and angler demand.

Chaffey Dam and the Peel River upstream and downstream are important recreational fishing areas.

DPI (fisheries) provided the following stocking undertaken within Chaffey Dam and upstream and downstream along the Peel River (Table 2-3).

Table 2-3 Stocking of Murray Cod (fry or fingerling) within Chaffey Dam and the Peel River upstream and downstream of the impoundment. Data provided by DPI (fisheries) on 1 May 2013.

Location	Year	Number of releases	Total number released
Chaffey Dam	1986	1	500
Chaffey Dam	2003	1	41,000
Chaffey Dam	2004	1	25,000
Chaffey Dam	2007	2	10,600
Chaffey Dam	2012	1	12,000
Chaffey Dam	2013	1	1,300
TOTAL release for Chaffey Dam: 90,400			
Peel River (upstream of Chaffey Dam)	2008	1	1,515
Peel River (upstream of Chaffey Dam)	2008	1	1,515
TOTAL release for Peel River upstream of Chaffey Dam: 3030			
Peel River (downstream of Chaffey Dam)	2002	1	3,032
Peel River (downstream of Chaffey Dam)	2003	1	4,000
Peel River (downstream of Chaffey Dam)	2004	10	3,407
Peel River (downstream of Chaffey Dam)	2006	14	14,494
Peel River (downstream of Chaffey Dam)	2007	2	2,300
Peel River (downstream of Chaffey Dam)	2010	2	2,765
Peel River (downstream of Chaffey Dam)	2011	7	4,600
Peel River (downstream of Chaffey Dam)	2013	6	5,500
TOTAL release for Peel River upstream of Chaffey Dam: 40,098			

Consultation was undertaken with the Nundle Fishing Club. Ray Daniels indicated that Murray cod numbers were good in all areas of Chaffey Dam and upstream at Nundle in the deeper parts of the river. With the water level in the river being very low cod are mainly found in the deep holes from Nundle downstream to Chaffey Dam. Cod numbers downstream of Chaffey, in his experience, are greater than any other area, with larger and older fish being found. Nundle fishing club released 2000 cod fingerlings in their local area three years ago and they currently have a grant application being considered to buy more fish (Ray Daniels, pers. comm., 2 May 2013).

Important populations

In accordance with the definition of the EPBC Act Significant impact guidelines 1.1, an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The closest important population identified in the National Recovery Plan for the Murray Cod (National Murray Cod Recovery Team 2010) is identified as the one occurring within the Namoi River from Peel River junction downstream to Wee Waa, including most major tributaries except upper Mooki River. This population is around 100 km (river length) downstream of the downstream limit of the potential impact zone of the proposed Chaffey Dam augmentation (Figure 2-8).

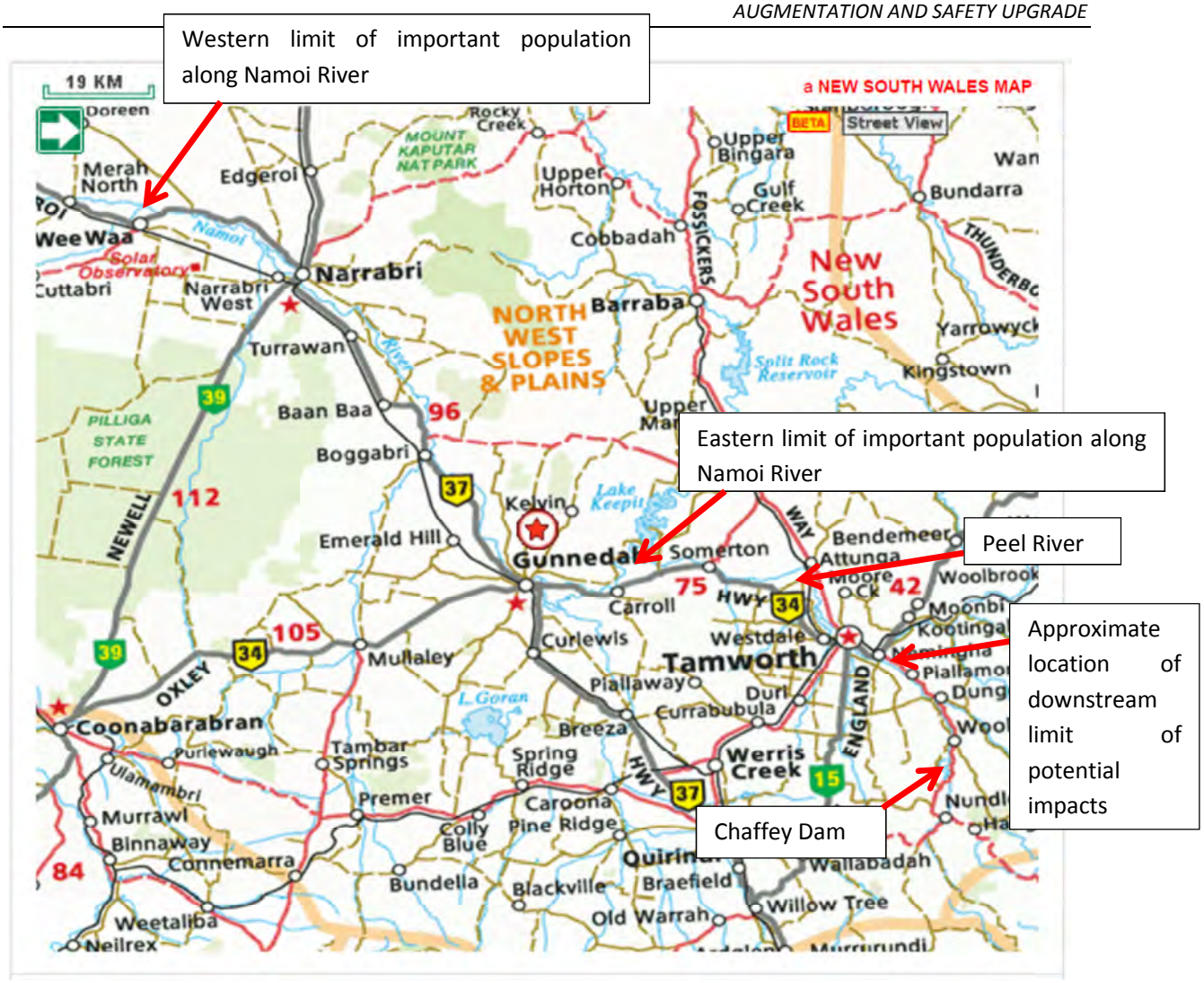

Figure 2-8 Location of important population of Murray Cod relative to Chaffey Dam and downstream limit of potential impact.

The Peel River and Chaffey Dam are an important recreational fishing area where the Murray Cod is regularly stocked (Table 2-3). It is therefore not considered an important population under the definition of the EPBC Act Significant impact guidelines 1.1.

The National Murray Cod Recovery Team (2010) has not identified the Murray Cod population within the Peel River or Chaffey Dam to be a population under threat.

2.4.2 Potential Flow Regime and Water Quality (Oxygen and Temperature) Impacts on Murray Cod and its Habitat Downstream of Chaffey Dam

The majority of the information on the ecology of the Murray Cod provided below is taken from the National Recovery Plan for the Murray Cod *Maccullochella peelii peelii* (National Murray Cod Recovery Team 2010).

Importance of flows for the Murray Cod and potential flow regime impacts on the Murray Cod and/or its habitat downstream of the dam

The Murray Cod occurs in a range of flowing and standing waters, from small, clear, rocky streams on the inland slopes and uplands of the Great Diving Range, to the large, turbid, meandering slow-flowing rivers, creeks, anabranches, and lakes and larger billabongs, of the inland plains of the MDB. Within these broad

habitat types, Murray Cod are usually found associated with complex structural cover such as large rocks, large snags and smaller structural woody habitat, undercut banks and over-hanging vegetation (Dakin and Kesteven 1938; Lake 1967b; Langtry in Cadwallader 1977; Cadwallader 1979; Cadwallader and Backhouse 1983; Harris and Rowland 1996; Koehn 1996, 2006; Rowland 1988a, 2005).

The species has an annual reproductive cycle and a short, defined, breeding season. Murray Cod form pairs and spawn in spring-summer, in response to rising water temperatures of 16.5-23.5^{o}C, with most spawning thought to occur at around 20^{o}C (Cadwallader and Gooley 1984; Gooley et al.1995; Rowland 1985, 1998a). Reproduction appears largely dependent upon water temperature, with flooding or a rise in water level apparently not required to initiate spawning (Rowland 1983a, b, 1988; Cadwallader and Gooley 1985).

While spawning does not apparently require flooding, recruitment success appears to be strongly linked to river flow, with good year classes in some rivers coinciding with a rise in water level or flooding at or soon after spawning (Rowland 2005; Ye et al. 2000). Recruitment success is likely to be linked to timing, duration and water quality, especially temperature, of flows, and flooding in spring appears to provide optimum conditions for survival and recruitment of larvae and juveniles in rivers (Kearney and Kildea 2001; Rowland 1985, 1989, 1998a).

Considering the species inhabits a range of flowing and standing water, any potential changes to the flow regime is unlikely to substantially affect the distribution of the Murray Cod. Furthermore, Chaffey Dam currently impacts the natural flow regime of the Peel River. The assessment of potential impacts as a result of the proposed Chaffey Dam augmentation therefore needs to be assessed in this context that is whether existing flow regime impacts have the potential to be exacerbated following the augmentation. Considering the ecology of the Murray Cod, any flow regime changes including magnitude, timing and duration, are likely to be more detrimental at the recruitment stage of its lifecycle.

Outflows from Chaffey Dam through the morning glory spillway comprise unregulated spills and regulated releases via the multi-level offtake tower. The rate of unregulated spills through the morning glory spillway depends on its hydraulic characteristics, which are defined by the dimensions of the crest and throat. The rate of outflow for a given depth of water above the crest is characterized by a stage-discharge relationship. The raised morning glory spillway has been designed to achieve a stage-discharge relationship which is a close match to the existing (Black and Veatch 2012).

A hydrologic model was developed to simulate the operation of Chaffey Dam over the climatic sequence between 1892 and 2008. The model simulates river flows, dam storage, water extraction, losses and operation, irrigation demands and water sharing plan rules (NSW Office of Water 2010a). The model results assume operational rules which precede the Peel Valley Water Sharing Plan. However, they are useful in demonstrating the impact of augmentation alone on the downstream hydrologic regime.

The results are presented in Figure 2-9 for the Peel River in the form of a flow duration curve- for a site located downstream of Chaffey Dam at Piallamore. A flow duration curve shows the percentage of time that the range of flows in a stream are likely to be equalled or exceeded. The effect of river regulation is most significant in this reach of the Peel River due to the limited number of tributaries contributing to flows at this location and because many diversions of ordered water occur downstream of this point (NSW Office of Water 2010a).

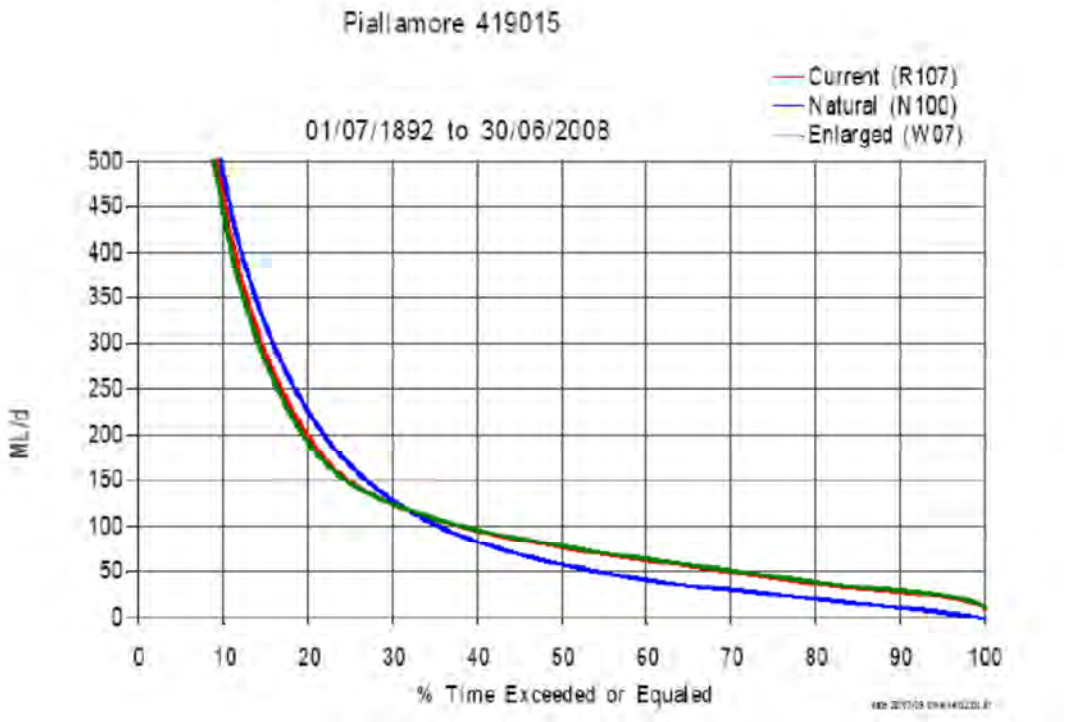

Figure 2-9 Impact of river regulation at Piallamore (all year flow) (NSW Office of Water 2010a)

The results show very little difference in flow regime between the current and enlarged dam configurations. For example, results for the current dam size show that a flow of 200 ML/day is equalled or exceeded approximately 20% of the time. This is also the case for the enlarged dam configuration.

Without implementation of the Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010, data analysis suggests that annual average flows in the Peel River immediately below the dam would decrease by about two per cent compared to existing conditions as a result of the raising of the dam wall and increase in full supply level (GHD 2008b). More specifically, the proposed augmentation is likely to increase the volumes of low flows while reducing the flow volumes for high flows during summer. Compared to the percentage changes in summer flows, the impact of the proposed augmentation on winter flows would be more pronounced. Furthermore, low flow volumes appear to have increased, while mid and high flow volumes decreased. The degree of impact diminishes further downstream on approach to Tamworth. Considering this, the existing flow regime impacts as a result of the dam are unlikely to be exacerbated to a substantial degree that it would affect the life cycle of the Murray Cod. Furthermore, the environmental contingency allowance which would be made available following augmentation has the potential to be used to improve recruitment of the Murray Cod.

Environmental releases

Clause 31 of the Peel Valley Water Sharing Plan (the Plan) provides provisions in relation to environmental release rules for Chaffey Dam and requires that a minimum daily release of 3ML be made, both prior to and following augmentation of the reservoir to 100 GL.

Under the Plan the provision of environmental releases above the minimum daily release will change following augmentation. The current environmental release provision requires a total of 1,600 ML to be released over seven days. Following augmentation of Chaffey Dam, Clause 31(2) requires the implementation of an environmental contingency allowance (ECA) of 5,000 ML, which may be released over any period of time at the discretion of the NSW Environmental Water Manager. The current

environmental release provisions also stipulate a peak flow of 500ML/day on day 2 of the seven day period, however, after augmentation the magnitude and timing of releases is not prescribed.

At present, environmental releases are only provided once a minimum storage volume is reached, only in certain months of the year and only if flood flows of a given magnitude have not occurred. None of these conditions apply after augmentation. The background document to the Plan (NSW Office of Water 2010) states that although magnitude, timing and duration of environmental releases after augmentation is not prescribed, the ECA is likely to be used as a stimulus flow over seven days with a peak on day 2 of 1,200 ML/day.

The change in management of environmental releases from pre to post augmentation offers more environmental water and greater flexibility in its release, ensuring environmental outcomes are maximised. In the specific case of the Murray Cod, if environmental releases are proposed during the breeding season of the Murray Cod (late Spring to early summer), they have the potential to increase recruitment success. However, there is a need to consider all environmental assets of the Peel River to maximise the ecological benefits of the ECA. Environmental Water Delivery: Namoi River (Barma Water Resources *et al*. 2012) provides information on the environmental assets and potential options for environmental water use in the Namoi catchment including at Chaffey Dam. The document provides recommendations on water uses to best meet desirable ecological outcomes for the Peel River and monitoring requirements.

Potential physical habitat modifications

In a study on the downstream geomorphic impacts of the existing dam, Gorrick (2004) found that floods of low to moderate frequency have undergone reductions of around 90% for all events up to the 1 in 50 AEP decreasing to 24% for the 1 in 200 AEP. Under such flow regime changes it would be expected that the downstream system would undergo significant geomorphic change. However, Gorrick (2004) found that the geomorphic response to the altered flow regime has been largely limited to the development of in-channel benches and pool infilling downstream of the two major tributaries (Duncans and Dungowan Creeks). Gorrick (2004) attributes the limited geomorphic change to a number of intrinsic factors controlling the form of the Peel River downstream of Chaffey Dam. These include armoured gravel surfaces, well-vegetated cohesive banks, limited sediment inputs and the dissipation of flood waters across relatively wide floodplains in comparison to channel width. Hence, it is considered the relatively minor changes flow regime generated by the augmentation would not result in further significant geomorphic change to the downstream river form. The physical habitat of the Murray Cod downstream of Chaffey Dam is therefore unlikely to be substantially modified compared to existing conditions, especially as the Murray Cod is known to inhabit a large range of habitats and flow conditions.

Potential downstream flow regime impacts during construction

To enable construction activities to be carried out and to reduce the risk of flood flows discharging through the incomplete spillway, the reservoir will be required to be maintained at approximately 2 m or more below the current FSL. If the reservoir is at or near FSL at the commencement of construction, it is proposed to draw the reservoir down to 2 m below FSL immediately prior to and during works to construct the upgraded morning glory spillway. During this period the inflows and any downstream demand will be managed by operating the valves within the morning glory structure to ensure environmental and riparian flows are maintained.

Lowering of the storage level by 2 m will reduce the storage volume of Chaffey Dam by 11 GL (approximately 18%) and will be required for a maximum period of six months.

State Water has and continues to carry out consultation with the NSW Office of Water in regard to the required drawdown. On 21 November 2012, State Water sought formal approval from the NSW Commissioner for Water, NSW Office of Water, to maintain a temporary FSL 2 m below the current FSL for a period of six months, from May 2014 onwards. This request has been made to enable construction of the raised morning glory spillway.

Increased flows downstream have the potential to impact the lifecycle of the Murray Cod and may have a positive impact on recruitment if undertaken at appropriate times. Recommended safeguards include a requirement to prepare a water release management plan to manage the lowering of the dam during construction to ensure downstream impacts are minimised.

Similarly, flood flows could occur through the incomplete auxiliary spillway during reconfiguration of the fuseplug, potentially resulting in the loss of soil and rock downstream. The distribution of soil and rock downstream has the potential to infill the streambed and temporarily increase turbidity, thereby reducing the suitability of water for downstream consumptive uses and potentially resulting in impacts to aquatic ecosystems.

At the current FSL, a flood with a frequency of 1 in 1,000 years would be required for reservoir water levels to reach the sill of the auxiliary spillway (Black & Veatch 2012). This is considered to be an acceptably low level of risk. Therefore, the potential for the impacts associated with flood flows discharging through the auxiliary spillway during construction to manifest, is considered to be very low.

Importance of temperature regime for the Murray Cod and potential water quality (oxygen and temperature) impacts on the Murray Cod and/or its habitat downstream of the dam

The species has an annual reproductive cycle and a short, defined, breeding season. Murray Cod form pairs and spawn in spring-summer, in response to rising water temperatures of 16.5-23.5^{o}C, with most spawning thought to occur at around 20^{o}C (Cadwallader and Gooley 1984; Gooley et al.1995; Rowland 1985, 1998a). Murray Cod have been shown to spawn in the wild with water temperatures as low as 15^{o}C (Humphries 2004; Koehn and Harrington 2006). Reproduction appears largely dependent upon water temperature, with flooding or a rise in water level apparently not required to initiate spawning (Rowland 1983a, b, 1988; Cadwallader and Gooley 1985). Eggs are laid on a hard substrate such as large structural woody habitat, rocks and clay surfaces, while in ponds and dams, captive cod have spawned inside hollow objects such as concrete pipes and metal drums, on fallen timber and directly on the substrate (Cadwallader et al. 1979; Cadwallader and Gooley 1984; Gooley et al.1995; Rowland 1988a). Eggs hatch after 4-13 days, depending on temperature (Cadwallader et al.1979; Cadwallader and Gooley 1984; Kailola et al. 1993; Rowland 1988b, 1998, 2005). After several days at the spawning site, larvae rise in the water column and drift with the current (Humphries et al. 2002; Koehn and Harrington 2005, 2006). Peak abundance occurs in November, although larvae may be present for up to 10 weeks (Koehn and Harrington 2006).

Chaffey Dam is subject to both thermal and oxygen stratification (MHL 2005; GHD 2007). Thermal stratification in Chaffey Dam results in a warm upper layer of water (the epilimnion) overlying a cold lower layer of water (the hypolimnion), separated by a transition layer (the thermocline). Thermal stratification promotes oxygen stratification, which results in a depletion of oxygen in the hypolimnion. This results in reduced water quality in the hypolimnion from anaerobic decomposition, including the production of hydrogen sulphide and the release of phosphorus. When water is released from the hypolimnion, both the cold temperature and reduced quality of the released water can reduce downstream water quality. According to MHL (2005), augmentation of Chaffey Dam is predicted to:

- Increase the size of the epilimnion from 46 GL (78% of current reservoir volume) to 64 GL (64% of augmented reservoir volume).
- Increase the size of the hypolimnion from 13 GL (22% of current reservoir volume) to 36 GL (36% of augmented reservoir volume).
- Extend stratification longer into autumn.

According to MHL (2005), the epilimnion is sufficiently large to supply current water demands and an increase in Tamworth's supply to its full entitlement of 16,400 ML (provided the epilimnion water is of sufficient quality).

The proposed works will raise the morning glory spillway offtake tower relative to the increase in FSL. The depth from surface and thickness of the thermocline will not change as a result of augmentation, because this is determined by local environmental factors such as seasonal weather variations and solar radiation. Therefore, as a result of raising the offtake tower, the current ability to withdraw from above, below or within the thermocline to access the highest quality water available will be retained. Should the withdrawal of water through the multi-level offtake access colder, deeper water, MHL (2005) state that the relatively low flow and slow downstream propagation will result in an equilibration of downstream river temperatures to mean air temperature within a relatively short distance of the dam.

Therefore, it is considered that changes to the stratification layers within the reservoir as a result of the augmentation will not result in a measurable reduction in downstream water quality compared to existing conditions. When it occurs, cold water pollution is generally observed for a short period in mid to late summer, which is outside the spawning and recruitment period of the Murray Cod (see below for specific details on cold water pollution downstream of the dam).

Consequently, the current water quality impacts downstream of the dam (temperature and oxygen) on the Murray Cod are unlikely to be substantially exacerbated compared to existing conditions. The recommendation to review and amend the current operating protocol for water releases following augmentation has the potential to further minimise cold water pollution and other downstream water quality impacts.

Potential downstream water quality impacts during construction

As discussed above, construction activities may require the dam water level to be lowered. This would only be required if the dam is at or within 2 m of the FSL during the construction period. This will likely be required during construction works on the morning glory spillway. Depending on timing and quantity of water released this may result in a number of potential downstream impacts including water quality impacts (e.g. cold water pollution). Recommended safeguards include a requirement to prepare a water release management plan to manage the lowering of the dam during construction to ensure downstream impacts are minimised.

Extensive earthworks will be required as part of the proposed upgrade. Most of these would be undertaken in close proximity to the Chaffey Dam reservoir and/or its tributaries, sometimes within the waterways themselves.

These activities would include, but would not be limited to the excavation and stockpiling of rock and soil; vegetation clearing, construction of roads and bridges. Most of these activities would be undertaken at or immediately downstream of the dam wall except for the realignment of roads and bridges around the Chaffey Dam reservoir. Use of a barge may also be required for the raising of the morning glory spillway.

Impacts on aquatic habitats and aquatic flora and fauna as a result of potential erosion and sedimentation of waterbodies could include:

- Reduction of water quality such as increased turbidity and/or increased nutrient levels
- Reduction of light penetration (as a result of increased turbidity) and subsequent reduction of aquatic macrophytes (loss of habitat)
- Increased potential for algal growth with potential for toxic algal blooms (as a result of increased nutrients) resulting in negative impacts on aquatic fauna
- Potential sedimentation of aquatic habitats including but not limited to rocky areas, riffles and macrophytes (loss of aquatic habitats)

These impacts have the potential to impact downstream areas as well as areas close to the earthworks or construction activities.

Proposed works also have the potential to impact water quality through accidental chemical spills (e.g. hydrocarbons, concrete). Potential pollution sources may include but not be limited to:

- Compound sites
- Barges and boats
- Construction plant

Recommended safeguards include the preparation of a soil and water management plan and safe work method statements to avoid or minimise these impacts.

2.4.3 Potential Cold Water Pollution Impacts Downstream of Chaffey Dam Following Augmentation

A desktop assessment of New South Wales dams ranked Chaffey Dam as a low priority in terms of cold water pollution potential to downstream environments because of small discharge volumes and predominately an extraction from shallow depths (and hence warm temperatures) (Preece 2004). Cold water releases from Chaffey Dam were predicted by IESC Pty Ltd (1974) to lower the downstream temperature by 6 to 10°C with the potential for resultant fish kills. Bishop and Harris (1990) reported lower water temperatures later into summer and depressed temperatures for up to 50 km downstream of Chaffey Dam. However, MHL (2005) state that due to the relatively low flow and slow downstream propagation, the majority of the equilibration of downstream river temperatures to mean air temperature would occur within a relatively short distance of the dam. Differences in water temperatures of the Peel River upstream and downstream of Chaffey Dam were simulated with a reservoir water quality model over two periods from 1995-1997 and 2005-2007. The simulated water temperature is often up to 10°C cooler during January and February because of extraction of hypolimnetic cool waters (GHD 2008b).

Chaffey Dam has a multi-level offtake (i.e. intake) tower that can be configured to extract water from a range of reservoir depths. In particular water from the reservoir can be extracted from two different depths simultaneously through the multi-level intake. Hence, there is opportunity to control the temperature of the released waters during the period of thermal stratification through extraction of cooler deep (hypolimnetic) waters, warmer surface (epilimnetic) waters or a blend. While the multi-level offtake tower is typically positioned within the thermocline there is some release from the hypolimnion and surface waters (Preece 2004). The operating protocol for the mutli-level offtake also needs to consider the management of algal blooms which requires the release of hypolimnetic waters which can result in the release of colder waters. Data provided by State Water Corporation indicates that cold water pollution occurs during a short time over the summer period, with temperatures around 7.5°C cooler downstream of the dam compared to upstream (Figure 2-10). Cold water pollution therefore does

occur at Chaffey Dam. However, the intensity and duration of cold water pollution is mostly linked to the successful use of the multi-level offtake in accordance with the operating protocol. As the proposed augmentation of Chaffey Dam would include the upgrade of the multi-level offtake to manage cold water pollution, the impact of cold water pollution are unlikely to be worse than current conditions.

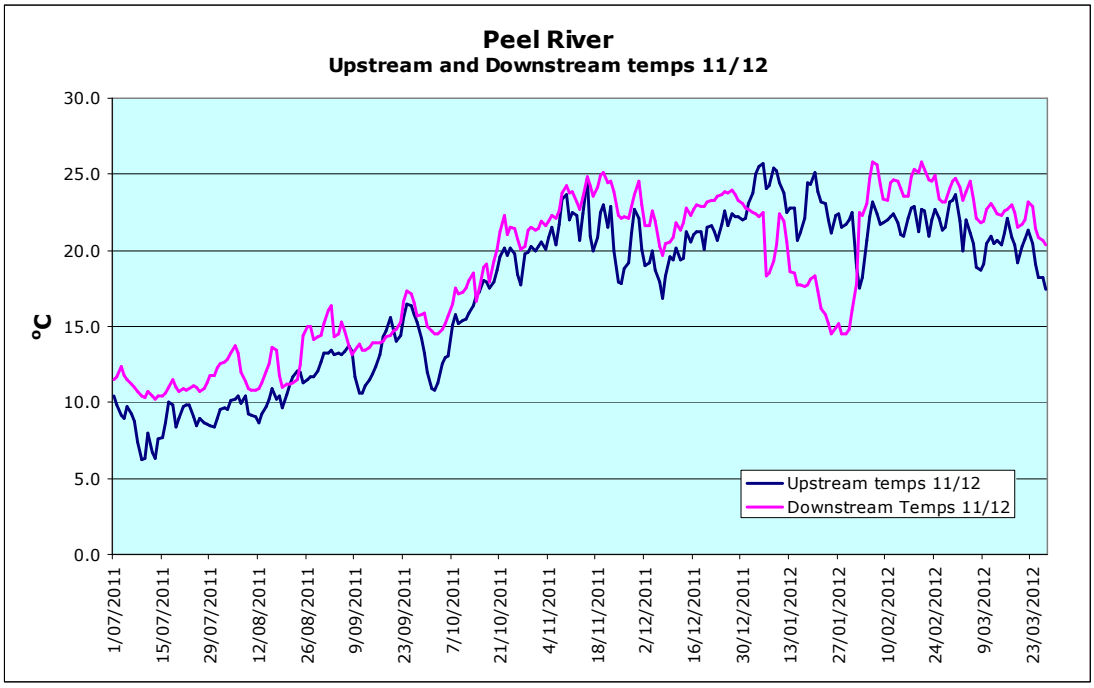

Figure 2-10 Recorded water temperatures downstream and upstream of the dam between July 2011 and March 2012 (State Water Corporation 2013).

Based on this, cold water pollution following the augmentation of Chaffey Dam would be similar to existing conditions:

- Cold water pollution would generally occur during the summer period.
- Based on simulations, water temperature downstream of the dam during this period can be up to 10 degrees cooler than upstream.

The depressed temperatures have the potential to be felt for up to 50 km downstream of Chaffey Dam, though due to the relatively low flow and slow downstream propagation, equilibration of downstream river temperatures to mean air temperature would occur within a relatively short distance of the dam.

2.4.4 Cold Water Pollution Management

The Stage 1 of the NSW Cold Water Pollution Strategy (NSW Cold Water Pollution Interagency Group, 2012) has cold water mitigation actions including the implementation of improved operating protocols (including monitoring) and structural modifications recommended by the NSW Environmental Trust Project for the priority dams that already have selective off-take capability. This includes Chaffey Dam.

For Chaffey Dam, NSW Cold Water Pollution Interagency Group (2012) provides the following suggestions to meet the requirement of the Water Management Act 2000 in regards to cold water releases:

- The licence holder is to prepare and submit an approved operating protocol for the management of cold water pollution in accordance with the Guidelines for managing cold water releases from high priority dams (NOW, 2011).

- The licence holder is to use its best endeavours to operate the dam according to the operating protocol.
- The licence holder will provide within three months of the end of each year or annually on agreed date a report to Office of Water detailing its performance against the protocol, including instances of and reasons for departure from the operating protocol, outcomes achieved (in accordance with NOW 2011) and proposals for improvement in performance.

The current operating protocol for Chaffey Dam, which includes cold water and algal management has been prepared and is used in accordance with the above requirements and minimises cold water pollution which occurs downstream of Chaffey dam (refer to Section 2.4.3). The proposed augmentation of the dam would not increase the impact of cold water pollution as the multi-level offtake would be upgraded and raised to ensure water from various water depths can continue to be used to minimise impacts.

2.4.5 Mitigation Measures

The following provides the list of mitigation measures for aquatic biodiversity as provided in **ngh**environmental (2012) and amended as required to comply with the SEWPaC requirements as well as DPI (fisheries) comments on the PIR dated 17 April 2013:

Mitigation measure	Objective	Threshold for corrective action	Corrective action
Should large woody debris need to be removed for any construction activities the following management guidelines would be followed in accordance with the *Key Threatening processes in NSW Removal of large woody debris from NSW rivers and streams prime fact 11* (DPI 2005): Lopping (trimming) should be considered as a first option. Instream realignment should be considered as the next option. If realignment is unfeasible, relocation within the river channel is preferable to removal. Removal should be considered as a last resort.	Minimise impacts to important fish habitat	Not Applicable	Not Applicable
Removal/relocation of snags would be undertaken so as to cause the least disturbance to the bed or nearby sensitive aquatic habitat. An aquatic ecologist would be present on site when working with snags that require lopping, realignment, relocation and/or removal.	Minimise impacts to important fish habitat	Not Applicable	Not Applicable
An Erosion and Sediment Control Plan (ESCP) will be prepared detailing erosion and sediment controls and other water quality controls that would be put in place to avoid or minimise impacts to waterways during construction activities. The ESCP would be prepared in accordance with the *NSW Soils and Construction – Managing Urban Stormwater Volume 1 and 2*. The ESCP would be reviewed by State Water's Senior Environmental Officer prior to commencement of works.	Avoid or minimise impacts to water quality and fish habitat as a result of potential erosion and sedimentation.	The ESCP should include thresholds for corrective actions and the corrective actions that would need to be implemented.	The ESCP will include thresholds for corrective actions and the corrective actions that would need to be implemented.
Work method statements (WMS) would be prepared for high risk activities within waterways (e.g. bridge	Avoid or minimise impacts to water quality and fish	As per safeguard, the WMS should include thresholds for	As per safeguard, the WMS should include thresholds for corrective actions and the

Mitigation measure	Objective	Threshold for corrective action	Corrective action
construction). The WMS would include, but not be limited to, the following and be reviewed by State Water's Senior Environmental Officer prior to commencement of works: Description of works/activities including machinery. Outline of the sequence of the works/activities An environmental risk assessment to determine potential risks to discrete work elements or activities likely to affect the environment. A map indicating the locations of likely potential environmental impacts. Evaluation of methods to reduce environmental risks. Mitigation measures to reduce environmental risks (including those listed in this assessment). A process for assessing the performance of the implemented mitigation measures. A process for resolving environmental issues and conflicts. Emergency procedures for chemical spills and other potential emergency incidents.	habitat during high risk construction activities.	corrective actions and the corrective actions that would need to be implemented.	corrective actions that would need to be implemented.
Compound and stockpile sites should be located at least 40 m from any waterways where possible and should be adequately protected to avoid or minimise any potential pollution of waterways through adequate erosion and sediment controls or impervious bunds.	Avoid or minimise impacts to water quality and fish habitat as a result of potential erosion and sedimentation and/or chemical spills.	Waterway is impacted through erosion and sedimentation and or accidental spills	Relocate compound sites further from waterway to ensure impacts are avoided in the future.
Stage works so that construction activities that need to be undertaken within waterways are undertaken during low dam levels (bridge construction).	Minimise impacts to water quality and fish habitat.	Not applicable	Not applicable
Water releases required to reduce the dam level during the construction period should be appropriately	Avoid and or minimise downstream impacts such	The water release management plan would be prepared and	Thresholds and actions required are currently provided in the current operating

Mitigation measure	Objective	Threshold for corrective action	Corrective action
managed. A water release management plan will be prepared and the following considered: Where possible use water releases undertaken as part of the water sharing plan to reduced water levels where required for construction activities. Adequate monitoring of water quality (temperature, algal blooms) should be undertaken to ensure water quality impacts due to release of water are avoided or minimised. The multi-level intake should be used in an effective manner to minimise potential water quality impacts. The water release management plan should be developed in consultation with all relevant stakeholders including but not limited to State Water and DPI (Fisheries).	as cold water pollution during the release of water to temporarily lower the dam water level for construction purposes.	include temperature and algal bloom thresholds to ensure downstream impacts are avoid or minimise. Thresholds and actions required are currently provided in the current operating protocol of the mutli-level offtake and should be taken into consideration in the development of the water release management plan for construction purposes.	protocol of the mutli-level offtake and should be taken into consideration in the development of the water release management plan for construction purposes.
The riparian zone of the Peel River should be replanted at the new full supply level along upstream waterways for a minimum of 10 m from the new FSL and along the shoreline of the dam where practicable, particularly in areas identified as having a high risk of erosion. Revegetation should be undertaken using natives species of local provenance. A riparian vegetation plan would be prepared in consultation with DPI (fisheries).	Improve aquatic habitat quality following construction.	Multi-year monitoring and reporting of the riparian zone should be undertaken following replanting to ensure riparian zone is adequately established and provides bank protection.	Corrective actions, such as further planting, would be determined as required during the monitoring and reporting period.
The raising and design of the multi-level off-take tower will be undertaken so as cold water pollution and algal bloom impacts can be adequately managed (i.e. allow for releases of water from various depths independently and/or concurrently to allow mixing of water if required to mitigate cold water pollution).	Avoid or minimise downstream cold water pollution and algal blooms during operation.	Not applicable	Not applicable
The release of water during operation will be undertaken under the Water Sharing Plan for the Peel	Improve the aquatic ecosystem through the	Multi-year monitoring and reporting of the use of the ECA	Multi-year monitoring and reporting of the use of the ECA would need to be

Mitigation measure	Objective	Threshold for corrective action	Corrective action
Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010 (NOW 2010). An adequate operating protocol for the use of the ECA will be developed to provide the best ecological outcome. The operating protocol should consider the Environmental Water Delivery: Namoi River (Barma Water Resources *et al*. 2012) which provides information on the environmental assets and potential options for environmental water use in the Namoi catchment including at Chaffey Dam. It should also include monitoring requirements, as described in Barma Water Resources *et al*. (2012), to assess the success of the releases. The operating protocol should be developed in consultation with all relevant stakeholders including but not limited to State Water and DPI (Fisheries).	appropriate use of the ECA.	would need to be undertaken as per safeguard and in accordance with Barma Water Resources *et al*. (2012). This would assess the success of the use of the ECA and any corrective actions that would be required.	undertaken as per safeguard and in accordance with Barma Water Resources *et al*. (2012). This would assess the success of the use of the ECA and any corrective actions that would be required.
The existing operating protocol for avoiding or minimising cold water releases will be improved if required in accordance with the guidelines for managing cold water releases from high priority dams (NOW 2011). The following will be considered: The water to be released should match as closely as possible the natural temperature regime, especially during the spring, summer and autumn periods. The natural seasonal temperature regime should be determined through effective monitoring of upstream and downstream reference sites. The impact of water releases on temperatures downstream will be monitored through the selection of appropriately located downstream sites and comparisons with reference locations. The protocol would be followed in consultation with relevant stakeholders including DPI (Fisheries).	Avoid or minimise downstream cold water pollution and algal blooms during operation.	The existing operating protocol would follow the guidelines for managing cold water releases from high priority dams (NOW 2011) which requires the establishment of monthly targets and performance criteria. Multi-year monitoring and reporting in accordance with the guidelines for managing cold water releases from high priority dams (NOW 2011) would be undertaken and the operating protocol improved if required.	The operating protocol will be reviewed in accordance with the guidelines for managing cold water releases from high priority dams (NOW 2011) which requires the establishment of monthly targets and performance criteria. The operating protocol would be improved if required, following multi-year monitoring and reporting.

Mitigation measure	Objective	Threshold for corrective action	Corrective action
DPI-Fisheries is to be notified in accordance with the DPI – Fisheries Fish Kill Protocol if any fish kills occur in the vicinity of the works.	Minimise impacts to aquatic biodiversity.	Fish kills occur during construction.	Report fish kill in accordance with Fish kill protocol
An incident emergency spill plan would be developed and incorporated into the CEMP. The plan would include measures to avoid spillages of fuels, chemicals, and fluids into any adjacent/nearby waterways and an emergency response plan. Emergency spill kits would be kept onsite at all times. A boom would be at hand in the case of any spills or material entering waterways.	Avoid or minimise impacts to water quality.	A spill occurs within a waterway.	The incident emergency spill plan would include an emergency response plan with corrective actions.
Exclusion zones for riparian zones that do not need to be accessed would be established before works start to avoid any disturbances of the banks.	Avoid disturbances to riparian zones.	Not applicable. Riparian zones would be designated as no go zones as required.	Not applicable. Riparian zones would be designated as no go zones as required.
Temporary works, flow diversion barriers and in-stream sediment control barriers would be removed as soon as practicable and in a manner that would not exacerbate future channel erosion.	Minimise impacts to aquatic habitats as a result of temporary construction structures.	Not applicable	Not applicable
Detailed design and construction of the bridges would be in accordance with requirements for fish passage and in consultation with DPI (Fisheries) where necessary.	Avoid impacts to fish passage.	Designs would be reviewed by DPI (fisheries) to ensure these are in accordance with relevant guidelines.	Designs would be reviewed by DPI (fisheries) to ensure these are in accordance with relevant guidelines.
Should detailed design determine that fish passage needs to be temporarily blocked for construction purposes, a permit under part 7 of the FM Act would be sought.	Avoid or minimise impacts to fish passage.	Permit would be required should fish passage need to be temporarily or permanently blocked any time during construction or operation.	Apply for permit.

2.5 THREATENED FLORA SPECIES AND VEGETATION COMMUNITIES

2.5.1 EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Box-Gum Grassy Woodlands and Derived Grasslands were historically found throughout the western slopes and tablelands of the Great Dividing Range from southern Queensland to Victoria. Due to land clearing, weed invasion and overgrazing, less than 5% of the original extent remains in good condition, and this is largely made up of disjunct patches scattered throughout the region. Generally found on soils of moderate to high fertility, the community occurs where rainfall is between 400 and 1200 mm per year, and at altitudes of between 170 m and 1200 m (NSW Scientific Committee 2002). Blakely's Red Gum and Yellow Box are most common in grassy woodlands on the tablelands, whereas White Box predominates in woodlands on the western slopes. In the woodlands of the northern regions of NSW the community contains many species, such as Native Olive (*Notelaea microcarpa*), that are not generally found in the southern areas. It is also significant for containing the Nandewar Bioregion, in which there is a unique type of the community found. Box-Gum Woodland in the Nandewar Bioregion may have Western Grey Box (*Eucalyptus microcarpa)* or Coastal Grey Box (*E. moluccana*) as a dominant or co-dominant overstorey species. Historically (prior to 1750), the bioregion had an area of Box-Gum Grassy Woodland and Derived Grassland totalling approximately 151 198 ha, of which 94% has been cleared, so that today just 9 045 ha remains (NPWS 2000). The Tamworth Regional Council area, which includes Chaffey Dam and the surrounding region, was once extensively covered by Box-Gum Woodland, which has now largely been cleared. Just 1.3% of the council area is protected in a national park or nature reserve, and problems such as the invasion of woodland by Coolatai Grass (*Hyparrhenia hirta*) and other weeds, heavy stock grazing, and continued land clearing are having a considerable impact on the remaining Box-Gum Woodland of the area.

Some of the Box-gum grassy woodlands, Brigalow Belt South and Nandewar (Regional Vegetation Community RVC 17) vegetation community within and surrounding the project site meets the definition of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed as a Critically Endangered Ecological Community (CEEC) under the EPBC Act.

The distribution of the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC is shown on Figure 4-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) within the study area and within a 1km radius of the site.

As described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (Table 5-2), approximately 6 ha of EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland occurs within the area to be impacted by the inundation to the new FSL. A further 4 ha of this community was expected to be impacted by the required realignment of roads.

Also as described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment, approximately 506 ha of the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland community occurs within a 1 km buffer around the study site.

Following the refinement of the road works areas through the detailed design phase, the impact to this community has been reduced from 4 ha to 1.4 ha. The area to be inundated will remain unchanged (approximately 6 ha), however given the reduction in impact from the works areas, a total of approximately 7.4 ha of the EPBC listed community will be impacted by the Project.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment, the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland will not be significantly impacted by the Project.

No offset is required under the EPBC Offsets Policy. An offset is required for all vegetation loss under the NSW BioBanking Assessment Methodology

2.5.2 TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland

All of Box-gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17) and Derived grasslands, Brigalow Belt South and Nandewar (RVC 28) vegetation communities within and surrounding the project site meet the definition of the White Box-Yellow Box-Blakely's Red Gum woodland listed as an Endangered Ecological Community (EEC) under the TSC Act.

As described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), and shown in Figure 2-11 approximately 117 ha of this community occurs within the area to be inundated by the new FSL. Approximately 1300 ha of the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland occurs within a 1 km buffer around the study site. An additional 63 ha was expected to be impacted by the required realignment of roads.

Following refinement of the road footprint works areas, the impact to this community has been reduced by more than 50% to 33 ha. The area to be inundated will remain unchanged (approximately 117 ha), however given the reduction in impact from the works areas, a total of approximately 150 ha of the TSC listed community will be impacted by the Project.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment, the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland will not be significantly impacted by the Project. However, in accordance with the NSW BioBanking Assessment Methodology offsets for this community are provided in the Offset Plan.

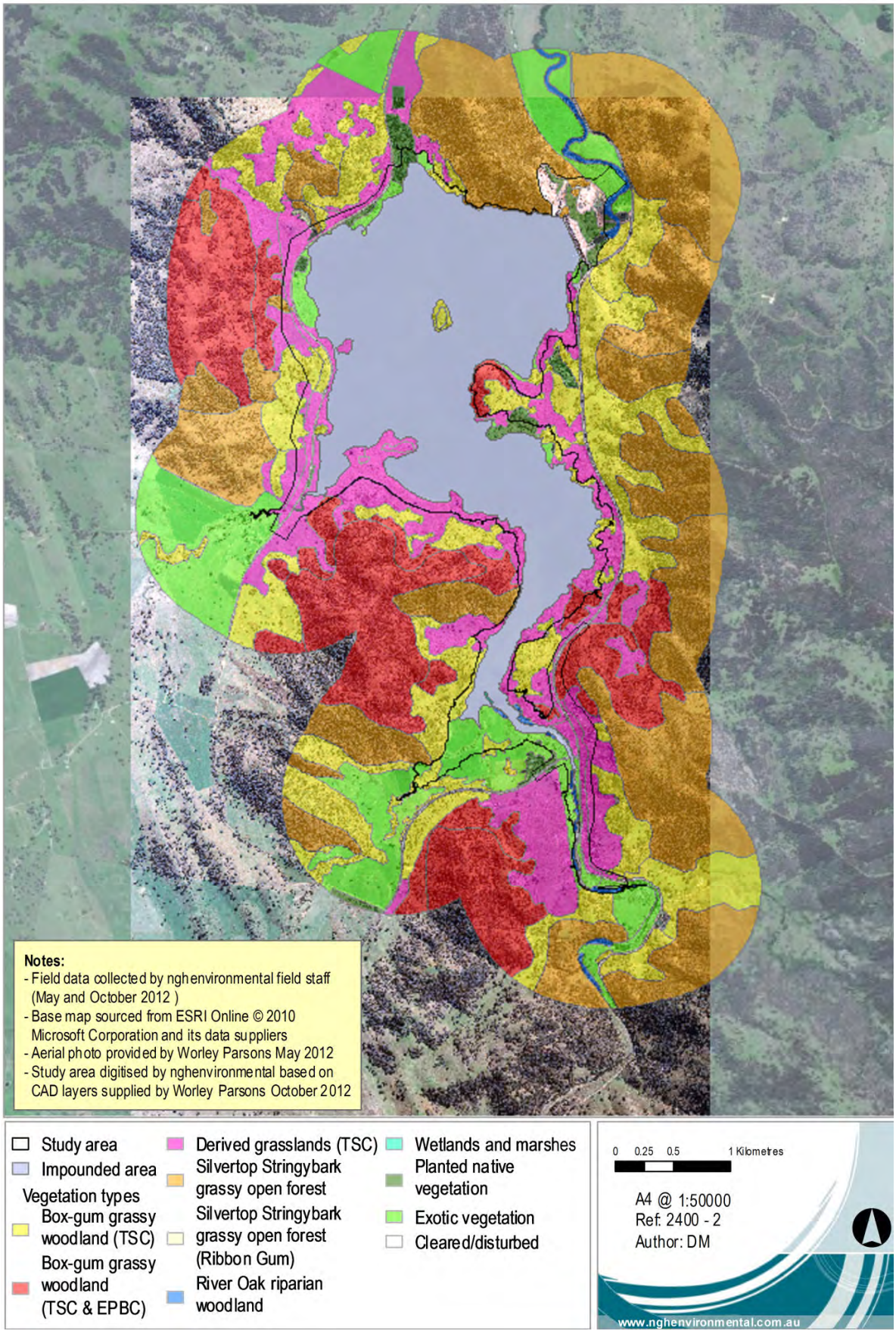

Figure 2-11 Vegetation Communities within the study area

2.5.3 Small Snake Orchid and Euphrasia arguta

The Small Snake Orchid (*Diuris pedunculata*) is listed as endangered under the TSC Act and the EPBC Act. *Euphrasia arguta* is listed as critically endangered under the EPBC Act.

Table 3-2 and Figure 3-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) documents the location of targeted surveys and the associated survey effort for these species during the original survey of the site.

Targeted searches were carried out in suitable habitat for these species during October 2012. Survey timing was considered suitable for the Small Snake Orchid. Although not optimal, the survey timing was also considered suitable for detecting *Euphrasia arguta* given that flowering has previously been recorded in October. Further, it would have been possible to identify this species in its vegetative state if it was not flowering at the time of survey.

As documented on the Terrestrial and Aquatic Flora and Fauna Impact Assessment, targeted surveys did not detect these species and it is considered unlikely that the Small Snake Orchid or *Euphrasia arguta* occur within the study area and that they are unlikely to be impacted by the Project.

The locations of nearest records for the Small Snake Orchid and *Euphrasia arguta* are provided in the Habitat Evaluation attached as Appendix B to the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), Appendix 8 to the EIS (WorleyParsons 2012).

2.5.4 *Justification for not targeting* Eucalyptus rubida *subsp*. barbigerorum*,* Thesium australe *and* Bothriochloa biloba *as part of this assessment.*

The potential for these species to be present at the development site and to be impacted by the proposed works was assessed within the habitat evaluation included as Appendix B of nghenvironmental 2012. Further justification for not specifically targeting these species as part of the assessment is as follows:

Eucalyptus rubida subsp. *barbigerorum* – As stated in the habitat evaluation, this species is a conspicuous species. It may be detected at any time of year and during the course of the original vegetation surveys, almost all of the areas of impact were traversed by vehicle or foot. This species was not detected and no further targeted surveys were considered warranted.

Thesium australe – Potential habitat for this species was present at the site in localised areas and was not of high quality. Additionally, the nearest record of the species is approximately 50 km north-east of the site. Accordingly, it was considered unlikely that it would occur at the site.

The timing and location of the targeted flora surveys carried out at the site in spring (October) 2012 would have also been suitable for detecting this species and it was not identified.

Bothriochloa biloba – Heavier soils with which this species is associated were present at the site however, not the preferred brown or black clays. One record from 1997 was located in Nundle approximately 10 km from the site.

2.6 THREATENED SPECIES HABITAT AVAILABILITY

2.6.1 Historical threatened species data

In preparing the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), the following databases were searched for records of EPBC Act and TSC Act listed threatened species previously recorded within a 10 km radius of the site:

- Primary Industries Fisheries Records viewer
- OEH Bionet Wildlife Atlas:
- EPBC Protected Matters Search tool

The results of database searches were detailed in Appendix A of **ngh**environmental (2012) (Appendix 8 of the EIS). Appendix B of **ngh**environmental (2012) provides a threatened species evaluation table that assesses the likelihood of occurrence and the potential for impact on those species revealed in database searches.

In summary, the database searches returned three trees, three shrubs, four forbs (including one orchid) and two grasses listed as threatened that occur or have the potential to occur within 10 km of the study site. Forty-two migratory or threatened terrestrial fauna species and/or their potential habitats have been recorded within 10 km of Chaffey Dam. Of these species, 16 are listed under the TSC Act, and 25 under the EPBC Act. Five of these threatened fauna species and three of the listed migratory species have been recorded within the study area since 1990; the Brown Treecreeper, Speckled Warbler, Little Lorikeet, Border Thick-tailed Gecko, Booroolong Frog, White-bellied Sea-eagle, Rainbow Bee-eater and Great Egret.

Appendix A shows the NSW OEH Wildlife Atlas data[1] of records within 10 km of the site and 1 km of the site and notes the EPBC Act status of TSC Act listed Species. The EPBC Act Protected Matters search tool does not provide location records of threatened species predicted to occur.

These are historical records of threatened flora and fauna species within a 1 km radius of Chaffey Dam, and are in addition to those detected by **ngh**environmental in 2012 and NWES in 2013. Record locations for Booroolong frogs were not provided in NWES 2009.

Targeted surveys and threatened species evaluations carried out by **ngh**environmental (2012) for the EIS ruled out the likelihood of impacts on all but one fauna species (Booroolong Frog) and one flora species (Queensland Bluegrass).

Forty-two migratory or threatened terrestrial fauna species and/or their potential habitats have been recorded within 10 km of Chaffey Dam. Of these species, 16 are listed under the TSC Act, and 25 under the EPBC Act. Five of these threatened fauna species and three of the listed migratory species have been recorded within the study area since 1990; the Brown Treecreeper, Little Lorikeet (Austeco 1990; GHD 2008a), Speckled Warbler, Border Thick-tailed Gecko (NWES 2009a; **ngh**environmental 2012), Booroolong

[1] This information is sensitive and is not to be reproduced or put on public display. The data is provided to **ngh**environmental under a data licence agreement that prohibits its display at a resolution that would allow the identification of threatened species locations. The data is provided for the review of OEH, SEWPaC and DP&I.

Frog (NWES 2009a; NWES 2009b; **ngh**environmental 2012), White-bellied Sea-eagle (GHD 2008a; **ngh**environmental 2012), Rainbow Bee-eater (Austeco 1990) and Great Egret (GHD 2008a).

An evaluation of the likelihood and extent of impacts on threatened fauna, found 19 other species with the potential to occur at the site (**ngh**environmental 2012). They included the Gang-gang Cockatoo, Varied Sittella, Little Eagle, Swift Parrot, Hooded Robin, Turquoise Parrot, Barking Owl, Powerful Owl, Scarlet Robin, Flame Robin, Australian Painted Snipe, Diamond Firetail, Large-eared Pied Bat, Spotted-tailed Quoll, Eastern Bentwing-bat, South-eastern Long-eared Bat, Squirrel Glider, and Grey-headed Flying-fox.

However, the impacts to these species were assessed to be low, as the habitat present at the site is not considered to be optimum and none of these species were recorded in surveys of the site. For some species, only a small amount of potential and marginal foraging habitat will be impacted by the Project (Swift Parrot, Powerful Owl, Scarlet Robin, Large-eared Pied Bat, Spotted-tailed Quoll). Other resources such as hollow-bearing trees for Squirrel Gliders and nesting or roosting resources for threatened birds and bats are low in abundance and quality at the study site.

An assessment of threatened species habitat in relation to vegetation communities was included in Section 4.2.3, 4.2.4 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012). Detailed assessment of the potential for impact on threatened species potentially present within the study area as a result of the project was undertaken in Appendix B of Terrestrial and Aquatic Flora and Fauna Impact Assessment. Threatened species evaluations were undertaken for all threatened species for which there were previous records in the locality. In order to determine whether a threatened species was likely to be impacted by the Project, the evaluation took into consideration the age and proximity of records with 10 km of the site, the availability of suitable habitat on the site, and the likelihood that the activity would impact on habitat for the species.

3 REVISED IMPACT ASSESSMENT

3.1 SUMMARY OF POSITIVE CHANGE IN OVERALL IMPACT

As a result of additional surveys, data analysis and detailed design since the submission of the EIS (Worley Parsons 2012) the extent of impact of the project has been reduced as follows:

- Impact of road works areas has been refined and reduced from a worst case scenario of 168 ha in total to a realistic area of 38 ha in total.
- Updated surveys have shown that the number of Booroolong Frogs to be impacted on reduced from 634 to 50 individuals over time (note: continued fluctuation of frog numbers is likely).
- Updated surveys have shown that there will be no impact on Queensland Bluegrass following confirmation that the species does not occur on site.
- The scope of works has changed since the submission of the PIR such that the raising of the dam wall by placement of rock on the downstream face is no longer required. As an alternative, a vertical reinforced earth embankment for wall raising will be constructed on the crest of the dam wall. As a result, the 50,000 m^2 of Border Thick-tailed Gecko habitat on the downstream face of the wall will no longer be impacted. Impacts to Border Thick-tailed Gecko habitat associated with the revised construction methodology will only occur along the upstream face of the wall between the left bank and the morning glory spillway. This constitutes an impact area of 2,000 m^2as a result of construction. Therefore the area of gecko habitat to be impacted has been reduced by 48,000 m^2 and relocation of geckos to an area of artificial habitat will no longer be required.

3.2 SUMMARY OF POTENTIAL IMPACTS ON THREATENED SPECIES

Table 3-1 provides a revised summary of the potential impacts to the Subject Species Queensland Bluegrass, Booroolong Frog, and Border Thick-tailed Gecko as a result of the Project.

Table 3-2 provides an updated assessment of impact for vegetation communities.

Table 3-1 – Revised Assessment of impact to Subject Species

Species	Extent of impact from inundation (inside FSL)	Extent of impact from construction (outside FSL)	Total
Queensland Bluegrass	None	None	N/A
Booroolong Frog	50 individuals	None	50 individuals
Booroolong Frog Habitat	1.6 km of known Booroolong Frog habitat on the Peel River	None	1.6 km
Border Thick-tailed Gecko	None	Unknown number of individuals living within the artificial habitat of the dam wall.	Unknown number of individuals living within the artificial habitat of the dam wall.

Border Thick-tailed Gecko Habitat	2,600 m^2 (area of upstream face of dam wall to be inundated).	2,000 m^2 (area of upstream face of dam wall).	4,600 m^2

Table 3-2 Revised areas of impact based on updated and more specific data on area of impact for roads and bridges.

Regional Vegetation Community (RVC)	Area to be inundated (ha)	Road area total	Road area overlap with FSL	Road Impact area	Area within a 1 km radius (ha)
Endangered Ecological Community (TSC)	117	63	n/a	33	117
Critically Endangered Ecological Community (EPBC)	6	4	n/a	1.5	509
Box–gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17)	30	6	0	6	1014
Derived grasslands, Brigalow Belt South and Nandewar (RVC 28)	87	31	4	27	293
Silvertop Stringybark grassy open forests, eastern Nandewar and New England Tablelands (RVC 39)	3	1	0	1	892
River Oak Riparian Woodland, eastern NSW (RVC 71)	6	0	0	0	15
Wetlands and marshes, inland NSW (RVC 70)	0.25	0	0	0	0
Planted non-indigenous native vegetation (no RVC)	9	2	0	2	21
Exotic non-native vegetation	45	4	2	2	276
TOTAL	**180.25***	**44**	**6**	**38**	**2510**

*This total area does not include existing cleared and disturbed areas

4 MITIGATION AND MANAGEMENT MEASURES

A comprehensive list of mitigation measures designed to avoid and minimise impacts to threatened species is provided in section 6.1 of **ngh**environmental (2012), amended by this report for the Border Thick-tailed Gecko (Section 2.3.3).

Detailed descriptions of the proposed management measures for the Booroolong Frog are detailed above in this report (Section 2.1.10) and in the attached Offset Plan (Appendix D). The Offset Plan provides details of proposed management actions and monitoring to be undertaken in the offset sites for the Booroolong Frog and Box-Gum Woodland.

5 CONCLUSION

Chaffey Dam is ranked by the NSW Dams Safety Committee as being in the "extreme" hazard category, having inadequate flood capacity, which is based on the population at risk and the severity of damage and loss that would result from dam failure (Dams Safety Committee 2008/2009). In terms of the Australian National Committee on Large Dams (ANCOLD) guidelines and NSW Dams Safety Committee risk framework, the dam failure risks at Chaffey Dam are considered to be intolerable. The proposed upgrade will provide the opportunity to bring the dam up to an acceptable level of risk. The proposed augmentation will increase water security for the region.

Specific recommendations and mitigation measures have been proposed in order to minimise where possible the level of impact on threatened species and ecological communities as a result of the Project. Where residual impacts remain, an Offset Plan has been prepared in accordance with the *Principles for the use of biodiversity offsets in NSW* and the *EPBC Environmental Offsets Policy* order to counterbalance specific impacts of the Project on biodiversity.

Rigorous surveys for the Queensland Bluegrass indicate that the species is unlikely to occur within the study area and is therefore unlikely to be impacted by the Project. As such, recommendations and mitigation measures specific to Queensland Bluegrass are not required.

The implementation of the proposed offset and management measures will assist in reducing the operation of threatening process on the larger population of Booroolong Frogs on the Peel River resulting in positive long term impacts. The proposed measures have been developed with reference to the National Recovery Plan for the Booroolong Frog (NSW OEH 2012a) in consultation with Namoi CMA, OEH, SEWPaC and species experts, with the overall aim of improving the habitat available for the species outside of the new FSL.

The proposed offset strategy and associated management and monitoring programs provide excellent opportunities for improving knowledge of the operation of threats on the Booroolong Frog population on the Peel River, and will have relevance to the species recovery elsewhere in its range. The extent of impact on the frog population will be loss of approximately 2.2% of the known population on the Peel River (50 frogs from a population of over 2285).

An assessment of significance according to the EPBC Act Significant Impact Guidelines has been undertaken and is provided in Appendix A.3. The loss of 1.6 km of Booroolong Frog habitat on the Peel River constitutes a loss of 6.4% of the known occupied habitat of the species on the Peel River. As the species' known range is approximately 50% of its historic distribution (NSW OEH 2012a) and the Peel River is considered to be the stronghold of the species in northern NSW, the loss of 6.4% of the known occupied habitat for the species is considered to be significant. As such, an offset is required under both the State and Commonwealth offset policies.

The Border Thick-tailed Gecko will not be adversely impacted by the Project. A population of the Gecko occurs within the artificial habitat created by the construction of the existing dam wall. Construction associated with the raising of the dam wall has been designed to avoid impacts to the Border Thick-tailed Gecko. Construction works along the dam wall will follow a staged and strategic plan. The entire wall will not be impacted, therefore the geckos will be able to continue to utilise areas of the wall during construction. The loss of habitat during construction will be temporary at worst. Coolatai Grass infestations around the dam that pose a threat to survival of the Gecko will be controlled under the Vegetation Management Plan. The proposed mitigation measures for the Border Thick-tailed Gecko on the dam wall are considered to be effective in avoiding significant impacts to the species. There are no other habitats suitable for the Border Thick-tailed Gecko that will be impacted as a result of the Project.

An offset strategy under the EPBC Environmental Offsets Policy is not required for the Border Thick-tailed Gecko. Offsets for Border Thick-tailed Gecko habitat are not required as no habitat for the species is being lost. However, the offsets provided for vegetation loss in accordance with the *Principles for the use of biodiversity offsets in NSW* incorporate Goat Mountain, an area of known habitat for the species. Goat Mountain is known to support a population of the Border Thick-tailed Gecko which is not currently protected.

Regular stocking of the Murray Cod is undertaken in Chaffey Dam and the Peel River, including downstream of the dam. The Project is unlikely to have a long term impact on the Murray Cod or its habitat and therefore its recovery is unlikely to be compromised. Overall, a significant impact to the Murray Cod is unlikely to occur as a result of the proposed augmentation of Chaffey Dam. The implementation of the proposed mitigation measures will assist in avoiding impacts to the Murray Cod and aquatic biodiversity in general.

No significant impacts to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland or the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland are expected to result from the Project. Accordingly, an offset strategy under the EPBC Environmental Offsets Policy is not required for this community.

Residual impacts to vegetation, including the TSC Act listed EEC, will be offset at a ratio of approximately 2:1 and will be representative of all vegetation types to be impacted by the Project. In addition, management measures will target the restoration of foreshore areas, control of weeds and implementation of grazing regimes suitable for regeneration of understorey elements of the communities.

Thus, overall, the Project can be deemed acceptable in that, notwithstanding the residual impacts, the losses can be offset and substantial conservation gains can be achieved for threatened species and vegetation communities impacted by the Project through the ongoing monitoring and management of offset areas.

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APPENDIX A REVISED THREATENED SPECIES IMPACT ASSESSMENT

A.2 EVALUATION TABLE FOR SUBJECT SPECIES

Using searches undertaken for the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments using the OEH Atlas of NSW Wildlife threatened species database (as the subject site occurs close to the boundaries of these sub-catchments) and over a 10 kilometre radius using the Commonwealth EPBC Act Protected Matters search tool.

Species	Description of habitat2	Presence of habitat	Likelihood of occurrence	Possible impact?
Dichanthium setosum **Queensland Bluegrass** **TSC-V, EPBC-V**	Bluegrass is an upright grass less than 1 m tall. Occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Flowering time is mostly in summer. Associated with heavy basaltic black soils. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra* aff. *longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species. Locally common or found as scattered clumps in populations.	Typical habitat absent.	Unlikely. Recorded at Bowling Alley Point (500 m east of the study area) in similar habitat to that in areas around the dam. However species not detected during targeted surveys in January 2013.	No. Species not detected during optimal flowering period despite rigorous searches.
Litoria booroolongensis **Booroolong Frog** **TSC-E, EPBC-E**	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi	Present	Present	High. Assessment of significance has been prepared.

[2] Information sourced from species profiles on OEH Atlas of NSW Wildlife threatened species database (http://www.environment.nsw.gov.au/threatenedspecies/) or the Australian Government's Species Profiles and Threats database (SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Species	Description of habitat2	Presence of habitat	Likelihood of occurrence	Possible impact?
	catchment. The species is rare throughout most of the remainder of its range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Known to be associated with the following vegetation formation: dry sclerophyll forests (shrub/grass sub-formation), dry sclerophyll forests (shrubby sub-formation), forested wetlands, freshwater wetlands, grassy woodlands, heathlands, wet sclerophyll forests (grassy sub-formation). Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. Forage on stream banks or vegetation and timber within 100m of stream. May shelter on stream banks or vegetation and fallen timber within 100m of stream. Best detected from December to February.			
Uvidicolus sphyrurus **Border Thick-tailed Gecko** **TSC-V, EPBC-E**	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Often occurs on steep rocky or scree slopes. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter.	Present – dam wall	Present - on dam wall	Unlikely. Small amount of habitat to be disturbed on the upstream face of the wall as a result of construction (2000m^2) and inundation (2600m^2). The 50,000 m^2 of habitat on the downstream face of the wall will continue to provide suitable habitat for the species.
Maccullochella peelii **Murray Cod** **EPBC-V**	Found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. Murray cod are able to live in a wide range of habitats from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or	Habitat present within Chaffey Dam and upstream and downstream	Present. Murray Cod is stocked in Chaffey Dam and is found in downstream and upstream reaches (Stocking for	Possible. Assessment of Significance undertaken.

Species	Description of habitat2	Presence of habitat	Likelihood of occurrence	Possible impact?
	overhanging banks. It appears that Murray cod prefer protected spawning sites, and typically spawn large adhesive eggs onto firm substrates such as hollow logs, rocks, pipes and clay banks, from spring to early summer.		recreational fisheries enhancement).	

A.3 ASSESSMENT OF SIGNIFICANCE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999.

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies nine factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species listed on the schedules of the Act. These 'significant impact criteria' are listed within the 'Significant Impact Guidelines for Matters of National Environmental Significance' (DEWHA 2009).

The following assessments of significance considers the potential impact of the proposed action on the Booroolong Frog (EPBC-E), Border Thick-tailed Gecko (EPBC-V), Murray Cod (EPBC-V), and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC-CEEC).

Booroolong Frog (*Litoria booroolongensis*), EPBC-E

Is there a real chance or possibility that the action will:

a) lead to a long-term decrease in the size of a population?

In summer 2013 a total of 50 individuals were recorded over the 1.6 km of Peel River inside the new FSL (excluding four individuals within a 200 m section of the existing FSL) and 2235 individuals along the Peel River and its tributaries outside the new FSL.

Of the frogs recorded outside the new FSL, 2037 individuals were recorded over a 19.5 km stretch of the Peel River upstream of the new FSL, 118 individuals were recorded within a 1.5 km stretch of Wombramurra Creek, and a further 80 individuals were recorded within a 0.5 km stretch of the Peel River further upstream. Thus the surveys have found the Booroolong Frog to be well distributed along 25 km of the Peel River indicating that this entire stretch of river provides important habitat for the species.

The Booroolong Frog is known to exhibit large fluctuations in abundance from one year to the next, therefore population abundance is not a useful indicator of population resilience (NSW OEH 2012). These fluctuations are due to the rapid life-cycle of the Booroolong Frog, and variation in survivorship prior to sexual maturity. The factors driving variation in survivorship prior to sexual maturity are unknown. Due to these fluctuations, area of occupancy can be expected to fluctuate over short time periods. Therefore impacts have been assessed in relation to Booroolong Frog habitat. The lack of long-term studies on the Booroolong Frog within the Namoi Catchment, and probably elsewhere, makes it difficult to ascertain the reasons for these explosive population events. While the population seems to be viable in this moment in time, it may be much more restricted in future years due to changing conditions such as drought or flooding (Phil Spark, *pers. comm.*).

b) reduce the area of occupancy of a species?

The Project will reduce the area of occupancy for the Booroolong Frog. Given the outcomes of the summer 2013 surveys, the loss of habitat as a result of inundation to the new FSL has been assessed to include the entire length of the river between the existing FSL and the new FSL for a distance of 1.6 km. This constitutes 6.4% of the known occupied habitat on the Peel River, which is considered to be the stronghold of the species in northern NSW. In isolation this level of impact would place pressure on the long term viability of a local population.

c) fragment an existing population into two or more populations

The Project will not fragment an existing population into two or more populations. The area of inundation is at the southernmost point of Chaffey Dam. There is unsuitable habitat available for the Booroolong Frog at Chaffey Dam, and there are no recent records for the Booroolong Frog downstream of the dam.

d) adversely affect habitat critical to the survival of a species?

The National Recovery Plan for Booroolong Frog (OEH 2012) states that "habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency (e.g. pumping water) or results in loss of rock crevices (e.g. smothering by weeds or sedimentation), is likely to threaten the persistence of local populations of this species." The area of river that will be inundated as a result of the Project contains habitat critical to the survival of the Booroolong Frog. The habitat equates to 6.4 % of the total known habitat along the Peel River, immediately upstream of Chaffey Dam.

e) disrupt the breeding cycle of a population?

It is unknown to what extent the project will disrupt the breeding cycle of the Booroolong Frog within the impact area. Breeding is known to occur in spring and early summer, from October through to early January. The species uses a range of habitats at different life stages, with tadpoles developing in slow-flowing connected or isolated pools (Anstis 2002). Tadpoles take 2-4 months to develop, metamorphosing in late summer to early autumn (NSW OEH 2012; Anstis 2002). It is therefore evident that the Booroolong Frog has a reliance on both riffle and pool habitats, which are the features that comprise the surveyed sections of the Peel River. The loss of habitat for the Booroolong Frog as a result of the Project will also reduce the extent of breeding habitat for this species.

f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Project will result in the effective removal of 1.6 km of known habitat for the Booroolong Frog. Not enough is currently known about this species, therefore the impacts of the Project on the population of the Booroolong Frog along the Peel River cannot be fully understood. The site to be inundated is historically known as a high density location, probably due to floods in 2008. Suitable habitat is a limiting factor for the persistence of the Booroolong Frog, therefore the removal of 6.4% of habitat of the local population is deemed to contribute to the decline of the species.

g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The Project will not result in the establishment of invasive species in the habitat of the Booroolong Frog, either within the impact area or further upstream. Threats from invasive species such as predatory fish and foxes already exist, and will not be exacerbated by the Project.

h) introduce disease that may cause the species to decline?

The Project will not increase the impact of infection with the amphibian chytrid fungus on the Booroolong Frog population along the Peel River. Chytrid fungus is already a known threat in the area, and will not be amplified by the Project.

i) interfere with the recovery of the species?

The National Recovery Plan for Booroolong Frog *Litoria booroolongensis* identifies eight overall objectives each with a number of priority actions within it (NSW OEH 2012). The overall objective of recovery is to

minimise the probability of extinction of the Booroolong Frog in the wild, and to increase the probability of populations becoming self-sustaining and viable in the longer term.

Recovery Plan Objective	Recovery Plan Objective details	State Water response
1	Determine the species distribution in areas that have not been the focus of targeted surveys.	State Water and Namoi CMA funded the summer 2013 surveys along the Peel River, which has increased our understanding of the present status and distribution of the Booroolong Frog along 25 km of the Peel River. A management plan will be developed and implemented by State Water for the Booroolong Frog population on the Peel River that will include provision for post-construction monitoring for a period of 2 years to monitor the impacts of the Project on the population both within and outside the new FSL.
3	Reduce the impact of known or perceived threats contributing to the ongoing decline of the Booroolong Frog.	The management plan to be developed and implemented by State Water for the Booroolong Frog population on the Peel River will include provision for an Offset Plan which includes remediation and threat mitigation as required at offset sites (e.g. stock exclusion, weed removal, restoration of the riparian zone).
4	Determine population trends across the species range, and in areas subject to different management regimes.	Post-construction monitoring will detect changes in populations both within and outside of the new FSL, and relate those changes to specific habitat features and the presence/absence of threats at recorded locations.
6	Identify other potentially threatening processes.	Post-construction monitoring will record the presence/absence of Chytridiomycosis within the population Post-construction monitoring will also allow for the detection and quantification of other threatening processes presently unknown that may be contributing to the decline of the species.
7	Increase community awareness and involvement in the Booroolong Frog recovery program.	State Water to consider future possibilities for raising community awareness and collaborative work with Namoi CMA.
8	Achieve the effective implementation of the recovery plan.	All of the actions above will contribute to effectively implementing the objectives of the recovery plan.

OEH has prepared a Priorities Action Statement (PAS) to promote the recovery of threatened species and the abatement of key threatening processes in New South Wales. A Priorities Action Statement (PAS) has identified 19 broad strategies to help the recovery of the Booroolong Frog. Seven of these action statements will be contributed to by State Water.

Priorities Action Statement	Priorities Action Statement details	State Water response
1	Prepare and implement an annual monitoring program to determine population status and the influence of management actions	A management plan will be developed and implemented by State Water for the Booroolong Frog population on the Peel River that will include provision for post-construction monitoring for a minimum of 2 years to monitor the population within the new FSL. An offset site management plan will also monitor the population at sites outside of the new FSL along the Peel River. Monitoring will be designed to monitor the influence of management actions and to actively respond to the success or failure of those actions accordingly.
2	Determine current distribution and abundance in relation to landscape and habitat quality attributes.	Surveys in summer 2013 determined the current distribution and abundance of the Booroolong Frog along the Peel River in relation to landscape and habitat quality attributes. This will be further assessed during the post-construction monitoring and offset site monitoring programs.
4	Determine the influence of habitat disturbance on persistence, abundance and demography.	The effects of habitat degradation (stock, weeds, erosion, humans) on the presence and distribution of the Booroolong Frog will be considered as part of the monitoring programs to be implemented as part of the Booroolong Frog Management Plan and the Offset Site Management Plan.
7	Use management agreements and incentives for riparian fencing and re-snagging to reduce further habitat degradation and enhance the extent of suitable habitat.	Conservation Agreements at offset sites will be implemented to reduce the impacts of habitat degradation and disturbance, and promote restoration of the riparian zone. This will be detailed in the Offset Site Management Plan.
10	Investigate and implement options for reducing the potential impact of introduced fish, including the control of	Control of carp in streams is deemed to be ineffective, therefore it has not been recommended (Anna Cronin, *pers. comm.*).

Priorities Action Statement	Priorities Action Statement details	State Water response
	carp in streams with known populations.	However, the presence and abundance of predatory fish will be monitored during post-construction and offset site monitoring programs.
16	Negotiate, develop and implement conservation management agreements for known high priority sites.	Conservation Agreements will be implemented at offset sites according to the Offset Plan and Offset Site Management Plan. The offset site will be located on the Peel River where Booroolong Frogs are known to occur. The Peel River is a high priority site.
17	Implement hygiene protocol to reduce the transmission of harmful pathogens within and between populations.	The hygiene protocol for the control of disease in frogs will be implemented when working with frog populations.

The Threat Abatement Plan (TAP) 'Infection of amphibians with chytrid fungus resulting in chytridiomycosis' has two broad objectives:

Threat Abatement Plan	Threat Abatement Plan details	State Water response
1	To prevent amphibian populations or regions that are currently chytridiomycosis-free from becoming infected by preventing further spread of the amphibian chytrid within Australia.	The hygiene protocol for the control of disease in frogs will be implemented when working with frog populations.
2	To decrease the impact of infection with the amphibian chytrid fungus on populations that are currently infected.	As above

References

Anstis, M. (2002). *Tadpoles of South-eastern Australia: a Guide with Keys.* Reed New Holland, Sydney.

NSW Office of Environment and Heritage (NSW OEH) (2012). National Recovery Plan for Booroolong Frog (*Litoria booroolongensis*) Office of Environment and Heritage (NSW), Hurstville.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Matters of National Environmental Significance: Significant impact guidelines 1.1.

Border Thick-tailed Gecko (EPBC-V)

Is there a real chance or possibility that the action will:

a) lead to a long-term decrease in the size of an important population of a species?

Individuals of this species have been recorded on the Chaffey Dam wall. Border Thick-tailed Geckos have been recorded frequently throughout the Nandewar bioregion, and the species was considered for delisting in 2008. However, due to the increasing threat that Coolatai grass is having on its habitat throughout the Nandewar bioregion, it was retained as a vulnerable species.

NWES (2009a) found the Border Thick-tailed Gecko to be relatively common within the region, and recorded it many times in shrubby rocky remnants around Woolomin, including Goat Mountain, to the immediate northwest of the dam wall. The Border Thick-tailed Gecko individuals present on the dam wall are likely to be part of a much larger population that occupies a large remnant of approximately 100 ha of suitable habitat (NWES, 2009a). Surveys in October 2012 confirmed the presence of this species on the Dam wall (three individuals). One individual was also recorded on Goat Mountain where there is abundant habitat available for this species. A planted corridor was created in late 2011 and early 2012 with the aim of linking Goat Mountain with the Peel River and habitat areas to the east. This corridor in its current state of growth is not suitable as a wildlife corridor, but may facilitate movement of Border Thick-tailed Geckos between Goat Mountain and the dam wall in the future. The rock used for raising of the dam wall will be consistent with that currently inhabited by the species on the wall.

With the revised construction methodology there has been a dramatic reduction in the level of impact to the Border Thick-tailed Geckos inhabiting the dam wall. The raising of the morning glory spillway access bridge and platform on the piers, and changes to the auxiliary spillway and fuse plug will no longer proceed as part of the proposed works. As an alternative, a vertical reinforced earth embankment for wall raising will be constructed on the crest of the dam wall (Figure 2-6). As a result, the 50,000 m^2 of Border Thick-tailed Gecko habitat on the downstream face of the wall will no longer be impacted. Impacts associated with the revised construction methodology will only occur on the crest of the dam wall during construction of the vertical wall, and along the upstream face of the wall between the left bank and the morning glory spillway. This constitutes a total impact area of 2,000 m^2 where some individuals on the upstream face of the dam wall may be impacted by construction. The Border Thick-tailed Geckos on the dam wall have not been identified as an important population. Construction associated with the raising of the dam wall has been designed to avoid impacts to those individuals that may be impacted. Provided that the proposed mitigation measures are carried out, the Project is unlikely to lead to a long-term decrease in the size of the population that inhabits the dam wall. The loss of some individuals within the impact zone may be unavoidable, however the mitigation measures proposed aim to reduce those impacts. No natural habitat for the species will be removed. An area of artificial habitat on the dam wall will be removed and replaced. Furthermore, this species is unlikely to be significantly impacted by the increased FSL.

b) reduce the area of occupancy of an important population?

The Border Thick-tailed Gecko population on the dam wall has not been identified as an important population.

The crest of the existing dam wall will be raised by 6.5 m to 525.1 m AHD, and the proposed works may impact on habitat utilised by some individuals on the upstream face of the dam wall. As a result, there may be a temporary reduction of the area of occupancy during construction, however mitigation measures have been designed to prevent impacts to those individuals, and will allow geckos to continue

inhabiting the remainder of the dam wall during construction. The impact area (2000 m^2) constitutes a very small area of known Border Thick-tailed Gecko habitat (56,000 m^2) on the dam wall. Pre-clearance surveys will also be undertaken to minimise impacts to Border Thick-tailed Geckos within the impact area. Overall, at the completion of construction additional habitat will be available for the Border Thick-tailed Gecko through the raising of the dam wall.

Known habitat for the Border Thick-tailed Gecko exists on Goat Mountain, to the north-west of the dam wall, and will not be impacted by the Project.

c) fragment an existing important population into two or more populations?

The Border Thick-tailed Gecko population on the dam wall has not been identified as an important population. The area of Border Thick-tailed Gecko habitat on the dam wall that will be impacted by construction will not become further fragmented or isolated as a result of the Project, and will ultimately provide the species with additional habitat as a result of raising the dam wall. The Project will not permanently fragment an existing population into two or more populations.

d) adversely affect habitat critical to the survival of a species?

No areas of critical habitat have been declared for this species. The habitat to be impacted by the Project is artificial, but it is evident that the dam wall provides habitat suitable for the species. However, impacts to the upstream face of the dam wall will be temporary and the species will be able to continue to use this area of habitat post-construction.

e) disrupt the breeding cycle of an important population?

The Border Thick-tailed Gecko population on the dam wall has not been identified as an important population. However, little is known of the breeding cycle of this species. They breed during their period of activity (between September and April), and are likely to produce multiple clutches over the breeding season. Construction activities within an area of approximately 2000 m^2 are unlikely to disrupt the breeding cycle of the Border Thick-tailed Gecko population on the dam wall, which encompasses a potential area of 56,000 m^2. The breeding cycle of the population on Goat Mountain would not be disrupted.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

During construction, approximately 2000 m^2 of habitat on the downstream face of the dam wall will be modified, temporarily reducing the availability of habitat for some individuals on the dam wall. However, the remaining 50,000m^2 of habitat on the dam wall will not be impacted and will continue to provide suitable habitat for the population inhabiting the dam wall. Mitigation measures, including pre-clearing surveys, have been proposed to alleviate risks associated with construction. Overall, the Project will not decrease the availability or quality of habitat to the extent that the species is likely to decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Coolatai grass is common in the locality (but not on the dam wall), and is listed as a key threatening process for the Border Thick-tailed Gecko. The dam wall is not currently threatened by this invasive species, and the Project is unlikely to result in the establishment of it on the wall due to the wall being an artificial habitat. Safeguards have been proposed that will ensure weeds are adequately controlled at the site, and a Vegetation Management Plan will be prepared for the Project, thereby improving habitat available for the Border Thick-tailed Gecko in the study area.

h) introduce disease that may cause the species to decline?

The Project is unlikely to introduce disease that may cause the species to decline.

i) interfere substantially with the recovery of the species?

Recovery and threat abatement plans have not been prepared for the Border Thick-tailed Gecko. However a Priorities Action Statement (PAS) has identified 15 broad strategies to help the recovery of the Border Thick-tailed Gecko. State Water intend to respond to 13 of these.

Recovery Plan Objective	Recovery Plan Objective details	State Water response
1	Control and monitor feral and domestic ungulate disturbance in known and potential habitat. .	As part of the stock management plan stock will be prevented from entering the wildlife corridor area, and habitat between dam wall and goat mountain. Goat Mountain, a known location for the species, will be offset as part of the Offset Plan and will also be subject to a stock management plan
2	Control feral cat and fox populations in areas where key populations of the species is known to occur.	Fox baiting will be undertaken as part of the Fauna Management Plan. This action will benefit a range of species including but not limited to the Border Thick-tailed Gecko.
3	Provide map of known occurrences to Rural Fire Service and seek inclusion of mitigative measures on Bush Fire Risk Management Plan(s), risk register and/or operation map(s).	State Water will provide a map of known occurrences to Rural Fire Service.
4	Ensure logging waste in forest or woodland is not stock-piled or burnt where the species occurs.	As part of the offset site, Goat Mountain will not be at risk from logging, stockpiling or fire.
5	Encourage the retention of dead fallen timber in areas where the species is known to occur. .	As part of the offset site, fallen timber on Goat Mountain will be retained.
6	Provide fire wood in areas where recreational use overlaps with species habitat to preserve large fallen logs and groundcover vegetation. .	Signage will be implemented to prevent fire wood collection in areas where recreational use and Border Thick-tailed Gecko habitat may overlap, particularly at the Bowlo Fishing Club.
7	Retain and protect areas of rocky dry open forest and woodland from clearing, fragmentation and disturbance.	As part of the offset site, Goat Mountain will not be at risk from clearing, fragmentation or disturbance.
8	Retain bushrock in its natural setting within the species range and encourage rocks be obtained for gardens only from licensed dealers.	As part of the offset site, Goat Mountain will not be at high risk from bushrock collection. Signage will be incorporated at the Bowlo Fishing Club where there may be a small risk.
9	Develop and implement firewood collection policies to ensure large logs and woody debris are not removed from	Signage will be implemented to prevent fire wood collection in areas where recreational use and Border Thick-tailed

Recovery Plan Objective	Recovery Plan Objective details	State Water response
	Border Thick-tailed Gecko habitat.	Gecko habitat may overlap, particularly at the Bowlo Fishing Club.
10	Identify locations supporting key populations.	Goat Mountain has been identified as a key area.
11	Determine site specific management strategies to protect and enhance key populations.	Weed management would be ongoing as per the Vegetation Management Plan particularly focusing on Coolatai Grass infested areas around the dam wall and planted wildlife corridor.
12	Identify sites in key habitats and corridors for vegetation rehabilitation and undertake revegetation to provide links between key populations.	A planted corridor was established in late 2011 and early 2012 in order to maintain connectivity from the dam wall to Goat Mountain. Once established, it is likely this will provide habitat for a range of native species protected under both State and Commonwealth legislation, particularly the Border Thick-tailed Gecko.
15	Control and monitor weed invasion within known and potential habitat. .	Weed management would be ongoing as per the Vegetation Management Plan particularly focusing on Coolatai Grass infested areas around the dam wall and planted wildlife corridor.

Overall, the Project will not interfere with the recovery of the Border Thick-tailed Gecko in the long-term. A very small amount of artificial habitat will be impacted, with no predicted impact to the geckos. Mitigation measures have been designed to minimise impacts to the species during construction.

Murray Cod (EPBC-V)

Is there a real chance or possibility that the action will:

a) lead to a long-term decrease in the size of an important population of a species?

Not applicable. The Murray Cod population in the Peel River is not identified as an important population in a recovery plan. The Murray Cod population is stocked in Chaffey Dam and the Peel River downstream of the dam. The Murray Cod population is not considered to fit the definition of an important population under the EPBC Act Significant impact guidelines 1.1 (refer to Section 2.4).

b) reduce the area of occupancy of an important population?

Not applicable. The Murray Cod population in the Peel River is not identified as an important population in a recovery plan. The Murray Cod population is stocked in Chaffey Dam and the Peel River downstream of the dam. The Murray Cod population is not considered to fit the definition of an important population under the EPBC Act Significant impact guidelines 1.1 (refer to Section 2.4).

c) fragment an existing important population into two or more populations?

Not applicable. The Murray Cod population in the Peel River is not identified as an important population in a recovery plan. The Murray Cod population is stocked in Chaffey Dam and the Peel River downstream of the dam. The Murray Cod population is not considered to fit the definition of an important population under the EPBC Act Significant impact guidelines 1.1 (refer to Section 2.4).

d) adversely affect habitat critical to the survival of a species?

In accordance with the EPBC Act Significant impact guidelines 1.1 definition 'Habitat critical to the survival of a species' refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified in a recovery plan for the species as habitat critical for that species and/ or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

Habitat critical for that species has not been identified in the recovery plan or the register.

As discussed in Section 2.4, the proposed augmentation is unlikely to substantially modify the habitat of the species and therefore the survival of the species is unlikely to be compromised.

e) disrupt the breeding cycle of an important population?

Not applicable. The Murray Cod population in the Peel River is not identified as an important population in a recovery plan. The Murray Cod population is stocked in Chaffey Dam and the Peel River downstream of the dam. The Murray Cod population is not considered to fit the definition of an important population under the EPBC Act Significant impact guidelines 1.1 (refer to Section 2.4).

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Upstream of the dam wall, the filling of the dam, which would occur naturally, to the new full supply level would flood any fringing aquatic habitat currently present. This loss of habitat is likely to be temporary as new similar habitat would become available along the new perimeter of the reservoir. Some riparian vegetation would also be lost along the edges of the reservoir and upstream reaches. The loss of riparian vegetation may increase bank and channel erosion and temporarily impact water quality (e.g. through the degradation of riparian vegetation as it progressively floods). The impact would be minor considering the currently limited availability of riparian habitat around the dam, most likely a result of the existing fluctuations in the dam water level. While this loss cannot be avoided there are opportunities to rehabilitate the riparian zone along the new full supply level as part of the proposed works. The inundation of the riparian zone has the potential to increase the availability of some important aquatic habitat sources for the Murray Cod such as large woody debris. The raising of the full supply level would also increase by maximum 185 hectares the area of potential lake habitat but would result in a minor decrease of riverine habitat (approximately 1% decrease of the total riverine habitat along the Peel River and its tributaries upstream of the dam). The Murray Cod occurs in both types of environments and the species is regularly stocked within the impoundment and upstream. As such the potential short term and long term impacts of the proposal on aquatic habitats are unlikely to be substantial and are unlikely to result in a decline of the species within the dam or upstream.

Regular stocking of the Murray Cod is undertaken in Chaffey Dam and the Peel River, including downstream of the dam. The population of the Murray Cod has not been identified as a population under threat in the recovery plan. Downstream of the dam wall potential impacts as discussed in sections 3 and 4 are unlikely to result in substantial modifications of the habitat of this species such that its extent the species is likely to decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Exotic fish species, including Carp, Rainbow Trout, Brown Trout, Redfin Perch are known to be established downstream and upstream of the dam.

Upstream of the dam wall, the raising of the full supply level would increase by maximum 185 hectares the area of potential lake habitat but would result in a minor decrease of riverine habitat (approximately 1% decrease of the total riverine habitat along the Peel River and its tributaries upstream of the dam). The additional lake habitat would be available to the Murray Cod but also invasive species.

The natural filling of the dam to the new full supply level would flood any fringing aquatic habitat currently present. This loss of habitat is likely to be temporary as new similar habitat would become available along the new perimeter of the reservoir. Some riparian vegetation would also be lost along the edges of the reservoir and upstream reaches. The loss of riparian vegetation may increase bank and channel erosion and temporarily impact water quality (e.g. through the degradation of vegetation). The impact would be minor considering the currently limited availability of riparian habitat around the dam, most likely a result of the existing fluctuations in the dam water level. While this loss cannot be avoided there are opportunities to rehabilitate the riparian zone along the new full supply level as part of the proposed works. The inundation of the riparian zone has the potential to increase the availability of some important aquatic habitat sources for the Murray Cod such as large woody debris.

Temporary disturbances which may occur during construction or when the dam fills to the new supply level have the potential to favour exotic species which may be more tolerant to disturbed environments. However, exotic species are currently established and Murray Cod is regularly stocked in the dam.

The impact of invasive species on the Murray is not well known. Possible impacts on Murray Cod include through predation, competition, habitat alteration and spread of diseases and parasites. Carp is a typical invasive species, which is resilient and well-adapted to exploiting riverine environments that are already degraded (Koehn et al. 2000; Koehn 2004). At high densities Carp may increase turbidity and reduce aquatic vegetation through their feeding habits, reducing habitat for native species. As discussed above, temporary disturbances may favour the Carp, especially in the dam. However, although Carp may compete with Murray Cod for space, there is no evidence for any other form of competition between Murray Cod and Carp, and young Carp may provide a source of food for Murray Cod. Despite public opinion, there is no scientific evidence that increases in Carp have affected Murray Cod numbers (Koehn et al. 2000). There is however some correlation between high numbers of alien fish, especially Carp and Redfin Perch, and low numbers of native fish including Murray Cod (Rowland 2005). The recent apparent increases in cod number in NSW coincide with historically low numbers of Carp and Redfin Perch. Predation by and competition with Redfin Perch in the 1950s and 1960s may have been a contributing factor to the decline of Murray Cod in the southern part of MDB during that time (Rowland 2005). Effects of other species that can reach very high densities are not known.

As discussed in section 3 and 4, downstream impacts are unlikely to substantially alter the habitat of the Peel River compared to existing conditions. As such, considering invasive species are known to occur downstream, invasive species are unlikely to become established in new areas.

h) introduce disease that may cause the species to decline?

Very little is known about the prevalence and impact of diseases on Murray Cod. The major concern probably relates to those exotic diseases introduced to Australia with imported fish which have found their way into the environment. Diseases and pathogens of potential major concern include the Epizootic Haematopoietic Necrosis (EHN) virus, Viral Encephalopathy and Retinopathy (VER), Goldfish Ulcer Disease (GUD), Asian Fish Tapeworm Bothriocephalus acheilognathis and the parasitic copepod Anchorworm Lernaea cyprinacea. The introduced Redfin Perch carries EHN (Langdon et al. 1986), to which Murray Cod are highly susceptible (Langdon 1989; Langdon et al. 1986; Langdon et al. 1987; MDBC 2004a). A MDBC project is currently underway investigating the susceptibility of native fish species to EHN and its epidemiology in the wild.

A new iridovirus has been detected in cultured Murray Cod in Victoria but has not yet been detected in wild fish (Prof. Richard Whittington pers. comm.; unpubl. data). The abundance of alien fish such as Carp and Eastern Gambusia may act as source for introduced pathogens such as Anchorworm and Asian Fish Tapeworm. Ectoparasitic protozoans including Chilodonella species, Ichthyophthirius species, Myxosoma species and Trichodina species are widespread and can be problematic in fish culture conditions (Ashburner 1978; Ashburner and Ehl 1973; Langdon 1989; Langdon et al. 1986; Langdon et al. 1987; Rowland and Ingram 1991), but their occurrence or impact in the wild is unknown. Chilodonella infestation has killed adult Trout Cod kept at a hatchery (Ingram and Rimmer 1992) and has been suggested as a threat to wild populations (Douglas et al. 1994). There is the potential to introduce disease to wild populations through the release of hatchery-bred fish. All hatcheries breeding Murray Cod need to comply with the National Policy for the Translocation of Live Aquatic Organisms guidelines (MCFFA 1999), requiring disease screening prior to release.

Exotic fish species, including Carp, are known to occur downstream and upstream of the dam and have the potential to carry diseases. However, native or exotic fish would not be introduced as part of the proposal and therefore it is unlikely that the proposal would introduce a disease.

i) interfere substantially with the recovery of the species?

The Murray Cod recovery plan includes a list of priority actions for the recovery of the species. These are:

- Population structure and management
- Determine the distribution, structure and dynamics of Murray Cod populations across the Murray Darling Basin and devise appropriate Spatial Management Units and monitoring program.
- Recruitment
- Identify and quantify the environmental parameters (e.g. flows and available food) that drive recruitment and population growth.
- Habitat use, protection and repair
- Identify, protect and repair key aquatic and riparian habitats for Murray Cod in each Spatial Management Unit.
- Sustainable take
- Manage the recreational fishery for Murray Cod in a sustainable manner while recognising the social, economic and recreational value of the fishery.
- Community ownership
- Encourage community awareness and support for Murray Cod management (including angling and conservation groups).
- Recovery Plan implementation
- Establish a long-term structure for the implementation of the national Murray Cod Recovery Plan.

The proposal would not interfere with any of the actions outlined in the recovery plan.

Regular stocking of the Murray Cod is undertaken in Chaffey Dam and the Peel River, including downstream of the dam. The population of the Murray Cod has not been identified as a population under threat in the recovery plan. As discussed the proposal is unlikely to have a long term impact on the Murray Cod or its habitat and therefore its recovery is unlikely to be compromised.

Overall, a significant impact to the Murray Cod is unlikely to occur as a result of the proposed augmentation of Chaffey Dam.

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Is there a real chance or possibility that the action will:

a) reduce the extent of an ecological community?

Approximately 10 ha of EPBC-listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (hereafter called Box-Gum Woodland) is likely to be inundated or be cleared as a result of the Chaffey Dam safety upgrade and augmentation (the Project). The works are thus going to effectively clear this extent of the community from the landscape. Field surveys conducted within a 1 km buffer zone surrounding Chaffey Dam and subsequent GIS mapping indicate that there is approximately 506 ha of Box-Gum Woodland currently present in the area.

b) fragment or increase fragmentation of an ecological community?

Habitat within the study area has already been highly modified and fragmented due to agricultural and recreational pressures. Habitat for this community is substantially more contiguous above the new FSL in areas where it currently exists. There is approximately 1300 ha of lower-quality TSC-listed Box-Gum Woodland that is present in the buffer zone which also assists in the connectivity of the EPBC-listed community. Considering this, the Project is unlikely to result in any substantial further fragmentation of Box-Gum Woodland in the region.

c) adversely affect habitat critical to the survival of an ecological community?

A draft National Recovery Plan for Box-Gum Woodland (2010) states that habitat critical to the survival of Box-Gum Woodland is "*on the moderate to highly fertile soils of the western slopes of NSW and Queensland, the northern slopes of Victoria, and the tablelands of the Great Dividing Range from southern Queensland through NSW and the ACT*". It also suggests that any areas that meet the minimum conditional criteria for Box-Gum Woodland should be considered critical to the survival of the community. Within the area to be affected by the Project, 10 ha of habitat that meets the conditional criteria will be adversely affected by inundation or vegetation removal.

d) modify or destroy abiotic factors necessary for an ecological community's survival?

The area surrounding the dam that is to be inundated will have a number of abiotic factors altered. In essence, there will be increased saturation of the soil by water (raising of the water table) as well as potential erosion and sedimentation impacts. It is assumed that the changes in abiotic factors that the area will experience will effectively remove 10 ha of Box-Gum Woodland. However, this is unlikely to place the local occurrence of the community (506 ha within a 1 km buffer zone that will not be impacted) at risk of extinction.

e) cause a substantial change in the species composition of an occurrence of an ecological community?

Impacts resulting from inundation would be likely to substantially change the species composition of the community within the study area. The removal of all Box-Gum Woodland within the Project boundaries (10 ha) is expected to occur. The proposed works are unlikely to cause a substantial change in the species composition of Box-Gum Woodland outside of the Project boundaries (outside the new FSL and road footprint areas).

f) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including assisting invasive species to become established or causing regular mobilisation of chemicals or pollutants into the ecological community?

There will be a substantial reduction in the quality or integrity of approximately 10 ha of Box-Gum Woodland due to the predicted inundation. The Project has the potential to spread weeds such as the invasive Coolatai Grass (*Hyparrhenia hirta*) and Blackberry (*Rubus fruticosus* aggregate) that are already common in the vicinity of the dam. Many of these species are already established within and near to the Box-Gum Woodland that surrounds the dam. Safeguards have been proposed that will ensure weeds are adequately controlled at the site, and a Vegetation Management Plan will be prepared for the Project. With the appropriate implementation of weed controls during and following construction, weed impacts of the Project are not expected to be significant.

It is not expected that there will be any regular mobilisation of fertilisers or herbicides or other chemicals or pollutants into the ecological communities within the buffer zone around the dam that will kill or inhibit the growth of native species in the ecological community. Weed control will occur during and after the project, which will likely involve the application of herbicides to exotic species, but this is unlikely to cause the death or injury of native species in the ecological community.

g) interfere with the recovery of an ecological community?

The recovery of the ecological community within the Project boundaries (10 ha) will be prevented due to inundation and construction works. The management of the Box-Gum Woodland outside the new full supply level in perpetuity (roughly estimated to be 75 ha) should ensure that its condition is improved and the rate of recovery is accelerated. In this sense, there should be a beneficial effect on the recovery of Box-Gum Woodland outside of the project boundaries as the result of the proposed Offset Plan..

The draft National Recovery Plan for Box-Gum Woodland (2010) identifies seven overall objectives each with a number of priority actions within it. The specific objective to be achieved is to minimise the risk of extinction of the ecological community.

Recovery Plan Objective	Recovery Plan Objective details	State Water response
1	Achieving no net loss in extent and condition of the ecological community throughout its geographic distribution	The loss of approximately 10 ha of Box-Gum Woodland within the Project boundary will be offset by the active management in perpetuity of the ecological community in the surrounding area. The active management of TSC-listed Box-Gum Woodland outside the boundary has the potential to considerably increase the area of the EPBC-listed community in the region.
3	Increasing protection of sites in good condition	Depending on the final calculated value of the area to be offset, it is likely that between 40 and 75 ha of Box-Gum Woodland will be protected and actively managed in perpetuity by State Water, as well as protecting a larger area of the lower quality TSC-listed ecological community.
4	Increasing landscape functionality of the ecological community through	The Box-Gum Woodland that surrounds the dam has been degraded as the result

	management and restoration of degraded sites	of moderate to heavy grazing and recreational activities. With the active management of both TSC- and EPBC-listed Box-Gum Woodland around the dam, including the reduction of stocking rates and weed management, there should be a rapid and noticeable increase in the landscape functionality of the ecological community.
6	Increasing transitional areas around remnants and linkages between remnants	The offset site, which already has a much greater contiguity than the patches within the immediate vicinity of the dam, will be managed to benefit the connectivity of higher quality patches by increasing the quality of the TSC-listed community that often surrounds them. In time, it is likely that the size of the high-quality patches will expand to encompass the surrounding lower-quality habitat.
7	Bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland	As much of the offset sites are located on leasehold land, there will be considerable landholder involvement in the management of the Box-Gum Woodland. A Conservation Agreement is likely to be established, and a number of management measures will be suggested. These may include, but are not limited to, the exclusion of feral species, weed control, and the management of stock grazing for conservation purposes. It is expected that a number of land managers (for different leaseholds) will be heavily involved in all of these aspects.

References

Department of Environment, Climate Change and Water NSW (2010). National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Draft for Public Comment. Department of Environment, Climate Change and Water NSW, Sydney.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Matters of National Environmental Significance: Significant impact guidelines 1.1.

APPENDIX B RESPONSE TO SUBMISSIONS ON PIR (RECEIVED APRIL 2013)

Documents referred to in this response to submissions are:

1. WorleyParsons (2012) Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement State Significant Infrastructure. Report prepared for State Water.
2. **ngh**environmental (2012). Terrestrial and Aquatic Flora and Fauna Impact Assessment. Appendix 8 of WorleyParsons (2012).
3. **ngh**environmental (2013a). Terrestrial and Aquatic Flora and Fauna Impact Assessment – Addendum Report.
4. **ngh**environmental (2013b). Terrestrial and Aquatic Flora and Fauna Impact Assessment – Revised Addendum Report.

RESPONSE TO SUBMISSIONS ON PIR

Documents referred to in this response to submissions are:

1. **ngh**environmental (2013b). Terrestrial and Aquatic Flora and Fauna Impact Assessment – Revised Addendum Report.

Concern/Issue	Comment	Response
Department of Planning and Infrastructure, dated 12 April 2013		
Booroolong Frog		
	Please present a breakdown of the data for the various life stages of the frog recorded along the length of the river upstream of current full supply level (FSL).	A more detailed representation of the Booroolong Frog along the Peel River has been supplied as a map series in Appendix C, 2013b These maps and associated graphs (Figure 2-1 and Figure 2-2, 2013b) give a clear indication that Booroolong Frogs at all life stages are present along the length of the river surveyed (25 km). From this representation of the data it is evident that suitable breeding habitat for the Booroolong Frog is present along the 25 km stretch of the Peel River and Wombramurra Creek surveyed. .
The department is concerned that the method used to calculate the area of Booroolong Frog habitat present within the Peel River, which assumed an average habitat width of 14.5 m for the entire 25 km length of stream, may not accurately reflect the area of habitat within the new FSL and upstream of the new FSL.	The use of this average figure for river width requires further explanation. It is important that the area of Booroolong Frog habitat within the new FSL and upstream of the new FSL is accurately measured so that the proportion of habitat being impacted by the proposed action can be quantified. If the method used is inadequate for this purpose, further measures to more accurately estimate these areas are likely to be required.	Due to concerns over the assumption of stream width, the river channel in both the impact site and offset site has been mapped and the corresponding area calculated using ArcGIS. It should be noted that the Peel River is a dynamic system; areas of suitable Booroolong Frog habitat will change in response to rainfall or lack thereof. Therefore, the total river channel width has been used as opposed to the average stream width as depicted in the Google Earth imagery (dated 28/09/2010) used previously. A total of 4.77 ha (previously 2.32 ha) has been calculated within the 1.6 km of the impact site (Section 3.1.1 of the revised Offset Plan). The 9 km identified for the offset site equates to a total area of 31.82 ha (previously 13.1 ha). The EPBC calculator has been updated accordingly. While previously the % of impact offset gave a value of

Concern/Issue	Comment	Response
		100.08%, the new calculations give a value of 118.24% of impact offset. The updated calculation has been provided in Appendix B of the revised Offset Plan.
The proponent concludes that the impact on Booroolong Frog habitat (2.3 ha) would result in a significant impact on the species, however it is considered possible that this area of habitat is an underestimate. Regardless, the department agrees that the impact on the Booroolong Frog would be significant, and as such avoidance, mitigation and/or offset measures are required for the purposes of the EPBC Act. It is noted that no avoidance or mitigation measures have been proposed for the Booroolong Frog. Based on the information provided, it is not clear to what extent the proposed Booroolong Frog offset provides additional conservation benefit to the species, above and beyond that which is already provided by the existing Management Agreements between the owners of the proposed offset properties and the Namoi CMA.	The department requests that the following additional information be provided: • A description, quantified with available evidence, of the extent to which the existing factors reported to be impacting on the Booroolong Frog (e.g. weeds, cattle access, water extraction) are doing so under the existing Management Agreements (MAs). • A quantified description of how the management of the proposed offset area would result in an overall conservation benefit for the Booroolong Frog, compared with its existing management under MAs. Under section 7.6 of the EPBC Act Environmental Offsets Policy it is necessary to clearly demonstrate how the proposed Booroolong Frog offset provides additional conservation benefit to the species. If this is not possible, it is unlikely that the proposed Booroolong Frog offset would adequately offset the impacts of the proposed action on this species and further avoidance, mitigation and/or offset measures would be needed. •Further details of the legal mechanism proposed to protect the offset site, including the legislation under which the mechanism exists and any process that may allow it to be retrospectively removed from the land title. • Any measures to ensure that land within the proposed Booroolong Frog offset areas would be managed in accordance with the Conservation Agreements made between landowners and the proponent, particularly given current management	• No threat mapping has yet been conducted but there is strong anecdotal evidence from OEH and Namoi CMA the threats discussed below and addressed in the proposed offset plan are acting to reduce the security of the Booroolong Frog population on the Peel River. Under the proposed funding agreement CMA have identified threat mapping to be conducted as part of the implementation of the offset plan, to ensure on ground conservation efforts are directed according to priority threat management. Prioritisation of actions and threats will be done in conjunction with OEH. • Table 4-2 and Table 4-3 of the revised offset plan list the additional conservation benefits of the proposed offset plan over the existing management agreements. We have been unable to access any monitoring data from CMA to demonstrate to what extent the existing management actions are contributing to improvement of Booroolong Frog Habitat. State Water and nghenvironmental have made requests for the records of monitoring and audit reports but these have not been made available. Furthermore we have been told that when a Management Plan is referred to in relation to the current agreements it is a “loosely used term” and there is no Management Plan document. (Anna Cronin pers. comm. to Jacqui Coughlan 31 Jan 2013). See Table 4-3 in the revised Offset Plan in relation to the success of the current management agreements and the need for further conservation efforts. Detailed management measures have been provided within the revised Offset Plan. Table 4-2 gives a comprehensive assessment of how the proposed management of the Booroolong Frog offset site

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	practices referred to in section 3.2 of the Offset Plan. • Consideration of the likelihood that the existing MAs between landowners and Namoi CMA would be renewed after they expire. It is expected that this assessment could be based on advice from Namoi CMA.	will result in an overall conservation benefit for the Booroolong Frog, compared with its existing management under MAs. These management measures have been proposed in consultation with David Coote and David Hunter of OEH.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		
The department considers that the impact of the proposed action on 7.4 ha of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community (BGW) would result in a significant impact on this ecological community. This is in contrast to the proponent's view that this impact would not be significant. The department acknowledges the proponent's intention to offset this impact, irrespective of its conclusion on the significance of the impact, through the inclusion of approximately 207 ha of BGW in the proposed offset area. However, the information provided in relation to the proposed offset is not sufficient to enable a proper assessment of its adequacy.	The following additional information is required to inform an assessment of the proposed BGW offset: • The area (in hectares) of BGW represented by each of the three condition classes described in the Commonwealth Conservation Advice on this ecological community within the offset area and the impact area. • Details of the legal mechanism proposed to protect the offset site, including the legislation under which the mechanism exists and any process that may allow it to be retrospectively removed from the land title. • Further detail on the resources required to support the	• The three condition classes identified in the Conservation Advice for the community are: - A eucalypt overstorey but no substantial native understorey - A native understorey, but trees have been cleared - Both a native understorey and a eucalypt overstorey exist in conjunction Within the area to be impacted all of the EPBC listed community (7.38 ha) occurs with both a native understorey and a eucalypt overstorey. Within the offset site, the majority of the EPBC listed community occurs in this state (164 ha). Some areas have been cleared of the eucalypt overstorey and only a native understorey remains (43 ha). The distribution of these two condition classes within the proposed offset site is mapped in Appendix D of the revised Offset Plan. • A Conservation Agreement is a formal agreement used to protect and conserve land in perpetuity. The Conservation Agreement is made between the landholder and the NSW Environment Minister (through OEH) under the National Parks and Wildlife Act 1974. The Conservation Agreement is listed on the certificate of title of the land and is legally binding, meaning that future owners must

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	ongoing management measures and who will be responsible for implementing them. • Further explanation on how ongoing cattle grazing would be consistent with the conservation management of the proposed offset site.	continue protecting and conserving the land in accordance with the terms set out in the Conservation Agreement. Penalties will be enforceable under the National Parks and Wildlife Act for breaches of the conservation agreements. • The establishment of Conservation Agreements will ensure the long-term and effective management and protection of the offset site. The Conservation Agreements will be registered on the land title. • The Conservation Agreement will be lodged with the Department of Lands and registered on the certificate of land title for the property. Thus sale of a property would not negate the compliance obligations of the agreement. • Breaches of the Conservation Agreements by landholders would be subject to penalties under the National Parks and Wildlife Act 1974 (see section 69G enforcement of agreements). • As stated in the Offset Plan (Section 4.2 and Table 4-1), State Water is the responsible party for the implementation and monitoring of all management measures at the western offset site. • Full details on the resources required to support ongoing management measures will be included in the Offset Site Management Plan, to be developed in consultation with OEH. • Strategic grazing is proposed for the North-West offset site (See Table 4-1 of the Offset Plan) and an appropriate grazing regime will be determined by an agronomist and detailed in the north-west offset site management plan.
Border Thick-tailed Gecko		
Based on the information provided, the magnitude of the impacts on the Border Thick-tailed Gecko (BTTG) are unknown and this must be addressed. In	In order to clarify the likely impacts of the proposed action on the BTTG, the department requires the following information:	The design of the project has changed so that there will no longer be any disturbance to the downstream face of the dam wall and therefore no disturbance or impact to habitat for the Border Thick-tailed Gecko on the downstream wall. The raising of the morning glory spillway access bridge and platform on the piers will no longer

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addition, the likely efficacy of the proposed mitigation measures is not clear.		proceed as part of the Project. Raising of the dam wall by placement of rock on the downstream face is no longer required. Instead, a vertical reinforced earth embankment for wall raising will be constructed on the crest of the dam wall. The Revised Addendum Report provides a detailed description of the revised construction methodology, mitigation and management measures to be put in place during construction, an updated impact assessment and Assessment of Significance against the EPBC Act Significance Assessment Guidelines (Section 2.3).
	• Records of BTTGs made by North West Ecological Services and referred to in the EIS and PIR must be provided, in accordance with supplementary DGR 4c. These records are necessary to better understand the local distribution of the species and to determine the importance of the occurrence of the species on the Chaffey Dam wall.	• All existing available data for the Border Thick-tailed Gecko, including records referred to in NWES (2009), have been previously provided in the Terrestrial and Aquatic Flora and Fauna Impact Assessment – Addendum Report (Section 2.3 and Appendix A.1 provides the database records) and are provided again in the Revised Addendum Report Section 2.3, Appendix A.1.
	• The nature of the materials which make up the "rockfill" proposed to be used in all parts of the dam wall construction; particularly whether clay or other sediment materials will be placed on the wall in addition to rocks.	• The dam wall raising will be achieved by construction of a 6.5 metre high reinforced earth wall on the crest of the dam wall. The reinforced earth wall will comprise of precast modular panels tied together by reinforcing steel strips and filled with graded fill comprising of processed gravel and sand.
	• The extent (dimensions) of the proposed excavation works on the crest of the existing dam wall.	• Excavation on the crest of the dam wall will be up to 1 metre deep and will require removal of the parapet wall (Section 1.4 of the Revised Addendum Report).
	• Confirmation of whether pre-clearance surveys for the BTTG on the dam wall would be undertaken on all parts of the wall being affected by the proposed works and whether all works/surveys would be undertaken during the times when the species is likely to be active and readily detectable.	• Pre-clearance surveys will be conducted over three nights immediately prior to construction. Due to the revised impact area, access to those parts of the wall will be possible. Pre-clearing surveys and disturbance to the gecko habitat on the crest of the dam wall to be impacted will not commence before September and must finish before April, as outside of this period the species will be inactive and undetectable (Todd Soderquist, *pers. comm.*). Please refer to the Revised Addendum Report

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	• An assessment of the proportion of the BTTG population expected to be detected and removed from the dam wall during pre-clearance surveys for this species, with reference to survey effort, impact area coverage and timing of surveys.	Section 2.3 for the revised impact assessment and mitigation and management measures. • There is no current abundance data for the dam wall, however the individuals on the dam wall are likely to be part of the larger population on Goat Mountain and would represent a small proportion of that population (NWES 2009). NWES (2009) states that "*The author has found it to be relatively common within the region, and has recorded it many times in shrubby rocky remnants around Woolomin, including Goat Mountain*"…."*The Border Thick-tailed Gecko is secure in the locality and likely to continue to recover as large areas of immature regrowth mature to provide additional areas of suitable habitat*" (NWES 2009, pp.24). Of the available natural habitat (100 ha, NWES 2009), 5.6 ha of artificial habitat is present on the dam wall. While results of surveys may indicate that the largest population of Border Thick-tailed Geckos occurs on the dam wall, this is skewed by probability of detection. The species is much easier to detect in this homogeneous and relatively simple environment on the dam wall, compared to its more complex natural environment (such as that found on Goat Mountain). Due to the steepness of the wall, access to all parts of the wall has not been possible. As such, there is no data available to indicate the abundance or density of the species within this artificial habitat. Furthermore, without abundance or density data, an assessment of the proportion of the Border Thick-tailed Gecko population expected to be detected and removed from the dam wall during pre-clearance surveys is not possible. However, due to the revised area of impact, pre-clearance surveys will be able to detect the species within the entire impact area with relative ease and relocate individuals to adjacent areas on the wall that will not be disturbed.
	• An assessment of the likelihood that BTTGs not detected during pre-clearance surveys could be smothered, crushed or trapped within the dam wall during construction, and how	• Considering that population data is unavailable for the Border Thick-tailed Geckos inhabiting the dam wall, it is not possible to assess the likelihood that individuals not detected during pre-clearance surveys could be smothered, crushed or trapped within

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	many individuals, or what proportion of the population, would likely to be affected. • Please specifically address all components of supplementary DGR 6d. • An assessment of significance of the impacts of the proposal on this species with reference to the EPBC Act *Significant impact guidelines 1.1.*	the dam wall during construction. Management measures have been proposed with assistance from OEH in order to mitigate impacts to the Border Thick-tailed Gecko individuals within the impact area on the dam wall. Furthermore, an ecologist will be on site during construction activities on the wall in order to relocate any fauna found. • An Assessment of Significance for the Border Thick-tailed Gecko has been provided in Appendix A of the revised Addendum Report.
Murray Cod		
The PIR acknowledges that the proposed action would impact on habitat for the Murray Cod downstream, upstream and within the Chaffey Dam impoundment. It concludes that the impacts would be minimal, however, no evidence or assessment of significance has been provided. Supplementary DGR 4c requires that a description, including maps, of known records and habitat for the Murray Cod be provided within the area likely to be affected by the proposed action. This has not been provided. It is not clear to what extent potential changes to key hydrological flows and water quality (particularly temperature) downstream of Chaffey Dam could impact on the Murray Cod and its	The department requires the following information to enable an adequate assessment of the impacts of the proposed action on the Murray Cod: • Details of Murray Cod populations downstream of the dam including a number of known records, location of habitat, importance of the population downstream of Chaffey Dam including the known important population in the Namoi River (e.g. National Recovery Plan for the Murray Cod). • Details of how changes to flow regimes, including flows known to be important to Murray Cod, and water quality (particularly oxygen and temperature) are likely to affect the habitat and population/s of the Murray Cod downstream of Chaffey Dam, including in the long term. • State whether cold water pollution impacts are expected downstream of Chaffey Dam as a result of water releases and quantify the likely extent and seasonality of any expected temperature changes and the distance that temperature depression is expected to extend downstream. • Confirmation that the dam operator has the capacity to match the temperature of water released from Chaffey Dam to the natural temperature regime, as is proposed to be included in an operating protocol for avoiding or minimising cold water	Please refer to the revised Addendum Report, Section 2.4 and Appendix A for a detailed impact assessment. Chaffey Dam uses a multi-level offtake which allows water to be released from various depths and allows the temperature of the released waters to be effectively managed when thermal stratification occurs in the summer period. This is one the most effective measures for managing cold water releases. The current operating protocol for the multi-level offtake has been prepared and is used in accordance with the Guidelines for managing cold water releases from high priority dams (NOW 2011) and effectively avoids or minimises potential cold water releases. The proposed augmentation of the dam would not increase the impact of potential cold water pollution as the multi-level offtake would be upgraded and raised to ensure water from various water depths can continue to be used to avoid or minimise impacts and the operating protocol would be reviewed and continue to be used in line with the requirements from the Guidelines for managing cold water releases from high priority dams (NOW 2011).

Concern/Issue	Comment	Response
habitat, including in the long term, as is required to be discussed by supplementary DGR 5a.	releases. • Specifically address supplementary DGR 6d in relation to the Murray Cod. • An assessment of significance of the impacts of the proposal on this species with reference to the EPBC Act *Significant impact guidelines 1.1.*	
Other comments	Please remove comment on page 108 of the PIR that "*The Offset Plan has been developed in consultation with….SEWPaC*". This is not an accurate reflection of the department's role in providing advice in relation to the EPBC Act Environmental Offsets Policy and has the potential to be misleading.	The PIR will not be re-submitted, however the original reference is from page 1 of the Offset Plan, which has been revised.
Department of Planning and Infrastructure, dated 19 April 2013		
Booroolong Frog Offset Site		
	Further discussion and clarification of the extent of the SSI site and proposed offset site that is suitable and/or optimal Booroolong Frog habitat, considering river features that may affect suitability such as shading, depth and substrate. Agencies have queried the 6.4% figure given on page 104 of the PIR based on its assumption that suitable and unsuitable habitat is found in equal ratios in both the SSI site and the offset site. I'm still trying to clarify with agencies whether there is an expectation that the 9km proposed offset site is re-surveyed (and will advise as soon as that is clarified), but the answer to that may depend on existing records or mapping that has been carried out. I note that the pie chart on p. 104 gives the proportion of frogs found in each river feature type. Was there any recording of the extent of each type during the population survey?	Please refer to Section 2.1.8 and Appendix C of the Revised Addendum Report.
	The application of the average river width of 14.5m across the SSI and offset sites has also been questioned, as it may understate the width of the river within the SSI site (where it may widen as it approaches the top of the dam) and overstate	Please refer to Section 2.1.8 of the revised Addendum Report. Due to concerns over the assumption of stream width, the river channel in both the impact site and offset site has been mapped and the corresponding areas calculated. It should be noted that the

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	the width upstream. Are there measurements that would allow the average width to be given in segments, perhaps using the 1.7km within the SSI site as the first segment, and then similarly sized segments upstream? This may provide a more accurate calculation of the affected area.	Peel River is a dynamic system, therefore areas of suitable Booroolong Frog habitat will change in response to rainfall or lack thereof. Therefore, the entire river channel has been taken into consideration as opposed to the stream width as depicted in the Google Earth imagery (dated 28/09/2010).
	Offsets (potentially based on revised numbers from the first two points) need to be calculated against both NSW and Commonwealth requirements, using their own calculators.	Both the BioBanking Credit Calculator and the EPBC Offsets Calculator have been updated. Details are provided in the revised Offset Plan, Appendix B.
The Department notes the comments of Namoi Catchment Management Authority in relation to the existing management agreements in place and the suitability of the proposed offset site.	Given that there are conservation agreements in place, the Department requires a demonstration of the additional conservation benefits that the proposed conservation agreements will deliver to the Management Agreements currently in place between Namoi CMA and landholders (i.e. it should discuss what is and isn't working within the current agreements and what the proposed agreements can deliver over and above the existing). The additional benefits must be demonstrated in terms of conservation outcomes and security of tenure.	Please refer to response to Namoi CMA comments on this issue. See Table 4-2 and 4-3 in the revised Offset Plan for a detailed assessment of the current MAs compared to the proposed management actions which have been costed into the funding proposal for State Water's offset.
North West Offset Site		
It is noted that while the proposed offset site meets the overall credit requirements under the NSW Biobanking Assessment Methodology, there is a deficit for the NSW EEC Yellow Box-Blakely's Red Gum Grassy Woodland and for the White Box Grassy Woodland.	Further justification is required on the proposed use of the Tier 3 – Mitigated Net Loss outcome proposed for the offset area in relation to these communities. Page 5 of the NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects gives three criteria under which a Tier 3 outcome may be acceptable. An assessment against these criteria is required.	The Project will not significantly impact upon White Box Grassy Woodland. The proposed offset includes a surplus of this community which also meets the definition of the state and federally listed EEC and CEEC. The offset plan contains a section which explicitly discusses how the interim policy applies to the Project (Section 2.4). This has been updated to include further information on how the proposal meets the criteria under a Tier 3 mitigated net loss outcome.
The Department notes that page 37 of the Offset Plan states that the offset provided under the NSW	Can calculations to demonstrate this please be provided?	These calculations were included in Section 3.1.2 of the original Offset Plan. They are provided again in Section 3.1.2 and Appendix B of the

Concern/Issue	Comment	Response
calculator is likely to also meet Commonwealth requirements for offsetting the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.		Revised Offset Plan.
Offset Agreement and Mechanism		
	Written confirmation (in a reliable form) from relevant landowners to enter into a conservation agreement. This confirmation should specify that the agreement will exist in perpetuity and should broadly outline required conservation measures.	State Water has written to NSW Office of Water and NSW Crown lands seeking approval to enter into conservation agreement and to register a covenant. We are yet to receive confirmation. This will be provided as soon as we get them.
	A draft copy of the specific conservation agreement, to allow the Department and relevant agencies to determine whether it provides for sufficient security that the agreements will deliver required outcomes in perpetuity.	The conditions of the conservation agreements will be developed and registered in the covenant on Offset land with consultation with OEH, SEWPaC and Namoi CMA.
Miscellaneous		
	Responses to agencies' queries about other species, such as the Border Thick-tailed Gecko and the Murray Cod should also be provided.	**ngh**environmental has responded to agency queries regarding the Border Thick-tailed Gecko and the Murray Cod. They have been provided in this table and the revised Addendum Report (Sections 2.3, 2.4 and Appendix A).

Concern/Issue	Comment	Response
NSW Office of Environment and Heritage 5th April 2013		
PIR		
Estimation of habitat for Booroolong Frog The extent of shading, depth and substrate that might render areas unsuitable for breeding at both the impact site and	*Recommendation:* That more detail regarding distribution of suitable habitat components for the Booroolong Frog be provided and the level	The extent of shading along the Peel River was not taken into account during the summer (January-February) 2013 surveys by Phil Spark (NWES), however

along the surveyed sections of Peel River and Wombramurra Creek has not been defined. The stated percentage impact of 6.4% assumes that the entire length of both the impact site and Peel River/Wombramurra Creek are occupied. It is also assumed that the ratio of suitable versus unsuitable habitat is of the same proportion. Therefore, confidence that the level of impact on the population of Booroolong Frogs being 6.4% is low.	of significance of impact be reassessed accordingly.	observations pertaining to depth and substrate were made at every location where a Booroolong Frog was located. This gives an indication of preferred habitat by the Booroolong Frog and is included in the Addendum Report (Appendix C). Detailed maps showing the distribution of the Booroolong Frog population on the Peel River, upstream of Chaffey Dam is provided in the revised Addendum Report Appendix C. It is clear from these maps that Booroolong Frogs are well distributed upstream of Chaffey Dam, as are the habitat features utilised by the species at each of those locations. This is further supported by the graph presented in Figure 2-4 which portrays the proportion of each habitat type within each of the maps (stream sections surveyed). From the maps provided in Appendix C of the revised Addendum Report it is evident that there is no gap in Booroolong Frog occupation along the Peel River greater than 200 m (with most gaps much less than this). Therefore, it seems reasonable to assume that the ratio of suitable versus unsuitable habitat is relatively even. As a mobile species, the Booroolong Frog is likely to range outside of the locations identified by Phil Spark in summer 2012/2013. As such, we have assumed that the entire length of river both within the new FSL and outside the new FSL provided a similar proportion of habitat for the Booroolong Frog. The stated percentage impact of 6.4% is a conservative estimate. The impact of 6.4% is calculated according to the area of stream over which Booroolong Frogs were recorded during the summer 2013 surveys. There is a high probability that Booroolong Frogs would also occupy the 15 km section not surveyed between Pearly Gates Bridge and Wombramurra Creek, and further upstream along the Peel River (Phil Spark, *pers. comm.*) (refer to Figure 2-3 of the Addendum Report). The presence of Booroolong Frogs at the upstream and

		downstream extent of the survey area, strongly suggests they would also be present in the un-surveyed section. This would mean a total occupied area of more than 40 km and an impact area therefore of less than 4%. However, with the aim of quantifying the impact of the Project on *known* Booroolong Frog habitat as opposed to potential habitat, a conservative calculation of 6.4% has been provided (not 4%).
Translocation of Border Thick-tailed Gecko It is noted that it is no longer proposed to relocate Border Thick-tailed Geckoes to remnant vegetation on Goat Mountain. However, it is intended to relocate geckoes to an area of artificial habitat adjacent to the dam, and from impacted areas of the dam wall to newly constructed areas. There are concerns regarding the effectiveness of translocation of individuals. The effectiveness of this proposal will need to be assessed.	*Recommendation:* • To determine the effectiveness of translocation, a mark – recapture program be implemented that includes investigation of an ethical marking technique (i.e. other than toe-clipping). • Creation of artificial habitat be done in such a way that it does not adversely affect existing habitat or other environmental features.	The design of the project has changed so that there will no longer be any disturbance to the downstream face of the dam wall and therefore no disturbance or impact to habitat for the Border Thick-tailed Gecko on the downstream wall. The revised Addendum Report provides a detailed description of the revised construction methodology, mitigation and management measures to be put in place during construction, an updated impact assessment and Assessment of Significance against the EPBC Act Significance Assessment Guidelines (Section 2.3 and Appendix A). No translocation is being conducted. OEH have confirmed that they do not consider a mark-recapture program is required as no translocation is taking place (David Coote and Todd Soderquist *pers. comm*. to Jacqui Coughlan and Freya Gordon 2/5/2013).
Offset Strategy		
North-West Offset Site While the proposed vegetation offset goes some way to meeting the Principles for the use of biodiversity offsets in NSW, there is a 4609 credit deficit for the combined Yellow Box – Blakely's Red Gum grassy woodland and White Box grassy woodland. Additionally, there is a credit deficit of 263 credits for River Oak riparian woodland. Therefore, despite an overall ecosystem credit surplus of 2184 credits (which is	*Recommendation:* That additional offset areas be sought targeting those Biometric vegetation types currently in credit deficit, and a revised offset plan be provided prior to project approval.	The project offsets have been determined using the guidance on offsets within the NSW OEH Interim Policy on assessing and offsetting biodiversity impacts of SSI. How the proposal meets the criteria for a 'Mitigated Net Loss' outcome according to this policy is discussed in detail within the Offset Plan (Section 2.4). A Mitigated Net Loss outcome does not require all of the credits required by the BioBanking Assessment Methodology

predominantly Rough-barked Apple – Silvertop Stringybark – Red Stringybark grassy open forest), the proposal does not yet meet Principle 10, Offsets must be targeted, which requires a like-for-like or better conservation outcome. There is no indication in the PIR or Offset Plan as to whether attempts have been made to find appropriate additional offset areas to make up the credits required.		(BBAM) to be met with a like for like offset in terms of the credits generated at the offset site. The proposed offset surpasses the minimum 2:1 ratio for area cleared to area offset (as stipulated in the interim SSI policy) on a like for like basis with regard to the Box-Gum Woodland EEC and other more common vegetation types (refer to revised Offset Plan) (Refer to section 2.4 of Offset Plan). When the variation criteria for a Mitigated Net Loss outcome are applied, the credit requirements are met according to the interim SSI Policy. Finding additional offset areas is cost prohibitive for the proposal. As the proposal meets the requirements of the Interim SSI offsets policy and addresses all of the Principles for the use of Biodiversity Offsets in NSW, additional offset areas are not considered to be required.
Booroolong Frog Offset Site The Offset Plan for impacts on the Booroolong Frog proposes an offset of 9km (covering a total area of 13.1ha) of Booroolong Frog habitat on the Peel River, to be protected in perpetuity via conservation agreements with a number of landholders. It does not appear that the offset proposal for the Booroolong has yet been assessed using the Biobanking Assessment Methodology (BBAM). The detail of this proposed offset is not yet clear, in particular, the mechanism by which the offset will be secured. The stretch indicated in figure 3-1 and Appendix C (map C.3) comprises a wide variety of tenure over which it is stated (for example on page 60) that conservation agreements will be implemented between State Water and the landholders. Exactly what such agreements would entail and how they would be implemented is not explained. In addition, the offset proposal appears to assume that the entire length of 9km (figure 3-1) is suitable habitat for the Booroolong Frog. It is possible that some sections are not	*Recommendation:* That the details of the Booroolong Frog offset be assessed using BBAM and details of the intended conservation agreement mechanism(s), quantification of vegetation types and distribution of suitable habitat components, be provided in a revised Offset Plan prior to project approval.	The proposed Booroolong Frog offset site has been assessed using BBAM and has been included in the revised Offset Plan (Section 2.1.4, 2.2.2, 2.2.3, and 2.3). A credit summary is provided in Table 2-12 of the revised Offset Plan. Details of the intended funding mechanism have also been provided in the revised Offset Plan (Section 4.3.2). More comprehensive maps of the Booroolong Frog 2013 summer survey data have been provided in the Revised Addendum Report (Appendix C). The figures show the relationship between habitat components present in the offset site relative to numbers and life stages of Booroolong Frogs recorded. A detailed assessment of suitable habitat components and the presence of those habitats along the entire length of the area surveyed (25 km) is provided in the Revised Addendum Report (Section 2.1.8 and Appendix C. River Oak woodland within the Booroolong Frog offset site has been included within the revised offset

suitable due to factors such as shading, depth and substrate. With regard to the River Oak riparian woodland credit shortfall mentioned above, the Offset Plan states (page 28), "An offset site upstream of the new FSL has been proposed for the Booroolong Frog and has been calculated according to EPBC Environmental Offsets Policy (EOP). It is considered likely that this offset will satisfy the ecosystem credit requirements for the River Oak riparian woodland as well as the species credit requirements for the Booroolong Frog." No quantification of River Oak riparian woodland or other vegetation types has been provided for the Booroolong Frog Offset Site.		calculations based on aerial image interpretation (revised Offset Plan Figure 2-6 and Section 2.3). It is not possible to determine what other vegetation types occur within this area without further survey.
Management Plans		
Section 6.2 of the PIR includes reference to a number of management plans relevant to biodiversity that will be developed and implemented for the project	OEH considers that a revised Offset Plan is required. OEH would like to have input to the management plans and Offset Plan. *Recommendation* That OEH be consulted during the preparation of management plans relevant to biodiversity and any revised offset plan.	A revised Offset Plan has been provided in consultation with OEH. OEH will be consulted during the preparation of management plans relevant to biodiversity.

Concern/Issue	Comment	Response
Namoi Catchment Management Authority comments dated 5th April 2013		
Biodiversity Offsets Approach		
Namoi CMA expressed concern about the inadequacy of the current NSW and Federal Government's approaches to biodiversity offsets in terms of insufficient gain, equivalence and time lags.	Adequacy of response provided in Response to Submission: Inadequate to prevent a net loss of native vegetation extent Namoi CMA feels that the statutory offset requirements are not sufficient to compensate for	The offset package has been designed to fulfil the requirements of both state and commonwealth offset policies. Given that the Project is a State Significant Infrastructure development (SSI), the NSW OEH interim policy was used for assessing and offsetting biodiversity impacts of the project. We acknowledge the Namoi CMAs philosophical disagreement with

Concern/Issue	Comment	Response
	biodiversity loss. The proposed offsets do not compensate for the loss of extent of native vegetation. The proposed offsets are merely trading the loss of extent of native vegetation for an improvement in condition within an existing patch of vegetation. In order to compensate for the loss of native vegetation extent the offset needs to rehabilitate an area of non-native vegetation at least equivalent in size to the area lost.	the offset policies, however in determining an appropriate level of offset we have been guided by the State and Commonwealth offset policies and their in-built calculators that provide a non-subjective methodology to arrive at a required amount of offset.
Biodiversity Offset Plan		
Adequacy of response provided in Response to Submission: • Inadequate • Namoi CMA acknowledges the consideration of its Biodiversity offsets policy and commends the substantial reduction in impact on native vegetation by redesign of road construction activities. However, the proposed offsets do not compensate for the loss of native vegetation extent.	Namoi CMA is consulted during the preparation of the Offset Strategy. Recommended inclusions: • Consideration of the Namoi CMA Biodiversity Offset Policy 2011; • Offsets achieve multiple identifiable benefits; • The whole 203 ha of native vegetation be adequately offset; • Biobanking Assessment methodology be used; • At least 203 ha be planted to native vegetation to offset net loss of native vegetation; • That a pro-rata area of native vegetation be planted to offset the loss of equivalence and functional time lags, Offset Monitoring Plan and the completion of a CPVP. Namoi CMA would like to have input into the Offset Monitoring Plan. Namoi CMA look forward to negotiating management conditions for the CPVP should the proponent choose a CPVP over a Biobanking or other agreement to secure in perpetuity management of the offset areas.	The degree to which the North-West offset site compensates for the loss of native vegetation extent has been discussed in Section 2.4 of the Offset Plan. An amount of 980 ha is being offset to compensate for the loss of 218 ha. The offset site will also be secured in perpetuity, thereby averting the potential future loss of the vegetation within the offset. The request to plant an additional 203 ha has not been incorporated as it would be prohibitively expensive, is not a requirement of the current OEH and SEWPaC policies. The development offset package is considered to improve or maintain biodiversity values. The Booroolong Frog Offset Site Management Plan includes vegetation management of the riparian zone conducted to enhance the condition and extent of native vegetation. Rehabilitation and revegetation will be undertaken within the riparian zone along the proposed offset site. The exact width of restoration activities will be determined following detailed threat mapping and with consideration of property boundaries, fencelines and grazing agreements in place. The Namoi CMA will be consulted during the preparation of the Offset Site Management Plan which will include details for monitoring.

Concern/Issue	Comment	Response
Biodiversity Offsets - Booroolong Frog		
Namoi CMA requested additional research and investigation is undertaken prior to project approval into possible mitigation measures for the protection and conservation of the Booroolong frog and its habitat. Adequacy of response provided in Response to Submission: • Inadequate	The majority of interventions outlined in the Offset Plan to protect and conserve the Booroolong Frog and its habitat are already in place in the Namoi CMA's 10 year management agreements (MAs) with landholders. These agreements are currently monitored. Whilst Namoi CMA supports the replacement of the MAs with conservation agreements (CAs), simply replacing the MAs with CAs will not create additional habitat that will be lost. • Namoi CMA recommends securing additional CAs with landholders further upstream. Further information is required on the following (Appendix I): • Details of how the listed actions will be implemented (i.e. predator control measures, revegetation implementation, prevention of impacts from introduced fish, weed eradication). • Monitoring protocols • Site inspection intervals • Reporting procedures and non-compliance strategies	The mitigation measures proposed have been developed with the assistance of David Hunter and David Coote of OEH. Threats to the Booroolong Frog are well documented, as are measures for the protection and conservation of the Booroolong Frog and its habitat (NSW OEH 2012). As such, the mitigation measures proposed are in line with already documented measures rather than undertaking further research. Whilst the majority of interventions currently in place will be continued under the proposed conservation agreements, the Offset Plan proposes substantial additional active on-ground management that will have direct conservation benefits to the frog and its habitat. Furthermore, the baseline threat mapping and habitat mapping proposed have not been undertaken previously and will ensure that any further management interventions will be monitored for success, and related to the health of the Booroolong Frog population. This will result in long term conservation benefits to the Upper Peel population of the Booroolong Frog and will have applications to the species throughout its range. It is to be expected that there is some overlap in the measures being proposed in the Offset Plan, and those being carried out under the NCMA MA's, because both focus on the current threats to the Booroolong frog. Substantial additional management, baseline surveys, monitoring and reporting are proposed under the revised Offset Plan and proposed conservation agreements. This will translate directly into conservation benefit that will build on the existing Management Agreements, namely: Longevity – current Management Agreements will end in 2018 and there is no certainty that the agreements will be extended. Security – Appropriate and agreed funding will be provided to

Concern/Issue	Comment	Response
		implement identified management measures within the Booroolong offset site, via the Booroolong Frog Recovery Program, for the life of the dam. Baseline surveys – so that management efforts are carried out in direct response to the current presence and level of threats to be managed. Namoi CMA have not undertaken threat mapping and agree that it would be the only meaningful way to determine what would need to be addressed in the proposed offset site. At a minimum this would entail mapping of weeds (species and extent), riparian vegetation condition, stock access and areas of fossicking impact. **Further detailed information on the conservation benefit and comparison to existing management are provided in the Revised Offset Plan.** In regard to the need for habitat creation, advice received early in the project (May 2012) from Anna Cronin and James Hutchison-Smith of the Riverine Management Branch of the Namoi CMA strongly discouraged the use of translocation and habitat creation as mitigation measures. Suitable sites were not considered to be available for translocation of the frog, and there would be the risk of spread of Chytrid. Similarly, habitat creation was not considered feasible due to the high degree of uncertainty of success and difficulty in creating complex microhabitat requirements of the frog. The proposed offset for the Booroolong Frog has therefore focused on improving the habitat available in the upstream area to support their habitat. The following mitigation measures will be incorporated into the project to limit impacts to the Booroolong Frog during construction: • Strict Hygiene protocols • Sediment controls during construction • Ecologist to identify sensitive areas to create awareness and reduce any potential for trampling of sensitive areas.

Concern/Issue	Comment	Response
		• Inductions of all contractors to include awareness and mitigation measures associated with protection of the frog and in accordance with the "Hygiene Protocols for the Control of Disease in Frogs". • Management plans that outline the management and monitoring timeframes and responsibilities and performance indicators will require approval from the regulator. How the listed actions will be implemented will be detailed in the Offset Site Management Plan. Detailed roles and responsibilities will be outlined in the OFSMP which will be developed in consultation with OEH, SEWPaC and Namoi CMA. The EPBC Offsets Policy defines "direct offsets" as "actions that provide a measurable conservation gain for an impacted matter". A conservation gain is the **benefit the offset delivers** to the protected matter and may be achieved by: · improving existing habitat for the protected matter, · reducing threats to the protected matter; and · averting the loss of a protected matter or its habitat that is under threat. The proposed Offset Plan will substantially improve security of the Upper Peel population of the Booroolong Frog on all three of these points. The baseline data collection and mapping, monitoring and reporting protocols built into the Offset Plan will ensure that the conservation gain for the population will be measurable.

References

NSW Office of Environment and Heritage (NSW OEH) (2012). National Recovery Plan for Booroolong Frog (*Litoria booroolongensis*) Office of Environment and Heritage (NSW), Hurstville.

NWES (2009). Flora and Fauna Impact Assessment for the proposed Chaffey Dam Safety Upgrade Options 1 & 2- Addendum report to the GHD Ecological Assessment Report.

APPENDIX C BOOROOLONG FROG DISTRIBUTION ON PEEL RIVER (2013 DATA)

APPENDIX D OFFSET PLAN

WorleyParsons

resources & energy

Offset Plan

CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

MAY 2013

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TABLES

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ACRONYMS AND ABBREVIATIONS

BBAM	BioBanking assessment methodology
BCC	BioBanking credit calculator
CA	Conservation Agreement
CEEC	Critically endangered ecological community
CPVP	Conservation property vegetation plan
Cwth	Commonwealth
DECCW	Refer to OEH
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community
EIS	Environmental impact statement
ha	hectares
km	kilometres
m	Metres
NES	Matters of National environmental significance under the EPBC Act (*c.f.*)
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PFC	Projected foliage cover
SEWPaC	(Cwth) Department of Sustainability, Environment, Water, Population and Communities
SSD	State significant development
SSI	State significant infrastructure
TEC	Threatened ecological community – as defined under relevant law applying to the proposal
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

1.1 BACKGROUND

The Chaffey Dam Augmentation and Safety Upgrade Project (the Project) proposes to increase the capacity of Chaffey Dam from 62GL to 100GL at Full Supply Level (FSL), which will increase the current FSL by 6.5 m, from 518.6 m Australian Height Datum (AHD) to 525.1 m AHD. Associated works will include the modification of selected roads and bridges, including Tamworth-Nundle Road, Western Foreshore Road, Rivers Road and Bowling Alley Point Bridge.

A flora and fauna assessment was conducted as part of the Environmental Impact Statement (EIS) for the Project, pursuant to Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Director-General's Environmental Assessment Requirements (DGRs) for the EIS were issued on 23 January 2012 by the Director-General of the Department of Planning and Infrastructure (DP&I). The DGRs were accompanied by comments from other relevant NSW Government Agencies, comprising the Department of Primary Industries (Office of Water, Agriculture, Mineral Resources, Forestry and Fisheries), Environment Protection Authority, Office of Environment and Heritage (Heritage Council of NSW), Namoi Catchment Management Authority (CMA) and Roads and Maritime Services.

On 29 August 2012, the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 28 September 2012, SEWPaC advised that the Commonwealth Environment Minister deemed the Project to be a Controlled Action pursuant to the EPBC Act.

On 19 October 2012, supplementary DGRs were issued by the DP&I on behalf of SEWPaC. Both the DGRs and supplementary DGRs contained specific requirements relating to environmental offsets under both State and Commonwealth legislation. The Commonwealth *EPBC Act Environmental Offsets Policy* applies to the Project because the Flora and Fauna Impact Assessment prepared for the Project determined that the Project will have a significant impact on an endangered species, the Booroolong Frog.

The Project comprises "*development for the purpose of water storage… carried out by or on behalf of a public authority that has a capital investment value of more than $30 million*" pursuant to Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011 and was declared by the Minister for Planning and Infrastructure to be a State Significant Infrastructure project. Accordingly, the *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (hereafter referred to as the OEH SSI Interim Offsets Policy) applies to the Project.

An EIS was prepared by WorleyParsons and placed on public exhibition from 11 December 2012 to 31 January 2013. Seven submissions from various State Government Agencies were received by the DP&I during the EIS public exhibition period. No submissions from the public were received. Relevant to biodiversity matters were submissions from OEH, Namoi CMA and DP&I. The submission from Namoi CMA requested the consideration of the *Namoi Catchment Management Authority Biodiversity Offsets Policy*. The DP&I also received comments from SEWPaC.

A Preferred Infrastructure Report and Offset Plan was prepared to address the comments raised in the seven submissions, including the requirement for environmental offsets) and were submitted to the DP&I on 15 March 2013.

This revised Offset Plan has been prepared to provide additional detail and address further comments from State and Commonwealth Agencies following their review of the Offset Plan submitted with the Preferred Infrastructure Report.

Throughout the preparation of this Offset Plan we have sought advice from OEH, SEWPaC, Namoi CMA and additional relevant experts.

The Offset Plan has been developed to satisfy NSW and Commonwealth government requirements with regard to offsetting, specifically:

- The DGRs and supplementary DGRs issued by DP&I
- OEH SSI Interim Offsets Policy
- OEH's Principles for the use of biodiversity offsets in NSW
- EPBC Act Environmental Offsets Policy

A hierarchy of principles in regard to Project impacts to biodiversity values within the study area have been followed:

- Avoid impact
- Minimise impact
- Mitigate impacts
- Offset residual impacts

Wherever possible, impacts to biodiversity values have been avoided and minimised. For example, the impact of road works areas has been refined and reduced from a worst case scenario of 168 ha in total to a realistic area of 38 ha in total as a result of the reduction in size of works areas. The dam wall construction methodology has also been altered to reduce impacts to Border Thick-tailed Gecko habitat by 48,000 m^2 to 4,600 m^2. Where impacts are unavoidable, mitigation and management measures have been incorporated into the Project to reduce impacts. In some instances there are residual impacts that cannot be adequately mitigated.

Residual impacts are proposed to be offset in accordance with the NSW OEH SSI Interim Offsets Policy. Where significant residual impacts to matters of national environmental significance remain, these are also proposed to be offset in accordance with the EPBC Act Environmental Offsets Policy.

Residual impacts to biodiversity values identified for the Project include:

- A loss of 160 ha of naturally occurring native vegetation including areas comprising 150 ha of a listed Endangered Ecological Community (EEC).
- A loss or modification of habitat for a variety of protected and threatened native fauna species. This includes 4.77 ha of habitat suitable for the endangered Booroolong Frog.

Significant residual impacts to matters of national environmental significance identified for the Project include:

- A loss of 4.77 ha of habitat suitable for the endangered Booroolong Frog.

1.2 PURPOSE AND SCOPE OF THIS OFFSET PLAN

As part of mitigating the biodiversity impacts of the augmentation and safety upgrade of Chaffey Dam (the Project), offset sites are required. This Offset Plan aims to address the requirements of both State and Commonwealth Governments' biodiversity offset policies

In NSW, offset sites are required to be comparable in terms of vegetation and habitat type and sufficient in area to allow the long-term improvements of the offset site to compensate for the loss of habitat at the development site. The BioBanking Assessment Methodology (BBAM) (DECC 2009) is used in this report to assess the biodiversity values that will be impacted upon as a result of the Project (at the 'development site') and to determine if the values contained at a designated site nearby (the 'offset site') are adequate as an offset. The results of the BBAM are interpreted with regard to the OEH SSI Interim Offsets Policy.

Under Commonwealth legislation, the EPBC Act Environmental Offsets Policy (2012) applies to all protected matters under the EPBC Act. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures, and can help to achieve long-term environmental outcomes for Matters of National Environmental Significance (MNES) protected under the EPBC Act. The Offsets Assessment Guide used in this report is a tool for assessing the suitability of offset proposals, and has been used in conjunction with the EPBC Act Environmental Offsets Policy.

Whilst the NSW and Commonwealth offset policies are focused on different levels of biodiversity protection, it is the aim of this plan to ensure that the processes are consistent and complementary to allow for both objectives to be met within one offset package.

1.3 DETAILED METHODOLOGY

1.3.1 Steps in the assessment

This Offset Plan aims to achieve the following objectives:

NSW	Commonwealth
Objectives	
1a) Determine the ecosystem and threatened species credits required at the *development site* using the BBAM (Section 2.1).	2a) Determine the area of habitat to be significantly impacted by the development specifically as it relates to MNES (Section 3.1).
1b) Determine the ecosystem and threatened species credits that would be generated at the *offset site* using the BBAM (Section 2.2).	2b) Determine if the proposed offset site meets the 90% direct offset requirement (Section 3.1 and Appendix A)
1c) Make an assessment as to whether the development site impacts can be adequately compensated for by the protection and management of the proposed *offset site* (compare 1a to 1b: Section 2.3).	2c) Make an assessment as to whether the development site impacts can be adequately compensated for by the protection and management of the direct offsets proposed and discuss other compensatory requirements (Section 3.2).
1d) Make recommendations for the security and management of the *offset site*, to ensure that its biodiversity values are protected and maintained in perpetuity (Section 4).	2d) Make recommendations for any additional security and management requirements to ensure that biodiversity values as they relate to MNES, are protected and maintained in perpetuity (Section 4).

Key outputs of the BioBanking credit calculator (BCC) and the EPBC Act Offsets Assessment Guide are provided in Appendix A and Appendix B of this Plan, respectively. With regard to the NSW assessment, vegetation type nomenclature referred to in this plan is as defined within the Biometric Vegetation Types Database and utilised within the BBAM.

1.3.2 Key resources

BioBanking Assessment Methodology (online calculator version 2)

The BBAM was used to undertake Steps 1a and 1b. The discussion in Section 2.3 is based on the outputs of the assessment and supplemented by additional information relevant to the sites, as detailed below.

The assessment calculations were undertaken using the NSW OEH BioBanking Calculator (online version 2), under the direction of an accredited BioBanking assessor (Brooke Marshall, ID35).

OEH SSI Interim Offsets Policy

The OEH SSI Interim Offsets Policy was applied to the calculation of offsets for native vegetation. This interim policy relates to proposals that are assessed by DP&I under the Part 3A, SSD or SSI provisions of the EP&A Act, and are not being considered as part of the Biobanking Scheme.

This interim policy:

- acknowledges that proposals assessed as State significant projects or Part 3A do not have to meet the "improve or maintain" standard, which is required under the Biobanking scheme;
- nevertheless, adopts the use of the Biobanking Assessment Methodology (BBAM) for the purpose of:
    - quantifying and categorising the biodiversity values and impacts of State significant projects or Part 3A proposals;
    - establishing, for benchmarking purposes, the offsets that would be required if the State significant project or Part 3A proposal had been expected to meet the improve or maintain standard;
- provides a structured approach to determining how proposals may, in lieu of meeting the improve or maintain standard, meet one of two alternative standards established under this policy.

The OEH SSI Interim Offsets Policy is explained further in Section 2.4 of this plan.

Environment Protection and Biodiversity Conservation Act 1999 Offsets Assessment Guide

The EPBC Act Offsets Assessment Guide is used to support application of the EPBC Act Environmental Offsets Policy (October 2012). The EPBC Act Offsets Assessment Guide utilises a balance sheet approach to estimate impacts and offsets for threatened species and ecological communities listed under the EPBC Act.

The assessment calculations were conducted by staff trained in the use of the EPBC Act Offsets Assessments Guide by SEWPaC.

Site assessments and investigations

This assessment utilises information gained from a number of assessments as well as additional surveys, undertaken by two botanists (Dave Maynard and Brenton von Takach Dukai), two ecologists (Dr Jacqui Coughlan and Freya Gordon), and frog experts Phil Spark and Dr Andrew Stauber to further delineate homogenous zones and threatened species habitats and derive plot data at the development and offset sites.

Previous assessments that are relevant to the study site include:

- Austeco (1990). Chaffey Dam Enlargement Proposal: Impact on Terrestrial Fauna. Report prepared for Department of Water Resources, August 1990
- GHD (2007). Chaffey Dam upgrade, further assessment of long-term options. Contract No 3571, State Water Corporation
- GHD (2008a). Chaffey Dam Upgrade Ecological Assessment
- GHD (2008b). Chaffey Dam Upgrade Preliminary environmental assessment (stage 1) summary report, State Water Corporation
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- NWES (2009a). Flora and Fauna Impact Assessment for the proposed Chaffey Dam Safety Upgrade Options 1 & 2 – Addendum report to the GHD Ecological Assessment Report
- NWES (2009b). Review of the conservation status of the Booroolong Frog (*Litoria booroolongensis)* within the Namoi River Catchment. Report prepared for the Namoi Catchment Management Authority.
- **ngh**environmental (2012). Terrestrial and aquatic flora and fauna impact assessment, Chaffey Dam Augmentation and Safety Upgrade. Report prepared for State Water.
- **ngh**environmental (2013). Addendum Report. Terrestrial and aquatic flora and fauna impact assessment, Chaffey Dam Augmentation and Safety Upgrade. Report prepared for State Water.

These assessments describe the existing environment at the study site and evaluate the presence of known and potential threatened species and communities. Survey effort has included targeted surveys for threatened species known to occur and with the potential to occur.

1.4 THE DEVELOPMENT SITE: OVERVIEW

Chaffey Dam is located on the Peel River approximately 30 km south-east of Tamworth. The Project comprises the augmentation and safety upgrade of the existing Chaffey Dam (Figure 1-1). The proposed works will result in an increase in the full supply level (FSL) of 6.5 m and an increase in the permanent storage capacity from 62 GL to 100 GL.

The Project is proposed to be carried out by State Water and includes the following components:

- Augmentation of the dam to 100 GL at FSL, through raising of the dam wall and modification of the existing spillways.
- Modification of selected roads and bridges, including Tamworth-Nundle Road, Western Foreshore Road, Rivers Road and Bowling Alley Point Bridge.
- Relocation of facilities within the Bowling Alley Point Recreation Area and the South Bowlo Fishing Club.

The Project will result in an increase to the FSL footprint of approximately 185 ha, in areas surrounding the existing reservoir and an additional footprint of up to 38 ha for the realignment of existing roads and bridges.

1.4.1 Impacts of the Project

The Project will impact on areas of habitat that comprise EEC and habitat for threatened species. Impacts on native vegetation will predominately result from inundation with additional areas being cleared for associated road works (refer Table 1-1).

Impacts to vegetation to be offset in accordance with OEH SSI Interim Offsets Policy (and consequently the BBAM) are highlighted in Table 1-1.

Table 1-1 Approximate impact areas of the Project by vegetation type

Regional Vegetation Community	Area to be inundated (ha)	Additional Road Area Impact (ha)
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion (TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC)	117	33
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3	1
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	6	0
Semi-permanent open freshwater wetlands of the inland slopes and plains	0.24	0
Planted non-indigenous native vegetation	9	2
Exotic non-native vegetation	45	2
TOTAL	**180.25**	**38**

Impacts on threatened species and communities

The Project will result in the effective removal (through inundation or clearing) of approximately 150 ha of Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, which is listed as an EEC (White Box-Yellow Box-Blakely's Red Gum Woodland) under the NSW TSC Act.

Approximately 7 ha of this community also meet the criteria for the Commonwealth (EPBC Act) listed White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grasslands Critically Endangered Ecological Community (CEEC). The Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) concluded that no significant impact to this CEEC will result from the Project. Accordingly, no offset for the Yellow Box - Blakely's Red Gum grassy woodland is required under the EPBC Act Environmental Offsets Policy.

The Project will result in the inundation of an area supporting a population of the endangered Booroolong Frog (*Litoria booroolongensis*) (TSC and EPBC Acts) along the Peel River, directly upstream of Chaffey Dam. Approximately 1.6 km of habitat for this species would be effectively removed as a result of the Project. This would result in a significant impact to this species.

Requirement to offset

All residual impacts are required to be offset in accordance with the NSW OEH SSI Interim offsets Policy. Where significant residual impacts to matters of national environmental significance remain (such as the identified impacts of the Project on the Booroolong Frog), these are also required to be offset in accordance with the EPBC Act Environmental Offsets Policy.

1.5 THE PROPOSED OFFSET SITE: OVERVIEW

State Water has nominated an area of land, approximately 980 ha in size, on the northern and western foreshore of the dam for consideration as an offset site (the North-West Offset Site). The land identified for the offset site is registered in the name of the Water Administration and Ministerial Corporation (WAMC). This land is vested in State Water and available for State Water to enter into covenants or agreements (Figure 1-1). Part of the land, comprising the area west of the Western Foreshore Road is currently leased to local farmers for grazing on a permissive occupancy basis. They have been informed that this lease will be terminated on 31 December 2013 and from that time onwards the land will be available for dedication as an offset site. To the east of the Western Foreshore Road, the offset area is not being used for any activities excluding the far eastern section where it surrounds the existing dam. Within this area, there appears to be some grazing by cattle on the floodplain associated with the Peel River. The Peel River is also accessed by the general public for recreational purposes.

The proposed North-West offset site contains vegetation similar to that within the development footprint. Yellow Box – Blakely's Red Gum grassy woodland occupies the lower slopes and Rough-barked Apple – Silvertop Stringybark forest on the steeper upper slopes and River Oak riparian woodland along the Peel River. However, it also includes another community, White Box grassy woodland, which occurs as an intermediate between the Yellow Box and Silvertop Stringybark communities.

The Yellow Box – Blakely's Red Gum grassy woodland and White Box grassy woodland (collectively "Box-gum woodland") are considered to comprise the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC. Components of these communities also comprise the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC).

The offset site supports known habitat for threatened fauna species including the Regent Honeyeater, Border Thick-tailed Gecko and Speckled Warbler (Atlas of NSW Wildlife accessed 24/08/2012; NWES 2009a). The offset site provides suitable habitat for a range of other threatened fauna species including the Spotted-tailed Quoll, Little Lorikeet, and woodland birds including the Brown Treecreeper.

An additional offset site is proposed for the Booroolong Frog upstream of the impact area along the Peel River for a length of 9 km (the Booroolong Frog Offset Site). This area is known habitat for the Booroolong Frog (Figure 3-1).

The proposed Booroolong Frog Offset Site is currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA. Lands currently subject to this MA are displayed in Appendix C. These MAs are due to expire in five years (2018). The current MAs can be terminated with one month notice and are not attached in any way to the title of the land. The current MAs have a range of conditions agreed to by four Funding Recipients (see Appendix C). However, the effectiveness of actions carried out under these conditions is unclear, as no formal management plans exist and no monitoring data is available. Despite these MAs, residual threats to the Booroolong Frog such as stock access and weeds, are still ongoing (Phil Spark, *pers. comm.*) and Anna Cronin of Namoi CMA has stated that while there has been some success the management actions need to be ongoing and controls need

to be tighter. The current MAs focus on restrictions in land use, but do not include actions to actively manage and improve habitat along the Peel River. Under the present management the future quality of the offset site is uncertain. Furthermore, the proposed offset plan will incorporate additional management measures to value-add to those conditions already in place. Management actions for the offset site will greatly improve on restoration and revegetation of the riparian zone. The effectiveness of management actions will be assessed during annual monitoring. Compliance with those management measures will also be assessed. Management Plans will be adaptive to allow for amendments in response to monitoring results.

The location of the 'development site' and proposed 'offset sites' are shown in Figure 1-1.

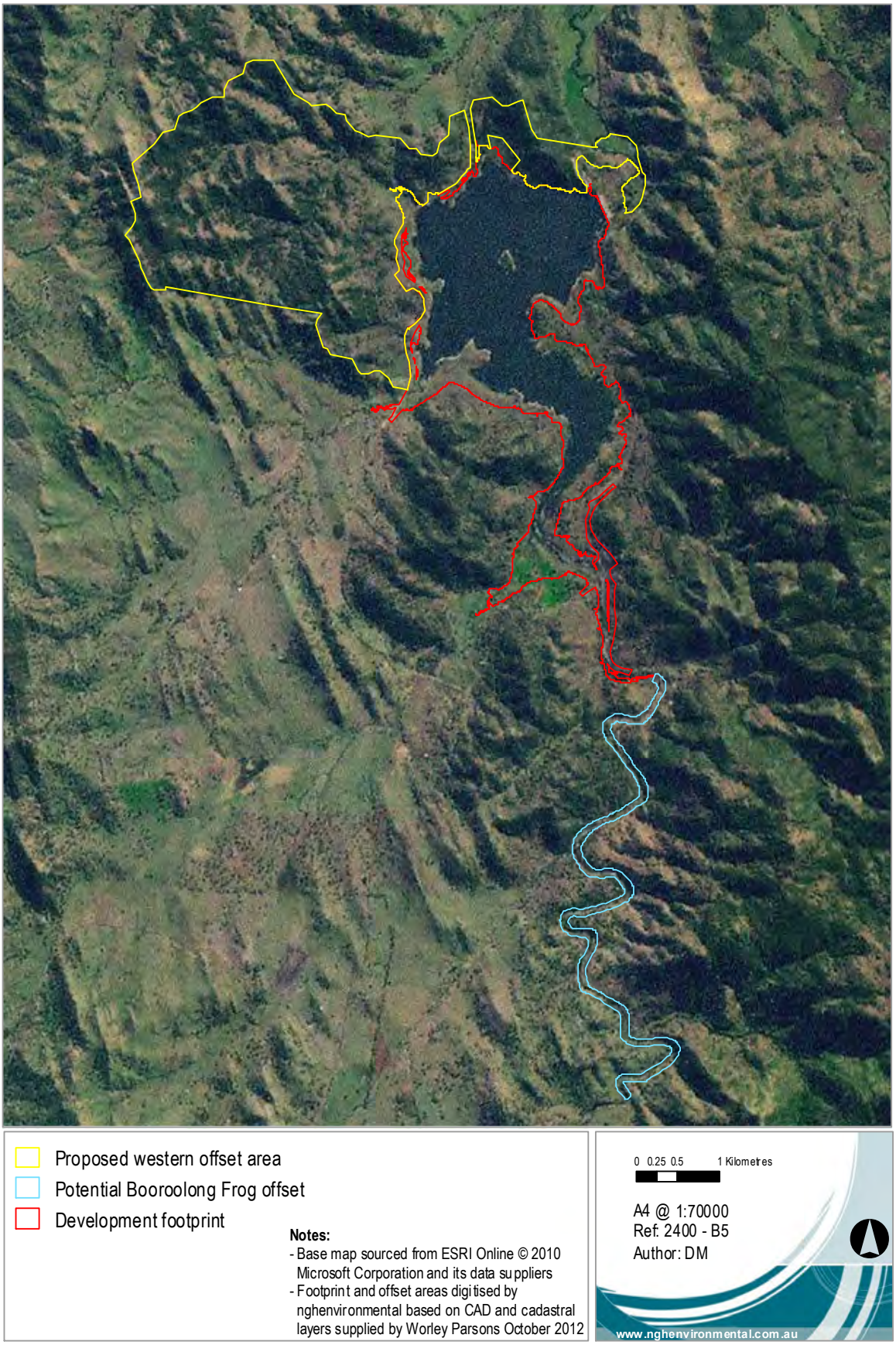


Figure 1-1 Development site and proposed North-West and Booroolong Frog offset sites for the Project

2 NSW OFFSET REQUIREMENTS

The OEH endorsed BBAM has been utilised to assess the suitability of the proposed offset site to adequately offset the impacts associated with the development with regard to the requirements of the State. The OEH SSI Interim Offsets Policy adopts the use of the BBAM for the purposes of:

- quantifying and categorising the biodiversity values and impacts of State significant projects
- establishing, for benchmarking purposes, the offsets that would be required if the State significant project had been expected to meet the improve or maintain standard.

The OEH SSI Interim Offsets Policy acknowledges that proposals assessed as State significant projects do not have to meet the "improve or maintain" standard which is required under the BioBanking scheme. The BBAM instead provides a structured approach to determining how proposals may meet one of two alternative standards established under the policy (refer to Section 2.4).

The key steps that are involved in the methodology are outlined below along with explanations for key decisions and any variations from the methodology. The BBAM assesses the development and proposed offset sites individually to determine the number of credits that are required of generated respectively. As such, each assessment is outlined individually.

2.1 DEVELOPMENT SITE CREDITS

Within the BCC, this assessment is proposal ID 0035/2013/0467D V1.

2.1.1 Delineation of the development site

For the purposes of this assessment, the development site was defined as all areas that would be permanently impacted by the proposal. This included the entire area within the new FSL and all areas within the proposed road works footprint.

2.1.2 Landscape assessment

The development site occurs within the Namoi Catchment Management Area, Peel subregion. The majority of the site falls within the Tamworth - Keepit Slopes and Plains Mitchell Landscape along the northern, western and southern foreshores of the dam. Some areas in close proximity to the dam occur within the Peel Channels and Floodplain Mitchell Landscape while on the eastern side of the dam and upstream areas of the development site, some areas extend into the Nundle Hills Mitchell Landscape. For the purposes of the BioBanking Calculator, the Tamworth - Keepit Slopes and Plains Mitchell Landscape has been used as it is the dominant landscape across the development site.

Two '1000 ha assessment circles' were required to cover the development site (outer yellow lines, Figure 2-1)[1]. Adjacent remnant vegetation has been disturbed by clearing and agricultural practices in the past and the properties continue to be grazed by cattle. The vegetation communities are comprised of forest,

[1] A small proportion of the development site occurs outside of the assessment circles. This area is predominantly cleared of overstorey and therefore would not influence the landscape assessment. This approach was discussed with the OEH BioBanking team (Andrew Remnant *pers. comm.* 04.02.3013) and considered appropriate.

woodland and derived grasslands with a predominantly native species composition although some areas that have been subject to pasture improvement now contain predominately exotic vegetation.

Within the northern assessment circle, the percentage overstorey cover is scored as 21-30% before and after development within the 1000 ha circle and 31-40% prior to development and 21-30% after development within the 100 ha circle. Within the southern assessment circle, the percentage overstorey cover is scored as 51-60% before and after development within the 1000 ha circle and 41-50% before and after development within the 100ha circle. The 100 ha circles has been placed to capture the greatest impact from the development as required by the BBAM.

The 'most limiting link' was identified in the south-west of the development site and has a width of approximately 160 m. The average condition of the link is moderate to good, determined on the basis of overstorey cover and projected foliage cover (PFC) has been rated at >25% of the lower benchmark. The groundcover in this area is predominately exotic.

The development would have a major impact on this link as it would be inundated within the new FSL. No native or midstorey/ground cover was recorded within the after development fields.

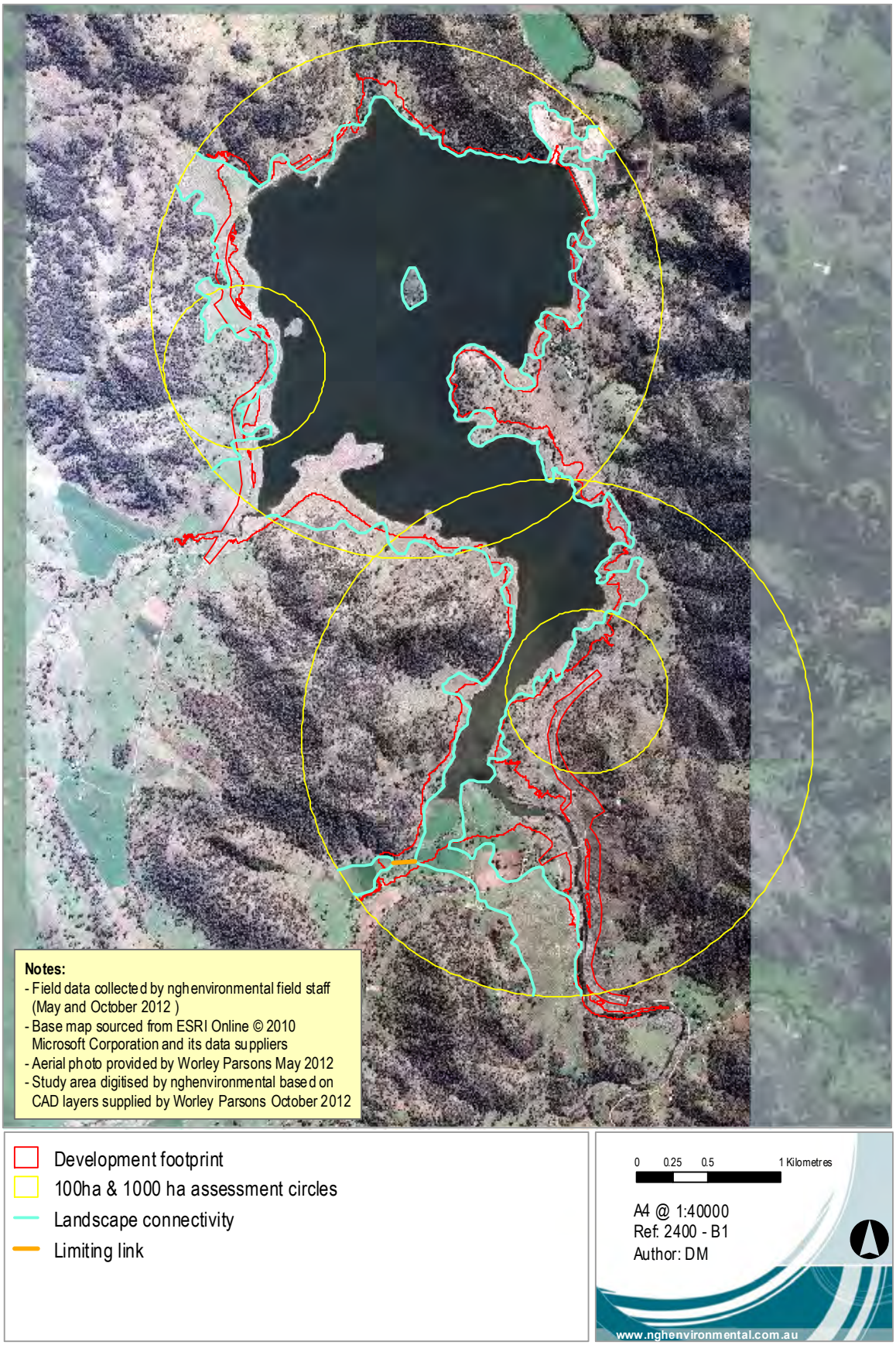


Figure 2-1 Landscape assessment for the development site

2.1.3 Mapping zones

'Homogenous vegetation zones' were mapped during the Terrestrial and Aquatic Flora and Fauna Impact Assessment (FFA) (**ngh**environmental 2012) for the Project and have been refined during subsequent surveys. It should be noted that although separate vegetation types were defined in the FFA for Box-Gum grassy woodland and derived grassland, that within the BBAM, derived grasslands are included within the vegetation types they are derived from. Hence, the Box-Gum grassy woodland and derived grasslands have been mapped as a single zone.

Three homogenous zones were mapped on the basis of vegetation type and condition corresponding to the permanent development footprint. Dominant vegetation types were determined with reference to previous detailed assessments at the site (**ngh**environmental 2012) and the OEH Biometric Vegetation Types Database. It should be noted that there are only two Biometric condition categories for native vegetation: 'low' and 'moderate to good'. The 'moderate to good' category includes the relatively degraded pasture derived from woodland communities as it is still predominately native, albeit low diversity. Although all zones are considered moderate to good, the plot data are intended to provide the more precise measurement of vegetation quality in the Biometric assessment.

The zones are defined in Table 2-1 and mapped on Figure 2-2[2]. Remnant areas were assessed to be over 500 ha for all zones as all surrounding vegetation is considered to be native vegetation. Plot data was collected based on the entire area of each homogenous zone and the number of plots conducted was sufficient to meet the minimum requirements for these areas. However, once the site was divided into two assessment circles, then the number of plots required becomes specific to each homogenous zone within each circle and the number required increased. The condition of the vegetation at the site is relatively consistent, that the BBAM is being used only to indicate the suitability of the proposed offset and that the number of plots undertaken was sufficient to satisfy the requirements of the methodology. It was decided in consultation with OEH (David Coote *pers. comm.* 06.02.13) that it was acceptable to duplicate some of the plot data within each assessment circle to meet the required number of plots. Plots that have been duplicated are denoted in Table 2-1 by an asterisk (*). Plots duplicated are those that were located closest to the relevant assessment circle.

Geographic/habitat features were selected with respect to threatened species as outlined in

[2] No individual map unit was less than 0.25ha. Vegetation that did not qualify as native vegetation was not mapped. This included areas with no native overstorey, no native mid storey and where less than 50% of the ground cover is indigenous species or greater than 90% of the ground cover was cleared.

Table 2-2. Suitable habitat was identified at the development site for eight species.

'After development' management scores were decreased to zero, assuming that all habitat within the development footprint would be effectively removed by the Project.

Table 2-1. Development site: homogenous zones

Assessment circle	ZONE ID	Vegetation type code	Vegetation name	Condition	Area effectively removed (ha)	Plot IDs
North	1	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	89.58	D4, D5, D6, D7*, D8*, D9*
North	2	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	3.11	D1, D2, D3*, D16
South	4	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	62.77	D7*, D8*, D9*, D14, D15
South	5	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	0.54	D3*
South	6	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	5.71	D11, D12, D13

* Duplicated plot data

Table 2-2 Threatened species considered to occur at the development site according to relevant habitat features

Common name	Scientific name	Feature
Austral Toadflax	*Thesium australe*	Coastal headlands, grassland, grassy open forest or woodland on fertile or moderately fertile soils
Grey-headed Flying-fox (Breeding)	*Pteropus poliocephalus*	Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	Land within 100 m of rocky areas
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Shallow or infertile soils
Black-breasted Buzzard	*Hamirostra melanosternon*	Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts
Dungowan Starbush	*Asterolasia* sp. 'Dungowan Creek'	Land within Dungowan Dam area near Tamworth in Peel CMA subregion
Pale-headed Snake	*Hoplocephalus bitorquatus*	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
Booroolong Frog	*Litoria booroolongensis*	Land within 100 m of stream or creek banks

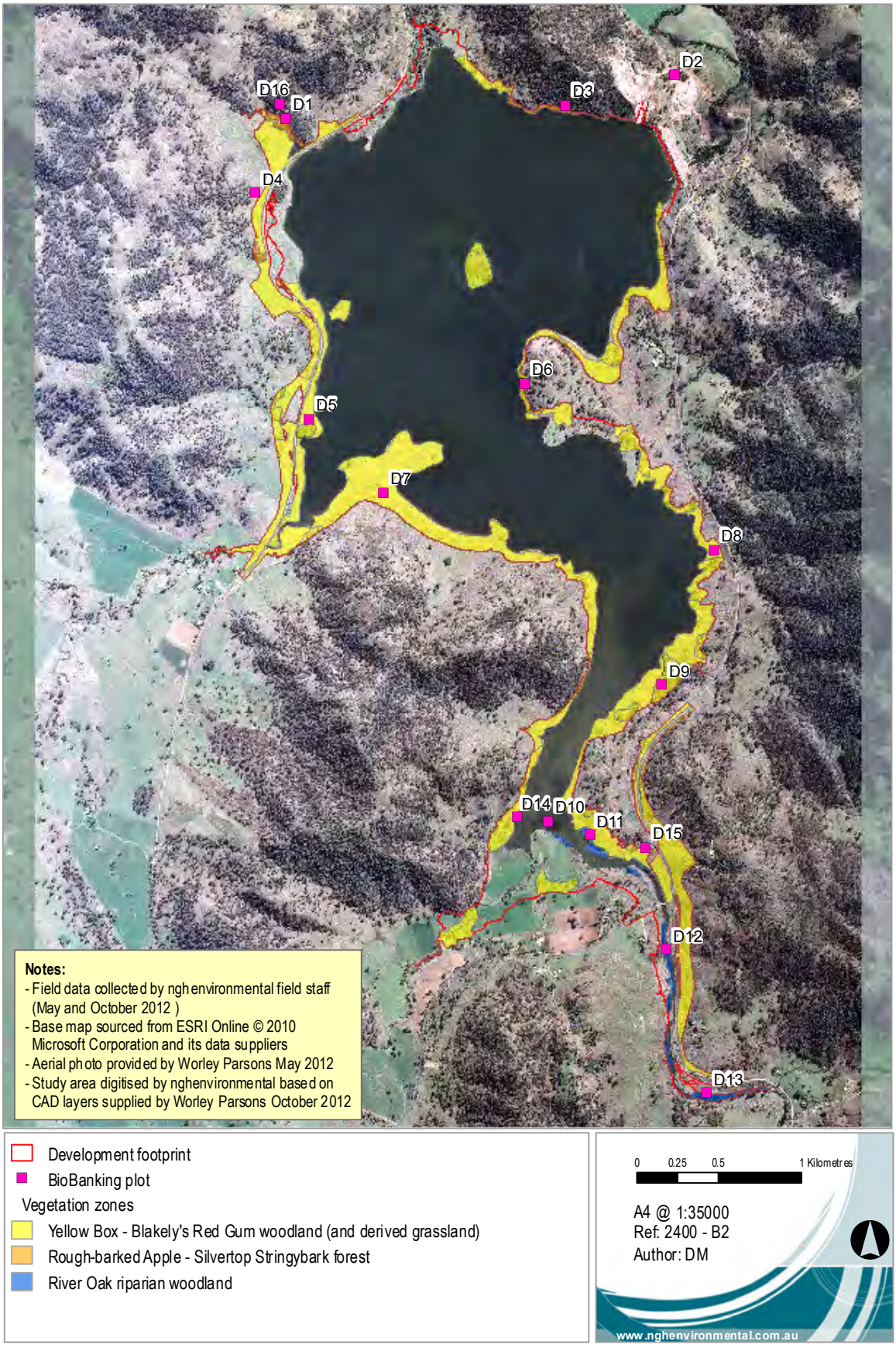


Figure 2-2 Development site homogenous zones and plot locations

2.1.4 Credit calculator results

Species predicted to occur

The species listed in Table 2-3 are predicted by the BCC to occur at the development site and contribute to the ecosystem credits required to be offset. The Tg values are accessed by the BBAM from the Threatened Species Profile Database (TSPD). They are a measure of the species ability to respond to improvement in site value or habitat value at a BioBank (offset) site. They are also used in the calculations performed for the development site to determine ecosystem credits required.

Table 2-3 Species predicted by the BCC to occur at the development site

Scientific name	Common name	Tg value
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	0.5
Dasyurus maculatus	Spotted-tailed Quoll	0.35
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Glossopsitta pusilla	Little Lorikeet	0.58
Grantiella picta	Painted Honeyeater	0.75
Lathamus discolor	Swift Parrot	0.75
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	0.75
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Neophema pulchella	Turquoise Parrot	0.55
Ninox connivens	Barking Owl	0.33
Ninox strenua	Powerful Owl	0.33
Nyctophilus timoriensis	Greater Long-eared Bat (south eastern form)	0.48
Petaurus australis	Yellow-bellied Glider	0.43
Petaurus norfolcensis	Squirrel Glider	0.45
Petroica boodang	Scarlet Robin	0.6
Petroica phoenicea	Flame Robin	0.6
Phascolarctos cinereus	Koala	0.83
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	0.75
Pteropus poliocephalus	Grey-headed Flying-fox	0.93
Pyrrholaemus saggitatus	Speckled Warbler	0.4
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45
Stagonopleura guttata	Diamond Firetail	0.75
Tyto novaehollandiae	Masked Owl	0.33
Xanthomyza phrygia	Regent Honeyeater	0.75

Species requiring survey

A total of 15 species were returned by the calculator requiring survey (Table 2-4). An extensive series of surveys were undertaken as part of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) which allowed for the confident conclusion that ten of these species were unlikely to occur at the development site and would not be impacted by the development. No impact was assumed for an additional three species based on the lack of habitat availability within the development site and proximity of nearest records. One species, the Border Thick-tailed Gecko, is known to occur at the site but will not be impacted by the Project. One species requiring survey, the Booroolong Frog, was recorded during surveys at the site and has the potential to be impacted by the development. The impact to this species generates species credits that require offsetting.

Table 2-4 Species requiring survey at the development site and potential to be impacted

Scientific name	Common name	Impacted?	ID method	Loss	Units of loss	Tg value
Thesium australe	Austral Toadflax	No	Survey	0.00	indiv	0.58
Hieraaetus morphnoides	Little Eagle	No	Survey	0.00	ha	0.74
Circus assimilis	Spotted Harrier	No	Survey	0.00	ha	0.74
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	No	Survey	0.00	ha	0.93
Dichanthium setosum	Bluegrass	No	Survey	0.00	indiv	0.13
Digitaria porrecta	Finger Panic Grass	No	Assumed	0.00	indiv	0.75
Phascogale tapoatafa	Brush-tailed Phascogale	No	Assumed	0.00	ha	0.5
Lophoictinia isura	Square-tailed Kite	No	Survey	0.00	ha	0.74
Callocephalon fimbriatum	Gang-gang Cockatoo	No	Assumed	0.00	ha	0.5
Uvidicolus (Underwoodisaurus) sphyrurus	Border Thick-tailed Gecko	No	Survey	0.00	ha	0.75
Eucalyptus nicholii	Narrow-leaved Black Peppermint	No	Survey	0.00	indiv	0.7
Hamirostra melanosternon	Black-breasted Buzzard	No	Survey	0.00	ha	0.74
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	No	Survey	0.00	indiv	0.13
Hoplocephalus bitorquatus	Pale-headed Snake	No	Assumed	0.00	ha	0.3
Litoria booroolongensis	Booroolong Frog	Yes	Survey	4.77	ha	0.4

Red flags: Director-General approval required

When using the BioBanking assessment pathway, red flags generated by the assessment indicate that the Project will not be permitted without the approval of the Director General (Department of Premier and Cabinet).

Relevant to the development site, these include:

- Yellow Box – Blakely's Red Gum grassy woodland (vegetation type being >70% cleared or it contains an EEC)

Under the BioBanking assessment pathway, clearing these vegetation types would not be permitted without the approval of the Director General. In this instance however, the Project is being assessed according to the SSI Interim Offsets Policy and the BioBanking assessment methodology is solely being used to assess the suitability of the proposed offset. As such, approval of the Director General is not required.

A high number of credits can be expected to be generated for this entity.

Credit summary

The BioBanking credit statement produced the following ecosystem and species credits required to offset the loss of habitats as a result of the development proposed (summarised in Table 2-5, provided in full in Appendix A).

Table 2-5. Development site permanent habitat loss: credit summary

Biometric vegetation type	Area impacted (ha)	Credits required
Ecosystem credits		
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	152.35	8128
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.65	254
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	323
Species credits		
Booroolong Frog	4.77	119

2.2 OFFSET SITE CREDITS

Within the BCC, this assessment is proposal ID 0035/2013/0507B V1.

2.2.1 Delineation of the offset site

Several allotments constitute the North- West Offset Site as listed in Table 2-6. The allotments are contiguous, though exclude the existing Western Foreshore Road and associated road reserve. The offset site is contiguous with the development site.

The delineation of a potential offset site for the Booroolong Frog has been based on the likely area required to generate the threatened species credits needed for this species and constitutes approximately 9 km of the Peel River channel and adjacent foreshore (30 m buffer) immediately upstream of the new FSL. The area included in this assessment is considered to be representative of the habitats that are available to this species within the 25 km stretch of the river that it is known to inhabit. Any deviations to the exact area identified in this assessment would maintain the same amount (or greater) of total habitat.

Table 2-6 Allotments constituting the North-West Offset Site

Lot	DP	Lot	DP
1	589247	7012	1026362
1	589245	2	615111
5	1139917	1	1174369
2	589247		
6	1139917	2	631895
3	615111	7	1139917

2.2.2 Landscape assessment

North- West Offset Site

The proposed North-West Offset Site occurs within the Peel subregion of the Namoi Catchment Management Area. The majority of the site falls within the Tamworth - Keepit Slopes and Plains Mitchell Landscape with some areas in close proximity to the dam within the Peel Channels and Floodplain Mitchell Landscape. On the eastern side of the dam, the offset area just extends into the Nundle Hills Mitchell Landscape. For the purposes of the BioBanking Calculator, the Tamworth - Keepit Slopes and Plains Mitchell Landscape has been used as this is the dominant landscape within the offset site.

Two '1000 ha assessment circles' were required to cover the offset site (outer yellow lines, Figure 2-3). Similarly to the development site, adjacent remnant vegetation has been disturbed by clearing and agricultural practices in the past and the properties continue to be grazed by cattle. The vegetation communities are comprised of forest, woodland and derived grasslands with a predominantly native species composition although some areas that have been subject to pasture improvement now contain predominately exotic vegetation.

Within the eastern assessment circle, the percentage overstorey cover is scored as 21-30% before the offset and estimated to increase to 31-40% after the offset within the 1000 ha circle. Within the 100 ha assessment circle native vegetation cover is scored as 41-50% prior to the offset and estimated to increase to 51-60% after the offset. Within the western assessment circle, the percentage overstorey cover is scored as 51-60% before and 61-70% after the offset within the 1000 ha circle and 71-80% before and 81-90% after the offset within the 100 ha circle. The 100 ha circles has been placed to capture a representative sample within each 1000 ha assessment circle.

The 'most limiting link' was identified in the central area of the offset site providing connectivity from the east to the west with a width of approximately 100 m. The average condition of the link is moderate to good, determined on the basis of overstorey cover and PFC has been rated at >25% of the lower benchmark. The groundcover in this area is predominately native and has also been rated at >25% of the lower benchmark.

The offset would be likely to have a positive impact on this link (evidence of good regrowth potential was noted onsite, connecting it with adjacent vegetation to the south. This would increase the width to over 500 m and this was recorded in the 'after BioBank' field.

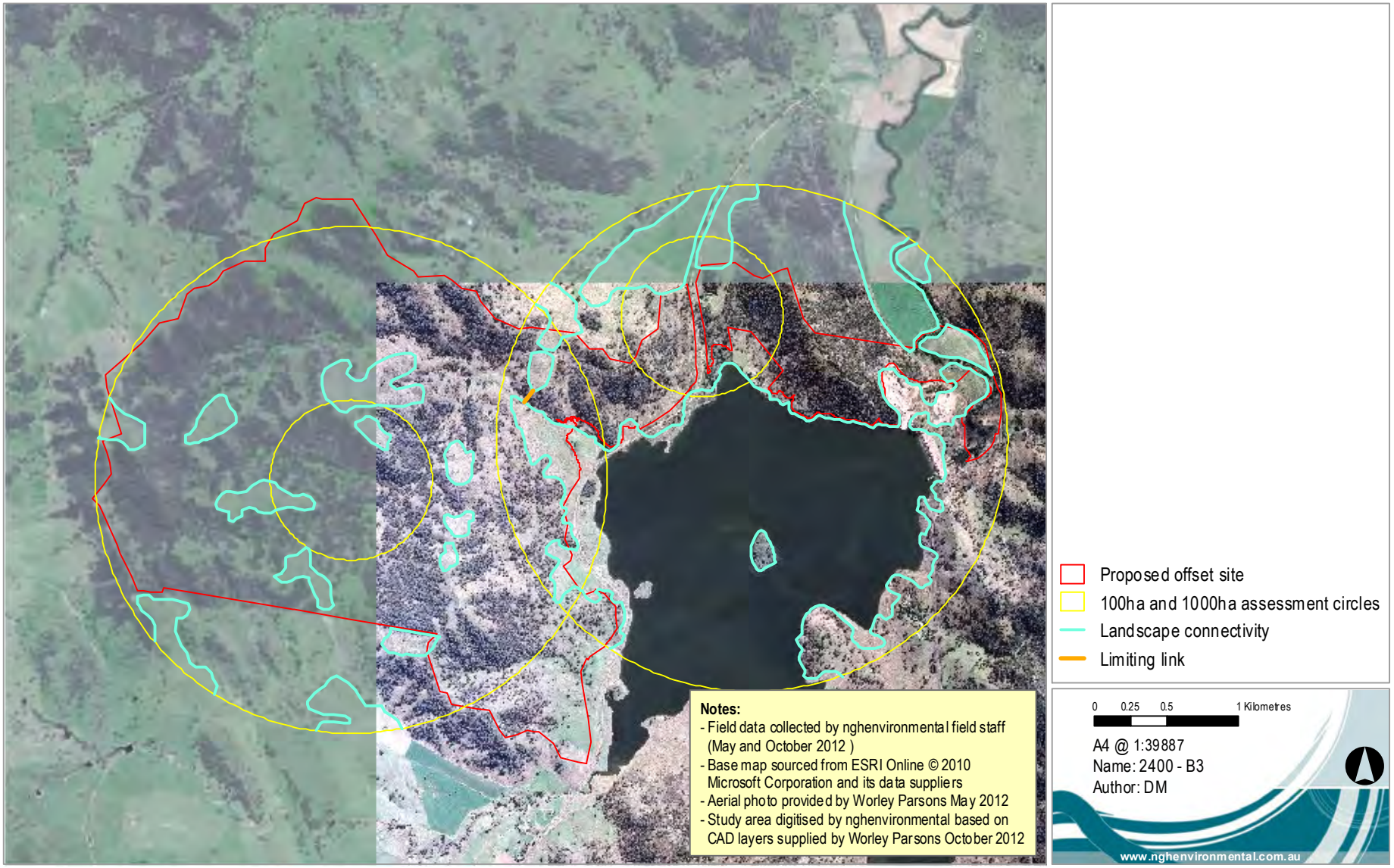


Figure 2-3 Landscape assessment for the Proposed North-West Offset Site

Booroolong Frog Offset Site

The proposed Booroolong Frog Offset Site occurs within the Peel subregion of the Namoi Catchment Management Area. The entirety of the site falls within the Peel Channels and Floodplain Mitchell Landscape.

Two '1000 ha assessment circles' were required to cover the offset site (outer yellow lines, Figure 2-4). Similarly to the development and western offset site, adjacent remnant vegetation has been disturbed by clearing and agricultural practices in the past and the properties continue to be grazed by cattle.

Within the northern assessment circle, the percentage overstorey cover is scored as 51-60% before the offset and estimated to remain the same at 51-60% after the offset within the 1000 ha circle. Within the 100 ha assessment circle native vegetation cover is scored as 51-60% prior to the offset and estimated to remain at 51-60% after the offset. Within the southern assessment circle, the percentage overstorey cover is scored as 21-30% before and after the offset within the 1000 ha circle and 11-20% before and after the offset within the 100 ha circle. The 100 ha circles has been placed to capture a representative sample within each 1000 ha assessment circle.

The 'most limiting link' was identified to the north-west of the offset site providing connectivity from the east to the west with a width of greater than 500 m, however in general, most of the vegetation within the 1000 ha assessment circles is considered to be relatively well connected. The average condition of the link is moderate to good, determined on the basis of overstorey cover and PFC has been rated at >25% of the lower benchmark. Although not directly surveyed, the groundcover in this area is considered likely to be predominately native (based on other vegetation surveyed with a similar landscape position and overstorey cover) and has also been rated at >25% of the lower benchmark. The offset would have no impact on this link.

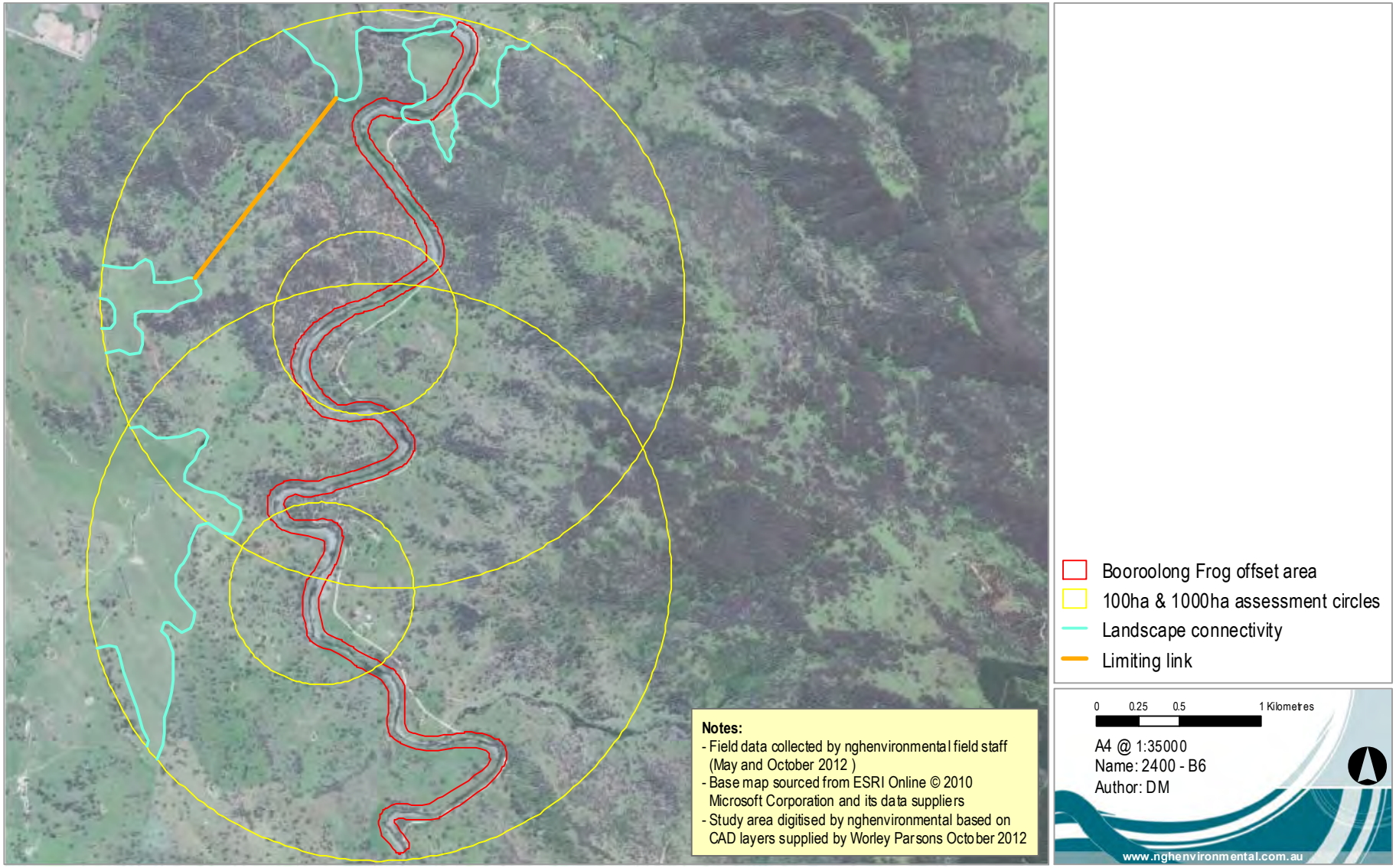


Figure 2-4 Landscape assessment for the proposed Booroolong Frog Offset Site

2.2.3 Mapping zones

North-West Offset Site

Homogenous vegetation zones were broadly mapped for the majority of the North-West Offset Site during the original Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012), which included broad scale mapping to encompass a one kilometre radius of the development site, of which the offset site is continuous. During surveys conducted during February 2013 to collect plot data at the North-West Offset Site, the homogenous zones were more accurately refined. As discussed for the development site, derived grasslands are included within the vegetation types they are derived from.

Four homogenous zones were mapped on the basis of vegetation type and condition corresponding to the defined offset site. Dominant vegetation types were determined with reference to the previous detailed assessments at the site (**ngh**environmental 2012) and the OEH Biometric Vegetation Types Database. All vegetation within the offset site was considered to be in moderate to good condition.

The zones are defined in Table 2-7 and mapped on Figure 2-5[3]. Remnant areas were assessed to be over 500 ha for all zones as all surrounding vegetation is considered to be native vegetation.

Plot data was collected based on the entire area of each homogenous zone and the number of plots conducted was sufficient to meet the minimum requirements for these areas. An exception was the number of plots required for the Rough-barked Apple – Silvertop Stringybark forest. During the refinement of the area of impact for the Project, following the development site surveys, two plots (D1 and D16) were located within the proposed offset. In addition Plot D3 was located slightly upslope of the development site (but still representative of the vegetation within the development site) and also located within the proposed offset. The plot data from these plots has been used within the offset site calculations. Given the consistency of the vegetation within this homogenous zone and the close proximity of the offset site to the development site, plot D2 has also been included as it was also considered to be highly representative of vegetation and habitat features within the proposed offset site. The use of the development site plot data for this homogenous zone was discussed with OEH (David Coote *pers. comm.* 06.02.13) and considered to be acceptable given the objectives of the assessment, that it was representative of the offset site and that the particular vegetation type is common and not of conservation significance.

Two plots were conducted within the River Oak riparian woodland within the offset site and two were conducted within this community upstream of the new FSL on the Peel River (plots O17 and O18, Figure 2-6) within the area proposed as an offset for the Booroolong Frog. These plots were included within the assessment to make up the minimum plot requirement and also because they were considered to be representative of the vegetation within the offset site.

Plot O19 was not included within the assessment as it was within an area not being considered as an offset and not representative.

Similarly to the development site, offset site plot data was duplicated only when required to satisfy the minimum plot requirements for each assessment circle. Plots that have been duplicated are denoted in Table 2-7 by an (*). Plots duplicated are those that were located closest to the relevant assessment circle.

[3] No individual map unit was less than 0.25 ha. Vegetation that did not qualify as native vegetation was not mapped. This included areas with no native overstorey, no native mid storey and where less than 50% of the ground cover is indigenous species or greater than 90% of the ground cover was cleared.

Geographic/habitat features were selected with respect to threatened species as outlined in Table 2-8.

'After BioBank' management scores were as determined by the BCC and not modified.

Table 2-7 North-West Offset Site: homogenous zones

Assessment circle	ZONE ID	Vegetation type code	Vegetation name	Condition	Area within offset (ha)	Plot IDs
East	1	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	76.6	O6*, O7*, O14, O16, O20
West	5	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	48.98	O3, O4, O6*, O7*
East	2	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	91.29	D1*, D2, D3*, D16*, O9*
East	3	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	6.98	O17, O18, O21, O22
East	4	NA226	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate/ Good	53.3	O10*, O11*, O12*, O13*, O15*
West	6	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	557.31	O1, O2, O5, O9*, D1*, D3*, D16*
West	7	NA226	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate/ Good	142.75	O8, O10*, O11*, O12*, O13*, O15*

* Duplicated plot data

Table 2-8 Threatened species and relevant habitat features considered to potentially occur at the North-West offset site

Scientific name	Common name	Feature
Thesium australe	Austral Toadflax	Coastal headlands, grassland, grassy open forest or woodland on fertile or moderately fertile soils
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Land within 100 m of rocky areas
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Shallow or infertile soils
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	Land within Dungowan Dam area near Tamworth in Peel CMA subregion
Hoplocephalus bitorquatus	Pale-headed Snake	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
Litoria booroolongensis	Booroolong Frog	Land within 100 m of stream or creek banks

Booroolong Frog Offset Site

Vegetation within the proposed Booroolong Frog Offset Site was not surveyed beyond the locations of the two BioBanking plots (O17 and O18) conducted in the north of the site as the boundaries of the site had not been determined at the time of the survey. As such, detailed vegetation zone mapping has not been undertaken. It was however, possible to map with a degree of certainty the extent of River Oak riparian woodland based on desktop interpretation of digital aerial imagery (Figure 2-6). The areas mapped within each assessment circle are detailed in Table 2-9.

The two plots conducted (O17 and O18) were adequate to meet the minimum number required for each zone however, plot O17 was duplicated for each assessment circle. As discussed for the North-West Offset Site above, this is considered acceptable given the objectives of the assessment, that it is likely to be representative of the offset site and that the particular vegetation type is common and not of conservation significance.

Geographic/habitat features were selected with respect to threatened species as outlined for the western offset area in Table 2-8.

Table 2-9 Homogenous zones within the Booroolong Frog Offset Site

Assessment circle	ZONE ID	Vegetation type code	Vegetation name	Condition	Area within offset (ha)	Plot IDs
North	8	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	3.5	O17*, O18
South	9	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	1.6	O17*

* Duplicated plot data

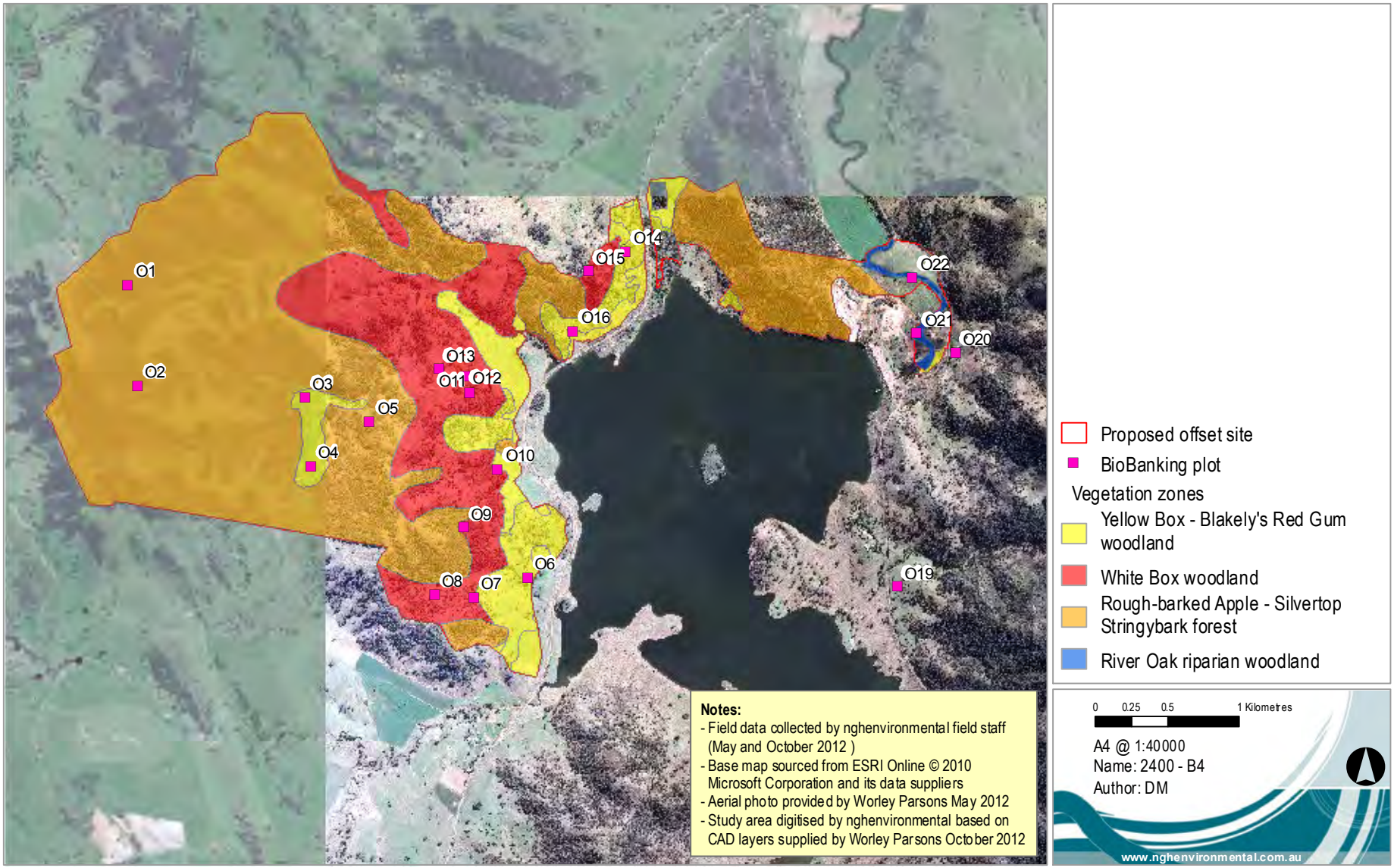


Figure 2-5 North-West Offset Site homogenous zones and plot locations

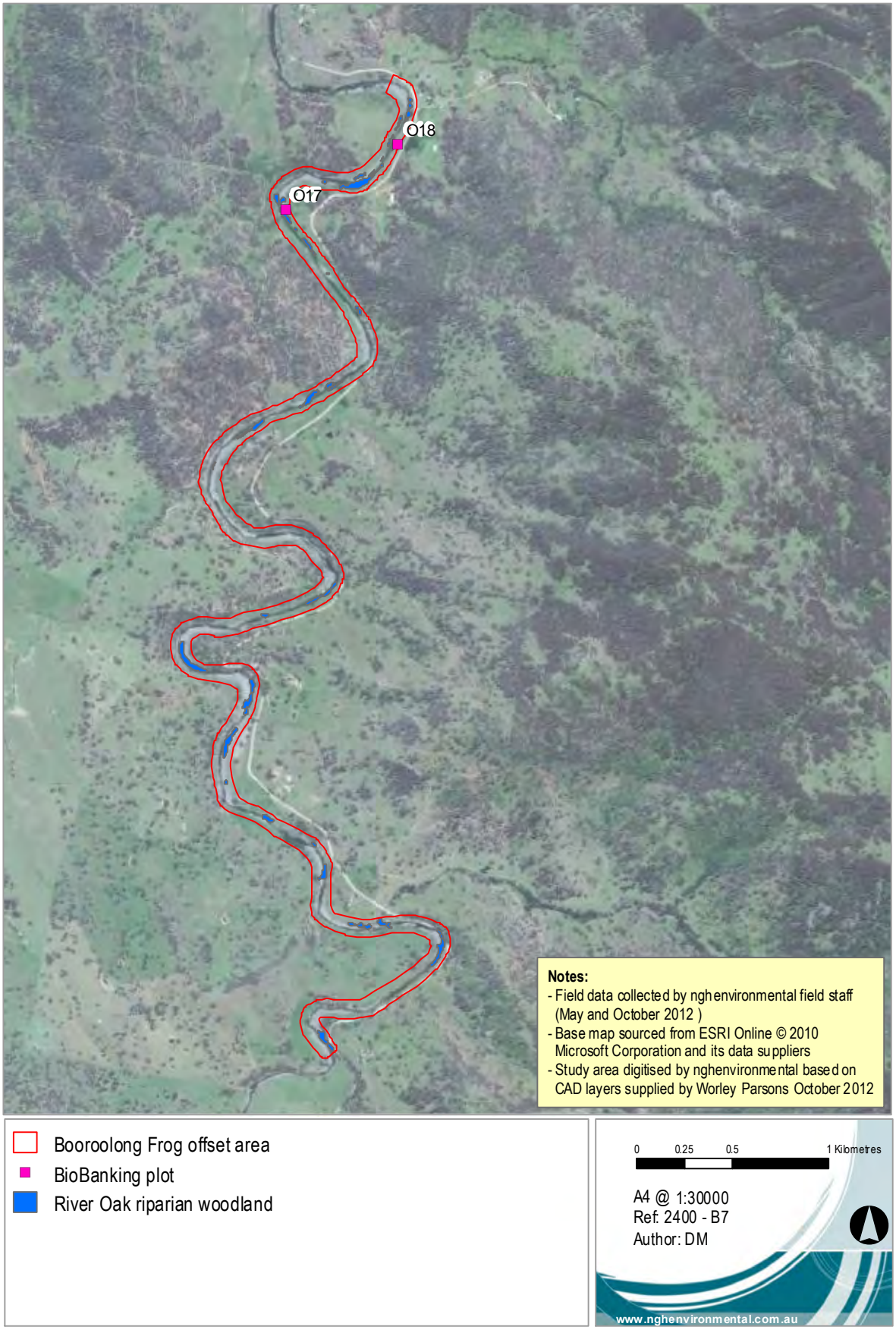


Figure 2-6 Booroolong Frog offset site, River Oak Riparian Woodland and plot locations.

2.2.4 Credit calculator results

Species predicted to occur

The species listed in Table 2-10 are predicted by the BCC to occur at the offset site and contribute to the ecosystem credits generated.

Table 2-10 Species predicted to occur at the offset site

Scientific name	Common name	Tg value
Burhinus grallarius	Bush Stone-curlew	0.4
Cercartetus nanus	Eastern Pygmy-possum	0.5
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	0.5
Dasyurus maculatus	Spotted-tailed Quoll	0.35
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Glossopsitta pusilla	Little Lorikeet	0.58
Grantiella picta	Painted Honeyeater	0.75
Lathamus discolor	Swift Parrot	0.75
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	0.75
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Neophema pulchella	Turquoise Parrot	0.55
Ninox connivens	Barking Owl	0.33
Ninox strenua	Powerful Owl	0.33
Nyctophilus timoriensis	Greater Long-eared Bat (south eastern form)	0.48
Petaurus australis	Yellow-bellied Glider	0.43
Petaurus norfolcensis	Squirrel Glider	0.45
Petroica boodang	Scarlet Robin	0.6
Petroica phoenicea	Flame Robin	0.6
Phascolarctos cinereus	Koala	0.83
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	0.75
Pteropus poliocephalus	Grey-headed Flying-fox	0.93
Pyrrholaemus saggitatus	Speckled Warbler	0.4
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45
Stagonopleura guttata	Diamond Firetail	0.75
Tyto novaehollandiae	Masked Owl	0.33
Xanthomyza phrygia	Regent Honeyeater	0.75

Species requiring survey

A total of 14 species were returned by the calculator as requiring survey (Table 2-11). Note, survey is not essential for the offset site. These species are assumed *not* to occur, unless demonstrated to occur through survey. An extensive series of surveys were undertaken as part of the Terrestrial and Aquatic

Flora and Fauna Impact Assessment, however, the majority of these did not focus on the offset site. As such it cannot be said with confidence that the majority of these species would be managed at the offset sites and it is assumed that most would not. The exception is the Border Thick-tailed Gecko and Booroolong Frog.

The Border Thick-tailed Gecko was detected during surveys on Goat Mountain on the northern foreshore of the dam just west of the auxiliary spillway. A conservative estimate of a minimum of 2 ha of habitat for this species would be managed at the offset site. Species credits are generated for this species.

Extensive surveys were undertaken for the Booroolong Frog along the Peel River upstream of the new FSL by the Namoi CMA in early 2013. These surveys identified that the species occupies habitats within the Peel River up to 25 km upstream. A potential offset area encompassing an approximate 9 km length of the Peel River has been proposed. Due to the dynamic nature of the Peel River, habitat for the Booroolong Frog was defined as the river channel which, within the 9 km length, occupies an area of approximately 31.82 ha. Species credits are generated for this species. The Booroolong Frog Offset Site has also been assessed using the EPBC Environmental Offsets Policy (refer to Section 3.1.1).

Table 2-11 Species requiring survey at the offset site and those that would be managed

Scientific name	Common name	Managed at offset site?	ID method	Gain	Units of gain	Survey date
Thesium australe	Austral Toadflax	No		0.00	indiv	
Hieraaetus morphnoides	Little Eagle	No		0.00	ha	
Circus assimilis	Spotted Harrier	No		0.00	ha	
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	No		0.00	ha	
Dichanthium setosum	Bluegrass	No		0.00	indiv	
Digitaria porrecta	Finger Panic Grass	No		0.00	indiv	
Phascogale tapoatafa	Brush-tailed Phascogale	No		0.00	ha	
Lophoictinia isura	Square-tailed Kite	No		0.00	ha	
Callocephalon fimbriatum	Gang-gang Cockatoo	No		0.00	ha	
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Yes	Survey	2.00	ha	17/10/2012
Eucalyptus nicholii	Narrow-leaved Black Peppermint	No		0.00	indiv	
Hoplocephalus bitorquatus	Pale-headed Snake	No		0.00	ha	
Litoria booroolongensis	Booroolong Frog	Yes		31.82	ha	01/2013-02/2013
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	No		0.00	indiv	

Credit summary

The BioBanking credit statement produced the following ecosystem and species credits that are generated at the proposed offset site (summarised in Table 2-12, provided in full in Appendix A).

Table 2-12. Offset sites: credit summary

Biometric vegetation type	Area offset (ha)	Credits generated
Ecosystem credits		
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	125.76	1500
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	196.05	2019
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	649.88	7310
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	12.08	231
Species credits		
Border Thick-tailed Gecko	2.00	12
Booroolong Frog	31.82	112

2.3 CREDIT COMPARISON: DISCUSSION

2.3.1 North-west offset site

The summary in Table 2-13 compares the ecosystem credits generated at the North-West offset site with those required for the development site.

Table 2-13 Credit comparison summary

Biometric vegetation type	Permanent habitat loss (ha)	Area within offset (ha)	Development credits required	Offset credits generated	Credit difference
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	152.35	125.76	8128	1500	-6628
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.65	649.88	254	7310	7056
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	12.08	323	231	-92
White Box grassy woodland of the	0	196.05	0	2019	+2019

Biometric vegetation type	Permanent habitat loss (ha)	Area within offset (ha)	Development credits required	Offset credits generated	Credit difference
Nandewar and Brigalow Belt South Bioregions					
Total	161.71	983.77	8705	11060	+2355

Overall, the proposed offset provides a 6:1 offset to development area ratio with an ecosystem credit surplus of 2355 credits. The proposed offset provides like for like with regards to the vegetation types it contains however, it does not meet the credit requirements on this basis. The largest deficiency is that of the Yellow Box – Blakely's Red Gum grassy woodland (comprising Box-Gum grassy Woodland EEC) with a credit shortfall of 6628 credits. This is considered to be somewhat compensated for by the White Box grassy woodland contained at the offset site (also comprising the Box-Gum grassy woodland EEC) which is identified in the BCC credit report (Appendix A) as a suitable offset option for this vegetation type. Considering that both these communities are afforded the same level of statutory protection and provide similar threatened species habitats, this is considered to be appropriate and is supported in principle by OEH (David Coote *pers. comm.* 22.02.13). In combining these two vegetation types, a 2.1:1 offset to development area ratio is achieved with a 4609 credit deficit. This is discussed further below with regard to the SSI Interim offsets policy.

The results of the BBAM also show a shortfall in the amount of River Oak riparian woodland contained within the offset site. The current proposed offset offers a 2.1:1 offset to development area ratio with a 92 credit deficit. This is also discussed further below with regard to the SSI Interim Offsets Policy.

The proposed North-West Offset Site may be somewhat deficient according to the outputs of the BBAM methodology with respect to the Yellow Box – Blakely's Red Gum grassy woodland however, a number of other factors should be considered in assessing its suitability. The vast majority of the community that is to be impacted comprises derived grassland that has been degraded by grazing and recreational pressures. The proposed offset also contains degraded areas however, there are extensive areas were the overstorey is regenerating and with proper management would respond well resulting in a net improvement to the biodiversity values at the site within a relatively short time frame.

In addition, the North-West Offset Site provides an important corridor for connectivity between areas of native vegetation east and west of the reservoir. The reservoir in its present state forms a large barrier in a landscape that has also been extensively cleared for agriculture. The offset would improve the function of this corridor and secure it in perpetuity.

The offset is also located within the catchment for Chaffey Dam and would contribute to the preservation and improvement of catchment values associated with the water supply.

Although the Rough-barked Apple – Silvertop Stringybark forest community that comprises the majority of the offset site is considered to be a common vegetation type, it also provides high quality habitat for a range of threatened species such as the Masked Owl, which contributed the largest number of ecosystem credits for this vegetation type in the development site assessment. The large area to be included in the offset (approximately 650 ha) provides habitat suitable for species with large home ranges and it also provides a buffer for the Yellow Box and White Box grassy woodland communities. This vegetation type also supports habitat for the threatened Border Thick-tailed Gecko which is known to occur within the offset site and generated a surplus of 12 species credits in the assessment.

2.3.2 Booroolong Frog Offset Site

The proposed Booroolong Frog Offset Site generates 112 species credits of the 119 required, leaving a credit deficit of 7 (6% of the requirement). These results indicate that the proposed offset almost entirely meets the requirements of the BBAM without imposing any variations (such as those allowed by the OEH SSI Interim Offsets Policy).

It should be noted that a riparian buffer either side of the Booroolong Frog Offset Site will be managed as part of the Offset Site Management Plan. This is additional to the area calculated for the Booroolong Frog Offset Site (stream channel). The restoration of the riparian zone is regarded as a high priority for the recovery of the Booroolong Frog, and the additional approximate 50 ha that will be protected and restored is deemed to provide a further positive outcome. Further, the Booroolong Frog offset site has been assessed as adequate according to the EPBC Environmental Offsets Policy and this is further discussed in Section 3.1.

2.4 ASSESSMENT OF NORTH-WEST OFFSET SITE AGAINST THE OEH SSI INTERIM OFFSETS POLICY

The OEH SSI Interim Offsets Policy relates to proposals that are assessed by DP&I under the SSD, SSI or former Part 3A provisions of the EP&A Act, and are not being considered as part of the BioBanking Scheme.

This interim policy:

- Acknowledges that proposals assessed as State significant projects or Part 3A do not have to meet the "improve or maintain" standard, which is required under the BioBanking scheme (this would be a Tier 1 standard);
- Nevertheless, adopts the use of the BioBanking Assessment Methodology (BBAM) for the purpose of:
    - quantifying and categorising the biodiversity values and impacts of State significant projects or Part 3A proposals;
    - establishing, for benchmarking purposes, the offsets that would be required if the State significant project or Part 3A proposal had been expected to meet the improve or maintain standard;
    - provides a structured approach to determining how proposals may, in lieu of meeting the improve or maintain standard, meet one of two alternative standards established under this policy referred to as Tier 2 'no net loss' and Tier 3 'mitigated net loss'.

The BBAM has been used in determining the suitability of the proposed offset. The credit comparison in Section 2.3 demonstrates that the current proposed offset site is a Tier 3 'mitigated net loss' standard.

In considering whether a mitigated net loss standard is appropriate consideration should be given to:

- Whether the credits required by the calculator are available on the market
- Whether alternative offset sites (other than credits) are available on the market
- The overall cost of the offsets and whether these costs are reasonable given the circumstances

Consideration of the above points is discussed below:

- The BioBanking Public Register was searched on the 26 February 2013 and no credits for the Yellow Box – Blakely's Red Gum community were found to be available on the market.
- Alternative areas of Crown land have been identified around the dam that would be suitable as offset areas however, these areas are not in State Water ownership, are not immediately available and may require prolonged negotiations with the land owners which could be both time consuming and costly resulting in delays and potentially preventing the project from proceeding.

Therefore a Tier 3 'mitigated net loss' standard is considered appropriate.

To achieve a 'mitigated net loss' outcome, it is possible to apply specific variation criteria according to the OEH SSI Interim Offsets Policy to the point that:

- Suitable offset sites can be found within a reasonable[4] timeframe
- The costs of offsetting is brought within a reasonable[4] range
- An offset to clearing ratio of at least 2:1 vegetated to cleared hectares is achieved

The variation criteria that may be applied to achieve a 'mitigated net loss' standard are outlined in Table 2-14 along with comments on how each of these apply to the current proposal.

Table 2-14 Variation criteria for a Tier 3 'mitigated net loss' standard

Variation criteria	When is this option appropriate?	How this applies to this proposal
Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion	When no matching ecosystem credits are available	Insufficient credits are available at the offset site for Yellow Box – Blakely's Red Gum grassy woodland. White Box grassy woodland credits have been used to satisfy the minimum 2:1 vegetated to cleared hectares requirement for the Box-Gum grassy woodland TEC. Both the Yellow Box –Blakely's Red Gum grassy woodland and Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest are of the 'grassy woodland' formation. This criteria would also allow for the transfer of the credits between these communities, which would then satisfy the credit requirements of the BBAM.
Convert one type of species credit to another type of species credit with the same or more endangered conservation status	When species credit is not available and the matching species credit is considered a greater conservation priority.	Not applicable to this proposal.

[4] As stated in the OEH SSI Interim Offsets Policy, "*What is reasonable is contingent upon a range of factors and needs to be considered on a case by case basis"*.

Variation criteria	When is this option appropriate?	How this applies to this proposal
Remove/reduce the need for offsetting	Where clearing is minimal (less 4 ha) and where the vegetation is not a highly cleared vegetation type or a Commonwealth or State listed TEC.	Not applicable to this proposal as a TEC is being impacted.
Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value	Where suitable offset sites are known to exist but: • there is insufficient time to secure the offset sites at the time the decision is made; or • the proposal is to use the services of a third party provider such as the Nature Conservation Trust to secure offset sites and an estimate of cost is required.	Not applicable to this proposal.
Waive the requirement for species credits **NB: This criteria should not be used for EPBC Act listed species where the proposal is a controlled action**	Where no matching credits are available and all ecosystem credits have been obtained in accordance with this policy	Not applicable to this proposal. Species credits apply to an EPBC listed species, the Booroolong Frog. An offset site has been proposed for this species using the BBAM and the EPBC Environmental Offsets Policy (EOP).
Convert ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar	When no matching credits are available and variation 1 is not feasible	Variation 1 employed for vegetation.

The land identified for the North-west offset site is registered in the name of the Water Administration and Ministerial Corporation (WAMC). This land is vested in State Water and available for State Water and is available immediately. The time required to negotiate the acquisition of additional lands in multiple ownerships, could be lengthy and has the potential to hold up the Project. The Project commits to securing and managing lands totalling almost 1000 ha for offsets. Managing an area of this size for conservation for the life of the dam entails a large financial commitment from State Water Corporation.

Application of the BBAM shows that an overall ratio of 6:1 vegetated to cleared hectares is achievable including a like for like ratio of 2.1:1 for the Box-Gum grassy woodland TEC and River Oak riparian woodland. This meets the minimum 2:1 vegetated to cleared hectares requirement. In addition, employing variation criteria 1 allows credits to be transferred from the Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest to the Yellow Box - Blakely's Red Gum grassy woodland community which would actually enable the credit requirements to be satisfied. The credit requirements for the Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest are easily met by the remaining credits generated for this community.

The Project has been assessed according to the BBAM and meets the requirements for a mitigated net loss outcome according to the OEH SSI Interim Offsets Policy. As such the proposed north-west offset is considered to be adequate under this policy.

2.5 PRINCIPLES FOR THE USE OF BIODIVERSITY OFFSETS IN NSW[5] – CHECKLIST

The following principles, developed by OEH, provide a useful framework for developing offset proposals. They have been considered in developing this Offset Plan, as detailed below.

Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

The proposal has avoided and mitigated to the extent that the proposed new FSL is the minimum required to meet the long term objectives of the Project. The road works footprint has been minimised to avoid impacts to some areas of EEC. Mitigation measures have been applied and are outlined in the Flora and Fauna Addendum Report. Residual impacts are being offset only, primarily resulting from inundation by the raised water level of the dam.

All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

The Offset Plan will be required as part of the NSW consent conditions and Commonwealth Controlled Action conditions. The proposed offsets will not be used to satisfy approvals or assessments under other legislation.

Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

This is addressed in two ways:

a) The offset site will be set up in perpetuity – this removes the incentive to degrade the offset site to facilitate development at a later date

b) The management measures will have clear targets and be set out to push most management to the beginning of the agreement, where successful accomplishment of targets would be rewarded by less intensive management in ongoing years. This suits measures such as weed control which are more easily achieved with intensive efforts than small ongoing efforts.

Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

A Conservation Agreement (CA) is the preferred option for security of the North-West Offset Site. A Conservation Agreement is a legally binding covenant between the landholder and the Minister established under s69A-KA of the NPW Act. It provides in-perpetuity protection for the conservation values on the land and associated water. The agreement is registered on the title of the land, ensuring that, if the land is sold, the agreement and management requirements remain in place for successive

[5] Accessed 28 February 2013 from http://www.environment.nsw.gov.au/biocertification/offsets.htm

owners. Private conservation lands complement public reserves and contribute to the protected area system in NSW. Funding will be provided directly to the Booroolong Frog Recovery Program providing security of funding to the Booroolong Frog Offset Site. This has the express purpose of enabling continuation and enhancement of management activities to improve habitat for the species on the Peel River.

Offsets must be underpinned by sound ecological principles

They must:

- *include the consideration of structure, function and compositional elements of biodiversity, including threatened species*
- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*
- *ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

BioBanking credit calculation is the most accurate and demonstrable way to take these issues into account and has been used in formulating this plan. The management measures to be implemented on the offset sites focus on restoration and removal of threatening process which are both highly effective ways to enhance threatened species resilience and persistence. Additionally, progress and outcomes of such management measures can be monitored and adapted over time to ensure continuing beneficial outcomes.

Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

This Offset Plan:

- Identifies threats to the offset site's values
- Sets out suitable management measures that can be undertaken for the long-term
- Includes enhancement options, where required

Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a

public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

The Offset Plan is proposed for the life of the dam. The offset will be secured by Conservation Agreement for vegetation offsets and a funding agreement for the Booroolong Frog.

Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

It is proposed that the in-principle agreements to the offset actions will be finalised prior to construction.

Offsets must be quantifiable - the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

Preparation of this Offset Plan has had regard to the above methodology. As stated, biometric assessment offers the most demonstrable method to undertake the first six points and BioBanking has been designed to address the last point – long term security. While it is not mandatory, aspects of the system should at least be considered. The offset will be secured by a Conservation Agreement for vegetation offsets and a funding agreement for the Booroolong Frog ensuring the long term security of the offset.

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*

Preparation of this Offset Plan has applied the best available information and data to assess impacts of biodiversity loss and gains from offsets. The proposed offset sites and nominated security and management measures ensure the offset sites are of high biodiversity value.

Management actions must be deliverable and enforceable.

Management actions and their objectives, proposed methods of delivery and monitoring requirements are outlined in Section 4 of this plan.

Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Both Offset Sites have been proposed based on their ability to achieve a 'like for like' outcome with regard to the vegetation types and threatened species being impacted at the development site, that is, the same vegetation types and habitats are present within the offset sites that occur within the development site. Further, the proposed North-West offset site consists of ecological communities that are equal in conservation status, thus meeting the requirement of this principle.

Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

In the case of the North-West offset site, locating the offset site adjacent to the impacts within the same vegetation types achieves this aim. The proposed Booroolong Frog offset site is located immediately upstream and contiguous with the impact site on the Peel River and contains the same ecological characteristics. The offset site supports a known breeding population of the Booroolong Frog and is connected with a greater population inhabiting at least 25 km of upstream habitat.

Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

The proposed vegetation offset is not covered by any existing covenants or agreements. The land is owned by government however, it is not being managed for conservation. The offset is considered supplementary.

The proposed Booroolong Frog offset site is subject to a further 5 years of management under agreements between the Namoi Catchment Management Authority and landholders. The proposed offset will increase the security and longevity of these agreements by providing funding to implement management actions for the life of the dam (impact). The funding will be legally binding by inclusion in the Project Approvals and provides protection for the conservation values on the land and associated water via associated management. The provision of funding to the Booroolong Frog Recovery Program managed by OEH will ensure the use of funds for targeted on ground conservation works to enhance the security and viability of the Booroolong Frog population on the Peel River.

Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Monitoring requirements are outlined in Section 4 of this plan and have been designed to ensure that the actions lead to positive biodiversity outcomes.

2.6 ASSESSMENT AGAINST THE NAMOI CATCHMENT MANAGEMENT AUTHORITY BIODIVERSITY OFFSETS POLICY

The Namoi CMA has developed the *Namoi Catchment Management Authority Biodiversity Offsets Policy* specific to activities that occur within the Namoi Catchment to ensure that biodiversity values within the Namoi Catchment are protected. The principle objective of the policy is to avoid further loss of biodiversity identified in the Catchment Action Plan as a result of critical thresholds being crossed.

The Policy states that any offsets proposed for the Namoi Catchment will need to:

Compensate for predicted impacts of a development proposal on biodiversity values

The ability of the proposed North-West Offset Site and Booroolong Frog Offset Site to compensate for the predicted impacts of the proposal has been assessed according to the NSW OEH SSI Interim Offsets Policy and the EPBC Act Environmental Offsets Policy. The outcome of this assessment confirms that the proposed offset compensates for the predicted impacts of the proposed development.

Ensure that the development results in no net loss of native vegetation in the catchment

The development will result in the loss of native vegetation through inundation and construction activities. However, management actions proposed at the offset site (refer to Section 4) will result in regeneration of woodland communities within areas that have been previously cleared. The majority of these areas where regeneration will occur will ultimately be occupied by a State and Commonwealth listed EEC (Box-Gum grassy woodland). Given that much of the development site has been cleared of overstorey vegetation, the potential gains at the offset site are considered likely to result in a net gain in terms of the native vegetation that would have originally occupied the development site.

Ensure that development avoids the Namoi catchment or sub-catchments crossing critical thresholds identified in the Namoi CAP

a) 30% (in cleared sub-catchments) woody native vegetation extent threshold

b) 70% (in intact sub-catchments) woody native vegetation extent threshold

c) 30% of Regional vegetation Communities threshold within the Catchment

As discussed above, the proposed management of the offset site is considered likely to result in a net gain for the State and Commonwealth listed Box-Gum grassy woodland EEC. Gains are also likely for the more common vegetation types that are to be impacted (i.e. the Rough-barked Apple – Silvertop Stringybark forest). With the proposed management of the offset site, it is considered unlikely that the development will result in vegetation within the Namoi Catchment or sub-catchments crossing critical thresholds.

Be consistent with the existing NSW Government and Commonwealth legislative requirements as a minimum standard.

NSW Government and Commonwealth offset requirements have been addressed in Sections 2 and 3. The proposed development has been assessed against all relevant legislative requirements within the Environmental Impact Statement for the development (WorleyParsons 2013).

In addition, the following principles must be applied when considering using biodiversity offsets in the Namoi Catchment for any development:

Offsets will be used as a last resort, after consideration of alternatives to avoid and/or mitigate impacts

The proposal has avoided and mitigated to the extent that the proposed new FSL is the minimum required to meet the long term objectives of the Project. The road works footprint, which accommodates the realignment of existing roads, has been minimised to avoid impacts to some areas of EEC. Mitigation measures have been applied and are outlined in the Flora and Fauna Addendum Report and Revised Flora and Fauna Addendum Report. Residual impacts are being offset only, primarily resulting from inundation by the raised water level of the dam.

Offsets must be kept within the Namoi Catchment boundaries (either wholly or in part – as a contiguous area of native vegetation)

The proposed North-West Offset Site and Booroolong Frog Offset Site occur wholly within the Namoi Catchment (being adjacent to the development site).

The proposed North-West Offset Site area is predominately contiguous with only a single lane dirt road traversing the offset site.

The proposed Booroolong Frog Offset Site and proposed North-West Offset site are not contiguous because the purpose and therefore ecological characteristics of the two offsets is different. The Booroolong Frog offset site needs to be located within known Booroolong Frog habitat, such as the stream environment of the Peel River. Suitable offsets for the vegetation and the frog cannot be found in the same habitats.

Offsets must be of the same vegetation type and be at least the size, equivalent biodiversity value & configuration of the vegetation lost through development and additional to existing native vegetation areas

As discussed above, the proposed offset contains the same vegetation types and with proposed management will result in a net gain to biodiversity values.

The proposed Booroolong Frog offset site is located immediately upstream and contiguous with the impact site on the Peel River and contains the same ecological characteristics. The offset site supports a known breeding population of the Booroolong Frog and is connected with a greater population inhabiting at least 25 km of upstream habitat.

Offsetting must achieve biodiversity benefits in perpetuity and be registered on title.

The vegetation offset will be secured by Conservation Agreement and managed for the life of the dam. The Booroolong Frog offset funding agreement will be accompanied by a legally binding contract which, if the resource management body ceases to exist, the responsibilities for implementation of the Booroolong Frog Recovery Program funding within the offset site for the life of the dam would be transferred.

Offset conditions must be monitored, enforceable, clearly mapped, recorded and publicly available.

Monitoring requirements are outlined in Section 4 of this plan and have been designed to ensure that the actions lead to positive biodiversity outcomes. A management plan will be produced for the offset that will clearly outline management actions and their locations and will be publicly available.

An offset area, once designated, cannot be used for further offsetting of subsequent developments in the future

Both State and Commonwealth offset policies enforce the principle of 'additionality'. Any future offsets would have to meet the requirements of these policies and would have to be additional to what already exists.

3 COMMONWEALTH OFFSET REQUIREMENTS

The EPBC Act Environmental Offsets Policy (EOP) (SEWPaC 2012) outlines the Commonwealth Government's approach to the use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This policy relates to all matters protected under the EPBC Act. As the Project has been determined to be a 'Controlled Action', and the potential for significant impact to the endangered Booroolong Frog remains, the EPBC Act EOP applies and must be addressed for this species.

An Assessment of Significance has been undertaken for the Booroolong Frog in view of new survey results from 2013 (Appendix A). Overall, the removal of 6.4% of *known* Booroolong Frog habitat immediately upstream of Chaffey Dam has the potential to significantly impact this population. Habitat for the Booroolong Frog is a limiting factor, and this is the largest and most continuous population currently known anywhere in NSW, and potentially Australia.

The National Recovery Plan for Booroolong Frog (NSW OEH 2012a) states that *"habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency or results in loss of rock crevices is likely to threaten the persistence of local populations of this species."*

The suitability of the proposed Booroolong Frog Offset Site to specifically offset the residual impacts on the Booroolong Frog has been assessed using the EPBC Offsets Assessment Guide (OAG) which accompanies the EPBC Act EOP. The methodology applied in utilising the guide and the results obtained are described below.

The overarching offset principles outlined in the EPBC Act EOP and how the current Offset Plan addresses these principles are presented below. This Offset Plan has also been produced according to the NSW BioBanking Assessment methodology which is a methodology endorsed by the NSW OEH.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), no significant impact to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC will result from the Project. In accordance with the EPBC Act EOP, no offset is required for this community.

However, the offset proposed under the NSW OEH SSI Interim Offsets Policy for the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC incorporates a large area of the EPBC listed CEEC. As such, information is provided here to demonstrate the conservation outcomes for the CEEC through implementation and management of the proposed offset site.

3.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE REQUIRING OFFSETS

3.1.1 Booroolong Frog

The Project will impact on 4.77 ha of Booroolong Frog habitat along a 1.6 km stretch of the Peel River as a result of inundation. Known Booroolong Frog habitat is present upstream of the dam along an additional 25 km of the Peel River and one of its tributaries (Refer to Flora and Fauna Addendum Report). Therefore the loss of 1.6 km constitutes 6.4 % of known Booroolong Frog habitat along the Peel River. It should be noted that the impact of 6.4% is calculated according to *known* Booroolong Frog records from the summer 2013 surveys. There is a high degree of certainty that the Booroolong Frog is also present

between Pearly Gates Bridge and Wombramurra Creek, and further upstream along the Peel River (Phil Spark, *pers. comm.*). As indicated in Figure 2-2 of the Addendum Report, there was a gap in surveys between these locations (for a total distance of 15 km), however, the presence of Booroolong Frogs at the upstream and downstream extent indicates that they are probably also present here. However, with the aim of quantifying the impact of the Project on *known* Booroolong Frog habitat as opposed to potential habitat, a conservative calculation of 6.4% has been provided (instead of 4%).

"Area of habitat" was used as the impact attribute for input into the OAG. Area of habitat was chosen instead of "number of individuals" because the Booroolong Frog can exhibit large fluctuations in abundance from one year to the next, therefore population abundance is not a useful indicator of population resilience (NSW OEH 2012). Also, there is confidence in the known amount of habitat available for the Booroolong Frog, whereas the number of individuals can vary according to conditions during the time of the survey and detection rates.

Methods

The OAG was run according to the information contained in the document titled 'How to use the Offsets Assessment Guide' (which is published on the SEWPaC's EPBC Act environmental offsets policy web page) and also from information obtained during the OAG workshop (conducted by SEWPaC and attended by **ngh**environmental staff members).

In running the OAG with respect to the Booroolong Frog, the user is required to enter a number of variables which require a quantitative assessment of the habitat quality at the development and offset site and also factors such as the time until the ecological benefit of the offset is realised, the risk of the loss of the offset and the level of confidence in these results. The reasoning used in reaching these values is discussed individually for each below. A conservative approach has been adopted.

Quality of habitat to be impacted and the start quality of habitat at the offset site

The overall habitat quality score (0-10) was determined by considering the following factors (as outlined in the 'How to use the Offsets Assessment Guide') individually:

- Site condition. Condition of the site in relation to the ecological requirements of the species including diversity of habitat and the number of habitat features.
- Site context. The biodiversity importance of the site in terms of its landscape position.
- Species stocking rate. The usage and/or density of a species at a particular site.

The contribution of these factors was then weighted according to their level of importance to achieve an overall habitat quality score. The results of this analysis are provided in the tables below.

Table 3-1 Habitat quality of Booroolong Frog habitat to be impacted by the development

Factor	Score	Importance	Reasoning
Site condition	8	1	The Booroolong Frog has specific habitat requirements, which include a mosaic of microhabitats including riffles, pools, cobble banks or bedrock structures within stream margins (NSW OEH 2012). The Peel River, upstream of Chaffey Dam and within the new FSL (the impact site) is known habitat for the Booroolong Frog and supports a breeding population. The impact site contains all of the habitat variables important to the Booroolong Frog, which is evidenced by its even distribution along this 1.6 km section of the river.
Site context	7	2	The development site is located at the very northern end of the

Factor	Score	Importance	Reasoning
			population of Booroolong Frogs that occur along the Peel River. There is no opportunity for the Booroolong Frog to move further north due to the presence of Chaffey Dam. In this sense, the loss of the development site will not fragment the population. There is a long stretch of suitable habitat for the Booroolong Frog upstream of the impact site. At least 23 km of this habitat was shown to be occupied by the frogs during surveys in summer 2012/2013. It is also considered highly likely that a distance of 15 km upstream of Pearly Gates Bridge that was not surveyed in 2013 (between the upstream and downstream confirmed extent of the frogs) would also be occupied (Phil Spark *pers. comm.)*. This would result in a total of 40 km occupied habitat.). Previous surveys in 2009 found the majority of the then known population (600 individuals) to be located within the new FSL (impact area). However it appears that this was probably due to floods in 2008 which washed eggs, and possibly young tadpoles, downstream (NWES 2009). Surveys undertaken in January 2013 found 50 frogs in the impact area and 2235 frogs in the areas surveyed upstream of the impact area. Thus, the habitat within the 1.6 km impact area cannot be considered of any greater importance to the population than other occupied areas of the Peel River and Wombramurra Creek, and is of lesser significance than was previously thought on the basis of the 2008/2009 survey results. Threats that occur at the impact site include habitat degradation (sedimentation due to erosion, inappropriate stock management and fossicking), and disease (NSW OEH 2012).
Species stocking rate	8	3	The role of the area to be impacted in sustaining the community within the area to be impacted is considered to be relatively important. Surveys in January 2013 found there to be 50 Booroolong Frogs within the impact site (inside the new FSL) and 2037 frogs 19.5 km directly upstream of the new FSL. This indicates that while the impact site provides valuable habitat for the Booroolong Frog, upstream areas provide the same value.
Overall habitat quality score	8		

Table 3-2 Starting quality of Booroolong Frog habitat to be offset

Factor	Score	Importance	Reasoning
Site condition	8	1	The condition of the offset site has the same score as the development site. Due to the offset site's location immediately upstream of the development site, it has the same habitat features and is subject to the same pressures. This is evidenced by the species being well distributed along the 25 km of the Peel River and Wombramurra Creek that has recently been surveyed.
Site context	7	3	The offset site occurs within a landscape that is subject to stock pressures and human disturbance. With the removal of habitat directly north of the site, the offset site will contain the northernmost extent of the Booroolong Frog population on the Peel River. The offset site provides important linkages to the south

Factor	Score	Importance	Reasoning
			of the site.
Species stocking rate	8	2	The occurrence of the Booroolong Frog population within the offset area is considered to be important to the survival of the species within the broader area. Densities in this area are currently extremely high (approximately 7 frogs every 100 m). The density of frogs can vary considerably among years, with a study in Victoria recording a seven fold difference in the abundance of adult males from one year to the next (NSW OEH 2012; Hunter 2007). With the implementation of management measures to reduce the impacts of habitat degradation along the Peel River, factors such as erosion and sedimentation will maintain and improve habitat available for the Booroolong Frog.
Overall habitat quality score	8		

Time over which loss is averted for the offset

As the Booroolong Frog Offset Site is to be legally secured for the life of the dam, the maximum forecast term of 20 years was selected for this variable.

Future quality with or without offset and time until ecological benefit

Although the offset site currently provides suitable habitat for the Booroolong Frog, without the implementation of management measures to reduce the impacts of habitat degradation along the Peel River through establishment of an offset site, factors such as erosion, weed invasion, predation on adults by foxes, predation by introduced fish, shading from introduced Willows, sedimentation and substrate disturbances as a result of stock trampling and fossicking, will reduce the quality and availability of habitat for the species. Even though the species occurs in the presence of ongoing threats, there is a risk that overall habitat quality would degrade to a value of 7.

The values of the future quality of the site, with implementation of an offset, are largely based on the management actions proposed as part of the offset plan. This includes the following actions relevant to the Booroolong Frog:

- Riparian protection and restoration
    - Eradication of weeds
    - Stock management
    - Native revegetation of the riparian zone
    - Prevention of fossicking
    - Limit herbicide and pesticide use
- Predator control
    - Prevent introduction of predatory fish
    - Fox control
- Monitoring
    - Identify population trends in relation to stream drying and riparian restoration
    - Adhere to strict quarantine protocols, such as those outlined in the 'Hygiene protocols for the control of disease in frogs' (NSW NPWS 2001)
    - Identify presence/absence of threats at offset site in order to quantify the success or failure of management measures implemented (e.g. predator and weed abundance, riparian vegetation condition, fossicking activities)

It is considered reasonable that the overall quality of the habitat for the Booroolong Frog within the Booroolong Frog Offset Site could be increased from a value of 8 to a value of 9 by implementing these management actions.

The proposed management measures have been identified as objectives in the National Booroolong Frog Recovery Plan (NWS OEH 2012). As the degradation at the site has been largely caused by stock access, weed invasion and human disturbance (especially in relation to fossicking), and the management actions described above are ensured to be carried out as part of a management plan, a confidence level of 80% has been applied to the time until ecological benefit. This is considered reasonable as it still allows for unforeseen circumstances such as extreme weather events, or unknown responses to those management measures. The offset site management plan will comprise a series of adaptive management plans which will be approved by OEH within six months of project approval and will allow the detection and response to those factors.

A conservative estimate of five years has been given for the time until ecological benefit. The proposed management measures will be incorporated prior to construction and while some of the measures will be evident immediately (manage stock access), other measures will be evident over a longer timeframe (riparian restoration, weed control). It is considered that it will take approximately five years for the habitat quality improvement of the offset site to be realised.

Risk of loss of the offset site with or without the offset

The Booroolong Frog Offset Site is currently utilised as a watering point for stock and for recreational activities including fossicking. The offset site is owned by multiple private landowners and is not protected by any conservation agreements or reservation schemes. A number of Management Agreements (MAs) currently exist between landholders and Namoi CMA for the offset site, however evidence of the success of these management actions through monitoring and auditing is not publicly available.

Field surveys indicate that these conditions are not being met sufficiently (Phil Spark, *pers. comm.*). Furthermore, the current MAs can be terminated with one month notice. These MAs are due to expire in five years (2018). The plan for the Booroolong Frog Offset Site is to assume management of the lands subject to these MAs, continue to implement the current management actions, improve upon the current management actions and carry out additional on-ground restoration works that are not currently being undertaken.

The Conservation Agreement for a given property will be lodged with the Department of Lands and registered on the certificate of land title for the property. Thus sale of a property would not endanger the agreement.

The proposed management of the Booroolong Frog Offset Site detailed in this Offset Plan (Section 4) will incorporate additional conditions subject to ongoing monitoring, thereby reducing the risk of loss of the offset site. There are no known pending mining leases or development applications that apply to the offset site.

As stated in the 'How to use the Offsets Assessment Guide', degradation to the quality of the site due to current management practices and use should not be incorporated into the risk of loss as these factors are incorporated in the quality score. However, it is considered reasonable that future land management practices be taken into account. An estimate of 30% risk of loss without offset has been applied as the site is unprotected, however, there is no indication that it is likely to be lost in the future.

With the offset in place, the risk of loss is considered to be very low as the offset would be legally secured for the life of the dam. There is a small chance that the offset may be lost due to unforeseen circumstances. A 5% risk of loss has been applied to account for this.

Considering the extensive amount of field survey and time spent on assessing the site, a good understanding of the site and associated land use pressures has been obtained. Furthermore, State Water is a public entity with a strong environmental record. The estimated values for risk of loss are considered to be reasonably informed; a 70% confidence in these results has been applied.

Results

Utilising the values described above, the OAG returned a 191.44% direct offset for the impact (included as Appendix A). No additional compensatory measures are considered to be required.

3.1.2 Box-Gum grassy woodland CEEC

Approximately 7.38 ha of Box-Gum grassy woodland that meets the criteria for the EPBC listed CEEC will be impacted by the development. As documented in the Terrestrial and Aquatic Flora and Fauna Assessment, this impact will not be significant.

However, the proposed offset site contains approximately 207 ha of the community which variably meets the EPBC criteria based on understorey diversity, the density of mature trees and the presence of overstorey regeneration. The OAG was run using the above figures as detailed below.

Methods

The OAG was run as described above for the Booroolong Frog. As with the Booroolong Frog, a conservative approach has been adopted. The reasoning used in reaching key values for each of the OAG inputs is discussed individually for each below.

Quality of habitat to be impacted and the start quality of habitat at the offset site

The overall habitat quality score (0-10) was determined by considering the following factors (as outlined in the 'How to use the Offsets Assessment Guide') individually:

- Site condition. Including vegetation condition (weediness), structure and species diversity.
- Site context. The biodiversity importance of the site in terms of its landscape position.
- Species stocking rate. The number of individual populations at the site.

The contribution of these factors was then weighted according to their level of importance to achieve an overall habitat quality score. The results of this analysis are provided in the tables below (as the offset site is immediately adjacent to the area to be impacted, the start quality of both areas was considered to be the same.)

Table 3-3 Habitat quality of Box-Gum grassy woodland CEEC to be impacted by the development

Factor	Score	Importance	Reasoning
Site condition	8	1	The area to be impacted north of the camping ground exhibits quite a high diversity of native forbs. Weeds are common but not prolific. The area south of the camping ground has a moderate diversity and similar weediness. Overstorey regeneration was evident in all areas. Areas of the community with a moderate to high diversity within the development area are rare.

Factor	Score	Importance	Reasoning
Site context	6	2	The areas to be impacted are located adjacent to a large barrier, Chaffey Dam, and are also subject to high recreational pressures and grazing. Other high quality areas also exist in the area that are not subject to such intense pressures.
Species stocking rate	7	3	The role of the area to be impacted in sustaining the community within the area to be impacted is considered to be relatively important, however, not essential to the survival of the community. The community is not widespread within the area to be impacted.
Overall habitat quality score	8		

Table 3-4 Starting habitat quality of Box-Gum grassy woodland CEEC to be offset

Factor	Score	Importance	Reasoning
Site condition	7	2	Generally, a moderate diversity of native forbs is present with small patches of high diversity. Lower diversity areas are widespread as are common pasture weeds. Regeneration of the overstorey is evident throughout.
Site context	7	1	The offset site occurs within a landscape that has been cleared for agriculture and is subject to grazing pressures. It provides an important link in habitat between the north and south of the dam, however, similar examples of the community are common throughout the broader area.
Species stocking rate	6	3	The occurrence of the community within the offset area is not considered to be essential to the survival of the community within the broader area, however, some higher quality areas would provide an important source for dispersal. It is anticipated that this value would increase substantially through the offset
Overall habitat quality score	7		

Time over which loss is averted for the offset

As the North-West Offset Site is to be legally secured for the life of the dam, the maximum forecast term of 20 years was selected for this variable.

Future quality with or without offset and time until ecological benefit

The values for these variables are largely based on the management actions proposed as part of the offset plan including the following relevant to Box-Gum grassy woodland:

- Weed control
- Feral and or native herbivore control
- Stock grazing management
- Assisted regeneration

It is considered reasonable that the overall quality of the habitat for the Box-Gum grassy woodland CEEC within the North –West Offset Site could be increased from a value of 7 to a value of 8 over a period of 10

years by maintaining these management actions. Conversely, if current land management practices continue, it is considered likely that the site would potentially degrade in quality predominately due to a continued loss of diversity within the groundcover. Over the 10 year period it is considered likely that the overall habitat quality would degrade to a value of 6.

As the degradation at the North-West Offset Site has been largely caused by weed invasion and grazing and that the management actions described above are ensured to be carried out as part of a management plan for the forecast period, a confidence level of 85% has been applied. This is considered reasonable as it still allows for unforeseen circumstances such as extreme weather events.

Risk of loss of the offset site with or without the offset

The North-West Offset Site is currently utilised for grazing and is situated within a landscape where this is the dominant land use. It is owned by State Water and leased to private landowners and not protected by any conservation agreements or reservation schemes.

There are no known pending mining leases or development applications that apply to the offset site.

As stated in the 'How to use the Offsets Assessment Guide', degradation to the quality of the site due to current management practices and use should not be incorporated into the risk of loss as these factors are incorporated in the quality score, however, it is considered reasonable that future land management practices be taken into account. Given the land is owned by State Water, it is considered unlikely that future land use would lead to the loss of the offset site unless the site was sold, which must be considered as a possibility. An estimate of 10% risk of loss without offset has been applied as the site is unprotected however it is considered unlikely that it would be lost over the forecast term.

With the offset in place, the risk of loss is considered to be very low as the offset would be legally secured for the life of the dam. There is a small chance that the offset may be lost due to unforeseen circumstances. A 5% risk of loss has been applied to account for this.

Considering the extensive amount of field survey undertaken, a good understanding of the site and associated land use pressures has been obtained. The estimated values for risk of loss are considered to be reasonably informed, however, a conservative 70% confidence in these results has been applied.

Results

Utilising the values described above, the OAG returned a 304.18% direct offset for the impact (included as Appendix B).

3.2 PRINCIPLES OF THE EPBC ACT EOP

In order to satisfy the EPBC Act EOP suitable offsets must:

Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action

Booroolong Frog

The Project will directly impact upon approximately 4.77 ha of Booroolong Frog habitat on the Peel River (total area of river channel to be impacted). According to the EPBC Offset Assessment Guide (OAG), an offset of 31.8 ha (or 9 km) of Booroolong Frog habitat will provide a 191% direct offset for the anticipated impact to this species.

There is 23.2 km upstream of the new FSL that is known habitat for the Booroolong Frog, within which 2235 individuals were recorded in summer 2013. It is proposed to establish an offset site immediately upstream of the new FSL for a distance of 9 km (Figure 3-1).

Several allotments constitute the Booroolong Frog Offset Site as listed in Table 3-5. The allotments are contiguous and the offset site is contiguous with the development site. The delineation of the offset site for the Booroolong Frog is further discussed in Section 3.

Table 3-5 Allotments constituting the Booroolong Frog offset site (Lot and DPs supplied by Tamworth Regional Council, 2013)

Lot	DP	Area (ha)	Lot	DP	Area (ha)
10	1125418	216	1	744739	671
7317	1140215	1	297	40575	1
99	755335	1	304	705107	0.3
7008	1060952	6	2	595586	76

The proposed Booroolong Frog Offset Site which would provide a 191% direct offset (as calculated by the OAG), contains Booroolong Frog habitat that is considered to be in similar condition to that to be impacted.

Proposed management measures at the offset site will ensure that the long-term viability of Booroolong Frog habitat at the site is maintained or improved. This can be confidently expected with measures such as restoration and revegetation of the riparian zone, weed control, and stock management. These actions are in response to known threats listed in the National Recovery Plan for the Booroolong Frog and will reduce habitat degradation along the Peel River (NSW OEH 2012). Fossicking has also been identified by Namoi CMA and OEH as a threat to the Booroolong Frog population along the Peel River (Anna Cronin *pers. comm.*; David Coote *pers. comm*.). The Fossickers Way is a touring route in northern NSW which promotes recreational activities such as fossicking. The southern part of the Fossickers Way incorporates the Peel River between Tamworth and Nundle, which includes both the development site and proposed offset site. Measures to discourage and/or promote responsible fossicking will be implemented, adopting an adaptive approach in consultation with Namoi CMA.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The Project will directly impact upon approximately 7.4 ha of vegetation considered to comprise the CEEC. The proposed North – West Offset Site contains approximately 207 ha of vegetation considered to comprise the CEEC in slightly lower condition to that to be impacted providing a 304% direct offset (as calculated by the OAG). Proposed management measures at the offset site will ensure that the long-term viability of the CEEC at the site is maintained or improved.

Be built around direct offsets but may include other compensatory measures

Booroolong Frog

The proposed offset site offers a 191% direct offset for Booroolong Frog habitat to be impacted by the Project with funding to be provided via the Booroolong frog Recovery Program managed by OEH. Management of the offset site will incorporate additional management measures to value-add to those conditions already in place under the current MAs. Monitoring of the offset site will ensure compliance with those management measures and allow for adaptive management.

As a 191% direct offset will be achieved, no other compensatory measures are required in accordance with the EPBC Act EOP.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The proposed North – West offset site offers a 304% direct offset in terms of the same aspect of the environment that is to be impacted (Box-Gum grassy woodland CEEC). A Conservation Agreement (CA) or Conservation Property Vegetation Plan (CPVP) is proposed for securing the direct offset. Either the CA or CPVP would be a legally binding agreement ensuring the site is secured for the life of the dam.

Be in proportion to the level of statutory protection that applies to the protected matter

Booroolong Frog

The offsets required for protected matters with higher conservation status must be greater than those with a lower status. The "endangered" conservation status of the Booroolong Frog was used in the OAG, to give an annual probability of extinction of 1.2%. This is an automated value in the OAG and is an estimate of the average chance that a species or ecological community will be completely lost in the wild each year, given recent rates of decline.

The proposed offset site provides a 191% direct offset for the endangered Booroolong Frog.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The offsets required for protected matters with higher conservation status must be greater than those with a lower status. The proposed offset site provides a direct offset for the CEEC and the same level of statutory protection applies.

Be of a size and scale proportionate to the residual impacts on the protected matter

Booroolong Frog

A total of 9 km of Booroolong Frog habitat has been proposed that offers a 191% direct offset as calculated by the OAG. According to the OAG the size and scale of the proposed offset is suitable.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The proposed offset site offers a 304% direct offset as calculated by the OAG which confirms that the size and scale of the offset is suitable. An offset is not required for this community under the EPBC Act EOP as the Project will not have a significant impact on the community.

Effectively account for and manage the risks of the offset not succeeding

Booroolong Frog

The proposed offset site provides a 191% direct offset. It is recognised in the EOP that direct offsets present a lower risk than other compensatory measures as they are more likely to result in a conservation gain for a protected matter. The direct offset will be managed in perpetuity for biodiversity under a legally binding agreement which provides surety of the offset succeeding for the long-term. An adaptive management plan will be incorporated into the management of the offset site. The Plan will be prepared in close consultation with OEH and approved within 6 months of Project approval. This will ensure that the results of offset site monitoring will guide and improve management over the long-term.

White box-Yellow Box Blakely's Red Gum Grassy Woodland

The proposed offset site provides a 304% direct offset. It is recognised in the EOP that direct offsets present a lower risk than other compensatory measures as they are more likely to result in a conservation gain for a protected matter. The direct offset will be managed in perpetuity for biodiversity under a legally binding agreement which provides surety of the offset succeeding for the long-term.

Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)

Booroolong Frog

The Booroolong Frog Offset Site provides a 191% direct offset for Booroolong Frog habitat on a like for like basis. Management of the offset site will incorporate additional measures to those set out by the current MAs. The establishment of Conservation Agreements will ensure the long-term and effective management and protection of the offset site. Under the current MAs, the offset site is subject to residual threats and is not being managed effectively. Furthermore, these MAs can be terminated with one month notice. The offset site will count toward the offset required under the TSC Act for River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions. No additional compensatory measures are considered to be required to account for any residual impact to Booroolong Frog habitat on the Peel River.

White box-Yellow Box Blakely's Red Gum Grassy Woodland

This Offset Plan has been produced incorporating the BioBanking methodology which is a methodology endorsed by the NSW OEH. As stated in the EOP, a state or territory offset will count toward an offset under the EPBC Act to the extent that it compensates for the residual impact to the protected matter identified under the EPBC Act. The offset site provides a 304% direct offset for the CEEC on a like for like basis.

However, it should be noted that although an offset is not required for this community, this Offset Plan does meet the requirements of an offset site according to the EPBC EOP.

Be efficient, effective, timely, transparent, scientifically robust and reasonable

Booroolong Frog

The proposed Booroolong Frog Offset Site has been determined in accordance with the requirements of the NSW OEH and EPBC EOP. The Offset Plan will be effective, and will be implemented prior to and during the impact arising from the action. Timeframes and responsibilities for implementation of management actions as well as monitoring and auditing requirements will be outlined in the approved Offset site Management Plan. The plan will be adaptive, in order to guide and improve management over the long-term. Management plans will be prepared in consultation with OEH and Namoi CMA and will be approved by OEH. The Booroolong Frog Offset Site will be protected for the life of the dam. Proposed management measures for the offset site are based on input from Booroolong Frog experts and taking into account local knowledge, as well as the objectives of the National Recovery Plan for the Booroolong Frog (NSW OEH 2012). Management measures will therefore be efficient and effective they are designed to reduce known threats operating on the target species on the offset site.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

An Offset Plan has been prepared in accordance with the requirements of the NSW OEH. This Offset Plan is not required to satisfy the direct offset requirements of the EPBC EOP for this community.

The Offset Plan will be effective, being implemented immediately after the impact arising from the action.

Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

Booroolong Frog

A funding agreement is recommended for securing and managing the direct offset. This ensures that the management measures for the frog are implemented for the life of the dam.

During the operational life of the dam, the management and maintenance of the offset site will be auditable through the Project's Offset Site Management Plan which will detail monitoring and reporting requirements (Section 4).

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

A CA or CPVP is proposed within this Offset Plan for securing and managing the direct offset. This ensures that the site is protected for the life of the dam and that restrictions on land use that apply will be attached to the title, as will management measures.

During the operational life of the dam, the management and maintenance of the offset site will be auditable through the project's Offset Site Management Plan which will detail monitoring and reporting requirements.

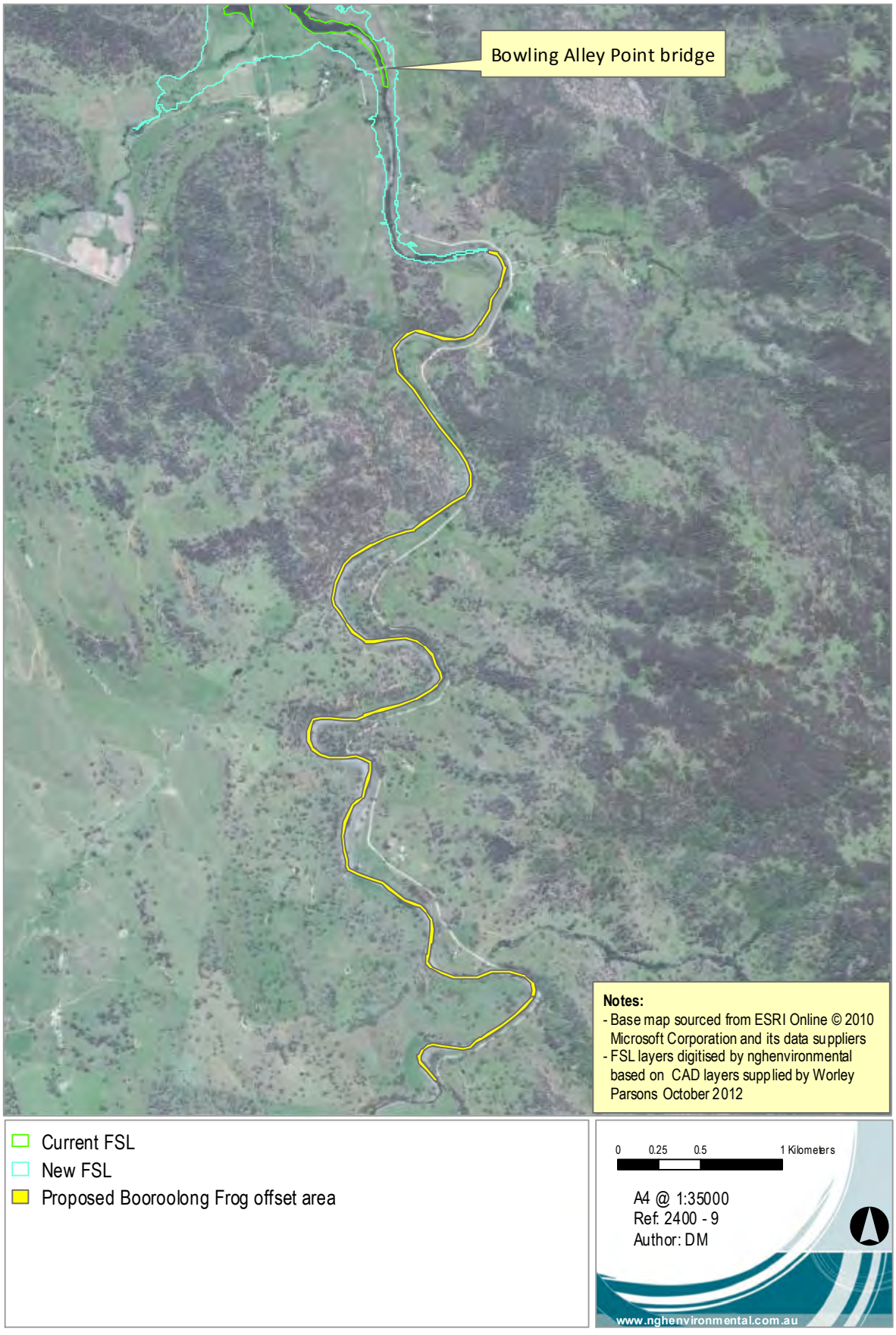


Figure 3-1 Proposed Booroolong Frog Offset Site

4 SECURITY AND MANAGEMENT OF THE OFFSET SITES

4.1 MANAGEMENT VEHICLES

An appropriate management vehicle is required that:

- Secures the site in perpetuity
- Allows for the ongoing management of the site (including how the designated management actions will be funded)

The following six options are considered by OEH as being suitable and acceptable for securing an offset site in perpetuity as outlined in the OEH *Guidance on Appropriate Mechanisms for Securing Biodiversity Offsets* document. Note that option 6 (a CPVP) is only considered acceptable where the first five are not able to be negotiated:

1. BioBanking agreement, a system set up by OEH and offering the most security in terms of ongoing management outcomes
2. Dedication to the public reserve system
3. Conservation Agreement (CA)
4. Trust agreement
5. Planning Agreement
6. Conservation Property Vegetation Plan (CPVP)
7. Incentive funding

4.2 PROPOSED NORTH-WEST OFFSET SITE (AS ASSESSED USING THE BBAM)

It is proposed that a CA will be established over the North-West Offset Site and that it will be attached to the land titles. To ensure that the CA is binding on successors in title, an abstract of the CA will be registered with the Land and Property Management Authority under the *Real Property Act 1900.*

The CA will be a legally binding agreement under relevant Acts and will include management actions associated with the offset area that will apply for the life of the dam. These management actions should be consistent with recommendations specified in this document.

As a CA is attached to the land title, the land owner (currently State Water) is ultimately responsible for funding the management actions required at the offset site and monitoring the effectiveness of their implementation. State Water, as the owner of the site will hold this responsibility.

4.2.1 North-West Offset Site Management Plan

The BCC recommends specific management measures as they apply to each vegetation zone within an assessment. The requirements for the proposed offset site were returned by the offset credit statement (Appendix A) for all vegetation zones as follows:

- Cat and/or fox control

- Exclusion of miscellaneous feral species
- Feral and /or native herbivore control/exclusion (e.g. rabbits, goats, deer etc)

These management measures would be incorporated into a detailed management plan for the offset site. In addition, the following measures would also be undertaken:

- Restriction of public access including fencing and signage
- Weed control (several noxious weeds are widespread across the offset site)
- Management of stock grazing for conservation purposes (this would be conducted in consultation with a local agronomist)
- Assisted regeneration of cleared areas by either stock exclusion or strategic rehabilitation including plantings
- Implementation of controlled burns

The management plan would be prepared and be ready for implementation with the establishment of the offset site. A summary of the proposed management measures, their justification, proposed actions and monitoring are provided in Table 4-1. All management measures are the responsibility of State Water.

For each of the measures described, the detailed management plan for the site would:

- Describe the existing situation
- Detail the proposed management measure including
    - Specific locations where management is required
    - The objectives of the management
    - The proposed actions to achieve the objectives
    - Identify persons responsible
    - Estimated costs and timeframes
- Proposed monitoring regime
- Reporting requirements

At the end of the operational life of the dam, the ongoing management would be the responsibility of the landowner. It is expected that by this time the majority of the required management actions would have been undertaken and ongoing management tasks will largely coincide with routine agricultural activities. Land use restrictions will remain in place on the offset site so that any activities undertaken on the offset site must be compatible with the site's overall function: to improve biodiversity values.

For the duration of the project, the success of the management actions would be audited and reported as part of an annual environmental report to OEH for the project.

Table 4-1 Summary of management measures for the North-West Offset Site

Note, all management measures are the responsibility of State Water

Management measure	Objective	Justification	Action	Timing	Monitoring
Cat and/or fox control	To minimise the presence of cats and foxes within the offset site	Predation by cats and foxes can have serious impacts on the populations of native fauna, particularly threatened species	• Conduct baiting as part of existing pest management strategies (Namoi CMA, Central North LHPA)	• At establishment of the offset site • March and April are considered the most effective months in which to carry out control programs when foxes are dispersing and finding new territory (LHPA) • Baiting will be conducted twice per year as recommended by LHPA.	• Annual inspections of fencing.
Exclusion of miscellaneous feral species **Feral and /or native herbivore control/exclusion (e.g. rabbits, goats, deer etc)**	To minimise the presence of feral species and/or native herbivores	Feral species can compete for resources with native fauna Overgrazing by herbivores can prevent the successful ongoing establishment and persistence of native vegetation and lead to degradation	• Survey to determine the presence of target species.	At establishment of the offset site	Annual inspections of fencing.

Management measure	Objective	Justification	Action	Timing	Monitoring
Restriction of public access including fencing and signage	To minimise adverse impacts resulting from interference by humans	Various activities such as rubbish dumping, recreational vehicle use (motorcycles and 4WDs) and camping (including collection of firewood) can lead to degradation of habitats. Humans are often a vector for weed ingress and spread.	• Install suitable preventative fencing • Install adequate signage • Conduct regular inspections • Take enforcement action where required	• At establishment of the offset site • Ongoing	Annual inspections of fencing, signage and for evidence of human disturbance

Weed control	To minimise the occurrence of weeds within the offset site particularly Weeds of National Significance (WoNS) and listed noxious weeds	Weeds compete with native species and degrade habitats. The offset site has extensive infestations of noxious weeds including Blackberry, Sweet Briar, Hawthorn and Bathurst Burr	• Preparation of a weed management plan which would include:
			  ○ Survey and mapping to identify target locations for weed control
			  ○ Weed control using appropriate methodologies considering target species and landscape context
				• At establishment of the offset site
				• Ongoing as required. The timing of weed control and eradication will depend on the target species to be controlled and the methods to be employed, including the requirement for follow up treatment
				• After the first year, the frequency of weed control activities will be informed by results of monitoring
					• Annual survey to record progress and identify additional target locations
					• Adaptation of the weed management plan if required

Management measure	Objective	Justification	Action	Timing	Monitoring
Management of stock grazing for conservation purposes	To prevent overgrazing and encourage the regeneration of native vegetation Strategic grazing can be utilised for a number of benefits including: - Intermittent grazing to control biomass and open up inter-tussock spaces to allow for the colonisation of native forbs - Timing of grazing to control particular target weed species - Timing of grazing to promote successful overstorey regeneration	The proposed offset site has a history of grazing, with some areas (particularly the lower slopes) more intensively grazed than others. The sudden cessation of grazing may result in detrimental effects in these areas including the vigorous growth of weeds or tall tussock grasses that may smother the growth or prevent the colonisation of other native species. Proper stock grazing management can control weeds and assist in the recovery of previously heavily grazed areas.	• Prepare a grazing management plan in consultation with a qualified local agronomist • Ensure any lease holders comply with the plan	• At establishment of the offset site • Ongoing	Annual inspection by a qualified agronomist and subsequent modification of the plan if required.

Management measure	Objective	Justification	Action	Timing	Monitoring
Assisted regeneration of cleared areas by either stock exclusion or strategic rehabilitation including plantings	To rehabilitate previously cleared areas (particularly those derived from EECs) to be representative of the original vegetation	Much of the cleared areas have resulted from clearing an EEC. Re-establishment of the overstorey in these areas will contribute to the conservation of this community and provide connectivity and habitats for threatened flora and fauna.	• Prepare a vegetation management plan which would include measures to: • Strategically exclude stock from areas that are naturally regenerating • Conduct rehabilitation plantings in more heavily grazed areas where regeneration has been suppressed • Integrate the grazing management plan	• At establishment of the offset site • Ongoing	• Annual inspections of naturally regenerating areas • Regular monitoring and adaptive management of planted areas as required by the vegetation management plan
Implementation of controlled burns	To re-introduce a more natural fire regime and assist in the recovery of degraded areas	Fire is an integral part of the Australian landscape. Many plant species depend on it for successful germination. Fire can also assist in maintaining the balance of species within an ecosystem	• Prepare a fire management plan in conjunction with an ecologist and the local RFS • Conduct burns as per the plan	• At establishment of the offset site • Ongoing	As required by the fire management plan

4.3 PROPOSED BOOROOLONG FROG OFFSET SITE

As the proposed Booroolong Frog offset site of 9 km of the Peel River occurs over multiple private properties (refer Appendix C) and only a proportion of each property would be included within the offset, funding for the implementation of management measures via the Booroolong Frog Recovery Program Recovery is proposed. As the majority of these lands are not owned by State Water the funding proposal would provide the finance to the nominated resource management agency who ultimately is responsible for implementing the management actions, an agreement between the CMA (or other resource management agency) and State Water will need to be negotiated.

The proposed offset site is currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA (5 years of which has passed). Lands currently subject to this MA are displayed in Appendix C. The offset plan provides for additional management measures to those already in place under existing MAs, thereby providing additional conservation benefits to the Booroolong Frog.

The primary way in which the proposed offset plan improves on the current situation is by ensuring that the management and protection of the Booroolong Frog habitat on the Peel River is carried out in the long term. In addition, site specific management plans and monitoring programs will be written to ensure compliance with those management measures and allow for adaptive management. Management plans will be approved by OEH. Table 4-2 outlines all proposed management measures for the offset site and the additional conservation benefit they contribute.

4.3.1 Funding via the Booroolong Frog Recovery Program.

The following outlines the key features of a proposal for a direct funding offset to satisfy both State and Commonwealth offset policies. The proposal is to provide an agreed amount of funding in lump sum payments to the Booroolong Frog Recovery Program. The express intention is that the funding be used to fund direct on-ground measures that will have clear conservation benefits in relation to known threats to the population of Booroolong Frogs on the Peel River. The funding would apply to the 9km offset site defined in the offset plan. All measures outlined in the plan remain relevant.

Outlined below are some suggested parameters for the implementation of the funding offset. The Upper Peel is an identified priority for investment under PAS2, and priority actions have been identified to address habitat loss and fossicking (education, targeted exclusion, management agreements and monitoring). As such, OEH should have a role in determining the nature and location of investment, and especially the more specialist activities like population monitoring.

Prescriptions for on-ground investment will be developed to the satisfaction of OEH and SEWPaC prior to completion of construction but would largely centre around the actions described in Table 4-2.

- An agreed amount of funding would be provided by State Water, with an initial 20% instalment provided at commencement of construction and the remaining amount at completion of construction.
- Funding would contribute directly to the Booroolong Frog Recovery Program as part of the National Recovery Plan for Booroolong Frog in the upper Peel River, which was prepared in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Threatened Species Conservation Act, 1995*, and the Victorian *Flora and Fauna Guarantee Act, 1988*. Therefore the proposed offset strategy will be contributing directly to the recovery strategy for this population.

- Funding would be provided via a Catchment Management Authority or any other approved resource management body and administered by that body.
- NSW OEH lead the recovery program for the species and must retain a concurrence role in determining priorities for expenditure of the funding.
- Obligation to comply with consent conditions remains with State Water.
- Funding provided under the Booroolong Frog Offset Plan must contribute specifically and directly to on-ground management measures that will have a measureable positive conservation benefit to the Booroolong Frog in the Upper Peel River.
- Funding may contribute to education programs where approved by OEH and specifically in relation to raising the profile of the endangered Booroolong Frog and / or discouraging fossicking in important habitats for the species. This would be considered an indirect offset and would therefore constitute a maximum of 10% of the offset package funding according to the EPBC Act Environmental Offsets Policy.
- The funding will provide for monitoring and reporting of the Booroolong Frog population on the Upper Peel River for the duration of impact (life of Chaffey Dam).
- The funding may be used to implement management actions upstream of the area currently managed by Namoi CMA, so that over time, the conservation benefit of the funded management actions can be expanded, if conditions a) and b) have been met.
    a) Monitoring results demonstrate that the Peel River population of the Booroolong Frog has recovered to the extent that intervention and management are no longer required in the Offset area, as agreed by Commonwealth and State Government agencies, Catchment Management Authority, and independent experts with specific knowledge of the species; *and*
    b) The threats known to be operating on the Upper Peel River population of the Booroolong Frog at commencement of funding are shown to no longer be operating on the population.
- Allocation of the funds per management task will be guided by OEH.

4.4 MANAGEMENT AND MONITORING PLAN BOOROOLONG FROG OFFSET

Management measures and monitoring proposed for the Booroolong Frog offset site are provided in Table 4-1. The measures have been recommended in consideration of the National Recovery Plan for the Booroolong Frog, recommendations in NWES (2009), and following consultation with Booroolong Frog experts from OEH and Namoi CMA.

The National Recovery Plan lists 5 threats that are contributing to the decline of the Booroolong Frog. They include:

- **Disease**
- **Habitat Degradation**
- Stream Drying
- Predation by Exotic Predatory Fish
- **Herbicide Use**

The OEH profile for the Booroolong Frog lists ten threats contributing to the decline of the species:

- **Modification of stream channels and loss of cobble banks;**
- **Loss of native streamside vegetation;**
- **Damage to stream margins by stock;**
- Predation of eggs and tadpoles by introduced fish;
- **Weed invasion of streamside habitats, particularly by willows;**
- **Disease - chytrid fungus;**
- **Changes to water quality through sedimentation and use of herbicides or pesticides near streams;**
- Stream drying caused by severe drought or water extraction/impoundment;
- Large amounts of sedimentation due to wild horse activity in the National Park, causing filling of breeding crevices;
- **High density of fossicking and in particular the illegal use of powered sluices and deliberate damming of stretches to facilitate use.**

Following consultation with David Coote and David Hunter of OEH, and Anna Cronin of Namoi CMA, those threats listed in **bold** will be prioritised through the implementation of the management and monitoring measures outlined in Table 4-2, thereby contributing to the recovery of the Booroolong Frog in the Namoi Catchment.

Table 4-3 provides a comparison of the existing measures under the Management Agreements between land holders and the Namoi CMA and how the proposed offset plan provides additional conservation benefit. Management Conditions under the existing management Agreements are provided in Appendix C.

Table 4-2 Management measures and monitoring proposed for the Booroolong Frog Offset Site.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
RIPARIAN PROTECTION AND RESTORATION					
Threat Mapping					
Detailed mapping of the distribution and extent of threats operating on the Booroolong Frog in the 9km offset site on the Peel River and adjacent riparian vegetation.	To provide a baseline for all subsequent management activities and provide guidance for all management activities and clearly identify priority areas for action.	Undertake detailed mapping of threats for 9km offset site and adjacent riparian zone. Produce maps showing each threat as a separate layer (weeds, stock access, fossicking activities, condition of riparian zone vegetation, condition and extent of fencing).	Threat mapping to commence within 6 months of commencement of construction - to be conducted at the outset of the project as a one-off activity. Subsequent monitoring under the weed and vegetation management plans will identify areas in which threats continue to occur (see below).	State Water to provide agreed funding for action by land resource manager	Results of baseline mapping and revegetation activities will be reported in the first annual report. Results of revegetation activities will be audited annually against the objectives outlined in the vegetation management plan. Corrective actions required to address non-conformances will be outlined. No detailed mapping of threats to the Booroolong Frog on the Peel River has been conducted to date. Threat mapping is recommended by OEH and Namoi CMA. Baseline threat mapping will allow informed prioritisation of funding for onground management and ensure effort and expenditure is targeted to areas most in need, where threat levels are highest.
Revegetation and assisted natural regeneration of the riparian zone.					
Rehabilitate and revegetate the riparian zone of the offset site using a combination of active planting and assisted regeneration. Carried out in conjunction	The aim of the riparian restoration is to restore a healthy riparian zone (natural floristic and structural	Prepare Vegetation Management Plan (VMP) that details: • Rehabilitation and revegetation activities within adjacent riparian	Revegetation activities to commence within 6 months of commencement of construction. Threat mapping will be completed prior to	State Water to provide agreed funding for action by land resource manager	**No active riparian restoration is undertaken under current Management Agreements.** Baseline mapping will be conducted along the length of the offset at the commencement of the offset plan. This will provide data on the areas of stream bank that require replanting, or other forms of assisted regeneration, other than weed

[6] The preparation of all management plans is currently the responsibility of State Water, however those responsible for implementing those plans will be detailed in the Offset Site Management Plan. All Management Plans will be prepared and approved in consultation with OEH.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
with weed control activities and stock management (see below).	composition) that will provide a functional ecological buffer to the in-stream environment. This will reduce erosion and sediment impacts to the stream, improve water quality and provided a natural deterrent to stock and human access.	zone. Assisted natural regeneration will include weed removal. Plantings will be saplings of species naturally occurring with thin the riparian zone. • Establish a minimum of 2 20m x 20m monitoring plots per 1 km of offset site (1 per bank). • Monitoring will be conducted annually to measure restoration success. • Monitoring results will be reported annually and will outline corrective actions required.	finalisation of VMP. Expenditure of funding contributions to riparian restoration will reduce over time as riparian vegetation establishes.		removal and control. This constitutes one of the most important recovery actions for the conservation of the Booroolong Frog (Action 3.1, NSW OEH 2012) Recommended by Phil Spark (NWES 2009) and David Coote (OEH). Active revegetation will increase the extent and rate of recovery of riparian vegetation, which will have a direct positive impact on stream health and Booroolong Frog habitat. Restoration of the riparian zone will enhance the overall habitat quality of the in-stream environment by improving the natural buffering and filtration role of the riparian area for the stream. It will also have the effect of deterring human and vehicular access to the stream, thus reducing the threats of trampling, sedimentation and erosion and spread of chytrid.
Weed control					
Control and eradicate exotic trees and shrubs, and other environmental weeds, which have the potential to dominate the riparian zone (e.g. Willows, Blackberry). Weeds, particularly large	To assist with the restoration of the riparian zone (as above). For large woody weeds such as willow, this will reduce any	Prepare Vegetation Management Plan (VMP) detailing: • Areas and species requiring weed control, as per results of baseline threat mapping.	Baseline weed surveys (threat mapping) will be conducted along the length of the offset site within six months of commencement of construction. This will allow identification and prioritisation of control	State Water to provide agreed funding for action by land resource manager	No data is publicly available on extent to which weeds have been brought under control, which species and in what areas. According to Anna Cronin of Namoi CMA, woody weed control has been successful, but needs to be ongoing. Under the proposed offset plan results of weed control will be monitored and reported at a minimum annually. Over time the cumulative benefits of weed control will result in improved habitat quality

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
woody weeds such as willows, are known to create excessive shading and surface roots fill rock crevices required by the Booroolong Frog for oviposition.	overshading.	• Methods and timing of weed control activities Control and eradication of exotic trees, shrubs and vines from within the riparian zone, particularly willows, poplars, elms, Pyracantha sp., Cotoneaster, tree of heaven, blackberry, honey locust etc. Establish a minimum of two 20m x 20m monitoring plots per 1 km of offset site (1 per bank. Monitoring will be conducted annually to measure success of weed control activities Monitoring results will be reported annually and will outline corrective actions required.	areas and species. Qualified weed control contractors will be engaged to carry out weed control works. Weed removal to commence within 6 months of completion of construction. The timing of weed control and eradication will depend on the target species to be controlled and the methods to be employed, including the requirement for follow up treatment. After the first year, the frequency of weed control activities will be informed by results of monitoring. Monitoring will be carried out to measure the response to weed management and identify any outbreaks following weed removal or suppression. Weed distribution and abundance should be		for the Booroolong Frog. Weed control is Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Funding contributions to weed control will reduce over time as riparian vegetation establishes and weed infestations are brought under control. Weed control activities will be ongoing, ensuring cumulative conservation benefits.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
			remapped and control methods and timing updated accordingly. Monitoring will be conducted annually Monitoring reports will be provided to OEH annually.		
Stock management					
Disturbance to the riparian zone and stream bed by stock causes erosion, increased sediment loads and trampling of frogs and in stream habitat. Increased sediment loads can change the rocky riffle zones by filling the crevices under rocks within the stream bed, eliminating the habitat that provides protection for the Booroolong Frog and their eggs (NWES 2009). However, an appropriate level of grazing can contribute to the suppression of weeds. Thus an appropriate grazing regime is required	To remove threats to Booroolong Frog habitat that result from the impacts of stock activity in the riparian zone and in-stream habitats. To establish and maintain a grazing regime that is conducive to weed control without having adverse impacts on Booroolong Frogs and their habitat.	• Restricting location and timing of stock access to the riparian zone according to the CAs. • Determine appropriate grazing regime in relation to weed suppression. • Compliance with stock access controls will be audited annually during vegetation monitoring and reported within the Riparian Management Plan monitoring report. • Fencing on river bank of crown land	Threat mapping to identify areas of continuing stock access within a year of commencement of construction. Ongoing for life of dam.	State Water to provide agreed funding for action by land resource manager	Significant benefit to the frog would be provided by tighter restrictions or complete exclusion, and allowance made for compliance activities within the areas to ensure stock management is undertaken as agreed. Phil Sparks has commented that cattle were evident along the entire stretch of the Peel River that was sampled (25 km). Numbers and presence were not formally recorded. Under the proposed Offset Plan, stock exclusion will be increased through fencing and monitoring during the frog breeding season to ensure compliance. Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Recommended by Phil Spark (NWES 2009), Namoi CMA and OEH.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
within the riparian zone.		and TSRs to exclude entry of cattle into the river and restrict grazing for periods that are beneficial to the Frog habitat and breeding. • A grazing regime should be maintained that enables weed control.			
Prevention of fossicking					
Fossicking activities (including accessing stream banks and sluicing) cause impacts to riparian and in stream environments such as reduced bank stability, erosion, sediment disturbance, increased turbidity, disturbance and removal of rock habitats, water quality impacts and may result in the increased proliferation of weeds. This may have a significant impact on this species (NSW OEH 2012).	Increase community awareness and involvement in the Booroolong Frog Recovery program. Use signage and public awareness activities to increase profile of Booroolong Frog and discourage fossicking within the offset site.	• install bollards to discourage sluicing at key sites where the species occurs and where stream is accessible. • Install signage at popular fossicking locations. • distribute educational pamphlets communicating the impacts of fossicking and sluicing on Booroolong Frog habitat. • Maintain signage	Within 6 months of completion of construction, following completion of threat mapping. Ongoing for life of dam.	State Water to provide agreed funding for action by land resource manager	The Recovery Plan identifies fossicking as representing a possible conflicting use in the Namoi Catchment (NSW OEH 2012). Identified as a threat to Booroolong Frogs along the Peer River by OEH and Namoi CMA.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
		and audit compliance • Report on non-compliance and corrective actions required in annual Riparian Management Plan monitoring report.			
Limit water extraction					
During drought periods; maintaining stream flow and pools for as long as possible will assist the Booroolong Frogs to survive droughts.	To ensure no loss of habitat for the Booroolong Frog within the offset site, particularly pools that provide refuge during drought. Maintain habitat availability year round.	The location of surface water extraction points will be reviewed in 2015 to assess whether current extraction practices are exacerbating threats to the species.	Ongoing	OEH during the Water Sharing Plan review	Recommended by Phil Spark (pp.4, NWES 2009) Stream drying is a major threat identified in the Recovery Plan (pp.8, NSW OEH 2012)
Limit herbicide and pesticide use					
The active ingredient in many formulations, glyphosate, and the surfactants, has been shown to be toxic to frogs and tadpoles. Limit chemicals used to those on an approved list, and limit application methods to approved and	Maintain and improve habitat condition and quality	• Provide a list of approved chemicals within the VMP, including recommended methodology • Provide a list of alternative methods within the VMP	At establishment of the offset site Ongoing	State Water to provide agreed funding for action by land resource manager	Identified as a potential contributing factor for the decline of the Booroolong Frog in the Recovery Plan (pp.9, NSW OEH 2012). Recommended by Phil Spark (pp.5, NWES 2009) and Namoi CMA.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
recommended techniques to minimise potential impacts					
Fox control					
Foxes may be a threat to the Booroolong Frog (Clemann 2003). They are thought to prey on adult frogs.	Reduce predation threats to the Booroolong Frog and other fauna	Conduct fox baiting in coordination and with the assistance of LHPA and/or Namoi CMA	March and April are considered the most effective months in which to carry out control programs when foxes are dispersing and finding new territory (LHPA) Baiting will be conducted annually as recommended by LHPA.	State Water to provide agreed funding for action by land resource manager	Fox control is best undertaken by coordinated baiting in and around offset area- again, needs to be ongoing. Note, it is not known whether fox baiting has been undertaken in the project area in the past 5 years, other than the one off event at the start of the management agreements. Recommended by Phil Spark (pp.53, NWES 2009). Will benefit other biodiversity matters and is easy and cost effective to implement.
Monitoring					
Booroolong Frog surveys will be carried out within the offset site commencing in summer 2013.	Identify the effectiveness of the proposed management measures. Identify population trends in relation to stream drying and riparian restoration. Enable adaptive management if any problems arise. Results will contribute to our	Systematic surveys for the Booroolong Frog will be carried out by OEH approved personnel using OEH approved survey methodology. Surveys will be conducted during the peak activity period of the Booroolong Frog.	Monitoring is to be conducted every 2nd year between October and March.	State Water to provide agreed funding for action by land resource manager	Recommended in the Recovery Plan (Action 4.1, NSW OEH 2012). • Recommended by Phil Spark (pp.53, NWES 2009). Monitoring will be audited through the preparation of annual reports • Monitor stream and riparian zone condition during monitoring activities • This response of the Booroolong frog population to the active management will be measurable over time. This will have a long term conservation benefit to the species.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
	understanding of the decline and recovery of the Booroolong Frog.				
The disease Chytridiomycosis is contributing to the historic and continued decline of the Booroolong Frog, and is present within the population along the Peel River.	Reduce the transmission of potentially harmful pathogens both within and among populations of the Booroolong Frog	Monitoring of the Booroolong Frog will adhere to these hygiene protocols Adhere to strict quarantine protocols, such as those outlined in the 'Hygiene protocols for the control of disease in frogs' (NSW NPWS 2001). Surveys for the Booroolong Frog will record the presence of symptomatic individuals.	Commencing Summer 2013 and ongoing whenever frog surveys are carried out.	Persons carrying out frog surveys.	Regular frog surveys are not currently undertaken as part to the Namoi CMA MA. Any projects involving the handling of frogs should incorporate protocols to minimise the potential spread of harmful pathogens among individual frogs Infection of frogs by amphibian chytrid causing the disease chytridiomycosis is listed as a KTP (OEH & SEWPaC).
Preparation of Management Plans	Approved management plans will ensure that the objectives of management actions for the offset site are clearly outlined and that monitoring and reporting	Prepare, in collaboration with OEH the following Management Plans • Offset Site Management, • Vegetation and • Booroolong Frog.	Prior to completion of construction	State Water to provide agreed funding for action by land resource manager	There are currently no physical, approved management plans for the NCMA Management Agreements that can be reviewed and updated. Our proposal incorporates a range of issue specific adaptive management plans that will be approved prior to implementation, reviewed annually and updated to take account of monitoring results.

Description	Objective	Action	Timing	Responsibility [6]	Additional Conservation Benefit over existing Management Agreements
	timeframes and responsibilities are defined. Details of the content of the management plans are provided in Section 5.				

Table 4-3 Demonstration of Additional Conservation Benefit from proposed Offset Plan, relative to existing Management Agreements.

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
Clearing of native vegetation must be undertaken in accordance with the Native Vegetation Act.	Assumed to have complied.	Maintain legal compliance.	Penalties for breaches.
All fencing is to be maintained in a stock proof condition for the life of this agreement. To protect wildlife, fencing erected as part of this project will not have a top strand or a bottom strand consisting of barbed wire. Electric fence wires will not be placed closer than 30cm to the ground.	Fencing was part of some contracts between NCMA and landholders. Current condition of fences and length of offset fenced is unknown.	Maintain and monitor.	The *implementation of management measures* will be extended beyond the next 5 years to the life of the dam. The funding agreement for the offset site cannot be terminated as is the case with current arrangements. ***Maintenance*** of fencing will be ongoing for the life of the dam. Long term maintenance of fencing provides protection of the offset site against the key threatening process of stream degradation in the long term. This will provide ***long term protection*** of the riparian zone and stream environment from the adverse impacts of stock trampling. Ultimately this will result in greater breeding success of the frogs as important oviposition sites in rock crevices will not be lost and impacts of sedimentation will be reduced. Improved breeding success over the long term will improve the resilience of the population to stochastic events such as drought and flood. ***Additional fencing*** of crown land will occur under the proposed offset. Fencing will be maintained for the life of the dam. ***Comprehensive threat mapping*** will be conducted at implementation of offset plan. This will establish a baseline against which progress can be measured in the long term. Threat mapping will include an audit of fence condition and maintenance needs. Thereafter fence condition and maintenance needs will be reviewed annually and reported in monitoring reports.

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
Off-stream alternative stock watering schemes must be maintained in an operational condition for the term of this Agreement.	Unknown. No data available.	Maintain and monitor	The *implementation of management measures* will be extended beyond the next 5 years to the life of the dam. The funding agreement for the offset site cannot be terminated as is currently the case with current arrangements.
Surface water extraction will be limited during periods of drought and low flows to maintain water pools in the project area.	Unknown. No data available.	Maintain and monitor	Comprehensive habitat mapping will be undertaken at the implementation of the offset plan. Results will be correlated with Booroolong frog survey results from summer 2012/2013 and summer 2013/1014. This will allow a better understanding of the importance of the pool habitats to the Booroolong Frog. The location of surface water extraction points will be reviewed in 2015 to assess whether current extraction practices are exacerbating threats to the species.
Surface water extraction or stock watering laneways will be located at pools, as far as practicable from Booroolong Frog habitat of riffles and small rapids.	Unknown. No data available.	Maintain and monitor	As above.
Livestock access to the project area will not exceed 14 days per annum. Livestock will be excluded from the project area for the period 1st October to 28th February inclusive.	Stock have been excluded from the TSR (Anna Cronin *pers comm*.). Phil Sparks has commented that during surveys carried out in the Booroolong frog breeding season (Dec 2012 to Feb 2013) cattle were evident	Maintain and monitor.	***Comprehensive threat mapping*** will be conducted at implementation of offset plan. This will establish a baseline against which progress can be measured in the long term. Threat mapping will include an assessment of the extent of uncontrolled cattle access and the locations where access is occurring. Additional audits will be carried out in September each year to ensure compliance immediately prior to the breeding season. The *implementation of management measures* will be extended beyond the next 5 years to the life of the dam. The funding agreement for the offset site cannot be

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
	along the entire stretch of the Peel River that was sampled (25 km).		terminated as is currently the case with current arrangements. An additional audit will be undertaken during the frog breeding season surveys each year to ensure compliance. Disturbance by stock creates erosion and increased sediment loads. Increased sediment can change the rocky riffle zones by filling the crevices under rocks within the stream bed, eliminating the habitat that provides protection for the Booroolong Frog and their eggs (NWES 2009). Strict removal of cattle will reduce erosion in the long term.
The Funding Recipient is not to remove any standing or fallen dead timber from the project area except to allow for the construction or maintenance of tracks and fences where clearing is to the minimum extent necessary and any necessary approvals have been granted.	Unknown. No data available.	Maintain and monitor.	A **tighter restriction** of timber removal in the riparian zone provides greater protection and conservation benefit through reducing the level of degradation in riparian areas, specifically the erosion and sedimentation impacts related to timber removal. The **riparian area protected under the proposed offset is greater** than that protected under current management agreements.
Fertiliser will not be applied within the project area.	Unknown. No data available.	Maintain exclusion and monitor water quality.	**Long-term protection** of water quality in Booroolong Frog habitat.
Gravel extraction will not occur within the project area.	Unknown. No data available.	Maintain and monitor	**Long-term protection** against erosion and sediment impacts to Booroolong Frog habitat as well as direct loss of habitat.
Machinery access will be restricted to designated tracks.	Unknown. No data available.	Maintain and monitor. Additional fencing and bollards will be put in place to ensure machinery access is limited in riparian areas.	Long term controls on disturbance to riparian areas will result in improved condition. In turn regenerated riparian vegetation will deter human and vehicular access.
No active burning will occur within the	Unknown. No data	Maintain and monitor	Long term protection of riparian vegetation.

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
project area.	available.		
No exotic fish releases are permitted within the project area.	Exotic fish control has been attempted by Namoi CMA with dubious results (Anna Cronin, *pers. comm*.).	Restrictions on stocking of Carp into the Peel River will be maintained. Based on advice from OEH, is not considered feasible, achievable or cost-effective to control carp in the river.	Predatory fish are recognised as a threat to the Booroolong Frog as they prey on tadpoles and eggs. Long term restrictions on the stocking of Carp are an important control.
Landholder will not move or remove rocks from the project area.	Unknown. No data available.	Maintain this condition.	Long term protection of in-stream habitat for Booroolong Frogs.
Landholder will avoid handling frogs in a manner which may spread Chytrid fungus. Namoi CMA can provide a copy of the NPWS 'Hygiene Protocol for the control of Disease in Frogs' upon request.	It is not known whether these pamphlets were requested or provided.	Maintain this condition.	Importance of frog disease and appropriate protocol for handling will be incorporated into the proposed education program.
All signage (if provided by Namoi CMA) will be maintained and any damage will be reported to Namoi CMA.	No data available as to what signage was installed as part of the current management agreements.	Additional signage will be installed	Whilst an indirect measure, raising the profile of the Booroolong Frog and the importance of reducing threats to its survival.
The Funding Recipient is to control all infestations of pests and weeds within the project area as per the Offset and Vegetation Management Plans.	We have been unable to gain access to the Pest and Weed Management Plan referred to by Namoi CMA and no weed monitoring data has been made available.	Continue weed control and feral pest management. A Vegetation Management plan will be produced.	Refer to **Table 4-2** above for weed management measures. The key additional conservation benefit is that the weed control benefits will be ongoing and cumulative. Efforts will be target in Conduct baseline weed mapping and formal monitoring plots will be established.
Control activities must be in accordance	Unknown. No data	Maintain this condition.	

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
with relevant legislation governing the use of pesticides and herbicides	available.		
The Funding Recipient is to restrict any disturbance of native vegetation required to conduct the weed treatment to the minimum extent necessary.	Unknown. No data available.	Maintain this condition.	
The Funding Recipient may only use chemicals registered under the Pesticides Act 1999 for use around waterways for weed control in the project area.	Unknown. No data available.	Maintain this condition.	
The Funding Recipient or subcontractor must keep records in line with the Pesticides Act 1999 and a copy must be provided to the Namoi CMA upon request.	Unknown. No data available.	Maintain this condition.	
Use of chemicals within the stream channel (streambank toe to streambank toe) will not occur from dates 1st October to 28th February inclusive.	Unknown. No data available.	Maintain this condition.	
Prevention of fossicking	Unknown. No data available.	Increase community awareness and involvement in the Booroolong Frog recovery program Install bollards to discourage sluicing at key sites where the species	The Recovery Plan identifies fossicking as representing a possible conflicting use in the Namoi Catchment (NSW OEH 2012). Bollards will be erected Threat mapping will identify locations where bollards must be erected or fences repaired to prevent access to the creek. Educational material

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
		occurs and where streams are accessible Install signage at popular fossicking locations and distribute educational pamphlets communicating the impacts of fossicking and sluicing on Booroolong Frog habitat.	Liasion with Tamworth Council Reduce erosion Reduce sedimentation fossicking an adaptive approach in consultation with Namoi CMA will have to be undertaken.
Carp Control	Exotic fish control has been attempted by Namoi CMA with dubious results (Anna Cronin, *pers. comm*.).	Restrictions on stocking of Carp into the Peel River will be maintained. Based on advice from OEH, is not considered feasible, achievable or cost-effective to attempt carp removal or control. DPI also believe it's useless to try to control Carp and given the lack of overlap in habitat preference between Carp and frog their presence is not an issue. (Anna Cronin pers. comm. 31 Jan 2013	Predatory fish are recognised as a threat to the Booroolong Frog. **Long term** restrictions on the stocking of Carp are an important control.
Fox control	Early in the program some limited fox control was undertaken in conjunction with LHPA. This was not followed up and Anna Cronin of NCMA was unaware of any further fox control	State Water to provide agreed funding for action by resource manager to undertake annual fox control.	There is some anecdotal evidence that foxes prey on adult Booroolong frogs. Fox control is not currently being carried out under the NCMA management agreements and there are no plans to do so.

NCMA MANAGEMENT MEASURES RELEVANT TO BOOROOLONG FROG	NCMA ACTUAL	PROPOSED MEASURE UNDER THIS OFFSET PLAN	ENHANCEMENT/ ADDITIONAL CONSERVATION BENEFIT PROVIDED BY THIS OFFSET PLAN
	activities.		
Adhere to strict quarantine protocols, such as those outlined in the 'Hygiene protocols for the control of disease in frogs' (NSW NPWS 2001)	Reduce the transmission of potentially harmful pathogens both within and among populations of the Booroolong Frog		The disease Chytridiomycosis is contributing to the historic and continued decline of the Booroolong Frog, and is present within the population along the Peel River. Any projects involving the handling of frogs should incorporate protocols to minimise the potential spread of harmful pathogens among individual frogs.

5 COMPLIANCE MONITORING AND MANAGEMENT OF THE OFFSET SITE

The offset sites will be managed as part of the offset site management plan (OSMP) to maintain and enhance the ecological values of each ecological community, whilst conserving threatened flora and the associated habitat of native fauna.

The OSMP would provide the following:

- The aims of the management and monitoring
- Clear maps showing areas under management, for each category of threat management
- Timeframes and reporting requirements
- Thresholds for adaptive action
- Site Management responsibilities.
- Corrective actions for non-compliance on audited aspects
- Background on general Booroolong Frog ecology
- Background on Booroolong Frog habitat and resources in context within the Upper Peel River catchment
- Prescribe any restrictions on activities that are not to occur during specific breeding season times
- Prescribe an installation, maintenance and monitoring schedule for any infrastructure (signage, fencing etc)
- Document a Monitoring Program on the Booroolong Frog population. The monitoring program will included detail on appropriate survey methodology timing and expertise required and will be developed in consultation with and approved by OEH
- Document a Monitoring Program on the weed management activities, including location of vegetation monitoring plots, data collection requirements, reporting requirements
- Provide a Reporting Program on all monitoring outcomes, including provision of annual monitoring report submitted to the OEH
- Provide for revision and update of the monitoring program if required on the basis of expert recommendations to reflect any results of the monitoring work
- Include an Implementation Schedule which details timing and responsibilities for all aspects of the Management Plan

The management and monitoring measures to be implemented under the funding agreement would include:

- Fixed vegetation plots within riparian vegetation to monitor and document success of riparian restoration and weed removal activities.
    - Monitoring will be conducted annually. Annual Monitoring Reports will be provided to OEH.
    - Targets and thresholds are to be set in consultation with and in agreement with OEH.
- Annual population and habitat monitoring in the Booroolong Frog Offset Site of the Upper Peel River as prescribed in the National Recovery Plan for Booroolong Frog, including documentation of the distribution of all life stages along the occupied habitat.

  - Monitoring will be carried out to measure the response to weed management and identify any outbreaks following weed removal or suppression. Weed distribution and abundance should be remapped and control methods and timing updated accordingly.
  - Monitoring by landholders or public land managers according to the agreements in place. This would include an assessment of fencing, bollards, signage and any other exclusion or deterrent measures in order to determine maintenance requirements.
  - Adherence to hygiene protocols for Chytrid and collection of data on symptomatic individuals during annual frog monitoring.
  - Monitoring would be conducted at different scales depending on the variable being measured.
- An annual monitoring report will be produced outlining:
  - Fencing, maintenance needs.
  - Stock access – breaches, related habitat disturbance, weed presence
  - Progress in riparian restoration
  - Weed control progress
  - Report on any vertebrate pest control activities
  - Results of Booroolong Frog surveys, including detailed maps and information on life stages.
  - Evidence of fossicking activities, erosion

6 CONCLUSION

This Offset Plan has been developed to satisfy NSW and Commonwealth Government requirements with regard to offsetting, specifically:

- The DGRs and supplementary DGRs issued by DP&I
- OEH SSI Interim Offsets Policy
- OEH's Principles for the use of biodiversity offsets in NSW
- EPBC Act Environmental Offsets Policy

The Offset Plan demonstrates that the Project impacts can be adequately compensated for by the protection and management of two proposed offset sites.

In offsetting the vegetation types to be cleared, the BBAM has been utilised and with consideration to the OEH SSI Interim Offsets Policy and Principles for Biodiversity Offsets in NSW, the proposed offset site is considered adequate. The proposed offset site is available and can be secured for the life of the dam.

Ecosystem credits for River Oak riparian woodland and species credits for the Booroolong Frog are also required under the BBAM, however, an additional offset site has been calculated for this community and species.

As documented in the Terrestrial and Aquatic Flora and Fauna Assessment, no significant impact to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC will result from the Project. In accordance with the EPBC Act EOP, no offset is required for this community. However, the offset proposed under the NSW Principles for the use of offsets policy for the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC incorporates a large area of the EPBC listed CEEC. As such, information is provided here to demonstrate the conservation outcomes for the

CEEC through implementation and management of the proposed offset site according to the EPBC Act EOP.

In relation to the Booroolong Frog offset, the EPBC OAG has been utilised to propose an adequate offset site immediately upstream of the development site. Negotiations are underway to establish a funding agreement with CMA for implementation of the Booroolong Frog Recovery Program along a 9 km reach of the Peel River which is known Booroolong Frog habitat. The funding agreement will be a legally binding agreement ensuring the site is managed for the life of the dam. The funding agreement will provide security and longevity of protection and improvement measures aimed at protecting important habitat for the Booroolong frog. Management of the offset site will continue and build on to the existing management measures to provide comprehensive and long term management of the offset site Monitoring of the offset site will ensure compliance with those management measures and allow for adaptive management. The offset package as a whole is considered to satisfy all State and Federal requirements.

Proposed measures for management of the offset sites, to ensure that its biodiversity values are protected and maintained for the life of the dam, have been provided and will be developed further in detailed management plans prior to completion of construction.

APPENDIX A BIOBANKING ASSESSMENT METHODOLOGY CREDIT STATEMENTS

A.1 DEVELOPMENT SITE

BioBanking Credit Calculator

NSW GOVERNMENT Office of Environment & Heritage

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 3/05/2013 Time: 3:42:13PM Tool version: 2.0

Development details

Proposal ID:	0035/2013/0467D
Proposal name:	Chaffey Dam Augmentation
Proposal address:	Chaffey Dam Nundle NSW 2340
Proponent name:	State Water Corporation
Proponent address:	PO Box 1018 Dubbo NSW 2830
Proponent phone:	1300662077
Assessor name:	Brooke Marshall
Assessor address:	PO Box 470 Bega NSW 2550
Assessor phone:	6492 8333
Assessor accreditation:	0035

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	89.58	4,617	Yes
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.11	218	No
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	62.77	3,511	Yes
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	0.54	36	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	323	No
Total	161.71	8,705	

Credit profiles

1. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	218
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Apple Box valley herbaceous woodland mainly of the NSW western slopes (Benson 275), (CW207) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Cabbage Gum open forest or woodland on flats of the North Coast and New England Tablelands, (HU526) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the	Peel - Namoi Wollemi (Part A) Yengo - Hunter/Central Rivers Wyong Armidale Plateau Stanthorpe Plateau

New England Tablelands, (NA113) Black Sallee grassy woodland of the New England Tablelands, (NR113) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tablelands, (NR127) Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tablelands, (NR131) Candlebark - Manna Gum woodland of the New England Tablelands, (NR146) Fuzzy Box open forest of the New England Tableland Bioregion (Benson 203), (NR165) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tablelands and North Coast, (NR186) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tablelands, (NR214) Snow Gum - Black Sallee grassy woodland of the New England Tablelands, (NR237) Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tablelands, (NR238) Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest of the eastern New England Tablelands and North Coast, (NR239) Snow Gum woodland of the New England Tablelands and North Coast, (NR240) Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tablelands, (NR282) Yellow Box - Grey Box - Red Gum woodland of the central eastern parts of the New England Tablelands, (NR283)	

2. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	36
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Cabbage Gum open forest or woodland on flats of the North Coast and New England Tablelands, (HU526) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tablelands, (NA113) Black Sallee grassy woodland of the New England Tablelands, (NR113) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the	Peel - Namoi Yengo - Hunter/Central Rivers Wyong Armidale Plateau Stanthorpe Plateau

New England Tablelands, (NR127) Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tablelands, (NR131) Candlebark - Manna Gum woodland of the New England Tablelands, (NR146) Fuzzy Box open forest of the New England Tableland Bioregion (Benson 203), (NR165) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tablelands and North Coast, (NR186) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tablelands, (NR214) Snow Gum - Black Sallee grassy woodland of the New England Tablelands, (NR237) Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tablelands, (NR238) Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest of the eastern New England Tablelands and North Coast, (NR239) Snow Gum woodland of the New England Tablelands and North Coast, (NR240) Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tablelands, (NR282) Yellow Box - Grey Box - Red Gum woodland of the central eastern parts of the New England Tablelands, (NR283)	

3. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	4,617
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tablelands, (NA144) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226) White Cypress Pine - Silver-leaved Ironbark grassy woodland of the Nandewar Bioregion, (NA230)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers

4. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	3,511
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tablelands, (NA144) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226) White Cypress Pine - Silver-leaved Ironbark grassy woodland of the Nandewar Bioregion, (NA230)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers

5. River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191)

Number of ecosystem credits required	323
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191) River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78), (NA193)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers Pilliga - Central West

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Booroolong Frog	Litoria booroolongensis	4.77	119

A.2 OFFSET SITE

BioBanking Credit Calculator

Office of Environment & Heritage

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 3/05/2013 Time: 11:12:45AM Tool version: 2.0

Biobank details

Proposal ID:	0035/2013/0507B
Proposal name:	Chaffey Dam Offsets
Proposal address:	Chaffey Dam Nundle NSW 2340
Proponent name:	State Water Corporation
Proponent address:	PO Box 1018 Dubbo NSW 2830
Proponent phone:	1300662077
Assessor name:	Brooke Marshall
Assessor address:	PO Box 470 Bega NSW 2550
Assessor phone:	6492 8333
Assessor accreditation:	0035

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	76.60	906	No
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	48.98	594	No
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	91.29	874	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	19.98	192	No
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	53.30	554	No
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	557.31	6,436	No
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	142.75	1,465	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	3.50	25	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	1.60	14	No
Total	995.31	11,060	

Credit profiles

1. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	874
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

2. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	6,436
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

3. White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226)

Number of ecosystem credits required	554
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

4. White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226)

Number of ecosystem credits required	1,465
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

5. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	906
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

6. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	594
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

7. River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191)

Number of ecosystem credits required	206
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

8. River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191)

Number of ecosystem credits required	25
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Border Thick-tailed Gecko	Underwoodisaurus sphyrurus	2.00	12
Booroolong Frog	Litoria booroolongensis	31.82	112

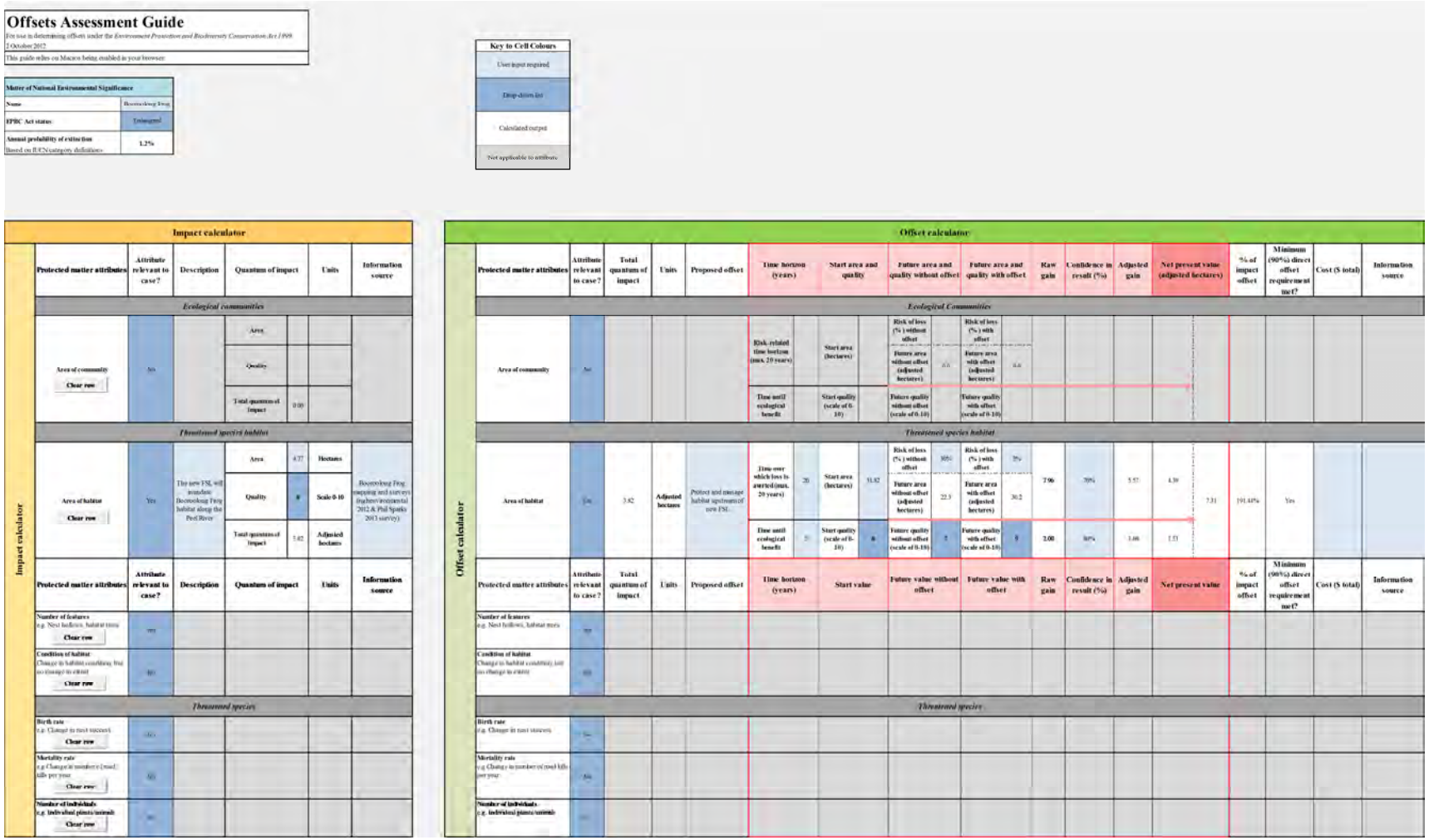
Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Cat and/or Fox control
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Exclude miscellaneous feral species
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Cat and/or Fox control
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Exclude miscellaneous feral species
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Cat and/or Fox control
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Exclude miscellaneous feral species
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Cat and/or Fox control
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Exclude miscellaneous feral species
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)

APPENDIX B EPBC OFFSETS ASSESSMENT GUIDE OUTPUTS

B.1 BOOROOLONG FROG



Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*.
1 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Booroolong Frog
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

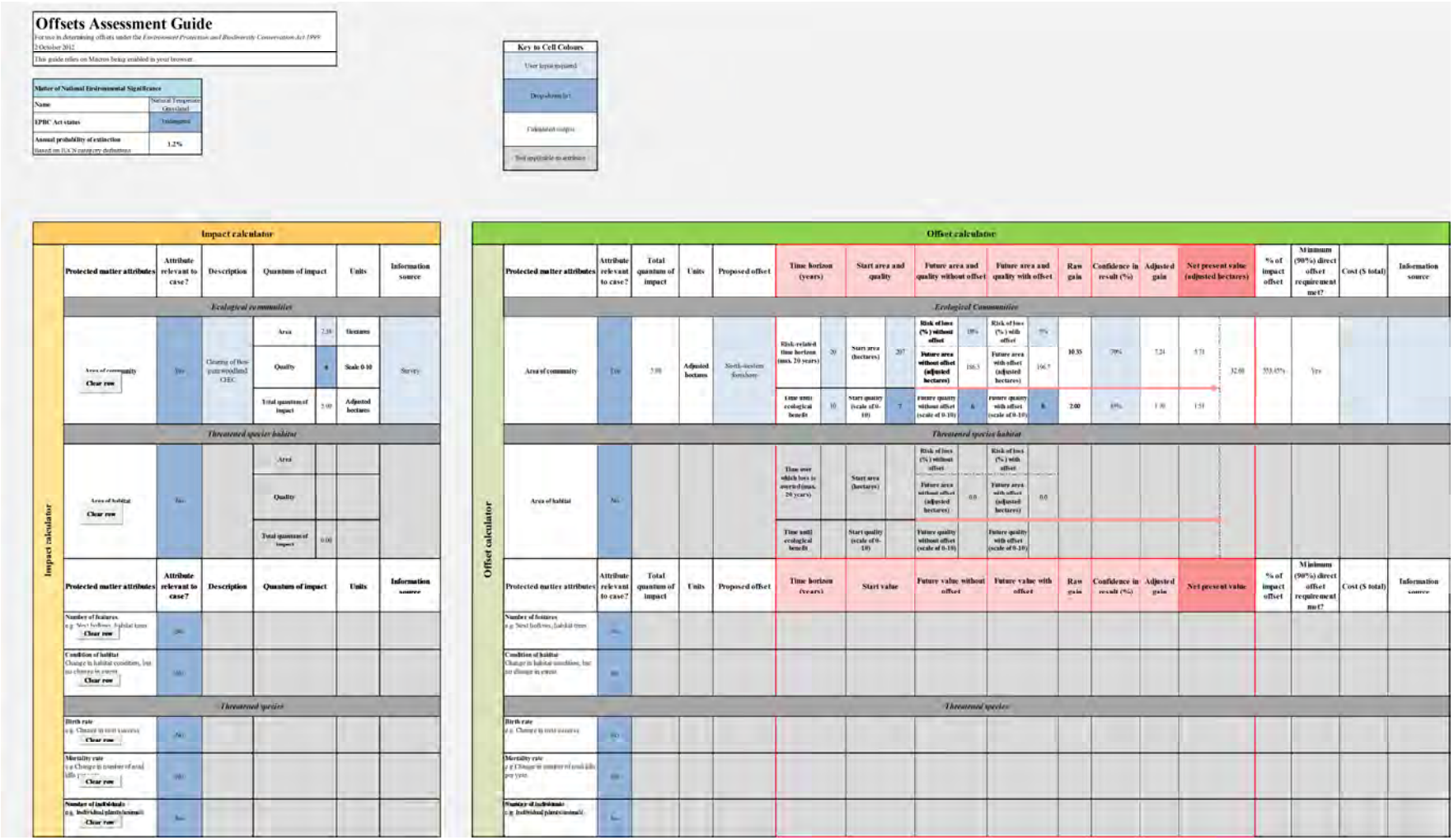
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes	The new FSL will inundate Booroolong Frog habitat along the Peel River	Area	4.77	Hectares	Booroolong Frog mapping and surveys (hydroenvironmental 2012 & Phil Sparks 2013 survey).
			Quality	8	Scale 0-10	
			Total quantum of impact	3.82	Adjusted hectares	
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat condition, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g. Change in number of road kills per year Clear row	No					
Number of individuals e.g. individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset								
							Future area without offset (adjusted hectares)	Future area with offset (adjusted hectares)	0.0							
					Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)								
Threatened species habitat																
Area of habitat	Yes	3.82	Adjusted hectares	Protect and manage habitat upstream of new FSL.	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	31.82	Risk of loss (%) without offset	30%	Risk of loss (%) with offset	3%	7.96	70%	5.57	4.39	7.31	191.48%	Yes		
									Future area without offset (adjusted hectares)	22.3	Future area with offset (adjusted hectares)	30.2									
					Time until ecological benefit	5	Start quality (scale of 0-10)	8	Future quality without offset (scale of 0-10)	5	Future quality with offset (scale of 0-10)	8	3.00	80%	1.66	1.53					
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start value	Future value without offset	Future value with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Number of features e.g. Nest hollows, habitat trees	No															
Condition of habitat Change in habitat condition, but no change in extent	No															
Threatened species																
Birth rate e.g. Change in nest success	No															
Mortality rate e.g. Change in number of road kills per year	No															
Number of individuals e.g. individual plants/animals	No															

ngh environmental

B.2 WHITE BOX-YELLOW BOX BLAKELY'S RED GUM GRASSY WOODLAND



Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Natural Temperate Grassland
EPBC Act status	Endangered
Annual probability of extinction based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculation completed
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	Yes	Clearing of Box gum woodland CEEC	Area	7.10	Hectares	Survey
			Quality	8	Scale 0-10	
			Total quantum of impact	5.68	Adjusted hectares	
Threatened species habitat						
Area of habitat Clear row	Yes		Area			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat conditions, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g. Change in number of road kills per year Clear row	No					
Number of individuals e.g. Individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	5.68	Adjusted hectares	North-western Australia	Risk-related time horizon (max. 20 years)	20	Start area (hectares)	207	Risk of loss (%) without offset	10%	Risk of loss (%) with offset	5%	10.35	70%	7.24	5.71	32.68	553.05%	Yes		
									Future area without offset (adjusted hectares)	186.3	Future area with offset (adjusted hectares)	196.7								
					Time until ecological benefit	10	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	69%	1.38	1.51				
Threatened species habitat																				
Area of habitat	No				Time over which loss is averted (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
									Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat conditions, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

C.2 LANDHOLDER MANAGEMENT AGREEMENT WITH NAMOI CMA

MANAGEMENT AGREEMENT

The Fund's Recipient agrees to carry out the terms of the Management Agreement hereunder and acknowledges that the term of the Management Agreement is ten (10) years from the date the CMA issues the Certified Completion of Works Report.

Management Conditions

1. The project area refers to the location of agreed activities described by this funding agreement as identified in *Schedule Four –Plan of Works*.
2. Cultural sites must be protected from damage at all times.
3. Clearing of native vegetation must be undertaken in accordance with the Native Vegetation Act 2003
4. All fencing is to be maintained in a stock proof condition for the life of this Agreement.
5. To protect wildlife, any fencing erected in the project area will not have a top strand or a bottom strand consisting of barbed wire.
6. Electric fence wires will not be placed closer than 30cm to the ground.
7. Surface water extraction will be limited during periods of drought and low flows to maintain water pools in the project area.
8. Surface water extraction or stock watering laneways will be located at pools, as far as practicable from Booroolong Frog habitat of riffles and small rapids.
9. Livestock access to the project area will not exceed 14 days per annum. Livestock will be excluded from the project area for the period 1st October to 28th February inclusive.
10. The Funding Recipient is not to remove any standing or fallen dead timber from the project area except to allow for the construction or maintenance of tracks and fences where clearing is to the minimum extent necessary and any necessary approvals have been granted.
11. Fertiliser will not be applied within the project area.
12. Gravel extraction will not occur within the project area.
13. Machinery access will be restricted to designated tracks.
14. No active burning will occur within the project area without agreement from Namoi Catchment Management Authority.

15. No exotic fish releases are permitted within the project area.

16. Landholder will not move or remove rocks from the project area.

17. Landholder will avoid handling frogs in a manner which may spread Chytrid fungus. Namoi CMA can provide a copy of the NPWS 'Hygiene Protocol for the control of Disease in Frogs' upon request.

18. All signage (if provided by Namoi CMA) will be maintained and any damage will be reported to Namoi CMA.

19. All Media releases regarding the project must carry the Namoi CMA logo and be approved by Namoi CMA prior to release.

Pest and Weed control

20. The Funding Recipient is to control all infestations of pests and weeds within the project area.

21. Control activities must be in accordance with relevant legislation governing the use of pesticides and herbicides.

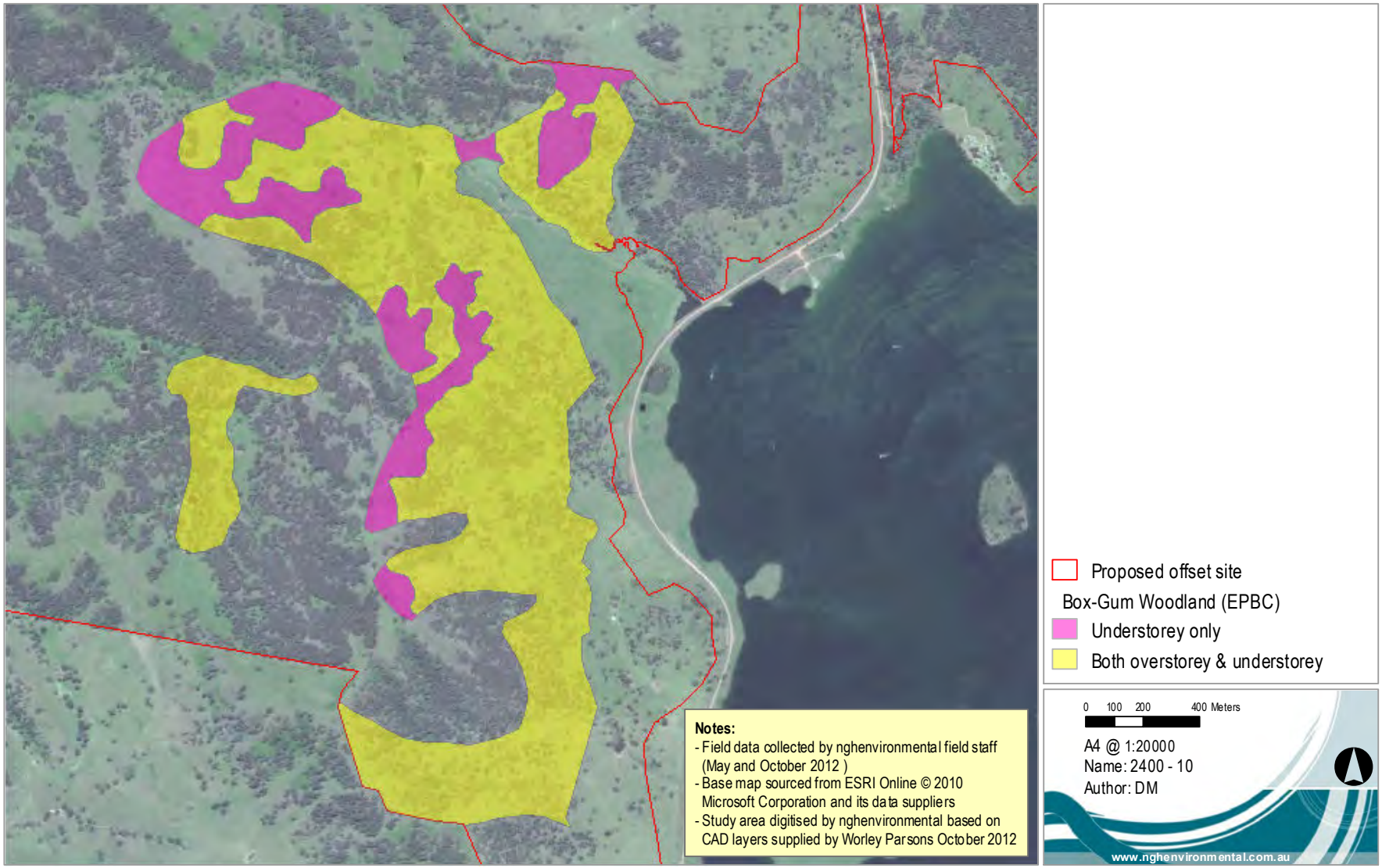
22. The Funding Recipient is to restrict any disturbance of native vegetation required to conduct the weed treatment to the minimum extent necessary.

23. The Funding Recipient may only use chemicals registered under the Pesticides Act 1999 for use around waterways for weed control in the project area.

24. The Funding Recipient or subcontractor must keep records in line with the Pesticides Act 1999 and a copy must be provided to the Namoi CMA upon request.

25. Use of chemicals within the stream channel (streambank toe to streambank toe) will not occur from dates 1st October to 28th February inclusive.

APPENDIX D NORTH-WEST OFFSET SITE CONDITION CLASSES (COMMONWEALTH)



WorleyParsons

resources & energy

ATTACHMENT B

State Water Letter

Contact: Jubrahil Khan
Phone: 02 8245 2049
Fax: 02 8245 2104

Our Ref: STW120142
Electronic Only

Alexander Scott
Planning Officer – Infrastructure Projects
NSW Dept. Of Planning and Infrastructure
G P O Box 39
Sydney NSW 2001

30 May 2013

Re: Chaffey Dam Augmentation – Booroolong Frog Offset

Dear Alex

State Water Corporation provides this letter as ancillary information related to the funding proposal for the Booroolong Offset detailed in the *Revised Addendum Report Terrestrial and Aquatic Flora and Fauna Impact Assessment Addendum Report Chaffey Dam Augmentation and Safety Upgrade*, dated May 2013. The funding proposal supersedes the strategy presented in the PIR and is summarised below.

- Augmentation of Chaffey Dam will impact on 1.6km of Peel River that is Booroolong Frog habitat and 9 km of the river upstream has been assessed as the offset area.
- State Water will provide a lump sum funding agreement for the direct offset of impacts associated with the Augmentation. Funding would contribute directly to the Booroolong Frog Recovery Program as part of the National Recovery Plan for Booroolong Frog (NRPBF) in the upper Peel River, which was prepared in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Threatened Species Conservation Act, 1995*, and the Victorian *Flora and Fauna Guarantee Act, 1988*.
- Funding would be provided to Namoi Catchment Management Authority (NCMA) who will retain, invest and make payments for activities undertaken for the implementation of the Offset Management Plan, to be prepared in consultation with Office of Environment and Heritage (OEH).
- Funding provided as the Booroolong Frog Offset Package must contribute specifically and directly to on-ground management measures that will have a measureable positive conservation benefit to the Booroolong Frog in the Upper Peel River.
- Funding may contribute to education programs where approved by OEH and specifically in relation to raising the profile of the endangered

Booroolong Frog and / or discouraging fossicking in important habitats for the species. This would be considered an indirect offset and would therefore constitute a maximum of 10% of the offset package funding according to the EPBC Act Environmental Offsets Policy.

- The funding will provide for monitoring and reporting of the Booroolong Frog population on the Upper Peel River for the duration of impact (life of Chaffey Dam).

The funding would be conditional to implementation of management and monitoring measures activities with the following provisions:

- All management activities must be conducted under an approved Offset Site Management Plan and appropriate sub plans.
- Strategies to implement the recovery actions will be developed in accordance with the NRPBF and in consultation with NSW OEH, Namoi CMA and SEWPaC.
- The plan must be reviewed and updated with results of monitoring, as required.
- Detailed mapping of the distribution and extent of threats (including weeds) operating on the Booroolong Frog in the offset area of the Peel River and adjacent riparian vegetation is to be conducted prior to implementation of any further management. This will allow identification of funding priorities so that effort and expenditure is targeted to areas most in need, where threat levels are highest.
- Priorities for distribution of funding are to be approved by OEH and SEWPac. .

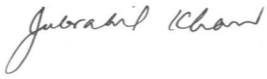
State Water proposes a sum of $362,000 for the direct offset of the impacts assessed for the Chaffey Dam Augmentation and Safety Upgrade. An additional sum of $44,000 would be paid directly to the CMA to cover any administrative costs associated with the management of the fund. These figures were calculated on current dollars to implement activities detailed in the Offset Plan and guided by the NPRBF Priority Recovery actions.

It is anticipated to provide 20% of the funding on commencement of construction to facilitate the undertaking of threat mapping and subsequent development of required management plans. The remaining funds are to be paid in full on the completion of construction. In calculating the offset the following assumptions were built into the calculation:

⇒ Term of impact is the remaining life of Chaffey Dam. Based on a 100 year life since construction completed in 1979 the remaining life is to 2079 (66 years).
⇒ A discount rate of 5.5% has been adopted for Net Present Value (NPV) calculation.
⇒ The State Water costs have been estimated on activities that are aligned with the NPRBF Priority Recovery actions.
⇒ Amount of annual costs will reduce over time.

Please contact Jubrahil Khan Project Manager Chaffey Dam Augmentation and Safety Upgrade on email: Jubrahil.Khan@statewater.com.au for further information

Yours sincerely



Jubrahil Khan
Project Manager Chaffey Dam