Public Works
NSW Water Solutions

Environmental Services Section

BOOTAWA DAM RAISING
PRELIMINARY ENVIRONMENTAL ASSESSMENT

Report number: DC11186

Date: January 2012

MidCoast Water

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			Name	Date
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Erin Alley

Environmental Scientist

Level 13w McKell Building

2-24 Rawson Place

Sydney NSW 2000

T: 02 9372 7863

F: 02 9372 7822

E: erin.alley@mhl.nsw.gov.au

W: www.publicworks.nsw.gov.au

Foreword

This Preliminary Environmental Assessment (PEA) has been prepared for MidCoast Water. The report presents the preliminary investigations undertaken into the environmental impacts of the proposal to raise Bootawa Dam by 7m.

MidCoast Water intends to lodge an application under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for approval to carry out the state significant project. As such, the Director General's Requirements for an Environmental Impact Statement are being sought from the Director General of the Department of Planning and Infrastructure.

Prepared by:

Name: Erin Alley

Designation: Environmental Scientist, NSW Water Solutions

Signature: _____ Date: 16 / 01 / 12

Reviewed by:

Name: Anastasia Assargiotis

Designation: Environmental Scientist, NSW Water Solutions

Signature: _____ Date: 16 / 01 / 12

Executive Summary

Bootawa Dam is an off-river storage and is located on an unnamed tributary of the Manning River, 8km west of Taree. The dam is owned and operated by MidCoast Water and supplies the Greater Taree area and the surrounding Great Lakes region. MidCoast Water is currently licensed to extract up to 12,500 ML/annum from the Manning River. Water is pumped to the dam from the Manning River via an intake located upstream of the township of Wingham.

Water sharing plans are being progressively developed for rivers and groundwater systems across New South Wales following the introduction of the *Water Management Act 2000*. These plans include rules for protecting the environment, extractions, managing licence holders' water accounts, and water trading in the plan area.

The plan that applies to the Manning catchment is the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009*. In Year 6 of the water sharing plan, commencing August 2014, a cease to pump constraint will be introduced at a 98 percentile flow in the Manning River unless environmental studies demonstrate otherwise. There is currently no cease to pump rule for the Manning River in low flow.

In order to achieve the environmental flow requirements for the Manning River and maintain long term security of the Manning District Water Supply Scheme after the new environmental flow regime is active, MidCoast Water is proposing to increase the storage capacity of Bootawa Dam from 2,275ML to 4,500ML. The main dam embankment would be raised by 7m from 55.3m to 62.5m AHD. In addition a new intake tower, spillway and saddle dam would be constructed.

A due diligence archaeological assessment and flora and fauna assessment have been completed. The archaeological assessment found there are potential impacts on items of Aboriginal and European heritage within the project area.

The flora and fauna assessment found the proposal would result in a small incremental loss of habitat for a number of addressed threatened species. However, assuming the recommendations of the flora and fauna assessment are implemented, it is considered the proposed works are unlikely to disrupt the life cycle of any addressed threatened species, endangered population or endangered ecological community such that extinction would occur.

Planning approval would be obtained for the proposal under Part 5.1 of the *Environmental Planning and Assessment Act 1979,* which enables infrastructure to be declared "State Significant Infrastructure" by means of a State Environmental Planning Policy (SEPP) or by order of the Minister for Planning and Infrastructure. This preliminary environmental assessment has been undertaken by NSW Public Works on behalf of MidCoast Water for the purposes of seeking the requirements for an Environmental Impact Statement from the Director General of the Department of Planning and Infrastructure. MidCoast Water intends to lodge an application under Part 5.1 of the *Environmental Planning and Assessment Act 1979* for approval to carry out this proposal, which is considered to be state significant infrastructure in accordance with SEPP (State and Regional Development) 2011.

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CEMP	Construction Environmental Management Plan
DPI	Department of Primary Industries
DECCW	Department of Environment, Climate Change and Water (now OEH)
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPA	Environment Protection Authority, now part of OEH
EPBC Act	Environment Protection and Biodiversity Conservation 1999
ESCP	Erosion and Sediment Control Plan
FMA	Fisheries Management Act 1994
LEP	Local Environment Plan
LGA	Local Government Area
MCW	MidCoast Water
NOW	NSW Office of Water
NPW Act	National Parks and Wildlife Act 1974
OEH	Office of Environment and Heritage
OEMP	Operation Environmental Management Plan
OH&S	Occupational Health and Safety
POEO Act	Protection of the Environment Operations Act 1997
PTLALC	Purfleet-Taree Local Aboriginal Land Council
ROTAP	Rare of Threatened Australian Plants
SEPP	State Environmental Planning Policy
SWMP	Soil and Water Management Plan
TMP	Traffic Management Plan
TSC Act	Threatened Species Conservation Act 1995
VENM	Virgin Excavated Natural Materials

1 Introduction

This section provides details on Bootawa Dam, the project development history, objectives and justification.

1.1 Overview

The Bootawa Dam off-river storage was constructed in 1968 and is located on an unnamed tributary of the Manning River, 8km west of Taree (refer to Figure 1-1). The dam is owned and operated by MidCoast Water and supplies the Greater Taree area and the surrounding Great Lakes region. Bootawa Dam is a zoned earthfill embankment. Water is pumped to the dam from Manning River via an intake located upstream of the township of Wingham.

MidCoast Water is currently licensed to extract up to 12,500 ML/annum from the Manning River. The current storage capacity of the dam is 2,275 ML. It has a catchment area of 1.1 sq km and surface area of approximately 22 ha. The existing main embankment has a crest length of 335m, a crest width of 9.1m and a maximum height of 25m.

It is proposed to raise the full supply level by 7m. In addition a new spillway, intake tower and outlet system would need to be constructed.

The existing dam has performed to a high standard. There are no obvious engineering or performance defects that would inhibit the raising of the existing storage. To date, no discharge through the abutments is apparent and seepage measurements through the main embankment are consistently small (less than 10 l/sec). The storage and dam foundations generally are also tight with low associated permeability estimates (less than 10^{-7} m/sec). Additionally, the dam has a history of low deformation behaviour and there are no signs of cracking or erosion on the embankment surface.

1.2 Project Development History

In 1996, MidCoast Water engaged the Department of Public Works and Services (now NSW Public Works) to project manage and carry out the strategic infrastructure planning for the Manning District Water Supply Scheme. The Department prepared and issued an Options Study Report in 1998 and subsequently a Strategy Review Report in 1999. The Strategy Review Report evaluated six main scheme strategies based on the outcome of community consultation in late 1998.

The six scheme strategies were presented and ratified at an inter-departmental meeting and at a value management study. Following this, the scheme strategies were presented to the public at various venues throughout the district. Using feedback from these consultation processes, MidCoast Water adopted Scheme Strategy 6B (referred to as Scheme Strategy 6B) as the preferred Scheme Strategy for augmenting the existing water supply scheme.

The proposed components of Scheme Strategy 6B were:

- implementation of a water efficiency program;
- construction of a water filtration plant at Bootawa Dam;
- continuation of the Manning River source, and enlargement of Bootawa Dam; and
- development of a groundwater source near Nabiac.

Subsequent to MidCoast Water's decision, Scheme Strategy 6B was put on display for public comments. Following the public comment period, MidCoast Water at its meeting reaffirmed its decision to proceed with the implementation of Scheme Strategy 6B works with some modification (referred to as Scheme Strategy 6B.1). The preferred option was further optimised in the Scheme Strategy 6B Optimisation Report (MidCoast Water 2004) following a Planning Review Workshop in October 2003.

A number of factors have resulted in the postponement of various components since the adoption of Scheme Strategy 6B. However, the Bootawa Water Filtration Plant has been completed and construction of the Nabiac Borefield has commenced. In addition, MidCoast Water has implemented a successful demand management program which has considerably reduced potable water demands despite a growth in water connections.

The sustainable water needs for the Manning, Great Lakes and Karuah catchments across the long term were again considered in the comprehensive MidCoast Water Sustainable Water Cycle Management Plan (2008). The other long term options considered were:

- Construction of Peg Leg Creek off-stream storage at an estimated net present value of $49.3 million (MidCoast Water, 2008)
- Recycled purified water for drinking at an estimated net present value of $74.9 million (MidCoast Water, 2008).
- Brackish water desalination from the Manning River estuary at an estimated net present value for $41.8 million (MidCoast Water, 2008).

In the 2004 strategy review report, it was determined that Bootawa Dam raising was preferred over a new storage at Peg Leg Creek. Nothing has changed since 2004 that would change this priority. MidCoast Water's position is that customer confidence needs to increase and regulatory regimes will need to change before a recycled water type of project can be implemented, but will continue to be pursued for the long term. The brackish water desalination option requires a number of longer term investigations to prove the viability of a project of this type. The Bootawa Dam raising is considered a more appropriate short term option to address the environmental flow requirements of the Manning River.

The different design options for raising Bootawa Dam were previously examined by NSW Public Works in the *Concept Design Report for Dam Raising* in 2005 and again in the *Bootawa Dam Raising Investigation Report* in 2009. The options included:

- raising the dam's main embankment by 7 metres or by 5 metres in a single construction
- raising the dam by 2 metres using a reinforced concrete parapet wall along the existing dam embankment
- a second raising from either 5 metres or 2 metres to 7 metres.

For all options, the existing intake tower and outlet system would be decommissioned.

Raising the dam by 7 metres and increasing the storage capacity from 2,275ML to 4,500ML was considered the dam's optimum height for the following reasons:

- a 7m raised dam sits well in the topography without spilling over into the surrounding abutments and downstream area
- there is sufficient volume of suitable core material available in the vicinity of the dam for a 7m raising. Beyond a 7m raising, the sourcing and supply of suitable core material would not be economically viable as it would have to be imported over very large distances
- a 7m dam raising would have a minor additional imposition on the dam's foundation and on storage foundation permeability compared to, say, a 12m or 15m dam raising (this is important since the existing dam has no conventional grout curtain).

1.3 Project Justification

The main objective of the dam raising project is to achieve the environmental flow requirements for the Manning River, maintain the Manning District Water Supply Scheme security after the new environmental flow regime is active and maintain a diverse water supply in tandem with Nabiac Inland Dune Aquifer Borefield, along with other future water sources. The other desired outcome is to meet current safety standards for extreme flood.

The *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources* was adopted in August 2009. There is currently no cease to pump rule for when the Manning River is in low flow. In Year 6 of the Water Sharing Plan, commencing August 2014, a cease to pump constraint will be introduced at a 98 percentile flow in the Manning River, unless environmental studies demonstrate otherwise.

Despite a reduction in water usage, a secure yield analysis of the Manning District Water Supply Scheme has determined that;

- after five years of water conservation initiatives, current demand is 8,177 ML/annum,
- based on the implementation of the environmental flow rules as stated in the Water Sharing Plan the secure yield of the existing scheme will be 4,800 ML/annum,
- Nabiac Borefield alone will yield 2,920 ML/annum, only restoring the secure yield of the scheme to 7,720ML/annum.

A secure yield assessment has determined that raising Bootawa Dam by 7m (3,600ML/annum increase) is required to restore secure yield of the water supply system to 11,320 ML/annum. However, it is noted that if river flows were reduced by 25% as a result of climate variability or climate change, the secure yield would be reduced to 9,490 ML/annum.

Analysis shows that any water supply scheme with a secure yield of more than 10,000ML/annum will meet growth to 2020 and beyond, see Figure 1-2. The analysis shows the 2003 estimated water efficiency forecast demands and revised water efficiency based on 2008 data. It is forecast that water efficiency should not vary greatly from the 2003 estimates.

In addition, increasing the storage of Bootawa Dam would provide greater operational flexibility by allowing pumping from the Manning River to occur over increased periods in optimal conditions such as when flows are high and water quality is good. This would avoid the need to pump during periods of low flow and high turbidity, thereby protecting low flows within the Manning River. Pumping rates from the River are expected to remain unchanged under the operation of the raised dam. The capacity to store greater water volume would provide an increased ability to guarantee environmental flows in the Manning River in accordance with Water Sharing Plan.

Bootawa Dam is classified as having a Consequence Category “High C”. The term Consequence Category is used to categorise dams based on the consequences of a potential dam break. Due to Bootawa Dam’s Consequence Category Assessment, it is a requirement (in accordance with Dam Safety Committee’s (DSC) guidelines) that the spillway safely passes the 1 in 100,000 Annual Exceedance Probability (AEP) flood. However, it has been determined that, because the catchment area of the dam is relatively small (1.1sq km), the 1 in 100,000 AEP flood is close to the PMF.

Preliminary studies carried out for the 1994 Dam Safety Surveillance Report indicated that the existing spillway structure could handle 50% of the Probable Maximum Flood (PMF). Further studies reported in the 2009 Dam Surveillance Report concluded that the existing spillway could pass only 20% of the PMF. The opportunity would be taken as part of the proposed works to make sure the dam can safely pass the Probably Maximum Flood (PMF).

Figure 1-1 Bootawa Dam Location Map

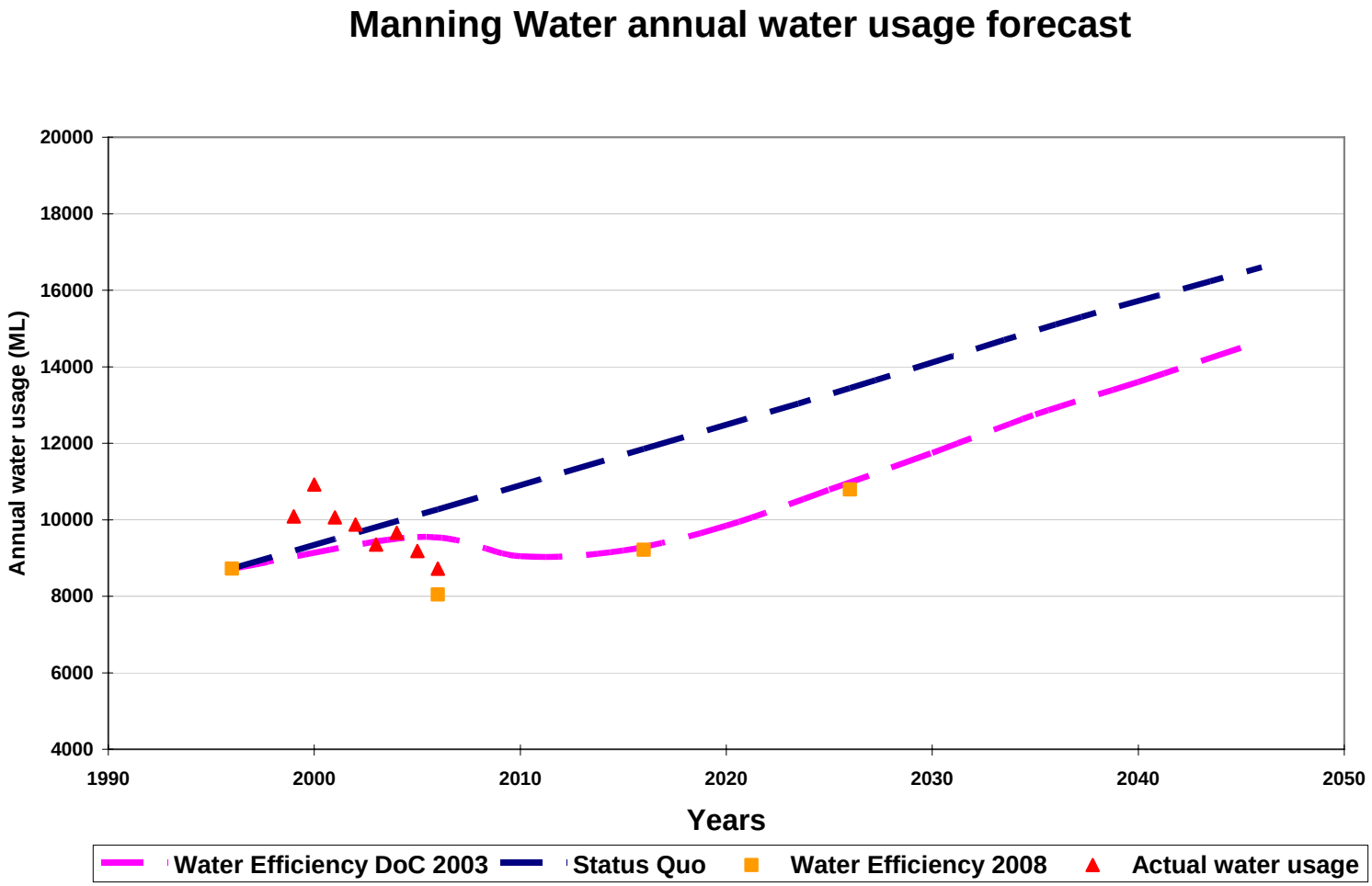

Figure 1-2 Manning Water Annual Water Usage Forecast

2 Scope of the Proposed Works

The following section provides a summary of the proposed works as taken from the *Bootawa Dam 7m Raising Concept Design Report* (NSW Public Works 2011).

2.1 Description of the Proposed Works

The proposed works to raise Bootawa Dam by 7m would increase the storage capacity from 2,275ML to 4,500ML.The proposed works would involve the following:

- construct a new intake tower and access bridge
- excavate a channel between the existing dam storage and the new intake tower
- construct a new penstock through the right abutment leading downstream of the tower base, incorporating separate branch lines downstream from the penstock to supply the recently built water treatment plant and to provide emergency discharges downstream of the dam
- modify the existing inlet pipes and relocate the existing inlet structures providing water to the dam
- decommission the existing intake tower/outlet system.
- demolish the existing pump house buildings
- raise the main embankment
- construct a saddle dam across the existing spillway channel
- construct a new spillway channel higher on the right abutment
- modification of the existing access roads and provision of new ones to suit the raised dam and new structures

Each component is discussed in more detail below and a general arrangement of the concept design is provided in Appendix A.

It is envisaged that, once the new intake tower and outlet system are constructed, the existing systems would be decommissioned. This is expected to take five months, followed by construction of the raised main embankment, saddle dam and spillway over a ten month period.

The cost estimate of $35.6M (refer to Appendix C) is based on the concept design. The estimate does not include the demolition of the existing pump house buildings. The estimates assume that the excavation for the intake tower inlet channel is carried out completely in the dry, i.e. the storage is lowered temporarily to allow completion of the excavation. This is considered to be the most economical arrangement.

The total costs include 10% of the direct cost for pre-construction and 10% for contract supervision, as well as 20% for general contingencies to allow for the concept nature of the designs.

2.1.1 Intake Tower and Outlet System

A new intake tower and outlet works are proposed through the right side of the storage to facilitate connection to the existing treatment plant. The tower and outlet works would be in accordance with NSW Dams Safety Committee requirements where outlet pipework is to be isolated against possible leakage into the surrounding embankment. The tower is located so that it and the outlet pipe can be constructed in the dry.

The top of the tower would be 2 metres above the proposed dam crest level to allow for possible future (further) raising of the storage. The intake tower consists of reinforced concrete base, stem and deck structures. The base is approximately 5.4m wide, 5.2m deep

and 6m high and is slotted into a sound rock foundation. It is designed to support the stem and deck under water load and earthquake conditions and provide inlet to the 1,050mm diameter outlet pipe.

An inlet channel would be excavated which allows connection of the tower to the storage. Excavation of the inlet channel between the intake structure and the storage is envisaged in two stages. Lowering of the storage to RL49.00m (AHD) has been assumed for a short duration (2-3 weeks typically) to facilitate initial excavation in the dry and construction of the intake tower and penstock. The remaining upstream section of the channel, over a relatively short length of about 50 metres at RL45.00 (AHD), has been assumed to be carried out by underwater excavation techniques or in the dry by temporarily lowering the dam storage. Lowering the storage generally to RL49.00m (AHD) also facilitates construction of the raised main embankment and saddle dam.

It is envisaged that the 1,050mm diameter penstock would be directionally drilled from the downstream end. The existing Water Treatment Plant Valve Building 2 would accommodate the guard valve and thrust block for the main penstock.

Emergency releases from the dam would be discharged downstream via a 600mm diameter pipe and a 450mm diameter submerged discharge valve housed in a concrete pit. The pit size is 4m square by 5m deep designed to dissipate the flow energy from a full dam head through the discharge valve under water. Flow from the pit is then discharged gently into an existing pond located below the dam. Emergency drawdown from Full Supply Level (RL61.10m AHD) to minimum drawoff level (RL46.0m AHD) in the intake tower can be achieved in about 32 days. The drawdown rate complies with USBR guidelines.

It is proposed to relocate the existing inlet pipe and dissipater. A new 900mm diameter pipe would tap into the existing line along the road to the Raw Water Balance Tank and then follow a route adjacent the new access road to the raised embankment and intake tower before turning off to connect into a new reinforced concrete dissipator structure. The new dissipator would be located at RL 63.0m (AHD) approximately to allow for possible future dam raising with a parapet wall and would be similar in design to the existing structure. With this inlet pipe alignment, the required pumping head to the dam is reduced by about 12 metres compared to the existing arrangement.

2.1.2 Access Bridge

An access bridge, spanning about 30 metres, would be provided for pedestrian and trolley access for the transportation of gates, shutters and screens and support of electrical supply cables and other equipment to the tower deck. The bridge comprises precast prestressed concrete girders in two spans with a cast in-situ reinforced concrete deck. The bridge would be designed to carry a 2T gross weight trolley.

2.1.3 Existing Intake Tower/Outlet System

Following completion of the proposed transfer system, including excavation of the final section of inlet channel, it is proposed to seal the base of the existing intake tower with a massive concrete plug, fill the existing outlet pipe with grout and remove all mechanical components from the existing structure. Cut-off filters would be provided at the downstream end of the existing outlet pipe to ensure that any possible leakage along the outside or around the pipe is arrested.

2.1.4 Demolition of Existing Pump House Building

It is understood that the existing pumping station buildings immediately downstream of the dam would be demolished which would facilitate the preparation of foundations and construction of the raised embankment.

2.1.5 Embankment Raising

Bootawa Dam would be raised by 7m using an earthfill type embankment. The top 4 metres of the existing fill material would be excavated to provide a continuous zone of high density core (impervious) material and a continuous zone of filter (free draining) material. It is envisaged that core and outer zone material would be obtained from Borrow Areas A and B, within the raised dam storage level. Filter and rockfill materials would need to be imported.

Borrow Area A is located on the western shore of Bootawa Dam and Borrow Area B is situated on the south-eastern shore where an ephemeral drainage line enters the dam.

The new crest length would be approximately 590m. The crest and downstream face of the raised embankment would be topsoiled and grassed. A flatter downstream embankment slope of 3H to 1V is preferred for long term maintenance of the grass cover. The additional random fill materials required for the flatter downstream slopes would be obtained from within the dam storage.

Piezometers would be installed within the raised main embankment and the saddle dam for pressure monitoring purposes. A seepage measurement weir would also be constructed at the downstream toe.

2.1.6 Saddle Dam

A new saddle dam would be constructed over the site of the existing spillway channel. This would involve stripping depths of 0.3m to 1m, as well as the provision of a 1.5m deep cut-off trench. A sand filter would separate the core and outer zone while a drainage blanket and seepage measurement weir would be provided at the downstream toe.

As for the main embankment, it is envisaged that core and outer zone material would be obtained from Borrow Areas A and B within the raised dam storage level, whilst filter and rockfill materials would need to be imported.

2.1.7 Spillway

The spillway shall pass the PMF discharge safely without overtopping the raised main embankment or new saddle dam.

To maintain spillway discharge into the existing waterway right of the dam, a new spillway channel would be excavated in the right abutment and would be 40m wide at the base with side slopes of 1V to 2H in competent rock and 2H to 1V in other rock. An excavation of 2 metres is envisaged to expose highly to moderately weathered rock. A concrete sill would be constructed to provide spillway control. Concrete lining of the spillway channel is preferred by MidCoast Water to avoid possible erosion and the removal of regrowth as well as to facilitate general maintenance of the structure. The concrete lining would require underdrains to reduce the potential for uplift of the slabs. The maximum wall height of the concrete lining would be at the dam crest level of RL62.5m (AHD).

2.1.8 Access Roads

Access to the raised main embankment and spillway would be off the existing road to the Raw Water Balance Tank. It is proposed to continue the road along the upstream side of the new spillway channel to the crest of the saddle dam.

It is proposed that all road access is sealed and suitably drained. Turning and parking areas as well as the main embankment and saddle dam crest roads would be finished with a gravel pavement. The existing four wheel drive road around the periphery of the dam storage would be maintained but may have to be rerouted in some places to account for the raised storage level.

3 Legislative Considerations

3.1 Greater Taree Local Environmental Plan 2010

Bootawa Dam is located in the Greater Taree City Council local government area and as such the Greater Taree Local Environmental Plan (LEP) 2010 applies.

The general dam area is zoned Zone SP2 (Infrastructure), while part of the saddle dam and new spillway are zoned Zone RU4 (Primary Production Small Lots) under the LEP.

Under Zone SP2 (Infrastructure) development for a particular purpose including any development that is ordinarily incidental or ancillary to development for that purpose are permitted with consent. Under Zone RU4, this development is not listed as a permissible item, with or without consent. However, under Part 5.12 (1) of the LEP this development is permissible under *State Environmental Planning Policy (Infrastructure) 2007*.

3.2 State Environmental Planning Policy (State and Regional Development) 2011

The State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) declares certain types of development and infrastructure to be of State and regional significance. This SEPP lists those infrastructure projects which are intended to be classified as State Significant infrastructure.

Schedule 3 of the SEPP includes:

(1) Development for the purpose of water storage and water treatment facilities (not including desalination plants) carried out by or on behalf of a public authority that has a capital investment value of more than $30 million.

The proposed dam raising works are to be carried out by a public authority (MidCoast Water) and are expected to have a capital investment value of more than $30 million (cost estimates are provided in Appendix C).

The SEPP also requires that the works be permissible without development consent under Part 4 of the *Environmental Planning and Assessment Act 1979*.

3.3 State Environmental Planning Policy (Infrastructure) 2007

Clause 125 (2) of State Environmental Planning Policy (Infrastructure) 2007 (SEPP (Infrastructure) 2007 states that development for the purpose of water storage facilities may be carried out by or on behalf of a public authority without consent on land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone SP1 Special Activities, Zone SP2 Infrastructure or an equivalent land use zone.

As the main storage area is zoned SP2 Infrastructure (Water Supply System), it is permissible without consent under Clause 125 of SEPP (Infrastructure) 2007. Part of the saddle dam and new spillway are zoned Zone RU4 Rural Small Holdings, with the primary function of the saddle dam and spillway being flood mitigation. Therefore these aspects of the works are permitted without consent under Clause 50 (1) of SEPP (Infrastructure) 2007, which states that development for the purpose of flood mitigation work may be carried out by or on behalf of a public authority without consent on any land.

The proposed works are considered to meet the requirements of the SEPP (Infrastructure) 2007 and therefore can be undertaken without development consent.

3.4 State Environmental Planning Policy 44 - Koala Habitat Protection

The principal aim of *State Environmental Planning Policy 44 - Koala Habitat Protection* (SEPP 44) is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline. Although

SEPP 44 is not applicable to projects assessed under Part 5.1 of the EP&A Act, consideration of the policy has been given in this PEA.

The flora and fauna assessment (Wildthing Environmental Consultant, 2011) found that although much of the study area had been previously cleared in the past one species of 'Koala Feed Tree', *Eucalyptus tereticornis* (Forest Red Gum) was recorded. However the results of the SEPP 44 assessment revealed that *E. tereticornis* is unlikely to comprise over 15% of the total trees present within the study area.

Therefore the study area would not be considered to constitute 'Potential Koala Habitat', and no further considerations are given to SEPP 44.

3.5 Environmental Planning and Assessment Act 1979

The EP&A Act provides a framework for environmental planning and assessment in NSW. Recent amendments to the Act repealed the previous Part 3A of the Act and introduced Part 5.1 to provide an assessment and approval process for state significant infrastructure projects.

Section 115U of the Act enables infrastructure to be declared "State Significant Infrastructure" by means of a State Environmental Planning Policy (SEPP) or by order of the Minister for Planning and Infrastructure.

State Significant Infrastructure can only proceed with the approval of the Minister who must require that an Environmental Impact Statement (EIS) be prepared.

The Director General (Department of Planning and Infrastructure) issues Director General's Requirements setting out the requirements for the EIS.

According to Section 115ZG of the EP&A Act, the following authorisations are not required for approved State Significant Infrastructure:

(a) the concurrence under Part 3 of the Coastal Protection Act 1979 of the Minister administering that Part of the Act,

(b) a permit under section 201, 205 or 219 of the Fisheries Management Act 1994,

(c) an approval under Part 4, or an excavation permit under section 139 of the Heritage Act 1977,

(d) an Aboriginal heritage impact permit under section 90 of the National Parks and Wildlife Act 1974,

(e) an authorisation referred to in section 12 of the Native Vegetation Act 2003 (or under any Act to be repealed by that Act) to clear native vegetation or State protected land,

(f) a bush fire safety authority under section 100B of the Rural Fires Act 1997,

(g) a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000.'

Also Division 8 of Part 6 of the Heritage Act 1977 does not apply to prevent or interfere with the carrying out of approved State Significant Infrastructure.

Under Section 115ZH of the EP&A Act, a number of authorisations cannot be refused if it is necessary for carrying out approved State Significant Infrastructure and is to be substantially consistent with the approval under this part. This includes, but is not limited to:

- *An environment protection licence under Chapter 3 of the Protection of the Environment Operations Act 1997; and*
- *A consent under s138 of the Roads Act 1993.*

The Act defines infrastructure to include, amongst other things, “water supply systems” and “flood mitigation works”. The proposed dam raising would fit both definitions.

MidCoast Water intends to lodge an application under Part 5.1 of the EP&A Act for approval to carry out the project.

3.6 Other Relevant NSW Legislation

3.6.1 Dams Safety Act 1978

Bootawa Dam is a prescribed dam under the *Dams Safety Act 1978*. The *Dams Safety Act* establishes Dams Safety Committees, the function of which is to examine and investigate the location, design, construction, reconstruction, extension, modification, operation and maintenance of prescribed dams. The upgrade would need to be consistent with the Dams Safety Committee requirements.

MidCoast Water plans to commission an addendum to the 2006 Dambreak Study to consider the future raised dam conditions.

3.6.2 Protection of the Environment Operations Act 1997

The Office of Environment and Heritage (OEH) is responsible for the administration of the *Protection of the Environment and Operations Act 1997* (POEO Act) which regulates air, noise, land and water pollution.

The proposed works would be carried out with appropriate mitigation measures in place so that air, water and noise pollution would be minimal.

Schedule 1 of the Act refers to “extractive industries” as an activity that requires an Environment Protection Licence. This includes development which is proposed to be carried out which would enable scheduled activities to occur.

(1) This clause applies to the following activities:

land-based extractive activity, meaning the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods.

(2) In this clause, ***extractive materials*** means clay, sand, soil, stone, gravel, rock, sandstone or similar substances that are not minerals within the meaning of the *Mining Act 1992*.

Land based extractive activity is declared to be a scheduled activity if it involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. The proposed works would involve the excavation of approximately 245,500m^3 of core and downstream outer zone materials, with an estimated weight of 500,000 tonnes. Therefore the proposed works constitutes a scheduled activity and an environmental protection licence is required.

3.6.3 Local Government Act 1993

Under Section 60 of the *Local Government Act* 1993, a Council must not undertake any works to the water supply system including the construction or extension of a dam or any associated works without approval from the NSW Office of Water. It is noted that MidCoast Water obtained the Section 60 approval from OEH for the augmentation of Bootawa Dam by 7 metres on 28 January 2010.

Approval of the works was granted subject to compliance with all other relevant statutory provisions and requirements. Such requirements include the submission of the relevant final specifications and drawings, the project construction report and final design report on completion of the works, and all other relevant documentation as required in Clause 138 under Part 6 of the *Local Government General Regulation 2005.*

This approval specified that MidCoast Water must also ensure that the final design is carried out by suitably qualified engineers highly experienced in dam engineering, and that the final design must satisfactorily demonstrate that the following, as well as any other relevant issues, have been addressed:

1. Allowance must be made in the final stability analysis for the difference in Horizontal and Vertical permeabilities of the compacted zone 1 material in the new and existing portions of the dam.
2. Careful consideration needs to be given to the issue of differential settlement across the various zones; and of the methodology of joining the existing and new portions of the embankment.
3. Consideration should be given to the flow capacity of the new filters in the event of a crack developing in the upper level core. Such considerations should be on a "risk basis".
4. Availability of material for the new filters and rip rap must be established before construction begins.
5. The capacity of the existing downstream shell zone under seismic loading should be investigated and allowed for in the final design.
6. A piping risk assessment must be carried out and the results allowed for in the final design.
7. Carry out an assessment of the dam's seismic stability and allow for this in the final design.

The requirements described above would be addressed in the final detailed design.

3.6.4 Fisheries Management Act, 1994

Under Section 218 of the *Fisheries Management Act 1994* a public authority that proposes to construct, alter or modify a dam, weir or reservoir on a waterway must notify the Minister of the proposal.

Section 200 of the *Fisheries Management Act 1994* requires a local government authority to obtain a permit to undertake dredging or reclamation work in water land. Water land is defined as any land submerged either permanently or temporarily by water and includes artificial areas. Therefore any in-stream works would require a permit from DPI.

No threatened or protected aquatic species or ecological communities are likely to occur within the proposed works area. Therefore a Seven Part Test for aquatic species under the *Fisheries Management Act 1994* is not required.

Key threatening processes as listed under the Schedule 6 of the FM Act have been addressed in Section 5.6 of this PEA. No significant impacts to threatened aquatic species are predicted due to the proposal.

3.6.5 Heritage Act 1977

The *Heritage Act 1997* aims to conserve the environmental heritage of New South Wales. Environmental heritage is broadly defined under Section 4 of the *Heritage Act* as consisting of "those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance" (Heritage Branch, DoP 2009:4). Aboriginal places or objects that are recognised as having high cultural value (potentially of local and State significance) can be listed on the State Heritage Register and protected under the provisions of the *Heritage Act 1977.*

Under Section 115ZG of the amended EP&A Act, an approval under Part 4 or an excavation permit under section 139 of the *Heritage Act 1977* are not required for approved State Significant Infrastructure.

No known registered sites were identified in the project impact area. However, the proposal would directly impact and destroy 1960s plant buildings, 1960s pontoon and a memorial stone plaque and park which lie in the proposed embankment excavation and earthfill area.

As a best practice measure, MidCoast Water proposes to assess these items to determine their heritage value in accordance with the *Heritage Act 1977*.

3.6.6 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act* 1974 (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features.

A cultural heritage assessment (Virtus Heritage, 2011) recorded a scarred tree (Bootawa PAST-1) within the proposed inundation area. The proposal has potential to directly impact the scarred tree from the increased inundation resulting from the raised storage.

An isolated quartzite flake (Bootawa IF-1) was also identified on a 4WD vehicle track outside the proposed area of works and no impacts are predicted.

Under Section 90 of the Act, it is an offence for a person to destroy, deface, damage or desecrate an Aboriginal Object or Aboriginal Place without prior issue of a Section 90 consent. However, under Section 115ZH of the EP&A Act no consent under Section 90 is required for approved State Significant Infrastructure.

MidCoast Water would undertake consultation with the Purfleet-Taree Local Aboriginal Land Council (PTLALC) and all other relevant Aboriginal stakeholder groups in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) regarding management of the scarred tree.

3.6.7 Native Vegetation Act 2003

The *Native Vegetation Act 2003* applies to the clearing of native vegetation outside certain specified areas and requires development consent from the Minister for the Environment. Section 12 of the *Native Vegetation Act 2003* states that native vegetation must not be cleared except in accordance with a development consent granted in accordance with the Act.

However, under the provisions of Part 5.1 of the EP&A Act, an authorisation referred to in Section 12 of the *Native Vegetation Act 2003* would not be required for approved State Significant Infrastructure.

3.6.8 Water Act 1912

MidCoast Water presently holds water licence no. 20SL046844 (Manning River Extraction Licence) authorising a total annual volume extraction allowance of 12,500 ML from the Manning River, as well as, water licence no. 20SL029347 relating to dam seepage.

Licensing is administered by the NSW Office of Water and will continue under the *Water Act 1912* until the Water Sharing Plan for the region comes into effect in 2014, at which point licensing will be administered under the *Water Management Act 2000*.

Extraction volumes from the Manning River are not expected to increase due to the augmentation of Bootawa Dam, and as such the extraction licence is not expected to change. However, due to the increase in water volume behind the main embankment, seepage rates could increase by approximately 35% and the existing seepage licence would need to be modified.

3.6.9 Water Management Act 2000

Under the *Water Management Act 2000*, there are three kinds of water management works approvals including water supply work approvals which authorise the holder to construct and use a water supply work.

However, under Section 115ZG of the amended EP&A Act these authorisations are not required for approved State Significant Infrastructure.

3.6.10 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act* 1995 (TSC Act) protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW.

A flora and fauna assessment of the proposed works has determined that the raising of Bootawa Dam is unlikely to have an adverse impact on endangered ecological communities, threatened species or their habitats.

3.6.11 Roads Act 1993

Under Section 138 of the *Roads Act 1993* a person must not: *erect a structure or carry out a work in, on or over a public road, or dig up or disturb the surface of a public road*, otherwise than with the consent of the appropriate roads authority.

However, under Section 115ZH of the EP&A Act, a consent under s138 of the *Roads Act 1993* cannot be refused if it is necessary for carrying out approved State Significant Infrastructure.

The requirement for any works to local roads would be confirmed by the successful construction contractor.

3.6.12 Environment Protection and Biodiversity Conservation Act 1999

The *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist 'matters of national environmental significance'. Matters of national environmental significance include:

- *World Heritage properties;*
- *National Heritage places;*
- *Ramsar Wetlands;*
- *Nationally threatened species and ecological communities;*
- *Migratory species;*
- *Commonwealth marine areas; and*
- *Nuclear actions (including uranium mining).*

One nationally listed species *Pteropus poliocephalus* (Grey-headed Flying-fox) was recorded within the study area. However a specialist flora and fauna assessment for the works (Wildthing Environmental Consultant, 2011) determined that the proposed works are unlikely to have significant impact on this species. No other Matters of Environmental Significance are anticipated to be impacted by the works..

3.7 Policies, Guidelines and Standards

3.7.1 Water Sharing Plan

Water Sharing Plans prepared under the provisions of the *Water Management Act 2000* establish rules for access to and the sharing of water between the environmental needs of the surface or groundwater source and water users.

The plan that applies to Bootawa Dam is the *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009*. The Water Sharing Plan was adopted in August 2009. There is (currently) no cease to pump rule for when the Manning River is in low flow. In Year 6 of the Water Sharing Plan, commencing August 2014, a cease to pump constraint will be introduced at a 98 percentile flow in the Manning, unless environmental studies demonstrate otherwise.

Once the plan is enacted, all licences issued under the *Water Act 1912* within the catchment will be converted to licences under the *Water Management Act 2000*.

4 Agency Consultation

The organisations listed in Table 4-1 were consulted as part of the original REF process. The table provides a summary of the responses received. A copy of the responses received is provided in Appendix B.

Table 4-1 Agency Consultation

Agency	Comment
Greater Taree City Council	General locality contains significant koala habitat and Bootawa Dam Road is a well-documented koala black spot area.
Hunter Region, Environment Protection and Regulation, DECCW (now OEH)	Hydraulic dam break modelling should be undertaken to determine the effect of embankment failure in an extreme flood event on downstream development including Wingham Peninsula. Modelling should be conducted for a range of coincident flooding scenarios in the Manning River. Whether the proposal is consistent with the provisions of the Protection of the Environment Operations Act, 1997. MidCoast County Council currently holds Environment Protection Licence 6583 for the application of algicide to Bootawa Dam. EPA requests investigations be undertaken into alternatives to the use of algicides. Whether the outlet structure of the dam needs to be modified to prevent potentially cold anoxic waters being released downstream. Whether the proposal is likely to impact on areas of native vegetation, threatened significant flora and fauna species, populations and ecological communities and whether these impacts are likely to be significant in the context of s.5A of the Environmental Planning and Assessment Act 1979. This should include assessment against any relevant State Environment Planning Policies. Whether the proposal is consistent with the relevant threatened species provisions of the EP&A Act, *Threatened Species Conservation Act 1995* and the *Native Vegetation Act 2003.* Whether an appropriate level of Aboriginal cultural heritage assessment has been undertaken, and that the proposal is not likely to impact on areas of cultural significance to the Aboriginal community. Also, it is important that the views of the Aboriginal community groups be sought and fully considered in regard to the proposed development.
Aquatic Habitat Protection Unit, Division of Primary Industries, Industry & Investment NSW (now DPI)	No comments on the proposed works (S Carter, pers comm., 25 Nov 2011).
Hunter Region, Park and Wildlife Group, DECCW	No comments on the proposed works (R. Quirk, pers comm., 25 Nov 2011).

Agency	Comment
(now OEH)	
Urban Water, NSW Office of Water	No response received.
Hunter-Central Catchment Management Authority	No response received.

5 Existing Environment

This section provides a synopsis of those facets of the environment that could potentially be affected by the proposal.

5.1 Location and Land Use

Property ownership of Bootawa Dam and the surrounding area is shown in Figure 5-1. MidCoast Water owns the Bootawa Dam site, including the Bootawa Water Filtration Plant (built in 2010) and the land that would be inundated by the raised Dam. MidCoast Water also owns and maintains the picnic area to the northwest of the Dam.

The closest residents are located on the northwest and northeast boundary of the dam.

5.2 Traffic and Access

Access to Bootawa Dam from the Pacific Highway is via Bucketts Way, then a secondary sealed road (Bootawa Dam Road) to the site. Bucketts Way carries low to moderate volumes of traffic. The alternative access route from Gloucester Road is sealed, while access from Tinonee Road is unsealed.

A sealed driveway and carpark area provides access to the water filtration plant, directly downstream of the dam embankment. A four-wheel drive road generally forms the perimeter of the water storage catchment area. There are no houses located inside the boundary of this road.

5.3 Geology, Soils and Topography

The following information has been taken from the geotechnical investigation undertaken at the site (Commerce, 2009).

5.3.1 Regional Geology

Taree is located within the major structural unit known as the Hastings Block, which forms part of the New England Fold Belt. A sequence of sedimentary rocks belonging to the Tinonee Beds occurs in the Bootawa Dam area. The unit is Devonian in age and comprises laminite, tuff, spillite, greywacke, mudstone, shale and lithic sandstone.

5.3.2 General Topography

The left abutment rises with a very low slope from the existing crest level of RL55.3m to approximate RL59m. The abutment then flattens off for a length of approximately 55m, through the existing picnic area, before rising again at a low slope of approximately 4.6° (12.5H:1V). The right abutment rises with an even, moderate slope of approximately 9.5° (6H:1V).

5.3.3 Soils

An interbedded sequence of meta-sedimentary rocks occurs at the site. Bedding dips very steeply to the south. The diamond drilling and test pit investigations identified two rock types; fine to coarse-grained greywacke and Argillite. In the areas of geotechnical investigation, greywacke was found to be the prominent rock type.

Soils associated with the meta-sedimentary rock types at the site were found to be very thinly developed. Topsoil, comprising brown to dark grey slightly clayey to sandy silt with gravel, ranges from 0.10m to 0.3m thick. The underlying residual soils are generally in the order of 0.3m to 1m thick and comprise admixtures of gravel, sand, silt and clay. The soils generally range from clayey sands to sandy silty clays. Soils often include a gravel fraction comprising weathered meta-sedimentary rock.

5.4 Surface Waters

Bootawa Dam is located 3km to the south of the Manning River. Water is pumped from the Manning River upstream of Wingham and is piped to Bootawa water storage. The Bootawa Dam catchment covers an area of approximately 1.1 sq km. The surface area is approximately 22ha with a number of small ephemeral, highly disturbed, drainage lines running into the Dam.

Freshwater biologist, Dr. Keith Bishop, has been engaged over a period of years by MidCoast Water to assess environmental water needs in the lower Manning in regards to fish passage and migration, impacts of salinity at the tidal limit of the river, and aquatic flora and habitat. Interim reports were produced in 2007 for the fresh water zone and the estuary zone respectively.

The reports were inconclusive in terms of recommendations for pumping regimes for water extraction to Bootawa Dam, however it has been noted that there are no impacts from these activities during high flows. It is possible that a recommendation may be made to adjust pumping regimes during spring to assist with fish migration. This is considered easily achievable without adversely impacting the yield of the water supply scheme. Dr. Bishop's studies are expected to conclude in late 2011. The final recommendations are not expected to impact the design of the dam raising, but rather the pumping regime.

Manning River land management practices investigations have been ongoing in regard to tracking down sources of high turbidity. In extended periods of turbid flow in the Manning River, a 'wet drought' can ensue, which sees Bootawa Dam drawn down despite an abundance of water in the river.

Algal blooms have previously occurred in Bootawa Dam. Manning River water quality investigations have found a stronger link between phosphorus levels in the Manning River and algal blooms in Bootawa Dam rather than turbidity. MidCoast Water has installed an on-line phosphorus monitor that cuts out the Raw Water Pump Station via SCADA. In addition, a special aeration and mixing system is used to keep the water stratified and make sure there is enough oxygen in the dam. Both systems have greatly reduced the occurrence of algal blooms in Bootawa Dam and algaecide has not been applied to the waters since the installation of the aeration and mixing system.

5.5 Flora and Fauna

A terrestrial and aquatic ecology assessment of the proposal was prepared by Wildthing Environmental Consultant (2011). The following information on the existing flora and fauna conditions has been taken from the *Terrestrial and Aquatic Ecology Report for the Proposed raising of Bootawa Dam and associated infrastructure* (WEC, 2011). The report is provided in Appendix C of this PEA.

The field works was conducted over a four day period, which included two nights of spotlighting and bat detection.

5.5.1 Flora

A list of all flora species identified during the field survey is provided in Appendix B of the flora and fauna report and the results of transect and plot surveys can be seen in Appendix C of the flora and fauna report (provided in Appendix D of this PEA).

Land within the study area was found to be largely cleared with a large portion of cleared land recently been turned into a plantation. MidCoast Water, in conjunction with Forest NSW (DPI), have undertaken tree planting in the Bootawa Dam catchment which aims to achieve a 72 hectare area plantation. A mix of four ecualypt species has been planted on the previously cleared hills at Bootawa. It is intended to allow the trees to fully mature.

An area of open forest was present on the eastern shore of the dam. Other areas of native regrowth vegetation were present within a number of the minor gullies and drainage lines leading down to the waters edge. The study area was found to comprise six vegetation communities. These communities were:

- Open Forest;
- Moist Regrowth Scrub;
- Plantation;
- Open Woodland;
- Cleared Grassland within scattered remnant trees;
- Aquatic/Wetland Vegetation.

A map of the vegetation found within the site is shown in Figure 5-12. A brief description of the vegetation communities is provided below.

Tall Open Forest

An area of approximately 3.5 ha of Open Forest was present on the slopes of the eastern shore of Bootawa Dam.

Although this community did contain specimens of *Eucalyptus propinqua* (Small-fruited Grey Gum) other canopy species such as *Eucalyptus paniculata* (Grey Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Syncarpia glomulifera* (Turpentine) were also common. *Allocasuarina torulosa* (Forest Oak) was a common smaller tree species within the mid storey. Common shrub species included *Breynia oblongifolia* (Breynia) and *Phyllanthus gunnii* (Scrubby Spurge). The invasive weed Lantana *camara* (Lantana) formed areas of dense thickets within this assemblage. Native grass species such as *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica* var. major (Blady Grass) were found to be common ground covers. Other native ground covers recorded included *Desmodium rhytidophyllum, Plectranthus parviflorus* and *Desmodium rhytidophyllum*. The northern portion of this community had undergone some past underscrubbing and had a relatively clear grassy understorey.

Moist Regrowth Scrub

Areas of moist regrowth scrub occupied a number of gullies which ran down into Bootawa Dam. Within the study area Moist Regrowth Scrub occupied a combined total of approximately 5ha. The areas were generally densely vegetated and contained a number of flora species adapted to moister conditions. According to the Greater Taree Council Vegetation Extant

Trees within this assemblage were generally young and consisted of species such as *Syncarpia glomulifera* (Turpentine), *Lophostemon confertus* (Brush Box) and *Eucalyptus paniculata* (Grey Ironbark). Smaller tree species noted included *Melaleuca styphelioides* (Prickly-leaved Paperbark), *Callistemon salignus* (Willow Paperbark), *Glochidion ferdinandi* (Cheese Tree), *Commersonia fraseri* (Black-Fellow's Hemp), *Acacia melanoxylon* (Blackwood) and *Acacia binervata* (Two-veined Hickory). Common shrub species included *Phylanthus gunnii* (Scrubby Spurge), *Polyscias sambucifolia* (Elderberry Panax), *Acacia irrorata* and *Maytenus silvestris* (Narrow-leaved Orangebark). Common invasive weed species were *Lantana camara* (Lantana), *Rubus fruticosa* (Blackberry) and *Ageratina adenophora* (Crofton Weed). Common ground covers observed included *Pteridium esculentum* (Bracken Fern) and *Imperata cylindrica var*. major (Blady Grass).

Open Woodland

Two small areas of clumped and scattered native trees were present to the north of Bootawa Dam. These areas generally consisted of young eucalypt species such as *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus paniculata* (Grey Ironbark) and *Eucalyptus*

acmenoides (White Mahogany). A common small tree was *Acacia melanoxylon* (Black Wattle). The understorey generally consisted of native and introduced grasses such as *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica var*. major (Blady Grass).

Mixed Eucalypt Plantation/Grassland

A recently planted mixed eucalypt plantation established on formerly cleared land around Bootawa Dam occupied a large portion of the study area. Planting was undertaken in February and March 2010 with species utilised being *Corymbia variegata* (Spotted Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus agglomerata* (Blue-leaved Stringybark) and *Eucalyptus punctata* (Grey Gum) (Mid Coast Water, 2010). Grasses both native and introduced were common between the rows. The most common native grasses were *Themeda australis* (Kangaroo Grass) and *Imperata cylindrica var*. major (Blady Grass). Common introduced grasses included *Chloris gayana* (Rhodes Grass).

Cleared Grassland within scattered remnant trees

Mainly cleared grassland occupied the majority of the area situated between the boundary of the Plantation and the shore of Bootawa Dam. These areas were largely composed of grasses such as the native Themeda australis (Kangaroo Grass) and Imperata cylindrica var. major, and the introduced Chloris gayana (Rhodes Grass).

Aquatic/Wetland Vegetation;

Vegetation adapted to varying amounts of inundation was present around the periphery of Bootawa Dam. The water level was down approximately 1m at the time of the survey with an area of exposed drying mud present. Small clumped areas of species such as *Typha orientalis* (Cumbungi), *Eleocharis sphacelata* (Tall Spike-rush), *Schoenoplectus mucronatus, Philydrum lanuginosum* (Woolly Frogmouth) and *Juncus usitatus* (Common Rush) were common around the higher water mark of the dam. Exposed areas of drying mud below the high water mark were found to contain a number of small quick growing species such as *Cyperus eragrostis* (Umbrella Sedge), *Alternanthera dentata* (Lesser Joyweed), *Centipeda cunninghamii* (Sneezeweed) and *Gratiola pedunculata* (Stalked Brooklime). Few aquatic plants were observed within the water itself with small areas of *Potamogeton tricarinatus* (Floating Pondweed) one of the exceptions.

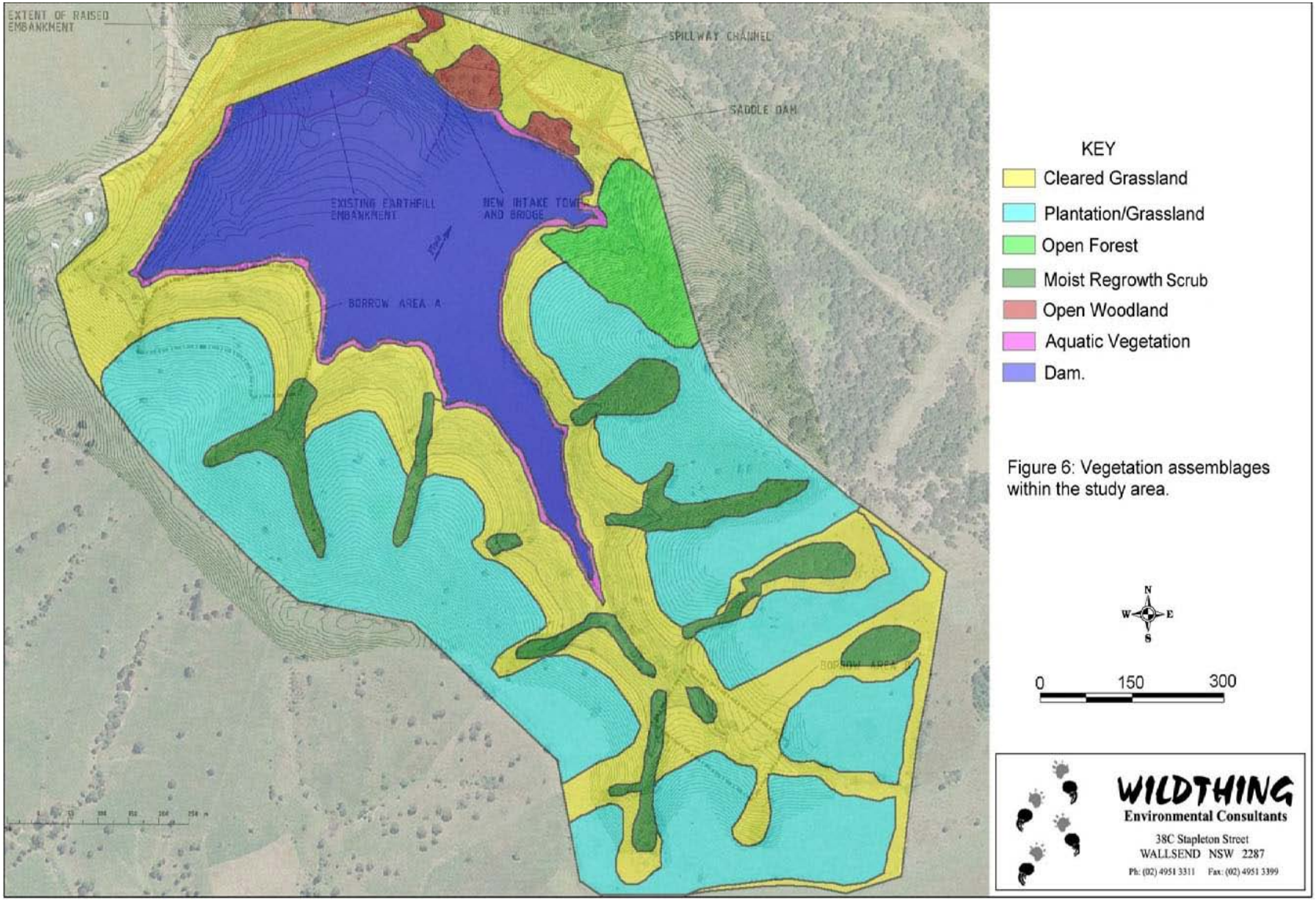

Figure 5-1 Vegetation Assemblages surrounding Bootawa Dam

5.5.2 Endangered Ecological Communities

Five Endangered Ecological Communities are known to occur within the local area:

- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

None of the above Endangered Ecological Communities were considered to be present within the study area. The areas of Moist Regrowth Scrub contained a small number of flora species found within Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions. However these areas are not likely to be regarded as this Endangered Ecological Community.

5.5.3 Threatened and Rare Species

Seven threatened plant species were recorded within 10km of the site on the OEH database. These are shown in Table 5-1.

Table 5-1 Threatened and Rare Flora Species recorded within the locality

Flora Species	TSC	EPBC Act	ROTAP
Cryptostylis hunteriana Leafless Tongue Orchid	E	V	
Diuris flavescens Pale Yellow Doubletail	E		
Allocasuarina defungens Dwarf Heath Casuarina	E	E	
Eucalyptus glauca Slaty Red Gum	V		3VCa
Melaleuca biconvexa Biconvex Paperbark	V		
Asperula asthenes Trailing Woodruff	V	V	3VC
Cynanchum elegans White-flowered Wax Plant	V		

E= Endangered Species, V=Vulnerable Species,

None of the flora species listed in Table 5-1 were found within the study area during fieldwork. However it is noted that the fieldwork was carried out outside the flowering season for *D. flavescens* (which is from September to October) and it would be unlikely to be observed during this period. With the exception of C. hunteriana and A. defungens suitable habitat was considered to be present within the study area for the remaining five threatened flora species. However habitat would be largely confined to the area of Open Forest.

5.5.4 Weeds

The following noxious weed species were identified in the inundation area;

- *Lantana camara* (Lantana) Class 5
- *Rubus fruticosa* (Blackberry) Class 4

- *Xanthium occidental* (Noogoora Burr)

Lantana was quite invasive within the area of open woodland. Blackberries were common within the lower gullies which ran down into Bootawa Dam and specimens of Noogoora Burr were observed around the upper shoreline of the dam.

5.5.5 Habitat Description

In general, the area offers a wide range of habitat opportunities for a range of native species. The habitats proposed to be affected by the proposal range from less ecologically insignificant areas such as open grassland dominated by predominantly introduced species, to areas of Eucalypt Woodland/forest that would appear capable of offering suitable resources to both resident and transitory species.

Three main habitat areas were identified in the area, these being;

- Eucalypt forest / woodland
- Cleared grassland
- Aquatic

Eucalypt forest / woodland

Eucalypt Woodland/Forest occurring within the study area provides suitable habitat opportunities for a variety of species. This includes potential foraging resources for Frugivorous, nectivorous, granivorous and insectivorous birds and microchiropteran bat species. Twenty hollow-bearing trees have been identified in the area surrounding the dam which would provide some potential nesting and roosting sites for a variety of avifauna and other hollow dependant species such as arboreal marsupials and tree-roosting bats.

Hunting opportunities exist for birds of prey, given that the variable tree coverage and understorey vegetation has created a myriad of ecotones and habitat densities. Such habitat is suitable for terrestrial species including small and medium sized mammals, macropods, reptiles and potentially for some frog species adapted to such areas. Recognised species of Koala feed trees are also present.

Cleared grassland

The grassland habitat provides opportunity for a variety of avifauna, including predominantly terrestrial species preferring open spaces, seed eating birds and several birds of prey, which may hunt over this area in search of potential prey species. Macropods may also frequent such areas whilst grazing. The area also provides potential habitat for some species of bats which may also forage over this cleared area for insects. However, the lack of vegetative cover is likely to limit the habitat value for many species, particularly reptiles and small mammals which are vulnerable to predation in open spaces.

Aquatic

Aquatic habitat was contained within Bootawa Dam and its periphery. The dam provides habitat for fish, water birds, frogs and other herpetofauna, and acts as a water source for other native animals such as macropods. Bootawa Dam also offers potential habitat for bats that prefer to hunt above or around water bodies.

5.5.6 Fauna

Mammals

Two species of mammal, *Antechinus stuartii* (Brown Antechinus) and *Rattus lustreolus* (Swamp Rat) and *Rattus rattus* (Black Rat) were captured in the small mammal traps. No other mammals were captured in the traps.

Bats

Two species of microchiropteran bat, *Chalinolobus gouldii* (Gould's Wattled Bat) and *Chalinolobus morio* (Chocolate Wattled Bat) were positively identified during the bat call survey. The audible *Nyctinomus australis* (White-striped Freetail-bat) was also heard. Other calls were only identified to genus level, these being Vespadelus sp. Calls attributed to the genus Vespadelus were thought to be from either *V. pumilus* (Eastern Forest Bat), *V. vulturnus* or *V. troughtoni* (Eastern Cave Bat) which are known to occur in the local area.

None of the microchiropteran bat species positively identified are listed as threatened under either State or National legislation. However, *V. troughtoni* is listed under the TSC Act (1995).

Amphibians

Six species of amphibian, *Crinia signifera* (Common Eastern Froglet), *Litoria nasuta* (Rocket Frog), *Limnodynastes peronii* (Striped Marsh Frog), *Litoria fallax* (Dwarf Tree Frog), *Litoria wilcoxi* (Stony Creek Frog) and *Litoria peronii* (Peron's Tree Frog) were recorded within the study area during targeted and incidental surveys. None of these species are listed as threatened under State or National legislation.

Reptiles

Four species of reptile, *Lampropholis delicata* (Grass Skink), *Eulamprus quoyii* (Eastern Water Skink), *Physignathus lesuerii* (Eastern Water Dragon) and *Chelodina longicollis* (Eastern Long-necked Turtle) were recorded within the study area during the survey. *Lampropholis delicata* was found to be common within the area of Open Forest, *E. quoyii* was observed in debris near the edge of Bootawa Dam and a number of specimens of *P. lesuerii* were found to be common amongst the rocks on the Bootawa Dam Wall. A dead specimen of *C. longicollis* was found near the waters edge of Bootawa Dam. None of these reptile species are regarded as threatened according to State or National legislation.

Diurnal Avifauna

Within the Open Forest areas avifauna species commonly encountered included *Rhipidura fuliginosa* (Grey Fantail), *Lichenostomus chrysops* (Yellow-faced Honeyeater), *Todiramphus sancta* (Sacred Kingfisher), *Philemon corniculatus* (Noisy Miner), *Philemon corniculatus* (Noisy Friarbird), *Meliphaga lewinii* (Lewin's Honeyeater) *Platycercus eximius* (Eastern Rosella) and *Acanthiza pusilla* (Brown Thornbill). A number of *Allocasuarina torulosa* (Forest Oak) seed cones consistent with those chewed by *Calyptorhynchus lathami* (Glossy Black Cockatoo) were found on the ground within the area of open forest. *Calyptorhynchus lathami* is vulnerable under the TSC Act (1995) and was further assessed within Section 5 and Appendix A of the flora and fauna report.

Birds recorded within the open grassy areas included *Vanellus miles* (Masked Lapwing), *Anthus novaseelandiae* (Richards Pipit) and *Gymnorhina tibicen* (Magpie). Waterbirds observed within and around the periphery of Bootawa Dam included *Cygnus atratus* (Black Swan), *Anas superciliosa* (Pacific Black Duck), *Chenonetta jubata* (Australian Wood Duck) and *Phalacrocorax varius* (Pied Cormorant). According to the OEH database the threatened *Ephippiorhynchus asiaticus* (Black-necked Stork) has been observed within Bootawa Dam in the past. As a consequence, *E. asiaticus* was also been further assessed within Section 6 and Appendix A of the flora and fauna report.

Birds of prey recorded included *Haliastur sphenurus* (Whistling Kite) and *Haliaeetus leucogaster* (White-breasted Sea-Eagle). The White-bellied Sea-eagle is recognised as a Migratory Bird species under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and has been further addressed in Section 10 of the flora and fauna report.

Nocturnal Avifauna Survey

Ninox boobook (Southern Boobook) was commonly heard calling from within the area of open forest during nocturnal surveys. *Podargus strigoides* (Tawny Frogmouth) was also observed within this area. There were no responses as a result of the owl calls played during the survey.

Spotlighting Survey

Four species of native mammal, *Phascolarctos cinerea* (Koala), *Trichosurus vulpecula* (Brush-tailed Possum), *Macropus rufogriseus* (Red-necked Wallaby) and *Pteropus poliocephalus* (Grey-headed Flying-fox) were recorded during the spotlighting survey. One specimen of *P. cinerea* was observed on the boundary of the study area next to the open forest assemblage. *Trichosurus vulpecula* was also recorded within the area of open forest. A number of specimens of *P. poliocephalus* were observed foraging within flowering Ironbark species in the open forest assemblage. *Macropus rufogriseus* was encountered a number of times on the eastern side of Bootawa Dam.

The introduced species *Oryctolagus cuniculus* (European Rabbit) and *Lepus capensis* (European Hare) were commonly encountered within the cleared areas of the study area particularly in the northern portion around the wall of Bootawa Dam.

There were no responses as a result of the mammal calls played during the survey.

Both *P. cinerea* and *P. poliocephalus* are listed as vulnerable under the TSC Act (1995) and have been further assessed within Section 5 and Appendix A of the flora and fauna report. *Pteropus poliocephalus* has also been assessed under National legislation.

5.6 Aquatic Ecology

A rapid assessment in the form of a Stream Invertebrate Grade Number – Average Level (SIGNAL) test which is a bio-indicator to determine the health of a waterway by the absence or presence of certain indicator species was not performed within the dam as this type of survey is only suitable for flowing streams. However sampling carried out by Wildthing Environmental Consultants (2011) involved dip/sweep netting to sample invertebrate and fish species. No electro-fishing or gill netting was undertaken.

Aquatic fauna species present within the dam are typically those adapted to still water conditions at varying depths. Species noted included insects, molluscs, crustaceans and fish.

Aquatic Flora

As previously mentioned vegetation adapted to varying amounts of inundation was present around the periphery of Bootawa Dam. The majority of the edge of the dam contained few aquatic plants. Small sections of the dam primarily along the high water mark however did contain reeds and rushes. These areas included species such as *Typha orientalis* (Cumbungi), *Eleocharis sphacelata* (Tall Spike-rush), *Schoenoplectus mucronatus, Philydrum lanuginosum* (Woolly Frogmouth) and *Juncus usitatus* (Common Rush). The water level was down approximately 1m at the time of the survey with an area of exposed drying mud present. Exposed areas of drying mud below the high water mark were found to contain a number of small quick growing species such as *Cyperus eragrostis* (Umbrella Sedge), *Alternanthera dentata* (Lesser Joyweed), *Centipeda cunninghamii* (Sneezeweed) and *Gratiola pedunculata* (Stalked Brooklime). Few aquatic plants were observed within the water itself with small areas of *Potamogeton tricarinatus* (Floating Pondweed) one of the exceptions.

Aquatic Fauna

Invertebrates

Although not as diverse as a flowing stream a number of aquatic insects were recorded. Common species included those belonging to the Genus Notonectadae (Backswimmers). Other species noted included the dragonfly species *Rhyothemis graphiptera* (Graphic

Flutterer). Molluscs noted included Thiarid Snails and Freshwater Mussels. Common crustaceans noted were *Macrobrachium australiense* (Freshwater Prawn) and *Paratya australiensis* (Freshwater Shrimp).

Vertebrates
Few vertebrates were recorded within Bootawa Dam. Two species of fish *Anguilla reinhardti* (Longfinned Eel) and *Gambusia holbrooki* (Plague Minnow) were observed close to the waters edge. Predation by the introduced *Gambusia holbrooki* (Plague minnow) is a key threatening process listed under the Threatened Species Conservation Act 1995. *Gambusia holbrooki* was found to be relatively common around the edge of the dam. Other fish that are likely to be present within Bootawa Dam include *Anguilla australis* (Short-finned Eel). *Notesthes robusta* (Bullrout) has also been reported to occur within the dam. One dead specimen of *Chelodina longicollis* (Eastern Long-necked Turtle) was also observed on the shore of the dam.

5.7 Aboriginal Archaeology and Heritage

Virtus Heritage was engaged to undertake an archaeological assessment of the proposal. The assessment involved a field survey, with members of the Purfleet-Taree Local Aboriginal Land Council (PTLALC), in November 2010. The study was conducted in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* and *Archaeological Investigation of Aboriginal Objects Code of Practice* (DECCW 2010). The following information on existing Aboriginal values has been taken from the *Due Diligence Archaeological Assessment* (Virtus Heritage, 2011), which is contained in Appendix E of this PEA.

A search of the New South Wales OEH Aboriginal Heritage Information Management System (AHIMS) was conducted as part of this assessment. The search area included a five kilometre area around the centre of Bootawa Dam, including all of the project impact areas. One registered site was identified within the search area. After review of the site card, it was determined that this site had been incorrectly registered and was in fact 47 kilometres south east of the registered co-ordinate.

No known sites were identified within the project impact area based on the results of searches undertaken on the State Heritage Inventory Database, Australian Heritage and the Greater Taree Local Environment Plan was also reviewed.

During the site inspection, a mature Gum tree showed evidence of potential Aboriginal cultural scarring Bootawa PAST-1 (refer to Figure 5-3). The tree was located on a mid slope landform element within the proposed inundation area, refer to the concept design in Appendix A.

Figure 5-2 Aboriginal Scarred Tree (Bootawa PAST-1)

Subsequent to the site inspection, an aboriculturalist was engaged to provide advice on the tree and the scar. The tree was inspected in February 2011 by United Tree Management and concurred that the scar had an age determined between “125-150 years in origin” and that the “likely cause” of the scar was an “incision of Aboriginal cultural origin”. The trees existing condition was recognised as poor, with termite damage evident and an existing predicted short life expectancy (<15 years). The aboriculturalist report is Attachment 2 of the Virtus Heritage Report (Appendix D).

One isolated broken quartzite flake (medial fragment), identified as site Bootawa IF-1, was found on a 4WD vehicle track during the site inspection outside the project impact areas. The isolated find was identified in a small exposure on a ridge crest landform element and had no predicted surrounding Potential Archaeological Deposit (PAD).

5.8 European Heritage

Some historical heritage items were identified within the project impact areas. The original plant buildings (circa 1968) and the later 1989 plant building were within the project impact areas. A memorial stone plaque commemorating the establishment of Bootawa Dam and a small park area were also identified within the proposed extended embankment areas. Receding dam levels exposed the old pontoon within the dam close to the spillway channel area, dating to circa 1968 during the original dam construction.

5.9 Acoustic Environment

The area surrounding Bootawa Dam is rural with grazing as the major agricultural activity. Noise monitoring has not undertaken as part of the PEA. A noise monitoring study undertaken as part of the Bootawa Water Treatment Plant Environmental Assessment (Public Works 2002) found that the background noise levels were 35.9dB (A).

5.10 Air Quality

As previously mentioned, the proposed study area is located within a rural environment. The air quality in the area is typical of a rural environment, it is considered to be good.

5.11 Visual

Bootawa Dam is an existing feature on the landscape. It is visible from Bootawa Dam Road, two neighbouring residents and from the public picnic area located on the northwest corner of the dam. It is a 25m high grassed embankment and would be raised to 30m under the proposal. Minimal vegetation clearing (comprising mainly groundcover and grasses) is proposed at the dam wall.

6 Preliminary Environmental Assessment - Construction

This section identifies the likely potential impacts associated with the construction phase of the project.

6.1 Dam Operation

The dam would be lowered during the construction period to facilitate the initial excavation and construction of the intake tower and penstock. Lowering the storage also facilitates construction of the raised main embankment and saddle dam. The extent of lowering would be determined by MidCoast Water in liaison with the successful contractor. Factors to be considered include managing supply to the public, safety and stored water quality.

MidCoast Water requires the Nabiac Inland Dune Aquifer Borefield and Nabiac Water Treatment Plant to be in operation before the Bootawa Dam raising project commences to ensure that water supply is secure when the dam storage level is reduced during the construction phase.

6.2 Noise

The noisiest construction works are likely to be associated with the excavation and directional drilling of the penstock. Excavation would occur at different times over the 15 month period. The biggest noise impacts are likely to be on the two residents located on the northeast and northwest boundary of the Dam.

6.3 Traffic and Access

Some increase in traffic would be expected due to the delivery of construction equipment and materials. In addition there would be a minor increase in vehicle numbers as a result of construction personnel access requirements and for the transportation of waste materials. Adequate parking for construction vehicles is available on site.

On average, additional traffic movements to Bootawa Dam would be expected to be in the order of 10 to 20 per day depending on the phase of the construction works. The number of heavy vehicles required to transport materials to site would be reduced due to the availability of core and downstream outer zone material from within the dam site.

Access to Borrow Area A would most likely require a temporary construction road to be created around the periphery of the storage. This road would pass the dwelling located to the northwest of the Dam. Borrow Area B would most likely be accessed via the existing four wheel drive track.

6.4 Air Quality

The main impact on air quality during construction is expected to arise from the generation of airborne dust associated with earthworks and from initial movement of trucks transporting materials to and around the site on unsealed roads.

The greatest potential for dust generation associated with the works would arise from the excavation, stockpiling and construction of the main embankment, saddle dam and new spillway. The construction works therefore has the potential to exceed ambient criterion for deposited dust, total suspended particulates (TSP) and dust particulates below 10 micrometers (P10) at nearest sensitive receptors.

Local air quality may also be affected by emissions from construction traffic. These emissions would occur intermittently and are expected to be minor and temporary. It would be unlikely that they would contribute to a permanent detectable reduction in local air quality or cause significant air quality impacts.

6.5 Waste Management

The main waste material to result from the proposed dam raising works would be from the demolition of the existing pump house buildings and general miscellaneous construction waste, such as off cuts, packaging etc. The majority of excavated material would be reused on site for the main embankment and saddle dam.

There may be the requirement for some green waste associated with tree removal around the dam due to the raised storage level.

6.6 Water Quality, Erosion and Sediment Control

Given the location of the dam raising works within and adjacent to the Bootawa Dam, there is an elevated risk of water quality impacts arising from the construction works.

The main risk to water quality has been identified through the earthworks required to raise the dam. These works are predicted to require excavation of approximately 245,500m^3 of core and downstream outer zone materials from within the dam site and supply of a further 62,000m^3 of rockfill and filter material from external suppliers.

Uncontrolled sediment runoff from earthworks, including the high degree of disturbance at the two borrow areas, and underwater excavation of the inlet channel has the potential to increase turbidity and nutrients entering the receiving waters, which when present in large volumes may have ecological impacts. Strict mitigation measures would need to be employed to prevent sediment moving into the aquatic environment.

6.7 European Heritage

The original plant buildings (circa 1968) and the later 1989 plant building are immediately downstream of the Dam. The buildings would be demolished prior to commencement of the works in order to facilitate the preparation of the foundations and construction of the raised dam. The memorial stone plaque and the small park area are within the proposed extended embankment areas.

MidCoast Water is considering commissioning a historical heritage assessment of the 1960s plant buildings, the memorial stone plaque and park and the exposed 1978 pontoon to determine their nature under the *Heritage Act 1977* in consultation with the NSW Heritage Branch, as well as their significance and their value to the local community.

As part of this assessment, it may be considered necessary to carry out a photographic recording of these items before proceeding with the proposed works. Photographs used in the recording could be displayed in the lobby of the new plant buildings to illustrate the history of the dam. The photographic recording could also be deposited in the Local Histories section of the Greater Taree City Council library.

MidCoast Water could also consider relocation of the memorial stone plaque after such a recording, and its relocation in an area which is visible to the public (one possible site may be near the entrance of the new Dam administrative buildings or in the car park area).

7 Preliminary Environmental Assessment - Operational

This section identifies the likely potential impacts associated with the operational phase of the project.

7.1 Location and Land Use

The dam raising would inundate approximately 20 ha of land in addition to the existing inundation area. As MidCoast water owns the land surrounding the current storage level, no private land would be affected by the new area of inundation.

The extended embankment area would impact the small public picnic area located in the northwest corner of the dam. The picnic area would be restored upon completion of the dam raising so there would be no loss to recreational users.

7.2 Visual Amenity

The raised water level would result in a visual impact to those residents whose properties are located on the boundary of Bootawa Dam. The residents would perceive a noticeable change in the size of the dam embankment. Depending on the management of riparian vegetation, the majority of drowned trees would be visible during low flow periods. The main embankment would be replanted with native grasses.

7.3 Water Quality, Erosion and Sediment Control

The proposed works aims to pump and store water from the Manning River during periods of high flow thereby avoiding the need to pump during periods of low flow and high turbidity. The project would guarantee environmental flows in the Manning River in accordance with NSW Office of Water requirements. Pumping rates from the Manning River are not expected to increase.

MidCoast Water is currently licensed to extract 12,500ML/annum from the Manning River. There is currently no cease to pump rule for when the Manning River is in low flow, however MCW voluntarily ceases to pump at about 90ML/day in river flow since water quality dramatically drops at river flows less than this value. In Year 6 of the Water Sharing Plan (commencing August 2014), a cease to pump constraint will be introduced at 98 percentile flow in the Manning River, unless environmental studies demonstrate otherwise. To ensure a conservative strategy, MCW has assumed a higher 95 percentile flow of 240ML/day in the Manning River.

There is potential for upstream erosion as a result of the changed storage level and vegetation removal.

7.4 Downstream Impacts

A Dambreak Study was prepared for the existing dam by Brown Consulting in 2006. The hydraulic modelling estimated a 60mm incremental impact near Wingham (500m upstream of Wingham Bridge) for a dam breach occurring during a local PMF inflow into Bootawa Dam, coincident with similar flood conditions to the 1978 flood (14.9m AHD) of records in the Manning River.

During a sunny day dam failure, the flood level in the Manning River near Wingham is raised to 2.98m AHD. However, this flood level does not exceed the bankfull level of the Manning River, and is less than the 5m AHD level that triggers the State Emergency Services (SES) minor flood warning at Wingham Bridge.

In the Bootawa Dam Tributary, the incremental impact is significant, ranging from over 4m immediately downstream of Bootawa Dam to 1.5m near its confluence with the Manning River. The only buildings within areas of high hazard are those near the toe of the dam wall.

MidCoast Water plans to commission an addendum to the 2006 Dambreak Study to consider the future raised dam conditions.

Current seepage measurements through the main embankment are consistently small, less than 10 l/sec. The raised dam has potential to increase the seepage by 35%.

7.5 Terrestrial Flora and Fauna

The proposed raising of the dam would mainly result in the drowning of mostly cleared land. Areas of vegetation such as open forest and moist regrowth scrub also occur within the inundation area. Vegetation around the storage perimeter would be cut at the base and removed prior to inundation.

As discussed in Section 5.5, no endangered ecological communities or threatened flora species were recorded during the flora and fauna assessment. Four threatened fauna species, *Ephippiorhynchus asiaticus* (Black-necked Stork), *Calyptorhynchus lathami* (Glossy Black Cockatoo), *Phascolarctos cinerea* (Koala) and *Pteropus poliocephalus* (Grey-headed Flying-fox) were found to have utilised the study area. A species of microchiropteran bat, *Vespadelus troughtoni* (EasternCave Bat) was also regarded as present within the study area as a precaution.

The raising of Bootawa Dam would result in a small incremental loss of habitat for the threatened species assessed in the flora and fauna report. However, assuming recommendations from that assessment are implemented, it is considered that the proposed works is unlikely to disrupt the lifecycle of any addressed threatened species, endangered population or endangered ecological community such that local extinction would occur.

7.6 Aquatic Ecology

Tree root balls would remain within the inundation area which would provide habitat for a number of invertebrates and fish. Similar aquatic habitat to that currently present within the Dam would also be present after the dam raising. Therefore it is considered that the raising of Bootawa Dam is unlikely to result in any significant impact to aquatic habitat within the study area.

Predation by *Gambusia holbrooki* (Plague minnow) is a key threatening process listed under the *Threatened Species Conservation Act 1995*. Due to the high numbers of this introduced fish species recorded within Bootawa Dam it is likely that it has some impact on native freshwater fish, macroinvertebrates, frog eggs and tadpoles that are present. However the risk of the Plague Minnow increasing in abundance is minimal as a result of the proposal.

7.7 Aboriginal Archaeology and Heritage

An Aboriginal scarred tree has been identified in the proposed inundation area (see Section 5.7 of this PEA). MidCoast Water is currently considering the management strategies associated with the Aboriginal scarred tree (Bootawa PAST-1) and is intending to undertake further consultation with PTLALC and all relevant Aboriginal stakeholder groups in relation to the management of Bootawa PAST-1 in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010).

Possible strategies considered may include the construction of a levy around the scarred tree, relocation of the scarred tree or preservation of the scarred section of the tree to the new picnic area or proposed interpretive garden in the Bootawa Dam Water Treatment Plant carpark.

7.8 Socio-Economic

Post construction the raised Bootawa Dam and expansion of the Manning water supply system would provide enhanced water supply security to the Greater Taree and Great Lakes

regions. This would enable development to proceed, hence stimulating economic growth in the region.

8 Conclusion and Recommendations

As detailed in Sections 6 and 7 of this PEA, a number of potential impacts have been identified as a result of the proposed works such as operation of the dam during construction, elevated noise, increased traffic, air quality, waste management issues, flora and fauna and aboriginal archaeology and heritage issues.

Specialist sub-consultants have been engaged to assist in the assessment of environmental impacts and to aid in the determination of whether a significant impact is predicted as a result of the proposal.

The flora and fauna assessment (Wildthing Environmental Consultants 2011) concluded that the raising of Bootawa Dam would result in a small incremental loss of habitat for a number of threatened species. However, it is believed that the proposal is unlikely to disrupt the life cycle of any addressed threatened species, endangered population or endangered ecological community such that local extinction would occur, assuming a number of recommendations are adopted.

The Aboriginal scarred tree requires further assessment and consultation with Aboriginal stakeholders, following the Aboriginal consultation guidelines (DECCW 2010). The European heritage items require further assessment to determine their significance and value to the local community.

All other impacts would need to be managed through the implementation of appropriate safeguards in accordance with industry best practice as prescribed by relevant statutes, policies and guidelines. The majority of the impacts would be temporary in nature during the construction process. Table 8-1 provides a summary of the draft management and mitigation measures identified during the preliminary environmental assessment.

Table 8-1 Draft Management and Mitigation Measures

Mitigation/Management Measures	Timing
General Management Plans	
Implementation of a Construction Environmental Management Plan (CEMP) in accordance with the requirements of the Environmental Impact Statement and other relevant guidelines, to document all management measures to be implemented during the construction works at the site. This would addresses controls for sediment and erosion, water quality, noise, air pollution, weed control, flora and fauna protection, traffic control, waste management and public safety.	Pre-construction
Aboriginal Archaeology and Heritage	
Further discussions will be held with Aboriginal stakeholders regarding the management of Bootawa PAST-1 in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010).	Pre-construction
European Heritage	
Undertake a historical heritage assessment of the 1960s plant buildings, the memorial stone plaque and park and the exposed 1978 pontoon	Pre-construction

to determine their significance and value to the local community.	
Flora and Fauna	
To reduce the impact of the proposal on the Koala it is recommended that additional specimens of *E. tereticornis* and E. propinqua be planted where possible around the dam to compensate those species that would be removed. Before any tree removal, trees would need to be inspected by a suitably qualified person on the day to prevent any avoidable harm to any Koalas that may be present. Any new fencing particularly along the eastern boundary would be required to allow the safe passage of Koalas to areas of habitat within the study area.	Pre-construction and Post-construction
To reduce the impact of the proposal in relation to any arboreal marsupials, microchiropteran bats and certain birds the removal of hollow-bearing trees should be supervised by a suitably qualified and vaccinated ecologist. It is recommended that suitable compensatory nestboxes be installed within the remaining area of open forest and adjacent areas prior to clearing.	Pre-construction and Post-construction
A small number of noxious weeds such as Lantana camara (Lantana) and Rubus fruticosus (Blackberry) were present within the study area. Aquatic weeds also pose a threat to the dam itself. Periodic weed monitoring and control would be required to be undertaken within the study area.	Pre-construction and Post-construction
Borrow areas are to be revegetated using locally native flora species.	Post-construction
Water Quality	
Site specific sediment control plans would be required to be prepared for the two borrow areas to help prevent sediment moving into Bootawa Dam.	Pre-construction
Operation of Dam in accordance with *Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009*.	Post-construction
Other	
MidCoast Water would conduct ongoing consultation with the community regarding the status of the proposal and likely impacts on the community.	Pre-construction

9 References

Brown Consulting (2006) *Bootawa Dam Dambreak Assessment,* X06023-02B, August 2006

DamWatch (2009) *Bootawa Dam Surveillance Report*, June 2009

Department of Environment, Climate Change and Water (2010) *Aboriginal Cultural Heritage Consultation Requirements for Proponents,* DECCW 2009/781, April 2010

MidCoast Water (2008) *The Manning, Great Lakes and Karuah Sustainable Water Cycle Management*

NSW Department of Public Works and Services (1998) *Manning District Water Supply Augmentation Options Study Report*, DC97109, June 1998

NSW Department of Public Works and Services (1999) *Manning District Water Supply Augmentation Strategy Review Report*, DC99104SS, May 1999

NSW Department of Public Works and Services (2002) *Manning District Bootawa Dam Water Treatment Plant Statement of Environmental Effects,* DC02094, July 2002

NSW Department of Commerce (2004) *Manning District Water Supply Scheme, Scheme Strategy 6B Optimisation Report*, DC03151, April 2004

NSW Department of Commerce (2005) *Bootawa Dam Concept Design Report for Dam Raising,* DC02160, April 2005

NSW Department of Commerce (2009) *Bootawa Dam Raising Investigation Report*, DC08018, February 2009

NSW Public Works and Services (2011) *Bootawa Dam 7m Raising Concept Design Report,* DC10126, February 2011

Wildthing Environmental Consultants (2011) *Terrestrial and Aquatic Ecology Report for the Proposed raising of Bootawa Dam and associated infrastructure*, Job No. 12002, January 2011

Virtus Heritage (2011) *Due Diligence Archaeological Assessment Proposed Bootawa Dam Raising Tinonee for MidCoast Water and NSW Public Services,* June 2011

Appendix A – Concept Design

FIGURE 1

EXISTING TREATED WATER RESERVOIR

NEW VALVE HOUSE

NEW OUTLET PENSTOCK

EXISTING RAW WATER BALANCE TANK

EXTENT OF RAISED EMBANKMENT

SPILLWAY CHANNEL

SADDLE DAM TURNING AREA 2

SADDLE DAM

SADDLE DAM TURNING AREA 1

MAIN EMBANKMENT TURNING AREA

INTAKE TOWER TURNING AND PARKING AREA

EXISTING EARTHFILL EMBANKMENT

NEW INTAKE TOWER AND BRIDGE

SCARRED TREE

MEMORIAL PLAQUE TO BE RELOCATED

Flow

BORROW AREA A

SCARRED TREE

BORROW AREA B

NOTE: LEVELS ARE IN AHD.

1:5000

0 50 100 150 200 250 m

50

BOOTAWA DAM 7m RAISING
SITE PLAN

15/03/2011 3:47:07 PM Zhang C2 g:\ls\watertec\pcad\bootawad2\CONCEPT GS\PBOOT FIG_1.DGN

Appendix B – Consultation Responses

NSW GOVERNMENT | Office of Environment & Heritage

Our reference: DOC11/18782 LIC11/195
Contact: Peter Jamieson, (02) 4908 6818

Lara Hess
NSW Public Works
Level 13, McKell Building
2-24 Rawson Pl
SYDNEY 2000

Dear Ms Hess

RE: PROPOSED RAISING OF BOOTAWA DAM

Reference is made to your letter dated 31 March 2011 seeking comments on issues to be included in a Review of Environmental factors (REF) for the above proposal. I apologise for the delay in replying.

Schedule 1 of the Protection of the Environment Operations (POEO) Act (1997) lists the activities that must be the subject of a licence issued by the Environment Protection Authority (EPA).

The EPA only has a statutory role in assessing an activity for threatened species impacts, if the consent authority determines that the activity is likely to significantly affect a threatened species, population, ecological community, or its habitat, as listed under the *Threatened Species Conservation (TSC) Act 1995.*

From time to time, EPA receives requests from the agencies for input into Review of Environmental Factors that are not listed in this Schedule and which require no formal approval from EPA. In the past EPA has responded to such requests with a standard response identifying issues for consideration such as potential water pollution and dust impacts. Several years ago, in the interests of efficiency, EPA changed this approach. Instead of contacting the EPA about each specific project, we encouraged agencies to rely on their own investigations to identify relevant issues and then adopt appropriate ameliorative measures. This position remains, although in this specific case EPA requests the following matters be specifically investigated:

- It is noted that the proposal requires the raising of the existing dam wall by 7m. This substantially increases the potential impact on downstream areas in the event of catastrophic failure of the embankment. Hydraulic dam break modelling should be undertaken as part of the REF investigations to determine the effect of embankment failure in an extreme flood event on downstream development including Wingham Peninsula. Modelling should be conducted for a range of coincident flooding scenarios in the Manning River.

- Whether the proposal is consistent with the provisions of the *Protection of the Environment Operations Act, 1997.*

We are now known as the
Environment Protection Authority

PO Box 488G, Newcastle NSW, 2300
Ground Floor, 117 Bull St,
Newcastle West, 2302
Tel: (02) 4908 6800 Fax: (02) 4908 6810
ABN 30 641 387 271
www.environment.nsw.gov.au

- Midcoast County Council currently holds Environment Protection Licence 6583 for the application of algicide to Bootawa Dam. The EPA does not support the use of algicides except as a last resort in an emergency as algicides are toxic to other aquatic life and ongoing algicide use could lead to less favourable water quality and algal conditions in the future. EPA requests investigations be undertaken into alternatives to the use of algicides as part of the REF. For example, storage management to reduce conditions favourable to algal growth, drawing water from unaffected areas of the dam where algal levels are small in biovolume and there is minimal chance of bloom affected waters entering the drinking water offtakes, use of alternative supplies while the dam is affected by a bloom, and implementation of activated carbon treatment of the drinking waters.

- Whether the outlet structure of the dam needs to be modified to prevent potentially cold anoxic waters being released downstream.

- Whether the proposal is likely to impact on areas of native vegetation, threatened significant flora and fauna species, populations and ecological communities and whether these impacts are likely to be significant in the context of s.5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This should include assessment against any relevant State Environment Planning Policies.

- Whether the proposal is consistent with the relevant threatened species provisions of the EP&A Act, *Threatened Species Conservation Act 1995* and the *Native Vegetation Act 2003*.

- Whether an appropriate level of Aboriginal cultural heritage assessment has been undertaken, and that the proposal is not likely to impact on areas of cultural significance to the Aboriginal community. Also, it is important that the views of Aboriginal community groups be sought and fully considered in regard to the proposed development.

If you would like to discuss the issues raised in this letter in more detail please contact Peter Jamieson, at this office, on (02) 4908 6818.

Yours sincerely

P. Jamieson 25-11-11

PETER JAMIESON
Head Regional Operations Unit – Hunter Region
Environment Protection Authority

From: "Tanya Cross" <Tanya.Cross@gtcc.nsw.gov.au>
To: <lara.hess@services.nsw.gov.au>
Date: 27/04/2011 11:07 am
Subject: Bootawa Dam Raising REF

Hi Lara

I refer to your letter dated 31 March seeking comment from Council in relation to issues to be considered in the REF for the Bootawa Dam project. Please be advised that Council has no immediate concerns apart from noting that the general locality contains significant koala habitat and that Bootawa Dam Road is a well-documented koala black spot area. Please ensure that these matters are given appropriate consideration in the REF & that adequate precautionary measures are employed during the construction phase. Further information on the local koala population can be sourced from Koalas in Care Inc. on 6552 2183.

Regards

Tanya Cross

Senior Environmental Planner | Greater Taree City Council
t: 02 6592 5248 | f: 02 6592 5311
e: tanya.cross@gtcc.nsw.gov.au <mailto:tanya.cross@gtcc.nsw.gov.au> |
w: www.gtcc.nsw.gov.au <http://www.gtcc.nsw.gov.au>

Appendix C – Cost Estimate

DATE: **FEBRUARY 2011**

OPTION 1A: **FSL61.1m (AHD) STORAGE CAPACITY 4,500ML**
DAM CREST RL62.5m (AHD) SPILLWAY WIDTH 40m
DOWNSTREAM EMBANKMENT SLOPE 3H TO 1V

ITEM	QUANTITY	UNIT	RATE	AMOUNT
PREPARATORY WORKS				
Site Services/Establishment/Disestablishment		LS		500,000
Dewatering and Flood Protection		LS		250,000
		Sub-total		750,000
MAIN EMBANKMENT				
Foundation Stripping/Preparation	78,000	m³	5	390,000
Embankment Excavation	30,000	m³	10	300,000
Core Zone	34,300	m³	16	548,800
Fine Filter	26,000	m³	100	2,600,000
Coarse Filter	25,000	m³	100	2,500,000
Upstream Slope Rockfill	18,000	m³	70	1,260,000
Random Fill	225,000	m³	12	2,700,000
Topsoil and Grass	25,000	m²	10	250,000
Crest Pavement (gravel,base,subbase,subgrade)	3,000	m³	80	240,000
Guardrail	600	m	150	90,000
		Sub-total		10,878,800
SADDLE DAM				
Foundation Stripping/Preparation	2,700	m³	5	13,500
Core Zone	2,200	m³	16	35,200
Fine Filter	900	m³	100	90,000
Coarse Filter	300	m³	100	30,000
Upstream Slope Rockfill	300	m³	70	21,000
Random Fill	2,400	m³	12	28,800
Topsoil and Grass	2,400	m²	10	24,000
Crest Pavement (gravel,base,subbase,subgrade)	700	m³	80	56,000
Guardrail	200	m	150	30,000
		Sub-total		328,500
SPILLWAY				
Excavation in OTR	5,000	m³	10	50,000
Excavation in Rock	17,000	m³	25	425,000
Drain Pipes	900	No	50	45,000
Drill Holes for Anchor Bars	4,000	m	30	120,000
Anchor Bars and Grout	4,000	m	30	120,000
Reinforced Concrete (floor, walls, sill)	1,020	m³	1,500	1,530,000

ITEM	QUANTITY	UNIT	RATE	AMOUNT
Rockfilled Mattresses	200	m²	100	20,000
		Sub-total		2,310,000
INTAKE TOWER/BRIDGE/INLET CHANNEL				
Stage 1 Excavation in OTR (in Dry)	2,500	m³	10	25,000
Stage 1 Excavation in Rock (in Dry)	1,500	m³	25	37,500
Stage 2 Excavation in OTR (assumed in Dry)	2,800	m³	10	28,000
Stage 2 Excavation in Rock (assumed in Dry)	2,500	m³	25	62,500
Rockface Protection		LS		200,000
		Sub-total		353,000
OUTLET PENSTOCK				
Establishment of site equipment		LS		200,000
Microtunnelling in rock	205	m	12,000	2,460,000
Spoil to re-use or disposal		LS		25,000
Grouting of the annulus - including repairs to the internal joints		LS		120,000
Supply, welding, testing and pushing steel pipes		LS		800,000
Demobilisation of equipment		LS		40,000
		Sub-total		3,645,000
INTAKE TOWER				
Foundation Preparation/Base Concrete		LS		240,000
Reinforced Concrete Stem	180	m³	1,800	324,000
Reinforced Concrete Deck	40	m³	1,500	60,000
Trashracks, Bulkheads and Crane		LS		600,000
Metalwork		LS		200,000
		Sub-total		1,424,000
ACCESS BRIDGE				
Foundation Preparation/Trimming		LS		20,000
Reinforced Concrete Abutment and Pier	60	m³	1,500	90,000
Deck System		LS		150,000
Metalwork		LS		40,000
		Sub-total		300,000
VALVE HOUSE				
Excavation in OTR	800	m³	10	8,000
Excavation in Rock	2,200	m³	25	55,000
Reinforced Concrete Floor, Walls, Roof, Plinths	850	m³	1,500	1,275,000
Pipework and Fittings		LS		800,000
Valves and Fittings		LS		600,000
Crane Installation		LS		50,000
Control Room Roof Structure		LS		60,000
Metalwork		LS		100,000
Electrical		LS		100,000
		Sub-total		3,048,000
SUBMERGED DISCARGE VALVE/PIT				

ITEM	QUANTITY	UNIT	RATE	AMOUNT
Excavation in OTR	150	m³	10	1,500
Excavation in Rock	60	m³	25	1,500
Reinforced Concrete Floor,Walls,Valve Support	120	m³	1,500	180,000
Pit Cover		LS		40,000
Metalwork		LS		40,000
Electrical		LS		20,000
Valve and Pipework		LS		200,000
Pipeline from Valve House Deviation/Installation		LS		200,000
		Sub-total		683,000
SEALING EXISTING TOWER/OUTLET PIPE		LS		150,000
INLET STRUCTURE				
Foundation Preparation/Excavation		LS		10,000
Reinforced Concrete	12	m³	1,500	18,000
Pipework Deviation/Installation		LS		300,000
		Sub-total		328,000
INSTRUMENTATION		LS		100,000
ROADWORKS/PARKING & TURNING AREAS				
Excavation in OTR	5,000	m³	10	50,000
Excavation in Rock	4,000	m³	25	100,000
Fill	500	m³	20	10,000
Sealed Surfaces	1,300	m²	60	78,000
Subgrade/Base/Subbase	1,300	m³	80	104,000
Gravel Pavement	300	m³	80	24,000
Guardrail	1,800	m	150	270,000
Concrete	300	m³	1,500	450,000
Pipework/Drainage		LS		20,000
	Sub-total			1,106,000
	TOTAL DIRECT COST			25,404,300
Preconstruction (10%)				2,540,430
Supervision (10%)				2,540,430
Contingencies (20%)				5,080,860
	TOTAL COST			**$35,566,020**
	Say			**$35.6M**

Appendix D – Flora and Fauna Report

Appendix E – Cultural Heritage Report