Public Works
Project Management

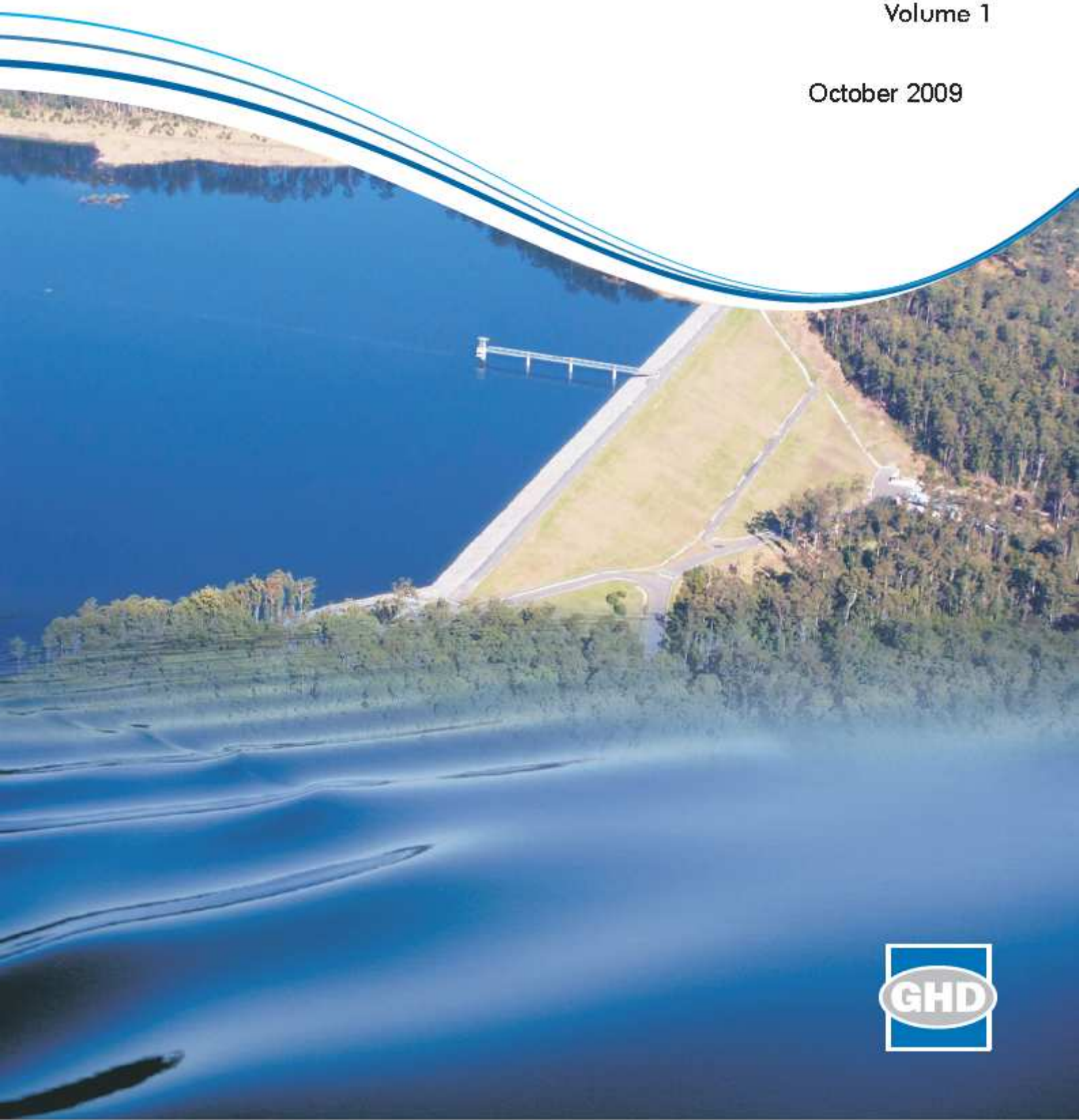
Nambucca District Water Supply Augmentation

Bowraville Off-River Storage & Associated Works

Environmental Impact Statement

Volume 1

October 2009



GHD

Submission of an Environmental Impact Statement (EIS)

prepared under the *Environmental Planning and Assessment Act 1979* Section 112

EIS prepared by

Name	Shaun Lawer
Qualifications	Bachelor of Urban and Regional Planning, Masters of Business Administration, Certified Practising Planner
Address	230 Harbour Drive, Coffs Harbour NSW 2450
In Respect of	Nambucca District Water Supply Augmentation, Bowraville Off-River Storage and Associated Works
Part 5 activity	
Proponent Name	Nambucca Shire NSC
Proponent address	44 Princess Street, Macksville 2447
Land in which activity is to be carried out **Lot No. DP/MPS, vol/fol etc No. and Address of**	Lot 1, DP 1076377, Lot 326, DP 777074, Lot 102, DP 809380, Lot 3, DP 253386, Lot 8, DP 253386, Lot 3, DP 1076377, Lot 2, DP 1073580, Lot 463, DP 710439, Lot 2, DP 788540, Lot 1, DP 788540, Lot 4, DP 786358, Lot 3, DP 612962, Lot 2, DP 612962, Lot 2, DP 612962

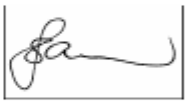
Environmental Impact Statement

Part D of the Environmental Impacts Statement (EIS) assesses the potential environmental impact of the proposed development.

Certificate

I certify that I have prepared the contents of this Statement and to the best of my knowledge:

- It has been prepared in accordance with Clauses 230 and 231 of the *Environmental Planning and Assessment Regulation 2000*;
- It contains all available information that is relevant to the environmental assessment of the activity to which the statement relates; and
- The information contained in this Statement is neither false nor misleading.

Signature: 

Name Shaun Lawer

Senior Environmental Planner

Date: 29 September 2009

Contents

Table Index

Figure Index

EIS Team

GHD

EIS Project Management

Shaun Lawer, John McGillvray, Tom Ryan, Mike Graver

Air Quality and Noise

Tristan Gribble, Scott Anderson

Soils, Landform Stability and Erosion Hazard

Guy Lampert

Flora and Fauna

Robert Harrison, Jayne Tipping, Aaron Dunlop, Katrina Rope

Surface Water and Groundwater

Kyle Horner, Dr Stuart Gray

Traffic Impact

Chris Weavers

Visual Amenity

Katrina Burbidge

Climate Change and Greenhouse Gas Emissions

Andrew Maddocks, Ben Luffman, Sue Trahair

EIS Preparation

Shaun Lawer, Katrina Burbidge, Ben Luffman, David Chubb, Monique Roser

Navin Officer Heritage Consultants

Kerry Navin, Nicola Hayes

KJA

Alessandra Pinzone, Sara Neville, Faye Rescignowould

Nambucca Shire NSC

Richard Spain

Department of Public Works – Project Management

Vincent Joseph, Michael Partridge, Tim Alexander.

Office of Water

Glenn George

Glossary

dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels.
FLDWAV	Model used by US National Weather Service to simulate dam breaks.
GHG Protocol	The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard developed by the World Business NSC for Sustainable Development
L_N	Statistical sound measurement recorded on the linear scale.
L_{AN}	Statistical sound measurement recorded on the "A" weighted scale.
$L_{A10\ (Time)}$	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{A10\ (1\ hour)}$	The L_{10} level measured over a 1-hour period.
$L_{A10\ (18\ hour)}$	The arithmetic average of the L_{10} levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
$L_{Aeq\ (Time)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Aeq\ (15\ hr)}$	The L_{Aeq} noise level for the period 7 am to 10 pm.
$L_{Aeq\ (9\ hr)}$	The L_{Aeq} noise level for the period 10 pm to 7 am.
$L_{Aeq\ (1\ hr)}$	The L_{Aeq} noise level for a one-hour period. In the context of the NSW DECC *Environmental Criteria for Road Traffic Noise*, it represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7 am to 10 pm, or 10 pm to 7 am, (whichever is relevant). If this cannot be defined accurately, the highest A-weighted L_{eq} noise level is used.
$L_{A90\ (Time)}$	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90\ (15\ min)}$.
$L_{AMax\ (Time)}$	The maximum sound level recorded during a specified time interval.
$L_{AMin\ (Time)}$	The minimum sound level recorded during a specified time interval.
Indirect impacts	Occur when project-related activities affect resources in a manner other than a direct loss of the resource. Indirect impacts may include: killing a species through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious changes in the water table, increased soil salinity, promotion of erosion, inhibition of nitrogen fixation, provision of suitable seed bed for introduced weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas.
Lacustrine	of, or pertaining to, a lake

Lifecycle	Is the series or stages of reproduction, growth, development, aging and death of an organism
Likely	Taken to be a real chance or possibility of a species occurring within the study area
Locality	The surrounding areas as defined by a 10 km radius of the study area
Local population	The population that occurs within the study area, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated
ML	Megalitre (1,000,000 litres)
NES	National Environmental Significance
Proposal	The action / works proposed to be undertaken
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes. It is defined as the median value of: ◗ All the day assessment background levels over the monitoring period for the day; ◗ All the evening assessment background levels over the monitoring period for the evening; or ◗ All the night assessment background levels over the monitoring period for the night.
Region	a biogeographical region that has been recognised and documented such as the Interim Biogeographical Regions of Australia (IBRA) (NSW NPWS, 2003). The study area falls within the North Coast Bioregion.
Riffle	Shallow reach with low flow characterised by small hydraulic jumps over rough bed material, causing small ripples, waves and eddies, without breaking surface tension
Study area	The areas, which are likely to be affected by the Proposal, either directly or indirectly. The study area is limited to the inundation area, the existing borefield and proposed borefields, other related infrastructure, including a pipeline connecting the off-river storage to the borefields and the immediate surrounds and the upgraded access roads
Thermocline	A layer of water in an ocean or certain lakes, where the temperature gradient is greater than that of the warmer layer above and the colder layer below

List of Acronyms

ANCOLD	Australian National Committee on Large Dams
ANZECC	Australian and New Zealand Environment and Conservation NSC
AADT	Annual Average Daily Traffic
ARI	Average Recurrence Interval
ASD	Available Sight Distance
AHIMS	Aboriginal Heritage Information Management System
BOM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
DCP	Development Control Plan
DEC	Department of Environment and Conservation (NSW), now DECCW
DECC	Department of Environment and Climate Change (NSW), now DECCW
DECCW	Department of Environment, Climate Change and Water (NSW)
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth)
DG	Director-General of the Department of Planning (NSW)
DI&I	Department of Industry and Investment (NSW)
DoP	Department of Planning (NSW)
DPI	Department of Primary Industries (NSW), now DI&I
DS Act	NSW *Dam Safety Act 1978*
DSC	Dam Safety Committee
DWE	Department of Water and Energy(NSW), now DECCW
EEC	Endangered Ecological Community
ECRTN	Environmental Criteria for Road Traffic Noise
EIS	Environmental Impact Statement

EMP	Environmental Management Plan
ENCM	Environment Noise Control Manual
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPBC Act	NSW *Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
FM Act	NSW *Fisheries Management Act 1994*
FMZ	Forestry Management Zone
FSL	Full Storage Level
FullCAM	Australian Government Full Carbon Accounting Model
INP	Industrial Noise Policy
IPCC	International Panel on Climate Change
IWCM	Integrated Water Cycle Management
LEP	Local Environmental Plan
LGA	Local Government Area
LG Act	NSW *Local Government Act 1993*
LWU	Local Water Utilities
MR	Main Road
NDWSS	Nambucca District Water Supply System
NPW Act	NSW *National Parks and Wildlife Act 1974*
NRCMA	Northern Rivers Catchment Management Authority
NSC	Nambucca Shire NSC
NWI	National Water Initiative
NW Act	NSW *Noxious Weeds Act 1993*
NWMF	Nambucca Waste Management Facility
OHS	Occupational Health and Safety
PAR	Population at Risk

PFM	Planning Focus Meeting
RBL	Range Background Level
POEO Act	NSW *Protection of the Environment Operations Act 1997*
REP	Regional Environmental Plan
RTA	Roads and Traffic Authority
SEPP	State Environmental Planning Policy
SISD	Safe Intersection Sight Distance
SSD	Stopping Sight Distance
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSLA Act	NSW *Threatened Species Legislation Amendment Act 2004*
VMS	Value Management Study
WM Act	NSW *Water Management Act 2000*

Executive Summary

Introduction

The Bowraville Off-River Storage and Associated Works Project ('the Proposal') has been proposed as part of an Integrated Water Cycle Management (IWCM) Strategy by Nambucca Shire Council (NSC) to secure the water supply of the Nambucca Local Government Area (LGA) for now and into the future. The Proposal has been developed following an extensive series of investigations into feasible water supply options for the LGA. It is the key water security component of the IWCM Strategy, ensuring the water supply system has sufficient capacity to meet the current and future demands of the LGA. The IWCM Strategy also proposes demand management measures such as effluent recycling, an enhanced tune up/ retrofit program focusing on water efficient washing machines and cisterns, a rain water tank refit program, a grey water rebate program, an enhanced system leakage reduction program and distribution mains upgrades.

The Proposal consists of expanding the existing borefield, upgrading the headworks and access roads, installation of pipelines, and storing the additional water obtained from the borefield in a 5,500ML off-river storage.

Project Need

The drought of 2002/2003 highlighted that the Nambucca and District Water Supply Scheme is highly vulnerable to extended drought conditions. During this period it was estimated that as little as 60 days' water supply may have been remaining within the system. To address this issue, NSC has determined that in addition to the demand management strategies outlined in the IWCM Strategy, additional water supply security is required as soon as possible. Additional water security would provide Shire residents and businesses with an increased level of drought security. The Proposal also provides additional benefits in securing environmental flows for the Nambucca River.

In addition to providing increased water security to the Nambucca LGAs current population, there is also a need to consider projected population increases as this would result in an increase in demand for urban water services. The *Nambucca Shire Structure Plan* (NSC, 2008) estimates the population in the Nambucca LGA would grow by approximately 2 percent per annum over the next 20 years. The Plan estimates that by 2026 the population would grow to 26,593 persons (8,697 additional persons from 2006). The IWCM Strategy (NSW WS, 2009) further projects that by 2046 the population would reach 29,943 with an annual growth of 1.6 percent per annum. The existing system is unlikely to accommodate such an increase in demand and therefore the system requires augmentation to provide an acceptable level of security for the current and future population of the Nambucca LGA.

Environmental Impact Assessment Process

This Environmental Impact Statement (EIS) has been prepared in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) *and* the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and other relevant environmental

legislation and planning requirements. In particular, Clauses 229 to 231 of the EP&A Regulation provide those issues that must be included in any EIS.

The EIS examines feasible alternatives to the Proposal and provides justification for the selection of the preferred approach to securing the water supply for the urban areas of Nambucca LGA. An assessment of the potential environmental, social and economic impacts associated with the construction and operational phases of the Proposal is undertaken and measures to safeguard and mitigate potential impacts on the environment are provided where required.

NSC is both the proponent and a determining authority for the Proposal. As the Proposal requires permits and licences under a range of legislative instruments the approval or concurrence of other determining authorities would be required before the Proposal can proceed. The other determining authorities are:

- Department of Environment, Climate Change and Water (formerly DECC and DWE);
- Department of Industry and Investment (formerly DPI); and
- NSW Heritage NSC.

Outline of Proposal

The Proposal involves enhancing the existing Nambucca River and South Creek water sources (groundwater bores) to deliver up to 40ML/day of additional water to a new off-river storage located on the headwaters of Bowra Creek for use during low river flow periods. The key elements of the Proposal are as follows:

Component	Description
Expanded Borefield	The existing borefield would be expanded with the construction of 15 additional bores and associated pipelines along the Nambucca River and 9 new bores and associated pipelines along South Creek, with interconnection with the existing borefield to allow flexibility in pumping sources. The system is planned to have a pumping capacity of up to 40ML/day to the storage in addition to the 17ML/day required for the future NDWSS demand. Extracation of groundwater would be monitored via an adaptive management framework.
New Headworks	It is proposed to construct a new 40ML/day high lift pumping station near the existing borefield collection tank to transfer water to the storage. A new collection tank (0.16 ML) would also be required to store extracted water prior to being pumped to the storage.
Transfer Pipeline	Approximately 2,000 m of 600mm diameter pipeline would be required to connect the new headworks to the storage.

Component	Description
Off-River Storage	A new off-river storage is proposed on the head waters of Bowra Creek with a capacity of 5,500 ML but with the provision for foundations to provide for a 14,000 ML storage in the future. The storage would consist of an earth embankment with a crest width of 7.7 metres at RL 40.1 m AHD. The storage would be filled from groundwater adjacent to the Nambucca River and South Creek with all inflows from the Bowra Creek catchment being released for environmental flows. The storage would also incorporate an aeration and mixing destratification system to control stored water quality.
Spillway	An open channel spillway has been designed to a width of 16 metres for the maximum peak discharge of 58 m^3/s. The outlet of the spillway would be located at RL 38.1 m on the right hand bank, discharging through a stilling basin into a gully at the downstream toe, leading back to Bowra Creek.
Multi-level off-take	A multi-level off-take structure with off-takes at least at RL 32m and RL 24 m is proposed. The first level would be at about 6 m below the Full Supply Level of 38.1 m, while the second level would be just below the level where no more water can be drawn off. This is to ensure the best quality water is released from the storage.
Upgrade of Bobo Road	It is proposed that Bobo Road be upgraded to allow for both the construction of the storage and its future operation.
Vegetation Clearing	Approximately 81 ha of land would require clearing for the 5,500ML storage inundation area and ancillary works (e.g. roads, pipelines). The inundation area is presently part of the Viewmont State Forest and is subject to sustainable forestry operations. All harvestable timber within the acquisition area (approx. 40%) would be removed by DI&I under existing approvals.
Fish Passage and Bank Stabilisation Works	Provision would be made for a fish ladder across the existing pipeline on the Nambucca River to improve fish passage. Bank stabilisation works at select locations would also be undertaken to provide further security to the expanded borefield into the future.

Component	Description
Acquisition/ Easements	The Proposal requires the acquisition of approximately 220ha of Viewmont State Forest to accommodate the off-river storage. Easements would also be required over all of the infrastructure within private property. A 5 metre wide easement for the full length of the borefield and transfer pipelines would be required as part of the Proposal for access and future maintenance. Any acquisitions would be undertaken in consultation with landowners, in accordance with the terms of the *Land Acquisition (Just Terms Compensation) Act 1991*.
Ancillary Works	The existing electricity network would need to be augmented to provide power to the relevant facilities. The Proposal would also require an extension to the existing telemetry system to accommodate the new facilities and modify the existing control program.

An overview of the Proposal and its components are illustrated in Figure 1.

Consultation

Statutory Consultation

Consultation undertaken with government authorities in preparing the EIS included:

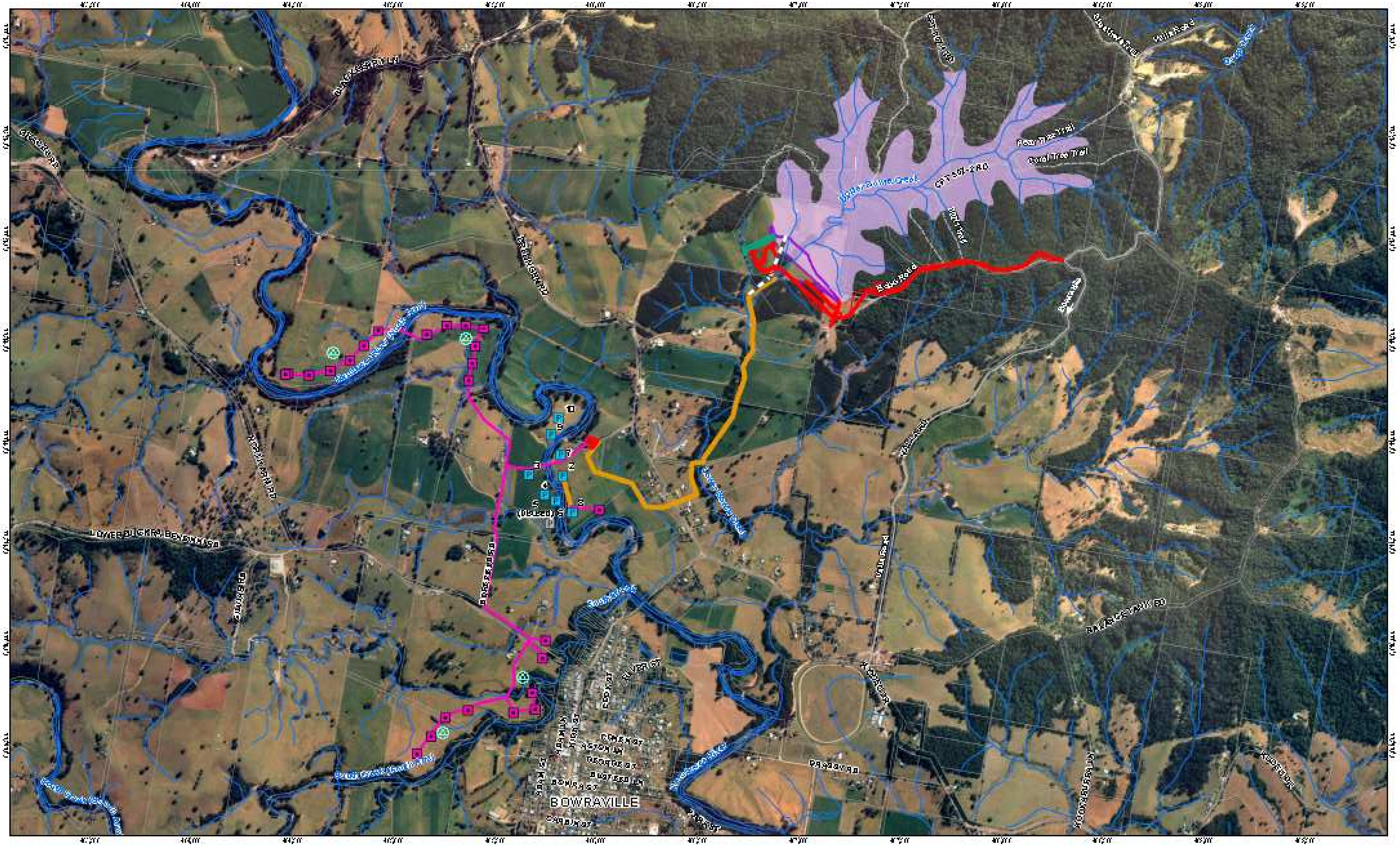
- The Director-General of the Department of Planning to obtain the Director-General's Requirements for the EIS as required under the EP&A Regulation;
- Letters were sent to all relevant government authorities regarding the Proposal;
- A Planning Focus Meeting and Environmental Risk Analysis Workshop was convened with key government authorities on 16 October 2008. Twenty government authorities were invited to attend, with 11 representatives of those agencies attending. It involved a presentation including introduction and overview of the Proposal, the EIS methods and sought comments from statutory authorities; and
- Establishment of a Technical Liaison Committee by the NSW Department of Public Works – Project Management to facilitate and encourage participation of relevant government authorities which regularly convened to discuss issues during the EIS preparation.

Community Consultation

Consultation with the community has been undertaken prior to and during the preparation of the EIS. Consultation activities have included:

- Direct liaison (meetings and written correspondence) with affected landowners;
- Information sessions held on 2 July 2008 and 10 September 2008;

- Community newsletters have been distributed to the Nambucca Shire Community with the rates notice and also through a targeted mailing distribution. In July and October 2008;
- Individual letters to local environmental groups; and
- The establishment of an Aboriginal Liaison Committee in 2007 (established by the NSW Department of Public Works – Project Management) to facilitate and encourage participation of the local Aboriginal community in the design and construction of the Proposal. To date nine meetings have been held between 20 November 2007 and 4 August 2009.



1:17,000 (at A3)

0 87.5 175 350 525 700

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Fire Trail
- Road
- Creeks
- Outlet Pipe
- Spillway
- Cadastre
- Existing Headworks Area
- Proposed Inundation Area
- Proposed Storage Wall
- Proposed Pipeline Option 7 (GHD Preferred)
- Preliminary Road Design
- Proposed Borefield Locations
- Existing Bores
- Disused Bores
- Proposed Borefield Transformers
- Proposed Borefield Collection Pipeline

GHD

CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off-River Storage

Job Number	22-14133
Revision	A
Date	07 OCT 2009

Proposal Overview

Figure 1

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

Next Steps

Community engagement activities for the next stages of the process and the exhibition period of the EIS would include the following:

- Public exhibition of the EIS in accordance with the requirements of Section 113 of the EP&A Act which allows interested parties to formally comment on the Proposal;
- A community newsletter would be distributed during the exhibition of the EIS; and
- A landowner information session would be held during the public exhibition period to update landowners on the findings of the investigations undertaken as part of the EIS and concept design studies.

Environmental Assessment

An assessment of the potential environmental impacts of the Proposal was undertaken in accordance with NSW requirements. The assessments provide information on the existing environment of the study area and surrounding area; the potential impacts of the Proposal and the proposed measures to mitigate and manage these impacts.

Air Quality

The Proposal involves extensive earthworks which has the potential to generate dust. If not managed appropriately, construction dust emissions have the potential to cause loss of amenity and health impacts, particularly to nearby residences. Sensitive areas and activities include trucks travelling along Valla Road and Bobo Road, pipe laying works near residences and the construction of the off-river storage, which is approximately 200 metres from the nearest receptor. To manage any potential impact, controls would be put in place through the implementation of a Construction Environmental Management Plan (CEMP). This plan would include protocols for avoiding dust generating activities during adverse weather conditions and the use of dust suppression techniques.

There may be a requirement for burning of any remaining cleared vegetation removed as part of the construction of the storage. If not managed appropriately, smoke emissions from vegetation burning may impact on nearby receivers. As such protocols for any vegetation burning would be included in the CEMP. In addition to specifying the weather conditions considered suitable for burning events, the protocol would also specify the consultation requirements for relevant authorities and the community.

Soil, Landform Stability and Erosion Hazard

The assessment of the impact of the Proposal on soils, landforms and geomorphology indicates that there are three main risk areas associated with the Proposal. These are:

- The risk of erosion of disturbed areas and the transport of sediment into Bowra Creek and the Nambucca River during the construction of the pipeline and storage embankment and the clearing of vegetation in the storage area;
- Pipeline crossing of the Nambucca River, Bowra Creek and a number of other smaller drainage lines; and

- The impact of the altered hydrological regime along Bowra Creek as a result of the construction and operation of the storage.

Erosion risk can be mitigated through the careful planning of construction staging, flow detention and diversion structures and general erosion and sediment control measures. Mitigation measures identified in the EIS would be implemented by the CEMP. Stringent adherence to the erosion and sediment control plan and regular monitoring of erosion and sediment control measures and practices would be required during the construction phase.

The proposed borefield pipeline from the expanded borefield would cross the Nambucca River at two locations. River crossings would be either by directional drill or for the smaller drainage lines by open trench. The transfer pipeline from the new headworks to the off-river storage would need to cross Bowra Creek on the existing access crossing. Specific control measures for these and the minor drainage line crossings would be implemented. These measures would include minimum depth of pipe below bed level to minimise the potential for scour and creek stabilisation works on completion of construction.

The proposed off-river storage is located in the headwaters of Bowra Creek. As part of the operation of the Proposal, it is proposed that, where feasible, catchment flows are diverted through the storage to minimise any change to the flow conditions of Bowra Creek. In addition to these transparent flows, two additional annual releases are proposed to limit the potential for vegetation encroachment and sedimentation within the pool environments of the creek. These flows would have a maximum capacity of 3.1 m^3 per second and a duration of several hours. Releases would occur during the higher rainfall season.

Terrestrial and Aquatic Flora and Fauna

The Proposal would require the clearing of approximately 81 ha of native vegetation including 27.2 ha of hardwood plantation, 20.02ha of Wet Flooded Gum and Tallowwood Forest, 7.85ha of Northern Wet Tallowwood – Blue Gum Forest, 6.796ha of Foothills Grey Gum – Broad-leaved Mahogany Forest, 0.64ha of Wet Bloodwood – Tallowwood Forest (Temperate Rainforest), 14.23 ha of pastureland and 3.98 ha of riparian vegetation. Whilst there is no obligation under the *Native Vegetation Act 2003* to provide compensatory habitat for the loss of the vegetation as part of the Proposal, opportunities exist to provide some protection areas via the acquisition of land in and around the storage.

Four threatened flora species listed under the *Threatened Species Conservation Act 1995* or *Environment Protection Biodiversity and Conservation Act 1999* Acts were identified as having the potential to occur in the study area. Species included Minute Orchid, Leafless Tongue Orchid, Rusty Plum and Tylophora. None of these species were identified in the study area during the survey completed for this assessment. Seven-part Tests completed for these species concluded that no significant impact is likely on these species as a result of the Proposal. The Assessment of Significance undertaken in accordance with the requirements of the *Environment Protection Biodiversity and Conservation Act 1999* also concluded that there would be no significant impact on these species.

Numerous exotic plant species were observed during field surveys. Several noxious weeds were recorded in varying populations (Camphor Laurel, Lantana, Small-leaf Privet, Broad-leaf Privet, Weeping Wouldow, Giant Parramatta Grass, Crofton Weed and Mistflower).

Thirteen species of fauna listed under the *Threatened Species Conservation Act 1995*, *Fisheries Management Act* and/ or *Environment Protection Biodiversity and Conservation Act 1999* were identified as having the potential to occurring the in the study area. The fauna of conservation significance includes six mammal species (Koala, Spotted-tail Quoll, Grey-headed Flying-fox, Eastern Bentwing-bat, Golden-tipped Bat and Little Bentwing-bat), eight bird species (Masked Owl, Barking Owl, Sooty Owl, Powerful Owl, Glossy Black Cockatoo and Wompoo Fruit-dove) including two migratory birds (Rufous Fantail and Cattle Egret), and two frogs (Giant Barred Frog and Southern Barred Frog). The 7-part Tests concluded that no significant impact is likely on these species as a result of the Proposal. Assessment of Significance undertaken in accordance with the requirements of the *Environment Protection Biodiversity and conservation Act 1999* also concluded that there would be no significant impact on these species.

No threatened aquatic fauna were recorded or assessed as likely to be occurring within the study area. The Proposal incorporates a number of mitigation measures to minimise the impact on flora and fauna including preclearance surveys, the provision of compensatory habitat around the storage, construction of a fish passage within Nambucca River and the on-going monitoring of the aquatic environments of the Nambucca River, South Creek and Bowra Creek.

Surface Water/ Groundwater

The existing borefield extracts water from the alluvial soils adjacent to the Nambucca River and South Creek. There is a direct connection between the flow in the river and the level of water in the groundwater aquifer and therefore any extraction from the groundwater bores impacts on the flow of water in the river and creek. Currently there is no limit on the amount of extraction which can occur other than an annual total limit of 3,100ML. The proposed expansion of the borefield would incorporate limits on extraction to protect the baseflow in the river system. The initial baseflow limit has been agreed to be set at the 95 percentile flow in the river. The flow extraction rules have been developed to provide low flow protection and safeguard key iconic/indicator species. Modelling work has also been completed to consider the impacts of any possible salinity changes within the system. In acknowledging the inherent uncertainties associated with any flow extraction regime, an adaptive management strategy would be implemented to monitor changes in river conditions.

The borefield pipeline crosses the Nambucca River at two locations and traverses a number of other smaller drainage lines. It is proposed that underboring be employed for the Nambucca River crossings whilst open trenching would be used for the smaller drainage lines. The transfer pipeline between the pumping station and the storage would cross Bowra Creek. It is envisaged that the pipeline be incorporated into the existing access crossing at Lot 2 DP 809380. The method by which this occurs would be confirmed during detailed design.

Construction of the storage would impede the transfer of flow and sediment along Bowra Creek. To ensure a balance, transparent flows and biannual discharges would be released to the tailwater receiving environment thereby replenishing surface water and underlying groundwater and reducing any impacts on the existing terrestrial and aquatic ecosystem.

Water Quality

The water quality results obtained from sampling and testing of the borefield throughout its development and from the Nambucca River during periods of low and high river flow have indicated a broad range of water quality that can vary substantially depending on the season and the length of dry periods experienced prior to sampling.

Given good weather conditions and a reasonable river flow, the water quality available from the borefield is seen to be of an acceptable quality with a "low risk" associated with the need for further treatment.

The off-river storage is located in a forested catchment with little to no land disturbance. As such the quality of water in the storage would remain reasonably good. Due to the depth of the storage there is a risk of stratification and the Proposal would include a destratification system, a multi level off-take with at least two off-takes and regular seasonal environmental releases to address the potential for algal blooms and adverse impacts to downstream water quality.

Noise and Vibration

Construction activities would primarily be undertaken between 7 am and 6 pm Monday to Friday, and 7 am to 1 pm Saturdays.

Noise from the proposed storage construction has the greatest potential to impact nearby sensitive receivers. Construction noise impacts from the storage may exceed the 41 dB(A) construction noise goal at nearby residential receivers based on the conservative estimates made. However these estimates would be reduced through the implementation of appropriate noise mitigation measures to reduce the impact of noise on sensitive receivers including communication with affected landowners of the construction program and progress on a regular basis, particularly when noisy activities are planned.

With the general type of construction operations and the typical separation distance to nearby receivers, vibration impacts from general construction activity would be negligible. However, blasting, if it occurs, is expected to generate the most significant vibration levels and may cause minor vibration impacts at nearby receivers. Should blasting be required at construction work areas, the activity would be subject to vibration controls to protect nearby receivers and stipulated in the Construction EMP.

Noise and vibration impacts during the operation of the Proposal are considered to be negligible provided identified mitigation measures are implemented.

Indigenous Heritage

An Indigenous heritage assessment has been undertaken for the Proposal. As part of this assessment, one possible Aboriginal manuport (NSW1) was identified approximately 50 m from the proposed full storage level (Navin Officer Heritage Consultants 2004). Site NWS1 would not be inundated when the storage is full, but as a precautionary measure it is proposed that this site be relocated in consultation with the local Aboriginal community.

One area of Potential Archaeological Deposit (NWPAD1) was identified in the course of the 2008 Navin Officer Heritage Consultants' survey. The proposed transfer pipeline traverses the PAD area and would need to be investigated prior to construction. Appropriate Department of

Environment, Climate Change and Water protocols would be followed to ensure there is minimal impact on any cultural heritage sites.

Several other areas of cultural significance have been identified by the local Aboriginal community including a burial ground [the rocks] and corroboree area near the Nambucca River and a mythological site near South Creek. These areas have been avoided and would not be impacted by the Proposal.

Non-Indigenous Heritage

Consideration has been given to non-indigenous heritage impacts as a result of the Proposal. A forestry stump and charcoal pit have been identified within the study area.

The forestry stump and felled trunk (NSWH1) is demonstrative of a past forestry harvesting method no longer practised. Based on its relatively poor condition, modified context, and lack of rarity, this site is assessed as having little heritage significance and is not considered to fulfil the criteria for local or State listing.

The reported charcoal pit (NSWH2) has been substantially modified and survives as an archaeological site only, with low ground relief providing the only above ground evidence. As a consequence, this site is assessed as having little heritage value and is not considered to fulfil the criteria for local or State listing. It would not be affected by the Proposal.

Traffic

The roads to be used for construction access would include Rodeo Drive, Valla Road, Bobo Road, Bellingen Road, North Arm Road and Borefield Road. All roads, with the exception of Bobo Road, are of a suitable standard to accommodate the expected traffic generated during construction. Bobo Road, as the main access to the storage, would require upgrading to a 6m wide formation with a 3 metre wide bitumen seal.

Most materials to be delivered to the site for the construction of the storage embankment, pipelines and the borefields are expected to be delivered in a range of trucks up to semi-trailer size or truck and dog combinations. Such vehicles can be adequately catered for by the existing road network.

A large proportion of the overall works would take place in areas away from public roads. Activities which may impinge on the availability of public roads for use by other motorists would include:

- Construction of the transfer pipeline, either by underboring or trenching, from the headworks to the storage site across Bellingen Road; and
- Crossing of North Arm Road, either by underboring or trenching, for the borefield collection pipeline.

Construction traffic using the Valla Road and at Bobo Road intersection is expected to increase from about 200 to 390 vehicles per day. Whilst this appears to be a relatively significant increase over the current traffic generation, this would have a negligible impact considering the capacity of the road is in excess of 600 vehicles per hour.

Rodeo Drive is the main road into Bowraville and would accommodate most of the traffic during the construction phase. The AADT (2011) on Rodeo Drive is expected to increase from 1,700 to 1,890. This is an increase of 11%. By comparison, if the natural traffic growth in the area is 3% then natural growth would produce a similar increase without the construction traffic in 3 years. No other roads within the study area are expected to experience significant increases in traffic during the construction period.

Long term traffic impacts are expected to be extremely low in comparison with the current background traffic and the natural growth of local traffic indicated to occur in the next 10 years.

Visual Amenity

The potential impact of the Proposal on the landscape character and visual amenity within Bowraville has been considered for the construction and operational phases.

Overall, the Proposal area portrays clear evidence of human occupation with large areas of the landscape cleared of native vegetation, particularly in the lower lying parts of the valley, whilst the steeper mountain slopes of the catchment appear natural and heavily vegetated with tall (over 20 metres) trees.

The storage would be visible from scenic ridgelines and slopes, however there are a low number of receptors on these elevated areas, the distance to the storage is significant and the views are largely screened by topography and local vegetation. There are only two residences that would be affected by views to the storage.

Views would be apparent from Bellingen Road and a private property on North Arm Road towards the proposed pumping station and power transformers along the Nambucca River and South Creek respectively.

Overall, the significance of the changes to the landscape and visual amenity of the surrounding catchment for the receptors is considered moderate to low. Mitigation measures have been identified to reduce the visual impact of the Proposal.

Waste Management

Waste materials generated during construction and operation of the Proposal would be managed in accordance with the principles of the waste management hierarchy. Prior to commencing construction works a detailed Waste Management Plan would be prepared as part of the CEMP. The Waste Management Plan would incorporate the principles of the waste management hierarchy and the mitigation measures identified.

Every contractor working on the site during construction and operation would be inducted on appropriate waste management practices identified in the Waste Management Plan. Audits of the waste management would be undertaken on a six monthly basis during construction and operation of the Proposal.

Based on the current understanding of the waste to be generated during the construction and operation of the Proposal, most would be able to be disposed of at the Nambucca Waste Management Facility if necessary.

Hazards and Risks

Key hazards and risks identified as part of the construction phase may include occupational health and safety risks, bushfires, flooding, dust, and noise whilst operational hazards and risks may include potential dam break, seismic activity, blue-green algal growth and other water quality security risks. Mitigation measures have been proposed to minimise and negate the impact that these hazards and risks may have on the Proposal or affected residents.

Social and Economic

Consideration has been given to the potential social and economic impacts of the Proposal, including potential changes to the social environment resulting from the construction and operation of the Proposal. Overall the proposal would have a positive benefit on the community by providing a secure water source. Mitigation measures have been identified to maximise the benefits of the Proposal for the local community and minimise potential impacts.

Mitigation measures to address operational impacts identified as part of the Proposal include:

- Communicate potential restrictions on land use and farming and land management practices for properties surrounding the inundation area.
- Communicate any increase in water rates to all users and the benefits of a secure water supply.
- Early consultation would be undertaken with property owners whose access may be altered to ensure potential issues are appropriately managed.

Land Use

The Proposal would require the acquisition of approximately 220 hectares of Viewmont State Forest No 1035. Amendments would occur to the boundaries of the Viewmont State Forest once acquisition of the State Forest is approved. The land would be transferred to the NSC under an acquisition agreement which would also include areas of hardwood plantation and native forest being harvested prior to acquisition.

Easements of 5 metres would be required for the full length of the borefield collection system and transfer pipeline in order to accommodate pipework, surface fittings and a 3 m access track to allow for future operation, repair and maintenance. An additional 5 metres would be required during the construction phase only for installation and access. The easements are not expected to result in the severance of any affected properties and would result in a negligible loss of productive agricultural land and therefore there is not expected to be any detrimental effect on the ongoing viability of existing farms. Negotiations with affected landowners for the use of the land (via easements) affected by the borefield collection system, transfer pipeline, access and power augmentation would be undertaken during the detailed design phase.

Climate Change and Greenhouse Gas Emissions

The main impacts that climate change may have on the Proposal are considered to be in relation to water availability, water quality and infrastructure management.

Changes in rainfall patterns and temperature may impact on the water available for the Proposal and the volume of water lost from the storage area. Sea level rise, bushfire and rainfall

intensity may impact on water quality. While changes in soil moisture, groundwater and higher temperature extremes may reduce the structural integrity of the proposed infrastructure.

To mitigate the potential impacts of climate change, consideration has been given to the materials and design of the key components of the Proposal. The IWCM Strategy (NSW Water Solutions, 2009) has also considered climate change as part of the development of the identified demand management strategies. Various mitigation measures have also been identified together with management plans and strategies during operation of the Proposal.

The total emissions (construction emissions and annual operational emissions) for the first thirty years of the operation of the Proposal are estimated to be 64,000 tonnes CO_2-e. Projections past thirty years may provide inaccurate estimates due to likely changes in emission factors associated with electricity production. The construction emissions contribute approximately 65% of the total emissions for the first thirty years. This percentage would decrease as the operation of the Proposal extends past thirty years.

Annualising the construction emissions over a 30 year period would result in average annual emissions of approximately 2,100 t CO_2-e for the first 30 years of operations. This is approximately 0.001% of NSWs annual greenhouse gas emissions.

Cumulative Impacts

Cumulative impacts as a result of the Proposal have been considered as part of this EIS. Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that provides the focus of cumulative impact analysis. The assessment has found that provided the identified mitigation and management measures are implemented, there are not likely to be any significant adverse cumulative impacts as a result of the Proposal.

Environmental Management and Monitoring

A draft outline of the CEMP has been prepared to address the potential environmental issues associated with the construction of the Proposal. The final CEMP would ensure that:

- Proposed mitigation measures and monitoring outlined in the EIS are implemented; and
- All activities comply with relevant legislation, regulations, standards and best management practices.

An adaptive management framework has been developed and a proposed adaptive management strategy would be developed in consultation with relevant government agencies to ensure that the operation of the Proposal does not significantly impact upon the aquatic environment.

Proposal Benefits

The key benefits of the Proposal are as follows:

- Remove the risk of substantial water restrictions being employed for long periods of time;

- Cater for local population growth, remove uncertainty and thereby facilitate investment in the LGA. This would encourage the creation of jobs both directly during construction and indirectly by supporting the areas population growth;
- Assist in avoiding environmental impacts associated with the potential over-use of water resources within the Nambucca River;
- The Proposal greatly reduces the economic consequences of reduced water supply on local businesses reliant on a secure water supply for on-going operations;
- In severe drought periods, the Proposal greatly reduces the likelihood of business and industry from being shut down to conserve water for essential household supply;
- The Proposal significantly reduces the risks associated with the community being forced to invest in emergency drought measures with unknown costs and uncertain feasibility;
- The Proposal represents a well researched and cost effective solution, compared to other potential water supply options; and
- The Proposal represents the most ecologically sustainable solution compared to other potential water supply options identified for the Nambucca LGA.

Conclusion

This EIS has considered the potential impacts of the Proposal, which involves expansion of the existing bore fields along the Nambucca River and South Creek and transferring this water to a new off-river storage located at the headwaters of Bowra Creek.

Environmental investigations were undertaken during the preparation of the EIS to assess the potential environmental impacts. These included specialist assessments on issues involving potential environmental impacts on hydrology, ecology, heritage, soils and groundwater, landscape and visual amenity, noise and vibration, climate change, greenhouse gas, social and community, traffic and transport, and health impacts.

The assessment has documented the potential environmental impacts associated with the Proposal, considering both potential positive and negative impacts of the Proposal, and identified mitigation and management measures to protect the environment where required.

To manage the potential impacts identified by the assessment, and in some cases remove them completely, the assessment chapters outline a range of mitigation measures that would be implemented. Both the construction and operation of the project would be supported by the implementation of best practice management techniques defined by the construction and operation environmental management plans, and the proposed monitoring plan. These plans would also ensure compliance with relevant legislation and any conditions of approval.

Part A Introduction

1 Introduction

This Chapter provides an overview of the Proposal, description of the study area, and presents the EIA process including the purpose and objectives of the Environmental Impact Statement.

1.1 Overview

The 1992/93 and 2002/03 droughts and subsequent studies undertaken by Nambucca Shire NSC (NSC) have highlighted that the secure yield of the existing Nambucca District Water Supply Scheme is insufficient to service the connected Nambucca Valley communities during an extended drought period. NSC has also identified the need to cater for significant population growth expected over the next 40 years without jeopardising the aquatic environment of the Nambucca River.

Following an extensive series of investigations into water supply options, the Bowraville Off-River Storage and Associated Works Project ('the Proposal') has been proposed as part of an Integrated Water Cycle Management (IWCM) Strategy by NSC. The Proposal is the key water security component of the IWCM Strategy which also proposes demand management strategies such as effluent recycling, an enhanced tune up/ retrofit program focusing on water efficient washing machines and cisterns, a rain water tank refit program, a grey water rebate program, an enhanced system leakage reduction program and distribution mains upgrades.

The Proposal consists of a 5,500ML off-river storage, expansion of the existing borefield, upgrade to the headworks and associated pipelines and access roads.

1.2 Purpose of EIS

The Environmental Impact Statement (EIS) provides the community, NSC, relevant government agencies and other interested stakeholders with information about the Proposal and its potential environmental impacts. The EIS also forms the basis for the assessment and approval of the Proposal by NSC. A summary of correspondence from government agencies outlining matters to be addressed in the EIS is located in Appendix A, Volume 2. The EIS also sets out NSC's environmental management commitments, to be incorporated into a Construction Environmental Management Plan, that would be implemented to ensure that potential impacts are mitigated satisfactorily. Those commitments would ensure that the environment is adequately protected during the site preparation works, the construction period and the longer-term operation of the Proposal.

The specific aims of the EIS are to:

- Examine feasible alternatives to the Proposal and justify the need for the Proposal to proceed;
- Identify and characterise the likely environmental, social and economic impacts associated with the site preparation works, construction and operational phases of the Proposal;
- Determine the nature and extent of the likely impacts;
- Identify appropriate safeguards to minimise and mitigate the likely impacts; and

- Seek and incorporate comments from all relevant Government Authorities, the community and stakeholders likely to be affected by, or have an interest in the Proposal.

This EIS has been prepared in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act) *and* the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and other relevant environmental legislation and planning requirements. Consideration has also been given to NSC's policies and instructions relating to the protection of the environment and its due diligence responsibilities.

1.3 Objectives of the Proposal

The principal objectives of the Proposal are to:

- Enhance the security of water supply in the Nambucca LGA to avoid the prospect of a supply failure;
- Adding headwork capacity to meet a projected population and demand of 20,000 people and 3,200ML/a respectively;
- Comply with the NSW *Water Management Act 2000* by explicitly allowing for the maintenance of environmental flows in Nambucca River past the extraction zone and applying adaptive management principles for the Proposal; and
- Ensure the quality of the stored water is managed to current best practice standards, to reduce the likelihood of the need for a water filtration plant in the future.

1.4 Study Area

The study area is situated about 2 kilometres (km) north of Bowraville and 15 km west of Nambucca Heads in the Nambucca River Catchment. The study area is approximately 250 hectares in size and includes the upper Bowra Creek catchment area (146 ha) where the proposed off-river storage is to be located. It also includes the riparian environment of Bowra Creek downstream from the proposed off-river storage to the confluence of the Nambucca River as well as the alluvial floodplains of the Nambucca River and South Creek.

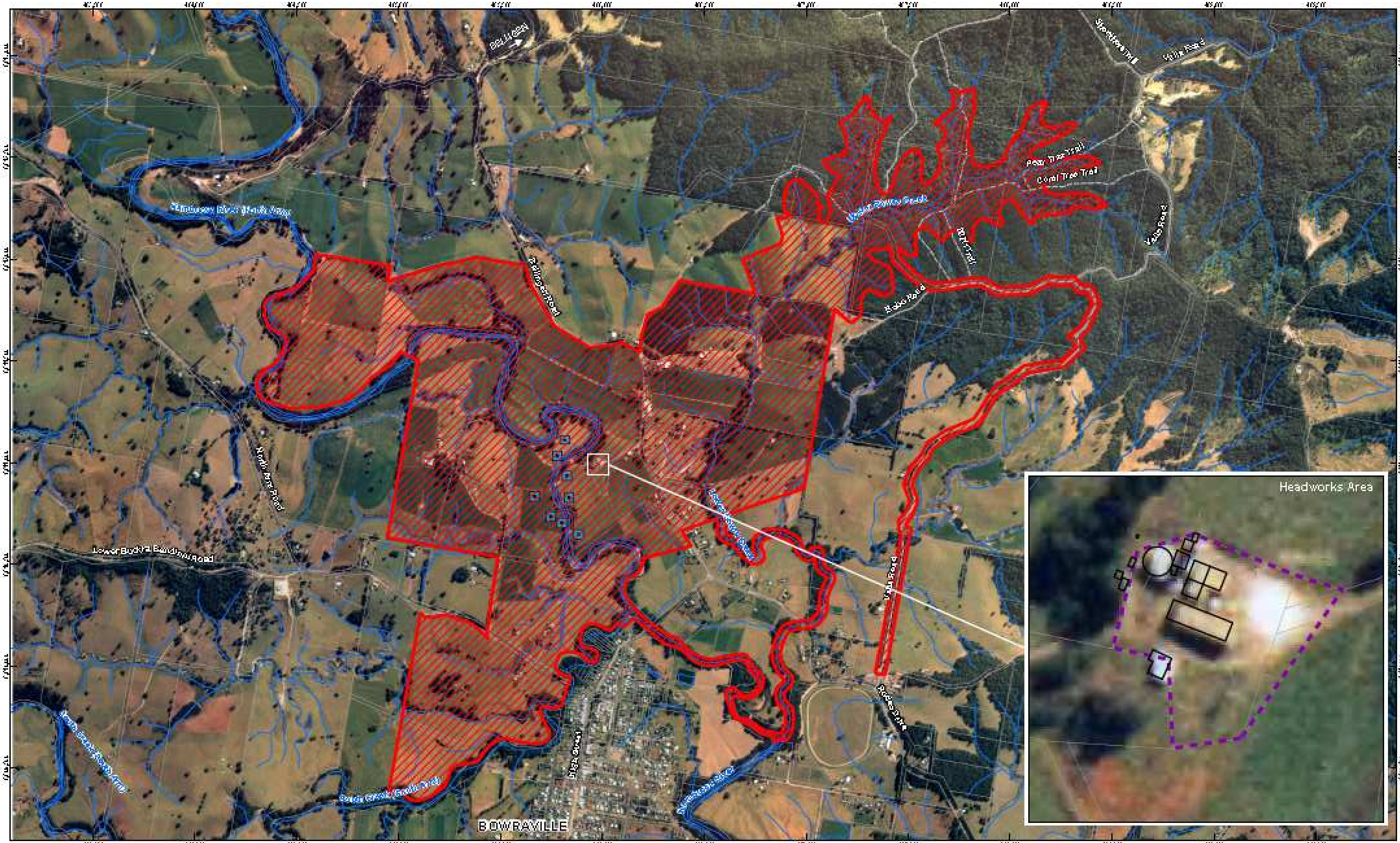
The majority of the proposed storage embankment would be located in cleared grazing land, while the inundation area would occupy the upper Bowra Creek catchment that forms part of the southern extent of Viewmont State Forest. Environmental investigations have targeted the inundation area, the alluvial floodplains of the Nambucca River, South Creek and Bowra Creek, the existing and proposed borefields, and the related infrastructure including pipelines connecting the off-river storage to the borefields. This area is known hereafter as the 'study area' and is shown in Figure 1.1.

1.5 Decision-Making Process

Part 5 of the EP&A Act applies to an "activity" which does not require development consent due to the provisions of an environmental planning instrument such as a Local Environmental Plan (LEP) or State Environmental Planning Policy (SEPP). An activity is defined as:

(a) the use of land,

(b) the subdivision of land,



1:17,000 (at A3)

0 85 170 340 510 680

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Creeks
- Cadastre
- Existing Borefield Locations
- Existing Headworks
- Existing Headworks Area
- Study Area

CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off River Storage

Study Area

Job Number	22-14133
Revision	A
Date	24 SEP 2009

Figure 1-1

21151 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

Data Source: Department of Lands: Cadastre, Aerial - 2007. Created by: hudbry, jmonsor

(c) the erection of a building,

(d) the carrying out of a work, (author's emphasis)

(e) the demolition of a building or work, and

(f) any other act, matter or thing referred to in section 26 that is prescribed by the regulations for the purposes of this definition,

but does not include:

(g) any act, matter or thing for which development consent under Part 4 is required or has been obtained, or

(h) any act matter or thing that is prohibited under an environmental planning instrument, or

(i) exempt development, or

(j) development carried out in compliance with an order under Division 2A of Part 6, or

(k) any development of a class or description that is prescribed by the regulations for the purposes of this definition.

Pursuant to Clause 125(2) of the Infrastructure SEPP and the provisions of Nambucca Local Environmental Plan 1995, the Proposal is permissible without the need for development consent. As the Proposal does not fall into any of the development categories listed within the SEPP (Major Projects) 2005, the Proposal would be an 'activity' as defined by the provisions of Part 5 of the EP&A Act. Under Section 111 of the EP&A Act, a determining authority is required to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment due to that activity.

Pursuant to Part 5 of the EP&A Act, an EIS would be required if impacts on the environment are considered to be significant. NSC has formed the opinion that there is likely to be a significant impact so an EIS is required. Clauses 229 – 331 of the EP&A Regulation provide those issues that must be included in any EIS.

1.6 Determining Authority

A determining authority is defined in Section 110 of the EP&A Act as "the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out."

Several authorities are determining authorities for the Proposal including Nambucca Shire NSC, Department of Environment, Climate Change and Water (formerly DECC and DWE), Department of Industry and Investment (formerly DPI) and NSW Heritage NSC.

1.6.1 Nambucca Shire NSC

NSC is required to exhibit the EIS for a minimum period of 30 days. Pursuant to Clause 243 of the EP&A Regulation, NSC must prepare a report on the Proposal upon determination of the EIS. The report must be prepared as soon as practicable after a decision is made to carry out or refrain from carrying out the activity or to approve or disapprove the carrying out of the activity. The report must comment on, and have regard to, each of the following matters:

(a) the environmental impact statement,

(b) any representations duly made to it about the Proposal,

(c) the effects of the Proposal on the environment,

(d) the proponent's proposals to mitigate any adverse effects of the activity on the environment,

(e the findings and recommendations of:

(i) any report given to it by the Director-General under section 113 of the Act, and

(ii) any advice given to it by the Minister under section 114 of the Act, and

(iii) any review by the Planning Assessment Commission, with respect to the Proposal.

The report must also give full particulars of the determining authority's decision on the Proposal and, if the authority has granted approval to the carrying out of the activity, any conditions or modifications imposed or required by the authority in connection with the carrying out of the activity.

1.6.2 Other Determining Authorities

Although NSC is a determining authority it cannot determine the Proposal in isolation. The approval and concurrence of the other determining authorities would be required before the Proposal can proceed. Other determinations are triggered by the need for licences and approvals under a number of legislative instruments (refer Table 1-1). These include:

Table 1-1 Summary of approvals

Act	Approval / requirements	Authority
Environmental Planning and Assessment Act 1979	◗ Part 5 'Activity' Approval.	NSC and others
Heritage Act 1977	◗ Notification required only (but subject to whether S139 excavation permit required) of intention to impact the forestry stump, site NWSH1, in writing to the Director of the NSW Heritage Office.	NSW Heritage NSC

Act	Approval / requirements	Authority
National Parks and Wildlife Act 1974	◗ Section 87 permit to carry out sub-surface investigations within the identified PAD adjacent to Bowra Creek. ◗ Should any items of significance be identified as part of the sub-surface investigations, a Section 90 consent to destroy would be required.	NSW Department of Environment, Climate Change and Water (formerly DECC)
Protection of the Environment Operations Act 1997	◗ Environment Protection Licence for the excavation of material from on site borrow areas. ◗ Environment Protection Licence for water releases from the storage that may pollute the environment.	NSW Department of Environment, Climate Change and Water (formerly DECC)
Water Act 1912	◗ Licence to construct bores under Section 112. ◗ Section 167 flood control work approval.	NSW Department of Environment, Climate Change and Water (formerly DWE)
Water Management Act 2000	◗ A controlled activity approval would be required for the Proposal for water access.	NSW Department of Environment, Climate Change and Water (formerly DWE)
Fisheries Management Act 1994	◗ Section 200 approval for dredging and reclamation. ◗ Section 218(5) notification to Minister. ◗ Section 219 permit in relation to the construction of fish passage at existing pipeline crossing of Nambucca River.	NSW Department of Industry and Investment (formerly DPI)
Forestry Act 1916	◗ The acquisition approval process required under the *Forestry Act* but would not take place until it is known whether the Proposal has been approved and NSC begins land acquisition prior to commencement of construction.	NSW Department of Industry and Investment (formerly DPI)
Local Government Act 1993	◗ Approval under s60 of the Local Government Act 1993 to construct the off-river storage.	NSW Department of Environment, Climate Change and Water (formerly DWE)

1.7 Contents of the EIS

This EIS covers the construction and operation of the Proposal. The structure of the EIS is as follows:

Volume 1

Part A – Introduction: Provides the context for the Proposal, describes the approval process, the development in general and the purpose and scope of the EIS.

Part B – Context for the EIS: Provides information on the issues raised by the Proposal that would need to be addressed.

Part C – Proposed Development: Provides a detailed description of the Proposal.

Part D – Environmental Assessment: Provides an assessment of the potential environmental impacts of the Proposal. This includes a description of the existing environment and surrounding areas against which the potential environmental impacts are considered and assessed.

Part E – Environmental Management and Monitoring: Provides information on the additional licences and approvals required, the recommended environmental management and monitoring requirements for the Proposal, and an outline of the proposed Construction Environmental Management Plan.

Part F – Conclusion – Provides an outline of the EIS findings and the justification for the Proposal.

Volume 2

Appendix A: Director-General's Requirements and Authority Correspondence

Appendix B: Geomorphology Assessment (Hydroilex, 2008)

Appendix C: Aquatic and Terrestrial Flora and Fauna Assessment

Appendix D: Construction and Operational Noise and Vibration Impact Assessment

Appendix E: Cultural Heritage Assessment

Appendix F: Traffic Impact Assessment

Part B Context for EIS

2 Need for the Proposal

This Chapter outlines the need for the Proposal by providing details of the existing water supply and current consumption against the future water supply required to reliably service population and industry growth. Information in this Chapter has been sourced from the Nambucca Integrated Water Cycle Management Strategy prepared by NSW Commerce - Water Solutions for NSC. An unabridged version of the Strategy can be found on NSC's website.

2.1 Proposal Background

Following the droughts of 1991 and 1992, NSC became aware of the need to examine the security of the Nambucca District Water Supply System (NDWSS) and completed the 1994 Strategy Report. The study concluded that additional water supply security was required in addition to demand management measures such as user pays pricing. Supply source options considered in the study included expansion of the existing borefields and off-river storage on Bowra Creek, an alternate source of groundwater from the alluvial floodplains of Taylor Arm, Bellinger and Macleay Rivers, a storage on Nambucca River and a regional scheme with Coffs Harbour. The preferred option was an 8,000ML storage at Bowra Creek.

A Value Management Study (VMS) workshop was undertaken in February 1995 based on the findings of the 1994 Strategy Report. The VMS workshop was attended by a number of agency and NSC representatives and it confirmed that the population and demand projections used in the study were appropriate. The VMS workshop did not determine a preferred option, although there was general agreement that a storage was favoured. The VMS also raised alternative options such as rainwater tanks, water reclamation and reuse, desalination, separate northern and southern schemes, a joint scheme with Bellingen and a regional scheme with Coffs Harbour. These alternatives were evaluated and presented within a Supplementary Report in August 1995 (1995 VMS Report). Feasibility studies were also conducted on a number of alternative storage sites.

Based on the 1994/95 studies and community feedback, NSC successfully implemented a number of demand management measures and was also in the process of implementing activities associated with the storage at Viewmont State Forest across Bowra Creek. This process was delayed when the Midco abattoir indicated its intention to scale down its operation. As Midco's consumption was about 20% of total annual consumption, a review to assess the impact was undertaken and the results were reported in the 1999 Project Development Plan (1999 PDP). Based on information available at that time, the 1999 PDP indicated that the existing headworks (based on existing extraction license conditions) was adequate in meeting average annual demands up to the year 2020, with the closure of Midco and with an anticipated average annual population growth rate of 1.7%. However, the 1999 PDP indicated that if the licence conditions were to be modified to incorporate the objectives of the Water Management Act and incorporate environmental flow requirements, then the storage was required immediately.

During the extended drought of 2002/2003 increased levels of water restrictions were applied and it was estimated that as little as 60 days' supply may have been remaining, prompting NSC to activate the drought emergency response strategy (DERS). Rainfall, which occurred in late

January 2003, eased the situation and NSC and the then Department of Energy, Utilities and Services (now DECCW) commissioned a study to review the security requirements based on information available at the time.

The 2003 Strategy Review concluded that the NDWSS is highly vulnerable to drought and that additional water supply security would be provided as soon as possible (with planning for an additional security measure to commence immediately) to provide Shire residents and businesses with an acceptable level of drought security and to secure the current and future sustainability of the Nambucca River's aquatic ecology and its river dependent industry.

2.2 Overview of Existing Nambucca District Water Supply System

There is one main water supply system in the Nambucca Shire, that being the NDWSS. The NDWSS was commenced in 1953 and serves all the urban areas within the local government area (LGA). Water, prior to distribution to customers, is adequately buffered with lime and carbon dioxide, disinfected with chlorine and fluoridated to minimise dental problems. The scheme is compromised of:

- Bowraville borefield (containing 8 bores with a maximum potential capacity of up to 23.4 ML/d) in the Nambucca River Alluvium;
- Water treatment facilities consisting of a 0.16 ML collection tank and chemical dosing facilities consisting of lime, carbon dioxide, fluoride and chlorination;
- A 13.4 ML/d pumping station capable of transferring the water through 3 km of 450 mm rising main to two balance tanks to the east of Bowraville with a combined capacity of 1.45 ML;
- Water gravitates from the Bowraville balance tanks to either the Nambucca reservoirs, of which there are three (combined capacity of 11.2 ML), or the Macksville reservoirs, of which there are three (combined capacity of 6.0 ML).
- A 1.3 ML/d capacity booster pump station downstream of the South Macksville Reservoir services Scotts Head reservoir (1.4 ML capacity) during periods of high demand. At other times Scotts Head is served via gravity flow.
- Water gravitates from the Nambucca Heads reservoirs to the Valla Beach service reservoir (2.0 ML capacity);
- An off-take from the Bowraville balance tank rising main serves the Bowraville service reservoir (1.3 ML reservoir); and
- A 690 kL concrete reservoir serves the rural residential estate of Kingsworth.

The water supply for the Nambucca Valley is currently sourced from a borefield located in the alluvium adjacent to the Nambucca River just upstream of the Bowraville township.

The water is pumped to a collection tank. There is a flowmeter pit immediately upstream of the collection tank (inlet), where fluoride and lime dosing takes place. The chlorine injection point is immediately downstream of collection tank (outlet). CO_2 dosing is on outlet of the high lift pumps.

The conditioned water is then pumped to two balance tanks and gravitated to the LGA. The balance tanks are located on a hill near Bowraville at an elevation that can gravity feed water to

all other reservoirs in the LGA. A booster pump located at Macksville is utilised to increase supply to Scotts Head during periods of high demand.

The high lift pumps at the headworks commence pumping when the balance tanks call for water. The high lift pumps draw water from the collection tank and when the collection tank reaches a low level, the bore pumps are engaged to commence pumping to keep up with the high lift pump demand. The water is metered at a meter pit immediately downstream of the collection tank, which is also the dosing point for chlorine, lime and fluoride. Figure 2-1 shows the broader network of the Nambucca District Water Supply Scheme.

The current capacity of the water supply system is limited by the high lift pumps which can each pump at approximately 130 L/sec. One pump can satisfy a daily demand of 8ML/day. At times of high peak demand two pumps operate. At present there are no environmental flow rules in place which restrict pumping to protect the aquatic environment of the Nambucca River with the exception of a 3,100ML/annum limit on NSCs water licence.

2.3 Integrated Water Cycle Management Strategy

IWCM planning by local water utilities (LWU) is a way of managing the urban water cycle in which all parts of the water system are integrated so that water is used efficiently and optimally. This efficient and optimal use would result in minimal impact on the water resource and on other resources and users. For a LWU this means that the three main urban services – water supply, sewerage and stormwater – would be planned and managed in an integrated manner to ensure that the maximum value is obtained from the resource and that an appropriate return to the environment is maximised. Integration also means that local water management is integrated with other human waste management and recycling processes such as garbage removal, and various external elements. These elements can include global issues such as the greenhouse effect, natural processes within the catchment areas, Commonwealth and State policies, neighbouring LWUs and the community. The IWCM planning process for Nambucca began in early 2006 with the first stage of the study (the Concept Study) being completed in September 2006. The Concept Study identified the IWCM issues and provided a list of management opportunities that may be used to control these issues in the second stage of the IWCM study process. The issues were ratified and prioritised in a workshop session held prior to the finalisation of the Concept Study report.

NSC, based on the recommendation of the Concept Study report, proceeded in mid 2007 to undertake the various tasks in the second stage of the IWCM process in conjunction with the NSW Water Solutions. The draft IWCM Strategy was placed on public exhibition in July 2009.

2.4 Security of Supply

The NSW Government has defined 'secure yield' as the maximum supply rate that can be maintained by the supply system without exceeding any one of the following three acceptability criteria (NSW Government, Water Supply and Sewerage Management Guidelines, 1991):

- Reliability – The proportion of time when supply is unrestricted. Over any extended period, restrictions would not be in place for more than 5% of the time. In Nambucca for example this would mean that based on 100 years of stream flow the total duration of water restrictions would be less than 60 months.

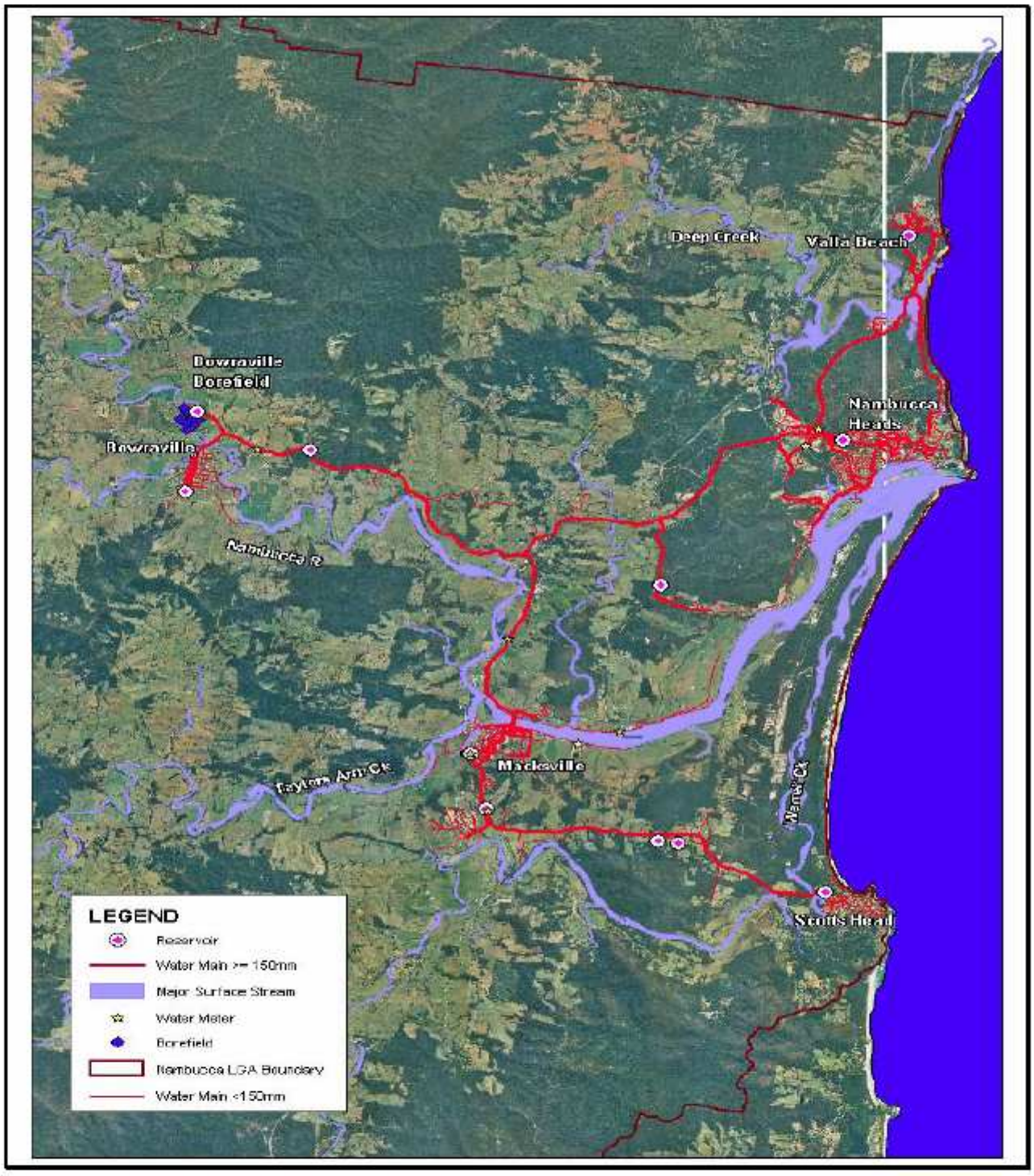


Figure 2-1 Nambucca District Water Supply Scheme

- Robustness – The average frequency of restriction would be less than once every 10 years. More precisely there would be less than a 1 in 10 chance of having to impose restrictions in any one year.
- Security - The storage would not be drawn down to below a critical level which would prevent NSC providing even a basic supply or require alternative supply measures. The IWCM strategy guards against this scenario by ensuring that the system can supply 80% of unrestricted demand from the time restrictions are imposed. This is based on the conservative assumption that the full drought of record could recommence at this time.

The calculation of secure yield requires modelling of the water supply source and system, which is related to the following:

- Weather pattern in the water supply catchment and the urban areas;
- The environmental needs of the rivers including access sharing rules with other water users;
- The quantity of water that can be taken and available in storage;
- The rate of storage depletion during drought and filling after drought; and
- The ability to conserve water during drought.

Although the IWCM strategy guards against storage levels being drawn to a critical level by ensuring that the system can supply 80% of unrestricted demand from the time restrictions are imposed, this margin would reduce over time with aggressive demand management.

Setting the security of supply standard defines the yield of the system, and consequently the future supply infrastructure provision requirements. For a given level of demand reduction there is a trade-off between the setting of security of supply standards and the timing and extent of supply source development.

At one end of the spectrum, an attempt to 'drought proof' the regional scheme would incur considerable capital expenditure and environmental costs, while at the other end insufficient supply source infrastructure would put the Nambucca community at increased risk of running out of water, with associated economic and social impacts. The guidelines allow a system to be developed that would provide sufficient storage and management of water supply through a worse drought than on record. Management during a drought would be assisted by NSC's restriction policy. Whatever drought it is designed for there is always a statistical possibility of a worse drought occurring. The Nambucca Shire's restriction policy aims to maintain a balance between minimising the frequency of restrictions and maximising the duration that available water can be made to last in a drought.

2.5 Performance of Bowraville Aquifer

The secure yield of the regional water scheme is dependent on the volume of water available in the Bowraville aquifer during prolonged dry weather periods. Studies undertaken in the past have estimated the aquifer storage to be about 1,200ML and a study undertaken during the 2002/03 drought estimated the storage to be about 300ML. A strategy review paper completed by NSW Water Solutions (April 2004) suggested that the leakage rate from the aquifer could be up to 5ML/d. The aquifer storage volume was characterised as a time dependent volume that diminishes over time due to the steady leakage of water into the estuary.

Table D1 in NSC's drought management plan calculates aquifer inflows, outflows and demands at various restriction levels. It suggests that there are potentially only 32 days available between going from level 5 restrictions to the highest restriction level 6 where there is no domestic external water use and most commercial and industry water use is banned and they would be effectively shut down. Level 6 is a real "emergency mode" restriction level.

The estimated 60 days' supply left was insinuated from the 300ML assumed storage capacity in the aquifer and a leakage rate of 5ML/day.

This current level of security is below the best practice standard level of drought security normally adopted for NSW country town water supply schemes.

Environmental Flow and Access Sharing

The *Water Management Act 2000* aims, using the adaptive management principles, to achieve a better balance between water use and environmental protection by setting environmental objectives for all NSW rivers covering river flow and water quality objectives. The Act acknowledges the environment as a legitimate water user and therefore aims to ensure that it is guaranteed a certain allocation of water in the statutory Water Sharing Plans.

Furthermore the Act aims to clearly identify all water users, and formalise their share and access rights. It is generally accepted that ecosystems are highly vulnerable during low flow periods, and that natural flow regime variations are important to ensure a healthy and diverse ecological community. Accordingly, it is likely that the first water sharing plan would require the lowest 5% of the flows be left for the environment (95th percentile). When the plans are reviewed after the mandated 10 year period, it is possible that in light of additional environmental data the environment may be allocated the lowest 20% of the flows (80th percentile). Of the remaining water, only 30% may be available for extraction by all users.

Although the Act in the long-term would improve the environmental health and the long term sustainability of the river and estuary; analysis shows that the regional water scheme would have no secure yield as access to the borefield would not be available on average 5% of the time. This means NSC would have to provide a storage and/or a new water source to enhance the security of supply. Although the quantity of water required for the environmental flows has yet to be signed off under a water sharing plan; based on significant field and modelling studies and consultations initiated by NSC, it has been established that the foraging and migration movement for all the native fish species and platypi could be economically accommodated by restraining pumping between dusk to dawn when the flow conditions are suitable.

The Quality of the Source and Reticulated Water

NSC routinely monitors the water quality of the raw water at the headworks and the distributed water at strategic locations within the reticulation. This routine monitoring is carried out in accordance with NSW Health quality assurance requirements under the Public Health Act 1991, to monitor long term trends and for operational and emergency response management.

During normal weather conditions, average rainfall and healthy river flows, the water quality extracted from the borefield is seen to generally meet the Australian Drinking Water Guidelines. However, following a storm event turbidity levels are seen to increase in line with the rapid rise seen in the river and following an extended period of drought the water quality is seen to deteriorate with an increase in the levels of dissolved minerals and an increase in the nutrient load. Saltwater intrusion appears to be restricted to downstream of Lanes Bridge.

2.5.1 Determining Secure Yield

The following information has been extracted from the *Task Paper 3 - Feasibility Review of Short-listed Options* undertaken by NSW Water Solutions (2005).

Aquatic Ecology Review

Based on the review of the results of the initial water balance modelling using the previously adopted river extraction rules, specialist sub-consultant, Keith Bishop at the request of Department of Infrastructure Planning and Natural Resources (DIPNR) [now DECCW] and Department of Primary Industries (DPI) [now DI&J] was asked to review and better align the river extraction rules previously proposed under the current water management objectives and outcomes. Based on his experience, the previous Aquatic Ecology Study and site data collected from Nambucca River for this review, Bishop suggested amendments to the rules to better meet the requirements of the known species of native fish populations and their habitat.

Based on the review findings, three main modelling scenarios with an aim to deliver the varying native fish species passage past the river reaches where extraction occurs, were developed and the off-river storage size requirements for each scenario were evaluated using the water balance model. The three main modelling scenarios and their objectives are outlined in Table 2-1.

Table 2-1 Modelling Scenarios Based on Environmental Constraints & Outcomes

Main Modelling Scenario	Aquatic Ecology Conditions	Environmental Outcome
1	Do not pump the whole day or between dusk to dawn when flow at the gauging station is 80ML/d to 120ML/d during January to September and 40ML/d to 120ML/d during October to December.	Movement passage for all native fish species and platypus protected throughout the year and during drought periods. Biodiversity & critical habitat for fish enhanced including increased thalweg height & reduced velocity impact enhancing juvenile fish migration. Salinity sensitive freshwater aquatic plant species in upper estuary protected.
2	Do not pump the whole day or between dusk to dawn when flow at the gauging station is 80ML/d to 120ML/d during April to July & September, 40ML/d to 120ML/d during October and 40ML/d to 70ML/d during November and December.	Movement passage for native Iconic (Australian bass and Bellinger River eel-tailed catfish) fish species and platypus protected during the migration season including drought periods. Biodiversity & critical habitat for fish enhanced including increased thalweg height & reduced velocity impact enhancing juvenile fish migration. Salinity sensitive freshwater aquatic plant species in upper estuary protected

Main Modelling Scenario	Aquatic Ecology Conditions	Environmental Outcome
3	Do not pump the whole day or between dusk to dawn when flow at the gauging station is 80ML/d to 120ML/d during May, June, September & October and 40ML/d to 120ML/d during November and December	Movement passage for Iconic (Australian bass and Bellinger River eel-tailed catfish) fish species and platypus protected for a short duration during the peak migration months only including drought periods. Biodiversity & critical habitat for fish enhanced including increased thalweg height & reduced velocity impact enhancing juvenile fish migration during peak months. Salinity sensitive freshwater aquatic plant species in upper estuary protected.

Water Management Policy Requirements

NSW Water Solutions consulted with other government agencies to comment in general on the policy framework that would affect the future management of Nambucca River and in particular the previously adopted extraction rule for the off-river storage. DIPNR indicated the need to include daily limit on extraction, in accordance with the *Water Management Act 2000*, to the previously agreed extraction rule. Therefore, in addition to the above three main ecology based modelling scenarios, two main water management policy principles were added resulting in a large number of modelling combinations to be analysed in each scenario. The two main water management policy principles and their objectives are outlined in Table 2-2.

Table 2-2 Modelling Scenarios Based on Policy Constraints & Outcomes

Policy Principle	Policy Constraint	Policy Outcome
Protection of low river flows	(a) Under normal operating condition - Stop pumping when the flow at the gauging station reaches the 95%ile flow corresponding to that month.	Meets Government's immediate goal to leave the low flows in the river and to minimise irrigators on-farm requirements.
	(b) Under normal operating condition - Stop pumping when the flow at the gauging station reaches 80%ile or 90%ile flow corresponding to that month.	Meets Government's long-term goal for protecting low river flows and to minimise irrigator's on-farm requirements.
Protection of the natural flow variability	(a) Under normal operating condition - Allowed to take up to 60% of the daily flow provided other constraints are satisfied.	Meets government's immediate hydrological stress indicator goal.
	(b) Under normal operating condition - Allowed to take up to 30% of the daily flow provided other constraints are satisfied.	Meets government's long-term hydrological stress indicator goal.

Policy Principle	Policy Constraint	Policy Outcome
Override for drought operating condition	An override is applied during a drought where daily limit on extraction is waived and pumping is allowed to continue until the flow at the gauging station reaches 95%ile flow corresponding to that month's 95%ile flow.	Meets Government's water management goal for giving priority to community water supplies during drought periods to safeguard public health and ensure sustainability.

The storage size requirements for the various water balance modelling scenario combinations are discussed below.

Specialist Technical Studies

Specialist technical studies included an update on the hydrology and secure yield water balance analysis, a review/update of off-river storage costs and a prediction of the likely stored water quality.

Hydrology and Secure Yield Water Balance Assessment

In order to accommodate the water management policy and environmental objectives, daily stream flow sequences were generated at the gauging station back to the 1890s using historical local climatic data. The daily streamflow sequence together with a typical drought year daily demand sequence was used in the water balance model to establish the off-river storage size for the year 2040s average annual demand equivalent to about 3,200ML for the different modelling scenarios and cases therein.

Table 2-3 presents a summary of these results. The water balance modelling process and the results of the various modelling scenarios.

Table 2-3 Modelling Scenarios and Required Storage Size

Modelling Scenario	Required Storage Size
Main modelling scenarios 1 to 3 with aquatic ecology conditions and different combination of policy constraints in the two policy principles.	Storage size of about 30,000ML to 12,000ML for transfer capacities of 25ML/d to 80ML/d.
No aquatic ecology conditions but only different combination of policy constraints in the two policy principles.	Storage size of about 4,500ML immaterial of the transfer capacity.
Main modelling scenarios 1 to 3 with aquatic ecology conditions applying to dusk to dawn time only and different combination of policy constraints in the two policy principles	Storage size of about 12,000ML to 4,000ML for transfer capacities of 25ML/d to 80ML/d.

Based on a review of the results of the various modelling scenarios, it was considered that the foraging and migration movement for all the native fish species and platypus could be economically accommodated by restraining pumping between dusk to dawn when the flow conditions are suitable. However, a general lack of long-term local environmental and ecological data and local knowledge of the interaction of the upper estuary with its surrounding environment prevented from establishing the most appropriate and economical low flow cease

to pump threshold. Accordingly, the four scenarios shown in Table 2-4 were short listed for further ecological and economic assessment. These scenario results are based on the 'most likely' streamflow sequence.

Table 2-4 Storage Size Results Summary

		Modelling Scenario			
		MS1B446	MS1AB446	MS1B466	MS1AB466
Normal conditions	CTP borefield	Monthly 80th%ile	Annual 80th %ile	Monthly 95th%ile	Annual 95th %ile
	CTP River Intake	Monthly 80th%ile	Annual 80th %ile	Monthly 90th%ile	Annual 90th %ile
Dry conditions	CTP borefield	Monthly 95th%ile	Annual 95th %ile	Monthly 95th%ile	Annual 95th %ile
	CTP River Intake	Monthly 95th%ile	Annual 95th %ile	Monthly 95th%ile	Annual 95th %ile
CTP for irrigators		Annual 95th %ile	Annual 95th %ile	Annual 95th %ile	Annual 95th %ile
Percentage of flow that can be taken		30%	30%	60%	60%
Maximum extraction rate	borefield	25ML/day	25ML/day	25ML/day	25ML/day
	River intake	40ML/day	40ML/day	40ML/day	40ML/day
Biological protection	Fish passage (range of species)	Dusk to dawn	Dusk to dawn	Dusk to dawn	Dusk to dawn
Annual demand (ML/a)		3,100	3,100	3,100	3,100
Off-stream storage volume to meet secure yield (ML)		6,700	6,200	5,400	5,400

CTP = Cease To Pump; Dry conditions = town on level 4 and above restrictions with off-river storage level <60%.

Borefield = Supply to existing customers. River Intake = Supply to future customers and off-river storage.

After reviewing the affected flow sequences, storage size requirements and costs for the above four and other modelling scenarios, DIPNR and DPI confirmed their 'in principle' support to proceeding with the current augmentation based on scenario labelled MS1B466 in Table 2-4 above pending future review when more local information and knowledge becomes available. The adopted environmental flow-operating regime is as follows:

1. *Do not pump between dusk to dawn when flow at the gauging station after extraction by upstream irrigators is between 80ML/d to 120ML/d during January to September and 40ML/d to 120ML/d during October to December.*

2. *Stop pumping to distribution system to meet existing demands when the flow at the gauging station reaches the 95%ile flow corresponding to that month.*

3. *Stop pumping to distribution system to meet future growth demands and to fill the storage when the flow at the gauging station reaches the 90%ile flow corresponding to that month.*

4. *The upstream irrigators and town water supply are allowed to extract up to 60% of the total daily flow provided other constraints are satisfied.*

5. *When off-river storage is drawn-down to say 60% and the water supply is subject to level 4 and above restrictions, the previous rules are relaxed with pumping to water supply ceasing at 95%ile flow corresponding to that month.*

6. *Upstream irrigators are to cease pumping when the previous day's affected flow at the gauging station reaches the annual 95%ile flow, which is about 10ML/d.*

In confirming their 'in principle' support to the above regime, DIPNR and DPI also requested that an adaptive management approach be taken up in the development of the scheme, which includes allowing provision in the storage for future raising, regular collection and review of ecological and hydrological data and development and implementation of the shire- wide IWCM Strategy.

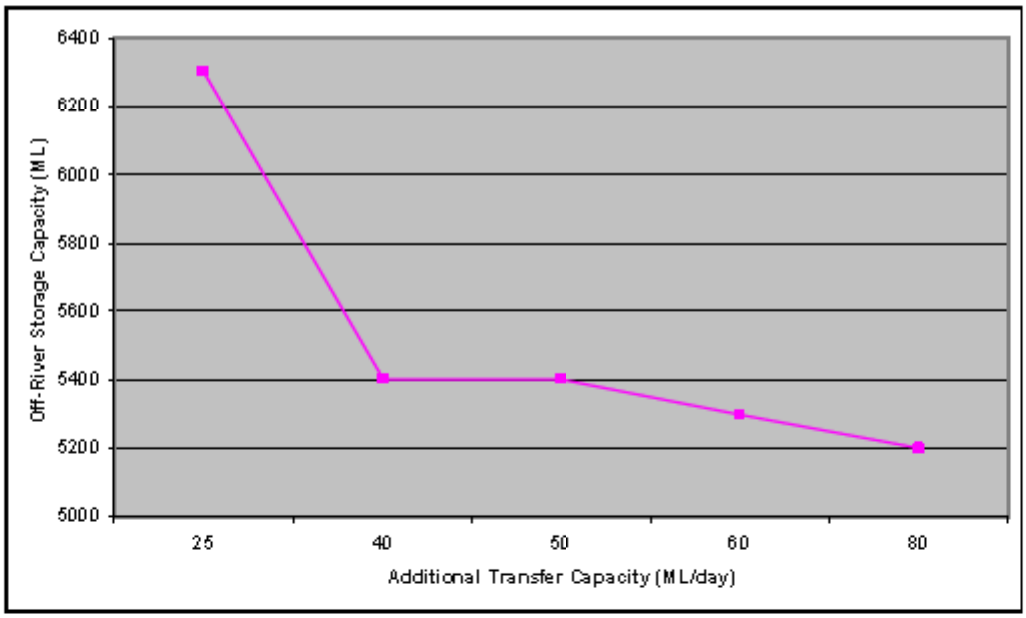


Figure 2-2 Optimum Transfer Rate to Storage

The above figure indicates that the optimum transfer rate to the storage is about 40ML/d and hence the pumping facility used for filling the storage would be sized for 40ML/d.

To assess the likely impact of climate change on system yield, water balance modelling for the preferred scenario was undertaken with the streamflows reduced by 10%. The analysis indicated that with a 10% less streamflow, the storage size would have to be increased by about 1,000ML on a secure yield basis.

2.6 Current Population

Table 2-5 illustrates that the Nambucca LGA has grown from 17,610 persons in 1996 to 17,974 persons in 2006 representing an annual growth rate of 1.4% (ABS, 2006).

Table 2-5 Population of Nambucca LGA

	1996 Census	2001 Census	2006 Census	Change 1996 to 2006	Change 2001 to 2006
Nambucca LGA	17,610	17,718	17,974	0.6%	1.4%

Source ABS Census 2006, 2001 Place of Enumeration

Year 2007 populations were established for water supply, wastewater and stormwater by matching customer billing database assessments and connections on a spatial basis with 2006 Census household sizes (HHS). Table 2-6 shows the 2007 connected population for urban water services.

The Task 3 Paper (IWCM Strategy, NSW WS, 2009) contains more detailed analysis with population and tenements distributed into reservoir zones (water supply), sewer pump station catchments (wastewater) and stormwater sub-catchments.

Table 2-6 2007 Permanent Population Served by Urban Water Services (NSW WS, 2009)

	Permanent Residential Population Served			
Location	Water Supply	Reticulated Sewerage	On-Site Systems	Stormwater[1]
Bowraville	992	992	0	992
Macksville	2,705	2,580	187[3]	2,705
Nambucca Heads	5,984	5,876	108[3]	5,984
Valla Beach[2]	1,486	1,481	5[3]	1,486
Scotts Head	804	804	0	804
Rural	1,069	0	1,069[3]	257[6]
			5,179[4]	
Total	13,040	11,733	6,548	12,228

1. Stormwater populations were established using sub-catchments defined in the Nambucca Heads Stormwater Management Plan plus some additional catchments for Nambucca and Kingsworth
2. Includes Hyland Park
3. Connected to water supply
4. Not connected to water supply
5. Kingsworth only
6. Numbers have been corrected (1.8%) for urban population given error in ABS collection data.

2.7 Urban Water Consumption in Nambucca Shire

Figure 2-3 shows the historic extraction of water from the existing borefield located adjacent to the Nambucca River from 1991 to 2006.

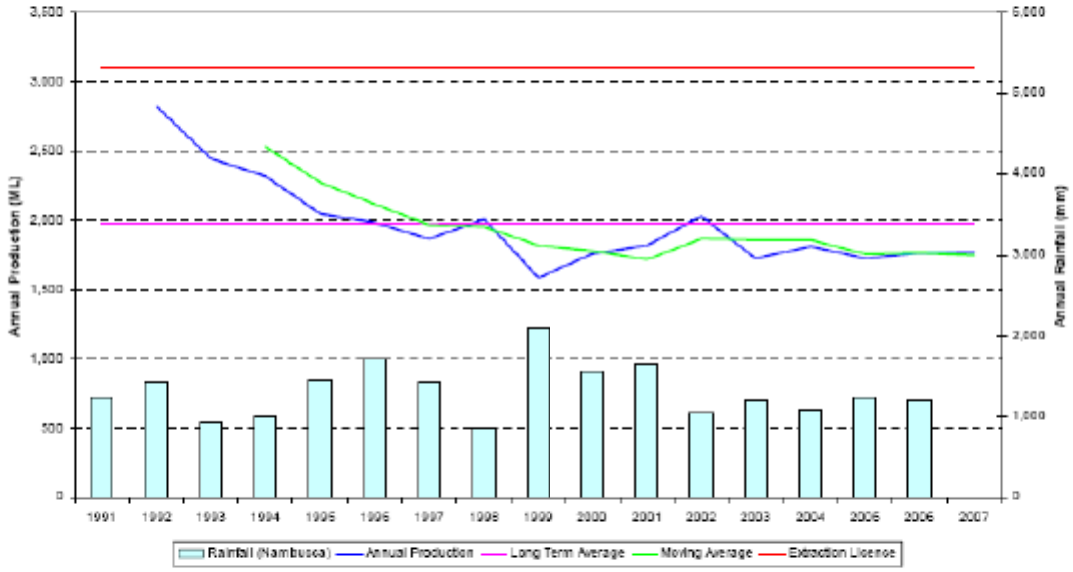


Figure 2-3 Historic Annual Extraction from Borefield (NSW WS, 2009)

The above figure shows that the annual extraction has been steadily decreasing until year 2000 after which it has stabilised between 1,500 and 2,000ML. This steady decrease has been due in part to the implementation of two part water pricing in the mid 1990s, natural propagation of water efficient fittings and appliances and the significant scaling-down of the Midco operation in year 2000.

Figure 2-4 shows the historic peak day extraction in each year from the borefield since 1992.

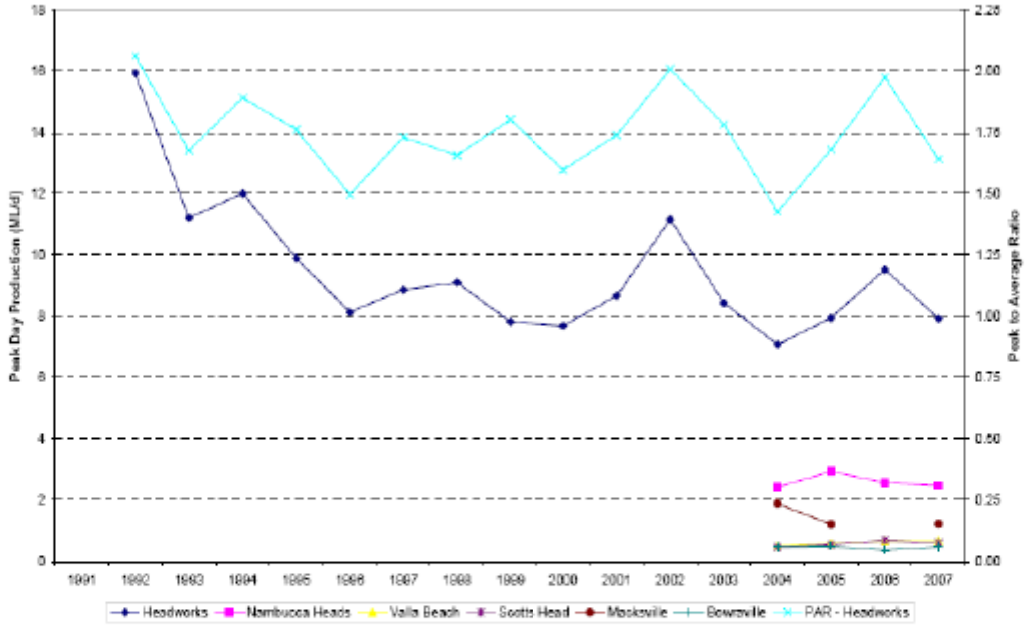


Figure 2-4 Historic Peak Day Extraction from Bowraville Borefield (NSW WS, 2009)

Similar to the annual extraction volumes, the peak day extraction has also been decreasing and it is currently about 8ML/d (2009).

Figure 2-5 shows customer category usage as a percentage of total production for the 2005 water year. Residential users connected to the scheme consume the majority of potable water (52%), while non-revenue water (NRW) accounts are the next largest category (16%). Estimates of the Infrastructure Leakage Index (ILI) using the IWA methods puts it at 2.66, which is relatively high compared to other Australian water utilities.

Industrial, commercial, tourist and rural consumers use approximately the same amount of water in Nambucca Shire. Although, the industrial demand supplied by the regional scheme is small, any increase in future industrial demand needs to be gained by acquiring new entitlements in the market and/or by accommodating within the existing town water entitlements.

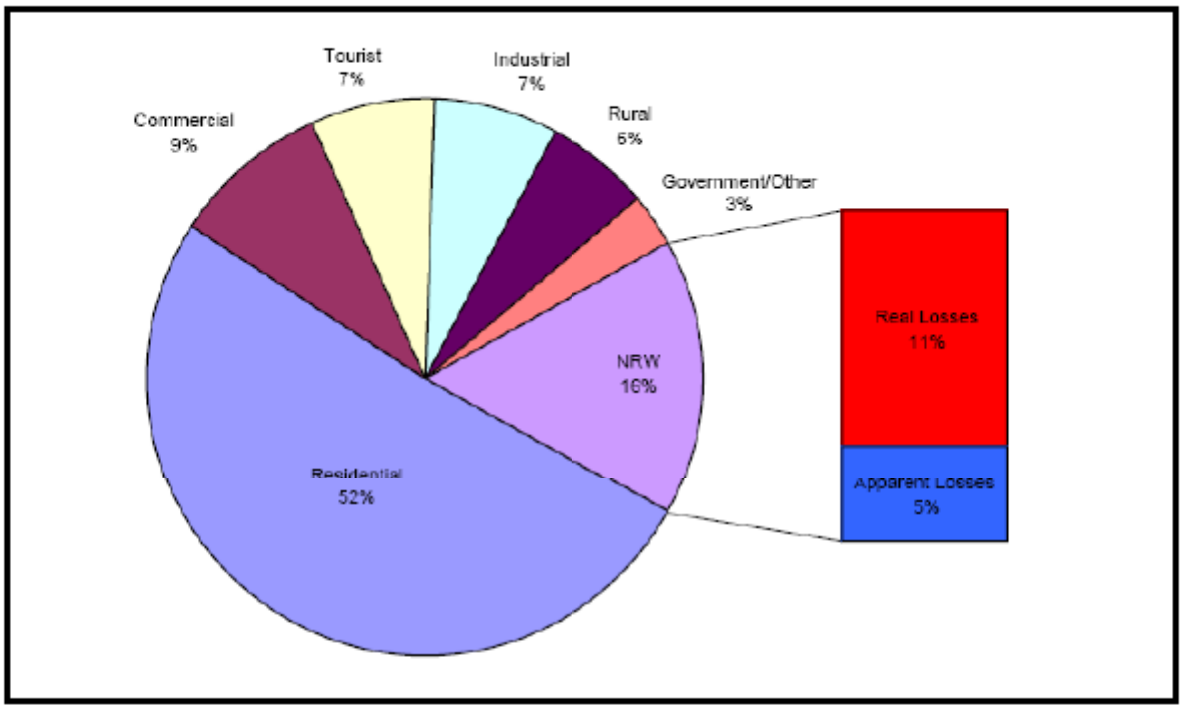


Figure 2-5 Urban Communities Water Consumption Profile (NSW WS, 2009)

In view of the regional scheme servicing two different climatic zones, coastal and inland, separate climatic correction analysis of historic water production and consumption was undertaken. Table 2-7 summarises the results of the residential simulation.

Table 2-7 Climate Corrected Residential Demands (NSW WS, 2009)

System	Annual Residential Demands (kL)		
	Long-term Average	2002	Maximum
Coastal	223	254	265
Inland	249	279	294
Combined	231	261	275

Figure 2-6 shows the major non-residential water users for the 2007 water year. Note all consumptions are in ML. Figure 2-6 shows that Midco and the caravan parks are the predominant users in this group. Analysis suggests that Midco had a fairly constant

consumption of about 0.3 ML/d throughout the year whilst the consumption at the caravan parks was heavily influenced by the seasonal tourist population.

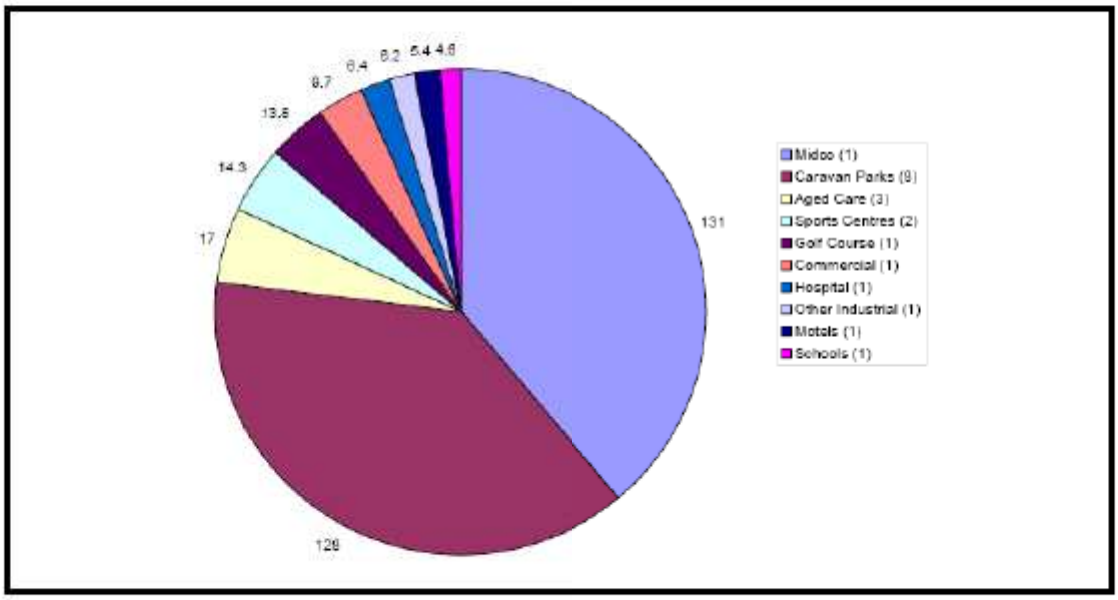


Figure 2-6 Top 20 Non-Residential Water Users in 2007 (DoC, 2009)

2.8 Future Population Growth

2.8.1 Regional context

The *Mid North Coast Regional Strategy* (MNCRS) estimates that the mid north coast could experience a potential population increase of 91,000 between 2006 and 2031. This would take the population from 333,400 to 424,400, an increase of more than 27 percent over 25 years (Department of Planning, 2007).

According to the MNCRS, the average annual growth rate is expected to be approximately 1 percent per annum over the next 25 years, which would be among the highest regional growth rates in NSW (Department of Planning, 2007).

2.8.2 Local context

Between 1991 and 1996 the average population growth rate of the LGA was 1.1 percent per annum. Between 1996 and 2001 the average population growth rate declined to 0.1 percent, with some years recording a population loss.

Since 2001, growth in the LGA has continued to slow, with an annual average population growth at 0.2 percent. The annual average growth for the last 25 years has been 1.7 percent.

The *Nambucca Shire Structure Plan* (NSC, 2008) estimated the population in the Nambucca LGA would grow by 2 percent per annum over the next 20 years. The Plan estimates by 2026 the population would grow to 26,593 persons (8,697 additional persons from 2006).

Table 2-8 shows the LGA population further projected as part of the IWCM Strategy (DoC, 2009) and those in the Structure Plan. The difference between the Structure Plan permanent

population projection and that developed as part of the IWCM Strategy is primarily due to the delay in release of future urban release areas.

Table 2-8 Projected Population

Location	2006	2011	2016	2021	2026	2036	2046	Growth
Permanent Total (IWCM Strategy)	18,219	19,661	21,481	23,877	25,810	28,774	29,943	1.6
Permanent Total (Structure Plan)	19,880	21,949	24,233	-	29,540	-	-	2.4

1. The 2006 ABS Shire Population was 17,897
2. Urban population was increased by 1.8% given historical error in ABS collection data (Ref. 3).
3. Population growth in % per annum between 2006 and 2046
4. Growth rate was calculated between 2006 and 2026

The projected increase in LGA population over the next forty years would result in an increase in demand for the existing urban water services.

2.8.3 Future growth areas

The MNCRS identifies four Subregions of which Nambucca LGA is incorporated in the Coffs Coast Subregion. Within this Subregion 18,600 dwellings are projected, with the majority of growth occurring within the Coffs Harbour LGA.

The MNCRS as well as the *Nambucca Shire Structure Plan* (NSC, 2008) has identified a potential release area in Boggy-Cow Creek near Valla with a total land area of 574 ha (see Figure 2-7). The site currently consists of undulating farmland dissected by the two creek lines. Much of the site is cleared farmland and enjoys expansive rural and sea views.

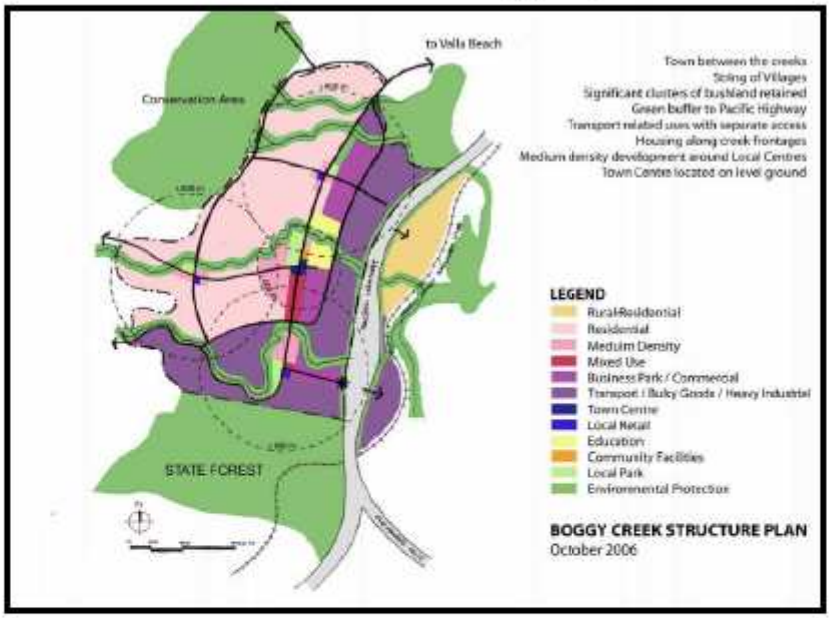


Figure 2-7 Boggy Cow Creek Urban Release Area (NSC, 2008)

This area is located near a proposed exit from the planned realigned upgraded Pacific Highway.

Areas of potential population growth within existing zoned urban areas at Scotts Head, South Macksville and Congarinni were also identified (Figure 2-8 and Figure 2-9).

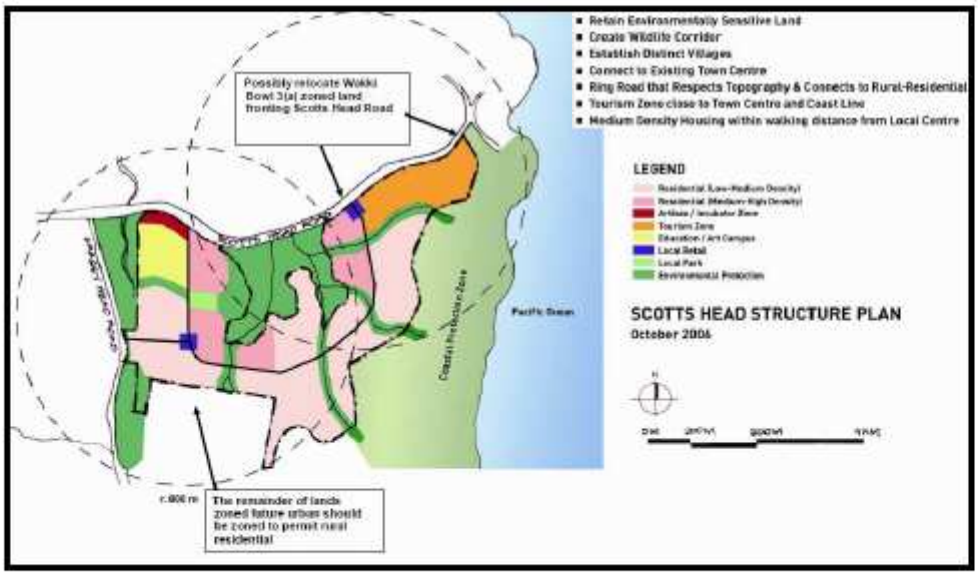


Figure 2-8 Scotts Head Growth Area (NSC, 2008)

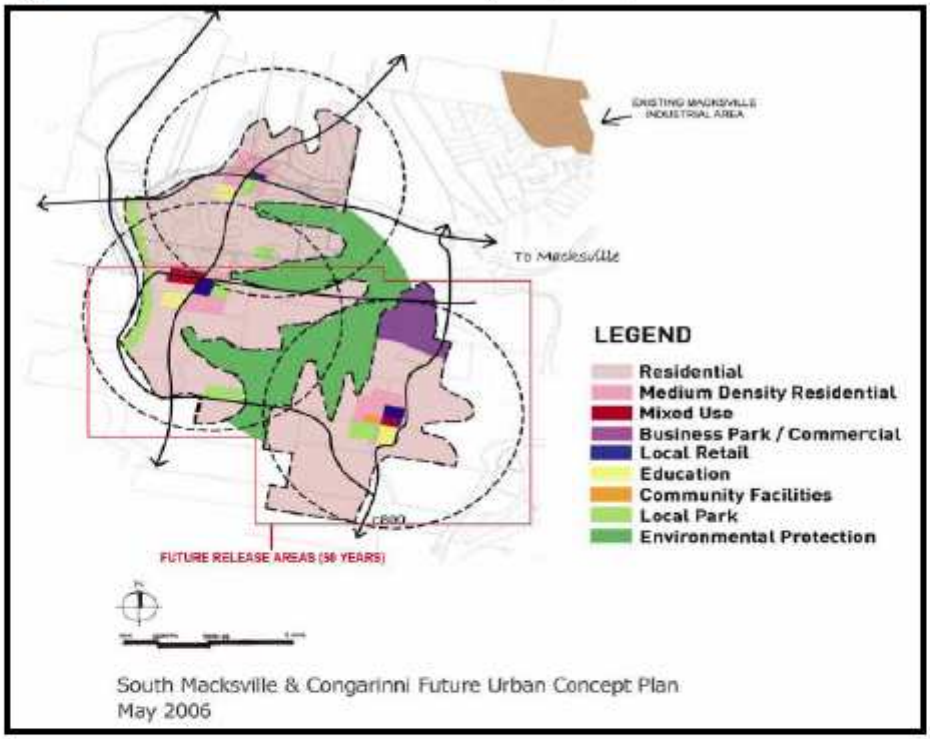


Figure 2-9 South Macksville and Congarinni Growth Area (NSC, 2008)

The projected increase in population growth over the next forty years would result in an increase in demand for the existing urban water services. Table 2-9 and Table 2-10 show the

projected population and projected served water supply equivalent tenements that would be connected to the Nambucca and District Water Supply Scheme to 2046 respectively.

Table 2-9 Projected Growth in Population Serviced by Nambucca District Water Supply Scheme (NSW WS, 2009)

Location	2006	2011	2016	2021	2026	2036	2046	Growth (% per year)
Bowraville	992	1,009	1,031	1,036	1,036	1,036	1,036	0.1
Macksville	2,705	3,038	3,454	3,712	3,953	4,129	4,306	1.5
Nambucca Heads	5,984	6,368	6,848	7,140	7,385	7,875	8,366	1.0
Valla Beach	1,486	1,710	1,990	2,085	2,135	2,236	2,336	1.4
Scotts Head	804	1,148	1,579	2,043	2,200	2,461	2,677	5.8
Boggy-Cow Creek Growth Area	0	0	0	1,089	2,178	3,921	3,921	-
Rural	1,069	1,164	1,297	1,417	1,486	1,499	1,512	1.0
Total Permanent Connected	13,040	14,438	16,199	18,523	20,374	23,160	24,151	2.1
Visitors (Peak)	6,354	6,869	7,383	7,562	7,659	7,852	8,045	0.7
Total Peak Connected	19,394	21,307	23,582	26,085	28,033	31,012	32,196	1.7
Unconnected	5,179	5,223	5,282	5,354	5,436	5,614	5,792	0.3

Table 2-10 Projected Served Water Supply Equivalent Tenements (NSW WS, 2009)

Location	2006	2011	2016	2021	2026	2036	2046	Growth	Growth (% per year)
Bowraville	435	444	451	453	453	453	453		0.1%
Macksville	1,526	1,770	2,059	2,187	2,261	2,340	2,423		1.5%
Nambucca Heads	3,169	3,370	3,598	3,735	3,848	4,074	4,301		0.9%
Valla Beach[1]	680	792	923	969	989	1,029	1,069		1.4%
Scotts Head	389	546	742	943	1,009	1,131	1,221		5.4%
Valla Urban Growth Area	0	0	0	455	910	1,638	1,638		-
Rural	938	952	967	977	983	990	996		0.2%
Total Permanent Connected	7,137	7,872	8,740	9,718	10,453	11,655	12,100		1.7%

1. Valla Beach includes Hyland Park

2.9 Future Water Supply Demand Projections

Table 2-11 shows the projected average year and dry year demands for the recommended Scenario 3 identified by the IWCM Strategy based on the predicted growth numbers. Table 2-11 also shows the impacts of climate change on the average and dry-year demands. Due to the revised population estimates and the estimated impact of climate change, the new projected dry year demands exceed those estimates as part of the previous Headworks Strategy (IWCM Strategy, NSW WS, 2009).

Table 2-11 Projected Scenario 3 Annual Water Demands (NSW WS, 2009)

Projected Demand (ML)		2006	2011	2016	2021	2026	2031	2036	2041	2046
Scenario 3 - Av Year	Connected	1,527	1,468	1,487	1,726	1,909	2,038	2,153	2,184	2,215
	Unconnected	57	57	58	59	59	60	61	62	63
	Losses	292	271	296	334	368	393	418	427	436
	Total	1,875	1,796	1,840	2,119	2,337	2,491	2,633	2,673	2,714
Scenario 3 - Dry Year	Connected	1,738	1,739	1,840	2,007	2,167	2,287	2,400	2,432	2,464
	Unconnected	94	95	96	97	99	100	102	104	105
	Losses	292	271	296	334	368	393	418	427	436
	Total	2,124	2,106	2,232	2,438	2,634	2,781	2,920	2,963	3,006
Scenario 3 - CC 2050 (Av Year)	Connected	1,603	1,587	1,663	1,843	2,012	2,138	2,256	2,288	2,320
	Unconnected	60	60	61	62	63	64	65	66	67
	Losses	292	271	296	334	368	393	418	427	436
	Total	1,955	1,919	2,020	2,240	2,443	2,595	2,739	2,781	2,823
Scenario 3 CC 2050 (Dry Year)	Connected	1,904	1,919	2,040	2,215	2,384	2,510	2,629	2,664	2,700
	Unconnected	108	109	110	112	114	115	117	119	121
	Losses	292	271	296	334	368	393	418	427	436
	Total	2,304	2,300	2,446	2,661	2,865	3,018	3,164	3,210	3,256

The projected increase in potable water demand requires appropriate management to ensure that the Nambucca River environment and community well-being are not compromised. In order to provide a cost effective and efficient IWCM Strategy (NSW WS, 2009) for the Nambucca LGA, NSC proposes the following major water supply and sewerage works:

- Enhanced residential tune-up retrofit program consisting of the basic residential tune-up retrofit program measures plus additional measures such as micro-irrigation, water efficient washing machine and cistern replacement units targeting 50% of existing residences with 75% rebate from NSC;
- Non-residential water efficiency program targeting both the NSC premises and other high water users;
- Enhanced system leakage reduction program consisting of mains replacement, improved response time, telemetry, metering and pressure management;
- Rain water tank (RWT) refit program targeting 50% of existing homes with 90% rebate from NSC;
- Grey water rebate program targeting 5% of homes with 50% rebate from NSC;
- Upgrade the distribution mains from Wirimbi Junction to Pacific Highway near Nambucca Heads and the PRV north of Nambucca River at Macksville (2025);
- Upgrade the distribution main from South Macksville to Scotts Head (2025);
- Construct a new reservoir and main from each of the urban growth areas (2016);

- 5,000 ML off-river storage on the upper reaches of Bowra Creek with provision in the storage foundation and embankment for future raising to the ultimate capacity of 14,000ML and up to an additional 40 ML/d borefield capacity along Nambucca River and South Creek;
- Opportunity WTP1 with comprehensive and effective catchment management plan including fencing and river bank stabilisation (up to 4 km), well-head protection and storage management plans and storage aerators and build a 16.75 ML/d WFP in 2023 but allow for the immediate collection of developer charges;
- BASIX compliance with harvesting of roof water into rainwater tanks for all new developments in existing urban areas only;
- Inflow and infiltration reduction measures for high, medium and low priority SPS catchments in all sewerage schemes;
- Optimise current Bowraville sewage plant performance and build a new plant by 2015;
- Optimise current Macksville STP operation by operating at high MLSS during peak load periods and then add a new reactor by 2017;
- Upgrade existing Scotts Head STP capacity to 3,500EP through chemical dosing and adding a reactor in 2011 plus provide a sewer mining plant and reclaimed water reuse system for the south Scotts Head release area for BASIX compliance;
- Upgrade existing Nambucca Heads STP capacity to 18,000EP in stages (10,000EP reactor in 2009 and 3,000EP reactor in 2028) plus provide a sewer mining plant and reclaimed water reuse system for the Valla Urban Growth area for BASIX compliance; and
- Centralised reuse with treated wastewater from the Macksville STP for Macksville Park, High School Playing Fields and Golf course.

NSC have opted for a 5,500 ML storage to maximise the efficiency of the system, accommodate potential climate change impacts and inaccuracies in population estimates. Figure 2-10 shows how the Integrated Scenario 3 (IWCM Strategy, NSW WS, 2009) measures impact upon the water demand and supply components over the planning horizon.

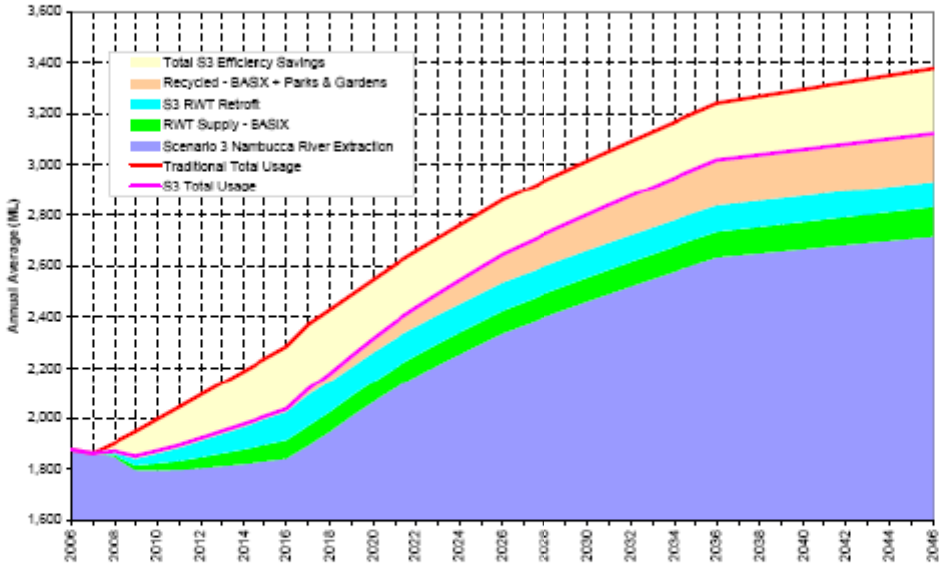


Figure 2-10 IWCM (Scenario 3) Water Supply and Demand

2.10 Summary

The drought of 2002/2003 highlighted that the NDWSS is highly vulnerable to drought. Studies in 2002/03 indicated that the scheme may have come close to failure, with estimates of as little as 60 days' water supply possibly remaining. To address this issue, additional water supply security is required as soon as possible to provide Shire residents and businesses with an acceptable level of drought security. The Proposal also provides additional benefits in securing environmental flows for the Nambucca River.

The Proposal is a key water security component of the IWCM Strategy by NSC. The IWCM Strategy proposes a number of demand management strategies including effluent recycling, an enhanced tune up/ retrofit program focusing on water efficient washing machines and cisterns, a rain water tank refit program, a grey water rebate program, an enhanced system leakage reduction program and distribution mains upgrades. Whilst demand management measures would assist in reducing water demand across the LGA, the Proposal is essential for water security, particularly in extended drought periods.

The *Nambucca Shire Structure Plan* (NSC, 2008) estimated the population in the Nambucca LGA would grow by 2 percent per annum over the next 20 years. The Plan estimates that by 2026 the population would grow to 26,593 persons (8,697 additional persons from 2006). The IWCM Strategy (NSW WS, 2009) further projected that by 2046 the population would reach 29,943 with an annual growth of 1.7 percent per annum.

The projected increase in population growth over the next forty years would result in an increase in demand for the existing urban water services. The existing system is unable to accommodate such an increase in demand and therefore the system requires augmentation to protect the current and future population of the Nambucca LGA.

Part C Proposed Development

3 Consideration of Proposal Alternatives

This Chapter summarises the findings of the specialist technical studies undertaken to consider realistic options available to enhancing the Nambucca District Water Supply Scheme and the options considered in developing the final concept design.

3.1 Alternatives to the Proposal

At a water supply planning workshop in August 2004, NSClors and NSC staff agreed that there was a need to secure the short and long term sustainability and security of the NDWSS. Further, after considering 14 potential scheme options within a multi-criteria analysis framework, the NSClors and staff agreed that this security could be best achieved by enhancing the existing Nambucca River source with the provision of an off-river storage in the short term and desalination, a southern off-river storage or enlargement of the Nambucca River off-river storage in the medium to long term. The NSClors and staff also agreed that prior to the selection of a preferred scheme option, further environmental, technical feasibility and economic investigation and analyses would be conducted on six of the potential scheme options considered. The six short-listed scheme options were as follows:

- Scheme Option A – Single scheme with off-river storage at site 2 (Bowra Creek), surface water extraction & stored water released to Nambucca River.
- Scheme Option B – Single scheme with off-river storage at site 2 (Bowra Creek), surface water extraction & stored water fed directly into reticulation system, a variation to scheme option A.
- Scheme Option C – Single scheme with off-river storage at site 2 (Bowra Creek), groundwater and/or sub-surface water extraction & stored water allowed to infiltrate into aquifer. Infiltration effected using pipe laterals.
- Scheme Option D – Single scheme with off-river storage at site 2 (Bowra Creek), groundwater and/or sub-surface water extraction & stored water fed directly into reticulation system.
- Scheme Option E – (Stage 1) off-river storage at site 2 (Bowra Creek) with groundwater and/or sub-surface water extraction & stored water fed directly into system followed by (Stage 2) Southern off-river storage based on Warrell Creek.
- Scheme Option F – Scheme based on existing Nambucca River headwork facility with seawater desalination plant replacing the off-river storage at site 2 (Bowra Creek).

Table 3-1 presents the summary of the multi criteria analysis score and rank for the six short listed scheme options together with the main reason in short listing the options.

Table 3-1 Multi Criteria Analysis

Scheme Option	Score %	Rank	Main Reason
A	61.98	2	◗ Short listed as it significantly improves the quality of stored water pumped to town without filtration plant & was previously agreed in-principle by the Agencies.
B			◗ As a slight variation to Scheme Option A, the stored water is fed directly into the system to overcome ecological & natural variability issues in the Nambucca River (Scheme Option B).
C	56.97	4	◗ Short listed based on piped infiltration system and not trench system. Open trench system has significant environmental & operational issues as the trenches are in floodplain. ◗ Also evaluate a variation, where sub-surface and/or groundwater are extracted instead of surface water.
D	63.30	1	◗ Short-listed as it delivers the best overall ecological sustainability and reliability. Acknowledged that the stored water supplied to town may be poor & filtration plant may be needed sooner
E	53.90	5	◗ Short listed due to the flexibility it offers in particular as it could be developer funded to cater for future growth in the area. Acknowledged that water resource in Warrell Creek may be a constraint & if its a major issue Nambucca River off-river storage is available as fallback
F	NS	-	◗ Short-listed, as it is an emerging technology with the capital and operating cost reducing significantly on a regular basis.

Table 3-2 below presents the summary of the capital cost expenditure for the next 30 years (30-year capital cost) and 30-year present value cost estimates for each scheme option without a water filtration plant. The figures are based on 2005 dollars.

Table 3-2 Capital and Present Value Estimate of Scheme Options without Water Filtration Plant

Scheme Option	30-Year Capital Cost ($M)	30-Year Present Value @ 7% ($M)	Multi-Criteria % Score	Multi-Criteria Rank
A	28.2	30.5	61.98	2
B	27.7	30.1	61.98	2
C	34.1	35.0	56.97	4
D	28.6	31.2	63.30	1
E	66.4	47.9[1]	53.90	5
F	64.4	64.9	NS	NS

[1] Includes a water filtration plant at Nambucca River when Stage 2 works consisting of the southern storage comes on line by 2020.

3.1.1 Proposed Option ('the Proposal')

The six scheme options were then subject to public consultation and feedback between December 2005 and March 2006. NSC, based on the study findings and community feedback, adopted Scheme Option D as the preferred regional supply side scheme option.

Scheme D ('the Proposal') consists of a 5,500 ML off-river storage on the upper reaches of Bowra Creek and up to an additional 40 ML/d borefield capacity along Nambucca River and South Creek. Additional pipework is required for the harvesting and transfer of medium to high river flows to the off-river storage. This headwork system has the ability to supply an annual demand of 3,200 ML/a on a secure yield basis.

3.2 "Do Nothing" Option

Investigations undertaken to date have concluded that the NDWSS is highly vulnerable to drought and that additional water supply security would be provided as soon as possible (with planning for an additional security measure to commence immediately) to provide local residents and businesses with an acceptable level of drought security and to secure the current and future sustainability of the Nambucca River's aquatic ecology and its river dependent industry.

If the Proposal is not pursued, the Nambucca LGA:

- Runs the risk of poor water security particularly during drought periods;
- Would face increased probability of water restrictions being enforced during drought periods;
- Could not accommodate the predicted population growth over the next 40 years. This would have flow-on effects on industry, commerce and ultimately employment.
- Faces on-going environmental impacts associated with the potential over-use of water resources within the Nambucca River due to the lack of controls over environmental flows; and
- Community may be forced to invest in alternative emergency sources of water which would require substantial financial commitment both in terms of capital investment and recurrent operating costs.

Even with the demand measures proposed by the IWCM Strategy, there exists a need to resolve water security and expected shortages during drought periods to ensure the community is not detrimentally affected.

The "do nothing" option was therefore not considered to be a viable option and the concept design process was commenced.

3.3 Transfer Pipeline Options

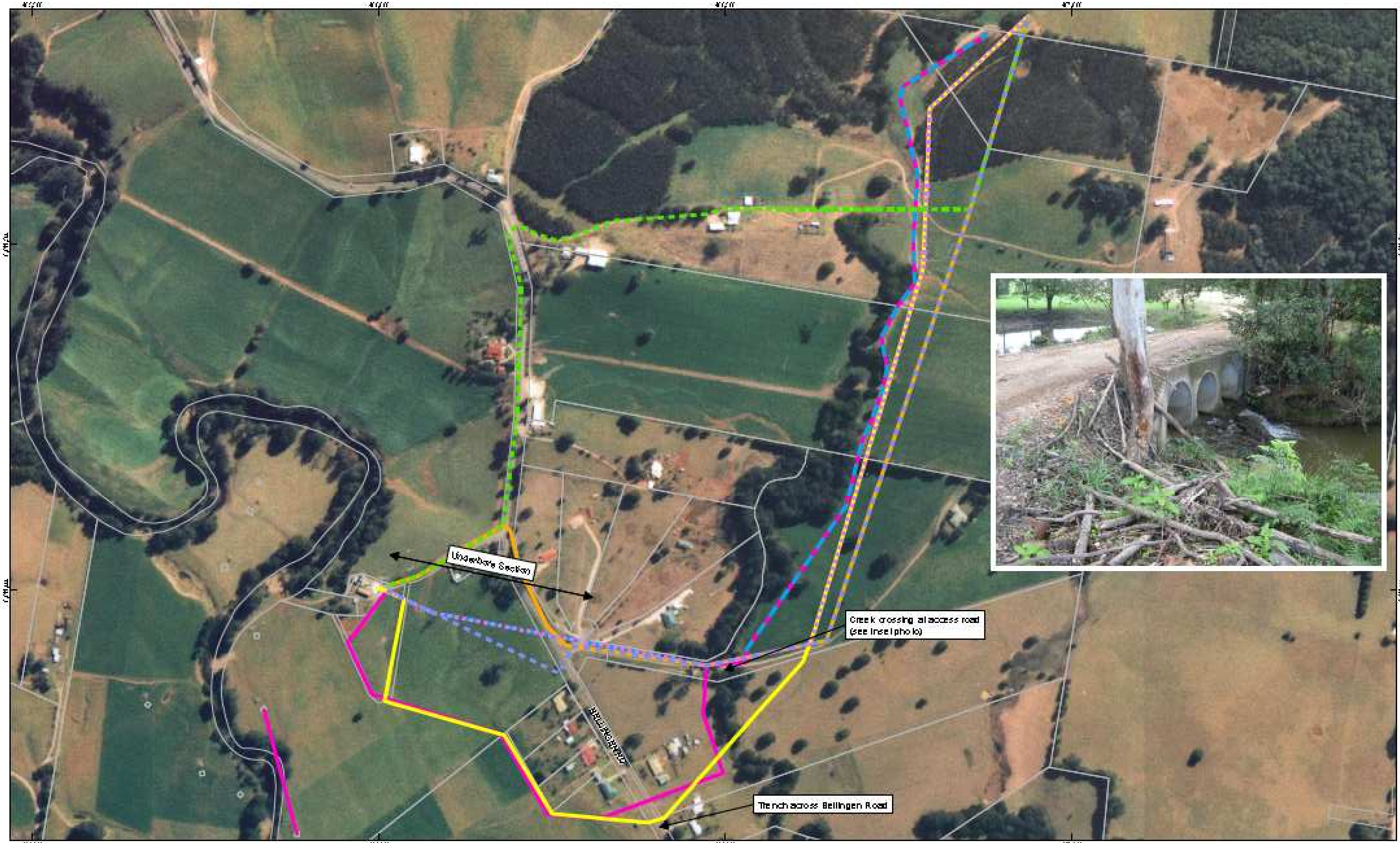
As part of the concept design, options for transfer pipeline routes from the proposed storage to the headworks area were assessed. Five (5) options were initially identified for the pipeline route. The issues with each of these options were as follows:

- Option 1 – This option would require a short thrust bore to enable flows to gravitate back from the storage to the headworks area. Once the route was over the high point it proceeds in a straight line to the storage embankment to minimise length (and therefore cost). Landowners along this route have opposed this option as it cuts more through the middle of their properties;
- Option 2 – The maximum elevation along this route is approximately RL 54m AHD. Locating the pipeline along this route would not enable flows to gravitate back down from the storage over this high point due to the proximity to the headworks area. As pumping back from the storage or constructing a long thrust bore would add too much cost, this options was excluded from further assessment;
- Option 3 – This option also does not allow flows to gravitate from the storage (similar to Option 2) and was therefore excluded from further assessment;
- Option 4 – Basically a refined version of Option 1 with a slightly longer thrust bore to straighten alignment near high point with alignment closer to Bowra Creek through private properties up to storage; and
- Option 5 – Option was selected to avoid boring under high point and go around the southern side of the high point. The route then follows the Option 4 route alignment.

With Options 1, 2 and 3 excluded or superseded by other options, this left Options 4 and 5 for consideration. To further reduce the impact on the private landowners along the pipeline route adjacent to Bowra Creek, Options 6 and 7 were developed. They were based on Options 4 and 5 respectively but with the alignment following access tracks adjacent to Bowra Creek (for improved access and to minimise impacts on landowners). Options 6 and 7 were therefore identified as the preferred options. Figure 3-1 illustrates all pipeline options and the key features along these routes.

The main differences between the two options are as follows:

- Preliminary hydraulic analyses indicate that Option 6 would require a tunnelled section for approximately 300 metres near the pumping station end of the route to maintain positive pressures in the pipeline to promote adequate operation of the pipeline. Due to this length, directional drilling is likely to be required. Minor changes expected to the preliminary calculations to cater for system arrangement alterations would not affect route selection. The proposed pipeline diameter is 600mm;
- To avoid the high point along Option 6, Option 7 circumvents the elevated area and is therefore approximately 410m longer. A trenched crossing of Bellingen Rod (allowed as this is a NSC owned road) would also be required for Option 7 in this section. Trench dewatering may be required for the lower lying section of Option 7; and
- Easements would be required for the private properties affected. In the non-common sections, Option 6 would only require approximately 300m (deep sections of underbore excluded) whilst Option 7 would require approximately 750m.



1:5,000 (at A3)

0 15 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Option 1 (DoC)
- Option 2 (DoC)
- Option 4 (GHD)
- Option 3 (DoC)
- Option 5 (GHD)
- Option 6 (GHD preferred)
- Option 7 (GHD preferred)
- Cadastre

GHD

CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off River Storage

Job Number	22-14133
Revision	A
Date	24 AUG 2009

Transfer Pipeline Options

Figure 3-1

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

Data Source: Department of Lands: Cadastre, Aerial - 2007. Created by: mhardy

Table 3-3 provides a summary of the pipeline route options.

Table 3-3 Comparison of Options

Option	Advantages	Disadvantages	Length (m)	Cost ($M)	Comment
1	Limited private property disruption	Through middle of properties	1,640	N/A	Superseded by Option 4
2	Follows existing access track within private property and within road reserve	Can't gravitate from storage, long (expensive) underbore	1,590	N/A	Cost likely to be 25% higher than Option 4
3	No underbore requirement	Can't gravitate from storage	1,720	N/A	Cost likely to be 15% higher than Option 4
4	Less private property disruption	Moderate impacts on private property owners	1,620	N/A	Better version of Option 1 with similar cost to Option 6
5	No underboring under high point	Moderate impacts on private property owners	1,990	N/A	Marginally cheaper than Option 4 without long underbore
6	Less private property impact than Option 4	More expensive than Option 7. Risk of increase construction costs for underbore	1,575	2.67	Shorter than Option 7 but has underbore
7	Less private property impact than Option 5	Minor private property impacts	1,990	2.43	Preferred option

3.3.1 Proposed Option

Closer inspection of the Option 7 alignment indicated that an underbore of Bowra Creek in this location would be expensive, so to reduce the total cost for this option (by at least $100,000 without underbore) it was redirected to the north to cross Bowra Creek at the existing vehicle access crossing with 3 culverts. Whether the pipe is attached to the side of the bridge, laid in the road with concrete encasement or would pass under the culverts would be determined in detail design.

To compare Options 6 and 7 further, a cost comparison was undertaken. It was decided to compare capital cost only as the pump sizes and therefore operating costs for both options would be similar thus giving little value to a net present value (NPV) approach. Pump costs were also excluded from the capital cost comparison for this reason.

Hunter Water Corporation (HWC) Estimating Guidelines (Sep 2008 version) were used to provide rates and contingencies for the capital cost comparison. Land values for easements were obtained from recent advertised figures in the Bowraville area for semi-rural land. Total estimated construction cost (2009 dollars) for each option would be as follows:

- Option 6 - $2.7M; and
- Option 7 - $2.4M. These estimates have an accuracy of ±40% and would only be used as an order of cost estimate.

Option 7 is therefore approximately $0.3M (or approximately 10%) less expensive than Option 6. Although Option 7 involves disturbance on one additional property, the cost difference from Option 6 makes it preferred. Option 6 also presents a greater risk of the cost increasing with the long trenchless crossing. Therefore Option 7 was adopted as the proposed option and was progressed in the concept design.

3.4 Borefield Options

Hydroilex was commissioned by the NSW Public Works – Project Management on behalf of NSC in March 2008 to conduct hydrogeological investigations along the Nambucca River floodplain including South Creek. One of the objectives of these investigations was to provide recommendations and specifications for the design and construction of an expanded borefield along the North Arm and South Creek of the Nambucca River directly upstream of Bowraville.

Following Hydroilex's investigations and modelling work, GHD was instructed by NSW Public Works – Project Management to develop borefield layout Option 7 as it represented the most efficient and environmentally sustainable option.

Figure 3-2 illustrates the layout of Option 7. Option 7 consists of an expanded borefield along both the North and South Arms of the Nambucca River, with no alteration to the existing borefield. The model was run at a range of river stages and cycles. Minor adjustments to the borefield layout were made in order to move some of the proposed bores away from unstable river bank conditions and out of recognised Aboriginal sites.

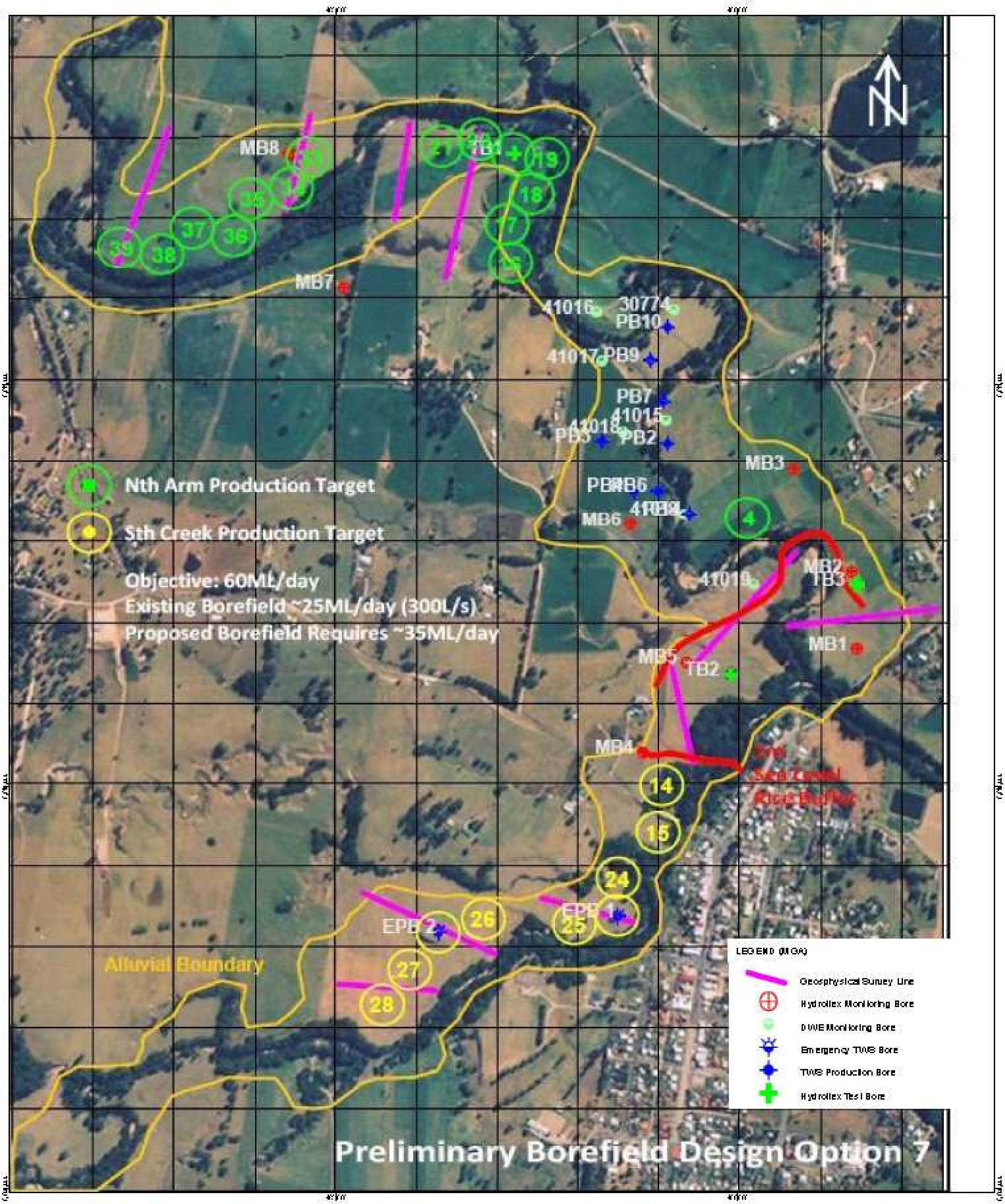
3.5 Borefield Collection Route Options

An assessment of options for the pipeline routes connecting the proposed bores to the collection tank was undertaken. Initially 7 options were identified using the Option 7 borefield layout proposed by Hydroilex; four (4) options for the North Arm and three (3) options for the South Creek.

Figure 3-3 illustrates the borefield collection pipeline options. These routes were field verified and surveyed. Minor modifications to the borefield layout were made to avoid a cultural heritage site and additional river crossings on South Creek. From this, additional routes were identified and investigated further.

Factors considered in the route selection include:

- Engineering constraints and cost factors (pump sizes, pipe lengths and diameter and river crossings)
- Impacts on Aboriginal site,
- Impacts to property owners, and
- Security and flexibility of the borefield network.



LEGEND

1:3,750 (at A3)

Metres

Nambucca Shire Council
Bowraville Off River Storage

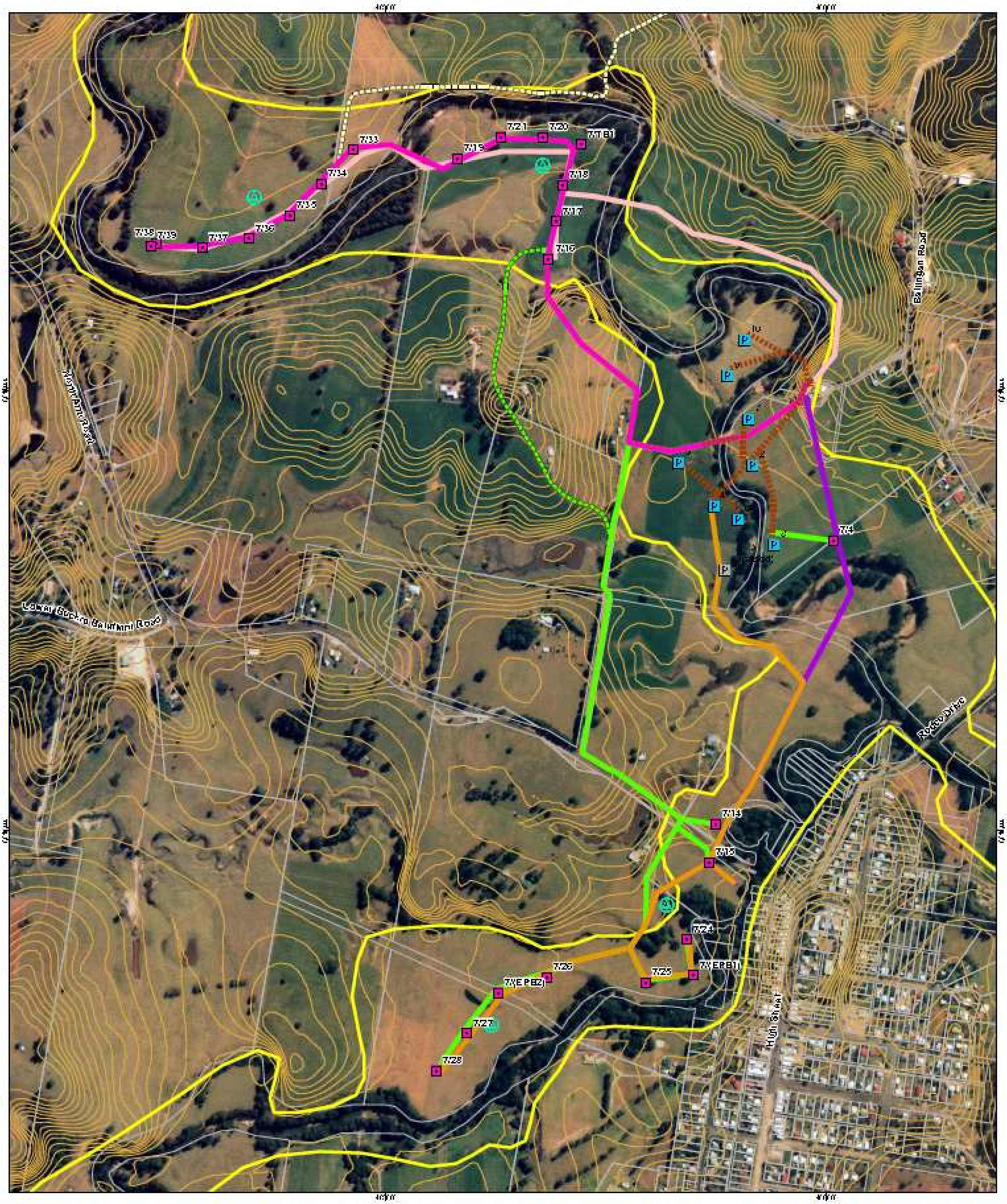
Job Number 22-14133
Revision A
Date 26 AUG 2009

CLIENTS | PEOPLE | PERFORMANCE

Preferred
Borefield Option

Figure 3-2

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E W www.ghd.com.au



LEGEND

Borefield Collection
Pipeline Options

Figure 3-3

3.5.1 North Arm Bores

Option 1 North

This route was considered because it impacts the least number of properties. It would require two river crossings and approximately 2,235m of 150 to 400mm pipe.

This route was superseded by Option 5 North to keep the borefields out of a known cultural heritage site and the river crossing location was moved to avoid an existing rock outcrop.

Option 2 North

This route was considered as it is the shortest pipeline route and has the ability to collect water from the existing Bores 9 and 10. Approximately 2,060m of 150 to 400mm pipe and four river crossings would be required to transfer water from the proposed bores to the new collection tank.

The option exists to connect the existing bores into the new pipeline, thereby increasing the security of the borefield network. In order to pump the new and old bores simultaneously, the diameter of the pipe from the existing bores to the collection tank (approximately 220 m), including the river crossing would need to be increased to a 500mm.

The option of connecting the new bores into the existing 300mm diameter pipe for Bores 9 and 10 was also examined but was excluded from further considerations because:

- The velocities in the pipe exceeded scour velocity;
- Larger pumps would be required for the proposed bores; and
- The model showed a reduction in pumping capacity of existing bore pumps due to increased head if the new bores and existing bores were required to run simultaneously.

Option 3 North

This route was considered as it only requires 2 river crossings. It would require approximately 2,150m of 150 to 400mm water main, impacts 5 properties and the cultural heritage site.

This route was marginally longer and therefore slightly more expensive than Option 4 North and does not offer the increased security of connecting the existing bores into the new watermain, therefore Option 4 North is preferred over Option 3 North.

Option 4 North

This route was similar to Option 3 North and only requires 2 river crossings. It would require approximately 2,140m of 150 to 400mm water main, impacts 5 properties and the cultural heritage site.

This option was modified into Option 5 North to avoid the cultural heritage site and reduce the total length of pipe by combining the collection pipes from both the North and South Arms of the Nambucca River.

Option 5 North

Option 1 North was modified to Option 5 North to keep the borefields pipelines out of the cultural heritage site and the river crossing location was moved to avoid an existing rock outcrop. It would require two river crossings and approximately 2,235m of 150 to 400mm pipe.

Topographic survey of this route revealed a high point with an elevation of 26.85m AHD. The top water level in the collection tank is 23.2m AHD. This option would therefore require a relatively long directional bore in order to prevent negative pressures in the pipeline.

Option 5 North was excluded from further assessment due to the high costs associated with the underbore (and 2 river crossings) and the lack of opportunity to provide additional security by connecting existing bores to the new pipeline.

Option 6 North

The water main follows a similar route to Option 4 North, but makes use of the existing access and pipeline easements on Lot 1 DP 252550 to and Lot 326 DP 777074.

Approximately 1,840m of 150 to 400mm water main across three properties would be required to connect the bores on the North Arm to the junction with the pipeline from South Creek (Option 4 South).

Approximately 460m of 500mm pipe would be required from the junction to the Collection Tank at the headworks site. The pipeline would be installed in the existing easements where practical, but there would still be an impact on 2 properties and the requirement for an 80m bore under the Nambucca River.

The existing bores can connect to the new pipeline on both the eastern and western side of the Nambucca River to increase the security of supply from the borefields.

This option avoids the cultural heritage site and has lowest impact to landowners.

3.5.2 South Creek Bores

Option 1 South

This route was initially considered as it directly linked all the proposed bores on South Creek and Bore 4. It was revised to Option 5 South following the initial site inspection to avoid an additional 80m long crossing under South Creek near Bore 24.

Option 2 South

This route was considered as it included the option to replace the existing river crossing and collect flows from the existing bores on the western side of the river. The northern bores could connect into the existing pipe near existing Bore 7 and it has the option of connecting the existing bores into the new watermain. This was revised to Option 3 South following the initial site inspection to avoid the additional 80m long crossing under South Creek near Bore 24.

Option 3 South

This route is a modification of Option 2 South to avoid the additional 80 m crossing under South Creek. It would require approximately 3,000m of 150 to 400mm pipe, impacts 6 properties and requires an 80m bore under North Arm near the existing bore. This pipeline route has the

highest risk of damage due to erosion and unstable bank conditions and would require riverbank stabilisation and additional pipeline protection.

The option exists to connect the existing bores into the new pipeline. In order to pump from the new and old bores simultaneously, the diameter of the watermain from the existing bores to the collection tank (approximately 350 m), including the river crossing would need to be increased to a 500mm.

The option also exists to connect into the pipeline for the North Arm Bores for Option 5 North. This option would require approximately 2,290m of 150 to 400mm pipe, impacts 6 properties and requires a 80m bore under North Arm near the existing bore. Approximately 80m of riverbank stabilisation would be required to protect the pipeline.

The option of connecting the new bores into the existing 12 inch (300mm) diameter pipe near bore 4 was also examined but was excluded from further considerations as:

- The velocities in the pipeline exceeded internal scour velocity (4 m/s);
- Larger pumps would be required for the proposed bores;
- There would be a reduction in pumping rate of existing bore pumps due to increased head if the new bores and existing bores were required to run simultaneously; and
- It was also considered a higher risk to ensuring adequate operation of the existing system during connection and commissioning of the new bores as the river crossing and pipelines were installed in 1968 and previous repairs have been required on this pipeline.

Option 4 South

In this option, all the proposed bores on South Creek are collected in a similar configuration to Option 3 South, but instead of following the river as is the case with Options 3 and 5 South, the watermain would be constructed within the proposed right of way for North Arm Road and Borefield Road. From this point the alignment for this option follows the access easement and connects into the 500mm pipeline proposed for Option 5 North.

Approximately 2,300m of 150 to 400mm water main is required to connect the bores on South Creek to Option 5 North. Only two properties are impacted and the remainder of the pipeline is within the right of way or existing easements.

This is the preferred route because it has:

- The lowest impact to property owners;
- Lowest cost;
- Lowest risk of damage to pipeline due to river bank erosion or geomorphologic reasons;
- Ability to connect existing bores into new pipeline.

Option 5 South

This route is a modification of Option 1 South to avoid the additional 80 m crossing under South Creek. It would require approximately 2320m of 150 to 400mm pipe, impacts 6 properties and requires a 120m bore under North Arm near Bore 4.

The option exists to connect the existing bores into the new pipeline. In order to pump the new and old bores simultaneously, the diameter of the water main from the existing bores to the

collection tank (approximately 350 m), including the underbore would need to be increase to a 500mm pipe.

The option of connecting the new bores into the existing 12 inch (300mm) diameter pipe near bore 4 was also examined but was excluded from further considerations because:

- The velocities in the pipeline exceeded scour velocity;
- Larger pumps would be required for the proposed bores;
- There would be a reduction in pumping rate of existing bore pumps due to increased head if the new bores and existing bores were required to run simultaneously; and
- It was also considered a higher risk to ensuring adequate operation of the existing system during connection and commissioning of the new bores as the river crossing and pipelines were installed in 1968 and previous repairs have been required on this pipeline.

3.5.3 Options Comparison

In order to compare the alternatives, a selection matrix was developed. The superseded options were excluded from the matrix. Scores were given to the remaining options for the North and South routes respectively, 1 being most favourable (or least expensive) and 3 being least favourable (or most expensive). The selection matrix is included in Table 3-4.

Table 3-4 Comparison of Options

	North			South		
	N2	N5	N6	S3	S4	S5
Cost	3	2	1	2	1	3
Length	1	2	3	2	1	3
Security	2	3	1	1	1	3
River Crossings	3	2	1	1	1	3
Geomorphology	3	2	1	3	2	1
Cultural Heritage	2	2	1	1	1	1
Landowners	1	2	3	2	1	3
Easements	3	2	1	2	1	3
Total	18	17	**12**	14	**9**	20

3.5.4 Preferred Options

Option 6 North and Option 4 South are proposed.

Additional security can be obtained by connecting the bores on the eastern bank with the bores to the new crossing near Bore 3. The valve would remain closed during normal operation so as not to negatively impact on existing and proposed pumps.

Bore 7 would be connected to the new watermain on the eastern side of the crossing.

Approximately 200m of 250mm water main would be required to connect Bore 7/4 to the existing watermain near Bore 8. There would be minimal change to the existing bore capacities as anticipated yield for Bore 7/4 is similar to Bore 8.

Further security can also be obtained by connecting the bores on the western bank with the bores to the new crossing near Bore 8. The valve would remain closed during normal operation so as not to negatively impact on existing and proposed pumps.

3.6 River Crossing Options

Piped crossings of the Nambucca River are required to connect the borefield collection pipelines to the headworks. The number and exact location and size vary (from a 300 to 600mm) for the different pipeline route options, however, the site conditions for potential crossing locations are similar. The following issues were considered when determining an appropriate method to be used for the crossings:

- River geometry and geomorphology;
- River and bank ecology;
- Geotechnical conditions; and
- Potential crossing methods available.

3.6.1 River Geometry and Geomorphology

In the vicinity of the proposed borefield pipeline crossings, the Nambucca River is approximately 10-20m wide and varies in depth from 0.5 to 3m (approximate). The banks are generally steep (1H:1V) on each side with the overbank area 2 to 3m above water level.

A geomorphology investigation has revealed that the characteristics of the pipeline crossings are as follows:

- There is a scour potential in the river of up to 1 metre (or possibly greater) in areas immediately upstream of the existing weir;
- As the course of the river has moved in the past and is predicted to move more in the future, locating any crossings on bends would be avoided; and
- Preliminary agency consultation has indicated concerns with trenching through the creek due to the potential for further damage to the geologic composition of the river.

River and Bank Ecology

The ecology investigation undertaken as part of the Proposal has identified the potential impacts listed in Table 3-5 to flora and fauna if trenching or dredging through the river was undertaken.

Table 3-5 Potential Ecology Impacts for Trenched River Crossings

Potential Impact	Description
Invasion of native plant communities by exotic perennial grasses in riparian vegetation	There exists the potential for the spread of Giant Parramatta Grass (Sporobolus fertilis) along the pipeline route. This species has been already recorded within the study area.
Invasion, establishment and spread of Lantana camara in riparian vegetation	There exists the potential for the spread of Lantana (Lantana camara) along the pipeline route. This species has been already recorded within the study area.
Blockage of fish passage	There exists the potential for the blockage to fish passage would trenching and sheet piling be adopted during construction. Possible species include Pacific blue-eye (*Pseudomugil signifer*) and empire gudgeon (*Hypseleotris compressa*)

It is also unlikely that the Department of Industry and Investment would support trenching through the river given the potential impacts to flora and fauna.

Geotechnical Conditions

Information taken from the Hydroilex Groundwater Report indicates that the general geotechnical conditions for the creek crossings would be loose alluvial gravels (with high permeability) to a depth of 5-10m that is underlain by base rock (phyllite).

Potential Crossing Methods

Three basic crossing methods were identified (with several sub-options) as follows:

- Trenched or dredged;
- Trenchless; and
- Aerial.

These options and the relevant sub-options are discussed in the subsections below.

Trenched or Dredged

Trenched

A suitable methodology for construction of a trenched river crossing is as follows:

- If the area to be used is soft or unstable, it may be necessary to construct a hardstand of adequate strength to carry a 100/150 tonne crawler pin jib crane. Depending on the stability of the riverbank, it may also be prudent to drive a row of sheet piles along the bank alongside the crossing. This allows the hardstand to finish close to the edge;
- Because of the accuracy required when driving the sheet piles, a purpose built frame around ten metres long is used. To position the frame, two piles are driven ahead of the frame one either side of the centreline. The driving frame is then secured to the driven piles by welding;

- The sheet piles are then driven progressively along both sides of the driving frame. When the frame is full, it is cut free from the previously driven support piles. The support piles are then pulled from the ground and driven a further nine metres in advance of the pile embankment. This process is repeated until the first stage is completed;
- Pump out the coffer storage to one metre below the top whaler and attach the whaler support bracket. Continue to lower the water level to the bottom whaler and repeat the previous bracket installation;
- Excavate to the required levels and lay a concrete blinding slab complete with a sump;
- Proceed to install and test the pipes and place the concrete surround in the first stage. Once this is complete, slowly fill the coffer storage with water removing the bottom whalers and bracing as the water rises; and
- Repeat the above for stage two after establishing on the opposite bank.

Another option for trenching across the river is to dump soil into two thirds of the river (using sheet piles and silt curtains to reduce the extent of the impact) and install half the pipe length in the dry to maintain fish passage. Large pipes are inserted through the embankment to maintain normal flows. The second half is then installed in a similar fashion. This option is likely to have a similar cost to the dredging option below but has the following comparative disadvantages:

- If flooding were to occur during construction, there is a risk of the hydraulic restriction caused by the embankment causing significant upstream flooding; and
- There is a greater disturbance area than the dredged option and it would be difficult to return the creek bank to the existing levels as required are likely to be required by the DPI.

For these reasons, this option was not considered any further.

Dredged

Traditional dredging methods, such as jetting, cutter and suction dredging, were reviewed and were found to involve high set-up costs and are uneconomic for comparatively short lengths. These methods are also more appropriate for crossings with high amounts of sediment. The geotechnical conditions of the riverbed are more suitable for normal excavation methods. Therefore, the following methodology would be appropriate:

- A detailed aquatic survey of the river crossing (as would be likely to be requested by DPI) is required as it is possible that endangered species would occur at the site;
- Silt curtains would be installed in the river around the proposed extent of the staged excavation sections (trench excavated in two separate halves to maintain fish passage) to minimise the effect on river sedimentation that the works would have. Before undertaking any excavation works, water quality measurements of turbidity and dissolved oxygen would be recorded as baseline levels. Water quality testing would need to be undertaken after excavation and before the silt curtains are removed to ensure that any potentially contaminated sediments have resettled out of the water column, that an 'anoxic bloom' doesn't travel upstream or downstream and that the baseline levels are achieved. Further monitoring procedures would need to be outlined in an Environmental Management Plan (EMP);

- Long-reach excavators on both banks would excavate a trench in the river bottom (where sediment is deeper in the area 5-10m from each bank, sheet piling may be used to reduce the trench batter slope);
- One of the long-reach excavators is transferred to a floating barge to excavate the middle section of the river that cannot be reached from the banks (may not be required depending on width at exact crossing location and river flow);
- A crane is used from the bank to separately lift each half of the fully welded crossing into place for the central connecting weld to be made on the floating barge (welding the entire section on shore and dragging it in may be possible at the site); and
- After welding, the pipe would be lowered into the trench with backfill placed. Silt curtains would be required along either side of the backfill extent to minimise the transfer of sediment in the water column (water quality tests are again required for this step). This would block fish passage for up to a day but is expected to only have a minimal impact on fish species. Excavators would be used to backfill the trench with small diameter ballast/pebbles.

Trenchless

Horizontal Directional Drilling (HDD)

With the soil conditions present, the crossing could be located in the gravel layer (possibly 5-10m deep). If a polyethylene rising main were used with no casing pipe, the curve radius of a 300 HDD would require the crossing to be over 100m long to ensure sufficient clearance under the river. This would require the setup areas to be located well away from the riverbanks. Experienced contractors indicate that due to the large setup cost and the approximate per metre rate of $2,500, that other trenchless crossing methods would be more appropriate and cost effective by a fair margin. GHD's trenchless technology group have also advised that HDD would not be the most cost-effective option and that it is not worth considering. For these reasons, HDD was not considered any further.

Thrust Boring

This method would only be suitable in a clay layer and would therefore require a much greater depth for the launch and receival pits.

Closed Face Tunnel Boring

Information previously sourced from DJ & MB MacCormick (trenchless technology contractors from Western Australia) for similar projects was used. They have previously recommended for projects of similar ground type that a closed face slurry shield tunnel boring method would be used.

Further detailed geotechnical data would be required and the following methodology would be employed:

- 5m diameter receival and thrust shafts (sunk as caissons in approximately three 2m lifts – this depth is needed to ensure that fissures through the soil beneath the creek do not allow the pressure from the boring machine to burst into the river bed) would be placed at each end of the underbore with a concrete plug poured in each to make them water-tight;
- Jacking rig and associated equipment (such as an entrance ring and a gasket) placed in the launching shaft with a thrust block at the rear embankment;

- Stabilisation and ground improvement around jacking eye launch and reception;
- Platform for caisson would need to be constructed prior to the sinking to enable extra thrust or in the case of over-penetration, stopping the caisson from sinking too far;
- Tunnel boring machine lowered and launched with steel pipe and then casing/jacking installed behind machine in 2.4m lengths;
- As each pipe length is installed, slurry pipes and 100/150 discharge pipes are installed for removal of slurry spoil from face of machine;
- Service lines are then installed for surface monitoring (TV) and control (machine is laser guided and steerable) of pipeline levels;
- Spoil is returned through slurry pipelines to the surface and then to settlement tanks (this soil would be then sent to the ASS remediation area for treatment);
- When the machine reaches the receival shaft, it is removed;
- Each 3m steel pipe length is then welded (and internally mortared if necessary) and drawn through. When all are in place the steel pipe would be pressure tested and grouted into the casing pipe;
- Grout the annulus between the jacking pipe and the steel product pipe; and
- Vertical bends would be welded on at each end and connected to the other sections of pipe at each end with the top of the caissons broken out and then backfilled.

To enable the trenchless crossing, shafts would need to be constructed for both the launch and the receival of the machine. The shafts are expected to be constructed by sinking concrete caissons to depth, in order to support the subsurface material. The soft ground conditions (in the gravel layer) that are present at the site are favourable for this type construction method. However it is recommended that once final alignment has been established, two new geotechnical boreholes be sunk, at the centre point of each of the shaft locations. This is done to confirm the ground conditions at the location of the shaft sinking.

Pipe Ramming

Pipe ramming methodology is as follows:

- Launch and receival pits are constructed. A launch pit size of suitable width to allow 6m casing pipe lengths to be used;
- A rail is constructed in the launching pit at the required alignment and grade of the pipe to position and guide the casing pipe and support the hammer;
- The hammer is installed on the rails, setup and then hammers the first casing pipe length in;
- The next pipe length is aligned along the rail in front of the hammer and welded to the previous pipe length. Once welded this length is then hammered in and the process is repeated for the entire length. At times during this process soil may needed to be augered out from inside the casing pipe if the friction becomes too great; and
- Once the pipe is cleaned out, the product pipe is installed similar to the closed face tunnel boring methodology above.

This method with an open face machine specified for the pipe ramming would not succeed for an underwater crossing due to the inability to control water inflow at the face. GHD has concerns with the risks associated with this construction methodology (control of water inflow, force required to push the casing, and hitting a boulder).

Aerial

Information previously sourced from pipeline contractors for similar projects was used for the proposed construction methodology as follows:

- Silt curtains are installed in the creek either side of the proposed extent of works to minimise the effect on creek sedimentation that the piling works would have;
- Pile driver on floating barge (depends on level in river) would drive piles to required depth (likely to be well into layer below gravel layer) with headstocks at the top of each pile then formed;
- Crane would lift fully welded half section of the pipe to be welded in the centre and connected to headstocks for each pile; and
- Anchor blocks at each end constructed.

Generally aerial options are cheaper than trenchless, but have a higher environmental impact than trenched/dredged options. The main issues with aerial crossings are that they need to either be designed to resist flood loads (or raised above the flood level), are be subject to a higher risk of accidental and deliberate damage by being located in an area open to the public and are also a potential liability risk. The visual impact on the landscape would also be a significant concern to nearby landowners.

Proposed Option

Closed face tunnel boring trenchless technology is proposed for the borefield pipeline crossing of the Nambucca River for the following reasons:

- Visual impact and potential liability issues make an aerial crossing unfavourable;
- Trenched or dredged options would result in a high impact to the ecology and geomorphology of the river and surrounds; and
- Other trenchless technologies are either not feasible given the soil/site conditions or would be prohibitively expensive.

A preliminary construction cost estimate of $480,000 has been calculated for the recommended crossing option for 300mm pipe, $650,000 for a 500mm pipe and $720,000 for a 600mm pipe. This estimate has an accuracy of ±40% and would only be used as an order of cost estimate. The soil conditions are the main factor for the high cost of this crossing method.

3.7 Headworks Alternatives

Three (3) options were investigated for housing the pumps to transfer flows from the headworks to the storage as follows:

- Option 1 - Utilises the existing collection tank for not only suction but for housing the pumps. Installing submersible pumps in the tank would not pose a noise issue but would mean that access to the motors would mean using a large crane. Vertical line shaft pumps could be

used to locate the motors on the tank roof for easier access with noise covers used. A sump under the tank may be required to ensure adequate suction pressure.

- Option 2 - Uses a below ground well to house the pumps with a valve to regulate the level in the well from the collection tank. The well would be in the order of 5m diameter to house 3 submersible pumps (2 duty/1 standby used for the purposes of the comparison) of the size required. The well is located as close as possible to the collection tank to reduce suction pipework. Adjustments to the layout may be possible to reduce this further. Pumps would be easier to access than Option 1.
- Option 3 - Needs a new above ground building to house the pumps. The only spare location on the site for the pumping station building was adopted (putting building closer to collection tank would again reduce suction pipework cost) with horizontal centrifugal pumps, either end suction or horizontal split casing, and the switchboard inside. This would be the easiest option to maintain.

Cost estimates of each option and Net Present Values (NPVs), taking into account operation, replacement and maintenance costs, were undertaken to compare the options (refer to Appendix C for details). Note that the capital cost estimates have an accuracy of ±40% and are to be used for comparison purposes only. A comparison of the options is shown in Table 3-6 below.

Table 3-6 Comparison of pump installation options

Option	Capital Cost ($M)	% higher than Option 1	NPV ($M)	% higher than Option 1
1	1.15	-	1.53	-
2	1.98	72%	2.36	54%
3	1.48	29%	1.72	12%

Note: 7% discount rate on NPV

As noted in the table above Option 2 has an estimated capital cost and NPV much higher than the other two options and was therefore excluded. Whilst the capital cost difference between modifying the existing collection tank and constructing a new building to house the pump made Option 3 more expensive than Option 1, the lower operation, maintenance and replacement costs associated with horizontal split case pumps when compared to submersible pumps bring the NPVs relatively close.

The other issue to consider in this comparison is whether a water treatment plant at the headworks site is required into the future and whether the building to house the pumps could also be used to locate some small water treatment equipment prior to any full treatment plant coming on-line. It would also be noted that from an operation perspective, NSC prefers dry mounted pumps in a building.

Option 3 has therefore been adopted for the concept design.

3.8 Storage Embankment Options

A number of investigations into the siting of the storage and alignment options have previously been performed by NSW Department of Public Works and Services (DPWS) (now NSW Public Works – Project Management) and Woodward Clyde.

DPWS

Preliminary reconnaissance geological studies were undertaken by DPWS (DPWS, May 1995) which considered a number of potential storage sites in the area outside of the Nambucca River flood plain. Further evaluations of the alternate storage sites were undertaken (DPWS, May 1996) which resulted in the selection of Site 2B as the preferred storage site.

Woodward Clyde

The site 2B storage alignment follows the ridge line of the abutments, and on the right abutment deviates from a straight line forming a kink in the alignment. A concern was raised that this kink in the alignment could potentially induce a zone of stress concentration which would present a risk of embankment cracking under significant hydrostatic and/or seismic loading.

Three alternative alignments were identified and investigated which would allow the storage alignment to be straightened as described below:

- 2C, slightly upstream of the existing 2B alignment;
- 2D, slightly downstream of the existing 2B alignment; and
- 2E, slightly upstream of the 2B alignment with a smaller kink.

Both alignments 2B and 2C represented a significant increase in earthworks volume and hence a significant additional cost to the project, while alignment 2D could only provide a maximum storage volume of 8,000 ML, without a massive increase in earthwork volume and cost.

As a result, 2B was chosen as the preferred alternative and the following defensive design features were proposed in the vicinity of the kink:

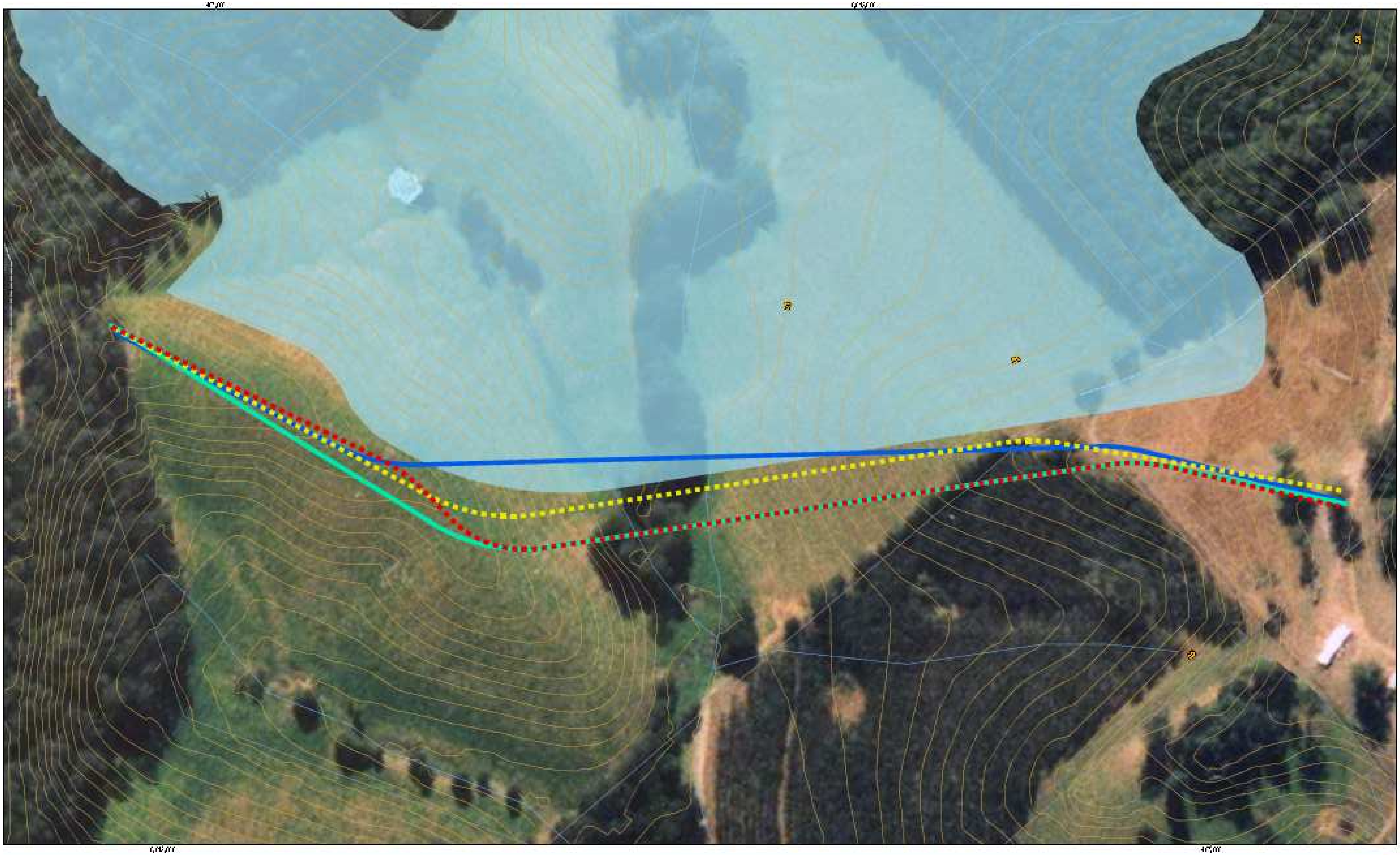
- Locally increase the width of the filter zones;
- Locally flatten the embankment slopes increasing the upstream-downstream width of the embankment zones.

3.8.1 Proposed Alignment

For the current design, alignment 2B has been modified by introducing a gradual bend to replace the kink proposed above. The curve was incorporated to eliminate any stresses that would have been introduced with the kink, and therefore no local widening or flattening of the embankment slopes is required, thereby reducing the total earthworks and hence cost.

A detailed topographical survey of the proposed storage embankment area and entire inundation area was performed by Newnham Karl Weir and Partners in 2008/09 for the Proposal. Four options were considered for the alignment of the storage embankment by optimising the earthworks.

The options and their configuration are illustrated in Figure 3-4.



1:2,000 (at A3)

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

LEGEND

- Cadastre
- 2m Contours
- Fire Trail
- Creeks
- Dam Centreline Option 1
- Dam Centreline Option 2
- Dam Centreline Option 3
- Dam Centreline Option 4
- Proposed Inundation Area

GHD CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off-River Storage

Job Number	22-14133
Revision	A
Date	27 AUG 2009

Storage Embankment Alignment Options

Figure 3-4

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

3.9 Spillway

The spillway for the storage would be designed for a maximum peak discharge of 58 m^3/s, which is the peak outflow calculated for the PMF in the Preliminary Dam Break Study (GHD, 2009). Two options were investigated for the spillway design. The first option is a drop inlet pipe spillway and the alternative is an open channel spillway.

Drop Inlet Pipe and Emergency Spillway

The drop inlet spillway comprises an inlet riser, a pipe through the embankment with an energy dissipater downstream, and an emergency spillway.

For the drop inlet spillway locations on both the left and right abutments of the storage were considered. The left abutment alignment would require less excavation and a smaller length of pipe but would require a energy dissipater into a open concrete channel to turn the flow towards the river. In addition a stilling basing would be required at the end of the channel to release flow into the river. In comparison a drop inlet spillway location on the right abutment would require a longer pipe but only a single energy dissipation structure to release flows into the river.

Open Channel Spillway

The second and proposed option investigated is a reinforced concrete open channel spillway with a width of 16 m. The crest of the spillway is located at RL 38.1 m on the right hand bank, discharging through a stilling basin into a gully at the downstream toe, leading back to Bowra Creek. The open channel spillway would be founded on residual phyllite.

To prevent uplift of the spillway, an under-drain system is incorporated into the slab of the spillway using 100 mm diameter slotted PVC pipes. The pipes are surrounded by free draining gravel for the draining system. The transverse drains are spaced at 12 m spacing along the spillway, about 1 m downstream of the transverse construction joints. Three rows of longitudinal drains, one on each side of the spillway and one in the middle would link the transverse drains and discharge underground water into the stilling basin. Both transverse and longitudinal drains would have clean-out points to prevent blockage in the drainage system.

3.10 Inlet and Outlet Works

3.10.1 Inlet Works

A 600 mm diameter inlet pipe is proposed to enter the storage through the embankment at a location below the spillway. The inlet pipe would discharge at RL 35 m and would have an energy dissipater and a rip rap lined channel to control erosion.

3.10.2 Outlet Works

Intake Tower

Both dry and wet towers options were considered for concept design. A wet tower is favoured over a dry intake structure due to the height of the tower for any future rising of the storage crest. Thicker concrete sections would be required to resist hydrostatic pressure in the case of a

dry tower. In addition a dry tower would require more pipework, valves and a larger access bridge.

For the wet tower, two different options for the outlet works were considered.

The first was a vertical concrete intake tower located at the upstream toe of chainage 80. The intake tower would be a wet tower with intake pipe at RL 30 m and 25 m. Intake of water would be controlled by opening of slide gates from the intake control tower.

The second option investigated was a concrete leaning tower located on the upstream embankment at chainage 80. The leaning tower would also be a wet intake tower with 2 intake levels as for the vertical tower.

Advantages of the leaning tower include less excavation as the leaning tower does not need to be founded on good rock. Also, the control tower for operating the slide gate can be located on the crest of the storage embankment, whereas for the vertical tower required an access bridge to be built from the crest to the control tower.

But due to the upstream slope of 1:3 of the storage embankment, the total length of the leaning intake structure would be 73 m. This would require significantly much more concrete than the vertical tower and would push up the construction cost. Thus the vertical tower was selected for the intake structure.

Outlet Pipe

A 1,000 mm diameter pipe is required for the outlet pipe due to requirement of emergency dewatering based on the US Bureau of Reclamation ACER Technical Memorandum 3. Dewatering time is based on a flow speed of 3 m/s.

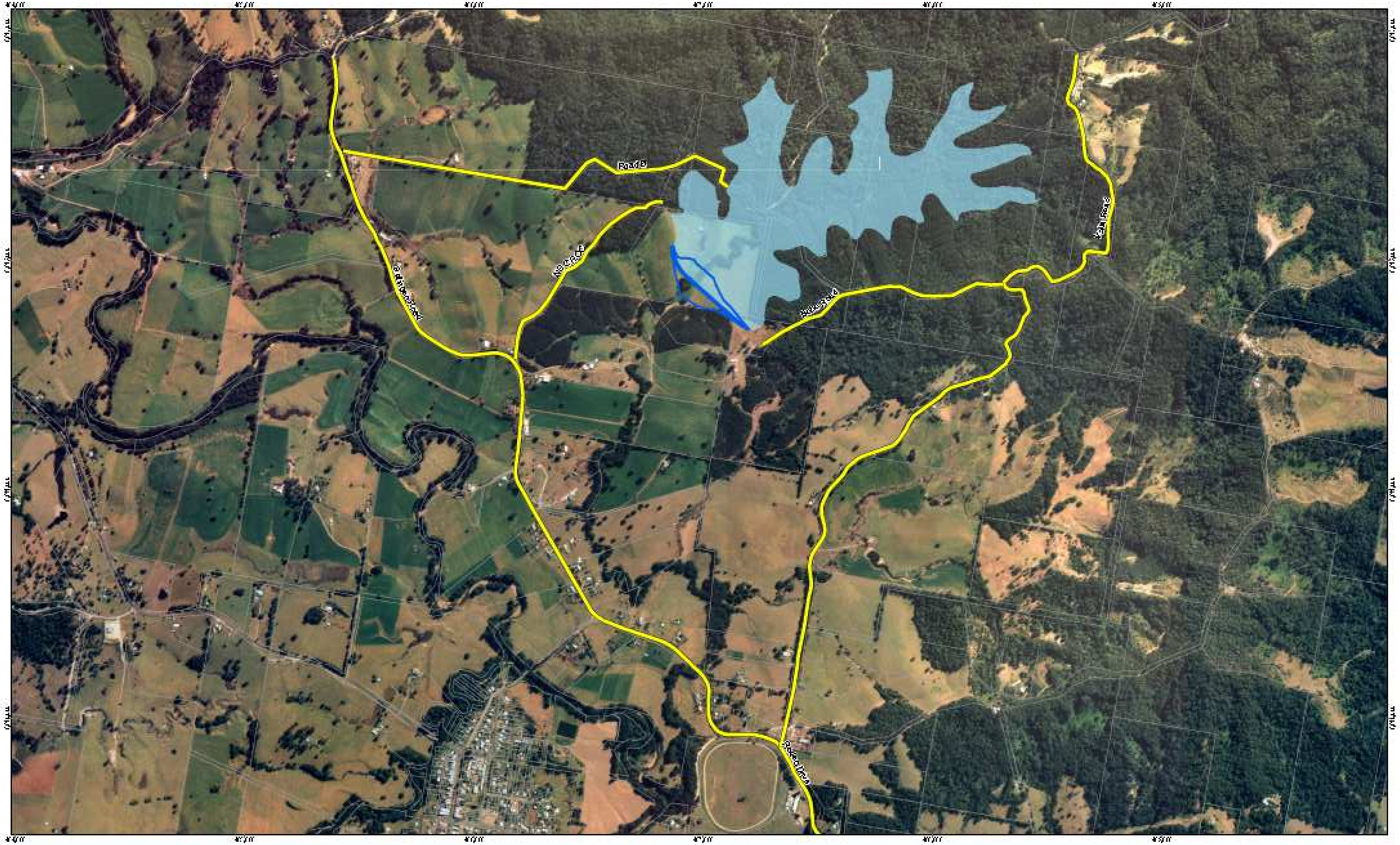
The outlet pipe would be located at RL 17 m and would be connected to the valve chamber at the downstream end where it would be connected to the collection tank. Underneath the storage embankment, the outlet pipe would be encased in reinforced concrete.

3.11 Storage Access Road Options

Three alternative routes are available to gain access to the storage site. The alternatives are shown in Figure 3-5.

Road A (Bobo Road) is the eastern access road off Valla Road and Road B is the western access road off Bellingen Road. Roads A and B are referred to as the eastern and western ends of the East-West Link Road which is currently classified as a Crown Road.

The third access route is a 10m wide Right of Carriageway (ROC) created over Pt 5 in DP 1076377. The ROC has a length of 935m from Bellingen Road to the northwestern corner of Lot 6, which is owned by NSC as part of the storage site. The route of the ROC generally follows the existing track to the house on Pt 5 owned by Ussher. Beyond the house the ROC appears to be unformed. Due to the limited width of the ROC it appears that it was acquired in order to provide access for occasional maintenance. For construction of the storage a wider road reserve is required in order to provide access for two-way traffic by heavy vehicles. Consequently, no further consideration was given to use of the ROC for access to the storage site for general construction activities.



1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

Cadastre

Stage 1 Inundation Area

Stage 1 Dam Wall

Storage Access Roads

Nambucca Shire Council
Bowraville Off-River Storage

Job Number 22-14133
Revision A
Date 27 AUG 2009

Storage Access Route Options

Figure 3-5

CLIENTS | PEOPLE | PERFORMANCE

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

3.11.1 Eastern Access Route from Valla Road

The shortest route to the storage site is from Valla Road along the existing Crown Road Reserve, 2.5km from Rodeo Drive, to an area, which could be used as a public viewing and turning circle approximately 900m from Valla Road.

NSC would be obligated to dedicate the access road to the public. The existing ROC created under DP 1092320 relies upon the existing Crown Road to provide legal access to Lot 2 DP 1076377, which would otherwise be landlocked. The ROC joins the Crown Road at the eastern boundary of Por 183 approximately 720m from Valla Road. The upgraded access road for public access could be terminated at this point and an "internal" access provided for maintenance purposes beyond this point to the storage infrastructure.

A preliminary design has been completed for upgrading of the existing Crown Road as it is currently unsuitable for a higher level of use. The design indicates that the characteristics of the road would be as follows:

- Length from Valla Road to turning circle = 900m
- Road formation width = 8m, containing 2 x 3m lanes;
- Maximum longitudinal grade = 9%;
- Average total width including cut and fill batters = 22m;
- Maximum width of formation for roadway including cut and fill batters = 30m;
- Parking and turning area approximately 120m x 25m;

The preliminary access road design continues past the viewing area to a point below the storage embankment approximately 1,900m from Valla Road. It is assumed that NSC would install security gates at the end of the viewing area, approximately 1040m from Valla Rd to restrict public access. Approximately 300m past the anticipated limit of public access, provision has been made for access connection directly to Lot 2 DP 1092320. This would permit the existing ROC to be expunged provided the property owner agreed and provision was made for the owner and visitors to traverse the "non-public" section of the access road.

3.11.2 Western Access Route from Bellingen Road

The alternative western access route is via the same Crown Road, which intersects Bellingen Road 2.5km from High St. At present the Crown Road is used for access to a dwelling on Lot 1 DP 1083234, which is approximately 500m from Bellingen Road. The road reserve follows the boundary of Lot 1 for 965m before turning northwards and easterly within Lot 1 to meet the boundary of land acquired by NSC being Lot 2. The additional length of roadway within the forest area on Lot 1 is approximately 450m. Immediately upon reaching the boundary of the storage site a 135^0 right turn is required to avoid the storage area and travel 200m south to the end of the Stage 2 embankment.

From an engineering perspective, it would appear that use of the Crown Road to access the storage site for construction would result in fewer environmental impacts as the surrounding forest area does not contain mature vegetation as it has been logged and replanted. The turn

at the boundary of the storage site may prove to be an impasse due to the limited turning radius available based upon the anticipated area to be inundated if the Stage 2 embankment is constructed.

In addition, the limited area of land available is compounded by the steep slope of the area. Slopes of 25% appear to be typical in which it would be desired to construct the visitor and observation area. It would also have to be substantially within the area which would be inundated by the Stage 2 works. Consequently, due to the limited site area, and the need to construct a Crown Road, which is currently not constructed, or in use, the western access does not appear to be suitable for long term access to the storage site.

3.11.3 Proposed Route

The concept design investigation into an appropriate access to the storage site has revealed that the eastern access route from Valla Road would be the most environmentally and cost effective option.

Advice received from the Department of Lands indicated that it would be expected that NSC would acquire part of the Crown road within the area of the State Forest at the same time as the acquisition process required for the State Forest.

Following acquisition, NSC would be expected to dedicate the storage access road as a public road. Generally it would be anticipated that any new public road opening and dedication to NSC would be constructed to a sealed standard with details subject to detailed design and acceptance by NSC. NSC's DCP 4 – Subdivision, together with NSC's Aus-Spec specification and relevant Austroads specifications would be the basis of preparing a design for consideration and approval by NSC.

3.12 Destratification Options

Water storage reservoirs have a tendency to 'stratify' during warmer weather, whereby an upper layer of water is heated by the sun, whilst a lower layer remains at a lower temperature. This effect results in a lower layer of water that does not mix with the upper layer, and over time the oxygen levels are depleted. This in turn can result in iron, manganese and other impurities being released into the water. Later in the summer when the surface layer cools, the water 'destratifies' (mixes), and the poorer quality water from the lower levels mixes with the upper layer, combining the two into a single layer of lower quality water.

It is therefore normal practice to provide some form of artificial mixing system, to seek to avoid the initial stratification of the water body.

3.12.1 Artificial Mixing

There are two primary methods to destratify reservoirs, either by mechanical means with a large propeller (or impeller) or by pneumatic means such as a bubble plume aerator (Lyall & Macoun 1998). Examples of impeller systems implemented in Australia are the Manly Storage and Sooley Storage in NSW (R 2000). Impeller systems operate by pumping a portion of the surface waters into the hypolimnion. This serves to control algae through decreasing light availability (pump algae to depth) and decreasing the residence time of algae in the surface layer. Impellers have been configured to promote horizontal and vertical mixing. Some success has

been reported for impellers that promote horizontal mixing. However, vertical impellers have proved highly successful in depriving algae of light availability in smaller capacity reservoirs of order 1,200 ML (Kirke 2001). The promotion of top-down circulation with the vertical impeller systems can control blue-green algae growth through instantaneous pressure changes and turbulent flows (Elliott and Morgan 2006).

Technology for implementing impeller systems in Australian storages has been developed by WEARS Australia. The WEARS Surface Mounted Destratification Impeller (SMDI) system has been successfully applied in smaller reservoirs such as the Medway Storage on the Southern Tablelands New South Wales, (1300 ML capacity), and the Happy Valley and Myponga Reservoirs in South Australia (WEARS 2006). The system consists of a slow rotating impeller that pushes warmer, aerated surface water to the bottom to destratify the storage. With a 4-8 kW mechanical circulation system this system has much lower energy requirements than bubble plume destratification systems. Once a uniform temperature profile is established the static head is reduced thereby lowering the required power for the system (Morgan and Elliott 2006). Further, energy reductions are achieved through the programmable electronics that enable the impeller speed to be set and controlled such that flow rates match storage capacities (Morgan and Elliott 2006). Successful results have been reported in a reservoir approximately twice the size of the potential future 14 GL Off-River Storage (30.5 GL in Morgan and Elliott 2006). A potential advantage of the surface impeller system over a bubble plume destratification system is the lower operating costs. However, the reliability of hardware, public access, liability and the number of impellers needed to achieve algal management criteria are uncertain (CSIRO 2000).

Similar to the impeller system, bubble plume destratification aims to mix the water body so that the typical temperature gradient and corresponding dissolved oxygen stratification (i.e. anoxia or low oxygen in the hypolimnion) is improved. Bubble plume destratification aims to manage algal blooms through several mechanisms, namely:

- Through deepening the surface layer (epilimnion) through erosion of the thermocline, phytoplankton are transported deeper into the water column with concomitantly less light and thus photosynthesis and growth are reduced; and
- Through reducing the flux of dissolved nutrients that are released from the sediments by increasing oxygen at the sediment-water interface. Hence, lower nutrient levels also restrict algal growth through phosphorus and/or nitrogen limitation.

If bubble plume destratification systems are sized too small and not effective in breaking down thermal stratification and deepening the epilimnion, it can be an effective manner to entrain nutrients from the bottom waters and transport them to the surface waters and making them available for algal growth (Kirke and Gezawy 1997), having a further negative impact on water quality.

3.12.2 Comparison of Options

A comparison of the withdrawals for both water supply and environmental releases for all three cases (baseline case, bubble plume and surface impeller artificial mixing systems) for a range of water quality parameters was undertaken. These comparisons indicate:

- The baseline simulation often predicts cold water pollution for environmental releases whereas artificial mixing yields an appropriate seasonal temperature distribution;

- Dissolved oxygen levels are consistently elevated with artificial mixing, whereas the single withdrawal depth strategy of the baseline case can at times yield anoxic water; and
- Elevated nutrient and metal levels are withdrawn for water supply and environmental releases for the baseline case relative to the artificial mixing simulations.

In short the artificial mixing strategies generally provide more consistent and improved water quality relative to the baseline simulation for both water supply and environmental releases.

As extraction for water supply and environmental releases are neither sufficient in terms of quantity nor temporal consistency to manage water quality in the entire storage, a selective withdrawal strategy via a multi-level offtake is not recommended. On the basis of water quality simulations, an artificial mixing strategy is recommended to maintain water quality for this relatively small off-river storage. Both surface impeller mechanical mixing and bubble plume destratification systems are effective strategies to maintain good water quality in the proposed off-river storage. It is likely that the bubble plume destratification system would have higher operational costs to run an air compressor relative to the more energy efficient surface impeller, but capital expenditure is likely to be lower.

Both destratification strategies, if designed appropriately, would provide:

- Continuous well-mixed conditions;
- Continuous oxic water column with substantially reduced nutrient and metal levels in the bottom waters, and withdrawals for water supply and environmental flows;
- Prevention of cold water pollution from environmental releases; and
- Decreased algal levels in the surface waters.

Artificial mixing would also mitigate against poor water quality that can potentially develop during the initial filling and operation of the reservoir during decomposition of the large organic pool over the surface and within the soils of the region to be inundated by the storage. An overview of the predicted water quality of the 4 generic cases considered here is provided in Table 3-7.

Table 3-7 Comparison of representative water quality values of withdrawals and environmental releases

Parameter	Case 1 – No Artificial Mixing	Case 2 – Artificial Mixing	Case 3 – No Artificial Mixing for New Storage	Case 4 – Artificial Mixing for New Storage
Cold Water Pollution	Yes	No	Yes	No
DO (mg/L)	0-8	8	0-8	8
pH	~7	~8	6-7.5	7.5-8.5
TSS (mg/L)	~1	~1	~3	~3
TN (mg/L)	0.3-0.7	0.3	1-9	0.7
TP (mg/L)	0.04-0.1	0.02	1-2	0.2
Chla (ug/L)	2-5	5-10	10-60	20-30
TFe (mg/L)	0.5-3	0.1-0.2	0-8	0.1-0.4
TMn (mg/L)	0.1-1	0.05	0-4	0.1-0.2

Capital costs for the surface impeller system is in the order of $200,000-$500,000 with energy costs of approximately $5,000-$10,000 per year.

For the bubble plume destratification system the capital cost is likely to be lower, around $100,000, but operational costs (power, maintenance, operator visits) would likely be greater, approximately $20,000 per year.

3.12.3 Proposed Option

In short, both destratification systems have comparable capital and operational costs. The bubble plume system is recommended on the basis of proven effectiveness and reliability in numerous Australian reservoirs. However, the surface impeller system's reliability needs to be addressed and the energy saving more fully evaluated during detailed design. It is noted that the bubble plume system needs to be installed prior to commencing filling of the storage, whereas the surface impeller system can be retrofitted after filling.

Water quality monitoring of groundwater inputs into the storage would be collected regularly (e.g. monthly to quarterly) to allow improved estimates of current loads into the reservoir. In-storage and withdrawal water quality monitoring is recommended to assess the performance of management strategies and to track the long-term behaviour of this future water supply storage.

4 Description of the Proposal

This Chapter provides an overview of the Proposal and the existing infrastructure within the study area, a detailed description of the key elements of the Proposal, the anticipated techniques and methodologies to be used during construction and the operational requirements and systems of the Proposal.

4.1 Proposal Objectives

The principal objectives of the Proposal are:

- Enhance the security of water supply in the Nambucca LGA to avoid the prospect of a supply failure;
- Adding headwork capacity to meet a projected population and demand of 20,000 people and 3,200ML/a respectively;
- Comply with the NSW *Water Management Act 2000* by explicitly allowing for the maintenance of environmental flows in Nambucca River past the extraction zone and applying adaptive management principles for the Proposal; and
- Ensure the quality of the stored water is managed to current best practice standards, to reduce the likelihood of the need for a water filtration plant in the future.

4.2 Overview of Proposal

The Proposal involves enhancing the existing Nambucca River and South Creek water sources to deliver up to 40ML/day of additional water to a new storage located on the headwaters of Bowra Creek for use during low river flow periods. The key elements of the Proposal are as follows:

Component	Description
Expanded Borefield	The existing borefield would be expanded with the construction of 15 additional bores and associated pipelines along the Nambucca River and 9 new bores and associated pipelines along South Creek, with interconnection with the existing borefield to allow flexibility in pumping sources. The system is planned to have a pumping capacity of up to 40ML/day to the storage in addition to the 17ML/day required for the future NDWSS demand. Extraction of groundwater would be monitored via an adaptive management framework.
New Headworks	It is proposed to construct a new 40ML/day high lift pumping station near the existing borefield collection tank to transfer water to the storage. A new collection tank (0.16 ML) would also be required to store extracted water prior to being pumped to the storage.

Component	Description
Transfer Pipeline	Approximately 2,000 m of 600mm diameter pipeline would be required to connect the new headworks to the storage.
Off-River Storage	A new off-river storage is proposed on the head waters of Bowra Creek with a capacity of 5,500 ML but with the provision for foundations to provide for a 14,000 ML storage in the future. The storage would consist of an earth embankment with a crest width of 7.7 metres at RL 40.1 m AHD. The storage would be filled from groundwater adjacent to the Nambucca River and South Creek with all inflows from the Bowra Creek catchment being released for environmental flows. The storage would also incorporate an aeration and mixing destratification system to control stored water quality.
Spillway	An open channel spillway has been designed to a width of 16 metres for the maximum peak discharge of 58 m^3/s. The outlet of the spillway would be located at RL 38.1 m on the right hand bank, discharging through a stilling basin into a gully at the downstream toe, leading back to Bowra Creek.
Multi-level off-take	A multi-level off-take structure with off-takes at least at RL 32m and RL 24 m is proposed. The first level would be at about 6 m below the Full Supply Level of 38.1 m, while the second level would be just below the level where no more water can be drawn off. This is to ensure the best quality water is released from the storage.
Upgrade of Bobo Road	It is proposed that Bobo Road be upgraded to allow for both the construction of the storage and its future operation.
Vegetation Clearing	Approximately 80 ha of land would require clearing for the 5,500ML storage inundation area and ancillary works (e.g. roads, pipelines). The inundation area is presently part of the Viewmont State Forest and is subject to sustainable forestry operations. All harvestable timber within the acquisition area (approx. 40%) would be removed under existing DI&I approvals.
Fish Passage and Bank Stabilisation Works	Provision would be made for a fish ladder across the existing pipeline on the Nambucca River to improve fish passage. Bank stabilisation works at select locations would also be undertaken to provide further security to the expanded borefield into the future.

Component	Description
Acquisition/ Easements	The Proposal requires the acquisition of approximately 220ha of Viewmont State Forest to accommodate the off-river storage. Easements would also be required over all of the infrastructure within private property. A 5 metre wide easement for the full length of the borefield and transfer pipelines would be required as part of the Proposal for access and future maintenance. Any acquisitions would be undertaken in consultation with landowners, in accordance with the terms of the *Land Acquisition (Just Terms Compensation) Act 1991*.
Ancillary Works	The existing electricity network would need to be augmented to provide power to the relevant facilities. The Proposal would also require an extension to the existing telemetry system to accommodate the new facilities and modify the existing control program.

Figure 4-1 illustrates the proposed infrastructure as part of the Proposal.

4.3 Existing Infrastructure

4.3.1 Headworks

The Nambucca water supply headworks infrastructure is located adjacent to the Nambucca River near Bowraville. It comprises bore pumps, bore delivery pipelines, raw water collection tank, water treatment facility, high lift pumping station and delivery pressure main.

Eight bores (Nos 2, 3, 4, 6, 7, 8, 9 and 10) are located along the Nambucca River, with six having a capacity of around 30L/s and two 55L/s, providing a nominal total of 290L/s (25ML/d). The pumps are connected into a pipeline network with 150mm pipes running from the bores to connect to larger trunk mains which vary in size from 300 to 375mm. Bores 9 and 10 are the newest and these connect to a separate 375mm pipeline.

The bores pump to a collection tank at the water treatment facility (WTF) located on an elevated area above the river flats. Prior to entering the tank, the two 375mm pipelines connect into a common section of 375mm pipe in which a flow measuring device is located.

Lime and fluoride are dosed into the inlet pipe before entering the top entry collection tank. The lime dosing is for pH control and fluoride is added to the tank for dental health benefits. Chlorine for disinfection, in the form of sodium hypochlorite, is injected into the tank outlet pipe.

Treated water is directed by gravity to a nearby high lift pumping station which transfers the water through a pipeline to the Bowraville balance tanks and the Bowraville service reservoir. Carbon dioxide is injected into the pumping station delivery pipe for water softness correction. From the balance tanks the water is distributed throughout the Shire.

During the winter period, one high lift pump is adequate to supply demand. In the warmer periods two pumps are often required. Three pumps cannot be operated together because of a limitation on the power supply to the site.

The site has become slightly congested as it has expanded from the original scheme. This has resulted in a mixture of buildings of different ages and construction, and hence appearance.

The buildings and structures are:

- Collection tank;
- Main building constructed of brick and housing the fluoride room, chlorination room and laboratory;
- Storeroom – constructed of concrete blocks. Houses the air compressor for the lime silo;
- Store shed – constructed of brick and houses the mower and spare parts, and contains the WC and hand basin;
- Lime silo – has a small metal shed at the base;
- Carbon dioxide storage vessel; and
- High Lift Pumping Station – part concrete with metal clad embankments and roof.

4.3.2 Existing Borefield

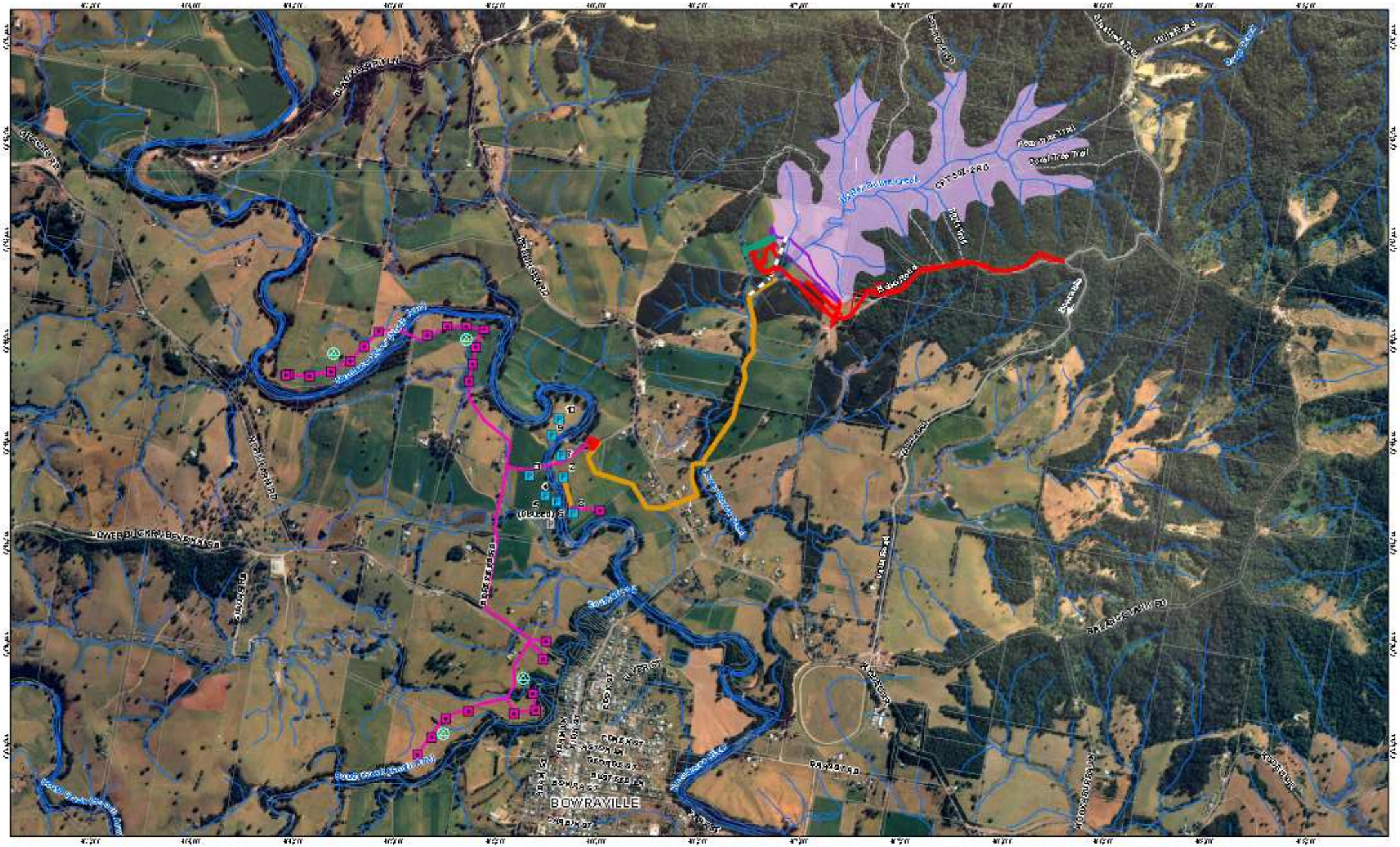
Location

The existing borefield is located on the North Arm of the Nambucca River approximately 600m upstream of Lanes Bridge at Bowraville. The borefield consists of eight production bores installed between 1968 and 1982. The production bores were installed in the Nambucca River alluvium to depths of between 8.6 and 13.5m.

Bores

The bores are distributed along the flats either side of the Nambucca River. Concrete pits house the pump discharge pipes and valves. The pits are covered with checker plate lids. The switchboard is located on an elevated platform on the adjacent power pole to keep it above the 100 year ARI flood level. The typical bore arrangement is shown in Figure 4-1 below.

Figure 4-1 Typical bore arrangement



GHD Pty Ltd | ABN 39 008 488 373
21 15 Victoria Street | High Street | Coffs Harbour NSW 2450 | T 61 2 6650 5600 | F 61 2 6652 6021 | E coffs@ghd.com.au | W www.ghd.com.au

Data Source: Nambucca Shire Council: Cadastre & Aerial - 2007; Department of Lands: Topography - 2005. Created by: Geomodelling Studios, Armidale

Pumps

The location and production rates (from Hydroilex modelling data) for the existing bores are summarised in Table 4-1 below.

Table 4-1 Existing Bore Capacities

Bore	X	Y	Pump Capacity (L/s)	Max Bore Production (kL/day)
PB2	485824	6610842	33.0	2,851
PB3	485662	6610848	23.3	2,013
PB4	485741	6610750	28.1	2,428
PB6	485801	6610725	33.4	2,886
PB7	485814	6610954	26.1	2,255
PB8	485878	6610668	53.7	4,640
PB9	485781	6611047	40.7	3,516
PB10	485824	6611128	56.0	4,838
MAXIMUM CAPACITY - 8 wells			294.3	25,427

Pipelines

The pump discharge pipes are all 150mm and the start of the pipe can be seen from the valve pit. The pipe diameters include 150mm (immediately at the bores), 200, 225, 300 and 375mm. Materials are generally UPVC Class 9, AC and Class C Epoxy Pipe.

Three production bores (Bores No. 2, 7 &8) are located on the east side and 5 production bores (Bores No. 3, 4, 6, 8 & 9) are located on the west side of the Nambucca River (refer Figure 4-1). There is an existing 12-inch (300mm) diameter AC pipe crossing under the Nambucca River between Bores 2 and 4 and a 300mm diameter uPVC pipe crossing near Bore 10. Both pipeline crossings are concrete encased.

4.4 Proposed Infrastructure

4.4.1 Proposed Storage Embankment

General Dimension

The proposed storage consists of a crest width of 7.7 metres at RL 40.1 m AHD. The proposed storage consists primarily of a central clay core with a downstream and upstream shell. The upstream slope would be 1 in 3 while downstream slope would be 1 in 2.5, with a rock toe at the downstream face. A chimney drain is located at the interface with the core and the downstream shoulder to act as a filter between the clay core and the shell. The clay core has an upstream slope of 0.25 in 1 and would be vertical at the downstream side. The clay core is tilted at 45° at the top to facilitate raising of the storage in the future. A horizontal drainage blanket is also proposed between the foundation and downstream shoulder to ensure that seepage water does

not build up within this part of the embankment. Figure 4-2 illustrates the proposed layout of the storage design, whilst Figure 4-3 shows the cross sections of the storage design.

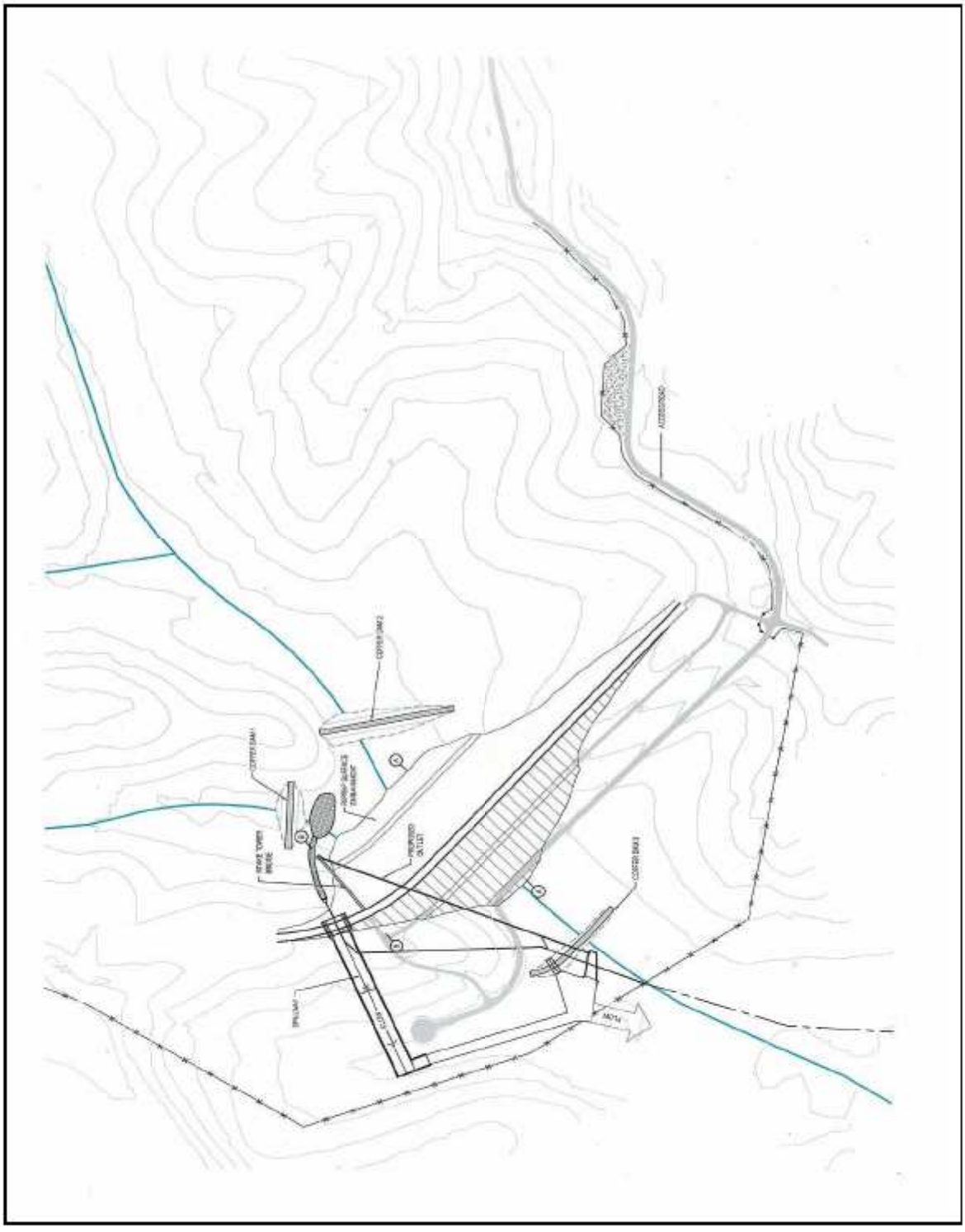


Figure 4-3 Layout of Storage Design

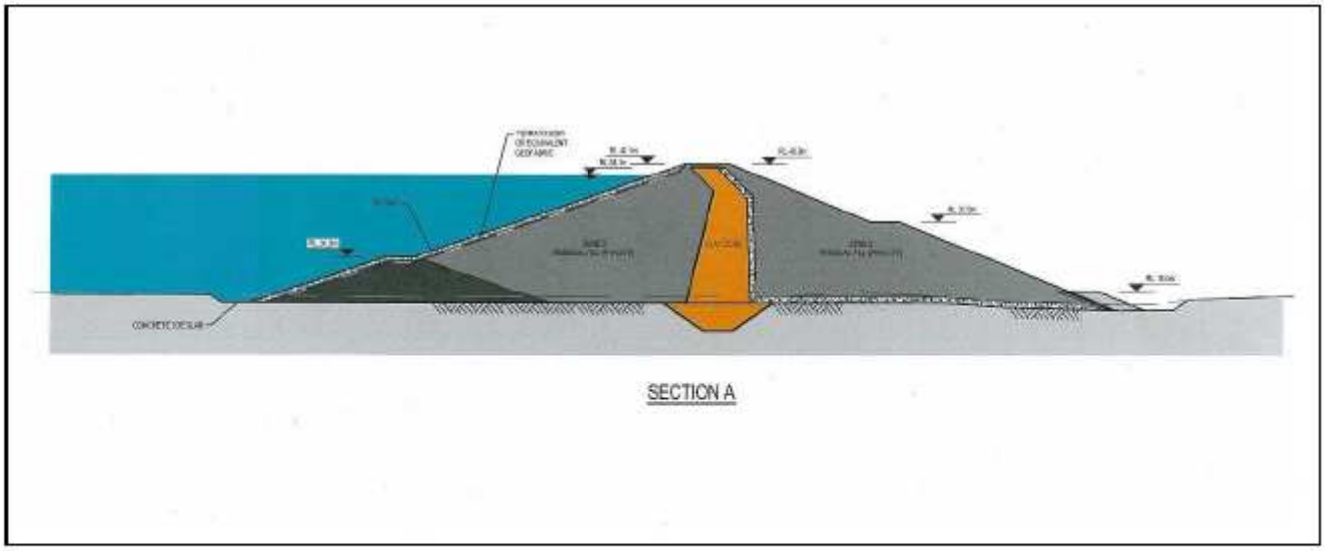


Figure 4-4 Cross Sections of Storage Design

Foundation

For the foundation of the storage on the flanks, all topsoil and colluvium would be stripped such that the storage embankment is founded on weathered phyllite. On the left and right abutments, it is anticipated that about 1 metre of stripping would be required. In the river channel, the embankment would be founded on deeper colluvium and alluvium below the upper few metres of softer soil. The consistency of the colluvium and alluvium encountered below the upper few metres is generally stiff to very stiff, thus making it sufficient for founding purposes.

Material

Based on the investigation carried out on site, material for the clay core and residual fill can be sourced from within the storage site. Table 4-2 shows the quantities for each material required for the construction of the embankment.

Table 4-2 Material for Embankment

Zone	Description	Estimated Quantities (m^3)
Zone 1	Colluvial Clay (Core + Cut-off)	56,800
Zone 2	Sand Filter	21,000
Zone 3	Residual Fill	299,100
Zone 4	Upstream Rip Rap	18,900
Zone 5	Downstream Toe Rock	1,600
Zone 6	Rock	320

Sand filter material, upstream rip rap and downstream toe rock would need to be sourced locally.

Proposed Spillway

The open channel spillway for the storage would be designed with a width of 16 metres for a maximum peak discharge from the storage during a Probable Maximum Precipitation of 58m^3/s.

The outlet of the spillway would be located at RL 38.1 m on the right hand bank, discharging through a stilling basin into a gully at the downstream toe, leading back to Bowra Creek. The open channel spillway would be founded on residual phyllite. The average depth of excavation is around 2.5 m to strip off the overlying colluvium.

To prevent uplift of the spillway, an under-drain system is required beneath the slab of the spillway. A 100 mm diameter slotted PVC drainage network surrounded by free draining gravel is proposed. The transverse drains would be spaced at 12 m centres along the spillway, about 1 m downstream of the transverse construction joints. Three lines of longitudinal drains, one on each side of the spillway and one in the centre would link the transverse drains and discharge seepage water into the stilling basin. Both transverse and longitudinal drains would have clean-out points to enable maintenance of the drainage system.

Proposed Intake Structure

A 600 mm diameter inlet pipe is proposed to enter the reservoir through the embankment at a location below the spillway. The inlet pipe would discharge at RL 35 m and would have an energy dissipater and a concrete lined channel to control erosion.

The alignment of the inlet pipework and the location of the energy dissipater and lined channel is shown in Figure 4-3.

Proposed Outlet Works

A wet tower, located within the storage, is proposed for the outlet works. The tower would be a vertical concrete intake tower located at the upstream toe at chainage 80 (refer Figure 4-4). The tower would have at least 2 levels of intakes at RL 32 m and RL 24 m. The first level of intake is about 6 m below the Full Supply Level of 38.1 m, while the second level is just below the level where no more water can be drawn off.

Water would generally be drawn from the outlet nearer to the storage surface, where generally the best water quality is available. In the event that the water at the top layer is over populated with algae, water would be drawn from the lower level.

Intake of water would be controlled by opening of slide gates on the intake control tower. The intake control tower at the top of the intake structure would house the pulling mechanism of the slide gates.

A 1,000 mm diameter pipe is required for the outlet pipe due to requirement of transparent flows to Bowra Creek. The outlet pipe would be located at an RL of 17 m and would be connected to the valve chamber at the downstream end where it would be connected to the collection tank at the headworks. Underneath the storage embankment, the outlet pipe would be encased in reinforced concrete.

Proposed Apron and Dissipater

To reduce flow velocity downstream of the spillway and to reduce the risk of scouring Bowra Creek and undermining the downstream toe of the storage, a forced hydraulic jump stilling basin has been adopted (refer Figure 4-3).

Proposed Storage Inundation

The storage would inundate approximately 75 ha at full storage level (FSL). The inundation area at FSL and a buffer zone is based on the peak surface water level reached during a 1 in 100 AEP flood. A comparison of modelled 1 in 100 AEP flood with and without the storage indicates that there would be no significant change to the extent of flooding beyond the upstream limit of storage.

Stage-Volume-Area Relation

Dead storage is required to prevent negative pressures in the pipeline when gravitating from the storage to the collection tank. The 9.5m of dead storage equates to 650 ML or approximately 0.8m on the storage embankment height. The stage-area-volume relations are shown in Table 4-3.

Table 4-3 Stage-area-volume relation

Elevation (m AHD)	Area (m^2)	Storage Volume (ML)	Available Volume (ML)
16.5	0	0	0
17	734	197	0
18	10,356	6,461	0
19	26,517	25.4	0
20	44,767	60.7	0
21	63,334	114.7	0
22	83,922	187.7	0
23	108,516	283.5	0
24	143,537	407.6	0
25	175,440	569.1	0
26	206,804	759.3	113.6
27	246,484	989.2	343.6
28	285,659	1,254.9	609.2
29	323,247	1,560.1	914.5
30	363,701	1,903.3	1,257.6
31	402,184	2,286.7	1,641.0
32	439,730	2,707.3	2,061.6
33	478,510	3,166.6	2,520.9
34	519,791	3,665.2	3,019.5
35	561,117	4,206.0	3,560.4
36	602,754	4,787.8	4,142.1
37	647,694	5,413.7	4,768.0
38	689,634	6,082.4	5,436.7
39	731,418	6,793.5	6,147.8
40	772,558	7,545.4	6,899.7

Seepage

Seepage analyses have been carried out for the Proposal. The purpose of conducting seepage analyses is to estimate the seepage through the storage embankment and its foundation. The analysis has assumed a FSL of RL 38.1 m.

The result of the seepage analysis under steady state condition is summarised in Table 4-4.

Table 4-4 Summary of Total Seepage

Total seepage through storage core		Total seepage through D/S storage foundation	
L/sec	ML/a	L/sec	ML/a
2.59	81.7	1.73	54.6

It is therefore expected that up to 136.3 ML/annum would pass through and under the embankment into the downstream Bowra Creek.

Freeboard

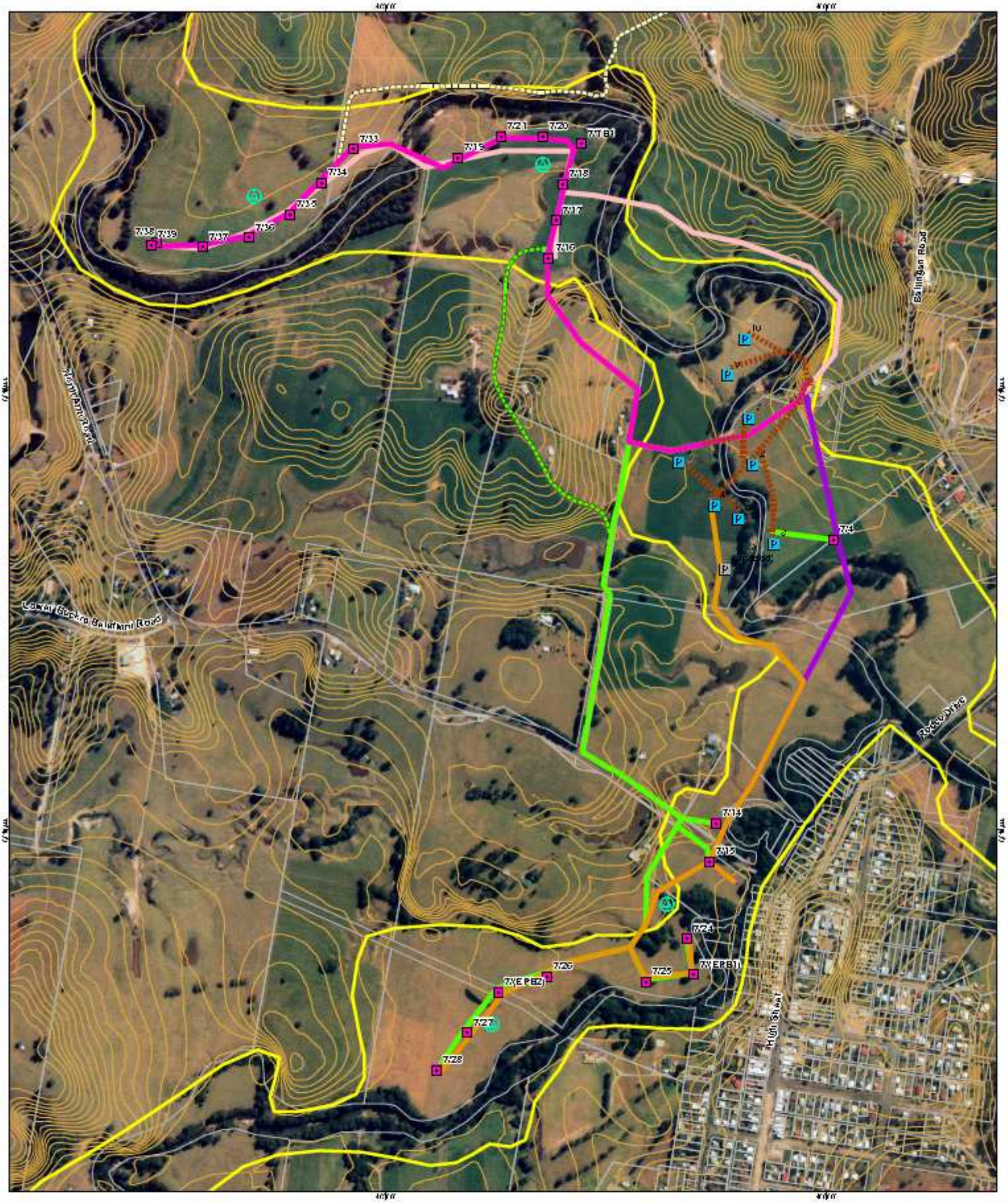
A minimum freeboard would be required to accommodate waves generated by prevailing wind conditions. A minimum dry freeboard of 440 mm was calculated. This was based upon a wind fetch of 2.2 km, average water depth of 22 m, 3H:1V rip rap protected upstream slope, and wave height of 320 mm. The flood level for a PMP event is 39.65 m. Given that the crest level is 40.1 m, the crest would be constructed to cater for the required freeboard.

4.4.2 Proposed Borefields

The layout of the proposed bores and collection system is shown in Figure 4-4. Minor adjustments to Hydroilex's original borefield layout were made in order to move some of the proposed bores away from unstable riverbank conditions and away from cultural heritage sites. The proposed bores would be installed to between 10 and 15 metres deep depending upon location and capacity.

Production Capacity of the Proposed Borefields

The anticipated maximum production rates for the existing and proposed bores are summarised in Table 4-5.



Nambucca Shire Council
Bowraville Off River Storage

Proposed Borefield Layout

Job Number 22-14100
Revision A
Date 24 AUG 2009

Figure 4-5

GHD
CLIENTS | PEOPLE | PERFORMANCE

Table 4-5 Production Capacities

	Pumping Capacity		
	L/s	ML/d	ML/0.25day
North Arm (Bore 4)	25	2.16	0.54
North Arm (Bores 33-39)	154	13.30	3.33
North Arm (Bores 16-21 + TB1)	150	12.96	3.24
South Arm (Bores 24-28, 14-15, EPB1-2)	131	11.32	2.83
Total for new bores (24 wells)	460	39.75	9.94
Total for existing bores (8 wells)	295	25.43	6.36
Grand Total (32 wells)	755	65.17	16.29

4.4.3 Proposed Borefield Collection Network

Borefield Modelling

The borefield collection network was modelled by GHD using WaterCAD. The pipes and pumps have been designed so that all bores can be run simultaneously, or as a group of bores without exceeding pump capacities or scour velocities in the pipes.

Under normal operating procedures, the existing borefield collection network would not connect into the proposed borefield collection system prior to discharging into the collection tank, and therefore the new borefield network has minimal effect on the existing bore pumps or pipes.

The existing bores can be pumped into the new pipeline by opening a valve near Bore No. 3 (for existing bores on the western bank of the Nambucca River) or a valve near Bore No. 7 (for the existing bores on the eastern bank of the Nambucca River).

Pipeline Route Alignment

The concept route alignment has been produced using the borefield concept developed by Hydroilex, aerial photography, limited survey and a numerical groundwater model. The actual positions of the bores on site would need to be confirmed during detailed design. The position of the bores may change by up to 10m, which in turn would affect the route alignment but would not affect the overall borefield concept design.

On-going consultation would be required with the affected property owners. The alignment may need to be revised slightly following these negotiations.

North Arm Bores

The pipeline to service the 15 additional bores along the Nambucca River would extend from the pumping station in a south-westerly and cross the Nambucca River(via underboring) at the existing pipeline crossing before heading in a north-west direction across Lot 4 DP 786358 and the boundary of Lot 1 DP 788540. From this location the pipeline would run in a northerly direction before crossing Lot 1 DP 788540. The pipeline would run parallel to the Nambucca River but some 120 metres away from the top of the bank across Lot 2 DP 788540 before

reaching the proposed bores on Lot 463 DP 710439. The pipeline would cross the Nambucca River (via underboring) at the north-western corner of Lot 463 DP 710439 before running parallel with the northern bank of the river on Lot 326 DP 777074 and Lot 2 DP 1073580.

Approximately 1,840m of 150 to 400mm of pipeline across three properties would be required to connect the bores on the North Arm to the junction with the pipeline from South Creek. The pipeline and bores would traverse existing pasture land with no requirement for the removal of vegetation.

Approximately 460m of 500mm pipe would be required from the junction to the Collection Tank at the headworks site. The pipeline and bores would traverse existing pasture land with no requirement for the removal of native vegetation. The pipeline would be installed along existing easements where practical, but there would still be an impact on 2 properties and the requirement for an 80m underbore under the Nambucca River. The pipeline is not expected to impact the viability of the properties affected.

The existing bores can connect to the new pipeline on both the eastern and western side of the Nambucca River to increase the security of supply from the borefields.

South Creek Bores

The pipeline to service the 9 additional bores along South Creek would extend from Lot 1 DP 788540 in a southerly direction along Borefield Road before reaching North Arm Road. From here it would head in an easterly direction along the existing road reserve towards South Creek. Prior to reaching South Creek, the pipeline would branch in both a northerly and southerly direction serving 1 bore to the north and 8 bores to the south respectively.

Approximately 2,300m of 150 to 400mm water main is required to connect the bores on South Creek to the junction with the North Arm bores. The pipeline and bores would traverse existing pasture land with no requirement for the removal of native vegetation. Only two properties would be impacted and the remainder of the pipeline would be located within the right of way or existing easements. The pipeline is not expected to impact the viability of the properties affected.

Pipe Materials

Pipeline

The borefield collection pipeline would be either polyvinyl chloride modified (PVC-M) or ductile iron cement lined (DICL) with a pressure rating of PN20. The pipe would have a nominal diameter range of between 150mm to 500mm depending on the distance from the headworks.

Well Head

Configuration

At each bore pump location, the wellhead configuration would be as follows:

- Bore pump with casing;
- Tee with air release valve;
- Check valve;

- Pressure gauge and flowmeter (both would be linked back to telemetry along with bore pump dry-running level sensor);
- Sluice valve; and
- Pit with lockable lid.

Well Head Protection

Each wellhead needs protection from damage from both vertical loads (i.e. farm machinery) and sediment from floodwaters. To provide greater protection from vertical loads, the top of the valve pit shall sit around 300mm proud of the ground surface to minimise the chance of machinery driving over it. This is preferred to designing a heavy trafficable pit lid that would be difficult to lift. Stopping the ingress of flood waters is difficult to achieve given the low ground levels of the proposed bore locations, however, raising the pit for load protection would also offer protection from localised run-off and smaller flood events entering the bores.

The Wellhead Protection Plan would need to be amended to include the new borefields.

4.4.4 Proposed Headworks Building and Pipework Layout

Building

All aspects of the station such as building floor, embankment and roof frame construction, external cladding, location of the switchboard and pipework layout arrangement would be similar to the existing high lift pumping station.

The raw water pumping station building would be of similar length to the existing high lift pumping station building. The length has been determined based on the actual total number of pumps and a similar allowance for the loading bay as for the high lift station. The building would be approximately 16.5m long x 5.5m wide x 6m high and would have vehicular access (loading bay) via a roller shutter door at the front end. A personnel access door would be provided at the side of the building toward the end furthest from the roller door. An overhead gantry crane would be provided to service the pipework, valves, pumps and motors.

The proposed location for the building and associated pipework are shown in Figure 4-5.

Vehicle Access and Parking

There is an existing access road which is located alongside the existing high lift pumping station building to provide access to the plant and, through a locked gate, to the river flat. This access roadway would allow a vehicle to park inside the compound to allow personnel access. Vehicles required to enter the building would use the front entrance through the roller shutter door which would be facing east as does the high lift pumping station access doorway. General parking would be available at a parking area at the front of the facility.

Ventilation

The station would only operate when water is available from the bores when there is excess water available than is needed to satisfy demand and only after the river extraction rules and water quality criteria have been satisfied.

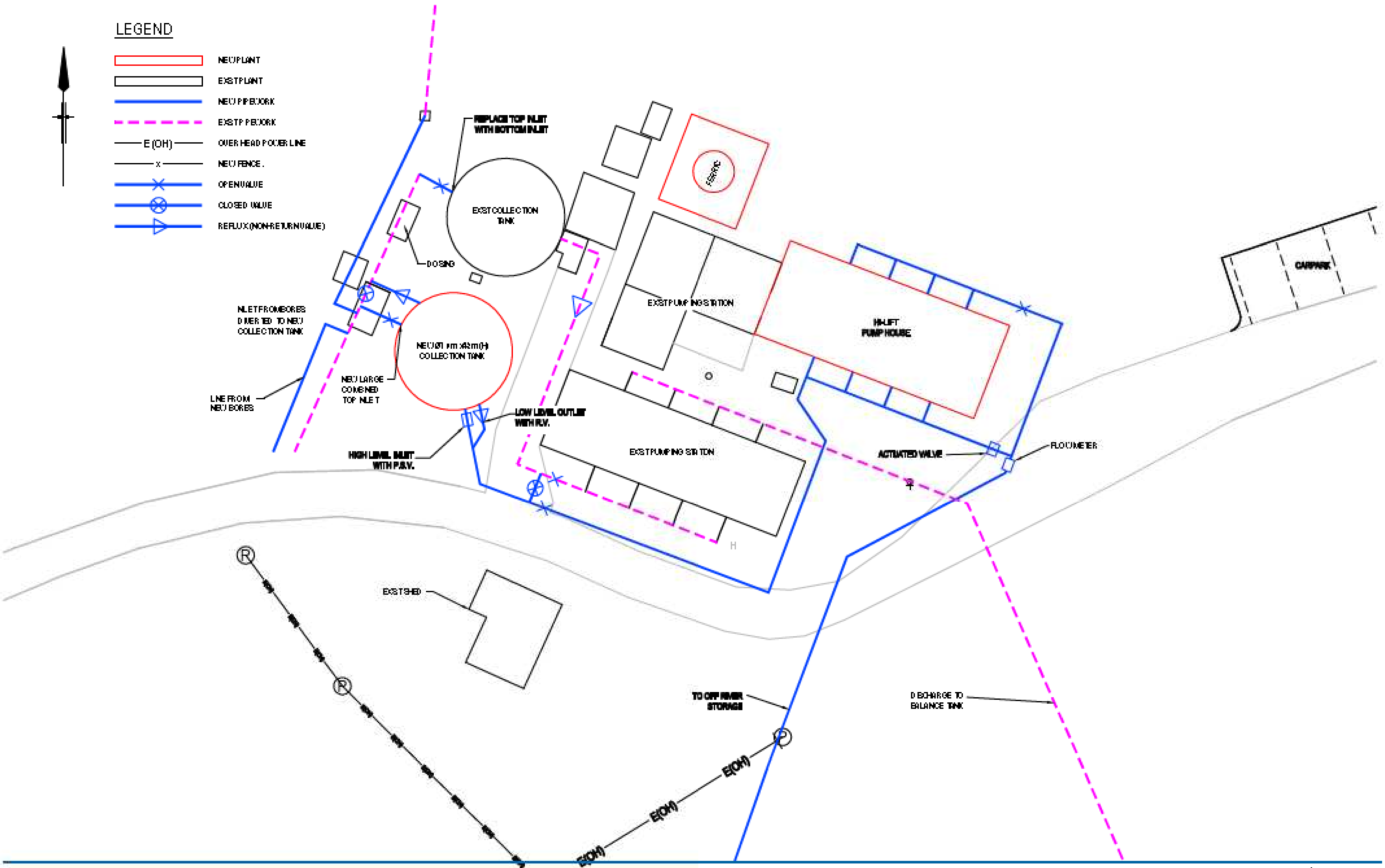
With the limited pump operating times, natural or motor driven roof ventilation would be used in the building to provide cooling air for the 110kW motors. Ventilation panels comprising acoustic louvres would be incorporated into the side embankments of the building.

Site Drainage

Site drainage from buildings and road surfaces constructed as part of the raw water pumping station and collection tank would be directed to drains installed as part of the station site and building works. Stormwater would be discharged to the same area as is presently the case.

Pumping System Details

The pumps would be located in the pumping station building and would draw from the raw water collection tank under gravity and pump to the storage. The station would be capable of providing up to 40ML/d pumping capacity to the storage.



SCALE 1:250 AT ORIGINAL SIZE

N

PLAN
SCALE 1:250

GHD
CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off-River Storage

Job Number 22-14133
Revision A
Date OCT 2009

Headworks Site
General Arrangement - opt 1
Figure 4.6

21 15 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 W www.ghd.com.au

Amenities

Existing amenities at the headworks site are located in a building proposed to be demolished. Alternate facilities in the new building would be provided. An on-site effluent management system would be installed for the amenities (refer to Chapter 20). The system would be designed in accordance with current best practice to meet NSC requirements.

Site Security

Security systems would be provided in and around the headworks building to protect the infrastructure.

4.4.5 Proposed Collection Tank

A new collection tank is proposed at the headworks site to provide suction head for the raw water pump station and a buffer storage volume for the water from the bores. The tank would have a capacity of 0.16 ML and be 7 metres in diameter. The tank also needs to be integrated into the headworks supply and treatment system whilst also providing future possible integration with a water treatment plant, should this be required.

Siting/ Layout

To adopt similar levels as the existing collection tank and to minimise 'dead' storage, the site directly to the south of the existing collection tank was adopted to locate the 7 m diameter tank.

A pipeline from the new collection tank to the existing collection tank would be installed with a reflux valve to only permit flows from the new to the existing tank (to segregate raw and dosed water).

4.4.6 Proposed Transfer Pipeline

A transfer pipeline is required from the headworks site to the storage to allow the transfer of raw water between these two locations. The proposed pipeline would run along the back of the existing houses fronting Bellingen Road from the existing headwork site before crossing Bellingen Road and heading towards Bowra Creek. The proposed pipeline would run adjacent to the western bank of Bowra Creek before crossing at the existing vehicle access at Lot 102 DP 809380. From here the pipeline would run to the east of Bowra Creek to the storage (refer to Figure 4-1). The pipeline and bores would traverse 5 private properties used as pasture land with no requirement for the removal of native vegetation. The pipeline is not expected to impact the viability of the properties affected.

Pipeline Design

The proposed transfer pipeline would be a 600mm pipe to accommodate a required flow capacity of 464 L/s (up to 40 ML/d to storage). The pipe would have a minimum cover of 600mm where the pipe is in the footpath, 750mm cover across NSC roads and 900mm cover through farming land. A minimum gradient of 1 in 500 has been adopted for the pipeline.

4.4.7 Proposed Power Supply

Provision of power supply is required to the following sites:

- Headworks Site (off Bellingen Road);

- Borefield System;
- Storage; and
- Other locations.

Headworks Site

It is proposed to upgrade the existing headworks substation from the pole mounted 500kVA transformer to a pad-mounted substation having a transformer rated at a maximum 1,500kVA and have the ability to operate more than two of the existing high lift pumps together, along with the new raw water pumps.

Borefield System

Country Energy has an existing pole mounted transformer conveniently located near seven of the proposed borefield pumps on the North Arm of the Nambucca River. These bores are located on the same side of the river as the existing Bores 9 and 10. It is proposed to supply these new pumps off a new 400m-long radial feeder, extending from the existing feeder.

The seven remaining proposed bores on the North Arm of the Nambucca River are recommended to be fed from another new 200kVA transformer located on the same side of the river as these bores. There is a powerline easement running part of the way out to these pumps however this line would need to be upgraded from two to three phases and the easement extended by approximately 400m, to reach these bore pumps. In this way, these pumps would be supplied off the 'Rural Feeder' and a river powerline crossing can be avoided.

It is proposed to supply the nine bore pumps proposed for South Creek from two new 100kVA transformers. The two new transformers would be supplied off the 'Town Feeder', by extending existing 11kV powerlines in the town a distance of approximately 500m, running along existing easements and Right-of-Ways for the majority of the distance to the borefield.

One new feeder can cross South Creek at the North Arm Road bridge along an existing Right of Way. The second supply would cross the creek after coming along a separate Right of Way, running along Coronation Street, past the Bowraville Cricket Ground.

Country Energy 11kV aerial powerline easements would need to be established for all powerline extensions not on existing easements or Rights of Way.

It is proposed to have a central borefield control panel located close to each transformer for the future borefield pumps. Power and control cabling would run to each bore pump using underground cabling to minimise visual impact. Where possible, the cabling to individual pumps would follow similar paths to the pipelines. NSC easements for the pipelines and these underground cable routes would need to be established.

Storage

To supply the actuated valve, aerators, telemetry, rain gauge and level sensors at the proposed storage site, an upgrade of an existing line to 3-phase power, plus a new line along the north-south section of Bobo Road, would be required.

Other Locations

The proposed telemetry repeater station, north of the headworks site on Bellingen Road, would have power supplied from the 11kV lines that run along Bellingen Road.

4.4.8 Proposed Fish Passage and Bank Stabilisation Works

Fish Passage Structure

The existing bed level pipeline crossing which links the bores on the true right bank of the Nambucca River to the existing headworks currently does not provide for fish passage. This structure comprises a concrete encased pipe with loose rock placed on the downstream side to restrict scour. A vertical drop of approximately 1 to 1.5 metres is exhibited across the overall structure. As a result, the structure acts as a key bed control, maintaining the level of the channel bed in the immediate upstream reach. Hence, given the propensity for the channel to undergo vertical adjustments (Hydroilex, 2008), it is proposed that the crossing be retained. However, in its current form the structure presents a significant impediment to fish passage, such that during low flows the upstream pool level is considerably lower than the crest of the structure (Hydroilex, 2008). It is considered that making the structure more impermeable to allow low flows to overtop the structure is unlikely to improve this situation, as flows within the upstream pool are likely to be diverted laterally to the broad alluvial aquifer.

Instead, to improve fish passage, it is proposed that a fish passage structure and bank revetment works be installed on the true left (western) bank to allow fish to bypass the existing pipeline crossing obstruction in line with the concepts developed by Hydroilex and detailed in Appendix B.

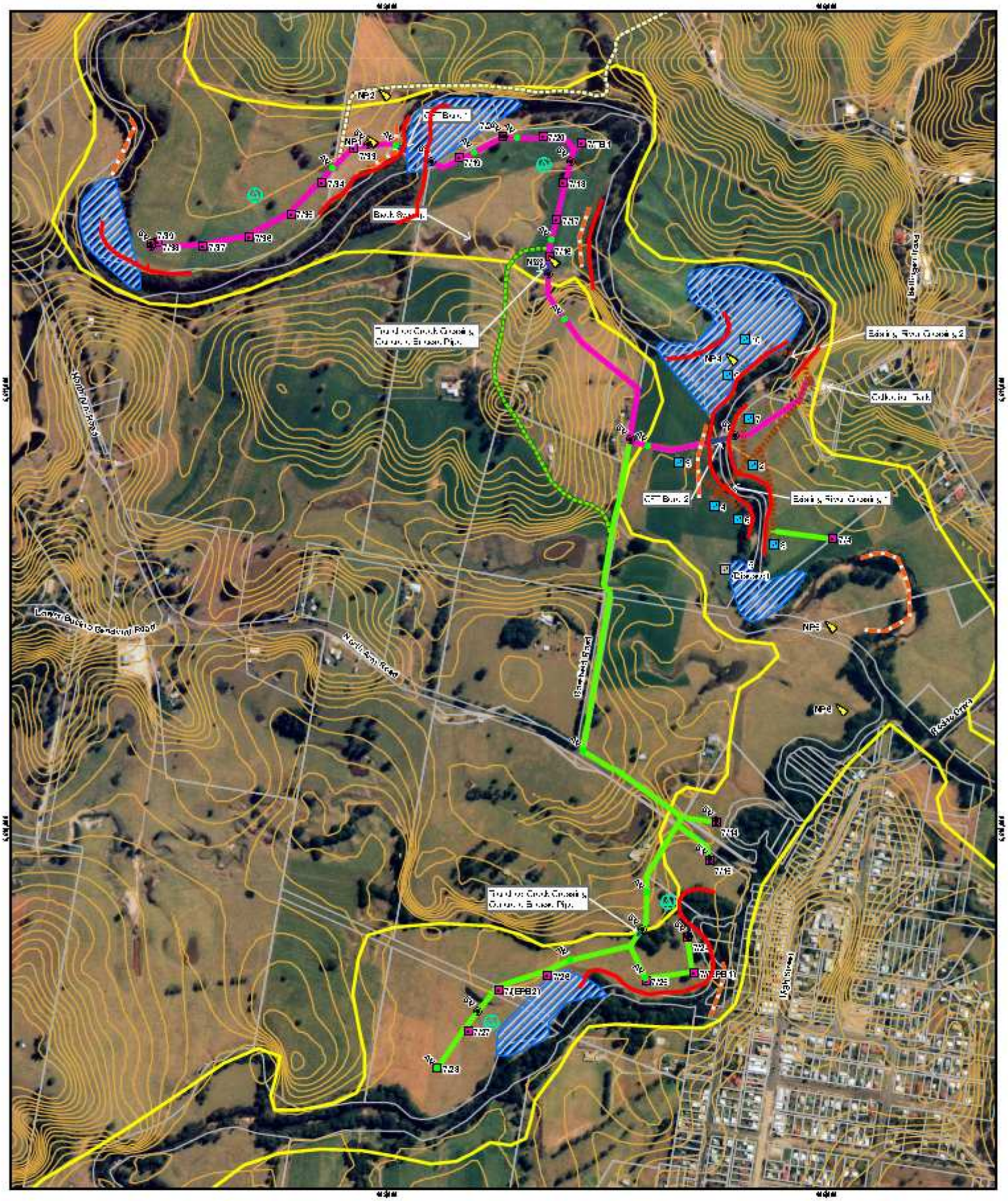
Bank Stabilisation Works

In respect to other river stability risks, the investigation by Hydroilex (2008) contained in Appendix B, identifies that the river has the potential for future bed instability through the formation and upstream migration of knick points or changes in the channel planform.

As most bores along the Nambucca River are proposed to be located on higher floodplain surfaces and generally at a distance of at least 50 metres from the channel banks, the risk of damage to or loss of bores due to future channel adjustments is considered to be low. To ensure no future impacts are experienced on the existing and proposed bores, stabilisation works are proposed to protect the bores from future channel lateral adjustments (see Figure 4-6). Monitoring of Nambucca River channel adjustments and assessment of erosion risks to bores following large floods is also proposed, especially along the true right (eastern) bank in the vicinity of Bores 16 and 17 and the concave true left bank to the south of Bore 4.

Along South Creek several bores, namely bores 7/24 and 7/25, are located within 20 metres of the bank. While these areas were not considered by Hydroilex (2008) to be at risk of potential river instability, it is proposed that this stabilisation works be undertaken in these locations in line with the design concepts developed by Hydroilex and documented in Appendix B.

Consultation would be undertaken with Department of Industry and Investment, Northern Rivers Catchment Management Authority and Nambucca Valley Landcare during the design of the proposed fish passage and bank revetment.



Tweed Shire Council
Boyds Bay to Old Bilambil Storage

Proposed Stabilisation Works

Job Number 22 14[illegible]
Revision A
Date 13 AUG 2009

Figure 4-7

CLIENTS | PEOPLE | PERFORMANCE

4.5 Construction Techniques

The Proposal is made up of 4 separate but interrelated sub-systems and could be constructed separately under different work packages depending on how the Proposal would be procured and managed. Details of the construction programming and sequencing are detailed below.

4.5.1 Storage Construction

Construction program and sequencing

A simple construction methodology has been provided to allow an assessment of the extent and nature of potential environmental impacts. The final staging and sequencing/ methodology selected by the successful contractor(s) may vary from the description proposed but would be in accordance with any conditions of approval for the Proposal.

The storage would be constructed in the following order:

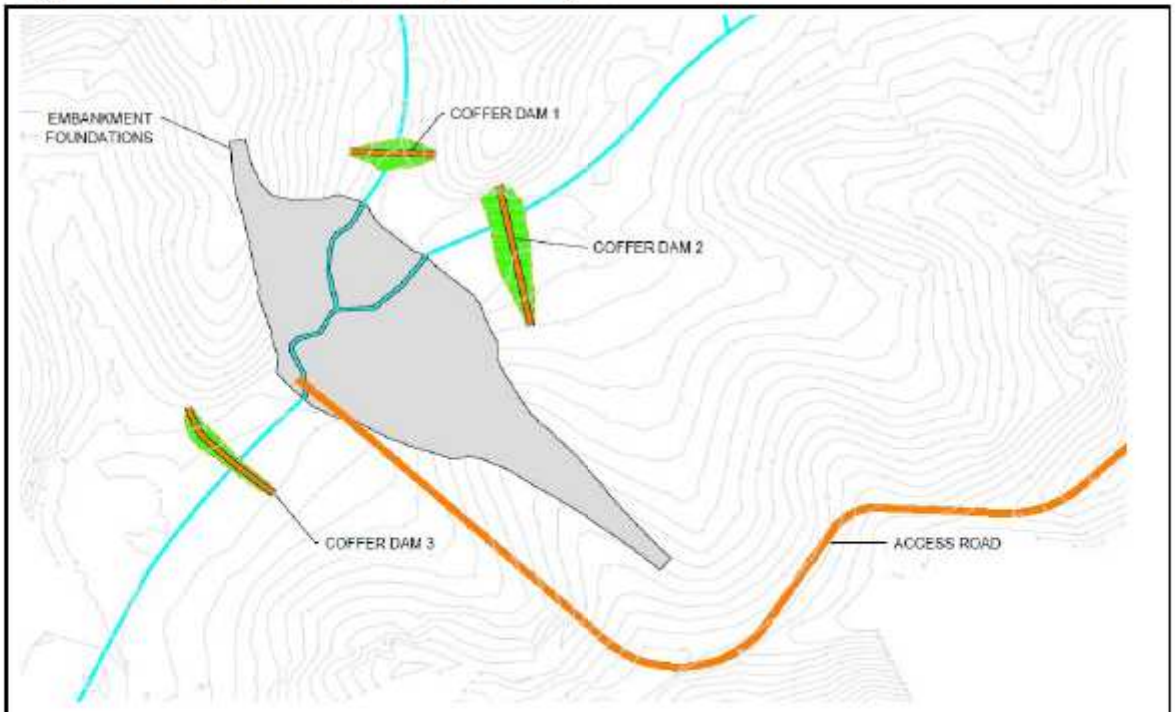
- Management planning, site establishment and preparation and implementation of Construction Environmental Management Plan;
- Upgrade Bobo Road - 6m formation with 3m seal (one coat);
- Clearing of embankment, coffer dams and borrow areas (excluding riparian areas), progressing upslope to full storage level (FSL);
- Excavate and construct Coffer Dams 1, 2 & 3 with spillways;
- Excavate, shore trench, dewater trench, install outlet pipe, pressure test pipe, concrete encase pipe and backfill trench;
- Construct intake tower with cut-out for diversion, up and downstream erosion protection;
- Excavate for foundations and construct Coffer Dam 4 on embankment and inlet pipe and divert river into outlet pipe;
- Clear embankment riparian zone, excavate for foundations and cut off trench, install cut-off trench and construct embankment with clay core;
- Construct spillway, complete embankment, construct intake bridge and remaining infrastructure around storage; and
- Repair access roads and apply 2nd coat seal.

The above sequencing has been illustrated in Figure 4-7.

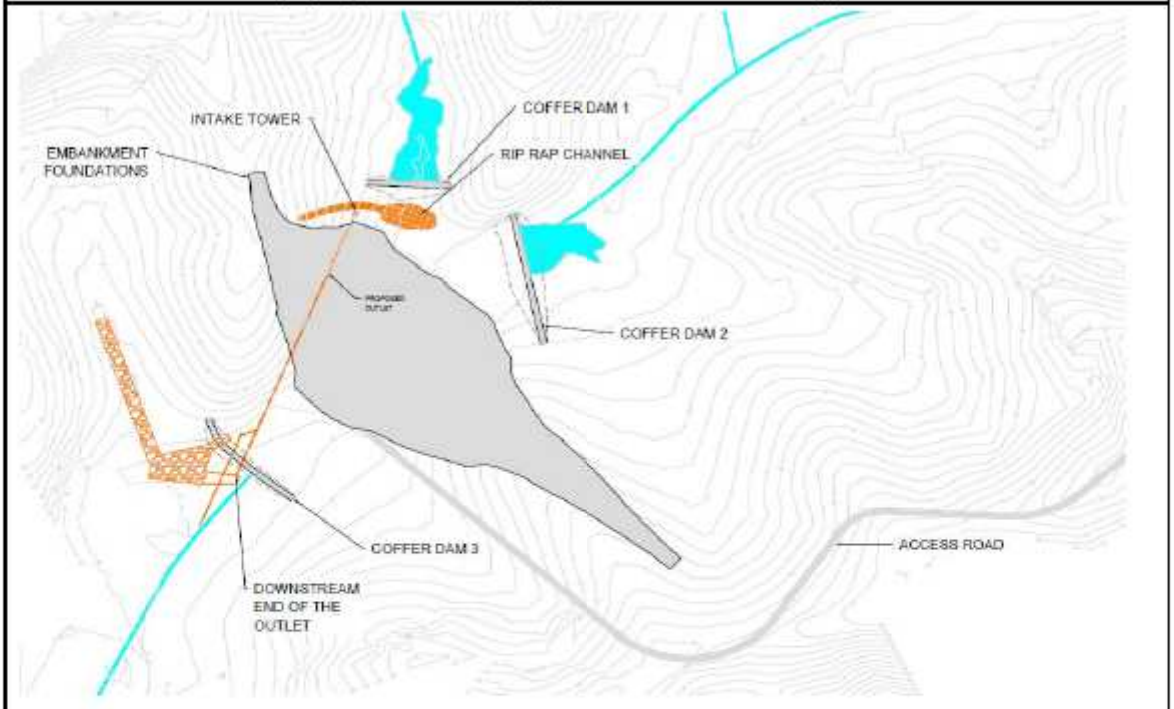
Vegetation Clearing Sequencing

The majority of the clearing required for the storage is within the Viewmont State Forest and is presently owned by the Department of Industry and Investment (DI&I) (formerly Forests NSW). An agreement between NSC and DI&I has been reached for NSC to acquire the land required for the Proposal. Based on the composition of the vegetation within the acquisition area, and forestry management zones, DI&I could harvest up to 40% of the proposed acquisition area under its current licence prior to transfer of the land to Council..

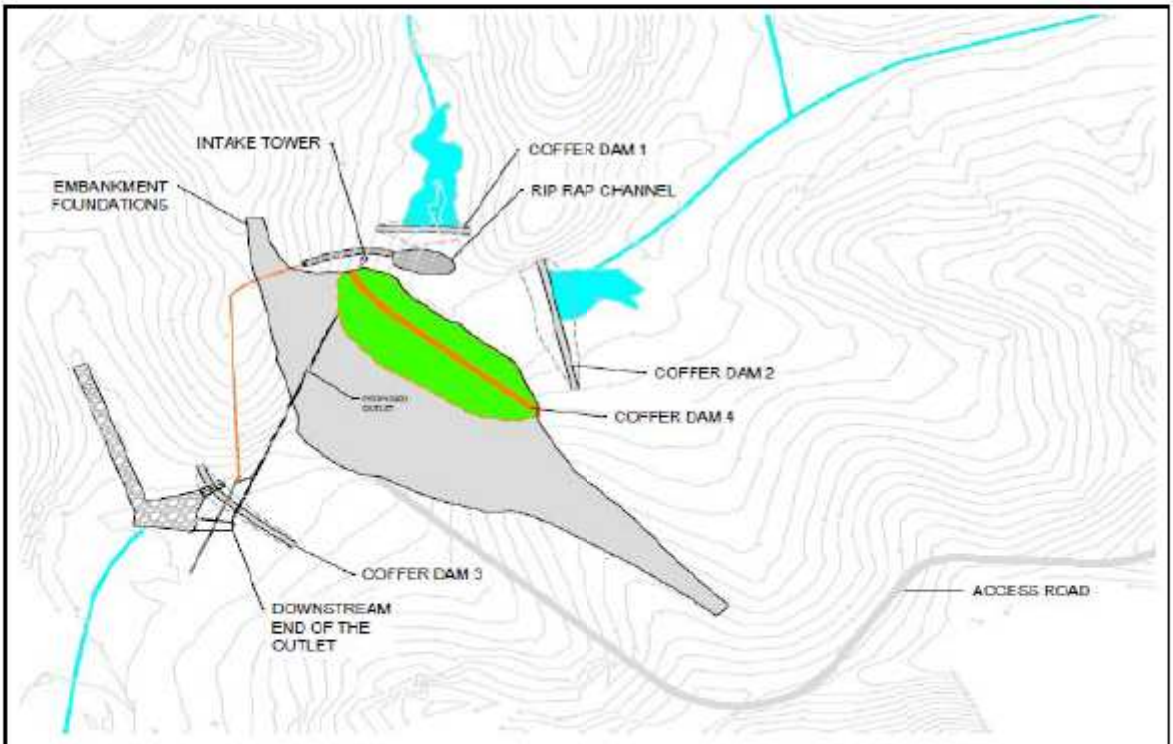
Figure 4-8 Proposed Sequencing of Storage



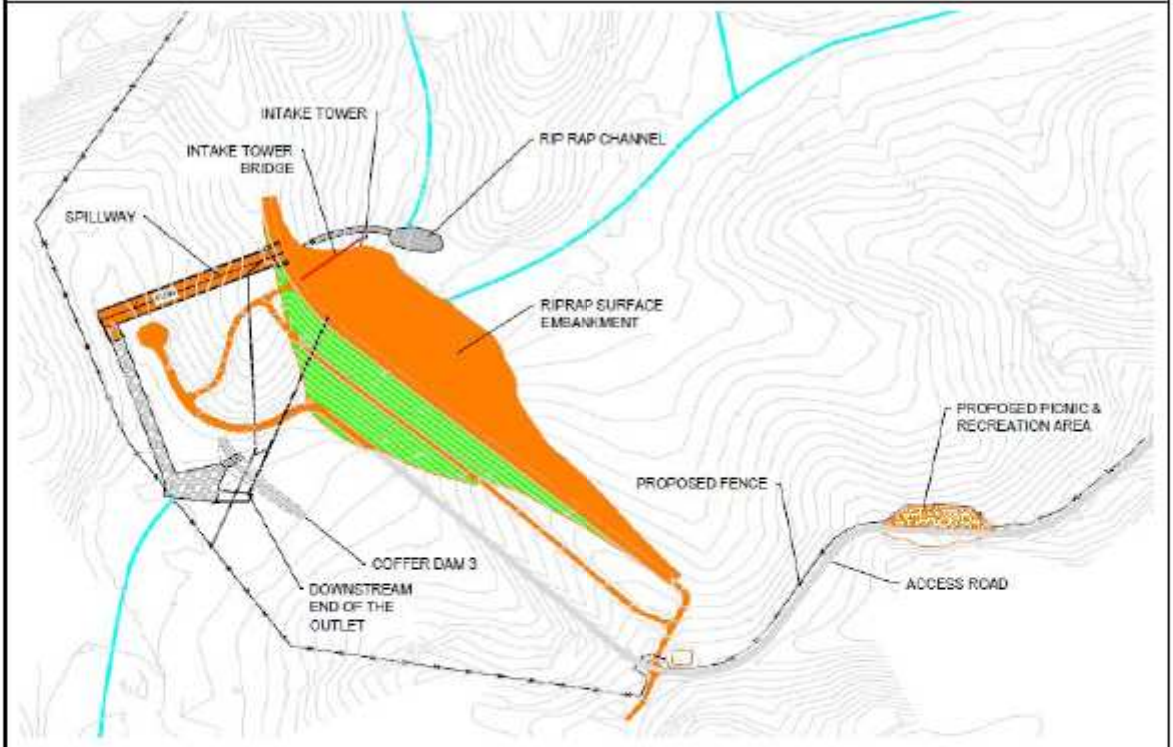
Phase 1 – Clearing of embankment and borrow areas, excluding riparian zone, excavate and construct Coffer Dams 1, 2 & 3 with spillways, and excavate, shore trench, dewater trench, install outlet pipe, pressure test pipe, concrete encase pipe and backfill trench.



Phase 2 - Construct intake tower with cut-out for diversion, up and downstream erosion protection, excavate for foundations and construct Coffer Dam 4 on embankment and inlet pipe and divert river into outlet pipe.



Phase 3 – Clear embankment riparian zone, excavate for foundations and cut off trench, install cut-off trench and construct embankment with clay core.



Phase 4 - Construct spillway, complete embankment, construct intake bridge and remaining infrastructure around storage and repair access roads and apply 2nd coat seal.

Although DI&I could conceivably harvest 40% of the timber at any time, it would seem logical that the clearing would be a continuous operation considering the cost associated with locating heavy machinery to site and access issues getting to selective trees only. Thus, given the relatively small area to be cleared, it is not proposed that DI&I clear any of the forest prior to transfer of the land to Council.

Potential habitat trees would be identified and marked by an ecologist prior to clearing. The non habitat trees would be cleared first, and the potential habitat trees would only be cleared following a reassessment by the ecologist. The contractor would have the contact details of the local WIRES representative in case fauna are injured during clearing or logging practices. It is anticipated that the clearing and removal of trees would take in excess of three months, which should allow sufficient time for the fauna to migrate away from the works site and find new homes in areas that will not be disturbed.

Clearing would commence with Bobo Road corridor, coffer dams and borrow pits and the storage embankment. These areas would be completely cleared and stripped, and contoured and rehabilitated upon completion of work in the respective areas.

The trees in the remainder of the inundation area would be removed for saw logs or mulched. The stumps and roots will remain in place to minimise natural ground disturbance and maximise ground stability. Smaller trees will be swept up with leaf litter and debris and mulched or burned via pit burning to reduce smoke emissions if required. Marketable non-sawlogs (chips and mulch) will be stockpiled for later use or relocation. Clearing of the inundation area would advance in a north-easterly direction up the catchment to the FSL.

As the clearing for each work area below FSL is complete, the area would be re-contoured to avoid the presence of isolated hollows in the base of the storage. Excavated areas such as borrow pits would be re-contoured. As these areas would eventually be inundated, revegetation would be limited to grass establishment.

4.5.2 Borefield Construction

It s proposed that the bores required for the Proposal be installed and tested. Underboring of the Nambucca River (refer below) would be undertaken concurrently with bore installation and prior to pipeline construction. Following bore testing, the pipeline would be constructed to connect the headworks to the bores.

Borefield Pipeline Trenching

Construction would generally be by open trench excavation for the borefield pipeline. Construction would commence at the headworks towards the outer limit of the bores to confirm maximum yield requirements. Dewatering, batter slopes on the trench/trench supports or rock breaking equipment are unlikely to be required for the construction of the majority of the pipeline routes given the results from the geotechnical investigations undertaken.

Nambucca River Crossings

It is proposed that the two borefield pipeline crossings under the Nambucca River be bored trenchless technology in order to reduce visual impact and limit impacts on the geomorphology of the river.

To enable the trenchless crossing, shafts would need to be constructed for both the launch and the receival of the machine. The pipe would be laid at about 2 metres beneath the riverbed to avoid any future riverbed scouring.

Intermittent Drainage Lines

Open trench excavation methods are proposed for crossings of smaller drainages and depressions along the borefield collection system route. These are generally small tributaries and the locations have been selected adjacent to the existing road crossings to minimise environmental impacts. Most are less than 500mm in depth.

Roads

The proposed borefield collection system route would cross North Arm Road, Borefield Road and local farm roads. These crossings would be trenched with traffic control used to avoid major disturbances during construction and encased if required. North Arm Road and Borefield Road are to be repaired to NSC standards, and farm roads are to be restored in agreement with the respective landowners.

4.5.3 Transfer Pipeline Construction

Similar to the borefield pipeline, construction would generally be by open trench excavation for the transfer pipeline. Construction would commence at the headworks towards the storage to limit stormwater intrusion. Dewatering, batter slopes on the trench/trench supports or rock breaking equipment are unlikely to be required for the construction of the majority of the pipeline routes given the results from the geotechnical investigations undertaken.

Transfer Pipeline Trenching

Creeks and Intermittent Drainage Lines

To avoid a trenchless technology crossing of Bowra Creek, it is proposed that the crossing be located at the existing vehicle access. Whether the pipe is attached to the side of the bridge, laid in the road with concrete encasement or would pass under the culverts would be determined in detail design.

Open trench crossings of smaller drainage lines and depressions along the route are proposed (generally small tributaries to Bowra Creek in the last 700m of the pipeline route to the storage). Most are less than 300mm in depth.

Roads

The only road crossing required is the crossing of Bellingen Road. This would be trenched with traffic control used to avoid major disturbances during construction and encased.

4.5.4 Headworks Construction

The new pumping station would be constructed concurrently with the borefield and transfer pipelines in order to coordinate system commencement. The pumping station and collection tank would be constructed as detailed in Sections 4.4.4 and 4.4.5.

4.5.5 Concrete Supply

Given the relatively small size of the Proposal and the limited use of concrete, there is no requirement for on-site concrete batching plants. Concrete is to be supplied from local batch plants and brought to each construction site. Supply options for sand, aggregate, flyash and cement are considered in Chapter 17 – Waste Management and Resource Use. Concrete is to be delivered by truck and placed using a mobile concrete pump or by hand.

4.5.6 Construction Water

Potable water would be required at the main worksite offices and amenities located at the headworks and at the storage. Potable water would be required for drinking, washing and ablutions. During the main pipeline construction and extension of the borefield small supplies of drinking water would be carried in vehicles and portable WC's would be provided in locations not convenient to the main ablutions.

NSC has advised that potable water could be made available from a dedicated standpipe located in the vicinity of the intersection of Rodeo Drive and Valla Road. No licensing would be required however, the standpipe would be metered and the contractor would be charged at the usage rate applicable at the time.

Water used for construction purposes, whilst not required to be fully potable, is normally of similar quality to reduce the risk of contamination of the works. However, water from sedimentation basins and dewatering activities would also be collected and reused where possible. Where dewatering is undertaken in an area with the potential of being contaminated, collected water would be disposed of at the Bowraville Sewage Treatment Plant. The main uses for this water would include dust suppression of Bobo and Valla Roads, other access and haul roads, and water required to condition earth and clay fill for the embankment earthworks.

4.5.7 Indicative Construction Timetable

The indicative timetable for construction of the Proposal, assuming it is approved through the EIS process, is approximately two years (2011 – 2012 incl.). The proposed construction timetable is shown in Figure 4-9 Construction Timetable.

Hours of Operation

It is proposed that construction activities would be undertaken between 7 am and 6 pm Monday to Friday, and 7 am to 1 pm Saturdays. Staff arriving or leaving the site for maintenance before 7 am or after 6 pm would be made aware of the potential for noise impact at nearby receivers.

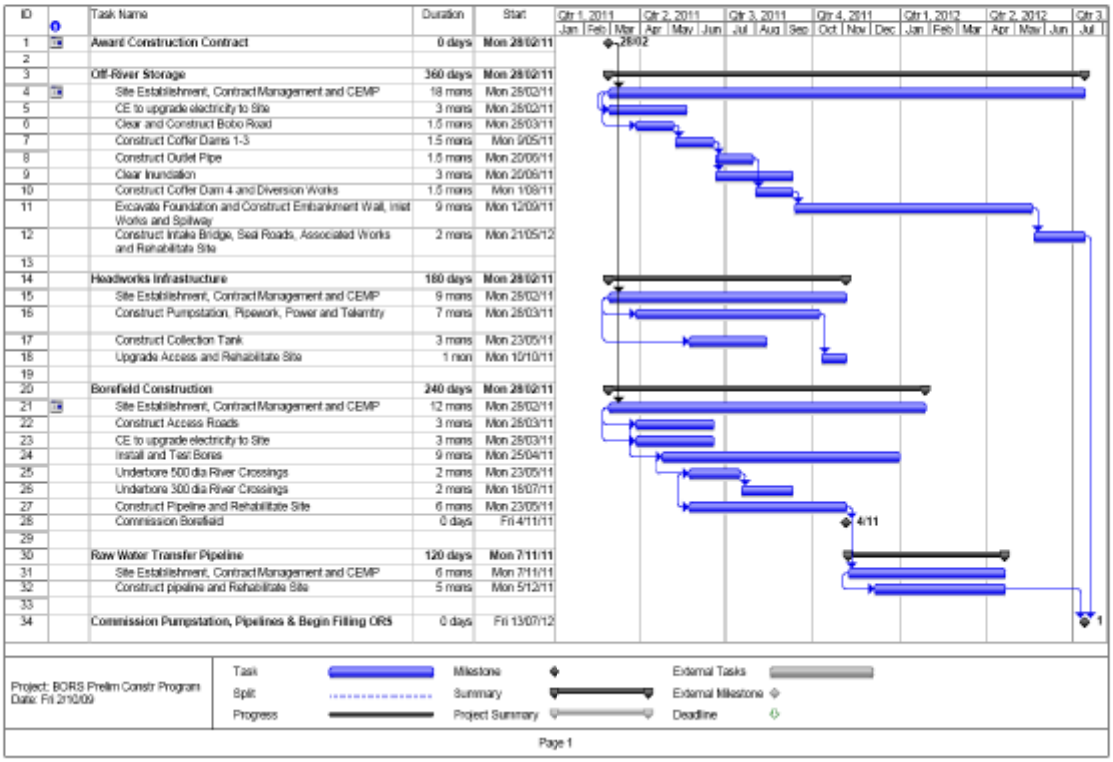


Figure 4-9 Construction Timetable

4.5.8 Construction Methods and Containment / Disposal of Construction Spoil

Excavation material from the initial stripping other than rock may be used in the upstream coffer dams over Bowra Creek and within the storage embankment.

At a time when the coffer dams are no longer required the spoil may be re-handled and disposed of either within the storage area or on the downstream face of the embankment. There is also the option for suitable material to be used in access road embankments.

4.5.9 Plant and Machinery Requirements

A preliminary assessment of vehicles, machinery and equipment that may be required during the excavation and construction of the Project is shown in Table 4-6.

Table 4-6 Anticipated Plant Requirements

Work Item	Anticipated Plant Requirement
Clearing	A variety of excavators with attachments including tree grabs, hooks, mulchers
	Horizontal tub grinders
	Broad acre mulchers
	Tippers and semi-tippers
	Transport vehicles

Work Item	Anticipated Plant Requirement
Topsoil and overburden removal from storage site east side to working platforms and to disposal	2 x D10 dozers 1 x 657 scraper 2 x water trucks 1 x 825 compactor 2 x graders
Topsoil and overburden removal from storage site west side to working platforms and to disposal	2 x 657 scrapers 3 x water trucks 3 x 825 compactors 2 x graders
Site establishment	4 x broad-acre mulchers, 2 x excavators (tree pullers, mulchers, pincers), 2 x horizontal tub-grinders, 3 x 6x6 dump trucks 2 x concrete batch plants 1 x concrete batch plant 1 x transportable water treatment package plant 1 x sand screening plant 2 x dozers 2 x excavators 1 x grader 3 x scrapers 4 x 6x6 dump trucks 1 x compactor 2 x water carts
Earth Dam Construction	2 x excavators 2 x SP56 pad foot rollers 2 x water trucks 4 x 6x6 dump trucks 1 x grader 1 x 966 loader 1 x CC10
Clay Core Conditioning Area	1 x water truck 1 x grader 1 x rotary hoe

Work Item	Anticipated Plant Requirement
Restoration	Graders
	Water trucks
	2 x dozers
	2 x excavators
	4 x 6x6 dump trucks
	Spray grass equipment

4.5.10 Contractor's Area and Stockpiles

Designated locations would be required for construction compounds/ temporary holding yards for construction equipment and material. It is anticipated that at least 5 compounds with areas of approximately 600m^2 would be required throughout the construction phase. These compounds would be located on cleared and relatively flat land adjacent to the northern and southern banks of the Nambucca River, eastern and western banks of Bowra Creek and western bank of South Creek in the vicinity of the proposed borefield and transfer pipeline but away from residential receivers. Agreement for contractors' work areas and material stockpiles would need to be sought from private landholders as large sections of the pipeline route pass through private properties (refer to Chapter 21- Land Use).

An additional construction compound for the storage would be located on Bobo Road adjacent to the storage area within the proposed acquisition area. This area would be transformed following construction to the proposed viewing and recreation area.

4.5.11 Workforce and Accommodation

Of the 60 personnel expected to be working on the Proposal, a typical allowance for storage construction site personnel for a Proposal of this size would be of the order of 30 to 35 people during the peak construction period. This includes a professional work force of 20 to 25, including senior and junior engineers, clerical staff, supervisors, foremen as well as soil technicians, environmental officer/s and their support staff. This would be increased further during shift operations.

This total does not include the manpower resources working off site such as on infrastructure or quarries, or suppliers.

Crib rooms would be provided on-site and toilet and shower facilities would be provided in demountable buildings. Grey water would be re-used where feasible and toilet waste would go to pump-out facilities. Site offices would be air conditioned, meet all occupational health and safety requirements and be regularly audited for compliance, including with respect to vector and vermin control and fire safety. This would also apply to any construction camp required, though not all parts of the camp are likely to be air conditioned.

Accommodation requirements are likely to include short-term lodging for temporary workers, more flexible accommodation options for long-stay workers (e.g. those staying for the duration of the Proposal) and more permanent accommodation for those workers that choose to relocate their families to the area for the duration of the construction of the Proposal.

The proportion of the workforce that may be drawn from the local area and the training to be provided to workers is addressed in Chapter 19 - Social and Economic.

4.5.12 Consultation during Construction

Subject to the approval of the EIS and the finalisation of the detailed design of the Proposal, a consultation plan would be prepared as part of the Construction Environmental Management Plan (CEMP) to ensure on-going communication with directly affected land owners and the wider community.

Advanced Notice on Construction Activities

Local affected residents would be given notice on when and how construction activities would be undertaken to inform them of the proposed staging and sequencing of the Proposal. Information would be given on likely location of activities, duration of activities and the potential for traffic, noise or air quality impacts.

On-going Communication

To ensure external communication is timely and transparent, only nominated personnel would be involved in consultation with affected landowners and wider community. The contractor would be responsible for nominating all staff members responsible for external communication. The following communication protocol would be adopted during the construction phase:

Activity	Form of Communication
Work on private land	Face to face and telephone contact
Work within public land	Letters to adjoining land owners
Work within or adjacent to public roads	Newspaper advertisement and signage
General work progress	Meetings with relevant government agencies; Community newsletters via rates notice

Any incidents resulting in environmental harm during construction of the Proposal would be reported to the DECCW as soon as possible.

Complaints and Responses

The environmental management process managed by the contractor would include a procedure for receiving and acting upon complaints. Attention to complaints would be carefully managed, prompt and effective, and would form a key part of the environmental reporting mechanism.

Responsibility for maintaining the complaints procedure would rest with the contractor during construction.

While the CEMP would establish the procedure for complaints, basic requirements would include:

- A procedure for receiving and responding to complaints which is acceptable to NSC and DECC;

- The contractor maintaining, during the construction phase, a complaints telephone service (24hr / 7 days Customer Contact number);
- A process for registering and handling all complaints received in terms of:
  - Time and date of complaint;
  - The identity of the complainant and the recorder of the complaint;
  - The specific action or activity causing the complaint;
  - Whether environmental compliance requirements are being met;
  - The action taken to address the complaint if necessary;
  - A database for tracking of complaints and actions taken in response;
  - Immediate communication of the complaint to the contractor;
  - Details on how the action taken is to be communicated to the complainant, NSC and the Contractor;
  - Feedback to the complainant, NSC and DECCW within a specified time period;
  - Any subsequent remedial action required to avoid cause for future complaints if relevant;
  - Regular reporting to DECCW and NSC on complaints and corrective actions; and
  - Monitoring and auditing of the complaint handling system.

Other informative resources are also to be accessible by external stakeholders via NSC website that would also offer feedback forms for complaints and grievances.

4.6 Rehabilitation

It is proposed to rehabilitate all disturbed areas (above the FSL), particularly stabilisation of the landscape around the storage embankment, spillway access roads and pipeline excavations. Every effort would be made to:

- Minimise the areas disturbed during construction;
- Provide temporary erosion control and water quality control wherever needed;
- Progressively reshape and revegetate with native species as work phases above FSL are completed; and
- Ensure that water leaving the site is of similar or higher quality than the receiving waters.

Rehabilitation of the disturbed areas downstream of the storage would be completed as the work in the surrounding areas has been completed and would include both the temporary and final scour and erosion control measures.

Erosion control measures would be required around the perimeter of all areas of work and would remain around areas restored following the completion of the storage and roads for an establishment and maintenance period.

The construction of the permanent storage access road would be completed early on in the construction program, but with the volume of traffic during the construction stage it is likely that restoration of the pavement and rehabilitation of the roadsides may be necessary.

Rehabilitated areas would be monitored to ensure that vegetation cover is maintained and that any minor erosion is repaired and the area re-stabilised.

4.7 System Operation and Control

4.7.1 Operation Staffing

Staffing for the Proposal and the associated water supply works would require 1 - 2 full time NSC officers.

Vehicles and equipment used during normal operations are likely to include:

- Utilities and four-wheel-drive vehicles;
- Small outboard-powered boats; and
- Tractors and slashers.

Operation of the Proposal would be integrated across the 3 sub-systems including the borefield collection system, headworks and storage.

4.7.2 General

The Proposal is made up of 3 sub-systems that are linked together as part of the overall system. They are as follows:

- Borefield pumping system;
- Headworks pumping system; and
- Storage release system.

To maintain high quality water in the system whilst maximising the borefield output and storage functions, a management strategy need to be set-up for operation of the overall system. Issues that feed into the management strategy include:

- Extraction protocols in accordance with the Nambucca River flow rules and governing borefield water quality parameters specified;
- Initial storage filling and then normal operation requirements to maintain water quality; and
- Environmental releases and transparency from the storage.

4.7.3 Borefield Extraction Flow Rules

Agreed to in-principle river extraction "rules" would be put into place to regulate water extraction. Such rules would be used in the control of any pumping system used to take water from the river. These are summarised as follows:

1. *No pumping between dusk to dawn when river flow at the gauging station after extraction by upstream irrigators is between 80 to 120ML/d during January to September and 40 to 120ML/d during October to December;*
2. *Stop pumping to distribution system to meet existing demands when river flow reaches the 95%ile flow corresponding to that month;*
3. *Stop pumping to distribution system to meet future growth demands and fill the Off-River Storage when river flow reaches the 95%ile flow corresponding to that month;*
4. *Upstream irrigators and town water supply are allowed to extract up to 60% of the total daily flow provided other constraints are satisfied;*

5. *When the storage is drawn down to say 60% and the water supply is subject to Level 4 and above restrictions, the previous rules are relaxed with pumping to water supply ceasing at 95%ile flow corresponding to that month; and*
6. *Upstream irrigators are to cease pumping when the previous day's affected flow at the gauging station reaches the annual 95%ile flow, which is about 10ML/d.*
7. *The storage has to be "transparent" meaning any inflow volume to be matched by an equivalent outflow volume.*

4.7.4 Borefield Water Quality

Water Quality Extraction Protocols

In addition to the river flow extraction constraints, it is proposed that "initial" and longer term "target" water quality trigger values be adopted and, limiting the direct pumped transfer of poor quality water to the distribution system and ensuring a high quality water transfer to the storage. The initial proposed "trigger values" for filling of the storage may be lowered after the initial filling period as the volume of stored water increases, the level in the storage rises, the extent of dispersive soils is defined and the initial need for a backup water supply becomes less urgent.

Shutdown of the transfer pumps may initially be triggered by a rapid rise in the turbidity level in the bore which can be seen as a forerunner to a rise in other water quality parameters. Pumping may again be initiated after close monitoring of the nutrient, nitrogen and phosphorus levels indicates the river water quality has again returned close to normal.

After a minimum storage capacity of say 2,000 ML has been achieved in the storage, the trigger values could be reduced to match the ANZECC guideline values. Other more site specific values could be considered when NSC has a better understanding of local site specific river conditions and the efficiency of the aquifer to remove contaminants (following further testing).

Once the storage is operational, the trigger values for water extraction from the borefield and for transfer to the storage could be refined to allow storage of the best quality water available.

The following trigger values in line with ANZECC guideline values would be initially recommended for extraction from the aquifer and for transfer to the storage.

Table 4-7 Target Water Quality Trigger Values

Water Quality Indicator	Bore Extraction for transfer direct to town supply	Transfer to storage
Turbidity	5 NTU	5 NTU
Iron	0.3 mg/L*	0.3 mg/L*
Manganese	1.9 mg/L	1.9 mg/L
Ammonia (NH_4)	0.02 mg/L	0.01 mg/L
Total Kjeldahl Nitrogen (TKN)	0.5 mg/L	0.35 mg/L
Filterable Reactive Phosphorus (FRP)	0.02 mg/L	0.005 mg/L
Total Phosphorus (TP)	0.03 mg/L	0.01 mg/L#

Note: * The trigger value given in ANZECC/ARMCANZ (2000) for iron is an interim value due to insufficient data.
The current limit of detection at local laboratories is 0.03 mg/L.

Dosing of a phosphorus fixing agent (such as Phoslock) into the water transferred to the storage may also help reduce the potential for nutrients such as phosphorus from being available for algal growth.

Determination of longer term trigger values for changing the supply to the distribution system from the borefield to the storage and reverting back from the storage to the borefield could be confirmed after the water in the storage has had time to reach a dynamic equilibrium and NSC has the operational experience to ensure acceptable quality water for the consumer.

4.7.5 Storage Release Rules

The storage release rules (that feed into the management strategy for the overall system) are based on three broad categories; water quality, level and environmental flows. In each broad category are the following rules:

- Water quality – As the quality of the water that is transferred to the storage is controlled by the extraction protocols in the section above, only water quality parameters that can change whilst stored in the storage need to be monitored and measured to govern release. These parameters include algal blooms (visual monitoring), turbidity and dissolved oxygen.
- Level in storage – the level selected as the release cut-out is likely to vary depending on the water restrictions in place at the time. These levels would be confirmed in detail design; and
- Flows to Bowra Creek – Likely environmental approval conditions to minimize impacts on Bowra Creek would include 'transparent' release from the storage and release to simulate 1: 6 month or 1:1 year flood to maintain channel forming velocity in Bowra Creek. Again water quality and temperature would be monitored to ensure releases have no adverse impact on aquatic habitat.

Management Strategy

The management strategy for operation of the overall system is required to maintain high quality in the system whilst maximising the borefield output and storage functions. The strategy would take into account all the issues identified in the above sub-sections and is best summarised with a flow chart. Figure 4-8 shows the operational schematic for the Proposal.

The Water Quality Management Plan and the system control flow chart make up the overall system management strategy. Development of the management strategy to a process and logic control (PLC) format would be developed in the detail design phase.

4.7.6 Control Philosophy for the Borefield Pumping System

Bore water would be used as the primary supply for the shire and would be supplemented by gravitating from the storage when required.

The extraction from the borefield would be governed by both the environmental flow rules and water quality in the bores.

Provided that the above conditions are satisfied, the Raw Water Pumping Station would commence pumping and transfer water to the storage until it reaches its target storage level of 95%.

4.7.7 Control Philosophy for the Headworks Pumping System

The following pre-conditions would automatically control the Raw Water Pumping Station:

1. Off-River Storage level is not full;
2. Environmental Flow Constraints are satisfied, permitting borefield pumping and water transfer into storage;
3. Daily / weekly/ annual pumping schedules have not been exceeded;
4. Ensure that water is not being drawn from the storage to pump away to the community via the High Lift Pumps;
5. Ensure that Raw Water Pumps are available to operate (motors are selected to Auto / all protection devices are reset and associated isolation valves open to permit pumping; and
6. Some borefield pumps available for service.

Provided that the above conditions are satisfied, the Raw Water Pumping Station would commence pumping and transfer water to the storage until it reaches its target storage level of say 95% (value to be confirmed in the detail design phase).

4.7.8 Control Philosophy for Off-River Storage

The following would automatically control the storage system and trigger filling:

1. Storage level is not full;
2. Environmental flow constraints are satisfied, permitting borefield pumping and water transfer into storage;
3. Daily / weekly/ annual pumping schedules have not been exceeded;
4. Ensure that water is not being drawn from the storage to pump away to the community via the high lift pumps;
5. Ensure that raw water pumps are available to operate (motors are selected to Auto / all protection devices are reset and associated isolation valves open to permit pumping;
6. Some borefield pumps available for service;

Provided that the above conditions are satisfied, the raw water pumping station would commence pumping and transfer water to the storage until it reaches its target storage level.

The headworks would draw water from the storage when required to supply consumers when required, provided the raw water pumps are not filling the storage at the time and there is water in the storage available to use.

Rain falling in the catchment of the storage must be returned to Bowra Creek within the prescribed time, according to approved environmental discharge rules governing the rate of discharge and the maximum delay time to release. An automatic rainfall monitor would monitor

rainfall. The automatic control valve would operate as under the control of the storage control panel PLC/RTU to discharge water into Bowra Creek. The flow rates would be monitored by a flowmeter.

Environmental Releases from Storage

In order to maintain a degree of flow transparency from the storage, water will be released from the storage to Bowra Creek during rainfall events . As far as possible, these releases will be controlled to mimic the stream flows that would have occurred in Bowra Creek prior to construction of the storage. An automatic rain gauge would be installed at the storage to monitor rainfall within the catchment, and the corresponding runoff would be released to Bowra Creek downstream of the proposed embankment.

Periodically, higher intensity releases to simulate 1: 6 month or 1:1 year flood events would be discharged to maintain channel forming velocity in Bowra Creek.

4.7.9 Adaptive Management Framework

It is proposed that an Adaptive Management (AM) framework for the Proposal be developed in accordance with the Australian Government's National Water Initiative (NWI) 2007. The AM framework, illustrated in Figure 4-10, provides "a context within which existing groundwater and surface water management can be integrated and provides social, environmental and economic outcomes across industries and regions." Comprising six 'toolboxes', the framework is structured within a generic adaptive management cycle and each toolbox is "designed to house 'tools' in the form of water management methods or guides that are available at that point of the management cycle."

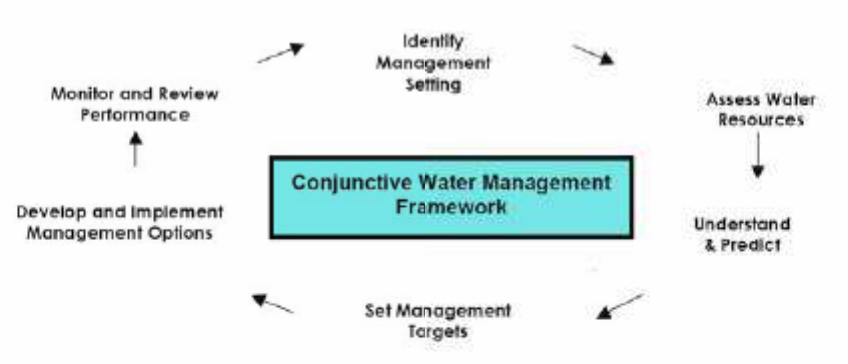
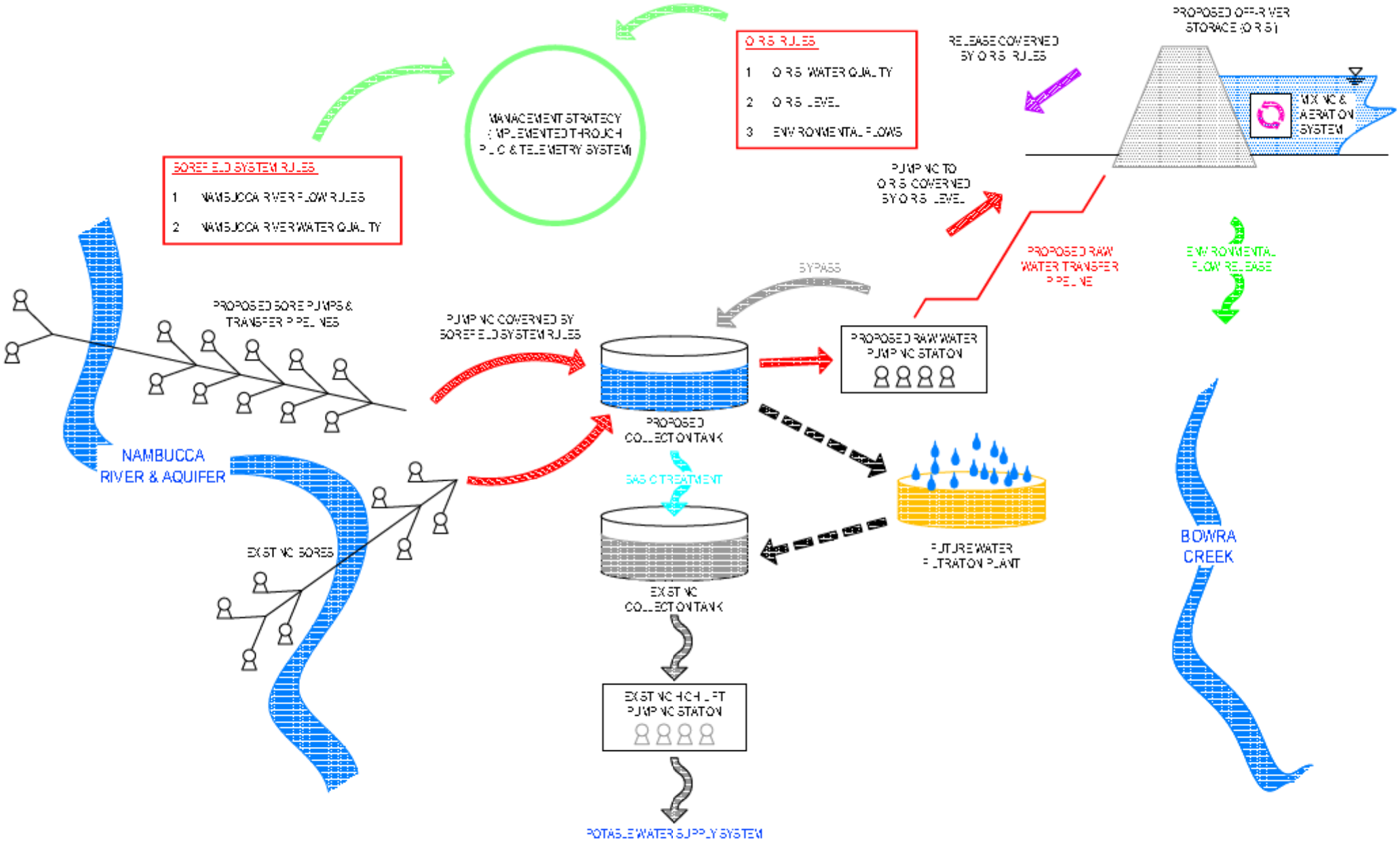


Figure 4-10 Adaptive Management Framework for Conjunctive Water Resources

4.7.10 Proposed Adaptive Management Approach

The AM framework would be used to address compliance with the WM Act by explicitly allowing for the maintenance of environmental flows in Nambucca River past the extraction zone. AM means having flexible legislative requirements that allow for re-allocation of environmental water on the basis of periodic reviews/monitoring.

The proposed AM approach is outlined below:



Nambucca Shire Council
Bowraville Off-River Storage

SYSTEM OPERATION SCHEMATIC

Job Number | 22-14133
Revision | A
Date | JULY 2009

Figure 4-11

CLIENTS | PEOPLE | PERFORMANCE

Levels 2 & 3 GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 Australia T 61 2 4979 9999 F 61 2 4979 9988 E nlmail@ghd.com.au W www.ghd.com.au

Identify Management Setting

Groundwater is currently extracted from the gravel layer within the unconfined alluvial aquifer at a pump rate of approximately 25 ML/day. Augmentation of the borefield is anticipated to increase groundwater extraction up to 57 ML/day. It is understood that other registered production bores in the area are 'hardrock' bores not in direct connection with the alluvium.

The alluvial aquifer is relatively shallow and highly connected to the Nambucca River. The Nambucca River tidal limit can reach the southern boundary of Bowraville, downstream of Lanes Bridge, during king tides.

Assess Water Resources / Understand and Predict

Hydroilex have undertaken a hydrogeological investigation of the borefield, including a desktop study of existing information, development of a conceptual geological model, geophysical surveys and a drilling and aquifer testing program. Numerical groundwater modelling has also been undertaken to assess various borefield design options.

Set Management Targets

The following management targets are considered appropriate for the Proposal operation:

- Generate sufficient town water to meet existing demand and future growth demands;
- Maintain environmental flows in the Nambucca River past the extraction zone;
- Protection of the alluvial groundwater resource; and
- Protection of groundwater dependent ecosystems that utilise the alluvial groundwater.

Develop and Implement Management Options

'In principle' environmental flow rules have been developed as part of the adaptive management approach to managing the impacts of the Proposal operation on the alluvial aquifer and the Nambucca River.

Depending on the data obtained through the adaptive management process, it may be necessary to modify these flow rules or implement additional policy or on-ground management actions.

Monitor and Review Performance

A well-designed monitoring programme is part of a conjunctive water management approach. The current understanding of catchment processes, evolved from the processes of data collation, assessment, conceptualisation and predictive modelling can be used to design a cost-effective and robust monitoring programme.

Catchment monitoring requires the establishment of a set of indicators that are able to show changes in management and in resource condition. Such indicators need to relate to the key management issues and the management targets established for the catchment at appropriate spatial and temporal resolutions. Such indicators are generally considered to have the properties of being simple, measurable, accessible, relevant and timely. Examples include:

i. Surface water gauging of flow, level and quality (eg salinity, nutrients);

ii. Groundwater levels and quality;

iii. Water usage from extraction points;

iv. Land use and land use practices;

v. In-stream ecosystem health such as indicator species.

Monitoring is the reality check for managers. This requires reviews on a regular basis to:

i. Identify any emerging management issues in the catchment that may need addressing;

ii. Identify information gaps that when corrected would improve assessment of catchment processes;

iii. Validate and potentially update the understanding and conceptualisation of key water processes;

iv. Help verify or improve the calibration of any predictive models;

v. Evaluate progress towards the management targets identified for the catchment;

vi. Check that conjunctive water management options were implemented appropriately;

vii. Test the appropriateness and effectiveness of these management options;

viii. Ensure that there is compliance with established rules and regulations.

The following indicators and triggers for monitoring the management targets for the Proposal are:

- Flow;
- Water Quality;
- Water Level;
- Macrophytes; and
- Macroinvertebrates.

Details of the adaptive management framework monitoring are contained in Chapter 24 – Environmental Management and Monitoring.

4.7.11 Flood Monitoring

The storage would be operated in accordance with ANCOLD and NSW Dam Safety Management Guidelines and it is anticipated that:

- At least 1 duty storage operator would be available at any one time;
- Standby operators would also be on-call;
- Storage operating procedures would require a duty flood engineer to be able to mobilise for flood operations within a two hour period;
- Major gate operating systems, other than the mains electricity supply, would be duplicated, including the switchboard, electrical motors and winches. A backup diesel generator and fuel supply would be permanently available at the storage; and
- Storage operating procedures would include a contingency plan in the event of loss of communications (telemetry).

4.7.12 Dam Safety Management

For the purpose of preliminary design, it has been assumed that the Proposal would be assessed as a High C category dam in accordance with NSW Guidelines and the definitions given by the ANCOLD. Further details on the dam safety and risks are contained in Chapter 18 – Hazards and Risks. The storage is expected to fall within Category 2 in terms of Failure Impact as defined under the *Water Management Act (2000)*. As a High C category dam, a comprehensive dam safety program would be required to be instituted under the current NSW legislation regarding dam safety. Such a program would be expected to adequately conform to the recommendations set out by ANCOLD under their current Guidelines on Dam Safety Management. Whilst remote monitoring of the storage and its instrumentation may be possible, the dam safety program would require, among other surveillance activities, daily visual inspection.

A maintenance program would be required. Some grassed areas may require slashing for aesthetic reasons and/ or to assist with fire control. As well, the results of routine visual inspection by operations staff would provide a key input to the development of the annual maintenance program and hence appropriate management of the asset.

It is anticipated that regular maintenance work would be required for tasks such as:

- Patch painting of metalwork such as baulks and gates;
- Lubrication of moving parts in hoists, cranes and replacing parts as necessary; and
- Replacing baulks in the off-take tower.

The public would be excluded from some parts of the storage and associated infrastructure for safety reasons.

4.8 Access

4.8.1 Access to the Storage

In light of the need to maintain access to private land which presently utilises Bobo Road through Viewmont State Forest, it is considered that the upgrading of Bobo Road off Valla Road would be required to provide access to the storage site. This route would provide access for both construction and for permanent public access to a viewing area adjacent to the storage. Restricted access for maintenance of the facilities would be provided beyond the public viewing area.

The upgraded Bobo Road and the viewing area would be constructed to a 6m wide formation and 3 metre wide seal. Site access roads beyond the viewing area would nominally be constructed with 3m wide sealed pavements. Sealed site access roads, including parking and manoeuvring areas, would be provided along all routes which have a maintenance function.

4.8.2 Access to the Headworks

The existing sealed access off Bellingen Road is satisfactory in its present condition and suitable for continued use after upgrading of the headworks. The width of the access handle to the headworks appears to vary from approximately 6.5m to 7.5m in width.

A 4m wide sealed access together with a widened passing bay adjacent to the existing stock grid would provide satisfactory access for construction and ongoing maintenance access to the headworks.

4.8.3 Access along Transfer Pipeline

With the provision of access to the storage site via Bobo Road the opportunity exists to minimise the impact and construction costs for the provision of permanent access along the route of the pipeline from the headworks to the storage.

A minimum impact gravel, all weather access track 3m wide would provide the functional attributes required to provide access along the pipeline route for inspection and maintenance of valves etc. In some locations it would be necessary to include culverts and to raise the track formation above the natural ground level to manage stormwater flows etc. The track would be in close proximity to the pipeline and within the 5m wide easement. Locked gates would be provided where the easement crosses property boundaries.

Access to the easement track would be provided from the headworks, Bellingen Road and the storage area.

4.8.4 Access to Borefield Facilities

With the expansion of the borefield there is a need to formalise access arrangements with property owners. The provision of 5m wide easements over pipeline routes and a suitably shaped and sized area covering the curtilage of each bore facility is recommended as being suitable for the functional requirements to facilitate access for construction, inspection and maintenance.

The provision of easements over each pipeline and bore as well as connecting links from public roads to the pipelines and bores would be subject to detailed negotiation with individual property owners by NSC.

The functional philosophy would be to ensure that NSC has continuity of access rights to discrete facilities, whilst minimising potential adverse impacts on the continued productive use of the land and also minimising risk of damage being occasioned by flood events and minimising visual impacts.

4.9 Easements

4.9.1 Borefield and Associated Pipelines

The proposed pipeline and access routes make use of existing rights of way, access easements and pipeline easements wherever practical. Some of these easements would need to be amended or revised to allow NSC access or to construct pipelines, power and access in said easement. Additional easements would be required on private properties.

Four types of easements would be required:

1. Access, pipeline and power easements;
2. Access and pipeline easements;

3. Access and power easements; and

4. Access Only easements.

Access, Pipeline and Power Easements

A 5-metre wide access, pipeline and power easement along the full length of each pipeline would be required as part of the Proposal. An additional 5 m temporary construction easement would be required adjacent to the proposed easement along the pipeline routes for the construction phase of the Proposal. Electrical power supply to each of the bores would be taken from a central hub and be laid underground in the easement adjacent to the pipelines.

Access and Power Easements

Access and power easements would be required to supply power from the Country Energy 11kV powerlines to the central borefield control panels. These easements would need to satisfy Country Energy's requirements as outlined in the document CEPG8046 "Easement Requirements". These easements are typically 15m wide (centred on the powerlines) and subject to the terrain and powerline conditions.

The buried power and control cables running between the central borefield control panels and the respective borefield pumps would also require NSC easements and where practical to do so, these shall be combined into the pipeline easements. Typically these easements are 2m to 3m wide, centred on the conduit route.

Access Only Easements

Access to the Bores 7/33 – 7/39 would be required from Bellingen Road across Lot 326 DP 777074. The access road is approximately 1.0 km along an existing farm road and fenced cattle run.

4.9.2 Transfer Pipeline

Easement Dimensions

A 5 metre wide easement for the full length of the transfer pipeline would be required as part of the Proposal. Access to the easement would be from either end of the easement (i.e. headworks and storage sites) with other access from public roads or existing easements. An additional 5 m temporary construction easement would be required adjacent to the proposed easement for the construction phase of the project.

Private Property

Where located in private properties, NSC prefers to acquire easement rights over major water mains.

Other Locations

Easements are not required when the proposed transfer pipeline is located in the road reserve.

4.9.3 Rights of Carriageway

Transfer Pipeline

One 150m long right of carriageway from Bellingen Road to Lot 102 DP 809380 is proposed to provide alternative access to the proposed transfer pipeline.

Borefield Pipelines

Pipelines in the Right of Way of North Arm Road and Borefield Road would be installed 2.5-4m from the boundary of the ROW as requested by NSC wherever possible.

Country Energy 11kV powerline extensions would be run in existing Right of Way paths where feasible, such as for the powerlines between Bowraville and the South Creek borefield.

4.10 Cost Estimate

Rider Levett Bucknall Pty Ltd was engaged to provide a preliminary cost estimate for the Proposal based on the current concept design details. The broad estimate breakdown is as follows:

- Project Infrastructure– $24.6M;
- Storage and associated works – $20.5M; and
- Total – $45.1M.

The estimate includes a contingency allowance of 30%, an escalation allowance to outturn prices, contractor's preliminaries (overhead and site establishment) and profit. The estimate excludes land costs and easement compensations, professional fees, and interest/cost of finance.

4.11 Decommissioning

The nominal engineering design horizon of the Proposal is 40 years, although it is likely to be maintained after that period provided that it continues to meet dam safety requirements and remains an integral part of the NSC's water supply strategy.

While unlikely, the Proposal may be decommissioned during or after initial engineering design life if the storage:

- Suffers significant damage that cannot be remedied to meet safety standards; or
- Is no longer needed to provide water.

Current practices for dam decommissioning are established by ANCOLD. ANCOLD (1994a) identifies two principal alternatives when decommissioning a dam. Both comprise completely abandoning the dam, with its removal to the extent that it no longer retains water. While this is best achieved by complete removal of the dam embankment and reinstatement of the bed and banks, in some situations it may be appropriate to only partially remove the structure.

Environmental issues associated with dam decommissioning must also be addressed. These include:

- Treatment and / or removal of silt sediments that may be anoxic or otherwise pose a threat to water quality and ecosystem health at the site and downstream of the site;

- Treatment of stratified water layers that may be low in oxygen and have other chemical characteristics that may be harmful to downstream ecosystems;
- Stabilisation and reinstatement of the river bed and banks at the storage site; and
- Stabilisation and reinstatement of lands formerly inundated by the storage.

When decommissioning a dam, the dam owners at the time would prepare a decommissioning plan. The decommissioning plan should:

- Include a time sequence of studies and works associated with the decommissioning; and
- Address all issues associated with the decommissioning including:
  - impacts of sudden loss of remaining embankments or other dam sections for a range of flood events in compliance with the Guidelines for Failure Impact Assessments of Water Dams;
  - provision of safe release of stored water;
  - assessment of altered hydraulic character of spillways and streams;
  - provision to minimise impact on the downstream residents; and
  - provision for consultation with downstream residents and landholders.

A decommissioning date for the Proposal has not been determined at this stage and the likely date is too far in the future to allow effective planning for decommissioning to occur at present.

5 Consultation

5.1 Overview

The key objectives of the community and stakeholder consultation during the EIS process were to inform the community about the Proposal, allow directly affected landowners the opportunity to contribute to the concept design and to provide the local and broader community with opportunities to provide input into the EIS process. The consultation strategy was also developed to incorporate the requirements of advisory and government bodies, and to keep them informed on the progress of the EIS.

Communication and involvement with stakeholders has taken place during the following phases of the Proposal development and assessment:

- Consultation on six short listed scheme options (December 2005 to February 2006)
- Communications and Consultation on preferred concept option (2008 to present).
- Statutory Consultation with government agencies and organisations for this EIS involved establishment of a Technical Liaison Committee, a Planning Focus Meeting and Environmental Risk Analysis Workshop and written requests for a formal response to the EIS (July 2008 to present).
- Consultation and liaison with the local Aboriginal community via the establishment of the Aboriginal Liaison Committee (2007 to present).

Upon submission of the EIS to NSC and other determining authorities, an invitation to the community and relevant government agencies for submissions on the EIS and the Proposal would take place during the public exhibition process.

5.2 Consultation Prior to EIS

5.2.1 Consultation on Scheme Options

A Value Management Study (VMS) workshop was undertaken in February 1995 to discuss the findings of the 1994 Strategy Report. The 1994 report concluded that additional water supply security was required and that in addition to demand management measures such as user pays pricing, an off-river storage with a capacity of 8,000ML would be the best option to meet the security shortfall and river flow objectives. The VMS workshop was attended by a number of agency and NSC representatives and it confirmed that the population and demand projections used in the study were appropriate. The VMS workshop did not determine a preferred option, although there was general agreement that an off-river storage was favoured. Alternatives to the off-river storage were evaluated and presented within a supplementary report in August 1995 (1995 VMS Report).

Based on the 1994/95 studies and community feedback, NSC successfully implemented a number of demand management measures whilst also undertaking a number of scheme options studies before selection of the preferred option. NSC began consulting with the community after reviewing the feasibility and cost of six short listed scheme options for a more secure and sustainable water supply. This included the following consultation tools.

- A flyer summarising the six scheme options was sent to every ratepayer in the Nambucca Shire along with their December 2005 water bill. The flyer indicated where more information could be obtained and invited the community to express their opinions regarding the scheme options;
- Displays were set-up in late December 2005 at Nambucca Heads, Macksville and Bowraville as well as on NSC's website; and
- An information evening was held on 7th February 2006, where information about the scheme options was presented.

The last date to receive community feedback was 24th February 2006 and during this period about 42 submissions were received.

As a result of this consultation, NSC resolved on 2 November, 2006 that the preferred option for an off-river storage located within the Bowra Creek catchment near Bowraville, be pursued.

Summary of Issues

Issues raised by the community during consultation undertaken by NSC in 2005-2006 included the following.

1. Request that NSC provide a financial incentive for the implementation of rainwater tanks;
2. Consider other water conservation measures such as effluent reuse;
3. Concern about the impact of the work on individual properties (raised by a couple of community members); and
4. The cost of the upgrade with some members of the community indicating that the developers would pay for the work as they felt the upgrade was only to meet future development demands.

Items 1, 2 and 4 above have been considered in the recent preparation of a draft Integrated Water Cycle Management Strategy (see Section 5.4). The impacts on property owners from Item 3 is considered in this EIS.

5.3 Consultation during EIS and Concept Design

5.3.1 Communications and Consultation on Proposal (2008 to present)

The community consultation process for the Proposal began in 2008 with the engagement of community consultation specialists, KJA Strategic Communications and Proposal Management Ltd (KJA). This section outlines the key tools used and the activities undertaken by KJA to inform the community and stakeholders of the EIS, and to obtain and integrate their input into the decision-making process. The issues raised to date are also outlined in Section 5.3.2.

Consultation during this period has involved a variety of methods and each is explained in more detail below.

Overarching Activities

KJA first developed a communications and consultation plan to assist with the planning and implementation of consultation activities. In addition to the consultation activities outlined below,

KJA has presented and briefed consultants working on the Proposal about the community relations program and protocols to be undertaken when liaising with the community. These protocols addressed issues relating to access of private properties.

Communications facilities to support the consultation process

The following communications facilities have been established for the Proposal.

- A Proposal web page on NSC's website – www.nambucca.nsw.gov.au which is regularly updated. Materials posted to date include a map of the investigation areas, the two community newsletters and a sheet of frequently asked questions;
- A Proposal-specific email – bowraville@kjassoc.com.au;
- A toll-free 1800 number – 1800 252 040; and
- A contact database – to summarise correspondence and phone calls.

Direct liaison with affected landowners

KJA has held regular one-on-one discussions with landowners throughout the process including:

- Three one-on-one briefings between KJA, NSC and landowners affected by the installation of test bores. The purpose of these discussions was to explain the work required, seek any issues or concerns from landowners and identify a location for the test bore that suited landowners. An access agreement was prepared following the meetings in consultation with landowners. An additional one-on-one discussion between NSC's consultants, Hydroilex and a fourth landowner was also held about installing the third test bore. These briefings took place in July 2008;
- Ongoing telephone liaison and face-to-face discussions with affected landowners to keep them informed about investigations being carried out on their property and to address any questions or issues they have raised; and
- Specific meetings between contractors and landowners during the EIS and concept design investigations to explain detailed investigations and agree locations for whether these investigations could take place.

Landowner Information Sessions

Two information sessions have been held throughout the EIS preparation phase and are described below.

- The first landowner information session was held on 2 July, 2008 at the Bowraville Theatre. It provided people with an opportunity to find out more about the Proposal and to ask questions of the Proposal team. 14 landowners attended the session; and
- The second information session was held on 10 September, 2008 and provided landowners with an update on the Proposal's progress and the commencement of the EIS and Concept Design Investigation Stage. Around 16 landowners attended the session. Information presented at the session was also sent to four landowners who were unable to attend the meeting but had requested further information.

The information sessions gave landowners the opportunity to find out more about the Proposal, discuss their issues and concerns with members of the Proposal team, ask questions about the technical aspects of the Proposal including the EIS investigations and concept design and provide information about how they wanted to be consulted during the Proposal.

Proposal Newsletters

Two community newsletters have been distributed to the Nambucca Shire Community, with the rates notice and also through a targeted mailing distribution (see section Distribution Strategy below).

- The first issue was distributed in July 2008. It introduced the Proposal to the community, outlined the Proposal background, the key stages, Proposal funding and contact details for further information; and
- The second issue was distributed in October 2008 and included an update on the test bore investigations, information about the various EIS and concept design investigations and when these would take place.

A number of pieces of written collateral have been distributed to liaise with affected landowners. These include:

- An introductory letter outlining the commencement of borefield investigations and studies to be undertaken as part of the EIS and concept design stage of the Proposal. Letters sent June 2008 to approximately 30 landowners;
- Agreement letters to the three landowners who had test bores installed on their property which outlined their specific requirements for access and installation. Letters distributed to the 3 identified landowners in July 2008;
- Access consent letters to landowners affected by the EIS and concept design investigations. The purpose of this letter was to seek permission to carry out a range of investigations on their property. Letters sent to approximately 32 landowners in October 2008; and
- A letter to affected landowners thanking them for their cooperation and assistance during the EIS and concept design investigation stage. Approximately 42 letters were sent to landowners in December 2008.

Distribution Strategy

The Proposal newsletter and other written materials have been distributed in the following ways:

- Delivered by direct mail to landowners directly affected by the investigation stage for the EIS;
- Delivered by direct mail to key stakeholders including community groups, clubs, schools, the Aboriginal Liaison Committee, NSClors and the local member;
- Copies available at the Proposal information sessions;
- Multiple copies sent to NSC, local schools, the post office, and local newsagent; and
- Digital copies of the newsletter were uploaded onto NSC's website.

5.3.2 Community and Stakeholder Issues and Concerns

The purpose of the consultation undertaken was to identify community and stakeholder issues for consideration during preparation of the EIS. Issues raised by the community throughout the planning and EIS and Concept Design Stage have been grouped into themes and are listed below.

Planning and Design Issues

The following planning and design issues were identified for NSC's consideration:

- Concern that the Proposal would draw too much water from the river thereby affecting the amount of water irrigators can draw from bores and personal wells;
- The possible impact of the Proposal on South Creek which the community identifies already has a low flow;
- EIS would address community's concerns, not just the technical design elements of the Proposal;
- The proximity of the pipeline route to residences, sheds and trees;
- Forest disruption and the felling of trees for Proposal infrastructure;
- Security issues during EIS and construction phases. (Not all landowners are present on their properties (some are managed by other farmers)); and
- Concerns about insurance and who would take responsibility for any damage to property during investigation and construction stages.

Construction

- Potential impact from the spread of weeds during EIS investigations and construction, particularly Giant Parramatta Grass.
- Impact of dust and noise during construction and also from vehicles frequently driving along unsealed roads as part of the EIS investigations.
- Impact on paddocks and their productivity, especially after rain, due to utes and larger vehicles including excavators and drill rigs for the EIS investigations, and concerns about this impact during construction.

Financial

- Impact of Proposal on property values and the ability to sell property following installation of Proposal infrastructure such as bores and pipelines.

Visual and Recreational

- Potential visual impacts of expanding the borefield. Planting native trees around the bores to minimise the impact has been suggested by members of the community.
- Effect of pipe laying on recreational users of the river. Investigate whether pipes can be located underground.

Operational Impacts

- How bores and Proposal infrastructure would impact on activities people undertake on their properties. E.g. one landowner is interested in growing organic crops, and is concerned that the installation of a bore and power supply would hinder ability to do so.
- Ongoing disturbance due to maintenance and servicing of bores.
- Blocking of access if pipelines are to be located across, along, or on people's private access roads.

5.3.3 Planning Focus Meeting and Environmental Risk Analysis Workshop

A Planning Focus Meeting and Environmental Risk Analysis Workshop was convened with key statutory authorities on 16 October 2008. 20 statutory authorities were invited to attend the meeting and workshop, with 11 representatives of those agencies attending. It involved a presentation including introduction and overview of the proposed upgrading, the EIS method and comments from statutory authorities.

The government agencies and NSCs who attended this briefing included:

- Department of Environment and Climate Change (now DECCW);
- Department of Water and Energy (now DECCW);
- Department of Primary Industries (Fisheries) (now DI&I);
- North Coast Area Health Service;
- Department of Commerce (now NSW Public Works – Project Management);
- NSC; and
- Unkya Local Aboriginal Land NSC

Apologies were provided by:

- Department of Primary Industries (State Forest) (now DI&I);
- Department of Planning;
- Northern Rivers Catchment Management Authority;
- Gumbaynggirr People Traditional Landowners; and
- Bowraville LALC.

The issues raised by various agencies have been taken into account in formulating this EIA. The comments made by statutory authorities at the meeting and workshop are outlined below:

Department of Primary Industries (DPI) (Fisheries) (now DI&I)

- The proponent would need to contact the Department of Lands for any works on Crown Land.
- The EIS would need to consider a new listed threatened fauna species the 'purple spotted gudgeon'.
- The proponent would need to consult with DWE for controlled activities approval for waterway crossings.

- DPI recommends the removal of the weir. However, this would be subject to geomorphic analysis and reporting. This may need to be retrofitted with rock fish ladder.
- DPI stated that even though under boring is achievable; the site may need to be trenched instead. This needs further consideration.
- It was advised all construction issues would be considered under one permit.
- Local Government is not exempt from requirements to gain Fisheries permits.
- The EIS would need to consider sediment erosion controls and environmental flows.
- A licence is needed for works in waterways under Crown Land. No additional approvals are required from DPI - only one licence / approval is required.
- Storage not likely to be available for recreational fishing due to water quality issues.

Department of Environment and Climate Change (DECC) (now DECCW)

General

- The EIS would need to consider air, noise and water issues and would need to refer to DECC's technical guidelines for each issue.
- Advised that a Protection of the Environment Operations Act 1997 licence would be dependant upon quantities. However, a water discharge licence might be required.

Cultural Heritage

- The EIS would need to consider and identify plants and animals that are important to Aboriginal heritage, for example native grass and local signature species. It was discussed that this might be an action of future cultural renewal activities, which might fall out from the EIS and any subsequent cultural heritage management recommendations.
- The proponent would need to consult with the Aboriginal Liaison Committee. There is a need to document any evidence of the Aboriginal use of the land, how they lived and what they did.
- DECC advised on the Cultural Heritage Management Model which was used for the Shannon Creek Dam. The model included an archaeological strategy (for examining and recording finds), a keeping place strategy, cultural renewal, Aboriginal participation (eg identifying employment opportunities for the Proposal).
- DECC advised there is a need to consider cultural heritage training for all persons involved in the scheme including persons undertaking EIS.
- DECC provided names of persons in the Aboriginal community they had been consulting.

Threatened Species

- DECC has no future threatened species issues with the site. However, with Shannon Creek some species where found and nominated at a later stage.
- DECC advised to keep in contact with NSW Scientific Committee as new listings of species and communities are made. The EIS needs to be pre-emptive and conservative and take into account potential for future listings.

Department of Water and Energy (DWE) (now DECCW)

- DWE advised they are satisfied with the current access regime.
- The EIS would need to consider the upper estuary and fish movements such as the Australian Bass.
- The EIS would need to consider groundwater dependant ecosystems and need to maintain groundwater quality.
- DWE advised that the transparency of flows would need to be maintained in Bowra Creek.
- The EIS would need to consider the impacts on other users such as licensed users.
- The EIS would need to consider the potential for saltwater intrusion and impacts of increased extraction.
- Extraction licence and monitoring laws to be considered under either Water Management Act or Water Act. The licence would need to be issued before construction.
- The EIS would need to consider environmental flows. DWE suggested that part of the flow could be considered a cultural flow. DWE indicated that their experience had been that it was very hard to determine what "cultural flow" was. In providing for environmental flow this had typically met cultural flow requirements.

Department of Health (DoH)

- DoH does not have any approval role in the EIS but is still concerned about water quality.
- The off-river storage would be a potential mosquito habitat and needs to be considered in the EIS.
- Need to consider water quality between existing and new bores.
- The EIS would need to consider blue green algae and advise on a management plan for risks.
- DoH not supportive of use of off-river storage for recreation especially motorised boating but recognise it is NSC's call and responsibility in the event of contamination.

5.3.4 Written Statutory Correspondence

All relevant organisations and statutory authorities were contacted and requested to supply any information or comments for consideration during the EIS preparation. A total of 8 organisations were contacted.

A summary of the comments formally received are summarised in Table 5-1. Full responses are contained in Appendix A.

Table 5-1 Statutory Consultation – Summary of Responses

Requirements	Addressed
NSW Department of Primary Industries (Forests NSW) (now DI&J)	
Comments were provided on 16 December 2008. Forests NSW interests were limited to the impacts on the State Forest affected either directly or indirectly and comments are summarised below:	
◗ *Tenure:* the area was dedicated as Viewmont State Forest No 1035 on 12 September 1984 and is included within the area covered by NSW Forest Agreement for Lower North East Region and Regional Forest Agreement for North East NSW. A crown road traverses the southern part of the area.	Noted
◗ *Zoning:* Zoned under Forestry Management Zoning and includes FMZ3A, FMZ4, FMZ5, FMZ8.	Noted
◗ *Flora and Fauna Details:* previously provided data on recorded threatened species in letter dated 23 Sept 2008.	Noted
◗ *Proposal:* NSC first advised Forests NSW in 1996 of the construction of storage, which includes State Forest land. Forests NSW advised that it would require compensation for the entire catchment.	Noted
In 2004, the Minister for Primary Industries consented in principle to the acquisition of land by NSC at an agreed compensation value. The agreement was also subject to the areas of native forest being harvested prior to acquisition. The approval was also subject to final determination of the EIS.	Noted
◗ *Operational Planning Issues:* Forests NSW has no objection to the use of road and trails that are located on State forest however, specific approval is to be obtained prior to the use of earthmoving machinery to improve access to the area. Any works would need to conform to Forests NSW standard operating requirements for roads and trails within State forest.	Section 4.4
◗ *Approvals:* Approvals would need to be obtained, such as Special Purposes Permits prior to conducting any studies on State Forest to ensure potential conflicts do not arise.	Noted

Requirements	Addressed
Department of Water and Energy (now DECCW)	
Comments were provided on 11 November 2008 and are summarised below:	
◗ *General Assessment Requirements:* DECCW attached specific guidelines on its requirements for the EIS, which include but are not limited to: location of facilities, requirements for water, management of stormwater, water quality impacts, soil suitability, flora and fauna assessment, vegetation to be cleared, cultural heritage impacts etc.	Noted
◗ *Specific Assessment Requirements:* DECCW provided additional requirements as part of this Proposal which include:	
– Assessment of the impact of the altered flow regime on the health of the upper estuary. Development of a monitoring strategy that would detect changes to in stream vegetation and / or salinity in the upper estuary.	Sections 10.3 and 10.4
– Assessment of the impact of the altered flow regime on the movement of native fish, in particular Australian Bass.	Sections 9.6 and 9.8
– Assessment of the impact of the altered flow regime on Aboriginal cultural values.	Section 13.4
– Assessment of the impact of increased groundwater extraction on any known groundwater dependent ecosystem.	Section 9.8.4
– Assessment of the impact on Bowra Creek, its in-stream values and down stream stock and domestic users.	Sections 8.4 and 10.3
– Assessment of the impact of increased groundwater extraction on the risk of salt water from the estuary intruding into the aquifer during extended drought periods.	Section 10.3.2
– Assessment of contamination risk of increased groundwater extraction.	Section 10.3.3
– Assessment of impacts on other groundwater users.	Section 10.3.2
– Assessment of the sustainability of the borefield.	Section 10.3.4
– Details of the IWCM justifying the need for the Proposal and the requested volume to be licensed.	Section 2.3
– Approval is needed from DECCW, under Section 60 of the *Local Government Act 1993* to construct and operate the storage at or near completion of the concept design.	Section 6.3.3

Requirements	Addressed
Northern Rivers Catchment Management Authority (NRCMA)	
Comments were provided on 26 November 2008. The NRCMA is primarily concerned that the natural resource condition is maintained or improved and comments are summarised below:	
◗ *Native Vegetation:* unless the vegetation being cleared is an EEC or in an over cleared Mitchell Landscape, the *Native Vegetation Act* (NVA) assessment process requires offsets depending on the classification of vegetation. As the proposal is considered under Part 5 of the EPA Act as meets the criteria of s25(g) and (h) of the NVA, NVA approval may not be required however, the provision of compensatory areas are recommended.	Section 6.3.10
◗ *Riverine Management:* it has been identified that the ground water source is highly connected to the Nambucca River surface water system. The CMA recommends the proposal quantify the threats to the groundwater system due to possible changes to the river system. Integrate recommendations emanating from the recent Geomorphic Assessment of Bowraville borefield.	Section 10.3
◗ *Hydroilex Report Review Comments:* the NRCMA reviewed the Geomorphic Assessment by Hydroilex and provided the following comments:	
Support is given for the recommendation to augment pipeline crossing with construction of a bed control structure incorporating a fish ladder.	Section 8.4.2
Support is given to generic designs for bank erosion, nick point, low lying terrace, causeway & culvert management options.	Section 8.4.2
A recommendation exists for the construction of one additional bed control structure for the reach upstream of the pipeline crossing.	Section 8.4.2
There is no mention of the maintenance of the existing lateral migration restoration site lying between PB9 and PB10. The future management of this site would be integrated into the management of the borefields.	Section 8.4.2
A formal landholder agreement process needs to be considered in the on-ground implementation of any of the recommendations of the study.	Section 21.3.3
The recommendations of this study need to be converted into a more detailed River Management Plan for the area incorporating post event monitoring.	Section 4.7.9

Requirements	Addressed
NSW Department of Primary Industries (Fisheries) (now Department of Industry and Investment)	
Comments were provided on 8 December 2008. NSW Fisheries is responsible for managing fish, fish habitat and aquatic biodiversity and comments are summarised below:	
General Assessment Requirements: NSW Fisheries attached minimum information requirements for the EIS including but not limited to the following:	
◗ *Requirements for activities that block fish*: purpose and type of works proposed, timing, duration and manner of proposed blockage, methods to be used to avoid stranding fish and any remediation works.	Sections 8.4.2 and 8.4.3
◗ *Requirements for dredging and reclamation works*: purpose of works, marine vegetation adjacent to proposed works, method of dredging, duration or dredging/reclamation works, dimension of area to be dredged/reclaimed, depth of dredging/height of reclamation activities, nature of sediment to be dredged, method of marking area subject to works, environmental safeguards, measures for minimising harm to fish habitat, spoil type and source location for reclamation activities, method of disposal of dredge material, location and duration of spoil stockpiling (if planned) and volume of material to be extracted or placed as fill.	Section 4.5
◗ *Requirements for activities that damage marine vegetation*: type of marine vegetation to be harmed; amount of marine vegetation to be harmed – map distribution noting percentage densities of species of marine vegetation; reasons for harming marine vegetation, methods of harming marine vegetation, construction details including proposed drainage, duration/timing of works, measures for minimising harm to marine vegetation, environmental measured to be employed and method and location of transplanting activities or disposal.	Section 9.4
◗ *Requirements for Activities that Could Impact on Threatened Species or Contribute to Key Threatening Processes*: statement about the presence of threatened species, consideration of habitat types, discussion of condition of habitat within the area, assess potential impacts on threatened species via the 'Eight-Part Test' and consult with NSW Fisheries prior to finalising the EIS, where a significant impact is likely, a Species Impact Statement must be prepared and note the penalties under the *Fisheries Management Act 1994*.	Section 9.4 and 9.6
◗ *Assessment of Likely Impacts*: investigate and report on area downstream and or upstream as far as is necessary, discussion of possible indirect effects on species/habitats, outline habitat requirements of threatened and commercially/recreationally fished species, discuss fish habitats within study area, discuss potential impact modification or removal of habitat, describe and discuss other locally occurring populations of all species likely to have their lifecycle patterns disrupted, discuss significant of this location for these species (extent, security, viability of habitat etc), describe potential contribution of the proposal to cumulative impacts on fish and fish habitat.	Section 9.8
◗ *Ameliorative Measures*: measures for minimising impacts on fish and fish habitat; nature of rehabilitation or environmentally compensatory works, describe ongoing management actions both during construction and after completion and detail monitoring programs including methodologies that assess before and after.	Section 9.9
◗ Identification of threatened species likely to occur in the area or be affected by the proposal.	Section 9.4.2
◗ How damage to marine vegetation and other fish habitats would be minimised.	Section 4.7.9

Requirements	Addressed
◗ Whether dredging, reclamation or activities that obstruct fish passage are proposed and if so, how impacts would be minimised.	Section 4.5
◗ The EIS would need to address the degree to which the creek would be impacted by the construction of access roads and details of locations and construction methods of such roads.	Sections 4.4 and 4.8
◗ As the Proposal involves clearing of a considerable area of land, the EIS would need to address methods to be employed to contain sediment, nutrients, and other materials associated with the works and prevent them affecting Bowra Creek.	Sections 4.4 and 8.4 and 8.5
◗ As Nambucca River contains important habitat for many species with commercial and recreational values, the EIS must address methods used to minimise disturbance and impacts to fish habitat within lower Bowra Creek and the Nambucca River.	Sections 9.8 and 9.9
◗ As the proposal involves pipeline infrastructure crossing Bowra Creek, the EIS would need to address methods for minimising harm to riparian vegetation and aquatic habitat associated with any crossing and detail dredge and reclamation works within the water land of Bowra Creek as defined by the *Fisheries Management Act 1994*.	Section 8.4.3
◗ The EIS would need to address the extent to which fish passage is impacted upon by the construction of the pipeline crossing and design methods for constructing crossings and strategies for ensuring ongoing fish passage.	Section 8.4.2 and 8.5
◗ The EIS would need to address the extent to which fish passage is impacted upon by the construction of the storage embankment including opportunities for works providing connectivity between the storage and Bowra Creek.	Section 9.6.1
◗ Strategies for managing water quality including temperature and timing of releases to ensure suitable conditions are met and timing of flows matches natural conditions.	Section 4.7
◗ Management of flow in the river would need to be addressed by the EIS for fish passage and prevention of salt intrusions in times of low flow.	Section 4.7, 10.3.2, 10.4
◗ Address adaptive flow management strategies that would respond to morphological changes within the river system.	Section 4.7.9
◗ Opportunities for compensatory actions to replace habitat loss as a result of the proposed works would need to be addressed by the EIS, these may include rehabilitation works to riparian zones.	Section 9.9

Requirements	Addressed
Department of Environment and Climate Change (DECC) (now DECCW)	
Comments were provided on the 1 December 2008 and comments are summarised below:	
◗ A number of residential dwellings are located in close proximity to the proposed site and these dwellings may be subject to unacceptable impacts particularly relating to noise and dust if not managed.	Sections 7.3, 7.4, 12.3, and 12.4
◗ The EIS would need to clearly demonstrate how to manage threatened fauna and key habitat to ensure there are no unacceptable impacts.	Section 9.9
◗ DECCW notes the existence of 16-registered Aboriginal sites in the immediate locality. The EIS would need to consider any potential impacts on the traditional aboriginal custodians and any relationship that may exist between these sites and any aboriginal cultural values.	Sections 13.3 and 13.4
◗ The EIS would also address the development in relation to the requirements of Section 5A of the *EP&A Act*, and determine whether a permit to disturb Aboriginal objects under Part 6 s 87 or whether a licence to destroy, deface or damage Aboriginal objects maybe required under Part 6 s90 of the *National Parks and Wildlife Act*.	Sections 13.3 and 13.4
◗ If the proposed development is to extract greater than 30, 000 tonnes per annum of material for reuse on the site than the operation would be scheduled under the *Protection of the Environment Operations Act* (1997).	Section 6.3.6

Requirements	Addressed
General Requirements: DECCW attached key information requirements for the EIS including but not limited to the following:	Executive Summary
◗ *Executive Summary*: including a brief discussion of the extent to which the proposal achieves identified environmental outcomes	Section 4
◗ *The Proposal*: including objectives of the proposal and location and description of the proposal.	Part D
◗ *The Environmental Issues*; baseline conditions, assess impacts and describe management and mitigation measures.	Section 7
◗ *Air*: baseline conditions, assess impacts and describe management and mitigation measures.	Section 12
◗ *Noise and Vibration*: a Noise Impact Assessment (NIA) for the proposal must be conducted by a qualified acoustics consultant, baseline conditions, assess impacts and describe management and mitigation measures.	Sections 10 and 11
◗ *Water*: baseline conditions, assess impacts and describe management and mitigation measures.	Section 8
◗ *Soils and Contamination*: baseline conditions, assess impacts and describe management and mitigation measures	Sections 10 and 11 Section 9.8
◗ *Water and Chemicals*: baseline conditions, assess impacts and describe management and mitigation measures.	Section 9.2
◗ *Flora and Fauna Impacts*: description of vegetation and fauna surveyed, plan showing distributions, statement about the degree of conformance with DECCW guidelines, assess impacts and describe management and mitigation measures.	Section 13
◗ *Surveys and Assessments*: would be undertaken and include dates site location, deign and methodology.	Section 10
◗ *Aboriginal Cultural Heritage*: the EIS would address and document information requirements set out in DECCW guidelines, include surveys by suitably qualified architects, identify nature and extent of impacts, significance of the sites, actions to mitigate impacts and demonstrate the effective communication with Aboriginal communities.	Section 4.7.9 and 10.3.2
◗ *Estuary health*: needs to be considered including implications of altered freshwater flow requirements on extensive aquatic beds and implications of changed flow requirements on salinity patterns and levels.	Section 10.3.4 and 22
◗ *Climate Change*: intensifications of droughts and sea level rise projections and implications on surface ground water interaction and estuary ecology.	Section 8.4.2
◗ *Riparian land management*: Nambucca EMP has identified as a high priority to improve riverbank condition. The proposal would need identify how riparian land is to be managed.	

Requirements	Addressed
◗ *DECCW Estate*: an assessment on the impacts of development on DECCW estate, if necessary.	Section 21.2
◗ *Matters of National Significance*: if any matters under NES may be affected, approval for the developed may be required from Environment Australia.	Section 6.4.1 and 9.8.6
◗ *DECCW Databases*: DECCW can provide services of flora and fauna and searches in AHIMS.	Section 13.2
◗ *Cumulative Impacts*: identify the extent of the receiving environment, impacts of the proposal against long-term air noise and water quality objectives and identify infrastructure requirements.	Section 23
◗ *Greenhouse Emissions*: comprehensive assessment of predicted greenhouse gas emissions, tonnes per unit, total annual emissions and direct and indirect emissions.	Section 22
◗ *List of approvals and licences:* identify all approvals and licences required.	Section 6.8 and 24
◗ *Compilation of mitigation measures*: outline how the proposal and its environmental measures would be implemented and managed and mitigation strategies.	Section 4 and 24
◗ *Justification for the Proposal*: reasons which justify undertaking the proposal.	Section 25

Requirements	Addressed
NSW Health Department: North Coast Area Health Service (NCAHS)	
Comments were provided on the 27 April 2009 and comments are summarised below:	
Australian Drinking Water Guidelines (ADWG)	
NSW Health supports the use of a multidisciplinary risk based framework approach to drinking water management. Guidelines are found in Chapter 3 of the ADWG.	Section 11.2.1
A water quality policy must address all elements of the framework including:	
◗ Undertaking a comprehensive risk assessment of the water supply system.	Sections 10, 11, and 18
◗ The design of the system to apply multiple barriers against contamination of the water supplied to consumers.	Section 4.7
◗ Comprehensive water quality monitoring plan.	Section 4.7.9
◗ Protocol for responding to incidents that threatens (or could threaten) water quality, public health or safety.	Section 4.7
◗ Means to investigate and manage complaints of water quality.	Section 4.7 and 4.7.9
◗ Plan to provide reports of water quality to consumers	Section 4.7
◗ Process for monitoring and auditing implementation of the Framework	Section 4.7.9
Recreational and Agricultural Considerations:	
◗ Public access for recreational use would be prohibited to ensure high water quality	Section 19.3 and 19.4
◗ Livestock would be prohibited from in and around the storage area to ensure no risk of contamination.	Section 21.3
Public Health Act	
◗ EIS would need to consider the NSW Drinking Water Monitoring Program	Section 6.3.13
◗ Results need to reported to the NSW Health via internet based NSW Health Drinking Water Database.	Section 4.7

5.3.5 Targeted Stakeholder Consultation

In addition to the formal statutory consultation, GHD consulted the following organisations:

- Telstra
- Country Energy
- Nambucca National Parks and Wildlife Association (Three Valleys Branch)
- Nature Conservation NSC

A summary of the comments received are summarised in Table 5-2. Full responses are contained in Appendix A.

Table 5-2 Targeted Stakeholder Consultation

Requirements	Addressed
Telstra	NA
No response received to date	
Country Energy	
Existing Pump Station – Power Supplies	
◗ A single 11kV overhead distributor feeds the existing pole mounted substation (500kVA) supplying the existing Bowraville Water Headworks (#31983), also supplying 3 (estimated) borefield pumps on the north side of the Nambucca River;	Section 20.2.1
◗ The distributor also supplies 3 (estimated) borefield pumps on the south side of the river via a separate pole-mounted substation (300kVA);	
◗ A third pole-mounted substation (50kVA) supplies 2 (estimated) borefield pumps also south of the river.	
Existing Pump Station – Power Quality	
◗ Country Energy have experienced voltage dips in the Bowraville area that are attributed to the existing headworks and borefield pump starting operations;	
◗ NOTE: Voltage regulators are being added to the existing 11kV distributors in order to improve power quality in the area, stabilising voltage levels.	
◗ The headworks pumps (200kW each) had soft starters added in 2004, while the existing borefield pumps (approx 30kW each) are believed to be direct on-line (DOL) starting;	
◗ NOTE: The headworks were upgraded in 1985;	
◗ Future pump upgrades would be assessed by Country Energy against it's Supply Standard, to ensure requirements to do with the number and frequency of voltage dips as well as other power quality issues are satisfied.	
Options for Additional Power Supply	
◗ Utilise available spare capacity on existing 11kV powerlines (limited to 900kVA for all consumers);	Sections 4.4.7, 20.3.1 and 20.3.2
◗ Overbuild existing 11kV feeders with a second supply (approximately 9km to Newee Ck [or South Macksville?] Substation);	
◗ Install a new dedicated feeder from Nambucca Substation (approximately 14km away);	
◗ NOTE: Pumping operation during periods of low community power demand this needs to be considered further – for enhanced medium to long term economic benefit	
◗ Options for rationalising revenue metering also require addressing (i.e. concentrating borefield pumps where possible). At present there are four separate electricity accounts of differing sizes and tariffs.	
Powerline & Substation Costs	
◗ Typical costs for powerlines:	Noted
◗ Upgrading existing 11kV lines - $100K per km;	
– Installing new 11kV lines - $150K to $200K per km depending on terrain (excluding easement acquisition costs)	
– Typical costs for new substations (excluding connection etc):	

Requirements	Addressed
– 63kVA pole-mounted – $40K each; – 250 to 500kVA pole-mounted – $80K each; – 1.5MVA pad-mounted – $240K each; Apportioned cost may be 100% to NSC as the primary user for any powerline upgrade; however this may be shared if other potential users identified (i.e. new subdivisions, new commercial demand [*supermarkets?*], etc.);	
Country Energy EIS is required for any new powerline or for changes to existing powerline (i.e. overbuild – *height change*) – 18 months is required for the EIS process before any planned start to powerline upgrades;	
NSC EIS for the water supply upgrade would be completed in 2009;	Noted
NSC EIS needs to consider the visual and other impact of power distribution at the different sites and particularly on the borefield (i.e. overhead or underground distributors, pole-mounted substations and electrical panels or pad-mounted subs and panels mounted on 'camouflaged' concrete block foundations, with electrical equipment 300mm above the 100yr flood level);	Section 16.3
Extent of borefield area also needs to be considered by NSC EIS (i.e. comparing scattered pumps over a wide area or denser concentration of pumps in smaller area);	Section 4.4
There would be some overlap between aspects of the NSC and Country Energy EISs;	
NOTE: The 415V aerial powerlines that supply individual borefield pumps at present are NSC owned. They share the use of the poles at present with the Country Energy 11kV overhead powerline above them.	Section 4.10, 16.3, 20.3.1, 20.3.2, 21.3.2
Nambucca National Parks and Wildlife Association (Three Valleys Branch)	NA
No response received to date	
Nambucca Valley Conservation Association Inc	
Fundamentally opposed to the construction of a dam and considers that growth management, water demand management, water recycling and rain and stormwater harvesting would be undertaken by NSC as a matter of urgency, in order to secure town water supply for existing and future residents, businesses and industry in the Shire.	Section 2.3
NSC would work with State Government to improve condition of Nambucca catchment.	Section 2.1
Concerned with ecologically sustainability issues regarding the proposed 5,500 ML dam at the headwaters of Bowra Creek.	Section 8,9, 10 and 11
Following points are made in regard to the preparation of EIS for the Proposal:	
◗ NVCA's primary concern is that of the impacts of extraction required, to fill and maintain dam levels, upon surface flows, aquatic and riparian flora and fauna, overall river ecology health and upstream water users.	Sections 9, 10 and 11
◗ Do not support proposal to extract from the borefield into low flows i.e. down to 90th percentile (or beyond), to fill and maintain levels in the dam. Extraction would only occur in medium and high flow events.	Section 10
◗ Greenhouse gas emissions , power requirements and costs would be considered not only for all stages of construction of the dam and all associated infrastructure, but also the operation and management of the dam and all associated infrastructure, including a filtration plant.	Section 22.3

Requirements	Addressed
◗ EIS to consider compensatory habitat for any threatened species identified to exist on the site and within the locality including large forest owls, microbats and koalas.	Section 9.9
◗ Survey work for fauna must be undertaken in appropriate seasons for any specific species.	Sections 9.5 and 9.6
◗ Water quality issues including thermal pollution must be addressed with regard to transparent flow releases proposed for Bowra Creek.	Section 14.7.9 and 11

5.4 Draft Integrated Water Cycle Management (IWCM) Strategy Consultation

NSC has recently initiated and exhibited a Draft IWCM Strategy for the LGA to holistically review and evaluate how the urban water cycle in Nambucca Shire could be improved. The draft strategy is to be used to demonstrate that improved management of the 'urban footprint' can help achieve NSC's strategic business objectives, State resource policy objectives and community expectations for natural resource management. Importantly, the draft IWCM Strategy is:

- Driven by the local community and has whole of government support;
- Holistic and comprehensive;
- Long term in its horizon, (30 years), but would be reviewed every 6 years;
- Flexible to accommodate future uncertainties; and
- Economically, environmentally and socially responsible.

A copy of the draft IWCM Strategy is available on NSC's website. The Proposal is an integral component of the draft IWCM Strategy in securing a sustainable water supply to provide drought security, meet population growth and legislative and best practice standards.

The draft IWCM Strategy was on public exhibition from 12 June to 24 July 2009, to give the community an opportunity to provide feedback. Feedback forms were included with recent water rate notices, which were sent to approximately 8000 property owners. Two information sessions were also held on 22 July 2009.

The community feedback period closed on 7 August 2009, with 71 completed feedback forms received.

From the feedback, 73% of the respondent said that the IWCM Strategy was very important, with 81% of the respondents paying both water and sewerage rates.

Community feedback was generally positive with key concerns about the cost of the Proposal, environmental impacts, and continual rate rises by NSC over the past years.

Where respondents did not support the Proposal, alternatives were suggested such as harvesting rain and storm water.

5.5 Aboriginal Consultation

The Proposal is located within the boundaries and area of custodial interest of the Bowraville Local Aboriginal Land NSC (BLALC). Consultation with the BLALC for the Proposal has been on-going since 2004 to date. A summary of the consultation undertaken is provided below.

5.5.1 Consultation Process

2004 Consultation

Gorman (2004) consulted with local Aboriginal community and documented information that was told to her by members of the Aboriginal community. Consultation conducted in the context of the 2004 heritage study included initial phone contact with Ms Carol Maher of the NSC Aboriginal Community Advisory Committee. The BLALC was then contacted by phone and fax and the Proposal was discussed with BLALC co-ordinator, Mr Brian Flanders.

Mr Flanders organised for a male and female Sites Officer to participate in the field surveys for the Water Supply Proposal. Subsequently Mr Fred Walker and Ms Dianne Jarrett joined the archaeologists in the field in November, 2004.

An informal meeting was held at the Bowraville LALC office in Bowraville on November 8, 2004, to discuss the Proposal and the survey results. In attendance were Kerry Navin and Kelvin Officer (archaeologists) and the following local community representatives including, Martin Ballangarry (NSCIor with Nambucca NSC); Wayne Buchanan (representing his father, community elder Mr Warren Buchanan); Brian Flanders (BLALC); Darrell Flanders (BLALC); Diana Jarrett (BLALC); Larry Kelly (Nambucca Heads LALC); Fred Walker (BLALC) and Bernadette Wilkes (community elder).

BLALC co-ordinator, Brian Flanders, was contacted five weeks later. Brian indicated that the Proposal had been tabled at a BLALC meeting by Mr Fred Walker (one of the sites officers who participated in the field survey). The community discussed the Proposal and indicated that they had no major concerns with the Proposal.

The representatives were invited to provide the consultants with any information that they believed was pertinent to the Proposal, particularly the identification of any areas or landscape features that may be of significance to the local community. The representatives were also asked to consider and discuss the water supply Proposal amongst the wider community for a few weeks and to provide the consultants with any relevant feedback.

Aboriginal Liaison Committee (ALC)

An *Aboriginal Liaison Committee* (ALC) was set up in 2007 by the NSW Department of Commerce – Project Management (DoC) to facilitate and encourage participation of the local Aboriginal community in the design and construction of the Nambucca District Water Supply Proposal. At the time DoC notified all stakeholders known to NSC. To date nine meetings have been held between 20 November 2007 and 4 August 2009.

In addition to the establishment of the ALC and to comply with DECCW Consultation guidelines, a newspaper advertisement was placed in the Guardian News and Coffs Coast Advocate on 2 and 22 April 2009 respectively to alert aboriginal stakeholders to the Proposal and to invite

registrations of interest. No additional stakeholders other than those who participated in the ALC came forward.

'Walk-through'

In December 2007, Nambucca NSC and the DoC conducted a 'walk-through' of the Nambucca borefields with Aboriginal community elders. This walk-through identified and mapped three areas of significance to the local Aboriginal community in the borefields investigation areas (pers comm Tim Alexander [DoC] 2008).

A mythological site was identified by the representatives during the walkover and a previously identified burial ground was also identified as a corroboree area. A record of the walkthrough, its findings and a map of identified places was prepared.

The BLALC was contacted in relation to the current survey and a representative was invited to participate in the fieldwork. Community elder, Mr Kevin Ballangarry, subsequently joined the archaeologists in the field survey.

Most Recent Consultation/ Field Work

Fieldwork was undertaken by Navin Officer Archaeologists Nicola Hayes and Deirdre Lewis-Cook, accompanied by Mr Kevin Ballangarry of the BLALC in December 2008. Field survey was undertaken (on foot) of the access road corridor, five pipeline options and five borefield location options. In areas of very poor ground surface visibility the general vicinity was viewed and an assessment of archaeological sensitivity was made for the area

5.5.2 Aboriginal Consultation Comments

Comments were provided during the above consultation sessions are summarised below:

Partnership

- There was general consensus that the proposed storage needs to go ahead in partnership with the local Aboriginal community.
  - Establishing protocols with the community regarding consultation about the Proposal;
  - Possible employment opportunities for local community people, particularly young men – this is considered to be an important goal for the community;
  - Monitoring of ground surface disturbance from start to finish because there have been problems in the past where subcontractors have damaged sites without knowledgeable people being present;
  - Consideration of using an Aboriginal name for the lake which would be impounded behind the storage;
  - Concerns for river safety - children use the river and therefore pump stations (and other works near the river) must be safe;
  - An area referred to as 'The Rocks' burial ground near the Nambucca River was identified as being of particular importance to the local community.

General Issues

- General concern for the health of the Nambucca River – locals have noticed changes to the river over time, including the presence of more gravels in the river bed;
- Discussion about the need for a NSC-wide Heritage Study;
- Agreement that the Gumbaingirri people need to get their heritage sites recorded and protected within the tribal area, not just in Shire NSC areas;
- General concern for the protection of Aboriginal cultural heritage sites, with comment that that there were still many Aboriginal sites that remained unrecorded and/or unprotected in the Shire;
- A comment that spear fishing is still very important up and down the Nambucca River; and
- Information that some elders came from the Yellow Rock area to the Bowra area.

5.6 Next Steps

Community consultation is an important part of the Proposal. The consultation process implemented so far has kept stakeholders and the community informed during the early Proposal development and the preparation of the concept design and Environmental Impact Statement. The process has enabled stakeholders to comment and the Proposal team to identify key issues to be addressed.

Community engagement activities for the next stages of the process and the exhibition period would include the following:

- The third issue of the community newsletter would be distributed once results from the EIS and concept design investigations are known;
- Communications with affected landowners would be ongoing throughout the final EIS and concept design investigations in late 2009;
- The next landowner information session would be held in late 2009 to update landowners on the findings of the investigations undertaken as part of the EIS and concept design studies;
- The EIS and draft concept design are due to be exhibited in October 2009 where the community would again be invited to provide feedback;
- Once the community's feedback has been reviewed and considered, the detailed concept design would be reviewed; and
- Opportunities would be provided for affected landowners and other stakeholders to provide a high level of awareness of all processes and activities associated with the construction.

5.7 Public Exhibition of EIS

The public exhibition of the EIS would conform to the requirements of Section 113 of the Environmental Planning and Assessment Act, 1979 as follows:

- EIS would be placed on public exhibition for a period of 30 days;

- Copies of the EIS would be available at NSC offices, NSC libraries at Macksville (41 Princess Street) and Nambucca Heads (23 Ridge Street) and on NSC website (www.nambucca.nsw.gov.au); and
- Any person may, within that period, make submissions in writing to NSC with respect to the Proposal to which the EIS relates.

Part D Environmental Assessment

6 Regulatory and Strategic Context

6.1 NSW Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) forms the statutory framework for planning approval and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local NSCs. The EP&A Act contains three parts, which set out requirements for planning approval:

- Part 3A provides for control of 'major development' or other projects that require project approval or other approval from the Minister for Planning;
- Part 4 provides for control of 'local development' that requires development consent from the local NSC; and
- Part 5 provides for control of activities that do not require development consent or approval of the Minister for Planning.

The EP&A Act is supplemented by a number of environmental planning instruments (EPIs), namely State Environmental Planning Policies (SEPPs), Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs). The relevant EPIs relevant to this Proposal are discussed below.

6.1.1 Confirmation of Part 5 Activity

State Environmental Planning Policy (Infrastructure) 2007 (SEPP Infrastructure) came into force on 1 January 2008 and applies to the State. Under Clause 125(2) of the SEPP Infrastructure, the Proposal is permissible without the need for development consent (refer to Section 5.2.1). As the Proposal does not fall into any of the development categories listed within SEPP (Major Development) 2005, the Proposal would be an 'activity' as defined by the provisions of Part 5 of the EP&A Act.

Section 111 of the EP&A Act identifies the duty of determining authorities in considering the environmental impacts of an activity. In addition, Section 112 requires the determining authority to consider whether the proposal is 'likely to significantly affect the environment' (including critical habitat), threatened species, populations, ecological communities, or their habitats. If a proposal is 'likely to significantly affect the environment' then an EIS would be required. A species impact statement (SIS) may also be required where there is a significant impact on a threatened species or endangered ecological community. NSC has considered the likely impact of the Proposal and has concluded that the Proposal has the potential to have a significant effect on the environment and as such has determined that an EIS is required for the activity.

Whilst the Minister for Planning declared on 29 July 2005, pursuant to Section 75B(1) of EP&A Act, that Part 3A of the EP&A Act applies to projects for which the proponent is also the determining authority and where the proponent has deemed that an EIS is required under Part 5, these provisions do not apply to local NSCs.

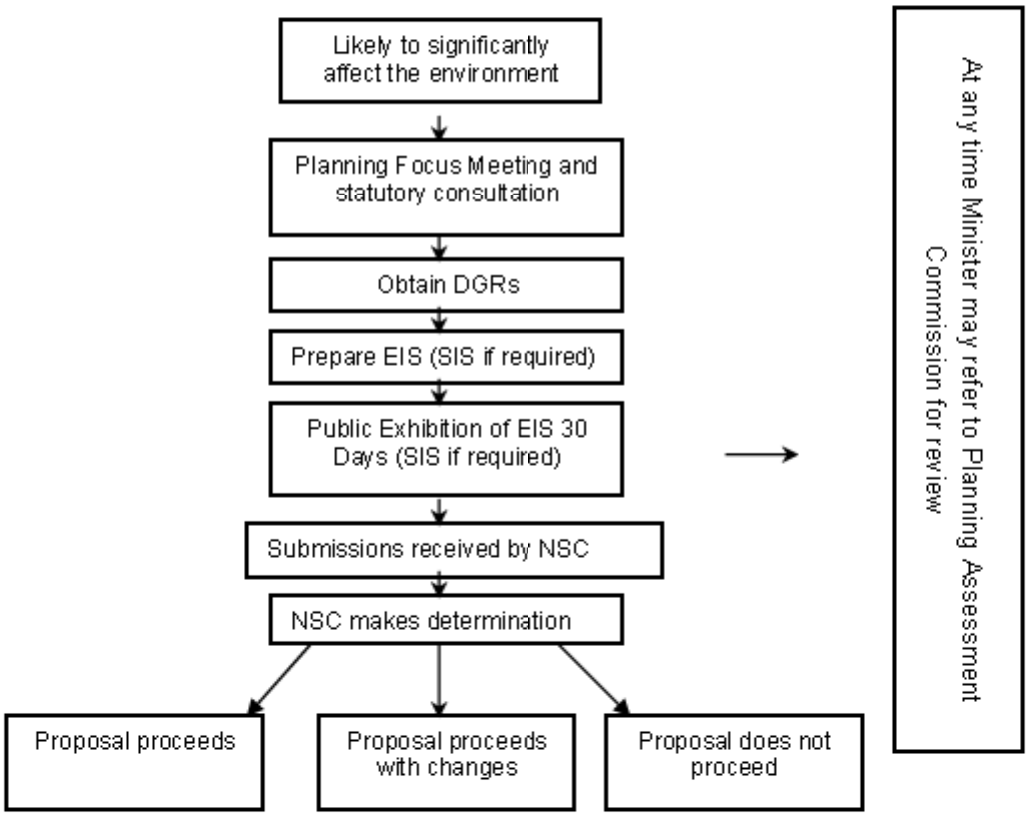
6.1.2 Determining Authority

NSC is the proponent for the activity and also a determining authority in accordance with Section 110A of the EP&A Act. Other determining authorities would be those public authorities whose approval is required to enable the activity to be undertaken (refer to Section 5.8).

In accordance with Clause 231 of the EP&A Regulation, the Director General has issued requirements (dated 6 May 2008) concerning the content of the EIS, a copy of which is in Appendix A, which have been used in the preparation of this document. NSC, as the determining authority, must publish the EIS, invite public comments on the EIS, consider those comments and provide the Director-General with a copy of the public comments.

This EIS has been prepared to fulfil the requirements of the EP&A Act (with particular reference to Clause 230 of the EP&A Regulation) and the requirements of the Director-General of the Department of Planning. Figure 6-1 illustrates the decision making process for the EIS.

Figure 6-1 Decision Making Process



6.2 Environmental Planning Instruments

6.2.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 came into force on 1 January 2008 and applies to the state. The aim of the SEPP is to facilitate the effective delivery of infrastructure across the State by, among other things, improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services.

Under Clause 125 of SEPP Infrastructure, for the Proposal to be permissible without the need for development consent it must comply with the provisions of sub-clause 2. Clause 125 (2) states:

> *(2) Development for the purpose of water storage facilities, including development for any of the following purposes, 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:*
>
> *(a) catchment management works,*
>
> *(b) public recreational facilities associated with a water storage facility.*

Further to Clause 125(2), Clause 125(5) states:

> *(5) In this Division, a reference to development for the purpose of a water supply system of any kind includes a reference to development for any of the following purposes if the development is in connection with the water supply system:*
>
> *(a) dams, reservoirs, weirs, levees, spillways and fishways,*
>
> *(b) catchment management works,*
>
> *(c) groundwater investigation works, groundwater bore stations, borefields, minewater works and the like,*
>
> *(d) access ways,*
>
> *(e) water intakes, pumping stations, pipelines, channels, tunnels, canals and aqueducts,*
>
> *(f) gauging and monitoring equipment,*
>
> *(g) power supply to the water supply system,*
>
> *(h) hydro-electric power generation equipment and associated connections to the electricity network,*
>
> *(i) construction works,*
>
> *(j) emergency works and routine maintenance works,*
>
> *(k) environmental management works.*

Pursuant to Clause 125(2), the Proposal is considered to comprise a water storage facility as it would consist of an off-river storage, spillway, pumping stations, pipelines, and power supply. Those parts of the Proposal which fall within the 1(a1) Rural, 1(a2) Rural (Prime/Flooding) and 1(a4) Rural (Lower Water Catchment) zones under Nambucca Local Environmental Plan (Nambucca LEP) 1995 are considered to be equivalent land use zones to those referred to in Clause 125(2) and as such development consent would not be required.

However as part of the proposed off-river storage would be located within the 1(f) Rural (Forestry) zone, and this zone is not considered to be an equivalent land use zone, Clause 125(2) could not be applied to that part of the off-river storage within the 1(f) Rural (Forestry) zone and therefore development consent would be required for that part pursuant to the Nambucca LEP. The implications of the need for development consent pursuant to the Nambucca LEP are discussed in Section 5.2.3.

State Environmental Planning Policy (Major Development) 2005

The *State Environmental Planning Policy (Major Development)* (the Major Development SEPP) identifies what constitutes a major project under Part 3A of the EP&A Act. Major developments require the approval of the NSW Minister for Planning.

Clause 6 of the Major Development SEPP defines Part 3A projects:

> *'(1) Development that, in the opinion of the Minister, is development of a kind:*
>
> *(a) that is described in Schedule 1 or 2, or*
>
> *(b) that is described in Schedule 3 as a project to which Part 3A of the Act applies, or*
>
> *(c) to the extent that it is not otherwise described in Schedules 1–3, that is described in Schedule 5,*
>
> *is declared to be a project to which Part 3A of the Act applies.'*

The Major Development SEPP does not list a project similar to the Proposal as being a project to which Part 3A of the EP&A Act applies.

State Environmental Planning Policy No 14 –Coastal Wetlands

The aim of this policy is to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State. The proposed works would not directly affect any SEPP 14 wetlands. However, the EIS considers the affect of flows downstream of the proposed storage and borefield and several SEPP 14 wetlands, which occur downstream (see Chapter 9).

State Environmental Planning Policy No 44—Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas in order to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

SEPP 44 applies to local government areas listed in Schedule 1. Nambucca LGA is included in Schedule 1; therefore consideration of the potential application of SEPP 44 is required. SEPP

44 technically only applies to development applications but the intent of the SEPP has been considered in preparing this EIS.

The only koala habitat affected by the Proposal is within the proposed inundation area, which contains a variety of preferred Koala food trees (e.g. Grey Gum, Flooded Gum, Blackbutt and Tallowwood). This habitat however is not considered core Koala habitat, because the one listed feed tree species (Tallowwood) does not occur in densities within the study area greater than 15 %, therefore the study area is only considered potential Koala habitat. No evidence of Koala activity (scats and scratches) was noted during the site inspection, but one male Koala was heard during a nocturnal survey. Due to their complex social hierarchy, territorial behaviour and the disturbed condition of the site, the sole male Koala recorded may have a large home range that extends beyond the inundation area, thus inferring that a low population density is probable.

It is considered unlikely that the proposed inundation area constitutes habitat critical for the maintenance of a local population of the Koala due to an expanse of native vegetation in adjacent forested lands that is of greater habitat value.

State Environmental Planning Policy No 55 – Remediation of Land

The aims and objectives of *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) are to provide a state-wide planning approach to potentially contaminated land. It also promotes the remediation of contaminated land to reduce the risk of harm.

SEPP 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. The SEPP applies to the whole of the State.

Clause 7(1) of SEPP 55 requires that contamination and remediation of land be considered by a consent authority in determining a development application.

As the Proposal is subject to Part 5 of the EP&A Act, the provisions of Clause 7 do not apply. However, the principles of the SEPP have been considered, and details on potential contamination issues are discussed in Chapter 8.

State Environmental Planning Policy (Repeal of REP Provisions) 2009

State Environmental Planning Policy (Repeal of REP Provisions) 2009 (the SEPP) has been prepared in order to remove a number of REPs from the planning system before all current REPs are deemed to be SEPPs.

6.2.2 Regional Environmental Plans

North Coast Regional Environmental Plan 1988

As of 1 July 2009, regional environmental plans (REPs) are no longer part of the hierarchy of environmental planning instruments in NSW. The North Coast Regional Environmental Plan (NCREP) is now deemed to be a SEPP under the new Division 2, Part 3 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

NCREP establishes a regional framework for the development of the NSW North Coast Region. The relevant provisions of the NCREP in relation to the Proposal are Clauses 12 and 15. Whilst

these provisions apply to development requiring consent, the intent of the provisions have been considered below.

Clause 12 of NCREP relates to impact of development on agricultural activities and states:

> *The NSC shall not consent to an application to carry out development on rural land unless it has first considered the likely impact of the proposed development on the use of adjoining or adjacent agricultural land and whether or not the development would cause a loss of prime crop or pasture land.*

The Proposal would result in the inundation of 13.55 ha of pasture land. This land is currently used for cropping purposes but has not been identified as regionally significant farmland (see Section 5.6.3). Given that a significant portion of the Nambucca Valley is available for agricultural purposes, the loss of 13.55 ha of pasture land is not considered to have a significant impact upon the local economy. In addition to the loss of pasture land, approximately 26.99 ha of hardwood plantation, part of the Viewmont State Forest would be lost from timber production in the region. As Viewmont State Forest covers an area of 1,000 hectares, the loss of 26.99 ha for a critical water supply project is not considered to have a significant impact upon the local economy.

Clause 15 of NCREP relates to wetlands or fishery habitats and states:

> *The NSC shall not consent to an application to carry out development for any purpose within, adjoining or upstream of a river or stream, coastal or inland wetland or fishery habitat area or within the drainage catchment of a river or stream, coastal or inland wetland or fishery habitat area unless it has considered the following matters:*
>
> *(a) the need to maintain or improve the quality or quantity of flows of water to the wetland or habitat,*
>
> *(b) the need to conserve the existing amateur and commercial fisheries,*
>
> *(c) any loss of habitat which would or is likely to be caused by the carrying out of the development,*
>
> *(d) whether an adequate public foreshore reserve is available and whether there is adequate public access to that reserve,*
>
> *(e) whether the development would result in pollution of the wetland or estuary and any measures to eliminate pollution,*
>
> *(f) the proximity of aquatic reserves dedicated under the Fisheries Management Act 1994 and the effect the development would have on these reserves,*
>
> *(g) whether the watercourse is an area of protected land as defined in section 21AB of the Soil Conservation Act 1938 and any measures to prevent soil erosion,*
>
> *(h) the need to ensure that native vegetation surrounding the wetland or fishery habitat area is conserved, and*
>
> *(i) the recommendations of any environmental audit or water quality study prepared by the Department of Water Resources or the Environment Protection Authority and relating to the river, stream, wetland, area or catchment.*

In designing the Proposal, consideration has been given to the potential impacts on water quality, fisheries habitat, downstream wetlands and estuaries and protected land. The Proposal is not expected to impact water quality, fisheries habitat, downstream wetlands and estuaries or protected land provided the identified mitigation measures are adopted as part of the Proposal.

The Proposal is therefore consistent with the relevant provisions of the NCREP.

6.2.3 Local Environmental Plans

Nambucca Local Environmental Plan 1995

The Proposal is located within the Nambucca Shire Local Government Area. The provisions of the *Nambucca Local Environment Plan 1995* (the Nambucca LEP) apply to the area in which the Proposal is located. The consent authority for the purposes of the Nambucca LEP is NSC. The Proposal falls under three separate definitions of public utility undertakings, utility installations and dams under the Nambucca LEP.

Public utility undertakings are defined by the LEP as follows:

> ***public utility undertaking*** *'means any undertaking carried out or carried on by, or under the authority of, any government department or in pursuance of any Commonwealth or State Act, for the purpose of:*
>
> *(a) railway, road, water or air transport, or wharf or river undertakings, or*
>
> *(b) the provision of sewerage or drainage services, or*
>
> *(c) the supply of water, hydraulic power, electricity or gas, or*
>
> *(d), (e) (Repealed)*
>
> *(f) fire fighting facilities, or*
>
> *(g) paramedical facilities, or*
>
> *(h) storing and collecting recyclable materials, where that undertaking does not occupy an area of more than 100 square metres,*
>
> *and a reference to a person carrying on a public utility undertaking includes a reference to a NSC, county NSC, government department, corporation, firm or authority carrying on the undertaking.'*

A utility installation is defined by the LEP as:

> ***utility installation*** *means a building or work used for a public utility undertaking.*

A dam is defined by the LEP as follows:

> ***dam*** *means a work designed for the containment of water by use of earthen embankments or embankments of other materials and includes an excavated storage licensed under Part 5 of the Water Act 1912.*

Whilst the definition for public utility undertaking covers the entire Proposal, the utility installation and dam definitions relate only to the headworks building and off-river storage respectively.

The Proposal including the off-river storage, pipelines, borefields, headworks and access roads would pass through land zoned:

- 1(f) Rural (Forestry);
- 1(a1) Rural;
- 1(a2) Rural (Prime/Flooding); and
- 1(a4) Rural (Lower Water Catchment).

The proposed off-river storage and access roads would be partly located within the 1(f) Rural (Forestry), 1 (a2) Rural (Prime/Flooding) and 1 (a4) Rural (Lower Water Catchment) zones, whilst the transfer and borefield pipelines and headworks are located within the 1(a1) Rural, 1(a2) Rural (Prime/Flooding) and 1(a4) Rural (Lower Water Catchment) zones.

The current zones are illustrated in Figure 6-2.

1 (f) Rural (Forestry)

According to the zoning provisions under the 1(f) Rural (Forestry) zone, public utility undertakings and roads are permissible without development consent, whilst dams are prohibited.

1 (a1) Rural

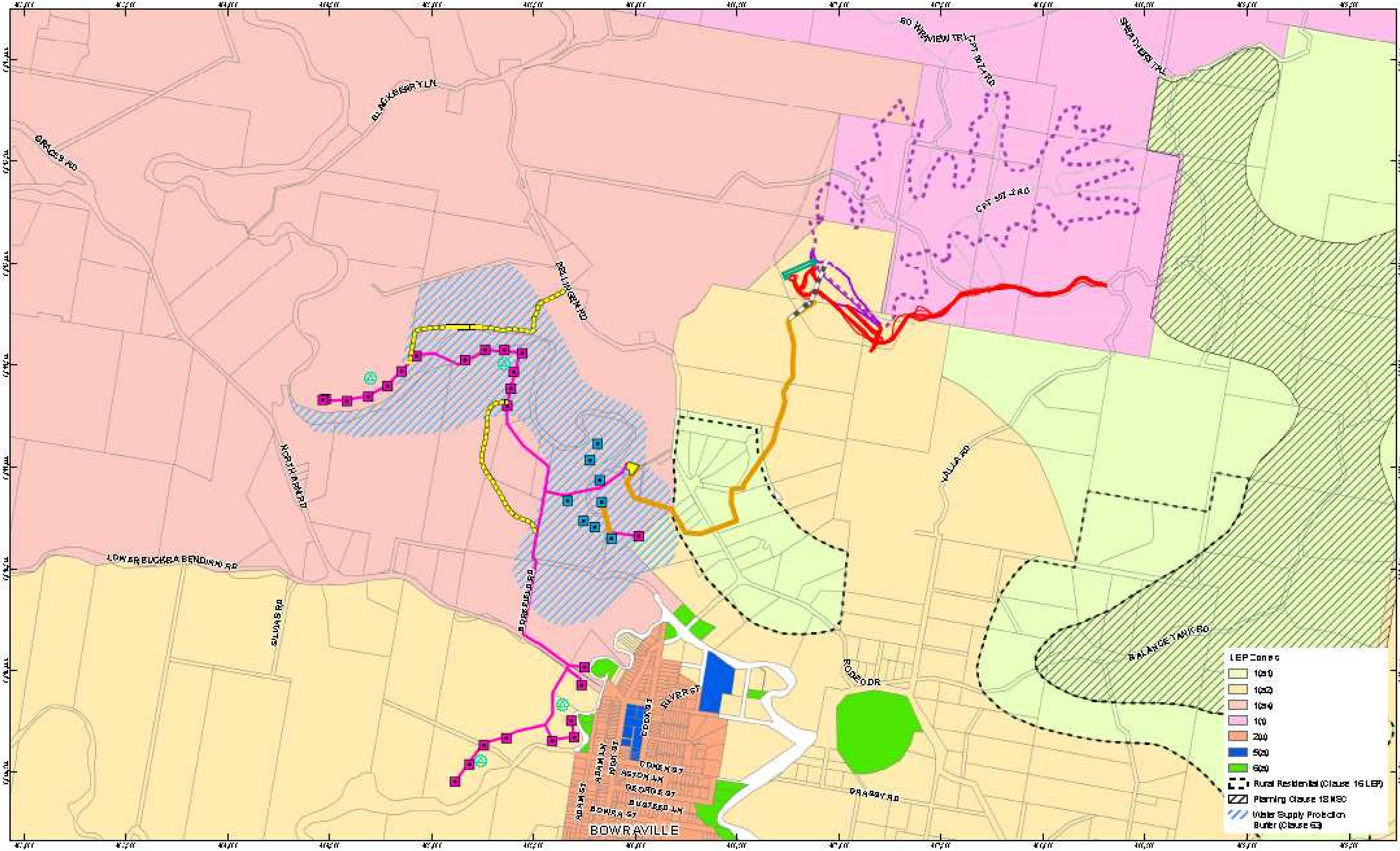
The proposed transfer pipeline would fall under the definition of public utility undertaking. According to the provisions under the 1(a1) Rural zone, public utility undertakings are permissible with development consent.

1 (a2) Rural (Prime/Flooding)

The proposed borefield pipelines, bores and associated power transformers at South Creek would fall under the definition of public utility undertakings. According to the provisions under the 1(a2) Rural (Prime/Flooding) zone public utility undertakings are permissible with development consent.

1 (a4) Rural (Lower Water Catchment)

The proposed borefield pipeline, bores and associated power transformers would fall under the definition of public utility undertakings, whilst the headworks building would fall under the definition of utility installation. According to the provisions under the 1(a4) Rural (Lower Water Catchment) zone, public utility undertakings are permissible with development consent, whilst utility installation are permissible without development consent.



1:17,000 (at A3)

0 85 170 340 510 680

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

LEGEND

- Fire Trail
- Cadastre
- Preliminary Road Design
- Outlet Pipe
- Spillway
- Proposed Borefield Collection Pipeline
- Proposed Pipeline Option 7
- Proposed Borefield Access Roads
- Existing Borefield Locations
- Proposed Borefield Locations
- Proposed Borefield Transformers
- Existing Headworks Area
- Proposed Storage Wall
- Proposed Inundation Area

CLIENTS | PEOPLE | PERFORMANCE

Nambucca Shire Council
Bowraville Off-River Storage

Job Number 22-14133
Revision A
Date 07 OCT 2009

Current LEP Zones

Figure 6-2

2/115 West High Street Coffs Harbour NSW 2450 T 61 2 6650 5600 F 61 2 6652 6021 E www.ghd.com.au

Data Source: Department of Lands: Cadastre, Aerial - 2007; Nambucca Shire Council: LEP - 2007; Created by: bruckley, hmoore

Development consent requirements

Pursuant to the provisions of Nambucca LEP, the proposed storage is prohibited within the 1(f) Forestry zone, whilst that part of the proposed storage, borefield and transfer pipelines within the 1(a1) Rural, 1(a2) Rural (Prime/Flooding) and partly 1(a4) Rural (Lower Water Catchment) zones require development consent. The Nambucca LEP adopts the *Environmental Planning and Assessment Model Provisions 1980* (EP&A MP)(with the exception of Clauses 4 (1), 15, 29, 30, 31, 33 and 34) via Clause 6 which removes the requirement for public authorities (such as NSC) to obtain development consent for certain public utility undertakings. It would be noted that the 1980 Model Provisions were repealed in 2005. However, clause 93 of Schedule 6 of the EP&A Act applies to save those provisions for the purposes of the Nambucca LEP.

Clause 35 of the EP&A MP states (in part) that:

> *"Nothing in the local environmental plan shall be construed as restricting or prohibiting or enabling the consent authority to restrict or prohibit:*
>
> *(a) the carrying out of development of any description specified in Schedule 1 ...'*

The Proposal has been assessed against the definitions contained in Item 2 in Schedule 1 which states:

> *'The carrying out by persons carrying on public utility undertakings, being water, sewerage, drainage, electricity or gas undertakings, of any of the following development, being development required for the purpose of their undertakings, that is to say:*
>
> *(a) development of any description at or below the surface of the ground,*
>
> *(c) the installation or erection of any plant or other structures or erections by way of addition to or replacement or extension of plant or structures or erections already installed or erected, including the installation in an electrical transmission line of substations, feeder-pillars or transformer housing, but not including the erection of overhead lines for the supply of electricity or pipes above the surface of the ground for the supply of water, or the installation of substations, feeder-pillars or transformer housings of stone, concrete or brickworks,*
>
> *(e) the erection of service reservoirs on land acquired or in process of being acquired for the purposes thereof before the appointed day, provided reasonable notice of the proposed erection is given to the NSC, or*
>
> *(f) any other development except:*
>
> *(i) the erection of buildings, the installation or erection of plant or other structures or erections and the reconstruction or alteration, so as materially to affect the design or external appearance thereof, of buildings, or*
>
> *(ii) the formation or alteration of any means of access to a road.'*

Pursuant to the above definition, the EP&A MP provides permissibility for that part of the off-river storage located within the 1(f) Forestry zone without development consent. As discussed in

Section 5.2.1, SEPP Infrastructure also acts to allow the remainder of the Proposal to be developed without the need for development consent.

Therefore development consent is not required and planning approval would be subject to the provisions of Part 5 of the EP&A Act.

6.3 NSW Legislation

6.3.1 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is administered by Department of Environment, Climate Change and Water (DECCW) and aims to "*provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations*".

Under the WM Act, a controlled activity approval is required for any of the following works:

- the erection of a building or the carrying out of a work (within the meaning of the EP&A Act), or
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- the carrying out of any other activity that affects the quantity or flow of water in a water source.

The Proposal constitutes a controlled activity as it would affect the quantity or flow of water in the Nambucca River. A controlled activity approval would therefore be required for the Proposal.

Under the Act, 31 statutory Water Sharing Plans have commenced. These plans cater for 80% of water extraction in NSW. In areas not covered by water sharing plans, licensing would continue under the *Water Act 1912* until plans are gazetted for these areas. The catchment within which the Proposal is to occur does not have a Water Sharing Plan in place. As such the licensing and approval provisions of the *Water Act 1912* apply.

6.3.2 Water Act 1912

The *Water Act 1912* is administered by the DECCW. The *Water Act 1912* is being progressively phased out and replaced by the *Water Management Act 2000* but some provisions are still in force. The relevant parts of the Act include Parts 2, 5 and 8. Pursuant to Part 2, Section 112, a licence would be required for the proposed borefield expansion as part of the Proposal. Section 112 states:

> *(1) The sinking of a bore shall not be commenced, nor shall a bore be enlarged, deepened, or altered unless:*
>
> *(a) in pursuance of a licence issued under this Part, or*
>
> *(b) the bore is to be sunk, enlarged, deepened, or altered by the Crown.*

Part 8 of the Act provides for flood control works. Section 165(A)(1)(d) states that a controlled work means:

> *'....any work, wherever situated or proposed to be constructed, that:*
>
> *(i) affects or is reasonably likely to affect the flow of water to or from a river or lake, and*
>
> *(ii) is used or is to be used for, or has the effect or likely effect of, preventing land from being flooded by water, and*
>
> *(iii) is declared by order of the Ministerial Corporation published in the Gazette to be a controlled work.'*

The Proposal would involve works that match the description in Section 165(A)(1)(d).

The licensing and approvals provisions of both the *Water Act 1912* and the *Water Management Act 2000* would continue to operate under the Water Act until it is phased out. Under the Water Act, a license would be required from DECCW for use, work and access for the off-river storage and new borefield.

6.3.3 Local Government Act 1993

The provisions of Section 60 of the *Local Government Act 1993* apply to the Proposal. Section 60 states:

> *A NSC must not, except in accordance with the approval of the Minister for Land and Water Conservation, do any of the following:*
>
> *(a) as to works of water supply—construct or extend a dam for the impounding or diversion of water for public use or any associated works,*
>
> *(b) as to water treatment works—construct or extend any such works,*
>
> *(c) as to sewage—provide for sewage from its area to be discharged, treated or supplied to any person,*
>
> *(d) as to flood retarding basins prescribed by the regulations—construct or extend any such basins.*

Approval of the Minister is required for the construction of the off-river storage together with any future water treatment plant.

6.3.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) is administered by the Department of Industry and Investment and its objectives are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

Pursuant to Section 200 of the FM Act a permit is required to undertake dredging and reclamation work in "water land". As the Proposal involves closed tunnelling beneath the Nambucca River to facilitate two borefield pipeline crossings and a crossing of Bowra Creek for the transfer pipeline, a permit is required.

Section 218(5) of the FM Act states that a public authority that proposes to construct, alter or modify a dam, weir or reservoir on a waterway (or to approve of any such construction, alteration or modification):

'(a) must notify the Minister of the proposal, and

(b) must, if the Minister so requests, include as part of the works for the dam, weir or reservoir, or for its alteration or modification, a suitable fishway or fish by-pass.'

NSC is considered a public authority and is therefore required to notify the Minister for Fisheries of the Proposal and consider any matters raised by the Minister.

Section 219 of the FM Act also requires a permit to be sought from the Minister for Fisheries in relation to the obstruction of fish passage due to construction of the Proposal.

Part 7A of the FM Act provides for threatened species conservation including measures: to conserve biological diversity of fish and marine vegetation; to prevent the extinction and promote the recovery of threatened species; and to provide for the listing of threatened species for the purposes of this Part. Threatened species, populations are listed in Schedules 4, 4a and 5 of the FM Act. The potential impact of the Proposal on threatened species and communities has been assessed in Chapter 9.

6.3.5 Dams Safety Act 1978

The NSW Dams Safety Committee (the Committee) has statutory functions under the *Dams Safety Act 1978* (DS Act). The Committee's basic role is to ensure that all "prescribed dams" are in such a condition as to not endanger downstream residents and property, or adversely affect the public welfare and environment, and to ensure that mining operations adjacent to or under reservoirs do not result in significant, inadvertent or uncontrolled loss of the storage, consistent with accepted world wide practice. Safety is assessed in relation to both structure and storage integrity taking into account possible actions. In line with legal opinion, the Committee requires dam owners to adopt a standard of care in dam safety, which conforms to accepted worldwide practice.

In accordance with the DS Act, the Proposal would be designed and constructed according to appropriate engineering standards for present and foreseeable future conditions. Accordingly, NSC must provide details of the Proposal to the Committee at an early stage, for its approval under the DS Act. Details of the Proposal have since been provided to the Committee.

6.3.6 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) aims to encourage the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and a better environment as well as ecologically sustainable development.

An environment protection license must be obtained from the DECCW for activities listed in Schedule 1 of the POEO Act. Such activities may include 'extractive industries'. An extractive industry, under this schedule, involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. Given the Proposal would involve the extraction

and processing of over 300,000m^3 or approximately 600,000 tonnes of material, a licence pursuant to the POEO Act would be required.

An environmental protection license is also required from DECCW under Section 43 of the POEO Act, to allow water releases from the storage at the completion of construction. As this water may have laid stagnant in the pipes or the storage and may have high nutrient and sediment content, a licence pursuant to the POEO Act would be required.

6.3.7 Heritage Act 1977

The *Heritage Act 1977* is administered by the NSW Heritage NSC and its purpose is to ensure that the heritage of New South Wales is adequately identified and conserved. The *Heritage Act 1977* is concerned with all aspects of conservation ranging from the most basic protection against damage and demolition, to restoration and enhancement.

Under Section 57 of the *Heritage Act 1977*, a permit must be obtained for works, which have the potential to interfere with a heritage item or place, which is either listed on the State Heritage Register or the subject of an interim heritage order. There are no heritage items listed on the State Heritage Register or subject to an interim heritage order in the vicinity of the Proposal (refer to Sections 13 and 14).

Section 139 of the Act prohibits disturbance of a relic unless in accordance with an 'excavation permit' from the Heritage NSC.

Certain activities are excluded from the s139 permit approval requirements. On the 5 March of 2003, the following s139 exceptions were notified:

> *Excavation or disturbance of the following land does not require an excavation permit under s139, provided that the Director is satisfied that the criteria in (a), (b) or (c) have been met and the person to undertake the excavation or disturbance has received a notice advising that the Director is satisfied:*
>
> *(a) Where an archaeological assessment has been prepared in accordance with Guidelines published by the Heritage NSC of NSW which indicates that there is little likelihood of there being any relics in the land or that any relics in the land are unlikely to have State or local heritage significance;*
>
> *(b) Where the excavation or disturbance of land would have a minor impact on the archaeological resource; and*
>
> *(c) Where the excavation or disturbance of land involves only the removal of fill which has been deposited on the land.*

A person proposing to excavate or disturb land according to the above criteria must write to the Director and describe the proposed excavation or disturbance and set out why it satisfies the criteria. The Director shall notify the applicant if he or she is satisfied that one or more of the criteria have been met.

A historic site (forestry stump) was found and falls under the definition of a relic has having been assessed as having local or a greater level of significance (Navin Officer, 2008). Notification of the intention to impact the forestry stump would be provided in writing to the Director of the NSW Heritage Office with a request that a determination be made as to whether the intended impact falls under an existing exemption to section 139 permit provisions. European heritage is discussed in Chapter 14.

Section 146 of the Act requires that the discovery of a previously unknown relic be reported to the Heritage NSC within a reasonable time of its discovery.

6.3.8 Forestry Act 1916

The main objective of this Act is the management of timber production on crown land under the control of NSW Forests consistent with the conservation obligations under this Act. Forests NSW and State forests are administered in accordance with the *Forestry Act 1916* and the regulations associated with that Act.

The Proposal would require the acquisition of approximately 220 ha of Viewmont State Forest No 1035. The process for approvals and acquisition of state forest land is legislated under the *Forestry Act 1916*.

Amendments would occur to the boundaries of the Viewmont State Forest No 1035 once the partially acquisition of the State Forest is approved. The land would be transferred to NSC under an acquisition agreement. The agreement would also include areas of native forest being harvested prior to acquisition. Forest NSW has provided in-principle approval for the acquisition.

However, action under this Act is not required prior to or during the environmental assessment period. The acquisition approval process under the *Forestry Act* would not take place until it is known whether the Proposal has been approved and NSC begins land acquisition prior to commencement of construction.

6.3.9 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is administered by DECCW aims to conserve the natural environment and its processes, and places and features of cultural value by employing the principles of ecologically sustainable development (ESD).

The Proposal does not fall within a designated National Park, nor would it affect any National Parks or other areas of National Park Estate.

The NPW Act provides the basis for legal protection and management of Aboriginal sites and objects in NSW. The implementation of the Aboriginal heritage provisions in the Act is the responsibility of the DECCW. The NPW Act aims to prevent the unnecessary or unwarranted destruction of relics, and the active protection and conservation of relics that are of high cultural significance. Prior to approval, any Aboriginal archaeological studies that require subsurface investigations would require a permit under section 87 of the NPW Act.

Aboriginal heritage is discussed in Chapter 13. The cultural heritage assessment identified several items of significance including a possible Aboriginal object, a potential archaeological deposit, and two areas of cultural value.

A Section 87 permit would be required to carry out sub-surface investigations within the identified PAD. Should any items of significance be identified as part of the sub-surface investigations, a Section 90 consent to destroy would be required.

6.3.10 Native Vegetation Act 2003

In 2005, the NSW Government introduced new laws to end broad scale land clearing across the state. The DECCW is the government agency charged with ensuring native vegetation is protected for future generations. The *Native Vegetation Act 2003* (NV Act) applies to the clearing of native vegetation outside certain specified areas, and requires that development consent from the Minister for Planning.

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 Section 25 of the NV Act, approval is not required for any clearing that is part of an activity that is carried out in accordance with a determination under Part 5 of the EP&A Act. Approval is therefore not required.

6.3.11 Noxious Weeds Act 1993

This Act outlines procedures for the definition, declaration, and control of noxious weeds throughout the State.

Eight noxious weeds listed under this Act for the Nambucca Local Control Authority occur within the inundation area. Further information on the noxious weeds recorded in the study area are addressed in Chapter 9 of this report.

6.3.12 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) is administered by the DECCW. Section 5A of the EP&A Act lists a number of factors to be taken into account in deciding whether there is likely to be a significant impact on threatened species, populations or ecological communities or their habitats.

Should a threatened species or community be impacted, a test of significance must be completed to determine the significance of the impact. A Species Impact Statement (SIS) is required if there is likely to be a significant impact on a threatened species, population or ecological community or its habitat.

The potential impact of the Proposal on threatened species and communities has been assessed in Chapter 9. No threatened flora were identified within the study area therefore no 7 part tests have been undertaken in regards to threatened flora. However, eleven species of threatened fauna listed were found. The 7-part Tests concluded that no significant impact is likely on these species as a result of the Proposal. Therefore no Species Impact Statements are deemed necessary.

6.3.13 NSW Public Health Act 1991

The *NSW Public Health Act 1991* is administered by NSW Health. Section 10 of the Act, defines the powers of NSW Health in relation to drinking water supplies. These powers as stated in the Act include:

- Require the issuing of advice to the public on the safety of a drinking water supply;
- Require the correction of any misleading information issued to the public;

- Enter and inspect premises of a supplier of drinking water;
- Require testing of drinking water;
- Require production of information including the results of testing; and
- Order the rectification or closure of a water supply.

NSW Health administers these powers through the following guidelines and programs.

Australian Drinking Water Guidelines: NSW Government has endorsed the Australian Drinking Water Guidelines 2004 (published by the National Health and Medical Research NSC and the Natural Resource Management Ministerial NSC). The guidelines provide a solid foundation for assessing drinking water quality, by specifying health-based and aesthetic criteria as well as the philosophy of a "multiple barrier approach" from catchment to tap, so to ensure safety of the water.

The ADWG define the quality of water that is considered fit for human consumption. The Framework describes a preventive risk management approach for drinking water supply systems.

A Water Quality Plan must address all elements of the Framework and include:

- The undertaking of a comprehensive risk assessment of the water supply system;
- The design of the system to apply multiple barriers against contamination of the water supplied to consumers;
- A comprehensive water quality monitoring plan;
- A plan to report monitoring results and any incident to NSW Health (and the Ministers and Organisations required by the Regulation);
- A protocol for responding to incidents that threatens (or could threaten) water quality, public health or safety;
- A means to investigate and manage complaints of water quality;
- A plan to provide reports of water quality to consumers; and
- A process for monitoring and auditing implementation of the Framework.

Drinking Water Monitoring Program (December 2005): Where a licensee is operating a community water supply (e.g. reticulated supply for a town or part of a city) the licensee would be required to comply with the requirements of NSW Health. Guidance on NSW Health's sampling and reporting requirements, for most size systems, is contained in the NSW Health Drinking Water Monitoring Program; which includes minimum number and type of drinking water samples to be collected and reporting arrangements to NSW Health.

A licensee operating a community water supply may be directed to fluoridate under the Fluoridation of Public Water Supplies Act 1957 (further details below).

Water quality and monitoring are addressed in refer to Chapters 10, 11, and 20.

6.3.14 The Fluoridation of Public Water Supplies Act 1957

The *Fluoridation of Public Water Supplies Act 1957* is administered by NSW Health. This Act gives NSCs who are water supply authorities the power to fluoridate the water supply in the locality with the approval of, or at the direction of NSW Health, in the latter case after a NSC has referred the matter to NSW Health and the Minister has received the advice of the Fluoridation of Public Water Supplies Advisory Committee.

Water supplies to which fluoride is added must meet the requirements of this Act as well as the *Fluoridation of Public Water Suppliers Regulation 2002* and the *Code of Practice for the Fluoridation of Public Water Supplies 2002*. These requirements include

- Daily and weekly tests at the headworks;
- A monthly test submitted to the Division of Analytical Laboratories; and
- Appropriate reporting to local Public Health Units of dosing above 1.5 mg/L and interruptions to dosing longer than 24 hours.

As the supply of water would be fluoridated, these requirements are discussed further in Chapter 10.

6.3.15 Roads Act

According to Section 138 of the *Roads Act 1993*, consent is required for certain actions in relation to public and classified roads, including disturbing the surface of the road.

Section 138 of the Roads Act states:

(1) A person must not:

(a) erect a structure or carry out a work in, on or over a public road, or

(b) dig up or disturb the surface of a public road, or

(c) remove or interfere with a structure, work or tree on a public road, or

(d) pump water into a public road from any land adjoining the road, or

(e) connect a road (whether public or private) to a classified road, otherwise than with the consent of the appropriate roads authority.

As the Proposal involves digging up and disturbing the surface of a public road, approval from NSC (as the roads authority for Bobo and Valla Roads) would be required.

6.4 Commonwealth Legislation

6.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) establishes a requirement for Commonwealth environmental assessment and approval for actions that are likely to have a significant impact on matters of national environmental significance, the environment on Commonwealth land, or actions taken on Commonwealth land. Matters of national significance include:

- World heritage properties;

- National heritage places;
- Wetlands of international importance;
- Listed threatened species and ecological communities;
- Listed migratory species;
- Commonwealth marine areas; and
- Nuclear actions.

The Proposal was assessed as to whether it is likely to have a significant impact on matters of national environmental significance. No Commonwealth land under the EPBC Act would be affected by the Proposal.

Three birds, four frogs, one insect, five mammals including two bats, one reptile and 10 plants that are listed under the EPBC Act have the potential to occur within the area. No ecologically endangered communities (EECs) are listed under the EPBC Act as occurring in the study area. 15 migratory species were identified as potentially using the study area at some time of the year. However, a review of the specific habitat requirements of these species, and the habitat present within the study area and its surrounds allowed a number of these species to be eliminated as having nil, or low likelihood of occurrence at the site.

Based on the results of this assessment contained within Chapter 9 –Flora and Fauna, the Proposal would not constitute a controlled action under the Act. Accordingly the Proposal has not been referred to the Commonwealth Minister for the Environment, Heritage and the Arts under the EPBC Act.

6.4.2 Native Title Act 1993

The *Native Title Act 1993* administers processes relating to the recognition, protection and determination of native title and dealings with native title land.

Native title is concerned with the rights and interests of Aboriginal and Torres Strait Islander peoples in relation to land and water in Australia and its territories. The Commonwealth Department of Environment, Heritage and the Arts administers this Act.

At the time of preparing this EIS there were no native title claims applicable to the Proposal.

6.5 NSW Government Strategies and Policy

6.5.1 Mid North Coast Regional Strategy

The primary purpose of the Strategy is to ensure that adequate land is available and appropriately located to accommodate the projected housing and employment needs of the Region's population over the next 25 years, and sets the policy to govern where and how growth can occur.

Chapter 7 – Environment and Natural Resources

Chapter 7 sets out the aims and outcomes for protecting the water quality in town water supply catchments, other waterways and significant groundwater reserves as well as the values and functions of riparian corridors, coastal wetlands, lakes, estuaries and fishery habitats. Natural

resources including farmland, extractive resources, energy resources and timber are also to be protected.

The Proposal relies on the protection of water quality within Nambucca River and South Creek and associated aquifers to continue to offer clean drinking water to the residents of the LGA. Consideration has also been given to protecting riparian corridors, wetlands, estuaries and fishery habitats through design development and identified mitigation measures.

In protecting water quality, NSC would give consideration to amending Clause 63 of LEP 1995 or incorporating similar provisions within the draft LEP to ensure the water supply protection buffer incorporates the expanded borefield design as part of the Proposal.

Chapter 8 – Natural Hazards

Chapter 8 sets out the aims and outcomes for managing major hazards such as flooding, bushfire, acid sulfate, soil disturbance and landslip. In order to manage risk associated with climate change, NSCs are to undertake flood investigations over lands with the potential to be affected by sea level rise and inundation to ensure that risks to public and private assets are minimised.

Consideration has been given to hazards such as flooding, bushfire, acid sulfate soils and soil stability/ erosion in the design of the Proposal. The Proposal is not expected to be influenced by sea level rise or inundation.

Chapter 9 – Cultural Heritage

The Mid North Coast is rich in cultural history to the region's Aboriginal communities, with many places and objects of spiritual, historical and social significance known to exist. Chapter 9 requires NSCs to ensure that cultural and community values that are important to Aboriginal communities are considered and resolved in the future planning and management of the local government area.

The Proposal has been designed in consultation with the local Aboriginal community. An Aboriginal Liaison Committee was established at the outset of the planning process and has continued throughout the EIS preparation. The results of the consultation are contained in Chapter 5.

Chapter 10 – Water and Energy Resources

Chapter 10 sets out the aims and outcomes for the regional water supply. In particular, the Strategy aligns with the work of the State Government to ensure a secure, safe and adequate regional water supply. The Proposal would facilitate the implementation of the Strategy, as it would seek to maintain a secure water supply system for the Nambucca Shire.

6.5.2 Mid North Coast Farmland Mapping Project

The *Mid North Coast Farmland Mapping Project* aims to protect agricultural land on the NSW coast. This project recognises and aims to conserve the best farmland or regionally significant farmland for current and future agricultural purposes. Planning recommendations for regionally significant farmland intend to protect the land from development including infrastructure and facilities unless there is an overriding public benefit.

No regional significant farmland is found within the inundation area. However, some of the bores may be located within regionally significant farmland. The impacts of the bores would generally be restricted to small areas adjacent to watercourses thus limiting their ultimate overall impact. The Proposal would provide a net benefit to the community through the provision of a secure water supply for the LGA.

6.5.3 Draft Sea Level Rise Policy Statement

The primary objective of the Sea Level Rise Policy Statement, prepared by DECCW in February 2009, is to minimise the social disruption, economic costs and environmental impacts resulting from long-term sea level rise. To achieve these objectives, the NSW Government would:

1. promote an adaptive risk-based approach to managing sea level rise impacts.
2. provide guidance to local NSCs to support their sea level rise adaptation planning.
3. encourage appropriate development on land projected to be at risk from sea level rise.
4. continue to provide emergency management support to coastal communities during times of floods and storms.
5. continue to provide updated information to the public about sea level rise and its impacts.

The draft Policy Statement includes sea level planning benchmarks which have been developed to support consistent consideration of sea level rise in land-use planning and coastal investment decision-making. The adopted benchmarks are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100. These benchmarks represent the Government's guidance on sea level rise projections for use in decision-making and are not regulatory standards.

The benchmarks adopted by the Draft Sea Level Rise Policy have been considered in the concept design of the Proposal and used in considering the impacts of climate change on the Proposal, particularly the proposed expanded borefield.

6.5.4 NSW Weirs Policy

The NSW Weirs Policy provides a framework for the efficient and sustainable reform of the water industry that included making formal allocations to the environment, based on the best scientific information available.

For the purposes of the policy, weir means a licensable "work" as described under the Water Act 1912, and could include any dam, lock, weir, regulator, barrage or causeway which effects the quantity or flow of water in a river or lake. Whilst this policy does not apply to the off-river storage it would apply to the existing pipeline crossing and its proposed modifications to incorporate fish passage.

6.5.5 The NSW State Groundwater Policy Framework Document

The purpose of the Groundwater Framework Policy document is to provide a clear NSW government policy direction on the ecologically sustainable management of the State's groundwater resources for the people of NSW.

The focus of the Policy is on water below the ground surface in a geological structure or formation, and on the ecosystems from which these waters are recharged or into which they discharge.

The Policy provides for the better consideration of all issues which affect or are likely to affect the condition and functioning of the resources of these areas, including water chemistry, geology, aquifer recharge and discharge, and dependent ecosystems such as wetlands, lakes and streams, springs and seeps. It requires that careful consideration be given to all factors affecting the stability, vulnerability and productivity of these systems.

The State Groundwater Policy is a framework policy designed to establish:

- Objectives and principles for groundwater management;
- A coordinated program for policy development, reporting and review;
- Tools for policy implementation; and
- Opportunities for information sharing.

The State Groundwater Policy is made up of the following component policies:

- Groundwater Dependent Ecosystems;
- Groundwater Quality Protection; and
- Groundwater Quantity Management.

6.5.6 NSW State Groundwater Dependent Ecosystems Policy

The *State Groundwater Dependent Ecosystems Policy* is specifically designed to protect our valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems are maintained or restored for the benefit of present and future generations.

The Policy provides guidance on how to protect and manage these valuable natural systems in a practical sense.

6.5.7 NSW Groundwater Quality Protection Policy

The *Groundwater Quality Protection Policy* is specifically designed to protect our valuable groundwater resources against pollution. Adoption of the Policy means that the sustainability of groundwater resources and their ecosystem support functions would be given explicit consideration in resource management decision making.

The focus of this Policy is to protect water below the ground surface in geological structures or formations (known as 'aquifers'), and the ecosystems from which these waters are recharged or into which they discharge.

The Policy would guide the decision-making of landholders and State and local government authorities in their management and use of groundwater. It would influence the type and selection of management activities and resource development opportunities that would be supported by the State's resource managers, land use planners and regulators.