Appendix B

Water supply feasibility assessment

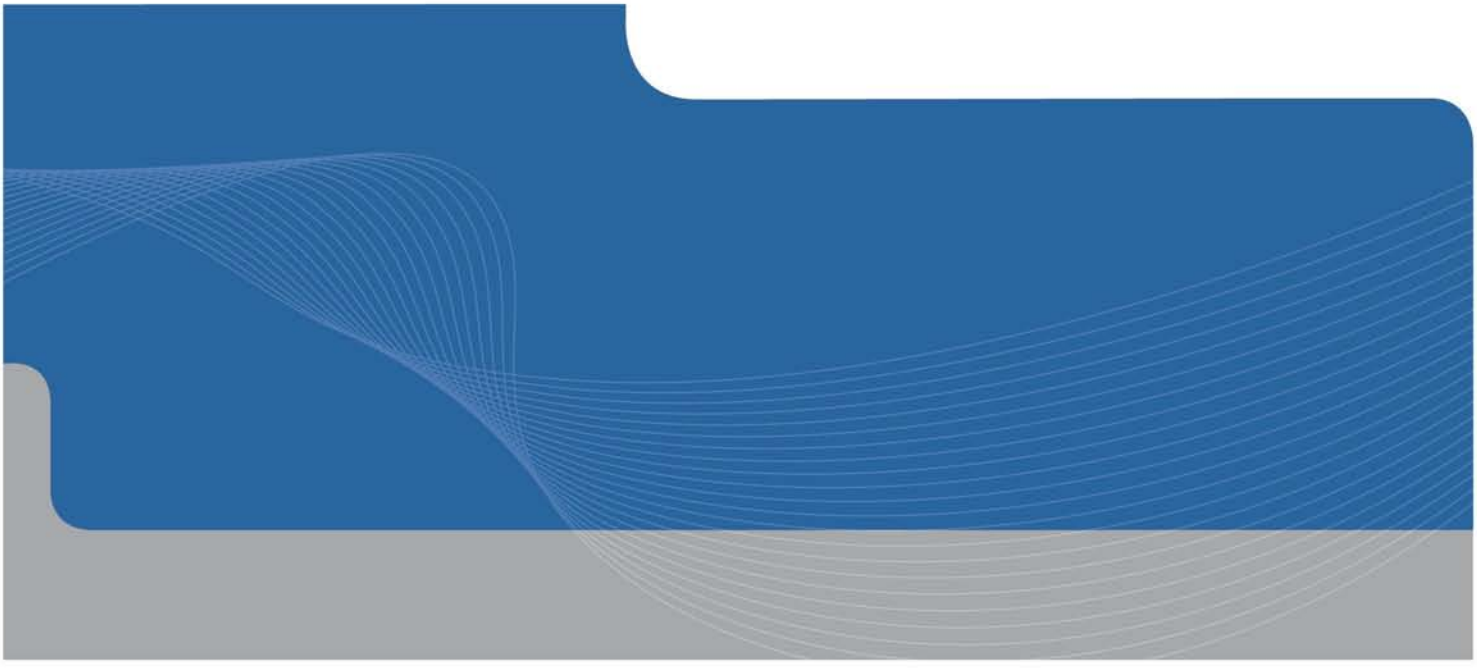
CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity

Proposed Gas Turbine Power Station at Bamarang, Nowra

Water Feasibility Assessment

March 2008



INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 General

Delta Electricity (Delta) proposes to facilitate the development of a gas turbine power facility at Bamarang (approximately 8 km south-west of Nowra), to meet future regional and national electricity needs.

The power facility is proposed to be developed in two stages:

» Stage 1 – A gas turbine peaking facility including two (2) Open Cycle Gas Turbines with approximate generating capacity of 300 MW; a gas pipeline to supply the proposed facility with gas from the Eastern Gas Pipeline; a 132 kilovolts electricity transmission line to transfer the electricity produced to the national electricity network; and ancillary infrastructure; and

» Stage 2 – A base load facility by converting the proposed facility to Combined Cycle Gas Turbine configuration with total generating capacity of approximately 400 MW.

The units to be used at the power facility and the final layout will be determined through a competitive tendering and detailed design processes.

An environmental assessment to support Delta's application for the Minister for Planning's approval of the proposal under Part 3A of the EP&A Act ('Proposed Gas Power Facility at Bamarang near Nowra, Environmental Assessment', May 2006, GHD) and a concept (functional) design for the facility were prepared (for the Stage 1 facility).

The environmental assessment was placed on public exhibition by the Department of Planning between 19 May and 19 June 2006. Following exhibition, on 29 June 2006, the Department of Planning provided Delta with a copy of submissions received. The submissions report, prepared by GHD, was lodged with the Department of Planning in August 2006. The following approvals were granted by the Minister for Planning on 27 February 2007:

» Concept approval for the Bamarang Gas Turbine Facility; and

» Project approval for construction and operation of an open cycle gas-fired power station (Stage 1) and associated infrastructure.

Delta has decided to progress with seeking a project approval for Stage 2 of the facility.

As noted by the Department of Planning's Director-General's Assessment Report, the Department confirmed that the main outstanding issues requiring resolution prior to the granting of project approval for Stage 2 were whether wet cooling was a feasible cooling option for the Stage 2 facility, and if so, what would be the infrastructure requirements and implications/impacts. This would need to be addressed in a Water Supply Feasibility Study.

Since then, Delta have indicated a preference for dry cooling rather than wet cooling as dry cooling utilizes significantly lower volumes of water within the process than the wet cooling process.

1.2 Statutory and Authority Requirements

Based on the requirements of condition 2.2 of the Concept Approval, an additional environmental assessment will be prepared necessitating the inclusion of a Water Supply Feasibility Study for Stage 2 development, as per condition 2.2(d). This involves preparation of:

> 'A Water Supply Feasibility Study developed in consultation with Council and DNR that quantitatively demonstrates water availability for the combined cycle gas turbine facility operation and the viability of these water sources for sustainable use over the life of the project. Consideration shall be given to security of supply, current and future water demand in the region, and in the event water source sharing is proposed, how the proposal will likely impact on potentially affected users.'

1.3 Aim and Objective

The aim of this Water Feasibility Assessment is to contribute to fulfilling the requirements of condition 2.2 of the Concept Approval and further develop the preliminary work undertaken on supply options in the Water Cycle Management Report (GHD, 2005) and Water Supply Options Study (GHD, 2007). The key objectives of this study are:

- Summarise the current and future water demand for the region
- Summarise all the potential water supply options, as identified by Delta, Shoalhaven City Council 'Council' and Shoalhaven Water (a division of Shoalhaven City Council) and previous reports to meet the water demand for Stage 2 of the Bamarang power facility;
- Identify preferred water supply option, quantities available and security of supply. Develop concept for connection of water source to enable environmental assessment; and
- Prepare a report outlining the work undertaken during the investigation.

1.4 Scope of Work

The feasibility assessment involved the following:

1. Summarise current and future water demand in the region and for stage two (based on figures outlined during the May 2006 environmental assessment, and updated information from Council/DECC where relevant)
2. Further site visits to Nowra to meet with relevant stakeholders to discuss the preferred option and infrastructure implications in further detail. This includes consideration of how the option has been developed and how it would fit within an overall water servicing strategy.
3. Summarise all water source options (from the Options Report, Water Cycle Management Report and the Water Supply Options Investigation Report) and the reasons for discarding options and selecting the preferred viable option.
4. Identify water quantities available and any likely fluctuations to these including security of supply. Review current and future water demand in the region as it relates to the preferred water supply option and any impacts on other uses where water sharing is selected as a preferred option.
5. Undertake a concept design for the water supply to determine infrastructure requirements of the preferred option. This will allow the technical feasibility of the option to be more readily assessed and provide sufficient detail for the environmental assessment.

6. Compile the results of the above for inclusion as an appendix to the environmental assessment.

2. Background

2.1 Previous Reports

As part of the previous environmental assessment, GHD prepared a Water Cycle Management Report, completed in December 2005 (Appendix G of the environmental assessment). This requirement came out of the Director General's requirements and was supported by comments from DECC. The Water Cycle Management Report built on work undertaken by Parsons Brinkerhoff (the Bamarang Gas Turbine Water Supply Options Investigation Report, April 2005) and assessed the water requirements for the project, and the management of the water cycle and stormwater. The Water Cycle Assessment considered additional alternative water sources including surface water runoff and industrial water (including likely quality, volumes, general treatment requirements). The report also considered process, domestic and irrigation water requirements and a whole of site integration of water use and management.

Following the environmental assessment, the Water Supply Options Study (GHD, 2007) was prepared to assess identified potential supply options and provide a recommendation of the preferred option/s for water supply.

The Water Supply Options Study considered options for an overall water servicing strategy based on the following water supply options:

- Purchase of water trading licence/s from upstream irrigators;
- Desalinated water provided by a project specific desalination plant constructed in the tidal flats;
- Industrial effluent from Manildra Starches;
- Reclaimed effluent from Shoalhaven Water under the REMS scheme.

The requirements for each option were outlined and an assessment of their relative advantages and disadvantages undertaken. The options (as developed into water supply strategies) were then assessed on the basis of economic and non-economic evaluations. All of the options were found to have significant limitations with respect to providing the 8.4 ML/d specified as being required for a wet cooling process.

Delta has since indicated a preference for dry cooling rather than wet cooling, as dry cooling requires significantly lower volumes of water, within the plant, than the wet cooling process.

2.2 Site Location and Description

The site is located at Bamarang, approximately 8 km southwest of Nowra on the NSW south coast. The site has frontage to Yalwal Road, which links Nowra with Yalwal.

The site area is approximately 20 hectares, of which 5 hectares would be required for the gas turbine plant and 2 hectares would be required for a switchyard. In addition, the development includes transmission line and gas pipeline routes. The site is bounded by Bamarang Nature Reserve to the north, Bamarang Dam to the west and Crown Land elsewhere.

The central portion of the site was previously cleared and developed as an abattoir, although the facility was never operated. There are a number of existing buildings on the site, which include stockyards. Some regrowth has occurred since the site was cleared for the abattoir development. The remainder of the site contains bushland that extends into the adjoining properties owned by the Crown and Council.

3. Existing and Future Water Environment

3.1 Existing Water Environment - Region Overview

The Delta Electricity site is within the Shoalhaven Local Government Area (LGA). The Shoalhaven LGA encompasses an area of some 4660 square kilometres (stretching from Broughton - just north of Berry, southwards to North Durras - just north of Batemans Bay) and comprises 49 towns and villages including Nowra and Berry. Shoalhaven City Council, through Shoalhaven Water supplies reticulated drinking water to some 45 towns and villages across the Shoalhaven LGA. Water is predominantly sourced from the Shoalhaven River downstream of Tallowa Dam at Burrier Weir.

Water is considered a valuable commodity within the Shoalhaven LGA with a high demand for water arising from urban, industrial (including Manildra Starches and Australian Paper) and agricultural users (particularly dairy farms).

3.2 Shoalhaven River

As noted above, water for the Shoalhaven LGA region is predominantly supplied from the Shoalhaven River downstream of Tallowa Dam at Burrier Weir. Figure 1 shows the extent of the Shoalhaven River catchment.

Discussions with DWE (Department of Water & Energy) indicated that there are only some 19 licenses on the Shoalhaven River itself and around 180 licenses within the Shoalhaven catchment. Total licensed extractions are in the order of 80,000 ML/a and this is predominantly licensed for town water supplies. Shoalhaven Water is licensed to extract 22,900ML/a (predominantly from the Burrier pump station but also Danjera Dam and Flatrock Creek). There are however a number of demands on the Shoalhaven River waters, particularly centred around Tallowa Dam

Tallowa Dam (located upstream of Burrier Weir) stores water from both the Shoalhaven and Kangaroo Rivers. The dam is managed by Sydney Catchment Authority with the water being used for a number of purposes including:

a. transfer to the SCA's dams serving the greater Sydney region's water supply during periods of drought;

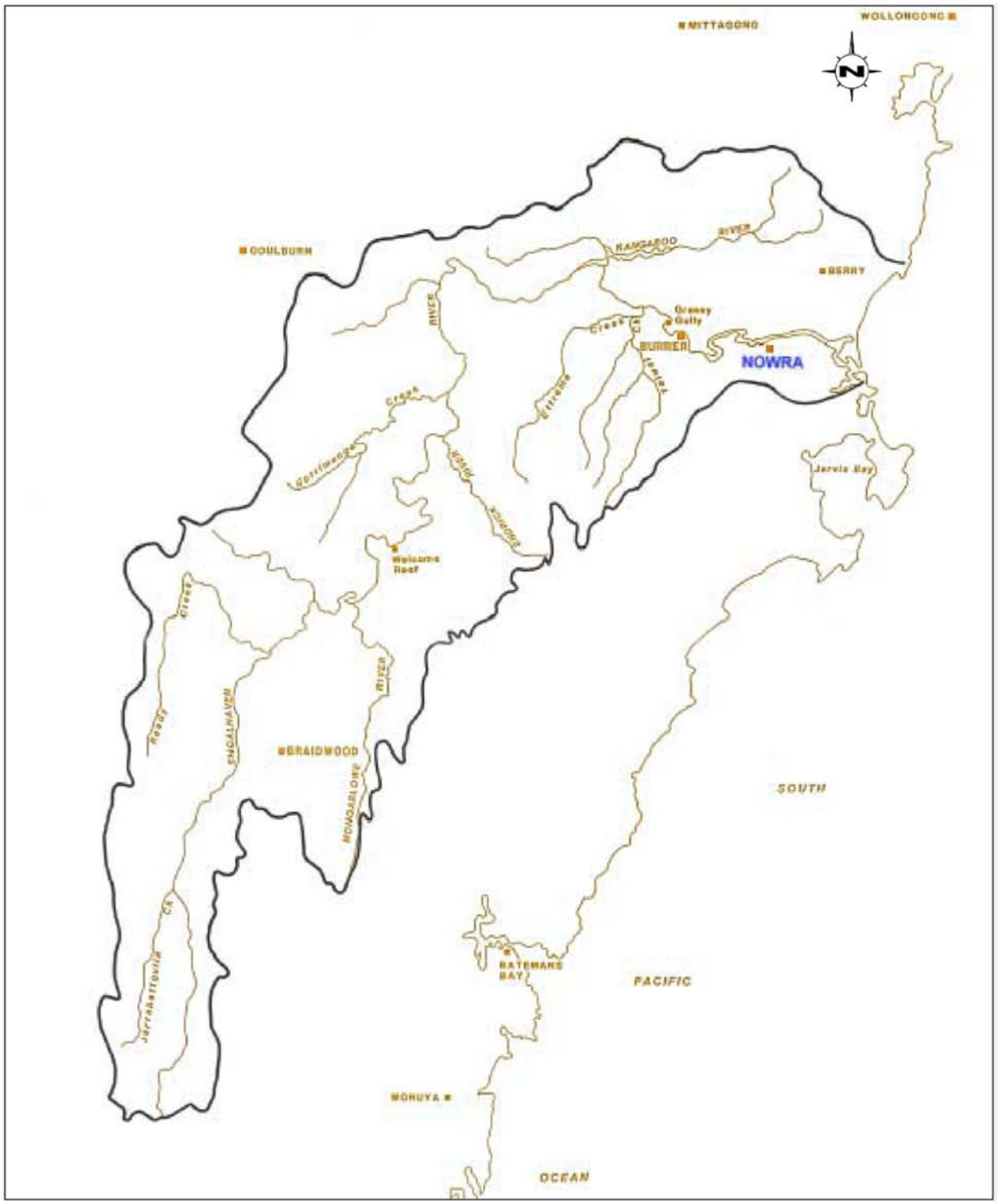
b. environmental flow releases to the lower Shoalhaven River; and

c. release from the dam to supply the Shoalhaven community's water supply.

(Source: Sydney Catchment Authority, "Shoalhaven Water Supply, Transfers and Environmental Flows, August 2006). A discussion on each of these water demands is provided in the following subsections.

3.2.1 Sydney Water Supply

In recent years, under drought conditions, a significant portion of the inflows to Tallowa Dam have been transferred to Sydney with the Shoalhaven Water Supply Transfer scheme supplying around 25% of greater Sydney's system demand (between April 2003 and June 2006 – some 410 billion litres over this period).



Source: Shoalhaven River Estuary Data, Compilation Study, Umwelt (Australia Pty Ltd), July 2005. (Sourced from Terara Village Floodplain Management Study, Shoalhaven City Council, 2002)

Figure 1 Shoalhaven River Catchment

As part of the 2006 Metropolitan Water Plan, the NSW government indicated that SCA would examine options for operational changes to its existing Shoalhaven Water Supply Transfer Scheme to increase the long-term available water supply to greater Sydney by around 30 billion litres per year. However, it is noted that whether or not this is undertaken, the health of the Shoalhaven River would be protected (through improved environmental flow release rules for Tallowa Dam) and that the future water supply for the Kangaroo Valley and Shoalhaven communities is secure. Thus while the Sydney water supply is a significant consideration with respect to the Shoalhaven Rivers waters, the plan does not impact on the security of supply for the Shoalhaven communities (which Delta Electricity's Bamarang site would form part of).

3.2.2 Environmental Flows

Recent studies undertaken in regards to environmental flows in the Shoalhaven River resulted in the recommendation by DNR (the Department of Natural Resources and now DWE) to the government that the following rule be applied: "Maintain or mimic natural flow variability by:

a. protecting 100% of inflows up to 250 ML/day, plus

b. 20% of inflows above 250 ML/day"

This recommendation increases the environmental flows from the previous 90 ML/day to some 250 ML/day.

3.2.3 Shoalhaven Community Water Supply

Shoalhaven Water (the water arm of Shoalhaven Council) is currently licensed to extract 22,900ML/a - predominantly from the Burrier pump station but also Danjera Dam and Flatrock Creek. The annual demand is currently around 18,000ML/a (as advised by Council). This fits within Council's Integrated Water Cycle Management (IWCM) Plan, (MWH, March 2006) which reported that the demand is expected to increase from approximately 15,000ML/a to just under 21,000 ML/a by 2035.

As noted in Section 2.2 the site is located some 8 km from Nowra and alongside Bamarang Dam. The Bamarang Reservoir is located to the immediate west of the proposed power facility site and is a source of reticulated water supply for Nowra (via the Nowra Water Treatment Plant).

3.3 Existing Water Supply - Shoalhaven Water

In addition to water from the Shoalhaven River, Shoalhaven Water also source water from Danjerra Dam, which is located on Yalwal Creek and Porters Creek Dam. Danjerra Dam was built to provide drought relief to Nowra (and the larger Shoalhaven LGA). During periods of low river flow water is released from Danjerra Dam to the Shoalhaven River and recovered at Burrier pump station (Source Shoalhaven City, "Water Supply System, No. 1 Information Brochure", 2005).

Shoalhaven Water also operates two other major dams named Bamarang Dam (adjacent to Delta's site) and Porters Creek Dam (which is located west of Milton). The Porters Creek Dam serves some of Southern Shoalhaven (Milton, Ulladulla, Mollymook etc.) although this area is also connected to the Northern Shoalhaven Scheme that sources water from the Shoalhaven River. Overall about 90% of the Shoalhaven LGA system's raw water is sourced from the Shoalhaven River at Burrier and stored in Bamarang. Access to water from the Tallowa Dam is triggered by low storage levels in Shoalhaven's dams.

Potable water supply for the Nowra urban area (the closest urban area to the Delta Electricity's Bamarang site) is treated at the Bamarang Treatment Plant.

Water supply is predominantly for residential purposes (some 63%) with commercial demands comprising some 14% of the total water demand for the Shoalhaven LGA. Rural / agricultural is the other significant component of the water demand (approximately 17%). (Source: Shoalhaven City Council, Integrated Water Cycle Management Plan, Concept Study, Draft Report, MWH, March 2006)

3.4 Future Water Requirements – Shoalhaven Water

The latest population figures (Australian Bureau of Statistics (ABS), Preliminary figures for June 2006) indicate a population of around 89,000 persons. This is slightly below those predicted by Shoalhaven Council (as shown in Table 1), which is based on previous census figures and predicted growth rates. The 2001 census results indicated a 1.72% compound growth rate, which is significantly higher than that of NSW as a whole (1.08%) (Shoalhaven City Council, 2003). This has implications in terms of demand for water, wastewater and other infrastructure services.

Table 1 Shoalhaven Council Population Figures

	Actual Number			**Projections**			
Year	1991	1996	2001	2006	2011	2016	2021
Population	70460	79068	87650	95590	102620	109166	117923

Source: www.shoalhaven.nsw.gov.au/applications/population

The Integrated Water Cycle Management Plan (IWCM), Concept Study (MWH, March 2006) undertaken for the Shoalhaven LGA, reported a baseline forecast for water demands to the year 2035. The demand was expected to increase to around 21,000ML/a (with the implementation of the Building Sustainability Index). This was determined following consideration of residential and non-residential growths in the region. It was assumed that other non-residential growth (excluding rural and caravan parks) would increase in proportion to residential growth in the area (i.e. calculated to be around 830 ML/a which is roughly equivalent to 14% of the total growth in demand from 2005 to 2035). Furthermore it is noted that some of the existing industrial water users in the region have shown a steady decrease in their water use which could also be available for other industrial / non-residential uses.

Despite the predicted growth, Shoalhaven Council have recently brokered an agreement that secures the City's (drinking) water supply for the next 30-50 years. This secured water supply allows for both current and future growth in residential and non-residential water demands.

3.5 Shoalhaven Wastewater

As noted in Section 2.2 the site is located some 8 km from Nowra. Thus, if the site was to be connected to a sewerage system / Wastewater Treatment Plants (WWTP), it would likely be in the vicinity of the Nowra township. The town of Nowra is serviced by the Nowra and Bomaderry WWTPs. Any local sites / farms (to the power station) are likely to be serviced by their own onsite treatment systems (eg. septic tanks/ absorption trenches).

Shoalhaven Water also operates a Reclaimed Water Management Scheme (REMS). This scheme involves water reclamation schemes at nine of its ten operating wastewater treatment plants. Currently (as reported in the "Shoalhaven Water Reclamation Annual Report 2005-06", Shoalhaven Water) the scheme reuses around 2300 ML/a, which represents about 34% of the reclaimed water produced. Proposed upgrades to the Nowra and Bomaderry WWTPs will allow for further addition of the reclaimed water to the REMS scheme. Discussions with Council indicated that that this additional recycled water is in high demand from other users already existing in the Shoalhaven region.

3.6 Delta Water Requirements – Water Supply

It is noted that the water requirements (for the option of wet cooling) were raised as an issue in the Department of Planning's Director-General's Assessment Report and hence drove the requirements for a Water Supply Feasibility Study. As noted in Section 1.1 and 2.1, Delta Electricity have now indicated their preference for dry cooling over wet cooling due to its significantly lower water demands. It is reported that dry cooling cuts water consumption, compared to wet cooling, by around 95%. (Queensland Government, Department of Energy, "Water Use in Power Stations"). Thus the required water demand for the dry cooling process will be significantly lower than the previously suggested wet cooling.

For the Stage 2 plant, Delta requires water supply for both domestic and process uses. The estimates of the two main sources of water demand for the site are listed as follows:

» Domestic water – estimated to be in the order of 400 kL/a (Water Cycle Management Report, 2005)

» Process water – For the dry cooling process, water requirements are reportedly some 0.5 ML/d (based on PB, 2005). This is significantly less than the estimated 8.4ML/d required for wet cooling.

  In the dry cooling process, water is predominately lost from the system due to boiler blowdown (which involves the discharging water from the boiler circuit to maintain the chemistry to avoid possible scaling and corrosion of parts).

It is noted that the process water requirements are considered a conservative estimate and could potentially be lower.

Overall the total annual water use is not expected to exceed around 200 ML/a (in comparison the wet cooled plant was expected to have an annual water use of around 3000 ML/a). Thus, the relatively small demand of Delta's power facility would be assumed to fit readily within this proposed growth in demand of non-residential water use. The demand fits well within the 830 ML/a non-residential (specifically commercial) growth allowed for within Council's IWCM (and does not take into account potential water reductions from existing non-residential water users).

A comparison of Delta's water demands against those for the Shoalhaven LGA (as provided in the IWCM) is shown in Table 2.

Table 2 Comparison of Delta's Water Demands Against Current and Future Water Demands for the Shoalhaven LGA

Year	Units	2005	2035
Licensed extractions (from Burrier Pump Station , Danjera Dam	ML/a	22,902	22,902

Year	Units	2005	2035
and Flatrock Creek)			
Annual Water Demand for the Shoalhaven LGA (ML/a)	ML/a	14798	20,731[1]
Proportion Residential Demand	%	63	
Proportion Commercial Demand	%	14 (approximately 2070ML/a)	14[2] (approximately 2900ML/a or an increase of 830ML/a)
Delta Water Demand	ML/a	200	200

Notes: 1 Baseline Forecast (Traditional approach) as reported in the Shoalhaven City Council, IWCM Concept Study, Draft (MWH, 2006)

2 Assumed to remain consistent given that non-residential growth was assumed to increase in proportion to residential growth in the area

Even if the predicted water demands within the IWCM Study did not allow for the additional demand that the Delta facility would place on the Shoalhaven LGA water supply, there is adequate spare capacity between the total predicted demand of 21,000ML/a (IWCM) and the licensed extractions (some 23,000ML/a) to cater for the additional 200 ML/a demand of the Delta facility.

The required water demand of the Delta facility represents less than 1% of the water demand for the Shoalhaven LGA based on both current and future water demands. Furthermore, this water demand fits well within the licensed extractions to which Shoalhaven Water is entitled. Thus, Shoalhaven Water have indicated that Delta's water demand can comfortably be accommodated within its water supply system

3.7 Delta Water Requirements – Wastewater

3.7.1 Domestic wastewater

From the facility, due to the limited number of staff, only a small amount of domestic wastewater would be generated (approximately 1 kL/day).

Sewage would be directed to an on-site septic system or pump out storage facility for removal to the Nowra wastewater treatment plant (WWTP). The system would comply with local council requirements.

Wastewater at the WWTP is currently treated and discharged to both a receiving waterway and a reuse (irrigation) area. As a result of the small volume and quality of the wastewater generated by the Delta Electricity facility, no impacts are expected. The relative proportion of wastewater from the proposed facility would be expected to be less than 0.5% of the total flow received at the Nowra WWTP.

3.7.2 Process wastewater disposal

Of the process water that is consumed, the majority is lost through general process losses (e.g. boiler blowdown). Around 6% of the process water is discharged as sludge water and liquid waste from the brine concentrator and ion exchange units.

For the Bamarang facility using dry cooling, this means that up to 30kL/day of concentrated wastewater could be generated. This is considerably less than would have been generated using wet cooling.

Concentrated wastewater from the reverse osmosis process (brine) would be pumped to a holding tank prior to offsite disposal during stage two. Offsite disposal is likely to be via an ocean outfall, potentially in conjunction with effluent outfall from a sewage treatment plant (to assist in dilution and dispersion). In the event that such an option is not available, then disposal via onsite evaporation or brine crystallisation would need to be investigated. If evaporation pans only were used, then areas of up to 2.5 ha may be required and hence it is more likely that brine crystallisers (or other mechanical equipment), which occupy a significantly smaller area, would be used. Crystallisers can be skid mounted and hence are likely to fit within the existing process area. This would be addressed as part of the detailed design process.

4. Water Source Options for Wet Cooling

4.1 Options Identified

Previous reports have identified a number of options for water supply for the Stage 2 wet cooling process of the Bamarang Power Station. While dry cooling is now the preferred option, the consideration of the water supply options for wet cooling provides a useful background for water source options for either cooling method. The water source options included:

1. Reclaimed effluent;
2. Industrial effluent;
3. River/raw water;
4. Ground water;
5. Stormwater;
6. Site wastewater;
7. Potable water;
8. Desalinated water provided by a project specific desalination plant constructed in the tidal flats.

Section 4.2 below, outlines the wet cooling water supply options and the issues with obtaining water from these potential sources. The high water requirements of wet cooling makes this cooling process not a feasible option due to inability to secure supply, high capital costs and environmental impacts of long pipelines. Hence the dry cooling process was the cooling process option (discussed in Section 5) selected by Delta Electricity.

4.2 Potential Water Sources

A number of potential water sources to supply the requirements of the wet cooled Stage 2 Power Facility have been identified and are outlined as follows below.

4.2.1 Reclaimed Effluent

Shoalhaven Water has implemented and continues to develop a Reclaimed Water Management Scheme (REMS), whereby treated wastewater from a number of their wastewater treatment plants is treated to a quality level suitable for reuse.

Shoalhaven Water have plans to implement a further stage of the REMS scheme which will include the output of the Nowra and Bomaderry wastewater treatment plants (WWTPs) and effectively double the reclaimed water available under the scheme. The Nowra and Bomaderry WWTPs are scheduled for upgrade under Stage 1b of the REMS scheme by the years 2009 – 2010.

Investigations undertaken as part of the Water Cycle Management Report and Water Options Study have indicated that the existing volumes of reclaimed water from the REMS scheme is already allocated under license type agreements. Furthermore, there is significant demand existing (from agricultural irrigators and the like) for any future reclaimed water available, such as that from the Nowra and Bomaderry WWTP upgrades. Shoalhaven Council have previously indicated that there is a preference for supply of reclaimed water to agricultural users (particularly dairy farmers) although contracts are open

to negotiation at the time of renewal. In general, it appears that access to this water is likely to be difficult.

Reason for Option Being Discarded

The option for sourcing water from the REMS system was discarded due to the inability to secure licence for the required water quantities for wet cooling. Additionally to transfer the reclaimed effluent from where it is generated to the Delta Electricity site would require a lengthy pipeline, which may have adverse environmental impacts and have significant costs.

4.2.2 Industrial effluent

A number of industrial facilities in the Nowra area are both large water users and wastewater generators. In particular, Manildra Starches and Australian Paper (AP) (both located in North Nowra) have indicated that effluent from their processes may be a potential water supply for the Bamarang power facility. These facilities were both identified in the Water Cycle Management Report (GHD, 2005) and Water Supply Options Study (GHD, 2007) as potential suppliers.

This option is considered favourable as it takes a 'waste' and beneficially reuses it. However, this may be offset by the environmental impact of transferring the treated effluent a significant distance to the power station site.

The security of supply (due to industrial viability, fluctuations in operations etc.) also represents a significant disadvantage to this option.

Reason for Option Being Discarded

The option for sourcing water from the industrial effluent was discarded due to the inability to secure the required water quantities for wet cooling. Additionally the variable qualities of industrial effluent may have led to poor quality or contaminated water being used in the power generation process and to transfer the industrial effluent from where it is generated to the Delta Electricity site would require a lengthy pipeline, which may have adverse environmental impacts and have significant costs.

4.2.3 River/raw water

Generally water can only be extracted from a water source such as the Shoalhaven River in accordance with an access licence. The Shoalhaven River is currently subject to the *Water Act 1912*. Across NSW, this legislation is gradually being replaced by the *Water Management Act 2000*. The provisions of the Act are being progressively implemented in NSW. A water management area is subject to the *Water Management Act* once a water sharing plan is created for that area. Once approved, the water management plan remains in force for ten years.

At present, over 30 water sharing plans have been implemented in NSW, which covers around 80% of water extraction in NSW. It is noted that there is no water management / sharing plan in place for the Shoalhaven River with no known proposed release date for such a plan (as advised by the Department of Water and Energy).

The Shoalhaven River will also be influenced by (subject to) the Greater Metropolitan Water Sharing Plan (GMWSP) when released. The GMWSP may restrict the allocation of reservoir extraction or place an embargo on the creation of new water licences within the Shoalhaven River catchment. The extent of the impacts of the GMWSP on Shoalhaven water allocations cannot be assessed until the GMWSP draft

report is made public by the Department of Water and Energy, expected to be available for public exhibition late 2007 (or thereafter). DWE have indicated that they hope to undertake targeted consultation (regarding the water sharing plan) with peak interest groups over the coming months.

The *Water Management Act* essentially places a state-wide embargo on the granting of new licences. In any case, it is noted that the Shoalhaven catchment is presently subject to an embargo on the issue of new licenses for new water license.

Thus in order to extract water from the Shoalhaven River it will be necessary to purchase an existing water access licence/s. Thus obtaining a new license is dependent on someone being willing to sell their water license.

Discussions with DWE (Department of Water & Energy) indicated that there are only some 19 licenses on the Shoalhaven River itself and around 180 licenses within the Shoalhaven catchment. Total licensed extractions are in the order of 80,000 ML/a but this is predominantly licensed for town water supplies. Only some 6,000 ML/a is licensed to irrigators and would therefore potentially be available to Delta. However, the required extraction by Delta Electricity of some 8.4 ML/day or 3066 ML/a represents around 50% of the available total licensed volume from the Shoalhaven catchment. Thus the potential for the purchase of a license is considered to be limited.

Reason for Option Being Discarded

The option for sourcing water from the river was discarded due to the inability to secure licence/s for the required water quantities for wet cooling.

4.2.4 Groundwater

A review of groundwater sources was undertaken as part of the PB report (April 2005) which indicated that, based on the local geological formations, the groundwater was likely to be fracture controlled with variable yields and salinities. Furthermore, PB raised the potential risk in obtaining approval from DIPNR (now Department of Natural Resources, the relevant consenting authority) to extract the required volumes of groundwater.

Reason for Option Being Discarded

The option for sourcing water from groundwater was discarded as the water quantities required for wet cooling would likely significantly exceed drastically outweigh the amount of water that could be sourced from the ground. Additionally the variable qualities (i.e. high salinity) of the groundwater may have led to difficult and expensive pre-treatment prior to being used in the power generation process.

4.2.5 Stormwater

A water balance analysis indicated that for the nominated site area of 20 ha, the existing site runoff would increase from around 48 ML/yr to around 96 ML/yr once the facility was developed (due to the creation of impermeable surfaces which affects the hydrological cycle). The results of these calculations indicate that there is potentially a considerable increase in runoff on account of the development. It is noted that the existing runoff (from the undeveloped site) has an important role in the hydrological cycle of the local and regional environment in that it provides environmental flows for local waterways. Therefore, the use of all runoff from the site (once the site was developed) would deprive these waterways of a significant volume of water and potentially adversely impact on the environmental flows of local waterways. Hence if the runoff were considered to be a source of water supply for the site then

only a portion of the runoff (in particular that which is in excess of that which currently occurs, i.e. 48 ML/yr) would be utilised. This does not meet the required 3066 ML/a of process water for wet cooling and 400 kL/a of domestic water demand required and hence an alternative additional source would be required.

Furthermore, significant storages would be required to store the runoff for times when it would be required.

Reason for Option Being Discarded

The option for sourcing water from stormwater was discarded, as the water quantities required for wet cooling are significantly greater than the amount of water that could be collected from the on-site runoff.

4.2.6 Site Wastewater

Any wastewater generated by the site is also a potential water supply. Wastewater is generated from the following: process wastewater (including brine concentrate from the RO plant, demineralised water treatment wastewater) oil / water separator (stormwater) and domestic type wastewaters. However, as the process is a net water user, additional water supply will be required for the site.

Reason for Option Being Discarded

The reason that site wastewater was discarded as a water supply option is that there is an insufficient volume available (even in combination with other options) for the wet cooling process.

4.2.7 Potable Water

Water from Bamarang Dam is currently pumped to the adjoining water treatment plant and then reticulated to Nowra. While this water is of a high quality it is unlikely that the treatment plant will have the capacity to treat and supply the required volumes (8.4 ML/d) to the Bamarang Power Facility. Furthermore, the costs of a treated water source are likely to be high.

Reason for Option Being Discarded

The option for sourcing water from the potable supply was discarded due to the inability to secure the supply for the required water quantities for wet cooling.

4.2.8 Desalination

The Shoalhaven River is located to the north west of the proposed power facility site. In the vicinity of the proposed Bamarang power facility, the Shoalhaven River has elevated salinity levels (TDS >6,500 mg/L, Parsons Brinckerhoff Report, April 2005) and an area of tidal flats. Desalination processes such as thermal desalination (e.g. multi flash distillation or multi-effect distillation) or membrane based technology (e.g. reverse osmosis) can be used to treat this water to a quality suitable for use within the power station. For brackish waters, reverse osmosis is usually recognised as being more efficient; however, the presence of a waste heat source may influence the selection of the appropriate technology. It is noted that reverse osmosis systems do not cope well with widely fluctuating raw water quality as would be expected in an estuarine stream.

The Shoalhaven River is currently subject to the requirements of the Water Act. Discussions with DWE indicated that this Act covers the freshwater section only and they have no legislative ability at the

moment regarding tidal waters. This is expected to change once the Shoalhaven is subject to a Water Sharing Plan and the Water Management Act comes into force for the area.

A desalination facility would need to be constructed in order to treat the brackish river water to a level suitable for process applications in the Bamarang power facility. The brine waste stream generated could then be discharged either back into the tidal flats system or via a pipeline to the ocean (would require a thorough EIS assessment) or stored (and potentially treated via evaporation or similar) and transported for offsite disposal.

Reason for Option Being Discarded

The extraction of estuarine waters and desalination is not preferred as an option due to:

- The approval method for extraction of water from the tidal flats of the river is not currently well defined;
- High capital and operational costs involved in treating brackish water by desalination;
- High energy process;
- Large volume of brine waste expected to be generated – discharge to the river or offsite disposal may be impractical or costly and not in accordance with Delta's objective of zero plant discharge.

4.3 Summary of Water Source Options for Wet Cooling

While some eight options have been identified as water source options for a wet-cooling process, these options were generally found to be infeasible or have severe limitation. A summary of the main options and the reasons for discarding are provided in Table 3 below.

Table 3 Summary of Water Source Options for Wet Cooling

Option	Limitation
Reclaimed effluent	Water already allocated elsewhere.
Industrial effluent	Low level of security of supply for required high security demand. Potential high cost (financial and economic) of transfer.
River/raw water	Limited water and licences available making the likelihood of securing supply very low.
Ground water	Limited volumes available on a sustainable basis.
Stormwater	Insufficient volumes available (even in combination with other options).
Site wastewater	Insufficient volumes available (even in combination with other options).
Potable water	Supply not available for required quantities.
Desalinated water	High capital and operational costs together with high energy usage and brine disposal issues.

Due to these limitations in securing a long term available water supply for wet cooling, dry cooling was selected as the preferred option. The water source options for dry cooling are described in Section 5.

5. Water Source Options for Dry Cooling

5.1 Introduction

The extensive number of water supply options that have been researched, none have been able to be secured to supply the 8.4 ML/d for the wet cooling process, due to inability to secure supply, high cost and environmental impacts of lengthy pipelines. Hence, Delta Electricity has chosen to pursue a dry cooling process (rather than a wet cooling process), for the Stage 2 facility. This has subsequently reduced the amount of water potentially required from 8.4 ML/d to approximately 0.5 ML/d.

Due to the reduced quantity of water required, water supply options close to the Delta Electricity site were seen to be the most viable. The closest water source options to the site are potable and raw water pipelines, which are operated by Shoalhaven Water.

5.2 Water Source Options

5.2.1 General

Discussions have been undertaken with Shoalhaven Water regarding access to the required volumes (~0.5 ML/d). A copy of correspondence from Shoalhaven Water indicating that the volume of water required by Delta Electricity is available is located in Appendix 1. Shoalhaven Water have agreed to provide the water from either their raw water or treated (potable) water supplies. Section 3 outlined the current and future water demands within the Shoalhaven LGA (into which the Bamarang site falls) and how Delta Electricity's Bamarang site's water demands can be accommodated within this.

Connection can be made to Shoalhaven Water's pipelines that are located in the proximity to the Delta Electricity site, which will eliminate construction of lengthy pipelines and associated potential environmental impacts.

Shoalhaven Water has identified one possible connection point for raw water and three possible connection points for treated water, as discussed in Sections 5.2.2 and 5.2.3. The information received from Shoalhaven Water relating to the connection points is located in Appendix 1.

5.2.2 Raw water

The Bamarang Reservoir is located to the immediate west of the proposed power facility site and is a source of reticulated water supply for Nowra (via the Nowra Water Treatment Plant). This water source currently supplies industries within the Nowra region (with the raw water pipeline passing to the north west of the power facility site). Shoalhaven Water has indicated that the Stage 2 Power Station's water requirement is available from the raw water pipeline at the north west of the site.

Shoalhaven Water have advised of possible connection points for raw water and one (1) possible raw water connection point is shown in Figure 2. This represents a tapping point from the raw water supply line from Shoalhaven River. For the raw water to reach the Delta Electricity site, the pipeline would need to be extended approximately 1.8 km along Longreach and Yalwal roads, which will entail trenching and installation of the pipe adjacent to the roads. Shoalhaven Water has also provided raw water quality figures, which can be found in Appendix 1.

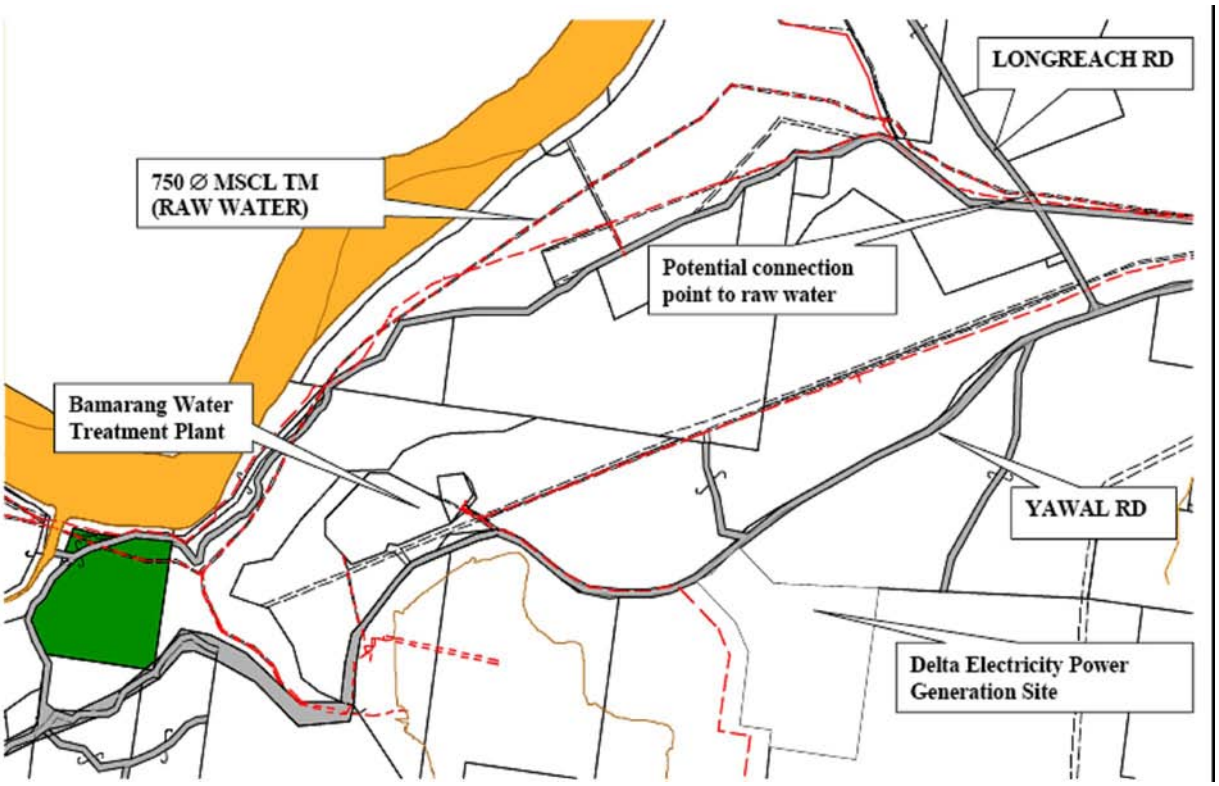


Figure 2 Potential Raw Water Connection Points[1]

This option has been discarded as the required pipeline length for raw water is longer compared to the pipeline required for treated water.

5.2.3 Potable Water

Water from Bamarang Dam is currently pumped to the adjoining water treatment plant and then reticulated to Nowra. Shoalhaven Water has indicated that they are able to supply 0.5 ML/d of treated water to the Delta Electricity site.

Figure 3 shows the three (3) possible treated water connection points, as advised by Shoalhaven Water. The possible connection points are:

- DN 600 Hobas Rising Main. This is the closest connection point to the Delta Electricity site. Connection to occur along Yalwal Road or on the site's western boundary;
- DN 750 MSCL. Connection and pipe extension to occur along easement, near overhead transmission lines; and
- DN 750 MSCL. Connection on Longreach Road and pipeline would need to be extended along Longreach and Yalwal roads.

[1] Figure supplied by Shoalhaven Water

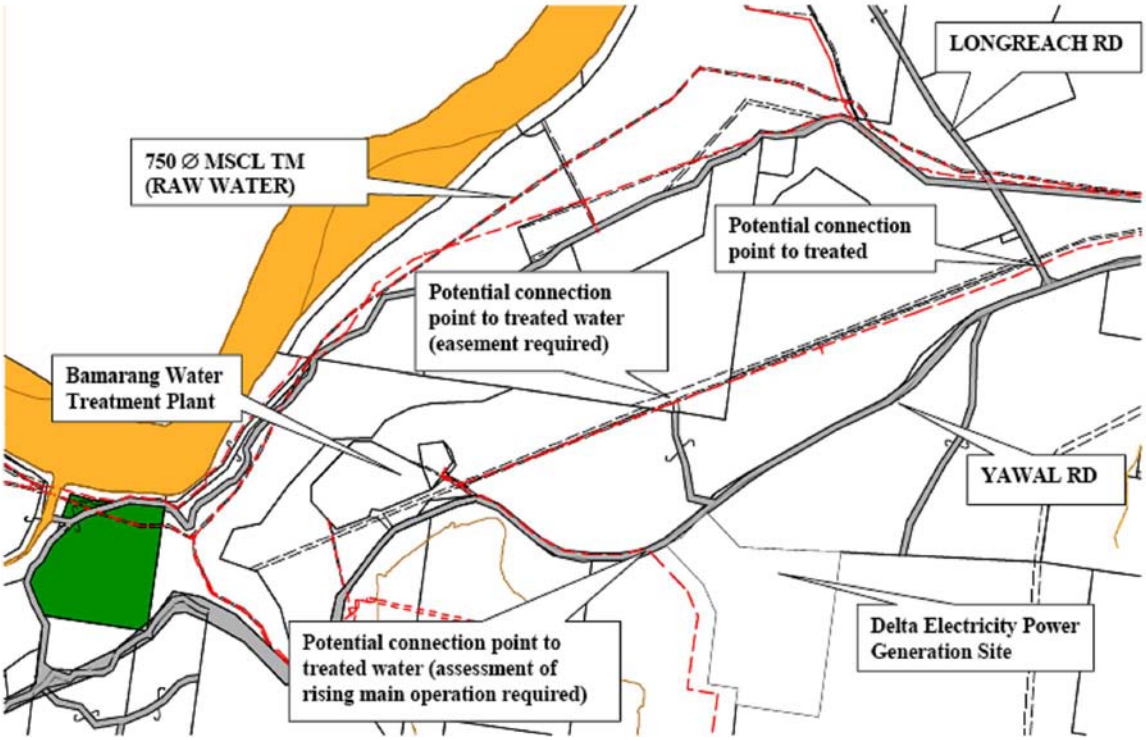


Figure 3 Potential Treated Water Connection Points[2]

Of these, the preferred option is the DN 600 Hobas Rising Main due to its proximity to the site. The connection to the DN 600 Hobas rising main would require an additional buffer tank on site, due to the operational nature of the pipeline.

The DN 750 MSCL accessible via the easement, is considered the second preferred option due to Delta Electricity already gaining regulatory approval for clearing of the easement, for transmission line placement. Additional approval from the roads authority (in this case Shoalhaven City Council) would still be required for the connecting pipeline to cross Yalwal Road. However, this road crossing will be located within approved transmission line easement, and is not expected to result in additional environmental impacts to the surrounding area. Approval is not being sought for this pipeline route at this stage.

The DN 750 accessible at Longreach Road is not the preferred connection option due to the length of pipeline that is required (i.e. it is the furthest of the three possible connection points to the site).

Shoalhaven Water has also provided treated water quality figures, which can be found in Appendix 1.

[2] Figure supplied by Shoalhaven Water

5.3 Preferred Water Connection Option – DN 600 Hobas Rising Main

5.3.1 General

The DN 600 Hobas Rising Main runs along the western boundary of the Delta Electricity site. The pipe to feed the Power Station site would travel through the site along the shortest route to the onsite buffer tank.

A Reduced Pressure Zone Device (RPZD) would also need to be fitted to the connection to the DN 600 pipe for backflow prevention.

Council have indicated that the connection point from the main to the site is open to negotiation with Delta Electricity as long as the requirements for water meter access are met (the water meter must be accessible at all times). A n indicative pipeline route showing the preferred water meter and connection route to the site is provided in

Figure 4.

The pipeline route across the site is in land to be cleared as part of the requirement for the asset protection zone (APZ), which is a cleared area to protect assets from bushfire hazards. Thus no additional clearing is required as part of the proposed pipeline route.

5.3.2 Infrastructure/Works Required

The infrastructure and construction works required for connection include:

» Connection point to water main
  – Including required valving and RPZD
» Pipeline (as detailed in section 5.3);
  – Preliminary pipe sizing indicates that a DN 100 pipe would be sufficient to supply the 0.5 ML/d to the site. There is sufficient sizing in the pipe for the 0.5 ML/d to be extracted over 12 hours.
  – A trench that is approximately 600 mm wide and 1200 mm deep will be needed to construct the pipe.
  – The pipeline would traverse the site from the DN600 Hobas Rising main along the southeastern side of the water treatment plant (and within the APZ) to the access road (As shown in Figure 4). From this location water can be delivered to the water treatment plant / service water tank (serving the process water requirement) or domestic water requirements (e.g administration building, gatehouse) along designated pipeline routes. The pipeline length is some 140m from the rising main connection point to the service water tank.
» Water meter at the connection point;
» Delivered to on-site service water tank and other domestic supply.

5.3.3 Backflow Prevention

For connection into the treated water system, protection against contamination of the potable water needs to occur. A reduced pressure zone device (RPZD) would need to be installed on the new pipeline at the connection point.

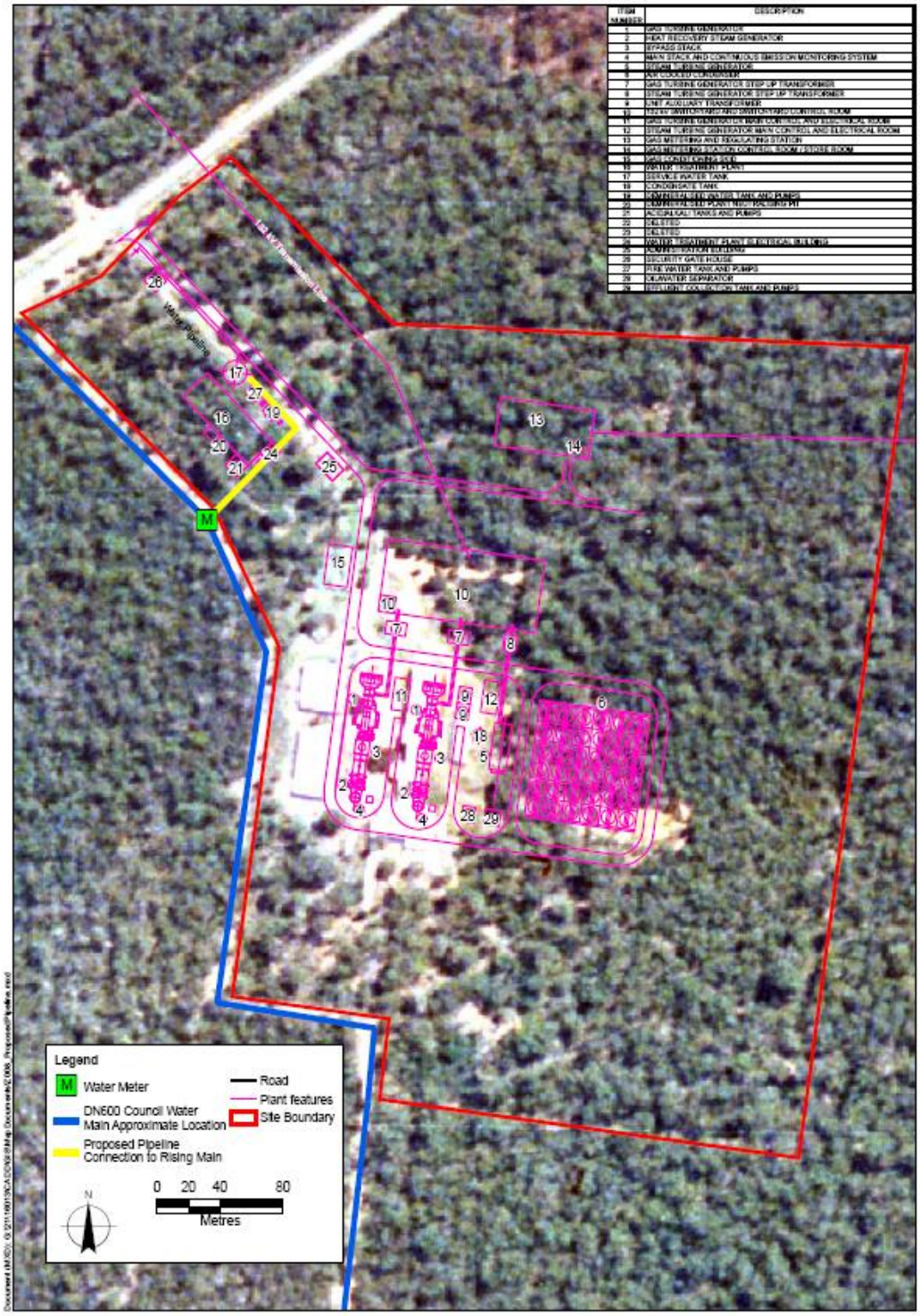


Figure 4 Proposed Pipeline and Connection to DN600 Hobas Rising Main

Figure 4 Proposed Pipeline and connection to DN 600 Hobas Rising Main

6. Summary and Conclusions

Delta Electricity (Delta) proposes to facilitate the development of a gas turbine power facility at Bamarang (approximately 8 km south-west of Nowra), to meet future regional and national electricity needs.

The power facility, as proposed, is to be developed in two stages:

» Stage 1 – A gas turbine peaking facility including two (2) Open Cycle Gas Turbines with approximate generating capacity of 300 MW; a gas pipeline to supply the proposed facility with gas from the Eastern Gas Pipeline; a 132 kilovolts electricity transmission line to transfer the electricity produced to the national electricity network; and ancillary infrastructure; and

» Stage 2 – A base load facility by converting the proposed facility to Combined Cycle Gas Turbine configuration with total generating capacity of approximately 400 MW.

The units to be used at the power facility and the final layout will be determined through competitive tendering and detailed design processes.

Delta Electricity has nominated a preference for a dry cooling process (rather than wet cooling), which has water requirements of approximately 0.5 ML/d (rather than the previously suggested wet cooling option which required some 8.4 ML/d).

Previous reports identified and assessed a number of water supply options (for a wet cooling process requiring some 8.4 ML/d). These include:

- Reclaimed effluent;
- Industrial effluent;
- River/raw water;
- Ground water;
- Stormwater;
- Site wastewater;
- Potable water; and
- Desalinated water.

As these options were found to have a number of restrictions in supplying the volume required for a wet cooling process, a dry cooled plant configuration was chosen. This will decrease the total water demands to approximately 0.5 ML/d consisting of 1 kL/d domestic and estimated 0.5 ML/d process water (based on PB, 2005).

Shoalhaven Council (as Shoalhaven Water) have indicated that they can readily provide this volume of water from either a raw or potable water source. Shoalhaven Council have commissioned an Integrated Water Cycle Management Study that considered existing and future water demands of the LGA. It has been shown that Delta's water demands fit within the future demands allowed for the water supply system and within the licensed extractions. Thus Delta's water demands are not expected to unduly impact on the Shoalhaven LGA's water supply requirements. Furthermore, it is not expected to unduly impact on the Shoalhaven River at large (from where Shoalhaven Water predominantly sources its' water) as it has been demonstrated that the requirements of Shoalhaven Water have been considered in

determining the extractions from Shoalhaven River. Shoalhaven Water have secured their water rights for the next 30-50 years. Hence the water source is considered to be both available and viable.

The preferred water supply is a potable source from DN 600 Hobas Main with connection along the western boundary of the site. Works involved with the water supply will include:

» DN 100 Pipeline;

» Trench through the site;

» Connection, including appropriate valving and flow meter.

7. References

"Bamarang Gas Turbine Water Supply Options Investigation Report", Parsons Brinkerhoff, April 2005

"Proposed Gas Turbine Power Station at Bamarang, Nowra, Water Cycle Management Report", GHD, December 2005

"Proposed Gas Turbine Power Station at Bamarang, Nowra, Water Supply Options Study", GHD, August 2007

Queensland Government, Department of Energy, "Water use in Power Stations"

Shoalhaven City Council 2003, *Shoalhaven Population, Population and Dwelling Trends 2002*, Shoalhaven City Council, accessed 17 December 2007, <http://shoalhaven.nsw.gov.au/council/pubdocs/PlanningDocs/PopulationTrends2002.pdf>

Shoalhaven City Council 2005, *Shoalhaven City Water Supply System,* accessed 21 December 2007, <http://www.shoalwater.nsw.gov.au/Publications/pdfs/SydMetroWaterPlan/Sydney_Metropolitan_Water_Plan_Background.pdf>

Shoalhaven City Council 2007, *Shoalhaven Population*, Shoalhaven City Council, accessed 17 December 2007, <http://www3.shoalhaven.nsw.gov.au/applications/population/>

Shoalhaven River Estuary Data, Compilation Study, Umwelt (Australia) Pty Limited, July 2005

"Shoalhaven Water Reclamation Annual Report 2005-06", Shoalhaven Water

Shoalhaven City Council, *Integrated Water Cycle Management Plan, Concept Study, Draft Report*, MWH, March 2006

Appendix 1

Information from Shoalhaven Water

Water Quality Data for Treated and Raw Water

Reference to Water Supply Availability

Details of Possible Connection Points

Shoalhaven Water
A Division of Shoalhaven City Council

WATER SUPPLY – QUALITY STANDARDS (Northern)

	Raw Water Shoalhaven River (typical)	After Treatment (typical)	NHMRC Guidelines (1987)	NHMRC/ARMCANZ Guidelines (1996)		Treatments
Physical Quality				**Health**	**Aesthetic**	
Turbidity	1.7NTU	0.20 NTU	5 NTU	*	5NTH	The treatment is a chemical process that is designed to purify water to meet the National Health and Medical Research Council / Agriculture and Research Management Council of Australia and New Zealand (NHMRC/ARMCANZ) 1996 Guidelines This is done in accordance with strict government regulations. These regulations include:- Clean Waters Act, 1970 Clean Air Act, 1961 Environmental Planning and Assessment Act, 1979 State Pollution Control Commission Act, 1970 Protection of the Environment (Administration) Act Protection of the Environment Operations Act 1997 Noise Control Act, 1975 Environmental Offences and Penalties Act, 1970 Local Government Act, 1993 Hazardous Chemicals Act, 1985 Catchment Management Act, 1989 Fluoridation Act.
Colour	25 Hazen	2.5 Hazen	15 Hazen	**	15 HU	
pH	7.4	7.8	6.5 – 8.5	*	6.5 – 8.5	
Taste and Odour	Pass	Pass	Not objectionable to consumers	**	Acceptable to most people	
Chemical Quality						
Chlorine Residual	NIL	0.8 ppm	0.1 ppm (min)	5 ppm	0.6 ppm	
Fluoride	0.06 ppm	1.0 ppm	0.5 – 1.7 ppm	1.5 ppm	-	
Iron	0.21 ppm	0.01 ppm	0.3 ppm	*	0.3 ppm	
Manganese	0.01 ppm	<0.01 ppm	0.1 ppm	0.5 ppm	0.1 ppm	
Copper	0.16 ppm	<0.02 ppm	1 ppm	2.0 ppm	1.0 ppm	
Zinc	<0.05 ppm	<0.05 ppm	5 ppm	*	3.0 ppm	
Aluminium	0.12 ppm	0.10 ppm	0.2 ppm	*	0.2 ppm	
Lead	<0.01 ppm	<0.01 ppm	0.05 ppm	0.01 ppm	-	
Cadmium	<0.001 ppm	<0.001 ppm	0.005 ppm	0.002 ppm	-	

Date Revised: Friday, 22 November 2002
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	Raw Water Shoalhaven River (typical)	After Treatment (typical)	NHMRC Guidelines (1987)	NHMRC/ARMCANZ Guidelines (1996)		Treatments
Chromium	<0.01 ppm	<0.01 ppm	0.05 ppm	0.05 ppm	-	**Chemical Dosages (typical)**
Nickel	<0.01 ppm	<0.01 ppm	N/A	0.02 ppm	-	• Aluminium Sulphate, dose rate 17 ppm, used as coagulant to assist in clarification of the water
Phosphorus	<0.02 ppm	<0.02 ppm	N/A	N/A	N/A	
Nitrate	<0.5 ppm	<0.05 ppm	N/A	50 ppm	-	• Lime and Carbon Dioxide Rates vary between 35 – 45 ppm each and are used to alkalinity and adjust pH
Alkalinity (total)	22 ppm	50 ppm	N/A	N/A	N/A	
Hardness (total)	22 ppm	75 ppm	500 ppm	**	200 ppm	• Fluoride, dose rate 1.0 ppm (max) used to prevent dental caries
Chloride	20 ppm	20 ppm	400 ppm	**	250 ppm	
Sulphate	6 ppm	13 ppm	400 ppm	500 ppm	250 ppm	• Chlorine (gaseous), dose rate 2.2 ppm, used to sterilise the water and make it safe for drinking.
Sodium	12 ppm	20 ppm	300 ppm	**	180 ppm	
Potassium	1 ppm	1 ppm	N/A	N/A	N/A	
Magnesium	2.5 ppm	2.5 ppm	N/A	N/A	N/A	
Calcium	5 ppm	5 ppm	N/A	N/A	N/A	
Specific Conductance	130 us/cm	160 us/cm	N/A	N/A	N/A	
Microbiological						
Total coliforms	40	<1	<1	NIL	-	ppm = Particles per millimeter * = Insufficient data to set a guideline based on health considerations ** = No health based guideline is necessary < = Less than
B. coli	6	<1	<1	-	-	
Faecal coliforms	6	<1	<1	NIL	-	

Kangaroo Valley:- The water quality is approximately the same other than total alkalinity and hardness which are tyically 25 ppm.

From: **Emma Every/Sydney/GHD/AU** on **14/12/2007 10:24:13 AM**
Repository: 2116013 Bamarang Stage 2 Project Approval

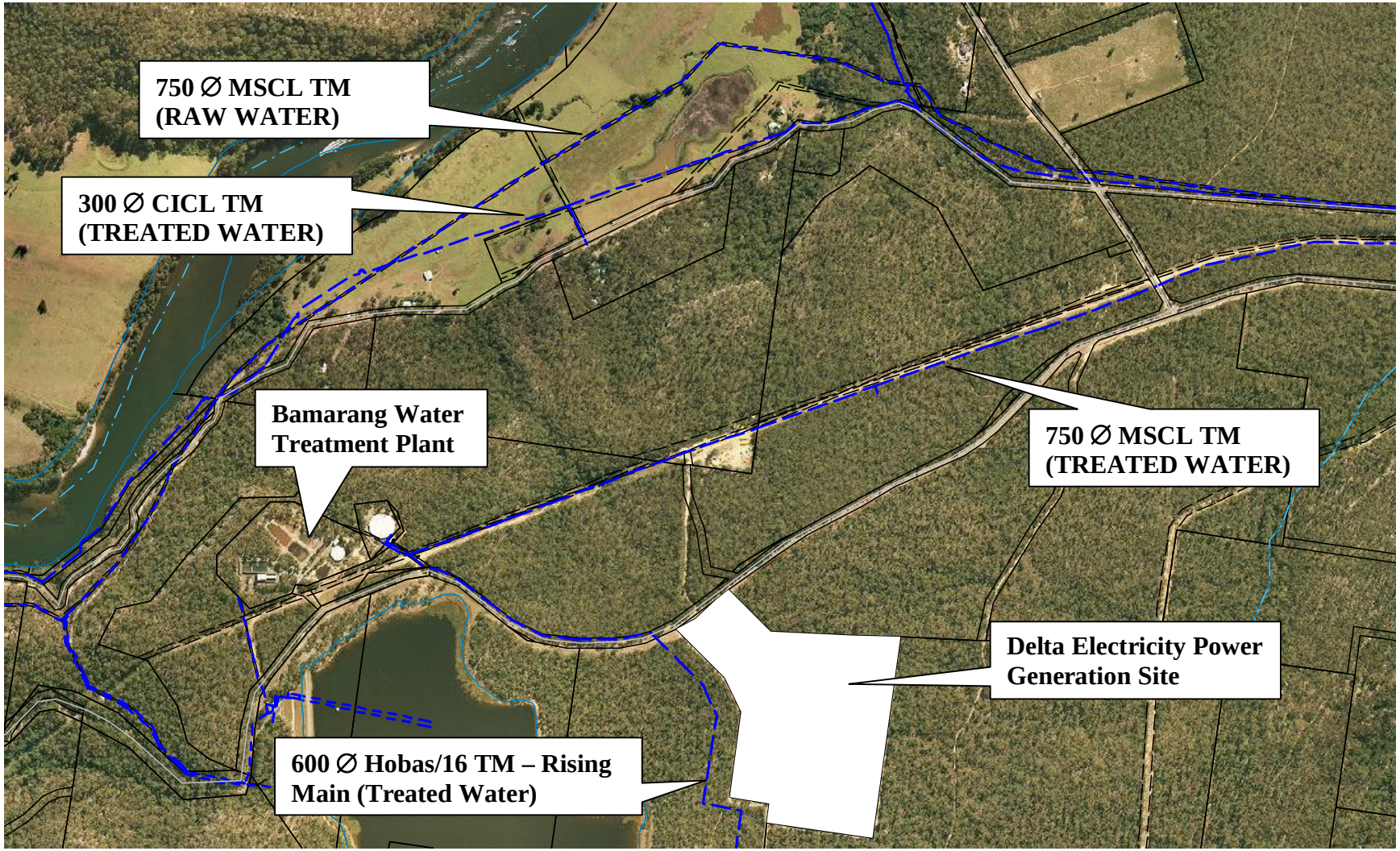
To: Lee-Anne.Carmody@ghd.com.au
cc:
Subject: Fw: Delta Electricity - Power Generation Plant - Bamarang

-----Forwarded by Emma Every/Sydney/GHD/AU on 12/14/2007 10:27AM -----

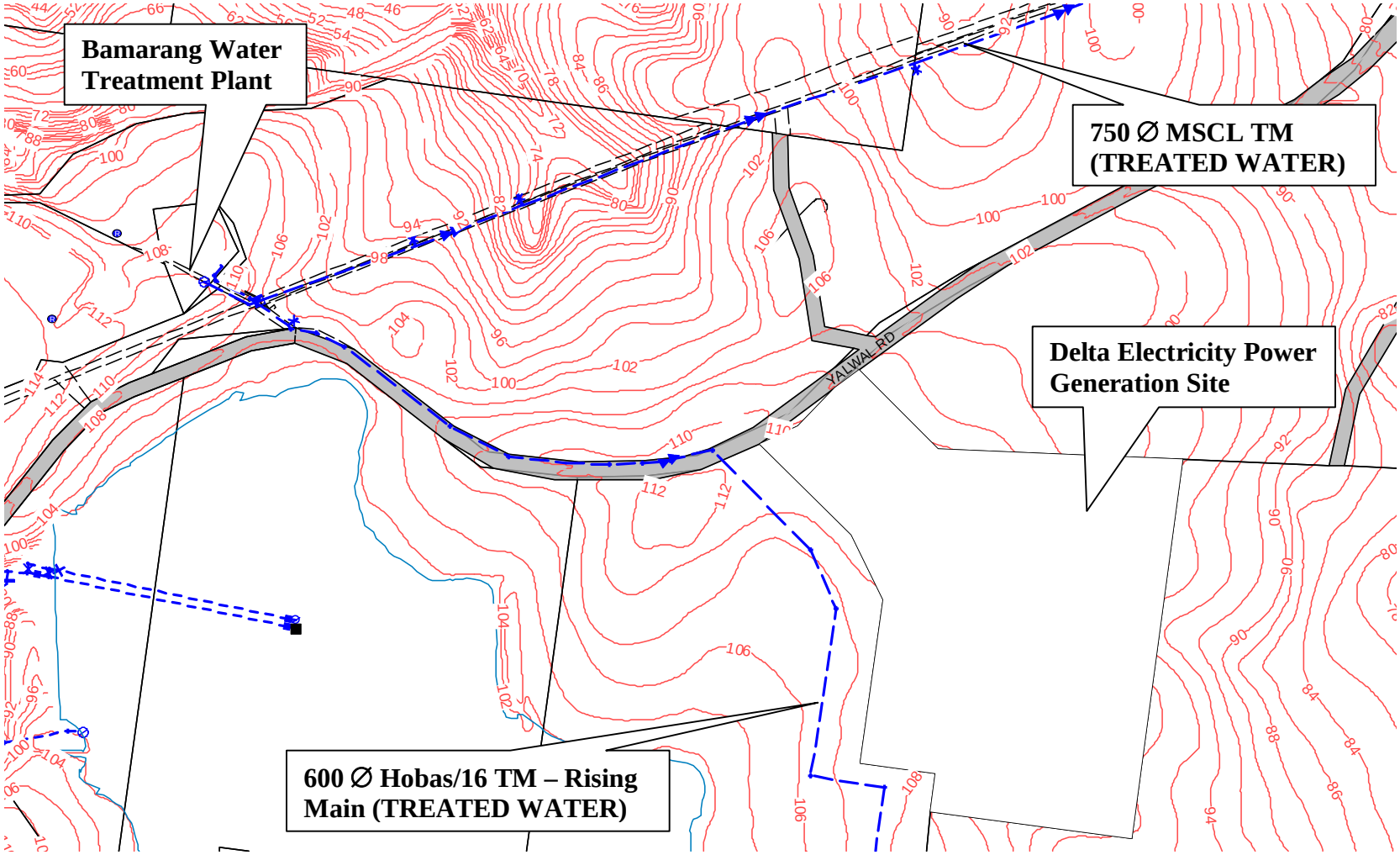
To: <Emma.Every@ghd.com.au>
From: "Lazarevski, Ljupcho" <LAZAREVSKI@shoalhaven.nsw.gov.au>
Date: 12/13/2007 03:27PM
Subject: Delta Electricity - Power Generation Plant - Bamarang

Emma,
Further to your client's inquiries:
I advise that your client has been advised by our management that 0.50ML/d is available for use by the proposed development and this would not unduly impact of current and future planned development.
Please find attached design plan of 600 diameter Hobas main adjacent to your client's land.
In relation to location of water meter, Shoalhaven Water requires that the meter be located at the front of the property for reading and maintenance purposes. Locating the meter of the trunk main further down along the trunk main is not acceptable for reading and maintenance purposes.
As the trunk main crosses Yalwal Road connection can be made on southern side of the road.
Our design plan shows the trunk main very close to your client's land (whilst our GIS plan shows it some distance away). The design plan is more accurate.
I trust the above information is of assistance.
Regards
Ljupco Lazarevski
Systems Development Engineer
Shoalhaven Water

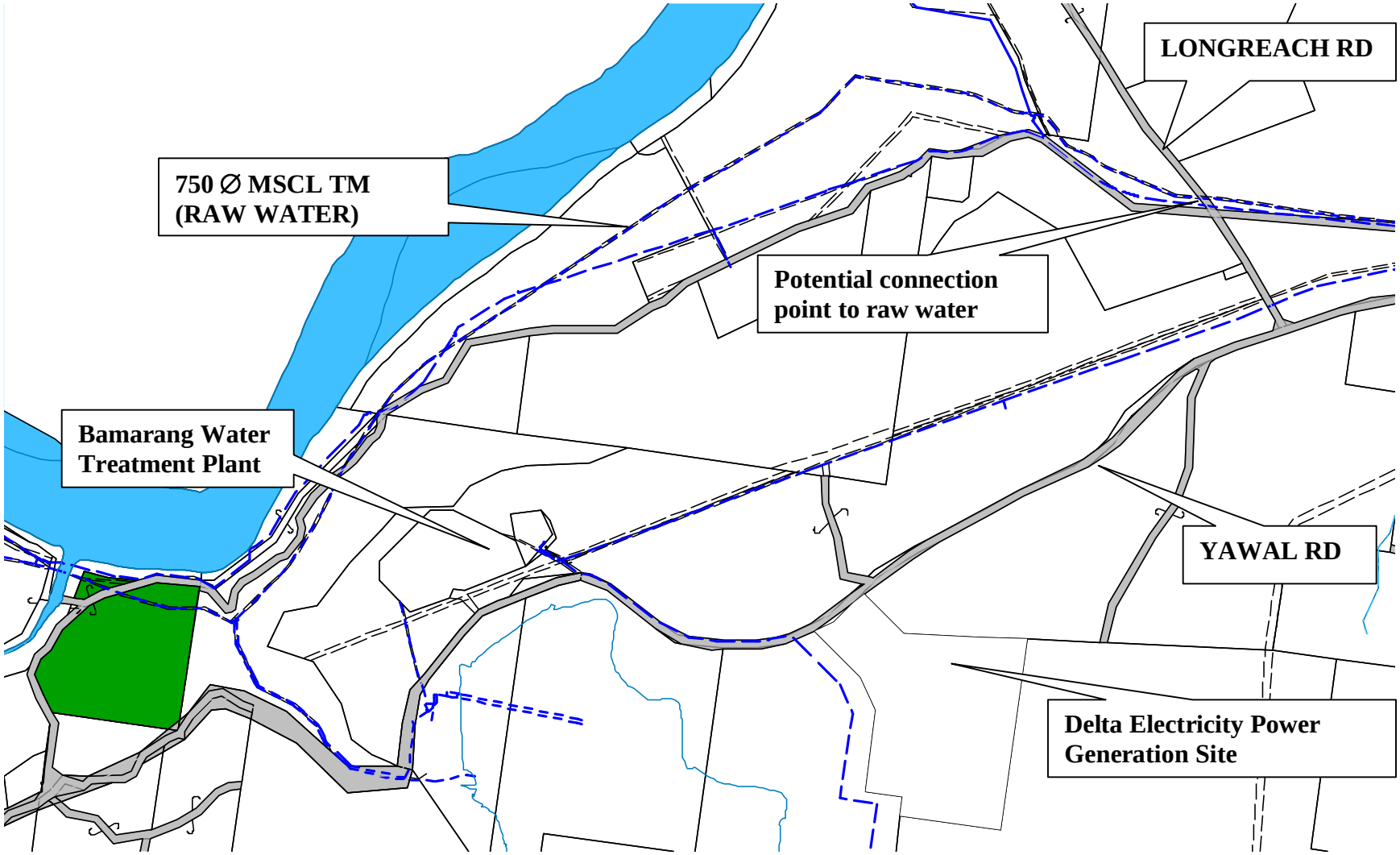
- W20769-02 Bamarang to Radar Hill TM.tif



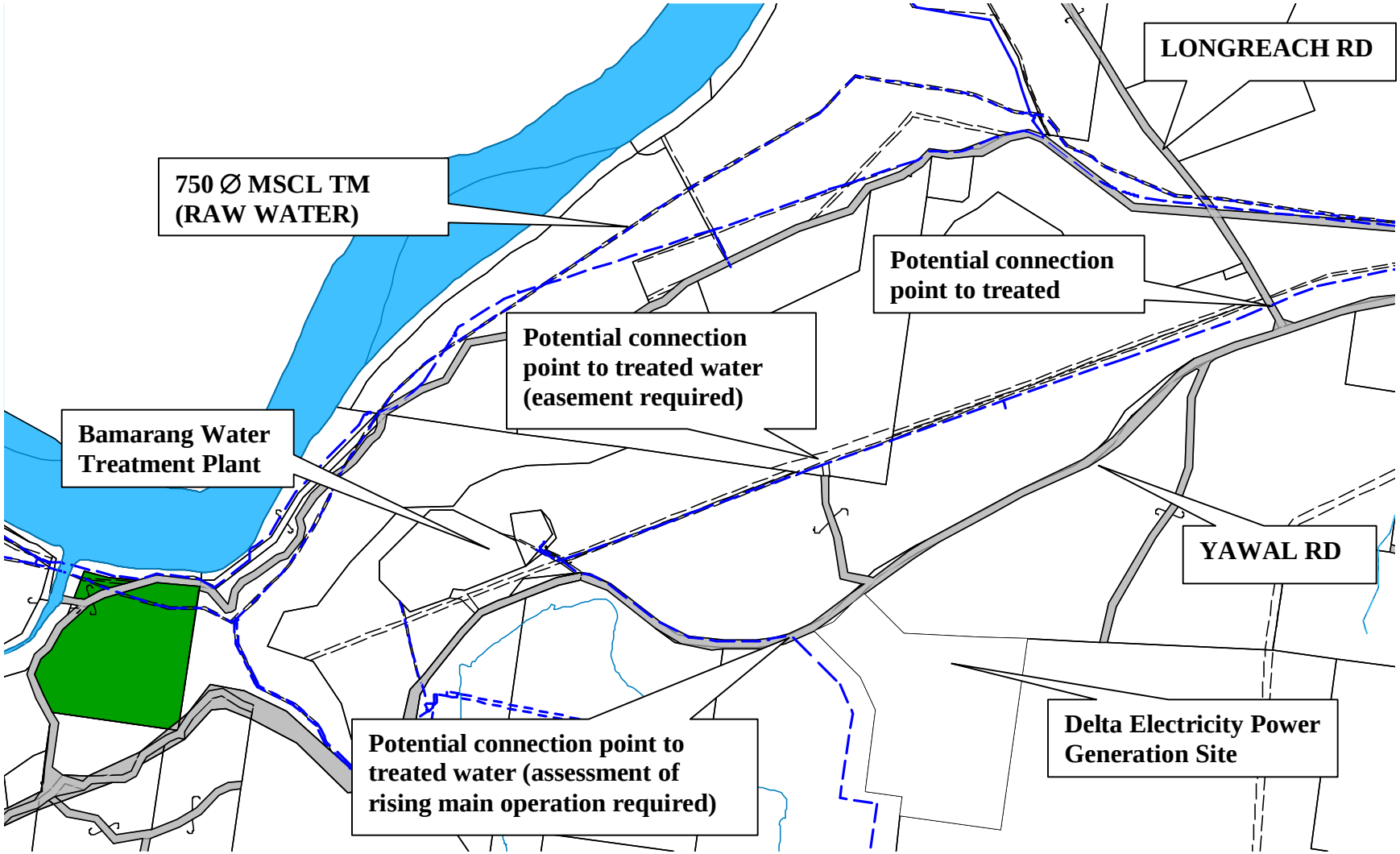
AERIAL PHOTO WITH WATER SUPPLY ASSETS – DRAWING No. 1



PLAN OF CONTOURS FROM BAMARANG WTP TO DELTA ELECTRICITY POWER GENERATION PLANT SITE – DRAWING No. 2



PLAN OF POTENTIAL RAW WATER CONNECTION POINT FOR DELTA ELECTRICITY POWER GENERATION PLANT SITE – DRAWING No. 3



PLAN OF POTENTIAL TREATED WATER CONNECTION POINTS FOR DELTA ELECTRICITY POWER GENERATION PLANT SITE – DRAWING No. 4

General Information on Water Supply Assets

Bamarang Water Treatment Plant
Clear Water Reservoirs

16ML Capacity:
TWL = 112.00m (AHD)
BWL = 107.00m (AHD)

5ML Capacity:
TWL = 112.00m (AHD)

Bamarang Off-Stream Storage (Dam)

TWL = 101.70M (AHD)

Radar Hill Reservoir

10ML Capacity
TWL = 162.40m (AHD)
BWL = 150.56m (AHD)

(Pumps at Bamarang WTP deliver treated water to Radar Hill reservoir via 600 ∅ Hobas/16 TM) This rising main runs close by Delta Electricity's site.

Potential Connections

If a gravity connection is to be provided to Delta Electricity's site for domestic and operational purposes then connection to the 600 ∅ Hobas/16 TM would be the appropriate option. A pressure reducing valve (PRV) would need to be installed at the connection point to ensure water pressure variation does not impact on the proposed development's operation (see Drawing No. 4).

A maximum static head of approximately 52.40m (162.40m – 110m) would be available at the front boundary of the site.

If Delta Electricity intends to pressurise its internal system then potential connection locations for treated water supply include:

1. off the 750 ∅ TM (via easement – see Drawing No. 4),
2. off the 750 ∅ TM at Longreach Rd (no easement – see Drawing No. 4),

If Delta Electricity intends to pressurise its internal system then potential connection locations for raw water supply include:

1. off the 750 ∅ TM at Longreach Rd (no easement – see Drawing No. 4).

With all options a water main extension would be required to the power generation site at the developer's expense.

General

The applicant is advised that they must make application for a Certificate of Compliance under Section 307 of the Water Management Act 2000.

The applicant is advised that a Water Supply Developer Charge will be applicable prior to any construction works for water supply.

All information is provided "without prejudice".

GHD Pty Ltd ABN 39 008 488 373

10 Bond Street Sydney NSW 2000

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T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	L. Carmody	E. Every	*E. Every*	M. Roser	*M. Roser*	21/12/07
B	L. Carmody	E. Every	*E. Every*	M. Roser	*M. Roser*	7/01/08
0	L. Carmody	E. Every	*E. Every*	M. Roser	*M. Roser*	11/01/08
1	L. Carmody	E. Every	*E. Every*	M. Roser	*M. Roser*	23/01/08
2	E. Every	E. Every	*E. Every*	M. Roser	*M. Roser*	10/03/08
3	M. Roser	M. Roser	*M. Roser*	M. Roser	*M. Roser*	28/03/08