14.1 Introduction

An assessment of the water requirements, wastewater production and stormwater management at the Site for the EnergyAustralia Facility has been undertaken. Both construction and operational aspects have been considered.

14.2 Methodology

This assessment has been conducted to include:

- an estimation of the flooding potential of the Site;
- an assessment of the water quantity and quality impacts, with particular reference to water needs and the *Drinking Water Catchments Regional Environmental Plan No. 1* (REP No. 1) heads of consideration;
- the proposed source of water;
- the implementation of water saving measures;
- identification of the quantity and quality of wastewater and how this wastewater is to be disposed of; and
- management of stormwater at the Site.

14.3 Existing Environment

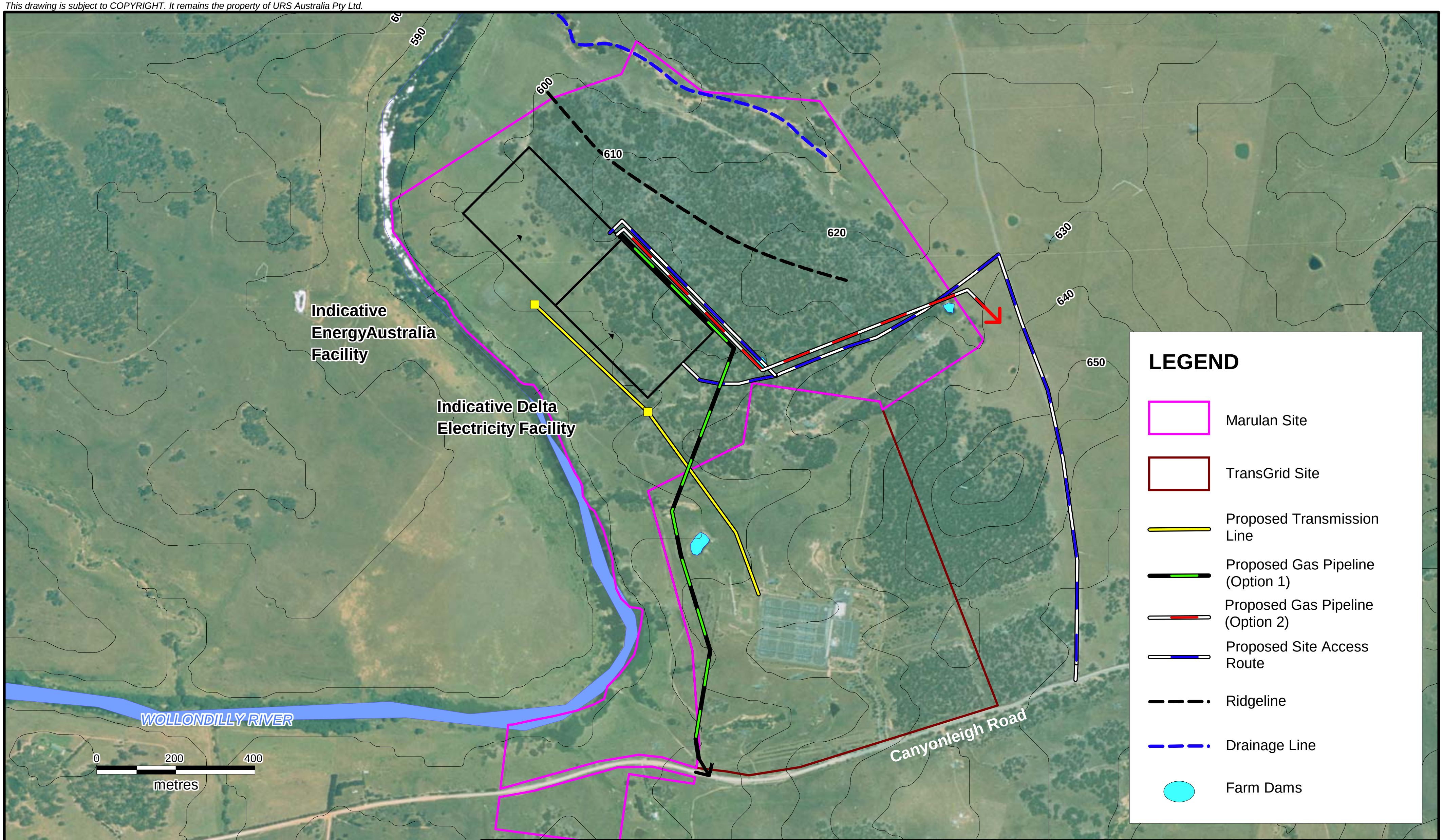
14.3.1 Marulan Site and Surrounding Area

The Marulan Site comprises approximately 116 ha of pasture land and woodland. Overall the Site slopes gently west towards the Wollondilly River, with the runoff from the Site and the ephemeral gullies flowing directly to the River (refer to **Figure 14-1**).

This development falls within the area covered by REP No. 1 and is also covered by the embargo on river water extraction. **Chapter 5** (Statutory Planning) provides more details on these policies and plans: however, the embargo makes it necessary to recycle rainwater runoff from the Facility and to use external resources such as effluent from existing sewage treatment plants.

Available information on surface water in the area is not extensive, though a recent quarry environmental impact assessment (Morse McVey,,2008), on the surrounding area indicated that surface water management has not been a significant constraint to infrastructure development.

Groundwater in the Goulburn Mulwaree Council area is dominated by the fractured rocks of the Lachlan Fold Belt which are generally poor aquifers.



Source: Delta Electricity, Energy Australia

Client	Project	Title
ENERGYAUSTRALIA	MARULAN GAS TURBINE FACILITY	NATURAL DRAINAGE AND WATER FEATURES
URS	Drawn: AJW · Approved: NB · Date: 14.03.08	Figure: **14-1**
	Job No: **43177371** · File No: 43177371-188.wor	

While no specific groundwater investigations have been conducted at the site, environmental impact assessments were conducted for the nearby Gunlake quarry, which show that a registered bore used for rural purposes has a low yield rate (2.9 L / sec). In addition, a Water Management Strategy conducted at the quarry by Parsons Brinckerhoff (2007) indicated that the groundwater quality was quite variable with salinity ranging from 400 – 7,500 ppm. It is expected that the higher salinities would be located in lower lying areas such as the Site.

14.3.2 Average Rainfall

Data obtained from the Department of Meteorology indicates that the Average Annual Rainfall (AAR) is approximately 700 mm. This is based on a dataset extending from 1895 to 2007. Investigations have indicated that whilst this may be considered moderate by Australian standards, departures from the average indicate there are significant periods of drought have occurred over the preceding 100 years. As such the AAR may not be entirely representative of the rainfall conditions that exist in the study area.

14.4 Flooding Potential

The Wollondilly River fronts the EnergyAustralia Facility to the west. The potential for flooding at this location is as a result of major rainfall events to the south of the Site that would affect the City of Goulburn prior to affecting this Site. As such, Goulburn is the primary flood warning location for the Site.

The smaller streams within the Site pose only limited risk to the proposed development. However, the evidence of severe gully erosion in steeper parts of the catchment indicates that local runoff occurs as a result of intense local rainfall.

It should be noted, that given the paucity of flood related data for the Site, the investigations reported here are estimates only. Investigations are based on available data transposed to the Site to estimate peak flows. Floodplain cross-sections have been developed from limited detailed Site survey in order to estimate flood levels and are best estimates based on URS' experience and judgement.

The facility is located on the Wollondilly River, downstream of the City of Goulburn. A schematic representation of the river system and gauging stations is provided in **Figure 14-2**. As the river progresses downstream to Warragamba Dam, it is joined by a number of significant streams that add to the total flow in the river.

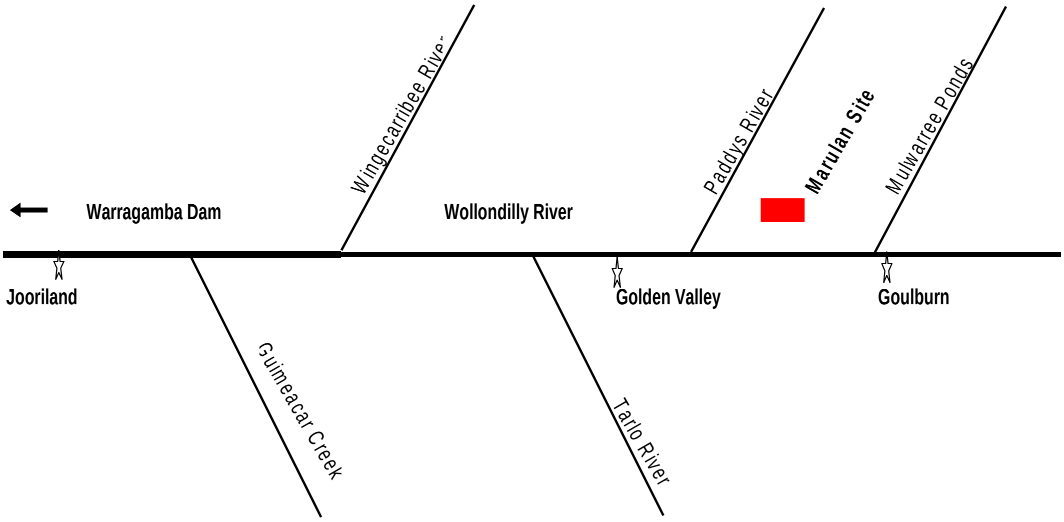


Figure 14-2 Schematic of Wollondilly River

Stream flow estimates are based on judgement correlation of flows at three gauging stations on the Wollondilly River at Goulburn, Golden Valley and Jooriland.

The gauging station at Goulburn has been used for a range of flood studies dealing with the City. The gauge records have been subjected to flood frequency analysis, though there are significant uncertainties in the results due to missing data and gauge anomalies.

Historically, the highest recorded flow for the Wollondilly River at Goulburn occurred in 1974 with a peak flow of 720 m^3/s upstream of the confluence with Mulwaree Ponds. It is estimated that the flow downstream of the confluence with Mulwaree Ponds was 1,115 m^3/s; however, this is not a gauged flow. The Goulburn Floodplain Management Study and Plan indicates that the 1 in 100 year Average Recurrence Interval (ARI) flood for the Wollondilly River at Goulburn is estimated to be 1,415 m^3/s upstream of the confluence and is estimated to be 2,185 m^3/s downstream of the confluence with Mulwaree Ponds.

The Golden Valley gauge has a relatively short history (since 1980) and has recorded only one significant flow (1990) of 2,349 m^3/s.

Historically, there have been three major floods recorded at Jooriland gauging station, 4,268 m^3/s in August 1974, 3,925 m^3/s in June 1975 and 5,038 m^3/s in August 1990.

It should be noted that the flood in Goulburn in August 1990 was not a record flood, indicating that other catchments contributed significantly to the high or record flows at Golden Valley and Jooriland gauging stations.

A flood frequency analysis of the Jooriland gauging record (1961 – 1998) provides an estimate that the 1 in 100 year ARI flood for the Wollondilly River at Jooriland is 5,405 m^3/s. The Confidence Limits on this estimate are:

- 5 % CL estimated at 13,260 m^3/s
- 95 % CL estimated at 3,132 m^3/s

These confidence limits, as expected for 38 years of record, are very wide and any extrapolation of the record beyond the 1 in 100 year ARI introduces significant uncertainty.

Adopted Site Flood Flows

Given the significant inflows that occur between the Site and the Jooriland stream gauge, it is not safe to use any estimates from that gauge to estimate the 1 in 100 year ARI at the Site.

The most appropriate approach is to use the estimates from Goulburn and extrapolate for the increased catchment size. This approach also involves a significant degree of estimation as there would be only an in-direct correlation between the peak flows at either Goulburn or Jooriland.

Accordingly, a range of flows was adopted to assess potential flood levels at the Site. These flows range from the estimate at Goulburn (2,185 m^3/s) to a maximum of 2,785 m^3/s. The impact on flood levels is discussed below.

To assess the effects of an extreme flood, the flow estimate of 2,485 m^3/s was adopted as an approximation of the 1 in 100 year ARI flood and then multiplied by three to replicate an extreme flood. This approach was adopted at Goulburn during its floodplain risk management process. The impacts of this flood are discussed below.

Estimation of Flood Levels

Flood levels for the Site were estimated with a HEC-RAS hydraulic model, utilising cross sections developed from detailed Site survey (0.5 m contours) and topographic maps of the area (10m contours) for areas outside the surveyed areas. A range of flood flows was modelled to address the uncertainty of the design 1 in 100 year Average Recurrence Interval (ARI) flood estimate and to assess the sensitivity of the area to a range of floods.

It should be noted that as there is no recorded flood data for the Site, the model could neither be calibrated nor validated. All hydraulic parameters were chosen based on experience gained from modelling similar situations throughout NSW.

Results for the cross section at the Site are presented in **Table 14-1**.

Table 14-1 Estimated Flood Level – Wollondilly River at Marulan

Flow (m^3/s)	Estimated Flood Level (m AHD)	Channel Velocity (m/s)
2185	596.71	1.67
2285	596.92	1.67
2385	597.12	1.68
2485	597.32	1.69
2585	597.51	1.70
2685	597.69	1.71
2785	597.86	1.72
Extreme Flood (3 x 2485 m^3/s)	603.44	2.40

These results indicate that there is a degree of stability regarding flood levels, based on the selected parameters in the model and that, with the modelling limitations stated, 1 in 100 year ARI flood levels at the Site would not exceed 600 m AHD. Based on the survey data available of the area, the Site is generally above 600 m AHD falling north-west from around 626 m AHD to the Wollondilly River corridor at around 590 m AHD.

The extreme flood estimate (i.e. a flood approaching a PMF- Probable Maximum Flood), considers flood levels above the 600 m AHD level. Given all the uncertainties associated with the hydrology and hydraulic modelling, and the lack of historical data, and as there remains the possibility that an extreme flood, such as a Probable Maximum Flood (PMF), may affect some of the overall Site, risk-averse property will be constructed above 605 m AHD.

14.5 Neutral or Beneficial Effect

As discussed in **Chapter 5** (*Statutory Planning),* this development falls within the area covered by REP No. 1. As such, it is essential that the development meet certain heads of consideration which, while not specifically stated in REP No. 1, are generally established in the Sydney Catchment Authority's (SCA) *Neutral or Beneficial Effect on Water Quality Assessment Guidelines* (Guidelines).

The Guidelines are stated in **Section 14.5.1** below and the responses are provided in **Section 14.5.2**.

14.5.1 Definition of neutral or beneficial effect

Under REP No. 1, proponents of a development are required to demonstrate a neutral or beneficial effect on water quality as a result of the development in order to obtain approval. Proponents of activities must consider whether their activity can demonstrate a neutral or beneficial effect on water quality in an environmental assessment.

Clause 28(3) of REP No. 1 specifies that a *"neutral or beneficial effect on water quality"* means development that:

a) has no identifiable potential impact on water quality, or

b) will contain any such impact on the site of the development and prevent it from reaching any watercourse, waterbody or drainage depression on the site, or

c) will transfer any such impact outside the site by treatment in a facility and disposal approved by the consent authority (but only if the consent authority is satisfied that water quality after treatment will be of the required standard).

Application of the Neutral or Beneficial Effect Test

The Guidelines state that for practical application, a proposed development or activity will have a neutral or beneficial effect on water quality if it complies with one of the following:

1. There are no factors involved that have any potential to impact on water quality. Changes to the site conditions and/or to the nature and location of development will not occur in any way that has the potential to:

a. Directly change pollutant loadings by introducing or increasing substances into the hydrological cycle (such as waste flows, increased erosion, nutrients and sediments), or

b. Indirectly change the quality of water in the hydrological system by changing the bio-physical characteristics of the site in any way that reduces, or poses a significant threat of reducing, the capacity of the site and related hydrological/ ecological components to assimilate, treat and otherwise produce water of at least equal quality to that contributed by the existing systems. Changes relate to the environmental values of the system, and may include:

- Significant changes to flows (reductions or increases in flows),
- Clearing or degradation of watercourses or of riparian corridors, or
- Changing the flow paths of water through these assimilative systems.

2. The development will not adversely affect water quality off the site because:

a. pollutant loads that occur as a result of the development / activity can be transported to acceptable downstream treatment and disposal facilities without adverse offsite water quality impacts, and/or

b. any water quality issues can be effectively managed onsite such that there are no adverse water quality impacts occurring offsite, and

c. there are no adverse water quality impacts that arise or are likely to arise indirectly as a result of changes to factors that affect the treatment, assimilation of pollutants, or affect the quality of water as part of the hydrological cycle (such as changes to flow or flow paths, water courses or riparian corridors) that can adversely affect water quality off the site.

The ‘site’ of a proposed development or activity, for the purpose of determining water quality impacts, is the land described in the development application, the Part 5 activity, or where relevant, the project application.

Pollutant loads or concentrations for each pollutant leaving a site are measured at the site boundary, or at that point where the pollutant enters a drainage depression, waterbody or watercourse.

14.5.2 Responses to Neutral or Beneficial Effect Tests

The EnergyAustralia Facility by itself and in conjunction with the adjoining development proposed by Delta Electricity satisfies the requirements laid out in the Guidelines.

Certain sections of the proposed development have the potential to impact on water quality if no mitigation measures are incorporated into the design. Detailed design would ensure all necessary measures are incorporated to ensure that any waste water or polluted water is captured within the Site and does not leave the Site, other than in operations to transport the waste to a suitable treatment plant.

A similar approach is adopted to capturing runoff from clean areas and this runoff is captured for recycling into the development processes and activities. Again, any waste water is captured and either recycled or transported offsite for treatment.

There will be a reduction of flows into the Wollondilly River; however, the reduction is not significant from an overall catchment or sub-catchment point of view.

There will be some clearing of vegetation however there are no watercourses affected by the development. Mitigation measures have been identified and designed for both the construction and operational phases of the proposed development to ensure that there is no degradation of flows into the River and that all flows that would have passed through the Site are diverted and returned to their natural course to the River.

Detailed design would ensure that only rainfall directly onto the Facility area would be captured for recycling. This water would be treated and cleaned for limited recycling with residues taken offsite for disposal in accordance with the requirements of REP No. 1.

There would be no clearing or degradation of watercourses, existing dams, or of riparian corridors as a result of the proposed development.

The Soil and Water Management Plan to be prepared as a part of the Project would include actions needed to meet the *Guidelines* and the Landcom's Blue Book (*'Managing Urban Stormwater: Soil and Construction')*. Surface waters falling or flowing through the site would be managed in accordance with the water management plan. Such management actions would include:

- water retained within the harvestable rights for the Site;
- water of suitable quality being diverted to a natural watercourse; and
- water treatment for those waters originating from disturbed areas.

14.6 Assessment of Potential Impacts - Construction – EnergyAustralia Facility

The potential impacts of the earthworks for the Facilities have been addressed in the *Concept Application* for the Common Shared Works. As the majority of earthworks would have been previously completed, this phase involves construction of each Facility. Some minor earthworks for minor reprofiling of the Site may be required.

Rainfall on these disturbed sites may cause soil erosion and runoff may contain elevated levels of sediments which could then enter the natural drainage system. The soils at the Site are likely to have a high percentage of fines, and may or may not be dispersible.

As the Site is located adjacent to the Wollondilly River there is potential for sediment laden runoff to reach the river.

The construction phase (approximately 12 to 18 months) water requirement for Facilities is estimated to be 6-8 kL per day for each Facility.

This requirement takes into account the following:

- personnel levels;
- minor allowances for wet trades during construction (bricklaying / blocklaying, rendering to small areas only, (for example, control rooms);
- all concrete mixing off-site (i.e., not allowed for in estimates);

- no on-site construction camp or canteen facility (i.e. no mess rooms, showers/toilet facilities only);
- no consumption for fire fighting purposes considered; and
- no allowance for water sprays for dust control.

It is noted that water sprays for dust control could be considerable, depending on a number of aspects such as the condition of the road network and prevailing weather conditions. Water requirements for the construction of the Facilities could be up to 100 kL per day during hot dusty windy weather.

There is also the potential for spills and gross pollutants to be mobilised by runoff and enter the natural drainage system if no mitigation measures are put in place.

However, with appropriate safeguards there is little likelihood that during the construction period that there would be an increase in either the rate or volume of water entering the stormwater system.

14.6.1 Mitigation

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. As a minimum, the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented.

Construction would be planned to minimise the time that disturbed land is exposed and appropriate erosion prevention and sedimentation devices would be installed and maintained where areas are disturbed, in line with *Managing Urban Stormwater – Vol 1 Soils and Construction guidelines* (Blue Book guidelines). This may include limiting slope length, the installation of sediment filters and the construction of a sediment basin downstream of the areas of earthworks. These devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.

Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.

Spills would be minimised through proper Site management. If any spill was to occur, it is likely to be of a small volume and contaminate only a small area. All possible pollutant materials would be stored well clear of Site boundaries and stormwater drainage lines. They would be stored in a designated covered area. Containment bunds would be constructed with provision for collection of any spilt material.

Waste collection areas would be designated. Appropriate bunding would be installed and appropriate containers would be provided. Waste disposal and collection would be properly undertaken. All vehicle and equipment maintenance would be undertaken offsite. Any vehicle washing onsite would be restricted to specific designated bunded areas.

Staff facilities would be installed and maintained so that pollutants, including wash water, are not conveyed from the Site in stormwater. All wastewater during the construction period would be disposed of offsite to a licensed facility.

During the construction period water may be required for dust suppression. This would be sourced from the existing dams if practicable or imported, if required.

Flood management for the construction phase would be addressed as part of the CEMP. However, flooding is unlikely to be an issue as the location within the Site is above the extreme flood level.

14.7 Assessment of Potential Impacts - Operation – EnergyAustralia Facility

14.7.1 Water Requirements

During operation of the Facility, water would be required for the following uses:

- process water;
- domestic uses;
- maintenance of equipment;
- fire fighting; and
- landscaping.

The requirements for these uses are discussed in more detail below and presented in **Figure 14-2**.

The EnergyAustralia Facility and Delta Electricity Facility have differing operational water demands. The process water demand, based on an assumption of the EnergyAustralia Facility operating for 10% of the year (i.e. operating intermittently but up to a total of approximately 40 days per year) is approximately 12 ML per annum.

To meet the construction and operational water requirements for the EnergyAustralia Facility, a number of current and potential water sources including potable, recycled and stormwater have been identified to provide water quantities which can meet and in fact exceed the requirements of the proposed Facility. These would be the primary sources of “raw water” for process and other water needs.

The EnergyAustralia Facility requires process or service water for various purposes including wash down, irrigation and water washing of gas turbines as well as for supply to the water treatment plant for process water as required by the evaporative cooler. Demineralised water may also be required within the process although the quantities required would be minor top-up quantities only.

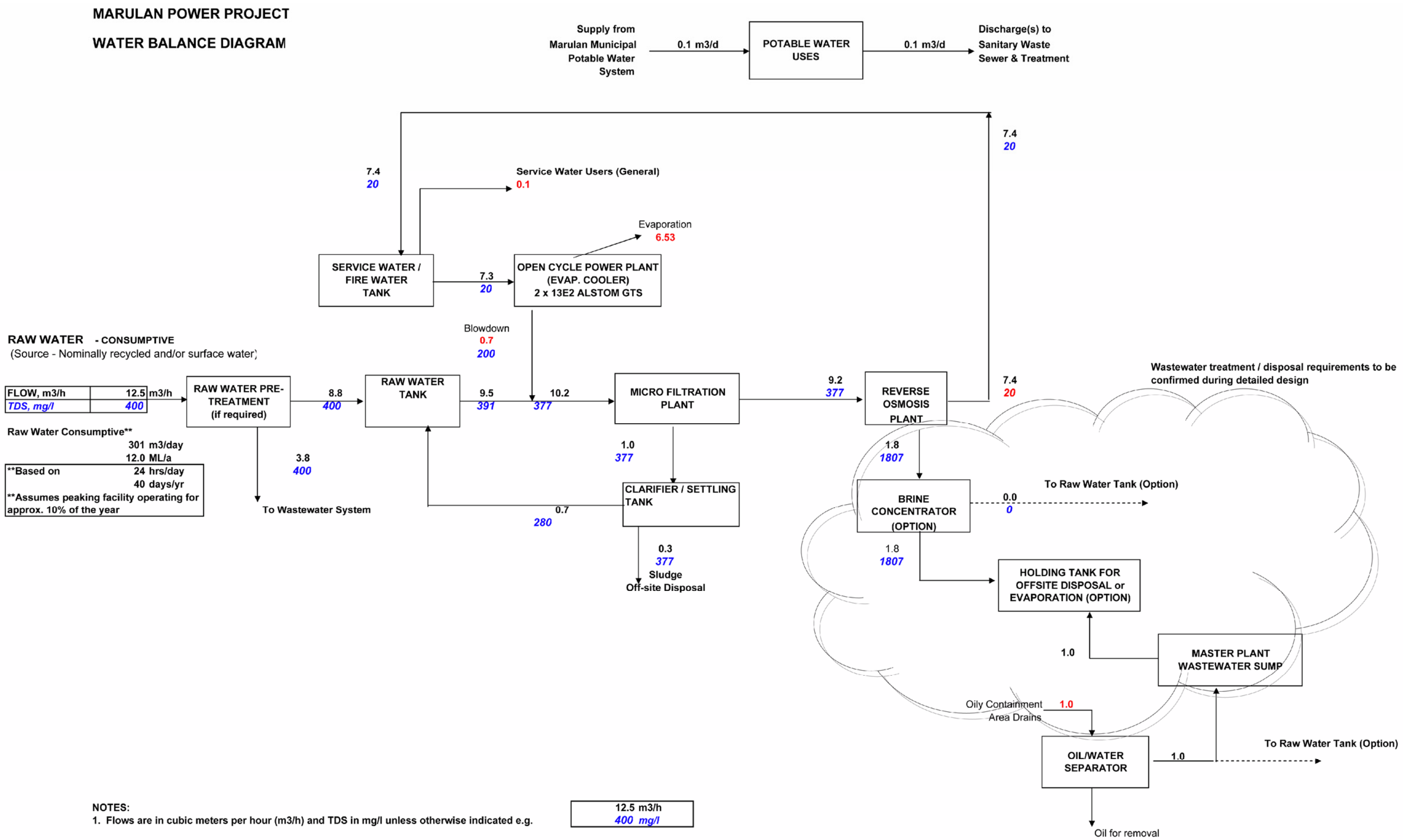
Water is required to be stored onsite for fire fighting purposes. This would consist of a storage tank, but storage may be in conjunction with process water requirements. The volume of the tank would be confirmed at the detailed design stage and in consultation with relevant authorities. **Table 14-2** provides a summary of indicative water demands. **Figure 14-2** presents the water management strategy for the proposed Facility.

Table 14-2 Summary of Indicative Water Demands – EnergyAustralia Facility

Staging	Indicative Water Requirements EnergyAustralia Facility (ML pa)
Potable	0.04
Demineralised	0.0012
Non-Potable	12.0
	(+ 7.4 EA startup[1])
Total Water Demand[1]	12.0

Source: GHD, 2008.
Notes: 1 . Startup volumes not included in total water demand (one off demand only). They will be required during startup of the EnergyAustralia Facility.

Figure 14-3 presents the water management strategy for the proposed Facility. The proposed location of key structures such as the raw water dam and sewage treatment plant is presented in **Figure 4-6**.



NOTES:

1. Flows are in cubic meters per hour (m3/h) and TDS in mg/l unless otherwise indicated e.g.

12.5 m3/h
400 mg/l

2. Arrangement shown is indicative and subject to change. Dependent on incoming water quality.

3. Water consumption estimate is based on GT Pro software output and projects of similar nature

4. Reverse Osmosis plant output and reject based on discussions with vendor

5. Some rounding has been undertaken

6. Note that following further analysis, it has been determined that consumptive water demand has been reduced from earlier figures as a consequence of water recovery from the treatment processes

INDICATIVE-NOT FOR DESIGN

Source: GHD, 2117301 - WMB Rev A, 2008

Client	Project	Title
ENERGYAUSTRALIA	MARULAN GAS TURBINE FACILITY	**INDICATIVE WATER MANAGEMENT WITH RECYCLING - ENERGYAUSTRALIA FACILITY**
URS	Drawn: AJW / Approved: NB / Date: 03/09/2008	Figure: **14-3**
	Job No: **43177371** / File No: 43177371-196.wor	

14.7.2 Potential Water Sources

The potential sources for water have been considered for the combined requirements of both the Delta Electricity and EnergyAustralia Facilities. Based on an average operation of 10 % per annum for the EnergyAustralia Facility and 500 hours per annum for Delta Electricity Stage 1 Facility, the total operational water requirement for the Facilities would be approximately 14 ML per annum. During Stage 2 of the Delta Electricity Facility, the total operational water requirement for the Facilities would be approximately 76 ML per annum.

To meet the construction and operational water requirements for the Facilities, it is proposed to use treated effluent from off-site sources and / or rainwater captured from the Facilities hard stand areas. A number of current and potential water sources, including potable, recycled and stormwater have been identified to provide water quantities which can meet and exceed the requirements of the proposed Facilities. The potential sources for water have been considered for the combined requirements of both the Delta Electricity and EnergyAustralia Facilities. Water source options include:

- Marulan water supply network
- Marulan sewage treatment plant;
- Moss Vale sewage treatment plant; and
- Site stormwater runoff.

Any of the above water servicing options for each of the Facilities' water demands could be adopted in conjunction with the other options. A decision would be made on the preferred option or option mixes following appropriate assessment of economic and non-economic factors. The water sources listed above have been identified to provide water quantities which can meet and exceed the requirements of the proposed Facilities. Whilst it is recognised that these potential sources will require further design and negotiation with the Water Supply authorities, the volumes, diversity of supply and timing reduce the risk that the water demand for the Facilities will not be met.

It is proposed that water would be trucked to the Site to meet the operational requirements for the EnergyAustralia and Delta Electricity Facilities. A new pipeline may be considered to meet operational needs for EnergyAustralia and Delta Electricity Stage 2 Facilities however this pipeline would be subject to further consultation, detailed design and approvals.

Current and Future Regional Water Demands

The Goulburn Mulwaree local government area is expected to experience modest population growth in selected areas, including Goulburn and Marulan with lower levels of growth expected in Tarago and rural villages. Goulburn Mulwaree Council is seeking to encourage population and employment growth across the whole of the Goulburn Mulwaree area. Evidence from recent development data indicates positive trends particularly in Goulburn. This may be largely attributed to the 'tree change' phenomenon, which has been stimulated by lifestyle choices and higher property prices in the Sydney metropolitan and the coastal areas.

The major water storages servicing the Goulburn Mulwaree local government area are the Sooley and Pejar Dams and the Rossi River. Goulburn's water supply is currently supplied from the Rossi Weir, with Pejar and Sooley Dams providing water storage and release flows when the flows at Rossi Weir are insufficient to meet supply needs or for environmental requirements. Marulan's water supply is sourced from the Wollondilly River.

Between 2000 and 2006 Goulburn's water resources became increasingly stressed due to below average rainfall. This led to significant water restrictions, emergency water supply measures and the planning and funding of a Wingecarribee Reservoir to Goulburn pipeline.

As indicated above, a number of the water sourcing options were influenced by the actions and proposed programs of Goulburn Mulwaree and Wingecarribee Shire Councils.

Discussions with Goulburn Mulwaree Council identified that;

- Council undertook a *Sewerage Master Plan for the Marulan Township Development* in 2005, however the (then) anticipated rate of developments have not materialised and as such Goulburn Mulwaree Council is currently in discussions with current and potential high water demand customers to determine its strategy forward.
- Goulburn Mulwaree Council's current water and waste water strategies are set out in its *Management Plan 2008/09* (available on Council Web Page) which makes provisions for:
  - Development of an Integrated Water Cycle Management Plan (*ongoing asset),* targeted for completion in December 2008.
  - Marulan Sewerage Treatment Plant Investigation and Design (*new asset*) commencing in the 2010/11 financial years.
  - A Sewer Pumping upgrade of the Marulan Pumping Station over the next four years.
  - Identified Marulan STP Investigation and then construction in its *'Forward Capital Works Plan'* for the next four years as a '*forward capital'*.
  - Identified a Marulan Raw Water Mains, Pumping Station upgrade though this is included in Council "*Projects NOT able to be included '*, as funds are not available.

Discussions with Wingecarribee Shire Council identified that;

- Some 600 ML per annum of recycled water available for the Moss Vale sewage treatment plant.
- Effluent is currently discharged to Whites Creek with no immediate plans for alternative effluent management.
- Plant augmentation is to be considered as part of a feasibility study to meet future requirements (nominally around 2010) which will also include consideration of reuse options.

Conclusion

To meet the construction and operational water requirements for the Facilities, it is proposed to use treated effluent from off-site sources (Marulan water supply network, Marulan sewage treatment plant, Moss Vale sewage treatment plant) and / or rainwater captured from hard stand areas. Any of these water servicing options for each of the Facilities' water demands could be adopted in conjunction with the other options. A decision would be made on the preferred option or option mixes following appropriate assessment of economic and non-economic factors.

It is proposed that water would be trucked to the Site to meet the operational requirements for the EnergyAustralia Facility and Delta Electricity Facility as these water requirements are relatively low. A new pipeline may be considered to meet the combined operational needs for EnergyAustralia and Delta Electricity Stage 2 Facilities; however, this pipeline would be subject to further consultation, detailed design and approvals.

14.7.3 Wastewater Generation and Management

This section discusses the options for the disposal of wastewater from the various water and wastewater treatment processes. Overall the plant is designed for zero water discharge with containment and safe disposal of any contaminants and wastes. Due to the proximity of the Site to the Wollondilly River (part of the water catchment for Sydney), offsite disposal of waste and wastewater is preferred to options involving onsite storage due to the risk of spills and contamination from any significant and/or long term storage facilities.

The Sydney Catchment Authority (SCA) has stated (refer **Appendix B**) that effluent management areas are to be located at least 150 m from the Wollondilly River, 100 m from a creek or gully and 40 m from a drainage depression.

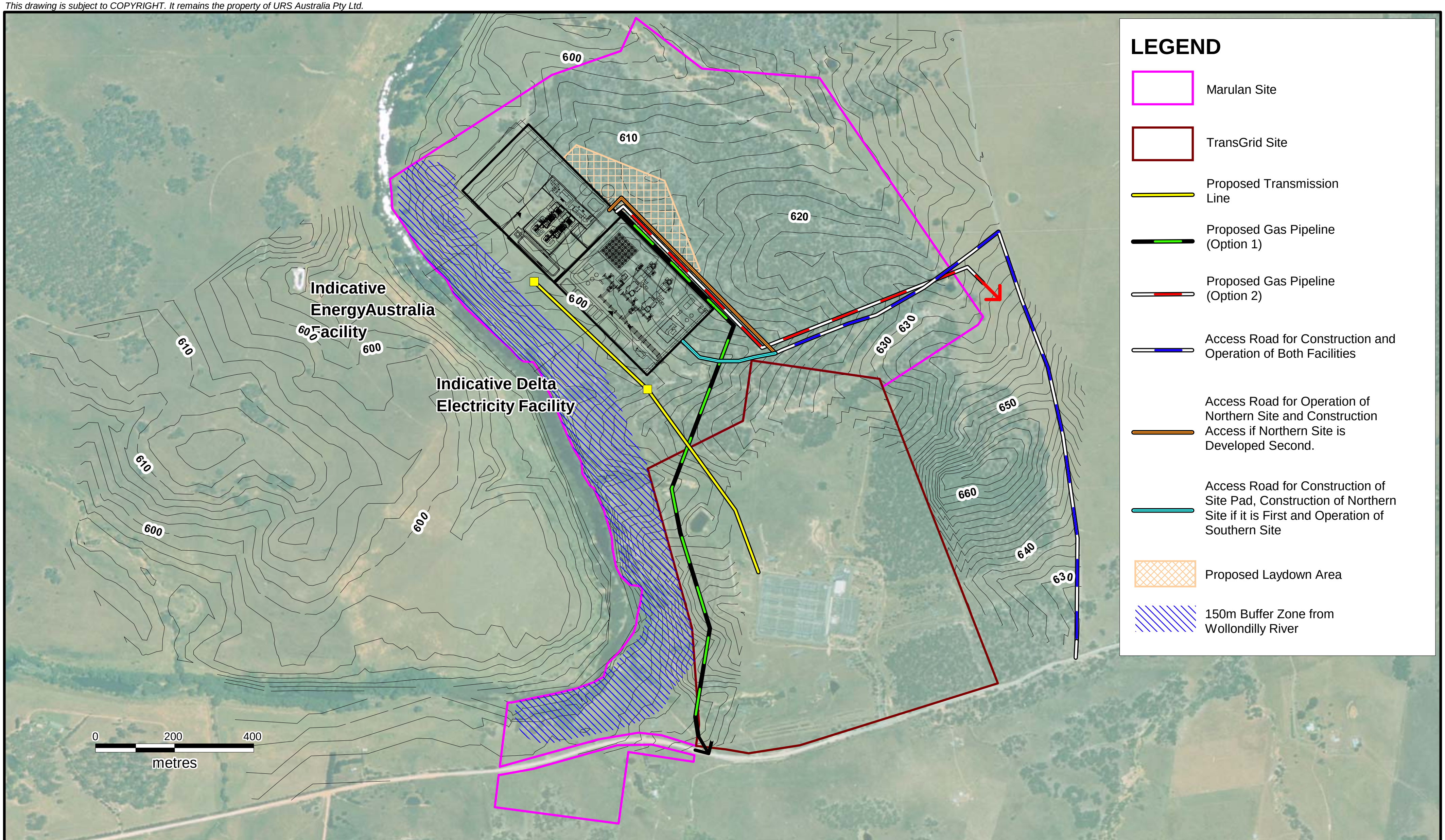
The 150 m distance for the Facilities as a whole has been adopted to account for domestic sewerage systems for staff facilities and the Facility water treatment systems. It has been assumed that the 150 m is measured from the river bank. The Facilities will also require some space between the pad and the river for stormwater management areas.

Given the scale of the development and the location of the Site, a 150 m buffer has been adopted for the significant components of the Facilities (refer to **Figure 14-4**).

Rainwater runoff from part of the landscaped areas would be directed to stormwater cut-off drains. The outlets of these drains would be designed to maximise the dispersion of these high flows and thereby minimise their potential to cause erosion downstream. Detention would be provided so that nominated peak flows from the Site do not exceed existing flows. Accumulated water in bunds would be directed to the stormwater pond after passing through the interceptor. Stormwater from the Site would pass through a sedimentation basin / storage pond before discharge from the Site.

Both the stormwater and wastewater storage ponds would be lined with an appropriate impermeable liner to minimise the risk of the water escaping into the natural groundwater system. When required the accumulated sediments / waste sludge collected in the storage ponds would be disposed of by a licensed contractor.

Wastewater volumes have been estimated and management strategies would be developed to maintain a zero discharge from the Site except as part of the natural surface flows.



Source: Delta Electricity, EnergyAustralia, Southern Cross Consulting Surveyors

Client	Project	Title
ENERGYAUSTRALIA	MARULAN GAS TURBINE FACILITY	**INDICATIVE BUFFER ZONE**
URS	Drawn: AJW · Approved: NB · Date: 28/08/2008 · Job No: **43177371** · File No: 43177371-190.wor	Figure: **14-4**

A summary of EnergyAustralia's Facility waste disposal is presented in **Table 14-3**.

Table 14-3 Indicative Waste Disposal for EnergyAustralia Facility

Process	Waste	Treatment and Disposal
Raw water treatment (filtering, softening, reverse osmosis, micro filtration, etc depending on quality)	Liquid sludge	Treated onsite by a water treatment plant (having a reverse osmosis capability)
Domestic Sewage	Sewage	Proprietary septic-type system and periodically disposed of offsite by a licensed contractor
Contaminated Drains Oil/Water Separation	Oil/Oily Water	Oil recovery pit.
Dirty Water Drains	Water with dust, oil, chemical contamination	Wastewater pond
Clean Water Drains	Water	Stormwater ponds

14.7.4 Stormwater Management

Runoff from impervious areas including the buildings and the plant would be both greater and faster than runoff from existing conditions. However, this is considered minor considering the relatively small areas of impervious surfaces involved.

Runoff from impervious areas could potentially be contaminated with minor amounts of gross pollutants, oils, greases or sediments. Discharge may also occur in one location causing a concentration of flows over and above what would normally occur, which could cause localised soil erosion. Without mitigation, runoff may potentially flow into the Wollondilly River.

There would be no direct drainage from operational areas of the Site to the Wollondilly River / waterways.

Liquid spills could potentially occur in the impervious areas or during transportation to the Site.

Mitigation

Surface water from the Site that may potentially be contaminated could include:

- rainfall runoff from impervious areas of the Site; and
- water accumulated within bunds.

In addition, where flows are concentrated, soil erosion may occur.

Water from the proposed development would be directed through oil and grit traps and a sedimentation pond designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge to the stormwater pond. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.

The outlet of the stormwater system would be designed to maximise the dispersion of high flows and thereby minimise potential to cause soil erosion downstream. Where possible, water would be pumped for irrigation of the landscaped areas to minimise the potential for nutrient runoff and subsequent weed invasion. This outlet would operate automatically; however, it would be able to be closed. In the unlikely event of a spill outside of bunded areas but within the stormwater catchment area, the outlet could be closed and this volume captured. Potentially contaminated water would then be disposed of offsite by a licensed contractor.

Other areas of the Site would be left undisturbed and runoff characteristics would not be altered.

14.8 Assessment of Potential Impacts - Cumulative

The EnergyAustralia Facility will be constructed adjacent to a similar Facility proposed for Delta Electricity.

The internal management of stormwater and wastewater will not be affected by the separate developments as the systems for managing these issues are effectively self-contained. Mitigation measures proposed will not be affected by the combined development. The responses to the Neutral or Beneficial Effect Tests are consistent to those stated in **Section 14.5.2**.

Flooding is not considered to be an issue as the proposed developments, including earthworks and structures, are located above the estimated level for an extreme flood event. There will be a reduction of flows into the Wollondilly River, however with individual Facility areas of approximately 7.8 ha each and a total area of approximately 34 ha, these developments are very small in a catchment of many thousands of square kilometres. Thus the reduction in overland flows reaching the Wollondilly River is not significant from an overall catchment or sub-catchment point of view.

From a water management viewpoint, the cumulative impact of the two Facilities relates to the management of surface water flows that would normally flow overland towards the Wollondilly River.

There are no watercourses affected by either development. Mitigation measures have been identified and designed for both the construction and operational phases of both proposed developments. These will ensure that there is no degradation of flows into the River and that all flows that would have passed through the Site are diverted and returned to their natural course to the River. Only rainfall directly onto each Facility area will be captured for recycling.

There will be no clearing or degradation of watercourses or of riparian corridors as a result of the construction of the Facilities.

14.9 Summary of Mitigation Measures

Table 14-6 presents a summary of mitigation measures related to water management for the EnergyAustralia Facility and the cumulative impact with the Delta Electricity Facility. The phase of implementation is indicated in the table by *Cons* – Construction, *Ops* – Operation, Design and Planning.

Table 14-4 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measure	
	EnergyAustralia Facility	**Cumulative**
As a way of further enhancing public infrastructure, and if deemed viable, upgrade works would be jointly considered by Delta Electricity and EnergyAustralia to be undertaken to local sewage treatment facilities to meet the Facilities operational water requirements.		✓ (Cons & Ops)
Site Design		
The Facilities would be designed to incorporate the following: • minimum elevation of risk averse property within the Facility is to be approximately 605 m AHD to minimise the potential for flooding; and • maintaining approximately 150 m between the Wollondilly River and the Facilities.	✓ (Design)	✓ (Design)
Soil Erosion		
All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation and managed through a Soil and Erosion Control Plan. These measures would be incorporated into the CEMP.	✓ (Design & Cons.)	✓ (Design & Cons.)

Mitigation Measures	Implementation of mitigation measure	
	EnergyAustralia Facility	Cumulative
Spills and Site management		
All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines and stored in a designated covered area.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Waste collection areas would be designated.		
Appropriate bunding would be installed and appropriate containers would be provided.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Waste disposal and collection would be properly undertaken.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
All major vehicle maintenance would be undertaken off-site.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Any vehicle washing on-site would be restricted to designated bunded areas.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Staff facilities would be installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater so there is no discharge to the environment.	✓ (Design & Cons. & Ops.)	✓ (Design & Cons. & Ops.)
Surface water		
There would be no direct drainage from the Site to Wollondilly River other than natural surface flows.	✓ (Design & Ops.)	✓ (Design & Ops.)
Water management strategies would be developed and implemented to maintain zero discharge from the site except for natural surface flows.	✓ (Design & Ops.)	✓ (Design & Ops.)
Water from impervious surfaces would be directed through oil and grit traps designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge from the site. This system may also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater.	✓ (Design & Ops.)	✓ (Design & Ops.)
The outlet of the Facilities' stormwater system would be designed to maximise the dispersion of these high flows and spread the outflow over a wider area and thereby minimise their potential to cause soil erosion downstream.	✓ (Design & Ops.)	✓ (Design & Ops.)
Wastewater Treatment		
Maintain minimum distance of 150 m from the Wollondilly River for effluent management areas.	✓ (Cons.)	✓ (Cons.)

Mitigation Measures	Implementation of mitigation measure	
	EnergyAustralia Facility	Cumulative
Staff facilities would be installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater. All wastewater generated during the construction period would be disposed of offsite to a licensed facility.	✓ (Cons.)	✓ (Cons.)
"Black" wastewater generated during operations would be treated by a proprietary septic-type system and waste products stored and then disposed of offsite by a licensed contractor.	✓ (Design & Ops.)	✓ (Design & Ops.)
Clean water drains would be directed to the stormwater storage pond from which any stormwater flow would be released in a regulated manner.	✓ (Design & Ops.)	✓ (Design & Ops.)
Dirty Water drains would be directed to settlement ponds and oil/water separators before discharge to the on-site wastewater pond.	✓ (Design & Ops.)	✓ (Design & Ops.)
Contaminated drains would be directed to a contaminated drains tank with oil water separator. Oil would be disposed of offsite to a licensed facility and water would be directed to the on-site wastewater pond.	✓ (Design & Ops.)	✓ (Design & Ops.)