4.1 Overview

The Marulan Site would be subdivided into two lots with one owned by Delta Electricity and the other by EnergyAustralia. Delta Electricity and EnergyAustralia are seeking approval to construct two separate Gas Turbine Facilities on this Site. The two Facilities would be constructed side by side but owned and operated independently.

The proposed Facilities would consist of a Gas Turbine Facility to be constructed by Delta Electricity in two stages and a Gas Turbine Facility constructed by EnergyAustralia. Both the EnergyAustralia proposal and the first stage of the Delta Electricity facility are known as "peaking facilities" as they supply power to the electricity grid during times of peak electricity demand such as very hot days or cold nights.

Delta Electricity Facility

Delta Electricity anticipates that its peaking Facility may be converted to combined cycle generation to supply intermediate / base load electricity. Depending on the future electricity demand and other generation projects, Delta Electricity could implement the combined cycle plant directly.

The implementation of the Delta Electricity Gas Turbine Facility would happen in two stages:

Stage 1: Two open cycle gas turbines with a total capacity in the range of 250 to 320 MW. Each turbine would have a capacity in the order of 125 to 160 MW depending on final equipment selected.

Stage 2: Conversion to combined cycle Facility to generate electricity for intermediate / base load electricity demand. The proposed capacity of the Stage 2 combined cycle Facility is in the range of 400 to 450 MW.

EnergyAustralia Facility

EnergyAustralia's Facility would be developed in one stage. The Facility would comprise two open cycle gas turbines each of approximately 175 MW capacity, producing a total nominal facility output of 350 MW designed to supply power to the main electricity grid during times of peak electricity demand.

Gas Pipeline

The sole fuel would be natural gas sourced via an underground lateral pipeline from the Moomba to Sydney natural gas pipeline. At this stage, the location of the connection to the Moomba to Sydney Gas Pipeline and the preferred route for the gas delivery pipeline has not been determined. However, the corridor for the pipeline route is included as part of this Environmental Assessment.

Common Shared Works

Common Shared Works refers to the following components:

- bulk earthworks on the Site (comprising benching out and creation of a laydown area);
- access road (comprising access to each Facility for construction and operational purposes); and

- transmission line (comprising high voltage transmission lines and connection to the TransGrid switchyard).

The total estimated capital cost for the Marulan Gas Turbine Facilities Project is $809 million. The breakdown between the two Proponents' Facilities and Common Shared Works is:

- Delta Electricity estimates that the total estimated capital cost (Stage 1 and 2) of its project is $515 million;
- EnergyAustralia estimates that the total estimated capital cost of its project is $266 million; and
- The total capital cost of the Common Shared Works for the two Facilities was estimated to be $28 million.

4.2 Site Location

4.2.1 Marulan Site

The Marulan Site is located on Canyonleigh Road, Brayton, approximately 12 km north of the village of Marulan. The site is 19.6 km from the Marulan Highway turnoff and 10.3 km from the Canyonleigh-Brayton Road turnoff (refer to **Figure 1-2**). The Site is described by land parcel Lot 2 DP1120270. The other land parcel, which would be affected by the Facilities is Lot 2341 DP 62834 (TransGrid switchyard).

The Site (refer to **Figure 4-1**) comprises approximately 116 ha of pasture land and woodland. Overall the Site slopes gently west towards the river. The Site is located in the Upper Lachlan Shire local government area.

Figure 4-2 presents the closest residences to the Site.

Facilities

The development of two separate Gas Turbine Facilities at the Site would comprise the following main elements:

- Gas Turbine Facilities including ancillary equipment, process control system and administration facilities;
- electricity transmission line;
- gas inlet delivery facility and gas pipeline connecting the Moomba to Sydney Gas Pipeline to the Site; and
- associated infrastructure i.e., site access roads, internal roads and water storage.

Linear Infrastructure

The following infrastructure within the Marulan Site would be jointly shared and operated by Delta Electricity and EnergyAustralia to serve both Facilities:

- gas pipeline within the Marulan Site including provision for metering, but excluding delivery station;

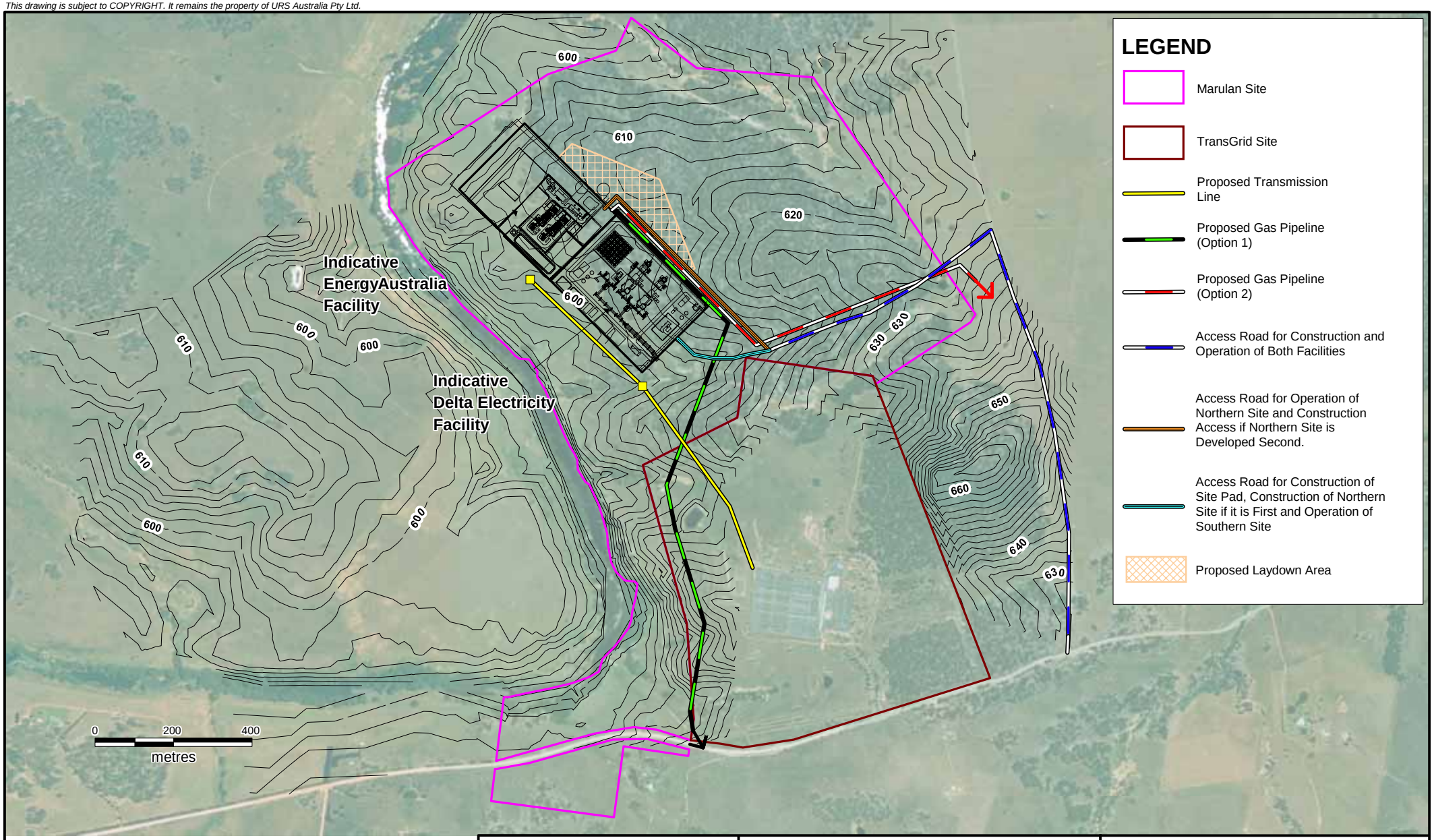
- high voltage transmission lines and connection (to be subject to agreement with TransGrid); and
- access roads for construction and operation.

An indicative route for the transmission lines and access road on the Marulan Site is shown in **Figure 4-1**. The exact layout and position will be finalised during the detailed design stage.

The Site will be further subdivided such that Delta Electricity and EnergyAustralia are the registered owners of the land on which their respective Facilities would be situated. Approval for the further subdivision will be progressed separately through Council.

4.2.2 Gas Pipeline

The exact location of the gas pipeline would be finalised at the detailed design stage and, subject to the Minister's determination, would be assessed in a future, separate Project Application. Delta Electricity and EnergyAustralia are currently considering route options for the gas pipeline within a corridor of land identified in **Figure 4-3**, with further studies and assessment underway. When a preferred route for the gas pipeline has been identified, easements or other appropriate rights of tenure will be negotiated with affected landowners.



Source: Delta Electricity, EnergyAustralia, Southern Cross Consulting Surveyors

Client
DELTA ELECTRICITY AND ENERGYAUSTRALIA

URS

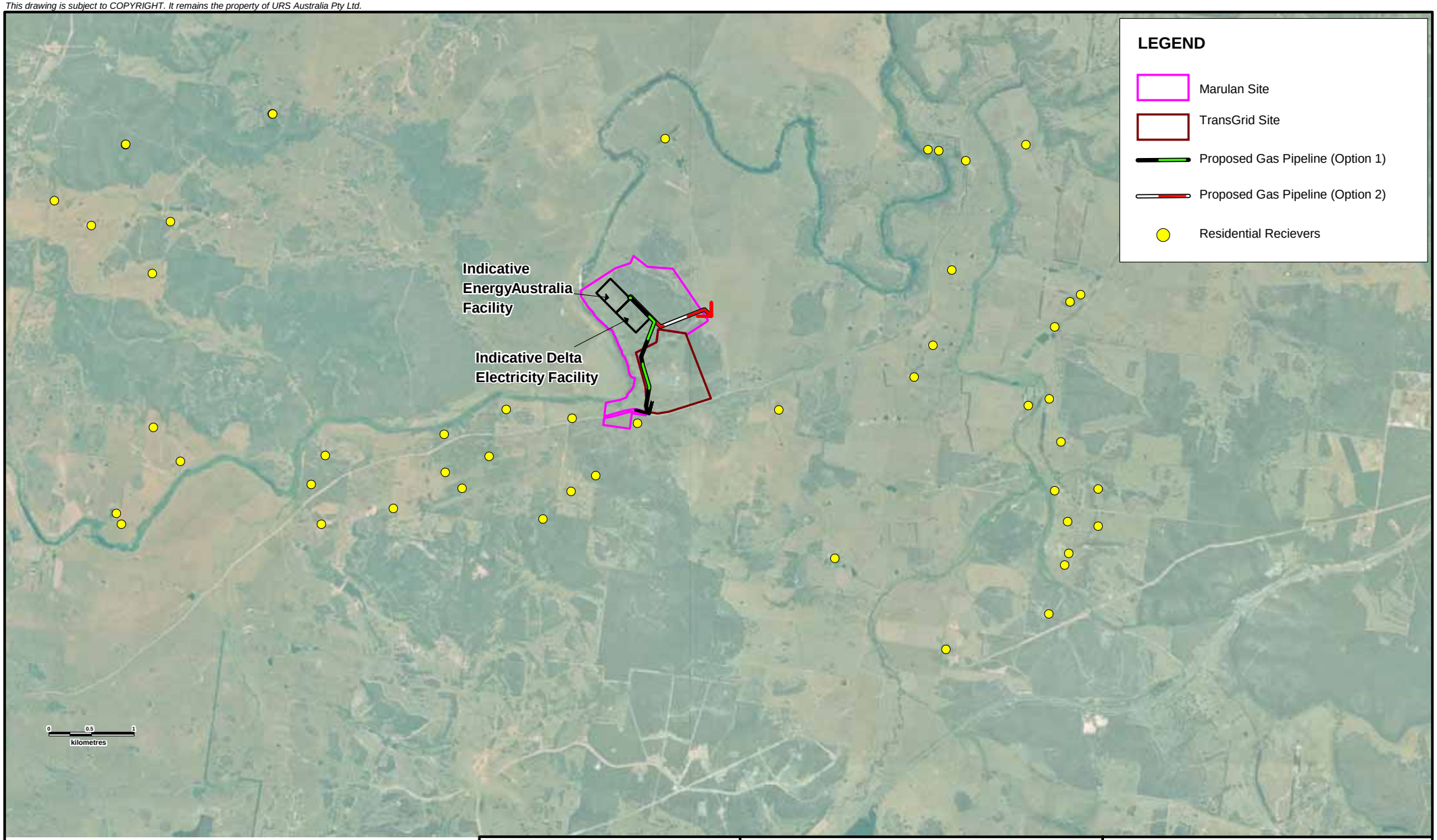
Project
MARULAN GAS TURBINE FACILITIES

Drawn: AJW | Approved: NB | Date: 02/09/2008

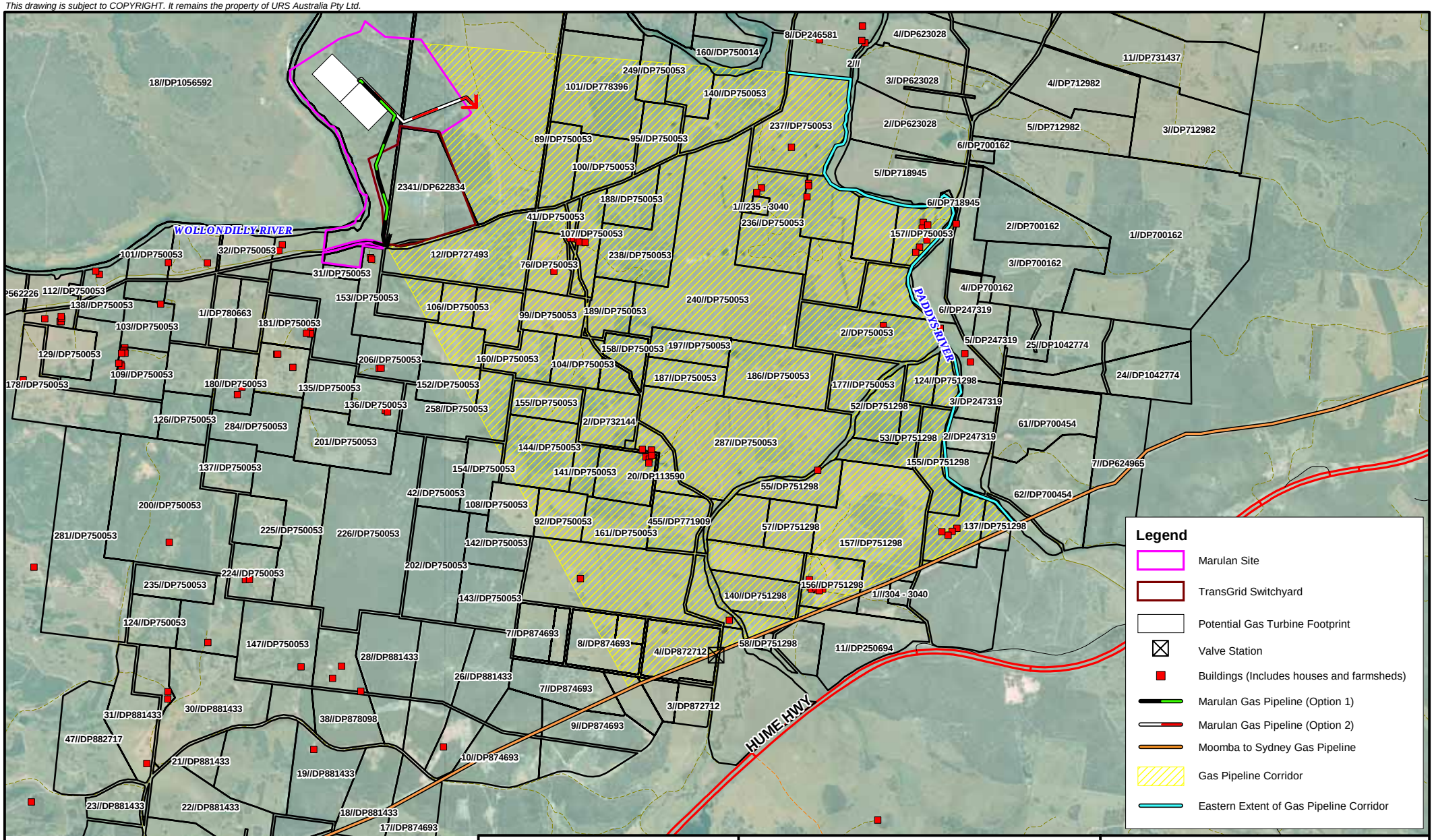
Job No: **43177371** | File No: 43177371-114.wor

Title
INDICATIVE LOCATION AND LAYOUT

Figure: **4-1**



Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES		Title: **RESIDENTIAL RECEIVERS SURROUNDING MARULAN SITE**
URS	Drawn: AJW	Approved: NB	Date: 02/09/2008
	Job No: **43177371**	File No: 43177371-175.wor	Figure: **4-2**



0 1 2
kilometres

Source: Delta Electricity

Client
DELTA ELECTRICITY AND ENERGYAUSTRALIA

Project
MARULAN GAS TURBINE FACILITIES

Title
PROPOSED GAS PIPELINE CORRIDOR

Drawn: AJW	Approved: NB	Date: 02/09/2008
Job No: **43177371**	File No: 43177371-115.wor	

Figure: **4-3**

4.3 Delta Electricity – Overview

The implementation of the proposed Delta Electricity Facility would be carried out in two stages:

Stage 1: Two open cycle gas turbines with a total capacity in the range of 250 to 320 MW. Each turbine could have a capacity in the order of 125 to 160 MW depending on final equipment selected.

Stage 2: Conversion to combined cycle Facility to generate electricity for intermediate / base load electricity demand. The proposed capacity of the Stage 2 combined cycle Facility is in the range of 400 to 450 MW.

This Environmental Assessment is seeking Concept Approval for Stage 1 and Stage 2 of the Delta Electricity Facility. Project Approval for Stage 1 is being sought in the Delta Electricity *Project Application*. Project Approval for Stage 2 would be sought through a separate *Project Application* and Stage 2 would be progressed depending on electricity market demand.

The main components of the Facility would be:

- two open cycle gas turbines comprising compressor, combustion and turbine stages (including low NO_x burners) and exhaust stacks (approximately 40 m high). Turbines would be connected to air cooled generators. The turbines would be converted to combined cycle during Stage 2 by inclusion of two heat recovery steam generators, steam turbine, generator and an air cooled condenser;
- ancillary equipment including power transformers, demineralised water storage and safety equipment;
- process control and monitoring systems; and
- administration, amenities and control building (approximately 10 m high).

4.4 EnergyAustralia – Overview

The proposed EnergyAustralia Facility would be developed in one stage only.

The EnergyAustralia Facility would comprise two open cycle gas turbines each of approximately 175 MW capacity, producing a total nominal facility output of 350 MW designed to supply power to the main electricity grid during times of peak electricity demand.

4.5 Delta Electricity – Stage 1 – Open Cycle

The open cycle gas turbine draws in cool filtered air, through a compressor, where it is mixed with natural gas and injected at high pressure into the combustion chamber of the gas turbine. The hot exhaust gas is used to drive the turbine which is connected to the electrical generator to produce electricity. The exhaust gases are vented to the atmosphere through the stacks.

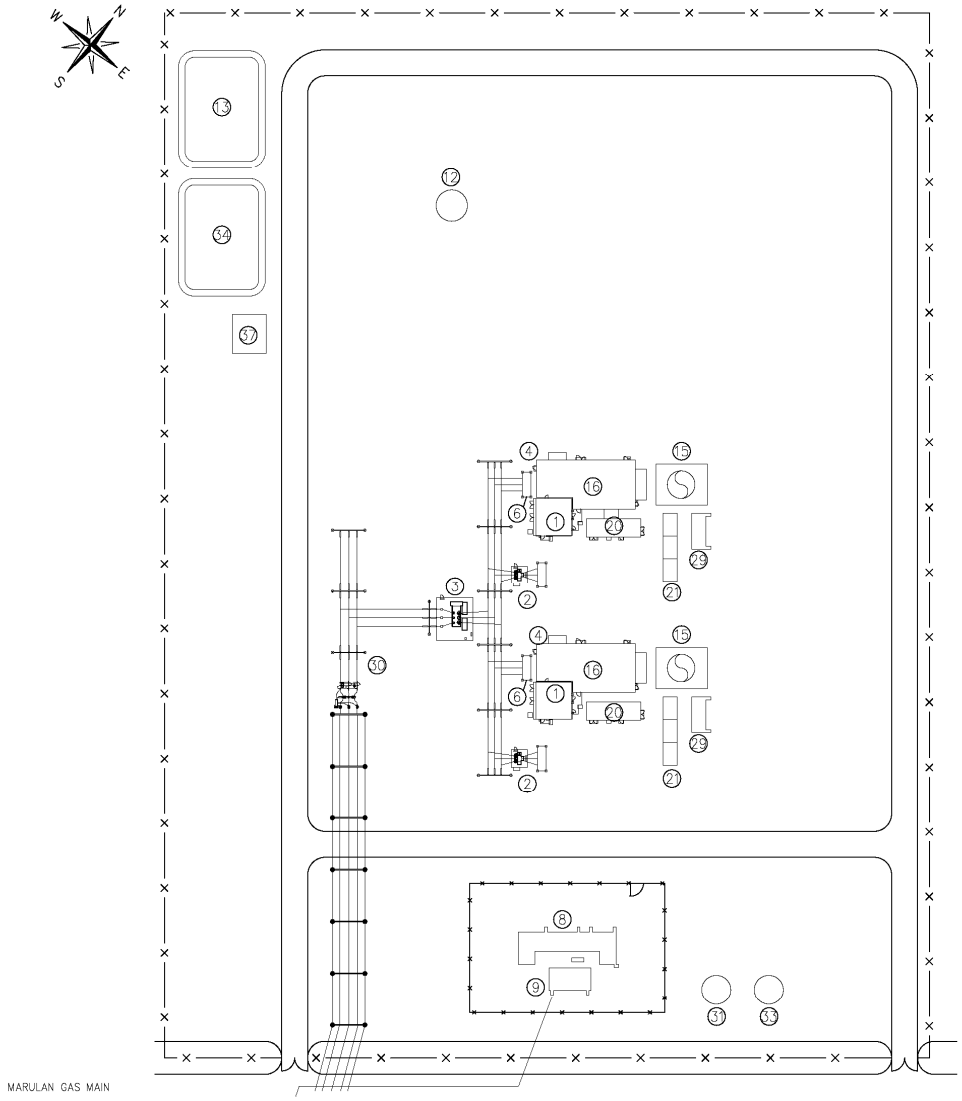
Chapter 4 Project Description

The supplier (and therefore the type) of the gas turbines would be selected through a competitive tender process as part of the overall procurement strategy.

Typical layouts for Stages 1 and 2 for the Marulan Site are shown in **Figures 4-4** and **4-5**. A process diagram of Stage 1 open cycle is presented in **Figure 4-6**.

Stage 1 of Delta Electricity's Facility would include the following systems:

- two gas turbines each comprising compressor, combustion and turbine stages and including low NO_x burners (~12 m long, ~7 m wide and ~5 m high);
- inlet air filters with silencing (~8 m long, ~7 m wide, ~9 m high and ~8 m above ground);
- exhaust stacks with silencing (diameter ~6 m and ~40 m high);
- air cooled generator (~7 m long, ~4 m wide and ~5 m high) associated with the each gas turbine and connected to a common step-up transformer;
- High Voltage Switchyard connected via circuit breakers to a 330 kV bus from which a single circuit transmission line connects to the TransGrid switchyard (this 330 kV bus would be extendable to allow common connection for Stage 2);
- natural gas supply pipeline with metering and regulating station;
- various gas turbine auxiliary systems including fuel control and conditioning systems, lubricating and hydraulic oil systems, starting systems, control and instrumentation systems, fire protection systems, compressor water wash systems, closed cooling system with fin fan coolers, etc;
- other Site services such as water and wastewater treatment, storage and truck loading / unloading facilities, fire fighting systems, workshop facilities and amenities, fences, roads, etc; and
- a small workshop and stores building to facilitate day-to-day maintenance with contractors to provide their own requirements for major outages.



LEGEND

1. POWER CONTROL CENTER
2. AUXILIARY TRANSFORMER
3. GENERATOR TRANSFORMER
4. OIL COLLECTING PIT
5.
6. CIRCUIT BREAKER
7.
8. CUSTODY TRANSFER STATION
9. GAS HEATING STATION
10.
11.
12. DEMINERALIZED WATER TANK
13. STORM WATER DRAINAGE / RAW WATER DAM
14.
15. EXHAUST STACK
16. GAS TURBINE BUILDING
17.
18.
19. WORKSHOP STORE BUILDING
20. MECHANICAL MODULE
21. LUBE OIL COOLER
22.
23.
24.
25.
26.
27.
28.
29. GAS METERING STATION
30. SWITCHYARD
31. FIRE WATER/SERVICE WATER TANK
32.
33. DOMESTIC WATER TANK
34. SETTLEMENT POND
35.
36.
37. CONTAMINATED DRAINS TANK
38.
39.

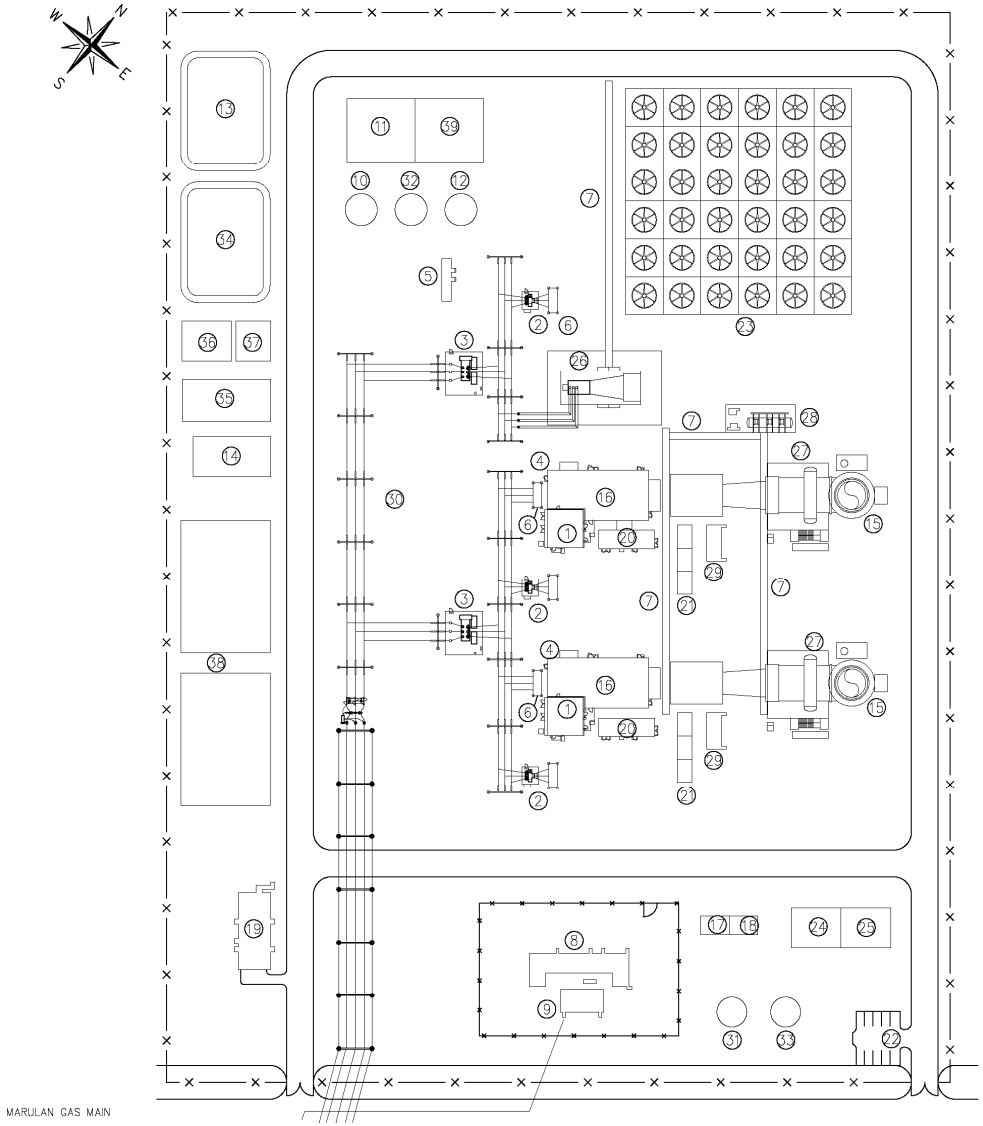
FENCE

0 10 20 30 40m
1:500

NOT FOR CONSTRUCTION

Source:BRW, C2815-D-000-502 Rev C

Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **DELTA ELECTRICITY STAGE 1 OPEN CYCLE INDICATIVE SITE LAYOUT**
URS	Drawn: AJW; Approved: NB; Date: 17/03/2008 Job No: **43177371**; File No: 43177371-116.wor	Figure: **4-4**



LEGEND

1. POWER CONTROL CENTER
2. AUXILIARY TRANSFORMER
3. GENERATOR TRANSFORMER
4. OIL COLLECTING PIT
5. EMERGENCY POWER DIESEL
6. CIRCUIT BREAKER
7. RACK STRUCTURES
8. CUSTODY TRANSFER STATION
9. GAS HEATING STATION
10. RAW WATER TANK
11. WATER TREATMENT PLANT BUILDING
12. DEMINERALIZED WATER TANK
13. STORM WATER DRAINAGE / RAW WATER DAM
14. SEWERAGE TREATMENT PLANT
15. EXHAUST STACK
16. GAS TURBINE BUILDING
17. FIRE FIGHTING PUMP HOUSE
18. FOAM STATION
19. WORKSHOP STORE BUILDING
20. MECHANICAL MODULE
21. LUBE OIL COOLER
22. PARKING AREA
23. COOLING TOWER STRUCTURE
24. POWER CONTROL BUILDING
25. ADMINISTRATION BUILDING
26. STEAM TURBINE
27. HRSG
28. DEAERATOR & PUMPS
29. GAS METERING STATION
30. SWITCHYARD
31. FIRE WATER/SERVICE WATER TANK
32. FILTERED WATER TANK
33. DOMESTIC WATER TANK
34. SETTLEMENT POND
35. WASTEWATER TREATMENT PLANT
36. CHEMICAL DRAINS TANK
37. CONTAMINATED DRAINS TANK
38. CHILLER (OPTION)
39. CHEMICAL STORAGE & UNLOADING

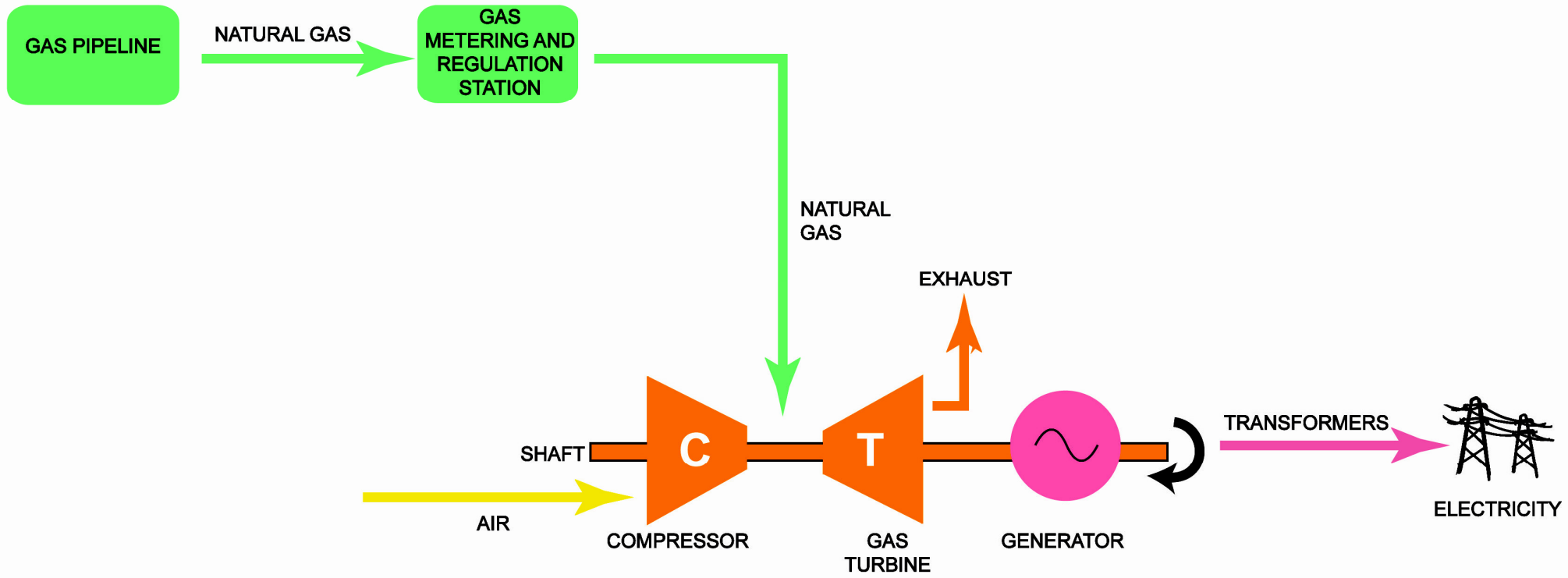
FENCE

0 10 20 30 40m
1:500

NOT FOR CONSTRUCTION

Source:BRW, C2815-D-000-501 Rev D

Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **DELTA ELECTRICITY STAGE 2 COMBINED CYCLE INDICATIVE SITE LAYOUT**
URS	Drawn: AJW; Approved: NB; Date: 17/03/2008 Job No: **43177371**; File No: 43177371-117.wor	Figure: **4-5**



Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **PROCESS DIAGRAM - OPEN CYCLE (DELTA ELECTRICITY STAGE 1 AND ENERGYAUSTRALIA)**
URS	Drawn: AJW · Approved: NB · Date: 17/03/2008	Figure: **4-6**
	Job No: **43177371** · File No: 43177371-118.wor	

4.5.1 Water Requirements

Construction Stage Water Requirements

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

This requirement takes into account the following assumptions:

- personnel levels;
- minor allowances for wet trades during construction (bricklaying/blocklaying), rendering to small areas only (for example, control rooms);
- all concrete mixing offsite (i.e. not allowed for in estimates);
- no onsite construction camp or canteen facility (i.e., 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.

Delta Electricity Stage 1 Facility Indicative Operational Water Requirements

Several water and wastewater systems are associated with the Facility. Service water is required for fire services, gas turbine wash down and domestic services. Demineralised water is used in the gas turbine cooling system. The quantity of demineralised water required for Delta Electricity's Stage 1 is relatively small and would be tankered in and stored onsite.

Site runoff and any process water generated from the Facility would be stored in onsite settlement dams prior to recycling or, if appropriate, disposal.

Service Water

Service water is required for fire services, wash down, irrigation and water washing of gas turbines and for supply to the filtered water plant which supplies the demineralised water treatment plant and domestic water treatment plant, where provided.

Generally service water would require minimal treatment before onsite storage. A dedicated fire water tank is normally required.

Water for washing gas turbines would need to be of high quality and treatment may be needed. Demineralised water may also be used for gas turbine water washing.

Where demineralised water and domestic water treatment plants are provided, the filtered water treatment plant would include softening, clarification and filtering (depending on water quality). This filtered water would be suitable for gas turbine washing.

Demineralised Water

For open cycle gas turbines (Stage 1), the quantity of demineralised water used would be relatively small and so tanker deliveries to onsite storage facilities may be adopted rather than onsite water treatment and storage facilities. No evaporative cooling of gas turbine intake air is anticipated.

The demineralised water treatment plant, if required, would comprise cation and anion exchanger vessels, degassers, mixed bed vessels, pumps and storage tanks and regeneration / resin cleaning systems.

Domestic Potable Water

Domestic water would be required for drinking, showers and other amenities provided for personnel at the Site. Suitable quality water may be available by tanker truck deliveries to onsite storage tanks or from an onsite domestic water plant, in which the filtered water is chlorinated and stored in domestic water tanks.

Clean Water Drains

Clean drains (i.e., heat recovery steam generation blowdown) and clean stormwater drains (i.e., roof drains) would be directed to the raw water dam, from which any stormwater overflow would be released in a regulated manner. The main aims of the raw water dam would be to allow onsite water to be recycled to the service water system and to prevent discharge of contamination from the Site.

Summary of Water Requirements

Table 4-1 summarises the assumed operational water flows for the Delta Electricity Stage 1 Facility (open cycle). For Stage 1, it was assumed operation would be 500 hours per annum. Rainwater flows and evaporation losses have not been considered. The following table assumes significant onsite recycling of wastewater to minimise the quantity of raw water required and no gas turbine evaporative inlet air cooling.

Table 4-1 Delta Electricity Stage 1 Facility (Open Cycle) Indicative Water Demand

Description	Quantity	Comment
Raw Water	2.3 ML pa	Net input required by plant assuming recycling
Service Water	3.2 ML pa	
Demineralised Water	0.2 ML pa	Tanker truck delivery
Domestic Water	0.2 ML pa	Assumes up to 5 personnel and tanker truck delivery
Clean Water Drains	-	No rainwater included
Dirty Water Drains	0.9 ML pa	Drainage of service water to settlement pond. No rainwater included
Contaminated Drains	0.6 ML pa	Drainage of service water to contaminated drains tank
Chemical Drains	-	Not required for Stage 1
Sewage	0.2 ML pa	Offsite disposal
Water Recovery	1.0 ML pa	From raw water dam

4.5.2 Potential Water Sources

The design of the Facility would aim for zero water discharge (other than natural flows) to the environment and to maximise onsite water recycling. Water management for the Facility is discussed in **Chapter 14**.

For Delta Electricity's Stage 1, the small water demands mean that water tankers delivering raw water, potable water and demineralised water to onsite storage facilities are a viable option particularly in conjunction with onsite rainwater storage and recycling.

Subject to further negotiations and detailed design investigations, it is intended that water would be sourced from a local water treatment plant and/or sewage water treatment. The potential sources for water have been considered for the combined requirements of both the Delta Electricity and EnergyAustralia Facilities.

Water source options would include:

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

Water would be trucked to the Site to meet the operational requirements for the Delta Electricity Stage 1 Facility.

4.5.3 Disposal of Wastewater, Sludge and Brine

There are several options for the disposal of wastewater, sludge and brine from the various water and wastewater treatment process. Overall the Facility would be 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 drinking 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.

Roads and other hard surfaces may be contaminated by traces of oil, chemicals, dust, etc. This water would be directed to settlement ponds, which would be drained by pumps and passed through oil water separators to the raw water dam. Any overflow from the settlement ponds would be directed to the raw water dam, while oil/oily water would be discharged to the contaminated water drains system. If necessary, settlement ponds can be drained and sediments/sludge transported by truck for offsite disposal.

Contaminated drains include those associated with transformer bunds, equipment drains, etc, that potentially contain quantities of oil or oily water. Drains from the gas turbine water washing undertaken during maintenance periods would be disposed of in the contaminated drains system. The drains are directed to a contaminated drains tank incorporating oil and water separation. The oil is recovered by suction tanker for offsite disposal while the water is directed to the dirty water settlement ponds.

For Delta Electricity Stage 1, as there would be no water treatment or large scale chemical storage facilities, chemical drains would not be required.

Given the limited number of staff on the Site during operation of Delta Electricity Facility Stage 1, there would be a limited amount of sewage produced. Sewage would be collected in tanks and transported by tanker truck for offsite disposal. Alternatively an onsite fully self contained proprietary treatment system (such as Advance Wastewater Treatment System or Ecomax) would be used.

Summary

For Stage 1, only limited onsite treatment processes are proposed with wastes and their disposal method described in **Table 4-2**.

Table 4-2 Waste Disposal for Delta Electricity Facility Stage 1 (Open Cycle)

Process	Waste	Treatment and Disposal
Raw water treatment (filtering, softening, reverse osmosis, micro filtration, etc, depending on quality	Liquid sludge	Thickening and offsite disposal by truck to a licensed facility.
Domestic Sewage	Sewage	Storage without treatment and offsite disposal by tanker truck to local sewage treatment plant or onsite treatment.
Contaminated Drains Oil/Water Separation	Oil/Oily Water	Oil separation and disposal offsite by tanker truck to commercial oil recycling facility.
Dirty Water Drains	Water with dust, oil, chemical contamination	Discharge to settlement pond to remove sediments and to separate any oil. Sediments removed can be buried on the Site or disposed of in landfill. Separated oil discharged to the contaminated water system. Clean water discharge would be to the raw water dam for recycling.
Clean Water Drains	Water	Discharge to raw water dam for recycling.

4.5.4 Fuel

As described previously, the turbines would be fuelled solely by natural gas. No contingency has been made for the use of any other type of fuel, as a back up source or otherwise.

Natural gas would be supplied from the existing Moomba to Sydney gas pipeline.

4.5.5 NO_x Emission Control

Dry Low NO_x emission technology is proposed for the Delta Electricity Facility and all gas turbine manufacturers can guarantee emissions of 25 ppm at full load.

4.5.6 Noise Control

Chapter 8 and the respective *Project Applications* provide detailed information on measures to manage noise; however, subject to detailed design, the noise control features incorporated in the Delta Electricity Facility inherently include:

- air intake silencers;
- generator transformer walls on three sides; and
- exhaust air silencers.

4.5.7 Project Employment

The anticipated employment generated during construction and operation of Delta Electricity's Facility is presented in **Table 4-3**. The employment levels during construction are shown as a proportion of full time jobs over a full year.

Table 4-3 Estimated Employment Generated - Delta Electricity's Facility

Phase	Employment Generation	
Construction	*Annual Full Time Equivalent - Maximum*	*Annual Full Time Equivalent - Average*
Stage 1	150 construction jobs.	50 – 60 at any one time
Operation		
Stage 1	Up to 2 full time staff Up to 8 full time staff most located offsite Up to 2 full time equivalent contract staff for various support services	
Scheduled maintenance	20 to 50 contractors for a period of approximately 2 months every 2 to 3 years	

Up to two full time staff have been assumed for operation of the Delta Electricity Facility Stage 1, although it is noted that the Facility could be run with remote automatic starting, stopping and control and remote condition monitoring and assessment.

Maintenance Phase

For open cycle peaking operation, the number and type of starts and stops become more relevant to the timing of the above maintenance schedule than running hours. Recommended service intervals vary between manufacturers with some manufacturers assigning equivalent running hours to each start and stop event to allow a combined running hours and start/stop value to be calculated while others recommend total numbers of starts and stops without reference to running hours. It is estimated the inspection intervals for a Facility operating in a peaking capacity would be about twice that of base load units (e.g., combustion inspection every two years rather than each year).

It is anticipated that a long term service agreement with a contractor, typically the supplier, would be used for routine maintenance of the Facility and for unscheduled maintenance.

4.5.8 Project Timetable

At this time the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. Key project dates are listed in **Table 4-4**.

Table 4-4 Key Project Dates for Delta Electricity Stage 1

Item	Date *(tentative)**
Common Shared Works commence	Early 2009*
Delta Electricity commences construction	2011/12 Actual timing to be determined (depending on electricity demand growth and other developments)
Delta Electricity Stage 1 or Stage 2 Operation	2013/14 (latest date dependent on electricity demand and other developments)

*Date assumes Conditions of Approval granted by the Minister for Planning by the end of 2008.
Note: Delta Electricity may seek Minister's approval and progress with the construction and operation of combined cycle plant directly. Refer to **Section 4.9** for description of Common Shared Works.

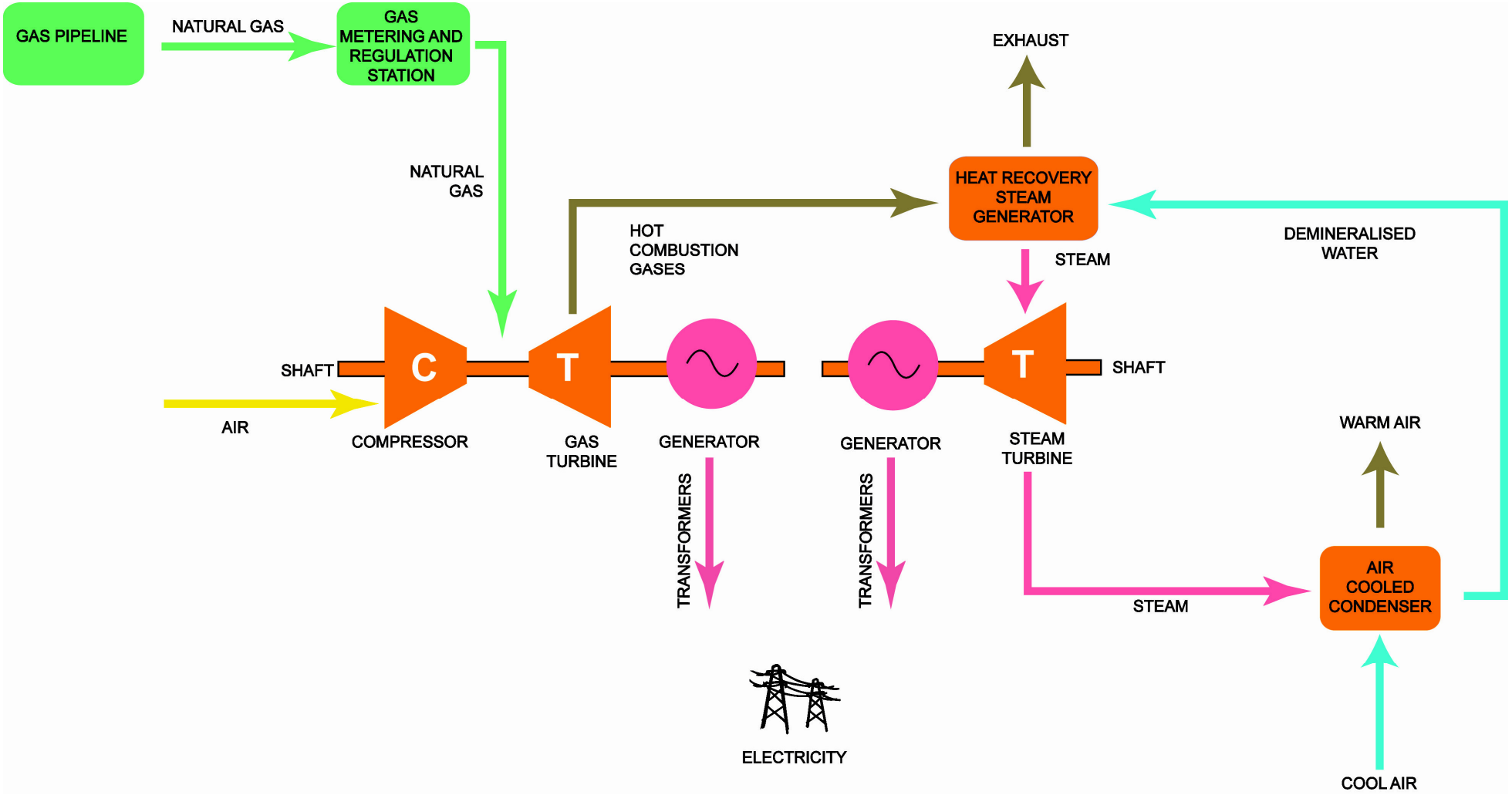
4.6 Delta Electricity - Stage 2 – Combined Cycle

The Stage 2 (combined cycle) Facility would require the addition of two heat recovery steam generators, steam turbine, generator and an air cooled condenser. The heat recovery steam generator acts to recover the heat energy previously emitted to atmosphere by the open cycle system by generating steam and producing electricity. Depending on the electricity demand growth, Delta Electricity may seek Minister's approval and progress with the construction and operation of the combined cycle Facility directly.

A process diagram of Stage 2 is presented in **Figure 4-7**.

The conversion of the Stage 1 open cycle Facility to combined cycle would involve the inclusion of the following systems in addition to those provided as part of Stage 1:

- two heat recovery steam generators (~35 m long, ~8 m wide and ~25 m high) installed on the exhausts of the gas turbines. Each heat recovery steam generator would include gas ducts, pressure parts (de-aerator, economisers, drums, evaporators, and super-heaters), pumps, pipework, controls and instrumentation, etc. The stacks would be relocated to the exhaust of each heat recovery steam generator;
- one steam turbine (~8 m long, ~5 m wide and ~5 m high) including steam valves receiving steam from both heat recovery steam generators;
- air cooled generator (~12 m long, ~5 m wide and ~5 m high) associated with the steam turbine;
- air cooled condenser (~70 m long, ~70 m wide and ~32 m high) cooling the steam exhaust from the steam turbine. Pumps and pipework return condensate to the heat recovery steam generators;
- various steam turbine auxiliary systems including lubricating and hydraulic oil systems, control and instrumentation systems, fire protection systems, closed cooling system with fin fan cooler, condenser air extraction plant, etc;



Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **PROCESS DIAGRAM - COMBINED CYCLE (DELTA ELECTRICITY STAGE 2)**
URS	Drawn: AJW; Approved: NB; Date: 17/03/2008 Job No: **43177371**; File No: 43177371-119.wor	Figure: **4-7**

- high voltage switchyard would be extended to accommodate the extension of the 330 kV bus to provide common connection from the steam turbine step up transformer circuit breaker to the transmission line;
- extension of, or additional, Site services including water and wastewater treatment, storage and truck loading / unloading facilities, chemical storage and delivery facilities, administration, workshop and stores building(s), fencing and roads, etc; and
- an administration building with a more extensive workshop and stores would be constructed.

4.6.1 Water Requirements

Several water and wastewater systems are associated with the Facility. Service water is required for fire services, gas turbine wash down and domestic services. Demineralised water is used in the gas turbine cooling system. The Delta Electricity Facility Stage 2 onsite treatment facilities are required to supply the required volume of demineralised water.

Site runoff and any process water generated from the Facility would be stored in onsite settlement dams prior to recycling or, if appropriate, disposal.

Service Water

Service water is required for various purposes including fire services, wash down, irrigation and water washing of gas turbines and for supply to the filtered water plant, which supplies the demineralised water treatment plant and domestic water treatment plant, where provided.

Generally, service water would require minimal treatment before onsite storage. A dedicated fire water tank is normally required.

Water for washing gas turbines would need to be of high quality and treatment may be needed. Demineralised water may also be used for gas turbine water washing.

Where demineralised water and domestic water treatment plants are provided, the filtered water treatment plant would include softening, clarification and filtering (depending on water quality). This filtered water would be suitable for gas turbine washing.

Demineralised Water

The Delta Electricity Facility Stage 2 configuration would use demineralised water in the gas turbine closed loop cooling system, for filling and make-up to the heat recovery steam generators, and as treated water for filling and make-up to the steam turbine closed loop cooling system.

The quantities of demineralised water used increases from the requirements of Stage 1 and onsite treatment facilities supplied by raw water would be necessary for Stage 2.

The demineralised water treatment plant would comprise cation and anion exchanger vessels, degassers, mixed bed vessels, pumps and storage tanks and regeneration/resin cleaning systems.

Domestic Potable Water

Domestic water would be required for drinking, showers and other amenities provided for personnel at the Site. Suitable quality water may be available by tanker truck deliveries to onsite storage tanks or from an onsite domestic water plant, in which the filtered water is chlorinated and stored in domestic water tanks.

Water Management for Gas Turbine Facility

Table 4-5 summarises the assumed water flows for Delta Electricity Facility Stage 2 assuming no gas turbine evaporative inlet air cooling. A capacity factor of 90 % was assumed in developing the estimated water demand for Stage 2. Rainwater flows and evaporation losses have not been considered.

The following table assumes significant onsite recycling of wastewater to minimise the quantity of raw water required.

Table 4-5 Delta Electricity Facility Stage 2 (Combined Cycle) Estimated Water Demand

Description	Quantity	Comment
Raw Water	63.5 ML pa	Net input required by plant assuming recycling
Service Water	7.9 ML pa	
Filtered Water	102.4 ML pa	Feed to demineralised water plant, domestic water plant. Includes recovery from brine concentrator
Demineralised Water	120.1 ML pa	
Domestic Water	0.7 ML pa	Assumes up to 15 personnel
Clean Water Drains	60 ML pa	No rainwater included
Dirty Water Drains	2.4 ML pa	Drainage of service water to settlement pond. No rainwater included
Contaminated Drains	13.6 ML pa	Drainage of service water to contaminated drains tank
Chemical Drains	30.8 ML pa	Drainage of service water and process water to chemical drains tank. Includes treated sewage effluent. Feed to Brine Concentrator
Sewage	0.7 ML pa	Treated effluent discharged to chemical drains system. Sludge stored onsite or disposed of offsite
Brine Concentrator - Feed - Recovery	 30.8 ML pa 24.6 ML pa	Quality water returned to Filtered Water Tank while brine disposed of offsite, stored in evaporation ponds or processed in a crystalliser (resultant salt disposed of offsite)
Water Recovery	53.5 ML pa	From raw water dam

4.6.2 Potential Water Sources

The design of the Facility would aim for zero water discharge (other than natural flows) to the environment and to maximise onsite water recycling. The water management plan for the Facility is discussed in **Chapter 14**.

Subject to further negotiations and detailed design investigations, it is intended that water would be sourced from a local water treatment plant, sewage water treatment and / or rainwater captured from the Facilities hard stand areas. The potential sources for water have been considered for the combined requirements of both the Delta Electricity and EnergyAustralia Facilities.

To meet the operational water requirements for the Delta Electricity Stage 2 Facility, water source options would include:

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

Water would be trucked to the Site to meet the operational requirements for the Delta Electricity Stage 2 Facility.

A new pipeline may be considered to meet operational needs for Delta Electricity Stage 2 Facility and EnergyAustralia; however, the pipeline would be subject to further consultation, detailed design and approvals.

4.6.3 Disposal of Wastewater, Sludge and Brine

There are several options for the disposal of wastewater, sludge and brine from the various water and wastewater treatment process. Overall the plant would be designed for zero water discharge (other than natural flows) 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.

Clean Water Drains

Clean drains (i.e., heat recovery steam generator blowdown) and clean stormwater drains (i.e., roof drains) would be directed to the raw water dam, from which any stormwater overflow would be released in a regulated manner. The main aims of the raw water dam would be to allow onsite water to be recycled to the service water system and to prevent discharge of contamination from the Site.

Dirty Water Drains

Drains (i.e., roads and other hard surfaces potentially contaminated by traces of oil, chemicals, dust, etc) would be directed to settlement ponds, which would be drained by pumps and plate separators (oil water separators) to the raw water dam. Any overflow from the settlement ponds would be directed to the raw water dam, while oil / oily water would be discharged to the contaminated water drains system. If necessary, settlement ponds can be drained and sediments/sludge transported by truck for offsite disposal.

Contaminated Drains

Contaminated drains include those associated with transformer bunds, equipment drains, etc, that potentially contain significant quantities of oil or oily water. Water from gas turbine washing would also be disposed in the contaminated drains system. The drains are directed to a contaminated drains tank incorporating oil and water separation. The oil is recovered by suction tanker for offsite disposal while the water is directed to the dirty water settlement ponds.

Chemical Drains

For Stage 1, there is unlikely to be any water treatment or large scale chemical storage facilities and so chemical drains would not be required.

For Stage 2, wastewater from the water treatment plants and drains from chemical storage areas would be collected in the chemical drains system. Neutralised wastewater from these plant areas would be stored in a chemical drains tank and would be transported offsite for disposal or processed in brine concentrators to recover distilled water for recycling to the filtered water tank and the demineralised water treatment plant. Concentrated brine waste would be transported by tanker truck for offsite disposal or would be further processed in crystallisers or evaporation ponds. The resultant solid waste would be transported offsite for disposal.

Domestic Sewage

For Stage 2, as the number of staff on Site during operation is higher than for Stage 1, a small package sewage treatment plant would be required. Treated water would be recycled in the brine concentrator system while sludge would be dewatered and disposed of offsite.

For Stage 2, water management systems would be expanded to cater for the more extensive water demands of the combined cycle plant. The onsite treatment processes, the wastes and their disposal methods are described in **Table 4-6**. Generally offsite disposal of waste and wastewater is preferred to options involving significant and/or long term onsite storage due to the possibility of spills and contaminants from such facilities.

Table 4-6 summarises the waste disposal for Stage 2.

Table 4-6 Waste Disposal for Delta Electricity Facility Stage 2 (Combined Cycle)

Process	Waste	Treatment and Disposal
Raw Water Treatment (filtering, softening, reverse osmosis, micro filtration, etc depending on quality	Liquid sludge	Thickening and offsite disposal by truck to a licensed facility.
Filtered Water Plant	Dewatered and liquid sludge	Liquid sludge would be thickened and combined with the dewatered sludge for disposal by truck to landfill.
Sewage Treatment Plant	Treated Effluent and Sewage Sludge	Effluent would be discharged to chemical drains system for reuse in the plant while sludge would be dewatered (belt filter) and disposed of offsite by truck to a licensed facility.
Contaminated Drains Oil/Water Separation	Oil/Oily Water	Oil separation and disposal offsite by tanker truck to commercial oil recycling facility. Water directed to settlement ponds.

Process	Waste	Treatment and Disposal
Dirty Water Drains	Water with dust, oil, chemical contamination	Discharge to settlement pond to remove sediments and to separate any oil. Sediments removed can be buried on the Site or disposed of in landfill. Separated oil discharged to the contaminated water system.
Clean Water Drains	Water	Discharge to raw water dam for recycling.
Chemical Drains	Water	Neutralised water would be supplied to a Brine Concentrator with quality water recycled to the Filtered Water Tank.
Brine Concentrator	Brine	Offsite disposal by truck to existing power station ash dam or similar disposal facility.

4.6.4 Fuel

As described previously, the turbines would be fuelled solely by natural gas. No contingency has been made for the use of any other type of fuel, as a back up source or otherwise.

Natural gas would be supplied from the existing Moomba to Sydney gas pipeline.

4.6.5 NO_x Emission Control

Dry Low NO_x emission technology is proposed for the Delta Electricity Facility and all gas turbine manufacturers can guarantee emissions of 25 ppm at full load.

4.6.6 Noise Control

During the tendering and detailed design processes, the Delta Electricity Stage 2 Facility would be designed to meet the specified noise limits and mitigation measures to be applied would be finalised.

Source noise control measures for the Delta Electricity Facility Stage 2 would be required and would be determined during the detailed design phase; however, may include measures such as:

- heat recovery steam generators would be designed to have a reduced sound power level; and
- condenser fans would be low noise and would likely require barriers (for example, screen around the condensing fans) and silencers.

4.6.7 Project Employment

The anticipated employment generated during construction and operation of the Delta Electricity Facility is presented in **Table 4-7**. The employment levels during construction are shown as a proportion of full time jobs over a full year.

Table 4-7 Estimated Employment Generated - Delta Electricity's Facility

Phase	Employment Generation	
Construction	*Annual Full Time Equivalent - Maximum*	*Annual Full Time Equivalent - Average*
Stage 2	200 construction jobs	100 at any one time
Operation		
Stage 2	18 full time most located onsite. Up to 2 full time equivalent contract staff for various support services.	
Scheduled maintenance	20 to 50 contractors for a period of approximately 2 months every 2 to 3 years	

For Stage 2, the following operating and maintenance team is anticipated for the Site:

- 5 two-man shift operating teams;
- 1 two-man mechanical maintenance team;
- 1 two-man electrical maintenance team;
- 1 station manager;
- 1 production manager;
- 1 storeman; and
- 1 secretary.

Maintenance Phase

Maintenance for the Facility is dominated by the scheduled maintenance requirements of the gas turbines. For base load applications these are generally determined by running hours. Recommended service intervals vary between manufacturers but typically include a combustion inspection (approximately one week duration) every 8,000 hours, replacement of selected high temperature components (approximately two weeks duration) every 24,000 hours and a major overhaul (approximately three weeks duration) every 48,000 hours. Shutdown inspection and maintenance of the heat recovery steam generator, steam turbine, generator and balance of plant can generally be accommodated within the gas turbine's requirements.

4.6.8 Project Timetable

As noted above, at this time the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. A date for Stage 2 construction and operation has not been specified. This stage is dependent on the electricity demand and supply of gas at the time. It is noted that Delta Electricity may seek Minister's approval and progress with the construction and operation of a combined cycle Facility directly. Key project dates are listed in **Table 4-8**.

Table 4-8 Key Project Dates for Delta Electricity - Stage 2

Item	Date *(tentative)**
Common Shared Works commence	Early 2009*
Delta Electricity commences construction	2011/12 Actual timing to be determined (depending on electricity demand growth and other developments)
Delta Electricity Stage 1 or Stage 2 Operation	2013/14 (latest date dependent on electricity demand and other developments)

*Date assumes Conditions of Approval granted by the Minister for Planning by the end of 2008.
Note: Delta Electricity may seek Minister's approval and progress with the construction and operation of combined cycle plant directly. Refer to **Section 4.9** for description of Common Shared Works.

4.6.9 Delta Electricity - Project Cost Estimate

Delta Electricity estimates that the total estimated capital cost (Stages 1 and 2) of their project is $515 million.

4.7 EnergyAustralia's Facility

The development of EnergyAustralia's Facility would comprise the following main elements:

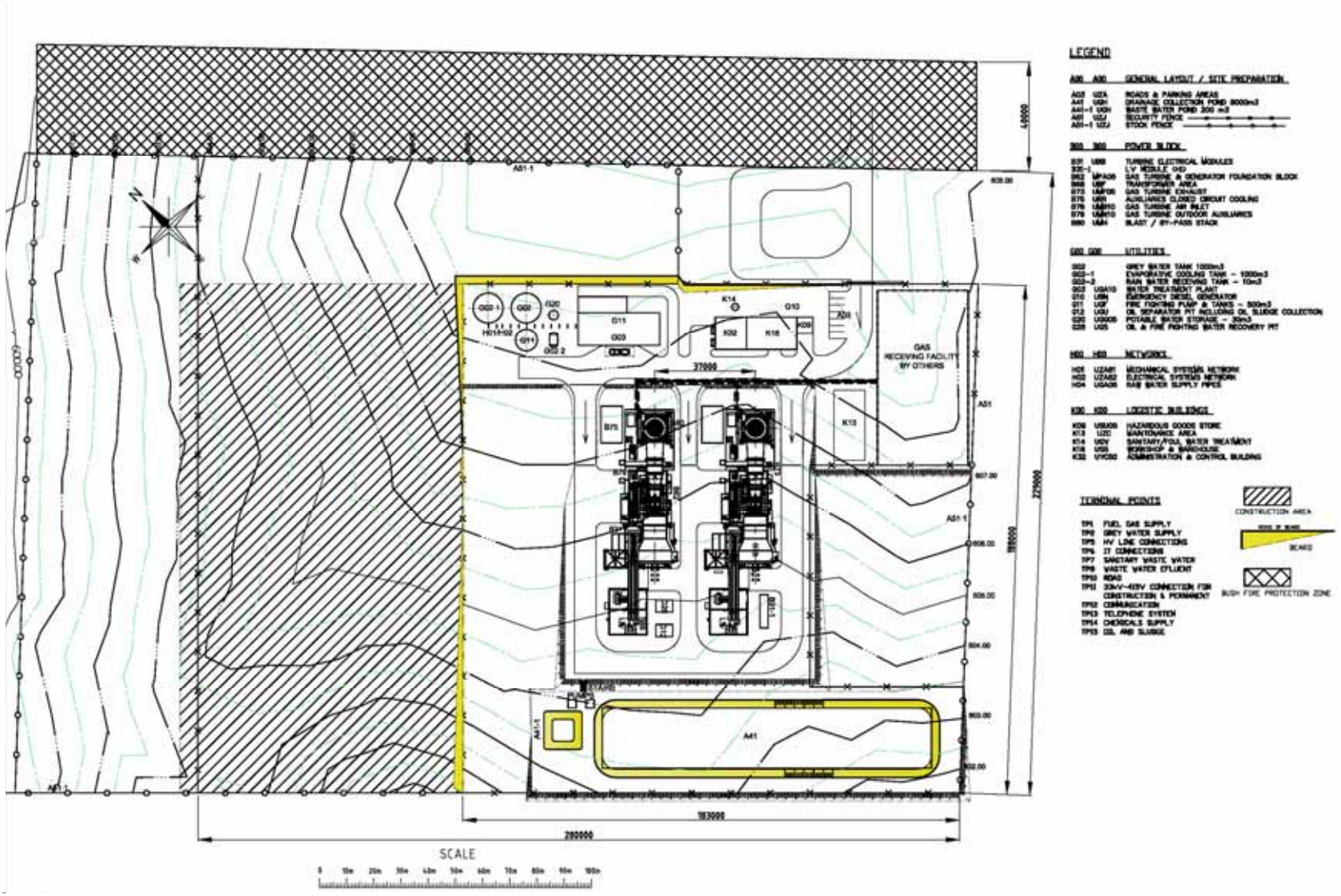
- two gas turbine generators together with associated, ancillary equipment and water, fuel and control systems;
- roads, drainage, and a workshop, control and administration facilities; and
- external infrastructure connections associated with electricity import and export, gas supply, road access and telecommunications.

Construction would be undertaken in a single stage.

The EnergyAustralia Facility would comprise two open cycle gas turbines, each with a capacity in the order of 175 MW, producing a total nominal facility output of 350 MW. Except for emergencies as allowed in its operating licence, the Facility would operate on an as-required, intermittent basis.

The open cycle gas turbine draws in cool filtered air, through a compressor, where it is mixed with natural gas and injected at high pressure into the combustion chamber of the gas turbine for combustion. The hot exhaust gas is used to drive the turbine which is connected to the electrical generator to produce electricity. The exhaust gases are vented to the atmosphere through the stacks.

The Facility would use E Class turbines operating as a peaking Facility. A typical indicative layout of the EnergyAustralia site is included in **Figure 4-8** and a process diagram is provided in **Figure 4-6**.



NOT FOR CONSTRUCTION

Source:Alstom MRN00MA00-GA002 Supplied by EnergyAustralia 5-12-07

Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **ENERGYAUSTRALIA INDICATIVE SITE LAYOUT**
URS	Drawn: AJW; Approved: NB; Date: 02/09/2008 Job No: **43177371**; File No: 43177371-120.wor	Figure: **4-8**

The main components of the Facility would be:

- two open cycle gas turbine units, each comprising compressor, combustion (featuring dry low NO_x burners) and turbine stages housed in sound attenuating enclosures approximately 8 m high;
- air inlet structures and ducting for each unit, approximately 24 m high;
- gas turbine exhaust stacks for each unit, 30 m high;
- water receiving, treatment and storage facilities;
- waste water storage and treatment facilities;
- workshop, electrical, control and administration facilities;
- monitoring and controls systems associated with fuel, water, waste, fire fighting and all other primary and ancillary systems;
- "step-up" transformers and connection to the 330 kV transmission grid;
- a gas receiving station associated with gas supply, pre-conditioning and metering; and
- external infrastructure interfaces associated with back-up electricity supplies, road access and telecommunications.

4.7.1 Water Requirements

Construction Stage Water Requirements

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

These requirements take into account the following assumptions:

- personnel levels;
- minor allowances for wet trades during construction (bricklaying / blocklaying), rendering to small areas only, (for example, control rooms);
- all concrete mixing offsite (i.e., not allowed for in estimates);
- no onsite construction camp or canteen facility (i.e., 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.

EnergyAustralia Facility Indicative Operational Water Requirements

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 4-9** provides a summary of indicative water demands.

Table 4-9 EnergyAustralia Facility - Summary of Indicative Water Demands

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.

4.7.2 Potential Water Sources

The design of the Facility would aim for zero water discharge (other than natural flows) to the environment and to maximise onsite water recycling. The water management plan for the Facility is discussed in **Chapter 14**.

Based on an average operation of 10 % per annum, the operational water requirements for the EnergyAustralia Facility would be approximately 12 ML per annum.

To meet the construction and operational water requirements for the EnergyAustralia Facility, it is proposed to use treated effluent from offsite sources and rainwater captured from the EnergyAustralia Facility hardstand area. These would be the primary sources of "raw water" for process and other water needs. Subject to further negotiations and detailed design investigations, it is intended that water would be sourced from a local water treatment plant and / or sewage water treatment.

The potential sources for water have been considered for the combined requirements of both the Delta Electricity and EnergyAustralia Facilities.

To meet the operational water requirements for both the EnergyAustralia Facility and Delta Electricity Facility, water source options would include:

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

Water would be trucked to the Site to meet the operational requirements for the EnergyAustralia Facility.

4.7.3 Disposal of Wastewater, Sludge and Brine

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.

A summary of EnergyAustralia's Facility waste disposal is presented in **Table 4-10**.

Table 4-10 Indicative Waste Disposal for EnergyAustralia's 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

4.7.4 Fuel

As described previously, the turbines would be fuelled solely by natural gas. No contingency has been made for the use of any other type of fuel, as a back up source or otherwise.

Natural gas would be supplied from the existing Moomba to Sydney gas pipeline.

4.7.5 NO_x Emission Control

Dry Low NO_x emission technology is proposed for the EnergyAustralia Facility and all gas turbine manufactures can guarantee emissions of 25 ppm at full load (average period 1 hour).

4.7.6 Noise Control

Chapter 8 and the respective *Project Applications* provide detailed information on measures to manage noise; however, subject to detailed design, the noise control features incorporated in the EnergyAustralia Facility would inherently include:

- air intake silencers;
- generator transformer walls on three sides; and
- exhaust air silencers.

4.7.7 Project Employment

The anticipated employment generated during construction and operation of EnergyAustralia's Facility is presented in **Table 4-11**. The employment levels during construction are shown as a proportion of full time jobs over a full year.

Table 4-11 Estimated Employment Generated – EnergyAustralia's Facility

Phase	Employment Generation	
Construction	*Annual Full Time Equivalent - Maximum*	*Annual Full Time Equivalent - Average*
	150 construction jobs	50 – 60 at any one time
Operation		
	2 full time onsite staff Up to 8 full time staff most located offsite (approximate 2 full time equivalent) Up to 2 full time equivalent contract staff for various support services	
Scheduled maintenance Minor Inspection	4 to 5 contractors for a period of 4-5 days every 6 to 7 years	
Major Scheduled maintenance:	40 personnel for a period of approximately 35-40 days every 36,000 equivalent operating hours for each unit	

4.7.8 Project Timetable

As noted above, at this time the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. Key project dates are listed in **Table 4-12**.

Table 4-12 Project Timetable - EnergyAustralia's Facility

Item	Date *(tentative)**
Common Shared Works commence	Early 2009*
EnergyAustralia commences construction	Early 2009*
EnergyAustralia commences operation	June 2010 (or earlier)

* Date assumes Conditions of Approval granted by the Minister for Planning by the end of 2008. Refer to **Section 4.9** for description of Common Shared Works.

4.8 Gas pipeline

4.8.1 Alignment

At this stage, the location of the connection to the Moomba to Sydney Gas Pipeline and the preferred route for the gas delivery pipeline has not been determined. However, the corridor for the pipeline route is included as part of this Environmental Assessment. Delta Electricity and EnergyAustralia are seeking Concept Approval for the Gas Pipeline Corridor (refer to **Figure 4-3**) and determination that further assessment to decide the preferred location for the gas main connection and the pipeline routes would occur at a later date. There are no specific constraints on the location of the connection point of the lateral to the Moomba to Sydney Gas Pipeline.

The landholders who may be affected by the Gas Pipeline Corridor would be contacted as part of a further consultation process. The Proponents would enter into negotiations for an easement for the gas pipeline across the relevant properties.

4.8.2 Gas Pipeline Route Selection Process and Criteria

Selection of the gas pipeline route within the identified Gas Pipeline Corridor will require consideration of the following factors:

- minimise the length of pipeline through selection of the shortest and most direct route;
- negotiations the with landholders;
- minimise the areas transversed that have significant changes in topography;
- minimise the clearing of native woodland or forest where possible;
- minimise the areas of archaeological potential transferred where possible; and
- minimise the crossings of waterways where possible.

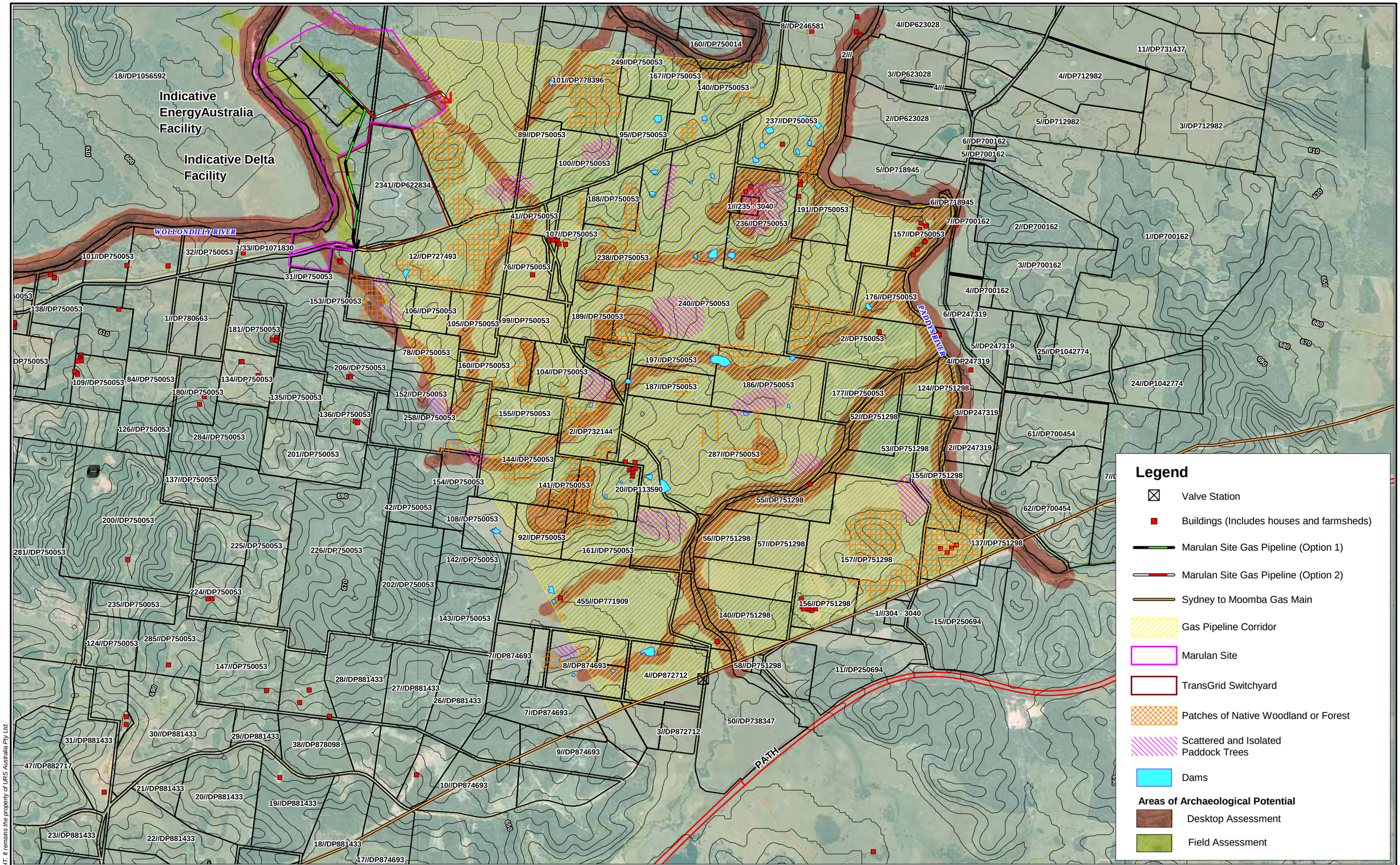
As part of this assessment, a desktop study has been undertaken for flora and fauna (**Chapter 11**) and heritage (**Chapter 12**). The results of these desktop assessments are presented on **Figure 4-9**. Further assessment would be undertaken once the route is defined.

The process for defining the gas pipeline route will broadly be undertaken in accordance with the following steps:

- undertake preliminary pipeline design;
- initiate discussions with affected landowners;
- refine design based on initial discussions and conduct field surveys (flora, fauna and heritage);
- progress negotiations with affected landowners to secure easements for gas pipeline and reach negotiated option agreement and/or use terms of *Lands Acquisition (Just Terms Compensation) Act 1991*; and
- conduct environmental assessment for Project Approval in accordance with the Part 3A assessment process.

The final easement would place restrictions on activities conducted by land owners covering:

- excavation;
- erecting a building / structure on, over or under the land;
- altering and disturbing existing levels, controls or gradients;
- planting / cultivating trees within certain distances of the pipeline; and
- undertaking any activity or place objects / vehicles / implements that may cause damage to the pipeline.



Source: Flora and Fauna Assessment, Gas Turbine Facilities Project, Marulan (URS, 2008) Archaeological Assessment of the Proposed Marulan Gas Turbine Facilities NSW (BIOSIS Research 2008)

Client: DELTA ELECTRICITY AND ENERGY AUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **GAS PIPELINE CORRIDOR CONSTRAINTS**
URS	Drawn: AJW · Approved: NB · Date: 17/03/08	Figure: **4-9**
	Job No: **43177371** · File No: 431773711-127.wor	

4.8.3 Operating requirements

The sole fuel would be natural gas sourced via an underground pipeline lateral from the Moomba to Sydney natural gas pipeline owned and operated by Australian Pipeline Trust (APT). A lateral would be connected to the main pipeline using a "hot tap" technique. A metering / regulating station would be located at the Marulan Site.

The proponents have consulted with APT, who manage the pipeline, regarding constructing a connection and supplying gas to the Facilities.

Advice from APT indicates the existing main pipeline would have sufficient capacity for the Delta Electricity Facility Stage 1 and EnergyAustralia Facility; however, upgrades to existing compressor stations as well as new compressor stations would be necessary to supply the Delta Electricity Facility Stage 2 gas demand.

The upgrade of the gas main is dependant on demand for gas in the future and the timeframe for Stage 2 of the development. Due to these uncertainties the upgrade of the gas main has not been considered as part of the scope of this assessment.

4.8.4 Supply

Gas turbines such as the E class turbines have a minimum fuel gas pressure requirement at the Site boundary (allowing for conditioning and control) in the order of 25-30 bar. It is anticipated that this pressure would be available from the main pipeline without the need for compression.

The fuel consumption for the two gas turbines is approximately 3.6 TJ/h, HHV which equates to annual consumption of approximately 2 PJ for Delta Electricity's Stage 1 and EnergyAustralia's open cycle operation (500 hours per annum) and approximately 32 PJ for Delta Electricity's Stage 2 combined cycle operation (90 % capacity factor).

Given the availability of natural gas, no provision has been made for dual fuel capability.

4.8.5 Conditioning

From the underground lateral pipeline, the high pressure gas would enter the metering, pressure reduction and gas conditioning plant located at the Facility sites. This would deliver the fuel gas to the gas turbines at the required pressure and temperature. Fuel heating to enhance plant performance may also be provided as part of the gas turbine control system.

4.8.6 Project Employment

The construction workforce requirements for the gas pipeline have not been determined at this point.

4.8.7 Project Timetable

At this time the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. Key project dates are listed in **Table 4-13**.

Table 4-13 Project Timetable – Gas Pipeline

Item	Date *(tentative)*
Gas Pipeline Construction commences	February 2009
Gas Pipeline Operation	June 2010 (or earlier)

4.9 Common Shared Works

Common Shared Works refers to the following components of the Project:

- bulk earthworks on the Site (comprising benching out and creation of a laydown area);
- access road (comprising access to each Facility for construction and operational purposes); and
- transmission lines (comprising high voltage transmission lines and connection to the TransGrid switchyard).

4.9.1 Bulk Earthworks

Bulk earthworks for the Site would be undertaken for the two Facilities, either in a staged manner or at the same time. For the purposes of this assessment it has been assumed that the earthworks are conducted in a single stage.

The bulk earthworks would involve clearing of vegetation for the Facilities, access road and transmission line. A total area of up to 30 ha would be cleared for these works. The impacts of these earthworks would be managed with appropriate soil and erosion control measures, in accordance with regulatory requirements.

This assessment seeks Project Approval for these works. The separate respective *Project Applications* for the Facilities address works commencing after bulk earthworks are complete. Following the bulk earthworks, the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. Soil and erosion control measures such as seeding or other stabilisation measures would be employed in the period between the bulk earthworks and further Site construction as required.

4.9.2 Laydown Area

The laydown area is a designated area within the Marulan Site to be used during construction for storage of construction materials and Facility components until they are installed at the Facility. The location of the laydown area is shown in **Figure 1-3**. It may be used by either Proponent. The laydown area is approximately 4 ha and the pad for the laydown area may be created at differing levels to the rest of the Facility pads and may be graded.

4.9.3 Access Road

Access to the Marulan Site would be via Canyonleigh Road. Internal roads would be constructed on the Site to facilitate the movement of construction and operation traffic to the Marulan Gas Turbine Facilities (refer to **Figure 4-2**).

4.9.4 Transmission lines

The development of the Facilities would require the construction of a transmission line to the nearby TransGrid switchyard.

The transmission line from the Facilities to the TransGrid switchyard would be approximately 1200 m in length. The line(s) would be located in the transmission line corridor as shown in **Figure 4-1,** and run north–south, from the southern boundary of the Site.

At the detailed design stage it would be confirmed if the Facilities require separate transmission lines.

The operation of the Facilities may also require the construction of new 330kV switchyard(s) and electrical plant. This may incorporate a single switchyard for both Facilities or separate switchyards for each Facility. These switchyard(s) would be incorporated into the footprint of the Facilities. The details of the 330kV switchyard(s) and electrical plant layout would be finalised at the detailed design stage.

The transmission line would have a nominal capacity of approximately 500 MVA to accommodate the output of Delta Electricity's Facility (Stage 1) and EnergyAustralia's Facility. The transmission line would remain the same for Delta Electricity's Stage 2 as for Stage 1.

4.9.5 Project Employment

The employment numbers for each Facility generally include joint construction works such as the earthworks, access road and transmission line.

4.9.6 Project Timetable

At this time the expected sequencing of the construction of the two Facilities is that EnergyAustralia would progress before Delta Electricity. Key project dates are listed in **Table 4-14**.

Table 4-14 Project Timetable – Common Shared Works

Item	Date *(tentative)*
Common Shared Works	Early 2009*
EnergyAustralia commences construction	Early 2009*
Delta Electricity commences construction	2011/12 Actual timing to be determined (depending on electricity demand growth and other developments)

*Date assumes Conditions of Approval granted by the Minister for Planning by the end of 2008.

4.10 Project Cost Estimate

The total estimated capital cost for the Marulan Gas Turbine Facilities Project is $809 million. The breakdown between the two Facilities and Common Shared Works is:

- Delta Electricity estimates that the total estimated capital cost (Stages 1 and 2) of its project is $515 million;
- EnergyAustralia estimates that the total estimated capital cost of its project is $266 million; and
- the Common Shared Works for the Facilities were estimated to be $28 million.

The cost breakdown is presented in **Table 4-15**.

Table 4-15 Estimated Capital Cost Breakdown

Component	EnergyAustralia	Delta Electricity (Stage 1 and Stage 2)
	$ million	
Common Works		
Gas pipeline	12	
Bulk earthworks	4	
Access road	6	
Transmission Line	6	
SUB TOTAL	28	
Cost split	14	14
Facilities	266	515
TOTAL - Each Proponent	**280**	**529**
TOTAL - Whole Project	**809**	