3.0 Project Infrastructure

Infrastructure for the project described in this section comprises water supply, electricity, natural gas, sewerage, stormwater drainage, telecommunications and buildings.

3.1 Water Supply

The refinery will require a number of types of water. These include:

- Raw water.
- Potable water.
- Seawater.

The circulation of all water types for the ultimate project (Stage 2) is illustrated in the water balance presented in Figure 3.1.1. Details of water recycling and re-use initiatives are provided in Section 4.

3.1.1 Raw Water

Raw water will be supplied by the Gladstone Area Water Board (GAWB). Between 2000 and 2002, the nearby Awoonga Dam on the Boyne River, a major water source in the region, was raised from 30 m to 40 m Australian Height Datum (AHD) to increase its storage capacity to 777,000 ML. Currently it is proposed that GAWB will supply raw water to the refinery from the Awoonga Dam. The location of proposed raw water pipeline is shown in Figure 3.1.2.

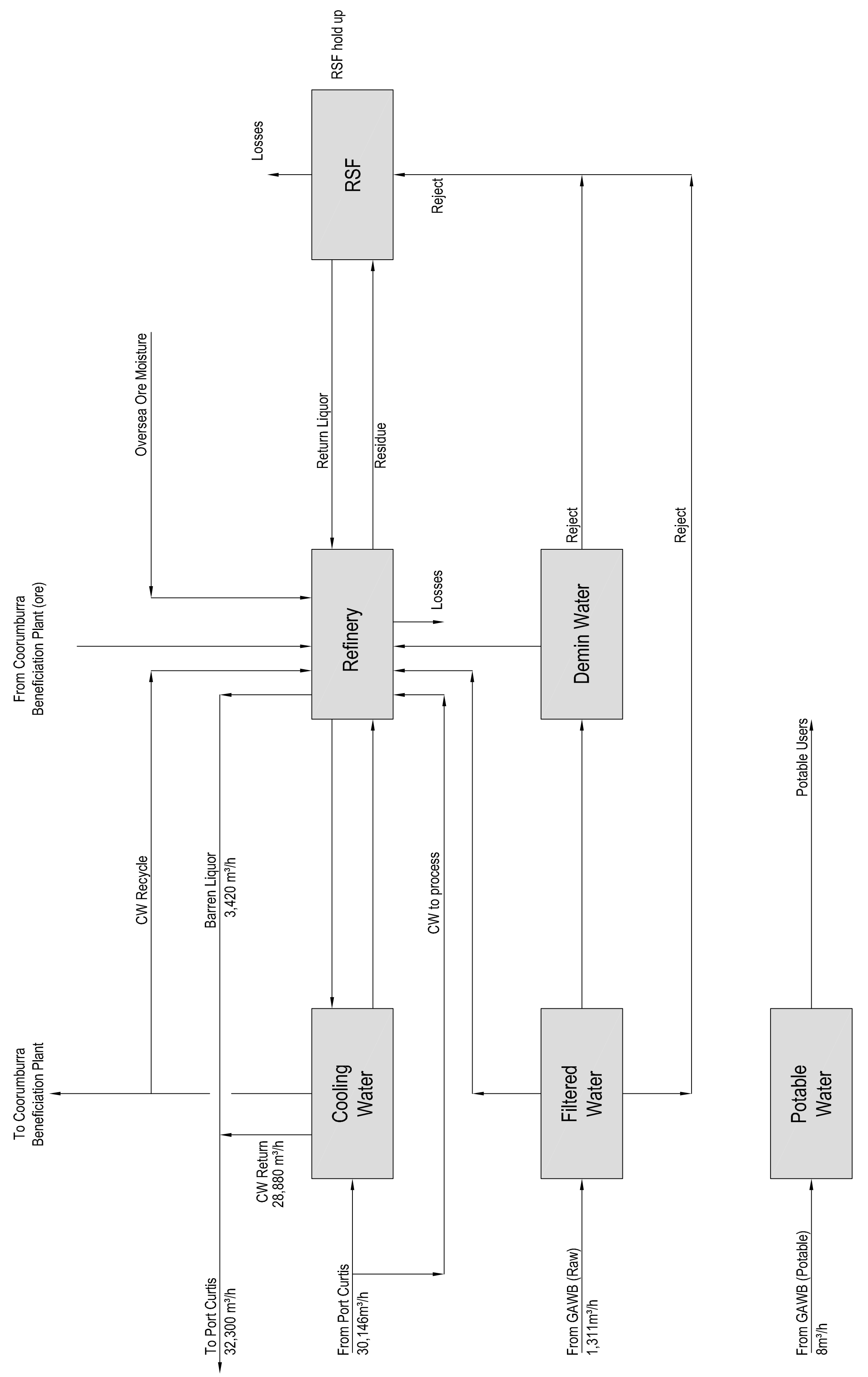
The initial raw water demand during Stage 1 of the project will be approximately 5,400 ML/y. This requirement will increase to an ultimate raw water demand of approximately 10,500 ML/y during Stage 2.

The raw water during Stage 2 will be sourced directly from the GAWB's Awoonga Dam facility. As the refinery increases its capacity for Stage 2 and other developments in Gladstone proceed, it is likely that raw water supplies will be sourced either from Awoonga Dam or from an augmented supply to be developed by the GAWB. The GAWB plans to develop a number of additional water supplies as identified in the report *Securing the Gladstone Region's Future Water* (GAWB, 2003). These include the following options:

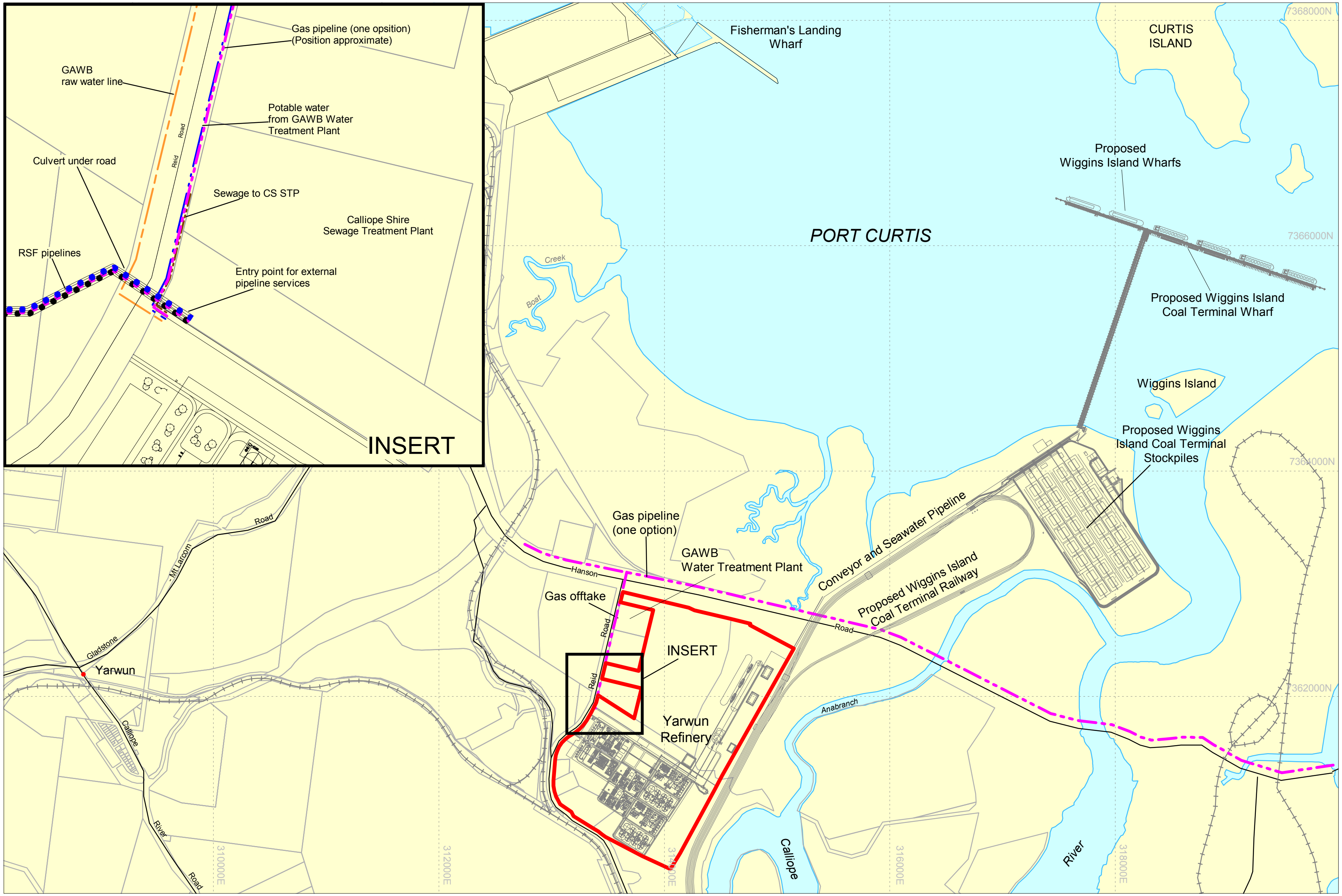
- Development of a weir at Rookwood Crossing on the Fitzroy River together with an associated delivery system.
- Development of a weir above Lowmead on Baffle Creek together with an associated delivery system.
- Raising of the existing Awoonga Dam from 40 m AHD to 45 m AHD by installing 5 m high gates on the existing spillway.
- Development of a large scale desalination plant.

3.1.1.1 Raw Water Treatment Plant

The raw water supplied to the refinery will be sent to the refinery's water treatment plant (WTP) for additional treatment prior to distribution within the leach and metals plants. The WTP will produce filtered water and demineralised water. Waste water is generated from the water treatment process. Ultimately, the WTP will treat approximately 10,500 ML/y of raw water. Table 3.1.1 outlines the ultimate quantities of water produced from the WTP and the uses throughout the refinery.



Client	Project	Title	
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT	**WATER BALANCE** **STAGE 2**	
URS	Drawn: SCB	Approved: CMP	Date: 20/11/2006	Figure: 3.1.1	Rev. B
	Job No.: 42625791	File No.: 42625791-g-051b.dwg		A4



0 1 2km

Scale 1:50,000 (A4)

MGA Z56, GDA94

Legend					
	Nickel Slurry and Seawater		Gas		Raw water
	Limestone Slurry		Sewage		Road
	Residue Liquor		Potable Water		Railway

URS

Client: Gladstone Pacific Nickel Ltd

Project: GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT

Title: YARWUN REFINERY UTILITIES

Drawn: TN | Approved: CMP | Date: 20-11-06

Job No: 4262 5791 | File No: 42625791-g-086.wor

Figure: 3.1.2 | Rev: A | A4

Table 3.1.1 Raw Water Treatment and Usage (Stage 2)

WTP Product	Rate (ML/y)	Main Uses
Filtered Water	6,300	Sulphide precipitation, filtration washing, reagent mixing, gland water, fire water
Demineralised Water	2,400	Sulphuric acid plant and power plant as boiler feed water system make-up, steam de-superheating, hydrogen plant.
Waste water	1,800	Disposal via the residue storage facility and return liquor system

The WTP is likely to consist of the following:

- Raw water treatment package to remove any blue green algae that may be present.
- Water filtration plant based on multi-media filtration to remove any suspended particles.
- Demineralised water package to produce high quality water.

3.1.1.2 Fire Water

Fire water will be piped through a distribution network (ring main) servicing all areas of the refinery. It will be drawn from the filtered water supply and augmented by pumping. The fire water system will be designed to meet the requirements of *AS 2941-2002: Fixed fire protection installations – Pumpset systems* (Standards Australia, 2005 (a)) and *AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning* (Standards Australia, 2005 (b))..

The fire water pump set will consist of electric and diesel pump(s) with a diesel tank included in the package. Additionally, an electric jockey pump will be provided to maintain the required pressure in the line. The system will be under the control of suitable instrumentation in order to maintain pressure in the line and timely availability.

In the event of a fire at the refinery, fire water will be collected in the refinery's drainage system and flow to the settlement ponds from where it will be returned to the process or disposed of through stormwater discharge following any necessary treatment.

Details of the preliminary design for the fire system are shown in Figure 13.7.1.

3.1.2 Potable Water

Potable water for the refinery will be sourced from GAWB's adjoining WTP (refer Figure 3.1.2). The refinery's potable water demand during Stage 1 will be approximately 32 ML/y. During Stage 2 of the project this requirement will increase to approximately 64 ML/y.

The existing GAWB WTP will be augmented if necessary to cater for the additional demand associated with the Gladstone Nickel Project (GNP) and other industrial development in the area. Proposed potable water supply pipelines between the GAWB WTP and the refinery are shown in Figure 3.1.2.

3.1.3 Seawater

Seawater will be extracted from Port Curtis and used:

- As process water in the leach plant.
- For cooling water at the refinery, which is the major requirement for seawater.

- For beneficiation at the Coorumburra beneficiation plant and for transport of ore slurry to the refinery.
- For other minor process water uses at the refinery.

The total seawater intake for Stage 2 is approximately 240,000 ML/y (140,000 ML/y for Stage 1). The majority of this water will be used for once-through cooling purposes and then returned to Port Curtis.

The requirement for seawater is likely to vary depending on the amount of process water being recycled within the refinery and the amount of nickel ore slurry being generated at the Coorumburra beneficiation plant.

Seawater will be drawn from an inlet located at the proposed Wiggins Island Coal Terminal (WICT) and pumped directly to the refinery's cooling water system for once-through cooling purposes. The pipeline route is shown on Figure 3.1.2. The seawater extraction pumps will be supported on an independent, piled structure.

Some of the spent cooling water is pumped via a high density polyethylene (HDPE) lined pipeline to the Marlborough mine for use in the Coorumburra beneficiation plant. A proportion of the spent cooling water is directed to the lime plant and re-used in the process where possible. The cooling water return system will be comprised of a system of tanks for distribution and ultimately the disposal of the remainder of spent cooling water and excess residue storage facility (RSF) return liquor to Port Curtis through an eduction system.

3.2 Electricity

3.2.1 Refinery and Wharf Facilities

Electricity for the refinery and WICT wharf facilities will be supplied from a combination of the existing electricity grid or generated on site from acid plant steam. Electricity requirements during construction are provided in Section 2.3.4. Details of on-site electricity generation and electricity grid requirements are provided in Table 3.2.1.

Table 3.2.1 Electricity Generation and Requirements

	Stage 1 (MW)	Stage 2 (MW)
Refinery Requirement	61	122
On-site Generation – Sulphuric Acid Plant	48	75
Electricity Grid Requirement	13	47

3.2.1.1 Refinery Design Requirement

Ultimate absorbed power requirements for Stages 1 and 2 of the refinery are 61 and 122 MW respectively. Fluctuations in plant load are not considered to vary significantly as it has been assumed the most significant load variation (the wharf-based ship unloader) will be taken from a different supply. Variations at the refinery occur during shutdowns.

The largest motors on site will be the sulphuric acid plant blowers (approximately 9 MW for the two Stage 1 blowers) and the air separation plant compressor (approximately 4.5 MW for Stage 1). In addition there will be seawater pumps (approximately 1.2 MW for Stage 1) which provide seawater for both process use and for cooling water duty.

3.2.1.2 On-site Generation – Sulphuric Acid Plant

The quantity of steam generated from the sulphuric acid plant will be greater than the plant's process steam requirements. Excess high pressure steam generated in the sulphuric acid plant will drive steam turbine alternators, generating electricity for use in the refinery. During Stages 1 and 2, up to 48 and 75 MW of electricity respectively will be generated from steam generated by the sulphuric acid plant and supplementary steam generated by on-site boilers.

When the sulphuric acid plant is off-line, high pressure steam is generated by package steam boilers and will be used as process steam and to generate electricity.

3.2.1.3 Electricity Grid

Normal refinery operations will require the difference between the total refinery power requirement and the amount generated in the sulphuric acid plant to be imported from Powerlink's electrical grid system.

The likely option for a power supply is a connection from the proposed new 132 kV transmission line between the proposed Powerlink substations at Black Harry Island and near the Comalco Alumina Refinery (CAR). The proposed Powerlink CAR substation will connect to the existing Ergon Energy 132 kV distribution powerline servicing CAR and other consumers.

A common bus at 132 kV will connect the two independent 132/11 kV 50 MVA transformers, each designed to independently deliver the total electrical requirement of the refinery. Oil retention bunds will be installed at each transformer.

At present, there are two 275 kV transmission lines crossing the refinery site. One easement runs in a south-west to north-east direction, while the other runs in a north-west to south-east direction (refer Figure 2.1.1). Both transmission line easements connect to the Gladstone Power Station located east of the site. Powerlink is proposing to relocate both transmission lines to the south of the refinery site.

3.2.2 Fisherman's Landing Facility

Ammonium sulphate (amsul) will be exported through the Fisherman's Landing wharf. Electricity will be required to run materials handling and storage equipment within the amsul storage shed (refer Figure 2.2.5). There are currently two existing 11 kV distribution powerlines that supply the Fisherman's Landing wharf area. A substation is located near the Cement Australia plant.

Based on the current electrical load required for the amsul export facility, Ergon Energy Network indicated it would provide delivery through an 11 kV/415 V pad mount transformer (up to 1000 kVA capacity) connected via a "tee off" from one of the two 11 kV distribution powerlines.

3.2.3 Residue Storage Facility

The existing electricity network within the vicinity of the RSF does not have adequate spare capacity to meet the requirements of the RSF. It is likely that a major infrastructure upgrade will be required to supply electricity to the RSF. Preliminary investigations by Ergon Energy suggest this will involve one of the following two alternatives:

- Develop a new dedicated distribution powerline at either 11 kV or 22 kV, from one of the closest Ergon Energy substations to a single 5 MVA transformer substation at the RSF facility; or
- Build a new substation and network infrastructure to deliver electricity to this substation from the one of the closest Ergon Energy substations and an 11 kV or 22 kV distribution powerline from the new substation to a single 5 MVA transformer substation at the RSF facility.

Ergon Energy Network will deliver electricity to the terminals on the load side of the transformer for both options. The supply voltage is yet to be confirmed.

3.2.4 Slurry Pipeline

During operations, power for the pumping facilities for the slurry pipeline will be sourced from either the mine site power supply (external to this project) or from the refinery. The only other power requirement for the operation of the pipelines is for the cathodic protection system, which will either be sourced from mains power (if available) or from local solar power generation.

3.3 Natural Gas

The refinery requires both high and low pressure gas, either natural gas or coal seam gas (CSG), as a process feed stock and as a fuel source. Natural gas will be supplied to the refinery through a natural gas metering station which will provide fuel for plant items including the nickel and cobalt sinter furnaces, the sulphuric acid plant (start-up only), the hydrogen plant, the standby boiler in the power plant, and the hydrogen sulphide gas incinerator.

Natural gas, at 2,750 to 10,200 kPa gauge from the main, will pass through a skid-mounted natural gas letdown and metering station where it is reduced in pressure to 2,310 kPa gauge and reticulated as required around the refinery site. The ultimate natural gas consumption for the refinery is approximately 4 PJ/y for Stage 2.

The gas supply into Gladstone is constrained by the current network infrastructure. Major investment in the network infrastructure is likely to be required to meet the anticipated gas requirements for the refinery and other future industrial users.

Gladstone Pacific Nickel Limited (GPNL) has approached Enertrade for a proposal for the supply of natural gas to the refinery, with the future option of converting CSG through a proposed new gas pipeline. The proposed Central Queensland Gas Pipeline (CQGP) will consist of a high pressure gas transmission pipeline to supply CSG from the Bowen Basin coalfields at Moranbah to industrial customers in Gladstone.

An alternative option involves connecting to the existing main Alinta pipeline providing natural gas to the Yarwun area. A spur line from the natural gas main can be provided in the pipeline corridor which approaches the refinery site at its western boundary (refer Figure 3.1.2).

3.4 Sewerage

The refinery sewerage system will comprise a system of underground gravity sewers, pumping stations and rising mains to allow sewage to be pumped to the adjacent Calliope Shire sewage treatment plant (refer Figure 3.1.2).

Typical sewage loads from industrial facilities are 120 L/person/day. Accordingly, the maximum domestic sewage generated by the refinery during operations will be 54,000 L/day (approximately 450 equivalent persons).

Calliope Shire Council has recently completed an upgrade of the sewage treatment plant. Based on the likely sewage loads generated, it is not anticipated that there will be any need to further upgrade the existing sewage treatment plant for the GNP.

3.5 Stormwater Drainage

Where there is potential for rainfall runoff from the refinery site to become contaminated it will be contained on-site for re-use as process water or treated prior to discharge. Only uncontaminated runoff will be discharged from the site.

The refinery will be designed to provide spill containment for equipment that contains process solutions and will be regularly subject to maintenance during normal operation. Tanks, vessels and pumps will be contained in concrete bunds capable of containing the volume of the largest tank located in the area of the bund. Process spillages into these bunded areas will be returned to the process upstream of the area.

No spill containment will be provided for items not commonly subject to maintenance or having a low probably of risk of failure such as pipes located on major pipe-racks. However, all site runoff from process areas within the refinery site will be collected in the site sediment pond(s).

Further details of the stormwater management system are given in Section 8.2.

3.6 Telecommunications

Telecommunication services already run along Hanson Road and service existing industries within the Gladstone State Development Areas (GSDA) and other developments in the area. No difficulties are expected in expanding these services to cater for the demands of the GNP.

A high speed, 12 core fibre optic cable will link the administration and control room buildings at the refinery site (refer Section 3.8). A series of cabling and components will link individual duel outlets within the administration and control room buildings to a building distributor. ATM/Ethernet switches, personal computers (PCs), network management, patch panels, racks and associated minor items will be provided to interconnect the cabling to provide an integrated set of communications infrastructure. The data network is distributed to computers and servers within each building and external requirements from those two nodes. The data network will also include computer file servers, printers, software and PCs.

Communications to on-site personnel will use one of several radio frequencies. One frequency will be exclusively allocated for use in emergencies.

3.7 Buildings

In addition to the processing plant and equipment, a number of buildings will be located within the refinery. Details of the main buildings are provided below. All buildings will be provided with fire systems that meet the relevant requirements of the Building Code of Australia. Building details are outlined in Table 3.7.1.

Table 3.7.1 Details of Buildings within the Refinery

Building	Details
Production and Administration Building	The production and administration building will provide office accommodation for permanent staff, plus storage, kitchen, toilet and shower facilities and spare office accommodation. The production and administration building will contain two storeys, ducted air conditioning and will be accessed through a double door seal system to minimise internal noise.
Control Room and Laboratory	The control room and laboratory will house the control room and laboratory personnel. The control room and laboratory will contain all the necessary equipment for plant operation and control. A metallurgical laboratory building will be located adjacent to the control room and laboratory building.
Gatehouse	The gatehouse will be located adjacent to the main entrance to the refinery and will house plant security personnel and security systems. Emergency services equipment and a training centre will also be located at the gatehouse.

Table 3.7.1 Details of Buildings within the Refinery

Building	Details
Workshop Building	The workshop will contain sufficient workshop equipment for normal, routine on-site maintenance.
Warehouse and Maintenance Control Centre	The warehouse will include a storage racking system and lay-down yard. The maintenance control centre will be located adjacent to the warehouse and workshop and will be used to house maintenance personnel.