3 PROJECT DESCRIPTION

3.1 PROJECT OVERVIEW

3.1.1 Project Background

The International Power Consortium South Africa (IPCSA), have developed a solution to ArcelorMittal Saldanha Steel's requirement for stable, economical electricity over the long term. The solution will supply baseload power and cater for a peaking demand up to 250MW and consists of a 1507 MW (net capacity) Combined Cycle Gas Turbine (CCGT) power plant to be erected adjacent to the ArcelorMittal's Saldanha Steel site [(1)]. This will ensure the medium to long term sustainability of ArcelorMittal's Saldanha Steel as well as the surrounding economy it operates in.

ArcelorMittal and IPCSA have signed a Power Generation and Natural Gas Project Development and Pre-Off Take Agreement that binds both parties to certain deliverables in developing the project up to the Bankable Feasibility Study (BFS) completion.

The Project is primarily a power supply project to the Saldanha Steel Plant as the anchor off taker. Additionally, the proposed power plant will either tie into the Department of Energy's (DoE) Gas to Power (G2P) programme [(2)] or the balance of power will be sold to large electricity users which will be determined in accordance with existing regulation.

The Project will support Liquefied Natural Gas (LNG) as its main fuel supply and will consume approximately 76 million Giga Joules of LNG per year (2 million tons of LNG per annum).

LNG will be supplied by ship to the Port of Saldanha, where it will be regasified and then offloaded via a submersible pipeline either from a mooring area located off shore or a berthing location in the Port in Saldanha. Initial discussions have been held with Transnet National Ports Authority (TNPA) in Saldanha in this regard. [(3)]

The Project will supply the power needs of ArcelorMittal Saldanha Steel (+/- 160MW of base load energy, peaking up to 250MW) and excess electricity will

(1)In order for the solution to achieve the economy of scale required to allow for cost effective gas importation, it is designed as a 1507 MW (net capacity) Combined Cycle Gas Turbine (CCGT) power plant.

(2) In 2012, the Minister directed in her Determinations that new generation capacity should be procured from hydro, coal and gas sources to support the South Africa's base load energy mix and generation from gas and cogeneration as part of the medium-term risk mitigation project programme. The Determinations require that 3126MW of baseload and/or mid-merit energy generation capacity is needed from gas-fired power generation to contribute towards energy security. The gas required for such power generation will be from both imported and domestic gas resources. (https://www.ipp-gas.co.za/)

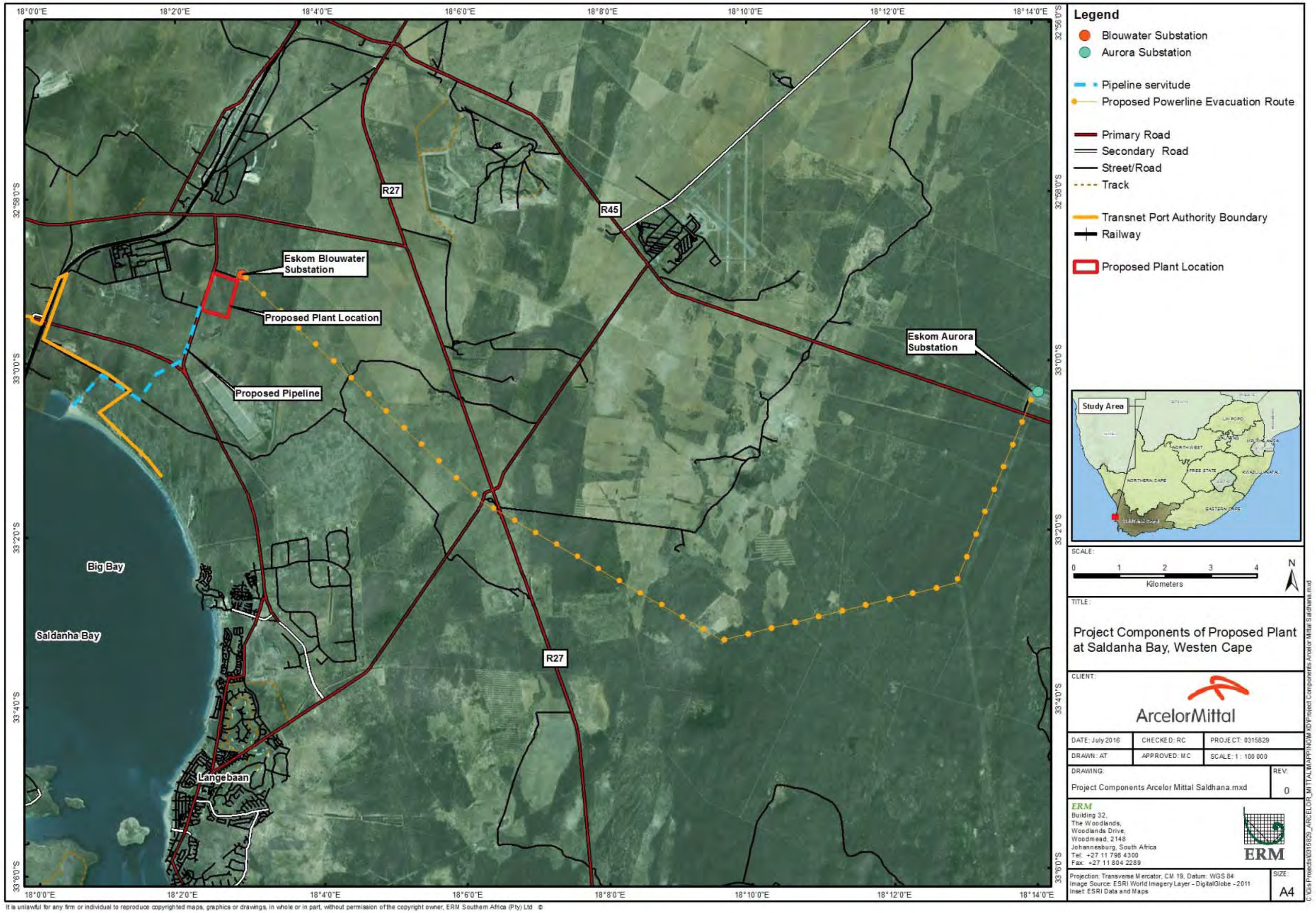
(3) It is anticipated that this project will connect to the Department of Energy's (DoE's) planned LNG import terminal. Should this not occur a separate EIA will be undertaken to permit the marine component of the import of LNG._

be made available to industries within the Saldanha Industrial Development Zone (IDZ) and/or Municipalities within the Western Cape Province.

3.1.2 Project Location

The Project is to be developed on a green field site owned by ArcelorMittal, approximately 5 km northeast of the Port of Saldanha (*Figure 3.1*). The site is located less than 1 km to the east of the existing ArcelorMittal Steelworks, immediately adjacent to the Blouwater substation. The site is located within an area identified for industrial development according the Saldanha Bay Municipal Spatial Development Framework (2011).

Figure 3.1 *Project location and key components**



*Note: 400kV transmission line is shown only for illustration purposes and is not included in the scope of this EIA.

3.1.3 *Land Ownership and Acquisition*

The two properties on which the proposed power plant site is located are detailed in *Table 3.1*.

Table 3.1 Properties which are intersected by the power plant footprint

Farm Name	Portion Number	Parcel Number	SG Code
Yzervarkensrug	129	Remaining Extent	W014C04600000000012900000
Jackels kloof	195	2	W014C04600000000019500002

The proposed pipeline corridor intersects with the properties as listed in *Table 3.2*.

Table 3.2 Properties which are intersected by the pipeline corridor

Farm Name	Portion Number	Parcel Number	SG Code
None	0	1185	W014C04600000000001185000000
STATE LAND 196	0	196	W014C046000000000196000000
Farm 195	195	0	W014C046000000000195000001
Farm 195	7	195	W014C046000000000195000070
Farm 195	1	195	W014C046000000000195000010
Jackals Kloof 195	2	195	W014C046000000000195000020
None	0	1132	W014C04600000000001132000000
YZERVARKENSRUG 129	0	129	W014C046000000000129000001

The proposed feeder transmission line from the power plant to ArcelorMittal Steel intersects with the properties as listed in *Table 3.3*.

Table 3.3 Properties which are intersected by proposed feeder transmission line from the power plant to ArcelorMittal Steel

Farm Name	Portion Number	Parcel Number	SG Code
YZERVARKENSRUG 129	0	129	W014C046000000000129000001
YZERVARKENSRUG 129	3	129	W015C046000000000129000030
None	0	1132	W014C04600000000001132000000

3.2 *Project Area of Influence*

For the purposes of this impact assessment, the definition of the Area of Influence (AoI) encompasses:

- *'The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but* *predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.*

- *Associated facilities are facilities that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.*

- *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.'*

For the Project, the **direct** AOI is the spatial extent of the Project footprint and related facilities on the receiving environment. This encompasses:

- Power plant total surface area (area within the fence line);
- Pipeline construction (temporary) Right of Way (RoW); and
- 132kV feeder transmission line to ArcelorMittal RoW.

A breakdown of the surface areas for these components is provided in *Table 3.1* and is shown later in this section in *Figure 3.4*.

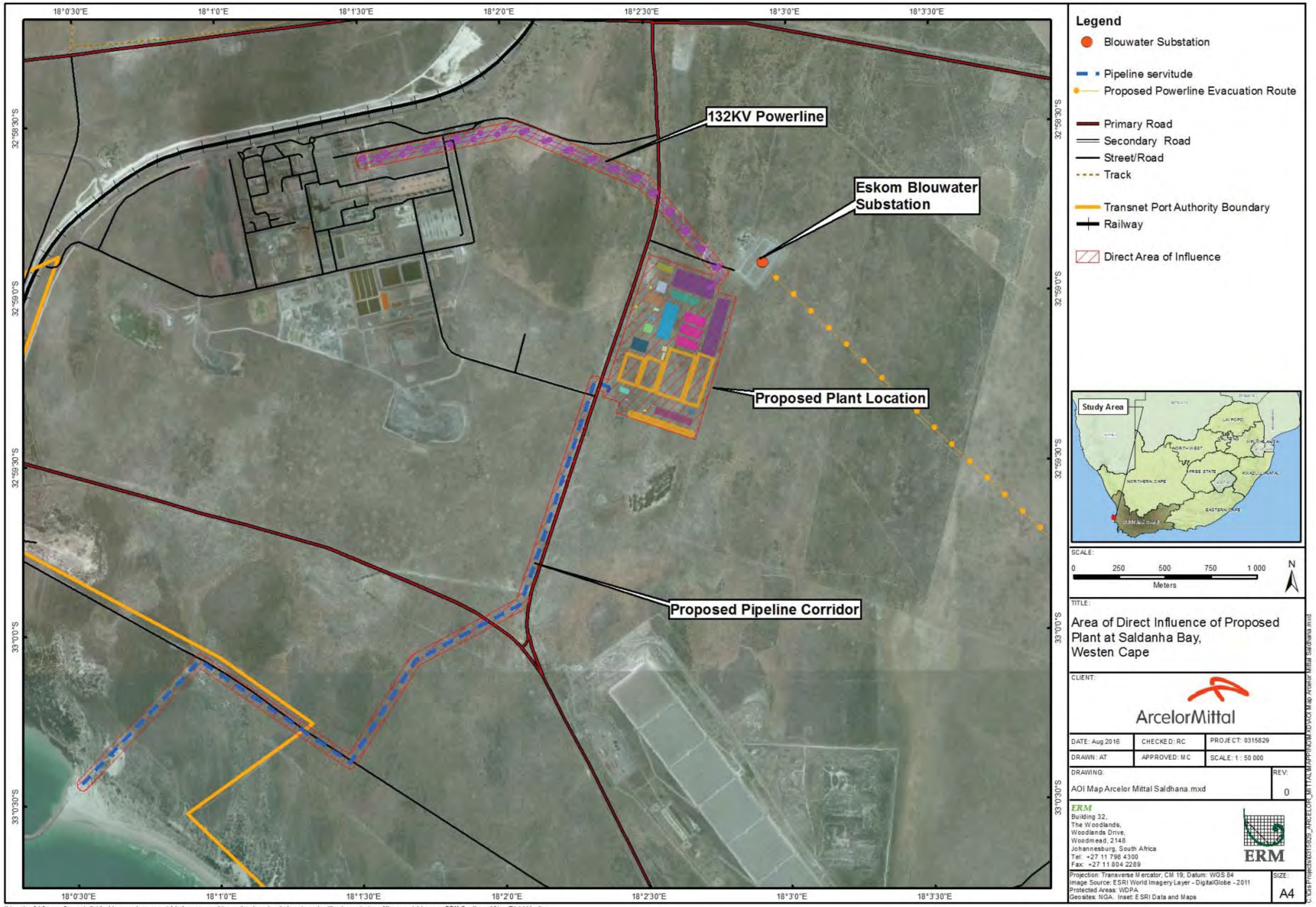
Table 3.4 Footprint of project components

Project Component	**Area (ha)**
Main Project Components	
Power plant total surface area (area within the fence line)	45.83
Pipeline construction (temporary) RoW	30.49
Pipeline permanent easement	2.76
132kV feeder transmission line to ArcelorMittal RoW	7.22
Components within the power plant site	
1.5 MW Generator	0.09
132KV Switchyard	2.40
440KV Switchyard	2.48
Admin, Control, Laboratory	0.25
Air-Cooled Condensers	1.56
Canteen, Changing Rooms, Ablutions	0.09
Clinic	0.01
Construction Changing Rooms & Ablution Block	0.18
Emergency Assembly Point	0.04
Gas Pipeline Receiving Area	0.18
Gas Turbine, Steam Turbine and HRSG Islands	1.89
Hard Standing Laydown Area	9.64
Laydown Area	0.69
Other	0.03
Pigging and Gas Metering Area	0.07
Reverse Osmosis, MSFD, Salt Residue	0.05
Sewerage Treatment Plant	0.12
Stormwater Collection Tanks	1.20
Trent Gas Turbines	0.73

Project Component	Area (ha)
Truck Staging & Laydown Area	0.36
Visitors and Training Centre	0.07
Water Filtration	0.02
Water Treatment, Raw Water Storage, Fire Fighting Water	0.59
Workshop Warehouse and Spares	0.33

The **indirect** AOI encompasses areas potentially affected by cumulative impacts as well as areas that could be impacted indirectly by Project activities. The indirect AOI will differ between various resources and receptors depending on the dependencies. For example, indirect impacts to soils would be likely limited to the immediate areas around the direct footprint. Indirect impact to social resources may however extend to nearby communities along the coast which may be affected by the Project.

Figure 3.2 *Project Area of Influence (AoI)*



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3.3 *PROJECT COMPONENTS*

The key project components considered in this EIA are as follows:

- Pipeline;
- Power plant; and
- Power evacuation and connection to the grid [(1)].

These are discussed in detail in the sections below. The general surface areas for the project components are listed in *Table 3.5* below.

Table 3.5 Project components general surface areas and lengths

Project Component	**Area / Length**
Power Plant total surface area	45.83 ha
Length of pipeline	4.6km
Pipeline construction (temporary) RoW (36m width)	30.49 ha
Pipeline permanent easement (6m width)	2.76 ha
132kV feeder transmission line to ArcelorMittal length	2.4km
132kV feeder transmission line to ArcelorMittal RoW (30m width)	7.22 ha
Proximity to grid connection	150m

It is envisaged that LNG will be supplied by ship to the Port of Saldanha where it will likely be offloaded to a Floating Storage Regasification Unit (FSRU). The FSRU will regasify the LNG and pump it via a pipeline to the power plant. The supply of fuel and import facilities have not been considered in this EIA. The Department of Energy initiated a project in 2015 to permit the construction of an LNG import terminal at the Port of Saldanha, it was understood that individual developers were not required to undertake the EIA for this component. Should this information change, a separate EIA for the import of gas will be undertaken.

In this regard a preliminary assessment of different options for landing gas in Saldanha has been conducted. Each option will be examined in detail during a feasibility study, which will identify the preferred alternative location to land gas in Saldanha Bay. Impacts will be assessed and addressed in an EIA for the marine component of the project.

LNG will be transported to Saldanha using purpose built ships. Depending on the size of the vessel, the number of vessels required will range between 14 to 20 ships per annum.

Three gas offloading options will be considered during the feasibility study:

(1) Note: The transmission connection for Phase 1, i.e. the 132 kV connection to Saldanha Steel, is included in this EIA. The transmission connection for Phase 2, i.e. the 400 KV connection to Eskom's Aurora substation, will be considered in a separate EIA application. See Section 3.4 for details about the phases referred to here.

1. Land based storage and regasification: This is the preferred long term option which can be state owned, however, it is not financially feasibly without a developed downstream gas market. Other options (below) can, however, be disbanded and connected to the land based option upon commissioning.

2. Floating Storage and Regasification Unit (FSRU): The FSRU is typically a modified LNG vessel and combines LNG shipping, storage and regasification on one ocean going vessel. This alternative is widely used internationally and includes all the components needed to offload gas (storage, regasification, offloading terminal, buoy and mooring system) using a subsea pipeline.

3. Gravity Float Unit: This is a concrete based modular structure that acts as an artificial island for ships to dock and offload LNG.

3.3.1 Power Plant

General Configuration

Figure 3.4 shows the proposed plant layout. Current plans include six Trent 60 DLE (low NOx) 50 MW (installed gross capacity, refer to *Box 3.1*) gas turbines in open cycle and three identical but independent 435MW SCC5 4000F (installed gross capacity) single shaft generating trains in combined cycle. *Figure 3.3* shows the equipment configuration in a combined cycle system. With reference to *Figure 3.4* the corner points of the proposed power plant boundary are listed in *Table 3.6.*

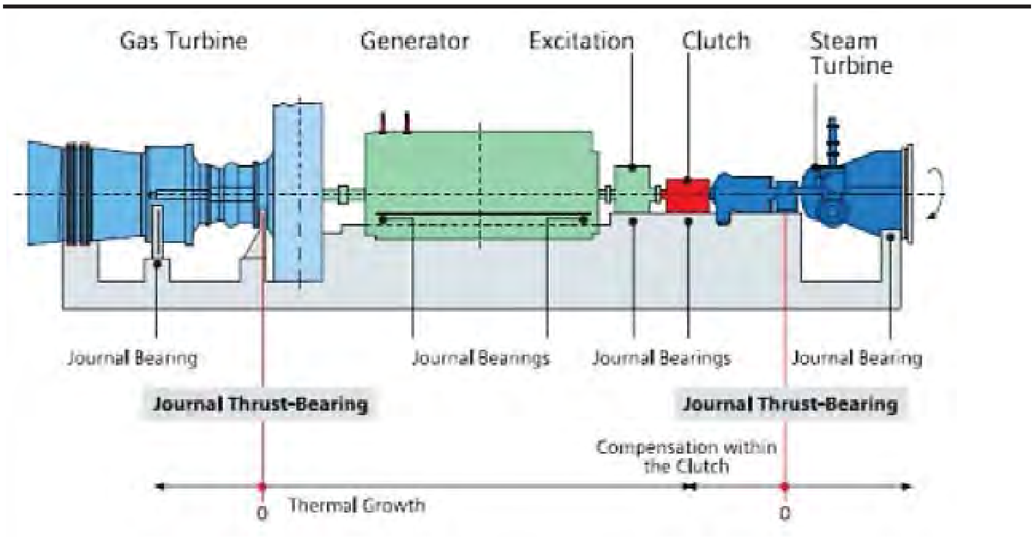
Box 3.1 Installed Gross Capacity vs Operating Capacity of the Power Plant

The Installed Gross Capacity is normally the plant generating capacity at 100% loading and ISO conditions. However, it is impossible to test ISO capacity performance in practice since the ISO conditions of temperature, humidity and pressure very seldom occur together for the purposes of testing. Installed gross capacity is the capacity at the generator terminals and is not the energy despatched from the plant.

In the project development environment, power plant engineers consider the power demand of the client and work backwards to design the plant with sufficient on-site capacity that will produce sufficient despatchable power that will fulfil demand. In addition, plant design will be based on site worst conditions, i.e. during summer at low barometric pressure and high humidity. This is known as the *Operating Capacity* of the power plant.

Therefore, a more meaningful expression of capacity is performance at site conditions. The Installed Gross Capacity of the proposed power plant is 1,605MW, and the Operating Capacity is 1,507MW. This report will thus refer to the *Operating capacity* of the power plant throughout, i.e. that of 1,507MW.

Figure 3.3 Combined Cycle Equipment Configuration



Source: Combined Cycle Process Description Flow, ArcelorMittal, 2015

The high temperature exhaust gases are captured at the outlet exhaust of each gas turbine. This is fed into each HRSG via a short section of ductwork at the exhaust outlet point. The HRSG is a triple pressure boiler comprising a high pressure steam system, a reheat/medium pressure steam system and a low pressure steam system. The hot exhaust gases will then transfer heat to water in the HRSG, creating steam in the form of superheated high pressure (HP) steam, reheat/medium pressure and low pressure (LP) steam. Steam from each pressure level will be admitted to the steam turbine. A condenser will convert exhaust steam from the steam turbines back into water.

The plant will have an air cooled condenser system behind each steam turbine.

Table 3.6 Co-ordinates of the corner points of the proposed power plant boundary.

Point	Longitude	Latitude
A	18° 2.521' E	32° 58.887' S
B	18° 2.755' E	32° 58.956' S
C	18° 2.765' E	32° 58.971' S
D	18° 2.759' E	32° 59.002' S
E	18° 2.823' E	32° 59.014' S
F	18° 2.675' E	32° 59.435' S
G	18° 2.398' E	32° 59.354' S
H	18° 2.410' E	32° 59.323' S
I	18° 2.350' E	32° 59.305' S

Figure 3.4 Power plant functional layout

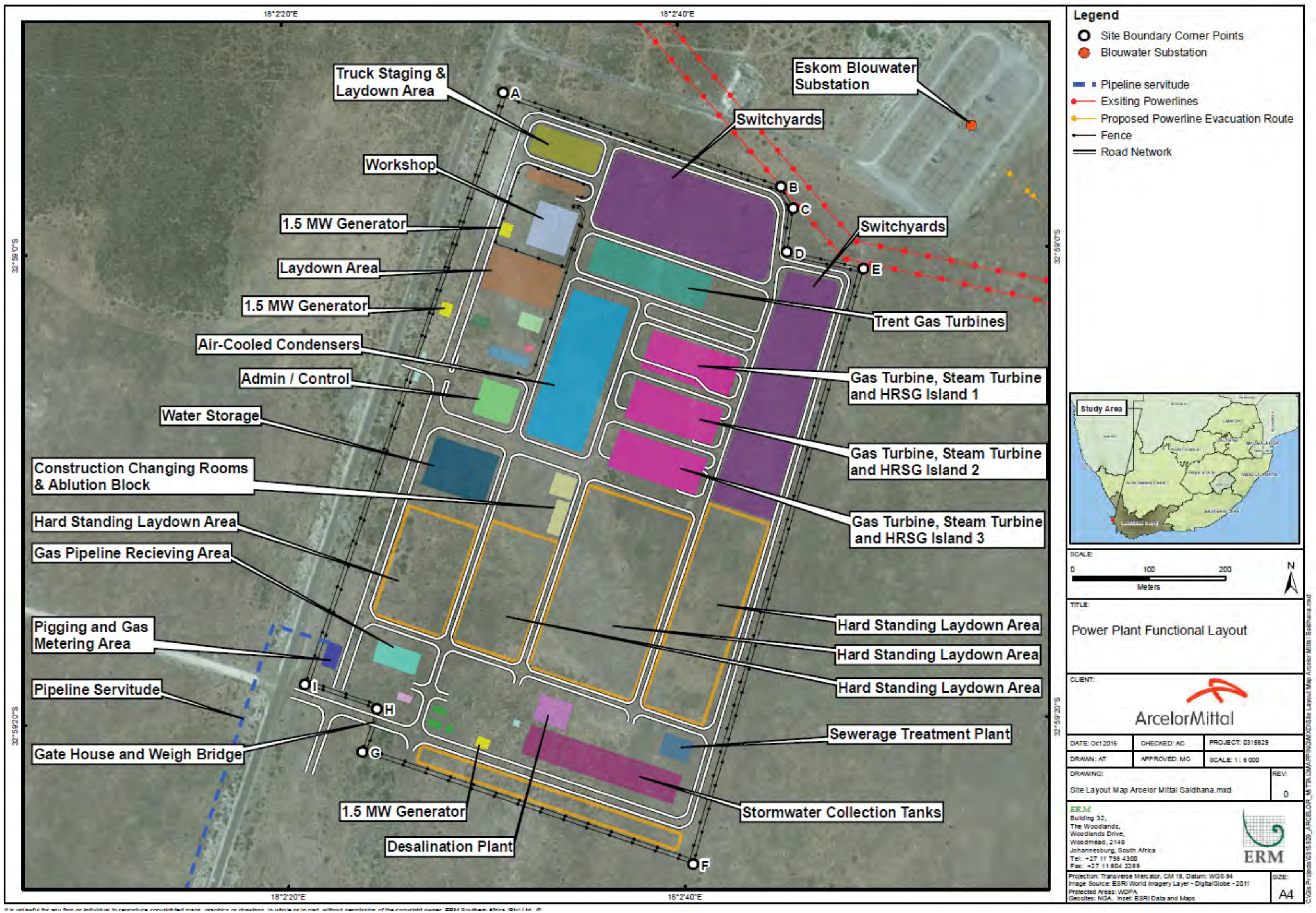


Table 3.7 Power Plant components and their respective footprint areas / lengths

Project Component	Area
1.5 MW Generator	0.09 ha
132KV Switchyard	2.4 ha
440KV Switchyard	2.48 ha
Admin, Control, Laboratory	0.25 ha
Air-Cooled Condensers	1.56 ha
Canteen, Changing Rooms, Ablutions	0.09 ha
Clinic	0.01 ha
Construction Changing Rooms & Ablution Block	0.18 ha
Emergency Assembly Point	0.04 ha
Gas Pipeline Receiving Area	0.18 ha
Gas Turbine, Steam Turbine and HRSG Island 1	1.89 ha
Hard Standing Laydown Area	9.64 ha
Laydown Area	0.69 ha
Other miscellaneous infrastructure	0.03 ha
Pigging and Gas Metering Area	0.07 ha
Reverse Osmosis, MSFD, Salt Residue	0.05 ha
Sewerage Treatment Plant	0.12 ha
Stormwater Collection Tanks	1.2 ha
Trent Gas Turbines	0.73 ha
Truck Staging & Laydown Area	0.36 ha
Visitors and Training Centre	0.07 ha
Water Filtration	0.02 ha
Water Treatment, Raw Water Storage, Fire Fighting Water	0.59 ha
Workshop Warehouse and Spares	0.33 ha
Road surface area (total)	6.9ha
Propane storage vessels	3
Propane storage volume on site (total)	30 m^2
Height of stacks	60m (max)

Project Component	Area
Capacity of on-site substation	132 KV substation for phase 1 400 KV substation for Phase 2
Type of perimeter fencing	ClearVu Reinforced
Perimeter fence length	2.8km
Perimeter fence height	3 m

Power generation equipment

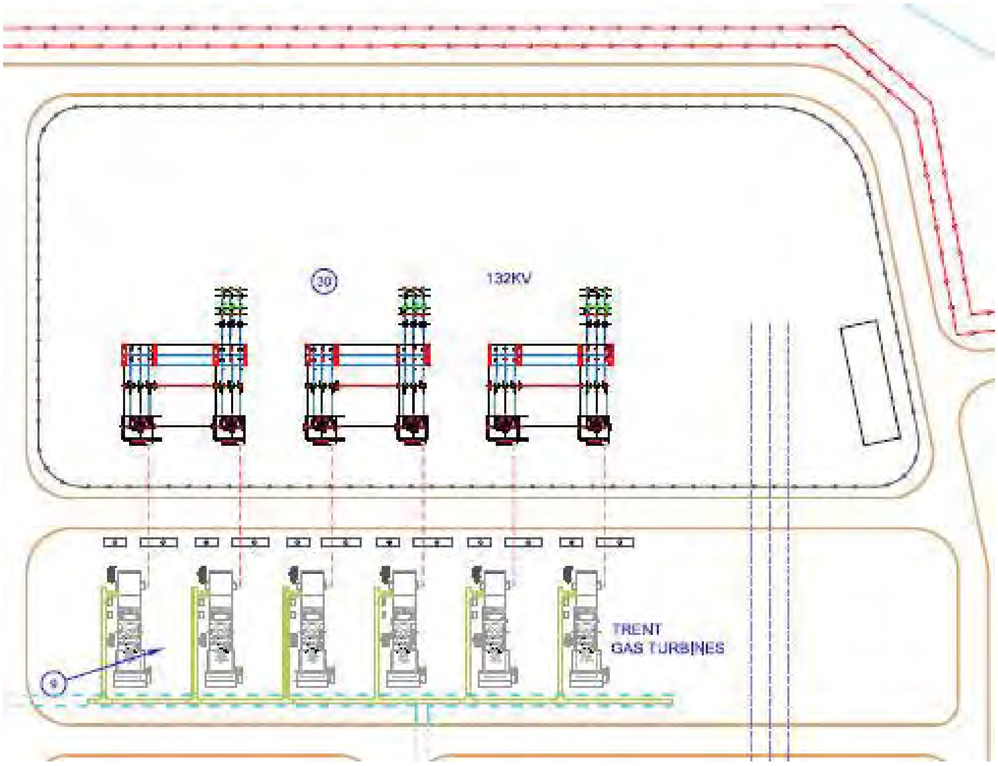
132 kV 300MWe Block

This consists of 6 x TRENT 60 DLE (low NOx) gas turbines. These will be the first units to be installed. They will operate on natural gas in open cycle and will be dedicated to supply ArcelorMittal. One gas turbine is a redundant unit to ensure continuous uninterrupted supply.

At a later stage, it would be possible to convert at least two units to combined cycle technology which would improve efficiency.

Figure 3.5 132kV, 300MWe Block layout (A) and 3D rendering (B)

A



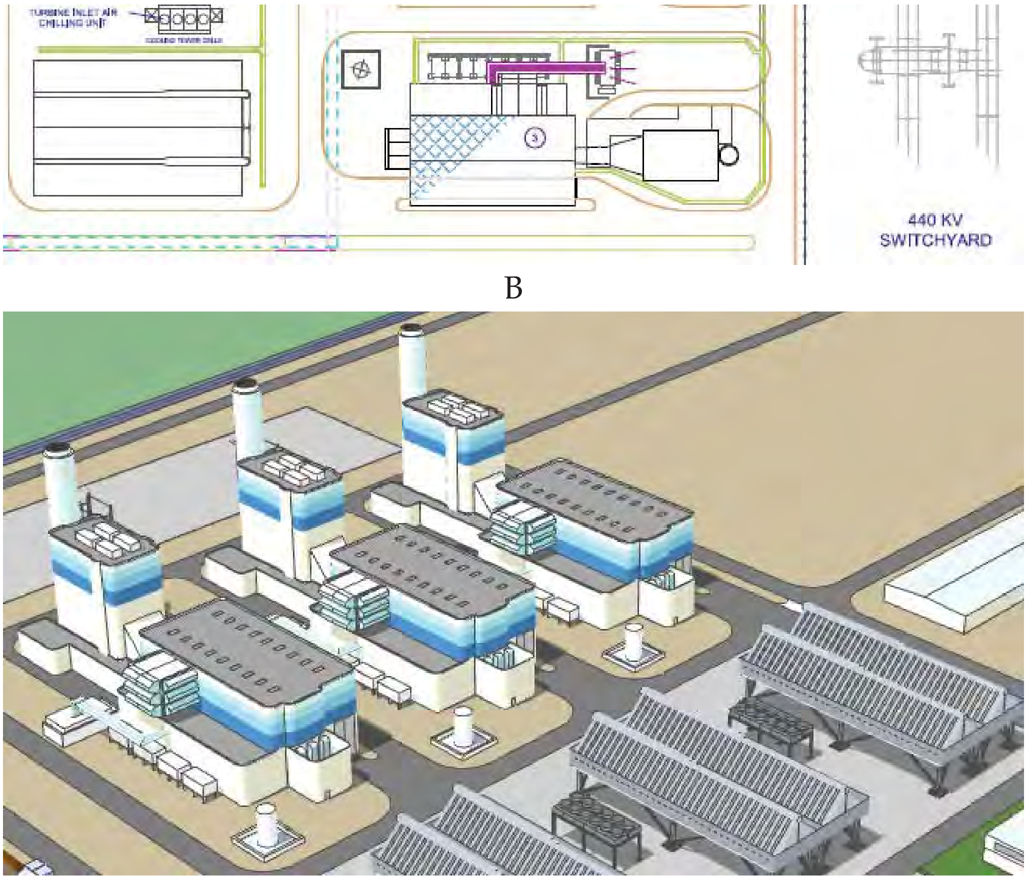
B

400kV 1200 MWe Block

This consists of three identical but independent, SCC5-4000F single-shaft generating trains, each providing 439 MWe net output capacity at 22kV net in combined cycle configuration [1]. The generated power will be stepped up to 400kV before being evacuated via the 400kV switchyard and through the national grid network. The steam turbine exhaust is condensed by ACCs and returned to the boiler feed storage tank in order to save on water consumption.

Figure 3.6 ***400kV 1200 MWe Block layout (A) and 3D rendering (B)***

A



B

Fuel is natural gas which will be piped up to the plant site at sufficient pressure for feeding directly to the gas turbines by underground pipeline. Emissions of $CO2$, NOx and CO are much reduced compared to coal-fired power plants.

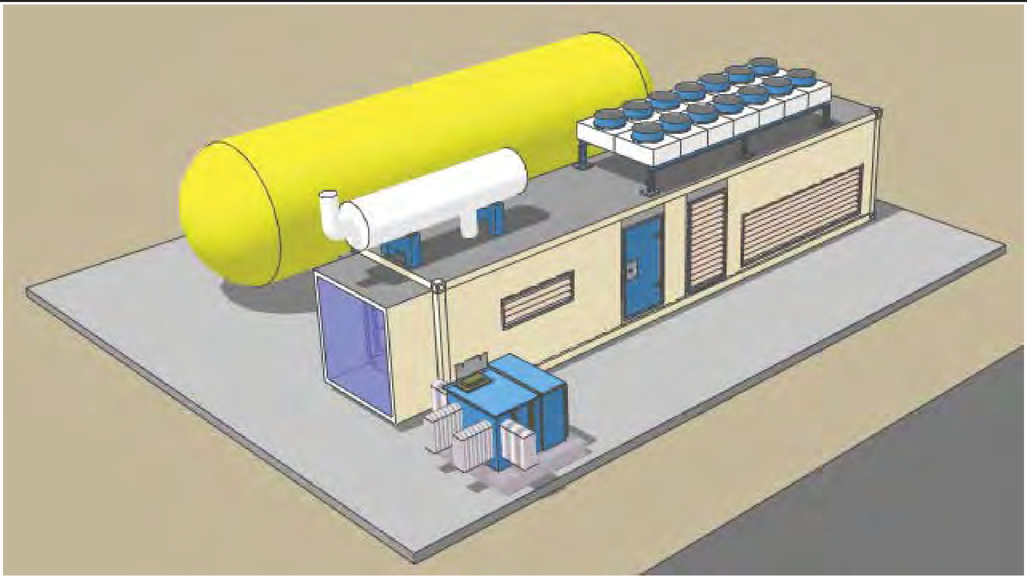
(1) Net gross capacity is 446 MW at ISO conditions 100% maximum continuous rating at average site conditions. The net power output, i.e. operational power at 100% loading is 439 MW at average site conditions.

Black-Start Power Generation

The construction phase will require electricity for security site lighting and for driving equipment such as air compressors, a cement batch plant, and lighting up site offices, water purification, isolation valves and safety instrumentation along the incoming sea-water and gas pipelines.

This initial electricity will be generated on site by three internal combustion generators running on liquid petroleum gas (LPG or propane) supplied by road tanker. The unit is shown in blue *Figure 3.7* below and the propane tanks are shown in yellow.

Figure 3.7 ***Black-start power generation***



After the plant has been constructed, the same generators will play an important part in assisting in the start-up and commissioning of the main power plant units, TRENTS and SCC5-4000F trains. They will also be used as stand-by emergency black- start generators, or in the event that some balance-of- plant system, for example outdoor site lighting, or workshops and warehouse, become unserviceable due to a fault.

Other power generation

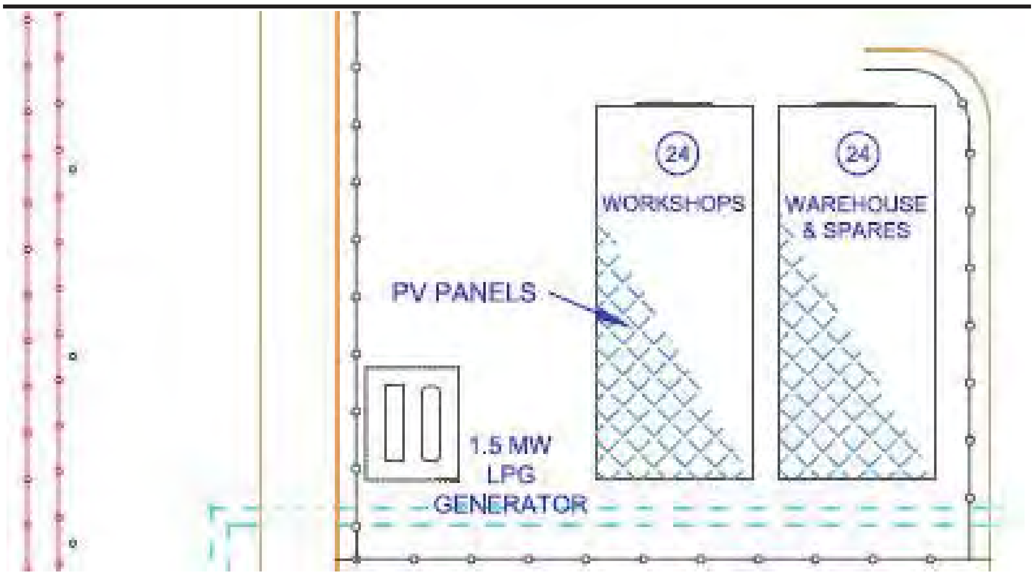
Buildings will be designed such that the roofs can be populated by solar PV panels. The integration of solar panels will be undertaken after the commissioning of the main plant. Available land area is limited for renewable power generation, as such the only viable option is a small capacity PV array. It is estimated that up to 500 kW of solar panels can be installed on building roofs, generating up to 800 MWh of solar power per year which will help dissipate the plant's parasitic loads (1) .

The excess solar power, not directly used on the plant, will be stored in the latest generation of vanadium redox flow batteries and will assist to keep the DC control and DC control back-up power system operational on a continuous basis.

Some of the renewable solar power generated will be utilised in the following facilities:

- Manufacture of hydrogen from sea water. Hydrogen is required on site for the cooling of the large SGT5 generators;
- Desalination of sea water;
- Powering of a site-wide local WiFi LAN system for information gathering and site- based communications;
- Powering of small local chemical dosing pumps;
- Main building LED lighting;
- Maintaining pressure of distributed potable water; and
- Charging the batteries of on-site electric personnel vehicles and cycles.

Figure 3.8 ***Example of the location of solar panels on building tops***



Access routes and roads

The Project has accounted for certain road works, described below, deemed necessary for safety and compliance with regional legislative requirements. Permissions have not yet been sought for the proposed road works, the costs

(1) Parasitic load refers to the load generated by activities at the power plant which consume electricity, such as the office buildings, workshops, water treatment plants, etc.

of which will be borne by the project and executed according to local Council and/or Department of Roads and Traffic and/or Committee of Transport Officials (COTO) regulations, requirements and guidelines; in particular Road Infrastructure Strategic Framework for South Africa (RISFSA) of the South African Department of Transport (DOT, 2006)

Figure 3.9 below shows the main access to the ArcelorMittal site branching westwards off the R27. A secondary road crosses the access road and access to the power plant is then southwards proceeding under the HV powerlines from Blouwater substation to the southern entrance to the power plant site.

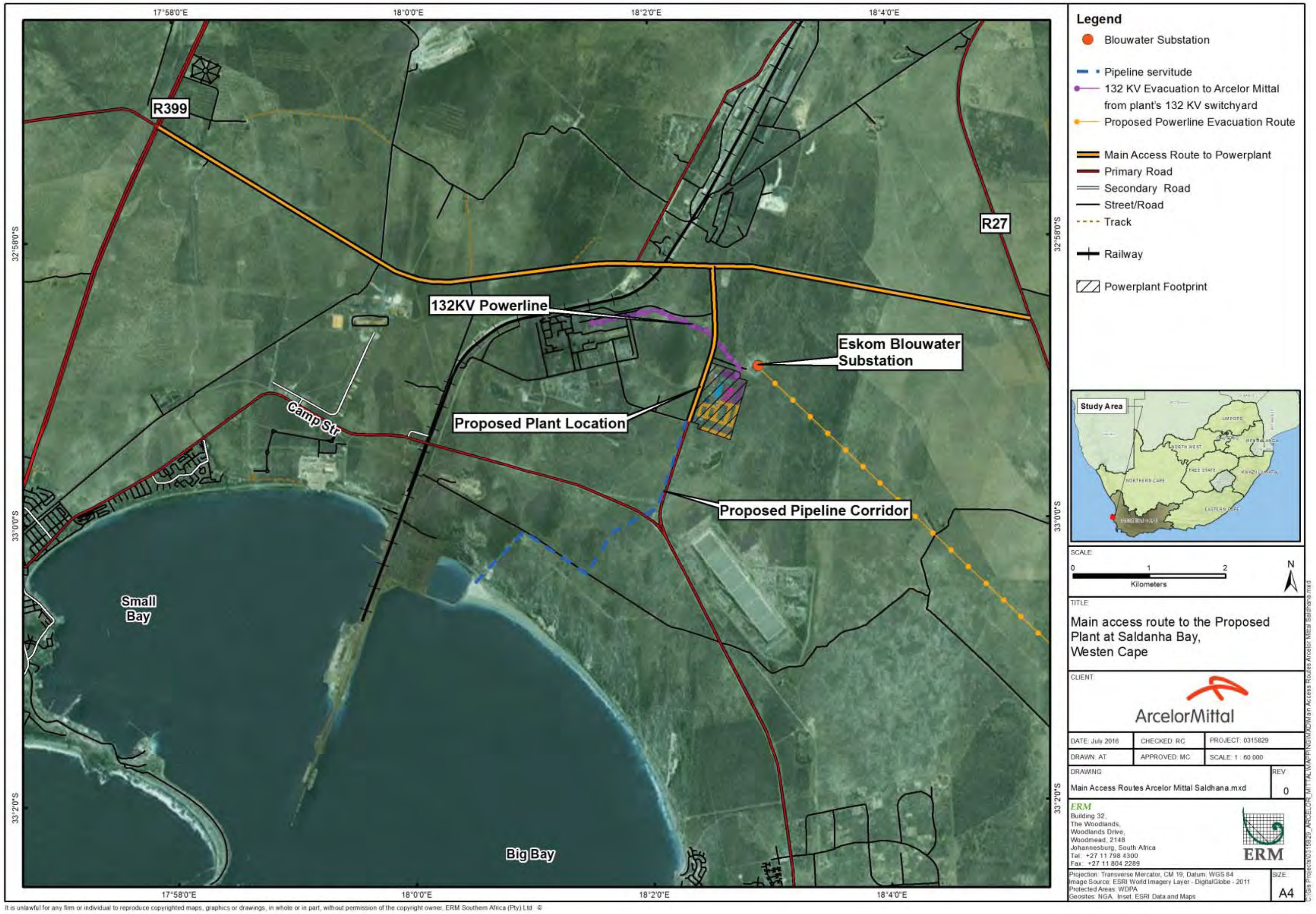
The access route indicated in *Figure 3.9* will be most affected by increased traffic, particularly from commencement of and during construction.

All of the approximately 6,900 m of road access on the 45.83 ha site will be concrete- paved. The total area of roads is 5.59 ha which represents approximately 12.4% of the fenced-in site area. Most roads are 8m width and others 12m. The 12m concrete-paved roads will be constructed early after commencement of construction works and will serve to carry heavy load traffic (mobile cranes, multi axle heavy equipment trailers, cement delivery trucks, etc.) during the early stages of construction.

All concreted roads will play an important role for rainwater harvesting, in addition to the concreted lay-down areas. The site's natural slope is towards the south where the raw water storage tanks will be situated. The east-west thoroughfares ('streets') will channel rainwater into the rain-water drains of the north-south thoroughfares ('avenues'). Rainwater will run southwards to the bulk water storage tanks.

The grid-like road system serves to provide a more precise local description as to the location of equipment, instrumentation or pipe-runs and a numbering system on the curb stones will aid in instrument position identification.

Figure 3.9 Main access to the power plant via the R27



Approach to the Power Plant

For road safety considerations and in light of the increased traffic (particularly during construction phase) the provincial road leading past the two power plant entrances will be widened from 11 m to a 20 m wide over-taking 4- lane section (*Figure 3.10*).

For the office and administration gate a wide entrance (12 m) and a 12 m radius bend into the power plant site and offices from the access road to the gate house is planned (*Figure 3.11*).

Figure 3.10 Illustration of widening of provincial road

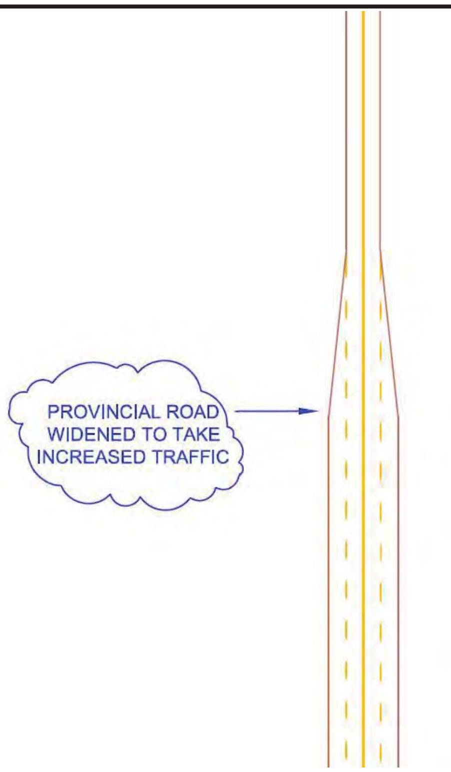
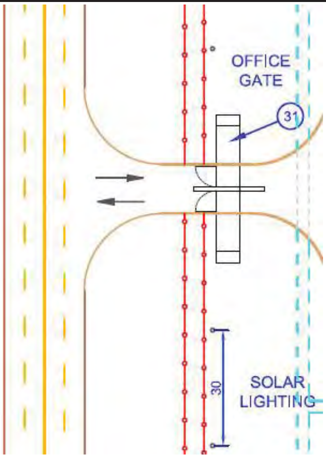


Figure 3.11 Illustration of office and administration entrance

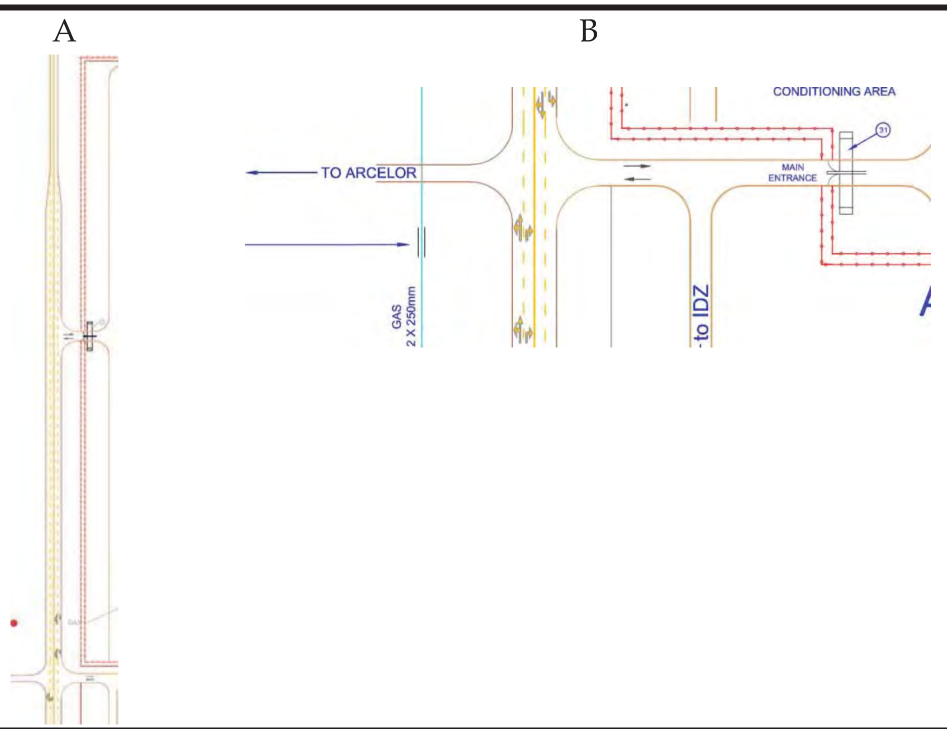


<u>Main Goods and Construction Personnel Entrance</u>

The widened provincial-road access approach, at full 12m width passes the administration office entrance and the southern main goods entrance, detailed below (*Figure 3.12 A*).

The drive-up from the main road to the site gate house is 135 m. A turnoff tees off southwards (*Figure 3.12 B*).

Figure 3.12 (A) Widened provincial-road access to the Power Plant and (B) Main entrance to Power Plant



Incoming Goods Traffic

Incoming goods traffic will pass over a weigh-bridge and will then be directed to a temporary truck staging and laydown area for paper-work to be checked before being directed to area of installation or unloaded at temporary laydown area or in the event of electrical goods and instrumentation, transferred by site transport and conveyed to the warehouse or workshops at the north end of the site.

Admin /Office Building, DCS Control, Labs

With reference to *Figure 3.13*, plant administration offices housing (*Figure 3.14*), main Control Room, DCS marshalling panels, water laboratory, and two meeting rooms, will initially be used during construction to house the offices of construction managers and site engineers. Parking for up to 60 vehicles will be provided under shade.

Figure 3.13 Access to Admin /Office Building, DCS Control, and Labs

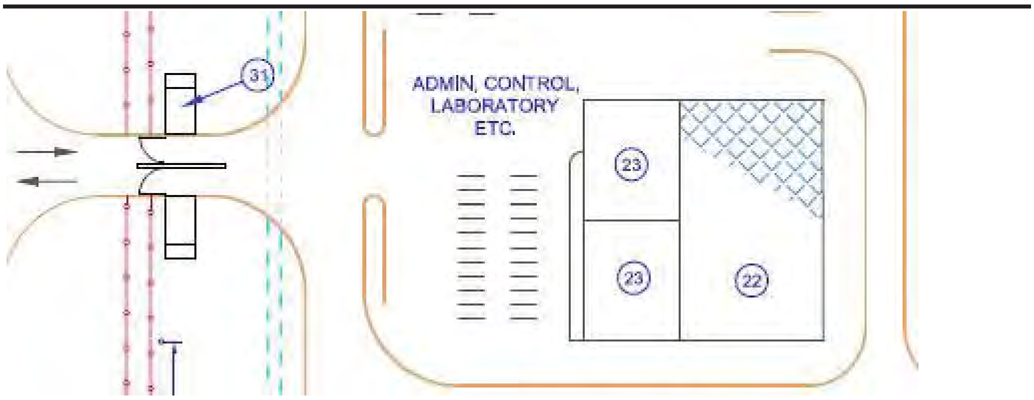


Figure 3.14 3D rendering illustrating the administration and office entrance with the permanent staff canteen and ablution block

Roads within the power plant complex

Within the power plant complex there are five different sizes of roads. This are listed in *Table 3.8* along with the cumulative length and surface area of each road type.

Table 3.8 List of road types, lengths and surface areas within the power plant complex

Roads within the Power Plant Complex	Length (m)	Surface Area (ha)
Road type: 8m wide	4652.2	3.7
Road type: 10m wide	148.5	0.1
Road type: 12m wide	1414.2	1.7
Road type: 20m wide	490.4	1.0
Road type: 32m wide	120.1	0.4

Ancillary Facilities

In addition, the project will include the following plant / machinery components:

- 132 KV Switchyard for 132 KV evacuation;
- 400KV Switchyard for 400 KV evacuation;
- Rain water treatment plant (Filtration);
- Sea-water treatment (filtration);
- Sea-water desalination / RO (Reverse Osmosis) plant, 50 m^3/hour;
- Post RO small –scale MSFD (Multi-Stage Flash Distillation) Fire Suppression system– water;
- Fire suppression - CO_2 gas storage Fire suppression – foam Instrument air compressors;

- Sewage treatment plant with water reclamation;
- Closed circuit air-cooling system (compressor-less);
- Miscellaneous treated and untreated water tanks:
    - o Rain water storage tanks, total: 15,000 m^3
    - o Demineralised water, total: 6,000 m^3
    - o Fire water storage (raw untreated water): 500 m^3
    - o Boiler water for demin polishing: 3 x 100 m^3
    - o Reclaimed water tank: 1 x 500 m^3
    - o Filtered sea-water buffer tank: 300 m^3
    - o RO-treated water tanks: 2 x 1,200 m^3
- Other tanks
    - o Concentrated sulphuric acid 98%: 1000 litres S/S
    - o Dilute sulphuric acid: 1000 litres CS
    - o Ethylene glycol: 50 m^3
    - o Ammonia: 20 m^3
- Site security, fencing (*Figure 3.15*), surveillance and communications.

Figure 3.15 Illustration of the fencing that will be used ('Clear Vu', 3m high)

Table 3.9 List of buildings associated with the power plant

Building	**Dimensions**
Power generation buildings x 3	55m L x 30m W x 25m H
Main office and control Centre	footprint 2500 m2 , floor space 4,000 m2
Gate house x 2	Total area 156 m^2 at each gate Permanent staff Canteen, Kitchen Ablutions: 825 m^2
Workshop	1,500 m^2
Spares & warehouse	1,500 m^2
Chemical storage	200 m^2
Various SSB rooms (system and switch-boards)	(pending)

Building	Dimensions
Site electric vehicle charge center	(pending)
Training and visitor's center	300 m^2
Site first aid and medical clinic	120 m^2
132 KV switchyard control and instrumentation room	(pending)
400 KV switchyard control and instrumentation room	(pending)

Gate house

The gate house will be set back approximately 135 m from the edge of the road. The gate-house will be manned 24 hrs/day. The gate house, covering 50 m^2 on each side of the road, is fitted with a restroom, ablutions and a surveillance office. The gate house will be is fully equipped with video surveillance for a team of four persons per shift. A gate alarm at 30 m from the gate office will alert the gate staff of a vehicle approach.

Sewage Treatment

It is estimated that approximately 5.5 m^3 / day of sewage will be produced during the site preparation phase and 25 m^3 / day during the construction phase. During commissioning and operational phase it is estimated that 4 m^3 / day of sewage will be generated.

Hired 'portaloos' will be placed on site and used during the site preparation and construction phase. These will be collected and removed by a suitable contractor. Disposal and treatment will consist of partial dewatering and disposal of concentrated slurry to a company who will own and operate a proposed biogas facility in Saldanha.

It is anticipated that the project will utilise a compact, modular, factory-constructed sewerage treatment plant which will be approximately 0.12 ha in size. The treatment facility will operate automatically and will recover 85% of all the water that has been delivered with the sludge for treatment. The remaining fifteen percent of the incoming water remains with the almost dry, spent, inactive material. The powdered sludge from sewerage treatment and ablution and canteen washing areas would vary and would be delivered to a suitably licenced waste facility or provided to a biodigester. Typically the dried waste can be bagged and reaching a sizable load (3.5 ton) disposed at for e.g. Vissershok.

The permanent, stand-alone, packaged sewage-treatment plant on-site facility will incorporate the following factory-built process units housed in a bespoke building:

- Sewage holding tank/s
- Lamella plate separators
- Submerged aerated filters (SAFs)
- Robust Aerobic digestion System (RADs)

- Final polishing water recovery for re-use

Please refer to *Figure 3.19* for a schematic flow diagram showing the hybrid desalination and sewage treatment with water reclamation solution proposed.

For the operational phase a prefabricated ablution facilities will be erected on site for the main office/admin and workshops/warehouse building. This will be a closed circuit and sewage will be pumped to an on-site treatment plant designed to meet standards for biological oxygen demand (BOD), suspended solids and ammonia. It will be sized for the equivalent of 400 persons.

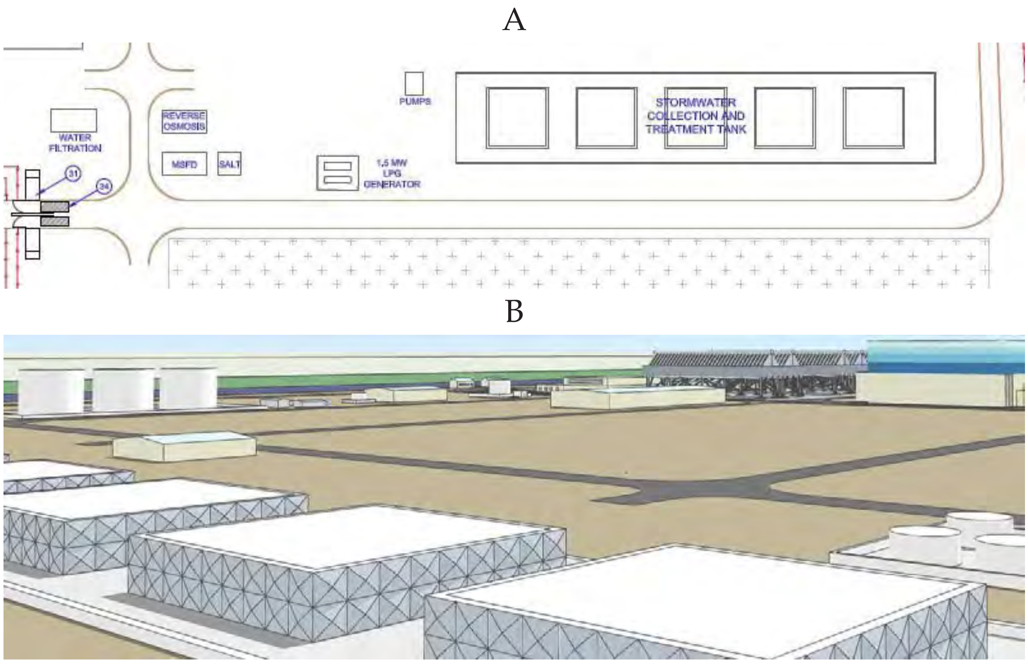
Water facilities

Water facilities will have a common source and consists of several discrete water systems. Two areas on the power plant site have been allocated to water treatment. The first area (*Figure 3.16*) is primarily for storage and treatment of raw rain water and is adjacent to the gas receiving station at the south end of the site.

This area receives:

- Surface rain water which is stored in a series of five 2 000 m^3 interconnected water tanks;
- Fresh water (not necessarily municipal) brought onto site by road tanker;
- Sea-water to be used in the zero liquid discharge (ZLD) desalination or other process; and
- Reclaimed water from the site sewage plant.

Figure 3.16 Water storage tank layout (A) and 3D rendering (B)



Storm water will be the main source of rain water to be stored in the interconnected water tanks. The site has a natural north to south gradient of approximately 1%. The site will be slightly graded to form a symmetrical V-shaped slope. *Figure 3.17* illustrates the drainage pattern of an imaginary sheet of water draining down the ungraded slope of the site.

Internal roads will be contoured to channel precipitation towards storm-water drainage points along the road curb. Storm water will flow into a single enclosed duct which will dump the water into a grit- pit. From the grit-pit dual submersible pumps (actuated by level controllers) will pump the water through coarse filters into the five interconnected steel water tanks situated at the most southern boundary of the property.

The pumps and drain ducts will be sized to cope with the maximum anticipated flow of rain water.

A stone-filled emergency soak-away channel will be constructed along the southern-most boundary to channel excess storm water (in case of an unusual rainfall event) away from the site. The soak-away channel will dissipate the energy of the water to prevent soil erosion.

Figure 3.17 Surface Water Drainage

The second area is for final water treatment, demineralisation and storage of water for fire abatement. After being processed by reverse osmosis (RO), purified water is pumped to zone two (top left in *Figure 3.18*).

- In this area, water from RO is deionised, chemically treated and stored for boiler feed water condensed steam is deionised, re-treated, stored and reused as boiler feed;
- Deionised water is stored for the lube-oil cooling circuit;
- Deionised water is distributed to day tanks close to the boilers and generation plant;

- Water from the RO plant is stored as emergency fire water in the event of a fire outbreak; and
- Raw water can be pumped back along the sea-water pipeline to assist in extinguishing a veld-fire that has been initiated by a gas leak or pipe rupture.

The reverse osmosis plant will be a hybrid plant occupying an area of about 600 m^2, without tanks, and it will have a capacity of approximately 50 m^3/hour. The plant will use sea water that will be pumped from the coast (the pipeline will be installed in the same servitude as the gas pipeline). The reverse osmosis process will be a zero discharge process. The process will use a combination of multistage flash distillation and thermal crystallisation using intermittent waste heat from the gas turbine combined cycle heat recovery boilers (HRSGs). Dry salts resulting from the process will be disposed by a registered waste handling and disposal contractor, or alternatively, being derived from sea water, the salts may be utilised by a company already in the sea salt recovery sector. A schematic diagram of the plant can be seen in *Figure 3.18*. Purified water from the reverse osmosis plant will be pumped to water storage tanks. A description of the process is provided in Chapter 3.3.1 under *Water Facilities.*

Please refer to *Figure 3.19* for a schematic flow diagram showing the hybrid desalination and sewage treatment with water reclamation solution proposed.

Figure 3.18 Water treatment plant layout, zone 2

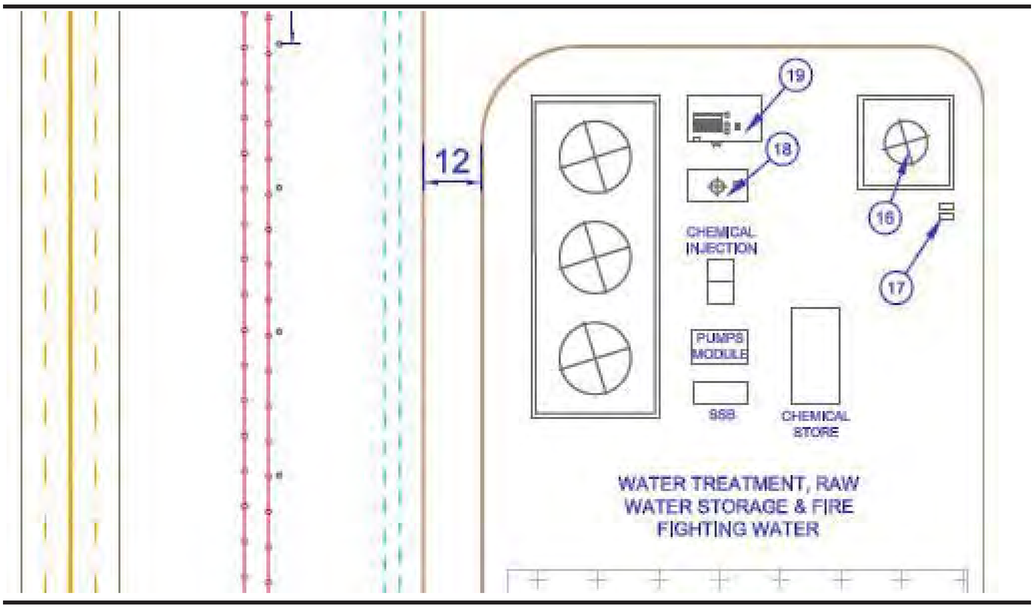
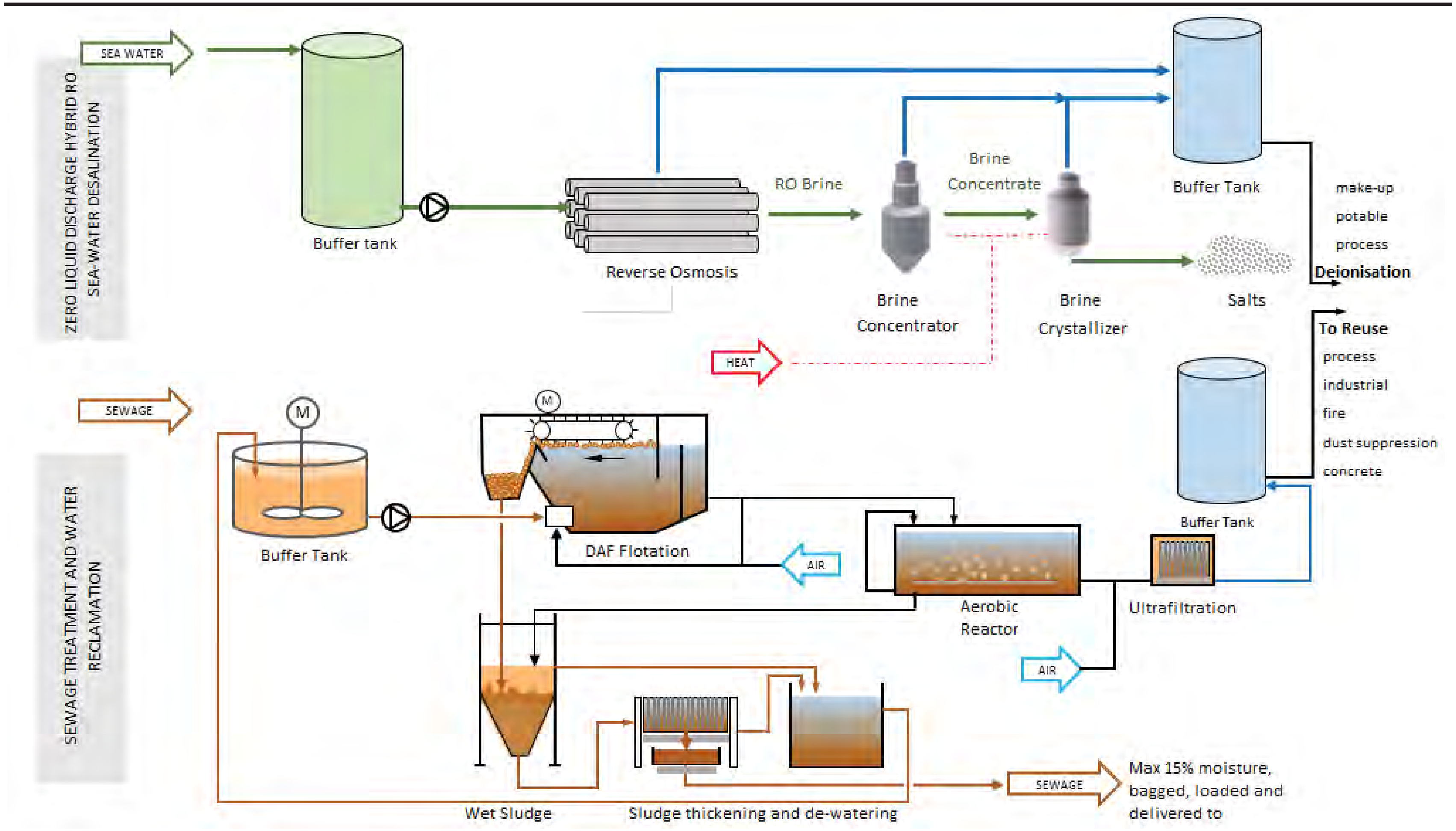


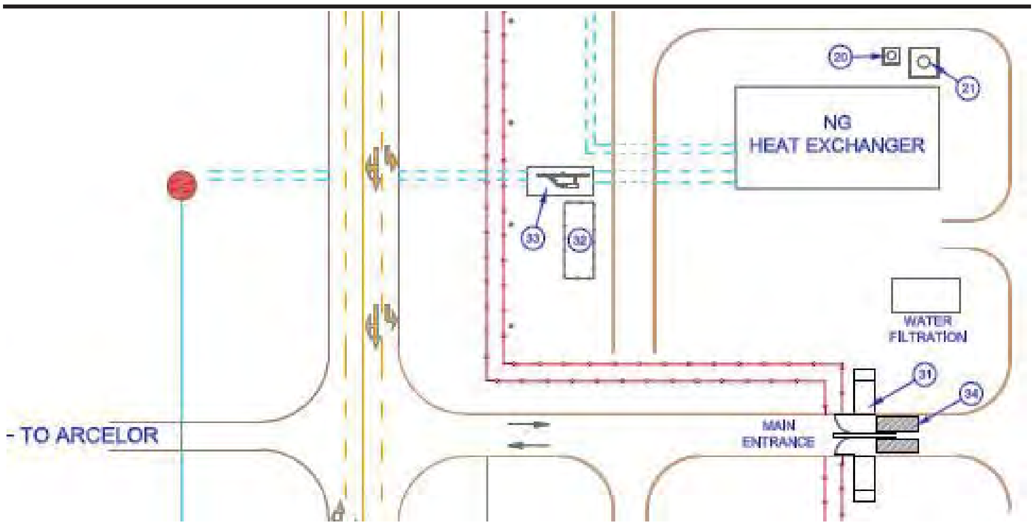
Figure 3.19 Hybrid desalination and sewage treatment with water reclamation



Natural Gas

This EIA is for the CCGT gas-fired power plant and gas pipeline only and does not include the import of gas and therefore a marine component [(1)]. The project operating company will take possession of the natural gas at the point where it comes on shore and enters the on-shore gas pipeline to the plant site. Natural gas will be piped to the power plant through a twin, 250 mm Ø nominal gas pipeline at entry gas pipeline-pressure of 90 barg and at a maximum rate of 60 kgs / sec and a temperature of -20ºC. The gas flow will follow the power demand load.

Figure 3.20 ***Gas pipeline entry to the power plant site***



The red dot in the *Figure 3.20* indicates where the gas pipeline is diverted towards the plant site boundary. At a pressure ranging between 45 barg and 60 barg the gas traverses under the newly widened access road, passing under the double security fence and surfacing aboveground as it proceeds to the gas receiving area above the main entrance gate.

At about -20 °C, the gas is heated to near ambient by cooling a 30 % glycol solution to -15 °C before being piped to the gas turbines for combustion.

(1) It is anticipated that potential impact on the marine environment will be considered as part of the Department of Energy gas to power project. The Department of Energy (DoE) has developed a 20-year energy plan for South Africa, the Integrated Resources Plan 2010-2030 (IRP 2010), which encourages the participation of independent power producers (IPPs) in electricity generation in South Africa. The Independent Power Producers (IPP) Office was established by the DoE, the National Treasury and the Development Bank of Southern Africa (DBSA) to facilitate the involvement of IPPs in the generation of electricity. It is currently intended that 3126 MW of new generation capacity will be generated from natural gas. For the Gas IPP Procurement Programme, the DoE through the IPP Office has, in collaboration with Transnet, developed an approach to facilitate the import of LNG to allow for the development of medium- to long-term gas power plants outside of the port boundaries. This EIA therefore forms a separate application by a private company for gas power plants and related infrastructure near the Port.

Propane

As discussed above, three 1.5 MW gensets are proposed. These will be situated near the workshops in the north of the site, near the air condensers in the middle of the site and near the water storage facility near the south of the site. LPG (Propane) will be trucked on to site by road tanker and stored in three tanks cumulatively not exceeding 30 m^3 in volume.

3.3.2 *Pipeline*

General

The pipeline transport system from the point of arrival on-shore to the power plant site will consist of the following:

- A gas and sea-water forwarding station at the start of the land-based pipeline system;
- A dual, parallel gas pipeline for security of gas supply;
- A 120mm diameter seawater pipeline to provide the power plant with sea water for desalination (rated maximum flow rate will be 14 litres per second);
- A power cable to provide motive power for a projected air compressor and actuated isolation valves and instrumentation along the pipeline route; and
- A gas and seawater receiving station at the power plant.

The LNG pipeline (regasified gas) and sea-water supply servitude will run from the pipeline entry point connecting to the power plant boundary. The gas pipeline will be buried to a depth of 3 to 4 m, cover a servitude width of approximately 15 – 20 m and be approximately 4600 m in length.

The gas and sea-water supply pipelines commence from the routing point #1, where the regasified LNG arrives on shore and enters the land-based servitude section of the supply line to the 1507 MW power plant. (1)

The pipeline will run along the indicated servitude approximately 4600 m to the gas receiving station within the power plant boundary. Over the 4600 m the pipeline will not intersect with any water courses.

The gas-carrying capacity of the pipeline for the envisaged 1507 MW power plant will be designed for 75,100 Nm^3 /hr or approximately 65 Kg/sec of regasified LNG (regasification of LNG will take place offshore). The management and operation of the gas pipeline will be in accordance with ASME B31.BS code of practice. The proposed pipeline system will be buried

(1) It should be noted that the gas pipeline through Transnets land has been excluded from this EIA based on the DoE EIA extending to the Transnet boundary. This portion of pipeline will be permitting in the

underground with the pipeline servitude extending 6m on either side of the pipeline trench.

Where the pipeline passes through sensitive areas the temporary RoW will be kept to between 20-2 5m in order to minimise impacts.

Table 3.10 ***Co-ordinates of the proposed pipeline***

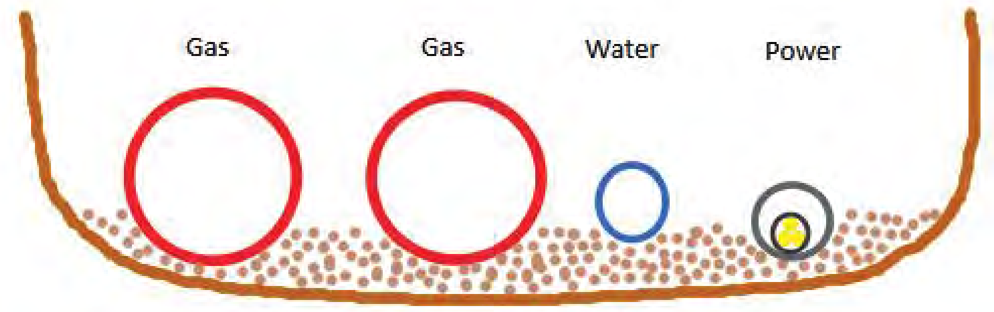
Point Number	South	East
#1	33° 0.075'S	18° 0.932'E
#2	33° 0.378'S	18° 1.457'E
#3	33° 0.379'S	18° 1.687'E
#4	33° 0.079'S	18° 1.687'E
#5	32° 59.912'S	18° 2.059'E
#6	32° 59.264'S	18° 2.325'E
#7	32° 59.278'S	18° 2.382'E

Pipeline arrangement concept

The pipeline arrangement (*Figure 3.21*) will consist of the following elements:

- Two steel gas pipelines with a clearance of 0.3m (as per EN 1594:2000);
- One steel water pipeline; and
- One electrical conduit (plastic compound).

Figure 3.21 ***Illustration of the pipeline arrangement concept***



Design parameters

The main design parameters for the pipeline are listed in *Table 3.11* below.

Table 3.11 ***Gas pipeline main design parameters***

Design Parameter	Specification
General safety rules	49CFR parts 191, 192, 193 and
General design code	ASME B31.8

Design Parameter	Specification
Pipeline material	API 5L, ISO 3183, ISO 1208, (sch. 40) or EN equivalent
Pipeline nom. Diameter, D	2 x 300 mm
Wall-thickness	10.31 mm
Operating design press.	90 bar
Pipe max. allowable stress	78,540 bar
No. of bends	5
Minimum pipe bend radius	6 x D (centreline)
No. of under-road crossings	4
Placement	Under-ground
Buried Depth	≥ 1.0 m (to be decided at detailed design stage)
Inner pipe coating	yes, to increase smoothness
External pipe coating	Yes, with fusion bonded epoxy, to prevent corrosion
No. of shut-off valves	min. 4, full bore
Overall location class	1
In-line inspection	According to NACE 35100 and RP0102-2002
Pipeline design working pressure	90 barg
Pipeline Design formula	CFR 192.105, ISO 13623:2000, EN 1594:2000
Pig launcher	1 off, design code ASME B31.8
Pig receiver	1 off, with drain lines, design code ASME B32.8
Gas/Liquid separator	1 off, design pressure 100 barg, ASME Class 600.
Pig Tracking equipment	YES, AGM type.
Width of pipeline servitude	30 m – 36 m
Cathodic protection	yes

Pipeline intersection with roads

There are four (4) road crossings, all of which will pass under the road through means of reinforced concrete road culvert. The co-ordinates of the road crossings are listed in *Table 3.12* and each of the road crossings are illustrated in *Figure 3.24.*

Table 3.12 Co-ordinates of where the pipeline intersects with roads

Road Crossings	South	East
Crossing 1	33° 00.375'S	18° 01.460'E
Crossing 2	32° 59.964'S	18° 01.947'E
Crossing 3	32° 59.300'S	18° 02.307'E
Crossing 4	32° 59.271'S	18° 02.344'E

At under-road crossings the gas pipelines will be encased in a second pipeline with maximum allowable stress at least equal to the gas pipeline itself.

Valves and pigging

A 'pig (1) launcher' and 'pig receiver' will be situated at each end of the pipeline as well as ATEX-rated remotely operable isolation valves ('plugs'). Location of the 'plugs' will be decided by the pipeline designer/contractor.

(1) Pigging in the context of pipelines refers to the practice of using devices known as "pigs" to perform various maintenance operations. This is done without stopping the flow of the product in the pipeline. These operations include but are not limited to cleaning and inspecting the pipeline.

Gas pipeline bends will be manufactured with a radius to the pipeline centreline of 6 x pipeline diameter (D) in order to facilitate 'pigging' and hence pipeline maintenance.

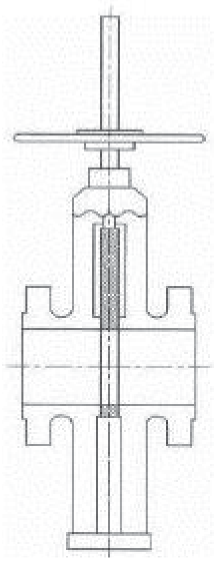
Isolation valves for the gas pipelines will be carefully selected from a range of appropriate through-conduit gate valves, wedge gate or parallel slide valves in order to accommodate and not obstruct the passage of the 'pig'. Check vales, if required in the gas pipeline, require that the flow area within the valve body be larger than the pipe inside diameter. The valves will be remotely actuated. Applicable standards are API, ASTM, ANSI/ASME, and in particular, for design and hazard analysis, API RP14J and API RP14C.

The gas pipeline being only 4600 m in length will have isolation valves positioned at the start of each pipeline, in the middle and at the receiving end (these are in addition to the isolation valves at the pigging stations). The valves will be automatically actuated as programmed by the pipeline designer/EPC contractor.

Valves and non-return valves for the sea-water pipeline will be manufactured from specialist alloys and will also be through-conduit. Valves for sea-water application will be in accordance with API, ANSI/ASME or ISO specifications. The sea-water pipeline will also be designed for 'pig' functionality.

On gas transmission pipelines, the pig design and all valves will be selected by the pipeline EPC contractor from main-stream renowned manufacturers in accordance with pipeline flow conditions, pressure, and velocity and pig functionality (*Figure 3.22*). There being two gas pipelines there will be two sets of pig launchers and pig receivers.

Figure 3.22 Example of a shut off valve



Pressure testing and water use

There are two testing procedures available in order to test how well the pipeline holds pressure. These are either hydraulic or pneumatic (ASME Section B31.1). From a technical perspective the hydraulic method is preferred because it has a lower level of potential energy than the pneumatic method thus it is safer. However, hydraulic testing will require 2,100 m^3 of fresh water per pipeline. However, after use, this can be pumped to the power plant water reservoir through the sea-water pipeline.

The pneumatic test, while not requiring water, requires multiple compressors to pressurise the pipeline and a high power feed or considerable diesel fuel for the compressors. The method of pipeline pressure testing will be decided upon by the EPC contractors based upon an analysis of the pros and cons of each method.

Cathodic protection and corrosion monitoring

Cathodic Protection (CP) is a technique used to control the corrosion of a metal pipeline by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded "sacrificial metal" to act as the anode.

CP requires the highest priority and most appropriate protection system for gas pipelines. The guidelines for this protection are provided by NACE International, the worldwide Corrosion Authority and will be implemented by the pipeline EPC contractor who will be guided by specialised consultancies.

Along a pipeline the corrosion protection system will be monitored after the selected corrosion system has been installed in order to obtain early warning of corrosion issues and maintain pipeline integrity. Therefore, an online, real-time corrosion monitoring system will be installed. The online, real time corrosion monitoring data sensors and measurement devices will be installed at strategic points along the pipeline. These strategic points are in turn identified by ICDA (Internal Corrosion Direct Assessment) methods.

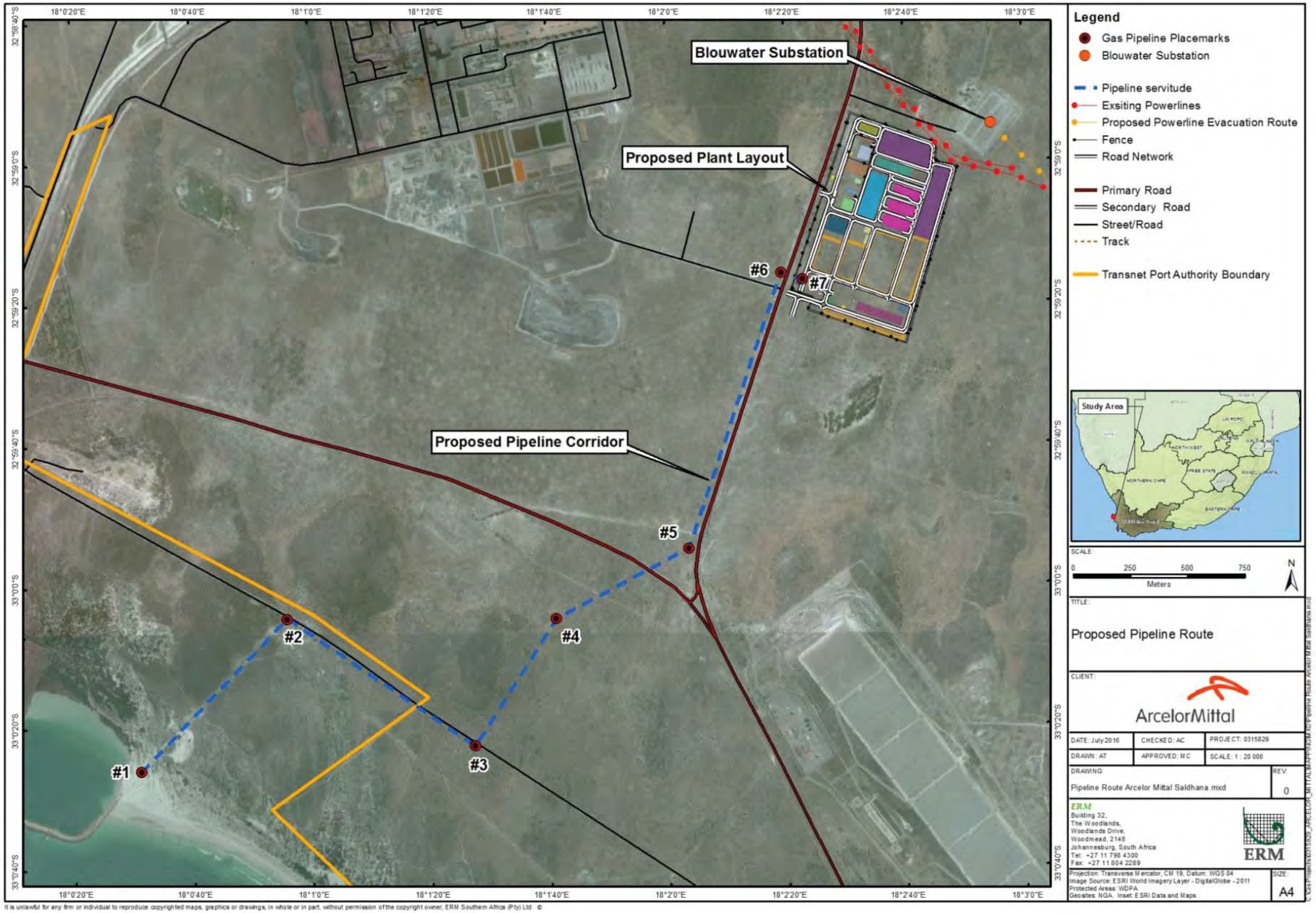
Because the natural gas that will be utilised by the power plant derives from regasification of LNG, water content in the gas is zero (regasified LNG does not contain any moisture). This is also evidenced by the analysis of the LNG that will be supplied under contract to the project (*Table 3.13*). Therefore the effects of corrosion on the inside of the pipe due to the presence of water in the gas stream can effectively be discounted. In addition, the Inner pipeline surface will be coated with a protective epoxy layer.

Table 3.13 Analysis of contracted gas supply

Component	Mole %

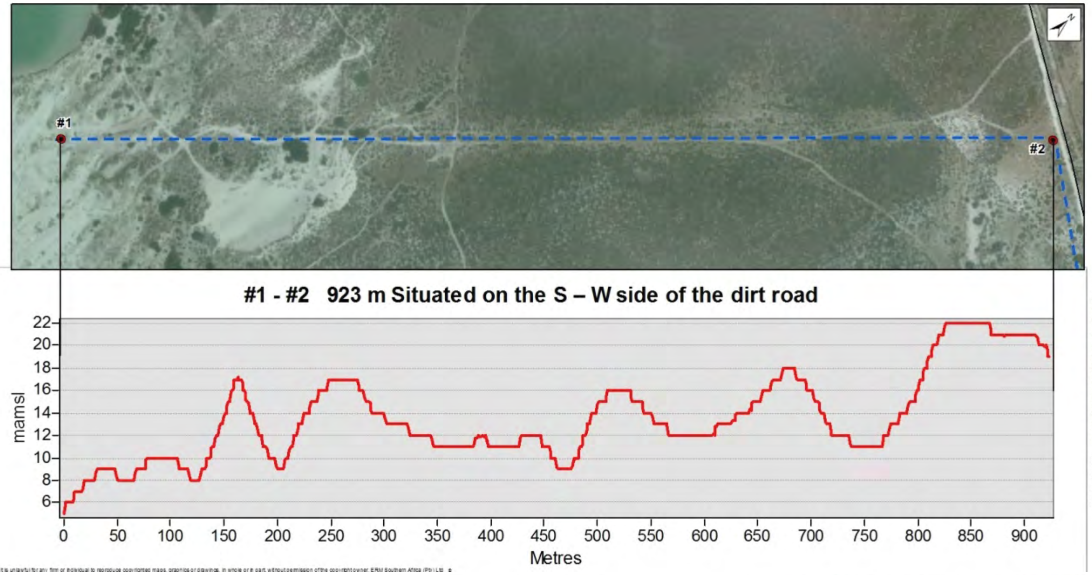
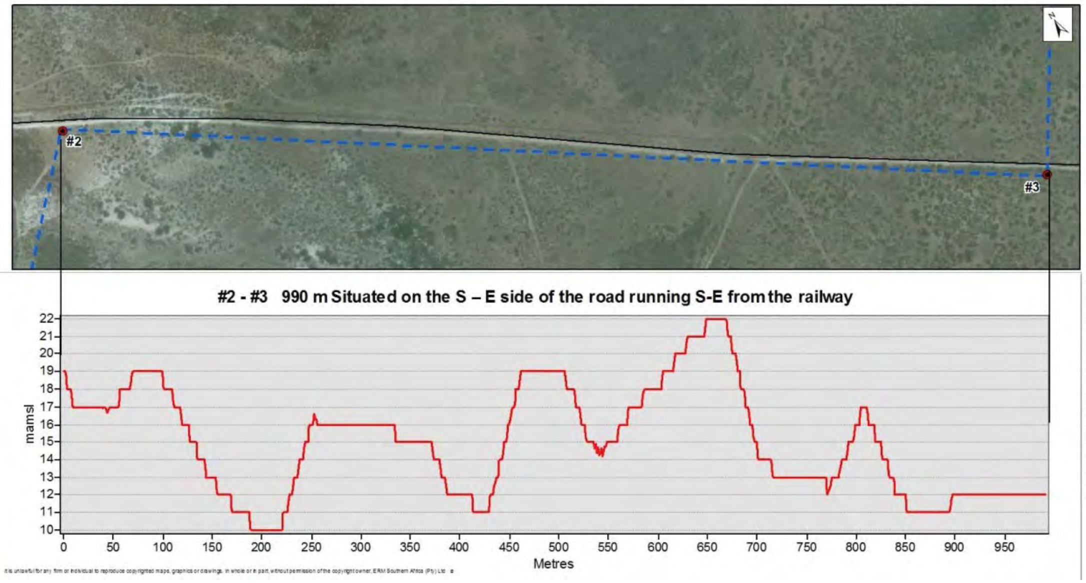
Component	Mole %			
	Original Dry		Normalised	
	Compn.	+ / -	Dry	Wet
Methane	96.109		96.109	95.53
Ethane	1.807		1.807	1.796
Propane	0.164		0.164	0.163
iso-Butane	0.028		0.028	0.028
n-Butane	0.028		0.028	0.028
iso-Pentane	0.011		0.011	0.011
n-Pentane	0.007		0.007	0.007
n-Hexane	0.008		0.008	0.008
n-Heptane	0.013		0.013	0.013
Nitrogen	0.357		0.357	0.355
Carbon Dioxide	1.468		1.468	1.459
Water				0.603

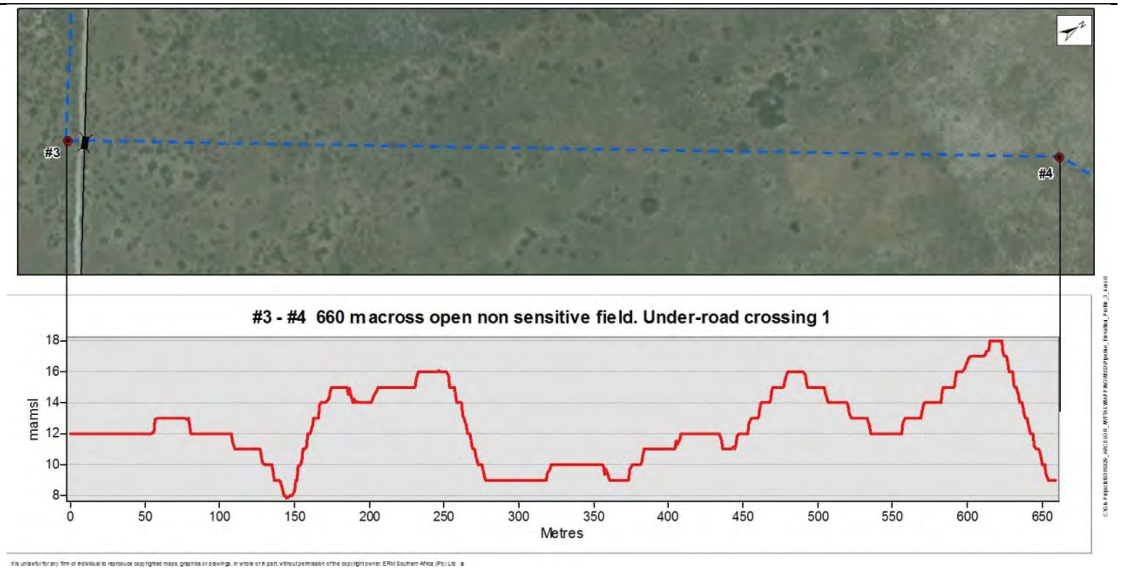
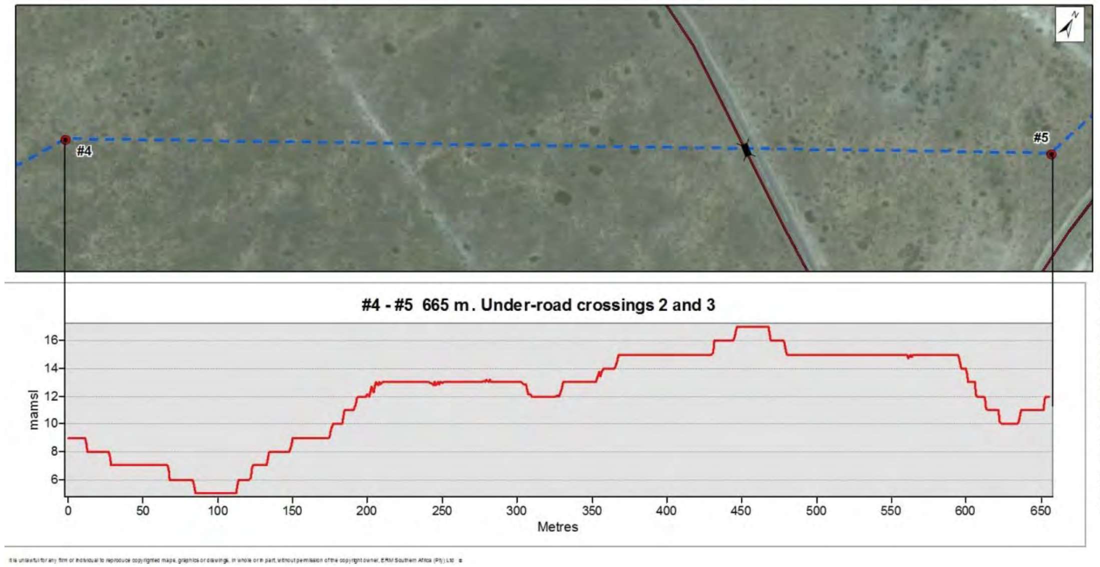
Figure 3.23 Pipeline Route



Note: The pipeline route depicted through Transnets land is for the seawater abstraction pipeline only as it has been indicated by the DoE that the LNG pipeline will be permitted along with the LNG Import Terminal.

Table 3.14 Servitude sections and elevation profiles

Servitude Section Description	Servitude Section Illustration
#1 - #2: 923 m Situated on the S – W side of the dirt road. Pig-Launching station is located at point #1 *Note: that the LNG pipeline through Transnet land will be permitted separately. AMSS will liaise with Transnet to ensure that a coordinated approach will be followed.*	
#2 - #3: 990 m Situated on the S – E side of the road running S-E	

Servitude Section Description	Servitude Section Illustration
#3 - #4: 660 m across open non sensitive field. Under-road crossing 1	
#4 - #5: 665 m Under-road crossings 2 and 3.	

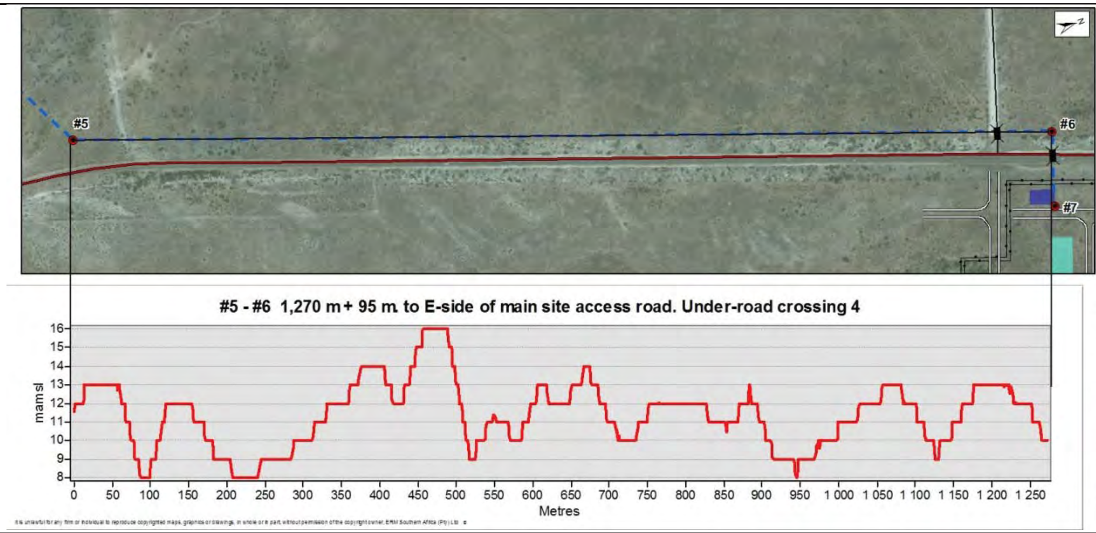
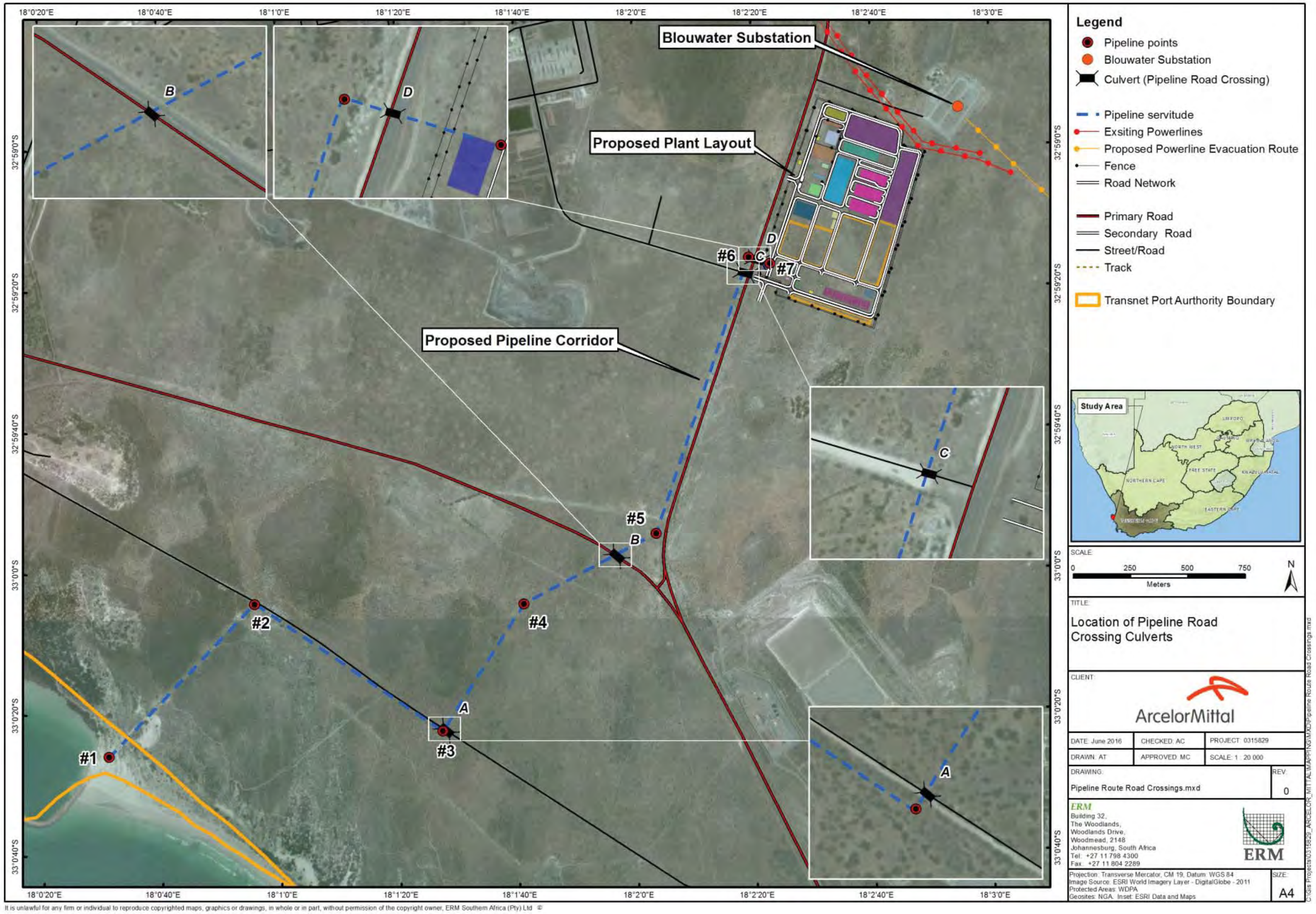
Servitude Section Description	Servitude Section Illustration
#5 - #6: 1,270 m + 95 m. to E-side of main site access road. Under-road crossing 4 Pig-receiving station is located at point #1	

Figure 3.24 Location of the pipeline road crossings



3.3.3 *Power Evacuation and Connection to the Grid*

132 kV Feeder line to ArcelorMittal Steel Works

The feeder power line for the initial 160 MW base load (peaking to 250 MW) from the power plant to the ArcelorMittal Steel Works will be the first priority. This 132 kV feeder line will be sized for a capacity of 400 MW. The proposed routing of the transmission line is illustrated in *Figure 3.25*, and the coordinates of the vertices for this transmission line are presented in *Table 3.15.*

The proposed Project plans on utilising the existing 132 KV lines; towers and conductors. The 132 kV plant substation would join directly on to these existing lines. It is noted that there are currently no observed bird deterrent measures on the existing lines. This may need to be introduced; however this would need to be determined between IPCSA and Eskom.

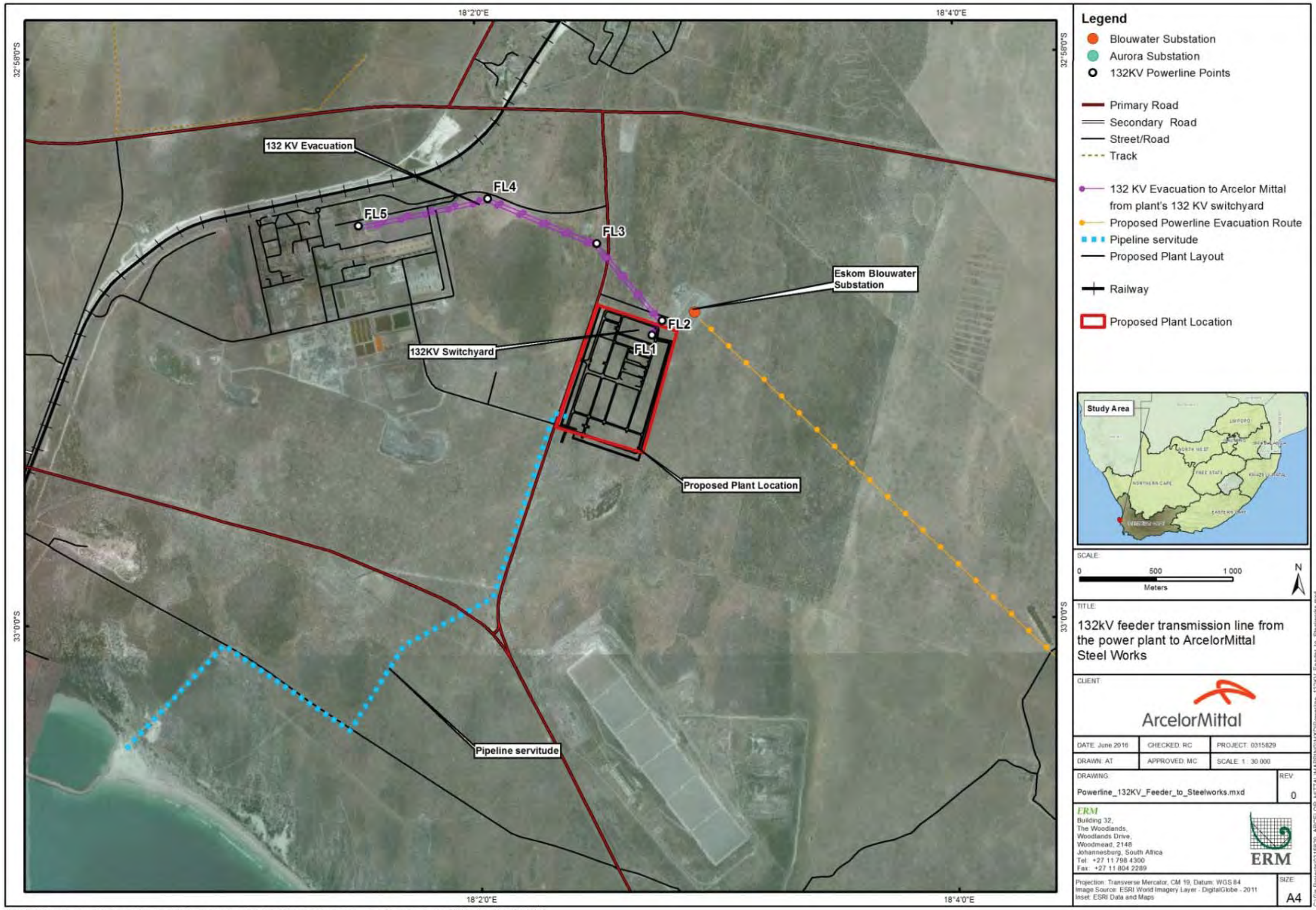
Table 3.15 Coordinates of the vertices for the proposed transmission line from the power plant to the ArcelorMittal Steel Plant

Point	Longitude	Latitude
FL1	18° 2.736' E	32° 58.992' S
FL2	18° 2.780' E	32° 58.943' S
FL3	18° 2.508' E	32° 58.667' S
FL4	18° 2.054' E	32° 58.506' S
FL5	18° 1.512' E	32° 58.598' S

400 kV Transmission line to Aurora Substation

The additional 1103MW (1400MVA) of power generated at the plant will be evacuated through the construction of a new 22 km High Voltage (HV) 400 kilo Volt (kV) line from the power plants own switch yard to the existing Aurora 400 kV substation, following the existing Aurora to Blouwater 132 kV feeder servitude. This transmission line in not considered as part of this EIA process and will be considered in a separate EIA process in coordination with Eskom.

Figure 3.25 132kV feeder transmission line from the power plant to ArcelorMittal Steel Works



3.4 PROJECT PHASING AND SCHEDULE

The proposed project will be implemented in two phases. Phase 1 and 2 combined will produce approximately 1500 MW net out-put.

Phase 1 and 2 will consist of six Siemens Trent60 50 MW nominal (Installed Gross capacity) gas turbines in open cycle (labelled T1 through to T6) and three Siemens SCC5-4000F 435 MW (Installed Gross capacity) nominal combined cycle plants, labelled UNIT 1, UNIT 2 and UNIT 3 respectively, and will be erected on three self-contained power 'islands' each approximately 150 m long x 60m wide.

3.4.1 *Phase 1*

Phase 1 of the project will constitute the following components:

- Site entrance with truck staging areas, hard standing areas;
- Offices and control room;
- Warehouse areas and workshops;
- Installation of six open cycle Siemens Industrial Trent 60 gas turbines (T1, T2, T3, T4, T5 and T6), one of which will be a redundant unit to ensure uninterrupted supply;
- Associated step-up transformers for every generating unit;
- 132KV and 400 kV switchyard;
- Site drainage;
- Gas receiving, conditioning and forwarding;
- Waste-Water treatment and water reclamation plant; and
- Storm water collection reservoir (25,000 m^3) and water treatment plant.

Construction period: 15 -18 months
On-site labour: 90 - 200
Completion Phase 1: September 2019 commercial operation

3.4.2 *Phase 2*

Construction of Phase 2 of the project will include the following components:

- Installation of complete UNIT 1, UNIT 2 and UNIT 3 open cycle Siemens SCC5-4000F gas turbine (total approx. 1,305 MW nominal (Installed Gross capacity) combined cycle plants);

- Associated step-up transformers, and station switchyard.

Construction period: 18 - 20 months
On-site labour: 200 - 450
Completion Phase 2: Mid- 2020 - Early 2021

3.5 *PROJECT IMPLEMENTATION*

The project will be undertaken in a number of stages, commencing with development (i.e. the work undertaken directly by IPCSA up to bankable feasibility which will also include a Front End Engineering Design) with up to-20 full-time staff at most. All other collaborators will be contracted third-party engineers, accountants and draughtsmen as well as various OEM staff and legal advisors. Thereafter the site preparation activities will be undertaken, as described below.

3.5.1 *Site Preparation*

Site clearance activities include clearing the land of vegetation, fencing the project boundary and site levelling. Internal site roads will be constructed as the site levelling will require a number of heavy trucks to bring infill to the site and remove unnecessary material.

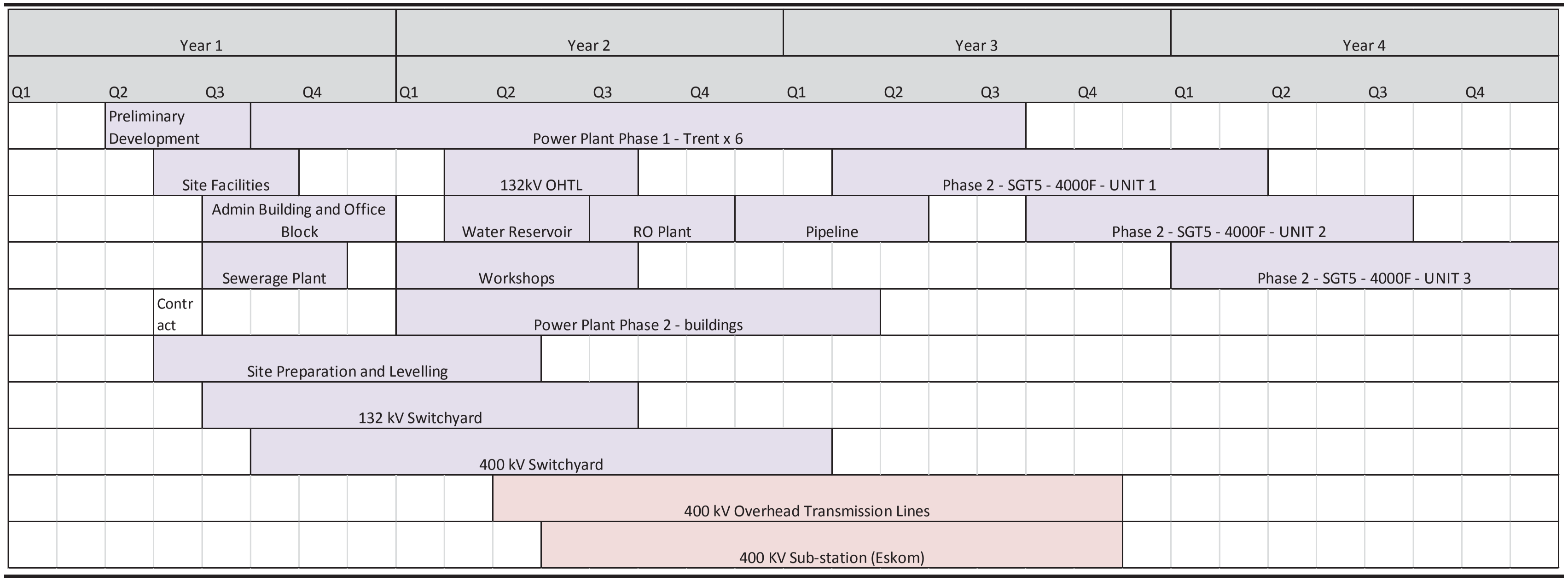
3.5.2 *Construction Phase*

Site roads constructed during the site preparation phase will be used to transport the heavy plant equipment required during the construction phase. In addition, earthworks will follow the site clearance earthworks and include the excavations necessary to achieve the works (e.g. for foundations) and the backfilling after completion of these works.

Construction schedule

The Project development will take approximately four years to complete. This is illustrated in *Figure 3.26* below.

Figure 3.26 High level Project development schedule



Water requirements

During the construction phase the main water requirement will be for the concrete batching plant. It is estimated that 30 000m^3 of water will be required for the concrete batching.

During the commissioning phase the following water will be required:

- 2,000 – 5,000 m^3 for blow-out of the steam piping (Testing/commissioning);
- 2,000 – 5,000 m^3 for blow out and chemical clean of the Benson boilers; and
- 23 000 m^3 (approximately) for pipeline cleaning and hydraulic pressure testing.

Initially water will be trucked in 30m^3 loads from local farms (ground and surface water sources) (1). It will be transferred to a temporary stainless-steel tank for immediate use in preparing concrete for a small lay-down area and foundations for the first permanent raw-water storage tanks.

Power plant

Foundations and Piling

Piling of the foundations (if required) for the first six Siemens Industrial Trent 60 gas turbines (T1 through to T6), the other gas turbines (Siemens SCC5-4000F, UNIT 1 to 3) and large main equipment items, will last for approximately 10 months until the foundations for the last item of equipment have been completed. Once the piles are in place, concrete slabs will be constructed and turbine pedestals constructed which will involve some large pours of concrete. At this stage the gas turbine main building will be constructed which will be the first visible building associated with the power plant. The Siemens Industrial Trent 60 gas turbines will not be enclosed in buildings.

Site hard standing

The construction phase will require substantial laydown hard-standing area for temporary placement of equipment and materials delivered to site. Several areas are demarcated as 'laydown areas' (*Figure 3.4*) but will used as such only during the construction phase. Laydown areas will be concreted to aid in rain-water harvesting.

After commissioning is completed, the hard-standing areas will be rehabilitated and available for any plant expansion which may be subject to additional EIA application.

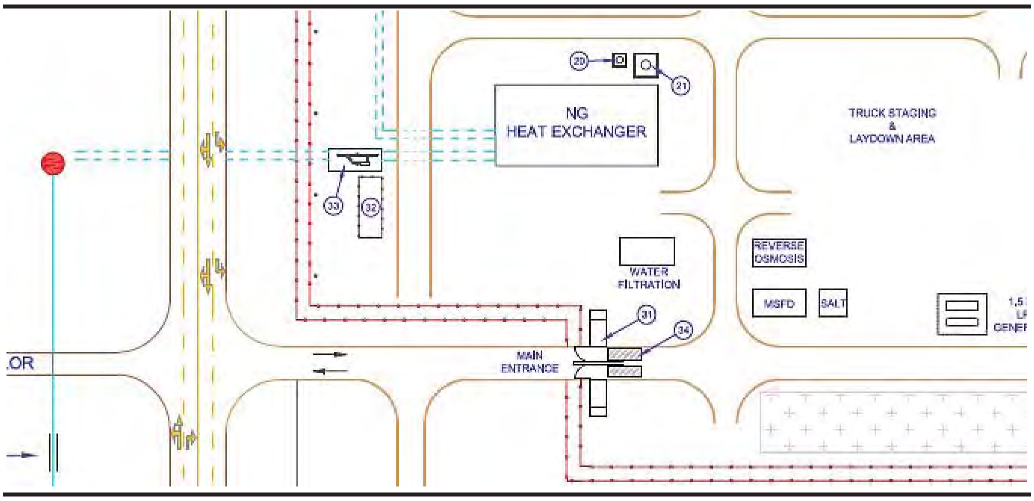
(1) Agreements with land owners are currently in the process of being developed.

Total hardstanding area is approximately 10.7 ha representing approximately 23.6 percent of the total site area. All hard-standing areas will drain into the rain-water collection system. Concreting over the hard-standing area will reduce dust especially during construction and will play a major role in rain water harvesting after the plant is in commercial operation.

Traffic

Approximately 35,000 tons of bulk cement and concrete aggregate, 800 tons re-bar steel, and 6,500 tons equipment and structural steel will need to be transported to the construction site.

Figure 3.27 Access during construction period

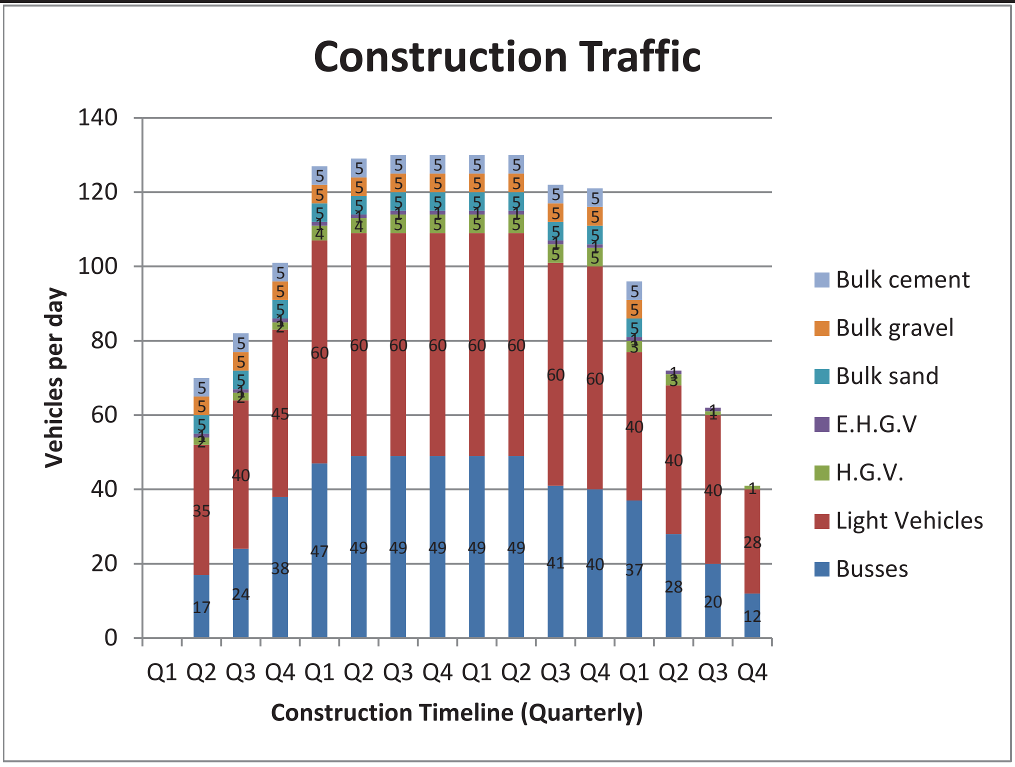


It is envisaged that construction staff, up to a maximum of 350 persons, would be bussed to site in 8-seater or 10- seater mini busses and pass through this gate; about 40 - 50 busses per day, twice a day. Light vehicle traffic due to construction will start at around 35 vehicles per day and increase rapidly to 60 per day where it will remain for the bulk of the construction period.

There will be an expected 5 vehicles per day of HGV's, bulk gravel, bulk sand, and bulk cement respectively for the duration of the construction phase right up to Q1 of year 4, after which it tails off rapidly.

The gas turbines and other heavy equipment will be delivered via truck. This will involve some abnormal loads being moved on the roads during this time.

Figure 3.28 Predicted traffic loads during the construction phase



<u>Employment</u>

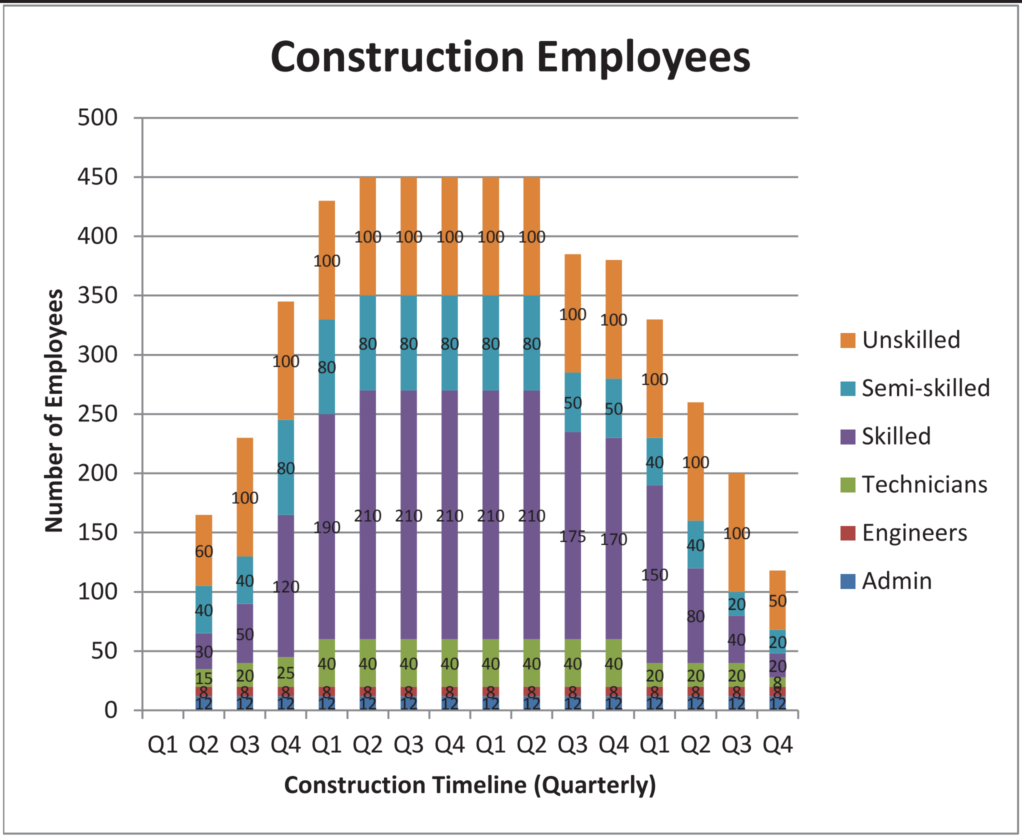
During peak construction activity, it is expected that up to approximately 450 workers will be directly employed (*Figure 3.29*). Most of this workforce will be employed by the engineering, procurement and construction (EPC) contractor and will consist in semi-skilled to skilled workforce.

The breakdown of skills required during the construction phase will be as follows:

- Skilled labour: 58 percent;
- Semi-skilled labour: 20 percent; and
- Unskilled labour: 22 percent.

It is understood that there will be no worker accommodation on site during construction. The unskilled workforce will, as far as possible be employed from the local community, reducing the need to the provision of accommodation. The skilled and semi-skilled workforce from outside the area will be housed within Saldanha Bay Local Municipality.

Figure 3.29 Employment requirements during the construction phase



<u>Commissioning</u>

After approximately 28 month's general site activity will decrease as the project moves into full commissioning where there will be a relatively small group of highly skilled engineers and technicians checking, testing, starting-up and finally commissioning the power plant.

Phase 1:

- The first Siemens Industrial Trent 60 gas turbine units (300 MW) will be commissioned within twelve to fourteen months from financial close.

Phase 2:

- The three Siemens SCC5-4000F units (UNIT 1, UNIT 2 and UNIT 3) will be commissioned twelve to fourteen months after Phase 1.

The current timeline estimates 48 months construction for Phase 1 and Phase 2 combined.

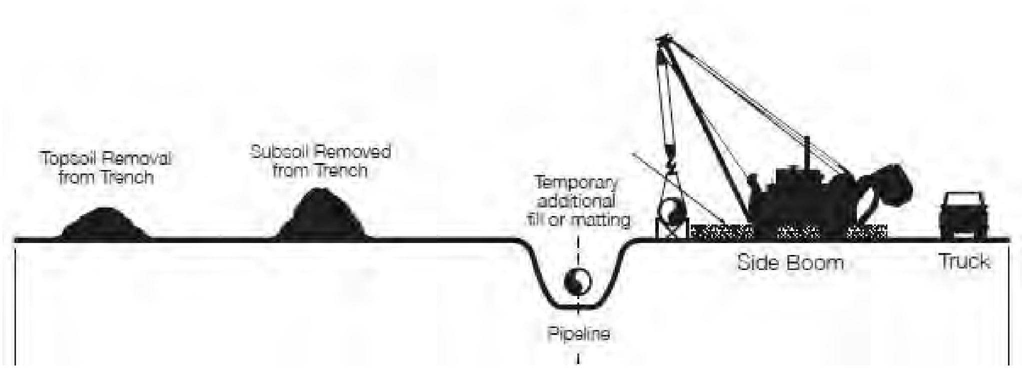
Pipeline Installation

Pipelines will be installed underground, and this implies the opening of a working strip along the right of way of the pipeline. During construction, the excavated trench will be clearly indicated and access and passage through the area will be restricted. The servitude is expected to 36 m in width (1) (including width of the pipe trench itself). *Figure 3.30* provides an overview of an indicative working strip for pipe laying.

The centreline of the trench need not coincide with the centreline of the servitude space requirement during construction, but may be situated closer to one side or the other of the servitude, depending on traffic and access, excavation programme and volume of topsoil and excavated soil. The pipeline trench is likely to have a width of 2 meters and a depth of between 1.5 m – 2 m (2). Generally speaking the deeper the trench, the more work space will be required.

The boundaries of the servitude route will be clearly marked, flagged, or posted, such that each mark will be clearly visible from each mark on either side of it along the route. Markings on each flag or post along the route will be consistent with best management practice and may emphasise specific location warnings or conditions. Traffic through active work areas along the route will be strictly controlled.

Figure 3.30 Indicative working strip



Source: ERM (2015) (drawing not to scale)

Table 3.16 provides a step by step description and illustration of the pipeline construction process. Prior to construction of the pipeline commencing surveying of the pipeline route will take place. Based on the information gathered during the surveying process which takes into account, amongst other things, environmental, developmental and local issues, a final route is developed.

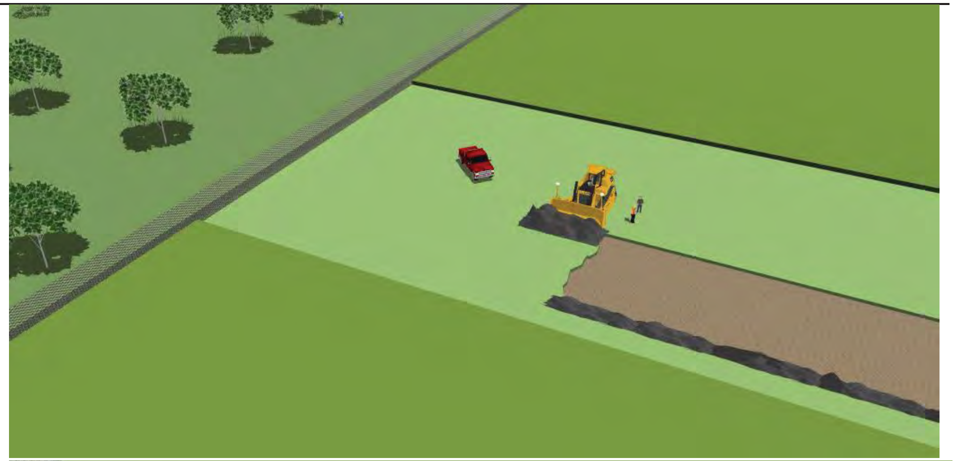
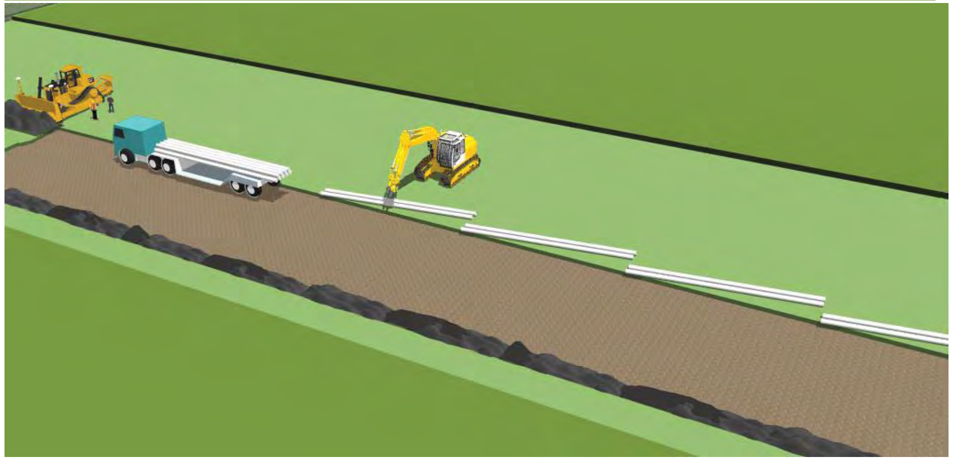
The EPC contractor will ultimately decide on the construction method to be used and is typically dependant on subsurface ground characteristics. Excavated sub-surface soil will be stored separately from the top-soil and large rocks, if any, may be removed and added later during the padding and back-fill stage. The slope and depth of the ditch will be in accordance with

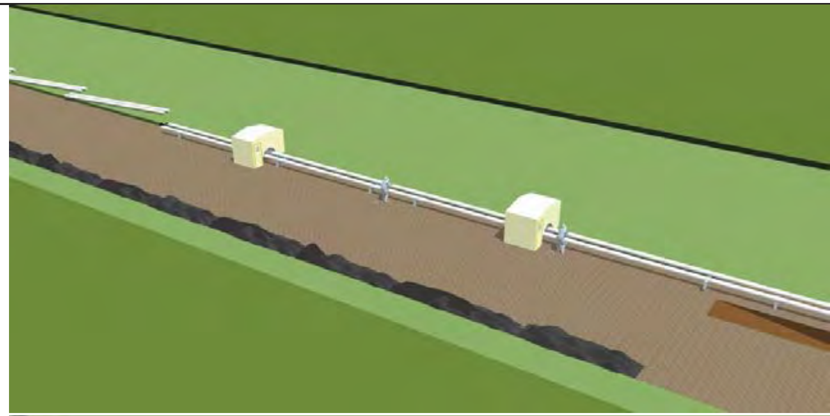
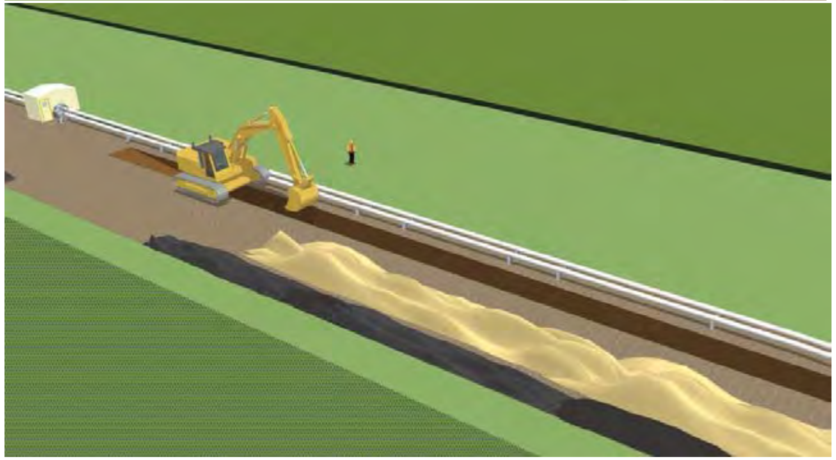
(1) The precise width will be determined by the EPC contractor after taking into account local ground and flora conditions and his projected site traffic estimates during construction
(2) Exact dimensions will be determined by the EPC contractor after geotechnical investigations.

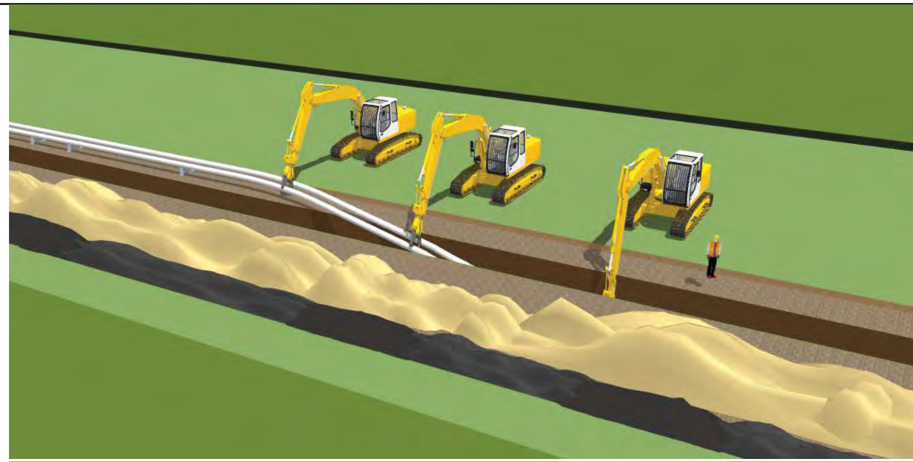
stipulated safety requirements which the EPC contractor will be acquainted with. From preliminary charting studies, blasting will not be required.

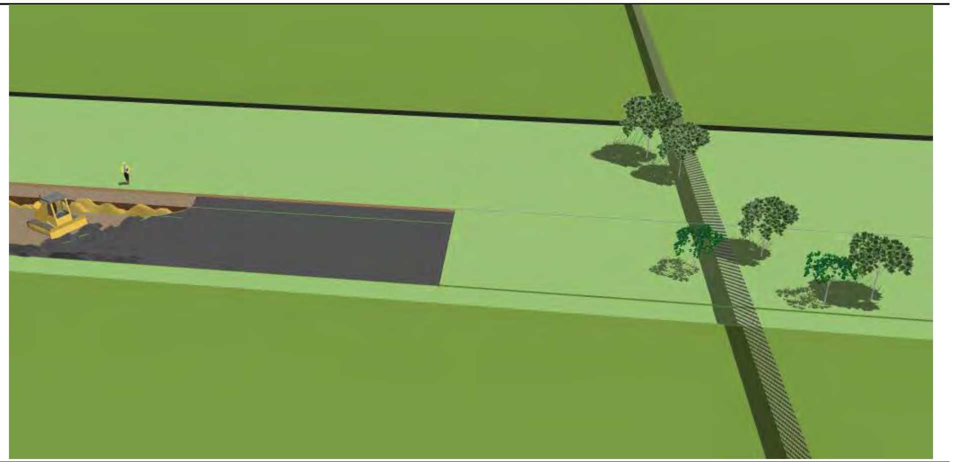
Road crossings will be designed by the EPC contractor according to ASME B31.4 and API RP 1102 or EN equivalent or as dictated by the Roads Authority. However, asphalt road crossings are usually carried out by a 'boring' method and crossings of gravel roads are typically by an 'open cut' method depending on traffic conditions and local regulations. Separate boring will be required for the sea-water pipeline and for the electrical cable conduit.

Table 3.16 Illustration of the pipeline construction process

Process Description	Illustration
Grading of the Right-of-Way: The topsoil along the right-of-way is stripped and stored for replacement following the installation of the pipeline.	
Laying out the pipe: Crews then re-stake the centre of the trench area and lay-out sections of the pipe along the right-of-way.	

Process Description	Illustration
Pipe preparation: Crews weld the sections of pipe into longer sections that follow the planned route. Individual sections have already been coated to prevent corrosion. Crews weld the sections of the pipe in mobile welding cabins to prevent wind and dust from compromising weld integrity. Each weld is inspected by X-ray and then coated again.	
Trench digging & soil separation: Once this process is complete, a trench is dug for the pipe run. The topsoil and subsoil are stored separately.	

Process Description	Illustration
Lowering the pipe: The pipe coating is inspected one more time before the pipe is lowered into the trench onto padding (sifted subsoil or sand).	
Backfilling, Grading & Testing: The trench is then carefully backfilled with sand, subsoil and preserved topsoil after the pipeline has been hydraulically pressure-tested.	

Process Description	Illustration
Clean-up & Restoration: The right-of-way and work area is regraded and vegetation is restored according to local requirements. A narrow compacted gravel track may be maintained along the pipeline route for access to monitoring equipment.	

Note: The above pictures are for illustration purposes only and do not take into account specific construction and restoration techniques which may differ depending on the area of operations.

Source: Client document: #1026.1.5 PCSA EIA/Gas Pipeline

Welding of the pipeline requires electric power. Power for the welding of the gas pipeline sections will be provided by a mobile diesel generator deployed to the pipeline construction site. The diesel will be supplied by mobile tankers on a daily basis. The interred power cable will eventually serve to operate seawater pumping and filtration plant at the coastline and located close to the "pigging" send-out station.

3.5.3 Operational Phase

Power Plant

The power plant will be operated on a 24 hour, 7 days a week basis. The number of workers on site during operations will be about 95 operational employees. These will include plant management and maintenance staff, skilled mechanical and electrical technicians, drivers, medical, quality control, and cleaning staff and a number of experienced plant operators who will operate and maintain the plant, and who are expected to be a mix of expatriate and local staff.

During commercial operations there will be some traffic bringing supplies and spares to the power plant. This will increase during shutdowns and periods of major maintenance.

Maintenance activities will be undertaken by an Operations and Maintenance (O&M) contractor.

<u>Water requirements</u>

Water requirements during the operational phase are estimated as follows:

- Combined Cycle circuit, replacement feed water: 1 500 m^3/y
- Potable water: 200 m^3/y
- Water for ablutions during construction 25 m^3/day: 1 250 m^3/y
- Vacuum system and steam seal evaporative water loss: 500 m^3/y
- Sundry cooling system evaporative losses: 250 m^3/y
- Water/glycol cooling circuit losses: 1 500 m^3/y
- Other evaporative losses PV system washing):1,500 m^3/y

It has been estimated that a provision of 25 000 m^3/year of water would be sufficient for operation of Phase 1 and Phase 2 of the power plant, it is currently envisaged that this water would be sourced as follows:

- Trucking from local farms during the construction phase;
- Collection of annual precipitation in 5 x 2000m^3 storage tanks – it is estimated that approximately 5 000m^3/y could be collected climate dependent;
- A Reverse Osmosis plant on site using sea water that will be pumped up from the coast along the gas pipeline servitude. 20 - 45 m^3/day, potable,

up to 14 000 m^3/y. The RO process will be a zero liquid discharge process; and
- Water recovery by condensation from the gas turbine exhaust.

Water during construction will be required for the following activities:

- Off-site dust control: Post treatment recycled water will be used for dust control on unsurfaced roads where required during high traffic periods and during construction. Estimated temporary provision of 5,000 m^3 per annum in 2017 and 2018.

- Domestic purposes by on site workers: Maximum water usage during peak construction period (600 site personnel) is estimated to be 60 m^3/day. This peak requirement is estimated to be needed for approximately 2 years – 2017 and/ 2019.

- Construction and on-site dust control: Water is required for the manufacture of concrete during construction. The power plant will require approximately 80,000 – 90,000 m^3 of concrete for foundations, road works, hard standing and other site works. Estimated temporary provision of 5,800 m^3 per annum - 2017 and/ 2019.

Water during operation of Phase 1 and Phase 2 will be required for the following activities:

Motive steam for the combined cycle (1): Estimated annual provision 1500 m^3.

- Annual Cooling water for condensation of steam from steam turbine seals and vacuum plant seals: Estimated annual provision of 500 m^3 (Phase 1 and Phase 2).

- Cooling of lubrication oil for gas turbine, alternators and steam turbine generator, gas compressor air: Estimated annual provision of 500 m^3per year.

- As water/glycol for combustion air inlet cooling: A cooled water closed-loop is used to cool down the inlet combustion air to as close to 15 °C as possible. Estimated annual provision of 1500 m^3 per year.

- Make-up water for treated water replacement in event of any boiler blow-down requirement: Estimated annual provision of 1000 m^3 per year.

- Fire abatement: Estimated storage provision of 3000 m^3.

(1) The Benson boiler does not consume water, in that there is no water discharge to out of battery limits, the quantity indicated here is a provision over and above what may be used for startup

Table 3.17 Summary Total Water Usage excluding Fire Contingency

Project Stage	Year 1	Year 2	Year 3	Year 4 Operation Phase 1 and 2	Year 5 Operation Phase 1 and 2
Construction (m^3)	20,000	20,500	16,500	0	16,500
Operation (m^3)	3,000	3,000	5,000	12,000	12,000

This will be confirmed as the design details for the plant are progressed through the BFS.

Utilities and materials

Table 3.18 presents a preliminary list of the incoming utilities and materials to the power plant site.

Table 3.18 Preliminary list of incoming utilities and materials

Utility	Notes
Natural Gas	Brought in by pipeline
LPG	Brought in by truck
Sea water	Brought in by pipeline
Process Materials	Brought in by truck
Hydrogen	Brought in cylinders for generator cooling
Ethylene Glycol	Brought in in steel drums for cooling water treatment & process chemicals
Ammonia	Brought in drums, by truck
Water treatment & process chemicals	
Ammonia	Brought in drums, by truck
Sulphuric acid	Brought in drums, by truck
Demineralizing resins	Brought in drums, by truck
Carbon dioxide,	Gas cylinders, brought in by truck
Sewage treatment chemicals (Organic)	
Workshop consumables	Fluxes, welding rods, gaskets, etc.
Maintenance consumables	
Paint	Brought in metal cans
Lubricating greases	Brought in metal cans
Fire-extinguishing foam	Standard gas/foam cylinders
Canteen food	Brought in by truck
Office consumables	
Construction Aggregates	Sand, gravel, cement, brought in by truck

Table 3.19 provides a preliminary list of the outgoing utilities and materials form the power plant.

Table 3.19 Preliminary list of outgoing utilities and materials

Outgoing Utility / Material	Estimated Quantity
Electricity	max. 34,800 MWhe/day
Potable water	max. 30,000 l/d
Waste lube oil	max. 15 tons/year

Outgoing Utility / Material	Estimated Quantity
Solid desalination salt residue:	approximately 900 kg/day
Canteen waste -food products	100 kgs/day
Dewatered solids from waste water treatment	max. 50 Kg/day
Spent anti-fire agent cylinders	
Waste, non-oil maintenance materials	est. max. 5 tons/y
Spent consumables and cleaning products.	est. max. 5 tons/y

Services

The following services will be provided by the project itself, managed by a services department on site or contracted to a third party:

- Electricity;
- Gas;
- Raw water treatment, including filtration RO and demineralisation;
- Water recovery from waste water;
- Sewage treatment;
- Boiler feed water;
- Boiler blow-down recovery;
- Condensate;
- Fire water;
- Cooling water;
- Hydrogen generator cooling system;
- CO2 fire abatement system; and
- Compressed air.

Emissions

Emissions from the plant will result from a number of sources and depend on the fuel used to generate power. It should be noted that propane will only be used for emergency black starts.

Phase 1
The likely emissions, at maximum continuous rating (MCR)[(1)], that can be expected during Phase 1 of the Project are shown in *Table 3.1.*

Table 3.20 Estimated Emissions from the Project – Phase 1**

Emitter	UNIT NUMBER	Capacity MWe at MCR	Stack Flow Kgs/sec	SOx	CO Mg/Nm^3	NOx Mg/Nm^3	CO^2 Kg/hr
Trent 60 DLE *	T1	48	152		46	50	27.161
Trent 60 DLE *	T2	48	152		46	50	27.161
Trent 60 DLE *	T3	48	152		46	50	27.161
Trent 60 DLE *	T4	48	152		46	50	27.161

(1) Maximum continuous rating (MCR) is defined as the maximum output (MW) that an electric power generating station is capable of producing continuously under normal conditions over a year.

Emitter	UNIT NUMBER	Capacity MWe at MCR	Stack Flow Kgs/sec	SOx	CO Mg/Nm³	NOx Mg/Nm³	CO² Kg/hr
Trent 60 DLE *	T5	48	152		46	50	27.161

*Open Cycle at site conditions 25°C, 20m, 65%RH
#Open cycle, nominal rating
**The 6th Trent 60 DLE unit is not included in this table as it is redundant.

Table 3.21 Exhaust Gas Emission Rate and Temperature

Emitter	UNIT NUMBER	Stack Height	Rate Kg/sec	Temperature °C
Trent 60 DLE *	T1 through T6	40 m	152	439

*Open Cycle at site conditions 25°C, 20m, 65%RH
#Open cycle, nominal rating

Phase 2

The likely emissions, at maximum continuous rating (MCR)(1), that can be expected during Phase 2 of the project are shown in *Table 3.1*.

Table 3.22 Estimated Emissions from the Project – Phase 2

Emitter	UNIT NUMBER	Capacity MWe at MCR	Stack Flow Kgs/sec	SOx	CO Mg/Nm³	NOx Mg/Nm³	CO² Kg/hr
SCC5-4000F 1S	UNIT 2	435	680	0	35	<20	152,200
SCC5-4000F 1S	UNIT 3	435	680	0	35	<20	152,200
SCC5-4000F 1S	UNIT 1	435	680	0	35	<20	152,200

*Combined Cycle at site conditions 25°C, 20m, 65%RH

Table 3.23 Exhaust Gas Emission Rate and Temperature

Emitter	UNIT NUMBER	Stack Height	Rate Kg/sec	Temperature °C
SCC5-4000F 1S	UNIT 2	60 m	675	90 - 110
SCC5-4000F 1S	UNIT 3	60 m	675	90 - 110
SCC5-4000F 1S	UNIT 1	60 m	675	90 - 110

*Combined Cycle

Waste Generation

Construction wastes will comprise general domestic waste including sanitary and food waste, office waste, organic material, small volumes of wastes

(1) Maximum continuous rating (MCR) is defined as the maximum output (MW) that an electric power generating station is capable of producing continuously under normal conditions over a year.

arising from mobile plant, chiefly waste lubricating oil and packing materials (e.g. crates).

Operational phase waste streams are as follows:

- Used generator and turbine lube oil (collected in a tank on site and then removed off-site in drums for controlled disposal);
- Occasional oily sludge recovered from on-site collected road surface or hard-standing surface water treatment;
- Spent gas turbine fabric air filter cartridges;
- Spent gas turbine lube-oil filter cartridges;
- Dried powdered sludge from sewerage treatment and ablution and canteen washing areas;
- Spent office consumables (paper, printer cartridges etc.);
- Organic waste food from canteen operations and organic cooking oil waste from canteen operations;
- Glass waste and metal can waste from canteen operations;
- Scrap steel and copper from irreparable mechanical equipment;
- Scrap plastics from equipment packaging;
- Dry solids (mineral salts) recovered from zero discharge reverse osmosis process;
- Spent resins from water demineralisation;
- Waste solvents and grease from workshop equipment cleaning operations; and
- Spent laboratory chemicals from water testing and water treatment.

No waste material will remain on site.

Potentially hazardous chemicals will be neutralised (if acidic) and then separately hermetically packed and labelled prior to disposal.

The disposal of waste will be carried out in accordance with the relevant legislation. All solid wastes generated will be disposed of at licensed landfill sites, for general and/ or hazardous waste streams.

The combined cycle circuit will generate steam through a Benson type boiler. This is a drum-less boiler that although there is a much diminished blow-down, compared to a conventional drum boiler, the blowdown water is recuperated and re-used.

Pipeline

<u>Pipeline operation, marking and monitoring</u>

The position and location of the buried gas pipeline will be indicated above-ground by special marker beacons laid above the pipeline in line-of-sight of each other along the pipeline servitude route (*Figure 3.31*). The markers will be able to collect and transmit essential pipeline information by means of telemetry, as described below.

Figure 3.31 Example of a marker indicating pipeline below ground

The pipeline is expected to operate continuously, for 8760 hours per year, only the flow rate will vary. The pipeline operating conditions are listed in *Table 3.24.*

Table 3.24 Pipeline operating conditions

Parameter	Operating Condition
Gas temperature	20 C (insulated pipeline)
Flow rate	25 – 65 kg/sec

Parameter	Operating Condition
Working pressure	max. 90 barg, min 45 barg, average 67 barg
Pipeline maximum allowable stress	78,500 barg (7854 Mpa)

Solar-powered data collection nodes along the pipeline route will constantly collect and retransmit pipeline operational statistics, cathodic or anodic protection performance or alarms to the power plant's control room. Pipeline gas flow interruption during maintenance interventions could also interrupt power generation, thus sophisticated measures will be put in place to pre-empt the need to shut off gas flow at any time.

Several leak detection technologies are available and will be incorporated by EPC contractor. Those currently available are as follows:

- In – pipeline instrumentation based on acoustic sensors
- In – pipeline condition assessment with pigging.
- Above-ground air sampling along the pipeline route (Unmanned Aerial Vehicle UAV or manually operated);
- Detection of tracer chemical introduced into the gas pipeline and detected above ground;
- Automatic solar-powered leak detection sensors capable to trigger control room alarm;
- Radio/WiFi instrumentation information transmitted to control room/pipeline operator; and
- Pipeline monitoring data collected regularly by plant operated security Unmanned Aerial Vehicle (UAV).

Emergency shut-down and emergency response

Whilst the emphasis for pipeline operation is continuous operability, the pipeline can be shut down in case of emergency. The pipeline can be isolated at three locations, namely at the LNG degasifier that feeds the pipeline with gas, and closing the two pipeline isolation valves either from the plant control room or manually. These valves are located at the despatch pigging station at the beginning of the land-based pipeline. The pipeline will be allowed to depressurise via a small gas flare at the pig-receiving station and residual gas will be expelled by a spherical 'pig'.

The prime risk associated with the pipeline emanates from undetected gas leaks from:

- Pipeline or valve rupture due to excessive pressure and failed welds;
- Pipeline or valve rupture due to sub-surface geological or subsoil instability; and
- Pipeline or valve rupture plus break-down of all leak detection and alarm systems.

The impact of an undetected gas leak can result in:

- Fire, or in the worst case, a high energy explosion of the ruptured gas pipeline;
- Setting alight surrounding flora and any habitation; and
- Hydrocarbon contamination of the natural environment.

Emergency response measures in the event of a sudden catastrophic rupture of the pipeline will be put in place, including:

- Reliable and immediate shut-off capability of all valves along the pipe-line route, including sea-water feed-valve and mid-route water isolation valve. Where the automatic valve actuators have been incapacitated, the pipeline will be isolated manually by a trained rapid response team;
- The underground power-cable will have been isolated automatically through loss of gas pipeline pressure;
- Immediate shut-down of the regasification facility;
- Immediate start-up of fresh water fire pump feeding the water pipeline;
- Rapid response fire response team;
- Shutting off all roads that have a pipeline crossing;
- Controlled shutdown of the power plant;
- Dissemination of information and knowledge of the pipeline location and hazards to local fire authorities; and
- Being a Class 1 location installation, personnel or habitation or buildings close to the pipeline will be minimal/non-existent. Nevertheless the plant medical team and fire response team will have access along the pipeline route.

Employment

The following information has been provided in the social impact assessment chapter, but is repeated here for ease of reference.

The number of workers on site during operations will be about 107 operational employees and up to 70 part-time employees. These will include plant management and maintenance staff, skilled mechanical and electrical technicians, drivers, medical, quality control, and cleaning staff and a number of experienced plant operators who will operate and maintain the plant, and who are expected to be a mix of expatriate and local staff.
As the plant will operate 24 hours a day, three full-time shifts will be created per day, and the breakdown of the skills required will be as follows:

- Skilled labour: 65 - 70 percent;
- Semi-skilled labour: 15 - 20 percent; and
- Unskilled labour: 10 - 15 percent.

A further breakdown of the employment opportunities is provided in *Table 3.25*.

Table 3.25 Estimated Employment Positions Available During Operation

Position	Number of Positions Available
Admin	4
Security	15
Warehouse and Stores	6
Medical	6
Plant Control	15
Engineers	9
Technicians	9
Skilled	9
Unskilled	9
Tuition and Training	4
Quality Control, Water	3
Canteen	6
Total	**95**

It is understood that there will be no worker accommodation on site during operation. The unskilled workforce will, as far as possible be employed from the local community, reducing the need to the provision of accommodation. The skilled and semi-skilled workforce from outside the area will be housed within Saldanha Bay Local Municipality.

3.5.4 Decommissioning Phase

Decommissioning is the term used to describe all stages involved in the closure and rehabilitation of the power plant site. The process can generally be categorised into the three key phases as follows:

- Pre decommissioning activities: includes the detailed planning (development of a Decommissioning Plan, Site Closure and Restoration Plan) and approval facilities;

- Decommissioning activities: removal of all infrastructure (including the cables and pylons for the connection to the existing transmission line). Machinery, steel and dismantled materials will be recycled where possible and disposed of at licensed disposal sites; and

- Post decommissioning activities: site survey, close out report and field monitoring as necessary.

It is likely that the project facilities will only be decommissioned once the gas supply has been exhausted, when it is no longer economical to continue operation, or the plant is rendered redundant or is no longer required for various reasons, or is unsafe to operate. As the development process of the site is yet to fully begin, detailed decommissioning plans have not yet been formulated; however, the initial plant life will be designed for 25 to 30 years. Upgrades during the life of the plant can increase the design life to 50 years.

A Decommissioning Plan will only be developed during the latter stages of the production life of the facilities. The assessment of the significance of the environmental and social impacts associated with decommissioning will need to be conducted once the Decommissioning Plan is finalised.

3.6 *ASSUMPTIONS*

The following assumptions have been made with respect to the project description chapter:

1. There will be a permanent easement above the pipeline of 3m either side of the centre line;
2. There will be a temporary Right of Way (RoW) of 36m (18m either side of the centre line) of the pipeline during the construction phase;
3. There will be a permanent 30m servitude for the feeder 132kV power line from the power plant to the ArcelorMittal Steel Works (15m either side if the centre line)
4. The site access arrangements illustrated in this section are conceptual and have been engineered and costed as they are represented using generic data from various contractors with past experience. Special requirements that may be requested in addition to the to-date assumptions and findings have not been taken into account in this report.