10 ASSESSMENT OF POTENTIAL IMPACTS

10.1 INTRODUCTION

This Chapter identifies and evaluates the actual and potential environmental consequences of the proposed activity. Furthermore, the potential for mitigation of negative impacts and enhancement of positive impacts are described.

Impacts have been assessed based on the methodology provided in Chapter 4. Specialist study methodologies are provided in each study in *Annex D*.

10.2 SUMMARY OF IMPACTS TO BE ASSESSED

10.2.1 *Bio-physical and Socio-economic Impacts Identified*

The following impacts were identified in the Scoping Report as potentially significant:

Risk/Impact Grouping	Potential Impacts
Physical Presence and Footprint	• Site clearance for the construction of the power plant and pipeline servitude in green-field areas will result in removal of vegetation and habitat, thus resulting in an impact on terrestrial fauna. • Impact that the presence of the power plant and pipeline may have on terrestrial flora and fauna, cultural heritage and visual and landscape character.
Air Emissions	• Dust from site clearance and construction activities. • Emissions from the combustion of fuel in the power plant. • Engine emissions from construction and operational traffic. • Emissions of air pollutants from gas venting during commissioning, maintenance shutdowns and from process vents.
Noise	• Noise from construction of power plant and pipeline may have an impact on sensitive receptors. • Noise from power plant operation may have an impact on sensitive receptors. • Noise and vibration from construction and operation traffic along main transport/access routes.
Waste and Wastewater Management	• Non-hazardous and hazardous wastes will be generated that will require to be transported and disposed of in a manner protective of the natural and human environment. • Improper storage, handling and transport of solid and liquid wastes at the power plant can lead to loss of containment and spillages which could give rise to soil and ground water contamination.

Risk/Impact Grouping	Potential Impacts
Socioeconomic	*Community Health Safety and Security* • Equipment and activities will create noise and vibration and changes to air quality during construction, operations and demolition that could impact human health; • Movement of materials and workers during construction, operation and demolition could impact public safety; and • The presence of workers and opportunistic workers in the Project area could result in a change in the disease profile of the local population, communicable diseases and sexually transmitted infections.
	Worker Health & Safety • Hazardous construction, operational or decommissioning activities could impact worker health and safety; and • Handling of hazardous materials could impact worker health and safety.
	Local Community Demographics • Influx of workers from outside of the local Project area will result in a change in demographics of the local communities; and • The presence of a construction workforce hosted within the Project area will result in temporary changes to demographics.
	Local and Macro Economy • Procurement of goods and services required by the Project during construction, operation and decommissioning of the Project may enhance the local economy both directly and indirectly; and • The presence of construction, operation and decommissioning workers in the Project area may enhance the local economy through their purchase of local goods and services.
	Traffic • Transport of equipment and machinery (i.e. gas turbines) during the construction phase may impact on local traffic patterns; • Transportation of waste from the site and materials and equipment to the site during operation may impact on local traffic patterns; and • Decommissioning activities could also impact local traffic conditions.
	Cultural/Heritage Resources • Construction activities could have an impact on local cultural sites (paleontological); and • The presence of workers in the Project area and the transportation of materials and equipment to the construction sites may impact on cultural areas.
Non-Routine Discharges (accidental and emergency events)	• Leaks or accidental releases of diesel or chemicals during construction and operation activities could impact on soil and groundwater. • Accidental release of natural gas could be a risk to surrounding receptors.

Risk/Impact Grouping	Potential Impacts
Cumulative Impacts	A cumulative impact is defined as an impact that results from incremental changes caused by other past, present or reasonably foreseeable actions together with the Project. The cumulative impact assessment will consider the impact of the Project along with the impacts of other industrial developments in the area that may also impact on the same receptors and resources. The following cumulative impacts may result from the proposed development: • Air; • Noise; • Biodiversity; • Socio-economic effects; • Infrastructure and services; and • Traffic.

10.2.2 Bio-physical and Socio-economic Impacts Investigated

Further to the commencement of the impact assessment and the commissioning of specialist work, the following impacts have been identified as being of negligible significance and as a result have been screened out of the impact assessment. A description of these and reasons for their screening out is provided below and mitigation measures for the management of these are included in the EMPr:

- Waste management during all phases of the Project;
- Surface, groundwater and soil contamination;
- Impact to marine ecology due to seawater abstraction;
- Marine traffic impact due to LNG import.

Waste

Waste from the Project may arise from a range of sources during the Project life including the following:

- excavated material (e.g. rock, sand, vegetation);
- construction activities (rubble, packaging, etc.);
- fuel spills and the clean-up thereof;
- 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;
- dried sludge from brown water (ablutions and canteen washing detergent) treatment;
- spent office consumables (paper, printer cartridges etc.);
- organic waste food from canteen operations;

- 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;
- occasional medical waste from on-site clinic;
- dry solids (mineral salts) recovered from the 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 (each product neutralised, (if acidic), separately hermetically packed, and labelled for disposal).

No waste material will remain on site or be disposed of or released to the environment as part of the Project activities. All wastes will be handled, stored and transported in accordance with the relevant legislation.

Measures for the minimisation and management of wastes have been included in the EMPr.

Surface, groundwater and soil contamination

Effective stormwater management on site during all phases of the Project will minimise the risk of surface and groundwater resources as well as soil contamination. Specifically during operation, all stormwater on site will be channelled towards storage tanks. A conceptual stormwater management plan is provided in the EMPr. Procedures for handling contaminated soils, which may result during the construction phase of the Project, is also detailed therein. Management measures for the protection of soil and groundwater

Marine Ecology

The seawater intake structure will be designed for a maximum feedwater abstraction capacity of approximately 20 to 45 m^3/day. This quantity of seawater is considered negligible and no significant impact to marine ecology is anticipated. To avoid impingement and entrainment of marine organisms seawater will be drawn into the pipeline at a velocity of 14 l/s, be screened through appropriate coarse and fine screens before being pumped to the power plant.

Marine Traffic

The power plant will be fuelled by LNG which is proposed to be imported via the import terminal planned by the DoE (1). For the fuelling of the power

(1) Should this terminal not proceed a separate EIA will be undertake by the project for the import of LNG.

station it is anticipated that the following number of LNG carriers will be required to enter the Port:

- Q Flex LNG Vessel 210 000 to 220 000 m^3 (14 to 16 ships pa.).
- Upper Conventional 145 000 to 210 000 m^3 (14 to 20 ships pa.).
- Conventional < than 140 000 m^3 more than 20 ships pa.

A maximum of 20 ships per year (or 1.67 per month) will therefore enter the Port. This is a negligible increase in marine traffic in the Port of Saldanha and has therefore not been assessed further. The marine components of the project, including the terminal itself, the offloading and regasification of LNG will be assessed in the EIA being undertaken by the DoE. (1)

Geotechnical

The Department of Environmental Affairs (DEA) raised comment regarding the need to assess geotechnical aspects associated with the Project. The consideration of geotechnical aspects is not an environmental or social impact assessment consideration, but a design engineering consideration. As a result geotechnical impacts have been scoped out of the impact assessment.

According to SANS code 10160-4 (Basis of Structural Design and Actions for Buildings and Industrial Structures – Part 4: Seismic Actions and General Requirements for Buildings) the project site is located with a Zone where natural seismic activity can occur. The detailed engineering design should therefore also consider seismic loading factors as part of the design.

A design level geotechnical investigation will be considered prior to finalising the detailed design. The scope of such a study would include but not be limited to:

- Soil sampling and geological core logging;
- Soil bearing capacity tests;
- Settlement analysis; and
- Laboratory testing.

The findings of the geotechnical study will be provided to the civil engineering design team who would then consider excavation methods and foundation design according to best practice. The present design has assumed that piling would be required under the foundations of heavy static and rotational loads as well as large tank foundations. Non-concrete vibro compaction will be considered rather than invasive drilling and concrete column piling.

Existing pipelines and industrial facilities (such as the Saldanha Steel Mill opposite the proposed Project site) in the area covering the same geological

(1) Or alternatively in a separate EIA to be undertaken by the project.

terrain indicates that engineering design can overcome any potential geotechnical constraints and that the area is suitable for development. The excavatability for the trenches is also not expected to be a problem because of the presence of existing underground pipelines. Test pit investigations along the proposed pipeline would determine the excavatability in detail.

Specialist studies undertaken as part of this EIA

Specialist input was obtained for the assessment of the following impacts:

- Air Quality;
- Climate Change;
- Noise;
- Flora
- Fauna;
- Avifauna;
- Traffic;
- Socio-economic;
- Heritage; and
- Risk Assessment.

10.3 AIR QUALITY

Relevant legislation and guidelines

The national ambient air quality standard (NAAQS) ((DEA, 2013a)) consists of a limit value and a permitted frequency of exceedance for an array of potential pollutants. The limit value is the fixed concentration level aimed at reducing the harmful effects of a pollutant. The permitted frequency of exceedance represents the tolerated exceedance of the limit value annually and accounts for high concentrations as a result of process upsets and meteorological variation. Compliance with the ambient standard implies that the frequency of exceedance does not exceed the permitted tolerance. The NAAQS relevant to the Project are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$) and benzene, as shown in *Table 10.1*.

Table 10.1 NAAQS for SO2, NO2, CO, O3, benzene and PM10 (DEA, 2009) and PM2.5 (DEA, 2012)

Pollutant	Averaging period	Limit value ($\mu g/m^3$)	Tolerance
SO_2	1 hour	350	88
	24 hours	125	4
	1 year	50	0
NO_2	1 hour	200	88
	1 year	40	0
CO	1-hour	30 000	88
	8-hr running mean	10 000	11

O_3	8-hr running mean	120	11
PM_{10}	24 hours	75	4
	1 year	40	0
$PM_{2.5}$	24 hours	65	4
		40	4
		25	4
	1 year	25	0
		20	0
		15	0
Benzene	1 year	5	0

Table 10.2 National limit values for dustfall rates in mg/m2/day as 30-day average (DEA, 2013c)

Area	Dustfall rate (D)	Permitted frequency of exceedance
Residential	D < 600	Two within a year, not in sequential months
Non-residential	600 < D < 1 200	Two within a year, not in sequential months

Baseline conditions

The West Coast is sparsely vegetated and is relatively dry, receiving an average annual rainfall of only 278 mm. It is naturally dusty, particularly during the drier summer months and prior to the winter rains when ploughing takes place in preparation for winter crops.

Ambient air quality in Saldanha Bay is also influenced by a number of anthropogenic sources of air pollution.

The effect of these emissions on ambient air quality is determined through ambient air quality monitoring. Despite the number of sources of air pollution in Saldanha Bay, ambient monitoring data from the Saldanha Bay Municipality (SBM) has shown that ambient concentrations of all pollutants are consistently below the NAAQS. Ambient monitoring by the SBM commenced in July 2014 and has continued reliably since then.

Without any major coal burning facilities in the area, the ambient hourly SO_2 concentrations are very low relative to the NAAQS of 350 µg/m^3 (*Table 10.1*), with hourly average concentrations consistently below 5 µg/m^3. Hourly ambient NO_2 concentrations are also very low relative to the NAAQS of 200 µg/m^3 (*Table 10.1*), with hourly average concentrations consistently below 10 µg/m^3.

Daily average PM_{10} concentrations are also relatively low compared to NAAQS of 75 µg/m^3, ranging between 22 and 30 µg/m^3. The maximum 24-hour average PM_{10} concentration of 69 µg/m^3 was recorded in March 2015. Ozone (O_3) is not emitted by any particular source, but is formed in a photochemical reaction involving NO_2 and volatile organic compounds. O_3 is

considered to be a regional pollutant. Ambient O_3 concentrations are relatively high compared with other pollutants in Saldanha Bay, but they are well below the 8-hour NAAQS of 120 µg/m^3. Typically hourly O_3 concentrations range between 20 and 30 µg/m^3.

10.3.2 Decreased Ambient Air Quality during the Construction and Decommissioning Phases of the Project

Impact Description

Most construction and decommissioning activities generate dust. The emission of particulates into the atmosphere is through vehicle dust entrainment, demolition, excavation, ground levelling, etc. The main environmental problem with dust that is generated from these activities is that it settles on surrounding properties and land which is often more of a nuisance problem than a health issue. The dust is generally coarse, but may include fine respirable particles (PM_{10}) and these are known to be a risk to human health.

Exhaust emissions from construction vehicles and equipment typically include particulates (including PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2) and volatile organic compounds (VOCs) including benzene.

The construction and decommissioning activities are typically short lived and the pollutants are released close to ground level with little or no buoyancy which limits their dispersion and the potential impacts to the site.

Impact Assessment

Air quality impacts during construction and decommissioning are predicted to be of *local* extent for all pollutants since these pollutants are released close to ground level, which limits their dispersion and the potential impacts, as described above.

The scale of the impact has been rated as Low as in the case of dust, SO_2, NO_2, PM_{10}, CO and benzene, impacts are expected to be within the site and ambient concentrations are expected to be well below the respective NAAQS.

Air quality sensitive receptors include, but are not limited to, schools, churches, residences, apartments, hospitals, day care facilities, elderly care facilities and nursing homes. These land uses do not occur in the area affected by the Project and as a result the receptor sensitivity on site is rated as low.

The frequency of the impact is related to whether the predicted exceedances of the limit values exceed the permitted number of exceedances provided in the NAAQS, i.e. the tolerance. In the case of dust, SO_2, NO_2, PM_{10}, CO and benzene, no exceedances of the NAAQS are expected. This impact is considered to be irreversible. See *Box 10.1.*

Proposed Mitigation

The following mitigation is proposed to minimise the impact:

- Covering of vehicle loads;
- Loading and unloading materials in wind-sheltered areas;
- Speed restrictions on site;
- Revegetation as soon as possible;
- Spraying of roads to minimise dust;
- Maintenance of vehicles and equipment.

Box 10.1 Decrease in ambient air quality during the during the Construction and Decommissioning Phases of the Project

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Short term
- **Scale:** Low
- **Frequency:** Rare
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE.
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will maintain the impact as **NEGLIGIBLE**

10.3.3 Decreased Ambient Air Quality during the Operational Phase of the Project

Impact Description

Emissions of air pollutants from the ArcelorMittal CCGT power plant will result during operations through the combustion of LNG resulting in NO_X, CO and CO_2 emissions and some methane (CH_4) (1). NOx and CO have been modelled as part of the air quality study and detailed in this impact assessment. Carbon dioxide (CO_2) and methane (CH_4) are emitted when LNG is combusted, but these are greenhouse gases and consideration of their effects is addressed under the contribution of the Project to climate change, which is detailed as a separate impact, see *Section 10.4*.

<u>NO_2 emissions</u>
The predicted annual average NO_2 concentration and the 99th percentile of the 1-hour concentrations at the points of predicted highest ground-level

(1) There is virtually no sulphur in LNG and therefore emissions of SO_2 have not been considered.

concentration were determined by dispersion modelling and are presented in *Table 10.3*.

With regard to NO_2, ambient concentrations are predicted from emissions of NO_X (NO_X=NO+NO_2). Emissions from combustion processes are dominated by NO_2, and furthermore, NO converts rapidly to NO_2 in the presence of N in the atmosphere. Comparing the predicted concentrations of NO_2 to the NAAQS is therefore somewhat conservative.

Table 10.3 ***Annual average NO_2 concentration and the 99th percentile of the predicted 1-hour concentration at the points of predicted maximum ground-level concentration in µg/m3***

Averaging period	Operational Phase
Annual	1.1
1-hour	40.7

Predicted annual average NO_2 concentrations during the operational phase of the Project are shown as isopleths in *Figure 10.1* and compared to the NAAQS of 40 µg/m^3. The 99th percentile of the predicted 1-hour NO_2 concentrations are also presented as isopleths in *Figure 10.2* and compared with the NAAQS of 200 µg/m^3. No exceedences are observed.

The predicted annual average NO_2 concentrations are well below the NAAQS. The NO_2 concentrations predicted are a maximum concentration of 1.1 µg/m^3. The maximum concentrations occur just to the north of the facility.

The 99th percentile of the predicted 1-hour NO_2 concentrations during operation are lower with a predicted maximum concentration of 2.1 µg/m^3, which does not exceed the NAAQS. The predicted maximum concentration of 2.1 µg/m^3 occurs close to the proposed site. No exceedences are observed.

Figure 10.1 Annual average NO_2

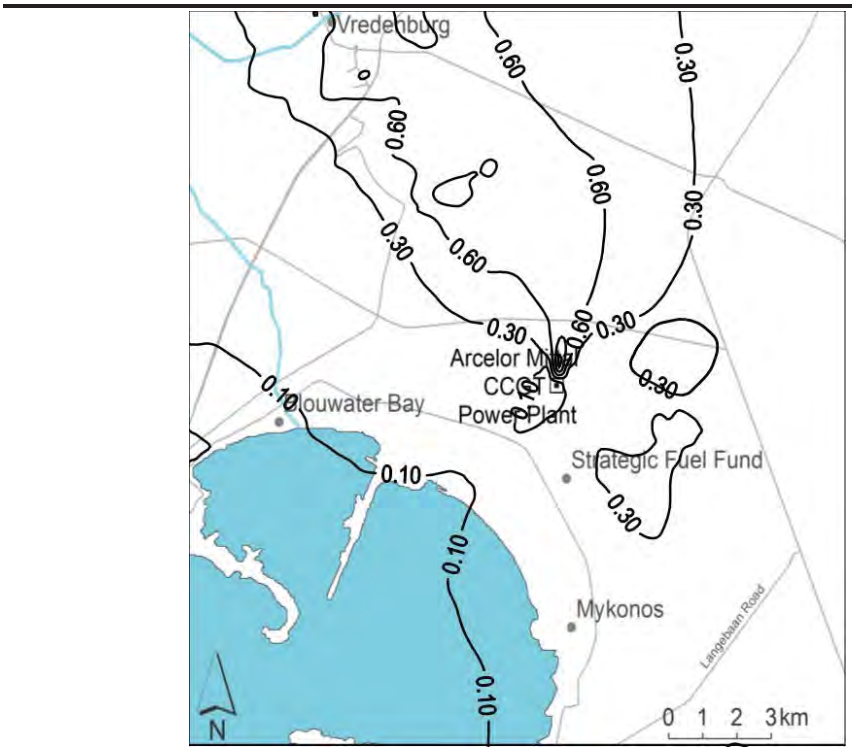
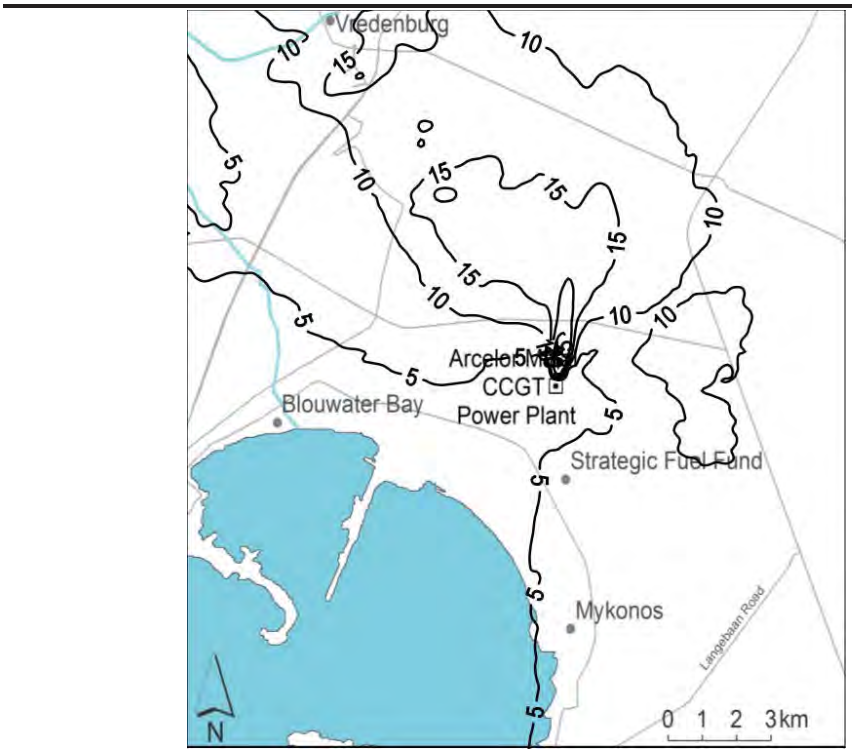


Figure 10.2 1-hour NO2



CO emissions

Predicted annual average and maximum 8-hour CO concentrations resulting from LNG combustion is very low and several orders of magnitude below the respective NAAQS. The concentrations at the points of predicted highest

ground-level concentration are presented in *Table 10.4*. No exceedences are observed.

Table 10.4 Maximum predicted CO concentrations in µg/m3

Averaging period	Operational phase
8-hour	6.1
1-hour	12.0

Figure 10.3 Predicted 8-hour average CO concentrations (µg/m3) resulting from emissions from ArcelorMittal CCGT power plant (operation)

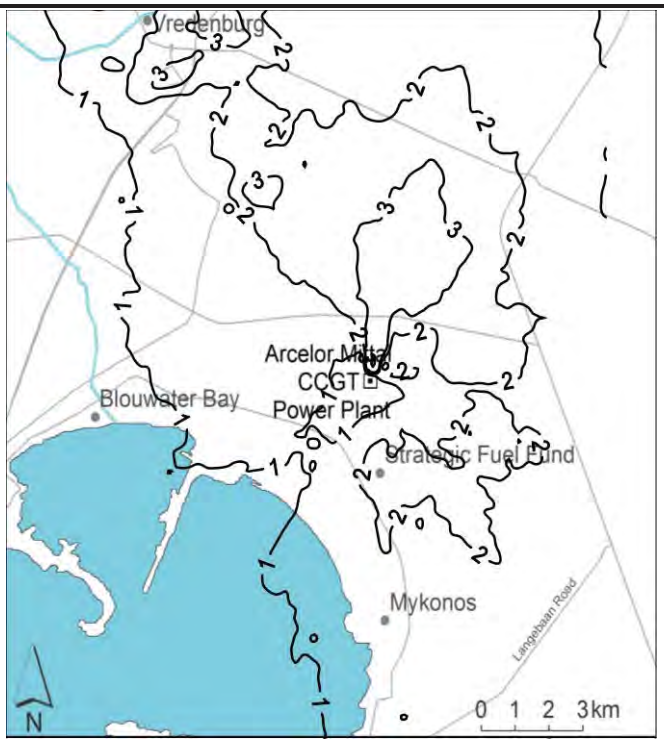
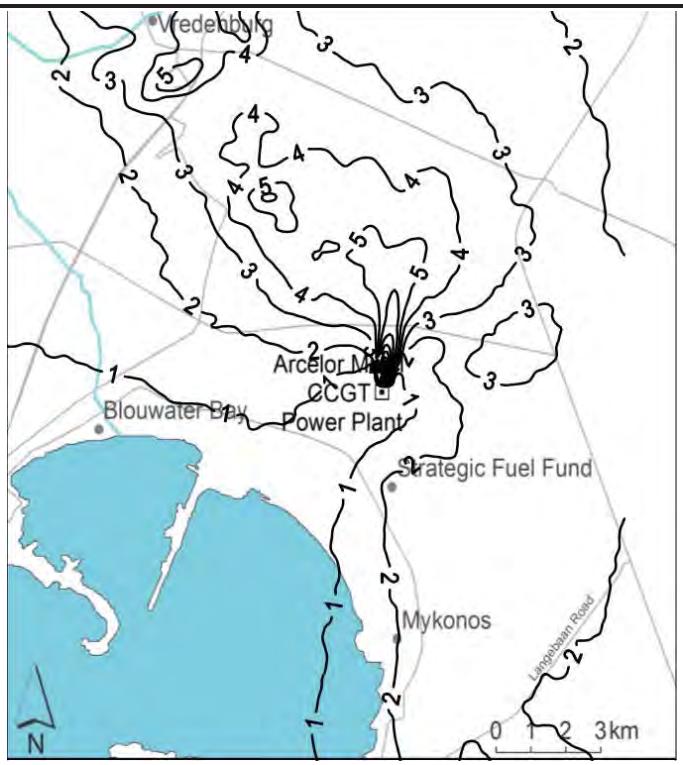


Figure 10.4 99th percentile of the predicted 1-hour CO concentrations (µg/m3) resulting from emissions from ArcelorMittal CCGT power plant (operation)



Impact Assessment

The impacts are predicted to be of local extent for all pollutants.

The scale of the impact is related to whether the predicted ambient concentrations of the pollutants exceed the limit values of the NAAQS in sensitive areas, i.e. residential or non-industrial areas. For all pollutants the predicted ambient concentrations are well below the respective NAAQS and the scale of the impact is scored low.

The sensitivity of receptors is rated as low as detailed for the construction phase impacts above.

The frequency of the impact is related to whether the predicted exceedances of the limit values exceed the permitted number of exceedances provided in the NAAQS, i.e. the tolerance. No exceedances of the NAAQS are expected. This impact is considered to be irreversible.

Proposed Mitigation

The following mitigation measures are proposed:

- Development and implementation of servicing programmes for all operational components of the facility.

- Stocking of critical components to ensure the availability of spares in the event of mechanical faults.

Box 10.2 ***Decreased ambient air quality during the Operational Phase of the Project***

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Low
- **Frequency:** Rare
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR

10.3.4 Residual Impacts

A summary of the impact of air emissions during the construction and operation phases of the Project is provided in *Box 10.1* and *Box 10.2*.

Table 10.5 ***Pre- and Post- Mitigation Significance for Air Quality***

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Decreased ambient air quality	Construction	Negligible	Negligible
Decreased ambient air quality	Operation	Minor	Minor

10.4 CLIMATE CHANGE

In the context of climate change impacts associated with GHG emissions from the Project, extent, duration, and frequency are the same irrespective of the Project context and the scale of its GHG emissions, and therefore do not form a good basis on which to assess the significance of the impacts associated with GHG emissions. Specifically, the extent of GHG (climate change) impacts is global, the duration of the impact is permanent (CO_2 has a residence time in the atmosphere of approximately 100 years), and the frequency of the impact is constant since GHG emissions will be produced throughout the lifetime of the plant.

As such, GHG impact significance is determined on the basis of the assessment of the scale of the GHG emissions from the power plant using benchmarks from international lender standards, further informed by reference benchmarks on the GHG intensity of electricity production for similar facilities and according to the grid emissions factor in South Africa, as

well as an analysis of the Project's alignment with South Africa's energy and climate change policies.

Table 10.6 summarises the Project's estimated annual GHG emissions during Operations (Phase 1 and 2). Emissions associated with the construction and eventual decommissioning of the Project are excluded from the assessment, since these are likely to be insignificant in the context of the Project's operational emissions arising from the combustion of LNG for power generation.

Total estimated annual emissions for the first phase of the Project (210 MW), assuming 8 400 operating hours per year, are 920 712 t CO_2e (0.92 Mt t CO_2e). For the second Phase (1 317 MW), annual emissions are estimated to be 3 677 050 t CO_2e (3.68 Mt t CO_2e). Cumulatively, after the completion of Phase 2, total annual emissions from both Phases (i.e. with five Trent60s and three SGT6-4000F turbines running concurrently) are estimated to be 4 597 761 t CO_2e. Assuming the same load factor and operating patterns, and not factoring in a decrease in thermal efficiency over time, total (cumulative) estimated emissions over the 30 year lifetime of the 1 507 MW [(1)] plant are in the range of 138 Mt CO_2e.

Table 10.6 Estimated GHG emissions arising from the operation of the Power Plant

Operational activity	Estimated Annual Emissions in Phase 1 (210 MW) (t CO_2e)	Estimated Annual Emissions in Phase 2 (1 317 MW) (t CO_2e)	Estimated Annual Emissions Phase 1 + 2 (1 507 MW) t CO_2e)	Data Source, Notes and Assumptions
Natural gas combustion for power production	920 633	3 676 971	4 597 604	Natural gas combustion volumes estimated based on: 16 327 920 GJ per year (Phase 1) and 65 213 074 GJ per year (Phase 2) (Engineer calculation); Lower Heating Value (LHV) for natural gas of 35 924 kJ / Nm^3 [(2);] and natural gas emissions factor of 2.0255 kg CO_2 / m^3 (ERM calculation based on API Compendium methodology) (API, 2009)

(1)Note that the total capacity according to the 210 MW (Phase 1) + 1 317.3 MW (Phase 2) is 1 527.3 MW. The slight discrepancy between this figure and the 1 507 MW mentioned for the whole plant is due to the estimated parasitic loads of the plant. This value will be confirmed upon final selection of the power plant equipment, and this report refers to an overall capacity of 1 507 MW.

(2) Response from PowerConsult to ERM on ERM's GHG Data Request – 26 June 2016.

Operational activity	Estimated Annual Emissions in Phase 1 (210 MW) (t CO_2e)	Estimated Annual Emissions in Phase 2 (1 317 MW) (t CO_2e)	Estimated Annual Emissions Phase 1 + 2 (1 507 MW) t CO_2e)	Data Source, Notes and Assumptions
Propane combustion in Gensets for back-up power	79	79	158	Estimated annual propane consumption based on one black start event every 5 years, assuming: average site load 2.5 MW; 220 kg propane per MWh generated; and 10 days' outage per event (Source: Response to ERM GHG data request by PowerConsult [1]. Applies IPCC 2006 Net calorific values (47.3 MJ / kg), carbon content (17.2 kg C / GJ, and CH_4 (0.001 kg CH_4 / GJ) and N_2O (0.0001 kg N_2O / GJ) emissions factors for Propane (IPCC, 2006a; IPCC, 2006b).
Total	**920 712**	**3 677 050**	**4 597 761**	

Table 10.7 illustrates the thermal efficiency of the plant, and the emissions intensity of grid electricity generated (using annual estimated emissions above and annual estimated generated electricity in MWh).

Table 10.7 Saldanha Gas-Fired Power Plant GHG emissions intensity and thermal efficiency

	Phase 1 (210 MW)	Phase 2 (1 317 MW)	Phase 1 + 2 (1 507 MW)	Data Source, Notes and Assumptions
Total estimated annual emissions (t CO2e)	920 712	3 677 050	4 597 761	Estimated total annual GHG emissions from the plant (calculations in *Table 10.6*)
Total annual electricity generation (MWh)	1 802 598	11 065 320	12 867 918	Plant net power (214.6 MW Phase 1 + 1 317.3 MW Phase 2) * 8 400 (annual operating hours)
Electricity emissions intensity (t CO_2e / MWh, or kg CO_2e / kWh)	**0.51**	**0.33**	**0.36**	Total annual emissions divided by total annual electricity output
Thermal efficiency	**39.93**	**58.30**	**56.51**	Thermal efficiency for Phase 1 and 2 using lower heating values (LHV) (Source: Response to ERM GHG data request) [2]

It should be noted that the GHG intensity factor, 0.36 t CO_2e per MWh for Phase 1 and 2 combined, reflects the emissions intensity of electricity generated by the plant for distribution. The total MWh output used to

[1] Email to ERM from Adrian Venzo, PowerConsult, 28 June 2016
[2] Response to ERM's information request from PowerConsult, 23 June 2016

calculate the emissions intensity excludes auxiliary power consumption by the plant, and excludes losses from transmission and distribution.

Finally, it is important to note that two of the Project's objectives relate to 'Education' and 'Demonstrating Technology', and that the Project plans to install 400 kW of renewable energy – namely solar PV – which will be used to provide stand-by emergency DC power and will power various features and activities including the main building LED lighting as well as the security lighting. The use of renewable (low carbon) energy to power these auxiliary processes will help to further reduce the emissions intensity of the plant.

Impact Description

The Project will result in the emission of greenhouse gases (GHGs) predominantly during the operational phase of the project, contributing to global climate change.

Impact Assessment

Contribution of the Project to South Africa's national GHG inventory

Table 10.8 illustrates the magnitude of the Project's emissions relative to South Africa's national GHG emissions.

Table 10.8 Estimated GHG Emissions from the 1 507 MW Gas-Fired Power Plant Relative to Projected GHG Emissions for South Africa

Year	Estimated annual emissions – South Africa (t CO_2e)– PPD Lower Range	Estimated annual emissions – South Africa (t CO_2e)– PPD Upper Range	Estimated annual emissions – Saldana Gas-Fired 1 507 MW Project (t CO_2e)*	Saldana Gas-Fired 1 507 MW Project % contribution to South Africa's projected national GHG emissions (as a % of upper and lower Range PPD trajectory)
2020*	398 000 000	583 000 000	4 597 761	0.8 – 1.2%
2025	398 000 000	614 000 000	4 597 761	0.7 – 1.2%
2030	398 000 000	614 000 000	4 597 761	0.7 – 1.2%
2035	398 000 000	614 000 000	4 597 761	0.7 – 1.2%
2040	336 000 000	552 000 000	4 597 761	0.8 – 1.4%
2045	274 000 000	490 000 000	4 597 761	0.9 – 1.7%
2050	212 000 000	428 000 000	4 597 761	1.1 – 1.2%

* Assumes Phase 2 will have commenced operations by 2020
Source: DEA (2011) and DEA (2014a) (estimated annual emissions for South Africa using lower and upper ranges of PPD). A linear decline to INDC targets by 2050 from 2035 levels is assumed.

As illustrated above, the Project's GHG emissions are estimated to comprise 0.8 – 1.2% of South Africa's national emissions in 2020, rising to 1.1 – 1.2% in 2050.

Scale of the Project's Emissions relative to GHG Magnitude Scale from Wider Standards

Various international lender organisations including the IFC, EBRD and EP, give guidance on the scale of a Project's GHG emissions based on thresholds of annual emissions that trigger requirements for quantifying, reporting and mitigating Project GHG emissions. The magnitude scale derived from these organisations is illustrated in *Table 10.9*.

Table 10.9 Magnitude scale for project-wide GHG emissions based on wider standards

Project-Wide GHG Emissions / annum	Magnitude Rating
>1 000 000 tonnes CO_2e	Very Large
100 000 – 1 000 000 tonnes CO_2e	Large
25 000 – 100 000 tonnes CO_2e	Medium
5 000 – 25 000 tonnes CO_2e	Small
<5 000 tonnes CO_2e	Negligible

Based on the magnitude scale above, and considering the estimated annual GHG emissions from the final 1 307 MW Project (4 597 761 t CO_2e), the magnitude of the project's GHG impact is considered to be **Very Large**. It should be noted that, in the absence of abatement technologies such as Carbon capture and storage (CCS) (which has historically almost exclusively been applied to coal – rather than gas - fired power plants), most if not all fossil-fuel based power plants will fall into this category by nature of their significant GHG emissions.

Benchmarking performance against other gas-fired power plants

The Project's estimated emissions intensity and stated thermal efficiency are compared to benchmarks for alternative gas-fired power plant technologies in *Table 10.10* below.

Table 10.10 Benchmarking emissions intensity and thermal efficiency of the Project against alternative gas-fired power plant technologies

Coal-fired power plant name / technology	Thermal efficiency (LHV, net)	CO_2e intensity factor (LHV, net)	Reference
The Project	39.93% (Phase 1); 58.30% (Phase 2); 56.51% (combined)	0.51 kg CO_2e / kWh (Phase 1); 0.33 kg CO_2e / kWh (Phase 2); 0.36 kg CO_2e / kWh (combined)	ERM calculations – see *Table 10.7*
Open cycle gas turbine (OCGT)	30 – 40%	0.48 – 0.58 kg CO_2e / kWh	IEA ETSAP (2010), C2ES (n.d.), IPIECA (n.d.)
Closed cycle gas turbine (CCGT)	50 – 60%	0.34 – 0.40 kg CO_2e / kWh	IEA ETSAP (2010), C2ES (n.d.), IPIECA (n.d.)
CCGT with Carbon capture & storage (CCS)*	Reduction of 7-8%	0.04 kg CO_2e / kWh	IEA GHG (2012)

* Based on a techno-economic study on CO_2 capture at natural gas fired power plants modelled using plant simulation software. Reflects results for post-combustion capture technologies.

The results from the benchmarking assessment highlight the following key messages:

- Thermal efficiency for Phase 1 (comprising six Siemens Trent60, OCGT plants) is reported to be 39.93% (net), and the emissions intensity is estimated to be 0.51 tCO_2e/MWh. This is within the expected range and is at the higher end of what can be expected (i.e. the proposed plant has relatively high thermal efficiency and low GHG intensity) for OCGT technologies;

- Thermal efficiency for Phase 2 (comprising three Siemens SGT5-4000F CCGT plants) is reported to be 58.30% (net), and emissions intensity is estimated to be 0.33 tCO_2e/MWh. This is on the higher end of what can be expected for CCGT technologies (i.e. relatively high thermal efficiency and low GHG intensity), and represents a significant improvement on Phase 1 from a GHG emissions perspective; and

- There is the potential for CCS to reduce the GHG intensity of fossil fuelled power plants significantly, though with a penalty on thermal efficiency which decreases due to the additional auxiliary power required for the carbon capture technologies. However, as noted, CCS technologies have to date almost exclusively been applied at coal-fired power plants, and the technology has not yet been demonstrated in South Africa, so this is not at present considered to be a viable option for the Saldanha Steel gas-fired power plant.

Implications of the Project on the South African grid emissions factor

The GHG intensity factor for the plant is estimated to be **0.51 t CO_2e / MWh** in Phase 1 and **0.33 t CO_2e / MWh** in Phase 2, based on total estimated annual GHG emissions and total electricity generated and sent to the grid (i.e. excluding plant auxiliary consumption and any losses from transmission and distribution). For Phase 1 and 2 combined, based on total estimated annual GHG emissions and total electricity generated, the emissions intensity is estimated to be **0.36 t CO_2e / MWh.**

By comparison, the emissions intensity of the electricity generated by Eskom (representing 95% of electricity generated and distributed in the South African electrical grid), for the period 1 April 2014 to 31 March 2015, as published by Eskom, was **1.01 t CO_2e / MWh** (further discussion in the specialist study in *Annex D*). This factor is based on total GHG emissions from Eskom facilities (noting that 90% of Eskom's power in 2014-15 was generated from coal and the remaining 10% from low-carbon energy sources), and total electricity generated and sent to the grid, excluding Eskom (auxiliary) consumption and excluding transmission and distribution losses.

The above analysis suggests that the emissions intensity of the electricity generated by the Project represents a significant improvement relative to the current grid emissions factor for South Africa. It also represents an

improvement relative to the emissions intensity of Eskom's gas power plants, which have historically run on liquid fuels (diesel and kerosene), and which in 2011 were reported to have an average intensity of **0.82 t CO_2e / MWh.**

Alignment with South Africa's climate change policy and international GHG mitigation commitments.

There is a clear mandate from the DoE for the procurement of additional capacity (3 126 MW) from gas-fired power plants under the Gas to Power Program and in alignment with the electricity generation plans set out in the IRP 2010-2030 (2010). The alignment between IRP 2010-2030 (2011) and the Government's Peak, Plateau and Decline (PPD) GHG emissions trajectory (which forms the basis of South Africa's climate change strategy and international GHG mitigation commitments) is undertaken in order to understand the project's alignment with South Africa's climate change mitigation commitments. An assumption is made that this project forms part of the allocation to gas-fired power plants under the IRP, and that electricity generation and new power projects will be aligned to the IRP 2010-2030 and not exceed it. The substantial changes in the economic and electricity landscape since 2011, when the IRP 2010-2030, should also be noted.

Noting the above, the DEA's Mitigation Potential Analysis study conducted in 2014, more aggressive decarbonisation of South Africa's energy supply will be needed in future iterations of the IRP if the targets set out in the PPD are to be achieved. Whilst this introduces some uncertainty as to the level of electricity generation that will come from coal post-2030, the introduction of new gas-based power will help to bring about the transition to a lower carbon energy mix required in order to meet the country's climate change commitments.

Project GHG impact significance rating

The above analysis shows that the magnitude of the Project's GHG emissions, estimated to be 4 597 761 t CO_2e annually during operations on completion of Phase 2, is '**Very Large**', as per the benchmarks from international lender standards which apply the highest rating ('Very Large') to projects emitting >1 000 000 t CO_2e per annum. Relating this to the impact significance scale being used for the project, this translates to an overall significance rating of **Major (Negative)**. As noted, in the absence of abatement technologies such as CCS, most (if not all) coal and gas power plants will fall into this category by nature of their significant GHG emissions.

Whilst the Project's GHG emissions and therefore climate change impacts are significant, these findings should be considered in the context of the following positive impacts associated with the Project in relation to efficiency and impact on the South African average grid factor:

- The power plant (notably Phase 2 which uses combined cycle technologies) has a high thermal efficiency (Phase 2: 39.93%; Phase 2: 58.3%) and low emissions intensity (Phase 1: 0.51 t CO_2e / MWh; Phase 2:

0.33 t CO_2e / MWh) both in terms of what is achievable for gas-fired power plants, and also when compared to coal-fired power plants [1]; and

- The emissions intensity of electricity generated by the power plant (0.51 t CO_2e / MWh in Phase 1 and 0.33 t CO_2e / MWh in Phase 2, or 0.36 t CO_2e / MWh for Phases 1 + 2 combined) is a significant improvement on the average emissions intensity of Eskom's plants of 1.01 t CO_2e / MWh. With electricity generated in Phase 2 likely to feed into the national grid, this Project will therefore help to contribute to a reduction in the average grid emissions intensity.

Finally, it is also important to note that the Project is being developed in line with South Africa's energy policy, which (through the IRP 2010-2030) seeks to increase installed capacity in order to meet increasing demands on the grid, and which (through the GUMP and the Gas to Power IPP Programme) seeks to initiate the development of South Africa's gas economy.

Proposed mitigation

The following specific emissions management measures are suggested:

- It is important that the plant's thermal efficiency is being maximised throughout the life of the plant in order to reduce the gas consumption and therefore GHG emissions per unit of electricity (i.e. kWh or MWh) generated. The plant should seek to identify specific measures that can be implemented in order to maximise thermal efficiency and therefore minimise GHG intensity over time. This will need to be based on a plant specific assessment informed by the operations and maintenance (O&M) requirements for the equipment in question, and assessments should be carried out upon final selection of the equipment and, subsequent to the commencement of operations, periodically.

- Whilst noting that, at present, the assumption is for the plant to operate for 8 400 hours per year (96% load factor) throughout its lifetime, it will be important to manage any changes to operating philosophy should these arise for example as a result of changes in grid dispatch rules (this will mainly be applicable to the three Siemens SGT5-4000F turbines in Phase 2 which are likely to feed electricity into the grid). Whilst noting that any reduction in the operating time or load factor (i.e. annual power generation in MWh) is likely to result in decreased total annual emissions from the plant, such changes to cycling philosophies could have an adverse impact on thermal efficiency and GHG intensity per MWh generated as a result of increased start-ups and wear and tear on the plant. As such, the potential impact of any future changes in operating

[1] For comparative purposes, coal-fired power plants have thermal efficiencies in the range of 30 – 38 % (subcritical plants) or 38 – 45 % (plants using supercritical steam technologies), and corresponding emissions intensities of > 0.88 t CO2e / MWh (subcritical plants), or 0.67 – 0.88 t CO2e / MWh (supercritical plants). Source: IEA (2012a), IEA (2012b), and Michener (2012).

philosophy should be investigated and managed for example through upgrades to plant hardware and modifications to operating practices, as applicable.

- The Project documents note the potential for converting at least two of the 42 MW Trent60 OCGTs in Phase 1 to combined cycle at a later stage for improved efficiency [1]. Whilst noting that the technological and economic feasibility of such a change will need to be assessed when that time comes, it is recommended that the option to make such a change is reviewed periodically and implemented when possible, and on as many of the six Trent60 turbines as is feasible. This will allow the Project to benefit from the much improved efficiencies and reduced emissions associated with the use of combined cycle technologies, and will improve the GHG profile of the plant.

- The development and implementation of a GHG management plan is critical if GHG emissions from the plant are to be managed over time. Since GHG emissions are primarily driven by the fuel consumption at the plant and are closely linked to the plant's heat rate and thermal efficiency, this can take the form of a combined thermal efficiency and GHG management plan. Key elements of a thermal efficiency / GHG management plan include:

    - Development of an overarching policy statement indicating the Plant's commitments with respect to minimising GHG emissions and implementing actions to ensure optimum emissions management;
    - Measuring GHG emissions on an annual basis [2], which will require data on:
        - the total amount of gas consumed, its chemical properties and GHG emissions factor; and the consumption of any other fuels such as LPG for the black starts; and
        - Plant heat rate / thermal efficiency should be closely monitored over time as this is closely correlated to the GHG intensity of the plant.
    - Setting short, medium and long-term targets relating to maximising and maintaining heat rate / thermal efficiency and GHG intensity (t CO_2e per MWh generated) over time, against which performance can be assessed;
    - Tracking South Africa's evolving GHG and energy related regulations, including the implications / requirements for the Plant of the proposed carbon tax, GHG reporting regulations, and energy reporting regulations, all of which are currently in draft form but likely to be finalised in 2016 or 2017;

[1] Updated Information for EIA Input and Consideration: 1 500 MW Saldanha Gas-to-Power Project. PowerConsult. 12 June 2016

[2] For example, IFC Performance Standard 3 requires that 'For projects which are expected to or currently produce more than 25 000 tonnes of CO_2e-equivalent annually'… 'Quantification of GHG emissions will be conducted by the client annually in accordance with internationally recognized methodologies and good practice'

- Identifying and implementing heat rate improvement / GHG reduction projects, based on any deviations from expected heat rate and knowledge of required maintenance or upgrades. Internal and external energy audits should be used to help identify opportunities for performance improvement, and a business case can be developed for each area of opportunity to help prioritise projects. More significant projects can be implemented during the major maintenance overhauls as scheduled by the Plant;
- Allocating responsibility to key individuals such that someone (or a team of individuals) is responsible and accountable for managing and reporting on the GHG performance of the plant;
- Communicating the Plan, including its key objective and any actions being taken, to staff working at the plant to ensure buy-in;
- Encouraging employee participation in the GHG management plan, including contribution of ideas relating to opportunities for improvement; and
- Reporting progress over time with respect to annual gas consumption and GHG emissions, GHG reductions / heat rate improvements achieved, and progress against targets set.

The Department of Energy (DoE) is currently developing an Energy Efficient Monitoring System (EEMS) to track the efficient consumption of energy within South Africa and the trends involved. The DoE will need reliable data from all legal entities operating in the most intensive sectors of the economy and they have set certain thresholds, that if exceeded will require certain steps to be taken:

- Companies using 400 terajoules or more per annum will be required to submit a detailed energy management plan; and
- The energy management plan must include an energy baseline determined in accordance with SANS 50001, as well as areas of energy efficiency savings potential and energy performance indicators. Additionally, it will be required to submit a list of technically and financially viable measures that can be put in place to meet the savings potential

- The Project plans to make use of solar PV energy to meet some of the plant's auxiliary load requirements. As a low or 'no' carbon form of energy, solar PV provides a means of reducing the emissions intensity of the plant and of the electricity it produces. Renewable energy can play a key role in the site's GHG emissions management plan and further opportunities to install more renewable capacity on-site should be investigated going forwards.

Box 10.3 Contribution to Climate Change

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: High

Impact Magnitude: Very Large

- **Extent:** Transboundary/International
- **Duration:** Long term
- **Scale:** High
- **Frequency:** Rare
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MAJOR
IMPACT SIGNIFICANCE (POST-MITIGATION): MAJOR

10.4.2 Residual Impacts

Whilst the above mitigation measures will help to ensure that GHG emissions are minimised as far as possible, the only mitigation technology that is likely to achieve deep cuts on GHG emissions from a combined-cycle gas power plant is CCS, which as discussed has yet to be demonstrated in South Africa. Thus the residual (post-mitigation) impact rating for the project will remain as Major (Negative).

A summary of the impact of climate change during the operation phase of the Project is provided in *Box 10.1* and *Box 10.2*.

Table 10.11 Pre- and Post- Mitigation Significance for Climate Change

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Contribution to climate change	Operation	Major	Major

10.5 INCREASED NOISE LEVELS

Relevant legislation and guidelines

In South Africa, the guideline for environmental noise is SANS 10103:2008. It defines land use districts and acceptable sound levels for day and night time noise.

Figure 10.5 Acceptable Sound Levels for Noise in Districts (SANS 10103:2008)

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req,T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}$[a]	Daytime $L_{Req,d}$[b]	Night-time $L_{Req,n}$[b]	Day/night $L_{R,dn}$[a]	Daytime $L_{Req,d}$[b]	Night-time $L_{Req,n}$[b]
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

SANS 10103:2008 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in sound level, the following criteria are of relevance:

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.

- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.

- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Note that an increase of more than 7 dBA is defined as a disturbing noise and prohibited (National and Provincial Noise Control Regulations).

International guidelines have also been considered in this impact assessment. The International IFC (Equator Principle) General EHS Guidelines for Residential; Institutional and Educational receptor types stipulates ambient noise levels as:

- Use of LReq,D of 55 dBA during the daytimes; and
- Use of LReq,N of 45 dBA during the night-times.

Baseline conditions

The area to the south, west and north of the proposed Project site is used for industrial purposes, with ambient sound levels west and north reflecting this industrial use.

The closest potential noise-sensitive receptors are located more than 2,000 m to the south-east. See *Figure 10.6*.

The following measurements have been recorded at sites in close proximity to the Project site, see *Table 10.12* and then through single measurements in the Project area, *Table 10.13*. Measurement locations are shown in *Figure 10.6*.

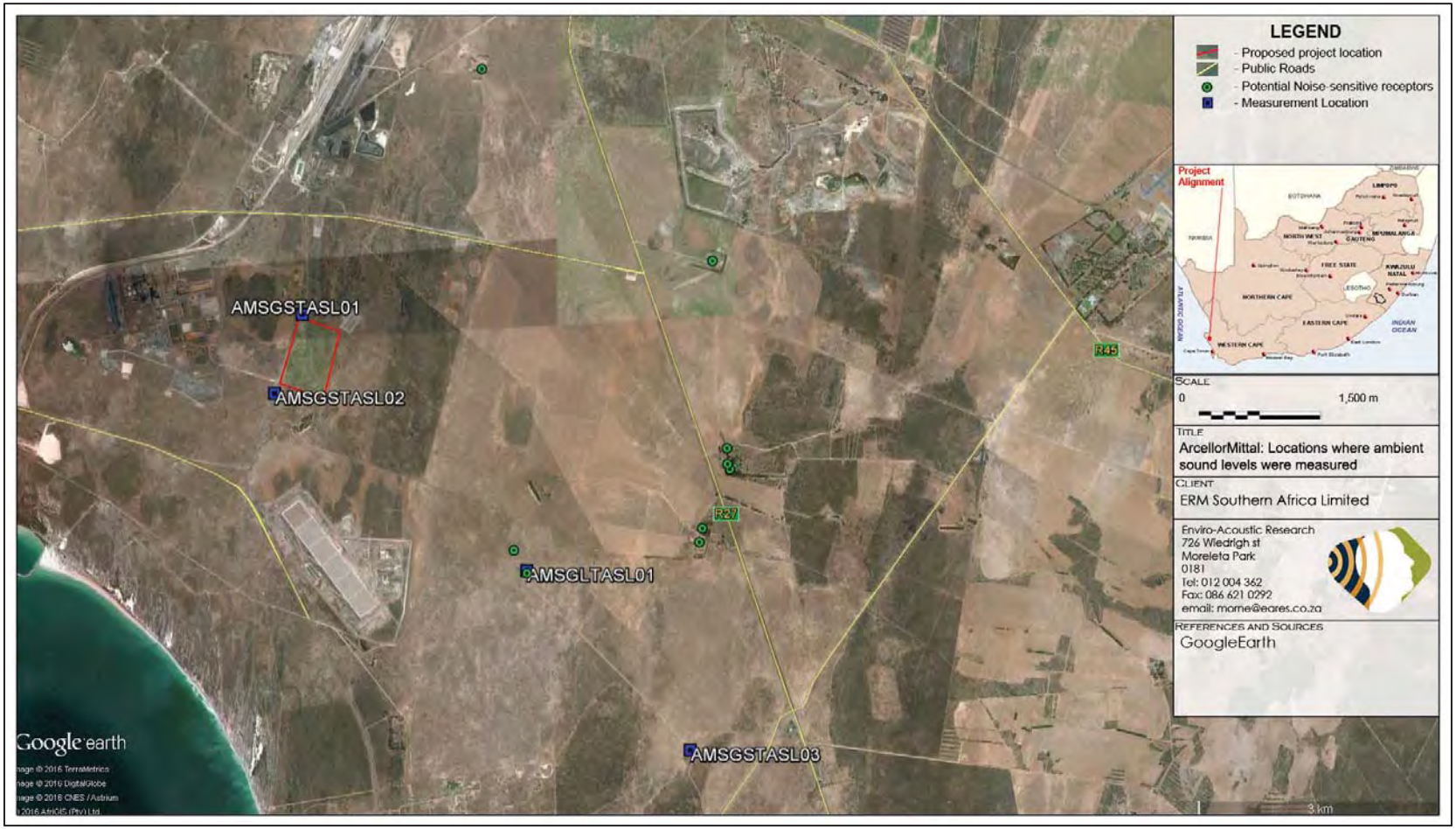
Table 10.12 Ambient Sound Level Measurements

Measurement	Day time	Night time
$L_{Aeq,10min}$ values	37 to 77 dBA	40 to 55 dBA
$L_{Aeq,I}$ arithmetic mean	49 dBA	47 dBA
$L_{Aeq,I,}$ equivalent sound levels	61 dBA	47-49 dBA
$L_{Aeq,10min,f}$	35to 74 dBA	38 to 54 dBA
$L_{Aeq,f}$ arithmetic mean	47 dBA	46 dBA
$L_{Aeq,f,}$ equivalent sound levels	55, 58 and 48 dBA	48 and 46 dBA
L_{FA90}	26 to 54 dBA90	23 to 50 dBA
L_{FA90} average	37 dBA	35 dBA
LIAeq - LFAeq average difference	2.6 dBA	1.3 dBA

Table 10.13 Results of single measurements of ambient sound levels

Measurement location	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} Level (dBA90)
AMSGSTASL01	76	73	52
Daytime	76	73	50
AMSGSTASL01	51	47	45
Night-time	52	48	45
AMSGSTASL02	75	72	51
Daytime	75	72	51
AMSGSTASL02	49	46	45
Night-time	51	47	46
AMSGSTASL03	49	47	39
Daytime	47	45	37
AMSGSTASL03	37	29	24
Night-time	32	24	20

Figure 10.6 Locations where ambient sound levels were measured



Given the ambient noise level measurements, the SANS 10103:2008 rating levels typical of a Rural Noise District have been considered for the noise impact assessment for this Project:

- Rating Level during the day (LReq,D) of 45 dBA; and
- Rating Level during the night (LReq,N) of 35 dBA.

10.5.2 Increased Noise Levels during the Construction Period

Impact Description

Noise levels are expected to increase as a result of construction activities on site. These activities include:

- Numerous road trucks that deliver various construction equipment;
- Earthworks using a combination of one or more graders, bulldozers, excavators and front-end-loaders for the clearing of vegetation, the levelling of the ground surface as well as developing access roads;
- The development of laydown areas for equipment and material;
- Dump or road trucks to deliver road building material as well as equipment used in road construction (grader, vibratory steel drum roller, bitumen sprayer, paver, roller and water truck);
- The use of one or more backhoe-loaders for the digging of trenches, foundations and assist in the installation of security fencing;
- Piling activities if required;
- The development of onsite batching plants or the delivery of ready-mix concrete using trucks, formwork, rebar construction and the pouring of concrete;
- Construction of buildings and installation of power generation structures and components (road trucks, cranes, welding, various impulsive sounds); and
- Cleaning of site, loading and removal of unused construction equipment.

Construction activities are highly variable, taking place at different locations, using various equipment, each piece of equipment operating under a different load. As a result, noises generated during the construction phase are highly variable and cannot be defined. The approach taken in this assessment is to assume a number of construction activities at numerous locations using various equipment, all operating at full load.

The location of activities that are likely to generate noise during the construction phase of the Project can be seen in *Figure 10.7*.

Impact Assessment

The anticipated ambient noise levels during the construction phase of the Project have been modelled using a sound propagation model. This has been presented in this report for the night-time noise impact only given that noise generated during the day by construction activities may be masked by other noises from a variety of sources surrounding potentially noise-sensitive developments. The night-time noise impact has therefore been used as the worst case scenario. It should be noted however that construction during the night is not anticipated and working hours are likely to be 6am until 6pm. The results thereof can be seen in *Figure 10.8*.

It is anticipated that the change in ambient noise levels will be negligible. Ambient noise levels are not expected to exceed the 35 dBA guideline at any of the identified receptors, although the construction phase sound levels may impact on the ambient noise levels for an area of 2 500 m from the proposed activity. This impact is considered to be irreversible.

Proposed Mitigation

Based on the modelling of the worst case scenario no mitigation measures are required.

Box 10.4 Increase in Ambient Noise Levels during the Construction Phase (Night time)

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium to High

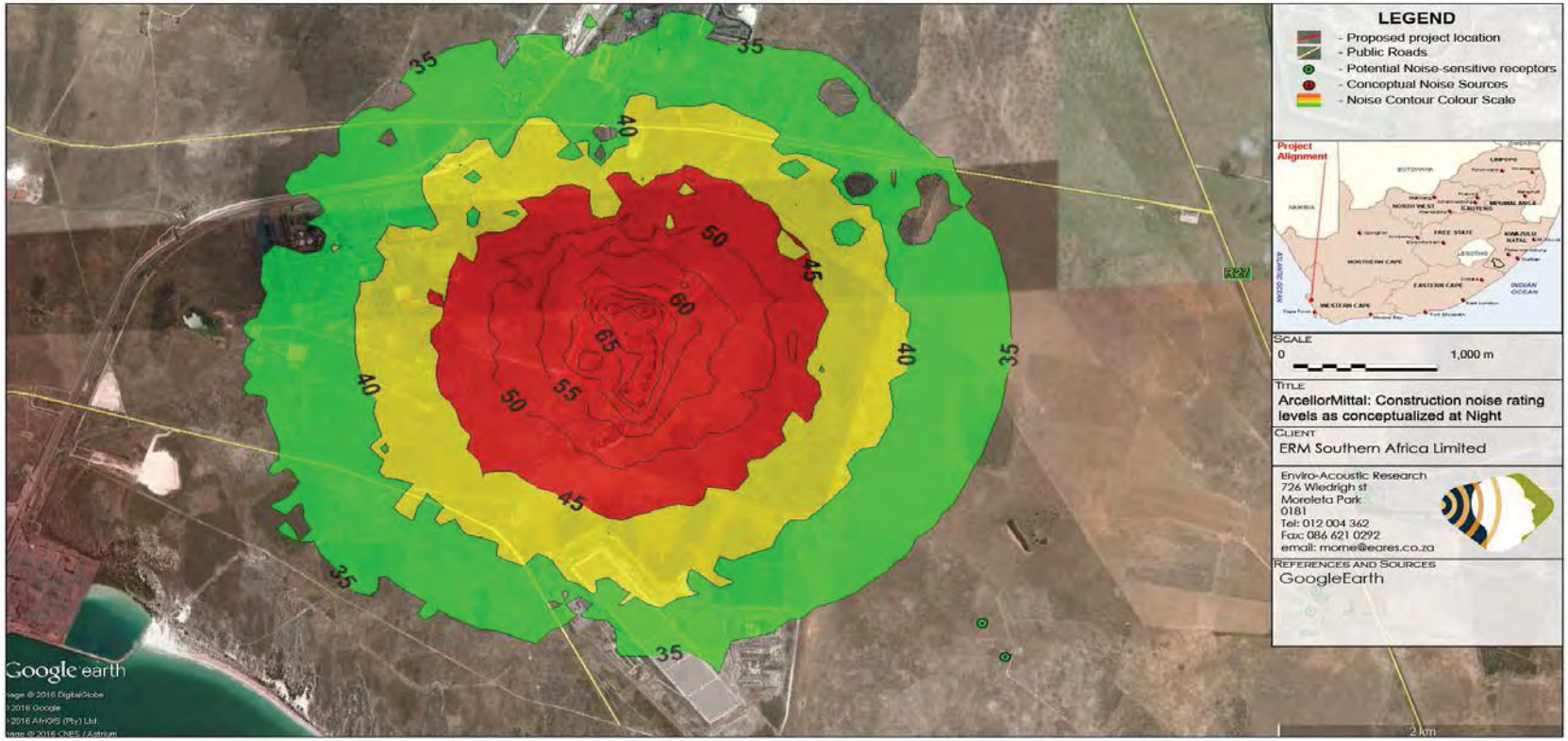
Impact Magnitude: Small

- **Extent:** Local
- **Duration:** Short term
- **Scale:** Low
- **Frequency:** Constant
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGIBLE. NO MITIGATION REQUIRED

Figure 10.7 Location of activities that are likely to generate noise

Figure 10.8 Contours of Noise Rating Levels for night-time construction activities



10.5.3 Increased Noise Levels during the Operational Phase

Impact Description

The operational phase of the Project will be undertaken over two phases and two different power generating regimes could be adopted depending on the supply agreement that is signed with Eskom.

The two development phases are: Phase 1 - the initial period to provide power to meet the demand for ArcelorMittal Saldanha Steel via an open cycle process; and Phase 2 - the second phase to supply additional power to feed other consumers via a combined cycle process. Both Phases will produce a mix of base load and peaking power.

Phase 1: Five Siemens Trent 60 50 MW open cycle gas turbines and ancillary equipment for peak power generation (six will be constructed with one turbine as backup).

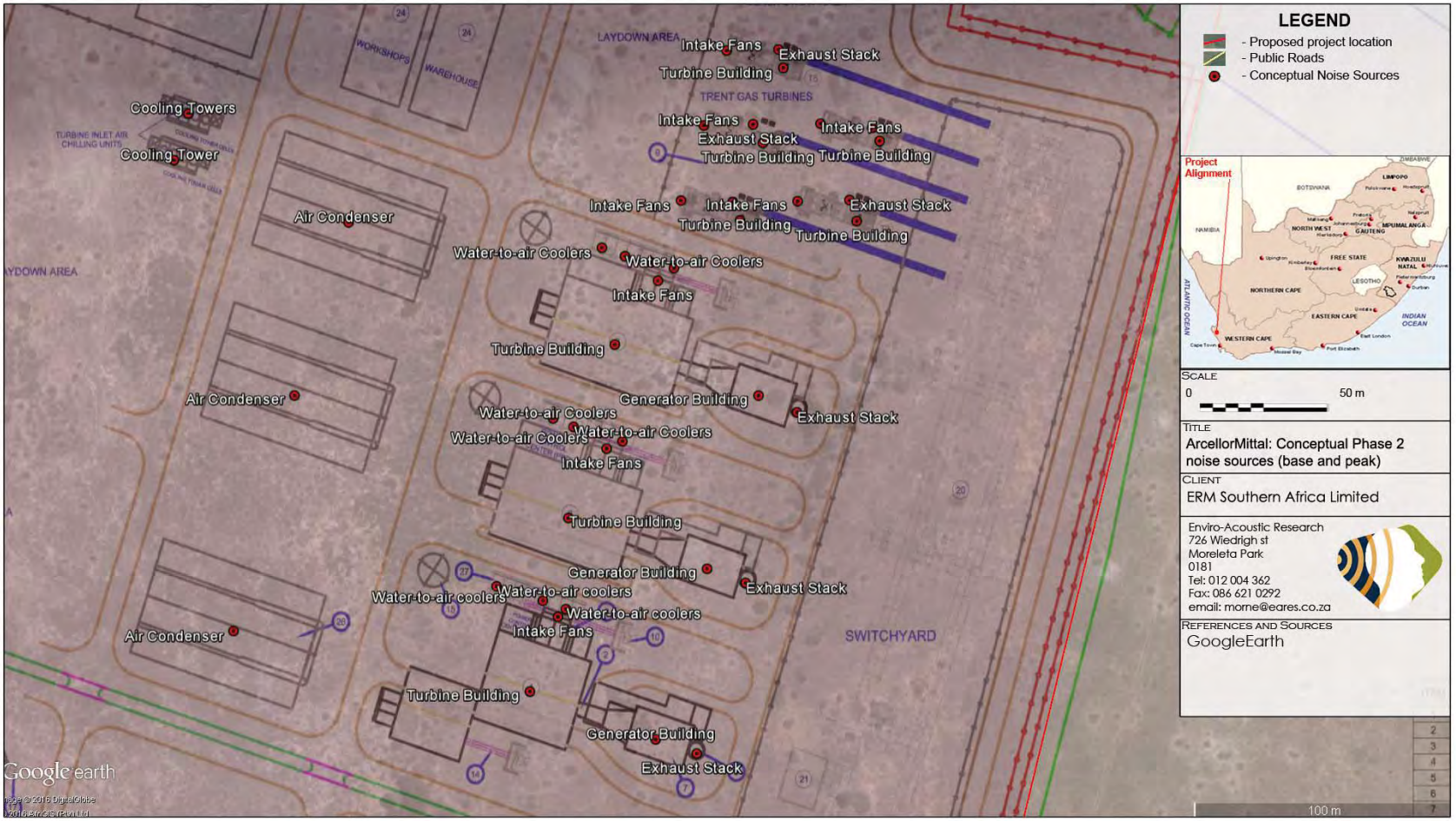
Phase 2: Three complete Siemens SGT5-4000F combined cycle power plants and ancillary equipment (gas turbines, heat recovery boilers, steam turbines, steam turbine condensers).

Both of these have been assessed for the operational phase impact and the following noise sources have been identified:

- The air intake fans;
- Fans located on the air and steam condensers;
- Gas turbine, steam turbine and generator (normally within building);
- Ventilation fans located on the turbine generator building; and
- Exhaust and flue stacks.

These sources can be seen in *Figure 10.9*.

Figure 10.9 Conceptual Noise Sources – Operational Phase



Noise will also be generated during the start-up and commissioning phase of the power plant, as follows:

- Hot commissioning and clean-out of the heat recovery boiler hot–path exchanger bundles and the super-heater piping using high pressure, high temperature steam in order to clean the pipe internals of all welding debris and mill scale. The high pressure steam would be vented to atmosphere, generating high noise levels for around 2 - 4 hours per day over 2 – 4 days.

- Hot commissioning of steam piping running from heat recovery steam generation (HRSG) to steam turbines, during 'blow-out' operations to clean the pipe internals of all debris and mill scale. High pressure steam will be blown through the live steam line and vented to atmosphere. This process could last for 3 – 4 hours per day for up to 2 – 4 days.

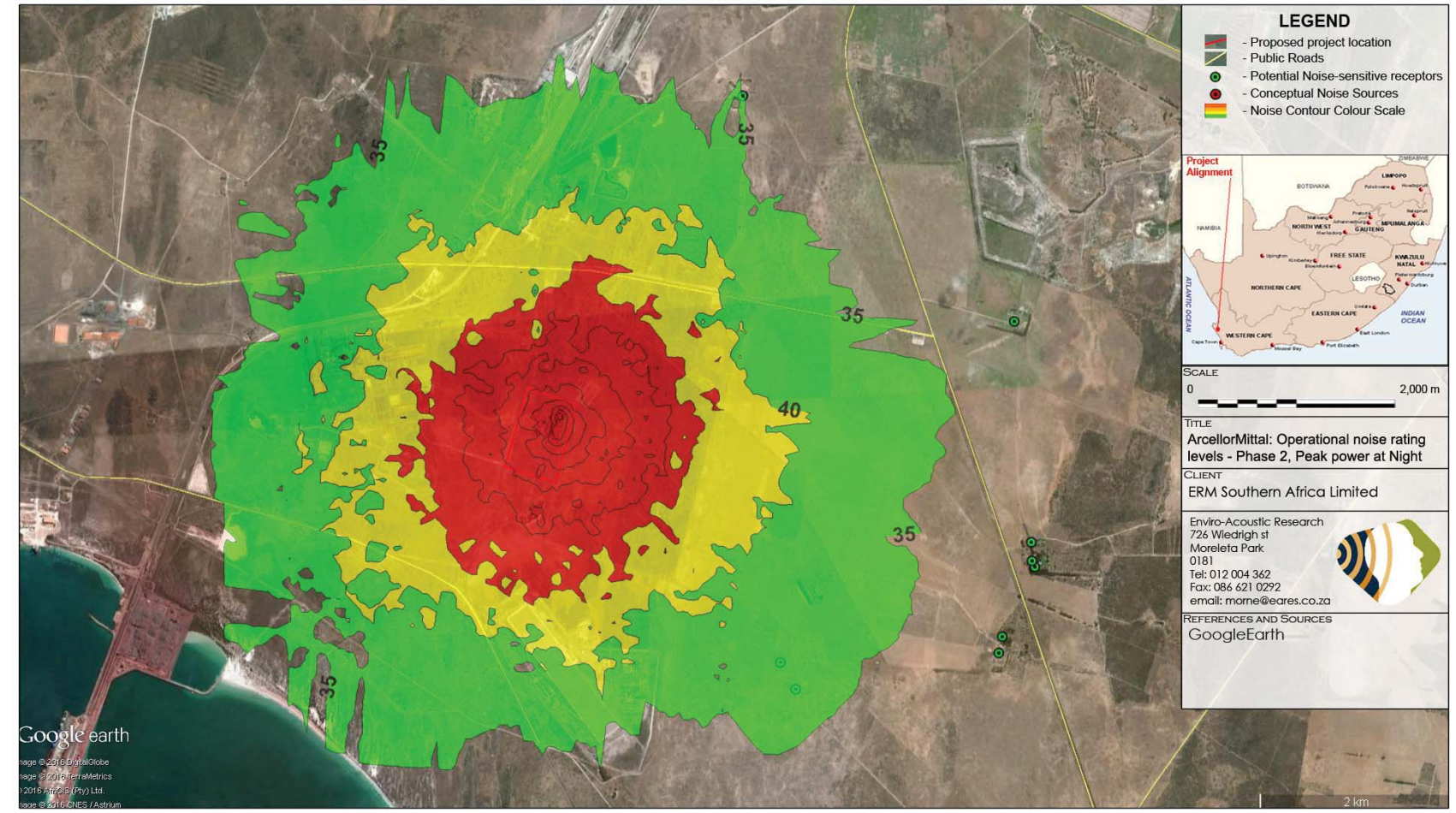
- Testing of high pressure steam safety valves during commissioning could generate a sound pressure level of 160 dBA. This state would be sustained intermittently only for a few minutes at a time over a one hour period at most.

These can be considered temporary noises, and excluding the testing of the safety valves, the noise levels are similar to the noises modelled for the operational phase of the Project. Noises from the testing of the safety valves will be high, but very temporary and the testing will be taking place during the day, when noises are of lower concern than noises at night.

Impact Assessment

The anticipated ambient noise levels during the operation phase of the Project have been modelled using a sound propagation model. This has been presented in this report for the night-time noise impact only given that daytime levels are anticipated to be lower and noise generated during the day by the power plant may be masked by other noises from a variety of sources surrounding potentially noise-sensitive developments. The worst case scenario in terms of noise generation during the operational phase has also been modelled, namely that of peaking power production throughout the night. The results thereof can be seen in *Figure 10.10*.

Figure 10.10 Contours of Noise Rating Levels for night-time operational activities (peaking power)



It is anticipated that the change in ambient noise levels will be negligible during Phase 1 of the Project and low during Phase 2, with the 35 dBA ambient guideline being slightly exceeded (by less than 3 dBA) at two sensitive receptors. Operational phase sound levels may impact on the ambient noise levels for an area of 3 000 m from the Project site. This impact is considered to be irreversible.

Proposed Mitigation

Given that the impact is anticipated to be Minor, monitoring is proposed if there are noise complaints or if people in the future settle closer than 2,000 m from the power plant.

Box 10.5 Increase in ambient noise levels during the Operation Phase (Night time)

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium to High

Impact Magnitude: Small

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Low
- **Frequency:** Constant
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR

10.5.4 *Increased Noise Levels during Decommissioning Phase*

Decommissioning starts when power generation stops, signalling the beginning of the dismantling of the equipment. Activities that can take place include:

- Dismantling of all equipment;
- Removal of all remaining redundant infrastructure (buildings and structures, dams, workshop, access roads, possibly the offices and other buildings, etc.);
- Removal of any contaminated soil;
- The rehabilitation of disturbed areas including the necessary ripping of compacted soils and the shaping of rehabilitated areas to ensure free drainage;
- Seeding of disturbed areas (if necessary to re-establish vegetation); and
- Monitoring and maintenance of the rehabilitated areas.
- Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment (due to the decreased urgency of the Project). While there may be various activities, there is a very small risk for a noise impact.

10.5.5 *Residual impacts*

A summary of the impact of noise levels during the construction and operation phases of the Project is provided in *Table 10.14*.

Table 10.14 Pre- and Post- Mitigation Significance for Noise

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Increase in ambient noise levels	Construction	Negligible	Negligible
Increase in ambient noise levels	Operation	Minor	Minor

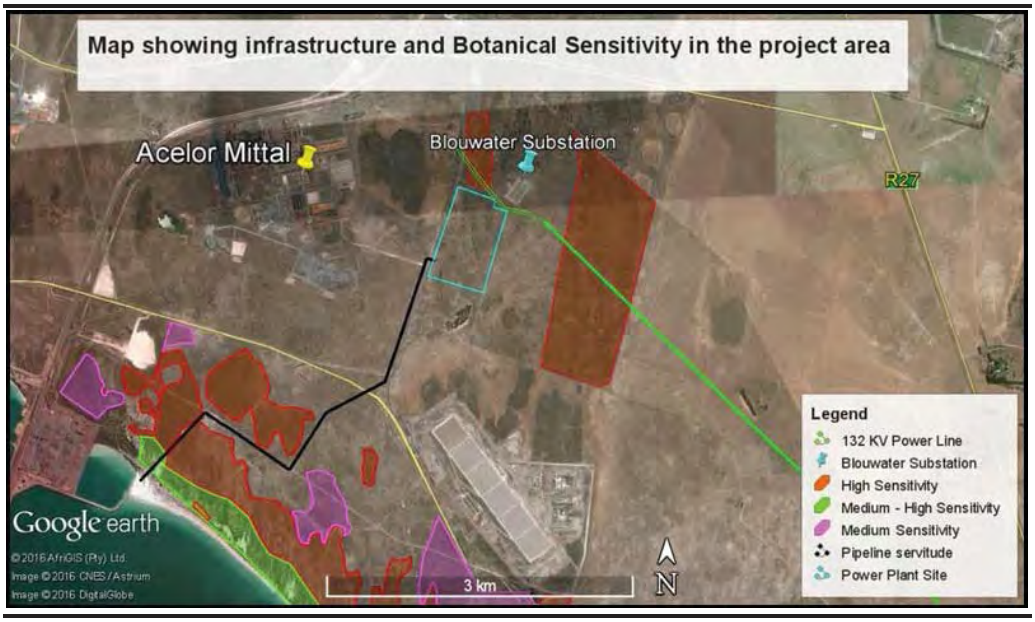
10.6 *IMPACT ON FLORA*

The study area is within the planning domain of the Saldanha Fine Scale Conservation Plan (Pence 2008). This important reference indicates that the majority of the Project area is a terrestrial Critical Biodiversity Area (CBA). Critical Biodiversity Areas are regarded as essential areas for the achievement of regional conservation targets, and are designed to ensure minimum land take for maximum result (Maree & Vromans 2010). It should be noted that the CBA mapping process in this area unfortunately suffered from a lack of groundtruthing and misinterpretation of the satellite imagery, and is therefore not considered particularly accurate or useful for planning purposes, and was in fact redone by Helme (2011) for the IDZ feasibility project. All ecological

assessments in this area should thus be based on detailed groundtruthing, as has been the case for the current study.

Figure 10.11 summarises the conclusions of the baseline floral studies by identifying and describing areas of botanical conservation value.

Figure 10.11 Areas of Botanical Conservation Value



- Areas of high sensitivity in the Project area are associated with:

    - Relatively intact examples of the locally restricted vegetation type Saldanha Limestone Strandveld (Helme & Koopman (2007)) found south of the coast road to Saldanha. These areas are considered ecologically irreplaceable, on account of the presence of relatively intact examples (with both high species diversity and high structural heterogeneity) of the Saldanha Limestone Strandveld, and due to the presence of regionally endemic plant Species of Conservation Concern (SCC). Conservation of such areas would contribute significantly to species and/or ecological process targets for the region, and should be considered No Go areas for development. Saldanha Limestone Strandveld habitat surrounds the pipeline footprint which has been specifically aligned to avoid these areas.

- Areas of medium-high sensitivity are associated with:

    - The Spreeuwal dune area. This area is largely pristine, apart from some alien plant invasion, and has high plant diversity and a high level of structural (growth form) diversity. It does not support many known populations of plant SCC. The pipeline will partially fall within this dune area.

- Areas of medium sensitivity are associated with:

    - Areas of Saldanha Limestone Strandveld that has been partly disturbed, but rehabilitated naturally to some degree. Populations of plant SCC may be present, although in limited numbers. These areas have been avoided in the placement of all project infrastructure.

- Areas of low sensitivity are associated with:

    - Areas that have been cultivated or ripped, have little botanical diversity or significant populations of plant SCC. The power plant site is characterised as being of low sensitivity.

10.6.1 Loss/Disturbance of Flora during the Construction Phase

Impact Description

Flora may be impacted in the following ways during the construction phase of the Project:

- Clearing of the vegetation on the proposed power plant site (50 ha);
- Clearance of a 36 m wide servitude for the pipeline, for a distance of 4 km; and
- Potential introduction of alien invasive vegetation.

Impact Assessment

Up to 50 ha of degraded but partly natural vegetation will be permanently lost within the power plant site, all of it during the construction phase of the Project. No plant SCC are known to occur in this area, and the vegetation in the area is deemed to be of Low sensitivity. The magnitude of the impact is likely to be Low – Moderate as a result. The loss of flora in the plant footprint area during the construction phase cannot easily be mitigated (irreversible).

Although only 4 km long the disturbance corridor of the pipeline will be up to 36 m in width in most areas. For about 80 percent of the route this passes through Low sensitivity habitat where this will have only a Low negative impact. In about 800 m (20 percent) of the route the corridor passes through High or Medium – High sensitivity habitat, where a number of plant SCC may be present. The magnitude of the impact in this more sensitive area is **Moderate**, and most of the impact should be of a long term nature (5-19 yrs) rather than a permanent impact, as the corridor should rehabilitate naturally over this period (partially reversible). However, disturbance favours certain species, and the more sensitive ones are unlikely to return to the disturbed habitat. See *Box 10.6*.

Proposed Mitigation

The following measures are proposed to minimise the impact:

- It is recommended that the pipeline construction corridor in the area within and between the High and Medium – High sensitivity areas should be minimised and kept as narrow as possible, and should ideally be less than 25 m wide in this area, or 30 m at most. The approved development footprint in this area must be surveyed and clearly demarcated with wire or coloured rope, and strung with warning signs, prior to any construction.
- Carrying out a search and rescue programme from the Medium – High and High sensitivity areas prior to construction, and use of these plants in the active rehabilitation of the disturbed corridor, will help speed up habitat recovery.

Box 10.6 Loss/Disturbance of Flora during the Construction Phase

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low to Medium

Impact Magnitude: Low to Moderate

- **Extent:** Local
- **Duration:** Long term to Permanent
- **Scale:** Low to Moderate
- **Frequency:** Once-off
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR TO MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **MINOR**

10.6.2 Disturbance of Flora during Operation

Impact Description

Flora may be impacted in the following ways during the operation phase of the Project:

- Potential introduction and spread of alien invasive vegetation; and
- Disturbance of ecological connectivity.

Impact Assessment

Operational phase botanical impacts of this Project are likely to be of very minor significance. The primary operational phase impact is loss of ecological connectivity, related mainly to the 50 ha power plant site. A secondary operational phase impact could be the proliferation of invasive alien plants in the pipeline route and around the power plant, facilitated by the soil disturbance during construction.

The loss of ecological connectivity in the power plant area is likely to be of Low negative botanical significance, as the site does not break a key ecological

corridor, with adequate natural or partly natural areas still surrounding the site. The pipeline will not have any significant negative impacts on botanical connectivity.

The alien invasive plant issue is one that can be successfully mitigated, by means of ongoing alien invasive plant management around the power plant, and in the servitude. After mitigation this could be reduced to a Very Low negative level in all areas assessed. See *Box 10.7.*

Impacts on flora during operation as a result of the proposed power plant are considered to be irreversible as construction phase activities would have impacted on connectivity and no rehabilitation of the site is proposed until post closure of the facility. For the pipeline, the impact is considered to be partially reversible.

Proposed Mitigation

The following measures are proposed to minimise the impact:

- Rehabilitation of pipeline corridor with rescued material and additional species brought in; and
- ongoing alien invasive plant removal within all corridors and on site.

Box 10.7 Disturbance of Flora during the Operation Phase

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low to Medium

Impact Magnitude: Very low to Low

- **Extent:** Local
- **Duration:** Long term to Permanent
- **Scale:** Low to Moderate
- **Frequency:** Ongoing
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE TO MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **NEGLIGIBLE TO MINOR**

10.6.3 Floral Impacts during the Decommissioning Phase

No further floral impacts are anticipated on the power plant site as a result of decommissioning activities. Should the pipelines be removed during the decommissioning phase, the floral impacts along the pipeline route would mirror that of the construction phase.

10.6.4 Residual Impacts

A summary of the impacts on flora during the construction and operation phases of the Project are presented below.

Table 10.15 Pre- and Post- Mitigation Significance for the Disturbance/Destruction of Flora

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Destruction/disturbance of flora	Construction	Minor to Moderate	Minor
Disturbance of flora	Operation	Negligible to Minor	Negligible to Minor

10.7 IMPACT ON FAUNA

The sensitivity map for the proposed power plant site and pipeline corridor is depicted *Figure 10.12*. The gas pipeline follows an existing road for the large part, which means its impact is fairly low. The area towards the coast is deemed to have the highest sensitivity on account of the better condition of the vegetation and sensitivity of the habitat within this area, but the extent of sensitive dune area on the existing proposed route is low, and the remaining habitat is historically overgrazed and fairly degraded in places. The natural but highly disturbed and transformed vegetation of the power plant is considered low sensitivity, given the low cover and low diversity.

Baseline conditions in the Project area can be summarised as follows:

- Although there are potentially 52 different terrestrial mammals in the area, there has been significant transformation and a lower number are likely to be present.
- Habitat variety is limited and there are no wetlands or rocky outcrops present.
- The following mammals were observed during the site visit: Cape Golden Mole, Cape Dune Mole Rat, Cape Porcupine, Bush Vlei Rat, Cape Gerbil, Cape Grey Mongoose, Bat-Eared Fox, Four-striped Grass Mouse and Steenbok.
- The majority of mammals are smaller mammals and tolerant of habitat fragmentation.
- Two listed species occur at the site namely the White-tailed Mouse *Mystromys albicaudatus* (EN) and Honey Badger *Mellivora capensis* (EN). Given the power station site is previously transformed, there is a lack of cover and adequate food resources for the Honey Badger. The White-tailed Mouse is potentially present with a low likelihood, given the low vegetation cover. The small footprint of the pipeline is not likely to have a high impact on mammal fauna.
- According to the SARCA database, 45 reptiles have been recorded in the area, which corresponds well with distribution records from the literature

As with mammals, a large proportion of these are not likely to occur at the site on account of a lack of suitable habitat and in particular the lack of any rocky outcrops.

- Species observed during the site visit include Cape Skink *Mabuya capensis* and Angulate Tortoise *Chersina angulata*, which was observed to be abundant at the site. The Cape Girdled Lizard *Cordylus cordylus* and the Brown House Snake were also observed at the site.
- Of concern is the fact that five listed species are known from the area including the Large-scaled Girdled Lizard *Cordylus macropholis*, Black Girdled Lizard *Cordylus niger*, Gronovi's Dwarf Burrowing Skink *Scelotes gronovii*, Kasner's Dwarf Burrowing Skink *Scelotes kasneri* and Bloubergstrand Dwarf Burrowing Skink *Scelotes montispectus*, all of which are listed as Near Threatened. The majority of these are however not likely to occur at the site as they are associated with coastal dunes and in the case of the Large-scaled Girdled Lizard the strand line. Although there are still some dunes remaining within the proposed pipeline corridor, the extent of the impact of the pipeline on this habitat is likely to be low, especially if the alignment can be placed within existing disturbance footprints. The Black Girdled Lizard is restricted to two isolated populations, one on the Cape Peninsula and the other on coastal rocks around Saldanha. Given the localised distribution of this species impact on it would be undesirable, but as there were no rocky outcrops within the site, it is not likely that this species occurs at the site or would be impacted by the development.
- The site lies within or near the range of 8 amphibian species, which along with the general lack of water or wetlands at the site suggests that frog diversity is likely to be fairly low. The only listed species which may occur at the site is the Cape Caco *Cacosternum capense*, which is restricted to low lying flat or gently undulating areas with poorly drained clay or loamy soils. Given the sandy soils at the site and the lack of suitable pans for breeding, it is not likely that this species occurs at the site.
- Species which are likely to occur at the site are likely to those less dependent on perennial water including the Cape Sand Toad *Vandijkophrynus angusticeps*, Sand Rain Frog *Breviceps rosei rosei* and Cape Sand Frog *Tomopterna delalandii*.

Figure 10.12 Areas of Faunal Sensitivity

10.7.1 Loss of Faunal Habitat during the Construction and Decommissioning Phases

Impact Description

Some loss of vegetation is an inevitable consequence of the development. As a result some habitat will no longer be available for use as a result of transformation or the presence of permanent infrastructure. This potentially includes the habitat for 5 red-listed reptiles, two red data-listed mammals and one listed amphibian.

This impact is likely to be very low for the operational phase of the Project given that no additional habitat will be lost. This impact has therefore only been assessed for the construction and decommissioning phases.

Impact Assessment

The extent of the habitat is likely to be low as the footprint will be onsite and limited in extent.

The impact will be medium to long term in duration as the disturbed areas will take time to recover and/or this will only take place during project decommissioning.

The scale is rated as Low to Moderate as the extent of sensitive dune area on the existing proposed route is low and the remaining habitat is historically overgrazed and fairly degraded in places. Faunal habitat diversity to low. The sensitivity of the fauna environment is considered Low to High, given that this entails red-listed species.

The impact is considered irreversible.

Proposed Mitigation

The following measures are proposed to minimise the impact:

- Demarcate all areas to be cleared with construction tape or similar material.
- ECO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially in the vicinity of sensitive features.
- All vehicles to remain on demarcated roads and no driving in the veld should be allowed except where necessary along the power line/pipeline route during construction when all vehicles should follow the same track.
- No fuelwood collection on site.
- No fires should be allowed on-site.
- Sensitive habitat features should be avoided.

Box 10.8 Faunal habitat loss during the Construction and Decommissioning Phases

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low for power plant; High for pipeline

Impact Magnitude: Low

- **Extent:** on-site
- **Duration:** Long term to Permanent
- **Scale:** Low to moderate
- **Frequency:** Once-off
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **MINOR**

10.7.2 Direct Faunal Impacts during the Construction and Decommissioning Phases

Impact Description

Smaller fauna such as many reptiles would either seek shelter or not be able to move away from construction activity sufficiently quickly during construction and would be killed by vehicles and earth-moving machinery. In addition, the presence of a work force on the site during construction would pose a risk to species such as snakes, tortoises and mammals which would be vulnerable to poaching for food, trade or killed out of fear and superstition. During the operational phase, the activity would be much lower.

During the operational phase of the project, it is envisaged that this impact will be negligible given that the majority of the species would have already migrated away from the area.

Impact Assessment

The extent of the habitat is likely to be local.

The impact will be short term as will only take place during the Construction Phase of the Project.

The scale is rated as Low to Moderate given that the extent of sensitive dune area on the existing proposed route is low, and the remaining habitat is historically overgrazed and fairly degraded in places. Faunal habitat diversity is low.

The impact is considered reversible.

Proposed Mitigation

The following measures are proposed to minimise the impact:

- All vehicles at the site should adhere to a low speed limit to avoid collisions with fauna such as tortoises.
- Personnel should not be allowed to roam into the veld.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- No activity should be allowed in the veld between sunset and sunrise.
- Any dangerous fauna (snakes, scorpions etc) that are encountered during construction should not be handled or molested by the construction staff and the ECO or other suitably qualified persons should be contacted to remove the animals to safety.
- No litter, food or other foreign material should be thrown or left around the site and should be placed in demarcated and fenced rubbish and litter areas.
- Holes and trenches should not be left open for extended periods of time and should only be dug when needed for immediate construction. Trenches that may stand open for some days, should have places where the loose material has been returned to the trench to form an escape ramp present at regular intervals to allow any fauna that fall in to escape.
- If there is any part of the site that needs to be lit at night for security reasons, then this should be with low-UV emitting types which do not attract insects.

Box 10.9 Direct faunal impacts during the Construction and Decommissioning Phases

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low for power plant; High for pipeline

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Short term
- **Scale:** Low to Moderate
- **Frequency:** Ongoing during the Construction Phase
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **NEGLIGIBLE**

10.7.3 Habitat degradation for Fauna during Construction and Operation

Impact Description

The noise and activity during the construction and operation of the pipeline and power plant would generate a lot of noise which will deter many animals from the area, or will curb the activity of those less able to move away, but in the long-term the operation of the pipeline and power plant would be of minimal disturbance to fauna. There is also the risk that construction would result in accidental spills of oil or chemicals and generate pollution. Amphibians in particular are very sensitive to such pollutants and should such pollution enter the breeding habitat the local amphibian population is highly likely to decline.

Impact Assessment

The extent of the habitat is likely to be local.

The impact will be long term as will only continue through the operational phase of the Project.

The scale is rated as Low.

The impact is considered reversible as with mitigation further degradation to the habitat can be avoided.

Proposed Mitigation

The following measures are proposed to minimise the impact:

- Personnel should not be allowed to roam into the veld.
- No activity should be allowed in the veld between sunset and sunrise.
- No litter, food or other foreign material should be thrown or left around the site and should be placed in demarcated and fenced rubbish and litter areas.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

Box 10.10 ***Habitat degradation for fauna during Construction, Operation and Decommissioning***

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low for power plant; High for pipeline

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Short to Medium term
- **Scale:** Low
- **Frequency:** Ongoing
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **NEGLIGIBLE**

10.7.4 Residual Impacts

A summary of the impacts on fauna during all phases of the Project is presented below.

Table 10.16 Pre- and Post- Mitigation Significance for the Impact on Fauna

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Loss of faunal habitat	Construction and Decommissioning	Moderate	Minor
Direct faunal impacts	Construction and Decommissioning	Minor	Negligible
Habitat degradation for fauna	Construction and Operation	Minor	Negligible

10.8 IMPACT ON AVIFAUNA

The area proposed for the power plant is characterised as the Strandveld shrubland habitat unit (Helme & Koopman (2007)) which is comprised of sparse shrub with scattered rock and succulent-dominated undergrowth. The habitat unit around the site is homogenous, lacking structural and compositional variation, and does not support a high diversity and abundance of bird species. One bird SCC – the Black Harrier *Circus maurus* – was recorded in and is known to favour this habitat unit.

The study area has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises such as agriculture and industry, due to its close proximity to the town of Saldanha.

The proposed development is in close proximity to the West Coast National Park, Saldanha Bay Islands and Berg River Estuary Important Bird and Biodiversity Areas (IBAs) which have been identified in terms of the Important Bird and Biodiversity Areas Programme, a Birdlife South Africa Conservation Initiative.

10.8.2 Avifauna Habitat Loss Due to Construction Activities

Impact Description

Habitat loss may result from the following activities during the Construction Phase of the Project:

- Clearing of the vegetation on the proposed power plant site (50 ha); and
- Clearance of a 36 m wide servitude for the pipeline, for a distance of 4 km.

Extensive areas of vegetation (habitat) are to be cleared to accommodate the infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013).

This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges.

Impact Assessment

Overall, the avifauna of the study area and the broader impact zone are not considered unique and are typical of what occurs across large areas of the Fynbos Biome. However, because of the expected occurrence of numerous priority species in the study area and the nearby proximity of two IBAs, the sensitivity of the site, from an avian perspective, will be of **moderate** significance.

The scale is considered high given that the integrity of the avifauna habitat within the Project footprint area will be compromised. This impact is considered to be irreversible for the power plant site and partially reversible for the pipeline alignment if there is effective rehabilitation. See *Box 10.11.*

Proposed Mitigation

The following mitigation measures are proposed:

- Minimise project footprint;
- Existing roads for access to be utilised as far as possible;
- Briefing of site personnel; and

- Nesting sites to be reported to ECO and monitored to inform further action which may include avoiding the nests of there are eggs or chicks present.

Box 10.11 Avifaunal Habitat Loss Due to Construction Activities

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Moderate

- **Extent:** On site
- **Duration:** Short term
- **Scale:** High
- **Frequency:** Once-off
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): Mitigation measures will reduce the impact to **MINOR.**

10.8.3 Disturbance to Avifauna during Construction

Impact Description

Construction of CCGT power plants requires a significant amount of machinery and labour to be present on site for a period of time. For shy, sensitive species or ground-nesting birds resident in the area, construction activities are likely to cause a temporary disturbance or even result in displacement from the site entirely. Birds are particularly sensitive to disturbance during the breeding season.

In addition, certain bird species may seek to benefit from the plant, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure. This may result in the fouling of critical components of the plant, bringing local bird populations into conflict with facility operators.

Impact Assessment

As detailed in *Section 10.6* above, the sensitivity of the site is considered to be moderate. The scale is considered high given that the integrity of the avifauna habitat within the Project footprint area will be compromised. This impact is considered to be partially reversible.

Proposed Mitigation

The following mitigation measures are proposed:

- ECO to be notified of roosting, nesting or breeding sites to inform further action which may include avoiding the nests of there are eggs or chicks present.;
- Laydown areas to be as close to the site as possible;
- Disturbance footprint to be restricted;
- Existing roads to be utilised; and
- Speed limit of 50 km/h adhered to on internal roads.

Box 10.12 Disturbance to Avifauna during the Construction Phase

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** On site
- **Duration:** Short term
- **Scale:** High
- **Frequency:** Ongoing
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation this impact will be reduced to **MINOR**

10.8.4 Avifauna Disturbance during Operation

Impact Description

Ongoing operation and maintenance activities at the facility are likely to cause some degree of disturbance to birds in the general vicinity.

Impact Assessment

As detailed above, the sensitivity of the site is considered to be moderate. The scale of this impact is considered medium as the ecological functioning and integrity of the site may improve from that of the construction phase with less frequent disturbance in the area. This impact is considered to be partially reversible. See *Box 10.13*.

Proposed Mitigation

The following mitigation measures are proposed:

- Measures to be put in place to discourage nesting on power infrastructure if problematic;
- No shooting, poisoning or harming of birds to control;
- Birds already with eggs and chicks allowed to fledge chicks before nests removed;

- Avifaunal specialist input to be sought if cannot be resolved;
- Restricted site access; and
- Use of existing roads and enforcement of speed limits.

Box 10.13 Disturbance to Avifauna during the Operation Phase

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Moderate

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Medium
- **Frequency:** Ongoing
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation this impact is reduced to **MINOR**

10.8.5 Avifauna Disturbance during Decommissioning

It is envisaged that the impact during the Decommissioning Phase will mirror that experienced for the Construction Phase. *Box 10.13*

10.8.6 Residual Impacts

A summary for the impact on avifauna during the construction and operation phases of the Project is presented in *Table 10.17* below

Table 10.17 Pre- and Post- Mitigation Significance for the Impact on Avifauna

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Avifaunal habitat loss during Construction	Construction	Moderate	Minor
Disturbance to avifauna during Construction	Operation	Moderate	Minor
Disturbance to avifauna during Operation	Operation	Moderate	Minor

10.9 ROAD AND TRAFFIC IMPACTS

Traffic operations at intersections are typically described in terms of the "Level of Service" (LOS). LOS is a qualitative measure of the effect of several factors on traffic operating conditions, including speed, travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort, and convenience. It is generally measured quantitatively in terms of vehicular delay and described using a scale that ranges from LOS A to F, with LOS A representing essentially free-flow conditions and LOS F indicating over-capacity conditions with substantial congestion and delay.

Table.10.18 summarises the relationships between the average control delay per vehicle and LOS for signalised intersections, roundabouts and stop and yield controls.

Table.10.18 Level-Of-Service Definitions Based on Delay (Highway Capacity Manual of the Transport Board, 2010)

Level of Service		Control delay per vehicle in seconds (d) (including geometric delay)	
		Signals and Roundabouts	**Stop Signs and Give Way (Yield) Signs**
A	Good progression, few stops, short cycle lengths	$d \leq 10$	$d \leq 10$
B	Good progression and/or short cycle lengths, more vehicle stops	$10 < d \leq 20$	$10 < d \leq 15$
C	Fair progression, significant proportion of vehicles must stop	$20 < d \leq 35$	$15 < d \leq 25$
D	Congestion becomes noticeable; longer delays, high v/c ratio	$35 < d \leq 55$	$25 < d \leq 35$
E	At or beyond acceptable delay, poor progression, long queues	$55 < d \leq 80$	$35 < d \leq 50$
F	Unacceptable to drivers. Arrival volumes greater than discharge capacity, unstable unpredictable flows	$80 < d$	$50 < d$

The following key conclusions can be drawn from the baseline road conditions:

The site is well served by existing road infrastructure. The road intersections that may be impacted on by the proposed development are (see *Figure 10.13*):

1. R27 (TR 77/1) and R45 (TR 22/1);
2. R27 (TR 77/1) and TR 85/1; and
3. TR 85/1 and OP7644.

Figure 10.13 Location of Road Infrastructure

According to the results of the Signalised and Unsignalised Intersection Design and Research Aid software package[1] (SIDRA) it appears that the traffic operations at the existing intersections are currently operating at a LOS A in the AM and PM peak hours, respectively.

There are two proposed access points to the site: the northern access which is proposed on the west of the power plant off the OP7644 and 5.8 km from the studied intersection of the TR77/1 (R27) and TR85/1; and the southern access (and main access) into the development via a new access road off OP7644. This main entrance is located approximately 6.35 km from the intersection of TR85/1 and TR77/1 (R27).

10.9.1 Impact on Traffic Levels during Construction and Decommissioning

Impact Description

Traffic levels are expected to increase in the area of the site during the construction phase of the project. Additional vehicle movements during peak periods are anticipated to be in the order of 450 person trips during the peak hour, or 206 cars, 14 minibus taxis and two buses. The cars may enter the site and park in the open areas during construction. The minibus taxis and buses may collect and dispatch passengers in the vicinity of the site.

[1] SIDRA Version 5 Software, SidraSolutions, Australia, 2010.

It has been assumed that the site traffic will be distributed as follows: 55 percent originating from the east of Vredenburg, Velddrif and Langebaanweg areas, 20 percent from the southern Yzerfontein and Melkbosstrand areas, 20 percent from the Langebaan and Saldanha areas, and 5 percent from Vredenburg and Saldanha.

Anticipated truck traffic is likely to be in the order of 246 trucks per day or 20 trucks per hour which equates to one every three minutes.

Impact Assessment

Predictions of the level of service at the project affected intersections is provided in *Table 10.19*, *Table 10.20*, and *Table 10.21* below, with the extent of the impact being dependent on when the project is implemented. Volume to capacity is a measure of the saturation flow rate which should ideally be below 0.9.Three different scenarios have been presented on the basis of anticipated traffic level increases as a result of delays in commencing with construction:

Table 10.19 Traffic Operations at Intersection of R27 (TR 77/1) / R45 (TR 21/2) during Construction

Measures of Effectiveness	Intersection Type					
	Stop Controlled					
	Existing 2016 Scenario Without the project		Future 2018 Scenario Construction		Future 2019 Scenario Construction	
	Peak Hour		Peak Hour		Peak Hour	
	AM	PM	AM	PM	AM	PM
Levels of Service (LOS)	A	A	A	A	A	A
Delay (Sec) Overall	6.9	7.0	6.9	7.5	7.1	7.7
Volume/Capacity (V/C) Ratio	0.208	0.248	0.324	0.384	0.341	0.404

Table 10.20 Traffic Operations at Intersection of R27 (TR 77/1) / TR 85/1 during Construction

Measures of Effectiveness	Intersection Type					
	Stop Controlled					
	Existing 2016 Scenario Without the project		Future 2018 Scenario Construction		Future 2019 Scenario Construction	
	Peak Hour		Peak Hour		Peak Hour	
	AM	PM	AM	PM	AM	PM
Levels of Service (LOS)	A	A	A	A	A	A
Delay (Sec) Overall	4.1	4.2	6.0	6.3	6.1	6.4

Volume/Capacity (V/C) Ratio	0.104	0.142	0.328	0.376	0.340	0.389

Table 10.21: Traffic Operations at Intersection of TR 85/1 / OP7644 During Construction

Measures of Effectiveness	Intersection Type			
	Stop Controlled			
	Future 2018 Scenario		Future 2019 Scenario	
	Peak Hour		Peak Hour	
	AM	PM	AM	PM
Levels of Service (LOS)	A	A	A	A
Delay (Sec) Overall	5.3	5.2	5.3	5.3
Volume/Capacity (V/C) Ratio	0.338	0.322	0.346	0.328

Therefore it is anticipated that the significance of the impact will be **negligible** and that the LOS of the three intersections will remain categorised as Level A. The vulnerability of the receptor is anticipated to be Low given that current service levels and access to the area is good. This impact is of short term duration and reversible. It is anticipated that decommissioning impacts will reflect those of the construction phase. See *Box 10.14.*

Proposed Mitigation

Although within an acceptable LOS in terms of capacity, the volume of construction traffic is considered to be intensive truck traffic and will need to be managed both in terms of surface damage as well as signage and marshalling at the delivery yard and at the site entrance. A road condition survey will need to be conducted prior to construction in order to gauge the damage to the road as a result of the intensive heavy traffic. Most of the damage is likely to occur within the proximity to the access to the site.

Planned turning lanes on the OP7644 are proposed for the development. These should be approved by the Road Authority. Minibus taxi embayment should also be provided on either side of the OP7644. Road condition survey to be undertaken.

Box 10.14 Impact on Traffic Levels during Construction

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Short term
- **Scale:** Low
- **Frequency:** Constant
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation this impact remains **NEGLIGIBLE**

10.9.2 Impact on Traffic Levels during Operation

Impact Description

Traffic levels are expected to increase in the area of the site during the operational phase of the project with the commuting of employees to and from work each day. Additional vehicle movements during peak periods are anticipated to be in the order of 177 person trips during the peak hour or 80 cars, the equivalent of five minibus taxis and one bus. The cars may enter the site and park in the open areas during construction.

The minibus taxis and buses may collect and dispatch passengers in the vicinity of the site. Site traffic distribution will be as anticipated during the construction phase of the project, although some heavy vehicle movements may remain.

Impact Assessment

Predictions of the LOS at the Project affected intersections is provided in the *Table 10.22, Table 10.23* and *Table 10.24* below, with the extent of the impact being dependent on when the project is implemented. Two different scenarios have been presented on the basis of anticipated traffic level increases as a result of the delay in commencing with operation:

Table 10.22 Traffic Operations at Intersection of R27/R45 during Operation

Measures of Effectiveness	Intersection Type			
	Stop Controlled			
	Existing 2016 Scenario		Future 2020 Scenario	
	Peak Hour		Peak Hour	
	AM	PM	AM	PM

Levels of Service (LOS)	A	A	A	A
Delay (Sec) Overall	6.9	7.0	7.1	7.4
Volume/Capacity (V/C) Ratio	0.208	0.248	0.273	0.334

Table 10.23: Traffic Operations at Intersection of R27 / TR 85/1 during Operation

Measures of Effectiveness	**Intersection Type**			
	Stop Controlled			
	Existing 2016 Scenario		**Future 2020 Scenario**	
	Peak Hour		**Peak Hour**	
	AM	**PM**	**AM**	**PM**
Levels of Service (LOS)	A	A	A	A
Delay (Sec) Overall	4.1	4.2	4.7	4.8
Volume/Capacity (V/C) Ratio	0.104	0.142	0.173	0.221

Table 10.24: Traffic Operations at Intersection of TR 85/1 / OP7644 during Operation

Measures of Effectiveness	**Intersection Type**	
	Stop Controlled	
	Future 2020 Scenario	
	Peak Hour	
	AM	**PM**
Levels of Service (LOS)	A	A
Delay (Sec) Overall	1.6	1.7
Volume/Capacity (V/C) Ratio	0.143	0.112

Therefore it is anticipated that the magnitude of the impact will be low to medium and that the Level of Service of the three intersections will remain categorised as Level A. The vulnerability of the receptor is anticipated to be Low given that current service levels and access to the area is good. See *Box 10.15.*

This impact is expected to be long term in duration, but following the life of the project, traffic levels will return to pre-construction levels (i.e. reversible).

Proposed Mitigation

Planned turning lanes on the OP7644 are proposed for the development. These should be approved by the Road Authority. Minibus taxi embayments should also be provided on either side of the OP7644.

Box 10.15 Impact on Traffic Levels during Operation

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low to medium

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Low
- **Frequency:** Constant
- **Likelihood:** n/a

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation this impact remains **MINOR**

10.9.3 Residual Impacts

A summary for the impact on traffic levels and road conditions as a result of the Project is provided in *Table 10.25*.

Table 10.25 Pre- and Post- Mitigation Significance for the Traffic and Road Condition Impacts

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impact on traffic levels during Construction	Construction	Negligible	Negligbile
Impact on traffic levels during Operation	Operation	Minor	Minor

10.10 EMPLOYMENT CREATION, SKILLS ENHANCEMENT AND LOCAL BUSINESS OPPORTUNITIES

The Project is expected to generate positive impacts on the local economy and livelihoods in terms of:

- employment and skills enhancement; and

- local business opportunities through the procurement of goods and services.

Positive impacts will be primarily associated with the construction phase and therefore temporary in nature. The termination of construction contracts will occur once construction activities are completed. Workers who have relocated to the area for the Project are likely to leave the area in search of other opportunities, especially if they are permanent employees of contractors and subcontractors.

Those who have worked on the Project will have an advantage when seeking alternative jobs on similar projects due to the experience and any training received through this Project. The area is characterised by a number of new industrial developments and is earmarked for other gas power projects which may offer alternative employment opportunities. This is considered within the cumulative impacts *Section 7.17*.

10.10.1 Construction and Decommissioning: Employment, Skills Enhancement and Local Business Opportunities

Impact Description

The construction phase will last approximately 48 months in duration (Phase One 15 -18 months; Phase Two 18 - 20 months) and it is expected that approximately 450 direct employment opportunities will be available during the peak of construction. 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.

Table 10.26 Estimated Employment Positions Available During Construction

Employment Position	Number of Positions
Admin	12
Engineers	8
Technicians	40
Skilled	210
Semi skilled	80
Unskilled	100
Total	**450**

It is assumed that the majority of skilled workforce will come from outside the Area of Direct Influence and Area of Indirect Influence, but that many of them will be South African. Given that almost half the population in the SBLM have some level of skills training, it is anticipated that many semi-skilled positions will be available to the local workforce, and that unskilled positions will also be available to the local workforce.

Indirect employment through the construction supply chain will be limited as the major components of the power plant are highly specialised and will be manufactured outside of South Africa. However, much of the balance of plant infrastructure for the Project will be procured within South Africa and where possible, from within the Local Municipality. Local procurement is going to benefit the hospitality and service industries primarily, such as accommodation, catering, cleaning, transport and security services. Local businesses will benefit during the construction phase as there will be increased spending within the area by the wage labour who will have improved buying power while employed by the Project.

Those who are able to secure employment on the Project will have the opportunity to improve their skills and experience through on-the-job training, and will thereby improve their opportunities for future employment.

Given that Saldanha Bay is ear-marked for further industrial development, with a focus on the oil and gas sector, the upskilling of the local workforce will put them in a favourable position to secure future employment.

Employment numbers during decommissioning are not known at this stage, but it is expected that the make-up of the workforce will be similar to the construction phase.

Impact Assessment

The creation of local employment opportunities, skills enhancement and local business opportunities will be a direct, indirect and induced impact. The duration will be short-term, for the duration of the construction phase and work contracts will vary in length, based on the type of work being performed. Employment will be created for South Africans at a local and regional level depending on skills and capacity availability, as such the extent will be regional. For those who are able to secure employment on the Project the scale will be medium, as they secure an income for the duration of their contract. The frequency of the impact will be constant for the duration of the construction phase. The magnitude of the impact will be positive.

Given the capacity of the local workforce to fill unskilled and semi-skilled employment positions, together with the opportunity to increase skills and work experience, the vulnerability is medium.

The significance of the impact is rated as **Moderate (+ve)**.

Proposed mitigation/ enhancement

The objective of mitigation is to optimise opportunities for employment of local people, wherever possible, or alternatively that employment of South Africans is prioritised over foreigners.

The following measures will be implemented to ensure that employment of local people is maximised:

- The Project will establish a recruitment policy which prioritises the employment of South African and local residents (originating from the Local Municipality) over foreigners. Criteria will be set for prioritising local residents and then other South Africans as part of the recruitment process.

- All contractors will be required to recruit in terms of the Project's recruitment policy, where practical.

- The Project will meet with the Local Municipality (and other appropriate institutions such as the Sakekamer) to access any available skills/employment-seekers database for the area. This database is to be updated and made available to the appointed contractors.

- The Project will advertise job opportunities and criteria for skills and experience needed through local media, at least three months ahead of recruitment. This information should also be provided to all relevant authorities, community representatives and organisations on the interested and affected party database.

- The recruitment policy and procedure should promote the employment of women as a means of ensuring that gender equality is attained.

- On-the-job performance and training will be monitored through performance reviews. Training needs will be identified and provided by the Project.

- No employment will take place at the entrance to the site. Only formal channels for employment will be used.

A local procurement policy will be implemented to ensure that local procurement is maximised, the policy will include:

- Reasonable targets for using local suppliers.

- A clause of none discrimination on any grounds of gender, ethnicity, religion.

- Criteria for monitoring local procurement and reporting on supplier performance management.

- Clearly communicate the criteria and tendering process prior to the commencement of construction activities; and

- The procurement policy and tendering requirements must be easily accessible to potential suppliers.

The following management measures will be implemented to enhance skills development and on-the-job training:

- Develop internal training 'certification' or reference letter provisions to those who receive internal training.

- Training plans will be developed according to each permanent employee' work agreement and relevant to their job description.

Residual impacts

A summary for the impact the construction and decommissioning phases of the Project is present below.

Table 10.27 Pre- and Post- Mitigation Significance for Employment Creation, Skills Enhancement and Local Business Opportunities

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Employment Creation, Skills Enhancement and Local Business Opportunities	Construction and Decommissioning	Moderate (+ve)	Moderate (+ve)

Table 10.28 Pre- and Post- Mitigation Significance for Employment Creation, Skills Enhancement and Local Business Opportunities during Construction

Nature and Type: Direct, indirect and induced positive impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Positive

- **Extent:** Regional
- **Duration:** Short Term
- **Scale:** Large
- **Frequency:** Constant
- **Reversibility:** N/A
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE POSITIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): Enhancement measure will ensure the impact remains **MODERATE POSITIVE.**

10.10.2 Operation: Employment, Skills Enhancement and Local Business Opportunities

Impact Description

The power plant will be operated on a 24 hour, 7 days a week basis for the duration of the operation phase. It is anticipated that there will be approximately 95 employment positions available during this phase. 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* 10.29.

Table 10.29 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**

Similar to the construction phase, local workers are expected to be qualified to fill unskilled and semi-skilled positions at first, whilst a limited number of people may be sufficiently qualified for skilled positions. Semi-skilled and skilled positions will initially be recruited from elsewhere in the region and South Africa. Over time, however, local workers will be able to fill more of the semi-skilled and skilled positions as training will be provided by the Project to the local workforce, which will improve skills levels relevant to the Project.

During the operation phase the contracts that were in place during the construction phase will be terminated and procurement opportunities will be centred around maintenance activities, and providing goods and services to the Project. For those companies that meet eligibility criteria, become approved suppliers and enter the supply chain, there will be long-lasting and sustained benefits to the businesses and their employees through increased

experience, capacity and training. As such, during the operation phase there will be opportunity for local business growth and development

Impact Assessment

The creation of local employment opportunities, skills enhancement and local business opportunities will be a direct, indirect and induced impact. The duration will be long-term, for the duration of the operation phase. Employment will be created for South Africans at a local and regional level depending on skills and capacity availability, as such the extent will be regional. For those who are able to secure employment or procurement contracts with the Project the scale will be large, as they secure long-term, stable income. The frequency will be constant for the duration of the operation phase. The magnitude of the impact will be Positive.

Given the limited employment and procurement opportunities during the operation phase, together with the lack of appropriate skills in the ADI, the vulnerability is low.

The significance of the impact is rated as **Minor (+ve)**.

Proposed mitigation/ enhancement

The mitigation/ enhancement measure provided for the construction phase, will apply to the operation phase.

Residual impacts

A summary for the impact during the operation phases of the project is presented below.

Table 10.30 Pre- and Post- Mitigation Significance for Employment Creation, Skills Enhancement and Local Business Opportunities

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Employment Creation, Skills Enhancement and Local Business Opportunities	Operation	Minor (+ve)	Minor (+ve)

Table 10.31 Pre- and Post- Mitigation Significance for Employment Creation, Skills Enhancement and Local Business Opportunities during Operation

Nature and Type: Direct, indirect and induced positive impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Positive

- **Extent:** Regional
- **Duration:** Long Term
- **Scale:** Large
- **Frequency:** Constant
- **Reversibility:** N/A
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR POSITIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): Enhancement measures will ensure the impact remains **MINOR POSITIVE.**

10.11 IMPACTS ON COMMUNITY HEALTH AND SAFETY

The presence of the Project could affect the health, safety and security of the communities in the area of influence as a result of worker-community interactions, in-migration to the area, increased incomes in the local community that may be used for drugs, alcohol and prostitution, the risk of injury associated with construction and decommissioning activities, increased pressure on health care resources and changes to the environment. Any community concerns or perceptions with regard to reduced health and physical safety and security by the community need to be addressed.

There are numerous ways in which the development of the Project could impact on community and individual levels of health. The term "health" is used broadly to include physical and mental health and well-being. The expected impacts on community health, safety and security as a result of construction, operation and decommissioning of the Project are:

- Impacts associated with the presence of the Project workforce.
- Impacts associated with an influx of jobseekers.
- Impact on human health due to air emissions.

10.11.1 Construction, Operation and Decommissioning: Impacts Associated with the Presence of the Workforce and Jobseekers

Impact Description

An increase in disposable income within the Project area (among Project workers, both local and external) has been observed to result in a change in spending habits and behaviour resulting in increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations, which

poses a threat to community health and safety. Anticipated impacts associated with the presence of the workforce are:

- Increased incidence of alcohol and drug use;
- Increase in the spread of HIV/ Aids and other STIs;
- Increased incidence of teenage or unwanted pregnancies; and
- Increase in prostitution.

It is estimated that there will be approximately 450 people employed during the peak construction phase. The Project will seek to maximise the employment of local people, thereby reducing the size of the external workforce in the ADI, however an external workforce will be required. The external workforce (largely comprised of semi-skilled and skilled workers) will be housed with the ADI, as onsite worker accommodation is not feasible for health and safety reasons given the Project site's close proximity to Saldanha Steel.

Experience from large infrastructure projects elsewhere in South Africa has shown that increased disposable income within the local workforce may result in increased incidences of illegal activities or antisocial behaviours such as prostitution and casual sexual relations as well as increased levels of substance abuse. Abuse of alcohol (and drugs, should this occur) often correlates with increased levels of criminal behaviour and violence (e.g. domestic violence) while under the influence of the substance. Such behaviour increases the number of people indirectly affected by, or vulnerable to, alcohol and drug abuse; and casual sexual relations could lead to an increased incidence of HIV/AIDS.

Further, it has been shown that members of an external workforce are likely to father children with local women while they are living in the Project Area. Given the temporary nature of the work, it is possible that both the women and children will be abandoned when the construction phase ends and the contractors move on, leaving single female-headed households.

A further impact associated with an influx of jobseekers is the potential for social tension, and increased competition for employment. The distribution of employment opportunities between locals and in-migrants often leads to tension and conflict, especially when locals perceive the migrants to be taking their jobs. Competition for jobs has been raised as a concern by some stakeholders.

Impact Assessment

The impacts related to the presence of the workforce and jobseekers in the Project Area will be indirect and negative as the presence of a mostly male workforce, with an increased disposable income may adversely impact on health, safety and security of the local community through a likely increase in illegal or antisocial behaviour. The impact will be experienced at a local level, within the ADI. While the workforce will be in the Project area for a limited

time during the construction phase, jobseekers may stay in the area. Those affected by antisocial behaviour, such as the victims of abuse, women with unwanted pregnancies and people living with HIV/ AIDS, the duration of the impact will be long-term. The scale of the impact will be large for those affected as it will lead to a fundamental change in their life, and/ or health status, particularly for those affected by violence, unwanted pregnancies or HIV/ AIDS. For those affected, the impact will be largely irreversible. The frequency of the impacts will not be uniform, but may be felt often. Given the above, the magnitude of the impact is considered medium.

The external workforce will be housed within the Saldanha Bay area, and will interact with the local community. The local workforce will come from residential areas within the ADI such as Diazville, White City and Saldanha.

Teenage pregnancies are already of concern in the region, and according to the WCDM, there has been a general increase in the numbers of recorded teenage pregnancies. The WCDM further notes that violence and substance abuse are also common in the District and that the HIV/ AIDS is increasing (see *Chapter 7*). In light of this, the vulnerability of receptors is considered medium, however, teenage girls are considered to be highly sensitive to this impact.

The significance of the impact is rated as **Moderate negative** overall, but the significance will be of **high** negative to those affected by unwanted pregnancies and HIV/ AIDS.

During the operation phase, there will be limited employment opportunities and the external construction workforce will likely leave the area. The number of local people with disposable income will decrease, as will the impacts associated with this. This impact will not be felt during the operation phase.

Proposed mitigation/ enhancement

The Project will develop an induction programme, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:

- respect for local residents and customs;
- zero tolerance of bribery or corruption;
- zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting;
- no alcohol and drugs policy during working time or at times that will affect ability to work;
- description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal.

The Project will implement a grievance procedure that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to. The Project will respond in a serious manner to any such complaints. Key steps include:

- Circulation of contact details of 'grievance officer' or other key Project contact;
- Awareness raising among the local community regarding the grievance procedure and how it works; and
- Establishment of a grievance register to be updated and maintained by the Project.

The Project will develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS.

Residual impacts

The implementation of the above mitigation measures would ensure that the construction phase significance is reduced to **Minor-Moderate** significance. A summary for the impact the construction phase of the Project is present below.

Table 10.32 Pre- and Post- Mitigation Significance for Impacts Associated with the Presence of the Workforce and Jobseekers

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts Associated with the Presence of a Workforce	Construction and Decommissioning	Moderate (-ve)	Minor - Moderate (-ve)

Table 10.33 Pre- and Post- Mitigation Significance for Impacts Associated with the Presence of a Workforce and Jobseekers

Nature and Type: Indirect negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Permanent
- **Scale:** Large
- **Frequency:** Constant
- **Reversibility:** Irreversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR - MODERATE NEGATIVE

10.11.2 Construction, Operation and Decommissioning: Pressure on Social Infrastructure and Services

Impact Description

It is generally accepted that large-scale infrastructure projects attract job-seekers into the Project Area. The Project is expected to stimulate in-migration as job-seekers enter the area with the intention of securing employment on the Project. In-migration of people will be further stimulated by possibility of business opportunities linked to the provision of goods and services to the Project, and by real or perceived opportunities arising from the general increase in economic activity in the area.

It is likely that a number of people will continue to stay in the area irrespective of whether they are able to secure employment and these people may move their families to the area. There is the possibility that people will return to their place of origin or move on to seek employment elsewhere if there are no employment opportunities for them, or when the construction phase is complete.

The expected impacts associated with an influx of jobseekers are:

- Pressure on existing social infrastructure – particularly housing, education and health facilities

The presence of the Project is likely to increase the rate of in-migration into the area, as people are attracted to the area in the hope of securing employment. The increase in population is expected to add pressure on existing infrastructure and services; specifically on housing services. Housing delivery has been slow in the SBLM and the housing backlog has been steadily increasing since 2001. The number of households on the waiting list for housing is currently estimated at 8,179 and the number of households affected

by the housing backlog is 6,730 (Saldanha Bay Local Municipality IDP, 2012). In-migrants will likely seek housing in Wards 3 and 4, where the SBLM is struggling to keep up with the local housing demand. This could be further exacerbated if job seekers decide to relocate their families to the area.

An influx of jobseekers and their families would place pressure on health and education facilities. SBLM has 14 medical facilities, but there are only two clinics located in the Saldanha Bay area (one in Ward 4 and the other in Ward 3). These already understaffed clinics would be placed under pressure to cope with the increase in population within their catchment.

Impact Assessment

The impacts related to pressure on social infrastructure and services will be an indirect impact. The impacts will be negative as they will place pressure on infrastructure and services and the local government, who will have to provide the services should the influx occur.

The impact will be experienced at a local level, within the ADI. The impacts will be long-term despite the fact that the period of influx may be limited to the construction phase, the associated impacts will continue to occur into the future. The scale of the impact will be medium, as the Project is not expected to attract large volumes of in-migration and the degree of change for local population will therefore be notable but will not dominate over existing conditions. The frequency of the impacts will not be uniform, but will felt often until in-migration stabilises and upgrades to infrastructure are undertaken. The impact is revisable as social infrastructure and services can be improved to address the impact. Given the information presented above, the impact will be medium in magnitude.

The population within the SBLM has been increasing at a rate greater than expected which has been attributed to the in-migration of people seeking economic opportunities. There is an existing housing backlog in the SBLM, and health services are under pressure. Therefore, the vulnerability of receptors is considered medium.

Therefore, the significance of the impact is rated as **Moderate negative,** the level of in-migration, and movement of job-seekers cannot be accurately predicted.

During the operational phase, there will limited employment opportunities and the Project is unlikely to attract further job seekers.

Proposed Mitigation Measures

The Project will implement a grievance procedure that is easily accessible to the local community, through which complaints related to contractor or employee behaviour can be lodged and responded to. The Project will respond in a serious manner to any such complaints. Key steps include:

- Circulation of contact details of 'grievance officer' or other key Project contact.
- Awareness raising among the local community regarding the grievance procedure and how it works.
- Establishment of a grievance register to be updated and maintained by the Project.

Implement management measures associated with the prioritisation of local labour, as outlined in *Section 10.10.1*

Residual impacts

The implementation of the above mitigation measures would ensure that the construction phase significance remains of Moderate significance. A summary for the impact the construction phase of the Project is presented below.

Table 10.34 Pre- and Post- Mitigation Significance for Impacts Associated with Pressure on Social Infrastructure and Services

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts Associated with Pressure on Social Infrastructure and Services	Construction	Moderate (-ve)	Moderate (-ve)

Table 10.35 Pre- and Post- Mitigation Significance for Impacts Associated Pressure on Social Infrastructure and Services

Nature and Type: Indirect negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Medium
- **Frequency:** Often
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MODERATE NEGATIVE

10.11.3 Construction and Decommissioning Phase: Impact on Human Health due to Air Emissions and Dust Generation

Impact Description

Most construction and decommissioning activities generate dust, which settles on surrounding properties and land, and is often more of a nuisance than a health issue. The dust is generally coarse, but may include fine respirable particles (PM_{10}) and these are known to be a risk to human health. Exhaust emissions from construction vehicles and equipment typically include particulates (including PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2) and volatile organic compounds (VOCs) including benzene. The creation of dust associated with vehicle traffic will be limited as most of the roads in the ADI are paved.

Impact Assessment

The impacts on human health due to air emissions and dust generation will be a direct, negative impact. The duration will be short-term, for the duration of the construction phase. The extent of the impact will be local, as the pollutants will be limited in dispersion and will occur onsite and around the main transport routes. Based on the outcomes of the Air Quality Specialist Report, *Section 10.3 of the EIR, and Annex D,* air emissions generated as a result of construction phase activities not expected to have an adverse effect on health, therefore the degree of change experienced by individuals will be negligible and the scale of the impact will be small. The impact is considered reversible. The frequency of the impact will vary depending on construction activities, but it will be often for the duration of the construction phase. Given the above factors, the magnitude of the impact is considered small.

The vulnerability of receptors is considered low as the Project site is located in an industrial area with no sensitive receptors located adjacent to the site. People living along transport routes have access to health care and would be able to seek medical attention if their health was adversely affect by air emissions.

Therefore it is anticipated that the significance of the impact will be **negligible.**

Mitigation

All of the mitigation measures outlined in *Section 10.3 of the EIR, and Air Quality Specialist Report, Annex D* must be implemented by the Project.

In addition, the Project will develop and implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

Residual Impact

The implementation of mitigation measures will ensure that the impact remains of negligible significance.

Table 10.36 Pre- and Post- Mitigation Significance for Impact on Human Health due to Air Emissions and Dust Generation

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impact on Human Health due to Air Emissions and Dust Generation	Construction	Negligible	Negligible

Table 10.37 Pre- and Post- Mitigation Significance for Impact on Human Health due to Air Emissions and Dust Generation

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Short-term
- **Scale:** Small
- **Frequency:** Often
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGABLE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGABLE

10.11.4 Operations Phase: Impact on Human Health due to Air Emissions

Impact Description

The operation of the power plant will result in emissions due to the operation of combustion sources mainly the turbines and generators, which could result in decreases in air quality. Emissions of air pollutants from the ArcelorMittal CCGT power plant will result during operations through the combustion of LNG or CNG resulting in NO_X, CO and CO_2 emissions and some methane (CH_4). Increased emissions of any of these pollutants can result in negative implications for human health. Respiratory diseases and cardiovascular diseases are most likely to result. In order to protect human health, air quality standards have been established and emissions below these standards are considered to have a negligible impact on the health of communities.

Exhaust emissions from Project associated vehicles and equipment typically include particulates (including PM_{10}), carbon monoxide (CO), nitrogen oxides

(NO_X), sulphur dioxide (SO_2) and volatile organic compounds (VOCs) including benzene.

Impact Assessment

The impacts on human health due to air emissions and dust generation will be a direct, negative impact. The duration will be long-term, for the duration of the operation phase. The extent of the impact will be local, as the pollutants will be limited in dispersion, occurring onsite and adjacent to the site, as well as the main transport routes. Based on the outcomes of the Air Quality Specialist Report, *Section 10.3 of the EIR, and Annex D,* for all pollutants the predicted ambient concentrations are well below the respective National Ambient Air Quality Standards (NAAQS). Therefore, air emissions generated as a result of the operation phase is not expected to have an adverse effect on health - the degree of change experienced by individuals will be negligible and the scale of the impact will be small. The impact is considered reversible. The frequency of the impact will be constant, as the power plant will operate 24 hrs a day, 7 days a week. Given the above factors, the magnitude of the impact is considered medium.

The vulnerability of receptors is considered low as the Project Site is located in an industrial area with no sensitive receptors located adjacent to the site. People living along transport routes have access to health care and would be able to seek medical attention if their health was adversely affect by air emissions.

Therefore it is anticipated that the significance of the impact will be **Minor (-ve).**

Mitigation

All of the mitigation measures outlined in *Section 10.3 of the EIR, and Air Quality Specialist Report, Annex D* must be implemented by the Project.

In addition, the Project will develop and implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

Residual Impact

The implementation of mitigation measures will ensure that the impact remains of Minor significance.

Table 10.38 Pre- and Post- Mitigation Significance for Impact on Human Health due to Air Emissions and Dust Generation

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impact on Human Health due to Air Emissions and Dust Generation	Operation	Minor (-ve)	Minor (-ve)

Table 10.39 Pre- and Post- Mitigation Significance for Impact on Human Health due to Air Emissions and Dust Generation

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Long-term
- **Scale:** Small
- **Frequency:** Constant
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR

10.12 INCREASED NUISANCE FACTORS AND CHANGE IN SENSE OF PLACE

The Project Site is located within an industrial area, adjacent to the Saldanha Steel facility. The land immediately surrounding the site it utilised for industrial purposes, grazing or is vacant land. Within the broader area, much of the surrounding land to the north and east is utilised for agriculture, nature reserves and recreational activities, residential and holiday homes. There are existing visual intrusions around the Project Site, such as power lines, railway pylons, industrial and port facilities, therefore, the landscape should not be seen as pristine.

The Project will introduce a gas-fired power plant and associated infrastructure such as a substation and Operation and Maintenance (O&M) buildings into the area, within close proximity to existing industrial infrastructure. The construction and operation of the Project will lead to an increase in ambient noise, the generation of dust and increased traffic volumes, all of which have the ability to alter the sense of place of the existing environment.

10.12.1 Construction, and Decommissioning Phase: Increased Nuisance Factors and Change in Sense of Place

Impact Description

Impacts associated with air quality, traffic and noise have been assessed by specialists and are discussed in *Section 10.9 of the EIR, the Traffic Assessment Report (Annex D), the Noise Impact Assessment Report (Annex D) and Air Quality Specialist Report (Annex D).*

The Project will cause nuisance of the communities in the ADI due to noise, dust and vibration, as well as increased traffic volumes during construction and decommissioning.

Noise levels are expected to increase as a result of construction activities on site such as trucks that deliver construction equipment and materials; earthworks using heavy machinery, and site preparation, or piling activities if required.

Additional vehicle movements during peak periods are anticipated to be in the order of 600 person trips during the peak hour or 275 cars, the equivalent of 18 minibus taxis and two buses. The minbus taxis and buses will collect and dispatch the workforce in the vicinity of the site, including areas in the ADI (such as Ward 3 and 4) and AII (such as Vredenburg).

The anticipated ambient noise levels during the construction phase of the Project has been modelled and based on the results thereof, it is anticipated that the change in ambient noise levels will be negligible during construction. The construction phase sound levels may impact on the ambient noise levels for an area of 2 500 m from the Project Site, the Site located in an industrial area and ambient noise levels are not going to exceed the 35 dBA guideline at any of the identified receptors.

The increase in traffic volumes will be notable during peak traffic times in the morning and afternoon, and may frustrate other road users, but the increase in traffic will be manageable through the implementation of mitigation measures.

Dust associated with the Project will be largely limited to the Project site.

While each of the above mentioned impacts are considered to be largely manageable, the combined effect of the noise, dust and traffic impacts are likely to have a negative impact on the sense of place for some stakeholders.

Impact Assessment

The impacts associated with increased nuisance factors and change in sense of place during construction and decommissioning will be a direct, negative impact. The duration will be short-term, for the duration of the construction

phase. The extent of the impact will be local, limited to the site and immediate surrounds, as well as the local transport routes.

The scale of the impact will be medium. The impact is considered reversible. The frequency of the impact will vary depending on construction activities, but it will be often as it relates to nuisance factors, and constant as it relates to sense of place. Given the above factors, the magnitude of the impact is considered medium.

The vulnerability of receptors is considered small to medium, as traffic volumes in the area are low, and road users will find the increased traffic volumes frustrating. The construction phase sound levels may impact on the ambient noise levels for an area of 2 500 m from the Project site.

Therefore it is anticipated that the significance of the impact will be **Moderate negative.**

Mitigation

All of the mitigation measures outlined in *Section 10.9 of the EIR, the Traffic Assessment Report, the Noise Impact Assessment Report and Air Quality Specialist Report (Annex D)* must be implemented by the Project.

In addition, the Project will develop and implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

Residual Impact

The implementation of mitigation measures will result in the impact being of Minor significance.

Table 10.40 Pre- and Post- Mitigation Significance for Increased Nuisance Factors and Change in Sense of Place

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Nuisance due to Noise, Dust and Vibration during Construction and Decommissioning	Construction	Moderate (-ve)	Minor (-ve)

Table 10.41 Pre- and Post- Mitigation Significance for Increased Nuisance Factors and Change in Sense of Place during Construction and Decommissioning

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Short-term
- **Scale:** Medium
- **Frequency:** Often to constant
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR NEGATIVE.

10.12.2 Operation Phase: Increased Nuisance Factors and Change in Sense of Place

Impact Description

The Project will cause nuisance to the communities in the ADI due to noise, dust and vibration, as well as increased traffic volumes during operation. This will affect the communities and households closest to the Project site and along the main access roads, as well as along the routes used to transport the workforce to and from the site on a daily basis.

During operation, the power plant will operate 24 hours a day, seven days a week. It is anticipated that the change in ambient noise levels will be negligible during Phase 1 of the project and low during Phase 2, with the 35dBA ambient guideline been slightly exceeded at two sensitive receptors. This noise will have a more constant characteristic and will be perceived as a humming sound. Operational phase sound levels may impact on the ambient noise levels for an area of 3,000 m from the proposed activity.

The Project associated traffic will decrease during the operations phase as there will be fewer people employed by the Project during this phase. Additional vehicle movements are associated with the commuting of employees to and from work each day. Additional vehicle movements during peak periods are anticipated to be in the order of 177 person trips during the peak hour or 80 cars, the equivalent of 5 minibus taxis and one bus.

The presence of the Project may alter the visual character of the landscape during the operation phase. While the Project Site is located in an industrial area, there are a number of tourism and recreational areas in the border surrounding areas, as listed above. *Figure 10.14* provides an analysis of the view shed of the Project, i.e. it indicated, based on topography and landscape features, where the Project will be visible from. It does not take into account how visible the how Project will be based on distance from the Project. Based

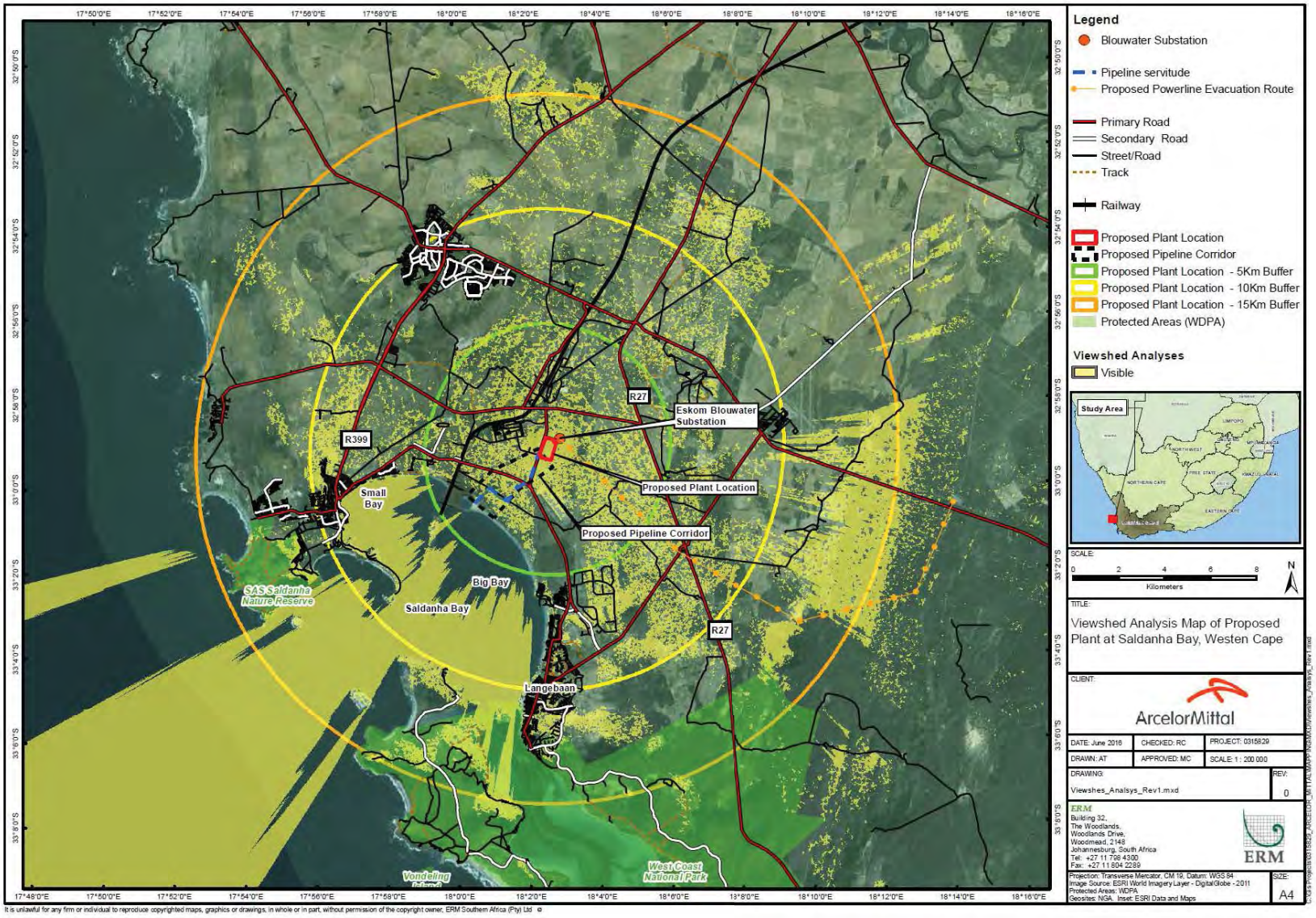
on *Figure 10.14* the Project may be partially visible from some sensitive areas, such as Langebaan, Mykanos, the West Coast National Park. It will also be visible from surrounding residential areas. Based on a Visual Impact Assessment for a similar power plant facility with an estimated height of 40 m in Saldanha Bay (M. Cilliers (PrLArch.) & D. Townshend (BL (UP)), it is noted that the vanishing threshold (1) is estimated at 8 km away during the day and 16 km away at night. The proposed facility is located in proximity to the following potentially affected receptors:

- 7 km from Blouwater Bay residential area;
- 8 km from Louwville residential area;
- 6.5 km from Mykonos tourism and recreational facilities;
- 6.5 km from the West Coast Fossil Park;
- 10 km from Langebaan residential area;
- 10 km from Langebaan Weg;
- 13 km from SAS Saldanha Contractual Nature Reserve;
- 14 km from Jacobsbaai residential area; and
- 20 km from the West Coast National Park.

The Project will be visible from a number of tourism and recreational areas, as well as residential area. Given the distance between the Project and the potential receptors (largely in excess of 6 km), it can be concluded that while the Project will be visible, it will not dominate the landscape or detract from the receptors experience in of the area

(1) This is the distance where no discernible impact is observed, even if the proposal is technically still visible.

Figure 10.14 View Shed for the Saldanha Steel Gas-fired Power Plant, not taking into Account Vanishing Threshold



Impact Assessment

The impacts due to increased nuisance factors and change in sense of place during operation will be a direct, negative impact. The duration will be long-term, for the duration of the operation phase. The extent of the impact will be local, limited to the site and immediate surrounds, as well as the local transport routes. It is anticipated that the change in ambient noise levels will be negligible during Phase 1 of the project and low during Phase 2, with the 35dBA ambient guideline being slightly exceeded at two sensitive receptors. The Project will be visible from a number of tourism and recreational areas, as well as residential area. Given the distance between the Project and the potential receptors (largely in excess of 6 km), it can be concluded that while the Project will be visible, it will not dominate the landscape or detract from the receptors experience in of the area. Never-the-less, for those receptors impacted by for increased nuisance factors and change in sense of place the scale of the impact will be medium.

The impact is considered irreversible. The frequency of the impact will be constant for the duration of the operation phase. Given the above factors, the magnitude of the impact is considered medium.

The vulnerability of receptors is considered medium as most sensitive receptors are located in quiet areas, with low ambient noise levels, low traffic volumes, and are people who are attracted to the area for outdoor and recreational activities (particularly in the case of those visiting parks and tourism facilities).

Therefore it is anticipated that the significance of the impact will be **Moderate (-ve).**

Mitigation

The ability to which visual impacts can be managed is limited by the size of the facility and the industry standards governing setbacks and fire control. However, the following measures should be implemented to minimise the impact of lighting at night:

- Lighting should be limited to areas where it is required.
- Lights should be directional and avoid light spillage.
- Low-level lights should be used over flood lights along walkways.

All of the mitigation measures outlined in *Section 10.9 of the EIR, the Traffic Assessment Report the Noise Impact Assessment Report and Air Quality Specialist Report (Annex D)* must be implemented by the Project.

In addition, the Project will develop and implement a Grievance Mechanism to address stakeholder concerns related to the Project in a timely manner.

Residual Impact

The implementation of mitigation measures will result in the remaining of **Moderate negative** significance.

Table 10.42 Pre- and Post- Mitigation Significance for Increased Nuisance Factors and Change in Sense of Place during Operation

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Increased nuisance factors and change in sense of place operation	Operation	Moderate (-ve)	Moderate (-ve)

Table 10.43 Pre- and Post- Mitigation Significance for Increased Nuisance Factors and Change in Sense of Place Operation

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Long-term
- **Scale:** Medium
- **Frequency:** Constant
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MODERATE NEGATIVE.

10.13 WORKER HEALTH AND SAFETY AND RIGHTS

Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labour abuses and to ensure fair treatment, remuneration and working and living conditions.

These issues will be considered not only for workers who are directly employed by the Project but also contractors (including sub-contractors) and workers within the supply chain. The main risks in relation to worker's management and rights are associated with the use of contractors and subcontractors and the supply chain.

The Project is expected create 450 direct employment opportunities during the peak of the construction period, which will be approximately 48 months in duration. The majority of workers will be engaged by the EPC contractor and will consist of a semi-skilled to skilled workforce. The operation phase is

planned for a lifespan of 25 - 30 years and will involve around 95 permanent site employees including skilled and semi-skilled staff.

The expected impacts on worker rights and H&S as a result of construction, operation and decommissioning activities and Project operation are as follows:

- Risk to workers H&S due to hazardous construction and decommissioning activities;
- Risk to workers H&S due to hazardous operation activities; and
- Violation of workers' rights.

This impact assessment is based on the assumption that no specific Project H&S policies, procedures and training provisions are in place for construction workers (both of EPC Contractor and subcontractors) as limited information is available on this at the current Project stage.

10.13.1 Construction and Decommissioning Phase: Risk to Workers' H&S due to Hazardous Construction Activities

Impact Description

The construction activities will involve the following main activities (in order of occurrence):

- Site preparation including levelling;
- Piling of the foundations;
- Concrete works in scope of building construction;
- Construction of fuel supply arrangements;
- Construction of the powerline; and
- Underground pipeline laying.

Details of the activities associated with decommissioning are not yet detailed but will involve removal of all installed infrastructure.

These activities will involve the operation of heavy equipment and trucks, working at height, working in confined spaces, construction traffic, use of electric devices, handling of hazardous materials and other hazardous activities. Due to the nature of the activities being undertaken during construction and decommissioning, worker H&S is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours.

Within South Africa, worker health and safety falls under the ambit of the Department of Labour, and is primarily governed through the Occupational Health and Safety Act (OSHA) (Act No. 83 of 1993). Employees working informally and those with limited or without awareness of their rights (for example, migrant workers, or those newly entering the labour market) are likely to be most at risk of working in unsafe conditions.

Impact Assessment

The impact on worker health and safety from the Project will be a direct, negative impact. The duration will be short-term, for the duration of the construction phase. The extent of the impact will be regional, as it will affect those directly employed by the Project, as well as people employed in the supply chain. The scale of the impact will be large for anyone adversely affected by a health and safety incident on the Project, as they may experience a temporary loss of work time, or in the worst-case scenario may be rendered permanently unable to work. In most instances, this impact is considered reversible, as incidences can be addressed through medical intervention where required and health and safety can be constantly improved to avoid future incidences. The frequency of the impact will not be uniform, but will likely occur often the duration of the construction phase. The magnitude of the impact is therefore considered Medium.

The vulnerability of the workers to this impact is considered low, as there are laws in place in South Africa to protect worker rights. However, migrant workers, or those newly entering the labour market may not be aware of their rights, and people may be willing to compromise their rights to secure employment in light of high unemployment rates.

The impact is therefore considered to be of Minor - Moderate negative significance.

Mitigation

- The Project will comply with all applicable South African legislation in terms of health and safety, and worker rights, which will include access to workmans compensation for loss of income resulting from an onsite incident.

- As part of the contractor and supplier selection process the Project will take into consideration performance with regard to worker management, worker rights, health and safety as outlined in South African law, international standards and the Project's policies.

- The Project will provide support to contractors and subcontractors to ensure that labour and working conditions are in line with South African law through capacity building.

- Workers will be provided with primary health care and basic first aid at construction camps /worksites.

- Facilities and operations will be developed, planned and maintained such that robust barriers are in place to prevent accidents. All employees have the duty to stop any works if adequate systems to control risks are not in place.

- In line with the worker code of conduct employees should not be under the influence of intoxicants which could adversely affect the ability of that employee to perform the work or adversely affect the health and safety of other employees, other persons or the environment.

- The Project will provide of Personal Protective Equipment (PPE), training and monitoring as well as ongoing safety checks and safety audits.

Residual Impact

Following the implementation of mitigation measures the impact significance will be (post-mitigation) of Minor negative significance**.**

Table 10.44 Pre- and Post- Mitigation Significance for Risk to Workers' H&S due to Hazardous Construction Activities

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Risk to Workers' H&S due to Hazardous	Construction	Minor to Moderate (-ve)	Minor (-ve)

Table 10.45 Pre- and Post- Mitigation Significance for Risk to Workers' H&S due to Hazardous Construction and Decommissioning Activities

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low to Medium

Impact Magnitude: Low

- **Extent:** Regional
- **Duration:** Short-term
- **Scale:** Large
- **Frequency:** Often
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR to MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): Enhancement measures will ensure the impact remains **MINOR NEGATIVE.**

10.13.2 Operation Phase: Risk to Workers' H&S due to Hazardous Operation Activities

Please note: For the operation of the Project the mitigation and prevention measures outlined above for construction (Section 10.13.1) are considered as embedded controls.

Impact Description

Hazardous activities during the operation phase and regular maintenance activities will include, but not be limited to; the operation of heavy equipment and trucks, use of electrical devices including high voltage, working at height, maintenance of high pressure pipework and vessels and handling of hazardous materials. During these activities the workers will be at risk for accidents and injury.

Impact Assessment

The impact on worker health and safety as a result of the Project will be a direct, negative impact. The duration will be long-term, for the duration of the operation phase. The extent of the impact will be regional, as it will affect those directly employed by the Project, as well as people employed in the supply chain. The scale of the impact will be large for anyone adversely affected by a health and safety incident on the Project, as they may experience a temporary loss of work time, or in the worst-case scenario may be rendered permanently unable to work. In most instances, this impact is considered reversible, as incidences can be addressed through medical intervention where required and health and safety can be constantly improved to avoid future incidences. The frequency of the impact will not be uniform, but will likely occur occasionally the duration of the operation phase. The magnitude of the impact is therefore considered small.

The vulnerability of the workers to this impact is considered low, as there are laws in place in South Africa to protect worker rights and most employees will be highly skilled engineers and technicians, who have likely been educated around their rights and H&S practices.

The impact is therefore considered to be of minor significance.

Mitigation

The implementation of mitigation measures defined for the construction phase will continued throughout the operation phase with consideration in the health and safety management system of the specific risks associated with operation and maintenance activities and the new size and structure of the workforce. In this regard, mitigation measures outlined in *Section 10.13.1* above are applicable to the operation.

Residual Impacts

The implementation of mitigation measures will ensure that the significance remains of minor negative significance.

Table 10.46 Pre- and Post- Mitigation Significance for Risk to Workers' H&S due to Hazardous Operation Activities

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Risk to Workers' H&S due to Hazardous Operation Activities	Operation	Minor (-ve)	Minor (-ve)

Table 10.47 Pre- and Post- Mitigation Significance for Risk to Workers' H&S due to Hazardous Operation Activities

Nature and Type: Direct, negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Regional
- **Duration:** Long Term
- **Scale:** Large
- **Frequency:** Rare
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): Enhancement measures will ensure the impact remains **MINOR NEGATIVE.**

10.14 IMPACTS ON ARCHAEOLOGY AND PALAEONTOLOGY

This Section discusses the potential impacts on heritage resources resulting from the establishment of the gas-fired power plant including physical effects on sites and features of cultural heritage interest and broader landscape.
The expected impacts on cultural heritage resources as a result of construction, operation and decommissioning of the Project are:

- Impacts to Pre-colonial & Colonial Archaeology
- Impacts to Graves and Cairns
- Impacts to buried Palaeontology

10.14.1 *Construction, Operation and Decommissioning: Impacts to Pre-colonial & Colonial Archaeology*

Impact Description

The site clearance, excavation of foundations, road construction, laying of the pipeline and other construction activities have the potential to destroy or damage archaeological and palaeontological resources. The key threat to pre-colonial archaeological remains is the potential impacts to sub-surface remains

and these are difficult to predict and to mitigate. The impacts are likely to be most severe during the construction period although indirect impacts may occur during the operational phase of the Project.

Archaeological sites are non-renewable, it is therefore, important that they are identified and their significance assessed prior to development. The main cause of impacts to archaeological sites is direct, physical disturbance of the material itself and its context as an archaeological site is highly dependent on its geological and spatial context.

Impact Assessment

The impacts to pre-colonial & colonial archaeology during construction, operation and decommissioning will be a direct, negative impact. The duration will be permanent as it relates to the loss of pre-colonial & colonial archaeology. The extent of the impact will be local, limited to the Project footprint. The scale of the impact will be medium. The impact is considered irreversible. The frequency of the impact will vary depending on construction activities, but it anticipated that it would be rare given nature of the baseline. Given the above factors, the magnitude of the impact is considered low.

The vulnerability of receptors is considered low as no pre-colonial or colonial period archaeological sites were found during a comprehensive field survey along the pipeline, and in the area identified for the power plant.

Therefore it is anticipated that the significance of the impact will be **Minor negative.**

Mitigation

Should any human burials, archaeological or palaeontological materials (fossils, bones, artefacts etc.) be uncovered or exposed during earthworks or excavations, they must immediately be reported to the Heritage Western Cape must be notified (Telephone: 021 483 9685).

After assessment and if appropriate a permit must be obtained from the SAHRA or HWC to remove such remains.

Residual Impact

The implementation of mitigation measures will result in the impact being of Negligible significance.

Table 10.48 Pre- and Post- Mitigation Significance for Impacts to Pre-colonial & Colonial Archaeology

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts to Pre-colonial & Colonial Archaeology	Construction	Minor (-ve)	Negligible

10.14.2 Construction, Operation and Decommissioning: Impacts to Graves and Cairns

Impact Description

The site clearance, excavation of foundations, road construction, laying of the pipeline and other construction activities have the potential to destroy or damage archaeological resources. Graves are typically considered to be of high heritage significance. They are best avoided by development. An extensive consultation process is required if exhumation is considered.

Human remains are protected by a number of legislations including the Human Tissues Act (Act No 65 of 1983), the Exhumation Ordinance of 1980 and the National Heritage Resources Act (Act No 25 of 1999). In the event of human bones being found on site, Heritage Western Cape HWC must be informed immediately and the remains removed by an archaeologist under an emergency permit.

Impact Assessment

Impacts to graves and cairns during construction, operation and decommissioning will be a direct, negative impact. The duration will be permanent as it relates to the loss of graves and cairns. The extent of the impact will be local, limited to the Project footprint. The scale of the impact will be medium. The impact is considered irreversible. The frequency of the impact will vary depending on construction activities, but it anticipated that it would be rare given nature of the baseline. Given the above factors, the magnitude of the impact is considered low.

The vulnerability of receptors is considered low as no evidence of graves or stone cairns were found within the Project footprint.

Therefore it is anticipated that the significance of the impact will be **Minor negative.**

Mitigation

Should any human burials, archaeological or palaeontological materials (fossils, bones, artefacts etc.) be uncovered or exposed during earthworks or excavations, they must immediately be reported to the Heritage Western Cape must be notified (Telephone: 021 483 9685).

After assessment and if appropriate a permit must be obtained from the SAHRA or HWC to remove such remains.

Residual Impact

The implementation of mitigation measures will result in the impact being of Negligible significance.

Table 10.49 Pre- and Post- Mitigation Significance for Impacts to Pre-colonial & Colonial Archaeology

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts to Pre-colonial & Colonial Archaeology	Construction	Minor (-ve)	Negligible

10.14.3 Construction, Operation and Decommissioning: Impacts to buried Palaeontology

Impact Description

The site clearance, excavation of foundations, road construction, laying of the pipeline and other construction activities have the potential to destroy or damage palaeontological resources.

A fossil record along the entire project area does not exist. However, based on the distribution and nature of known sites, sufficient information is available to make at least general assumptions of what may be expected in many areas. It is noted, however, that sub-surface palaeontological potential cannot properly be assessed superficially without digging.

It is entirely possible that excavations into sediments not normally accessible to palaeontologists will be encountered in sub-surface deposits of the Langebaan and Velddrif Formations. However, rather than treating this as a negative, implementation of appropriate management may enable observations otherwise impossible to be made and provide opportunities to recover important fossil material.

Portions of the proposed project area have been heavily disturbed by agriculture and these surfaces have been adequately covered during the foot survey, without revealing Palaeontological or Pleistocene archaeological remains other than terrestrial molluscs and insect burrows; these latter are ubiquitous and will have no effect on the project.

Table 10.50 Impact Characteristics: Impacts to buried Palaeontology

Characteristic	Description
Activity	Construction, operation and decommissioning activities.
Aspect	The site clearance, excavation of foundations, road construction, laying of the pipeline
Impact	Construction activities particularly have the potential to destroy or damage palaeontological resources
Impact Type	Indirect negative impact
Resource or Receptor	Palaeontological resources

Impact Assessment

Impacts to buried Palaeontology during construction, operation and decommissioning will be a direct, negative impact. The duration will be permanent as it relates to the loss of palaeontological resources. The extent of the impact will be local, limited to the Project footprint. The scale of the impact will be large. The impact is considered irreversible. The frequency of the impact will vary depending on construction activities, but it anticipated that it would be rare given nature of the baseline. Given the above factors, the magnitude of the impact is considered large.

The vulnerability of receptors is considered high, despite the fact that no palaeontological or Pleistocene archaeological remains were observed on the surface, sub-surface findings may be revealed through Project activities.

Therefore it is anticipated that the significance of the impact will be **Major negative.**

Mitigation

- Sub-surface excavations should be monitored by a palaeontologist or archaeologist with appropriate palaeontological knowledge. The frequency of this to be worked out a priori with the contractor to minimise time spent on site.
- Any material recovered will be lodged in the Cenozoic collections of Iziko South African Museum.
- If any palaeontological material is uncovered, permit for the disturbance and removal of palaeontological material will be required from the Western Cape Provincial Heritage Agency.
- Training in the nature and value of palaeontological and archaeological remains should be provided to project staff and equipment operators.
- Should anything of a palaeontological nature be encountered on site by the Contractor (or any other party), e.g. bones or wetland deposits, work is to be stopped in that area immediately, and the OM / Principal Agent notified. Failure to do so will result in a penalty and this must be carefully explained to workers during the Environmental Education Programme undertaken by the OM.

- In the event of palaeontological material being encountered, the OM will demarcate the area and notify the appointed specialist (palaeontologist/ archaeologist with appropriate experience) who will view the material and ascertain whether further study of the area is required.
- Should the specialist confirm a genuine fossil or sub-fossil and recommend further study of the area, work in the applicable area is to cease until further notice while arrangements are put in place. Heritage Western Cape (HWC) is to be informed immediately by the OM (Telephone: 021 483 9685).

Residual Impact

The implementation of mitigation measures will result in the impact being of Negligible significance.

Table 10.51 Pre- and Post- Mitigation Significance for Impacts to buried Palaeontology

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts to buried Palaeontology	Construction	Major (-ve)	Negligible

10.15 RISK ASSESSMENT

10.15.1 Introduction

The major hazards considered in a risk assessment are generally one of three types: flammable, reactive or toxic. With reference to the Project, only flammable hazards which may result from the loss of containment of the flammable Natural Gas being transferred in the pipelines (during operation), or the Propane from storage at the power station (highest concentrations during the second year of construction, but continued risk during operation), have been identified. Flammable hazards may manifest as high thermal radiation from fires and overpressures following explosions that may cause direct damage, building collapse, etc. These hazards pose a risk to current and future land uses and individuals.

Impacts that have been assessed as part of this section of the report therefore are:

- Land use planning impact for the construction phase;
- Risk to individuals for the construction phase;
- Land use planning risk posed by the pipelines during the operational phase;
- Land use planning risk posed by the propane storage facility during the operational phase; and
- Risk to individuals for the operational phase.

This introduction sets out the relevant legislation and guidelines for the assessment of these impacts and provides the baseline context which informs the assessment of all of these.

Relevant legislation and guidelines

The Occupational Health and Safety Act in South Africa offers the Major Hazard Installation regulations which govern major accidents in South Africa. These regulations do not currently offer criteria with which to assess the acceptability of developments from a major accident risk perspective. Therefore the risk criteria used are based on those adopted by the Health and Safety Executive (HSE) in the United Kingdom. This methodology is internationally recognised and accepted as a basis for risk management.

The HSE has developed different sets of risk criteria for different applications. One role that the HSE fulfils in the UK is to advise on development of land in the vicinity of existing major hazard installations. For this purpose the HSE uses its so-called land use planning (LUP) criteria. Another set of criteria is used by the HSE to judge the acceptability of risk from existing major hazard installations. These are known as risk tolerability criteria.

The individual risk tolerability criteria will also be used to assess whether the risks posed by the Natural Gas pipelines or Propane generator are acceptable to individuals in the vicinity of the pipeline servitude.

Land Use Planning Around Hazardous Installations

A three zone system is applied in the HSE approach - Inner Zone, Middle Zone and Outer Zone, with the outermost extent of the Outer Zone referred to as the Consultation Distance (CD). In combination with this, land-uses are classified according to Sensitivity Level, with Sensitivity Level 1 (typically places of work) being the least sensitive and Sensitivity Level 4 (typically large schools or hospitals) being the most sensitive. A set of rules (in the form of a 'decision matrix') is applied to determine which land-uses are appropriate for which zones.

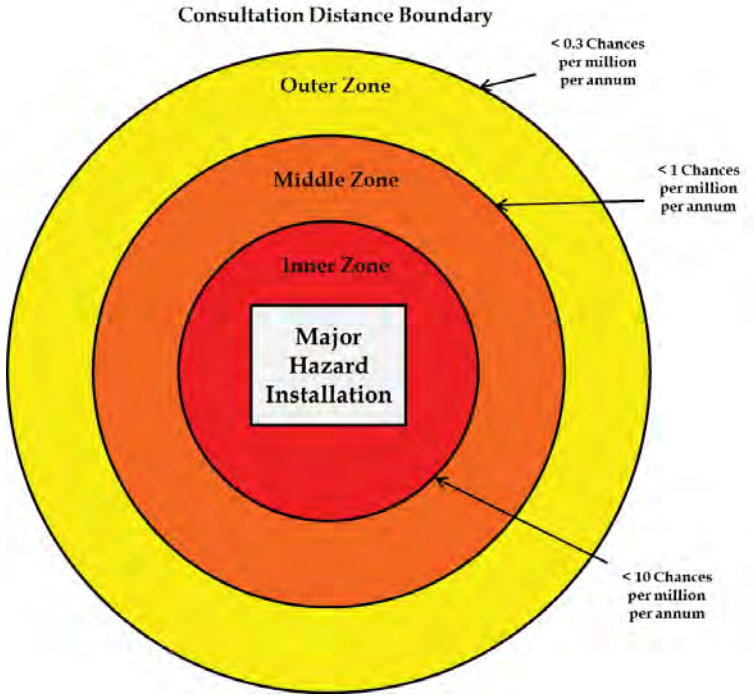
In practice, the zones are related to the risk of an individual being exposed to a dangerous dose or load which would "...cause severe distress to almost everyone, many [would] require medical treatment, some [would] be seriously injured and highly vulnerable people might be killed". This approach appreciates the general public's aversion not only to fatality but also to injury and other distress (i.e. the concept of harm), and is distinct from approaches solely related to fatality.

The zones for an individual being harmed from exposure to flame/heat, explosion overpressure, toxic gas or asphyxiant (i.e. a specified frequency of receiving a dangerous dose) have been set to correspond to the following risk levels:

- Inner Zone - 10 chances per million per year (1×10^{-5});
- Middle Zone - 1 chance per million per year (1×10^{-6}); and
- Outer Zone (Consultation Distance) - 0.3 chances per million per year (3×10^{-7}).

Examples of the various zones for major hazard sites are shown in *Figure 10.15*.

Figure 10.15 Land Use Planning Consultation Zones around Hazardous Sites



In November 2001 the UK HSE modified its zoning criteria. These are summarised in *Table 10.52* with proposed developments categorised as either 'advise against' (AA) or 'don't advise against' (DAA).

Table 10.52 Land-use Sensitivity to Risk

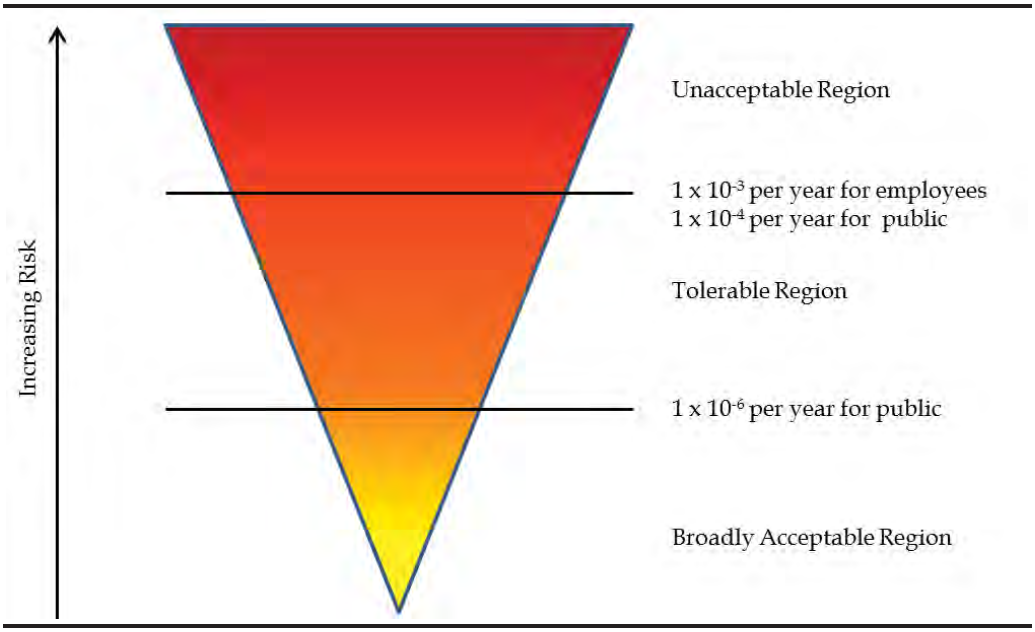
Level of Sensitivity	Inner Zone	Middle Zone	Outer Zone
1. The normal working public	DAA	DAA	DAA
2. The general public at home	AA	DAA	DAA
3. Vulnerable members of the public (schools, hospitals, etc.)	AA	AA	DAA
4. Large examples of No 3 & large outdoor examples of No 2 (i.e. recreational areas)	AA	AA	AA

Individual risk tolerability criteria

The HSE risk tolerability criteria are used to judge the acceptability of the risks from existing MHIs or pipeline servitudes. In the HSE tolerability of risk framework (1), risk levels are divided into three bands of increasing risk, as shown in *Figure 10.16.*

In the lowest band, within the 'broadly acceptable' region, the risk is considered to be insignificant and adequately controlled. Risks that are within the 'unacceptable' level fall into the uppermost band. In such cases, either action should be taken to reduce the risk levels, or the activity giving rise to the risk should be halted. Between the unacceptable and broadly acceptable regions, the risk is considered to be tolerable if it is As Low As Reasonably Practicable (ALARP). The risk is ALARP when the cost of any further risk reduction measures would be grossly disproportionate to (i.e. much greater than) the benefits gained.

Figure 10.16 HSE Risk Criteria Framework



The individual risk is the risk to which a hypothetical person (usually with defined characteristics and behaviour pattern) is exposed. The HSE criteria(1) are stated in terms of individual risk of fatality for two types of hypothetical person: a person who is engaged in the industrial activity under consideration (e.g., an employee); and a person who is not involved in the activity (e.g., a member of the public).

The HSE has provided individual risk values corresponding to the boundaries between the different regions indicated in *Figure 10.16*. These are summarised in *Table 10.53.*

(1) HSE (2001). Reducing Risks, Protecting People. HSE Books, C100.

Table 10.53 Individual Risk Criteria

Level	Individual Risk to Personnel Engaged in the Activity (/yr)	Individual Risk to People not Engaged in the Activity (/yr)
Unacceptable	Greater than 1 in 1,000 (10^{-3})	Greater than 1 in 10,000 (10^{-4})
Broadly Acceptable	No greater than 1 in 1,000,000 (10^{-6})	No greater than 1 in 1,000,000 (10^{-6})

Baseline conditions

Typically, quantitative risk assessments (QRAs) require information regarding the ambient temperatures, wind speed, wind direction and stability class.

Site-specific wind speed data were obtained for the Port of Saldanha. It is understood that to date no weather stations in South Africa measure both wind speed and atmospheric stability categories. Therefore, ERM selected the following stability classes and wind speed scenarios as being considered representative for modelling purposes:

- C4 – meaning a stability class of C (slightly unstable conditions) where the wind speed is greater than 4 m/s.

- C8 - meaning a stability class of C (slightly unstable conditions) where the wind speed is greater than 8 m/s.

The above weather scenarios reflect a conservative daytime weather condition.

- F2 – meaning a stability class of F (moderately stable) where the wind speed is less than or equal to 2 m/s. This class is often used by the US Environmental Protection Agency for determining worse case scenarios for vapour cloud dispersion consequence analysis. F2 gives a conservative night time weather condition.

Selecting the above categories gives an average and a 'worst case' condition for the risk assessment study.

The average ambient temperature and humidity for Saldanha Bay were obtained from www.weatherbase.com. A summary of the data is as follows:

- Average ambient temperature is 15.9 °C; and
- Average relative humidity is 78 %.

The area around the proposed Natural Gas pipelines' route and CCGT power plant site includes the following land uses:

- Sensitivity Level 1: The Saldanha Port area and the access road running adjacent to the CCGT power plant site as this is a single lane road; and

- Sensitivity Level 2: MR559 which is crossed by the pipelines as this is a dual carriageway.

The following built-in mitigation has been considered in this assessment:

- Multiple (at least two) safety systems will be implemented for Propane offloading. Such systems include wheel chocks, interlock brakes, interlock barriers, etc. In addition the site will implement an effective pull away mitigation system and inspection and pressure/leak tests to prevent transfer system leaks and bursts.

Based on the Risk Assessment undertaken (see *Annex D*), the following potential impacts have been assessed in this section:

- Land Use Planning Impact for the Construction Phase;
- Risk to Individuals for the Construction Phase;
- Land Use Planning Impact for the Operational Phase for the Natural Gas Pipelines;
- Land Use Planning Impact for the Operational Phase for the Propane Generator Installations; and
- Risk to Individuals for the Operational Phase.

Proposed Mitigation

The following mitigation is proposed for the Natural Gas pipelines and the Propane storage in order to minimise potential impacts. Impacts are assessed in the sections that follow.

Mitigation measure(s) for the proposed Natural Gas Pipelines

The following proposed engineering design features that reduce risks should be implemented:

- The pipelines should be designed to an international standard such as:
  - BS EN 14161: Petroleum and natural gas industries – Pipeline transportation systems;
  - ASME B31.8 Gas Transmission and Distribution Piping Systems; or
  - Other internationally recognised standards.

- The pipelines' wall thickness should be designed to accommodate the maximum operating pressure of 90 barg with a suitable safety factor;

- Isolation valves should be located at least at either end of the pipelines but ideally at intervals such that in the event of a leak only small amounts of Natural Gas would be released;

- Leak prevention systems such as cathodic protection and pipeline coatings suitable for the ground conditions should be implemented;

- The pipelines should include an emergency shutdown system that will shut emergency isolation valves and depressurise the pipelines safely;
- Areas of road crossing shall include specific protection measures to account for the weight from road traffic;
- A Leak detection system should be considered for the pipelines;
- The installation of non-return valves on the pipelines should be considered;
- Depth of burial of the pipelines along their length should be equal to, or greater than the minimum depth of burial specified;
- Potential other risk reduction measures include concrete sheathing, tiles above pipelines, marker tape above pipelines, route marker posts etc; and
- Emergency response plan for the pipeline must be compiled with the user of the pipelines and the Local Authority together.

The following protective measures should be put in place to reduce the risks:

- Third party interference protection measures should be included. These should differentiate between accidental interference (which can be protected against with safety marker tape, regular aboveground pipeline markers, etc) and deliberate interference (which can be protected against with regular pipeline surveys, ground disturbance early warning systems, etc);
- All Natural Gas processing areas should be equipped with gas detectors with appropriate logic that can initiate emergency shutdown of Natural Gas operations and even the pipelines if necessary;
- All of the automatic safety systems shall be designed so that they can also be manually activated.

Specific mitigation measures identified by the specialist include:

- Ensuring compliance with all statutory requirements (i.e. pipeline designs);
- Ensuring compliance with applicable South African National Standards (i.e. SANS 10087, etc.);
- Incorporating applicable guidelines or equivalent international recognised codes of good design and practice into the designs;
- Completing recognised processes of hazard analysis processes (HAZOP, FMEA, SIL, LOPA etc.) for the proposed CCGT power plant prior to

construction to ensure design and operational hazards have been identified and adequate mitigation has been considered;

- Ensure any amendments to the current design specifications are captured in amendments to the EIA and relevant specialist studies; and

- Ensuring a Major Hazard Installation (MHI) risk assessment is carried out for the facility after detailed designs have been completed for the pipelines and CCGT power plant in accordance with the Major Hazard Installation regulations;

Mitigation measure(s) for the proposed Propane generator installations on the CCGT power plant site

The following proposed engineering design features that reduce risks should be implemented:

- The installation must comply with all the requirements of SANS 10087-3:2015 *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L*;

- The Propane storage vessel shall be fitted with pressure relief valves, which would only lift when the vessel has reached its maximum operating pressure or level;

- All piping shall be rated to accommodate the required operating pressure of the system and allow for pressure relief to a safe area;

- All pressure relief systems should vent away from the generator air intake system;

- The Propane vessel shall be filled with sparge pipes in the vapour space to limit reverse flow to the off-loading point as well as preventing vessel stresses due to uneven temperature;

- All instrumentation and electrical equipment shall be specified in accordance to the Hazardous Area classification as per SANS 10108;

- Off-loading of Propane shall be done on a fully-automated system to prevent overfilling;

- Off-loading safety systems such as earthing of the road tanker are required;

- Emergency shutdown (ESD) shall be provided that would automatically shut down systems such as feed or off-loading pumps and emergency shut off valves in the event of an emergency; and

- Emergency shutdown should be initiated by local operators, CCGT control room operators as well as by gas detectors where appropriate.

The following protective measures should be put in place to reduce the risks:

- Active or passive fire protection on the Propane storage bullet in line with SANS 10087-3:2015;

- Propane road tanker offloading deluge system to cool equipment in the event of a fire if required by SANS 10087-3:2015;

- Gas detectors with appropriate logic which can initiate emergency shutdown;

- All of the automatic safety systems shall be designed so that they can also be manually activated;

- Procedures should ensure at least one person be present during Propane offloading;

Specific mitigation measures identified by the specialist include:

- Ensuring compliance with applicable South African National Standards (i.e. SANS 10087-3:2015, etc.);

- Incorporating applicable guidelines or equivalent international recognised codes of good design and practice into the designs;

- Completing recognised processes of hazard analysis processes (HAZOP, FMEA, SIL and LOPA etc.) for the proposed CCGT power plant prior to construction to ensure design and operational hazards have been identified and adequate mitigation has been considered;

- Ensure any amendments to the current design specifications are captured in amendments to the EIA and relevant specialist studies; and

- Ensuring a Major Hazard Installation (MHI) risk assessment is carried out for the facility after detailed designs have been completed for the pipelines and CCGT power plant in accordance with the MHI regulations.

10.15.2 Risk Assessment: Land Use Planning Impact for the Construction Phase

Impact Description

This impact will pose the maximum risk in the second year of the construction phase of the project when there will be the highest usage of the propane storage facility. Natural gas will not yet be in use on the Project site at that

time and thus there will be no risk posed by the pipelines during this phase of the Project.

The main hazards associated with potential releases of Propane from the Propane storage facility are jet fires (immediate ignition), flash fires (delayed ignition) and explosions (delayed ignition of the gas or vapour in a confined space). The hazards may be realised due to leaks/failures in the Propane storage vessel, off-loading road tankers or associated equipment, all of which can release significant quantities of flammable materials on failure. This would result in human exposure via thermal radiation and overpressures.

As the planned construction period in the second year is expected to consume the most Propane, this scenario has been modelled for the assessment of this impact.

Impact Assessment

Risk model outcome

The Land Use Planning risk contours for the Propane generator operations during the second year of construction are shown in *Figure 10.17*.

The risk associated with the increased Propane consumption during the second year of construction results in an area outside the power plant site falling within the 1×10^{-5} contour and therefore falling within the Inner Zone. This area extends approximately 110 m to the west and 40 m to the north of the CCGT site boundary. Therefore no Level 2, Level 3 or Level 4 developments should be allowed within this area during the second year of construction.

From the figure it can be seen that an area outside the power plant site falls within the 1×10^{-6} contour and therefore is within the Middle Zone. This area extends approximately 120 m to the west and 50 m to the north of the CCGT site boundary. Therefore no Sensitivity Level 3 or Level 4 developments should be allowed within this area during the second year of construction. No Sensitivity Level 3 or 4 land uses exist in the surrounding area.

From the figure it can be seen that an area outside the power plant site falls within the 3×10^{-7} contour and therefore is within the Outer Zone. This area extends approximately 140 m to the west and 60 m to the north of the CCGT site boundary. Therefore no Sensitivity Level 4 developments should be allowed within this area during the second year of construction. No Sensitivity Level 4 land uses exist in the surrounding area.

The current land uses within these areas result in the risk level being classified as 'don't advise against' during the second year of construction according to the land use planning criteria. Future land uses around the CCGT power plant site within the second year of construction should adhere to those of *Table 10.52* for risk contours presented in *Figure 10.17*.

The hazards as described above, would result in a direct negative type of impact on the natural vegetation, structures, employees and people in the immediate area. The duration would be temporary as such hazards would be of short duration and only happen occasionally, if at all. The extent for the impact is local.

The scale of the hazard effects of a dangerous dose as defined earlier, from the Propane generator installations are as follows:

- Jet Fire: 173 m;
- Flash Fire: 239 m;
- Vapour Cloud Explosion: 13 m; and
- Boiling Liquid Evaporating Vapour Explosion / Fireball: 114 m.

If facilities and equipment are designed to the prescribed specifications and standards, the likelihood of such an event occurring is considered **unlikely**.

The area surrounding the proposed CCGT power plant site is similarly unused with the exception of a small access road. Therefore, this land use sensitivity is also categorised as low.

Box 10.16 Land Use Planning Impact for the Construction Phase

Nature and Type: Negative direct

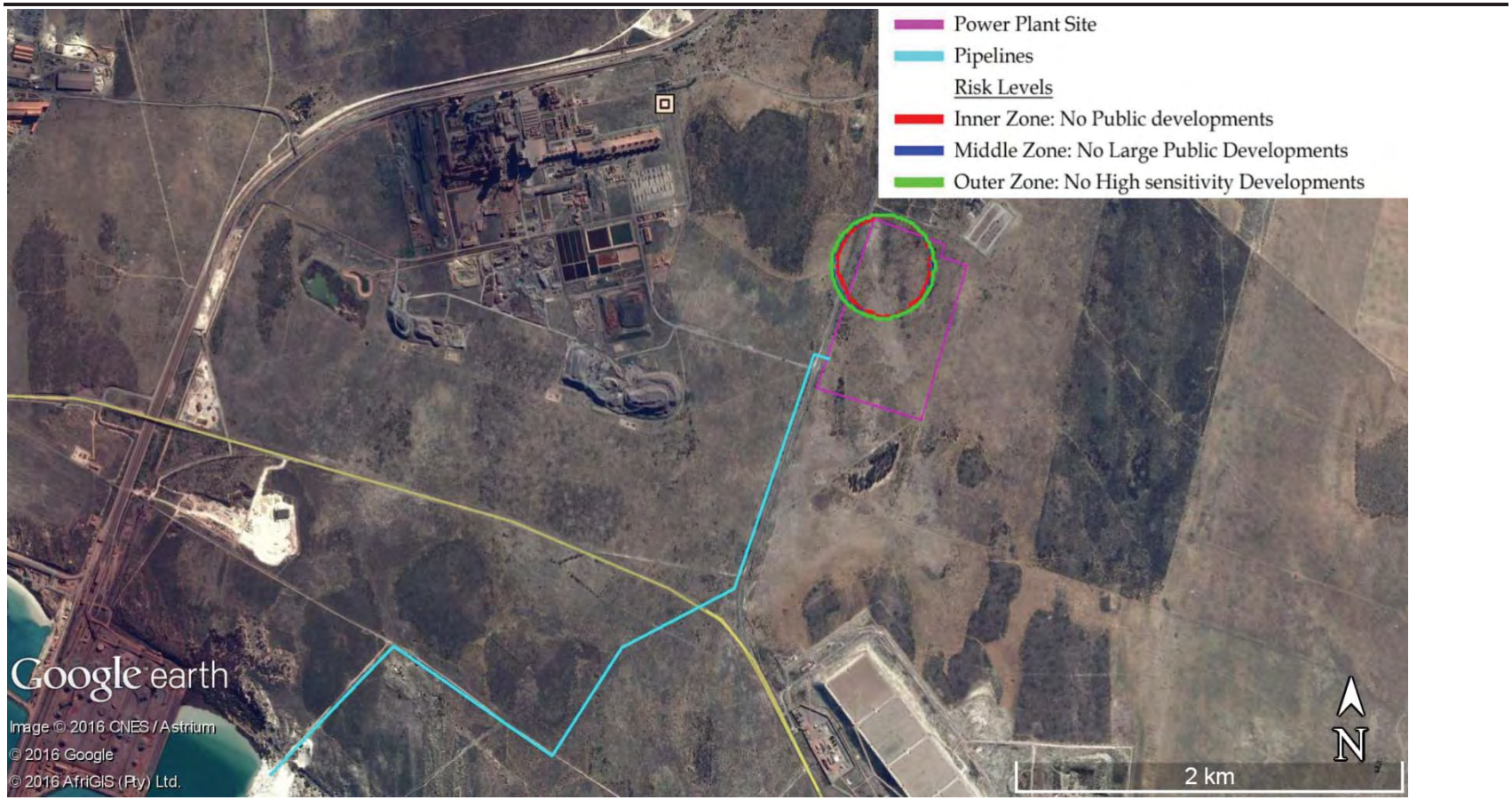
Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Temporary
- **Scale:** The largest hazard effects to Dangerous Dose are 239 m. The largest land use restriction extends 140 m to the west and 60 m to the north of the CCGT site boundary, centred on the Propane generator.
- **Likelihood:** Unlikely

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation, as detailed in Section 10.15.1, this impact remains **NEGLIGIBLE**

Figure 10.17 Contours for Land Use Planning for Saldanha Steel Natural Gas Pipelines and Propane backup generator with High Propane Consumption during the Second Year of Construction



10.15.3 Risk Assessment: Risk to Individuals for the Construction Phase

Impact Description

The main hazards associated with potential releases of Propane from the Propane storage facility are jet fires (immediate ignition), flash fires (delayed ignition) and explosions (delayed ignition of the gas or vapour in a confined space). The hazards may be realised due to leaks/failures in the Propane storage vessel, off-loading road tankers or associated equipment, all of which can release significant quantities of flammable materials on failure. This would result in human exposure via thermal radiation and overpressures.

As the planned construction period in the second year is expected to consume the most Propane and therefore presents the highest risk for the construction phase of the Project, this scenario has been modelled for the assessment of this impact.

Impact Assessment

Risk model outcome

Individual risks are by definition specific to individuals and need to take into account the extent and circumstances under which exposure arises. For instance, the risk will depend on the amount of time the individual spends outdoors as well as the time they may spend indoors which will afford them some protection. Risks are calculated for hypothetical persons located outdoors and indoors.

The risk contours presented in this section represent Location Specific Individual Risk (LSIR).It should be noted that the LSIR relates to an individual who is permanently exposed 24 hours a day 365 days a year. This is therefore an overestimate of the individual risk to personnel or public who may be present at these locations.

Individual risks of fatality contours for persons located outdoors and indoors at 1×10^{-6}, 1×10^{-5}, 1×10^{-4} and 1×10^{-3} for the Propane installation were calculated.

The areas surrounding the proposed developments that fall between the 1×10^{-6} contour and the 1×10^{-4} contour are small areas to the north and west of the CCGT power plant site. As the risk exceeds 1×10^{-6} but does not exceed the 1×10^{-4} risk level, the LSIR for the pipelines and Propane backup generator for persons located outdoors in these areas is not considered intolerable. The risks can only be considered tolerable if they can be demonstrated by the site to be As Low As Reasonably Practicable (ALARP).

The 1×10^{-4} contour exists for the area centred on the Propane backup generator. This contour does not extend offsite, therefore only workers involved in the construction and operation of the CCGT power plant are

exposed to this risk level and this is not considered intolerable according to the risk criteria. The risks can only be considered tolerable if they can be demonstrated by the site to be As Low As Reasonably Practicable (ALARP).

The 1×10^{-3} LSIR contour do not exist for individuals located outdoors, therefore the risk is below these levels.

Areas located beyond the 1×10^{-6} contour would be considered 'broadly acceptable'. The risks posed to areas located between the 1×10^{-6} contour and the 1×10^{-4} contour would be considered tolerable if they can be proved to be ALARP by the Propane installation operator. The risks posed to non-Natural Gas operational personnel and establishments as well as sensitive areas within the 1×10^{-4} contour are considered intolerable. The LSIR contours for individuals located outdoors and indoors for the proposed Propane backup generator during the second year of construction are shown in *Figure 10.18* and *Figure 10.19* respectively.

Figure 10.19 represents the LSIR for hypothetical persons located indoors for the Propane generator during the second year of construction. Areas located off the power plant site have an individual risk higher than 1×10^{-6}. As the risk exceeds 1×10^{-6} but does not exceed 1×10^{-4}, the LSIR for the Propane backup generator for persons located outdoors in these areas is not considered intolerable according to the risk criteria. The risks can only be considered tolerable, however, if they can be demonstrated by the site operator to be ALARP.

The 1×10^{-3} LSIR contour does not exist for individuals located indoors, indicating that the risk is lower than this level.

The general public sensitivity is categorised as medium while worker sensitivity is categorised as low, given that workers are more aware of the risks and adequately prepared to handle them as a result of emergency planning, PPE etc.

The hazards, as described above, would result in a direct negative type of impact on the natural vegetation, structures, employees and people in the immediate area. The duration would be temporary as such hazards would be of short duration and only happen occasionally, if at all. The extent for the impact is local.

The scale of the hazard effects of a Dangerous Dose as defined earlier from the Propane generator installations are as follows:

- Jet Fire: 173 m;
- Flash Fire: 239 m;
- Vapour Cloud Explosion: 13 m; and
- Boiling Liquid Evaporating Vapour Explosion / Fireball: 114 m.

Figure 10.18 *Contours for Individual Risk of Fatality for Saldanha Steel Propane Storage Facility during the Second Year of Construction – Persons Located Outdoors*

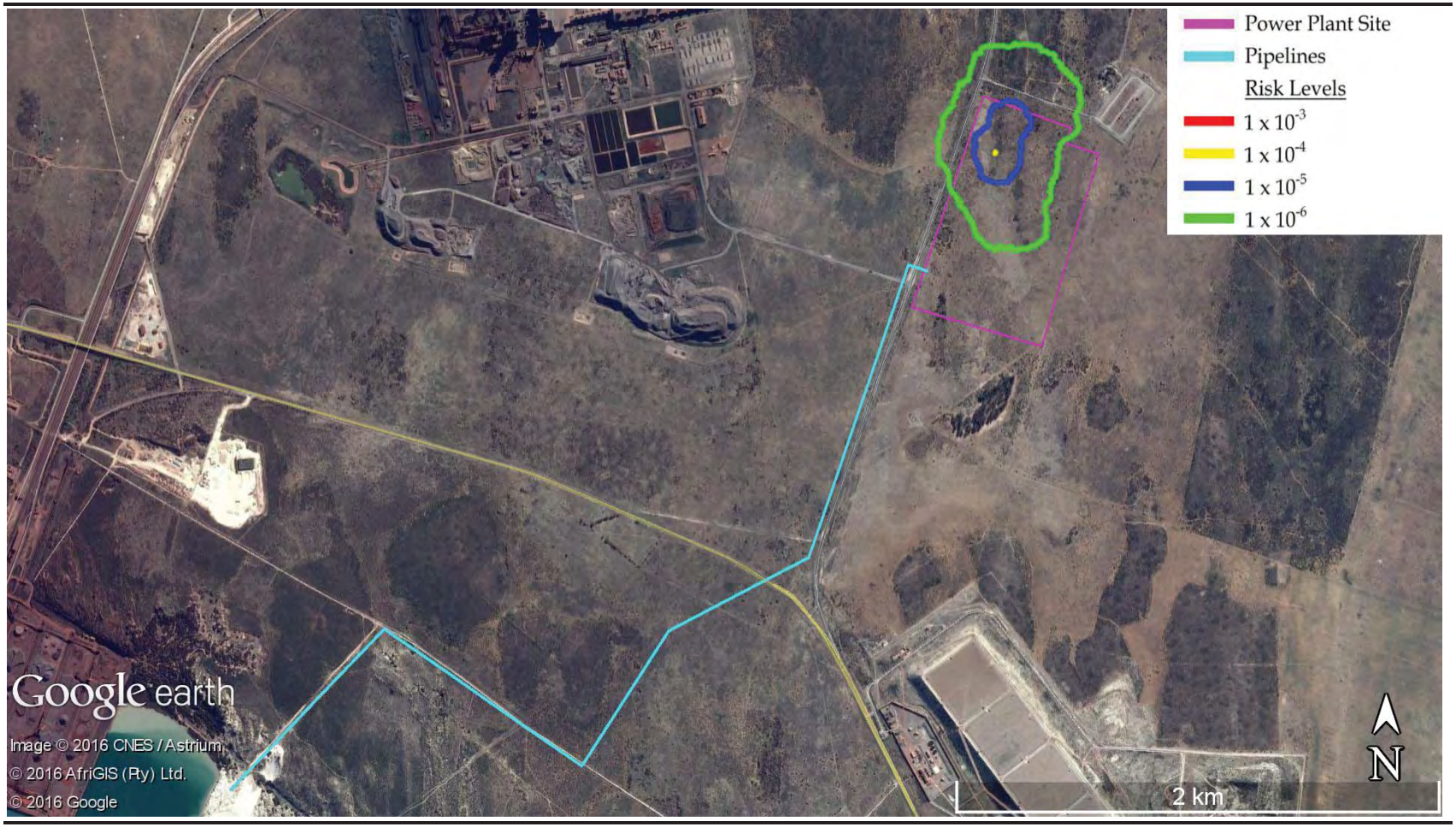
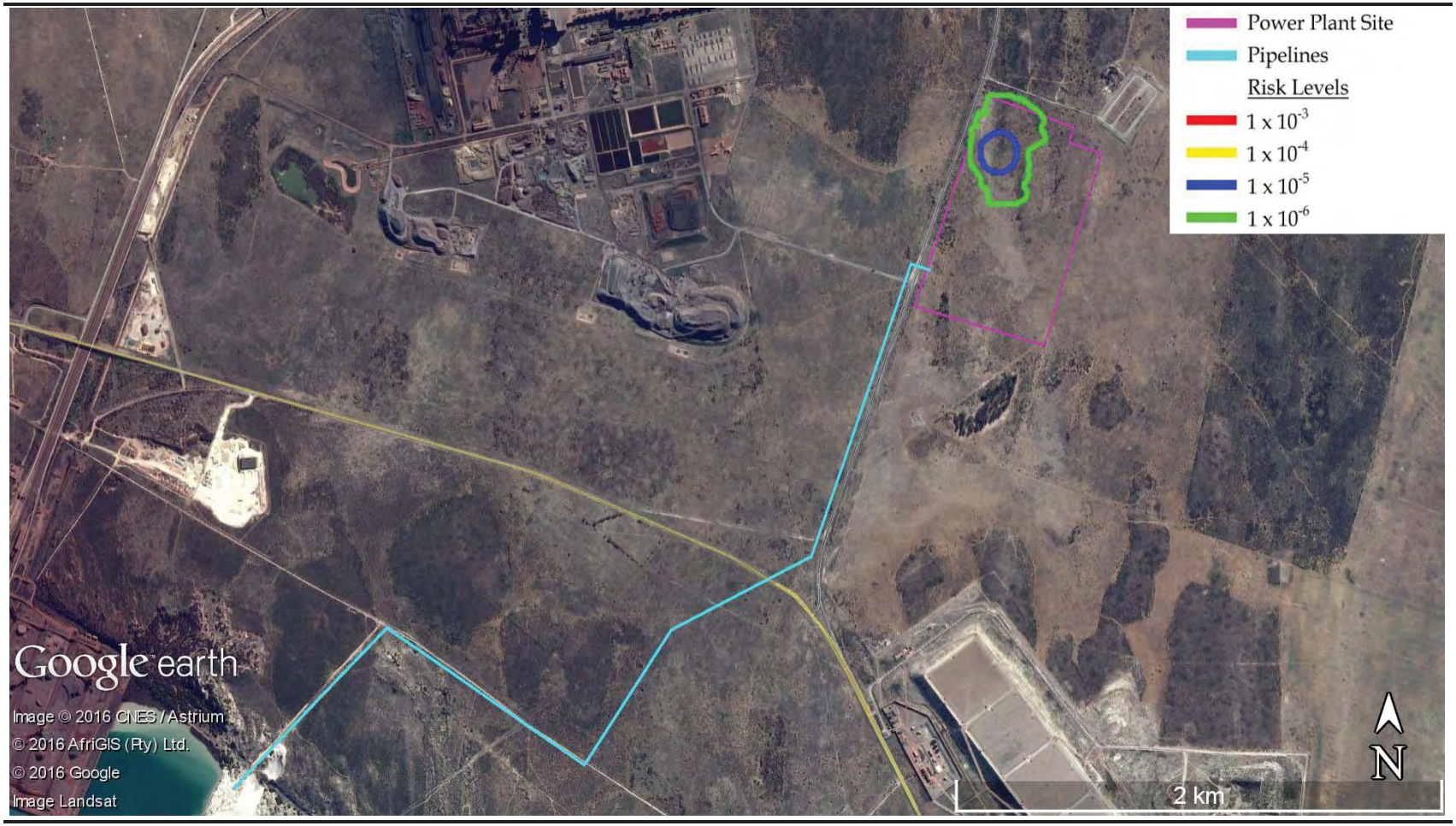


Figure 10.19 *Risk Contours for Individual Risk of Fatality for Saldanha Steel Propane Storage Facility during the Second Year of Construction – Persons Located Indoors*



If facilities and equipment are designed to the prescribed specifications and standards, the likelihood of such an events occurring is considered **unlikely**.

Box 10.17 Risk Assessment: Risk to Individuals for the Construction Phase

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium for Public Area; Low for Workers;

Impact Magnitude: High

- **Extent:** Local
- **Duration:** Temporary
- **Scale:** The largest hazard effects to Dangerous Dose are 239 m. The largest LSIR contours extend 360 m to the west, 320 m to the north and 80 m to the east of the CCGT site boundary, centred on the Propane generator. The area considered intolerable for the general public extends 60 m to the north of the CCGT site boundary. An area centred on the Propane generator is considered intolerable for workers.
- **Likelihood:** Unlikely

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation, as detailed in Section 10.15.1, this impact remains **MODERATE**

10.15.4 Risk Assessment: Land Use Planning Impact for the Operational Phase for the Natural Gas Pipelines

Impact Description

The main hazards associated with potential releases of natural gas from the pipelines are jet fires (immediate ignition), flash fires (delayed ignition) and explosions (delayed ignition of the gas or vapour in a confined space). This would be caused by leaks/failures in the pipelines. This would result in human exposure via thermal radiation and overpressures.

Impact Assessment

Risk model outcome

The LUP risk transect for the pipelines in the general public area are shown in *Figure 10.20* and in the Transnet Port Authority (TPA) area are shown in *Figure 10.21*. Third party activity in the TPA area is likely to be lower than elsewhere along the pipeline route due to strict access controls. A modifier has therefore been added to reduce the likelihood of third party activity.

Figure 10.20 Risk Transect for the General Public for Land Use Planning for Saldanha Steel Natural Gas Pipelines

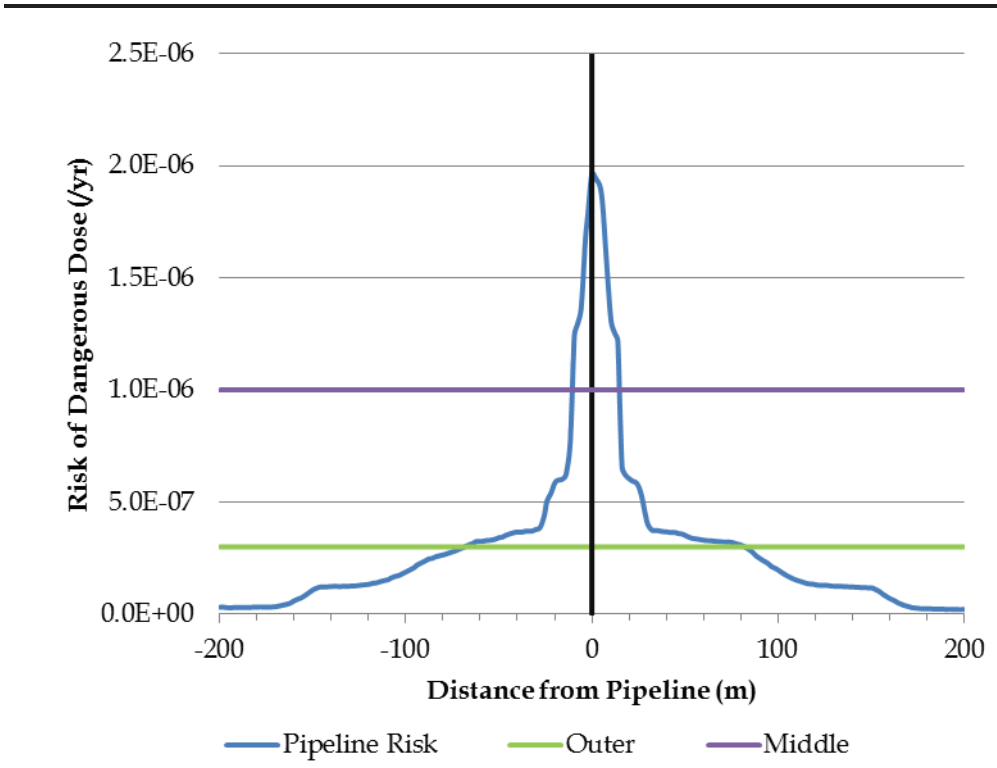
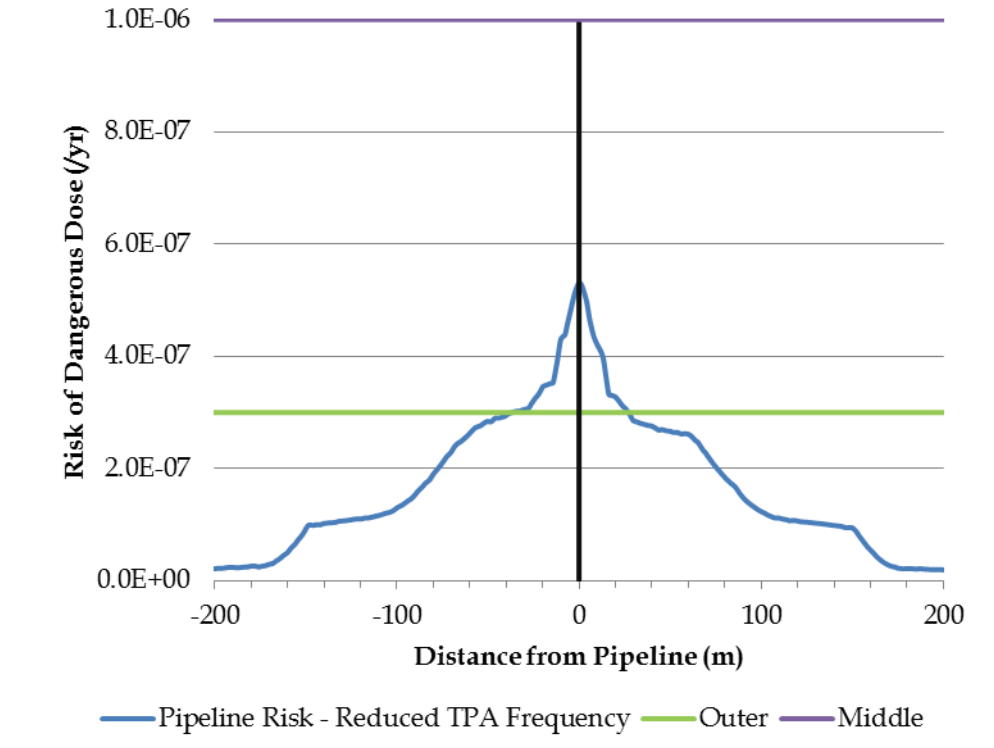


Figure 10.21 Risk Transect for Land Use Planning for Saldanha Steel Natural Gas Pipelines with Reduced TPA Frequency in the Port Area



The area of the Natural Gas pipelines that is accessible to the general public has a risk level within the Middle Zone which is approximately 10 m to either side of the pipelines. Therefore no Level 3 or Level 4 developments should be allowed within 10 m of the centre line of the pipeline servitude. No Sensitivity Level 3 or 4 land uses exist in the surrounding area.

The area of the pipeline that is accessible to the public has a risk level within the Outer Zone which is approximately 68 m to either side of the pipelines. Therefore no Level 4 developments should be allowed within 68 m of the centre line of the pipeline servitude. No Sensitivity Level 4 land uses exist in the surrounding area.

The area surrounding the pipelines' servitude within the port boundary is understood to be zoned for industrial use and therefore classified as Sensitivity Level 1.

Based upon the current land uses around the proposed Natural Gas pipelines' route, the risk level would be classified as 'don't advise against' according to the land use planning criteria. Therefore the current land uses can be considered tolerable. Future land uses around the Natural Gas pipelines should adhere to those of *Table 10.52* for the pipelines' risk transects presented in *Figure 7.1* and *Figure 10.21*.

The hazards, as described above, would result in a direct negative type of impact on the natural vegetation, structures, employees and people in the immediate area.

The duration would be temporary as such hazards would be of short duration and only happen occasionally, if at all. The extent for the impact is local.

The scale of the hazard effects of a Dangerous Dose as defined earlier from the Natural Gas pipelines are as follows:

- Jet Fire: 156 m;
- Flash Fire: 676 m; and
- Gas Cloud Explosion: 57 m.

If facilities and equipment are designed to the prescribed specifications and standards, the likelihood of such an event occurring is considered **unlikely**.

The area surrounding the Natural Gas pipelines' servitude is currently open land with the exception of MR559. A portion of this servitude also passes through an area owned by the Port. As these areas are not currently inhabited and future land use within the Port is understood to be categorised as Industrial, the land use sensitivity in these areas is categorised as low.

Box 10.18 Land Use Planning Impact: Operation Phase: Natural Gas Pipelines

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Temporary
- **Scale:** The largest hazard effects of Dangerous Dose are to 676 m. The largest land use restriction extends 140 m from the pipeline due to proposed bends which increase the risk in these areas. Risk transects indicate the normal pipeline area restrictions extend 68 m from the centre of the Natural Gas pipelines' servitude.
- **Likelihood:** Unlikely

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation, as detailed in Section 10.15.1, this impact remains **NEGLIGIBLE**

10.15.5 Risk Assessment: Land Use Planning Impact for the Operational Phase for the Propane Generator Installations

Impact Description

Risks associated with flammable hazards during the operation phase of the project as a result of the propane storage facility at the power station will exist. Risks are anticipated to be reduced from that experienced during the Construction Phase due to smaller quantities of propane been utilised in the plant.

Impact Assessment

Risk model outcome

The Land Use Planning risk contours for the Propane generator operations during normal operation are shown in *Figure 10.22*.

From the figure it can be seen that an area outside the power plant site falls within the 1×10^{-6} contour and therefore is within the Middle Zone. This area extends approximately 90 m to the west and 50 m to the north of the CCGT site boundary. Therefore no Sensitivity Level 3 or Level 4 developments such as those described in *Table 10.52* should be allowed within this area during normal operation. No Sensitivity Level 3 or 4 land uses exist in the surrounding area.

From the figure it can be seen that an area outside the power plant site falls within the 3×10^{-7} contour and therefore is within the Outer Zone. This area extends approximately 120 m to the west and 60 m to the north of the CCGT site boundary. Therefore no Sensitivity Level 4 developments such as those

described in *Table 10.52* should be allowed within this area during normal operation. No Sensitivity Level 4 land uses exist in the surrounding area.

The current land uses within these areas result in the risk level being classified as 'don't advise against' during normal operation according to the land use planning criteria. Future land uses around the CCGT power plant site during normal operation should adhere to those of *Table 10.52* for risk contours presented in *Figure 10.22*.

The hazards, as described above, would result in a direct negative type of impact on the natural vegetation, structures, employees and people in the immediate area. The duration would be temporary as such hazards would be of short duration and only happen occasionally, if at all. The extent for the impact is local.

The scale of the hazard effects of a Dangerous Dose as defined earlier from the Propane generator installations are as follows:

- Jet Fire: 173 m;
- Flash Fire: 239 m;
- Vapour Cloud Explosion: 13 m; and
- Boiling Liquid Evaporating Vapour Explosion / Fireball: 114 m.

If facilities and equipment are designed to the prescribed specifications and standards the likelihood of such an events occurring is considered unlikely.

The area surrounding the proposed CCGT power plant site is similarly unused with the exception of a small access road. Therefore this land use sensitivity is also categorised as low.

Figure 10.22 *Contours for Land Use Planning for Saldanha Steel Natural Gas Pipelines and Propane backup generator with Normal Power Plant Operation Propane Consumption*

Box 10.19 Land Use Planning Impact: Operation Phase: Propane Generator Installations

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Temporary
- **Scale:** The largest hazard effects of Dangerous Dose are to 239 m. The largest land use restriction extends 140 m to the west and 60 m to the north of the CCGT site boundary, centred on the Propane generator.
- **Likelihood:** Unlikely

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation, as detailed in Section 10.15.1, this impact remains **NEGLIGIBLE**

10.15.6 Risk Assessment: Risk to Individuals for the Operational Phase

Impact Description

The main hazards associated with potential releases of Propane from the Propane storage facility are jet fires (immediate ignition), flash fires (delayed ignition) and explosions (delayed ignition of the gas or vapour in a confined space). The hazards may be realised due to leaks/failures in the Propane storage vessel, off-loading road tankers or associated equipment, all of which can release significant quantities of flammable materials on failure. This would result in human exposure via thermal radiation and overpressures.

The main hazards associated with potential releases of natural gas from the pipelines are jet fires (immediate ignition), flash fires (delayed ignition) and explosions (delayed ignition of the gas or vapour in a confined space). This would be caused by leaks/failures in the pipelines. This would result in human exposure via thermal radiation and overpressures.

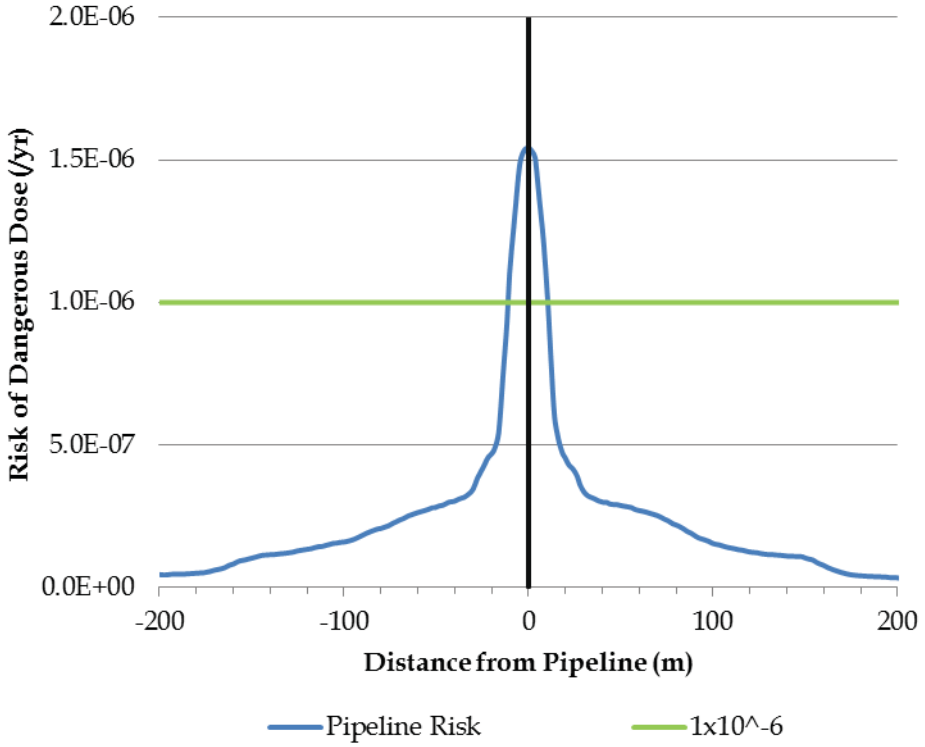
Impact Assessment

Risk model outcome

Risk transects representing the LSIR transect for hypothetical persons located outdoors and indoors for the pipelines were calculated for the areas accessible to the general public as well as those within the Port boundary. Only the transects for persons located outdoors for the area accessible to the general public were found to exceed 1×10^{-6} and therefore all other LSIR transects were excluded from further analysis.

Figure 10.23 represents the LSIR risk transect for hypothetical persons located outdoors for the Natural Gas pipelines. This transect is taken for the area accessible to the general public.

Figure 10.23 Risk Transect for Individual Risk of Fatality for Saldanha Steel Natural Gas Pipelines – Persons Located Outdoors



From *Figure 10.23* it can be seen that the individual risk of fatality exceeds the 1 x 10^{-6} contour. This extends approximately 10 m on either side of the pipeline's route. As the risk in this area exceeds 1 x 10^{-6} but does not exceed 1 x 10^{-4}, the LSIR for the pipelines for persons located outdoors along the pipeline route is not considered intolerable according to the risk criteria. The risks within this area can only be considered tolerable if they can be demonstrated by the site operator to be ALARP.

The LSIR contours for individuals located outdoors and indoors for the proposed Natural Gas pipelines and Propane backup generator developments during normal operation are shown in *Figure 10.24* and *Figure 10.25* respectively.

Figure 10.24 represents the LSIR for hypothetical persons located outdoors for the proposed Natural Gas pipelines and Propane backup generator developments during normal Propane backup generator operation. Areas located off the power plant site have an individual risk higher than 1 x 10^{-6}. As the risk exceeds 1 x 10^{-6} but does not exceed the 1 x 10^{-4} risk level, the LSIR for the pipelines and Propane backup generator for persons located outdoors

in these areas is not considered intolerable according to the risk criteria. The risks can only be considered tolerable if they can be demonstrated by the site operator to be ALARP.

The 1×10^{-3} and 1×10^{-4} LSIR contours do not exist for individuals located outdoors, therefore the risk is below these levels.

Figure 10.25 represents the LSIR for hypothetical persons located indoors for the proposed pipelines and Propane backup generator developments during normal Propane backup generator operation. Areas located off the power plant site have an individual risk higher than 1×10^{-6}. As the risk exceeds 1×10^{-6} but does not exceed 1×10^{-4} the LSIR for the pipelines and Propane backup generator for persons located indoors in these areas is not considered intolerable according to the risk criteria. The risks can only be considered tolerable if they can be demonstrated by the site operator to be ALARP.

The 1×10^{-3} and 1×10^{-4} LSIR contours do not exist for individuals located indoors, therefore the risk is below these levels.

Figure 10.24 *Risk Contours for Individual Risk of Fatality for Saldanha Steel Natural Gas Pipelines and Propane Developments during Normal Operation – Persons Located Outdoors*

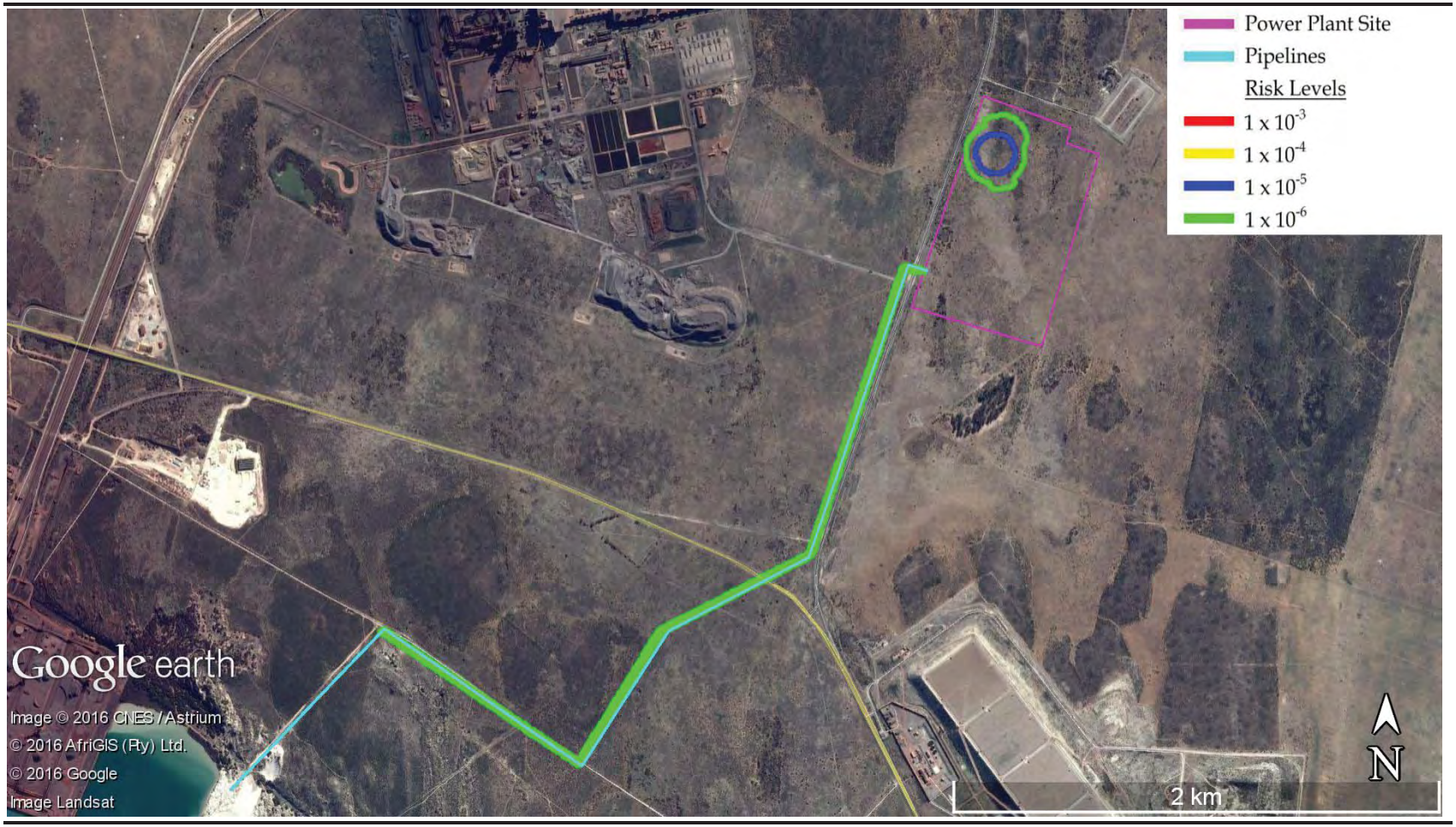
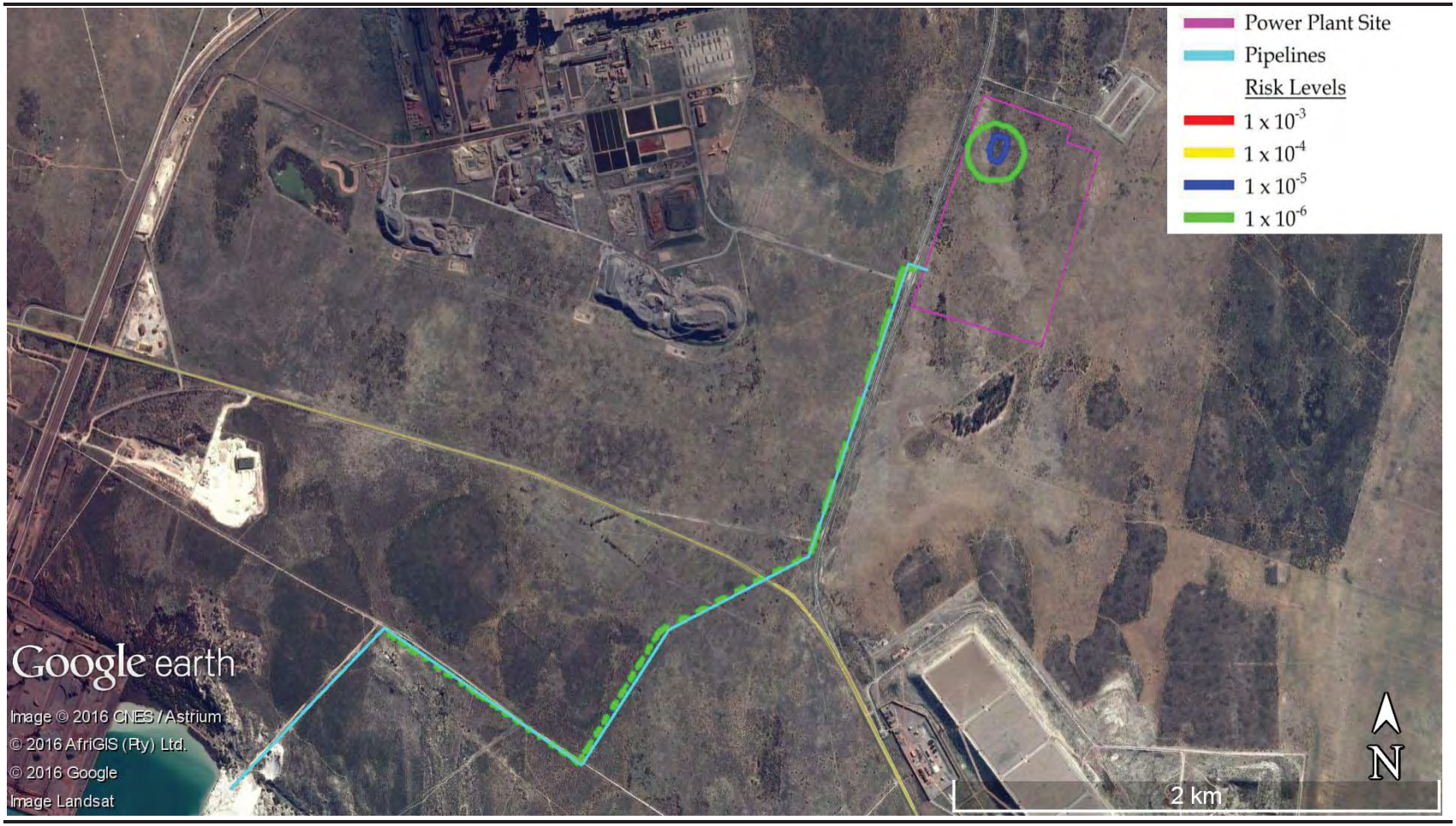


Figure 10.25 *Risk Contours for Individual Risk of Fatality for Saldanha Steel Natural Gas Pipelines and Propane Developments during Normal Operation – Persons Located Indoors*



Considering individuals, it is understood that the area surrounding the Natural Gas pipelines' servitude is not permanently inhabited as no homes, work places or other gathering areas exist in the vicinity. The general public does however have access to the area surrounding the servitude (with the exception of the Port property). Therefore the sensitivity of the general public in the area surrounding the Natural Gas pipelines' servitude is categorised as medium. For workers involved in the construction phase or operational phase of the CCGT power plant project, the sensitivity is categorised as low. This is due to these individuals being aware of the risks and being more adequately prepared to handle them as a result of emergency planning , PPE, etc.

A similar situation exists for the proposed CCGT power plant site and surrounding area. The general public sensitivity is categorised as medium while worker sensitivity is categorised as low. The hazards, as described above, would result in a direct negative type of impact on the natural vegetation, structures, employees and people in the immediate area. The duration would be temporary as such hazards would be of short duration and only happen occasionally, if at all. The extent for the impact is local.

The scale of the hazard effects of a Dangerous Dose as defined earlier from the Propane generator installations are as follows:

- Jet Fire: 173 m;
- Flash Fire: 239 m;
- Vapour Cloud Explosion: 13 m; and
- Boiling Liquid Evaporating Vapour Explosion / Fireball: 114 m.

The scale for the pipeline would be:

- Jet Fire: 156 m;
- Flash Fire: 676 m; and
- Gas Cloud Explosion: 57 m.

If facilities and equipment are designed to the prescribed specifications and standards, the likelihood of such an event occurring is considered **unlikely**.

Box 10.20 ***Location Specific Individual Risk Impact: Operation Phase: Natural Gas Pipelines and Propane Generator Installations***

Nature and Type: Negative direct

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium for Public Area; Low for Workers;

Impact Magnitude: High

- **Extent:** Local
- **Duration:** Temporary
- **Scale:** The largest hazard effects of Dangerous Dose are to 676 m. The largest LSIR contours extend 110 m to the west and 240 m to the north of the CCGT site boundary, centred on the Propane generator.
- **Likelihood:** Unlikely

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE
IMPACT SIGNIFICANCE (POST-MITIGATION): With mitigation, as detailed in Section 10.15.1, this impact is reduced to **MODERATE**

10.15.7 *Residual*

If mitigation measures as described above are implemented, the residual impact significance will change to for the construction phase as described in *Table 10.54* as the only receptors will be workers involved in the construction and operation of the CCGT power plant and their sensitivity is classed as **low.** The residual risk from the operation phase will remain the same.

Table 10.54 ***Pre- and Post- Mitigation Significance: Quantitative Risk Assessment***

Impact	Phase	Pre- and Post- Mitigation Significance:	Residual Significance (Post-mitigation)
Natural Gas Pipelines, LUP Assessment	Construction	Negligible	Negligible
Propane Generator, LUP Assessment	Construction	Negligible	Negligible
Natural Gas Pipelines and Propane Generator, LSIR Assessment	Construction	Moderate	Moderate
Natural Gas Pipelines, LUP Assessment	Operation	Negligible	Negligible
Propane Generator, LSIR Assessment	Operation	Negligible	Negligible

Natural Gas Pipelines and Propane Generator, LSIR Assessment	Operation	Moderate	Moderate

10.16 CUMULATIVE IMPACTS

10.16.1 Background

The preceeding impact assessment assessed the impacts associated with the Project largely in isolation. It is important to assess cumulative impacts associated with a proposed development and there also is a legislated requirement in South Africa to do so. A cumulative impact is one that arises from an impact associated with a proposed Project, that when viewed in isolation may be acceptable, but when combined with multiple developments in the greater area affected by the proposal may not be acceptable.

The DEAT Integrated Environmental Management Information Series (2004) suggest the following principles be applied when undertaking a cumulative assessment:

- Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions;
- Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken;
- Since it is not practical to analyse the cumulative effects of an action on every environmental receptor, the list of environmental effects must focus on those that are truly meaningful;
- Boundaries must be set so analysts are not attempting to measure effects on everything;
- Cumulative effects analysis on natural systems must use natural ecological boundaries, and analysis of human communities must use actual socio-cultural boundaries to ensure all effects are included;
- Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects;
- Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects;
- Cumulative effects may last for years beyond the life of the action that caused the effects; and
- Each affected resource, ecosystem, and human community must be analysed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

The assessment of cumulative impacts of the Project are presented in this section.

10.16.2 Methodology

The assessment of cumulative impacts requires a holistic and integrated view of the Project and other known projects in the area.

The Project is located in an area ear-marked for further industrial development. The National Department of Energy, through its Gas to Power Programme, is investigating the feasibility of development of a gas-fired power station in the Saldanha Bay area. In addition, the Integrated Development Zone (IDZ) is being promoted as an oil and gas hub and industrial development is being encouraged in the area.

There are numerous proposed developments in the Saldanha – Vredenburg area. At this stage, not all developments can be confirmed and the timing of the developments is not known. A selection of developments (see *Figure 10.26*) that may contribute to the cumulative impacts on similar natural or social resources and those either confirmed or most likely to come to fruition have been considered in this cumulative impact assessment, including:

- The IDZ development itself, covering an area of up to 4000 ha which could attract several industrial type developments;
- Afrisam Cement Plant;
- LPG Storage Facilities – Sunrise and Avedia ;
- Vredenburg Industrial Development, including:
    - Frontier Separation Plant;
    - Chlor-Alkali Facility;
- One desalination plant;
- One additional approximately 1000 - 1500 MW gas-fired power plant (location not confirmed);
- LNG Import terminal; and
- Expansion of the Port of Saldanha.

Input from specialists was obtained regarding cumulative impacts on the following aspects:

- Air Quality;
- Climate Change;
- Noise;
- Flora;
- Fauna;
- Avifauna;
- Traffic;
- Socio-economic;
- Heritage; and
- Risk.

How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g. already in existence, approved or proposed) and how much data is available to characterise the magnitude of their impacts. Where possible specialists' recommendations and conclusions from similar developments were taken into consideration in the assessment of cumulative impacts, as reflected above and in more detail in each specialist study (Specialist Studies are included in *Annex D*).

It is important to keep in mind that there is uncertainty as to whether the above-mentioned developments will all come to fruition.

Figure 10.26 Known Developments in the Vicinity of the Proposed Saldanha Steel Development

10.16.3 Air Quality

Impact Description

The cumulative effect of the proposed Project and other possible future development projects has been considered, taking into account the uncertainty of such projects. Future projects may include but not be limited to i) 1000 - 1500 MW LNG power plant in the vicinity of the IDZ, ii) LNG import and storage facilities, iii) a chlorine, caustic soda and hydrochloric acid plant in the Vredenberg Industrial Development, and iv) a cement manufacturing plant to the east of the IDZ.

Of these plants, emissions of CO and NO_X, i.e. those pollutants assessed for the ArcelorMittal CCGT, will occur from the power plant as a result of LNG combustion and from the cement manufacturing plant as a result of fuel combustion and heat generated in the kiln. For the cement plant, the predicted incremental NO_2 concentrations were very low, while CO was not assessed (Aurecon, 2013). For the power plant using LNG and Best Available Technology for power generation, the NO_X and CO emissions are also expected to be very low.

Impact Assessment

Given the findings of this impact assessment (the ArcelorMittal CCGT), that of the cement plant (Aurecon, 2013), and the understanding of emissions from LNG power plants generically, it is deemed unlikely that the cumulative effect will exceed the NAAQS for CO and NO_2 in Saldanha Bay.

With a low magnitude expected for NO_2 and CO concentrations resulting from emissions of the proposed Project in combination with the potential projects considered, together with a low sensitivity, the significance is predicted to be **minor** or **negligible**.

Proposed mitigation/ enhancement

No additional mitigations are proposed, other than those indicated in Section 10.3.

Residual impacts

No additional mitigation measures are proposed. The impact will remain **Minor.**

Table 10.55 Pre- and Post- Mitigation Significance for the Air Quality Cumulative Impact

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Air Quality	Cumulative Impact	Minor (-ve)	Minor (-ve)

A summary for the impact is presented in the following table.

Table 10.56 Pre- and Post- Mitigation Significance for the Air Quality Cumulative Impact

Nature and Type: Direct negative. The cumulative impacts are a direct consequence of emissions of pollutants into the atmosphere resulting from fuel combustion at the respective facilities. The impacts manifest as ambient concentrations of the respective pollutants with risks of exposure through inhalation.

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Low

- **Extent:** Local
- **Duration:** Long-term
- **Scale:** Low. The scale of the cumulative impact is related to whether the ambient concentrations of the pollutants are likely to exceed the limit values of the NAAQS in sensitive areas, i.e. residential or non-industrial areas. For NO_2 and CO, the cumulative ambient concentrations are likely to be well below the respective NAAQS and the scale of the impact is scored low.
- **Reversibility:** Low/Medium.
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR NEGATIVE

10.16.4 Climate Change

Impact Description

In the context of the Project's climate change impacts (i.e. GHG emissions), cumulative impacts can be considered as the combined impacts that result from the emission of GHGs from this development together with other existing and planned developments. Cumulatively, GHG emissions from developments and human activities across the globe are contributing to global climate change, which impacts ecosystems and communities across the globe in complex and varied ways. Whilst it is beyond the scope of this study to address global climate change impacts, cumulative impacts can be considered in the context of the combined effect of developments at a national level, and implications on South Africa's climate change mitigation commitments.

The cumulative impact with respect to GHG emissions from this Project and other developments in South Africa, and implications with respect to South Africa's GHG mitigation commitments, are addressed in Section 2.4.2 of the Specialist Report (included in *Annex D*). The analysis is based on assessing the alignment between the power sector generation plans in the IRP 2010-2030 (2011) and the Peak, Plateau, Decline (PPD) trajectory that forms the basis of South Africa's climate change mitigation commitments, assuming that this development forms part of the 3 126 MW of additional gas-based energy generation capacity provided for in the IRP 2010-2030 (2011) and that

electricity generation and proposed power projects will be aligned to the IRP and not exceed it.

DEA's Mitigation Potential Analysis study conducted in 2014 illustrated that, based on the IRP's projections for the energy sector and considering national mitigation potential, the PPD trajectory can only be tracked up to 2040 but after this point national GHG emissions exceed the boundaries depicted in the PPD. However, the study used the IRP 2010-2030 (2011) generation mix to estimate GHG emissions from the energy sector, and assumed that the generation mix would hold constant after 2030 until 2050. It is likely, however, that future updates of the IRP extending to later time periods will incorporate measures to help reduce emissions from the power sector, including the retirement of some of the existing coal-fired fleet and increased low carbon electricity generation. It should also be noted that an updated IRP is due to be promulgated, and will likely depict a different energy outlook on the basis of more up-to-date economic growth forecasts.

Detailed analysis will need to be undertaken on future iterations of the IRP that extend to later time periods in order to make a statement with respect to cumulative GHG impacts from this and other power sector developments, and alignment with South Africa's climate change policies and GHG mitigation commitments.

Impact Assessment

While the cumulative impact arising from additional GHG emissions from industries in the Vredenburg-Saldanha area is likely to get worse over the years, an overall National Climate Change Response Policy (NCCRP) has been developed to ensure the reduction of GHG emission to meet South Africa's GHG mitigation commitments. No additional mitigation measures are proposed other than those included in *Section 10.4*.

10.16.5 Noise

Impact Description

Ambient sound level is the cumulative effect of sound from sources both near and far, natural and man-made, with each sound being a complex mix of air pressure in different phases (with various interactions) with different spectral or transient character. As such the sounds we hear are generally the cumulative effect of numerous other sounds, with certain sounds dominating.

However, audibility does not necessary mean that there is a noise impact. In reality, sound sources only contribute significant levels to the soundscape if the levels are at least 3 dBA higher than the typical ambient sound levels. For an industrial activity or road traffic it requires the activity to be relative close to a receptor (depending on the character and magnitude of the noise source). If noise-generating activities are further than 2,000 – 4,000 m from a potential noise-sensitive receptor, the magnitude of noises levels are generally low,

decreasing the further the activities are located from the receptor(s) up to a point where they become inaudible at all times (when further than 10,000 m they should be inaudible for most industries). Therefore, to significantly contribute to the soundscape, or the cumulative sound level, activities should be located closer than 2,000 m.

At the closest receptor (NSD02 see *Figure 10.6*), the dominating sounds were due to noises from the house as well as natural sounds. Sounds of passing traffic (on the R27) and from the Saldanha Steel operation were audible at times but not dominant (definitely less than 3 dBA from the typical ambient sound levels).

These activities however are all further then 2,000 m from receptor NSD02, with the proposed Project being almost 4,000 m from NSD09. At NSD09 the dominant sound will be from the SALKOR and Namakwa Sands operations, less from the R27 with the proposed power plant being too far from NSD09 to cumulatively add any significant sound levels to the ambient levels at NSD09.

Considering the ambient sound levels (between 40 and 45 dBA) measured at NSD02 as well as the projected noise levels from the proposed power plant (around 37 dBA at peak), the potential cumulative noises levels from other industries in the area will even be less.

Impact Assessment

Based on the above, the significance of the cumulative increase in noise levels for the closest noise-sensitive receptors will be **Minor.**

Proposed mitigation/ enhancement

Mitigation as per *Section 10.5* should be adhered to.

Residual impacts

No additional mitigation measures are proposed. The impact will remain **Minor.**

Table 10.57 Pre- and Post- Mitigation Significance for the Noise Cumulative Impact

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Noise	Cumulative Impact	Minor (-ve)	Minor (-ve)

A summary for the impact is presented in the following table.

Table 10.58 Pre- and Post- Mitigation Significance for the Noise Cumulative Impact

Nature and Type: Direct negative.

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium - High

Impact Magnitude: Negligible. The cumulative addition will be low at NSD02 and NSD09 and insignificant to people located further from the activity.

- **Extent:** Local
- **Duration:** Long-term
- **Scale:** Low
- **Reversibility:** Low/Medium.
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR NEGATIVE

10.16.6 Flora

Impact Description

There are numerous proposed developments in the Saldanha – Vredenburg region, several of which will contribute to the overall cumulative impact on flora.

The primary construction phase impacts of these Projects are permanent loss of Saldanha Flats Strandveld, Langebaan Dune Strandveld, Saldanha Limestone Strandveld and Saldanha Granite Strandveld some of which are considered threatened/endangered, in addition much of the area is listed as a Critical Biodiversity Area in terms of the Saldanha Fine Scale Conservation Plan (Pence 2008). Future uncontrolled industrial development within the CBAs is likely to have an ongoing cumulative impact on flora.

Impact Assessment

The development would contribute to habitat loss through transformation and disturbance of vegetation. However this contribution would be minor when the extent of the development is considered together with the sensitivity of the vegetation on site i.e. previous farmed agricultural land. Sensitive areas along the pipeline route were also avoided. As such, the cumulative impact of this development is considered to have a minor significance without mitigation and a negligible significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

However, for other developments in the area, Biodiversity Off-sets have been required indicating a significant direct impact on the flora. While the direct impact of this development does not result in a cumulative impact that is unacceptable or significant, future industrial development as planned by the Saldanha Bay Municipality – see *Figure 2.1* showing future planned industrial corridor) may result in a significant cumulative impacts in the future.

Proposed mitigation/ enhancement

Mitigation as included in the Impact Assessment in *Section 10.6* should be adhered to. It is also strongly recommended that the appropriate regional and local authorities undertake a more strategic assessment to understand the cumulative impact of future industrial and other development on the sensitive biodiversity in the Vredenburg-Saldanha area. In this way the potential cumulative impacts can be identified and proactively managed at the appropriate planning level.

Residual impacts

The implementation of the above-mentioned mitigation measures will reduce the impact on Flora to **Minor.**

Table 10.59 Pre- and Post- Mitigation Significance for Cumulative Impact on Flora

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Flora	Cumulative Impact	Moderate (-ve)	Minor (-ve)

A summary for the impact is presented in the following table.

Table 10.60 Pre- and Post- Mitigation Significance for Cumulative Impact on Flora

Nature and Type: Direct negative. Loss of current levels of ecological connectivity and critical biodiversity areas; alien plant invasion in surrounding disturbed areas in combination with other proposed projects in the area.

Sensitivity/Vulnerability/Importance of Resource/Receptor: High

Impact Magnitude: Small

- **Extent:** Regional
- **Duration:** Permanent
- **Scale:** Medium to Large
- **Reversibility:** Low
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR NEGATIVE

10.16.7 Fauna

Impact Description

The main impacts on fauna from the Project are likely to result from noise and physical disturbance during the construction phase, but will be predominantly be local in nature and would thus not be of broader significance. The major impact from a cumulative perspective is the ongoing loss of landscape

corridors, which provide connectivity to fragmented faunal habitat and also allow for movement of wildlife when dispersing or under times of stress, such as droughts. Disturbance and vegetation clearing should therefore be kept to a minimum at all developments and, in order to prevent future loss of habitat, the invasion of alien plant species should be controlled on a regular basis.

The proposed development would, however, contribute to a relatively small disruption of habitat loss of fauna across the greater landscape, as the footprint is relatively low.

Impact Assessment

The cumulative impact of all development in the Vredenberg-Saldanha area and surrounds is likely to impact on fauna through increased habitat loss and fragmentation. Habitat fragmentation can result in the disruption of ecological corridors which aid in faunal dispersal, ensure ecosystem resilience, maintain population connectivity and provide refuge areas.

Provided the mitigation measures in the report are implemented, there would not be high impacts on a cumulative scale. As such, the cumulative impact of this development is considered to have a moderate significance without mitigation, and a minor significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

Proposed mitigation/ enhancement

Mitigation as included in the Impact Assessment in *Section 10.7* should be adhered to. It is also strongly recommended that the appropriate regional and local authorities undertake a more strategic assessment (e.g. integrated biodiversity and development management plan) to understand the cumulative impact of future industrial and other development on the sensitive biodiversity in the Vredenburg-Saldanha area. In this way the potential cumulative impacts can be identified and proactively managed at the appropriate planning level. Strategically, the Saldanha Bay authorities should maintain corridors of remnant natural vegetation in the landscape which new developments must avoid and which would provide for increased ecosystem resilience.

Residual impacts

The implementation of the above mentioned mitigation measures will reduce the impact on Fauna to **Minor.**

Table 10.61 Pre- and Post- Mitigation Significance for Cumulative Impact on Fauna

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Fauna	Cumulative Impact	Moderate (-ve)	Minor (-ve)

A summary for the impact is presented in the following table.

Table 10.62 Pre- and Post- Mitigation Significance for Cumulative Impact on Fauna

Nature and Type: Direct negative

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low - Medium

Impact Magnitude: Medium - High

- **Extent:** Regional
- **Duration:** Long Term
- **Scale:** Medium to Large
- **Reversibility:** Low
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MINOR NEGATIVE

10.16.8 Avifauna

Impact Description

The cumulative impact of planned development in the study area and surrounds is likely to impact on avifauna through increased habitat loss and disturbance as well a greater likelihood of injury or mortality by electrocutions or collisions on power infrastructure due to increased exposure.

Impact Assessment

The development would contribute to habitat loss through transformation and disturbance of avifauna and their habitats. However this contribution would be minor when the extent of the development is considered. As such, the cumulative impact of this development is considered to have a minor significance without mitigation and a negligible significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

The significance of the impact is rated as **Minor (-ve)**.

Proposed mitigation/ enhancement

Mitigation measures as per *Section 10.8* should be adhered to; in addition each development will impact on avifauna in a different way and as such, would require its own unique suite of mitigation measures. In order to ensure the cumulative impacts of the various developments do not exponentially impact on avifauna, it is imperative that each development in isolation abides by the prescribed mitigation measures set by the specialist working on the impact assessment.

Residual impacts

The implementation of the above mentioned mitigation measures will reduce the impact on Avifauna to negligible**.**

Table 10.63 Pre- and Post- Mitigation Significance for Cumulative Impact on Avifauna

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Avifauna	Cumulative Impact	Minor (-ve)	Negligible (-ve)

A summary for the impact presented below.

Table 10.64 Pre- and Post- Mitigation Significance for Cumulative Impact on Avifauna

Nature and Type: Direct negative

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Low/Medium

- **Extent:** Local
- **Duration:** Long Term
- **Scale:** Medium to Large
- **Reversibility:** Medium
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MINOR NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGIBLE NEGATIVE

Impact Description

The construction phase will require large amounts of material and equipment to be transported to the Project site. It is expected that the other projects in the area will use similar transport routes which will place pressure on the local road network especially during the construction phases of the projects.

As such there is increased potential for accidents and disruption to the road traffic network for local users associated with the increase in traffic movements from overlapping construction traffic.

As depicted in *Figure 10.27* the road infrastructure is planned to be expanded with dualling of links.The plan, developed by AECOM, shows the future dualling of the OP7644 and the planned interchange of the TR85/1 and the realigned OP7644. This project will provide additional network capacity in the study area.

The additional capacity provided by the new infrastructure is adequate to accommodate the future travel demands of the site and the surrounding development consisting of the immediate Vredenburg Industrial

Development (located between Namaqua Sands and Fossil Park). The other planned projects (as identified in *Section 10.16.2*) are more remote from the site and are unlikely to have any significant impact on the traffic in the immediate study area. The modal split of travel associated with the project is likely to produce a significant number of public transport trips and predominantly MBT and Bus patronage. This in itself is a travel demand measure that will enhance the sustainability index of the Project.

Impact Assessment

The cumulative impacts related to increased traffic in the Project area will be indirect and negative. The impact will be experienced at a local level, primarily within the Saldanha Bay area. The duration of the impact will be long term, as projects may occur in a phased manner, over an extended period of time. The scale of the impact will be small as the cumulative effects of the Project with the implementation of further projects in the Saldanha Bay IDZ were considered and were predicted to have no significant impact on the key intersections in the study area. The impact would be reversible. Given the above, the magnitude of the impact is considered small.

The vulnerability of receptors is considered **low** as the current traffic is fairly light and the planned infrastructure will be sufficiently robust to accommodate the additional traffic from the Project in combination with the background projects.

The significance of the impact is rated as **Negligible.**

Proposed mitigation/ enhancement

Mitigation as per *Section 10.9* should be adhered to.

Residual impacts

No additional mitigation measures are proposed. The impact will remain **Negligible.**

Table 10.65 Pre- and Post- Mitigation Significance for the Traffic Cumulative Impact

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Traffic	Cumulative Impact	Negligible	Negligible

A summary for the impact is presented in the following table.

Table 10.66 Pre- and Post- Mitigation Significance for the Traffic Cumulative Impact

Nature and Type: Indirect negative.

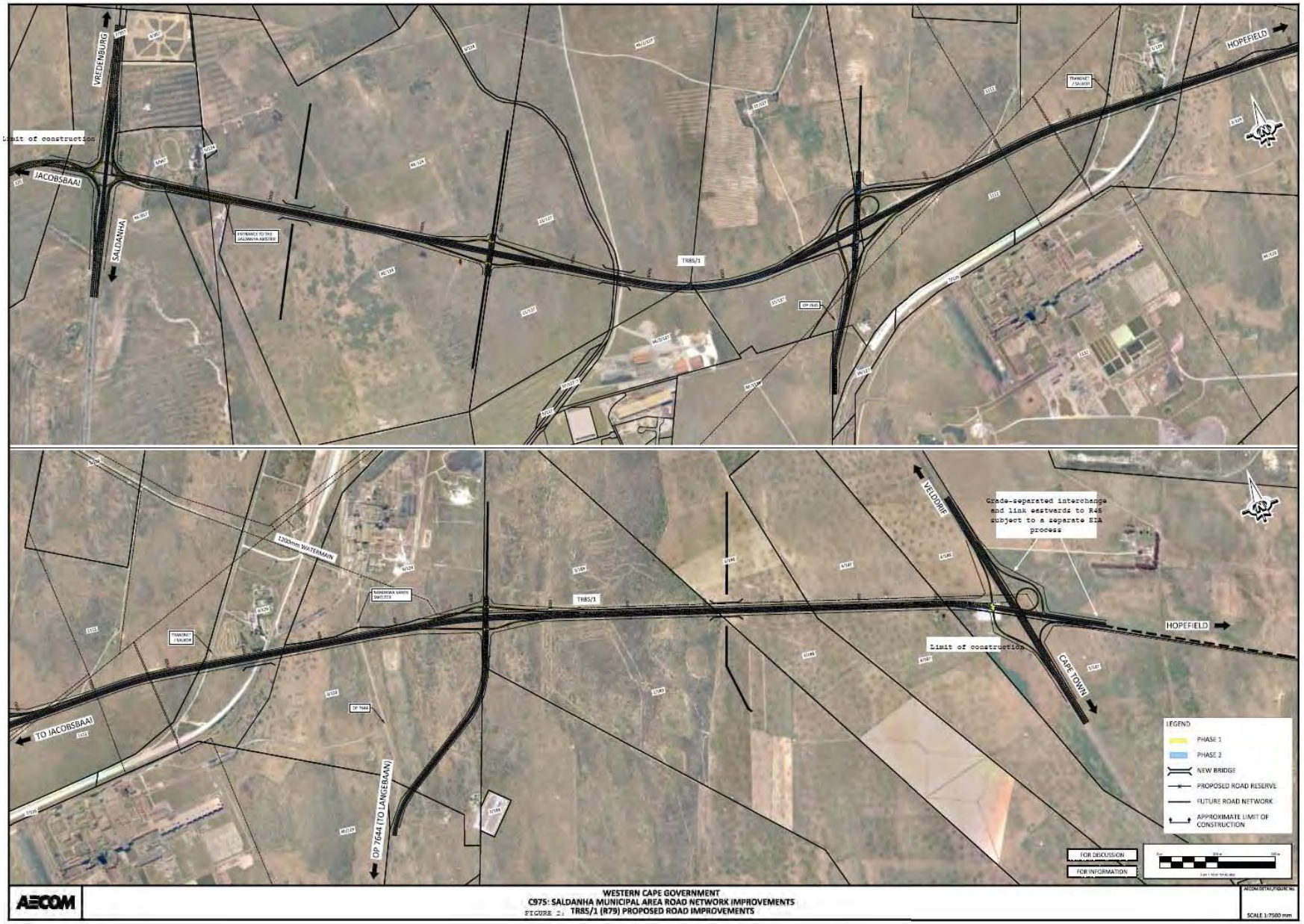
Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Small

- **Extent:** Local
- **Duration:** Long-term
- **Scale:** Small
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGIBLE

Figure 10.27 Saldanha Municipal Area Proposed Road Network Improvements



10.16.9 Socio-economic

The cumulative impact of the proposed Project in combination with the projects identified in *Section 10.16.1* above may impact on the following:

- Economy, Employment and Skills Development
- Community Health, Safety and Security
- Pressure on Social Infrastructure and Services

Economy, Employment and Skills Development

Impact Description

The development of large scale industrial projects will result in increased direct and indirect employment during the construction and operation of each of the projects. The nature and extent of the benefits will depend on the employment strategy of the various developers and the extent to which they are committed to maximise local employment.

There may be overlap between the construction phases of the Project with the other developments, or they may run consecutively. Either way, this will result in a significant uplift in local employment directly and indirectly through the procurement of goods and services. Furthermore, those that have been employed by one of the developers may be in a better position to find employment with the other developers as they will have increased their skills level and experience. As such, the potential during construction for cumulative positive benefits associated with economy, employment and skills development is considered to be higher than for the Project alone.

The operation of the developments outlined will occur over the same period of time and will be located in close proximity. As such the economic, employment and skills development opportunities outlined will be greater for all the projects combined than just for the Project development.

It should be noted that expectations regarding economic development, employment and skills development will be high amongst stakeholders in the local community and as such, in the event that one developer does not meet expectations, there is the potential for all developers to be the target of this negative feedback.

Impact Assessment

The cumulative creation of local employment opportunities, skills enhancement and local business opportunities will result in direct, indirect and induced impacts. The duration will be medium to long-term, as the projects will not all happen concurrently. Employment will be created for South Africans at a local and regional level depending on skills requirements of each project, and consequently the extent will be regional. For those who are able to secure employment on the projects, the scale will be medium to

high, depending on the duration of the contract. The magnitude of the impact will be positive.

Given the capacity of the local workforce to fill unskilled and semi-skilled employment positions, together with the opportunity to increase skills and work experience, the vulnerability is medium.

The significance of the impact is rated as **Moderate (+ve)**.

Proposed mitigation/ enhancement

It is recommended the Project investigates opportunities to work with other developers to formulate a collaborative approach to training, employment and skills development for the local population, starting in the run up to Project construction. This may include developing a coordinated standard set of requirements for service providers (e.g. required labour numbers of carpenters, welders, heavy goods vehicle drivers, etc. and the minimum qualifications required for these) and making the communities aware of these requirements. The developers should also plan and implement a coordinated approach to community skills development based on these requirements.

Residual impacts

The implementation of the above-mentioned mitigation measures will ensure that the positive impact on the Economy, Employment and Skills Development remains **moderate positive.**

Table 10.67 ***Pre- and Post- Mitigation Significance for Economy, Employment and Skills Development Cumulative Impact***

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Economy, Employment and Skills Development	Cumulative Impact	Moderate (+ve)	Moderate (+ve)

A summary for the impact is presented in the following table.

Table 10.68 Pre- and Post- Mitigation Significance for Economy, Employment and Skills Development Cumulative Impact

Nature and Type: Indirect positive impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Positive

- **Extent:** Regional
- **Duration:** Long Term
- **Scale:** Medium to Large
- **Reversibility:** N/A
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE POSITIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MODERATE POSITIVE.

Community Health, Safety and Security

Impact Description

The presence of an external workforce for the combined projects housed within the communities and construction camps could increase the spread of communicable diseases and STIs such as HIV/AIDS. The profile of these diseases will be influenced by the existing health profile of communities within the area of influence of the project and that of the workers, which is difficult to predict for the various projects.

Increased air emissions as a result of the Project and another power plants, as well as additional risks of industrial accidents and explosions could result in cumulative impacts on community health and safety. However, according to the Air Quality Report (*Annex D* of the EIR), the cumulative impact on air quality is expected to be minor and the cumulative risks associated with the Project are acceptable.

While the Project alone is not expected to attract vast numbers of jobseekers to the area, the development of multiple projects is likely to attract people seeking employment opportunities, particularly in light of a declining agricultural sector in the West Coast District Municipality, and given that Saldanha Bay is already seen as an economic hub. An influx of jobseekers will result in increased competition for employment which may contribute locally to social tension and conflict within the local communities.

Impact Assessment

The impacts related to community health and safety in the Project area will be indirect and negative. The impact will be experienced at a local level, within the Saldanha Bay area. The duration of the impact will be long term, as projects may occur in a phased manner, over an extended period of time. The

scale of the impact will be large for those affected as it will lead to a fundamental change in their life, and/ or health status, particularly for those affected by violence, unwanted pregnancies or HIV/ AIDS. For those affected, the impact will be largely irreversible. Given the above, the magnitude of the impact is considered medium.

In light of this, the vulnerability of receptors is considered medium. However, teenage girls are considered to be highly sensitive to this impact.

The significance of the impact is rated as **Moderate negative** overall, but the significance will be of **high** negative rating to those affected by unwanted pregnancies and HIV/ AIDS.

Proposed mitigation/ enhancement

- The Project should engage with other developers to ensure that community education and awareness campaigns in relation to health, safety and security are developed and implemented collaboratively to avoid duplication of effort.

- The Saldanha Bay Local Municipality should develop combined emergency response plans which take into account all the proposed developments and the community. This should consider combined risks from unplanned events.

Residual impacts

The implementation of the above mitigation measures would ensure that the impact significance remains that of **Moderate,** since the Project cannot influence the behaviours on the workforce associated with other projects, or that of jobseekers.

A summary for the cumulative impact is presented in the following table.

Table 10.69 ***Pre- and Post- Mitigation Significance for Community Health and Safety Cumulative Impact***

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impacts Associated with the Presence of a Workforce	Cumulative Impact	Moderate (-ve)	Moderate (-ve)

Table 10.70 Pre- and Post- Mitigation Significance for Community Health and Safety Cumulative Impact

Nature and Type: Indirect negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Large
- **Reversibility:** Irreversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MODERATE NEGATIVE

Pressure on Social Infrastructure and Services

Impact Description

Related to the above, the influx of jobseekers together with presence of the workforce associated with each project could place additional pressure on the delivery of social infrastructure and services, in particular housing. This is largely related to the unskilled workforce, as it is expected that the skilled and semi-skilled workforce would be able to enter the housing market.

Projects that bring a large external unskilled workforce into the area and do not provide accommodation will be increasing the burden on the provision of low cost housing. The Saldanha Bay Local Municipality is faced with a housing backlog, and healthcare facilities are under pressure.

Impact Assessment

The impacts related to increased pressure on existing social infrastructure and services will be indirect. The impacts will be negative as they will place pressure on infrastructure and services and the local government, who will have to provide the services as demand grows.

The impact will be experienced at a local level, within the Saldanha Bay area. The impacts will be long-term as the provision of social infrastructure and services may take time to catch-up with the increased demand. The scale of the impact will be medium, as it will notable but will not dominate over existing conditions. The impact is revisable as social infrastructure and services can be improved to address the impact. Given the information presented above, the impact will be medium in magnitude.

The population within the SBLM has been increasing at a rate greater than expected which has been attributed to the in-migration of people seeking

economic opportunities, resulting in the existing housing backlog and pressured health services. Therefore, the vulnerability of receptors is considered medium.

The factors described above result in the significance of the impact being rated as **Moderate negative.**

Proposed mitigation/ enhancement

Mitigation measures implemented by the Project, particularly a commitment to employing local labour, will help to minimise this impact. However, the potential impact on social infrastructure and services remains that of moderate, as the Project cannot influence how other developments employ or house their workforce.

Residual Impact

The impact significance remains of **Moderate** significance. A summary for the impact is presented in the tables below.

Table 10.71 ***Pre- and Post- Mitigation Significance for Cumulative Impacts Associated with Pressure on Social Infrastructure and Services***

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Pressure on Social Infrastructure and Services	Cumulative	Moderate (-ve)	Moderate (-ve)

Table 10.72 ***Pre- and Post- Mitigation Significance for Cumulative Impacts Associated Pressure on Social Infrastructure and Services***

Nature and Type: Indirect negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Medium

Impact Magnitude: Medium

- **Extent:** Local
- **Duration:** Long term
- **Scale:** Medium
- **Frequency:** Often
- **Reversibility:** Reversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): MODERATE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): MODERATE NEGATIVE

10.16.10 Cultural Heritage

Impact on Archaeological Resources

Impact Description

Each development within the greater Saldanha Bay area, irrespective of the nature of the project, will to some extent involve site clearance and the excavation of foundations. Such construction activities have the potential to destroy or damage archaeological resources, particularly sub-surface artefacts and remains.

The greater Saldanha Bay area is one of the best studied yet least significant tracts of landscape in the Western Cape in archaeological terms.

Previous archaeological impact assessments undertaken in the surrounding area were consulted and the following conclusions were made:

- Hart & Pether (2008) rate impacts of the Salkor Yard Expansion, the railway line and powerlines as of low scale, high confidence, and that the significance (with or without mitigation) is "Not Significant";
- Halkett (2011) with respect to the AFRISAM cement project does not provide any impact ratings but did not expect any significant impacts;
- Orton (2011) with respect the proposed Isivunguvungu Wind Farm described the probability of finding archaeological sites as "improbable", the significance as "very low" and commented that "No assessments in the immediate vicinity has yielded significant archaeology and none is present on this site. Cumulative Impacts are thus insignificant";
- Orton (2011) with respect to the proposed pipe yard in the Iron Ore terminal noted that no significant archaeological resources were expected on the development site (improbable), and the significance was expected to be very low.
- Kruger (2013) with respect to the Saldanha Separation Plant rated the archaeological remains as having low significance, and that impacts would be negligible.

Further, archaeologists who have conducted research in this specific area of the Saldanha IDZ, have expressed a high degree of confidence that the likelihood of finding significant remains was extremely low, and the cumulative impacts have therefore been assessed as "insignificant".

Impact Assessment

The cumulative impacts on archaeological resources will be direct and negative. The duration will be permanent as it relates to the loss of heritage resources. The extent of the impact will be local, limited to the greater Saldanha Bay area. The scale of the impact will be medium. The impact is considered irreversible. The frequency of the impact will vary depending on construction activities, but it is anticipated that it would be rare given the

nature of the baseline. Based on the above factors, the magnitude of the impact is considered low.

The vulnerability of receptors is considered low as the area is considered one of the least significant tracts of landscape in the Western Cape in archaeological terms.

Therefore it is anticipated that the significance of cumulative impacts will be **Negligible.**

Proposed mitigation/ enhancement

From a cumulative impact perspective, no mitigation is required, with the exception of the standard chance find protocol to consider the possibility of buried archaeology and/or human remains.

Residual Impacts

The impact significance remains Negligible. A summary for the impact is presented in the tables below.

Table 10.73 Pre- and Post- Mitigation Significance for Cumulative Impacts on Archaeological Resources

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impact on Archaeological Resources	Cumulative	Negligible (-ve)	Negligible (-ve)

Table 10.74 Pre- and Post- Mitigation Significance for Cumulative Impact on Archaeological Resources

Nature and Type: Direct negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Small

- **Extent:** Local
- **Duration:** Permanent
- **Scale:** Medium
- **Frequency:** Rare
- **Reversibility:** Irreversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE NEGATIVE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGIBLE NEGATIVE

Impact on Paleontological Resources

Palaeontological materials are likely to be destroyed by bulk earthworks. However palaeontological resources tend to be extensive (depending on the resource) and are rather more resistant to impact than archaeological material for the simple reason that there is more of it. Because palaeontological material is often very deeply buried, scientists often rely on human intervention in the land surface to collect data. Aside from natural exposures, open cast mines, quarries and deep road cuttings often present the only opportunities for palaeontologists to examine deep sediments which under normal circumstances they may not have access to.

Hart & Pether (2008) note that the palaeontological sequence of the Saldanha – Langebaan area is therefore well described. Numerous palaeontological impact assessment reports have been produced over the last two decades (see included in Paleontological Impact Assessment, *Annex D*). The reports are unanimous in noting the significance of the palaeontological resources. However, the distribution of resources is patchy and unpredictable and the resources have never been found to be a fatal flaw in development.

Impact Assessment

Cumulative impacts on buried palaeontological material will be direct and negative. The duration will be permanent as it relates to the loss of palaeontological resources. The extent of the impact will be local to the greater Saldanha Bay area. The scale of the impact will be large. The impact is considered irreversible. The frequency of the impact will vary depending on construction activities, but it anticipated that it would be rare given the nature of the baseline. Based on the above factors, the magnitude of the impact is considered small.

The vulnerability of receptors is considered low, provided that palaeontologists can use the opportunity arising from major construction works to adequately sample and record profiles and exposed material as part of the environmental management process. In this way, a potential negative impact can be transformed into a positive opportunity to increase the levels of knowledge about a locality and its past environments.

Therefore it is anticipated that the significance of the impact will be **Negligible.**

Proposed mitigation/ enhancement

From a cumulative impact perspective, no mitigation is required, with the exception of the standard chance find protocol to consider the possibility of buried palaeontological resources.

Residual Impacts

The impact significance remains of Negligible. A summary for the impact is presented in the tables below.

Table 10.75 Pre- and Post- Mitigation Significance for Cumulative Impacts on Palaeontological Resources Cumulative Impact

Impact	Project Phase	Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Impact on Palaeontological Resources	Cumulative	Negligible (-ve)	Negligible (-ve)

Table 10.76 Pre- and Post- Mitigation Significance for Cumulative Impact on Palaeontological Resources

Nature and Type: Direct negative impact

Sensitivity/Vulnerability/Importance of Resource/Receptor: Low

Impact Magnitude: Small

- **Extent:** Local
- **Duration:** Permanent
- **Scale:** Medium
- **Frequency:** Rare
- **Reversibility:** Irreversible
- **Likelihood:** N/A

IMPACT SIGNIFICANCE (PRE-MITIGATION): NEGLIGIBLE
IMPACT SIGNIFICANCE (POST-MITIGATION): NEGLIGIBLE

10.16.11 Risk

Impact Description

In consideration of the cumulative risk affects associated with the Project in combination with the proposed/future projects identified in *Section 10.16.2* ERM has reviewed the risk assessments undertaken for the Sunrise and Avedia LPG facilities, as well as the Chlor-Alkali Facility, located within the Vredenberg Industrial Development (see *Figure 10.26*). These are discussed in more detail below.

Sunrise LPG Facility
A QRA for Sunrise was carried out by Riscom in October 2012. The assessment indicates the following hazardous substance stored on site:

- 15 x 2 495 m^3 Liquefied Petroleum Gas (LPG) Vessels (stored at Phase 2 of project).

From a review of the Sunrise LPG QRA, it was found that individual risk of fatality contours from incidents at the Sunrise site would overlap those of the proposed Project's Natural Gas pipelines and the two LPG/propane developments. From observation, the maximum overlap for individual risk of fatality is approximately 1×10^{-6}. This risk level does not however reach the power plant site and therefore does not accumulate with the risk of the Propane facilities. The risk from the Saldanha Steel Natural Gas pipelines is in the order of magnitude of 1×10^{-6} to 1×10^{-5}. Therefore the addition of 1×10^{-6} from the Sunrise LPG facility will not escalate the risk a further order of magnitude to 1×10^{-4}, making the resulting risk level below that which would be considered intolerable according to the criteria shown in *Section 10.15*.

It must be noted that this analysis is purely based on observation of the Riscom report supplied. Technical methodologies and assumptions made as part of the QRAs may differ between Riscom and ERM. This has the potential to make the actual cumulative risk results generated by the two companies' QRAs differ slightly.

Avedia LPG Facility
A QRA for Avedia was carried out by MHR Consultants in July2013. The assessment indicates the following hazardous substance stored on site:

- 32 x 500 m^3 Liquefied Petroleum Gas (LPG) Vessels.

From a review of the Avedia LPG QRA, it was found that individual risk of fatality contours from incidents at the Avedia site would not overlap any contours from the proposed Project's Natural Gas pipelines and the two LPG/propane developments. Therefore no cumulative risk affects are relevant from the Avedia LPG facility. Once again it must be noted that this analysis is purely based on interrogation of the MHR Consultants report supplied.

Chlor-Alkali Facility
A QRA for the Chlor-Alkali Facility was carried out by ISHECON in September 2014. The assessment indicates the following hazardous substances stored on site:

- 3 x 500 ton Chlorine Vessels;
- 60 x 1 ton Chlorine Vessels;
- 400 x 0.07 ton Cylinders;
- 150 tons Sodium Hypo-chlorite;
- 4 000 tons Hydrochloric acid (31%);
- 25 tons Sulphuric acid (98%);
- 30 tons Sulphuric acid (70%); and
- 170 tons Liquefied Petroleum Gas (LPG).

From a review of the Chlor-Alki QRA, it was found that individual risk of fatality contours from incidents at the Chlor-Alki site would overlap those of the proposed Project's Natural Gas pipelines and the two LPG/propane developments. From observation, the maximum overlap for individual risk of

fatality is approximately 1 x 10^{-9}. This risk level is significantly lower than the risk levels from the proposed Project's Natural Gas pipelines and the two LPG/propane developments. The cumulative risk will therefore not materially increase above those from the proposed Project's Natural Gas pipelines and the two LPG/propane developments.

It must again be noted that this analysis is purely based on observation of the ISHECON report supplied. Technical methodologies and assumptions made as part of the QRAs may differ between ISHECON and ERM. This has the potential to make the actual cumulative risk results generated by the two companies' QRAs differ slightly.

Impact Assessment

The largest contributor to cumulative risk with the proposed Project's Natural Gas pipelines and the two LPG/propane developments is that of the Sunrise LPG facility. The cumulative risk of all the sites discussed above in the vicinity of the proposed Project's Natural Gas pipelines and the two LPG/propane developments is not expected to exceed 1 x 10^{-4}, making the resulting risk level below that which would be considered intolerable according to the criteria shown in *Section 10.15*.

10.16.12 Conclusion

The cumulative impacts on environmental and social receptors have been assessed by each specialist based on publicly available information relating to existing and planned developments in the Vredenburg-Saldanha Area. The significance of the cumulative impacts has been considered in the need and desirability of the Project (refer to *Chapter 2*).

The findings of the specialist show that the cumulative impacts for the Project will be acceptable, with most of the impacts being of **minor** significance, with some being of **moderate** significance.

Based on the outcome of the above cumulative assessment, and taking into consideration the mitigation measures proposed by the specialists, ERM is of the opinion that the proposed Project and associated pipeline should be authorised, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the EIA Report and EMPr being implemented.