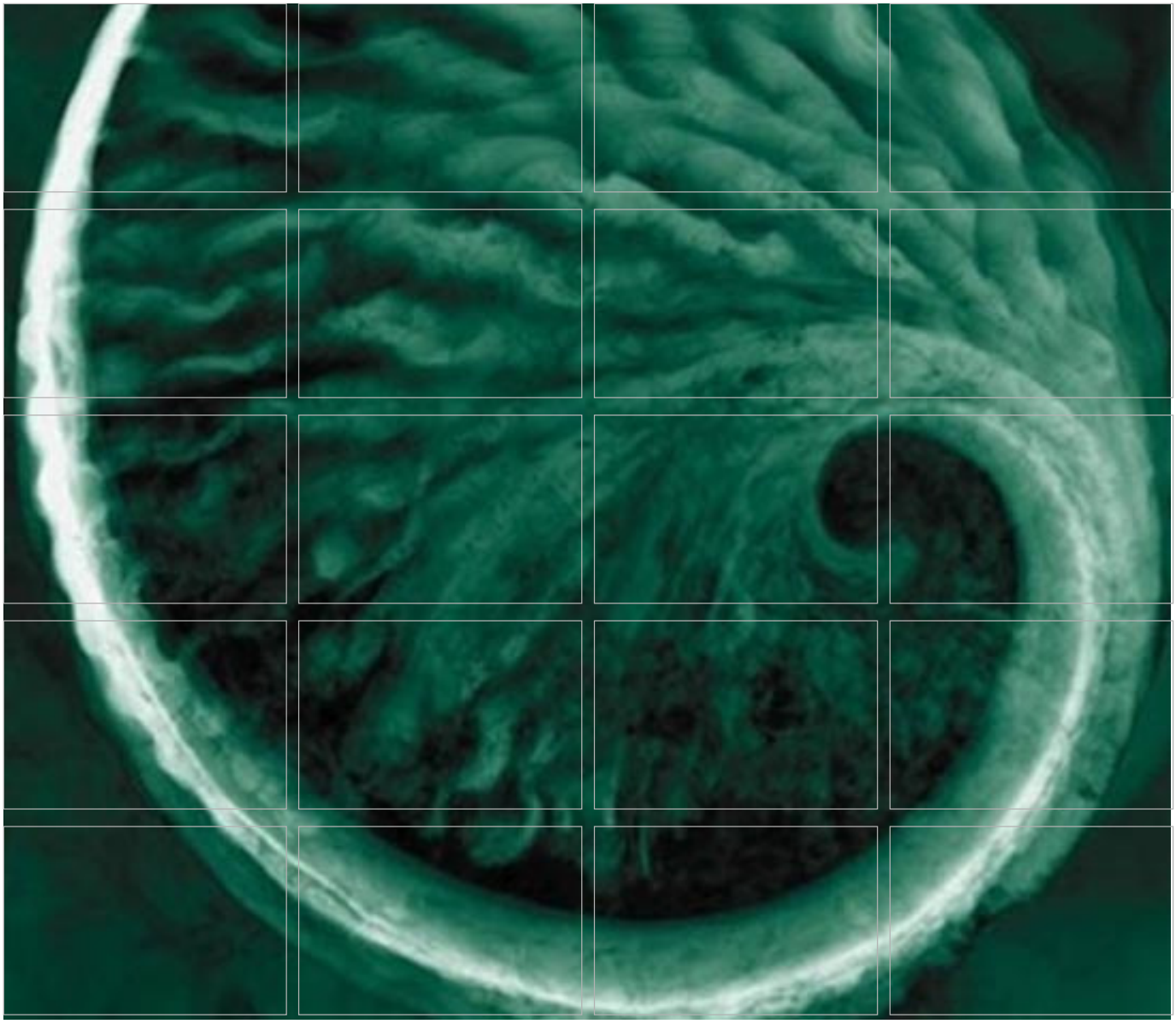

Etango Project: Linear Infrastructure Environmental Impact Assessment

Environmental Impact Report

March /April 2011

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Bannerman Mining Resources (Namibia) Pty Ltd

Etango Project: Linear Infrastructure Environmental and Social Impact Assessment Report

February 2011

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For and on behalf of
Environmental Resources Management

Approved by: Mike Everett

Signed:

Position: Partner

Date: February 2011

Bannerman Mining Resources (Namibia) (Pty) Ltd (Bannerman) proposes to establish the Etango Uranium Mine located approximately 41km (by road) to the east of Swakopmund and 47km to the north-east of Walvis Bay.

Bannerman appointed *A. Speiser Environmental Consultants* (ASEC) to undertake an Environmental and Social Impact Assessment (ESIA) of the Etango Project, in compliance with the Namibian Environmental Policy and the Environmental Management Act of 2007. Environmental clearance was granted by the Ministry of Environment and Tourism in March 2010. (An update of this ESIA as a result of updated project information is presently being undertaken by ASEC, and is the subject of a separate EIA process).

Bannerman appointed *Environmental Resources Management* (ERM) to prepare an additional ESIA for all ancillary linear infrastructure required in support of the Etango Project, including (1) electricity supply and powerlines, (2) water supply and pipelines, and (3) transport route options, including either rail and road options or a combination thereof.

1. PROPOSED ANCILLARY LINEAR INFRASTRUCTURE

Ancillary infrastructure, for the purposes of this ESIA, includes any proposed or planned external linear infrastructure which is not located directly on the mine site, but still forms part of the larger Etango Project. This includes (1) Transport Routes (both road and rail), (2) a Water Supply Pipeline, and (3) Electrical Supply and Power lines (See map overleaf).

1.1. TRANSPORT ROUTES

The proposed project will require the transport of personnel, goods, equipment and services between the mine site and Walvis Bay, both during the construction and operational phases. A number of transport options are available including:

Option 1 – Public Roads: The C28 and C34 would be used as the primary road route between the mine site and Walvis Bay, a total combined distance of 70km.

Option 2 – Railway: A proposed new railway line will run parallel to the C28 for approximately 37 km, before linking with the existing railway system to the south of Swakopmund. From this point the existing railway line to Walvis Bay would be used.

Option 3 – Combination of Public Roads and Railway: This option would involve the use of the C28 to transport goods by truck to link with the existing railway infrastructure, located just outside of Swakopmund. A railway siding would be required under this option to transfer loads from rail wagons to trucks and vice-versa.

Railway Siding – The siding would function as a loading/offloading facility of containerised materials between road and rail, and would entail a concrete pad of approx. 400m by 17m in dimension running road side alongside the existing railway line, with road access from the C34. The pad would include a loading crane – potentially a gantry crane on rails extending across the two siding rail lines. (Should this option prove feasible, the railway siding and the exact location thereof will be subjected to a separate EIA process, once more engineering information becomes available).

Access Road – In addition to the above, an internal access road will be required from the C28 to the mine site. The road would extend for approximately 7km, and would have a minimum width of 3.7 metres from the road centreline. It is envisioned that other linear infrastructure to the mine site (such as the water supply pipeline and powerlines) would all be positioned within this access road corridor.

1.2. WATER SUPPLY PIPELINE

NamWater and the surrounding mines have an in-principle agreement to establish the Swakopmund South Pipeline Scheme, which will provide bulk water to local mines. This scheme allows for the sharing of bulk infrastructure as recommended in the Uranium Rush Strategic Environmental Assessment (SEA). A separate EIA is presently being prepared for this scheme under the auspices of NamWater.

To supply the Etango mine, a dedicated pipeline would need to be established from the NamWater off-take to the mine site. This pipeline would extend for approximately 7km, running parallel and adjacent to the proposed access road. The pipeline would have a nominal 500mm diameter and would be located above ground.

1.3. POWERLINE INFRASTRUCTURE

There are limited options in terms of power supply infrastructure within close proximity to the Etango Mine site. This includes a temporary supply line for construction purposes, which is proposed either the Walmund substation or ERED System.

Long-term energy requirements can be met by NamPower from the 220kV National Grid though the Kuiseb Substation. A permanent 29km long transmission line will be established between the Kuiseb Substation and the mine site. The proposed route would likely follow parallel and adjacent to the existing transmission line linking the Kuiseb Substation and the Walmund Substation, and thereafter along the C28 to the mine site.

2. ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

The various linear infrastructure options were assessed in terms of their potential impact on the natural and/or social environment. The findings of this assessment can be viewed in the table below. **Overall the impact on the natural or social environment is low to moderate negative, assuming proper mitigation measures are adopted, as summarised in Table 1 overleaf.**

3. SUMMARY OF ESIA FINDINGS

- All three transport alternatives (road, rail and combination of both) are considered feasible from an environmental and/or social perspective.
- The railway line will have a higher environmental impact due to soil disturbance required for construction and the associated loss of vegetation communities and faunal habitats, and thus is not favoured by the ESIA.
- The road option will have minimal environmental impact; however the increase in traffic volumes will impact on local road conditions and will result in an increase in traffic risks.
- The combined use of road and rail is considered the preferred option – although this option will require the establishment of a railway siding, which will require a separate ESIA process.
- Bannerman will need to commit to the findings of the Swakopmund Southern Water Scheme EIA, in terms of bulk water supply, a process which is being run independently by NamWater.
- The dedicated water pipeline to the mine site is considered environmentally and socially acceptable on the assumption that it will be located within the access road reserve.
- Over 28km of new powerlines will need to be established between the substations and the mine site. The impact of the powerlines on the visual landscape will be moderate and can be mitigated if the new powerlines run in parallel and adjacent to existing powerlines, as well as other linear infrastructure, such as the C28.
- NamPower have indicated a potential transmission route coming into the proposed mine site from the west. This is generally not supported as it would require the creation of new access roads.
- The majority of impacts from powerlines will be as a result of required maintenance tracks. This impact can be greatly reduced if existing tracks associated with existing powerlines are used, negating the need for new tracks.
- A linear infrastructure corridor from the C28 to the mine site containing all required linear infrastructure is proposed, and is in keeping with the recommendations made in the SEA.
- This access road should be aligned so as to avoid washes and drainage lines as much as possible. A proposed alignment is provided in the ESIA, but should be subject to detailed engineering design.

Table 1 – Summary of Environmental and Social Impacts

Alternatives		Biophysical Environment				Biological Environment			Socio-Economic			
		Air Pollution	Noise Pollution	Geology and Soils	Geohydrology	Floral Species and Communities	Faunal Species	Biodiversity within NNP	Road Users and Traffic Safety	Investment in Infrastructure	Archaeology, Heritage and Culture	Eco Tourism and Tourism
Transport Routes	Public Roads	Low	Negligible	Low	Low	Low	Low	Low	Low	Low Benefit	Negligible	Moderate
	Railway Transport	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	No Impact	No Benefit	Low	Moderate
	Road and Railway	Low	Negligible	Low	Low	Low	Low	Low	Low	Low Benefit	Negligible	Moderate
Water Supply	Water Pipeline Route	Low	Negligible	Low	Low	Low	Low	Low	No Impact	No Benefit	Low	No Benefit
Powerline Route	Walmund Line	Low	Negligible	Moderate	Low	Low	Low	Low	No Impact	No Benefit	Low	Moderate
	ERED Line	Low	Negligible	Moderate	Low	Low	Low	Low	No Impact	No Benefit	Low	Moderate
	Kuiseb Line	Low	Negligible	Moderate	Low	Low	Low	Moderate	No Impact	No Benefit	Low	Moderate
Other Activities	Access Road	Low	Negligible	Low	Low	Low	Low	Low	Low	No Benefit	Low	No Benefits
	Railway Siding	Low	Negligible	Low	Low	Low	Low	Low	Low	No Benefit	Negligible	No Benefit

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1 INTRODUCTION

Bannerman Mining Resources (Namibia) (Pty) Ltd (Bannerman) is a subsidiary of the Australian company, Bannerman Resources Ltd. In 2005, Bannerman was granted the Exclusive Prospecting License (EPL) for uranium minerals over Licence 3345, located on the Welwitschia Tenement in the Erongo Region of Namibia, located approximately 41km (by road) to the east of Swakopmund and 47km to the north-east of Walvis Bay.

Bannerman appointed *A. Speiser Environmental Consultants* (ASEC) to undertake an Environmental and Social Impact Assessment (ESIA) of the Etango Project, in compliance with Namibia's Environmental Policy and Environmental Management Act of 2007. Environmental authorisation for the Etango Project was granted by the authorities in March, 2010.

Bannerman has appointed *Environmental Resources Management* (ERM) to prepare an ESIA for the ancillary linear infrastructure required to support the Etango Project.

For the purposes of this report, the terms *ancillary linear infrastructure* covers all infrastructure that will be established by Bannerman to supply and support the Etango Mine. This infrastructure is therefore limited to (1) electricity supply and powerlines, (2) water supply and pipelines, (3) and transport namely rail or road or a combination thereof.

While this document is a stand-alone report, it should be read in conjunction with the ESIA of the Proposed Uranium Mine 'Etango Project' (A. Speiser Environmental Consultants, 2009) and any amendments.

1.1 AIM AND OBJECTIVE OF THE ESIA

Fundamental to an ESIA is the identification, anticipation and evaluation of potential environmental and social consequences of an activity and the mitigation of negative impacts and enhancement of positive project benefits.

The objectives of this document are to:

- Communicate the results of the ESIA for the proposed linear infrastructure developments;
- Ensure that the impacts identified during the ESIA process are adequately addressed;
- Provide a record of comments and responses received from Interested and Affected Parties (I&APs) during the process; and
- Facilitate informed, transparent and accountable decision-making process by the relevant authorities.

1.2 THE PROJECT TEAM

ERM is a global environmental consulting firm employing over 3,300 specialists in over 145 offices in 41 countries. ERM Southern Africa in turn is one of the largest totally focused environmental consulting firms in the region. The contact details for ERM are as follows:

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1.3 STRUCTURE OF THIS REPORT

The structure of this Environmental Impact Report is as follows:

Table 1.1 Report Structure

Chapter	Contents
Chapter 1 Introduction	Presents a brief background to the project and the purpose and structure of the report.
Chapter 2 Applicable Legislation and Standards	Describes the legislative, policy and administrative requirements, as well as international best practise and local development plans and guidelines.
Chapter 3 The ESIA Process	Describes the adopted ESIA process.
Chapter 4 Project Description and Alternatives	Describes to the proposed linear infrastructure as well as potential alternatives that have been evaluated.
Chapter 5 Environmental and Social Baseline	Describes the receiving environment setting including biophysical and socio-economic aspects.
Chapter 6 The Public Participation Process	Describes the actions and findings of the Public Consultation Process.
Chapter 7 Summary of Specialist Studies	A summary of the key findings of the specialist studies commissioned as part of the ESIA.
Chapter 8 Impact Assessment	Describes and assesses the potential environmental impacts associated with the proposed project activities. Mitigation measures are also recommended.
Chapter 9 Environmental Impact Statement	Summarises the key findings of the ESIA and provides recommendations in terms of preferred alternatives.
Chapter 10 References	Contains a list of references used in compiling the report.

2 NATIONAL LEGISLATION AND INTERNATIONAL BEST PRACTICE

This Chapter establishes the national environmental policy, laws and standards against which Bannerman will need to comply. In addition, this chapter establishes the international best practices standards that have been adopted by Bannerman.

2.1 NATIONAL ENVIRONMENTAL POLICES AND LEGISLATION

2.1.1 Environmental Assessment Policy (1995)

Namibia's Environmental Assessment Policy was endorsed by Cabinet and published in 1995. The Policy provides a procedure for environmental assessments, as indicated in which sets out to:

- better inform decision makers and promote accountability of decisions taken;
- strive for a high degree of public participation and involvement by all sectors of the Namibian community in the environmental assessment process;
- take into account the environmental costs and benefits of proposed policies, programmes and projects;
- take into account the secondary and cumulative environmental impacts of policies, programmes and projects; and
- promote sustainable development in Namibia, and especially ensure that a reasonable attempt is made to minimise anticipated negative impacts and maximise the benefits of all development.

2.1.2 Environmental Management Act (2007)

The Act was gazetted on 27 December 2007 (Government Gazette No. 3966). However, at present implementation is difficult as no regulations or guidelines are in place; at present the second draft guidelines have been circulated for comment. Nevertheless this ESIA follows the described procedures of the new Act as far as possible.

The information to be included in the environmental report according to the Draft Regulations is provided in *Box 2.1* below:

Box 2.1 Schedule 3 - Information for Environmental Reports

In accordance with the provisions of the relevant procedures and guidelines the environmental report shall cover all relevant information with respect to the policy, plan, programme or project but not limited to the following:

a) An outline of the contents and main objectives of the plan, programme, or project, and of its relationship with other relevant policy, plan, programme, or project;
b) The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the policy, plan, programme, or project;
c) The environmental characteristics of the areas likely to be significantly affected;
d) Any existing environmental problems which are relevant to the policy, plan, programme or project including, in particular, those relating to any areas of a particular environmental importance, such as areas with recognized national, local community or international protection status;
e) The environmental protection objectives, established at international, community or Member State level, which are relevant to the policy, plan, programme or project and the way those objectives and any environmental considerations have been taken into account during its preparation;
f) The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects, on issues such as:
   (v) human health;
   (vi) population;
   (vii) cultural heritage, including architectural and archaeological heritage;
   (viii) landscape;
   (ix) biodiversity;
   (x) fauna;
   (xi) flora;
   (xii) soil;
   (xiii) water;
   (xiv) air;
   (xv) climatic factors;
   (xvi) material assets; and
   (xvii) the inter-relationship that may exists at plan, programme or project levels.
g) The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the policy, plan, programme or project;
h) An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
i) A description of the measures envisaged concerning monitoring in accordance with the relevant procedures and guidelines; and
j) A non-technical summary of the information.

The assessment of the social implications of policies plans or projects are required in terms of the Namibian Environmental Management Act (2007).

The terms "environment" in the context of the Environmental Management Act includes "*the human environment that is the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values*". It follows that the baseline human conditions and the effect of a project on these conditions in its environment need to be established and reported on as part of the environmental assessment process.

The act also provides for ensuring that there are opportunities for timeous participation of I&APs throughout the assessment process in matters affecting their lives.

2.1.3 Summary of other applicable legislation

Table 2.1 presents a summary of the most relevant and significant national legislation for Namibia that may apply (based on current understanding) to the Project.

Table 2.1 Summary of Relevant Namibian Environmental and Social Legislation

Issue	Applicable Legislative Instrument
Environmental	
Discharge to Surface Water (fresh and marine) and Groundwater	• *Water Act 54 of 1956 and the Water Resources Management Act 24 of 2004* *The Water Resources Management Act is presently without regulations; therefore the Water Act is still in force. Affords general protection against surface and underground water pollution. Provides for permits to abstract water from a water resource, disposal of industrial or domestic waste water and effluent. Prohibits the pollution of underground and surface water bodies. Includes liability of clean up costs after closure/abandonment of an activity.*
Waste Management	• *Hazardous Substances Ordinance 14 of 1974* *Control of substances which may cause injury or ill-health or death of human beings because of their toxic, corrosive, irritant, strongly sensitizing or flammable nature.* • *Pollution Control and Waste Management Bill* *Aims to prevent and regulate the discharge of pollutants to air, water, and land and will regulate noise, dust, and odour pollution. Further aims are to establish a system of waste planning and management, and to enable Namibia to comply with its obligations under international law in this regard.* • *Hazardous Substances Ordinance No. 14 of 1974*
Biodiversity	• *Article 95 of the Constitution* *"maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future"* • *Forest Act 12 of 2001* *Provision for the protection of various plant species.* • *Nature Conservation Ordinance 4 of 1975* *Protects inter alia nature reserves, conservancies, the hunting and protection of wild animals, and the protection of indigenous plants.* *Prohibits disturbance or destruction of the eggs of huntable game birds or protected birds without a permit.* *Requires a permit for picking (the definition of "picking" includes damage or destroy) protected plants without a permit.* • *Preservation of Trees and Forests Ordinance* *Protection to tree species.* • *Soil Conservation Act, No. 76 of 1969* • *Parks and Wildlife Management Bill of 2008*
Natural Heritage	• *National Heritage Act (2004)* *Heritage resources are to be identified and a permit obtained from the National Monuments Council for their removal/destruction, with mitigation measures approved before any development may commence.*
Noise & Vibration	• *Labour Act (1992)* *Set noise limits for processing plants and the identification of noise zones within which protective clothing is compulsory.*

Issue	Applicable Legislative Instrument
Social	
General Environmental Protection and Social and Environmental Assessment and Management Systems	• *Environmental Management Act (2007)* *Requires that projects with significant environmental impact are subject to an environmental assessment process.* • *The Constitution of the Republic of Namibia, No. [ ] of 1990* • *Namib Naukluft Park Regulations (original 1976 amended 1997) (No. 3556)*
Social Issues under Environmental Law	• *Environmental Management Act (2007)* *Requires for adequate public participation during the environmental assessment process for interested and affected parties to voice their opinions about a project.*
Labour, Working Conditions and Employment	• *Labour Act (1992)* *Health and Safety Regulations* *Minimum wages and working conditions including health and safety measures.* *Affirmative Action (Employment) Act 29 0f 1998* *Article 9 of the Namibian Constitution*
Public Health	• *Public Health Act 36 of 1919* *Provides for the prevention of pollution of public water supplies.*
Local and Regional Authorities	• *The Local Authorities Act, Act 23 of 1992* *Establishment of local authorities and defines the power, duties and functions of scheduled authority councils of local authorities.* • *The Regional Councils Act, Act 22 of 1992* *Establishes Regional Councils and defines the duties, functions and powers of the Regional Councils. Regional Councils are responsible for the general administration and development of a region excluding the local authority areas managed by local authorities.*
Land use planning issues	• *Town Planning Ordinance, Ordinance 18 of 1954* *Regulates the establishment of new townships and any subdivisions of non-urban land or changes in use of land (excluding the subdivision of commercial farmland.) Requires all local authorities to prepare Town Planning Schemes which are statutory schemes regulating issues such as land use zoning, building lines, heights, parking requirements, and even building quality.* • *The Township and Division of Land Ordinance, Ordinance 11 of 1963 as amended* *Regulates the Establishment of Townships and the subdivision and consolidation of urban land.*
Traffic and Road Safety	• Road Traffic and Transport Act, No. 22 of 1999

2.2 *DEVELOPMENT PLANS AND GUIDELINES*

This study will review and utilise as far as possible the recommendations, guidelines and lessons learnt in the development plans and case studies listed below:

2.2.1 *Mining Practices in Namibia's Protected Areas*

The Land, Environment and Development Project (LEAD) of the Legal Assistance Centre (LAC) of Namibia, in collaboration with the Mills International Human Rights Clinic (HRC) at Stanford Law School, published a report in 2009 which explores how Namibia may balance the economic benefit of mineral extraction with the threat that it poses to the long term integrity of

protected areas, with the economic benefits of ecotourism and the cost of implementing a viable environmental protection programme.

Mining in protected areas, such as national parks, is not restricted to Namibia and there are a number of approaches that may be taken. These include:

- Determining where developments may take place by:
  - establishing no go areas; and
  - establishing graduated areas of protection, in which lands with decreasing amounts of ecological sensitivity receive proportionately less protection.
- Assessing extent of potential environmental damage by:
  - assuming that there will be adverse impacts until proven otherwise;
  - requiring additional environmental assessment for biological "hot spots" or critical habitats; and
  - collecting adequate baseline data.

2.2.2 *Uranium Rush Strategic Environmental Assessment (SEA)*

The Southern African Institute for Environmental Assessment (SAIEA) was appointed by the Ministry of Mines and Energy (MME) to conduct the Central Namib "Uranium Rush" Strategic Environmental Assessment (SEA) of Uranium Mining in the Central Namib. The overall objectives of the SEA were to:

- Provide recommendations on accepted overall strategic approaches for sustainable mining development in the Erongo Region.
- Develop and assess viable scenarios of development in areas of specific relevance to the mining development as a basis for subsequent decision making and formal planning.
- Provide guidance for overall solutions on crucial (cumulative) impacts and challenges stemming from mining operations.
- Outline a Strategic Environmental Management Plan (SEMP).

It is the aim of this EIA to follow the recommendations of the SEA where applicable, and to provide more specific focus and detail pertaining to the linear infrastructure developments of the Etango project while taking into account the broader study area. Some of the key findings or recommendations made by the SEA, as relevant to the Etango Project linear infrastructure, are provided in *Box 2.2*.

Box 2.2 *Key SEA findings and recommendations*

Roads and Rail

- The D1984 road to the east of the dunes must be upgraded to a two-lane tar road as soon as possible;
- The unsurfaced sections of the C28 up to the Etango turnoff should be tarred;
- The road to the Welwitschia Flats should be restricted to tourist traffic only once the new Rössing South access road is in place;
- Certain tourist roads in the NNP should be restricted to tourist traffic only;
- Access roads to the mines should follow the shortest feasible route from the nearest existing road to minimise new disturbance.
- Mine access roads need to be tarred to minimise dust and noise.
- A cost-benefit analysis needs to be conducted (which should include environmental 'costs' and 'benefits') to determine whether new railway links to the mines are desirable and/or feasible. Such lines would have to be privately built, owned and operated;
- If railways are desirable and/or feasible, the routes should, as far as possible, given vertical and horizontal alignment constraints, follow existing infrastructure such as roads and pipelines;
- Careful thought will need to go into the siting of the rail-road or rail-pipe transfer facilities in order to reduce the visual and noise impacts and potential pollution impacts;
- State of the art loading and offloading facilities will need to be installed at the bulk material transfer points and comprehensive pollution control measures must be implemented;

Water Supply Infrastructure

- Supply schemes should comprise only one pipeline along a demarcated corridor – following other infrastructure e.g. roads, with a capacity to supply existing and future demands.

Electricity and Powerlines

- The proposed new power lines should preferably follow existing infrastructure routes such as roads, railways, pipelines and other power lines. Where this is not possible, the lines need to be carefully routed to avoid tourist routes, view points and bird flight paths;
- Where additional powerlines are contemplated to augment existing supplies the old lines should be removed and a new higher voltage line constructed so as to avoid ranks of parallel lines;
- Bird flappers and other flight diverters need to be placed on all power lines that cross river crossings and bird flyways, especially near the coast. Lines also need to be routed away from the lappet-faced vulture breeding areas at Ganab.

2.2.3 Namib-Naukluft Park Management and Tourism Development Plan

This Management & Development Plan (MDP) for the Namib-Naukluft Area (NNA) of the Namib-Skeleton Coast National Park (NSCNP) sets out the vision, objectives and guidelines (See Table 2.2) for the management and development of this area of the Park. As such, it represents the policies and intentions of the Ministry of Environment and Tourism (MET), the Ministry of Fisheries and Marine Resources (MFMR) and their partners.

Table 2.2 Key MDP Policies

Category	Policy Statement*
Natural Resources Protection	To sustainably use the natural resources to contribute towards the Strategic Goals while ensuring the wildlife (especially the endemics), associated habitats, ecosystems and unique landscapes are not compromised
Cultural, Historical and Archaeological Resources	To ensure that the cultural, historical and archaeological sites are conserved and where appropriate, sensitively used, to improve society's understanding and knowledge of the people and their cultures.
Zonation	The area is zoned to maximise tourist value which will increase Park income and economic development but within environmental limitations. It is recognised that some resources are limiting factors, and the attributes which tourists strive to enjoy must be preserved. These must contribute to achieving the Vision and Strategic Objectives.
Tourism	The nature of the environment limits the use of the area and for this reason the tourism product will generally focus on low volume high value products whilst still retaining some limited areas for Namibians where affordable access will be supplied.
Collaboration and Partnerships	Collaboration with outside parties must only be considered when there is a need for it as identified and initiated by MET and where roles, responsibility and outputs are defined via formal contractual agreements, where it is cost-effective to do it and it can be managed and controlled

2.3 INTERNATIONAL TREATIES, CONVENTIONS AND PROTOCOLS

Namibia is a signatory to a number of international conventions and agreements relating to industry and environmental management. In certain cases these have influenced policy, guidelines and regulations and must be complied with by the planning, construction and operation of the proposed development.

Table 2.3 lists the relevant international conventions and protocols to which Namibia is a signatory.

Table 2.3 Dates of Ratification of International Conventions

Date of Ratification	Name of Convention
Environmental Ratifications	
1997	United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification (UNCCD)
1975	UNESCO World Heritage Convention
1992	United Nations Convention on Biological Diversity
1992	United Nations Framework Convention on Climate Change
2003	Kyoto Protocol on the Reduction of Greenhouse Gas Emissions
1987	Montreal Protocol on substances that deplete the Ozone Layer
N/A	Statutes of the International Union for the Conservation of Nature and its Resources (IUCN)

Date of Ratification	Name of Convention
Environmental Ratifications	
1995	Basel Convention
1992	The Rio de Janeiro Convention on Biological Diversity
1989	The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal
Social Ratifications	
1966	International Covenant on Economic, Social and Cultural Rights
N/A	African Charter on Human and Peoples' Rights
2000	Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972
1992	Convention on the Elimination of All Forms of Discrimination against Women
1998	SADC Protocol on Energy

2.4 *INTERNATIONAL GUIDELINES AND STANDARDS*

Bannerman has elected to align with the following international standards as a framework to 'guide' its ESIA process, construction activities and operations. The standards include IFC Performance Standards and the Equator Principles

The aim of these international standards is to ensure the environmental and social risks associated with major infrastructure development projects are considered and managed by proponents in line with international best practice. Although the Project is not currently seeking external debt financing, and is therefore not formally required to meet the standards, their application as far as is practicable can serve as a useful risk and performance management tool.

2.4.1 *The International Finance Corporation*

The International Finance Corporation (IFC), a division of the World Bank Group that lends to private investors, has recently released a Sustainability Policy and set of Performance Standards on Social and Environmental Sustainability (see *Box 2.3*). These Standards replace the prior IFC safeguard policies and are used to evaluate any project seeking funding through the IFC.

Box 2.3 IFC Performance Standards

- Performance Standard 1: Social and Environmental Assessment and Management System;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Pollution Prevention and Abatement;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

The Performance Standards underscore the importance of managing environmental, social and health issues throughout the life of a project. They identify the need for an effective social and environmental management system that is dynamic and continuous, '*involving communication between the client, its workers, and the local communities directly affected by the Project*'. They require '*thorough assessment of potential social and environmental impacts and risks from the early stages of project development and provides order and consistency for mitigating and managing these on an ongoing basis*'.

The Performance Standards also reinforce the importance of effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them.

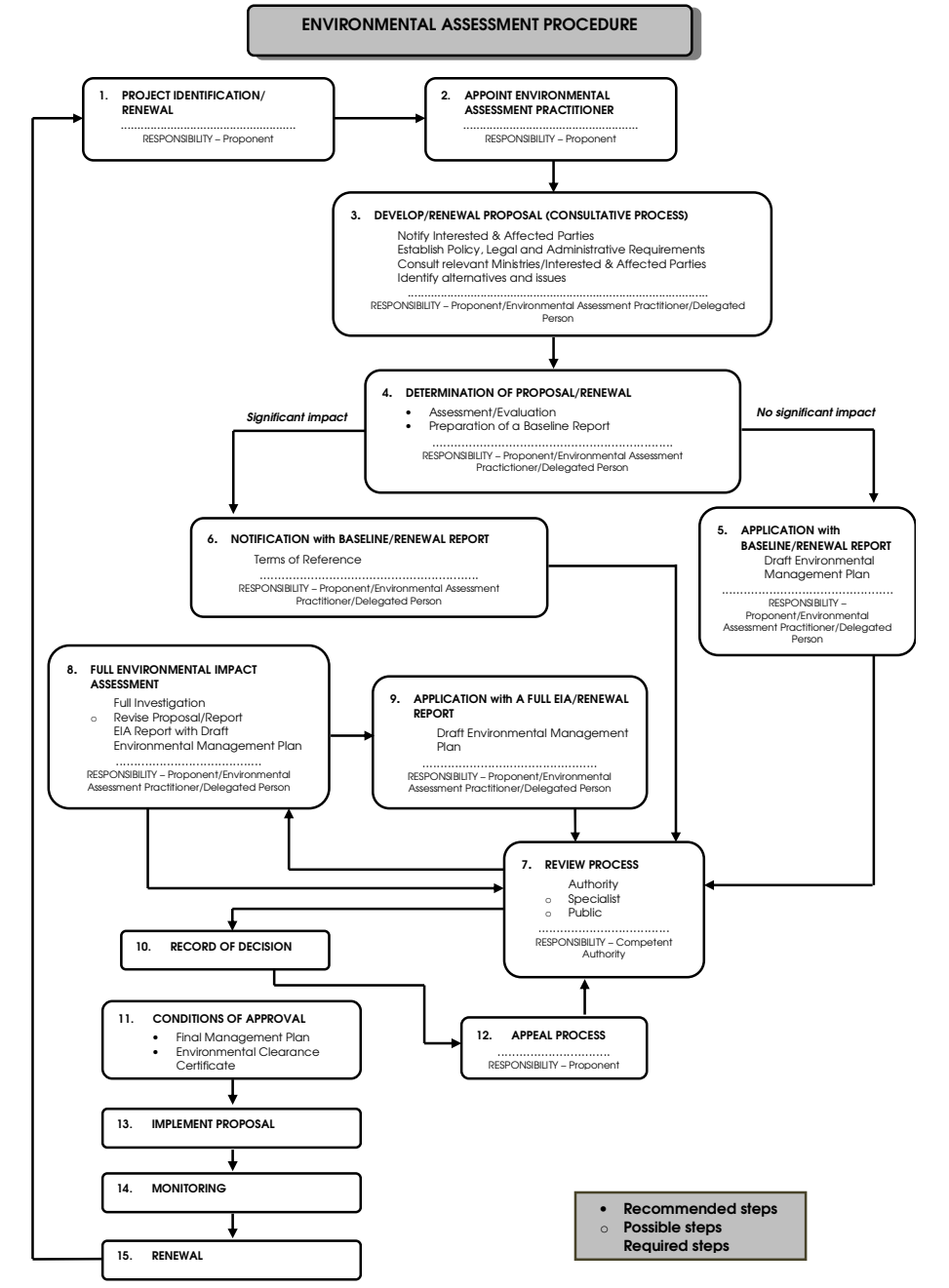
Through the Performance Standards, the IFC requires clients to engage with affected communities through disclosure of information, consultation, and informed participation, in a manner commensurate with the risks to, and impacts on, the affected communities.

2.4.2 Equator Principles

The Equator Principles are a set of standards developed by a consortium of major international banking institutions for the application of IFC-inspired environmental and social best practice guidelines to the financing of large projects. They have recently been revised to adhere to the new IFC Performance Standards. The Equator Principles Financial Institutions (EPFIs) do not, however, use the IFC's Sustainability or Disclosure Policy, as these were not adopted by the signatory banks. The EPFIs have their own sustainability and disclosure policies, and take the same approach, eg the borrower's/client's project must comply with the Performance Standards and the applicable Environment Health and Safety (EHS) Guidelines.

This chapter provides a summary of the ESIA procedure adopted in general conformance with, the yet to be promulgated, Draft Environmental Impact Assessment Regulations, 2010 under Section 56 of the Environmental Management Act, No 7 of 2007. The EIA procedure is present in *Figure 3.1.*

Figure 3.1 The ESIA Procedure



The above procedure can be divided into two keys stages, namely Scoping and the Environmental Impact Assessment. Theses stages are expanded below:

3.1 SCOPING

Scoping for this Linear Infrastructure was undertaken from August to September, 2010 and allowed for the identification of key environmental issues related to the linear developments required in support of the Etango Project. Specifically Scoping allowed for the:

- Presentation of the proposed development to stakeholders;
- identification of issues and concerns about the proposed development;
- identification of potential fatal flaws; and
- identification of issues which will require detailed investigation.

Scoping consisted of a number of activities including:

- Consultation with relevant government departments;
- consultation with key stakeholders;
- advertising of public meetings;
- distribution of the Background Information Document (BID) and invitations to public meetings;
- public meetings;
- production of the Draft Scoping Report;
- gathering public comment on the Draft Scoping Report; and
- submission of the Final Scoping Report to the environmental authorities.

The key issues identified during the Scoping Process and its associated Public Participation Process is summarised in *Box 3.1*, and detailed further in Chapter 6.

Box 3.1 Key issues identified during the Scoping Process

- Development corridors will result in impacts, and will be cumulative unless mining companies work together to share infrastructure.
- Will water abstraction be required and what are the long term water solutions?
- Will there be continued tourist access to view the Moon landscape and the Welwitschia?
- Status and maintenance of the C28 and the C34 if used for the transport of goods and materials to the mine?
- Traffic safety related to mine vehicles, notably when driving through Walvis Bay?
- Capability of existing road and rail structures to cope with all the newly developing business in the Erongo region?
- The need for the inclusion of the siding, handling facilities in the EIA?
- The options and potential impacts of establishing a new powerlines to power the mine. This includes an assessment of potential wildlife/power line interactions?

3.2 *ENVIRONMENTAL IMPACT ASSESSMENT*

The Environmental Impact Assessment (EIA) is the detailed assessment stage of the ESIA, and includes the following key activities:

- Undertake scientific studies to assess key environmental issues;
- Continued engagement with stakeholders;
- Assess the nature and degree of environmental impacts and benefits;
- Recommend actions to reduce negative environmental impacts and enhance project benefits;
- Prepare an Environmental Impact Report (EIR) and an Environmental Management Plan (EMP) to aid authorities in effective decision-making.

This Environmental Impact Report (EIR) has been prepared to present the findings of the EIA stage.

This EIA is concerned with infrastructure ancillary to the Etango Mine site. Ancillary infrastructure, for the purposes of this EIA, includes any proposed or planned external linear infrastructure which is not located directly on the mine site, but still forms part of the larger Etango Project, including (1) Transport Routes, (2) Water Supply and Pipeline, and (3) Electrical Supply and Powerlines.

4.1 THE PROJECT AREA

The Etango Project mine site is located approximately 41km (by road) east of Swakopmund and 47km northeast of the port town of Walvis Bay, within the Namib-Naukluft National Park (NNNP) (See *Figure 4.1*).

The site is situated in close proximity to the popular tourism areas known as the Moon Landscape, Goanikontes and the Welwitschia flats. Tour operators and self-drive tourists alike are attracted by the impressive views of the rugged ridges and ravines that flank the Swakop River in this area.

A number of smallholdings are situated in the Swakop River valley, west of Goanikontes. In general, the farmers are growing olives, date palms or vegetables, and are involved in ecotourism activities. No people live within the NNNP, and the area in which the Etango Project is situated has never been populated.

4.2 TRANSPORT ROUTES

4.2.1 Rationale and Need

The proposed project will require the transport of personnel, goods, equipment and services between the mine site and Walvis Bay, both during construction and operational phases. The annual freight projections for the Etango Mine, as well as transport requirements for personnel, are provided in *Table 4.1* below. (*Note:* The Heap Leach option is now the preferred option).

The aim of this section is to identify viable transport route options taking into consideration the following criteria:

- Construction and maintenance costs of new infrastructure;
- Maintenance costs of existing transport infrastructure;
- Transport distance and costs;
- Minimisation of environmental impacts on indigenous flora and fauna, local biodiversity, hydrology and soils;
- Minimisation of impacts on local road and railway users;

- Consideration of future growth and development in the area, and pressures on transport infrastructure; and
- Consideration of transport corridors as set out in the Uranium Rush Strategic Environmental Assessment.

Table 4.1 Annual Freight Projections

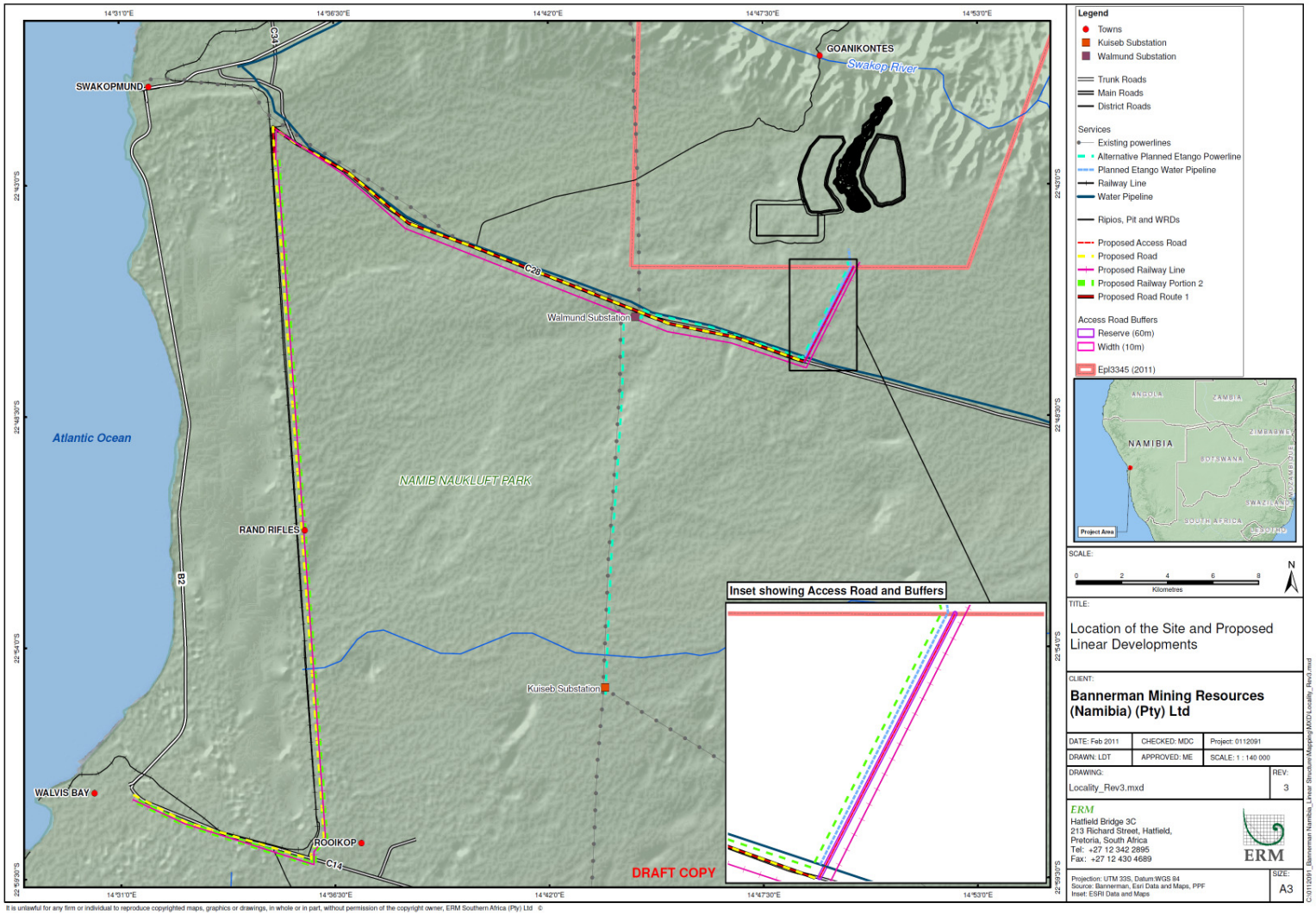
Annualised Freight Quantities (Average)			
Area	**Annual Freight (t)**		
	Heap Leach	**Agitated Leach (Wet)**	**Agitated Leach (Dry)**
Mining			
• Explosives	40, 000 (Delivered by Supplier)		
• Fuel	54 million litres per year (Delivered by supplier)		
• Other	5,000		
Process			
• Acid	199,000	265,000	255,000
• Other	36,000	163,000 (incl. ferrous)	81,000 (incl. ferrous)
Infrastructure/Administration	10,000		
Total	274, 000 to 345, 000	473, 000 to 544,000	376,000 to 450, 000

Source: Bannerman, 2010

The transport options presented for the proposed project are limited to those noted below. Each option is explored in more detail in the subsequent sections

1. Alternative 1 – Public Roads
2. Alternative 2 – Railway
3. Alternative 3 – Combination of Public Roads and Railway.

Figure 4.1 *Location of the Project area*



4.2.2 *Alternative 1 – Public Roads*

The use of existing public roads is considered a viable alternative in terms of the transport of goods to and from the mine site as it avoids the need to establish new roads; and avoids undue investment costs.

At present, the most viable road transport route is the establishment of an approximately 7km access road from the mine site to link to the C28 secondary road (See *Figure 4.3*). An appropriate and formalised intersection will need to be established at the intersection of the access road with the C28.

It is proposed that the C28 be used for materials and personnel transport, connecting the mine site to Swakopmund and surrounds. This leg of the road route would extend for approximately 37km from the mine site to the intersection of the B2. Bulk materials and goods would be diverted to the C34 to Walvis Bay whilst most traffic to the B2 and into Swakopmund would be limited to commuter or personnel traffic.

The C28 is an existing dual carriageway, gravel road that is currently being upgraded to a tarred road. The C28 services a range of road users, including heavy duty trucks from local mines, exploration drilling rigs, mining company vehicles, and private or tourism vehicles. Local mines in conjunction with the road authorities are currently upgrading portions of the C28 to improve road conditions and traffic safety. Bannerman has committed funds to tarring sections of the C28 (extending from the D1991 turnoff to the Walmund Substation).

The C28 links to the C34, to the south-east of Swakopmund. The C34 would form the second leg of the road route and would extend for approximately 32km to Walvis Bay. The C34 is a salt road that is considered to be in good condition; however the Ministry of Works, Transport and Communication plan to tar the C34 in the future.

It is anticipated that during the interim where construction and operational phases will coincide, that the existing road network will be used as a transport mode between the port, mine and surrounding towns (Aurecon, 2010).

4.2.3 *Alternative 2 – Railway Transport*

The use of rail (See *Figure 4.4*) has been considered as a viable alternative to road; however due consideration is needed in terms of the capacity and location of existing lines, as well as the significant investment costs (sidings, loading areas) that would be required.

The existing rail infrastructure is limited to a single line linking Walvis Bay to just outside Swakopmund, and then onto Usakos and the Namibian hinterland. No secondary or spur lines are located within close proximity to the proposed mine site. The existing railway line's primary function is the transfer of imported freight and fuel inland from Walvis Bay and export

freight from the hinterland to Walvis Bay (MME, 2010). Passenger rail is very limited.

As part of the Etango Mine Project, it is proposed that materials and goods be shipped to Walvis Bay and unloaded using existing port facilities. New storage facilities consisting of two 5,000t tanks in bunded yards will need to be established by Bannerman within the port (Bannerman, 2010).

Process materials (constituting primarily acids) will be transported using multi-modal ISO tank containers. Approximately 100 multi-modal tanks would be required; each of stainless steel construction, 6m in length, 14.5 m^3 volumes and with a 21t acid storage capacity (Bannerman, 2010).

Due to the lack of rail infrastructure in close proximity to the Etango Mine site, new infrastructure will need to be established by Bannerman under this alternative, which includes a new 30km railway line from the existing line to the mine site. It is proposed that the new railway line would run in parallel and adjacent to the C28 from the mine site to the existing railway line 10km to the south-east of Swakopmund.

As part of the establishment of the new railway line, Bannerman would be required to include at least two rail-road crossings at the C28 to reach the mine and at the C34.

4.2.4 Alternative 3 – Public Roads and Railway

The third alternative for transport is a combination both of road and railway (See *Figure 4.5*). This would entail the combination of the most viable options by route section considering:

- the need to avoid the construction of any new significant infrastructure and its associated development and construction costs;
- minimising environmental impacts; and
- reducing pressure on local road and railway infrastructure.

The most viable combination of road and railway would most likely involve the use of the C28 to transport goods by truck to link with the existing railway infrastructure, located just outside of Swakopmund.

Goods would be transported by railway for the remainder of the journey to Walvis Bay. This option would avoid the need for the establishment of any new road or railway.

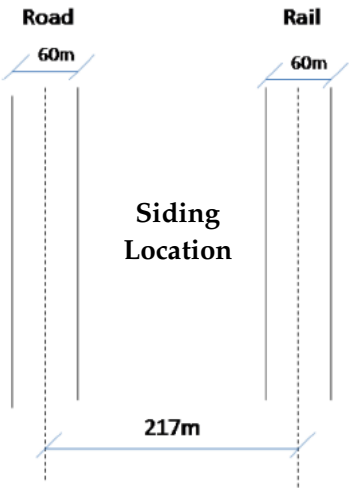
As this option involves two separate transport options, it is proposed that a railway siding be established approximately 10km south-east of Swakopmund to facilitate the transfer of freight and material from road to rail and vice versa. The general design characteristics of the siding comprise a 400m by 17m concrete pad located between the C34 and the existing railway line. Two parallel lines would be established from the main railway line, extending

approximately 400m, to allow for the offloading of materials without interrupting rail movement.

4.2.5 *Railway Siding*

A railway siding will be required should the rail to road transport option be adopted (See *Figure 4.7*). The proposed railway siding would be located at approximately 22°42'22"S, 14°34'59"E. The siding would function as a loading/offloading facility of materials between road and rail, and thus is located between the between the existing railway line and the C34 (See *Figure 4.2*). A suitable intersection along the C34 to the railway siding will be required with this option.

Figure 4.2 Conceptual Siding Configuration



Source: Bannerman, n.d.

The siding would entail a concrete pad of 400m by 17m in dimension running alongside the railway line. The pad would include a loading crane – potentially a gantry crane on rails extending across the two siding rail lines.

4.2.6 *Internal Access Road*

An internal access road will be required from the C28 to the mine site (See *Figure 4.6*) which would be established by the Namibian Roads Authority. The road would extend for approximately 7km, and would have a minimum width of 3.7 metres from the road centreline, or a 7.4 metre total width with 1.3 metre shoulder to allow for vehicles to pass safely in opposite directions. The road reserve will be an estimated 60m in width.

4.2.7 *Regional and Strategic Transport Planning*

The transport routes highlighted in the previous sub-sections are limited to project specific options. Effective planning requires coordination with planning initiatives and/or projects established at the regional or strategic level.

The Strategic Environmental Assessment (SEA) for the Central Namib Uranium Rush (MME, 2010) provides a strategic assessment of local road capacity to support existing and proposed uranium mines in the region. It noted that the B2 is deteriorating badly due to traffic increases and there is significant pressure on this road. The C28 is busy from Swakopmund to the Langer Heinrich turnoff with an average of 177 vehicles per day (dated 2008). Increased volumes of traffic associated with local mines has resulted in the C28 being unpleasant and unsafe for tourists and other road users. In response, Bannerman and local mines have invested in the tarring and upgrade of the C28.

The SEA (MME, 2010) notes that the local road infrastructure is under pressure and major upgrades will be needed in the future. The projects currently envisaged by the Roads Authority (RA) over the medium term (5-10 years) are presented in *Box 4.1*.

Box 4.1 Envisioned road projects

- Upgrade and surfacing of the C34 from Swakopmund – Henties Bay;
- Rehabilitation and widening of the B2 coastal road from Swakopmund – Walvis Bay;
- Upgrade and surfacing of the C34 (D1984) from Swakopmund to Walvis Bay. (This latter project is considered to be a priority in terms of the SEA. All heavy vehicles (except local traffic) should be directed to use this 'new' road, in order to relieve the congested and dangerous situation along the B2 coastal road)

Source: MME, 2010

In terms of railway infrastructure the SEA notes that there is a single line linking Walvis Bay to Swakopmund and the hinterland, whose primary function is the transfer of freight. The SEA notes that a number of additional rail infrastructure options are being considered as noted in *Box 4.2*.

Box 4.2 Envisioned rail projects

- A 28 km rail link between the existing line (east of Swakopmund) to the proposed Gecko
- chemicals plant (near Wlotzkasbaken)
- A roughly 22 km rail link from the Rössing spur line to Rössing South;
- A roughly 30 km rail link between the existing railway east of the dunes to Etango;
- The potential to extend the above eastwards to the possible future Tumas-Tubas plant (at a site not yet determined).

Source: MME, 2010

Figure 4.3 *Transport Alternatives: Public Roads*

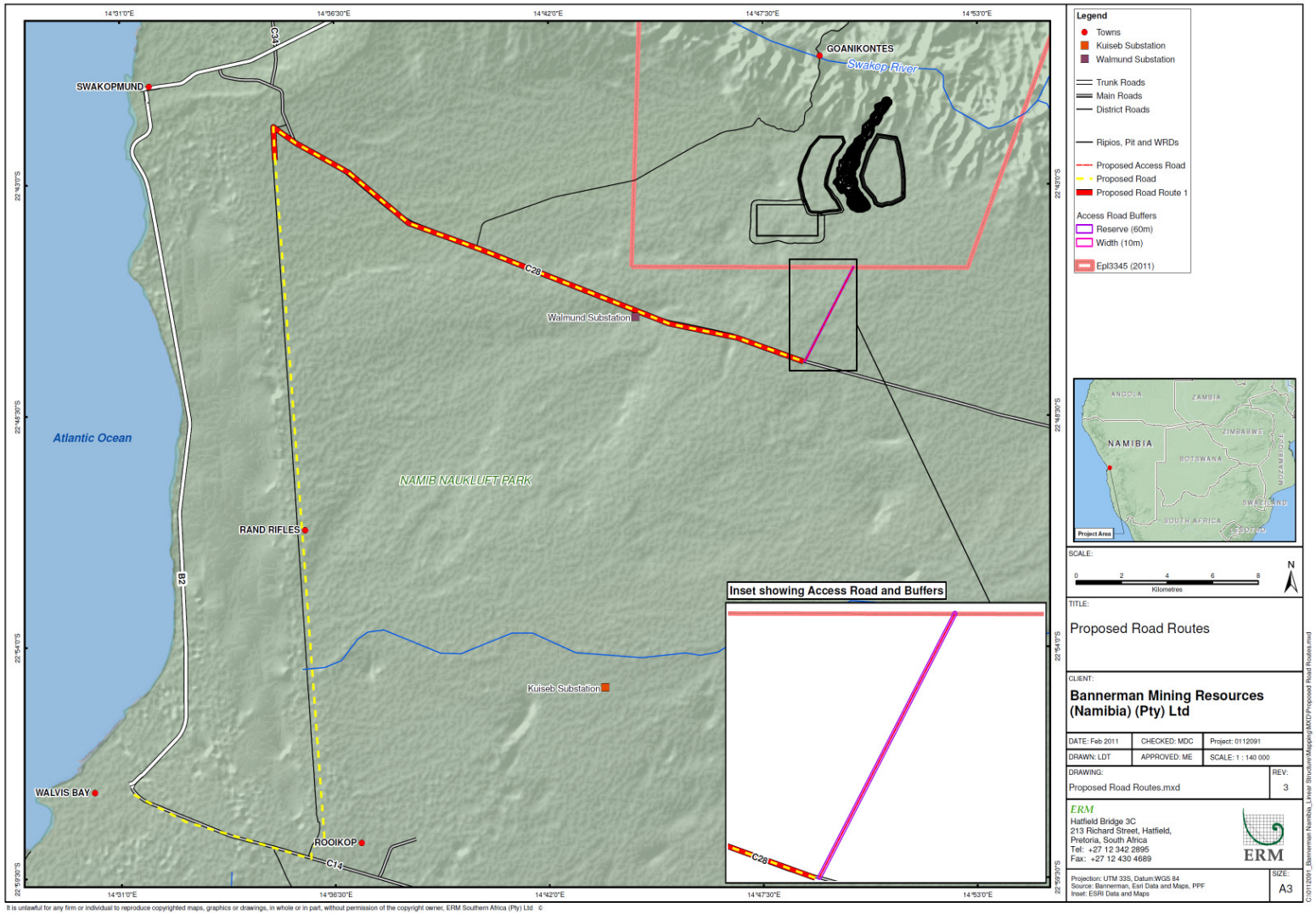


Figure 4.4 *Transport Alternatives: Railway*

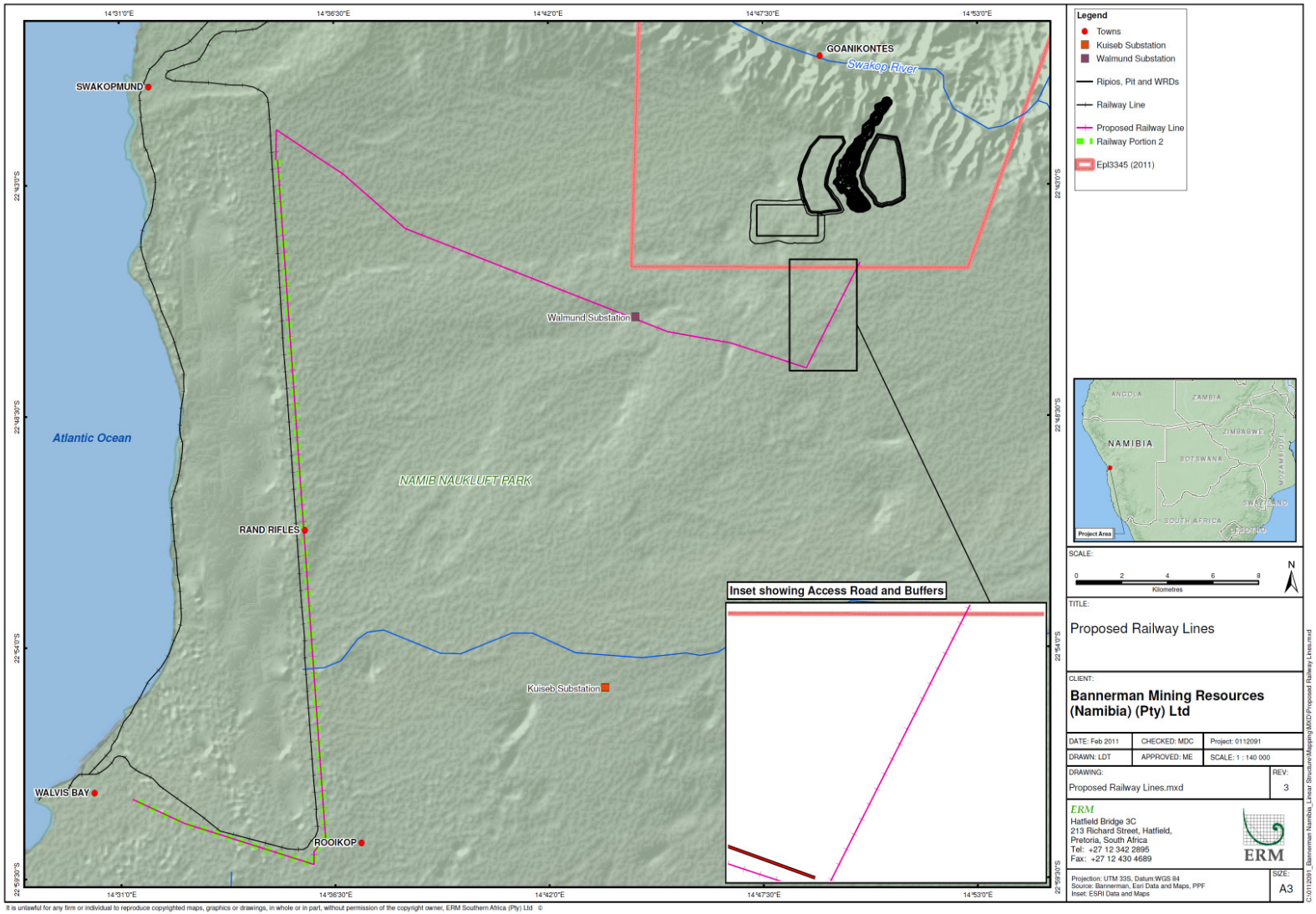


Figure 4.5 *Transport Alternative: Road and Railway*

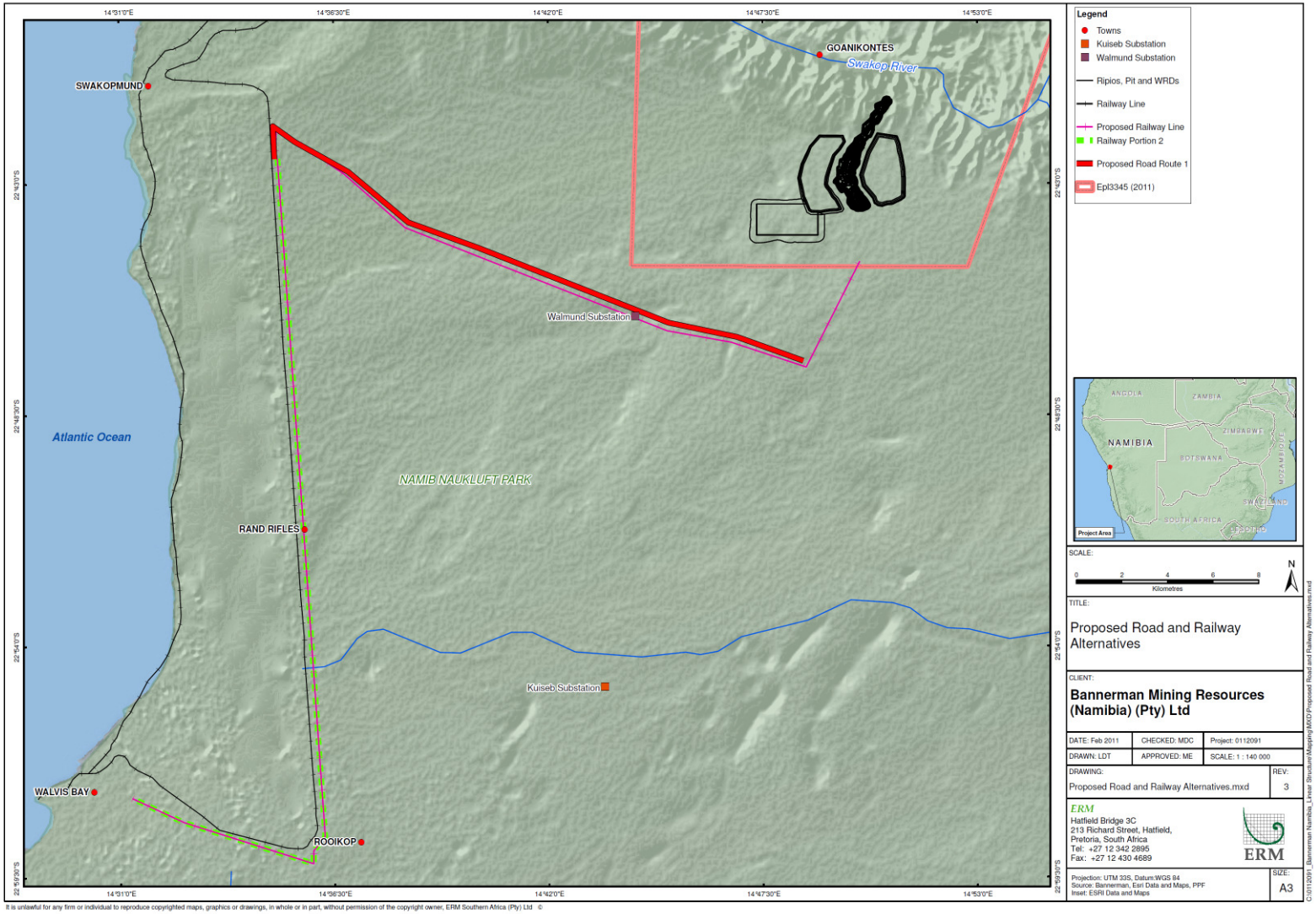


Figure 4.6 *Internal Access Road*

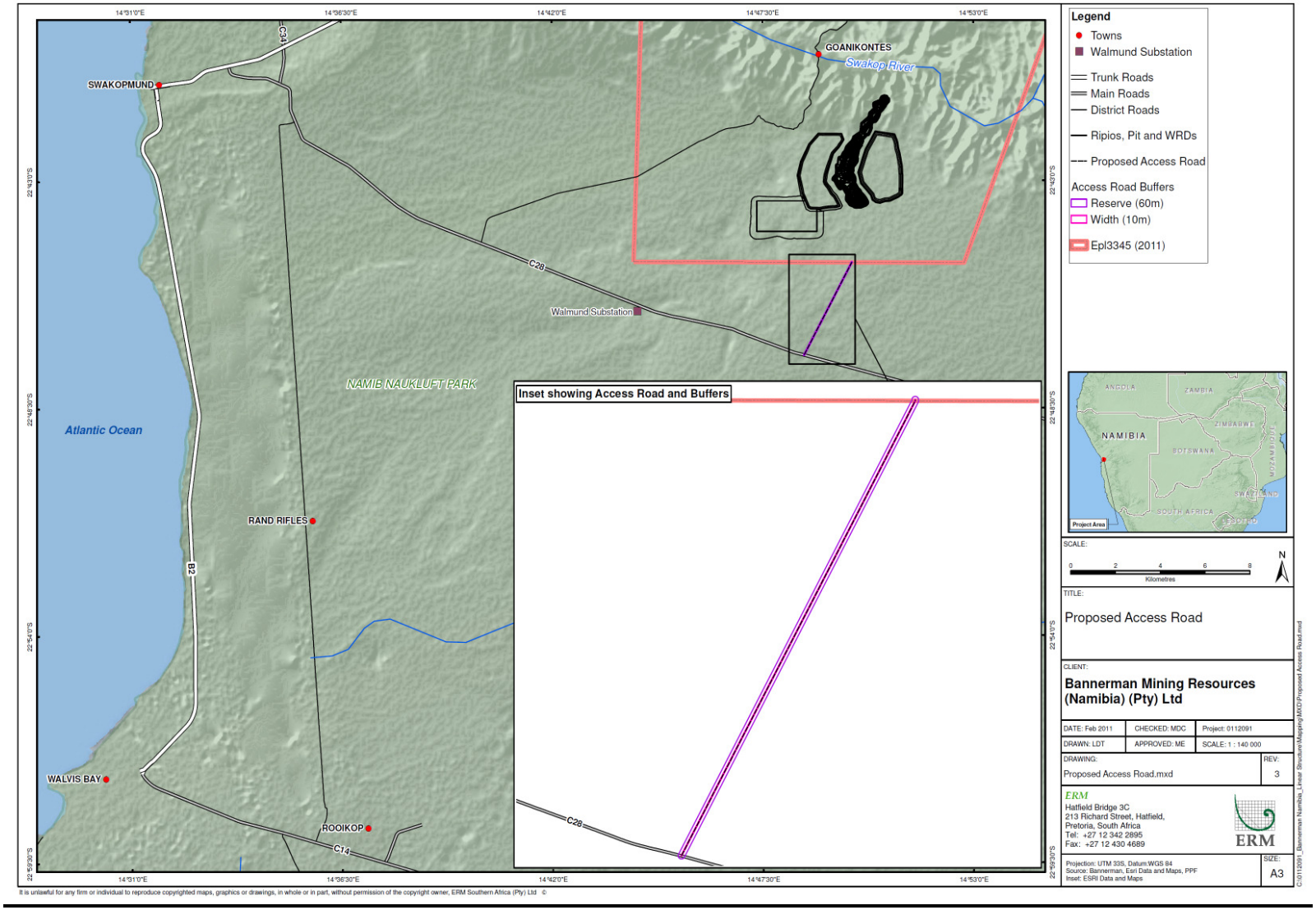


Figure 4.7 *Proposed Railway Siding Location*

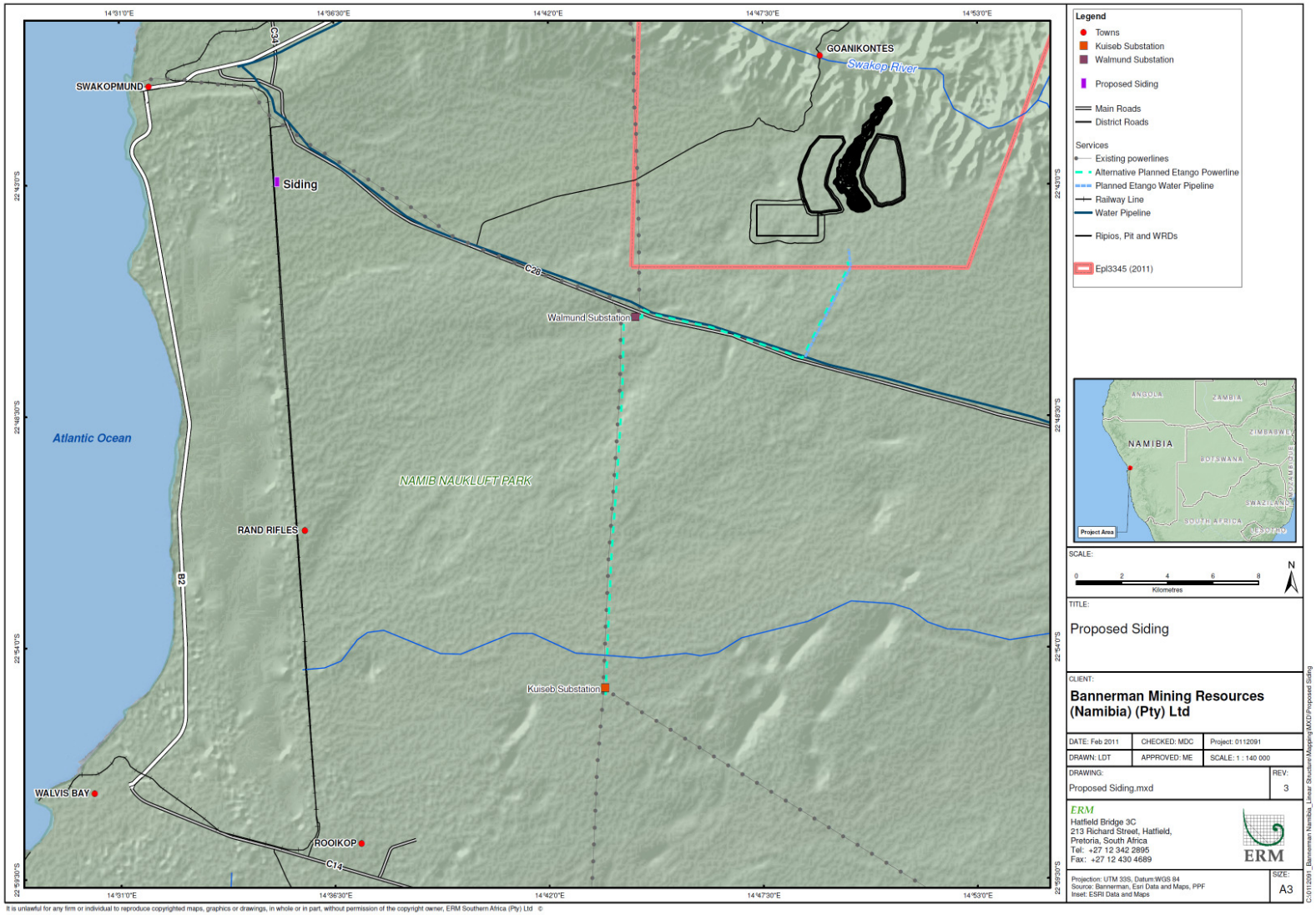
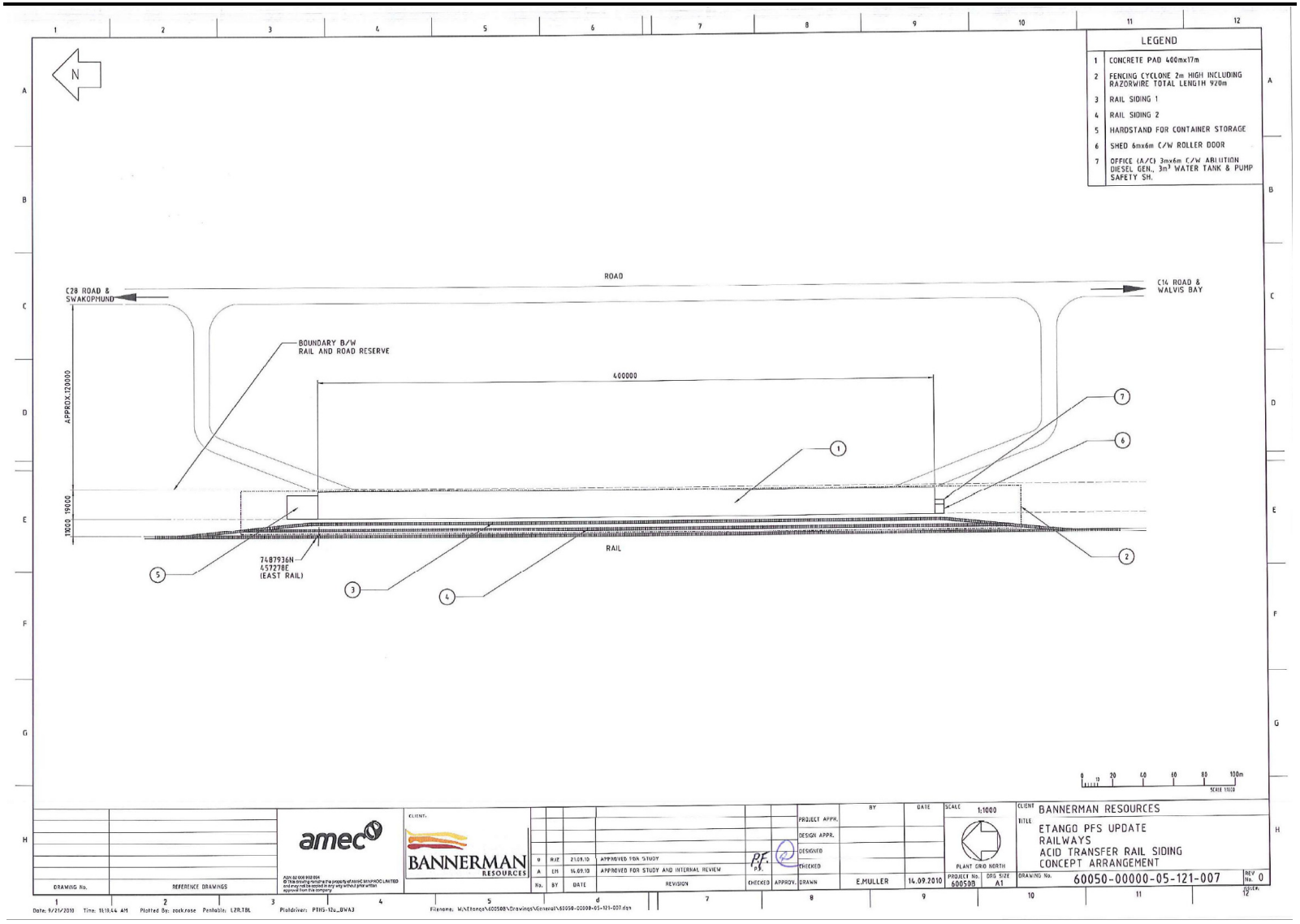


Figure 4.8 Proposed Railway Siding Basic Configuration



Source: Bannerman, 2010

4.3 WATER SUPPLY AND PIPELINE INFRASTRUCTURE

4.3.1 Rationale and Need

Water demand by the Etango mine will vary considerably during the construction and operational phases. The construction phase will require a maximum of 1.1Mm^3 per annum (See *Table 4.2*). Operational water demand will be approximately 3.4 Mm^3 per annum (See *Table 4.3*).

Table 4.2 Water demand for construction

Construction Water Requirements				
	Commence	Finish construction	Daily usage (m^3)	
Development Phase	construction (ML/a)	(ML/a)	Min	Max
Mining Development	10	60	30	170
Mining Pre-strip Phase	10	150	30	420
Process Plant Construction	100	100	200	280
Infrastructure Construction	150	70	80	190
Administration	10	20	30	50
Total	280	400	370	1,110

Table 4.3 Water demand for operations

Operational Water Requirements	
Area	Annual Usage (Mm^3) Heap Leach
Mining	0.5
Process	2.4
Infrastructure/Administration	0.2
Future Provision	0.3
Total	3.4

The Central Namib area is hyper-arid and the provision of this required water is considered critical to the sustainability of the project. The aim of this section is to identify viable water supplies and pipeline routes taking into consideration the following criteria:

- Acknowledgement that the region is hyper-arid and existing natural water resources are under stress from current overuse;
- Existing natural water resources and paleo-channels cannot be exploited;
- Construction and maintenance costs of new infrastructure;
- Maintenance costs of existing infrastructure.
- Transport distance and costs;
- Minimisation of environmental impact on indigenous flora and fauna;
- Consideration of future growth and development in the area, and pressures on natural water resources;
- Consideration of transport corridors as set out in the Uranium Rush Strategic Environmental Assessment;
- Visual Impact.

4.3.2 *Regional and Strategic Planning for Water Supply*

Water supply options are limited and only one water supply scheme is operational at this stage; namely the Central Namib Water Supply System. Water is sourced primarily from the Omdel and Kuiseb Aquifers.

There is presently a near exclusive reliance on this system, which supplies the domestic demand of Walvis Bay, Swakopmund, Henties Bay and Arandis, while also supplying the water requirements for the Rössing and Langer Heinrich mines.

Water abstraction from this scheme for 2009 is estimated to have exceeded the sustainable yield, with a net demand of 14.4Mm^3 of water per annum, of which 4.6Mm^3 per annum is for mining and 9.8Mm^3/a is for domestic and non-mining industries (MME, 2010). The Uranium Rush Strategic Environmental Assessment notes (MME, 2010) that this current water use is unsustainable.

To increase water supply capacity, NamWater is proposing to establish a Reverse-Osmosis Desalination Plant near Mile 6, north of Swakopmund. The plant is planned to produce approximately 25Mm^3/a of treated water per year with a minimum lifespan of 20 years (MME, 2010). The desalination plant would include additional ancillary infrastructure including a 20,000 m^3 storage reservoir on site, and a pipeline to the existing Omdel-Swakopmund pipeline.

In terms of water supply planning, the Uranium Rush Strategic Environmental Assessment notes (MME, 2010) provides some final conclusions as summarised in *Box 4.3* below.

Box 4.3 Water Supply Recommendations

- There is sufficient water from the existing NamWater groundwater schemes (Omdel and Kuiseb) to supply potable water to current domestic users in the coastal towns until 2020 However, under the high growth conditions, new water supplies will need to be found to meet domestic demand from about 2016.
- There is not enough water from existing groundwater sources to supply the operational needs of the existing mines, let alone the proposed new mines.
- There is not enough water in the primary alluvial aquifers of the Khan and Swakop Rivers to satisfy the water requirements of the mines for operations, but there may be enough to supply water for construction purposes in the short-term (within safe yield limits), without compromising existing water users (farmers in these valleys) and riverine ecosystems. Therefore NamWater needs to build a desalination plant as soon as possible to be ready to supply the new mines when they start operating from about 2012.
- A network of new pipelines will be required to supply the new mines with water which must be planned in 'proposed infrastructure corridors'. A working group should delineate optimal routes, based on the findings of the SEA.
- Desalinated water is expensive and the cost of this water should not be borne by domestic users while there is still sufficient groundwater to meet domestic demand.
- The high price of water from the desalination plant should be sufficient incentive for the mines to closely manage their water demand through reduction, re-use and recycling strategies.

Source: MME, 2010

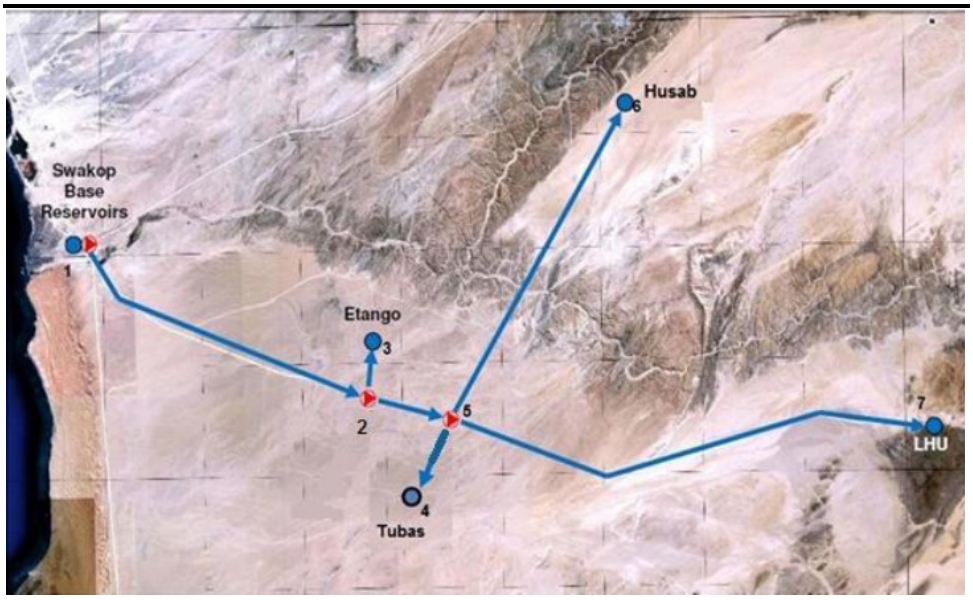
4.3.3 *Water Supply Infrastructure*

Water supply to the Etango mine site would require the established of new water supply infrastructure. This would entail a bulk water pipeline extending over 32km from the Swakopmund Reservoir to the mine site, and associated pumpstations.

In addition to the proposed Etango Mine, there are a number of existing and proposed mines within the region, whom will also require suitable pipelines to site. In order to coordinate efforts in terms of water supply planning, there have been discussions between NamWater, various government departments and the respective mines.

The net outcome for these discussions is to establish a combined conveyance system to all mines under the ambit of NamWater – termed the Swakopmund South Pipeline Scheme (See *Figure 4.9*).

Figure 4.9 Swakopmund South Pipeline Scheme Basic Concept



Source: NamWater, 2010

The proposed scheme is currently proposed to entail the following:

1. A shared pipeline from Swakopmund Base up to a pressure break and balancing reservoir near Etango Mine. The proposed pipe diameter and length is 1 000 mm and 25 km respectively.
2. At this pressure break, (Point No 2 on the map) a dedicated pump system and pipeline will convey water to the Etango Mine through a 500 mm diameter pipe, 7 km long.
3. A separate pump system will convey the balance of the water over a distance of 14 km to a second pressure break (Point No 5 on the map) at the proposed Husab off-take point. The pipe diameter over this section (from point 2 to point 5) will be 800 mm.

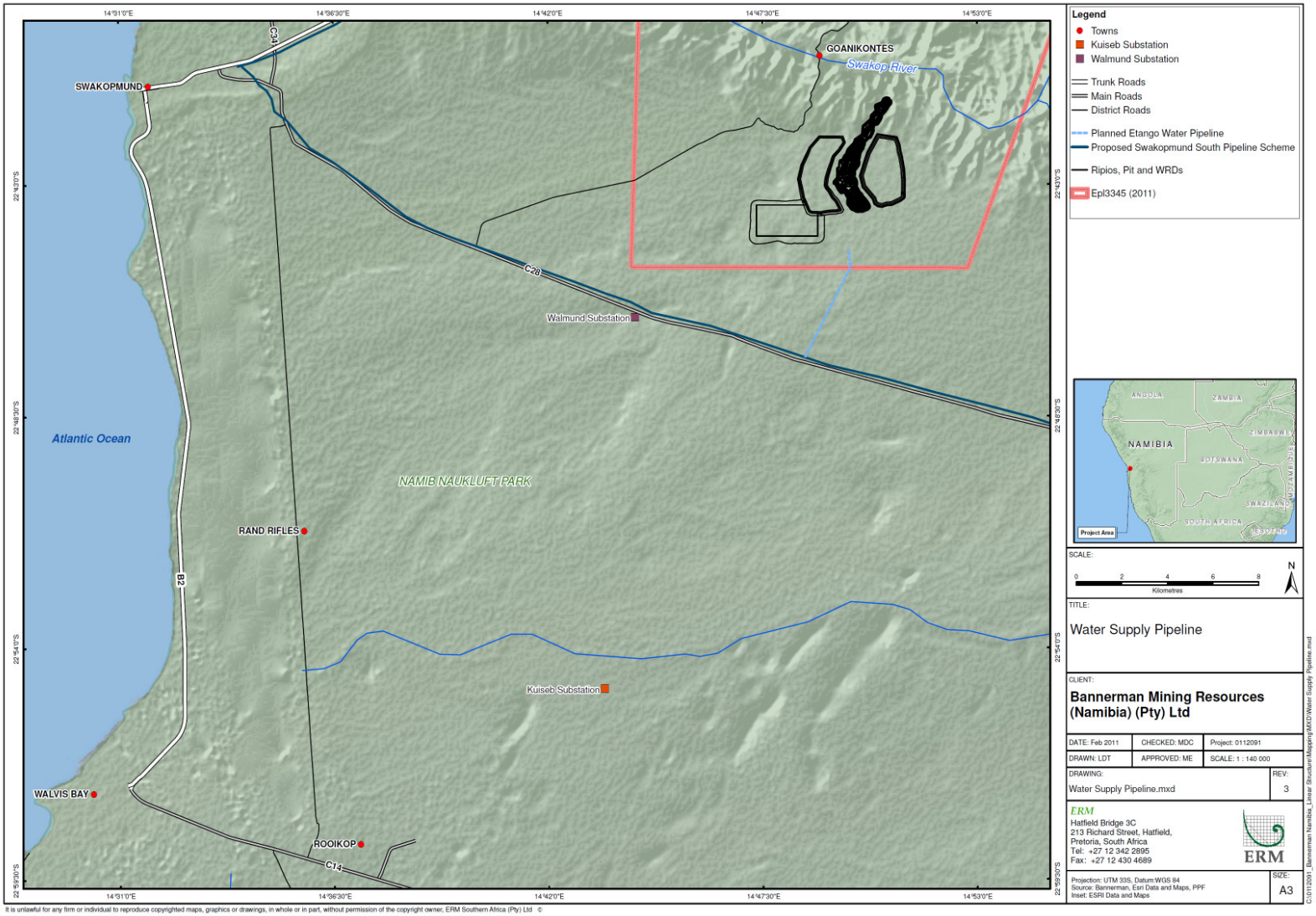
4. At this second pressure break, a dedicated pump system and pipeline will convey water to the Husab Mine through a 600 mm diameter pipe, 34 km long.
5. A dedicated pipeline to Tubas Mine, 250 mm, 8 km long.
6. Also at this second pressure break, a second dedicated pump system will convey water to the Langer Heinrich Mine through a 600 mm diameter pipeline, 45 km long.

As relevant to the Etango mine, the scheme would include a dedicated pipeline from the first reservoir to the mine site. This pipeline would extend for approximately 7km, running parallel and adjacent to the proposed access road. The pipe would have a 500mm diameter Ductile Iron Pipe with a Class K9 rating and would be located above ground. The spur line would require a booster station at the C28 turn-off.

The booster station and pipeline would remain under the management of NamWater – and thus NamWater standards are applicable. It is currently planned that the pipeline would run parallel and adjacent to the proposed access road, thus it falls within the recommendations of the SEA (MME, 2010. The pipeline would be located no nearer than 25m from the road centreline and will require 15m servitude.

Note: NamWater will initiate a separate EIA for the shared pipeline extending from Swakopmund Reservoir to Etango in early 2011. Therefore this component of the pipeline will not be addressed in detail in this EIA. The spur line extending to the Etango Mine site will however be covered in detail in this EIA.

Figure 4.10 Water Supply Pipeline



4.4 POWER SUPPLY AND POWERLINES

4.4.1 Rationale and Need

The maximum demand for the proposed mine and process plant at Etango is 500kW, with the constant load expected to be over 300KW. The Namibian power utility NamPower has confirmed its ability to provide power to the Etango Project and has offered a 30MVA supply for the Project.

Namibia has a current (2009) national demand for electricity of approximately 550MW, with a generation capacity of 384MW, leaving a net deficit of 166MW. This deficit is supplied from various sources from the Southern African Power Pool, including from South Africa, Zambia and Namibia (MME, 2010).

Recently, domestic demand in South Africa has exceeded the capacity that Eskom can generate, resulting in shortages both in South Africa and the wider Southern African Development Community (SADC) region (MME, 2010). NamPower, the Namibian power utility, is thus seeking to increase its power generation capacity and reduce dependency on imported energy.

In consideration of regional demand, the predicted demand from the existing and proposed uranium mines in the Etango region ranges from 120MW to a possible 278MW (MME, 2010) and therefore NamPower is not in a position at present to meet the requirements of the new mines (MME, 2010)

As such, NamPower is exploring a number of energy generation options including gas-powered stations, coal-fired stations, hydro-power stations, peaking stations and renewable energy. These regional schemes will be critical to ensuring energy sustainability and the long-term energy requirements of the proposed project.

4.4.2 Power Supply

Bannerman has confirmed Nampowers ability to provide power to the Etango Project and has offered a 30MVA supply for the Project (Bannerman, 2010). NamPower is currently upgrading supply and distribution capacity to cater for the anticipated increase in demand in the Erongo Region.

Provision is to be made for a temporary supply line to be constructed from either the Walmund Substation or the ERED system to the mine site. Either option will be used to provide a temporary supply for the construction phase only.

Temporary Power Supply Source Alternative 1 –Walmund Substation

A temporary supply line is proposed from the Walmund substation (*Figure 4.11*) in order to provide short-term energy requirements to the proposed mine (Bannerman, 2010). The substation would have the capacity to supply the required maximum 50MW needed by the mine, however the upgrade

requirements would include the construction of a new 66kV feeder bay at the Substation and a temporary substation at the mine site.

Temporary Power Supply Source Alternative 2 – ERED

A second option for the supply of temporary power is a 500KW supply from Erongo Regional Electricity Distributor (ERED) via a 22kV line that supplies the Namwater pump stations to Langer Heinrich. This alternative is however based on the assumption that there is spare capacity on this network for 500kW, which has not been confirmed.

Permanent Power Supply Source Alternative 1 – Kuiseb Substation

Long-term energy requirements can be met by NamPower from the 220kV National Grid though the Kuiseb Substation (Bannerman, 2010). The Kuiseb Substation (*Figure 4.11*) currently supplies a 66kV capacity which would need to be upgraded to a distribution voltage of 132kV.

4.4.3 Transmission lines

New transmission lines and transmission line routes will need to be established between the power supply source alternatives and the mine site. As with previous transport and water pipeline route options, an attempt will be made to site any new transmission lines in close proximity to existing infrastructure to minimise environmental impacts.

Transmission Line Route Alternative 1 –Walmund Substation to Etango Mine

Approximately 12km of transmission line will need to be established between the Walmund Substation and the Etango Mine (*Figure 4.11).* The transmission line would likely comprise of 132kV wood-pole structures. However, the Walmund alternative will be limited to the construction phase only. This is attributed to the fact that the Walmund substation is heavily corroded and in the long-term the substation is planned to be decommissioned by NamPower.

Transmission Line Route Alternative 2 – Kuiseb Substation to Etango Mine

To provide a permanent power source, it is proposed that the Walmund Line will be extended to link to the Kuiseb Substation. Approximately 29km of new transmission line will need to be established between the Kuiseb Substation and the Etango Mine (*Figure 4.11*). As with Alternative 1, the transmission line would likely comprise 132kV wood-pole structures. The proposed route would likely follow parallel and adjacent to the existing transmission line linking the Kuiseb Substation and the Walmund Substation.

NamPower presently propose a route from the Kuiseb substation in parallel to the existing line, branching off along the southern most boundary of the EPL, and coming in to the mining area from the west. A different route is proposed by ERM (*Figure 4.11*), which will need to be negotiated with Nampower.

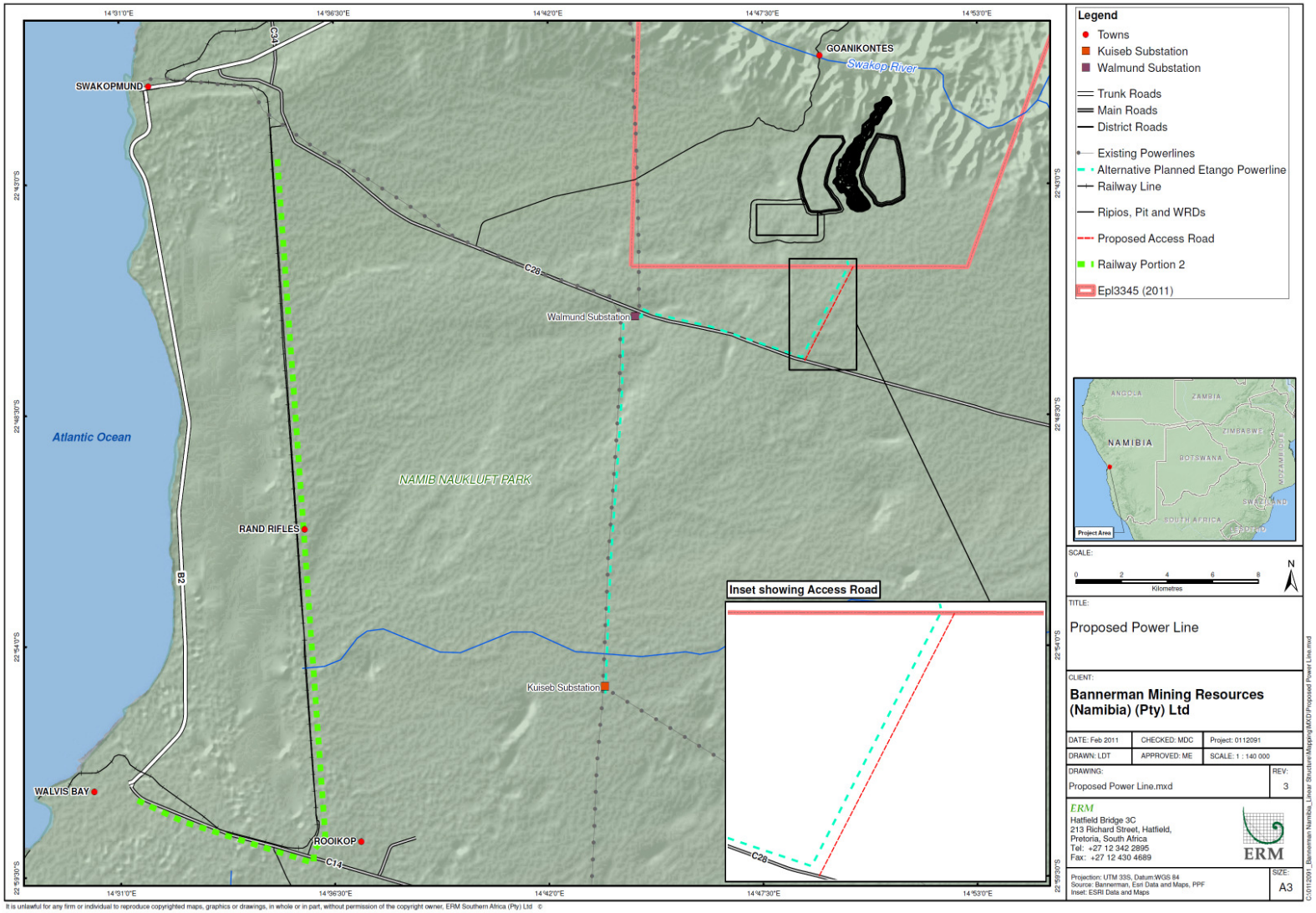
4.4.4 *Regional and Strategic Planning for Power Transmission*

The Uranium Rush Strategic Environmental Assessment (MME, 2010) notes that NamPower is considering reinforcing local power transmission to be able to provides a stable supply to the mines. As relevant to the Etango Mine potential future project proposed by NamPower are summarised in *Box 4.4.*

Box 4.4 Future Potential Power Transmission Projects

- 220 kV transmission line to connect the future Khan Substation to Kuiseb via the future Valencia and Rössing South Substations;
- Voltage support at Kuiseb Substation, to be operational on a permanent basis, through for example, the installation of an SVC (Static VAr Compensator) or similar dynamic voltage support technology;
- Replacement line from Kuiseb Substation to Langer Heinrich;
- New line from Kuiseb Substation to Etango, with a possible future extension to Tumas.

Figure 4.11 Electricity Sources and Transmission line Route Alternatives



5 DESCRIPTION OF THE NATURAL AND SOCIAL ENVIRONMENT

This chapter provides a description of the natural and social environment that may be affected by the proposed linear ancillary infrastructure. Additional detailed information may also be sourced from the specialist studies (Refer to Annexure C)

5.1 PROJECT AREA

The proposed ancillary infrastructure is linear in nature, and therefore the project area is not limited to a single site, as with the Etango Mine Site. For the purposes of this EIA, the project area is considered to include the 'development corridor' where infrastructure establishment and construction will take place. This therefore covers the linear infrastructure route and any servitude requirements.

5.2 THE BIOPHYSICAL ENVIRONMENT

5.2.1 Climate

The study area is located in the Erongo Region of Namibia - an area characterised by low rainfall with extreme temperature ranges and unique climatic factors influencing the natural environment and biodiversity.

The Etango Project area is considered hyper-arid, with an annual average rainfall of 14mm for Swakopmund. Rainfall however varies considerably with the net annual rainfall in Swakopmund for 2008 being 30mm. Rainfall in the Etango Project area may therefore range from 0-50mm rainfall per annum.

In addition to rainfall, fog functions as an important form of precipitation in this area. There is a relatively high incidence of fog in the Etango Project area, on average 100 to 125 fog days per annum (at Swakopmund), contributing an estimated 35-45mm of precipitation.

Evaporation rates greatly exceed rainfall with an average of 2,400-3,400mm per annum. The low rainfall and high evaporation rates contribute to the semi-arid nature of the study area.

The combination of the above climatic variables results in a relative humidity that varies between <10% and 70% during the least humid and most humid months respectively.

Temperature

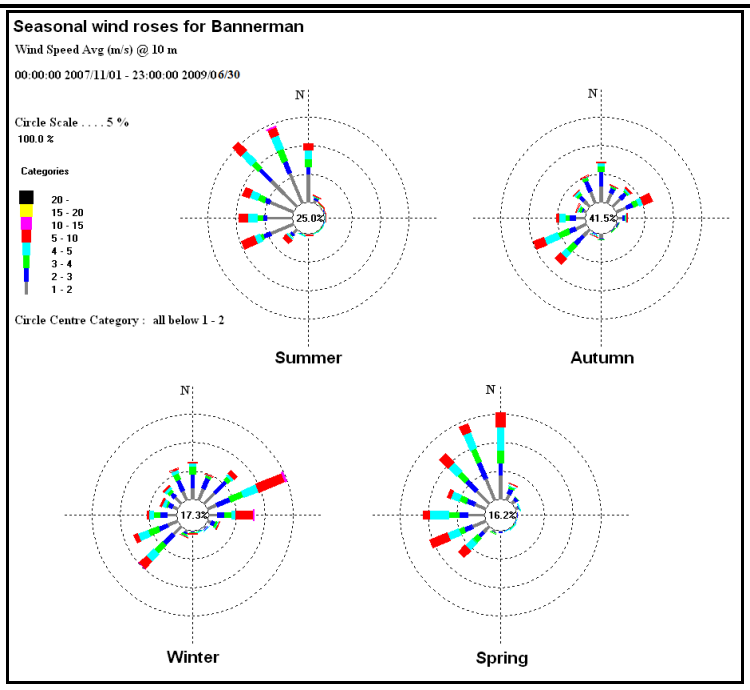
Typical diurnal temperatures at the Etango Mine Site range between a maximum daily temperature of 39°C (recorded at 15h00) and a minimum of 6°C (recorded at 07h00).

Wind

The prevailing wind direction is from the northwest and the southwest, with very little airflow from the southeast. Infrequent winds are also noted from the east-northeast. On average, the winds are strong, ranging between 2 m/s and 13 m/s for most of the time, with winds in excess of 5 m/s occurring for 10% of the time. The strongest winds are from the east-northeast, though for a limited period.

Figure 5.1 shows the seasonal wind roses, providing an indication in the shift in the wind regime between the main seasons and between months. During the summer months, the prevailing winds are from the northwest and to a lesser extent from the southwest. During autumn the wind field changes completely, with a distinct shift from the southwest and east-northeast. Similar wind patterns are noted for the winter months but with very prominent east-north-easterly flow. These winds are also characterised by very high speeds. The prevailing wind field returns to the dominant north-westerly flow during the spring months, with frequent northerly winds.

Figure 5.1 Seasonal Wind Roses



Source: Airshed, 2009

5.2.2 *Air Quality*

Air quality sampling (Airshed, 2009) was undertaken as part of the Etango Mine ESIA and indicates that ambient air quality in the project area is affected primarily by fugitive dust. Larger particle sizes (>10 µm) result in nuisance impacts while finer fractions (<10 µm) may be linked to potential health impacts.

The Air Quality Study undertaken as part of the SEA (MME, 2010) concluded that 82% of background PM10 concentrations and dustfall levels in the region could be attributed to natural windblown dust, whilst vehicle emissions were estimated to contribute approximately 13% to background PM10 concentrations.

Baseline studies undertaken in the project area (Airshed, 2009) indicate that local ambient air quality is not significantly affected by dust; exceedances of air quality standards are intermittent and occur on windy days.

Gaseous pollutants (such as sulphur dioxide, oxides of nitrogen, carbon monoxide, etc.) will originate from vehicle exhausts but are regarded as negligible in comparison to particulate emissions (Airshed, 2009).

There are no major heavy industrial developments within close proximity to the Etango Project Site. The closest major industrial area is located in Walvis Bay, approximately 65km to the south west of the Etango Site. In addition, surrounding existing or proposed mines are not located within close proximity to each other and cumulative air pollution is unlikely.

5.2.3 *Ambient Noise*

A Noise Impact Assessment (Malherbe, 2011) was undertaken for the Etango Mine which provides some background to ambient noise levels (See *Table 5.1*). In general, ambient noise levels are considered to be quite low in the absence of wind interference, and are generally lower than 40 dBA during the day and below 30 dBA during the night (Malherbe, 2011). However, noise monitoring indicates that vehicles passing on the C28 contributed significantly to the measured noise levels, but these noise episodes were intermittent.

Table 5.1 Results of Ambient Noise Measurements

Period	Point	Time	L_{Aeq} dBA	L_{A90} dBA	Comments
Day 1	1	09:35	53,0	37,9	Strong gusts of wind determine the measured noise level. Vehicles passing by on C28.
	2	10:26	51,7	40,0	Strong gusts of wind determine the measured noise level.
	3	11:03	45,5	32,4	Quiet periods between gusts of wind. Vehicles passing on C28.

Period	Point	Time	L_{Aeq} dBA	L_{A90} dBA	Comments
	4	11:58	41,3	22,2	Very quiet environment. Gusts of wind determine measurement result.
Day 2	1	14:46	55,0	24,7	Vehicles passing on road. In between gusts of wind it is very quiet.
	2	17:30	39,6	20,3	Some extremely quiet periods. Tourists arriving at viewpoint, slamming doors and talking.
	3	16:11	39,8	30,5	Some light gusts of wind. Vehicle passes on road. Diesel engine noise from farm. Otherwise very quiet.
	4	16:55	26,2	20,4	Extremely quiet at times. Light gusts of wind.
Night	1	22:43	20,9	20,1	Extremely quiet most of the time. Some light gusts of wind.
	2	23:29	51,7	31,7	Gusts of strong wind determine the measurement result.
	3	23:58	40,1	20,9	Gusts of strong wind with some short, quiet periods
	4	00:51	52,1	20,2	Light wind. Very quiet. Measurement result is suspect.

Source: Malherbe, 2011

5.2.4 Topography and Landscapes

The study area can be divided into three distinct areas - namely the coast, inland flats and the Swakop Valley. The coastline between Swakopmund and Walvis Bay is characterised by a south-north heading dune system - the northern most extent of the extensive dune system south of the Kuiseb River.

Heading inland, the local topography rises from sea -level to an altitude of 290 metres above sea level at the proposed Etango Mine Site. The main mine site is located on what may be defined as *inland flats* – or broad gravel peneplains (open outwash plains) with a low relief. These plains are occasionally interrupted by elevated dykes and extrusions.

The topography becomes hilly and rugged towards the Swakop River, and is generally described as the 'moonscape' – a tourist attraction - due to its moon-like appearance with rugged, black rocks that are almost devoid of vegetation.

5.2.5 Soils and Geology

According to Mendelsohn, *et al.*, (2002) the soil types located in the study area are largely composed of *Petric gypsisols* characterised by a solid layer with very shallow depths. The solid layer is generated by the percolation of calcium phosphate, during rainfall, and the crystallisation of this salt, during dry periods, which in turn binds with the surrounding materials to form a hard and solid layer at the surface, often referred to as a desert pavement.

This solid layer provides a stabilising influence on local soils and plays a vital role in the prevention of wind and water-induced soil erosion. Disturbance of

this layer results in accelerated and significant soil erosion, and the generation of particulate and dust related air pollution.

The underlying geology of the Project area comprises mainly of sediments and gneiss of the Swakop and Nosib Groups (Damara Sequence). The south-eastern part is dominated by the pre-Damara Abbabis Metamorphic Complex with outcropping gneiss and minor meta-sediments.

In the Etango Project area, the geology is predominately mixtite and pebbly quartzite of the Chuos Formation, overlying amphibolite of the Khan Formation, which is intruded by Ordovician uranium-bearing alaskite. The rocks are partly covered by Quaternary superficial deposits.

5.2.6 Hydrology and Geohydrology

The dominant hydrological feature located within the study area is the Swakop River system. The semi-arid nature of the region and erratic rainfall results in a highly variable and episodic water flow within the Swakop River. Surface water flow is considered to be limited to times of heavy rainfall in the catchment area.

Much of the remaining study area is drained in a south-westerly direction towards the coast, via shallow drainage lines. These drainage lines are intercepted by the south-north running dune system.

The watershed between the two catchments is located within the proposed mine site, and therefore portions of the mine activities will drain into the Swakop Catchment, while the southern located activities will drain towards the coastline.

Groundwater follows a similar pattern to that of surface water flow, with a groundwater divide located in a west-east direction, and runs through the mine area. Groundwater flows tend towards a southern flow, away from the Swakop River and towards to the coast.

Cognizance also needs to be taken of paleochannels which have found to occur in this region. Paleochannels are deposits of unconsolidated sediments or semi-consolidated sedimentary rocks deposited in ancient, currently inactive river and stream channel systems. These are sensitive systems and are addressed in the groundwater study for the mine.

5.2.7 Biophysical Constraints to Project Design

Box 5.1 provides a summary of the biophysical issues and constraints that need to be addressed during project design in order to ensure that environmental risks and impacts are minimised.

Box 5.1 Biophysical constraints to project design

- Ambient air quality is generally good. High dust concentrations are generally the result of natural conditions, especially in windy conditions (and in particular, during east wind events). Developments should therefore not result in increased dust levels (both TSP and PM10).
- Low ambient noise levels result in a more sensitive noise environment.
- Soils are very susceptible to erosion, especially if the top protective layer is disturbed.
- Paleochannels, drainage lines and washes are extremely sensitive to disturbance.

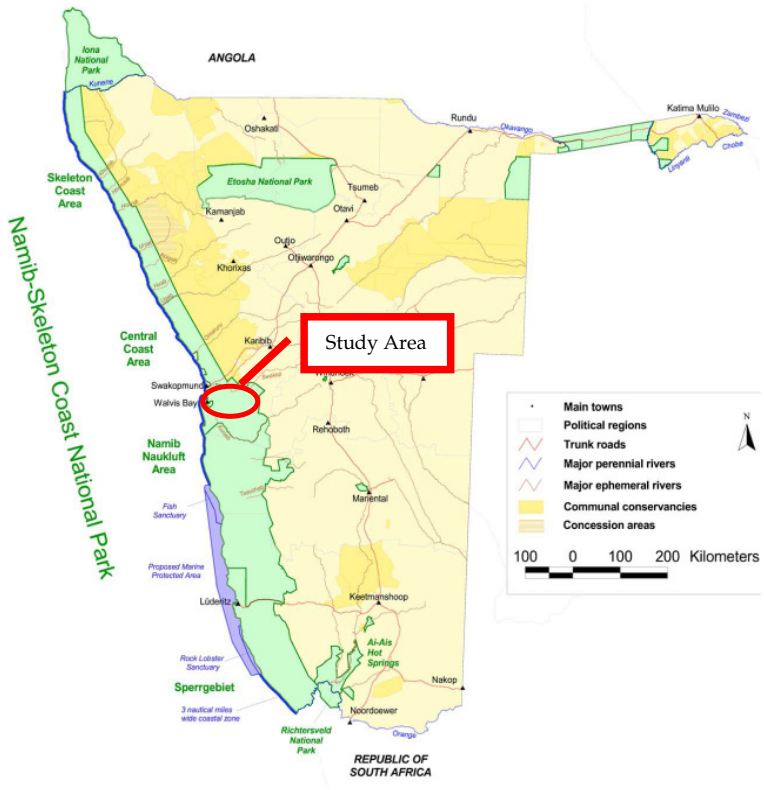
5.3 THE BIOLOGICAL ENVIRONMENT

This section provides a summary of all features of the biological environment that may potentially be impacted by the Etango Mine. For additional information please refer to the Terrestrial Ecology, Vegetation and Vertebrate Fauna Specialist Studies (See *Annexure C*).

5.3.1 Regional Conservation Planning

The study area is located within the Namib-Naukluft National Park (NNNP), and linked into the larger Namib-Skeleton Coast National Park. The latter is a continuous park that extends along the entire Namibian coastline (See *Figure 5.2*)

Figure 5.2 The Namib Skeleton Coast National Park



Source: Ministry of Environment and Tourism, 2009

The Namib-Naukluft National Park Management Plan (Ministry of Environment and Tourism, 2003) establishes the principles and management practices for the park in terms of biological conservation and tourism (See *Table 5.2)*

Table 5.2 Management Policies for the Namib-Naukluft National Park

Category	Policy Statement*
Natural Resources Protection	To sustainably use the natural resources to contribute towards the Strategic Goals while ensuring the wildlife (especially the endemics), associated habitats, ecosystems and unique landscapes are not compromised
Cultural, Historical and Archaeological Resources	To ensure that the cultural, historical and archaeological sites are conserved and where appropriate, sensitively used, to improve society's understanding and knowledge of the people and their cultures.
Zonation	The area is zoned to maximise tourist value which will increase Park income and economic development but within environmental limitations. It is recognised that some resources are limiting factors, and the attributes which tourists strive to enjoy must be preserved. These must contribute to achieving the Vision and Strategic Objectives.
Tourism	The nature of the environment limits the use of the area and for this reason the tourism product will generally focus on low volume high value products whilst still retaining some limited areas for Namibians where affordable access will be supplied.
Collaboration and Partnerships	Collaboration with outside parties must only be considered when there is a need for it as identified and initiated by MET and where roles, responsibility and outputs are defined via formal contractual agreements, where it is cost-effective to do it and it can be managed and controlled

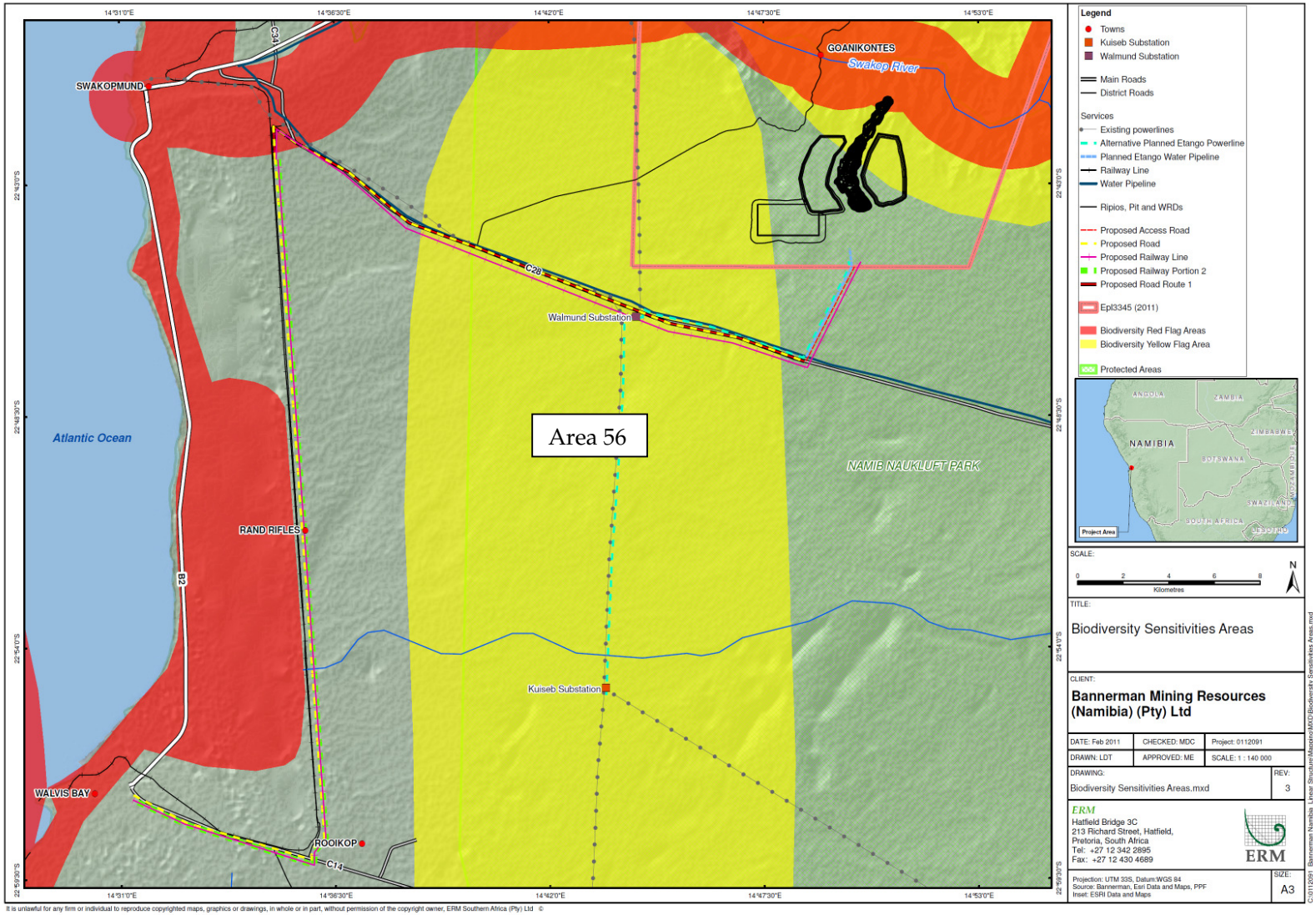
Source: Ministry of Environment and Tourism, 2003

The Management Plan does not specifically address the issue of mining. Despite the proclamation of the study area as a National Park, uranium mining has been permitted and there is likely to be continual development of this industry in the future.

This issue is addressed in greater detailed in the Uranium Rush Strategic Environmental Assessment (MME, 2010). The SEA identifies areas of high biodiversity value in the context of the development of Uranium mines (See *Figure 5.3*)

As relevant to this EIA, much of the linear infrastructure will be located outside of identified biodiversity areas with the expectation of Zone 56 (as noted in *Figure 5.3* overleaf). This area is rated as a 'Yellow Flag Area' due to the presence of lichens, invertebrates and biodiversity associated with Tumas drainage area as well as hummocks and ephemeral wetlands (MME, 2010). As a result of identified sensitivities with respect to biodiversity, specialist studies were undertaken for the specific study area and in the case if this project, especially along the access road off the C28 to the mine. The results of these studies are discussed in *Sections 5.3.2 and 5.3.3.*

Figure 5.3 *Yellow- flag and Red-flag Biodiversity Areas*



Source: MME, 2010

5.3.2 *Flora*

The proposed linear infrastructure will be located near exclusively on Central Namib undulating sandy-gravel plains, incised by ephemeral sandy washes (C.A. Mannheimer, 2010).

Traditional descriptions of floral communities do not apply to this area due to the scattered nature of plant species. Rather the floral environment is defined by landscape habitats – each habitat type providing different floral and faunal assemblages. A summary of these habitat types is provided in *Figure 5.6.* Each habitat type applicable to the linear infrastructure study area is described below:

Flat Sandy Gravel Plains

This habitat dominates the study area (See *Figure 5.4*) and is topographically flat with wide and shallow ephemeral washes. The flats are dominated by wind swept sands anchored by a hard surface layer created by the crystallization of calcium phosphate in the soils, while beneath this layer is a more fine-grained soil substrate. This substrate is fragile and extremely sensitive to vehicle tracks, especially where a gypsum crust, a well developed biological soil crust, and/or lichens are present.

Gravel plains are almost bare of plants most of the year with almost all growth being confined to the washes. After rains, it may be expected that these apparently bare plains will be covered in grasses, annuals and geophytes, which were not apparent during the field visit. A number of endemic and near-endemic species may be expected to occur (Mannheimer, 2010).

Figure 5.4 Image of Flat Sandy Gravel Plains with Shallow Ephemeral Washes

Source: Mannheimer, 2010

Washes and Drainage Lines

Washes or very shallow ephemeral water courses are formed by the limited precipitation in the region. These washes and drainage lines are all characterised by the presence of *Zygophyllum stapfii* (dollar-bush), *Arthraerua leubnitziae* (pencil bush) and *Hermbstaedtia spathulifolia* , all Namib Desert endemics, as well as several more near-endemic floral species, including *Citrullus ecirrhosus* and *Welwitschia mirabilis* (a formally protected species) in the case of the larger ones).

Washes and drainage lines function as critical habitats to animal life of every description on the plains and therefore protection and conservation of these habitats is considered to be critical (C.A. Mannheimer, 2010).

Low Rock Outcrops and Ridges

A number of rocky outcrops and ridges of varying composition are located throughout the gravel plains (Pallett, 2010) Opportunities for faunal habitation are linked with the sparse vegetation and shelter on the low rock outcrops and rock debris.

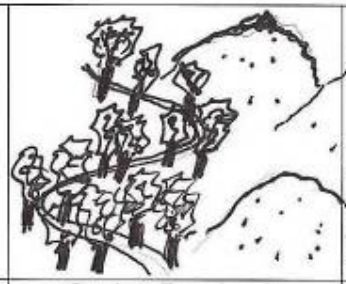
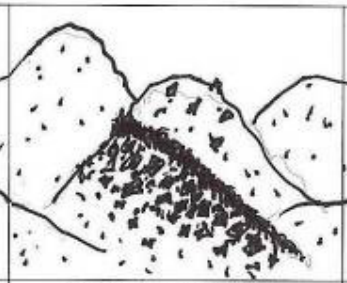
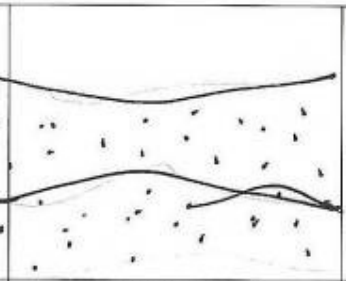
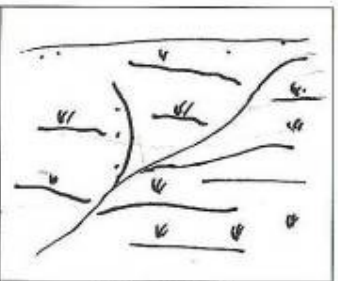
Two ridges transect the planned linear infrastructure routes; a Gravelly Gneiss Ridge and a Marble-Limestone Ridge. Superficially the Gravelly-Gneiss ridge appears largely unvegetated, but it is dissected by shallow 'valleys' that harbour considerable plant life, including endemic and near-endemic species.

The marble-limestone ridges of the central Namib typically harbour a number of species of conservation concern, including *Z. stapfii*, *A. leubnitziae*, *Aloe asperifolia*, *Commiphora oblanceolata*, *C. saxicola*, *Larryleachia marlothii* and *Hoodia pedicellata*. They represent a very limited habitat within the whole, and several ridges lie within areas of identified deposits (Mannheimer 2010).

Figure 5.5 Gently Undulating Hills with Shallow Soils and Low Rock Outcrops

Source: Mannheimer, 2009

Figure 5.6 ***Summary of Habitats Types***

				
	Swakop R and main tributaries	Incised rocky slopes	Undulating hills	Gravel plains
Food resources	Trees – foliage and pods. Abundant and permanent supply	Sparse, very few trees and shrubs	Sparse, shrubs and grasses	Patchily distributed grass pastures. Perennial shrubs in shallow washes
Water availability	Permanent (saline) groundwater. Episodic surface flows	Episodic rains, very quick runoff. Springs? Regular but low-volume fogs	Episodic rains, little infiltration. Springs? Regular but low-volume fogs	Episodic rains. Regular but low-volume fogs
Key ecological processes	Episodic floods. Groundwater supports linear oasis of trees, springs Animal movements to and from river bed.	Fog precipitation. Springs sustain wildlife Freedom of movement for large animals.	Fog precipitation. Springs sustain wildlife. Wind dispersal of detritus. Freedom of movement for large animals.	Fog precipitation. Wind dispersal of detritus. Freedom of movement for large animals. Nutrient cycling by plants, invertebrates, biological soil crusts

Source: ASEC, 2009

5.3.3 Fauna

The presence of fauna is largely determined by the presence of suitable faunal habitats. Animal life on the gravel plains tends to be concentrated in the washes and sustained by the plants in them (Seely & Pallett, 2008 in Pallett, 2010). Due consideration of the floral habitats noted in the previous section is needed in terms of faunal distributions.

Amphibians

Frogs are a rare phenomenon in this arid area but three species are known to occur in the gravel plains habitat (usually associated with inselbergs). They are all classified as secure (Griffin, 2003), and the proposed infrastructures pose no threat to their populations. The cumulative impact of uranium mines in the area is also expected to be very low (Pallett, 2010).

Reptiles

Reptiles are well adapted to desert conditions and species diversity of this group is high in the Namib (Barnard, 1998). Lizards are particularly diverse, with 28 species of geckos, skinks and typical lizards known or expected to occur in this area (Griffin, 2005).

Leopard Tortoise occurs marginally here and, while it is classified as Vulnerable (Griffin, 2005); its occurrence is only sporadic and low in numbers.

Lizards, geckos and chameleon species diversity in the overall area of the Etango Project is high, although only two taxa are of conservation concern; namely the Husab Sand Lizard (*Pedioplanis husabensis*) and an unnamed *Meroles* species. *P. husabensis* requires rocky substrate and does not occur on the plains. The new *Meroles* species is known only from one specimen collected immediately inland of Swakopmund (Hebbard, Griffin, pers. comm., 2008).

There are no snakes that are expected to occur on the gravel plains which are of conservation significance.

Mammals

Large mammals such as springbok and gemsbok are occasionally seen in the area, where they mostly frequent the open plains. They concentrate in areas after rain where grass growth is plentiful, and gemsbok may move to and from the Swakop River to use open water and pods from trees in the riverbed. There are a variety of other mammals which are largely unnoticed as they are relatively small, secretive and largely nocturnal, including rodents and rodent-like mammals, bats and small carnivores. Of these, Cape and Bat-eared Foxes are classified as Vulnerable although they both have strong populations in the Namib protected areas.

5.3.4 *Biological Constraints to Project Design*

Box 5.2 provides a summary of the biological issues and constraints that need to be addressed during project design in order to ensure that environmental risks and impacts are minimised.

Box 5.2 Biological constraints to project design

- Paleochannels, drainage lines and washes are to be avoided to the maximum extent possible during the detailed engineering design on all new linear infrastructure as these represent critical habitats for both flora and fauna.

5.4 *THE SOCIO-ECONOMIC ENVIRONMENT*

There are no established communities located within proximity to any of the proposed linear infrastructure. As such, the socio-economic environment as relevant to this EIA is largely targeted at roads users and potential socio-economic impacts associated with increased demand on existing power and water utilities.

5.4.1 *Regional Demographics*

The Erongo Region has a total estimated population of 108,000 for 2001 (ASEC, 2009) with a population density of 1.7 individuals per km^2. The majority of the population (80%) are located in urban areas including Swakopmund, Walvis Bay and Arandis.

Population growth in the region has been significant due to rapid in-migration of workers, the majority (65%) having come from the three northern regions of Omusati, Ohangwena and Oshana in search of work in the male-dominated fishing, mining and industrial sectors. One of the driving industries causing in-migration has been the uranium mines that form part of the 'Uranium Rush'.

5.4.2 *Settlement Patterns*

Much of the proposed linear infrastructure falls within the Namib-Naukluft National Park, and as such no rural communities or indigenous populations occur within the Project area. Several farms are located along the Swakop River. The farms closest to the Project Area include Weitzenberg, Goanikontes, and Hildenhof, the latter of which caters for camping tourists. None of these farms are located within close proximity to the proposed linear infrastructure, although they may be affected by changes in traffic volumes and access.

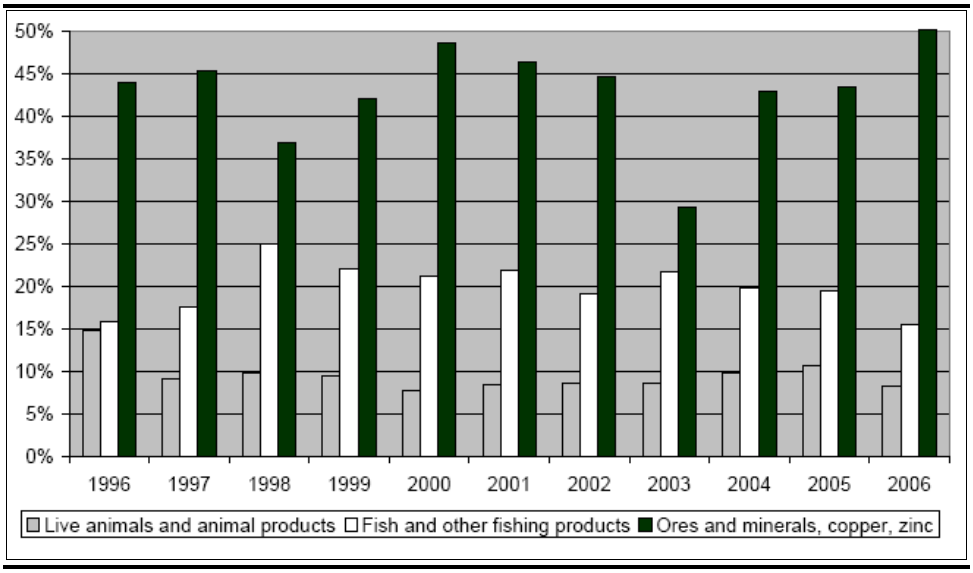
5.4.3 *Economy*

The dominant economic activities occurring within the Erongo Region include tourism, industry and mining (ASEC, 2010). Tourism is the primary economic

activity of Swakopmund, while Walvis Bay is directed primarily towards the fishing industry, industrial sector and port related activities. Mining has and will likely continue to be a critical economic sector in the Region, with a high potential for growth (ASEC, 2010).

Namibia's economy relies heavily on international trade, with imports and exports each totalling more than half of the GDP in value. The major exports which include beef, meat products, diamonds, uranium, a wide variety of fish products and beer is graphically represented below.

Figure 5.7 Major Export Products as Percentage of Total Exports



Source: NPC. Preliminary National Accounts for 2006

The mining sector of the Erongo region contributes significantly to the Namibian economy in terms of economic output and exports. By Independence in 1990, the mining sector contributed over 20% of GDP and employed some 14 000 people (ASEC, 2010). During 2001-2005, the mining and quarrying sector recorded an average contribution to GDP of 10.4%, with the value of mineral exports increasing from about N$6.2 billion in 2001 to N$7.1 billion in 2005 (ASEC, 2010).

Tourism in the Erongo region contributes an estimated N$6.8 billion in 2006, equivalent to 16% of the total GDP. Real growth has been around 10% in 2005 and 2006, and it is predicted to grow at 7.9% from 2007-2016 (ASEC, 2010). Direct employment related to tourism is estimated at 18 800 jobs in the national economy, equivalent to 4.7% in 2006.

The industrial sector (as a whole) of the Erongo region is the second largest, with the service industry being the largest. It employs 72 000 people, predominantly males.

5.4.4 *Heritage, Culture and Archaeology*

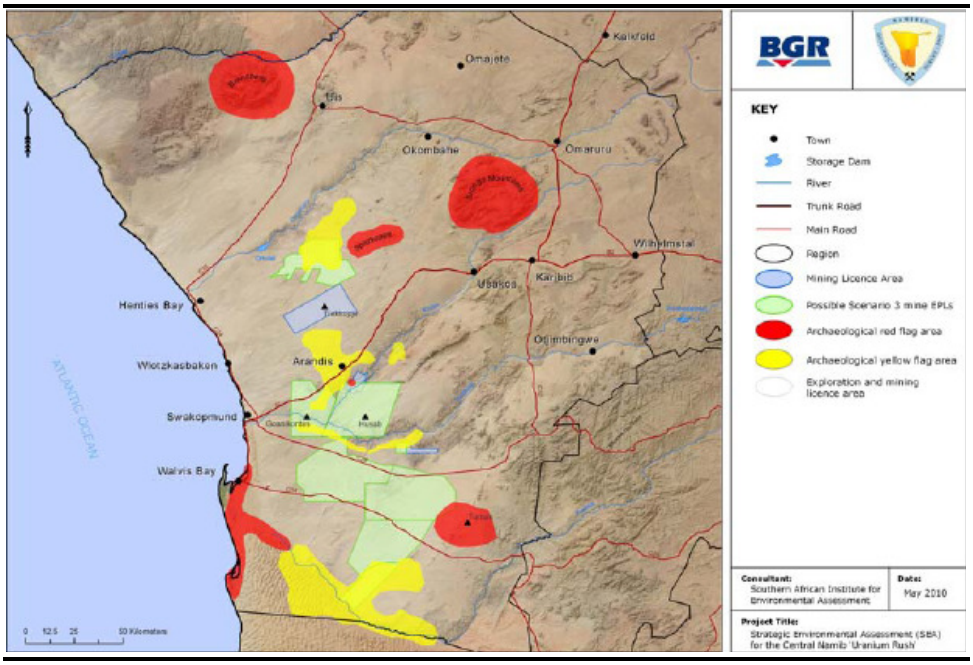
The area traversed by the proposed access route to the mine is a relatively undisturbed gravel plain of aeolian sands, covered by a lag of quartz gravel with remnant concentrations of Gobabeb gravels.

During past archaeological surveys, sporadic human occupation was identified on specific sites during the late Pleistocene, the Holocene and even in recent historic periods (ASEC, 2010). The local density of archaeological sites are extremely low at less than one site (irrespective of age, affinity or significance) per square kilometre, and reflects the scarcity and patchiness of resources necessary for human survival.

The Namib Desert has an archaeological sequence of almost one million years, which represents a globally important record of human responses to aridity and climatic fluctuation. The Central Namib Desert is particularly rich in archaeological remains, with well-preserved evidence of human adaptation to the highly arid conditions which prevailed in this area in the late Pleistocene and Holocene periods (ASEC, 2010).

The Strategic Environmental Assessment (MME, 2010) established a number of archaeological *hot-spots* (See *Figure 5.8*). A number of Red (High Sensitivity) and Yellow (Medium Sensitivity) Zones are located in proximity to the Etango Mine Site. However, as relevant to this ESIA, no proposed linear infrastructure would extend into these zones.

Figure 5.8 ***Archaeological Sensitivity Zones***



Source: MME, 2010

Despite its low archaeological profile, the Goanikontes area represents an important part of the traditional territory of the Aonin Topnaar, a pastoral Nama-speaking people whose numbers and wealth had been severely reduced by two centuries of raiding, cattle disease and colonial trade.

5.4.5 Land Use

The Etango Project is located in the Namib-Naukluft National Park and the immediate land-uses consist of conservation land. The Etango Project is located within 15km of some of the park's important tourist attractions, namely the moon landscape (dramatic landscapes) which is an important visual resource and geological heritage area, the Swakop River (dramatic landscape and linear oasis for plants and animals) and the Welwitschia flats (home to one of the largest populations of Welwitschia in the world).

There are already two operating uranium mines in the Erongo Region (Rössing and Langer Heinrich) and another mine (Trekkopje) is in its construction phase. There are also, as mentioned above, a number of smallholdings located on the banks of the Swakop River to the north of the proposed Mine Site.

5.4.6 Tourism and Recreation

Tourism is a significant contributor to the Namibian economy, and provides over 18,000 direct jobs and N$ 1,600 million per annum in revenue (MME, 2010). The Goanikontes-Moon Landscape (See *Figure 5.9*) and Welwitschia Flats (See *Figure 5.10*) are common routes for self-drives tourists, environmental tours, bus tours and scenic flights (MME, 2010).

The above tourism sites are within close proximity to the proposed Etango Mine. The proposed linear infrastructure will have a limited footprint and is unlikely to affect these sites. However, the establishment of linear infrastructure will result in visual intrusions and loss of sense of place along local tourism routes, namely the C28 and to a certain extent the C34. The proposed infrastructure will not be visual from popular viewing sites and camp facilities.

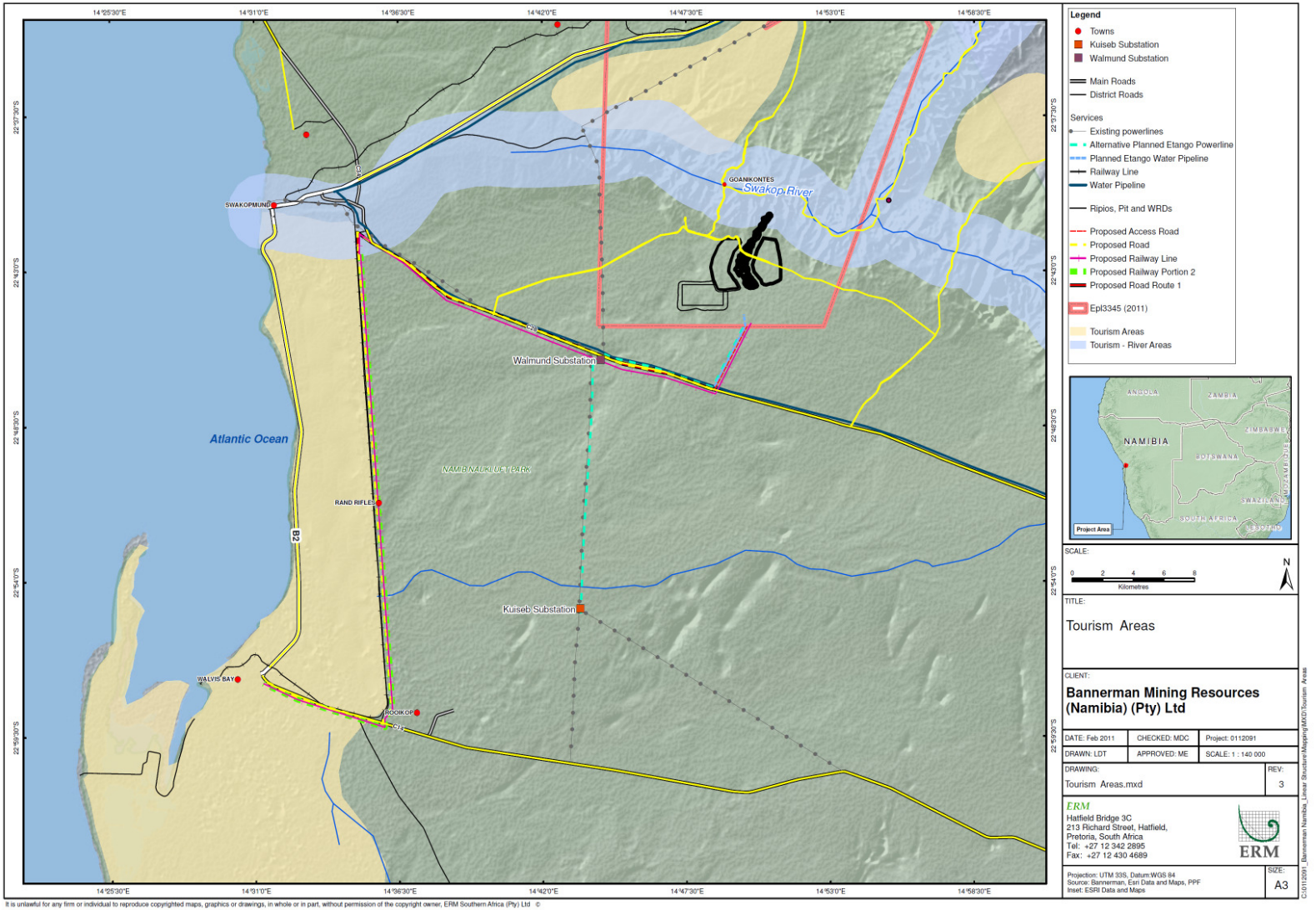
Figure 5.9 Moon Landscape

Source: ASEC, 2010

Figure 5.10 Welwitschia Flats

Source: ASEC, 2010

Figure 5.11 Tourism Sensitivity Zones



Source: MME, 2010

5.5 EXISTING INFRASTRUCTURE

5.5.1 Roads and Traffic

The road network within the study area is limited to one National Road and a number of smaller secondary and district roads. The B2 National Road links the western coastal towns with Windhoek and the interior. This road plays a critical role as the main arterial route in the region and forms part of the strategically important Trans-Kalahari and Trans-Caprivi corridor. The B2 is a dual carriageway, tarred road that supports heavy industry and mine related traffic (Rössing Uranium, Areva), as well as tourism and private traffic. High traffic volumes have resulted in a road that is deteriorating and is potentially dangerous (MME, 2010).

Other critical roads include the C28 which extends from Swakopmund, through the Namib-Naukluft National Park, to Bosua Pass. The C28 is a gravel access road that supports the local mining industry (Langer Heinrich and numerous exploration activities) with some tourist related traffic.

The C14 is a single carriageway, paved road that links the Walvis Bay Airport to Walvis Bay.

Traffic count data is presented in *Table 5.3* below. This data was obtained both through traffic counts conducted by Aurecon (2010), and also reflects traffic volume data collected from the National Roads Authority from November 2009. The data indicated in *Table 5.3* reflects average daily traffic.

Table 5.3 Relevant Background Traffic Data

Road Link	Direction	Total Volume	Heavy Vehicles	Light Vehicles	%Heavy Vehicles
Road B2 – Walvis Bay	To Swakopmund	2774	348	2426	13%
	To Walvis Bay	2747	224	2372	14%
Road B2/Trans Kalahari Highway	To Arandis	1165	244	931	20%
	To Swakopmund	1251	234	1007	20%
C14*	To Walvis Bay	641	216	425	34%
	To C34	714	247	467	35%
C34 – Gravel Road	To Henties Bay	86	26	60	30 %
	To Swakopmund	77	18	59	23%
C28 - Gravel Road	No Data available – Initiate traffic counts/anticipated low volumes (no impact)				
D1991 – Gravel Road	No Data available – Initiate traffic counts/anticipated low volumes (no impact)				

***Note:** Only based on 12hours counts from SSI Engineers and Environmental Consultants (Pty) Ltd: Namport Walvis Bay TIA. All other counts provided by Namibia Road Authority (NRA)

Traffic volumes are generally very low and the anticipated impact on the capacity of these roads is estimated to be low (Aurecon, 2010). No data is available for the C28 and the D1991 roads. It is assumed, however that as a result of the present low traffic volumes, only mine vehicles would contribute to future traffic volumes and a possible increase in recreational traffic, if roads are improved (Aurecon, 2010). It would be assumed that new developments

will stimulate business in the area and that background traffic will grow at a rate higher than the existing traffic volumes. The general rule for traffic growth in the region is between 2.5% to 3% per annum (Aurecon, 2010).

Most of the road infrastructure design standards do not make provision for high volumes of heavy vehicles.

5.5.2 Railway

The existing rail infrastructure located in the study area consists of a single track extending from Walvis Base to Swakopmund, which extends inland to Arandis and the hinterland. The major function of this line is the transport of imported freight and fuel inland from Walvis Bay, with only a very limited provision for passenger transport (SAEIA, 2009).

5.5.3 Water

Water supply options are limited in Namibia, and in the Etango Region there is a near exclusive reliance on groundwater extraction from alluvial aquifers associated with the Kuiseb and Omaruru Rivers. Water from these sources is distributed via the Central Namib Water Supply System. This system supplies the domestic demand of Walvis Bay, Swakopmund, Henties Bay and Arandis, and also supplies the water requirements of the Rössing and Langer Heinrich mines.

Water abstraction for 2009 from the Central Namib Water Supply System is estimated to have exceeded the sustainable yield, with a net demand of 14.4Mm^3 of water per annum – of which 4.6 Mm^3/a is for mining and 9.8Mm^3/a for domestic and non-mining industries (SAIEA, 2010).

To increase water supply capacity, NamWater is proposing to establish a Reverse-Osmosis Desalination Plant near Mile 6, north of Swakopmund. The plant is planned to produce approximately 25 Mm^3/a of treated water per year, with a minimum lifespan of 20 years (SAIEA, 2010). The desalination plant would include additional ancillary infrastructure including a 20,000 m^3 storage reservoir on site, and a pipeline to the existing Omdel-Swakopmund pipeline.

5.5.4 Electricity

Namibia has a current (2009) national demand for electricity of approximately 550MW, with a generation capacity of 384MW, leaving a net deficit of 166MW. This deficit is supplied from various sources from the South African Power Pool, including Eskom, the South African Power Utility (SAIEA, 2009) and electricity imports from Zimbabwe and Zambia.

Recently, domestic demand in South Africa has exceeded the capacity that Eskom can generate, resulting in shortages both in South Africa and the wider Southern African Development Community (SADC) region (SAIEA, 2009).

NamPower, the Namibian power utility, is thus seeking to increase its power generation capacity and reduce dependency on imported energy. As such NamPower is exploring a number of energy generation options including gas-powered stations, coal-fired stations, hydro-power stations, peaking stations and renewable energy. These regional schemes will be critical to ensuring energy sustainability and the long-term energy requirements of the proposed project.

5.5.5 Socio-Economic Constraints to Project Design

Box 5.2 provides a summary of the socio-economic issues and constraints that need to be addressed during project design in order to ensure that environmental risks and impacts are minimised.

Box 5.3 Biological constraints to project design

- Sparsely populated project area with the nearest sensitive receptors located in the Swakop River valley.
- Location of the project area within the Namib Naukluft National Park.
- Commuter and tourism traffic safety and security will be a concern along the C28, especially related to the increasing volumes of traffic along this road.
- Eco-tourism is important in the project area, and two tourism routes, namely the Moon landscape and Welwitschia plains will potentially be affected.
- routes and view points will need to be considered in terms of siting of infrastructure.
- Local heritage, cultural and archaeological resources are located away from proposed linear infrastructure routes.
- Local infrastructure is limited and therefore the Etango Mine Project will need to establish additional infrastructure.

6 SUMMARY OF THE PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) is a key component of an ESIA process. It provides an opportunity for those interested in or affected by the proposed development to comment on the ESIA process and raise any issues or concern. This chapter provides a summary of the PPP undertaken to date as part of the linear infrastructure EIA.

The PPP has been undertaken in general compliance with the, yet to be enacted, Draft Environmental Assessment Regulations under Section 56 of the Environmental Management Act, No. 7 of 2007.

6.1 PRINCIPLES OF PUBLIC CONSULTATION

Full and effective engagement with stakeholders to facilitate their participation through comment and regular feedback on Project design is a priority for the Etango Project.

In approaching the development of a Public Consultation and Disclosure Process (PCDP) strategy, the Project will apply a rigorous process, encouraging active engagement from stakeholders so that their suggestions can be taken into account and so that concerns and conflicts can be addressed in an ongoing, transparent manner.

6.2 STAKEHOLDER IDENTIFICATION, RECORDING AND CATEGORISATION

Stakeholder identification has taken place through conducting a social scan followed by stakeholder recording and categorisation. A preliminary stakeholder list comprising stakeholder groups and individuals who are identified as interested and affected parties as well as broader stakeholders who may be able to influence the outcome of the project was drawn up and is presented in *Table 6.1* below. Both elected and non elected community representatives/leaders were also identified.

A stakeholder database has been created in which each stakeholder's details are captured electronically and categorised. Each stakeholder's attendance at consultation activities and every mailing to stakeholders will be recorded.

The stakeholder database is a 'live' tool and will be further refined and updated as required throughout project implementation, to reflect new developments and interest from new and current stakeholders. The database and categories will be expanded upon where required with each new version of the PCDP as the Project develops.

6.3 SUMMARY OF SCOPING PHASE CONSULTATION AND DISCLOSURE ACTIVITIES

The draft Scoping Report was disclosed and consulted upon in order to inform the design of the EIA process going forward. The consultation and disclosure activities undertaken as part of the Scoping Phase of the EIA process are summarised below:

6.3.1 *Announcing the Opportunity to Comment*

A Background Information Document (BID) was prepared in English and distributed to all I&APs on our list, at meetings and to other stakeholders upon request. The BID was written in non-technical language with a map to describe the main project components. A copy of the BID is available in *Annex B*.

The dates and venues for the series of public meetings were advertised in a local newspaper in Swakopmund and Walvis Bay. A copy of the advert is available in *Annex B.*

An e-mail group and a fax group were compiled from the stakeholder list to inform the stakeholders either via e-mail or fax of the project intent and of the public meetings.

6.3.2 *Announcing Availability and Distributing Scoping Report for Comment*

The EIA team formally announced the availability of the draft Scoping Report for comment to stakeholders during a series of public meetings, as well as telephonically and in writing.

At each public meeting copies of the draft Scoping Report and BID were made available to stakeholders.

Copies of the draft Scoping Report were also made available for comment at libraries in Swakopmund, Windhoek and in Walvis Bay and on the ERM website at: www.erm.com/bannerman_etango.

Table 6.1 Provisional Key Stakeholders

Category	Stakeholder
Media	
Newspapers	The Namibian
	The Allgemeine Zeitung
	The Republikein
	The Namib Times
Environmental NGOs	
	Desert Research Foundation of Namibia (DRFN)
	Earthlife Namibia
	Southern Africa Institute for Environmental Assessment (SAIEA)
	IRDNC
	Namibian Nature Foundation (NNF)
	Namibia Environment and Wildlife Society (NEWS)
	Scientific Society
	International Society for Ecology and Culture (ISEC)
	Birdlife Africa
Social Development NGOs	
	Namibia Non Governmental Organisational Forum (NANGOF)
	Rössing Foundation
	Hospitality Association of Namibia
	Namibian Community Based Tourism Association (NACOBTA)
Private Sector	
	Smallholding owners
	Coastal Tourism Association of Namibia (CTAN)
	Walvis Bay Corridor Group
	Chamber of Mines
	Namibia Chamber of Commerce and Industry
Government Ministries and Parastatals	
	Ministry of Mines & Energy
	Ministry of Environment & Tourism
	Namibian Coast Conservation and Management Project (NACOMA)
	Namibia Tourism Board
	National Heritage Council
	National Botanical Research Institute (NBRI)
	Ministry of Works and Transport
	Roads Authority
	Roads Contractor Company
	Ministry of Information, Technology and Communication
	NamWater
	NamPower
	TransNamib
	Namport
	Telecom Namibia
	Ministry of Regional & Local Government, Housing and Rural Development
	Ministry of Labour and Social Welfare
Regional Councils and Local Authorities	
	Erongo Regional Council
	Swakopmund Municipality
	Arandis Municipality
	Walvis Bay Municipality

6.3.3 Obtaining Comments from Stakeholders

The public meetings were held at national, regional and district levels to obtain stakeholder comment on the draft Scoping Report. The objectives of the meetings were as follows:

- to present scoping report findings and receive comment from stakeholders;
- to inform stakeholders about the EIA for the proposed linear project;
- to gather comments and concerns regarding the project;
- to gather biophysical and socio-economic information that is relevant to the EIA; and
- to further establish relationships with project stakeholders.

Minutes of meetings, including attendance registers were completed at the end of the scoping phase are included as *Annex B* to this report and Project Public Consultation and Disclosure Plan.

Table 6.2 below lists the stakeholder meetings undertaken to date in relation to the scoping phase of the EIA, showing organisations and groups, locations and dates.

Table 6.2 Summary of Scoping Phase Consultation Activities

Activity	Location and Date	Registered Attendance
Public Meeting, Windhoek	Tuesday 20th July (17:30 – 18:30) at the GSN Auditorium, Windhoek.	See *Annex B*
Engineers Meeting	Wednesday 21st July (12:00) at the Bannerman Offices, Swakopmund	See *Annex B*
Neighbouring Land Owners Meeting	Wednesday 21st July (14:30) at the Bannerman Offices, Swakopmund	See *Annex B*
Public Meeting, Swakopmund	Wednesday 21st July (17:30) at the Namib Primary School, Sam Nujoma Drive.	See *Annex B*

6.4 RECORDING CONSULTATION FINDINGS

The EIA includes a framework Issues and Response Report which captures stakeholder concerns and comments on the EIA and the project at this early stage of project development.

The Issues and Response Report will be maintained and updated as a 'live' document and ongoing record of stakeholder issues and concerns raised. Issues raised will be tracked and monitored through the EIA process and throughout the life of the Project and responses to these issues reported/reflected in the EIA and in later iterations of the Project Public Consultation and Disclosure Plan. The Issues and Response Report for the Scoping Phase is summarized in *Table 6.3* below and may be found in *Annex A*.

Table 6.3 Issues and Response Report

Category	Stakeholder Concerns and Questions	Project Response
Pipelines	• Footprint of maintenance corridors • Need for companies to work together.	• Noted.
Water Supply	• Sharing of desalinated water between mines.	• Existing desalination facility will not be sufficient. • Discussions and an agreement have been made with other mines to work together. • Bannerman is currently discussing best size and location of pipelines.
	• What will Bannerman use until desalinated water is available.	• During exploration – water will be brought in by truck. • During construction – the preference will be desalinated water. • For construction, Bannerman will have to work with NamWater and may take water from other sources, which may include groundwater. Construction will have much smaller water consumption needs – approximately 1Mm^3/annum. • Bannerman have made a commitment to use desalination during operations.
Water Abstraction	• Groundwater abstraction volumes and the impact to the water balance with multiple mines abstracting water.	• Bannerman won't abstract water for processing during operations phase. • The Etango Project requires 5.5 Mm^3, a large quantity of this will be desalinated water, which will have to be supplied via a pipeline. • Bannerman stands by its commitment that it will only ask to abstract from the Swakop aquifer at a rate that is sustainable (an amount that will be recharged). • Bannerman will only abstract water during the construction phase. • Modelling studies, and application with the DWA, will need to be done to understand whether this it at all feasible.
	• Abstraction of water out of the Swakop River. • Regulation of abstraction out of the river.	• Mining companies are usually more guided by international best practise than by in-country legislation. Often international best practise has far stricter standards to which to comply.
Roads	• Tourist access to view the Moon landscape and the Welwitschia.	• LHU have tarred sections of the C28 already. Bannerman have agreed, with reptile and some of the transport companies to tar the road from the C34 to the Welwitschia plains turn-off. • Bannerman will have to close the road before the pit, at the Goanikontes turn-off. • Bannerman are considering options in consultation with the tourism industry, CTAN.
	• Building of an access road along the fence. • Stopping the D1991 beyond the Goanikontes turning, closer to the pit as there are two good viewing points of the moon-landscape.	• Noted.

Category	Stakeholder Concerns and Questions	Project Response
	• Allowing tourists to view the pit as mine tourism.	• Bannerman agree but are not pushing the tourism advantages at this stage.
	• Tarring of the C34.	• Bannerman believe this is preferable. • The Swakopmund Town engineers have requested the Roads Authority (RA) to do this and at this stage, RA would look for government funding.
	• Condition of the C28. • Tarring of the C28.	• LHU have tarred sections of the C28 already. • Bannerman have agreed with Reptile and some of the transport companies to tar the road from the C34 to the Welwitschia plains turn-off. • Bannerman have also agreed to stick to existing corridors for the infrastructure as far as possible. • Bannerman trucks will use the C34 behind the dunes.
	• Trucks driving through the town. • Safety risks. • Tarring of the C34 to prevent trucks wanting to drive through the town.	• Noted.
	• Capability of existing road and rail structures to cope with all the newly developing business in the Erongo region.	• Noted.
Rail	• Inclusion of the siding, handling facilities in the EIA.	• To be addressed in the cost-benefit analysis to be conducted by Bannerman. • Bannerman will discuss with existing and potential mines. • A Rail option will certainly reduce the pressure of the C34 created by truck transport. • Bannerman still need to identify a suitable siding area in front of the dunes.
Transmission Lines	• Use of the LHU power line?	• Bannerman will stick to existing infrastructure corridors as far as possible and if necessary will up-grade the existing structures rather than having several lines running in parallel.
	• Potential wildlife/power line interactions.	• Noted.
Telecommunication	• Inclusion of overhead Optic Fiber Transmission. • Alternatives for telecommunication needs.	• No decisions have been made as yet with regards to communication infrastructure between site and Swakopmund. • To be defined during the DFS. • Unlikely that a fibre optic line between site and Swakopmund will be installed as part of the Project.

Category	Stakeholder Concerns and Questions	Project Response
Service Corridors	• Communication between Bannerman and Swakop Uranium regarding infrastructure development.	• Bannerman are talking with Swakop Uranium. • Currently too early for Swakop Uranium to make calculations regarding the tonnage of chemicals they need to transport to site. • Swakop Uranium is also looking at the possibility of using the existing Rössing railway and to transport their goods in and out via the Khan River access. • Corporation of all existing and potential mines needs to occur to make the recommendations set out in the SEA happen.

The complete Issues and Response report for the Scoping Phase is attached in *Annex A.*

7 SUMMARY OF SPECIALIST STUDIES

The chapter provides a summary of the specialist studies that were undertaken as part of the EIA process. The studies themselves are available for review and form part of the EIA as *Annexure C.*

7.1 AIR QUALITY IMPACT ASSESSMENT

An Air Quality Impact Assessment was commissioned to determine potential air pollution impacts related to the Etango Project.

The study anticipates that particulate emissions would vary substantially from day to day depending on the level of mine activities and prevailing meteorological conditions. Vehicle-entrained dust emissions would however account for a great portion of fugitive dust emission from mining operations.

The study identified dust arising from unpaved haul roads to be the most significant source of unmitigated and mitigated, PM10 and TSP emissions.

The spatial extent of the sand and dust particulates is likely to be limited to the mine site and portions of the C28, located within proximity to the mine. Dust levels along the C28 will be below air quality standards and thus health impacts are unlikely, and impacts are likely to be limited to visual impacts and traffic safety.

7.2 NOISE ASSESSMENT

A Noise Assessment (Malherbe, 2011) was commissioned to determine potential ambient noise pollution levels generated by the Etango project.

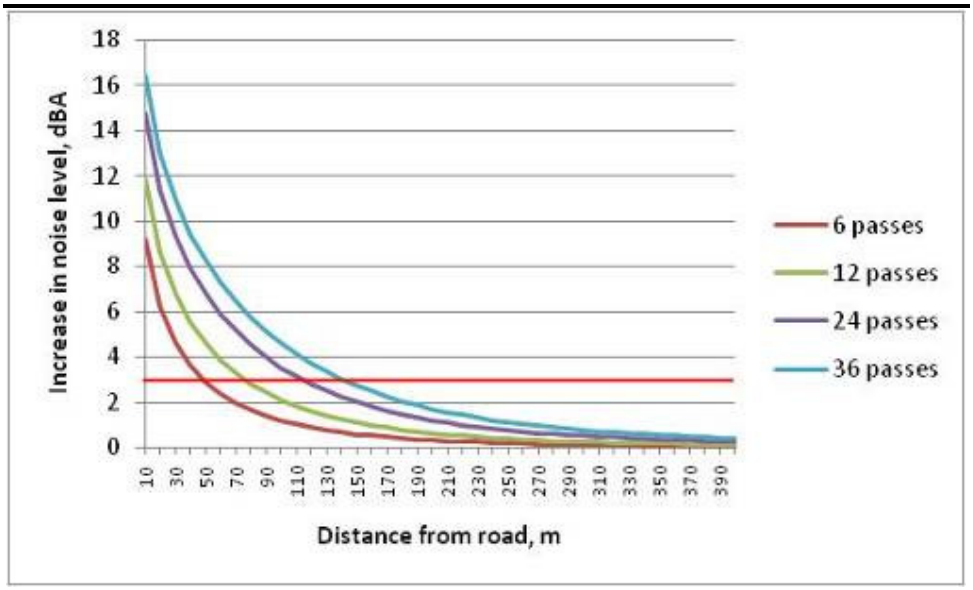
This study concludes that existing ambient noise levels tend to be extremely low to very low, typically in the range of 20 dBA to 40 dBA, depending on the wind speed and presence of human activity in the area (Malherbe, 2011).

Noise is likely to be generated during the construction of new infrastructure and mine traffic during operations. The Noise Assessment (Malherbe, 2011) notes that during construction the extent of the noise impact will be quite considerable due to the fact that all the activities will be above ground level and there will be no acoustic screening. However, since the resulting ambient noise levels are well below the guideline limits, the noise impact is considered to be low.

Referring to *Figure 8.3* and *Figure 8.4*, noise will be generated by construction and operational traffic. During the day (the increase in ambient noise level will exceed 3 dB for distances closer than 50 m (6 passes), 75 m (12 passes), 115

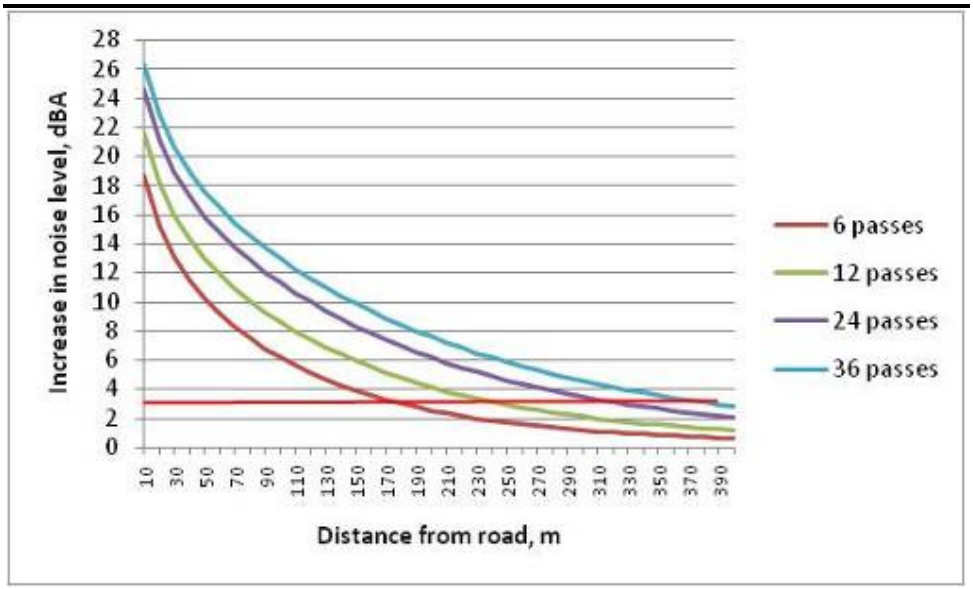
m (24 passes) and 140 m (36 passes) from the road(Malherbe, 2011). During the night the increase in ambient noise level will exceed 3 dB for distances closer than 170 m (6 passes), 235 m (12 passes), 315 m (24 passes) and 375 m (36 passes) from the road (Malherbe, 2011).

Figure 7.1 Road traffic noise graphs (day time)



Source: Malherbe, 2011

Figure 7.2 Road traffic noise graphs (night time)



Source: Malherbe, 2011

7.3 VEGETATION ASSESSMENT

A Vegetation Assessment (Mannheirmer, 2010) was undertaken to assess the potential impact on local vegetation by the establishment of the proposed linear infrastructure.

The Vegetation Assessment noted that the region harbours numerous endemic and near endemic plant species, of which many are of restricted distribution or habitat. This makes them extremely vulnerable to disturbance.

No fatal flaws were noted in terms of the establishment of the linear infrastructure. This is, however the potential for significant impact on local washes and drainage lines from the establishment of several linear infrastructure corridors, as these habitats are essential for the survival of many desert organisms, providing both food and shelter. This cumulative impact is related to multiple proposed mines in the area, which will need to establish similar infrastructure.

Additional impacts will be generated from uncontrolled vehicle tracks/access roads created during construction and operation. Such routes may also potentially damage plants, lichens and the biological crust that retards soil erosion in the desert environment.

7.4 VERTEBRATE FAUNA AND TERRESTRIAL ECOLOGY ASSESSMENT

A Vertebrate Fauna and Terrestrial Ecology Assessment (Pallett, 2010) was undertaken to assess the impact of linear infrastructure related to the Etango Project, on mammals, reptiles and amphibians in the study area.

The study findings indicate that the design and routing of the road, railway, water and electricity infrastructures are consistent with most of the recommendations of the Strategic Environmental Assessment for the Central Namib Uranium Rush (MME, 2010).

Never-the-less some of the key issues arising for the linear infrastructure include:

- Most infrastructure will be established in the Namib-Naukluft National Park.
- Increased disturbance to fauna will occur from activities such as road kills, poaching and other illegal activities such as off-road driving that are likely to occur as a result of greater numbers of people in the area.
- These, together with other features such as fragmentation of the habitat, reduced plant and soil crust productivity, interference with animal movements and possible blocking of surface flows in ephemeral water courses, can all cumulatively reduce the populations of animals in the area.

- Pollution from accidental spills of hazardous substances will affect local faunal habitats.

7.5 *TRAFFIC IMPACT ASSESSMENT*

A Traffic Impact Assessment (Aurecon, 2010) was commissioned by Bannerman to determine traffic related impacts associated with the Etango Mine, and by extension the potential transport routes considered in this ESIA.

The Traffic Impact Assessment identifies the following key issues with regard to traffic and transportation needs:

- Condition of the immediate current road infrastructure does not cater for the transport of high volumes of commodities and products.
- Alignment of the access road to be mine needs to be established.
- Local road network is used for local and recreational traffic in general and conflicts with industrial traffic may arise.
- Soil substrate would need to be sourced from borrow pits and haul roads.
- Maintenance and control of dust on roads is a major issue.
- Safety issues for road users are visibility in fog/dust and misty conditions on the gravel roads.

Traffic projections (assuming rail is not used and all proposed mines are established) indicated that heavy traffic on the local road network will increased by 160 heavy vehicles trips per day (Aurecon, 2010). This increase in volume is considered a low impact on tarred surfaces, but will have a high impact on gravel roads (Aurecon, 2010). Based on this conclusion the Traffic Impact Assessment recommends the following:

- The planned access road to the mine should be as short as possible.
- The proposed access road/C28 intersection should be paved, meeting the minimum NRA standards.
- Gravel and salt roads should be upgraded to paved roads where feasible.
- Level crossings at road intersections should be minimised as far as possible.
- Minimise potential conflict between mine vehicles and general road users.
- Implement dust prevention measures.
- Consult port and rail authorities in terms of transport and handling capacity of materials and products.
- Integrated planning by the port and rail authorities is needed to accommodate all mines in the area.

7.6 *SOCIAL IMPACT ASSESSMENT*

No specific Social Impact Assessment was undertaken as part of the Linear Infrastructure EIA. Such a study was deemed to be not required due to the

fact that all proposed linear infrastructure does not extend into, or is in close proximity to any settlements.

Potential social impacts would be limited to local road users only. The Social Impact Assessment and Health and Safety Assessment prepared for the Etango Mine is considered to be sufficient to inform the assessment in terms of impacts on local road users, and impacts to

7.7 *ARCHAEOLOGICAL ASSESSMENT*

The area of archaeological concern is the proposed road link between the Etango project and the C28. The remains found in the proposed site are evidence of Late Pleistocene material and cattle remains, the former being disturbed from its original condition as a result of extensive wind abrasion of artefact surfaces thus considerably reducing the information potential of the site. These sites are not considered sensitive and on archaeological grounds the proposed access road corridor is acceptable (Kinahan, 2010).

Other artefact debris noted included that which was from the Middle Stone Age in addition to a rarity of artefact debris from the Later Stone Age (as a result of intensive and repeated occupation). These sites are of low significance and therefore may be destroyed, should development occur (Kinahan, 2010).

Other linear developments associated with the Etango project, such as the provision of additional water and power supplies will mainly occur within the bounds of the existing development corridor flanking the C28. Although no archaeological assessment of the existing infrastructure was carried out, there would be little point in doing so, as the corridor has been extensively disturbed.

8 ASSESSMENT OF IMPACTS

This chapter provides a detailed assessment of the environmental and socio-economic impacts associated with the established of the Etango Project linear infrastructure. This assessment includes a brief background description, an impact statement and mitigation measures.

8.1 METHODOLOGY IN THE ASSESSMENT OF IMPACTS

To adequately assess and evaluate the potential impacts and benefits of that will be associated with the proposed project necessitates the development of a scientific methodology that will reduce the subjectivity involved in making such evaluations. A clearly defined methodology is used in order to accurately determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or social environment. For this the proposed project must be considered in the context of the area and the people that will be affected.

Nonetheless, an impact assessment will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and EIA practitioners. The evaluation of significance is thus contingent upon values, professional judgement, and dependent upon the environmental and community context. Ultimately, impact significance involves a process of determining the acceptability of a predicted impact to society.

The purpose of impact assessment is to identify and evaluate the likely significance of the potential impacts on identified receptors and resources according to defined assessment criteria, to develop and describe measures that will be taken to avoid, minimize, reduce or compensate for any potential adverse environmental effects, and to report the significance of the residual impacts that remain following mitigation.

There are a number of ways that impacts may be described and quantified. An impact is essentially any change to a resource or receptor brought about by the presence of the proposed project component or by the execution of a proposed project related activity.

The nature of the project may determine whether one needs to assess both routine and non-routine impacts. Non-routine impacts generally relate to accidents and could include oil/chemical/fuel spills, emergency venting of noxious gases, etc. In most cases, it would be sensible to have separate chapters for the assessment of routine and non-routine impacts.

The types of impacts and terminology to be used in the assessment are outlined in *Table 8.1.*

Table 8.1 Defining the Nature of the Impact

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (eg. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (eg. in-migration for employment placing a demand on resources).
Cumulative impact (1)	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect The same resources and/or receptors as the Project.

8.1.1 Assessing Significance

There is no single accepted definition of '*significance*' and its determination is, therefore, somewhat subjective. However, it is generally accepted that significance is a function of the **magnitude** of the impact and the **likelihood** of the impact occurring. It is widely accepted that Impact Magnitude (or Severity) is a function of the extent, duration and intensity of the impact.

The criteria used to determine significance are summarised in *Table 8.2*. These criteria (specifically Extent and Duration) should be customised to suit individual projects.

Table 8.2 Significance Criteria

Impact magnitude – the degree of change brought about in the environment	
Extent	**On-site** – impacts that are limited to the site boundaries. **Local** – impacts that affect an area in a radius of XX km around the site. **Regional** – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. **National** – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences. **Transboundary/International** – impacts that affect internationally important resources such as areas protected by international conventions.
Duration	**Temporary** – impacts are predicted to be of short duration and intermittent/occasional. **Short-term** – impacts that are predicted to last only for the duration of the construction period. **Long-term** – impacts that will continue for the life of the Project, but ceases when the Project stops operating. **Permanent** – impacts that cause a permanent change in the affected receptor or resource.
Intensity (1)	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the*

(1) The assessment of cumulative impacts is qualitative and is often discussed in a separate chapter in the ESIA Report. One should remember to include the assessment of cumulative impacts in the terms of reference to specialists.

	sensitivity of the biodiversity receptor (ie. habitats, species or communities). **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.*
	SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood – the likelihood that an impact will occur	
Unlikely	The impact is unlikely to occur.
Likely	The impact is likely to occur under most conditions.
Definite	The impact will occur.

Once a rating is determined for magnitude and likelihood, the matrix in *Table 8.3* can be used to determine the impact significance.

Table 8.3 Example of Significance Rating Matrix for Positive and Negative Impacts

SIGNIFICANCE RATING				
	LIKELIHOOD	**Unlikely**	**Likely**	**Definite**
MAGNITUDE	Negligible	Negligible	Negligible	Minor
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Moderate
	High	Moderate	Major	Major

A colour scale for negative and positive ratings is given in *Table 8.4*

Table 8.4 Colour Scale for Ratings

Negative ratings	**Positive ratings**
Negligible	Negligible
Minor	Minor
Moderate	Moderate
Major	Major

(1) The frequency of the activity causing the impact also has a bearing on the intensity of the impact, ie. the more frequent the activity, the higher the intensity.

Table 8.5 outlines the various definitions for significance of an impact and is based on the significance rating matrix.

Table 8.5 Significance Definitions

Significance definitions	
Negligible significance	*An impact of negligible significance is where the magnitude is negligible, low or medium and the likelihood of the impact occurring is unlikely or likely.* An impact of negligible significance is where a resource or receptor will not be affected in any way by a particular activity, or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background levels.
Minor significance	*An impact of minor significance is where the magnitude of the impact is low but the likelihood is high or where the magnitude is high but the likelihood of occurrence is unlikely or likely.* An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	*An impact of moderate significance is where the magnitude is medium to high and the likelihood of the impact occurring is likely or definite.* An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that "moderate" impacts have to be reduced to "minor" impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	*An impact of major significance is where the magnitude of the impact is medium to high and the likelihood of the impact occurring is also likely or definite.* An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors, such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.

8.1.2 Mitigation Potential and Residual Impacts

It is expected that for the identified significant impacts, the project team will work with the client in identifying suitable and practical mitigation measures that are implementable. Mitigation that can be incorporated into the Project design in order to avoid or reduce the negative impacts or enhance the positive impacts will be developed.

Residual impacts are those impacts which remain once the mitigation measures have been designed and applied. Once the mitigation is applied, each impact is re-evaluated (assuming that the mitigation measure is effectively applied) and any remaining impact is rated once again using the process outlined above. The result is a significance rating for the residual impact.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in *Box 8.1*.

Box 8.1 ***Mitigation Hierarchy***

THE MITIGATION HIERARCHY FOR PLANNED PROJECT ACTIVITIES
Avoid at Source; Reduce at Source **Avoiding or reducing at source is essentially 'designing' the project so that a feature causing an impact is designed out (eg a waste stream is eliminated) or altered (eg reduced waste volume). Often called minimisation.**
Abate on Site **This involves adding something to the basic design to abate the impact - pollution controls fall within this category. Often called 'end-of-pipe'.**
Abate at Receptor **If an impact cannot be abated on-site then measures can be implemented off-site - an example of this would be to use the stand-by vessel to help control the level of interference with fishing activity.**
Repair or Remedy **Some impacts involve unavoidable damage to a resource, eg land disturbance. Repair essentially involves restoration and reinstatement type measures, such as base camp closure.**
Compensate in Kind **Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be appropriate.**

8.2 ASSESSMENT OF POTENTIAL BIOPHYSICAL IMPACTS

This sub-section provides a detailed assessment of potential impacts on the biophysical environment (air, soils etc.) and potential constraints placed on any proposed infrastructure development.

8.2.1 Air Pollution (Fugitive Dust)

Impact Description and Assessment

Air pollution is primary concerned with sand and dust particulates generated by mine traffic along the proposed linear infrastructure. The Air Quality Impact Assessment anticipates that particulates emission would vary substantially from day to day, depending on the level of mine activities and prevailing meteorological conditions.

Local meteorological conditions contribute a considerable portion to ambient air quality by wind blown dust and particulates emissions. The increase in traffic along the proposed transport corridors would provide a cumulative increase in dust and particulates emissions.

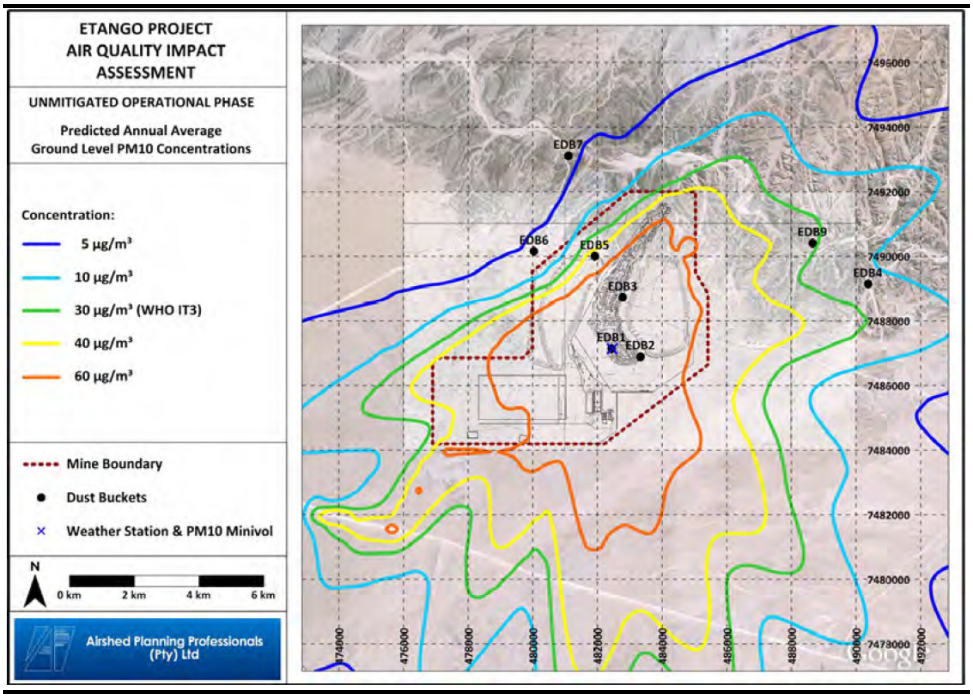
In particular, the Air Quality Impact Assessment (Airshed Planning Professionals, 2011) identified dust arising from unpaved haul roads to be the most significant source of PM10 and TSP emissions. The spatial extent of the sand and dust particulates is likely to be limited to the mine site and portions of the C28 (See *Figure 8.1* and *Figure 8.2*).

Should no mitigation measure be adopted, then exceedances of the air quality standards (75µg/m_3 of PM_{10}) will occur at the mine and along the C28. These exceedances are not expected to occur over more than 16 days per annum (Airshed Planning Professionals, 2011). The adoption of mitigation measures will significantly reduce the generation and distribution of dust and particulates emissions. In terms of the linear infrastructure, this largely entails reducing traffic generated dust by appropriate surfacing of roads. The C28 is currently being upgraded to a tarred surface and this will significantly reduce dust and particulates emissions to a state where impacts are negligible (See *Table 8.6*).

Dust levels along the C28 will be below air quality standards and thus health impacts are unlikely, and impacts are likely to be limited to visual impacts and traffic safety from the mine and access road.

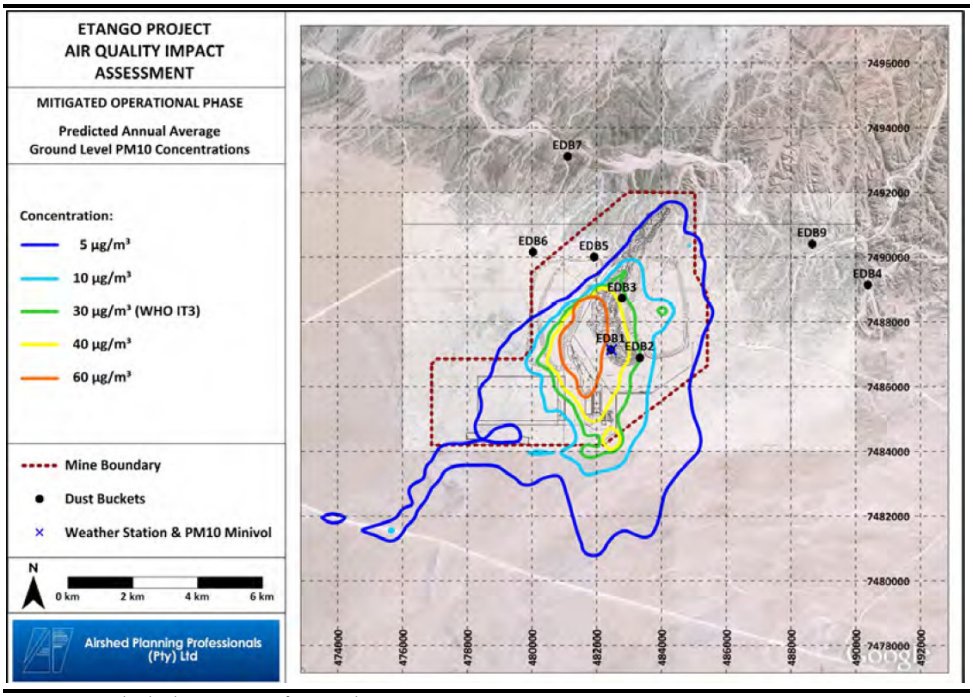
Dust and particulates emissions will be generated during the construction of any new linear infrastructure although this is considered to be short-term (See *Table 8.6*) and of limited impact to receptors. Operational dust and particulates emissions are considered to be negligible.

Figure 8.1 Operational phase unmitigated PM_{10} levels



Source: Airshed Planning Professionals, 2011

Figure 8.2 Operational phase mitigated PM_{10} levels



Source: Airshed Planning Professionals, 2011

Table 8.6 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	PRE-MITIGATION	POST MITIGATION
Transport Routes	Public Roads	Negative	Regional	Long Term	Low	Likely	High	MODERATE	LOW
	Railway Transport	Negative	Regional	Long Term	Low	Likely	High	MODERATE	LOW
	Road and Railway	Negative	Regional	Long Term	Low	Likely	High	MODERATE	LOW
Water Supply	Water Pipeline Route	Negative	Local	Short Term	Low	Likely	High	LOW	LOW
Powerline Route	Walmund Line	Negative	Regional	Short Term	Low	Likely	High	LOW	LOW
	ERED Line	Negative	Regional	Short Term	Low	Likely	High	LOW	LOW
	Kuiseb Line	Negative	Regional	Short Term	Low	Likely	High	LOW	LOW
Other Activities	Access Road	Negative	Local	Short Term	Low	Likely	High	LOW	LOW
	Railway Siding	Negative	Local	Long Term	Low	Likely	High	LOW	LOW

Residual Impact

Assuming that the mitigation measures and recommendations made in *Chapter 9* are appropriately adopted then the residual impact of air pollution is considered to be LOW.

8.2.2 *Noise Pollution*

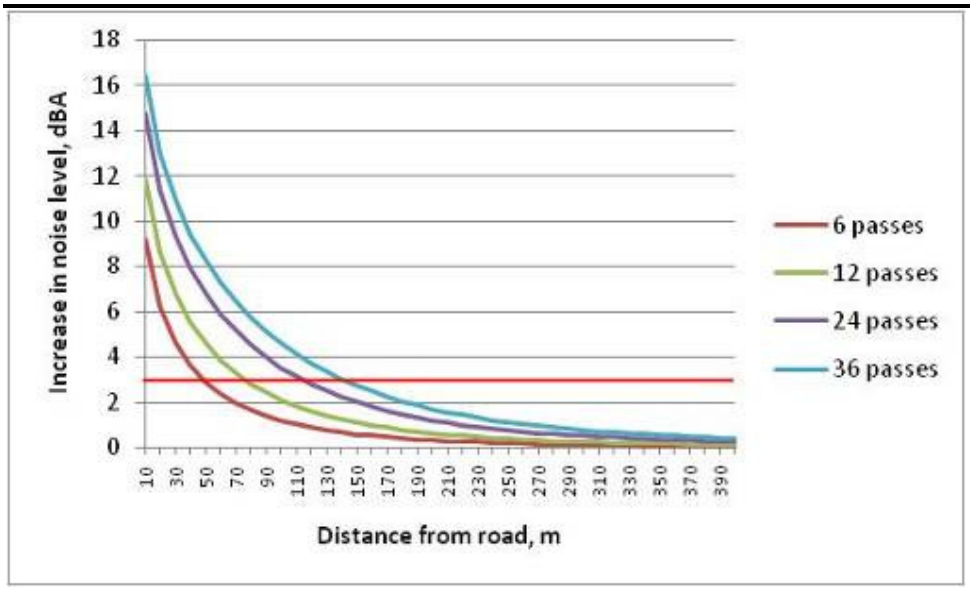
Impact Description and Assessment

Impacts from noise pollution are a function of noise volumes and the distance of receptors from the source of the noise. In terms of the proposed linear infrastructure, noise will be generated during the construction on any new infrastructure, and from traffic and trains during the operational phase.

Studies undertaken in similar projects indicate a linear reduction in noise levels as distance increases from source (See *Figure 8.3* and *Figure 8.4*). SANS 10103 noise volumes thresholds establish a general rule of 38dBA and 28dBA for day (07:00 to 22:00) and night (22:00 to 07:00), respectively.

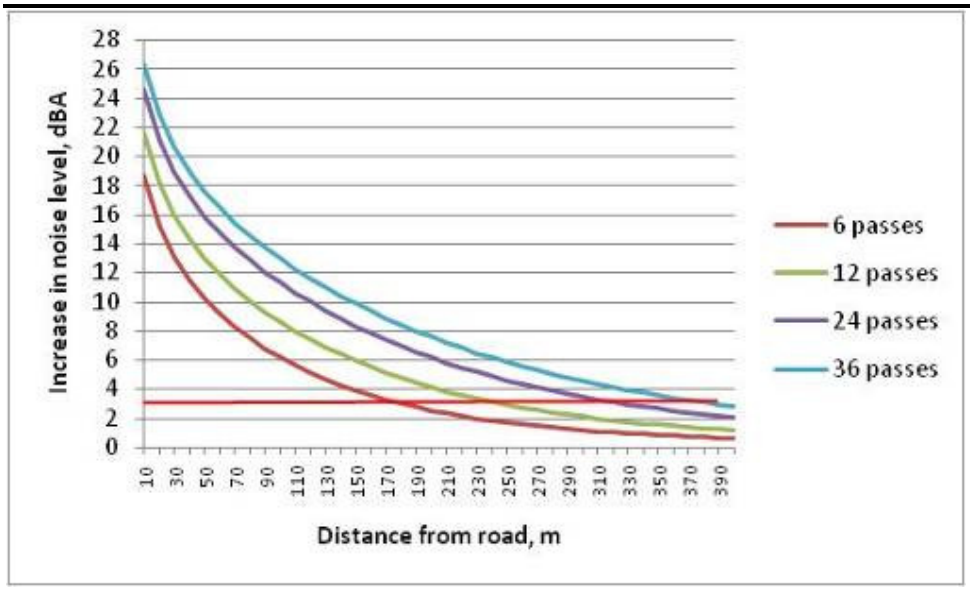
Referring to *Figure 8.3* and *Figure 8.4*, noise will be generated by construction and operational traffic. During the day (the increase in ambient noise level will exceed 3 dB for distances closer than 50 m (6 passes), 75 m (12 passes), 115 m (24 passes) and 140 m (36 passes) (Malherbe, 2011). During the night the increase in ambient noise level will exceed 3 dB for distances closer than 170 m (6 passes), 235 m (12 passes), 315 m (24 passes) and 375 m (36 passes). (Malherbe, 2011)

Figure 8.3 Road traffic noise graphs (day time)



Source: Malherbe, 2011

Figure 8.4 Road traffic noise graphs (night time)



Source: Malherbe, 2011

A major factor related to noise impacts is that the proposed linear infrastructure extends through an area entirely devoid of communities or settlements. Receptors are therefore limited to local commuter and tourism traffic on the local roads. Local wildlife may also be affected and actively move away from local roads and railway lines.

There is unlikely to be a major variation in terms of noise impacts related to either the use of road or railway, due to the lack of receptors within or close to the proposed transport corridor. There will be a high number of heavy vehicles, as apposed to rail and thus the frequency of noise generation will be higher (See *Table 8.7*) if roads are used. Local tourism and general traffic will also be direct receptors to noise pollution.

The railway alternative will generate some noise however this is mitigated by the lack of local receptors – largely limited to local road traffic along the C28 and portions of Walvis Bay communities. The former is not considered to be significantly affected due to the limited rail volumes required on any new railway line and that road traffic in itself generates noise. The existing railway through Walvis Bay suggests that noise already occurs, and the use of the existing line from the C34 to Walvis would likely result in a moderate cumulative increase in noise due to higher rail volumes.

The establishment of the water pipelines and powerlines will generate some noise during construction, but is largely negated by the lack of local receptors. Noise for this infrastructure will be negligible during operations.

The establishment of the access road and siding will result in noise pollution during construction and operations, due to the continual movement of traffic. No receptors are located within proximity to the route or siding and thus the impact is considered to be negligible (See *Table 8.9*).

Table 8.7 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre Mitigation	Post Mitigation
Transport Routes	**Public Roads**	Negative	Regional	Long Term	Low	Likely	High	Low	Negligible
	Railway Transport	Negative	Regional	Long Term	Low	Likely	High	Moderate	Moderate
	Road and Railway	Negative	Regional	Long Term	Low	Likely	High	Moderate	Low
Water Supply	**Water Pipeline Route**	Negative	Local	Short Term	Low	Likely	High	Negligible	Negligible

Powerline Route	**Walmund Line**	Negative	Regional	Short Term	Low	Likely	High	Negligible	Negligible
	ERED Line	Negative	Regional	Short Term	Low	Likely	High	Negligible	Negligible
	Kuiseb Line	Negative	Regional	Short Term	Low	Likely	High	Negligible	Negligible
Other Activities	**Access Road**	Negative	Local	Short Term	Low	Likely	High	Negligible	Negligible
	Railway Siding	Negative	Local	Long Term	Low	Likely	High	Negligible	Negligible

Residual Impact

As noted in *Table 8.7*, potential impacts will be limited only to when the local public roads or railways are used for the bulk transport of materials and goods. Impacts can be mitigated via the mitigation measures provided in Chapter 9, from Low to Negligible with appropriate road upgrade and traffic safety measures in place.

8.2.3 Impact on Geology and Soils (Erosion and Degradation)

Impact Description and Assessment

The hyper-arid nature of the region results in virtually no vegetation cover and local soils are highly exposed. In general the plains are largely comprised of *Petric gypsisols* characterised by a solid layer with very shallow soil depths.

This solid layer provides a stabilising influence on local soils and plays a vital role in the prevention of wind and water-induced soil erosion. Disturbance of this layer results in accelerated and significant soil erosion, and the generation of particulate and dust related air pollution.

The construction of new linear infrastructure will lead to the disturbance of local soils and result in both soil erosion and general degradation. In order to reduce soil erosion, it is generally considered that existing infrastructure should be upgraded and used rather than the establishment of new infrastructure. Where new infrastructure is required, specific soil conservations management plans and actions will need to be established.

Soil degradation and erosion will likely continue during the operational phase, but at a lower impact level than construction. Suitable soil conservation and stabilisation measures will need to be in place as part of operational management.

With regard to the transport options, soil erosion will likely occur during the construction of any new proposed railway line from Etango to the existing railway line. This will likely result in a high impact but limited to the construction phase, and suitable mitigation measures will be required.

The establishment of the access road from the C28 to the mine site will result in the disturbance of soil and result in soil erosion. No alternatives are available and therefore suitable soil conservation measures will need to be put in place during construction.

The use of existing public roads, or existing roads and railway will negate the need for the establishment of new infrastructure, and significantly reduce the occurrence of soil erosion. In terms of soil erosion, these are therefore considered the preferred transport options.

With regard to water supply, a secondary line will need to be established from the proposed regional supply to the mine site. This 7km long pipeline should follow the proposed access road to minimise soil disruption and negate the need to install a secondary access road during pipeline construction. No other alternatives are available and therefore suitable soil conservation measures will need to in place during construction.

The installation of transmission lines from either the Walmund, ERED or Kuiseb systems will result in soil erosion. The erection of the powerlines themselves will not result in soil erosion; however the access roads required using construction will result in impacts. To mitigate this impact the new powerlines should run adjacent and parallel to existing powerlines, the C28 and the proposed access roads. This negates the need for new access roads and allow for access for maintenance.

Table 8.8 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation
Transport Routes	Public Roads	Negative	Local	Short Term	Low	Likely	High	Low	Low
	Railway Transport	Negative	Regional	Long Term	Moderate	Likely	High	High	Moderate
	Road and Railway	Negative	Local	Short Term	Low	Likely	High	Low	Low
Water Supply	Water Pipeline	Negative	Local	Long Term	Low	Likely	High	Moderate	Low
Powerline Route	Walmund Line	Negative	Regional	Long Term	Moderate	Likely	High	High	Moderate
	ERED Line	Negative	Regional	Long Term	Moderate	Likely	High	High	Moderate
	Kuiseb Line	Negative	Regional	Long Term	Moderate	Likely	High	High	Moderate

Other Activities	**Access Road**	Negative	Local	Long Term	Low	Likely	High	Moderate	Low
	Railway Siding	Negative	Local	Long Term	Low	Likely	High	Moderate	Low

Residual Impact

As noted in *Table 8.8*, the residual impact varies between low and moderate impact depending of the alternatives selected. In general, the use of existing infrastructure should be supported as this would result in Low Impacts.

8.2.4 Impact on Washes/Drainage Line

Impact Description and Assessment

The Erongo region is considered to be hyper-arid and therefore water is critical natural resource. Sensitive natural habitats are generally constrained to localised washes and drainage lines, due to the water provided in these areas. The perennial vegetation in the washes and drainage lines function as important food sources, and shelter for local fauna.

The establishment of any linear infrastructure may function as a barrier to surface and sub-surface flow within the washes and drainage lines. This may result in the significant alteration of habitats downstream of the linear infrastructure. As such, the construction of any linear infrastructure may result in a disruption to local surface and sub-surface water. This is considered cumulative in relation to impacts from existing infrastructure.

In addition to the obstruction of surface and sub-surface water, the contamination of groundwater during construction and operation by vehicles transporting acids and need fuels to be appropriately managed.

The disruption of surface and subsurface water flow is possible as linear infrastructure can act as a barrier to water flow. The installation of new linear infrastructure, namely roads and railway lines, is likely to have a net cumulative impact (See *Table 8.9*).As such the preferred transport alternative is to use existing infrastructure where impacts have already occurred.

The installation of water pipelines and powerlines is not predicted to impact on surface and sub-surface water flow as infrastructure will be above ground. Associated access roads may however function as barriers and therefore it is recommended that existing access roads be used at all times. Where new access roads are required, suitable measures must be in place to allow for the continued movement of surface and sub-surface water.

Table 8.9 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre Mitigation	Post Mitigation
Transport Routes	Public Roads	Negative	Local	Perm.	Low	Likely	Moderate	Low	Low
	Railway Transport	Negative	Regional	Perm.	High	Likely	High	High	Moderate
	Road and Railway	Negative	Local	Perm.	Low	Likely	Moderate	Low	Low
Water Supply	Water Pipeline	Negative	Local	Perm.	Moderate	Likely	Moderate	Moderate	Low
Powerline Route	Walmund Line	Negative	Regional	Perm.	High	Likely	High	High	Low
	ERED Line	Negative	Regional	Perm.	High	Likely	High	High	Low
	Kuiseb Line	Negative	Regional	Perm.	High	Likely	High	High	Low
Other Activities	Access Road	Negative	Local	Perm.	Moderate	Likely	Moderate	Moderate	Low
	Railway Siding	Negative	Local	Perm.	Moderate	Likely	Moderate	Moderate	Low

Residual Impact

The adoption of the mitigation measures and recommendations made in Chapter 9 should result in a low residual impact. In particular, the use of existing infrastructure should be supported as this would result in low impacts.

8.3 ASSESSMENT OF POTENTIAL BIOLOGICAL IMPACTS

8.3.1 Impact on Floral Species and Floral Communities

Impact Description and Assessment

The flora of the study area is divided into three major habitat types – namely gravel plains, washes and drainage lines and ridges. Much of the landscape is devoid of vegetation due to the hyper-arid conditions in the study area, and flora is largely is largely restricted to local washes and drainage lines.

The local washes and drainage lines will contain endemic and near endemic species – including protected species. Therefore, while the spatial extent of these washes is very restricted in the study area, suitable management

measures will be required if any of the proposed linear infrastructure crosses any of the washes.

The construction phase will result in the removal of individual floral species or floral habitats as part of site clearing and establishment. This is of particular concern in the establishment of new linear infrastructure. The nature of the impact is mostly a function of the route length and the right-of-way or servitude widths.

The sparseness of vegetation however greatly reduces the extent of potential impacts. However where vegetation is present (in washes and drainage lines) this vegetation functions as a key habitat for local fauna and endangered plant species.

In order to reduce the loss of vegetation and habitat, it is generally considered that existing infrastructure should be upgraded and used rather than the establishment of new infrastructure. Where new infrastructure is required, specific vegetation transplanting and rehabilitation management plans and actions will need to be established. In addition, the alignment of any form of linear infrastructure within washes and drainage lines is to be avoided to the fullest extent possible.

With regard to water supply, a secondary line will need to be established from the proposed regional supply line to the mine site. This 7km long pipeline should follow the proposed access road to minimise soil disruption and negate the need to install a secondary access road during pipeline construction. No other alternatives are available and therefore suitable soil conservation measures will need to be in place during construction.

The establishment of the access road from the C28 to the mine site will result in the disturbance of vegetation to a limited extent. No alternatives are available and suitable management measures will need to in place during construction. As mentioned, this access road alignment should avoid washes and drainage lines to the fullest extent possible.

The installation of transmission lines from either the Walmund, ERED or Kuiseb systems should run adjacent and parallel to existing powerlines, the C28 and the proposed access roads to the mine. This negates the need for new access roads and will allow for access for maintenance.

Table 8.10 Impact Significance Rating for Alternatives

Alternatives	Impact Rating						Significance Rating	
	Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre Mitigation	Post Mitigation

Transport Routes	**Public Roads**	Negative	Local	Long Term	High	Definite	High	Moderate	Low
	Railway Transport	Negative	Regional	Long Term	High	Likely	High	High	Moderate
	Road and Railway	Negative	Local	Long Term	Low	Likely	Medium	Low	Low
Water Supply	**Water Pipeline**	Negative	Local	Long Term	Moderate	Likely	Moderate	Moderate	Low
Powerline Route	**Walmund Line**	Negative	Regional	Long Term	High	Likely	High	High	Low
	ERED Line	Negative	Regional	Long Term	High	Likely	High	High	Low
	Kuiseb Line	Negative	Regional	Long Term	High	Likely	High	High	Low
Other Activities	**Access Road**	Negative	Local	Long Term	Moderate	Likely	Moderate	Moderate	Low
	Railway Siding	Negative	Local	Long Term	Moderate	Likely	Moderate	Moderate	Low

Residual Impact

The adoption of the mitigation measures and recommendations in Chapter 9 should result in a residual impact of low to moderate as noted in *Table 8.10*. In general, the use of existing infrastructure should be supported as this would result in Low Impacts.

8.3.2 Impact on Faunal Species

Impact Description and Assessment

The faunal study (Pallett, 2010) identified a number of issues and threats that the proposed infrastructure will pose to the amphibian, reptile and mammal fauna, including:

- Increased incidence of road kills associated with road and railways and the likely increased in traffic volumes.
- Disturbance to fauna (notably larger mammals) which will be scared away from the general area by the noise and dust of vehicles and human activities.
- Increase in poaching by the provision of improved access to the area, from the tarring of the C28 and the establishment of access roads along the powerline and railway line.
- Restriction of movement of nomadic species (notably large terrestrial animals) whom move widely to make best use of patchily distributed resources. Their movements will be potentially affected by barriers such as powerline, pipeline and railway line.
- Loss and fragmentation of habitats, to a limited extent as the overall footprint of the infrastructures is small. This can be attributed to the loss or fragmentation of vegetation communities during construction.

- Degradation in plant and biological soil crust (BSC) productivity. Dust settling on plant and BSC surfaces reduces the photosynthetic rate and plant productivity. Dust-fallout can also depress invertebrate populations as it clogs up crevices and interstices in which they shelter.
- Habitat degradation by vehicle tracks can be expected from the C28 and the track running along the railway. Cumulatively, many tracks and repeated tracks over an area can significantly degrade the surface and soil micro-environment.
- Reduced flow down washes could prevent water, seeds or detritus from reaching downstream areas, thus negatively affecting vegetation and the associated animal life.

Any potential impacts to amphibians would likely be restricted to habitat destruction and fragmentation. The probability of impacts occurring can largely be negated by the using of existing infrastructure. The use of existing infrastructure will have a net Low Impact (See *Table 8.11*) and therefore is considered the preferred option.

The construction of new infrastructure including the access road, water pipeline and railway line will have a Moderate Impact (See *Table 8.11*) as whilst it does not extend into sensitive amphibians habitats (ridges and rocky outcrops), there may still be some impact related to habitat fragmentation.

Table 8.11 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre Mitigation	Post Mitigation
Transport Routes	Public Roads	Negative	Local	Long Term	High	Definite	High	Low	Low
	Railway Transport	Negative	Regional	Long Term	High	Likely	High	High	Moderate
	Road and Railway	Negative	Local	Long Term	Low	Likely	Medium	Low	Low
Water Supply	Water Pipeline	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low
Powerline Route	Walmund Line	Negative	Regional	Long Term	High	Likely	High	Moderate	Low
	ERED Line	Negative	Regional	Long Term	High	Likely	High	Moderate	Low
	Kuiseb Line	Negative	Regional	Long Term	High	Likely	High	High	Moderate
Acti	Access Road	Negative	Local	Long Term	Moderate	Likely	Moderate	Moderate	Low

	Railway Siding	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low

Residual Impact

The adoption of the mitigation measures and recommendations in Chapter 9 should result in a residual impact on faunal species of low to moderate as noted in *Table 8.11*. In general, the use of existing infrastructure should be supported as this would result in Low Impacts.

8.3.3 Impact on Biodiversity within the Namib-Naukluft Park (NNP)

Impact Description and Assessment

The greater portion of the proposed linear infrastructure would be located in the Namib Naukluft Park (NNP), which is destined to become part of the greater Namib-Skeleton Coast National Park.

The primary aim of any national park is to conserve the local natural biodiversity. Mining and mine infrastructure is generally considered to be a conflicting land-use. The establishment of linear infrastructure will lead to direct loss of biodiversity within the development corridor, and the impacts will be cumulative if multiple infrastructures are developed as other mines are established.

The impact is only mitigated by the limited size of the proposed infrastructure; however the linear nature of much of the infrastructure can function as barriers to migration, water flow and lead to habitat fragmentation. In general, the use of existing infrastructure should be promoted over the establishment of new infrastructure.

With regard to the transport options, impacts on local biodiversity will be of High Negative if a new railway line is established without appropriate mitigation (See *Table 8.12*) whilst the use of existing roads is considered the preferred option as it will not require the breaking of new ground.

With regard to water supply, a secondary line will need to be established from the proposed regional supply to the mine site. This 7km long pipeline should follow the proposed access road to minimise vegetation disruption and negate the need to install a secondary access road during pipeline construction. The limited length of the pipeline however indicates that impacts on biodiversity will be low.

The establishment of the access road from the C28 to the mine site will result in the disturbance of vegetation to a limited extent, and therefore local biodiversity will be reduced.

The installation of transmission lines from the Walmund, ERED or Kuiseb systems may required access roads required during construction will result in impacts on local biodiversity. To mitigate this impact the new powerlines

should run adjacent and parallel to existing powerlines, the C28 and the proposed access roads. This negates the need for new access roads and allow for access for maintenance.

Table 8.12 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation
Transport Routes	Public Roads	Negative	Local	Short Term	Moderate	Likely	High	Moderate	Low
	Railway Transport	Negative	Regional	Long Term	High	Likely	High	High	Moderate
	Road and Railway	Negative	Local	Short Term	Moderate	Likely	High	Moderate	Low
Water Supply	Water Pipeline	Negative	Local	Long Term	Moderate	Likely	High	Moderate	Low
Powerline Route	Walmund Line	Negative	Regional	Long Term	Moderate	Likely	High	Moderate	Low
	ERED Line	Negative	Regional	Long Term	Moderate	Likely	High	Moderate	Low
	Kuiseb Line	Negative	Regional	Long Term	High	Likely	High	High	Moderate
Other Activities	Access Road	Negative	Local	Long Term	Moderate	Likely	High	Moderate	Low
	Railway Siding	Negative	Local	Long Term	Low	Likely	High	Moderate	Low

Residual Impact

As noted in *Table 8.12*, potential impacts on park biodiversity will be low to moderate on the assumption that appropriate mitigation measures as provided in Chapter 9 are adopted. As with other impacts, this is largely mitigated if existing infrastructure is selected rather than the establishment of new infrastructure.

8.4 ASSESSMENT OF POTENTIAL SOCIO-ECONOMIC IMPACTS

8.4.1 Impact on Road-Users and Traffic Safety

Impact Description and Assessment

There is limited road infrastructure to and from the proposed Etango Mine, with the C28 and the C34 the only available road route options for materials transport between the mine site and Walvis Bay. Both are public roads and therefore mine traffic will impact on local road users and traffic safety.

A Traffic Impact Assessment was commissioned by Bannerman to determine traffic related impacts associated with the Etango Mine, and by extension the potential transport routes considered in this ESIA.
Traffic projections on the use of the C28 indicated that generated heavy traffic on the local road network will increase by 160 heavy vehicles trips per day (Aurecon, 2010) or a potential tenfold increase from current levels. This includes existing and proposed mines and therefore is considered a cumulative impact.

The increase in volume is considered a low impact on tarred surfaces, but will have a high impact on gravel roads (Aurecon, 2010). The use of the C28 and C34 is thus seen to be a high impact unless appropriate upgrades are implemented.

The C28 and C34 are currently used by both Heavy Vehicles and Light Vehicles, thus there is a mixture of commercial and private roads users. Currently traffic volumes are very low; however the increase in heavy vehicles will increase traffic risks in terms of reduced visibility (from dust and fog) and speed.

In terms of transport alternatives, the use of railway will negate any potential risks to road-users and traffic safety, and thus is considered the preferred option (See *Table 8.13*).

Should this road alternative be adopted then appropriate road upgrades are needed to mitigate the potential High Impacts (See *Table 8.13*). In this regard, the C28 is presently, undergoing upgrade which will significantly reduce safety impacts. The SEA (MME, 20101) recommends a similar upgrade for the C34; however no specific plans are currently in place.

Table 8.13 Impact Significance Rating for Alternatives

Alternatives	Impact Rating						Significance Rating	
	Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation
Transport Routes	Public Roads	Negative	Regional	Long Term	High	Definite	High	High	Low
	Railway Transport	No Impact Predicted							
	Road and Railway	Negative	Regional	Long Term	Moderate	Definite	High	Moderate	Low
Water Supply	Water Pipeline	No Impact Predicted							
Powerline Route	Walmund Line	No Impact Predicted							
	ERED Line	No Impact Predicted							
	Kuiseb Line	No Impact Predicted							
Other Activities	Access Road	Negative	Local	Long Term	Low	Likely	High	Low	Low
	Railway Siding	Negative	Local	Long Term	Low	Likely	High	Low	Low

Residual Impact

As noted in *Table 8.13*, potential impacts will be limited to only when the local public roads are used for the bulk transport of materials and goods. Impacts can be mitigated from High to Low with appropriate road upgrade and traffic safety measures in place. The use of the railway option will however negate any impacts and is considered this preferred option.

8.4.2 Impact from the Investment in Local Infrastructure

Impact Description and Assessment

Limited infrastructure (covering roads, water and power) is provided in proximity to the Etango Mine, and the Namib-Naukluft National Park in general. In general infrastructure development can be seen to have a positive spin-off, if it benefits not only be mine, but the general public as well.

The establishment of the proposed railway, water pipelines, access road, sidings and powerlines are not considered to benefit local communities or visitors to the national park.

Benefits will be accrued to local commuter and tourism traffic, in terms of the upgrade of the C28. This is however considered an off-set for the impacts associated with increased heavy traffic volumes and traffic safety issues.

Table 8.14 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation
Transport Routes	Public Roads	Positive	Regional	Long Terms	Low	Likely	Moderate	Low	Low
	Railway Transport	No negative impacts or positive benefits accrued.							
	Road and Railway	Positive	Regional	Long Terms	Low	Likely	Moderate	Low	Low
Water Supply	Water Pipeline	No negative impacts or positive benefits accrued.							
Powerline Route	Walmund Line	No negative impacts or positive benefits accrued.							
	ERED Line	No negative impacts or positive benefits accrued.							
	Kuiseb Line	No negative impacts or positive benefits accrued.							
Other Activities	Access Road	No negative impacts or positive benefits accrued							
	Railway Siding	No negative impacts or positive benefits accrued							

Residual Impact

There are minimal social or economic benefits associated with the investment in additional infrastructure. The upgrade of the C28 will provide low benefits which offset the impacts associated with higher traffic volumes and associated risks.

8.4.3 Impact on Archaeological and Cultural Features

The Erongo Region has an archaeological record spanning more than one million years (MME, 2010). The types of archaeological sites that are considered vulnerable to impacts by development include "surface scatters of stone artefacts, rock shelters with evidence of occupation, including rock art, graves, stone features such as hunting blinds and huts, and more recent sites such as colonial battlefields, old road-works and historical mines" (MME, 2010)

The Strategic Environmental Assessment (MME, 2010) denotes a number of archaeological sensitivity zones. A review of these zones suggests that the proposed linear infrastructure does not cross any 'yellow and red flag' areas.

The area of archaeological concern is the proposed road link between the Etango project and the C28. The remains found along the proposed site are evidence of Late Pleistocene material and cattle remains, the former being disturbed from its original condition as a result of extensive wind abrasion of artefact surfaces thus considerably reducing the information potential of the site. These sites are not considered sensitive and on archaeological grounds, the proposed access road corridor is acceptable (Kinahan, 2010)

Other artefact debris identified was from the Middle Stone Age including artefact debris from the Later Stone Age (as a result of intensive and repeated occupation). The sites discussed are of a low significance and may be destroyed should development occur (Kinahan, 2010).

Other linear developments associated with the Etango project, such as provision of additional water and power supplies will mainly occur within the bounds of the existing development corridor flanking the C28. Although no archaeological assessment of the existing infrastructure was carried, it was not deemed necessary as the corridor has been so extensively disturbed.

The use of existing infrastructure should be preferred over the establishment on new infrastructure. In particular the establishment of new railway lines, and new access tracks associated with water pipelines and powerlines is not supported.

Table 8.15 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	Pre-mitigation	Post-mitigation
Transport Routes	Public Roads	Negative	Local	Long Term	Low	Unlikely	Medium	Negligible	Negligible
	Railway Transport	Negative	Local	Long Term	Moderate	Unlikely	Medium	Moderate	Low
	Road and Railway	Negative	Local	Long Term	Low	Unlikely	Medium	Negligible	Negligible
Water Supply	Water Pipeline	Negative	Local	Long Term	Moderate	Unlikely	Medium	Low	Low
Powerline Route	Walmund Line	Negative	Local	Long Term	Moderate	Unlikely	Medium	Low	Low

	ERED Line	Negative	Local	Long Term	Moderate	Unlikely	Medium	Low	Low
	Kuiseb Line	Negative	Local	Long Term	High	Unlikely	Medium	Moderate	Low
Other Activities	**Access Road**	Negative	Local	Long Term	Moderate	Unlikely	Medium	Low	Low
	Railway Siding	Negative	Local	Long Term	Low	Unlikely	Medium	Negligible	Negligible

Residual Impact

In general the location of the proposed linear infrastructure is outside of any sensitive archaeological areas. The establishment of new infrastructure and the associated breaking of new ground may lead to the disruption of heritage resources and there is the potential for moderate negative impacts. As per *Table 8.15,* the use of existing infrastructure would likely result in negligible impacts.

8.4.4 Impact on Eco-Tourism and the Tourism Industry

Impact Description and Assessment

The Erongo Region is an important destination for tourism, and eco-tourism in general. The Etango Mine is located in the Namib-Naukluft National Park and specifically is in close proximity to the Moon Landscape and Welwitschia Flats – both considered to be tourism '*red flag areas*'.

The proposed linear infrastructure is unlikely to be visible from either of the above sites; however it is currently proposed that much of the linear infrastructure will extend along the C28 and C34. The C28 is rated as an important tourism route in accessing the Moon Landscape and Welwitschia Flats.

The establishment of the linear infrastructure will impact on the C28 tourism route in terms of (1) visual impact, (2) change in sense of place, (3) safety and (4) noise on local road users.

As noted in *Table 8.16*, the use of either road or railway will impact on tourism routes. The use of the C28 and associated increase of heavy traffic will result in increased noise and traffic risks, and will generally be disruptive to local tourism traffic. A railway will not impact directly on tourism traffic, however along with the C28; the railway will have a cumulative impact in terms of impacting on the local rural/natural tourism value.

The proposed powerlines would extend through the gravel plains, which are flat and very exposed. This results in the powerlines being very visible and is likely to impact on local tourism views. This is mitigated by the fact that the

plains are not designated as a critical tourism area. Impacts are therefore likely to be focussed on powerlines visible from the C28.

The water pipeline spur and access road will have no impact (See *Table 8.16*) on local tourism as it does not extend along tourism routes and is located within the Etango mine site. The proposed siding will also have no impact as it is located outside of the national park and is located adjacent to existing infrastructure.

Table 8.16 Impact Significance Rating for Alternatives

Alternatives		Impact Rating						Significance Rating	
		Nature	Spatial Extent	Duration	Intensity	Likelihood	Confidence	PRE-MITIGATION	POST MITIGATION
Transport Routes	Public Roads	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
	Railway Transport	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
	Road and Railway	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
Water Supply	Water Pipeline Route	No impact predicted							
Powerline Route	Walmund Line	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
	ERED Line	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
	Kuiseb Line	Negative	Regional	Long-Term	Moderate	Definite	High	Moderate	Moderate
Other Activities	Access Road	No impact predicted							
	Railway Siding	No impact predicted							

Residual Impact

Potential impacts to tourism will be associated with tourism traffic along the C28, by the transport options and powerlines. Most impacts will be moderate negative in nature, but cumulative and cannot realistically be mitigated.

9 MITIGATION MEASURES AND RECOMMENDATIONS

This chapter covers the mitigation measures and recommendations established by the ESIA in order to reduce environmental impacts related to the construction and operation of the linear infrastructure.

For the purposes of this report, the mitigation measures and recommendations will be divided into (1) fundamental recommendations – or overarching recommendations that reduce multiple impacts, (2) construction phase recommendations and (3) operational phase recommendations.

9.1 TRANSPORT ALTERNATIVE 1: PUBLIC ROADS

9.1.1 Fundamental Mitigation Measures and Recommendations

1. The C28 is currently undergoing an upgrade to a tarred road, and Bannerman has already committed resources in support of the upgrade. It is assumed that this SEMP finding will be fully implemented.
2. Bannerman is to coordinate with the Roads Authority and other mines in terms of ongoing road maintenance of the C28.
3. The C34 should be upgraded as per the Uranium Rush SEA (MME, 2010) recommendations, and Ministry of Works, Transport and Communication are planning to tar the C34 in the future.
4. Appropriate health and safety mechanisms need to be established to reduce traffic risks to road users (commuter, mine traffic, tourism), especially along the C28.

9.1.2 Construction Phase Mitigation Measures and Recommendations

1. The upgrade of the C28 has already commenced and thus no mitigation measures or recommendations are provided.
2. The upgrade of the C34 falls outside of the scope of this ESIA, thus no mitigation measures or recommendations are provided.

9.1.3 Operational Phase Mitigation Measures and Recommendations

1. As part of any agreed maintenance programme, road verges are to be appropriately maintained in order to prevent localised erosion.
2. Suitable speed limits should be enforced on all mine vehicles making use of the C28 or C34.
3. Suitable vehicle maintenance should be undertaken on all mine vehicles to ensure such vehicles are road worthy and do not pose a risk to other road users.
4. Truck transport through Walvis Bay is to be minimised at night times to reduce nuisances from noise.
5. Minimise night driving by mine staff.

6. Restrict off-roading by staff within the mine site at all times. All vehicles are to be restricted to access roads.
7. Bannerman should establish appropriate Emergency and Spills Management Plans for potential accidents/spillages of materials and products during transport.

9.2 TRANSPORT ALTERNATIVE 2: RAILWAY TRANSPORT

9.2.1 Fundamental Mitigation Measures and Recommendations

1. Should any new railway lines be established, then it is recommended that the route run parallel and adjacent to the C28.
2. The width of the railway servitude should be minimised to the greatest extent possible, for construction and operational phases.
3. Appropriate rail crossings will need to be designed in cooperation with the Roads Authority that do not pose a risk to other road users.

9.2.2 Construction Phase Mitigation Measures and Recommendations

1. The establishment of any new railway lines shall not impede surface and subsurface water flow. New railway lines should include suitable culverts, where it intersects with washes and drainage lines.
2. Construction shall be restricted to the servitude and suitable barriers/screens should be established to enforce this restriction.
3. A suitable rehabilitation and restoration programme will be initiated by the contractor prior to the cessation of construction.
4. A formal soil conservation and rehabilitation plan shall be established by the contractor for the construction phase, and shall form part of any work agreement contract.
5. Contractors during construction will establish a suitable Spill Control and Response Plan.

9.2.3 Operational Phase Mitigation Measures and Recommendations

1. Appropriate Spill Control and response plans are to be established to prevent and manage spillages from vehicles transporting products and waste along all railway lines during operations.
2. Bannerman, or a suitable representative, to review soil conservation measures along the railway line as part of ongoing maintenance and management.

9.3 TRANSPORT ALTERNATIVE 3: ROAD AND RAILWAY

9.3.1 Fundamental Mitigation Measures and Recommendations

1. The C28 is currently undergoing an upgrade to a tarred road, and Bannerman has already committed resources in support of the upgrade.

2. Bannerman is to coordinate with the Roads Authority and other mines in terms of ongoing road maintenance of the C28.
3. Appropriate health and safety mechanisms needs to be established to reduce traffic risks to road users (commuter, mine traffic, tourism).
4. The railway siding required as part of this option will be subject to a separate EIA process, once more detailed design information becomes available. The EIA process should establish the optimum location for this site.

9.3.2 Construction Phase Mitigation Measures and Recommendations

1. The upgrade of the C28 has already commenced and thus no mitigation measures or recommendations are provided.
2. The use of the existing railway line does not require construction and thus no mitigation measures or recommendations are provided.

9.3.3 Operational Phase Mitigation Measures and Recommendations

1. As part of any agreed maintenance programme, road verges are to be appropriately maintained in order to prevent localised erosion.
2. Suitable speed limits should be enforced on all mine vehicles making use of the C28.
3. Suitable vehicle maintenance should be undertaken on all mine vehicles to ensure the safety of other road users.
4. Minimise night driving by mine staff.
5. Restrict off-roading by staff within the mine site at all times. All vehicles to be restricted to access roads.
6. Bannerman should establish appropriate Emergency and Spills Management Plans for both road and rail legs in response to potential accidents/spillages of materials and products during transport.

9.4 WATER PIPELINE ROUTE

9.4.1 Fundamental Mitigation Measures and Recommendations

1. Bannerman is to commit to the requirements and recommendations made by the proposed EIA and EMP for the Swakopmund South Pipeline Scheme.
2. The spur line from the Swakopmund South Pipeline Scheme should run parallel and adjacent to the Etango Mine access road, to reduce the need for additional access roads that my impeded water flows.
3. Where possible, the water pipeline shall be located within the access road reserve to minimise the servitude width (in keeping with the recommendations made in the SEA).

9.4.2 Construction Phase Mitigation Measures and Recommendations

1. The pipeline servitude should be minimised to the maximum extent possible for construction and operational phases.

2. The water pipeline should be located above ground and sited on concrete plinths so as not to impede water flow.
3. A formal soil conservation and rehabilitation plan shall be established by the contractor for the construction phase, and shall form part of any work agreement contract.
4. Contractors during construction will establish a suitable Spill Control and Response Plan.

9.4.3 Operational Phase Mitigation Measures and Recommendations

1. Bannerman, or a suitable representative, to review soil conservation measures along the water pipeline as part of ongoing maintenance and management.

9.5 TRANSMISSION LINE ALTERNATIVES: WALMUND, ERED AND KUISEB LINE

9.5.1 Fundamental Mitigation Measures and Recommendations

1. It is recommended that, where feasible, existing powerlines are upgraded in capacity rather than the installation of new powerlines.
2. Where additional powerlines are required, it is recommended that they are placed in close proximity to existing lines to minimise visual impacts on the local landscape.
3. Existing access roads are to be used, and where ever possible the establishment of new access roads are to be avoided.
4. NamPower have indicated a potential transmission route coming into the proposed mine site from the west. This is generally not supported as it would require the creation of new access roads.
5. Entrances to access roads are to be appropriately gated to prevent public access to tracks.
6. The access road to the mine is to act as the maintenance road for all power lines.
7. The power line route alignment as recommended in this ESIA is to be negotiated with NamPower.

9.5.2 Construction Phase Mitigation Measures and Recommendations

1. Powerline poles are not to be located within any washes or drainage lines.
2. The establishment of new powerlines from Walmund, ERED or Kuiseb should avoid the need for new access/maintenance roads to the maximum extent possible.
3. Where access routes need to be established, the contractor shall establish a formal soil conservation and rehabilitation programme.

9.5.3 Operational Phase Mitigation Measures and Recommendations

1. Access to maintenance roads along powerline routes shall be restricted to mine and NamPower personnel only.

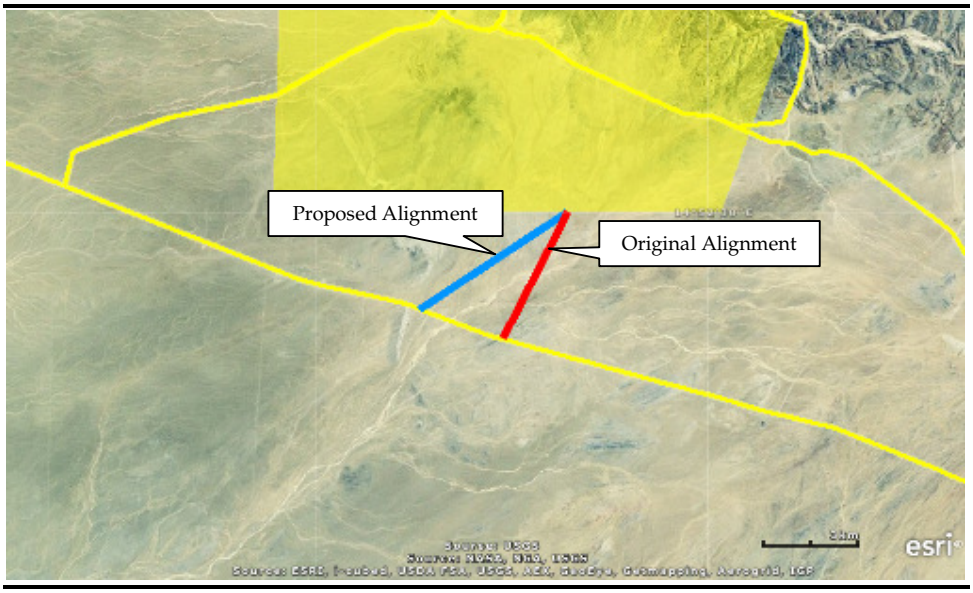
2. Existing maintenance roads, serving existing powerlines are to be used as maintenance roads for the proposed new powerlines. No new maintenance routes are to be established.

9.6 ACCESS ROAD

9.6.1 Fundamental Mitigation Measures and Recommendations

1. The access road should be aligned in order to avoid impacts on drainage lines and washes, as shown in *Figure 9.1*. This alignment should be included into the engineering designs for the access road.
2. The access road alignment should avoid the washes and water courses to the maximum extent possible, taking into consideration engineering and safety constraints.
3. The access road is to be tarred in order to avoid the generation of dust.
4. The C28 / Etango Access Road intersection should be adequately designed to reduce potential accidents and must be in compliance with applicable road standards noted in the Traffic Impact Assessment.
5. The water pipeline and powerline are to form one linear infrastructure corridor to the mine site. If possible, the water pipeline and power line are to run within the road reserve /corridor.

Figure 9.1 Conceptual access road alignment



9.6.2 Construction Phase Mitigation Measures and Recommendations

1. The road reserve should be minimised to the maximum extent possible for construction and operational phases
2. The access road alignment should avoid the washes and water courses to the maximum extent possible, taking into consideration engineering and safety constraints.

3. Where washes and water courses cannot be avoided, the access road should include suitable culverts, or similar structures, to allow for continued water movement.
4. Where washes and water courses are directly impacted, it is recommended that suitable plant translocation and rehabilitation is undertaken.
5. No liquids or liquid waste is to be discharged into washes and drainage lines at any time.
6. A formal soil conservation and rehabilitation plan shall be established by the contractor for the construction phase, and shall form part of any work agreement contract.
7. Contractors during construction will establish a suitable Spill Control and Response Plan.

9.6.3 Operational Phase Mitigation Measures and Recommendations

1. Suitable traffic calming and control measures should be established during operations, which may include:
    a. Strictly enforced speed limits (monitored by installed tachymeters)
    b. Regular and effective inspections and maintenance of mine vehicles.
2. Bannerman should establish appropriate Emergency and Spills Management Plans for potential accidents/spillages of materials and products during transport.
3. Bannerman, or a suitable representative, to review soil conservation measures along the railway line as part of ongoing maintenance and management.

9.7 RAILWAY SIDING

9.7.1 Fundamental Mitigation Measures and Recommendations

1. A separate EIA process will be required for the railway siding once more specific project information for this proposed development becomes available, and should the rail siding become an option for the Etango Project.

9.7.2 Construction Phase Mitigation Measures and Recommendations

1. No mitigation measures or recommendations are provided as this will be covered by a separate EIA.

9.7.3 Operational Phase Mitigation Measures and Recommendations

1. No mitigation measures or recommendations are provided as this will be covered by a separate EIA.

1. Bannermann should consult on a regular basis with the Uranium Stewardship Council in terms of standards for the conservation of heritage resources.
2. Where any visible heritage resources are positively identified during construction (chance finds), Bannermann will temporarily cease work and contact a suitable professional archaeologist to review and advise on the resources.
3. Establish a multi-stakeholder consultative forum with other mines and parks authorities in terms of supporting and promoting tourism in the region.

10 ENVIRONMENTAL IMPACT STATEMENT

This chapter provides a final synthesis and concluding recommendations in terms of the preferred linear infrastructure alternatives and mitigation measures required to reduce potential environmental and social impacts.

10.1 SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Each proposed activity or alternative was assessed using a standardised impact assessment methodology. This allowed for a comparative assessment of each activity. The findings of this comparative assessment can be viewed in terms of impacts both pre and post mitigation in the summary matrices, provided in *Table 10.1* and *Table 10.2.*

10.1.1 Transport of Goods and Materials

Based on the review of the summary impact matrices, all three transport alternatives (namely rail, road, or a combination of the two) are considered feasible from an environmental and social perspective.

It is noted that the establishment of a new railway line between the mine site and the C28/C34 intersection will have a higher environmental impact due to the disturbance to soils and the loss of vegetation communities and faunal habitats likely during construction. This impact is further cumulative as it adds to past impacts from the construction of the C28 and existing pipelines. In principle, the railway option is not favoured by the ESIA.

In addition, the establishment of a new railway line would require a considerable capital investment and it is not considered to be economically viable. Should this option be reconsidered in the future it is recommended that a separate EIA is undertaken in conjunction with a detailed cost-benefits analysis.

The sole use of the C28 and C34 will have minimal environmental impact as this option involves the use of existing infrastructure. The increase in traffic volumes will, however impact on local road conditions and increase traffic risks. This will be a concern for both mine commuter traffic and local tourism routes. This impact will be cumulative as additional mines are to be established in the area, and will use the C28.

It is acknowledged that the C28 and C34 cannot sustain a significant increase in traffic without suitable upgrades. The C28 is currently being upgraded as a joint project between the Roads Authority and local mines. Similar efforts are being considered for the C34 although this is solely a government responsibility and no set timeframes have been set.

The combined used of road (C28) and rail (the existing rail between Walvis Bay and Swakopmund) is considered the preferred option – although this does require the establishment of a railway siding. This negates the need for additional linear infrastructure and minimises road degradation and traffic risks and results in minimal noise and dust impacts, especially through the town of Walvis Bay (especially at night).

Table 10.1 Impact Assessment Matrix (Pre-Mitigation)

Alternatives		Biophysical Environment				Biological Environment			Socio-Economic			
		Air Pollution	Noise Pollution	Geology and Soils	Geohydrology	Floral Species and Communities	Faunal Species	Biodiversity within NNP	Road Users and Traffic Safety	Investment in Infrastructure	Archaeology, Heritage and Culture	Eco Tourism and Tourism
Transport Routes	Public Roads	Moderate	Low	Low	Low	Moderate	Low	Moderate	High	Low Benefits	Negligible	Moderate
	Railway Transport	Moderate	Negligible	High	High	High	Low	High	No Impact	No Benefits	Moderate	Moderate
	Road and Railway	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Low Benefits	Negligible	Moderate
Water Supply	Water Pipeline Route	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	No Impact	No Benefits	Low	No Impact
Powerline Route	Walmund Line	Moderate	Negligible	High	High	High	High	Moderate	No Impact	No Benefits	Low	Moderate
	ERED Line	Moderate	Negligible	High	High	High	High	Moderate	No Impact	No Benefits	Low	Moderate
	Kuiseb Line	Moderate	Negligible	High	High	High	Moderate	High	No Impact	No Benefits	Moderate	Moderate
Other Activities	Access Road	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	Low	No Benefits	Low	No Impact
	Railway Siding	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	Low	No Benefits	Negligible	No Impact

Table 10.2 Impact Assessment Matrix (Post-Mitigation)

Alternatives		Biophysical Environment				Biological Environment			Socio-Economic			
		Air Pollution	Noise Pollution	Geology and Soils	Geohydrology	Floral Species and Communities	Faunal Species	Biodiversity within NNP	Road Users and Traffic Safety	Investment in Infrastructure	Archaeology, Heritage and Culture	Eco Tourism and Tourism
Transport Routes	Public Roads	Low	Negligible	Low	Low	Low	Low	Low	Low	Low Benefit	Negligible	Moderate
	Railway Transport	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	No Impact	No Benefit	Low	Moderate
	Road and Railway	Low	Negligible	Low	Low	Low	Low	Low	Low	Low Benefit	Negligible	Moderate
Water Supply	Water Pipeline Route	Low	Negligible	Low	Low	Low	Low	Low	No Impact	No Benefit	Low	No Benefit
Powerline Route	Walmund Line	Low	Negligible	Moderate	Low	Low	Low	Low	No Impact	No Benefit	Low	Moderate
	ERED Line	Low	Negligible	Moderate	Low	Low	Low	Low	No Impact	No Benefit	Low	Moderate
	Kuiseb Line	Low	Negligible	Moderate	Low	Low	Low	Moderate	No Impact	No Benefit	Low	Moderate
Other Activities	Access Road	Low	Negligible	Low	Low	Low	Low	Low	Low	No Benefit	Low	No Benefits
	Railway Siding	Low	Negligible	Low	Low	Low	Low	Low	Low	No Benefit	Negligible	No Benefit

No specific designs have been established for the railway siding as yet, although it is likely to be configured as a concrete platform with a gantry crane on rails, extending across the two siding rail lines.

As no detailed engineering design has been established for the siding, a separate EIA process is required.

10.1.2 Water Supply Pipeline

Water supply is a critical concern and there has been a coordinated effort between NamWater and local mines in establishing a sustainable water supply and common water supply network.

The net outcome for these discussions is to establish a combined conveyance system to all mines under the ambit of NamWater – termed the Swakopmund South Pipeline Scheme. The proposed scheme is within keeping of the recommendations of the Uranium Rush SEA (MME, 2010) in terms of the sharing of infrastructure by mines.

As relevant to the Etango project, this scheme includes a shared pipeline from the Swakopmund Reservoir up to a pressure break and balancing reservoir near the Etango Mine. The proposed pipe diameter and length is 1 000 mm and 25 km respectively.

The scheme would include a secondary pipeline from the first reservoir to the mine site. This pipeline would extend for approximately 7km, running in parallel and adjacent to the proposed access road. The establishment of the pipeline is considered feasible from an environmental and social perspective. This assumes that the pipeline will extend within a common corridor with the proposed access road, and mitigation measures noted in the EIA, are adopted.

It should however be noted that the pipeline is only feasible should the larger NamWater Scheme be established. NamWater will initiate a separate EIA for the shared pipeline extending from the Swakopmund Reservoir to Etango in early 2011. Bannerman is committed to the findings of this separate EIA.

10.1.3 Powerlines

There are only two viable temporary power supply options to the Etango Mine, including the Walmund and ERED systems. In turn, the Kuiseb substation is the only viable long term power supply option. Suitable powerlines will need to be established from any of these systems.

The Walmund station is likely to function as a temporary power supply only as the station is heavily corroded and in the long-term the substation is planned for decommissioning by NamPower. The ERED system is being considered however it has not been confirmed if they system has the spare long-term capacity. Thus both systems are not considered viable long-term options.

The Kuiseb substation in turn is a fairly new substation which is to undergo an upgrade to meet increased demand from Walvis Bay, and will be able to supply the Etango Project over the long-term. Power from the Kuiseb substation is thus considered the only viable option.

The use of the Kuiseb Substation will require the establishment of approximately 28km of powerlines. In general the establishment of powerlines results in little environmental impact due to the limited footprint and span of the lines – and is largely limited to visual impacts. The net impact of the powerlines on the visual landscape will be moderate and can be mitigated if the new powerline run in parallel and adjacent to existing powerlines.

Environmental impacts will however be attributed to the need for any new construction/maintenance tracks required for the new powerlines. The significant distances involved suggest that the impact would be significant in terms of the loss of vegetation and faunal communities. This impact can be greatly reduced if existing tracks are used, negating the need for any new tracks.

10.1.4 Access Road

The proposed access road to the Etango mine is considered to be environmentally and social acceptable due to its limited length and footprint. Caution will be required in terms of the road intersecting with local drainage lines and associated impacts on water flow, loss of vegetation communities and faunal habitats.

This EIA recommends potential route realignments for the access road that should be considered during the detailed design phase, to avoid drainage lines to the maximum extent possible.

Where drainage lines cannot be avoided, Bannerman will be committed to ensuring the road does not impede water flow, and strict control measures will be established in the protection of vegetation, and the prevention of spills.

10.2 FINAL RECOMMENDATIONS

The proposed linear infrastructure is considered acceptable from an environmental and social perspective, and no fatal flaws have been identified. In general the use of existing infrastructure is strongly supported over new infrastructure.

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