ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT

Proposed Integrated Industrial Township & Related Infrastructure titled *"Bakersville Smart Industrial City"*, Situated in Registration Division G, Erongo Region, Namibia

First submission: September 2019 (affected by Covid19)
2ND Submission: October, 2022

EAP

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Proponent

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I. Executive Summary

Introduction

The proponent has planned to develop a smart integrated Township Situated in Registration Division G, Erongo Region. The proposed "Bakersville Smart Industrial City", is planned to address Industrial demand and new emerging housing need including affordable housing, by creating infrastructure and a globally competitive environment that attracts investment and promotes sustainable development. The proposed piece of land is owned by Bakersville Township Development CC, which is wholly owned by previously disadvantaged Namibians. The land to be serviced in accordance with the town planning regulations and be used for residential property development for middle to upper income individuals.

This document presents the Environmental Impact Assessment (EIA) of the proposed "Bakersville Smart Industrial City" Project. With a view to achieving diversification of the economy, and absorbing the growing workforce by creating productive jobs and also promote exportation through effective industrialization process leveraging on special economic projects, the Government of the Republic of Namibia has subscribed to the Key Performance Indicators for Smart Sustainable Cities (KPIs for SSC), a United Nations standard on smart sustainable cities, were developed by UNECE and ITU in 2015. The indicators were endorsed by the UNECE Committee on Urban Development, Housing and Land Management at its seventy-sixth session in 2016. They were further amended taking into account the SDG indicators and endorsed by the Committee in 2017. UNECE's work on Smart Sustainable Cities forms a part of the initiative United for Smart Sustainable Cities (U4SSC). U4SSC is a global platform for smart cities stakeholders, which advocates for public policies to encourage the use of ICT to facilitate the transition to smart sustainable cities. The initiative is coordinated by ITU, UNECE and UN-Habitat, and supported by fourteen other UN agencies and programmes[1].

The concept of industrial park is being promoted globally to fast-track industrialization, socio-economic development of designated areas and jobs/wealth creation. Bakersville Township, the Proponent, has keyed into the foregoing concept of "Smart City" and intends to embark on a project known as the "Bakersville Smart Industrial City" Project.

The project proposes to have sustainable economic base primarily driven by manufacturing product mix along with institutional and supported by residential and commercial activities. The township proposes to provide trunk infrastructure facilities including supporting social and physical infrastructure to boost the sustainable economy in combination of Solar Plant, etc.

However, this EIA is specifically for township development.
(It should be noted that this is an independent and private project, and doesn't fall under either the Swakopmund or Walvis Bay Local Authorities).

[1] https://unece.org/housing/sustainable-smart-cities

II. Project Justification

Need for the Project

Among other factors, this project is specifically engendered by structural reforms of the Namibian economy and the production spheres that are affected by ever stronger competitive struggle within the constantly changing global market space and the impacts of the global crisis. It is worthy of note that the previous production and industrial structure of economies could not stand; hence this new concept of industrial park development.

The development of this project can be viewed as an integrated solution to development and economic growth. *"Smart Cities"* has proven to be an instrumental tool in ensuring social and economic development in the world. The development of the project will lead to a significant reduction in the need for travel by thousands of people who depend on the surrounding towns like Walvis Bay and Swakopmund for one basic need or the other. Therefore, in this regard, the importance of the project cannot be overemphasized.

In a large and populous region like Erongo with several satellite rural settlements, widely spread across the region, more commercial and social hubs are required to be developed at areas suitable for both business and social development in order to allow for effective development cutting across the region. Therefore, in the overall consideration the need for construction of a Smart City is to meet the demand for sustainable development within and across Erongo Region and provide opportunities for collaboration amongst business operators for public good enhancement.

III. Project Description

The proposed development / project when fully completed phase three, to be completed in 2030s) will be made up of the following components: -

- A smart city with residential apartments of different sizes with uninterrupted power and internet services.
- Commercial area, business district
- Smart Primary/Secondary Schools.
- Recreational area for leisure and sports

The project will provide a range of services for potential tenants and offer a variety of investment and co-operation options to both tenants and investors alike. Numerous structures and facilities as highlighted above have been planned for this development. These will further include access roads, slipway, alternative power source, water supply, fire-fighting station, etc.

IV. Waste Generation and management

Expected waste categories to be generated during the different phases of the project shall include vegetal matter from project site clearing, domestic rubbish/trash, scrap metals, non-plastic combustible and packaging materials, plastic packaging materials, drum and containers, chemical waste hazardous substances and chemicals, waste oil, medical wastes, cement slurries and mix, kitchen waste (organic). The strategies for waste management and treatment have been outlined under the Environmental Management Plan (EMP) of this report.

V. Decommissioning, Rehabilitation and Restoration

This involves the following steps or processes;

- Dismantling of the buildings/ structures and installations.
- Dismantling of building/structure foundations
- Removal of all material from project site.
- Restoration of land to its original situation as much as possible

VI. Description Of the Existing Environment

The baseline information on the bio-physicochemical and socio-economic environment of the proposed project area were based on information from literature as well as findings of a two season field sampling studies, laboratory analyses and a detailed socioeconomic.

- **Climate and Meteorology**

Erongo is the coldest region in Namibia with an average high temperature of only 24°C. Several months of the year it is warm to hot at temperatures continuously above 25 degrees centigrade, sometimes up to 27 degrees. The number of hours of sunshine refers to the time when the sun is actually visible.

- **Ambient Air Quality and Noise Level**

The air quality/noise level result shows that the concentration of key contaminants (SOx, NOx, CO, N2S, VOCS and SPM Temp and Noise level) fall below the regulatory limits for both the dry and wet seasons.

- **Geology/Hydrogeology/Drainage**

The Erongo Region stretches from the Central Plateau westwards across the Central-Western Plains and Escarpment to the Central Namibian coast, roughly over a distance between 200 and 350 km. Northwards the stretches from the Ugab River in the north to the Kuiseb River in the south over a distance of up to 300 km. On the west it is flanked by the Atlantic Ocean.

The Central-Western Plains were largely formed by erosion cutting eastwards into the higher ground, thereby forming the catchment area of several major ephemeral rivers such as the Khan, Omaruru, Swakop and Ugab, which waters would all reach the sea when in full flood during a good rainy season. On its southern border the Kuiseb River, distinctively divides the large sea of dunes to the south and gravel plains to the north. Interestingly, this river does not reach the sea when in flood but the water disappears into the sand at the Kuiseb Delta, from which Walvis Bay extracts underground water supplies

The Brandberg, with its tallest peak Königstein at 2,606 m above sea level, is Namibia's highest mountain It is composed of a single mass of granite that rose through the earth's crust some 120 million years ago. The Brandberg has one of the richest selections of rock paintings, including the

world-famous 'White Lady'. The Damara/Nama name for the mountain is Dâures, which means 'burning mountain', and Otjiherero name, 'Omukuruvaro' means 'mountain of the Gods'.

Just southwest of this mountain is the Messum crater, a flat basin, with a diameter of up to 18 km. Consisting of barren reddish basalt rock, it is the remnant of a huge subterranean volcanic chamber from the time when Africa and South America split during the break-up of Gondwanaland.

- **Vegetation**

The vegetation comprises a few perennial grasses and the succulent Trianthema hereroensis. Hummocks formed by Acanthosicyos horridus occur between these sand dunes and the coast. The dunes move north, driven by prevailing southerly winds, and are brought to an abrupt halt by vegetation of the Kuiseb River.

VII. Legal Requirements

Under section 56 of the Environmental Management Act, 2007 (Act No.7 of 2007), the Minister has made the regulations for Environmental Impact Assessment as set out in the Schedule of Government Notice No. 30 (2012). These regulations require that all projects, plans, programmes and policies that have a detrimental effect on the environment must be accompanied by an EIA. Under section 27 of the Environmental Management Act, 2007 (Act No. 7 of 2007), and after following the consultative process referred to in section 44 of that Act, the Minister lists in the Annexure to the above-mentioned Schedule, activities that may not be undertaken without an environmental clearance certificate (Government Notice No. 29 of 2012).

The most important provisions in terms of guiding this Environmental Assessment process are those contained in the Town Planning, Road and Townships and Division of Land ordinances, the Water Act and the Forestry Act.

The proposed project will have an impact on sensitive aspects of the receiving environment, both biophysical and socio-economic. Key environmental sensitivities include those pertaining to vegetation and service provision.

VIII. Public Consultation

Public participation was carried out in accordance with the EIA Regulations. Various I&APs were identified and their input solicited. Online media plays a very important role in communicating with the broader community. Thus, an online advert was placed on the Consultancy page to solicit engagement with potential interested parties.

IX. Impact Assessment

The issues identified by the EAP are assessed using a range of assessment criteria. The application of these criteria involves a balanced consideration of duration, extent, and intensity/magnitude, modified by probability, cumulative effects, and confidence in order to determine significance. Mitigation measures are outlined for each impact.

- **Identification of Impacts and Activities Interactions**

Details of the development's construction, operations and decommissioning activities that could engender environmental impacts are as follows:

- Site preparation (land clearing/creation of access road and camping)
- Mobilization of construction elements
- Recruitment and community engagement Onsite fabrication (metal works, etc.)
- Building/other structures foundation.
- Building/other structures erection activities Waste management
- Fuel/hazardous material handling Painting and coating
- Fire/explosion (unplanned activity)
- Incident/Accidents (Unplanned activity e.g., building/other installation collapse)
- Commissioning
- Facilities operation/maintenance Facilities element replacement
- Decommissioning-Abandonment/Restoration

- **Mitigations**

Mitigation details for the development's construction, operations and decommissioning activities that shall help ameliorate environmental impacts are as follows:

1. Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed
2. Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities and implement resettlement action plan for project affected persons.
3. All vehicles are certified road / water worthy prior to being mobilized for work activities.
4. Creating requirements for contractors to hire local labour and ensure skill acquisition and development.
5. Project will develop a health plan to address potential health issues
6. Ensure inclusion of threatened and endangered species management strategies in the site-specific Environmental Management Plan to be developed by contractors to ensure appropriate flora and fauna management.
7. Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact.
8. Develop project specific waste management plan and ensure proper implementation.
9. Develop standard work procedures where work hazards are identified and addressed.
10. Enforce good environmental demobilization procedures (e.g., cleaning sites and restoring to original status).

11. Environmental Management Plan (EMP)

EMP is an important management tool which sets out conditions and targets to be met during project implementation. It is developed to ensure that the mitigation measures, monitoring requirements and any environmental compliance review shall actually be carried out in subsequent stages of the project.

The overall objective of (performance) monitoring shall be to identify any unanticipated changes to the biophysical, health and social environment brought about by the Project Baseline information against which development and post development impacts and mitigation measures can be measured and compared has been established.

12. Conclusion

The proposed Project is capable of achieving its goal of growing Namibian economy in an environmentally sustainable manner if the recommendations made in this report are implemented methodically with due diligence.

An Environmental Management Plan (EMP) covering the biophysical and socio-economic aspects of the project was developed in order to ensure that mitigation measures would be established and maintained throughout the life cycle of the project and consultation with the host communities is expected to be a continuous process. Mitigation measures were based on best available technology, safety, health and environmental considerations.

1. BACKGROUND

1.1. GENERAL

The concept of smart cities is being promoted globally to fast-track industrialization, socio-economic development of designated areas and jobs/wealth creation. Bakersville Township CC has keyed into the foregoing concept of the United for Smart Sustainable Cities (U4SSC) and intends to embark on a project known as the Integrated Industrial Township & Related Infrastructure titled "Bakersville Smart Industrial City", Situated in Registration Division G, Erongo Region, Namibia.

It is in view of the above, that Bakersville Township Development, the Proponent, engaged the services of Messr: Centre for Impact Evaluation and Research Design (C4IERD) - an Environmental Management consulting company duly registered and accredited in Namibia to carry out a comprehensive Environmental Impact Assessment (EIA) report for the project in view before the actual commencement of the project. The development has been planned to accommodate industrial concerns in various sectors of the economy. The development is conceived as a private entity owned by Bakersville Township Development CC that will comply with national regulations with full presence of relevant governmental authorities. It is expected to provide most modern and secured infrastructural facilities that will facilitate the attraction of economic activities to the area while bearing in mind the challenges facing the state and the country at large especially in the area of security.

The proponent took the decision to embark in the development of the smart city / township to among other things contribute to the attainment of the following:

- Provide an alternative, world class industrial estate devoid of familiar infrastructural challenges
- Contribute in the decongestion efforts of the existing nearby towns of Swakopmund, Walvis Bay, etc. thereby easing traffic and reduction in man-hour losses.
- Provide an opportunity by which similar industries can benefit from sharing of expertise and technology.
- Stimulation of further industrial growth in the Erongo Region and Namibia in general as well as creation of jobs opportunities.

The proposed development would involve the construction/ installation of the below mentioned components. These components will be in phases:

- Service road around the township to provide easy movement opportunities;
- Modern utility services including telecommunication, potable water, centralized waste collection and disposal;

The successful completion of these activities would require careful planning and management in the part of the proponent. The construction and installation of the above facilities would inevitably lead to some form of interactions between elements of the project activities and the environment, leading to either positive or negative impacts.

Statutorily, it is required in Namibia that projects of this nature are assessed as to their environmental impact. The Environmental Management Act 7 of 2007 (GG 3966) brought into force on 6 February 2012 by GN 28/2012 (GG 4878) seeks to:

- To promote the sustainable management of the environment and the use of natural resources by establishing principles for decision making on matters affecting the environment;
- to establish the Sustainable Development Advisory Council;
- to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

By this Act, for development/activity of this magnitude, consideration of its environmental consequences in the form of an environmental impact assessment is mandatory prior to project execution. This EIA has been carried in compliance with national statutes. Thus, the purpose of this document is to present the findings of the EIA carried out to identify and analyze the potential environmental impacts, both negative and positive, and develop a comprehensive Environmental Management plan for the proposed park.

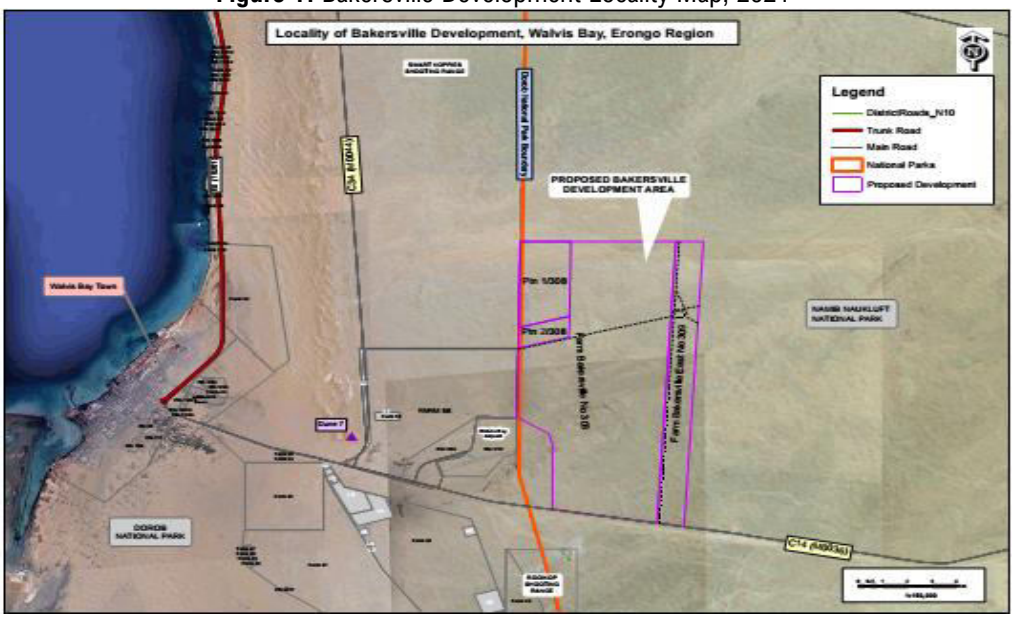
1.2. The Proponent

Bakersville Township Development CC (BTD), the proponent of the proposed project is a reputable indigenous Company legally registered in Namibia. The development of the proposed development is part of the strategic diversification plan of BTD into other vital economic areas. The development would be managed by BTD in such a manner to attract and offer unique investments and opportunities.

1.3. Project Location

The proposed project would be located at Farm 308 (7,280) hectares and 309 (1,493) hectares, totalling 8,773 Hectares. The solar plant to be on Farm 308 (a separate EIA shall be carried out). Separate card pt1 of Farm Bakersville 308 (786) hectares was created mainly for fast take-off on mix development, and potion 2 of Farm Bakersville 308 (201) hectare is reserved for proposed oil refinery, whilst Farm 309 mainly Agricultural purposes.

Figure 1: Bakersville Development Locality Map, 2021

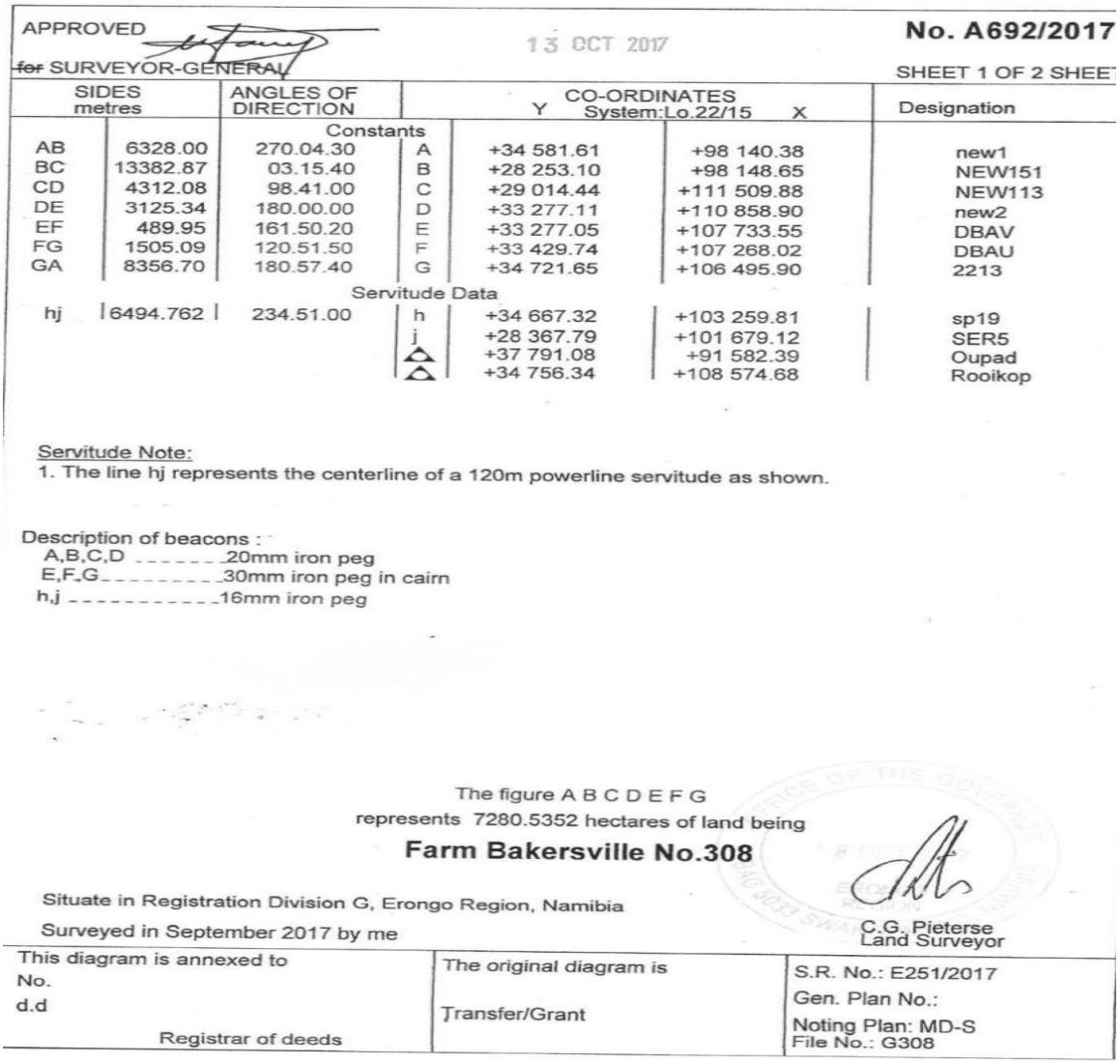


The proposed township establishments and layout at Farm Bakersville 308 & 309 are an indication of various developments planned for Erongo / Coastal Region. Township Establishment is one of a suite of the town planning instruments used for future spatial planning. In particular Township Establishment is a large-scale form of subdivision of land for urban use.

The proposed location offers easy access to the Walvis Bay Airport, C14 Road which links Walvis Bay town and Windhoek, thus, providing great logistical opportunities and neighbouring towns like Swakopmund, Arandis and Henties Bay, as well as delivery of imported raw materials.

The project expected lifespan is estimated at 30 years.

Figure 2: ABCDEFG represents 7280.5352 hectares of land, Coordinates, Angles of Direction, Side Meters for Farm Bakersville No. 308



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for SURVEYOR-GENERAL

13 OCT 2017

No. A692/2017

SHEET 1 OF 2 SHEET

SIDES metres		ANGLES OF DIRECTION		CO-ORDINATES Y System:Lo.22/15	X	Designation
		Constants				
AB	6328.00	270.04.30	A	+34 581.61	+98 140.38	new1
BC	13382.87	03.15.40	B	+28 253.10	+98 148.65	NEW151
CD	4312.08	98.41.00	C	+29 014.44	+111 509.88	NEW113
DE	3125.34	180.00.00	D	+33 277.11	+110 858.90	new2
EF	489.95	161.50.20	E	+33 277.05	+107 733.55	DBAV
FG	1505.09	120.51.50	F	+33 429.74	+107 268.02	DBAU
GA	8356.70	180.57.40	G	+34 721.65	+106 495.90	2213
		Servitude Data				
hj	6494.762	234.51.00	h	+34 667.32	+103 259.81	sp19
			j	+28 367.79	+101 679.12	SER5
			△	+37 791.08	+91 582.39	Oupad
			△	+34 756.34	+108 574.68	Rooikop

Servitude Note:
1. The line hj represents the centerline of a 120m powerline servitude as shown.

Description of beacons :
A,B,C,D _____ 20mm iron peg
E,F,G_____ 30mm iron peg in cairn
h,j _____ 16mm iron peg

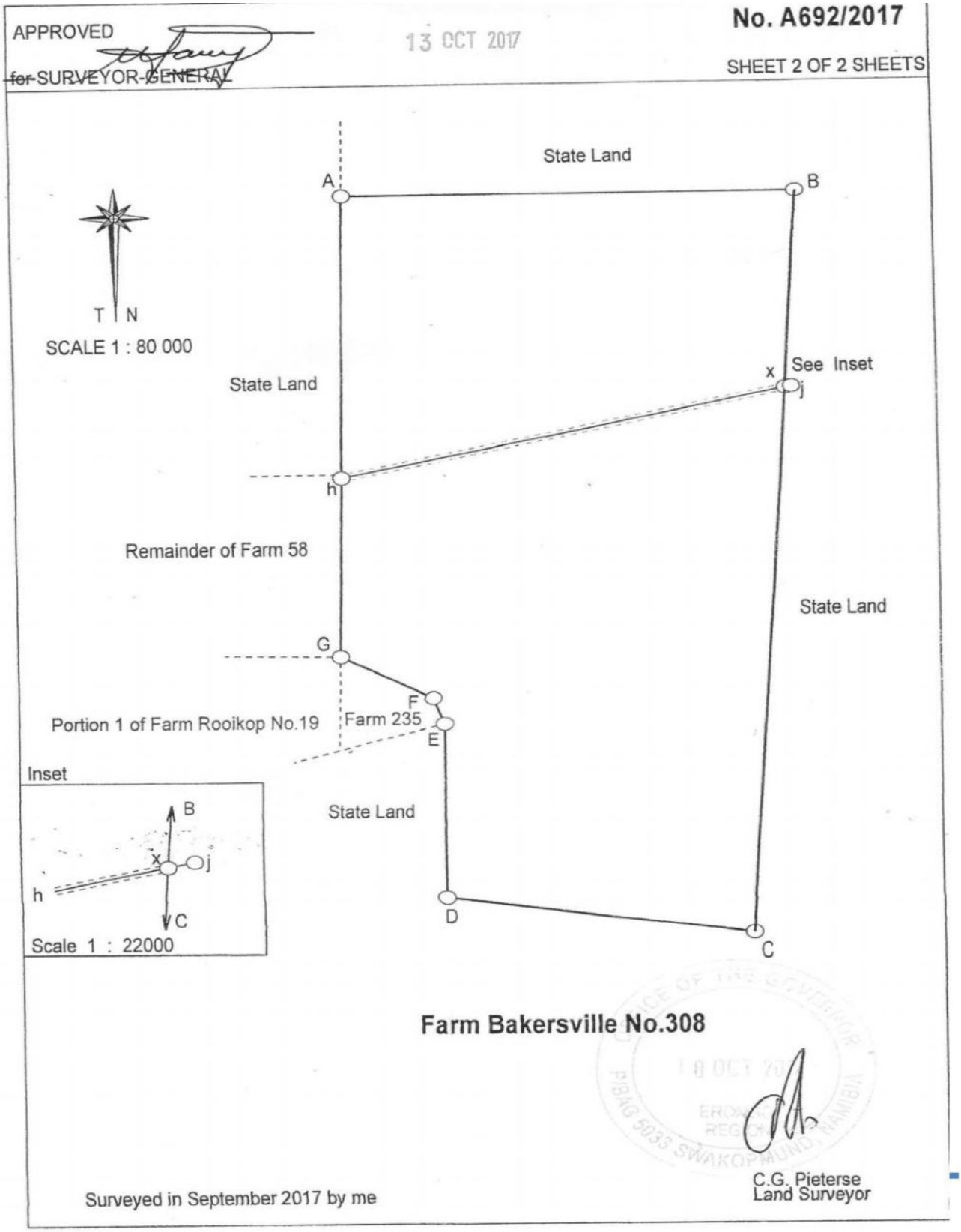
The figure A B C D E F G
represents 7280.5352 hectares of land being
Farm Bakersville No.308

Situate in Registration Division G, Erongo Region, Namibia

Surveyed in September 2017 by me

C.G. Pieterse
Land Surveyor

This diagram is annexed to No. d.d Registrar of deeds	The original diagram is Transfer/Grant	S.R. No.: E251/2017 Gen. Plan No.: Noting Plan: MD-S File No.: G308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for SURVEYOR-GENERAL
13 OCT 2017
No. A692/2017
SHEET 2 OF 2 SHEETS
State Land
A
B
T N
SCALE 1 : 80 000
State Land
x
See Inset
j
h
Remainder of Farm 58
State Land
G
F
Portion 1 of Farm Rooikop No.19
Farm 235
E
Inset
B
x
j
h
C
Scale 1 : 22000
State Land
D
C
Farm Bakersville No.308
18 OCT 2017
P BAG 5033 SWAKOPMUND, NAMIBIA
C.G. Pieterse
Land Surveyor
Surveyed in September 2017 by me

Figure 3: Farm Bakersville No. 308 Layout Plan from the Land Surveyor, 2017

APPROVED 13 OCT 2017 **No. A695/2017**

for SURVEYOR-GENERAL SHEET 1 OF 2 SHEETS

SIDES metres		ANGLES OF DIRECTION		CO-ORDINATES Y System:Lo.22/15	X	Designation
		Constants				
AB	1119.80	270.04.20	A	+28 253.10	+98 148.65	NEW151
BC	13549.55	03.20.20	B	+27 133.31	+98 150.08	NEW161
CD	1104.81	98.41.00	C	+27 922.30	+111 676.66	NEW111
DA	13382.87	183.15.40	D	+29 014.44	+111 509.88	NEW113
		Servitude Data				
ef	13399.59	3.23.20	e	+28 123.06	+98 148.74	NEW141
			f	+28 915.18	+111 525.00	NEW112
gh	1068.64	258.02.10	g	+28 357.07	+101 429.54	PEG4
			h	+27 311.66	+101 208.00	NEW162
jk	45.25	282.11.00	j	+27 929.43	+101 687.30	SER9
kl	619.64	301.55.20	k	+27 885.20	+101 696.84	SER8
			l	+27 359.28	+102 024.51	NEW163
km	158.59	215.51.50	k	+27 885.20	+101 696.84	SER8
mn	1124.44	158.15.40	m	+27 798.15	+101 576.43	SER7
			n	+28 214.62	+100 531.97	SER11
gp	439.00	275.01.30	g	+28 357.07	+101 429.54	PEG4
pq	301.54	2.31.10	p	+27 919.77	+101 468.00	PEG6
qr	438.25	93.02.10	q	+27 933.03	+101 769.24	PEG1
rg	316.78	182.27.30	r	+28 370.72	+101 746.02	PEG2
			△	+37 791.08	+91 582.39	Oupad
			△	+34 756.34	+108 574.68	Rooikop

Servitude Note:

1. The line ef represents the centerline of a 180m wide powerline servitude as shown
2. The line gh represents the centerline of a 60m wide powerline servitude as shown
3. The line jkl represents the centerline of a 60m wide powerline servitude as shown
4. The line jkmn represents the centerline of a 60m wide powerline servitude as shown
5. The figure gpqr represents 13.5537 hectares of land being a powerline servitude area as shown

The figure A B C D
represents 1493.3742 hectares of land being

Farm Bakersville East No.309

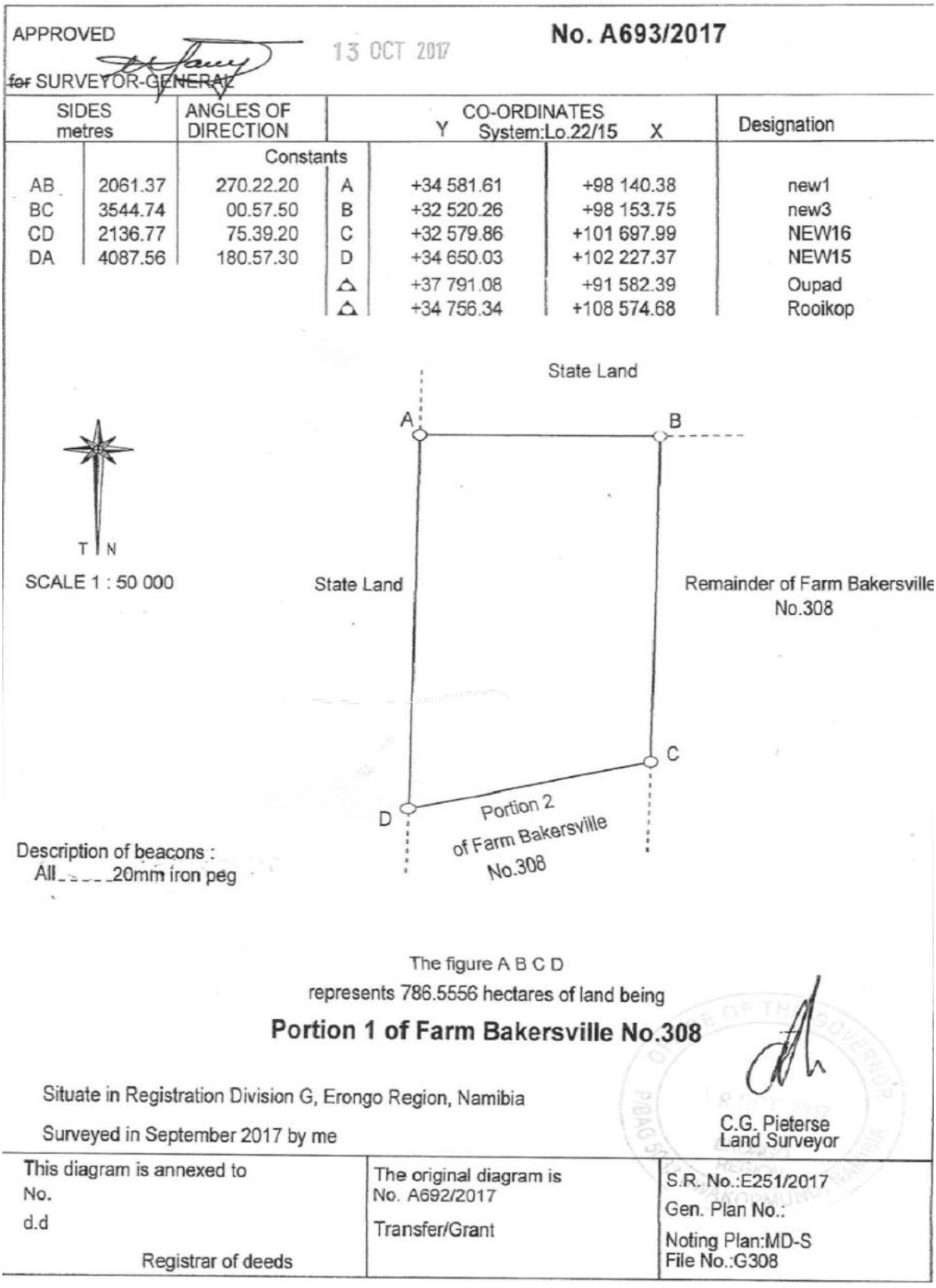
Situate in Registration Division G, Erongo Region, Namibia

Surveyed in September 2017 by me

C.G. Pieterse
Land Surveyor

This diagram is annexed to No. d.d Registrar of deeds	The original diagram is Transfer/Grant	S.R. No.:E251/2017 Gen. Plan No.: Noting Plan:MD-S File No.:G309

Figure 4: Figure 4: ABCD represents 1493.3742 hectares of land, Coordinates, Angles of Direction, and Side Meters for Farm Bakersville No. 309



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for SURVEYOR-GENERAL
13 OCT 2017

No. A693/2017

SIDES metres		ANGLES OF DIRECTION		CO-ORDINATES Y System:Lo.22/15 X		Designation
		Constants				
AB	2061.37	270.22.20	A	+34 581.61	+98 140.38	new1
BC	3544.74	00.57.50	B	+32 520.26	+98 153.75	new3
CD	2136.77	75.39.20	C	+32 579.86	+101 697.99	NEW16
DA	4087.56	180.57.30	D	+34 650.03	+102 227.37	NEW15
			△	+37 791.08	+91 582.39	Oupad
			△	+34 756.34	+108 574.68	Rooikop

Description of beacons :
All ____20mm iron peg

The figure A B C D
represents 786.5556 hectares of land being

Portion 1 of Farm Bakersville No.308

Situate in Registration Division G, Erongo Region, Namibia

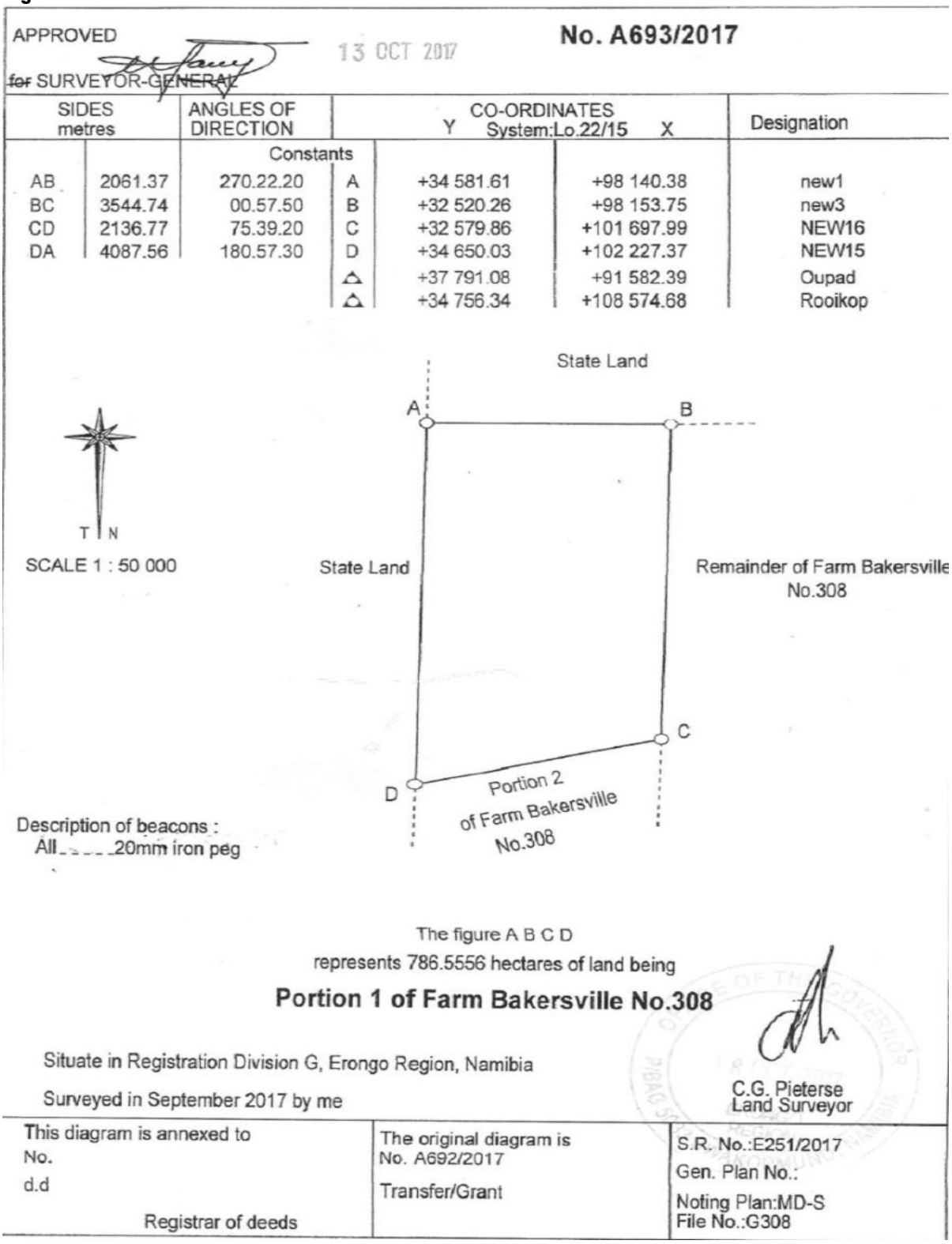
Surveyed in September 2017 by me

C.G. Pieterse
Land Surveyor

This diagram is annexed to No. d.d Registrar of deeds	The original diagram is No. A692/2017 Transfer/Grant	S.R. No.:E251/2017 Gen. Plan No.: Noting Plan:MD-S File No.:G308

Figure 5: Farm Bakersville No. 309 Layout Plan from the Land Surveyor, September 2017

Figure 5: Portion 1 of Farm Bakersville No. 308



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for SURVEYOR-GENERAL

13 OCT 2017

No. A693/2017

SIDES	metres	ANGLES OF DIRECTION		CO-ORDINATES Y System:Lo.22/15	X	Designation
		Constants				
AB	2061.37	270.22.20	A	+34 581.61	+98 140.38	new1
BC	3544.74	00.57.50	B	+32 520.26	+98 153.75	new3
CD	2136.77	75.39.20	C	+32 579.86	+101 697.99	NEW16
DA	4087.56	180.57.30	D	+34 650.03	+102 227.37	NEW15
			△	+37 791.08	+91 582.39	Oupad
			△	+34 756.34	+108 574.68	Rooikop

Description of beacons :
All ... 20mm iron peg

The figure A B C D
represents 786.5556 hectares of land being

Portion 1 of Farm Bakersville No.308

Situate in Registration Division G, Erongo Region, Namibia

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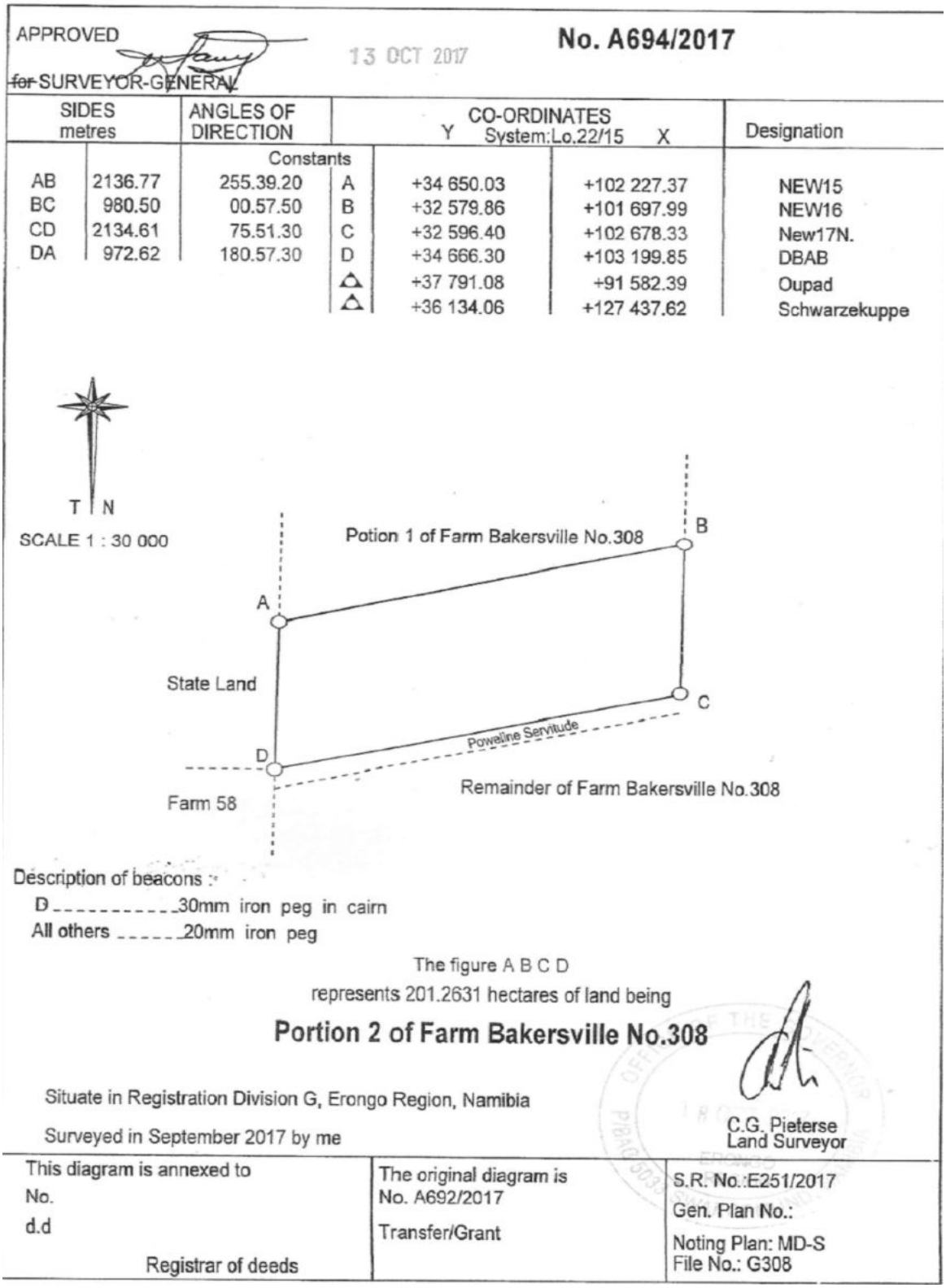
Figure 6: Portion 2 of Farm Bakersville No. 308



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for SURVEYOR-GENERAL
13 OCT 2017

No. A694/2017

SIDES metres		ANGLES OF DIRECTION		CO-ORDINATES Y System:Lo.22/15	X	Designation
		Constants				
AB	2136.77	255.39.20	A	+34 650.03	+102 227.37	NEW15
BC	980.50	00.57.50	B	+32 579.86	+101 697.99	NEW16
CD	2134.61	75.51.30	C	+32 596.40	+102 678.33	New17N.
DA	972.62	180.57.30	D	+34 666.30	+103 199.85	DBAB
			△	+37 791.08	+91 582.39	Oupad
			△	+36 134.06	+127 437.62	Schwarzekuppe

T N

SCALE 1 : 30 000

Potion 1 of Farm Bakersville No.308

A

B

State Land

C

Poweline Servitude

D

Farm 58

Remainder of Farm Bakersville No.308

Description of beacons :-
D _____ 30mm iron peg in cairn
All others _____ 20mm iron peg

The figure A B C D
represents 201.2631 hectares of land being

Portion 2 of Farm Bakersville No.308

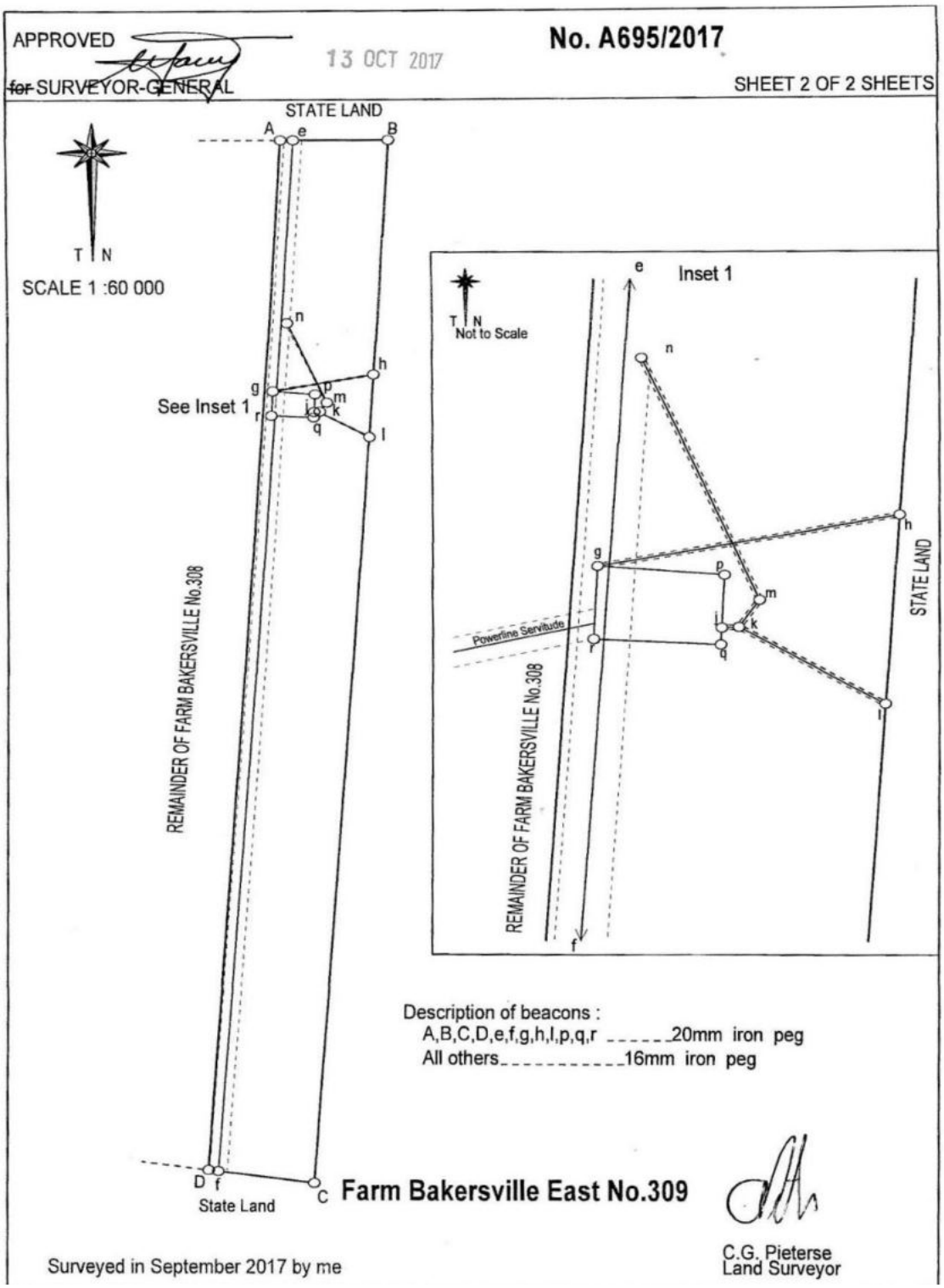
Situate in Registration Division G, Erongo Region, Namibia

Surveyed in September 2017 by me

C.G. Pieterse
Land Surveyor

This diagram is annexed to No. d.d Registrar of deeds	The original diagram is No. A692/2017 Transfer/Grant	S.R. No.:E251/2017 Gen. Plan No.: Noting Plan: MD-S File No.: G308

Figure 7: Figure 8: Descriptions of Beacons Farm Bakersville East No. 309,



1.4. EIA Terms of Reference

Terms of Reference (ToR) for the project have been developed in line with the Environmental Management Act 7 of 2007and its Regulations. The ToR contained the following:

- scope of work for the EIA including the overall data requirements on the proposed development;
- environmental regulations guiding the project;
- methods and procedures for adequate ecological and socioeconomic data gathering, identification, prediction and evaluation of associated/potential impacts of the project as well as impact mitigation/control measures;
- minimum requirements of an effective Environmental and Social Management Plan (ESMP);
- Establishing basis for consultation with stakeholders and regulatory authorities.

1.5. EIA Objectives

The main purpose of this EIA is to establish a baseline of existing conditions in the project area and to assess proactively the potential impact associated impacts, including health, socio-economic and gender issues of the proposed construction and operation of the roads on the environment. It aims at ensuring sustainable development (i.e., the minimization of negative impacts) during project conception and implementation through the conduct of baseline pre-impact studies of the environment, systematic identification and evaluation of the potential impacts of proposed projects, plans, programme or legislative actions and mitigating negative impacts from the project as well as monitoring the environment during and after the project. The main specific objectives of the EIA are to:

- Establish the existing biological, physical, Socio-Economic and health conditions of the project area;
- Characterize the environment, thereby identifying the resultant hazards (including social) associated with the project;
- Identify, evaluate and predict the impacts of the project on the environment including socio-economic and health aspects with adequate interfacing and project interaction;
- Make recommendations to eliminate/mitigate/control the magnitude and significance of the impacts;
- Ensure proper consultation with the host communities around the proposed project site;
- Development of an Environmental Management Plan (EMP) that will ensure environmental sustainability throughout the project life-span.

1.6. EIA Methodology

The EIA methodology adopted for this project involved the following:

1.6.1. Literature Review

Desktop studies were undertaken to acquire an environmental database required for the EIA studies. The literature search included information from previous EIA studies approved by the Directorate of Environmental Affairs – Ministry of Environment, Forestry and Tourism (MEFT) around the project area.

1.6.2. Consultation

Consultations with the relevant stakeholders is key in every EIA study. These aspects of the EIA have been carried out and are still ongoing at various levels. C4IERD has carried out consultation with relevant stakeholders. Stakeholders' views and opinions concerning the proposed project and its associated/ potential impacts have been integrated into the EIA process. However, consultations will continue throughout the project lifespan and issues and concerns raised by all Project Affected Persons (PAPs) / Interested and Affected Parties (IAPs) will be considered. The results of all concluded consultations are included as bases for potential impact assessment and as such have been clearly documented in this EIA report.

1.6.3. Field Research

Field research was undertaken so as to complement/verify or otherwise information gathered from desktop studies. Specific information on the was gathered during fieldwork execution. In particular, the survey covered the following environmental components:

- the physical environment – water and sediment characteristics, soil characteristics, air quality, noise and potential natural hazards;
- the biological environment – water, sediment, and soil microbiology, benthos, plankton, flora and fauna (particularly rare and endangered species);
- the socio-economic and cultural environment - population, land use and patterns of land ownership and tenure, community structure, employment, distribution, public health, cultural heritage, customs, aspirations and attitudes, etc.

1.6.4. Potential and Associated Impact Assessment

Identification and evaluation of the associated/potential impacts of the proposed project are based on appropriate standards and acceptable environmental assessment tools such as the ISO 14001 approach and the Hazard and Effect Management Process (HEMP). The Risk Assessment Matrix (RAM) has been employed in determining risks posed by the identified potential/associated impacts of the project in order to proffer appropriate mitigation measures. In predicting impacts, the experiential/practical 'worst case scenario' approach has been applied to determine the extreme effects of project activities on environmental components, while 'consensus of opinions' has been made use of to determine the importance of affected environmental components. The impact evaluation results from the pedestal for developing the EMP of the proposed project.

1.6.5. Regulatory Framework

As desirable and necessary as it is, development can become an albatross (not of itself though) if there is a dearth of appropriate policies to guide it. Unguided urbanization and industrialization can lead to desertification culminating in ruin and wreckage of the environment. Most projects on a large scale will trigger some policies both on national and international level. In Namibia, the power to enforce all activities that might impact on the environment is vested in the Ministry of Environment, Forestry and Tourism (MEFT), while international; agencies such as the World Bank, AfDB and other financial organizations have environmental criteria which must be obliged before the agencies invest in the project.

The pursuit of sustainability, with respect to any development, is guided by a sound legislative and policy framework. The regulatory framework review serves to inform the Developer of the requirements and expectations, as laid out in terms of these instruments, to be fulfilled before the proposed project may commence. The findings of the abovementioned review are summarised below.

Figure 8: Namibian Legislation relevant to the project

LEGISLATION/ GUIDELINE	RELEVANT PROVISIONS	IMPLICATIONS FOR THIS PROJECT
Namibian Constitution First Amendment Act 34 of 1998	"The State shall actively promote… 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" (Article 95(l)).	Ecological sustainability should inform and guide this EA and the proposed development.
Environmental Management Act EMA (No 7 of 2007)	▪ Requires that projects with significant environmental impact are subject to an environmental assessment process (Section 27). ▪ Details principles which are to guide all EAs.	The EMA and its regulations should inform and guide this EA process.
Environmental Impact Assessment (EIA) Regulations GN 28-30 (GG 4878)	▪ Details requirements for public consultation within a given environmental assessment process (GN 30 S21). ▪ Details the requirements for what should be included in a Scoping Report (GN 30 S8) and an Assessment Report (GN 30 S15).	
Forestry Act 12 of 2001 Nature Conservation Ordinance 4 of 1975	▪ Prohibits the removal of any vegetation within 100 m from a watercourse (Forestry Act S22(1)). ▪ Prohibits the removal of and transport of various protected plant species.	Even though the Directorate of Forestry has no jurisdiction within townlands, these provisions will be used as a guideline for conservation of vegetation.
Labour Act 11 of 2007	Details requirements regarding minimum wage and working conditions (S39-47).	The Walvis Bay Municipality and Bakersville Township Development should ensure that all contractors involved during the construction, operation and maintenance of the proposed project comply with the provisions of these legal instruments.
Health and Safety Regulations GN 156/1997 (GG 1617)	Details various requirements regarding health and safety of labourers.	
Public Health Act 36 of 1919	Section 119 states that "no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health."	

LEGISLATION/ GUIDELINE	RELEVANT PROVISIONS	IMPLICATIONS FOR THIS PROJECT
National Heritage Act 27 of 2004	Section 48(1) states that "A person may apply to the [National Heritage] Council [NHC] for a permit to carry out works or activities in relation to a protected place or protected object".	Any heritage resources (e.g. human remains etc.) discovered during construction requires a permit from the NHC for relocation.
Burial Place Ordinance 27 of 1966	Prohibits the desecration or disturbance of graves and regulates how bodies may be unearthed or dug up.	Regulates the exhumation of graves.
Water Act 54 of 1956	The Water Resources Management Act 24 of 2004 is presently without regulations; therefore, the Water Act No 54 of 1956 is still in force: ▪ Prohibits the pollution of underground and surface water bodies (S23(1)). ▪ Liability of clean-up costs after closure/ abandonment of an activity (S23(2)).	The protection of ground and surface water resources should be a priority. The main threats will most likely be concrete and hydrocarbon spills during construction and hydrocarbon spills during operation and maintenance.
Town Planning Ordinance 18 of 1954	Subdivision of land situated in any area to which an approved Town Planning Scheme applies must be consistent with that scheme (S31).	The proposed use of the project site must be consistent with the Karibib Town Planning Scheme (2012).
Townships and Division of Land Ordinance 11 of 1963	Details the functions of the Township Board including what they consider when receiving an application for Township Establishment (S3).	The proposed layout and land uses should be informed by environmental factors such as water supply, soil etc. as laid out in Section 3.
Road Ordinance 1972 (Ordinance 17 0f 1972)	▪ Width of proclaimed roads and road reserve boundaries (S3.1) ▪ Control of traffic on urban trunk and main roads (S27.1) ▪ Rails, tracks, bridges, wires, cables, subways or culverts across or under proclaimed roads (S36.1) ▪ Infringements and obstructions on and interference with proclaimed roads. (S37.1) ▪ Distance from proclaimed roads at which fences are erected (S38)	The limitations applicable on RA proclaimed roads should inform the proposed layout and zonings where applicable.

– International Guidelines and Conventions

In addition to the national laws/ regulations supporting the use of EIA as an environmental management tool, Namibia is also signatory or party to several international conventions and treaties that support the use of standard environmental management tools/ measures for achieving sustainable development. Some of these include:

Figure 9: International Guidelines and Conventions

African Convention on the Conservation of Nature and Natural Resources	African Convention on the Conservation of Nature and Natural Resources Adopted on the 15th of September 1968 in Algiers, Algeria, the African Convention entered into force on the 9th of October 1969. Its objectives are "to encourage individual and joint action for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind, from an economic, nutritional, scientific, educational, cultural and aesthetic point of view." It commits signatory parties (the Parties) to adopting "measures necessary to ensure conservation, utilization and development of soil, water, floral and faunal resources in accordance with scientific principles and with due regard to the best interests of the people." The Parties (Namibia inclusive) agree to use resources wisely, to manage populations and habitats, to control hunting, capture and fishing, and to prohibit the use of poisons, explosives and automatic weapons in hunting. They also agree to prevent and control water pollution, establish conservation areas and consider ecological factors in development plans (www.unep.ch/regionalseas/legal/afr.htm).
United Nations Guiding Principles on the Human Environment	Ever since it was formed, the United Nations (UN) has been concerned about negative environmental trends. Thus, at the UN Conference on Human Environment held in Stockholm in 1972, conservation of biological diversity was identified as a priority. The guiding principles established in that convention are formal declarations that express the basis upon which an environmental policy can be built and which provides a foundation for action. Some of the principles include: **Principle 2** The natural resource of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate. **Principle 4** Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperiled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development. **Principle 8** Economic and social development are essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.
World Heritage Convention	In 1972, the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized the need to identify and permanently protect the world's special areas and adopted the World Heritage Convention. Founded on the principle of international cooperation, the Convention provides for the protection of the world's cultural and natural heritage places. It came into force in 1975 after being initially ratified by 20 countries. (www.wettropics.gov.au)

The Ramsar Convention	The convention was developed and adopted by participating nations at a meeting in Ramsar on February 2, 1971, and came into force on December 21, 1975. The Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, that is, to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.
Vienna Convention for the Protection of the Ozone Layer	This convention held in 1985 places general obligations on countries to take appropriate measures to protect human health and the environment against adverse effects resulting from human activities which tend to modify the ozone layer.
World Bank Operational Manual	The World Bank Operational Directive 4.01: ''Environmental Assessment'' of 1989. This manual is designed as a tool to ensure that projects proposed for World Bank financing are environmentally sound, improve project performance and enhance their overall quality and sustainability. It does so by providing the rules and procedures that allow borrower decision makers and Bank operational staff the flexibility to ensure that the project options under consideration are environmentally sound and sustainable.
World Bank Environmental Assessment Sourcebook	The World Bank has provided in its Environmental Assessment Sourcebook, Guidelines for Urban Development. The guidelines are to ensure sustainable urban growth
Convention on Biological Diversity	This convention is the most important of all the international agreements on biodiversity. Negotiated under the auspices of United Nations Environment Programme (UNEP), the Biodiversity Convention was opened for signature in June 1992 at the 'Earth Summit' held in Rio de Janeiro, Brazil, and entered into force in December 1993. It is the first global agreement to cover all aspects of biological diversity: the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the use of genetic resources.
United Nations Framework Convention on Climate Change	The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys universal membership with 193 countries having ratified. Under the Convention (entered into force on 21 March 1994), governments: – gather and share information on greenhouse gas emissions, national policies and best practices; – launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; – cooperate in preparing for adaptation to the impacts of climate change. (http://unfccc.int)
The Copenhagen Accord	This Accord reached by some Heads of State, Heads of Government, Ministers and other heads of delegation at the United Nations Climate Change Conference 2009 in Copenhagen, Denmark recommends that deep cuts in global greenhouse gas emission be made. It also underlined the need to pursue various approaches, including opportunities to use markets, to enhance the cost-effectiveness of, and to promote mitigation actions.
IFC Environment, Health and Safety Guidelines	The IFC and the World Bank Group have developed a set of Sectoral Environment, Health and Safety (EHS) Guidelines specific to particular industries sectors or types of projects. The guidelines provide minimum limits, measures etc. required for each industry or sector.

Equator Principles	The Equator Principles (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk. Equator Principles Financial Institutions (EPFI) provides loans only for projects that conform to the principles (en.wikipedia.org). Two principles specific to environmental assessment and environmental standards are: **Principle 2: Social and Environmental Assessment** For all medium or high-risk projects, sponsors complete an Environmental Assessment, the preparation of which must meet certain requirements and satisfactorily address key environmental and social issues. **Principle 3: Applicable Social and Environmental Standards** The Environmental Assessment report addresses baseline environmental and social conditions, requirements under host country laws and regulations, applicable international treaties and agreements, sustainable development and use of renewable natural resources, protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems, use of dangerous substances, major hazards, occupational health and safety, fire prevention and life safety, socio- economic impacts, land acquisition and land use, involuntary resettlement, impacts on indigenous peoples and communities, cumulative impacts of existing projects, the proposed project, and anticipated future projects, participation of affected parties in the design, review and implementation of the project, consideration of feasible environmentally and socially preferable alternatives, efficient production, delivery and use of energy, pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.

1.7 EIA Report Structure

This EIA report is presented in eight chapters preceded by an executive summary.

- **Chapter one** contains the introductory part: project background, and outlines the objectives, scope and EIA methodology, and legal framework / data sources.
- **Chapter two** discusses the project setting, and presents the need / benefits, sustainability as well as the project alternatives and options.
- **Chapter three** describes the technical elements, components and processes of the proposed Industrial Park activities from design through construction and operation as well as scheduling.
- **Chapter four** describes the existing ecological (climatic, bio-physical and biological) and Socio-economic baseline condition of the area.
- **Chapter five** describes the associated and potential environmental, social and health impacts of the proposed project on the environment.
- **Chapter six** documents the mitigation measures accrued to the identified potential and associated impacts of the project on the environment.
- **Chapter seven** presents the environmental management plan to be adopted throughout the project life cycle. It also recommends the environmental monitoring program and the waste management plan.
- **Chapter eight** summarizes and concludes on the study findings, making appropriate recommendations.

2. CHAPTER TWO

2.1. Project Justification

General

Bakersville Township Development CC (BTD) decided to key into the new concept of the fourth industrial revolution era and the United Nations Sustainable Development Goal number nine by establishing the "Bakersville Smart Industrial City" Project to take advantage of proximity to Walvis Bay and Swakopmund towns / municipalities, proximity to Namport and Walvis Bay Airport, etc to rejuvenate industrial and socioeconomic activities within this naturally established smart city / township.

2.2. Need for the Project.

Integrated Industrial Township is one of the modern phenomena adopted according to the speed with which more and more business entities, cities, municipalities and regions in the world are growing. Following the complex changes of the macroeconomic environment, cities across the globe have been getting gradually to the discovery of industrial parks. Among other factors, this development is specifically engendered by structural reforms of the economy and the production spheres that are affected by ever stronger competitive struggle within the constantly changing global market space and the impacts of the global crisis. It is worthy of note that the previous production and industrial structure of economies could not stand; hence this new concept of industrial township development.

The development of Industrial township can be viewed as an integrated solution development and economic growth. Industrial township has proven to be an instrumental tool in ensuring social and economic development in the world. The development will lead to a significant reduction in the need for travel by thousands of people who depend on the surrounding towns like Walvis Bay and Swakopmund, and as far as Windhoek for one basic need or the other. Therefore, in this regard, the importance of the proposed industrial township cannot be overemphasized.

In a large and populous state such as Erongo Region with several satellite rural settlements, widely spread across the region, more commercial and social hubs are required to be developed at areas suitable for both business and social development in order to allow for effective development cutting across the region. Therefore, in the overall consideration the need for construction of an Industrial township at Farm 307 in Registration Division G, Erongo Region is to meet the demand for sustainable development within and across the Erongo Region and beyond and provide opportunities for collaboration amongst business operators for public good enhancement.

2.3. Value/Benefit of the Project

The benefits derivable from the proposed development include but not limited to the following;

- Improved electricity supply (solar) at lower system cost within the project area.
- Increase economic growth by enhancing the growth of small and medium scale industries.
- Create job opportunities for the Namibian citizens
- Attract foreign direct Investments to Namibia

- Serve as a major source of economic diversification from the mining and fishing sector for Namibia.
- Provide opportunities for tourism attraction (tours) for Erongo Region and Namibia by extension.

2.4. Envisaged Sustainability

2.4.1. Economic Sustainability

The natural and ever-increasing desire for private and corporate business growth in the country by business owners will sustain the need and value of the proposed project. Given the increasing population and the tendency for settlement within the project area, it is envisaged that major nodal centers for social and economic activity will develop within the project area and its environs over time as observed in the case of another existing industrial township. Secondly, the proposed industrial township will operate under uninterrupted electricity power supply from the proposed Solar Plant (separate EIA to be carried out separately). This will guarantee continuous operation of the businesses and activities under this industrial township development which would therefore economically sustain the project.

2.4.2. Technical Sustainability

The proposed project would be technically sustainable in view of the proven technologies to be adopted which will be in compliance with strict adherence to international and national engineering design, construction standards and codes of practices at all stages of the development.

2.4.3. Environmental Sustainability

This project would have some potential negative impacts on the environment. It is the policy of BTD to conduct EIAs for its entire major developmental project in accordance with the national guideline. The EIA will identify all potential impacts associated with the proposed Industrial township and proffer appropriate mitigation/ameliorative measures that will ensure that all the impacts are minimized or completely avoided. However, incorporating the findings and recommendation of this EIA, and implementing an effective Environmental Management Plan, at the planning, design, construction, operation and abandonment/decommissioning stages of the proposed project, will ensure its environmental sustainability.

2.5. Project Activities

The activities that are involved in the construction of the Industrial Township project include: -

- Sensitizing the stakeholders
- Delineation of the project area
- Evaluation of the affected properties for the purpose of compensation
- Clearing the project site of all vegetation and structures.
- Construction of various facilities, including schools,
- Project commissioning

2.6. Project Development Options

Three development options were considered and weighed against each other in line with the construction of the new Industrial Township in the country.

The Options include: -

- Option A: No action
- Option B: Alternative Site/Location Option
- Option C: Delayed Option
- Option D: Site project as proposed

2.6.1. Option A: No Action

No Action Option, the "no development" option will result in zero land take, zero health, safety and environmental impacts. No development options are usually considered in cases where the proposed development will have significant negative impact that cannot be effectively or satisfactorily mitigated. To maintain the status quo is the do-nothing approach. The Erongo Regional Council has overall authority and responsibility for all matters and activities in the proposed project area. The government has permitted industrial township development in the area. The area is not a forest reserve or de-reserved forest, but lies in an arid area. The project has a good control technology design that will ensure minimal impact on the environment. From the results of the field investigations there is no IUCN red listed or endangered or threatened or endemic plant species in the area. The project is justified on the basis of its scientific, educational and economic benefits to the Erongo Region, Namibia and several other SADC countries, and it is sustainable. Therefore a "no project" option is rejected

2.6.2. Option B: Alternative Site/Location Option

The selection of the proposed Industrial Park site was based on technical reasons including their suitability for reception and business potential. Technical evaluation of the project design and space requirement indicates that the project location is the most suitable within the state and can promote efficient cost benefit. The location is acquired by the proponent in accordance with extant land laws within the country. There were appropriate consultations with land owners, communities, surveyors and town planning authority for the state. In view of these considerations, the alternative site/location option is considered grossly inadequate, hence the decision to drop the option.

2.6.3. Alternative C: Delayed Project Option

This option means postponing the planned project development to a later date. Such options are usually taken when prevailing conditions are unfavourable to the project implementation such as war, when host communities are deeply resentful of the project or if the economics of the project are unacceptable or unattractive. But none of these conditions are applicable here on the contrary; both the economic and the political environment are favourably disposed towards the project. Furthermore, the overriding need for creation of jobs amongst our teaming youth who are either unemployed or seriously underemployed re-enforced the need for the immediate implementation of the project. Thus, delaying the project will negate its purpose. This option was also rejected on the basis of these reasons.

2.7. Option D: Site Project as Proposed

The proposed action is for Bakersville Township Development CC to carry out the construction and operation of the proposed project in its proposed location. The preliminary master plan and surveys for the project have been essentially concluded; the location, due to its proximity to Walvis Bay and Swakopmund towns, it has a source for adequate water supply sufficient for all the expected facilities that are to be put in place. Again, its proximity to the proposed Solar Plant will guarantee uninterrupted power supply to the industrial township as the necessary arrangement to ensure it will be realized has since been concluded with potential investors. The project will have an on-site wastewaters treatment facility that will cater for all the proposed and expected development that would be put in place. The location is not a forest reserve or of any special ecological or archaeological interest that may warrant the relocation of the planned development. Thus, the project development can therefore take place.

3. CHAPTER THREE

3.1. Project Description

General

The proposed industrial township project by Bakersville Township Development CC conceived as a huge business venture that will not only boost the status of Walvis Bay as an industrial hub but also serve as a revolutionary vision of changing the entire economy of the country and the SADC sub-region by extension as its objective is in line with the concept of free trade zone which is promoted globally to fast-track industrialization, socio-economics development of designated areas and jobs/wealth creation.

This project is planned to provide a unique business environment for stakeholders of innovation process in Namibia's industrial sector to interact with each other, attract domestic and foreign venture capital, as well as technological development, transfer and adoption. The uniqueness of this project lies in the fact that it is being executed in agreement with strategic partners to supply uninterrupted solar energy.

The project will act as catalyst in transforming the region into a 'focal point' for industry, trade and tourism as it will likely attract investors from domestic and the wider SADC region, as well as international investors looking to develop small-medium scale industries and businesses, taking advantage of its strategic location. The project when fully completed will be made up of the following components: -

- A smart city with residential apartments of different sizes with uninterrupted power and internet services.
- Commercial area, business district
- Recreational area for leisure and sport

3.2. The Project

The proposed project which is conceived and planned to be executed by Bakersville Township Development is a 100% privately owned industrial park which that will provide most technically advance facilities to meet up with identifies demands and concerns of business community. The project is designed to provide most conducive business environment alongside leisure facilities taking advantage of the proximity of its location to the existing Walvis Bay Airport, Town, Namport.

On completion, the proposed project would be located at Farm 308 (7,280) hectares and 309 (1,493) hectares, totalling 8,773 Hectares. The solar plant to be on Farm 308 (a separate EIA shall be carried out). The project will provide a range of services and facilities as highlighted earlier have been planned for this development. These will further include access roads, alternative power source, water supply, fire-fighting station etc.

Separate card pt1 of Farm Bakersville 308 (786) hectares was created mainly for fast take-off on mix development, and potion 2 of Farm Bakersville 308 (201) hectare is reserved for proposed oil refinery, whilst Farm 309 mainly Agricultural purposes.

3.3. Design Approach of Master Plan

The design principles for the Master Plan are as follows:

- The core commercial and residential developments are located in close proximity to the industrial areas in the north. Core Commercial Areas are located centrally with only limited commercial development along the waterfront.
- The township is located to the north of the development and is linked through a strong commercial axis activated by retail and mixed-use development nodes.
- Existing rivers and wet / dry gullies are preserved and integrated within an urban green network.
- City Centre is established along the main green network
- Green networks respect the topography
- Radial urban structure;
- Segregated residential areas that are developed around the green network create different "cluster" neighbourhoods.
- Primary roads provide a direct link from the township to other parts of the site / area.
- Industrial and urban vehicular flows are segregated. Lorry routes are segregated from light motor vehicles.

The design approach has been informed by the following design informants that have shaped the key direction of the Master Plan. The design informants have been identified through the findings of the data analysis study conducted and the appraisal of the physical features of the site. The following factors informed the design of the master plan;

- **Wind Direction:** Prevalent winds are from the south west and the south-east. The north of the site has therefore been identified as the optimum location for the industrial areas, so as to avoid any potential negative impacts of air pollution.
- **Site Contours:** the site contours slope gently from the west to the east, and the master plan road networks will need to take this into consideration.

3.4. Project Concept

The project will be developed and managed by Bakersville Township Development CC in line with relevant national regulations for such business concern. The management will be in such a way as to attract and offer investment opportunities in a special economic zone environment. In this regard, Incentives will be available to local and foreign investors. BTD is a special purpose vehicle established to promote this development. It will work on the infrastructure and facilities to provide industrialists and investors the best environment to live, work and play. The land on which this development will take place was acquired from the Namibian government. As earlier highlighted, the supply of electricity to the proposed development shall be uninterrupted.

3.5. Development Objective

A world-class industrial township today requires an environment that strikes a balance between core industries and their supporting services and amenities. Current regional surveys show that a

preferred industrial business environment is one that provides the following amongst numerous others:

- Solar Power;
- Green area;
- Telecommunication services;
- Land access;
- Security;
- Healthcare Facility
- Access roads

The design of this project will be a marked departure from the old concept of industrial park as it will put more emphasis on work environment quality that takes due cognizance of personnel and employee welfare. The main objective is to provide a world-class industrial park which provides attractive preferred and business environment in a highly competitive global market. The project intentionally departs from a conventional township approach which caters to a single industrial township use. The typical industrial township is designed strictly as a workplace without adequate considerations for the total well-being of its users and visitors.

Specifically, the development objectives of the project will include the following;

- To create a special economic zone that meets global standard
- To provide local and foreign investors with the best business environment to operate.
- To fast-track industrialization and socio-economic development of Namibia.
- To create employment opportunities, wealth and skills acquisition.
- To facilitate technology transfer and promotion of high-tech industries.
- To provide platform for utilization of Namibia's abundant resources e.g Raw materials, human capital, etc.
- To be a result oriented free zone, providing creative, innovative and efficient services towards sustainable industrial and socio-economic development in Africa.

3.6. Land Use Plan

At the moment, primary land use clusters identified in the adjoining area include Industrial, Commercial and Supporting, Residential, Tourism, Green and Blue links, Primary Roads, Secondary and Local Roads, Utilities and other open spaces. The land use for the area would be made up of designated areas for various category of development. The land use plan would serve as the basis for all the facility and service needs of the industrial township.

3.7. Phasing

The proposed development will be developed in phases.

- Phase 1 focuses on establishing a core residential and commercial node in close proximity to the industrial area (which will be developed in Phase four)
- Phase 2 will involve extension of the uses towards the centre of the site along the main roads
- While phase 3 will involve development of low-income residential uses and industries along the highway.
- Phase 0 implements the main industrial township sites throughout the Site

3.8. Landscape Strategy

The location and site conditions of the proposed project which feature Walvis Bay town in close proximity provide ample opportunity to explore other forms of activities to be engaged by working population the new industrial township.

3.8.1. Functional Arrangement/Zoning

Main Civic area, market area to be located more centrally to the site, and at the heart of the development. This location provides direct contact to all of the adjacent functional zones. The residential zones have been divided into smaller areas creating a tight urban fabric using landscape interventions to delineate the different areas. Within the residential zone, the areas allocated for workers are closest to the industrial area.

Landscape interventions, using existing topography landscape features, will provide buffer zones between functional zones, and also provide exciting public open space with integrated play elements.

3.8.2. Vehicular Access

Main vehicular route enters development, via the proposed highway at new mid-way access point minimizing vehicular disturbance to the site. Large vehicular traffic has direct access to the area to the north lighter vehicular traffic to be directed internally to serve the non-industrial zones. Secondary ring roads and tertiary connecting street networks allow access throughout development.

3.8.3. Wet/Dry Gullies - Landscape Corridors

dry gullies follow the natural low points in the topography and create a natural web/grid. The landscape concept is to follow these dry gullies, insert them into the Master Plan and to use them as linkages throughout the development. This provides the scheme with the natural solution to run off during wet weather conditions, is sympathetic to the existing condition, will provide the base for a flexible external realm design, and create a new city layout unique to the development, identified by natural landscape formations.

3.8.4. Planting

The preliminary selection of plant species intends to be coherent with the natural environment and specific climate of the site. In general, native plants are better than non-native plants, especially in such a natural environment characterized by a strong presence of water. For this reason, endemic species are to be preferred, spontaneously requiring great amounts of water as this special habitat offers and requiring little maintenance issues due to this factor. In addition to this, native wildlife will also benefit from native species, as local animals and native vegetation co-evolve and profit from each other. Not only human activities in correlation with nature take place here, but an important fauna and flora portion has to be respected and buffered.

3.8.4.1. Typologies:

- Streetscapes
- Public footpaths
- Private open spaces
- Car Parking

3.8.5. Design Approach

Soft landscape is a key and integral element of an open space environment. The primary purpose of planting material is to enhance the character of an area, promote biodiversity by augmenting the existing plant palette, provide shade and amenity, screen or delineate user zones, create visual identity for spaces within the development and to reinforce the overall design of the open spaces. Plant selection may serve the following functions:

- Provide shade
- Screen and buffer
- Create special identity
- Form shelterbelts

3.8.5.1. Green Buffers

Other than public parks, green buffers are also part of the overall landscape system of the proposed Industrial Township. Green buffers would generally be developed at the allocated area and along the peripheries of the park. Their main purpose would be to act as both a demarcation of the park from its surrounding as well as to project a green environment to outsiders. The buffer zones play an important role in the development of the landscape strategy.

The nature of the proposed development means that buffer planting is required not just to surround the development and screen off adjacent roads or visually poor zones, but internal screening is also required along the railway line, industrial zone, urban structure and lakeside. A buffer has also been added along the boundary. We propose to enhance the capabilities of the buffer planting to provide noise / visual reduction potentials by planting trees and shrubs on raised earth bunds where required.

Benefits include:

- Reduction of noise pollution to the adjacent urban development from roads and railway.
- Reduction of air pollution to the adjacent urban development from roads and railway.
- Increase aesthetical landscape quality by mitigating views towards roads and railway.
- Enhanced ecological corridors.

The master plan should ensure existing trees are preserved as much as possible. Where possible, mature trees should be retained in their current location. However, if necessary, they can be raised and relocated into a nursery area for holding before being moved into its new permanent location such and the green network, parks and buffers.

3.8.6. Fencing/Gateway Entrance

The developed will be fenced as a free trade park. The facility will have a landscaped entrance gateway to welcome visitors to the park. The entrance gateway will serve as an indication that

visitors are entering a different environment and will be fitted with appropriate signage.

The first main gateway connects the industrial township area to the main highway (c14).

3.8.7. Road Reserves

Road reserves will also be required to have planting strips incorporated in two (2) main areas - by the side of the road reserves as well as in the central median, if present. The landscaping will be implemented and maintained as part of the overall greenery effort of the township.

3.9. Planning Control

For the purpose of the proposed project, Planning Control Guidelines will be introduced to ensure optimal usage of land resources and to co-ordinate the integrated development of different building types. They serve to guide design and construction programs for the sole purpose of maintaining a pleasant environment, which in turn, will have significant impact on the overall success of the project.

3.9.1. Infrastructure Design Considerations

The design work for the Infrastructure Master Plan encompasses both the schematic routings and the preliminary estimates for the major infrastructure and utilities, namely:

- Landfilling & Earthwork Scheme; Surface Drainage;
- Water Supply & Distribution; Sewerage System;
- Solid Waste Disposal; Road Design;
- Power generation/ supply; Telecommunications; and Security

3.9.2. Proposed Earthwork Scheme

Early work for the site will require site fill to reclaim large portion of the area under threat of inundation to a prescribed datum that will ensure all facilities are designed above predictive 100-year flood conditions (despite the area being arid).

The principles that would govern drainage and sewerage systems would be based on gravity. The ultimate discharge point for surface runoff from the development, that is, the invert level at the final outlet of the drainage system shall be generally higher than the highest tide level to avoid back flow from the sea during high tide. The proposed road level shall be lower than the platform levels of individual plots for connection of plot drains to the drainage network of the development.

The proposed development ground level will result in filling up most areas of the site with additional earth as well as levelling of the existing highland area to match the proposed platform level.

3.9.3. Drainage

Presently, there is no any form of development on the proposed site and as such, there is no existing man-made drainage. Thus, there is no other outlet nearby as the site is mainly vacant land.

3.9.4. Proposed Drainage System

The proposed drainage system is designed to cater for the surface runoff within the project area solely by gravity flow. Covered drains will be used for the proposed drainage system in the development. This will reduce unauthorized garbage disposal into the drains and prolong service life of the underground drains since they are protected against the elements. Drains will be maintained, to ensure proper flow; maintenance would include inspection, de-silting, repair of any damaged drains and monitoring solid waste disposal. The following highlights how drainage system would be constructed. It should be noted that values presented here are estimates.

- All drains to be constructed are proposed along the roads;
- Drainage type would be closed box drain with reinforced concrete construction;
- Proposed minimum gradient would be 1:1000;
- All secondary drains are expected to discharge to the primary drains;
- The maximum primary drain width would be 2.5 m but the depth varies from 1.4m to 2.5m; and
- The maximum secondary drain width would be 1.5m but the depth varies from 0.6m to 2.0m.

3.10. Road Sections

Road network is pivotal to the overall operation of the proposed Industrial Township. Roads are necessary ingredients as they support smooth operation in terms of movement of goods, services and personnel within the park. For the purpose of this project, network of roads would account for 1.81% (2.39 hectares) of the total area. This includes primary and secondary roads.

3.10.1. Industrial Primary Road

Design Intent

- Public spaces within the road corridor should not impede through circulation of pedestrians on footpaths and should provide seating and lighting to make them attractive and functional places and can in some cases temporarily occupy the on-street parking lane.
- Create well-lit public seating areas along road to create a more comfortable pedestrian environment.

Sustainable Urban Drainage System (SUDs)

Street drainage uses a network of streetscape swales and water retention areas that are integrated in the streetscape framework. These are variable, according to street typologies, and are designed to function with the conventional drainage infrastructure. The landscape strategy also includes a Sustainable Urban Drainage System (SUDS). This system works to direct rainwater and run-off away from the industrial premises and into the natural drainage system. The increase in area of hard surfaces will affect the management of the water, and a SUDS system would alleviate potential flooding.

3.10.2. Urban Primary Road

Design Intent

- Public spaces within the road corridor should not impede through circulation of pedestrians on footpaths and should provide seating and lighting to make them attractive and functional places

and can in some cases temporarily occupy the on-street parking lane.
- Create well-lit public seating areas along road to create a more comfortable pedestrian environment.
- Provide a design link to the municipal community plaza and amenities.

Road Requirements:
- 4.75m wide public footpath, including seating and flowerbeds planting;
- 2.5m wide side planting rain garden;
- 1.6m wide dedicated cycle lane (both sides);
- 6m wide median planting, including trees and lighting;
- 2 lane road each way. Lane width is 3.65m;

SUDs

Street drainage uses a network of streetscape swales and water retention areas that are integrated in the streetscape framework. These are variable, according to street typologies, and are designed to function with the conventional drainage infrastructure. The landscape strategy also includes a Sustainable Urban Drainage System (SUDS). This system works to direct rainwater and run-off away from the industrial premises and into the natural drainage system. The increase in area of hard surfaces will affect the management of the water, and a SUDs system would alleviate potential flooding (anticipated).

3.10.3. Secondary Road

Design Intent
- public spaces within the road corridor should not impede through circulation of pedestrians on footpaths and should provide seating and lighting to make them attractive and functional places and can in some cases temporarily occupy the on-street parking lane.
- Create well-lit public seating areas along road to create a more comfortable pedestrian environment.

Road Requirements:
- 3.95 m wide public footpath, including seating and flowerbeds planting;
- 1.8m wide side planting rain garden;
- 1.6m wide dedicated cycle lane (both sides);
- 1 lane parking bays each way. Lane width is 3m;
- 1 lane road each way. Lane width is 3.65m;

SUDs

Street drainage uses a network of streetscape swales and water retention areas that are integrated in the streetscape framework. These are variable, according to street typologies, and are designed to function with the conventional drainage infrastructure. The landscape strategy also includes a Sustainable Urban Drainage System (SUDS). This system works to direct rainwater and run-off away from the premises and into the natural drainage system. The increase in area of hard surfaces will affect the management of the water, and a SUDs system would alleviate potential flooding.

3.10.4. Local Road

Design Intent

- Public spaces within the road corridor should not impede through circulation of pedestrians on footpaths and should provide seating and lighting to make them attractive and functional places and can in some cases temporarily occupy the on-street parking lane.
- Create well-lit public seating areas along road to create a more comfortable pedestrian environment.

Road Requirements:

- 3m wide public footpath, including seating and flowerbeds planting;
- 1.8m wide side planting rain garden;
- 1 lane wide parking bays one way. Lane width is of 3m;
- 1 lane wide road each way. Lane width is 3.65m;

SUDs

Street drainage uses a network of streetscape swales and water retention areas that are integrated in the streetscape framework. These are variable, according to street typologies, and are designed to function with the conventional drainage infrastructure. The landscape strategy also includes a Sustainable Urban Drainage System (SUDS). This system works to direct rainwater and run-off away from the industrial premises and into the natural drainage system. The increase in area of hard surfaces will affect the management of the water, and a SUDS system would alleviate potential flooding.

3.11. Pedestrian And Cycle Network

The pedestrian and cycle networks are split into two different categories; Urban Tracks and Natural Trails.

Urban Tracks:

- Linked Directly to the road network.
- Majority of roads provide an independent pedestrian footpath and cycle lanes.
- Quick and easy access throughout site.
- Designed for short journeys internally or to connect to nature trails.

Nature Trails

- Linked to the green network of connections across the township.
- Nature trails developed for pedestrian only and cycle only traffic.
- Routes follow natural topographical features and dry gullies.
- Possible to walk or cycle to all destinations using Nature Trails.
- No conflict with roads and vehicular traffic, so safer environment to travel in.
- Will promote health and wellbeing and encourage more active pursuits.

3.12. Transportation

3.12.1. Road Hierarchy

The Master Plan includes the following road hierarchy:

- Industrial Primary Roads;
- Urban Primary Roads;
- Secondary Roads;
- Local Roads.

The road hierarchy adopted within the Industrial Township aims at achieving an efficient road network whereby conflicts between the roadway and the adjacent land use are minimized and the appropriate level of interaction between the roadway and land use is permitted. A clear hierarchy will also act as the backbone for the development of local bus services. A structured hierarchy for the road network is proposed, as follows:

- **Principal Roads**: roads of regional or national significance that connect the major economic centres of Namibia and connect those centres to the Erongo Road network. They will often be expressways, with restrictions on access and prohibitions on stopping.
- **Primary Roads (Industrial & Urban):** these connect the main industrial and urban areas within the park, and connect these areas to the Principal Road network.
- **Secondary Roads:** these collect traffic within urban and rural areas and feed that traffic onto the Primary or Principal Road networks.
- **Local Roads:** these provide access to industrial and residential areas. The Principal Road network connecting the Industrial Township is the C14, linking Walvis Bay with Windhoek, and the MR44 road which connects Walvis Bay and Swakopmund and runs behind Dune 7 (now renamed after the second president of Namibia, Hifikepunye Pohamba). These roads play a act as important gateway to the world, serving the people of Southern Africa, Africa and the overseas nations

Typical road cross-sections will be used in different parts of the network considering the urban space available for the right of way, the need for expropriation where settlements reside (which will be minimized as much as possible), the road function, and provision of parking and prevailing local urban activity.

3.13. Utilities Network

Utility infrastructure comprises various types of utilities such as wet utilities, dry utilities and solid waste management.

3.13.1. Wet Utilities

The wet utility infrastructure networks considered for the proposed Industrial Township consists of the following networks:

- Storm water drainage
- Water supply and Firefighting
- Wastewater collection
- Irrigation

The design criteria are in accordance with the international standards and the Namibian guidelines and regulations.

The following sections cover the wet utilities networks;

3.13.2. Storm Water Drainage Network

This system will consist of gravity channels along the arterial and collector roads. As such it will follow the general topography of the site with assumption of some minimum grading works along roads to adjust the natural topography.

Design Criteria
The following design criteria have been adopted in the design of the storm water drainage network:

- A 10-year design storm frequency with no encroachment of flood water onto the carriage way.
- Ditches: the flattest grade recommended for design is 0.25% for earth ditches and 0.12% for paved ditches. This provides a velocity of about 0.7m/s which is non-silting.
- A minimum time of concentration of 10min is considered in the estimation of design flows.
- The runoff flows are collected by gravity and discharged into the lake and the adjacent natural streams.

3.14. Water Supply System

There is no pipe borne water supply system in close proximity to the project area. The park will thus utilize water from NamWater pipelines.

3.14.1. Water Demands Estimation

The water demands estimation is done according to the following rates:

- Residents: 250 l/day/person
- Visitors: 60 l/day/person
- White Collar Staff: 60 l/day/person
- Blue collar Staff: 60 l/day/person
- Domestic Staff: 60 l/day/person

3.14.2. Water Supply and Firefighting Network

A combined network will be provided for the domestic Water Supply and Fire Fighting. The following are the main design considerations:

- The domestic and firefighting water network has been designed based on the peak daily demand and fire flow event assuming that the plots will be provided with their own storage tanks to cater for the peak hourly.

3.14.3. Waste Water Collection System

This section describes the waste water collection, disposal, and recycling for the industrial township. The sewage system will collect the waste water and convey it to the disposal location which is a proposed waste water treatment plant (WWTP). This will allow the re-use of the treated effluent (TSE) for irrigation purposes.

3.14.4. Waste Water Generation

The waste water generation is estimated based on the water demands where Average Waste Water generation = 80% of average domestic water demand.

Accordingly, and based on the average water demands estimated in the previous. As Table 3.xx indicates, the total daily average waste water generation is 15,000 m3/day. The treatment of this waste water will allow the production of about 10,455 m3/day of TSE (estimated at 70% of the waste water). This amount will be used for irrigation purposes.

3.14.5. Waste Water Disposal

A Waste water treatment plant (WWTP) will be proposed at the shoreline which is the lowest area in the project in order to allow collecting the waste water by gravity and reduce the number of lift stations as much as possible. The WWTP will treat the collected waste water from the proposed network where the treated water will be reused for irrigation. The capacity of the WWTP is calculated based on the maximum daily flow which is generally 1.5 times the average flow, about 22,500 m3/day. The area required for the plant will be about 50,000 m2.

3.14.6. Proposed Sewage Network

The Sewage network will be based mainly on gravity. However, lift stations will be provided when the network becomes too deep and could not be reconnected to the main network by gravity. The design of the network is taking into consideration the following design parameters:

– The network design will be based on the peak flow:

Peak Flow = Peak Factor x Average Flow The peak factor is as follows:

PF = 5/P0.167 where P is the population in thousands

- The pipes will be designed 80% full.
- Minimum pipe diameter is 200mm.
- The hydraulic calculations for the gravity pipelines are done based on Manning's equation for open channel flow, given by:

V = 1/nR2/3S1/2

Where: V is the flow velocity (m/s)

S is the hydraulic gradient R is the hydraulic radius (m)

n is the Manning's roughness coefficient (0.013 for smooth pipelines)

The hydraulic Calculations are done using the SewerCAD software from Bentley. The sewage collection network will be made of pipe connected by manholes spaced about 80 to 100m. UPVC pipes will be used up to 300mm diameter, larger diameter will be GRP pipes. Sewage collection network will be made by gravity. However, due to the topography, the network will be divided into 4 sections each served by a lift station which will discharge into adjacent network flowing towards the plant. The total network length will be about 20.0 Km.

3.15. Irrigation Network

A fully automated irrigation system will be provided for the planted areas of the Project. The automatic control system is expected to conserve water and facilitate operation and

maintenance. The proposed irrigation network consists of the following components:

- Proposed reservoir and pumping station to store the water and deliver the required irrigation demand.
- Main irrigation network designed in a looped system supplying the secondary irrigation network.
- A secondary irrigation network consisting of remote-control pressure reducing valves, manifolds, laterals and irrigators.

3.15.1. Source of Water

Different sources of water can be envisaged for irrigating the planted areas of the Project.

3.15.2. Service Pressure:

The minimum pressure required in the system depends on the type of irrigators used. For the purpose of this report, it is assumed at a minimum of 3.0 bars in the main network at the control valves for external soft landscaped areas.

3.16. Power Supply and Distribution

3.16.1. power Supply

The project site for the proposed Industrial Township is virtually unoccupied and devoid of any meaningful economic activity. Operation of a project of such magnitude requires constant and reliable source of electricity which has been a great challenge throughout the country. This makes the provision of power supply fundamental to the success of the proposed industrial township park as no industry can be sustained without adequate and reliable source of energy supply.

3.16.2. Lighting System

In order to ensure adequate security and clear vision for motorists and road users within the park, adequate street lighting shall be provided especially at night time. Effective street lighting would illuminate streets and sidewalks within and around the park. Electrical energy supply requirements for the project will be assessed, based on the maximum demand loads of the master plan planning parameters.

3.16.3. Codes and Standards

All electrical systems shall be designed and specified in compliance with the recommendations, codes and standards, as follows:

- Latest edition of the “British standard”- Europe norms (BS –EN).
- Standard Handbook for Electrical Engineers, published by Mc Graw Hill Handbooks, Donald G. Fink and H. Wayne Beaty
- Nominal characteristics of all equipment forming part of the electrical works shall be specified to conform to the relevant BS Standards or the “International Standards Organization”(ISO).

3.16.4. Ambient Conditions

All electrical equipment, apparatus, materials, and accessories are designed, specified and derated for a continuous and trouble-free operation in the ambient conditions of the area, which are as follows:

- Maximum ambient temperature: 40°C (in the shade)
- Minimum ambient temperature: 21°C
- Maximum relative humidity: 88%

3.17. Existing Utilities

3.17.1. Transmission Lines:

The towns of Namibia are interconnected using overhead transmission lines operated at different voltage 330, and 132KV. Two OHTL circuits are passing nearby the proposed Industrial township connecting Walvis Bay with Windhoek and other towns. There is no information about the loading of these OHTL to assess from where the proposed project can be connected to the Grid. Therefore, further coordination with the power authorities – NamPower and Erongo RED should be conducted to confirm both the source and the network that will feed the project with the required demand loads.

3.17.1.1. Load Estimate

The Bakersville Smart Industrial City" project is comprised of industrial, residential and commercial areas. Load density factors for each area type (based on common practice / previous similar projects in Namibia) and diversity factors from international standards will be applied to estimate the total electrical demand load for the master plan.

Design Guidelines of Power Supply

The guidelines for the design of the power supply network for the project are as follows:

- The proposed power supply network will be designed to accommodate the peak load demand, reliably and safely.
- The 33 kV distribution from the power supply network will be in- stalled in phases.
- The ultimate power supply source will be derived from the proposed 132/33KV substation.
- Ultimately, the external power plant is proposed to deliver its output power at the 132 kV level, through 132 kV underground/overhead transmission cables, which will in turn supply one 132/33 kV primary sub-station.

3.18. Telecommunication Networks

Telecom service is critical infrastructure for the success of all operations in this facility. To ensure effective communication, the park management will partner the current service providers in the country to provide sufficient infrastructure for efficient communication with outside world. This will further attract investment into the area.

This section describes the works needed to meet the forecasted telecommunication requirements for *"Bakersville Smart Industrial City"* Master Plan. The design is proposed to derive the services of the telecommunication network from Telecom or an authorized telecom service provider, offering and delivering fixed telephone, Internet and TV services over the same network, namely a Fiber-To-The-Home (FTTH) network fanning from a telecom exchange that should be provided for the Bakersville development area.

3.18.1. Scope of work

The scope of work of the Telecom is only limited to Outside Plant (OSP) civil works including ducting systems, hand-holes, manholes, etc... On the other hand, the supply, pulling, installation, termination, testing, etc. of all cabling and equipment for the Telecom network are outside the scope of work and will be carried out by an authorized service provider.

3.18.2. Existing Network

There is a shortage of information on the existing telecommunication network installed in Bakersville Industrial township. Further investigations need to be made to acquire more data about the infrastructure of this network. Some queries are sent to the authorities regarding this matter looking forward to get back with the required information that would be needed to base the new design on.

Collected Data from Internet web sites has provided a summary about the national backbone fiber network especially what is near “Bakersville Smart Industrial City” development. The local operators have implemented a fibre optic backbone linking the Walvis Bay airport and Walvis Bay town, including Windhoek and Swakopmund.

This fiber would be useful to connect “Bakersville Smart Industrial City” the National network.

3.18.3. Projected Telecom Design

The infrastructure design of the telecommunication will incorporate the community needs for the basic and enhanced actual telecommunication services offered and will be ready to support future advanced services.

The vision is to have a converged telecommunication network framework to serve the plots and consequently connect and provide every residence, hotel, office, retail shop, facility, etc. with narrowband and broadband triple play services (voice, TV and internet connection). Bakersville development area will thus be served by a Fiber-To-The-Home (FTTH) network supplied from Telecom or authorized service provider. This FTTH network will be connected to national network.

3.19. Solid Waste Management

This Solid Waste Management (SWM) section presents a brief description of the main types, characteristics and quantities of solid wastes that could potentially be generated from “Bakersville Smart Industrial City”. This refers mainly to generated solid waste materials during the operational stages of the project. A proposed solid waste management strategy (SWMS) for handling potential generated waste from the various land uses has been prepared by the Consultants in the form of general guidelines that can be reviewed, refined where necessary, brought forward to progressive design stages, and enforced by relevant parties.

3.20. Sustainable Aspirations

In order to adopt a concept that follows a sustainable flexible approach and suits any potential future progress in SWM at the State-wide level (in terms of plans, policies and regulations), source separation practices based on 3 streams is proposed in the city. The Consultants believe such an approach would result in the establishment of an infrastructure that may suit and aid future sustainable plans set by relevant authorities at the Municipal level.

Based on the above, a 3 streams source separation was proposed as follows:

- Organic Waste
- Dry Recyclables (Paper/Cardboard, Plastics, metals, Glass)
- General Waste

The introduction of source-separation practices will aid in provision of flexibility during the handling of such waste streams at the downstream end of the entire SWM chain (i.e., treatment/disposal schemes) at offsite Municipality facilities. However, although it is good practice to propose sustainable solutions, it is of also important to uphold feasible solutions, on environmental and economic scales.

3.20.1. Solid Waste Minimization

This refers to all the activities generating waste whether residential, logistics, retail or industrial. Waste generators should adopt all practical and feasible efforts to minimize the amount of material to be discarded as 'waste'. Basic measures to be taken by waste generators, specifically at the industrial and logistics areas, include:

- Implementing good housekeeping through adopting environmental management systems and standards (EMS) such as ISO 14000 series,
- Conducting regular environmental audits particularly for solid waste involving material flow charts and optimized material balance models as applicable,
- Utilizing efficient and environment friendly raw material and technological processes in their activities,
- Using recycled material, where applicable,
- Reusing discarded material prior to storage,
- Establishing a waste exchange scheme and reusing material prior to disposal, i.e. taking into consideration that one industry's waste could be the other industry's raw or input material.

3.20.2. Industrial Symbiosis / Waste Exchange Program

Industrial Symbiosis (IS) engages traditionally separate industries and other organizations in a network to foster innovative strategies for more sustainable resource use (including materials, energy, water, assets, expertise, logistics, etc.) Through the network, business opportunities are identified leading to mutually advantageous transactions for innovative sourcing of required inputs, and value-added destinations for non-product outputs. Organizations are also exposed to best practice and knowledge transfer, resulting in cultural and process changes.

The principle behind industrial symbiosis is simple; instead of being thrown away or destroyed, surplus resources generated by an industrial process are captured then redirected for use as a 'new' input into another process by one or more other companies, providing a mutual benefit or symbiosis. Put simply, industrial symbiosis challenges the business world to operate in the same way as

the natural eco-system where everything has a place and function, and nothing goes to waste.

Although geographic proximity is often associated with industrial symbiosis, it is neither necessary nor sufficient nor is a singular focus on physical resource exchange. In practice, using industrial symbiosis as an approach to commercial operations – using, recovering and redirecting resources for reuse – results in resources remaining in productive use in the economy for longer. This in turn creates business opportunities, reduces demands on the earth's resources, and provides a stepping-stone towards creating a circular economy.

The onsite SWM strategy includes a Solid Waste exchange program to facilitate the exchange process between industries. This will increase waste diversion from landfilling, reduce carbon emissions, cut on waste disposal costs, storage, transport and material purchasing costs, creates new jobs, and saves on the purchase of raw materials.

Left-out waste materials unwanted by the available industries should ultimately be transported to final destination sites by a special service provider under a special contract with the Client for the provision of services.

3.20.3. Solid Waste Types and Sources

Solid wastes will be generated form basically all activities within the proposed township. The present land use plan depicts various industrial activities with associated logistics and accommodation. Most of these activities will generate mainly solid waste that is typical of the Municipal Solid Waste (MSW) stream, such as accommodation, educational facilities, retail centers, etc. However, specific industrial land uses could, in addition to MSW, also generate industrial wastes which in turn could be non-hazardous and hazardous.

The following SW characterization is used for the purpose of this project:

- **Municipal Solid Waste (MSW):** generated from residential and commercial land use areas and may typically contain food waste, paper, cardboard, plastics, uncontaminated textiles, glass, wood, metals, inert debris, yard trimmings, and other bulky items.

Industrial Waste (IW): generated from industrial facilities and comprising the following:

- **Industrial Non-Hazardous Waste (INHW):** similar in nature to MSW, however the various components might have different proportions, sizes and characteristics depending on industry size and type; and
- **Industrial Hazardous Waste (IHW):** likely to be hazardous in nature and exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity.

IHW may comprise used filters, sludge, empty oil/solvent drums, rubber, wood and containers, batteries, used electronic items, etc. in solid form. IHW may also appear in semi-solid or liquid form such pigments, paints, adhesives, spent oils/solvents, etc. The determination whether the waste is listed as a hazardous waste constituent should comply with applicable regulations such as the United States Environmental Protection Agency (US- EPA) and European Union (EU) definitions1. Other types of waste may include:

- **Landscape waste:** green waste from landscaped areas is likely to be generated in the project

area and should be properly managed by the Landscape Contractor under a special contract signed with the Client.

- **Construction and Demolition (C&D) waste:** This kind of waste will be generated during the construction stages of the project and should be managed by the Contractor in full compliance with Environmental Management Plan requirements.
- **Medical waste:** Medical waste will also be generated in limited quantities from healthcare facilities, with about 10% to 20% of its entire content considered potentially hazardous in nature (sharps, infectious non- sharp waste, expired or unwanted pharmaceuticals, etc.) and requires special handling. Such limited waste category is expected to be stored at dedicated clinics/ generation locations for collection by specialized contractors to avoid double handling. The remaining portion of the medical waste stream (around 80% - 90%) is considered to constitute discarded materials that are similar in composition to MSW and thus can be handled in a similar way.

3.20.4. Solid Waste Management System Basic Concept

Based on the initial assessment of waste characteristics, and at this planning stage where specific function/data regarding the individual industrial activities/facilities is yet to be fully defined, the consultants envisage that the main options for the proposed SWMS should take into consideration the following general planning aspects:

- The likely generation of both MSW/INHW as well as an anticipated lesser portion of IHW raises the need to handle such waste types separately;
- The adequate management of different waste types from different facilities within the project sites encourages the need to establish pertinent Health and Safety operational unit and environmental guidelines for enforcement and monitoring within the industrial districts;
- As part of a long-term vision towards achieving sustainable practices, waste minimization measures in the form of applying the 3R's (Reduce, Re-use, and Recycle) are of utmost importance to minimize any potential impacts from future operations. In practice, this can be complemented within the industries by establishing a waste exchange policy and programs;
- As part of their duty of care, tenants should be given the responsibility of proper storage and handling of their generated waste within their own premises, in close coordination with/authorization by the BTD Management prior to transfer of MSW to the Transfer Station (TS) or ultimate dispatch of Industrial Waste to offsite approved destination site(s);
- The management of upstream collection services for all waste types is encouraged to be handled by licensed Contractors under special agreements with tenants and in close coordination with the BTD management authority;
- The handling of downstream component (treatment/disposal of the various waste streams) should be incorporated with current approved operations and future plans set by the SWM relevant authorities.

Solid Waste Generation and Composition

Various sources are available that estimate generation rates with respect to various types of

land uses. The types and quantities of IW (both INHW and IHW) varies widely and depends on the individual industrial facility's characteristics such as type, size, processes, technology, materials involved, waste minimization practices, and quality environmental standards adopted and can only be best verified during operational stages using IW inventories.

Adequate and sufficient data on current waste generation practices/ quantities, waste inventories/classification, and types of future industries in both districts remain essential elements to anticipate potential future waste.

3.20.5. Solid Waste Storage and Collection

3.20.5.1. Storage

Municipal Solid Waste

Source-separated MSW generated at Bakersville Industrial Township, should be temporarily held at generation locations, and the transported for storage at proposed onsite Transfer Stations (TSs). Recovered MSW materials (in single streams) will then be further dispatched to the approved offsite destination site(s) such as recycling facilities or dedicated end-users.

Before being transported to the TSs, solid waste will be stored in satellite waste rooms/areas available in each land use. The source-separation practice should be maintained in storage areas at each generation point. Storage rooms/areas at all generation points will be provided with adequate provisions, made suitable to the specific aforementioned waste types, constituents, and categories. Such provisions for specific waste types/ categories shall include, but not necessarily be limited to, the following:

- Adequate capacity and durability of containers with respect to their contained waste,
- Adequate sizing of storage areas and their provision with all requirements to render them operational and safe to both public health and the environment,
- Adequate accessibility and manoeuvrability of containers to arrive from all storage locations to the collection vehicle standing point,
- Minimizing vehicle compaction efforts for source-separated dry recyclable materials (Plastics, metals, glass) to preserve their end- market value.

3.20.6. Solid Waste Collection

The solid waste collection system should adhere to a separated solid waste collection process. The particular items to be considered in this regard include mainly:

- Waste collection vehicles should be able to accommodate for the various types and sizes of waste storage containment; these should be specific for collection of all types of generated waste; thus, could be of the compacting and non-compacting type.
- Frequency of collection shall be minimized to at least daily, where food or other organic MSW is anticipated to be generated and could vary for potentially hazardous waste, depending on the generated solid waste quantities and adopted storage guidelines.
- Collection times and truck routes should be coordinated with traffic administration to minimize traffic congestions and nuisance.
- Collection trucks should be of different capacities in accordance with the frequency of collection.
- The transportation of potential hazardous waste should be performed by specialized and licensed service providers in dedicated enclosed vehicles to avoid spillage. The transportation operations should be complemented with consignment notes as part of a manifest system for

departure and delivery. This should take into account the types and quantities of material shipped, the transporter and receiver information, and any other measure deemed necessary by concerned public authorities.

3.20.7. Solid Waste Treatment and Disposal

As aforementioned, treatment and disposal of MSW generated from the township should be adequately integrated with dedicated solid waste treatment/disposal facilities in accordance with waste management requirements.

3.20.8. Project Schedule

The proposed project planned Perpetuity Project Period is 29 Years. The analysis period is as follows;

- 2 Years, Pre-construction
- 2 Years, Construction
- 25 Years, Operations

Pre-construction Period is defined as the period before start of construction.

The construction is when the real assets are created. The development Period is between Pre-construction and end of Construction. The operation is the post-construction when the revenue generation starts and the activities of the facilities are in full use. The project period is between start of Pre- construction and end of Operations. It has scheduled that 40% of the project to be completed in Year 1, while the remaining 60% will be completed in Year 2. Approval for the Environmental Impact Assessment of the project is expected to be granted by the regulator, Ministry of Environment, Forestry and Tourism: Directorate of Environmental Affairs before the commencement of the project.

3.20.8.1. Decommissioning/ Abandonment

This is the last phase of the project activities. It refers to the dismantling, decontamination and removal of process equipment and facility structures, the removal of surface installations, and re-contouring the land and planting vegetation to prevent soil erosion. The project lifespan is estimated at 25 years.

In line with statutory requirements, the programme is planned during the project conception and design phases. Such decommissioning and abandonment activities are expected to incorporate remediation/restoration of the project environment at the end of the project/facility lifespan.

At the close of the proposed project, all buildings, machineries and equipment will be dismantled and the whole area re-instated. This process will be in accordance with the Environmental Management Plan (EMP) for this project, which addresses the mitigation and restorative measures required to leave the project site for sustainable future use. However, should there be change in this plan due to exigencies of time, the facility will be converted to most appropriate use that will guarantee maximum benefit to the stakeholders.

The planned decommissioning may take place either stepwise or the entire infrastructure together with factories, warehouses, associated equipment/ machines may be decommissioned at once, dependent on specific industrial/operational preferences and priorities at that time.

Furthermore, contractors conducting the work will be required to operate according to similar management systems. The general order of preference of decommissioning options available for redundant structures and equipment include:

- **Re-use:** By sale and/or transport to another project or company;
- **Re-cycle:** Breaking down structures and equipment for raw materials. The majority of metals will be recycled. The break-up of structures can be performed in-situ or after transport to a breaking or salvage yard, depending upon ease of transport and safety conditions; and
- **Disposal:** Some materials are not suitable for recycling and must be disposed of by a licensed waste management facility.

At this stage, it is difficult to give precise details about the way in which the process of decommissioning will proceed because technology and science will have changed within the project life. However, a risk assessment study which will describe the processes and activities needed for the closure/decommissioning will be developed during the operational phase of the industrial park. This study will make a full assessment of potential impacts and describe methods of minimizing adverse environmental effects and will be executed, evaluated and implemented in close co-operation with stakeholders. There will however be certain principles during the de-commissioning/closure phase which can be established now which include sharing of risk assessment report with regulators. If the site is no longer to be used, full restoration and landscaping will be carried out. This would involve consultation with authorities and other stakeholders and re-instatement to the original vegetation type. Where necessary however, additional actions shall be taken that comply with any regulation's existent at the time of decommissioning.

4. CHAPTER FOUR

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1. General Baseline Study Approach

The overall study approach for the environmental baseline study took cognizance of the fact that EIA is an environmental characterization study that is commonly employed to fully establish in details the contemporary baseline status / conditions of the study area. It is considered as a process of getting detailed information about the environmental conditions of an area through the review of available reports, maps, and combining these with detailed field investigation and laboratory analyses of the various environmental media that could have been collected during the field study. The purpose is to be able to adequately predict the possible potential and associated impacts that may arise if the study area is put into specific developmental use. It also enhances the determination of the impacts of an existing project or facility on the ecosystem of the project area, and on the socio-cultural, economic and health status of the communities around the project and or facility. With these considerations, an interdisciplinary approach was adopted to acquire relevant environmental data covering the physical, biotic and social components of the environment of the proposed site.

Extensive review of available literature on the study area and on the facilities in and around the proposed site was conducted. This was with a view to acquiring all relevant background information on the environmental characteristics of the area. Furthermore, the field investigations and sampling strategies were planned and executed on the environmental issues outlined below:

4.1.1. Field Quality Assurance and Control Measures

Quality assurance / quality control formed an integral part of all aspects of the field work and was put in place to prevent sample contamination and deterioration. Sample chain of custody forms were used for the registration and tracking of samples from the field to the laboratory. The adopted QA/QC strategies employed were as follows;

The work was carried out in accordance with the terms of reference and the specification given by Environmental Management Act 7 of 2007 and its Regulations.

The study methodology was consistent with those approved by the Department / Directorate of Environmental Affairs (DEA) – Ministry of Environment, Forestry and Tourism (MEFT). Only the standard and commonly accepted field procedures were used. The study design adequately covered the entire project area, including the surrounding areas.

4.2. Environmental Field Survey

In order to effectively characterize the ecology of the study area, a comprehensive field data gathering exercise was carried.

During the sampling exercise, field observations were made and documented in field notebooks

and still photographs (details of these are presented in subsequent sections of this chapter). Features observed include water and soil characteristics, biodiversity, and socio-economic setting. The environmental components sampled include soil, surface water, sediment, air, and biodiversity and socio-cultural features. Furthermore, socioeconomic and health surveys were conducted within identified host communities.

The overall goal of the field exercise was to generate environmental baseline data that would be sufficient to characterize the ecological, socio-economics and health status of the project area and provide sound basis for the EIA of the proposed project. The specific objectives and scope of the fieldwork ensured that all aspects of the environment within the project area were completely characterized.

4.2.1. Sampling Procedures

Sample collection was done in line with recommended procedures and practices for environmental data collection in Namibia. An overview of sampling procedures for each parameter and observation made are discussed in the following sub-sections.

4.2.1.1. Vegetation

A reconnaissance survey provided insight into the selection of appropriate location, number, size, position and orientation of the transect. The study was conducted in approximately 7 belt transects, 1000m x 10m = 10,000 m2, each. Transects were established at intervals of approximately 1 km, alternating on the right and left flanks of the proposed route and including, as much as possible, all vegetation types along the proposed route within each transect the associated vegetation was characterized using the segmented belt transect techniques, to ensure maximum chances of finding most of the component species in the area. Blocks of 1mx1m were laid on randomly chosen sides of each transect for detailed studies. Such alternately spaced observation points which cover the entire area as demarcated by these transects are generally more efficient statistically, than the contiguous or 100% assessment on smaller length of transect. Among the parameters investigated in each transect were floristic composition, community structure and maximum tree height.

For each transects, there followed photographic records of representative segments. After assessing the general condition and status of the vegetation, all the plant species were, as much as possible, identified and listed on the field.

4.2.1.2. Wildlife

Studies on the desert wildlife diversity were conducted between 7am and 6.00pm local time. Thus, various conventional techniques; both direct and indirect methods (Moshby 1974; Dasmann 1964; Sutherland 2000; Davies 2002, etc.) were adopted. Principal objectives were to produce a comprehensive checklist of fauna, determine their distribution and conservation status (prior to commencement of the project), against which future changes and magnitude of change in wildlife populations would be detected. Critical habitats and microhabitats such as log, litter, forest undergrowth, crevices and burrows were ransacked with the aid of 1m long probe to dislodge any hiding herpetofauna and mammals (Heinen, 1992). To increase the chances of sighting wild animals or their evidence of presence, the search was carried out radially, along the northern, southern, eastern and western axis of each transect. With respect to amphibians, Visual Encounter surveys (VES), Dip-netting (DN), Acoustic encounter surveys (AES), were applied, while Pitfall traps with drift fence were used for reptiles, and ground-running mammals such as rodents (in the way of Heyer,

et al, 1994; Rodel and Ernst, 2004, Nago et al, 2006, and Akani, 2008).

Each transect was sampled for about two hours, five times (once in two days) during the period, between 7am and 6pm local time. All dislodged and sighted animal were identified to possible taxonomic levels, using the exquisite field guides and Keys of Happold (1987), Kingdon (1997), and Powell (1995) for mammals; Peterson (1980) and Borrow and Demey (2001) for birds; Branch (1988) and Spawls and Branch (1995) for reptiles; and Schiotz (1963,1969), and Rodel (2000) for amphibians. When and wherever possible, photographs were taken to demonstrate field observations.

Further information on diversity and conservation status of wildlife in the prospect area were acquired from (i) biodiversity reports of tertiary institutions and forestry government institutions, (ii) previous biodiversity reports of environmental assessments within the area and of similar habitats (iii) through inspection of animals displayed for sale in bush meat markets within the project area,

4.2.1.3. Soil

A soil survey was undertaken to characterise the soil's baseline physico-chemical characteristics and determine any existing contamination. A hand auger was used to collect samples at each station, at two depths, namely of 0-15 centimetre (cm) and 15–30 cm. Samples were characterised on site in terms of soil colour, soil texture and drainage characteristics. Samples were collected in plastic containers for chemical analysis. Samples were analysed at the laboratory for soil nutrients (sodium, potassium, magnesium, calcium, nitrate, nitrite, phosphate and sulphate), heavy metals (manganese, iron, nickel, vanadium, cadmium, chromium, lead, zinc and mercury), cations (sodium, potassium, magnesium and calcium) parameters were recommended by the laboratory to conform to MEFT requirement.

4.2.1.4. Air Quality / Noise

Air quality and ambient noise studies were conducted at designated air quality / noise points within the project area and a control point. Measurement methods and principles adopted for each parameter were based on sensitivity, stability, repeatability and capability for calibration during analysis.

4.2.1.5. Socio-economics / Health Studies

Socio-economic and health assessment involves studying affected host communities. Since the project is isolated, in arid area, it was deemed not necessary to acquire Information on socio-economics and community health data.

4.3. Climate And Meteorology

Meteorological data were collated from the Namibia Meteorological Service, for the Project Area covering 2000 - 2020.

4.3.1. Pattern of Climate and Meteorology of the Study Area

With an average of 300 days of sunshine annually Namibia is one of the sunniest countries in worldwide. The climate is generally arid which means that the potential evaporation is higher

than the precipitation, which again results in a very low humidity.

In general Namibia's climate can be described as hot and dry, substantial fluctuations during the seasons or even within one day are typical. The different regions show considerable climatic differences regarding precipitation and temperature though. The amount of precipita-tion increases from the southwest to the northeast from an annual 0 mm to a maximum of 600 mm.

Namib and Kalahari Desert
In the desert areas, the Namib and the Kalahari, only little rainfall can be expected, with the Kalahari receiveng higher rainfalls than the Namib. Temperatures may rise above 40°C in summer, sometimes even up to 50°C. In winter temperatures still reach a pleasant 20° C to 25° C. At night temperatures may drop below 0° C though. For some visitors these high fluctuations are rather challenging.

The harsh climate of the Atlantic coast
Sandwich Harbour at the Namibian coast - Where dunes and ocean meet Sandwich Harbour at the Namibian coast - Where dunes and ocean meet

The closer one gets to the Atlantic coast the less the rainfall. Here the climate differentiates drastically from the rest of the country. Due to the cold Benguela Current along the Atlantic coast the temperatures drop strongly compared to other areas of the country. The prevailing southwest wind is cooled down by the Benguela Current to the extent that no cloud formation can take place at this altitude. Yet a fog bank develops over the Atlantic which lingers along the coastal belt for about 200 days annually and which may also infiltrate several kilometres inland.

Due to the constant south-westerly wind the fluctuation in temperature during summer and winter months is moderate. Thus, the average temperature in January lies at 20 °C, whilst in August an average of 16°C is measured. During the winter month and especially when foggy it can be uncomfortably cold. Except for the days where the so-called east wind weather prevails and warm winds from the Namib Desert heat up the coast. Nevertheless, Namibia is not a country for the typical beach holiday as the water temperatures of the Atlantic rarely rise above 19° C and if they do then only during January – March.

4.4. Biophysical Environment

4.4.1. Climate

The proposed site is centrally located in the arid Namib Desert. The arid conditions are as a result of dry descending air and upwelling of the cold Benguela Current. Thick fog or low stratus clouds are a regular occurrence in Walvis Bay. This is due to the influence of the Benguela Current and forms the major source of water for the succulent and lichen flora in the Namib Desert.

Winds generated from the high-pressure cell over the Atlantic Ocean blow from a southerly direction when they reach the Namibian coastline. As the Namibian interior is warm (particularly in summer), localised low-pressure systems are created which draws the cold southerly winds towards the inland desert areas. These winds manifest themselves in the form of strong prevailing south-westerly winds, which range from an average of 20 knots (37 km/h) during winter months to as high as 60 knots (110 km/h) during the summer. Winds near Walvis Bay display two main trends; high velocity and frequency south to south-westerly winds in summer and high velocity, low frequency east to

north-easterly winds during winter. During winter, the east winds generated over the hot Namib Desert have a strong effect on temperature, resulting in temperature in the upper 30 degrees Celsius and tend to transport plenty of sand.

Figure 10: a summary of climate conditions in the project area

Element of Climate	Description
Average annual rainfall (mm/a)	0-50
Variation in annual rainfall (%)	< 100
Average annual evaporation (mm/a)	2400 – 2600
Water deficit (mm/a)	1701 - 1900
Temperature	▪ Average maximum: Between 24 °C in March/April and 19.3 °C in September ▪ Average minimum: Between 16.5 °C in February and 9.1 °C in August ▪ Average annual >16 °C
Fog	Approximately 900 hours of fog per year
Wind	Prevailing wind is average to strong south westerly

4.4.2. Topography and Vegetation

Compound transverse sand dunes is present in a north-south band, east of main road connecting Walvis Bay and Windhoek along the C14 Road, to the East there are dunes is a gravel plain with some inselbergs. To the west of the dunes is a relative flat area. Various small barchan dunes are present in project area with few dune hummocks as can be seen by the pictures below.

Site Photos 1: Topography of Farm 308 and 309

Site Photos 2: Dune Hummocks found on the identified site

4.5. Social Environment

The section aims to identify trends that are related to the importance of the assessment and determine potential impacts and/or implications of each that are relative to the project. It is important that the key-socio-economic trends in the region are understood as a basis for the assessment as they are of major importance.

4.5.1. Key Population statistics

The Erongo Region, and Walvis Bay specifically, is one of the fastest growing regions in terms of population size in Namibia. The population growth rate of Walvis Bay for the period 2001 to 2011 is 4.7% while that of the Erongo Region is 3.4% and that of Namibia 1.4%. In Walvis Bay, this growth can firstly be attributed to in-migration of job-seekers (42.63%) and secondly to in-migration by people who obtained jobs in Walvis Bay prior to moving. This goes hand in hand with a decline in rural populations of the Erongo Region.

During the last census of 2011, unemployment in Walvis Bay was 27% which is significantly lower than the Namibian level of 37%. The average annual household income in the Erongo Region during the 2009/2010 Namibian Household Income and Expenditure Survey was N$ 84,989 which is second to only the Khomas Region with N$ 132,209 (Namibia Statistics Agency, 2012). The main source of income in the Erongo Region is from salaries and wages with about 80% of households relying on this type of income (Namibia Statistics Agency, 2012).

The project area is made of the Cretaceous sediments of the down faulted and failed rift that is the Benue Trough which occur in a series of sedimentary basins that extend north east of the confluence of the Niger and Benue Rivers, bounded by the Basement Complex strata to the north and south of the Benue River. The Lower Benue Basin consists of shales, silts and silty shales with subordinate sandstones and limestone's intruded by dolerite dykes.

5. CHAPTER FIVE

5.0. PUBLIC CONSULTATATIONS

5.1. Summary of Public Consultations and the Opinions Expressed

The proponent considers consultation as a major feature of its operations; the thrust of the consultation programme for the proposed project is to promote mutually beneficial relationships with all the stakeholders through close contacts and regular consultations and also with the aim of notifying the stakeholders of the nature, scale and timing of the proposed project, thereby eliminating any fears or apprehension. The process was also used to facilitate information gathering between the state government and the other stakeholders. Consultation exercise commenced at the very early stage of the environmental impact valuation and it is planned to continue throughout the project duration.

5.2 Levels of Consultation

Two levels of consultations, as are generally recognized in the ESIA process, were held. These are institutional and Project affected communities / Interested & Affected Parties (PACs / EAPs) involvement. The subject of this section relied heavily on both, though with emphasis on PACs / IAPs involvement, i e. getting the public, host communities, all other stakeholders that may be directly or indirectly affected by the project to participate in assessing the project.

Site Notices, Newspaper adverts, and posters were utilized by the Consultant.

In all the consultation meetings, a brief on the project with regard to the following was given by the ESIA consultant.

- Purpose of the meeting / visit
- Background to the project
- Project description
- Benefit description
- The benefits of the project
- Environmental Management
- Community Affairs and relations.

At the end of the presentation, participants were given ample opportunity to ask questions and/or make comments on the project. They were unanimous in praising the proponent for considering them suitable to host the project and promised to accord the proponent all the needed support.

5.3 Identification of Stakeholders

In preparing this ESIA report the consultation process is implanted at three (3) levels: The first level of consultation identifies the social and economic issues in the project area and ensures visible management commitment to addressing them. This level starts with the project conception.

The second level streamlines the issues and makes plans for specific actions. This level recognizes various phases of engagements among project proponent, host communities, women/men's

groups, and youth organization. The third level ensures regular communication with stakeholders throughout the project's life; the second and third levels of consultation commence at project inception and continue through the life span of the project.

The key stakeholders identified and consulted for the proposed project are: Erongo Regional Council, Ministry of Urban and Rural Development (Previously named Regional and Local Government), Councils of Walvis Bay and Swakopmund, Namport, Walvis Bay Airport, Roads Authority, Ministry of Environment, Forestry and Tourism, Hospitality Association of Namibia, and other IAPs were all consulted. In the course of planning, the project proponent has established close working relationship and a sense of partnership with those key stakeholders and the host communities and shall maintain these throughout the project life.

5.4 Outcomes of Consultation

At the project consultation/field data gathering meetings with strategic stakeholders a number of questions, issues and concerns were raised and certain expectations were also discussed.

5.4.1 Concerns

- **Environmental damage: Most communities fear that construction activities will destroy the vegetation,**
- **Social problems:** Introduction and increase in vices like drug use and prostitution, teenage pregnancy, school dropout, and insecurity during project construction (as construction workers will likely be frequenting nearby communities including Walvis Bay and Swakopmund towns).
- **Health problems:** Increase in the occurrence of STDs and HIV/AIDs

5.5 stakeholder's Expectations

Expectations of the stakeholders consist mainly of human capital development and development of infrastructural facilities. They basically include the following:

- Creation of employment opportunities for residents of the communities.
- Empowerment of community members through skills acquisition, award of contracts and provision of scholarships.
- Infrastructural development in communities in terms of provision of potable water, electricity, functional orthodox health care facilities, renovation and equipping schools and erosion control projects.

6 CHAPTER SIX

6.0 POTENTIAL AND ASSOCIATED IMPACTS

6.1 Introduction.

This chapter presents the methods used in identifying, screening, analysing and ranking of potential and associated environmental, social and health impacts of the proposed development as well as the results from the entire process.

The use of appropriate impact identification and prediction methods is crucial for good EIA. A number of methods have been developed over the years for impacts assessment, while new approaches continue to emerge. Every method has merits and demerits; however, all good methods have certain elements in common, which are widely accepted as essential for a good EIA. The Scientific Committee on the Problems of the Environment (SCOPE) (1979) suggested that the following qualities should be considered while choosing Impact assessment methods:

6.1.1 Comprehensiveness

This implies that the method should be able to detect the full range of important elements and combinations of elements, directing attention to novel or unsuspected effects or impacts, as well as to the expected ones.

6.1.2 Selectivity

This has to do with the ability of the method to focus attention on major factors. It is often desirable to eliminate as early as possible (i.e., during identification) impacts that would dissipate effort if included in the final analysis. Although screening at the identification stage requires some pre-determination of the importance of an impact. Lindblom (1959), Beer (1967), and Holling (1978) provide some guidelines on how to deal with this issue.

6.1.3 Mutually exclusive

This quality ensures that double counting of impacts or effects are avoided. However, experience has shown that this is difficult because of the many interrelationships existing in the environment.

6.1.4 Yield to Confidence limits

Subjective approaches to uncertainty are common in many existing methods and can sometimes lead to quite useful predictions. However, explicit procedures are generally more acceptable, as their internal assumptions are open to critical examination, analysis, and, if desirable, alteration.

6.1.5 Objectivity

The objectivity of impact assessments has been well emphasized by many regulators including the MEFT: DEA. Objectivity minimizes the possibility that the predictions automatically support the preconceived notions of the promoter and/or assessor. Such pre-judgments are usually caused by a lack of knowledge of local conditions or insensitivity to public opinion. A second merit of objectivity is

to ensure comparability of EIA predictions amongst similar types of actions. An ideal prediction method contains no bias.

6.1.6 Prediction of Interactions

Environmental, social, and economic processes often contain feedback mechanisms. A change in the magnitude of an environmental effect or impact indicator could produce unsuspected amplifications or dampening in other parts of the system.

In view of the foregoing and as clearly stated by Canter (1996), there is no universal methodology that can be applied to all project types in all environmental settings. The United Nations Environmental Programme (UNEP, 1996) also emphasizes the need to use tools from existing methodologies that best suit the specific project situation. Lohani et al., (1997), further pointed out that since no single method will meet all the necessary criteria of an EIA, the objective should be to select an array of methods that collectively meet assessment needs. They further state that of the variety of techniques and methods available, only a few are applicable to developing countries.

Generally, impact assessment methods fall under seven types of approaches:

- The Leopold matrix approach
- The Battelle environmental evaluation system
- Checklists
- Matrices
- Flowcharts and Networks
- Mathematical/Statistical and computer models
- Overlays using maps and GIS

Each approach has merits and demerits. In selecting an overall impact assessment methodology for the proposed development, a number of widely used methods were reviewed and qualities considered appropriate, were incorporated in the assessment.

6.2 Impact Assessment Methodology

The assessment of project impacts and their significance is required both for the environmental management of the project and to communicate project information to stakeholders. These requirements could be addressed using the following approaches;

6.2.1 Activity led assessment of Impacts and development of mitigation measures

this approach is often suitable for the implementation of management actions; for instance, a proponent will want to understand what all the noisy activities are, as well as their impacts in order to provide adequate noise control mechanisms.

6.2.2 Resource/Receptor or key issues led assessment of Impacts and development of mitigation measures

this approach is often more suitable for stakeholders; for instance, environmental quality regulators may require that all impacts on biodiversity be discussed together.

The approach adopted in this impact assessment was geared towards addressing both requirements.

The methodology used for the proposed development project construction and operation activities, while a description of the process and the results obtained on application of the method are described in the following sections. In order to effectively carry out the impact assessment and prediction, the following inputs and approaches were relied upon:

- Superimposing project components on existing environmental conditions to identify potential impact areas and critical issues;
- Field investigations;
- Consultation with experts, stakeholders and nearby communities;
- Development and maintenance of a comprehensive database on the biophysical and socio-economic characteristics of the environment of the project area;
- Experience from similar projects worldwide;
- Discussions with project proponents and design contractors;
- Published and unpublished documents providing guidance on performing Impact analysis.

Figure 11: Schematic of the Impact Assessment Methodology

Step 1

Identification and description of project phases associated activities and their possible interaction with environmental, social and health components

Step 2

Preliminary identification of potential impacts on biophysical, social and health components of the environment.

Step 3

Screening for impact importance; elimination of activity/environment interactions producing no effects. Selection of focus impacts for further assessment.

Step 4

Detailed assessment of selected focus impacts under the following bases:

- **Nature**: Positive or Negative; direct or indirect
- **Magnitude**: Qualitative and Quantitative
- **Extent**: Qualitative and Quantitative
- **Frequency**
- **Location sensitivity**
- **Cumulative effects**
- **Duration;** including reversibility and irreversibility

Step 5

Final assessment and assignment of overall impact significance levels based on level four results and application of objective impact severity criteria and likelihood. Identification of impacts that requires mitigation.

Project Environmental Overview

The process adopted in the identification and assessment of the potential and associated impacts of the proposed development considered various phases of the project, namely:

- **Pre-construction:** - this will include mobilization of materials and personnel,
- community engagement, permit to work, site preparation, including site clearing activities, etc;
- **Construction / Installation:** - foundations, building /other structures construction, and other associated earth works;
- **Commissioning and Operation/Maintenance:** - project inspection, commissioning as well

as operations and subsequent maintenance activities;
- **Decommissioning:** - disusing/abandoning of project facilities

6.3 Identification of Impacts and Activities' Interactions

Details of the construction, operations and decommissioning activities that could engender environmental impacts are as follows:

- Site preparation (land clearing/ Surveying/ creation of access road and camping)
- Mobilization of construction elements
- Recruitment and community engagement Dredging
- Assemblage of heavy equipment and machines
- Civil Construction including fencing, Admin building, etc. Other services construction e.g., water treatment plant
- Onsite fabrication (metal works etc.) Building/other structure foundation.
- Building erection activities
- Waste management
- Fuel/hazardous material handling Painting and coating
- Fire/explosion (unplanned activity)
- Incident/Accidents (Unplanned activity e.g., building falling) Commissioning
- Operation and maintenance of the township
- Operation and maintenance of Airport, stacking area and other infrastructure facilities
- Security issues
- Material storage
- Power Infrastructure Maintenance
- Project decommissioning Emissions
- Abandonment/Restoration

At this stage of the impact assessment, a wide range of environmental components which project activities may possibly interact with were considered. The components that were not relevant to the project were not considered. The environmental components considered are presented below.

Table 1: Components of Environmental Aspects Prone to Project Activities

Aspect	Components
Biophysical	**Atmospheric elements:** Air Quality, GHG emissions, etc. Noise level **Terrestrial:** Geology, topography, soil quality, vegetation, Wildlife Ecosystem

Human, Socio-economic and Cultural	Land-use pattern Local population level Socio-economic systems Socio-cultural Systems Basic Amenities and Infrastructure Transportation System Environmental justice Aesthetics

The project construction and operation activities were examined for their potential to result in changes to the environmental components using impact indicators/indices as presented below.

Table 2: Environmental Components and their Impact Indicators

Aspect	Environmental Component	Impact Indicators
Biophysical		
	Atmospheric elements	Gaseous emissions (like: NOx, SOx PM, CO) that contaminates ambient air quality and contribute to atmospheric impacts both at local and global level.
	Noise levels	Increase in ambient noise level
	Geology	Changes in geology and geomorphology
	Soil	Changes In physico-chemical and biological properties of soil
	Topography	Changes in land terrain and topography
	Vegetation	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species
	Topography	Changes in land terrain and topography
	Vegetation	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species
	Wildlife	Changes in wildlife distribution and abundance
	Ecosystem	Changes in ecosystem level of impacts such as: animal and plant communities, nutrient balance, loss of habitats, etc.
Human, Socio-economic and Cultural	Land-use pattern	Changes in land-use patterns such as agriculture, hunting, etc,
	Local Population level	Immigration and in-migration of people
	Socio-economic system	Changes in income differentials, inflation, difference in per capita income, inequality of benefits to local population, employment opportunities, etc.

	Socio-cultural system	Changes in social structure, organization and cultural heritage, practices and beliefs, natural resources, rights of access, changes in value system influenced by foreigners, etc.
	Basic Amenities and Infrastructure	Access to goods and services such as housing, education, healthcare, water, fuel, electricity, sewage and waste disposal, consumer goods brought into the region, etc.
	Transportation system	Changes in transport systems and associated effects such as noise, accidents risk, changes in existing facilities, etc.
	Environmental Justice	Conflicts in choice making between development and protection natural resources use, recreational use, historical and cultural resources, tourism, etc.

6.4 Preliminary Identification and Screening of Environmental Impacts

In line with widely recommended impact assessment approaches (MEFT / EMA act of 2007 and Its Regulations; UNEP, 1996; Canter, 1996; Lohani *et al*., 1997), the first level of impact assessment involved preliminary identification and screening of potential environmental impacts from anticipated activity-environment interactions based on understanding of the activities and nature of interaction with environmental components.

To further guide the identification and screening of impacts using the matrix, impact indicators or indices were developed for each of the environmental component's interaction. Impact indicators are observable or measurable parameters of each environmental component that can be directly or indirectly linked to changes in environmental conditions. Table 2 gives a list of the typical impact indicators that were used for this impact assessment study.

A modified Leopold matrix (Leopold, 1971) was used for the identification and screening. The matrix arrays project activities against environmental (biophysical and socio-economic) components, and supports a methodical comprehensive and objective identification of impacts each activity could have on the environmental components. The matrix consists of a horizontal list of biophysical and socio-economic environmental components that could be affected by the proposed activities versus a vertical list of project activities, which represent environmental aspects, or sources of impacts associated with each project phase.

Entries in the matrix cells represent the nature and preliminary ranking of the impacts. Ranking of the severity is based on the colour code shown in Table 3 below.

Table 3: Impact Ranking Matrix

+	Positive Impact
0	Negligible/No Impact
1	Minor Impact
2	Moderate Impact
3	Major Impact

The impact ranking categories are defined as follows:

- **Positive Impact -** this is impact that adds a measurable benefit to the environment.
- **Negligible Impact -** this impact may occur but based on experience, available scientific information and expert knowledge will have very insignificant effect on the environment.
- **Minor Impact -** this impact could either affect a large (as defined below) or moderate (less than 40%) amount of an affected resource and has mid to long-term effect, but is most likely reversible.
- **Major Impact -** this impact would affect a large (higher than 40%) amount of a resource and/or has a relatively long-term effect.

In this preliminary screening, all potential impacts, whether likely or unlikely, are considered. The likelihood of an impact is further assessed in the detailed impact evaluation.

The result of the preliminary impact identification and screening is presented in Table 4.

Table 4: Modified Leopold Matrix – Preliminary Impact Identification and Screening Results

	ENVIRONMENTAL COMPONENT															
	Biophysical								Socio-economics, Human and Cultural							
Impact Ranking Matrix + Positive Impact 0 Negligible/No Impact 1 Minor Impact 2 Moderate Impact																
PROJECT ACTIVITY																
Mobilization of workers	0	0	0	0	0	0	0	0	0	3	+	1	1	2	1	0
Site clearing	1	2	0	3	3	1	0	1	2	0	+	0	0	0	2	1
Civil works	2	1	2	0	1	1	1	0	1	2	1	0	+	1	0	2
Wastes and emissions handling	2	2	0	0	0	0	1	0	1	0	0	0	0	0	2	2
Foundation	1	3	1	0	1	2	2	1	2	0	0	0	0	0	1	1
Haulage of equipment	1	1	0	1	1	0	0	0	0	0	0	0	0	3	2	1
Building /other structure erection	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Operation and maintenance	1	2	0	0	1	2	1	1	0	2	+	1	+	2	1	2
Decommissioning	2	1	1	0	2	0	0	0	+	+	3	2	3	1	0	1

Identification and screening of impacts relied on the following:

- Documented impacts of similar projects in similar environments
- Consultation with thematic experts
- Professional judgment.

6.5 Checklist Of Associated and Potential Impacts

The checklist of associated and potential impacts is shown in the following table.

Table 5: Checklist of Associated and Potential Impacts

Project Activity/Environmental Aspect	Associated and Potential Impacts
PRE-CONSTRUCTION ▪ **Permitting** ▪ **Surveying** ▪ **Mobilization** ▪ **Recruitment** ▪ **Site Preparation** ▪ **Land acquisition**	– Employment opportunities arising from recruitment of skilled and unskilled project personnel – Business opportunities for local contractors through sub-contracting activities – Local support services from road side supply markets and shops, etc – Skill acquisition and enhancements to local indigenes and workforce. – Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure – Increase of communicable diseases due to influx of people – Increase in social vices (like theft, prostitution etc.) resulting from increased number of people – Community agitation over compensations, land disputes, wrong stakeholder identification, leadership tussles etc – Increased traffic during mobilization on road with risk of accidents leading to injury/death and loss of asset – Exclusion of vulnerable groups from consultations which may lead to strife – Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting site workers and wildlife – Increase of dust particles and vehicular emissions – Conflicts/community agitations over employment issues (quota and methods)

CONSTRUCTION/ INSTALLATION: – **Building foundation** – **Building/Installation** – **Building erection** – **Installation electricity** – **infrastructure.** – **Painting and coating** – **Transportation logistics etc.** – **Commissioning** – **Waste management** – **Logistics.**	– Workplace accidents from burns, cuts, bruises, trips and falls, object at height leading to injury of fatalities. – Employment of local labor and skills acquisition for workers taking of advantage on new opportunities. – Increased business and economic activities as well as diversification of income sources due to supply contracting and sub-contracting – Increase in revenue opportunities for local population due to presence of non-resident workers and travelers – Generation of dust from automobile/heavy duty equipment – power emissions from construction earthworks. – Flora/habitat loss and disturbance through vegetation clearing and earthworks within project site and access roads. – Fauna disturbance and displacement as a result of migration away from construction activity area (this includes impacts on birds) – Soil/groundwater contamination resulting from accidental leakages and spill of hazardous substances(diesel, lubricants, hydraulic oil etc.) – Risks injury/death and loss of assets resulting from accidents – associated with road transportation to and fro construction sites – Traffic diversion and congestion along roads during installation. – Potential collapse of buildings/structures on land as a result of unstable geotechnical conditions – Reduction in wildlife population as a result of poaching due to easier access created by project site clearing – Inhalation by onsite workers of cement dust and toxic fumes during foundation works and welding of material components – Noise nuisance (including impulsive noise) from construction activities, resulting to temporal migration of sensitive mammals and rodents – Visual intrusion as a result of alterations from accidental ignition of onsite diesel storage tanks – Waste Disposal – Scrap metal, wood, sand, concrete, paper – Used oil and replace/obsolete equipment parts that may contaminate soil/ground water – Waste from project sites

DEMOBILISATION **Demobilization after construction phase**	– Workplace accidents from burns, cuts, bruises, trips and falls, object at height leading to injury of fatalities. – Soil/groundwater contamination resulting from accidental leakages and spill of hazardous substances (diesel, lubricants, hydraulic oil etc.) – Traffic congestion during transportation of demobilized equipment and personnel – Generation of dust and automobile/heavy duty equipment emissions – Reclamation of marshaling yards and laydown areas – Waste disposal (scrap metal, wood, sand, concrete, paper) – Reclamation and restriction of access roads to prevent unauthorized uses – Reclamation and restoration of areas used temporarily for construction. – Loss of employment and business opportunities due to completion of construction phase – Illegal access to the property leading to accident, sabotage, asset damage and loss – Soil runoff and erosion resulting in sedimentation problems
OPERATIONS **Maintenance of all facilities,**	– Increased electricity transmission and distribution capacity – Increased business opportunities and quality of life (small, medium and large scale) due to enhanced power delivery and other business concerns. – Improvement in environmental standards due to supply of electricity from Solar Plants which is a renewable energy source and reduced emission from standby diesel or fuel generators, use of fuel wood – Reduced demand on petrol and diesel used for power generation and further reduction in greenhouse gases and noise emissions – Injuries/fatalities of personnel due to road accidents during facility inspection and checks – Enhanced aesthetic appeal due to presence and eventual operation of many facilities in the project site and solar plant – Electric shock and burns to members of the public in the event of electricity installation collapse or damage to distribution wires. – Explosion and fire hazards at the facilities. – Injury/ mortality of birds due to collision with wires around the project area. – Fatal electric shock and severe burns to workers during facilities' maintenance work – Unchecked encroachment on the project site, leading to land-use conflicts and accident
DECOMMISSIONING /ABANDONMENT – **Unstringing conductor wires** – **Facility removal** – **Waste generation**	– Risk of accident and injury to workers during demolition of structures – Increased dust and vehicular emissions – Risk of soil and adjoining surface water contamination from accidental oil and hazardous substance leakages – Traffic obstruction from transportation of decommissioned structures and equipment – Availability of land for alternative uses

6.6 Impact Identification and Characterization

Impacts can be induced during the construction of the facility, and later during its operation. In the case of the *"Bakersville Smart Industrial City" facilities*, the main potential receptors are soil, flora and fauna, occupational health, in addition to socio-economic amenities. Impact assessment defines the criteria and processes against which potential project impacts can be measured and mitigated. A multidisciplinary team comprising engineers, scientist, environmentalists, etc were involved in the identification and characterization of impacts of the *"Bakersville Smart Industrial City"* project.

6.6.1 Impact Identification

The existing baseline description of the environment and the various project aspects/ activities were used to develop a checklist of potential and associated impact of the proposed development on the biophysical and socio-economic environment. The EIA Sectoral Guidelines for Infrastructures was used as reference in developing the checklist.

6.6.2 Characterization Of Associated and Potential Impacts

The checklist approach was adopted; this involved categorizing the project into activities/phases and then the project environment into various components. The interaction between these two elements (the project and environment) may lead to change in the environment as shown below:

This change may be direct or indirect, adverse or beneficial, cumulative or residual, long term or short term as described below.

- **Direct impact (D)** – These are impacts resulting directly (direct cause-effect consequence) from a project activity.
- **Indirect impacts (I)** – These are impacts that are at least one stop removed from a project activity. They do not follow directly from a project activity.
- **Beneficial Impacts (B)** - These are impacts that would produce positive effect on the biophysical or socio-economic environment
- **Adverse Impact (A)** – Adverse impacts are those that would produce negative effect on the biophysical or socio-economic environment.
- **Long term Impact (L)** – These are impacts whose effects remain even after a specific project activity (e.g. permanent vegetation loss due to forest clearing)
- **Short term impact (S)** - These are impacts whose effects will last only within the period of a specific project activity (e.g. noise due to construction activities).
- **Reversible Impacts (RV)** - can be addressed on the application of adequate mitigation measures.
- **Irreversible Impacts (IRV)** - These are impacts whose effects are such that the subject (impacted component) cannot be returned to its original state even after adequate mitigation measures are applied.
- **Cumulative impact (C**) - These are impacts resulting from interaction between on-going project activities with other activities, taking place simultaneously.
- **Residual Impact (R)** - These are impacts that would still remain after mitigation measures have been applied.

6.7 Impact Evaluation

The potential and associated impacts identified and characterized were evaluated. The evaluation which was based on clearly defined criteria(legal/regulatory requirement, risk, frequency of

occurrence, importance and public interest/ concern) was used to determine the significance of the impacts. The criteria and weighing scale adopted for the evaluation are described below.

– **Legal/Regulatory Requirements**

Here, the proposed project activities that resulted in impacts were weighed against existing legal/regulatory provisions to determine the requirement or otherwise for permits prior to the execution of such activities. Such legal/regulatory requirements were identified from the laws/guidelines, which have been reviewed in chapter one of this report.

The weighting scale used is as follows:

Table 6: Legal/Regulatory Requirements Criterion

CONDITION	RATING
No legal/regulatory requirement for carrying out project activity	Low (0)
Legal/regulatory requirement exist for carrying out activity	Medium (3)
A permit is required prior to carrying out project activity which may result in impact on the environment	High (5)

6.8 Risk Posed by Impact

The health, safety and environmental risks associated with each impact were assessed and ranked as "low", "medium" or "high", using the Risk Assessment Matrix. Three criteria (consequence, probability of occurrence and severity) were used as basis for ranking the risks of the impacts.

Risk: -was measured based on risk assessment matrix (RAM).

Risk Assessment Matrix

The risks (measure of the likelihood and magnitude of an adverse effect) associated with Industrial Park projects were evaluated in terms of:

- risk to human health;
- risk to the biophysico-chemical environment

Based on the matrix above, the weighting used was as follows:

Results of the Impact Assessment

For each of the three main project phases (pre-construction, construction and operation), the potential impacts and benefits were described using characterization and criteria listed above – for example: extent, duration, intensity, nature etc. and Legal, risk, frequency, importance etc. The impacts were then assessed in terms of their significance (major, medium, or minor).

The levels of significance for potential impacts of the proposed project were assigned as those impacts to which the following conditions apply.

Table 7: Risk Attribute Matrix

Risk	Attribute – Environmental, Human Health, Safety and Reputation
Low (0)	This means that no further mitigation may be required
Medium (3)	This means that the impact can be mitigated with additional controls and modifications
High (5)	This means that the impact require avoidance or major control / mitigation

Frequency of Impacts Occurrence

Evaluation of the frequency of occurrence was rated as "high", "medium" or "low" based on the historical records of accidents/incidents, consultation with experts and professional judgment. The frequency criterion is summarized below.

Table 8: Frequency Criterion

Frequency	Attribute – Environmental, Human Health and Safety
High (5)	– Major degradation in quality in terms of scale (>1% of study area or habitat within the study area), appearance, duration (beyond duration of project) Irreversible or only slowly recoverable (change lasting more than 1 year) degradation of environmental ecosystem level (population, abundance, diversity, productivity) – High frequency of impact (occur continuously and almost throughout the project execution period) – Geographic extent of impact (e.g., encompassing areas beyond the project area)
Medium (3)	– Degradation in quality in terms of scale (>0.1% of study area, habitat), appearance, duration (a few months) – Effect beyond naturally occurring impacts variability – Slow reversibility (change lasting a few months before recovery), lasting residual impact – Potential for cumulative impact – Intermittent frequency of impact (occur in only a few occasions during the project execution period) – Limited geographic extent of impact (large area within project area)
Low (1)	– Minor degradation in quality in terms of scale (<0.1% of study area, habitat, very localized), appearance, duration (a few days to a month) – Effect within range of naturally occurring impacts, changes, dynamics – Rapid reversibility (change lasting only a few weeks before recovery), no lasting residual impact of significance – No potential for significant cumulative impact – Low frequency of impact (occur in just about one occasion during the project execution period) – Only very localized geographic extent of impact (e.g. not more than a few meters from impact source point)

Importance of Impact

The importance of environmental component in respect of identified potential impact was also determined and rated as "high", "medium" or "low". The ratings were based on consensus of opinions among consulted experts including project engineers and other stakeholders in the proposed project. The importance criterion is summarized thus:

Table 9: Importance Criterion

Importance	Attribute – Environmental, Human Health and Safety
High (5)	– Highly undesirable outcome (e.g., impairment of endangered, protected habitat, species) – Detrimental, extended flora and fauna behavioral change (breeding, spawning, molting) – Major reduction or disruption in value, function or service of impacted resource – Impact during environmentally sensitive period – Continuous non-compliance with international best practices
Medium (3)	– Negative outcome (e.g., loss time injury from minor burns) – Measurable reduction or disruption in value, function or service of impacted resource – Potential for non-compliance with international best practices
Low (2)	– Non-detectable impact (e.g., emissions from automobile equipment) – Alteration in value, function or service of impacted resource that are not obvious – Within compliance, no controls required

Public Interest/Perception

Here, the interest/perception of the public on the proposed project and the identified potential/ associated impacts were determined through consultation with proposed project stakeholders. The ratings of "high", "medium" or "low" were assigned based on consensus of opinions among consulted known stakeholders. The public perception/interest criterion is summarized below.

Table 10: Public perception /interest criterion

Public Perception	Attribute – Environmental and Human Health
High (5)	– Elevated incremental risk to human health, acute and/or chronic – Possibility of life endangerment for community inhabitants and site personnel – Major reduction in social, cultural, economic value – Continuous non-compliance with international best practices – Any major public concern among population in the project region

Medium (3)	– Limited incremental risk to human health, acute and/or chronic – Unlikely life endangerment for community inhabitants and site personnel – Some reduction in social, cultural, economic value – Possibility of adverse perception among population – Potential for non-compliance

Consequence / Likelihood Evaluation

This impact assessment evaluates potentially significant impacts and prioritizes those potential impacts that require mitigation. Each potential impact is assigned a level of significance that reflects the significance of the consequence that could occur without consideration of control and/or mitigation measures, although reasonable best practices and planned control measures are assumed to be in place. Potential impacts may stem directly from the proposed project or from secondary and cumulative effects.

Construction Phase

This refers to all construction and construction-related activities that will occur within the study area until the contractor leaves the area. The construction activities will take approximately twenty-four months to complete and will occur in phases. The first phase will involve the pre-construction activities. The construction phase will be treated as an integrated whole, as dictated by the nature of the activities and impacts under discussion.

Operational and Maintenance Phase

All post-construction activities, including the operation and maintenance of the Industrial Township are included in this phase.

Decommissioning Phase

Being a permanent development project, it is not envisaged that the industrial park will be decommissioned in the foreseeable future. However, after operational design lifespan of 25 years, a reassessment of the current status of the Industrial Township shall be carried out.

6.9 Socioeconomic impacts

The socio-economic and health assessment provided the baseline social profile of the study area. The Industrial Township bill be located in the arid desert / area in Erongo Region. The baseline social profile of the affected communities has been discussed in chapter four of this report.

Construction Phase

Employment Opportunities

Based on the results of the socio-economic assessment, the un-employment rates in the area are low to average. The locals are however77optimistic about the increase in job availability

that the development of the Industrial Township will bring. Any available jobs will provide an immediate positive impact on the employment and income situation at the level of the study area as well as at the regional and national levels. The impact is beneficial.

Employment of casual un-skilled labour would occur, for short-term contracts or for the entire construction phase. This could result in a positive spin-off during the construction phase as any level of employment in this region of moderate unemployment and low wage levels will have a beneficial social spinoff. The impact is beneficial.

Contracting

During the construction phase, there will be provision for sub-contracting to local supplies. Supplies will include raw materials that meet standards as required for the construction of the Industrial Township facilities. Equal opportunities will be given to sub-contractors from the host communities. This is a positive impact.

Information Management

Improper dissemination of information about the project and its activities may pose a risk. This is because lack of information and improper sensitization of stakeholders such as men and women groups, religious groups, vulnerable groups (e.g. aged and widowed) youths, etc about the project may result in local disturbances. This impact is assessed as medium.

Community Agitations

After land acquisition by the proponent, there is tendency for agitations by some groups of people or individuals over non-satisfactory engagement and compensations over land and other associated properties. This could lead to strife within communities or groups. This impact has been assessed and ranked with a major significance. During labour recruitment and prior to full construction activities, there is also potential for conflicts between neighbouring communities or individuals over employment quota systems, sub-contracting procedures or recruitment methodology. This will pose major significant impact on the project construction phase.

Socio-cultural Conflicts

Other potential socio-economic impacts are expected to arise from socio-cultural conflicts between the construction workforce and natives due to differences in believes and religion. Another challenge in this direction is increased demand on existing infrastructures due to influx of people to project area. These impacts have been ranked with a medium significance level.

Visual Effects

Setting up of all the facilities within the desert may create visual intrusion by altering the normal land form pattern within the project area. This impact has been ranked as minor significance level.

Loss of Land

Acquisition and utilization of land for the Industrial Township and associated facilities may result in temporary and permanent loss of land, some of which are regarded as arable. The impact was ranked with a major significance.

Loss of Income

Completion of the construction phase of the project will lead to loss of employment and business opportunities. This impact has been assessed with a medium significance level.

Operational and Maintenance Phase

Community Agitations

After the construction phase of the project there exist the possibility of community or groups of individuals or individual dissatisfaction with the conduct of the proponent regarding compensation issues, recruitment of labour as well as general conduct during the construction and prior to operation. This impact could arise some few months to years after construction activities and could result in strife thereby affecting the operations of the Industrial Township. This impact has been assessed to have a major significant level.

Unauthorized Access

Prior to the operation of the Industrial Township, unchecked and unauthorized encroachment by locals or individuals into the Industrial Township may lead to land use conflict. This impact significant is ranked as medium.

5.7.2 BIODIVERSITY IMPACT

The construction of the proposed Industrial Township will result in the removal of large hectares of natural vegetation in the project area. The development may have a major, long-term, irreversible negative impact on the floral composition within the project site. Results from biodiversity studies conducted in the area shows the following ecological zones within the Industrial Township site.

Data on the floristic composition and fauna assemblage within the Industrial Township site and in the immediate vicinity of the proposed Industrial Township indicate presence of a varied assemblage of forest resources and plant species, some of which are economic and of ethno botanical importance to the people of the Region / communities. The main impacts of clearing the vegetation may however, be secondary and will affect the species that depend on the area for survival through habitat loss, fragmentation and the impacts of edge effects.

Construction Phase

The construction phase is the most destructive part of the planned development. During the construction phase various impacts could cause loss and disturbance of vegetation and animal habitats. Selective clearing within the confines of the project site is expected to be carried out to the minimum foot print required during the construction phase to allow for foundations, erection of towers and placement of conductors on the towers. The impacts on vegetation and habitat loss

due to vegetation clearing and other site preparation activities are put at a medium significant level.

Erosion

Erosion may take place when vegetation is removed, by the continual movement of vehicles and people, and where vegetation is cleared for construction. Areas of particular concern would be along the access roads, areas in which the laydown areas are located and disturbed areas around the towers. Impacts resulting from erosion around laydown areas, access roads, etc have been ranked with a medium significance.

Wildlife Disturbance

During construction there is expected faunal disturbance within the entire project site of the Industrial Park, in which sensitive ground dwelling animals like the ground squirrels, will move out of the area during construction. The impact is anticipated to be medium.

Avifauna

There is no peculiar bird breeding areas/migration routes identified within the project site. The impact is low and therefore no mitigation is provided.

Operational and Maintenance Phase

During this phase the impacts on the vegetation and habitat of the fauna would be relatively low as the industrial park is designed to increase its vegetation structure through a robust landscaping plan implementation. This impact is minor.

Impacts on Birds

The earth wire is the biggest risk, since it is much thinner and could be unseen by a bird in flight. Electrical faults caused by bird excreta being deposited on electricity infrastructure show that birds could also have negative impacts on Industrial Township. Baseline avifauna studies did not identify any bird migratory routes / breeding sites along the Industrial Township route. Large waterfowl/raptors are also not predominant in the area. This impact is ranked as medium.

6.10 Health, Safety and Security Aspects

Construction Phase

In any civil works, public as well as construction staff SHE risks can arise from various constructions activities such as earth works, operation, and movement of heavy equipment and vehicles, storage of hazardous materials, traffic, waste disposal, etc. Because of the long duration of the construction phase, such activities need to be controlled and consequently the associated risks reduced to as low as reasonably practicable.

Transportation Related Aspects

Construction and transportation activities will increase traffic congestion, risk of injuries, terrorist attack, hostage and kidnapping as well as damage to assets. These impacts are expected to be of medium to major significance depending on the severity of the impact. Accidents arising from road trips (transport of materials and personnel) along mobilization routes may result in injury or loss of life of personnel as well as damage to company assets.

Workplace Accidents

The probability of an accident occurring at the project site during the phases of the development is high. This is due to the intense use of machinery and other heavy-duty equipment used especially in the construction phase. Work related incidents and accidents resulting from trips, falls, object at height during construction activities are likely to occur. These impacts pose a medium to major significance ranking all depending on the severity of the impact. If the impact results in fatality it is ranked as a major significant impact.

Communicable Diseases

Construction activities have the potential to create new malaria vector (mosquito) habitats. An influx of workers with no partial immunity to malaria parasite (Plasmodium sp) increases the risk of serious illness which may result to death. This impact if not managed is expected to pose a major significance characteristic.

Influx of resident and non resident workers into the project area also increases the risks of sexually transmitted diseases (STDs) and could impact adversely on the spread of these illnesses especially relating to Acquired Immunodeficiency Syndrome (AIDS). This impact if left unmanaged may result in long term health issues which may eventually lead to fatality. Impact arising from this is ranked as major.

Fires and Explosions

Fire and explosions may be described as technological hazards, which can cause serious injury or result in loss of lives and damage to properties and the environment. Flammable substances including diesel and motor oil may be stored or used on the project site for heavy-duty equipment. These substances are precursors for fires and explosions. Envisaged impacts from accidental explosions resulting in fire have been ranked with a major significance level.

Waste Handling and Disposal

A significant amount of solid waste (including, wood, metal scarps, office and domestic wastes, excavated spoils, etc.) will be generated in this phase of the project. The methods put in place for handling and disposing of these wastes to be generated play an important role in the significance of impacts expected from wastes management. Waste handling and disposal have been assessed to pose a medium impact to the environment.

Collapse of Building and Other Structures

There exists the possibility of shock and burns to users of the industrial park, including visitors due to collapse of building or other structures due to poor geotechnical studies which could lead

to injury or fatality of affected persons. This is a major significant impact.

6.11 Decommissioning Impacts

The decommissioning phase refers to all the activities which relate to the proposed Industrial Park when it is no longer in use. Potential issues that relate to the decommissioning phase refers to impacts such as metallic installations lying strewn around, lack of rehabilitation of the access roads, overgrown vegetation within the project site, etc. During the decommissioning phase, the demolition activities are likely to have similar impacts on the environment as those identified for the construction phase. These include potential impacts such as sedimentation, surface water, visual impact, dust and noise pollution, a risk of fires and explosions, safety and security and traffic impacts, etc. Impacts arising from decommissioning activities have been ranked with significance levels of minor to major.

7 CHAPTER SIX

7.0 Mitigation Measures for Associated And Potential Impacts

The identified potential and associated impacts of the© Proposed Integrated Industrial Township & Related Infrastructure titled *"Bakersville Smart Industrial City"* construction have been identified and evaluated while the impacts significance (adverse and beneficial) have also been discussed in chapter five. Consequently, the mitigation and enhancement measures for the adverse and beneficial impacts of the proposed project are presented in this chapter.

Mitigation measures are activities aimed at preventing, eliminating or minimizing the impacts and their effects to levels that are considered as low as reasonably practicable (ALARP). In proffering mitigation measures, the primary objectives were:

- **Prevention**: methods aimed at impeding the occurrence of negative impacts, and/or preventing such occurrence from having harmful environmental/ social outcomes.
- **Reduction**: limiting or reducing the degree, extent, magnitude, or duration of adverse impacts. Reduction can be achieved by scaling down, relocating, or redesigning elements of the project.
- **Control**: ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

The framework for determining the form of mitigation measures to be applied for the significant impacts identified for the project is shown below. The frequency, severity, sensitivity, scale, magnitude and nature of the impacts were taken into consideration in the assessment.

Figure 12: Mitigation Definition Criteria

HIGH	Formal Control	Physical Control	Avoidance
MEDIUM	Training	Formal Control	Physical Control
LOW	Informal Control	training	Formal Control
	MEDIUM → **HIGH**		
	Likelihood of Occurrence		

Informal Control

This involves the application of sound judgment and best practice in mitigating the impacts of the of the project activities.

Formal Control

This involves the application of documented policy, process or procedure in mitigating the impacts of the project activities. It ensures that residual associated impacts are reduced to an acceptable level.

Physical Control

This involves the application of physical processes, barriers or instruments (pegs, fence, gates, sign post etc), not necessarily requiring any special technology in order to mitigate the impacts of the project.

Avoidance

This involves the modification of plans, designs or schedules in order to prevent the occurrence of an impact or impacts. Subsequently, the specific mitigation measures satisfying the mitigation criteria were established putting the following into consideration.

- Regulatory requirements
- Available resources and competencies On-site conditions
- Technology
- Public concerns

7.1 Proffered Mitigation Measures

Accordingly, this section presents the mitigation measures proffered for the identified impacts of the proposed Industrial Township project. These cost-effective measures have been proffered with reference to best industry practice, national guidelines as well as BTD's SHE considerations. BTD as proponent is responsible for implementation of stipulated mitigation measures. Based on the impact assessment overall significance rating in chapter five, the impact significance Major, Medium or Minor was established for each identified impact. The proffered mitigation measures for the identified potential and associated impacts are presented below.

Table 11: Proffered Mitigation Measures for the Proposed Integrated Industrial Township & Related Infrastructure titled "Bakersville Smart Industrial City", Situated in Registration Division G, Erongo Region, Namibia

Project Activity/Environmental Aspect	Associated and Potential Impacts	Mitigation Measures
PRE-CONSTRUCTION		
Permitting & Land Acquisition **Consultations** – **Acquisition of license to operate** – **surveying** – **Stakeholder identification** – **Land clearing**	Acceptance and co-operation/ participation from stakeholders (communities and government) leading to peaceful and timely execution of the project	BTD and contractor shall: – Ensure that all relevant stakeholders are identified – Ensure that early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed
	Uncertainty and increased perturbation due to a lack of information and communication.	BTD shall: – Early engagement of stakeholders – Provide the opportunities for all affected groups (women, youths, religious, etc) to participate in consultations and ensure that all concerns are duly addressed. – Plan and execute consultations to educate community members and stakeholders on project activities, schedules and potential impacts. – Ensure consultation throughout project life span.
	– Integration of men and women concerns into the project design – Exclusion of vulnerable groups from consultations which may lead to strife	BTD and Contractors contractor shall: – Ensure due consultation with relevant groups at all phases of the project. – Provide the opportunities for all affected groups to participate in consultations and that all concerns are duly addressed. – Establish and publicize grievance procedure

PRE-CONSTRUCTION	Community agitations over compensations, land disputes, wrong stakeholder identification, leadership tussles, etc	BTD and contractors shall: – Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities – Project will also develop and implement a Resettlement Action – Plan to ensure equitable settlement of all project affected persons – Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. – Establish and publicize grievance procedure – Stakeholders (communities, Govt., etc.) are adequately consulted and relevant issues addressed – Agreed fair compensation for land are paid to identified owners promptly as per set standards. – As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will immigrate into the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities drive the project and derive the most benefits from the development.
Transport of Personnel and Construction Elements – **Relevant roads** – **All road leading to project site**	Increased traffic during mobilization on road with risks of accidents leading to injury/death and loss of asset.	BTD and its contractors shall ensure; – All vehicles and boats are certified road / water worthy prior to being mobilized for work activities. – Compliance to all roads and water ways safety transport rules including speed limits – Competency training and certification of drivers before mobilization. – Limit movement to day time only. – Follow traffic management guidelines (EMP)

	Nuisance (noise and vibrations) due to movement from heavy duty equipment and vehicles affecting public and wildlife.	BTD and contractor shall: – Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. – Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. – Prolonged exposure to this impact should be reduced where possible. – Plan work activities to avoid heavy duty movement during peak hours – Consult with host communities and plan project activities accordingly – Limit movement and work activities to daytime only – Ensure equipment are properly maintained
	Increase in dust particles and vehicular emissions.	BTD and contractors shall: – Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction are properly maintained and serviced. – Ensure that all material (sand and aggregate) stockpiled within the project site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. – Reduce speed within earth roads – Plan journey to reduce travel times – Vehicles carrying earth materials should be covered
	Work place accidents/incidents from the use of cranes, forklifts, etc. during loading and offloading of materials/equipment.	BTD and its contractors shall ensure; – All personnel are qualified and certified for their relevant works – That approved safe work procedures are provided and complied with at all times – Use of appropriate personal protective equipment (PPE) e.g., rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site – Limit work activities to daytime only

	Obstruction of/damage to existing roads due to increased usage during mobilization	BTD and contractors shall: – Roads to be assessed prior to commencement of work to establish the status and its capability to safely handle material and personnel transportation, and after completion to determine extent of impact and where necessary, take steps to reclaim areas damaged by project activities – Plan work execution to reduce travels and restrict where necessary, use of access roads.
	Interference with other road users within mobilization route	BTD and its contractors shall ensure that – Equipment, materials and personnel are mobilized after due consultation with relevant transportation authorities (Roads Authority) and other stakeholders to minimize interference within mobilization routes. – Travels to and from sites shall be planned to maximize each trip and minimize number of travels
	Leakage of fuel or lube oil onto and or into water bodies during transportation and storage may lead to increased chemical toxicity.	BTD and contractor shall ensure: – Safe operating practices are enforced during mobilization – Implementation of project specific spill and emergency response plan hydrocarbon/chemical spill containment and prevention measures and equipment are functional and effective on site and for equipment and vehicles hydrocarbon and chemical transfers in safely contained areas – Double handling to be avoided where possible – When transfer has to take place, ensure it is affected in lined and secured areas where containment is possible – Educate personnel on hydrocarbon and chemical handling risks/hazards, through SHE briefings/tool box meetings
Recruitment of Labour	Employment opportunities arising from recruitment of technical and non-technical Industrial Township workers	BTD and contractor shall: – enhance this beneficial impact by – Creating requirements for contractors to hire local labour – Ensure skills acquisition and development – Recognize and commend personnel with outstanding performance

	Influx of people (migrant workers, sub- contractors and suppliers) and increased pressure on existing social infrastructure.	BTD and contractor shall: – Brief all employees to ensure awareness of any sensitivity to the local cultures, traditions and lifestyles – Continuous consultation while project is in progress – Implementation of community relations and engagement plan – Encourage hiring, as practicable, of appropriately qualified workers from areas in the vicinity of the project to discourage preventable influx of persons – Work with contractors to ensure that specialized skill workers from outside the areas have access to proper accommodations and other basic infrastructure – Educate all workers to enhance their Health, Safety, Security, and Environment awareness, and performance on the job – Maintain medical emergency response plan so that all injured or ill personnel can promptly access appropriate care
	Increase of communicable diseases due to influx of people and poor living conditions around pre-construction sites	BTD and contractor shall: – Project will develop a health plan to address potential health issues – Carry out health awareness program (malaria, corporate stop AIDS program, etc.) – Provision of site medical personnel to attend to emergency situations – Engage the services of retainer clinics to manage health issues – Educate workforce on the prevention of malaria as well as encourage the use of mosquito nets in construction camps
	Increase in social vices (like theft, prostitution) resulting from increased number of people	BTD and contractor shall: – Ensure its personnel and contractors undergo pre- employment background screening as required – Periodically discuss health and social education issues during toolbox/SHE meetings – Promptly deal with reported cases of misconduct to check recurrences

	Conflicts/community agitations over employment issues (quotas and methods)	BTD and contractor shall: – Project will develop a community relations and engagement plan that identifies fair strategies of engagement for all communities – Project will also develop and implement a resettlement action plan to ensure equitable settlement of all project affected persons – Establish and publicize grievance procedure – Early stakeholders' engagement sessions are held, and all agreed issues properly documented and signed. – All affected stakeholders and legacy issues are identified early, clearly defined, and agreed on. – Stakeholders (communities, Govt., etc.) are adequately consulted and relevant issues addressed – Agreed fair compensation/rent for land are paid to identified owners promptly as per set standards. – As far as possible employ persons from the surrounding communities during the construction phase of the development to reduce the numbers of persons that will migrate to the area seeking employment. This will also avoid any feelings of resentment and will ensure that the communities derive the most benefits from the development.
Site Preparation – **Access to Project site** – **Creation of Service roads** – **Camping and Campsites** – **Site clearing**	Business opportunities for local contractors through sub- contracting activities	BTD and contractor shall: – Encouraging indigenous contractors and suppliers providing them opportunities to supply materials of acceptable standards – Encourage contractors to hire and to develop local labour – Workers are paid promptly as at when due
	Local support services from road side supply markets and shops etc.	
	Contamination of surface water as a result of siltation caused by increased erosion, during site preparation.	BTD and contractor shall: – Employ appropriate industry practices in Industrial township construction and ancillary facilities in order to avoid adverse alteration drainage pattern – Implement where appropriate sediment run-off controls and visually inspect after rainfall events – Laydown areas/Marshalling yards are designed to include erosion control – Reclaim as practicable topography of excavated or compacted upland areas upon completion of activities.

	Disturbance of the vegetation cover / loss of forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation. Loss/disturbance of wildlife due to habitat loss/fragmentation from vegetation clearing within project site and access roads	BTD and contractor shall: – Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental – Management Plan to be developed by contractors to ensure appropriate flora and fauna management. – Vegetation clearing will be limited to minimum area required for work – Utilization of existing accessible tracks as much as possible
	Soil compaction, destabilization from excavation and runoff erosion resulting in sedimentation problems.	BTD and contractor shall: – Implement where appropriate sediment run-off controls and – visually inspect after rainfall events – Install siltation traps within the drainage design to collect silt and – sediments ensuring that they do not end up in adjacent aquatic – areas. – Construction on steep slopes and in soft or erodible material will – require erosion control measures and correct grassing methods. – Laydown areas/Marshalling yards are designed to include erosion – control – Reclaim as practicable topography of excavated or compacted – upland areas upon completion of activities.
	Fragmentation of wildlife habitats/increase in poaching due to an easier access for the local population and non-resident workers.	– Where possible plan site clearing to allow species the opportunity to relocate to suitable nearby habitats and to reduce the shock to the various habitats that may be disturbed. – Prohibit poaching particularly by workers and educate workers on good biodiversity conservation policies.
	Waste Disposal – scrap metal, wood, sand, concrete, paper, domestic waste – Waste from laydown areas (Material and wood)	BTD and contractor shall: – Develop project specific waste management plan (See EMP) and ensure proper implementation – Provide adequate containers for waste collection – Periodically assess contractor activities to check the level of compliance to regulatory waste management requirements. – Safe operating practices are enforced during construction – Ensure use of only government approved waste management contractors
CONSTRUCTION		

Fabrication and Metal works – **Cutting, bending and welding steel components** – **Painting** – **Handling of conductor wires and fittings**	Workplace accidents from burns, cuts, bruises, trips and falls, objects at height, leading to injury or fatalities.	BTD and its contractors shall ensure; – All personnel are qualified and certified for their relevant works – That approved safe work procedures are provided and complied with at all times – Use of appropriate personal protective equipment (PPE) e.g., rubber hand gloves, hard hats, safety boots, etc. by all personnel at the project site – Limit work activities to daytime only where practicable
	Employment of local labour and skills acquisition for workers taking advantage of new opportunities	BTD and its contractors shall enhance this beneficial impact by – Creating requirements for contractors to hire local labour – Ensure skills acquisition and development
	Risk of electrocution and burns (to onsite workers) from welding flashes and high currents during welding	BTD and its contractors shall ensure; – All personnel are qualified and certified for metal works – That approved safe work procedures are provided and complied with at all times – Use of appropriate personal protective equipment (PPE) e.g., rubber hand gloves, hard hats, safety goggles, etc. by all metal works personnel
	Noise and attendant vibration effects from fabrication and associated welding equipment	BTD and contractor shall: – Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. – These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected. – Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. – Prolonged exposure to this impact should be reduced where possible. – Ensure use of appropriate PPEs (ear plugs) by workers in areas with noise level above (90dBA) hourly work area limits.
	Inhalation by onsite workers of toxic fumes during welding of Building / Other Structures components	BTD and its contractors shall: – Utilize environmentally friendly electrodes, spray and paint liquids for welding as well as painting. – Use of appropriate personal protective equipment such as welding masks by welders shall be enforced. – BTD shall also install fume expellers or blowers at confined welding areas. – Implement appropriate work-site practices.

	Generation of metal scraps from conductor wires and steel elements associated with fabrication of Building/Other Structures components.	BTD and contractor shall: – Develop project specific waste management plan and ensure proper implementation – Provide adequate containers for waste collection – Periodically assess contractor activities to check the level of compliance to regulatory and BTD waste management requirements. – Safe operating practices are enforced during construction – Ensure use of only government approved waste management contractors
CONSTRUCTION		
Foundation / Earth Works – **On-site geotechnical testings** – **Building foundations, etc**	Increased business and economic activities as well as diversification of income sources due to supply contracting and sub- contracting	BTD shall enhance this by: – Encouraging indigenous contractors and suppliers providing them opportunities to supply materials of acceptable standards – Encourage contractors to hire and to develop local labour
	Increase in revenue opportunities for local population due to presence of non-resident workers and travellers	
	Soil / groundwater contamination resulting from accidental leakages and spills of hazardous substances (diesel, cleaning agents, lubricants, hydraulic oil)	BTD and contractor shall: – Plan and set on-site sanitary facilities for the disposal of wastewater. – Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (lube oils, chemicals, etc.) – Ensure safe management of hazardous materials (chemicals, etc.) – Ensure handling of fuels such as fuelling of vehicles and machinery, and fuels transfers, take place in contained areas, where sufficient measures are in place to ensure containment of spills. – Plan emergency response measures and equipment are available, and personnel are capable of effectively using it for cases of accidental spill.
	Increased jobs and job opportunities from local labour hire and sub-contracting to indigenous	BTD and contractor shall enhance this by: – Encouraging indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards

	Generation of dust and automobile / heavy duty equipment emissions from construction earth works.	BTD and contractor shall: – Ensure that all vehicles involved in the transport of construction material and staff and machinery involved in the construction is properly maintained and serviced. – Ensure that all material (sand and aggregate) stockpiled within the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping. – All staff employed at the construction site must be provided with dust masks and be asked to use them. – Reduce speed within earth roads – Plan journey to reduce travel times – Vehicles carrying earth materials should be covered
	Flora/habitat loss and disturbance through vegetation clearing and earthworks within project site, access roads and at Building/Other Structures sites	BTD and contractor shall: – Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental – Management Plan to be developed by contractors to ensure appropriate flora management. – Limit vegetation clearing to footprint required for construction purposes to minimize disturbances within proposed Industrial Township project site.
	Fauna disturbance and displacement as a result of migration away from construction activity area (this includes impact on bird life)	BTD and contractor shall: – Ensure inclusion of threatened and endangered species management strategies in the site specific Environmental – Management Plan to be developed by contractors to ensure appropriate flora management. – Plan and execute construction work to minimize interference on wildlife – Maintain construction equipment to optimal function conditions – Monitor presence of wildlife species during construction activities
	Potential collapse of transmission Building / Other Structures as a result of unsuitable geotechnical conditions	BTD and contractor shall: – Carry out side by side geotechnical investigations during construction to determine suitability of soil to carry Building/Other Structures – Recommendations from geotechnical appraisals shall be appropriately implemented – Construction of Building/Other Structures foundations shall follow good industry engineering practices.

	Reduction in (desert) wildlife population as a result of poaching due to easier access created by project site clearing	BTD and contractor shall: – Prohibit poaching by personnel – Periodically educate workforce on good principles of biodiversity conservation – Limit workforce concentration to project area and prohibit the possession of fire arms by members of workforce – Practice wildlife conservation principles (e.g., release back into the wild any wildlife incidentally caught by dug-up foundations or tranches.
	Noise nuisance (including impulsive noise) from construction activities (e.g., piling) resulting to temporary migration of sensitive mammals and rodents.	BTD and contractor shall: – Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. – Workers, especially those working with machinery, vehicles and instruments that emit high levels of noise should be supplied with ear plugs and ear muffs to reduce the risk of hearing impairment. – Prolonged exposure to this impact should be reduced where possible. – Regularly maintain construction equipment to optimal function – Limit heavy duty construction works to day hours only where practicable
Building / Other structure – **Construction and Erection** – **Crane lifting and erections** – **Bolts and nuts tightening** – **Anti-climbing guards and step bolts** – **Insulators and fittings, etc,** –	Pollution of soil as a result spilled fuel and other waste oil discharge during building/other structure construction and installation processes	BTD and contractor shall: – Develop and implement spill response plan – Maintain storage facilities at optimal holding condition – Train personnel in safe fuel handling procedures of chemicals and hydrocarbons – Ensure all fuel storage facilities are bunded and lined with impermeable materials – Vehicle and equipment maintenance activities implemented using proper containment or other strategies to guide against spills – Monitoring during maintenance of equipment to ensure that there is no discharge to the environment

	Traffic diversion and congestion within local roads during installation close to nearby roads.	BTD and contractor shall: – Coordinate Building/Other Structures construction and stringing activities to avoid heavy traffic periods – Use warning signs and traffic wardens/directors – Ensure activities causing blockages at road crossings are carried out within shortest time practicable – In the case of longer road blockages, divert traffic to approved alternate routes in liaison with appropriate authorities – Consult with affected communities prior to closures to provide warnings and alternatives. – Follow guidelines for traffic management (EMP).
	Workplace accidents / incidents (trip/falls etc) from heights during conductor wire stringing and bolt/nuts tightening project activities.	BTD shall ensure SHE briefings prior to commencement of work activities – Develop standard work procedures where work hazards are identified and addressed – BTD shall ensure personnel use appropriate PPE – BTD shall design work area to internationally acceptable standards – Ensure availability of first aid facilities onsite – Ensure retainer clinics are engaged and site medical personnel are available in case of accidents – Maintain medical emergency response plan so that injured or ill personnel can promptly access appropriate care.
	Risks of injury / death and loss of assets resulting from accidents associated with road transportation to and fro construction sites	BTD and its contractors shall ensure; – All vehicles are certified road worthy prior to being mobilized for work activities. – Compliance to all roads safety transport rules including speed limits – Competency training and certification of drivers before mobilization. – Limit movement to day time only
	Risks of fire/explosions resulting from accidental ignition of onsite diesel storage tanks	BTD and its contractors shall ensure; – All fuel storage tanks are kept at safe distances from work areas – Educate workforce on risks associated around storage areas and prohibit activities (such as smoking) that can ignite storage tanks – Designate no-smoking and smoke areas – Hold SHE meetings and talks on fire hazard

	Waste Disposal – scrap metal, wood, sand, concrete, paper, domestic waste – used oil and replaced/obsolete equipment pars that may contaminate soil/groundwater – Waste from lay-down area and project site	BTD and contractor shall: – Develop and implement a waste management plan – Provide adequate containers for waste collection – Periodically assess contractor activities to check the level of compliance to regulatory and BTD waste management requirements. – Ensure engagement of government approved waste – management contractors
	Localized economic benefits from Materials supplies by local contractors	BTD and its contractors shall enhance this by: – Encouraging indigenous contractors and suppliers by providing them opportunities to supply materials of acceptable standards – Encourage contractors to hire and to develop local labour
	Induced secondary development within the neighbouring host communities from increased economic activities	
OPERATION		
Operations – **After Commissioning and all facilities operations,**	Increased electricity distribution capacities within the project area	– Take into account the various land uses while designing the project in order to minimize the loss of land, particularly productive land. – Timely completion of the project so that associated benefits such as reduction in environmental pollution, business opportunities, quality of life, etc shall take effect.
	Increased business opportunities and quality of life (small, medium, large scale) due to enhanced power delivery from Solar Plants	
	Improvement in environmental standards due to reduced emission from standby diesel or fuel generators, use of fuel wood	
	Reduced demand on petrol and diesel used for power generation and further reduction in greenhousegases and noise emissions	
	Risk of collision of low flying air planes with Building/Other Structures and lines.	– Alternative analysis of the project site options ensured minimal to no interference with air traffic – BTD shall provide Aircraft Warning spheres and Building/Other Structures signs in areas where air traffic might occur in order to minimize risk of low flying aircraft colliding with Building/Other Structures and wires.

Operations **• Commissioning and all facilities operations,**	Electric shock and burns to members of the public in the event of Building/Other Structures collapse or damage to electrical installation.	– Building/OtherStructures shall be installed following the best engineering standard – Building/Other Structures shall be collapse tested to prove the building / Other Structures design is in line with the BTD requirements – BTD shall carry out routine inspection of Building/Other Structures in order to allow early detection of damaged Building/Other Structures. – Reported cases of damaged or fallen Building/Other Structures shall be promptly attended to – Adequate and automatic fault/damage detection system shall be installed. – Personnel shall be trained on the detection/handling of such emergencies arising from accidental damage

8 CONCLUSION

The report presents the EIA (and Environmental Management Plan (EMP)), for the proposed Integrated Industrial Township & Related Infrastructure titled "Bakersville Smart Industrial City", Situated in Registration Division G, Erongo Region, Namibia. The development shall be a centre of conglomeration of residential properties operating with state-of-the-art facilities and delivering in a highly environmentally sustainable manner using cutting edge and smart technologies in Namibia. The project is part of the efforts of Bakersville Township Development to contribute to the growth of Namibian economy.

The EIA shall serve as a reference platform against which future changes in the environment vis-à-vis the project in view can be monitored. The document shall also provide the necessary information required for the issuance of Approval and Environmental Impact Statement for the proposed project by the Environmental Commissioner – Ministry of Environment, Forestry and Tourism and other interest groups.

Multidisciplinary approach was employed in the assessment of the natural environmental status and sensitivities of the various ecological components of the project area with the use of extensive literature survey, field sampling, measurement/testing, analysis and methodologies compatible with national and international standards.

The sensitivity of the environment to element of the proposed project activities were identified and assessed and appropriate mitigation measures were developed to reduce their adverse effects to ALARP on one hand and enhance their beneficial contributions on the other hand.

This Environmental Management Plan (EMP) covering the biophysical and socio-economic aspects of the project was developed in order to ensure that mitigation measures would be established and maintained throughout the life cycle of the project. Mitigation measures were based on best available technology, safety, health and environmental considerations.

Consultation with the host communities was carried out and is expected to continue throughout the life cycle of the project. On the basis of the outcome and findings of the EIA document the proposed Integrated Industrial Township & Related Infrastructure titled "Bakersville Smart Industrial City", is capable of achieving its goal of growing Namibian economy in an environmentally sustainable manner if the recommendations made in this report are implemented methodically with due diligence.

IT IS THEREFORE RECOMMENDED THAT THE ECC BE GRANTED BY THE ENVIRONMENTAL COMMISSIONER TO ENABLE THE SWIFT IMPLEMENTATION OF THE ENVISIONED DEVELOPMENT.