APPLICATION FOR LAND USE CHANGE ACCORDING TO THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT (ACT 16 OF 2013)

OPWAG (UITKOMS) TOWNSHIP ESTABLISHMENT PROJECT: SUBDIVISION, CONSOLIDAITON AND REZONING

INVOLVED PROPERTIES:
PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT, NO. 48, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

PLOT 2642, BOEGOEBERG SETTLEMENT, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

SUBMISSION DATE: OCTOBER 2020

COGHSTA
Department:
CO - OPERATIVE GOVERNANCE
HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
NORTHERN CAPE

MACROPLAN
TOWN & REGIONAL PLANNERS
YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES
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SUBMISSION DATE:
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!Kheis Municipaliteit Municipality

97 Oranje Street
Tel 054 833 9500
Fax 054 833 0690
E-Mail: fvaneck3@gmail.com

Private Bag X2
Groblershoop
8850

Application for Land Use amendment in terms of Spatial Planning and Land Use Management Act 16 of 2013.

Application for land use amendments

(give full details in the attached motivation report, if space provided is not enough)

SECTION 1

Details of Applicant (See Planning Profession Act, Act 36 of 2002)

Name:	Macroplan	**Contact person:**	Len Fourie JP Theron
Postal address: **Code:**	P.O. Box 987 Upington 8800	**Physical address:**	4A Murray Avenue Upington 8801
Tel no:	054 332 3642	**Cell no:**	082 821 1025 082 821 1024
Fax no:	054 332 4283		
SACPLAN Reg No:	Len J. Fourie: Pr.Pln. A/1322/2006 J.P. Theron: Pr. Pln. A/2394/2016 (Annexure M)	**E-mail address:**	macroplan@mweb.co.za jptheron@mweb.co.za

Macroplan Town and Regional Planners, has been appointed by Barzani Development on behalf of the Department of Cooperative Governance, Human Settlements and Traditional Affairs (COGHSTA).

SECTION 2

Details of Land Owner (If different from Applicant)

Name:	The involved properties, Portion 14 of the Farm Opwag (Uitkoms) Settlement No. 48 and Plot 2642, Opwag (Uitkoms) Settlement, are held under the ownership of the Kheis Local Municipality.	**Contact person:**	!Kheis Municipality: Fanus van Eck	Barzani Development: Marike Joubert
Postal address:	Private Bag X2 Groblershoop 8850	**Physical address:**	97 Oranje Street	9 Cambridge Office Park
Tel no:	054 833 9500	**Cell no:**	082 662 2771	066 457 5755
Fax no:	054 833 0690	**E-mail address:**	fvaneck3@gmail.com	Marike@Barzanigroup.co.za

If the applicant is not the registered owner(s), attach a power of attorney from the registered owner(s) to the application.

SECTION 3

Details of Property (In accordance with Title deed)

Erf / Farm No and portion description:	*LOT 2642, OPWAG (UITKOMS) SETTLEMENT, Kenhardt RD, Northern Cape Province (hence refer to as Plot 2642, Opwag (Uitkoms) Settlement);* *PORTION 14 OF THE FARM OPWAG (UITKOMS) SETTLEMENT, NO. 48, KENHARDT RD, NORTHERN CAPE PROVINCE (hence refer to as Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48);* *Plot 1890, Boegoerberg Settlement, Prieska RD (hence refer to as Plot 1890, Boegoerberg Settlement)*	Area (m^2 or ha):	Plot 2642, Opwag (Uitkoms) Settlement: 11129.2886ha; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: 82.9405ha.
Physical address of erf/farm:	The informal community of Opwag (Uitkoms) can be located on the involved land portions, which is located between the towns of Wegdraai and Groblershoop.	Existing Zoning:	Plot 2642, Opwag (Uitkoms) Settlement: Agricultural Zone I; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: Agricultural Zone I.
Location from nearest town:	The portions of the properties involved in this submission are located 8km east of Wegdraai and 7km north-north-west of Groblershoop.	Existing land use:	Plot 2642, Opwag (Uitkoms) Settlement: Informal residential stands can be located to the northern corner of the involved property. The remaining section of this property is vacant; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: Informal residential stands can be located to the north eastern section of the involved property. The remaining section of this property is vacant.
Town/ suburb:	Within the rural community of Opwag (Uitkoms)	Area applicable to application:	Plot 2642, Opwag (Uitkoms) Settlement: 41ha will form part of this township establishment project; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: 11ha will form part of

			this township establishment project.
Registration Division:	Kenhardt RD	**Title deed no:**	Plot 2642, Opwag (Uitkoms) Settlement: T79244/2007; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: T59309/2007 (Annexure A)

SECTION 4

Type of Application being Submitted (Mark with an X and give detail)

Application for:

(Please mark applicable block with a cross)

The establishment of a township or the extension of the boundaries of a township.	X
The rezoning from one zone to another	X
The removal, amendment or suspension of a restrictive or obsolete condition, servitude or reservation registered against the title of the land.	
The amendment or cancellation a general plan or SG Diagram	
The closure of any public place or road and street reserves	
The secondary use as provided for in the regulations (not supported by SDF)	
The departure from the development parameters of the zoning scheme	
The departure to use land for a purpose not provided for in the zoning scheme granted on a temporary basis	
The secondary use as provided for in the regulations (supported by SDF)	
The subdivision of land	X
The registration of a servitude	
The consolidation of land	X
The extension of the validity period of an approval	
The application for the exemption of subdivision and consolidations as provided for in the regulations	
Any other application not provided for in the table above	
Please give a short description of the scope of the project:	

Our office, Macroplan Town and Regional Planners, has been appointed (See Annexure B) by Barzani Development on behalf of the Department of Cooperative Governance, Human Settlements and Traditional Affairs (hence referred to as COGHSTA), to facilitate the needed town planning procedures involved with a township establishment project for Opwag (Uitkoms).

The informal town of Opwag/ Uitkoms has been created by the farmworkers that work on the surrounding farmland. The informal town of Opwag (Uitkoms) has now grown to a point where formalisation is needed, as well as the provision of supporting land uses, such as schools, businesses, municipal infrastructure, recreational areas etc. The !Kheis Local Municipality has secured the properties on which the community of Opwag (Uitkoms) are established with the goal of registering this town as a formal proclaimed township. The recent commitment by COGHSTA to address the ***housing backlog*** *within the Northern Cape, presented the !Kheis Local Municipality with the ideal opportunity to undergo the necessary town planning processes to register Opwag (Uitkoms) as a proclaimed township, with registered properties that can be allocated to individual ownership.*

The proposed Opwag (Uitkoms) township establishment project entails the proclamation of Opwag (Uitkoms), formalisation of existing informal properties, provision of additional erven for future population growth, as well as the provision of supportive land uses normally associated with a township, such as institutional uses, municipal uses and business premises. The township establishment of Opwag (Uitkoms) will facilitate the process of converting farmland to a township, during this process the proposed erven and zonings become valid. The proclamation of Opwag (Uitkoms) is furthermore needed, since no transfer of individual stands in the township will be allowed without proclamation.

In order for the planned Opwag (Uitkoms) establishment project to take place, the following land use changes are required:

1. SUBDIVISION: (See Figure 4):
   1.1. Subdivision of a 112ha portion of Plot 2642, Boegoeberg Settlement:

2. CONSOLIDATION (See Figure 4):
   2.1. Consolidation of the newly subdivided portions of land, as mentioned under §1.1, with Portion 14 of the Farm Boegoeberg Settlement, No. 48 into an individual land unit.

3. SUBDIVISION (See Figure 5):
   3.1. Subdivision of the newly consolidated land unit, into 771 individual cadastral land units.

4. REZONING (See Figure 6):
   4.1. Rezoning of the newly created properties, thereby allocating appropriate land use rights to each of the newly created individual erven suitable to their future purpose within the Opwag (Uitkoms) township establishment project. The proposed zonings, in terms of the newly adopted !Kheis Scheme Regulations, are as follow and should be read together with the final layout plan attached as Annexure E to this submission:

Zoning	Primary Use/s	Erven Amount
Residential Zone I	Residential House	730
Business Zone I	Business Premises	10
Institutional Zone I	Place of Instruction/ Educational	2
Institutional Zone II	Place of Worship	3

Open Space Zone II	Public Open Spaces	23
Transport Zone I	Public Street	1
Authority Zone I	Municipal Uses	1
Total		770

5. TOWNSHIP ESTABLISHMENT:

5.1. The proclamation of Opwag (Uitkoms), in order to facilitate the conversion of farmland to a township and allow for the transfer of ownership of individual stands.

Please refer to Figures 4, 5 & 6, Annexure E, §2.8 & §3.3 of this report for more information in this regard.

SECTION 5

Detail of application (Mark with an X and give detail where applicable)

Is the land unit currently developed (buildings etc.)?	YES		If answered YES, what is the nature & condition of the developments / improvements?	The portions of the involved properties applicable to this submission have been occupied by informal stands to some extent.
Is the current zoning of the land utilised?		NO	If answered NO, what is the application / use of the land?	This application will rectify the discrepancy between land uses and zoning, causes by the establishment of informal houses.
Is the property burdened by a bond?		NO	If answered YES, attach the bondholder's consent to the application:	Not applicable
Has an application for subdivision/ rezoning/ consent use/ departure on the property previously been considered?		NO	If answered YES, when and provide particulars, including all authority reference numbers and decisions:	Not applicable
Does the proposal apply to the entire land unit?		NO	If answered NO, indicate the size of the portion of the land unit concerned, as well as what it will be used for and the same for the remaining extent:	Plot 2642, Opwag (Uitkoms) Settlement: 41ha will form part of this township establishment project; Portion 14 of the Farm Opwag (Uitkoms) Settlement, No. 48: 11ha will form part of this township establishment project.
Are there any restrictions, such as servitudes, rights,	YES		If answered YES, please provide detail description:	N/A

bonds, etc. with regard to the land unit in terms of the deed of transfer that should be lifted, as it might have an influence on this application?				
Are there any physical restrictions (e.g. steep inclines, unstable land formations, marshes, etc.) that might influence the intended development?	YES		If answered YES, name full particulars and state how the problem will be solved and submit detail layout plan:	A myriad of specialist studies have been conducted on account of the Opwag (Uitkoms) township establishment project. For the most part the physiography of the study area is ideal for township establishment, however, the following should be noted: 1. The Botanical Assessment Report (See Annexure F) identified numerous protected vegetation and the impact on the environment will be medium-low, but can be reduced to low through mitigation. Mitigation entails that the necessary permits from the relevant authorities be obtained for the removal of this vegetation prior to site clearance and construction; 2. The Geological Report (See Annexure G) concluded that the development site is intermediately suitable for residential development; 3. Fresh Water Report (See Annexure I) concluded that a general authorisation for the planned housing development can be issued. 4. The Heritage Impact Assessment (Annexure H) identified no significant heritage resources that will be impacted negatively by the proposed development.
Is any portion of the land unit in a flood plain of a river beneath the 1:50 annual		NO	If answered YES, please provide detail description:	Not Applicable

flood-line, or subject to any flooding?				
Is any other approval that falls outside of this Act, necessary for the implementing of the intended development?	YES		If answered YES, please provide detail description:	Various approvals/ no objections/ authorisations had to be obtained in relation to the proposed residential development and they are as follow: • Environmental Authorisation: The final scoping report (Annexure J) has been submitted to DENC. The processing of the application has been limited, due to the Covid-19 protocols that have been enforced by the Department of Environment and Nature Conservation. This application for land use change is therefore submitted without the EA; • DRPW: The Department of Roads and Public Works has been furnished with a formal notification letter (Annexure K) for review on the 8th of October 2020. The formal response form DRPW will be presented to the !Kheis Municipality upon receipt thereof. The !Kheis Municipality has granted permission to submit this application and commence with the public participation process without the Environmental Authorisation and DRPW no-objection. It should however be noted that this application will not proceed beyond the public participation process until the environmental authorisation and DRPW no-objection have been obtained. Kindly note that the involved properties are registered in

			the ownership of the !Kheis Municipality & the Northern Cape Province and therefore the input from the Department of Agriculture is not required.
What arrangements will be made regarding the following services for the development? (Full Engineering Reports must be supplied, where applicable). If services will be provided by the Municipality, proof of input from departments must be included as Annexure to the application.	Water supply:	BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow: *"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag 730 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag 730 Houses development."* *Kindly refer to the services report for more detail on the proposed upgrading of municipal infrastructure.* Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.
	Electricity supply:	BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow: *"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag 730 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag 730 Houses development."* *Kindly refer to the services report for more detail on the proposed upgrading of*

What arrangements will be made regarding the following services for the development? (Full Engineering Reports must be supplied, where applicable). If services will be provided by the Municipality, proof of input from departments must be included as Annexure to the application.		*municipal infrastructure.* Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.
	Sewerage and waste-water:	BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow: *"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag 730 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag 730 Houses development."* *Kindly refer to the services report for more detail on the proposed upgrading of municipal infrastructure.* Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.
	Storm-Water:	Storm water drainage will take place above ground, in natural furrows and along the streets of the proposed layout. The layout plan has been designed to accommodate all storm water furrows identified in the Freshwater Report, as well as align with the general topography of the development site. No Problems are expected in this regard.
	Road Network:	The community of Opwag (Uitkoms) has adopted the traditional grid pattern formation, with a coherent road network. The township establishment project will expand upon the existing internal road network of Opwag (Uitkoms), through a hierarchy of road types designed to promote accessibility and mobility. The community of Opwag (Uitkom) is not located directly to a provincial or national road, but receives access via two existing roads that that connect to a provincial road. DRPW has been informed of the Opwag (Uitkoms) township

		establishment project and approval for the existing access roads from the provincial road has been requested. The formal response from DRPW will be furnished to the !Kheis Municipality and ZF Mgcawu District Municipality upon receipt thereof. It is anticipated that a traffic impact assessment and detail engineering plans might be upheld as conditions to approval.

SECTION 6

List of Attachments and supporting information required / submitted with checklist for Municipal use (Mark with an X / number annexure)

Checklist (for the completion by the Applicant only)				Checklist (for the use of Responsible Authority only)		
YES	NO	ANNEXURE	DOCUMENT ATTACHED	YES	NO	N/A
x		Section A	Completed Comprehensive Application form			
x		Section B	Complete Motivation Report			
x		§2.3	Alignment to the Provincial, District and Municipal SDFs			
	x		Public participation report (minutes of meetings, copies of advertisement, etc.)			
x		Annexure B	Power of Attorney (Board of Directors' / Trustees' resolution / consent)			
x		Annexure A	Copy of Title Deed(s)			
	x		Mortgage holder's consent			
x		Annexure C	Cadastral information – diagram/General Plan including servitudes, lease areas, etc.			
	x		Status report from Surveyor General – street closure or state owned land			
x		Figure 4	Topographic map/ aerial map			
x		Figure 1 & 2	Locality Map			
x		Annexure E	Site Plan			
x		Annexure M	Zoning Map			
	x		Zoning Certificate			
x		Figure 4	Land Use Map			
	x		Conveyancer's certificate			
	x		Special endorsement/proxy			
	x		Home Owners' Association consent			
x		Annexure E	Proposed design/layout plan			
x		Figure 5	Proposed subdivision plan			
	x		Proposed consolidation plan			
	x		Proposed development plan			
	x		Mineral rights certificate (together with mineral holder's consent) and/or prospecting contract			
	x		Mineral impact assessment (MIA)			
x		Annexure J *(Final*	Environmental Impact Assessment (EIA – EA) including Heritage Impact			

		Scoping Report)	Assessment (approval from Dept Sport, Arts and Culture) and Archaeological Impact Assessment (AIA) (approval from relevant Department - SAHRA)			
x		**Annexure D**	Detail Engineering Services report (Bulk and internal)			
x		**Annexure K**	Traffic impact study **(DRPW no-objection)**			
x		**Annexure G**	Geo-technical report (including geology) report (NHRB Standards)			
	x		Social impact assessment			
	x		Flood line assessment (1:50 and 1:100 years)			
	x		Coastal setback report (consent from Dept of Environmental Affairs)			
	x		Subdivision of agricultural land (consent of the Dept of Agriculture)			
	x		List of sections in Title Deed conditions to be removed /amended			
x		**Annexure N**	Adherence to planning legislation including the Planning Profession Act 36 of 2002			
x			**At least three (3)** sets of full colour documentation copies			

SECTION 7

Declaration

***Note:** If application is made by a person other than the owner, a Power of Attorney is compulsory. If the property is owned by more than one person, the signature of each owner is compulsory. Where the property is owned by a company, trust, or other juristic person, a certified copy of the Board of Directors/Trustees' resolution is compulsory.*

I hereby certify the information supplied in this application form to be complete and correct and that I am properly authorised to make this application.

Applicant's / Owner's Signature:		Date:	2	0	2	0	1	0	2	5
Full name (print):	Justus Petrus Theron									
Professional capacity:	Professional Town and Regional Planner									
Applicant's ref:	Pr. Pln. A/2394/2016									
Applicant's / Owner's Signature:		Date:	2	0	2	0	1	0	2	5
Full name (print):	Len Jacobus Fourie									
Professional capacity:	Professional Town and Regional Planner – Senior Town Planner									
Applicant's ref:	Pr.Pln. A/1322/2006									

SECTION 8

Prescribed Notice and advertisement procedures

(for the completion and use of Responsible Authority only)

Checklist for required advertisement procedure			Checklist for required proof of advertisement		
YES	NO	DOCUMENTATION AND STEPS TO BE TAKEN	YES	NO	DOCUMENTATION TO BE PROVIDED AS PROOF
		Notice to be placed in the Local Newspaper			**Proof of Notice in Local Newspaper** Note: The original newspaper advertisement or full colour copy, indicating page number and date.
		Notice to be placed in the Provincial Gazette (for 2 consecutive weeks)			**Proof of Notice in the Provincial Gazette** Note: The original newspaper advertisement or full colour copy, indicating page number and date.
		Notices to neighbours Note: The map indicating the neighbouring erven and list of neighbours will be provided. If the applicant chooses to deliver the notices per hand (Option 1), two copies of the notice must be provided on or before the date of the notice to each neighbour. One copy of the notice must be signed by the respective party (neighbour) to be handed back to the Responsible Authority. Alternatively (Option 2), the notices can be sent via registered post.			**Proof of Notice to neighbours** Note: Option 1: The signed notices of all surrounding neighbours, as identified by the Responsible Authority, must be provided. Note: Option 2: The proof of the registered mail must be provided to the Responsible Authority
		Notice to be placed on the site Note: The notice provided must be placed on the site in a laminated A3 format (two language formats separate on A3) on or before the date of the notice.			**Proof of Notice in site** Two colour photos of the notice on site must be provided of which one is close up and the other one is taken from a distance in order to see the placing on the site itself.
		Public Meeting Note: The holding of a public meeting in order to inform the general public of the application.			**Proof of Public Meeting** The applicant must provide proof of the agenda, the attendance register and minutes of the meeting to the Responsible Authority.
		Any Additional components:			**Proof of additional components:**

SECTION B: MOTIVATIONAL REPORT

1. INTRODUCTION

1.1. BACKGROUND

GENERAL BACKGROUND

The Northern Cape Province is currently experiencing growth and development in a number of the urban centres throughout the province. The downscaling and slowing of the general economic market of South Africa, is however countered by development in the Renewable Energy field in some areas of the Northern Cape Province. This is due to the fact that a lot of the focus areas of the Renewable Energy Zones, are based in the mentioned province and brought new development opportunities through diversification. The diversification brought about by this economic sector has benefitted existing and new businesses/ industries and moved the primary focus of some Municipal areas away from the normal agriculture, mining and tourism basis.

The !Kheis Local Municipality which is situated alongside the mighty Orange River, was able to benefit from intensive agricultural activities and growth in this sector. In the context of the aforementioned, urban centres in the municipality clustered around the Orange River with Groblershoop having become the seat of local governance and primary town. The growth in the agricultural sector of !Kheis has not only had an economic impact, but has also led to an increase in the population of the municipality where it could be expected that such increase took place both in the form of immigration and natural growth. This, in turn, has caused for an escalated need for housing opportunity, especially in the Groblershoop area. The growth in population in rural areas also results in the congregation of people on farmland, in order to reside in close proximity of their place of work, in the case of Opwag (Uitkoms) agricultural practices. This community has grown to the point where the formalisation thereof is required, especially considering infrastructure is also already in place.

The informal town of Opwag/ Uitkoms has been created by the farmworkers that work on the surrounding farmland. The informal town of Opwag (Uitkoms) has now grown to a point where formalisation is needed, as well as the provision of supporting land uses, such as schools, businesses, municipal infrastructure, recreational areas etc. The !Kheis Local Municipality has secured the properties on which the community of Opwag (Uitkoms) are established with the goal of registering this town

as a formal proclaimed township. The recent commitment by COGHSTA to address the housing backlog within the Northern Cape, presented the !Kheis Local Municipality with the ideal opportunity to undergo the necessary town planning processes to register Opwag (Uitkoms) as a proclaimed township, with registered properties that can be allocated to individual ownership.

This land use change application, compiled within the clear context of the Spatial Planning and Land Use Management Act (Act 16 of 2013), forms the legal framework under which the proclamation of Opwag (Uitkoms), the formalisation of existing informal properties and the provision of additional erven, through sub-economic erven are proposed. The application seeks to obtain the necessary land use change approval for the creation of 730 residential properties, in order to formalise existing informal residential stands, provide additional erven for future population growth, as well as include supportive land uses as requested by the Opwag (Uitkoms) community.

It is important that all developments must align with the provisions of the Spatial Development Framework (SDF) of the local or district municipality, as well as the applicable scheme regulations of a municipality. In cases where a development proposal does not align with the provisions of the SDF, site specific motivations need to be provided as to allow the District Municipal Planning Tribunal to make informed decisions.

1.2. CURRENT REALITY

The undertaking of the township establishment project, consisting of 770 residential erven, for the Opwag (Uitkoms) Community by Macroplan derives from an indirect appointment by COGHSTA and is therefore a project of national and provincial importance. The development site comprise of sections of Portion 14 of the Farm Boegoeberg Settlement, No. 48 and Plot 2642, Boegoeberg Settlement, with both these properties registered under the ownership of the !Kheis Municipality. The portions of land identified for the Opwag (Uitkoms) township establishment project will cover a total of 52ha. The proposed township establishment project will provide sub-economic housing with the end goal of securing ownership of land for the current residents. An estimate of approximately 200 informal stands currently exists in the town of Opwag (Uitkoms) that will be formalised as part of this township establishment project, whilst an additional 530 erven will be created for the future expansion of the community. A small fraction of the development scope will cater to middle-income housing, which will provide much needed income tax to the local municipality.

The objectives of this application, which is handled in the terms of the provisions of the Spatial Planning and Land Use Management Act (Act 16 of 2013), !Kheis SPLUMA By-laws & the !Kheis Land Management Scheme are as follow:

1. Convert Opwag (Uitkoms) from farmland to a township, through the process of township establishment.
2. Formalise the existing informal stands currently established on the study area;
3. Provide additional residential properties for future population increases;
4. Incorporate land uses normally associated with residential expansion, such as institutional, recreational and business uses;
5. Create a coherent internal road network that adequately links to the existing road network of Opwag (Uitkoms).

The following table provides a breakdown of the involved land portions, in terms of size, land use and zoning:

Property Description	Property Size	Land Use	Zoning Status Quo
Portion 14 of the Farm Boegoeberg Settlement, No. 48 and	11129.2886ha	Informal residential stands can be located to the northern corner of the involved property. The remaining section of this property is vacant;	Agricultural Zone I
Plot 2642, Boegoeberg Settlement	82.9405ha.	Informal residential stands can be located to the north eastern section of the involved property. The remaining section of this property is vacant.	Agricultural Zone I

Table 1: Breakdown of property information

The title deed of the involved properties has been scrutinised to determine if there are any restrictive conditions that needs to be removed in order for the land use change processes to take place. No such restrictive title deed conditions have been found within the title deeds of the involved properties (Annexure A).

In order to achieve the objective of township establishment and providing sub-economic housing for the town of Opwag (Uitkoms), this formal land use change application, pertaining to township establishment, consolidation, subdivision & rezoning, is submitted to the !Kheis Local Municipality as municipality of first instance. This application for land use change is therefore submitted to the !Kheis Municipality in order to ensure legal compliance with the clear context of the Spatial Planning and Land use Management Act (Act 16 of 2013).

1.3. ASSIGNMENT

Our office, Macroplan Town and Regional Planners, has been appointed by Barzani Development on behalf of COGHSTA, to facilitate the needed town planning procedures involved with the formalisation and expansion of Wegdraai. The appointment letter from Barzani Development, as well as the preceding appointment letter from the !Kheis Municipality, serve as the power of attorney for this application for land use change. Please refer to Annexure B of this submission for the said authorising documentation.

1.4. OBJECTIVE

The objectives of this report are as follow:

1. SUBDIVISION: (See Figure 4):
   1.1. Subdivision of a 112ha portion of Plot 2642, Boegoeberg Settlement:

2. CONSOLIDATION (See Figure 4):
   2.1. Consolidation of the newly subdivided portions of land, as mentioned under §1.1, with Portion 14 of the Farm Boegoeberg Settlement, No. 48 into an individual land unit.

3. SUBDIVISION (See Figure 5):
   3.1. Subdivision of the newly consolidated land unit, into 771 individual cadastral land units.

4. REZONING (See Figure 6):
   4.1. Rezoning of the newly created properties, thereby allocating appropriate land use rights to each of the newly created individual erven suitable to their future purpose within the Opwag (Uitkoms) township establishment project. The proposed zonings, in terms of the newly adopted !Kheis Scheme Regulations, are as follow and should be read together with the final layout plan attached as Annexure E to this submission:

Zoning	Primary Use/s	Erven Amount
Residential Zone I	Residential House	730
Business Zone I	Business Premises	10
Institutional Zone I	Place of Instruction/ Educational	2
Institutional Zone II	Place of Worship	3
Open Space Zone II	Public Open Spaces	23
Transport Zone I	Public Street	1
Authority Zone I	Municipal Uses	1
Total		770

5. TOWNSHIP ESTABLISHMENT:
   5.1. The proclamation of Opwag (Uitkoms), in order to facilitate the conversion of farmland to a township and allow for the transfer of ownership of individual stands.

6. To serve as a support system for the !Kheis Local Municipality, in order for all the formalities to be handled correctly.

Date:

Title:

Figure 1: Locality Map: Region

Property Description:

Plot 2642, Boegoeberg Settlement & Portion 14 of the farm Boegoeberg Settlement, No. 42, !Kheis Municipality, Northern Cape Province.

Legend

- Opwag
- National Roads
- Regional Roads
- Railway Line
- Municipal Boundary

GROOTDRINK

GARIEP

TOPLINE

WEGDRAAI

OPWAG

GROBLERSHOOP

BOEGOEBERG

N10

N8

Municipality:

T. 054 833 9500

F. 054 883 9509

E. davyj@kheis.co.za

W. www.kheis.co.za

!Kheis Munisipaliteit Municipality

Consultant:

MACROPLAN

TOWN & REGIONAL PLANNERS

YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES

054 332 3642

4A Murray Avenue, Upington 8801 macroplan@mweb.co.za

PO Box 987, Upington 8800 www.macroplan.info

Reference: (FIG1) 200806 Opwag Township Establishment

Designed	Date
JP Theron	August 2020
Drawn	Scale
JP Theron	1: 175 000

Date:
18

Title:
Figure 2:
Locality Map: Local

Property Description:
Plot 2642, Boegoeberg Settlement & Portion 14 of the farm Boegoeberg Settlement, No. 42, !Kheis Municipality, Northern Cape Province.

Legend

- Study Area
- National Roads
- Regional Roads
- Urban Edge

Cadastral Information:

- Registered Erven
- Surveyed Erven

Municipality:

T. 054 833 9500
F. 054 883 9509
E. davyj@kheis.co.za
W. www.kheis.co.za

!Kheis
Munisipaliteit
Municipality

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054 332 3642
4A Murray Avenue, Upington 8801 macroplan@mweb.co.za
PO Box 987, Upington 8800 www.macroplan.info

Reference	
(FIG2) 200806 Opwag Township Establishment	
Designed: JP Theron	Date: August 2020
Drawn: JP Theron	Scale: 1: 6000

1.5. JURISDICTION

The !Kheis Municipality recently approved the all-inclusive Land Use Management System (LUMS) for the entire !Kheis Local Municipal area, as such the entire municipal area will make use of the same planning policy and municipal SPLUMA by-laws. The !Kheis LUMS has been informed, guided and developed in terms of SPLUMA and will also be enacted in these terms. §26 of SPLUMA states the following:

(2) Land may be used for the purposes permitted –

(a) By a land use scheme;

(b) By a town planning scheme, until such scheme is replaced by a land use scheme;

With the enactment of SPLUMA, the delegations of jurisdictions in terms of the decision making on land use change matters are however interpreted as follows:

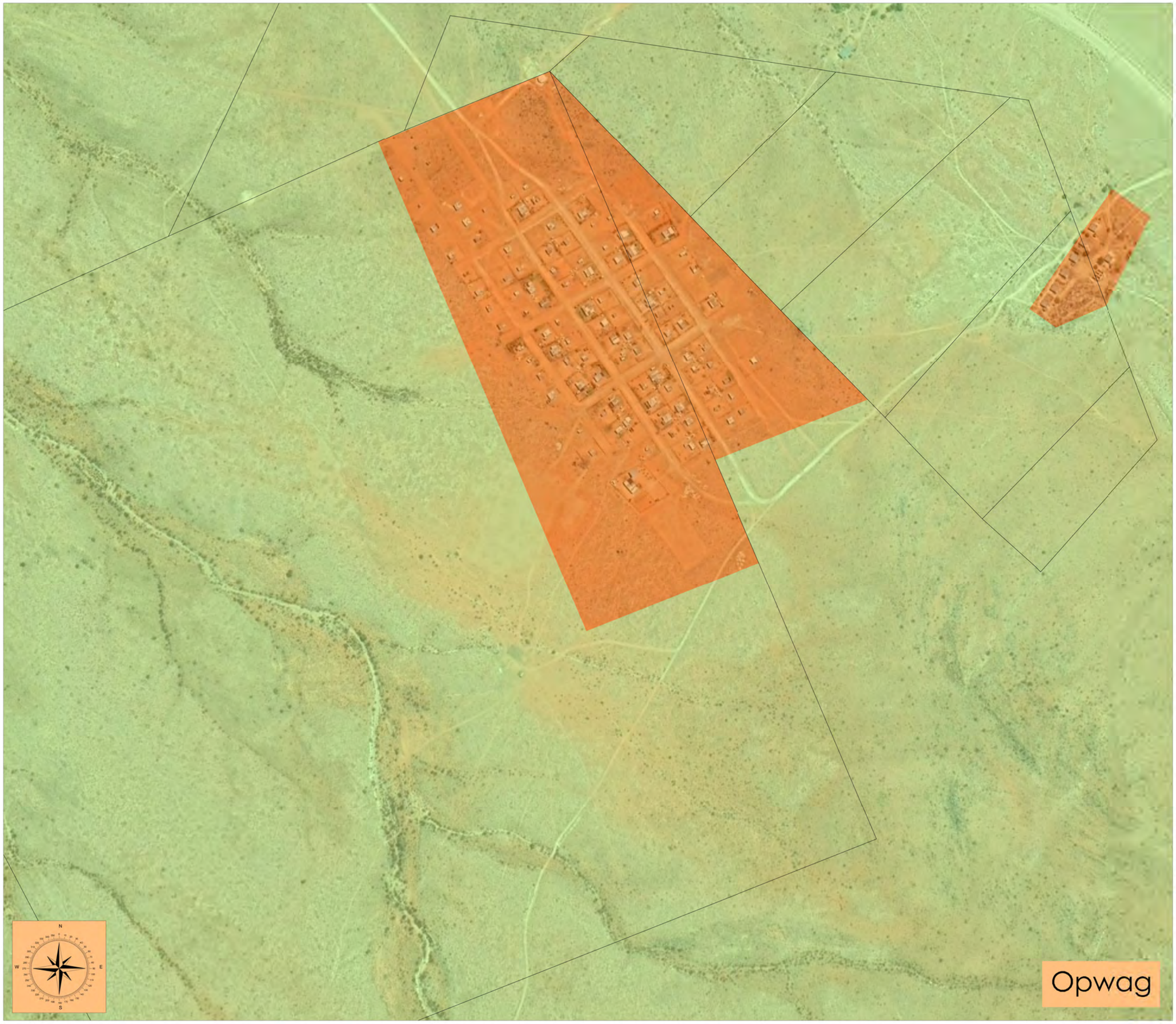
§26(4): A permitted land use may, despite any other law to the contrary, be changed with the approval of a Municipal Planning Tribunal in terms of this Act.

§33(1): …all land development applications must be submitted to a municipality as the authority of first instance.

§34(2): A district municipality may, with the agreement of the local municipalities within the area of such district municipality, establish a Municipal Planning Tribunal to receive and dispose of land development applications and land use applications within the district area.

§35(1): A municipality must, in order to determine land use and land development applications within its municipal area, establish a Municipal Planning Tribunal.

The !Kheis Municipality has established its own decision-making authority in terms of the parameters of SPLUMA. In the light of the above, this land use application is submitted to the !Kheis Municipality as the authority of first instance, for processing, administration and subsequent referral to the relevant decision-making authority.



Page:

20

Title:

Figure 3: General Land uses

Property Description:

PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT, NO. 48, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

PLOT 2642, BOEGOEBERG SETTLEMENT, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

Legend:

- Topline Township
- National Road
- Informal Housing
- Municipal Infrastructure
- Agricultural Land
- Cemetery
- Vacant within urban edge

Municipality:

!Kheis Munisipaliteit Municipality

Private Bag X2,
Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Consultant:

MACROPLAN
TOWN & REGIONAL PLANNERS
YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES

054 332 3642
4A Murray Avenue, Upington 8801 macroplan@mweb.co.za
PO Box 987, Upington 8800 www.macroplan.info

Reference:

(FIG6.TE.SUB.CON.REZ) 201023 Farm Boegoeberg Settlement, No. 48.14 & Plot 2642, Boegoeberg Settlement

Designed: JP Theron (A/2394/2016)

Date: October 2020

Drawn: JP Theron (A/2394/2016)

Scale: 1: 4500

Photo 1: Main Road of Opwag

The main road of Opwag can be seen in the image above, as seen from a south-westerly direction. This road links up to a provincial road, as such DRPW has been requested to formalise this access road. The response from DRPW will be provided to the municipality upon receipt thereof.

Photo 2: Access road to the south-east of Opwag

The alternative access road to Opwag can be seen in the image above, as seen from a westerly direction. DRPW was also requested to formalise this access road.

Photo 3: Southern Section of the study area

The southern section of the study area can be seen in the image above, as seen from a northerly direction. The suitable topography of the study area is visible in this photo.

Photo 4: Existing informal houses

Some of the existing informal houses can be seen in the image above, as seen from a north-easterly direction. As evident in the photo above, the informal stands have already been provided with electricity.

Photo 5: Housing Formation

The informal houses have been established in the traditional grid pattern, with a coherent road network. This allows for the formalisation of the existing houses in their current position.

Photo 6: Western section of the study area.

The western section of the study area can be seen in the image above, as seen from an easterly direction. The area will allow for the provision of additional erven for the future population growth of Opwag (Uitkoms).

1.6. COMPLIANCE WITH PRINCIPLES

SPLUMA sets out certain development principles (§7) to guide the development of land in the republic and any land use application should be considered with due cognisance of these principles. These principles may be briefly listed as follows:

1. THE PRINCIPLE OF SPATIAL JUSTICE;
2. SPATIAL SUSTAINABILITY;
3. EFFICIENCY;
4. SPATIAL RESILIENCE; AND
5. GOOD ADMINISTRATION.

The following sub-paragraphs may be highlighted in terms of this application, along with an explanation of their relevance:

(a) The principle of spatial justice, whereby –

(i) Past spatial and other development imbalances must be redressed though improved access to and use of land;

Relevance: This application for township establishment, formalisation of existing informal properties and provision of additional residential erven will address past spatial and other development imbalance, since integration will be achieved and the use of land will be improved.

(ii) Spatial development frameworks and policies at all spheres of government must address the inclusion of persons and areas that were previously excluded, with an emphasis on informal settlements, former homeland areas and areas characterised by widespread poverty and depravation;

Relevance: This component is applicable to public entities such as municipalities and government department; it is therefore not the responsibility of an applicant to adhere thereto.

(iii) Spatial planning mechanisms, including land use schemes, must incorporate provisions that enable redress in access to land by disadvantaged communities and persons;

Relevance: This component is applicable to public entities such as municipalities and government departments; it is therefore not the responsibility of an applicant to adhere thereto.

(iv) Land use management systems must include all areas of a municipality and specifically include provisions that are flexible and appropriate for the management of disadvantaged areas, informal settlements and former homeland areas.

Relevance: This component is applicable to public entities such as municipalities and government departments; it is therefore not the responsibility of an applicant to adhere thereto.

(v) Land development procedures must include provisions that accommodate access to secure tenure and the incremental upgrading of informal areas; and

Relevance: This component is applicable to public entities such as municipalities and government departments; it is therefore not the responsibility of an applicant to adhere thereto.

(vi) A Municipal Planning Tribunal considering an application before it, may not be impeded or restricted in the exercise of its discretion solely on the ground that the value of land or property is affected by the outcome of the application.

Relevance: This component is applicable to public entities such as municipalities and government departments; it is therefore not the responsibility of an applicant to adhere thereto.

(b) The principle of spatial sustainability, whereby spatial planning and land use management systems must –

(i) Promote land development that is within the fiscal, institutional and administrative means of the Republic;

Relevance: It is the opinion of this office that the proposed development will not place an unreasonable amount of stress on the fiscal, institutional and administrative capabilities of the area in which it will be situated, seeing as this request for township expansion will incorporate various uses that will address the additional pressure that such an expansion may cause; fiscally, institutionally and administratively speaking.

(ii) Ensure that special consideration is given to the protection of prime and unique agricultural land;

Relevance: The !Kheis Municipality and the Northern Cape Province are the registered landowners of the land units involved in this submission for land use change, as such the involved properties are exempted from the provision of the Act 70 of 1970 as clearly described in the definition of agricultural land which reads as follow:

***"Agricultural land"** means any land, except-*

(a) land situated in the area of jurisdiction of a municipal council, city council, town council, village council, village management board, village management council, local board, health board or health committee, and land forming part of, in the province of the Cape of Good Hope, a local area established under section 6(1)(i) of the Divisional Councils Ordinance, 1952 (Ordinance 15 of 1952 of that province), and, in the province of Natal, a public health area as defined in section I of the Local Health Commission (Public Health Areas Control) Ordinance, 1941 (Ordinance 20 of 1941 of the last-mentioned province), and in the province of the Transvaal, an area in respect of which a local area committee has been established under section 21(1) of the Transvaal Board for the Development of Peri-Urban Areas Ordinance, 1943 (Ordinance 20 of 1943 of the Transvaal), and, in South-West Africa, a peri-urban area established under section 9 of the Peri-Urban Development Board Ordinance, 1970 (Ordinance 19 of 1970 of South-West Africa), but excluding any such land declared by the Minister after consultation with the executive committee concerned and by notice in the Gazette to be agricultural land for the purposes of this Act;

(c) land of which the State or the administration of the territory of South-West Africa is the owner or which is held in trust by the State or a Minister or the Administrator of the said territory for any person;

(iii) Uphold consistency of land use measures in accordance with environmental management instruments;

Relevance: The magnitude of the proposed housing development necessitates the undertaking of an Environmental Impact Assessment (EIA), under the guidance of the National Environmental Management Act (107 of 1998). At present the EIA is still in process, due to the constraints brought forth by the Covid-19 pandemic. The Environmental Authorisation will be provided to the !Kheis Local Municipality and the ZF Mgcawu District Municipal Planning Tribunal upon receipt thereof.

(iv) Promote and stimulate the effective and equitable functioning of land markets;

Relevance: It is the opinion of this office that the proposed development will contribute to the value of land in the area surrounding thereto, but that it will not necessarily unfairly increase the cost thereof.

(v) Consider all current and future costs to all parties for the provision of infrastructure and social services in land developments;

Relevance: This application for the township establishment falls under the jurisdiction of the !Kheis Municipality, as such the provision of services will be the responsibility of the !Kheis Municipality. A services report was compiled on the basis of the proposed residential expansion, with the general findings being that the existing bulk service infrastructure is not sufficient to accommodate the additional erven. The !Kheis Local Municipality will be responsible for procuring funding from the various bulk services infrastructure grants.

(vi) Promote land development in locations that are sustainable and limit urban sprawl; and

Relevance: The SDF of !Kheis Local Municipality provides an urban edge for Opwag (Uitkoms), but the location for the formalisation of Opwag (Uitkoms) could not be determined during the compilation of the !Kheis SDF. Therefore the urban edge of Opwag (Uitkoms) is not fixed and will most likely form the outline of the area identified for this township establishment project.

(vii) Result in communities that are viable.

Relevance: This application proposes the proclamation of Opwag (Uitkoms), which consist of numerous informal stands, as such the individual transfer of ownership will be legal. Additionally, supportive land use normal associated with township development will also be provided to cater to the needs of the community. On the long term sufficient bulk service infrastructure will be available to promote a sustainable community. The purpose of this application in essence is to create a viable community.

(c) The principle of spatial efficiency, whereby –

(i) Land development optimises the use of existing resources and infrastructure;

Relevance: Please refer to §2.5 of this submission for details regarding the rendering of services;

(ii) Decision-making procedures are designed to minimise negative financial, social, economic or environmental impacts; and

Relevance: The SPLUMA By-laws and Land Use Management Scheme of the !Kheis Local Municipality indicates the specific procedures that are to be followed with a land use change application such as this. This will ensure that both the Municipality, the relevant community and our client will be guarded against negative social, economic and environmental impacts.

(iii) Development application procedures are efficient and streamlined and timeframes are adhered to by all parties.

Relevance: As the applicant in this instance, our office will do our very best to adhere to the timelines set by the local municipality. If this is not possible we will, if need be, endeavour to consult the municipality in these matters and find a solution thereto.

(d) The principle of spatial resilience, whereby flexibility in spatial plans, policies and land use management systems are accommodated to ensure sustainable livelihoods in communities most likely to suffer the impacts of economic and environmental shocks.

Relevance: This component is applicable to public entities such as municipalities and government departments, it is therefore not the responsibility of an applicant to adhere thereto.

(e) The principle of good administration, whereby –

(i) All spheres of government ensure an integrated approach to land use and land development that is guided by the spatial planning and land use management systems as embodied in this Act;

Relevance: This component is applicable to public entities such as municipalities and government departments, it is therefore not the responsibility of an applicant to adhere thereto.

(ii) All government departments must provide their sector inputs and comply with any other prescribed requirements during the preparation or amendment of spatial development frameworks;

Relevance: This component is applicable to public entities such as municipalities and government departments, it is therefore not the responsibility of an applicant to adhere thereto.

(iii) The requirements of any law relating to land development and land use are met timeously;

Relevance: Various approvals/ no objections/ authorisations had to be obtained in relation to the proposed residential development and they are as follow:

- *Environmental Authorisation: The final scoping report (Annexure J) has been submitted to DENC. The processing of the application has been limited, due to the Covid-19 protocols that have been enforced by the Department of Environment and Nature Conservation. This application for land use change is therefore submitted without the EA;*

- DRPW: The Department of Roads and Public Works has been furnished with a formal notification letter (Annexure J) for review on the 8th of October 2020. The formal response form DRPW will be presented to the !Kheis Municipality upon receipt thereof.

The !Kheis Municipality has granted permission to submit this application and commence with the public participation process without the Environmental Authorisation and DRPW no-objection. It should however be noted that this application will not proceed beyond the public participation process until the environmental authorisation and Sanral no-objection have been obtained. Kindly note that the involved property is registered in the ownership of the !Kheis Municipality and therefore the input from the Department of Agriculture is not required.

(iv) The preparation and amendment of spatial plans, policies, land use schemes as well as procedures for development applications, include transparent processes of public participation that afford all parties the opportunity to provide inputs on matters affecting them; and

Relevance: The Land Use Management Scheme of the !Kheis Local Municipality stipulates that the applicant (in this case our office) will be responsible for the application procedures that is to follow the submission of an application. Our office takes public participation very seriously and will follow all the by-law stipulations very closely to ensure full compliance, which will result in a completely transparent process.

(v) Policies, legislation and procedures must be clearly set in order to inform and empower members of the public.

Relevance: This component is applicable to public entities such as municipalities and government departments; it is therefore not the responsibility of an applicant to adhere thereto.

2. PLANNING CONSIDERATIONS

2.1. LOCATION OF STUDY AREA

The !Kheis Municipality is situated in the central sections of the Northern Cape Province, within the ZF Mgcawu District Municipality, and may be described as being one of the northernmost municipalities in the province. The urban heart of the municipality may be described as being Groblershoop, which is located in the north-eastern sections of the municipality on the banks of the Orange River.

This application for land use change pertains to the small rural community of Opwag (Uitkoms), with this settlement enjoying a north-easterly locale within the !Kheis Local Municipality. Opwag (Uitkoms) is futhermore located 8km east of Wegdraai and 7km north-north-west of Groblershoop. The coordinates for the center of the study area is as follows:

Lat: 28°50'14.90"S
Long: 21°57'24.58"E

Please refer to the figures attached to this submission for a visual interpretation regarding the locality of the study area.

2.2. PHYSIOGRAPHY

The physiography of the area within which the study area is located is discussed briefly.

2.2.1. TOPOGRAPHY

The proposed Opwag (Uitkoms) formalisation and expansion project necessitated the completion of numerous specialist studies that inform the Environmental Impact Assessment. The assessment has scrutinised the area earmarked for township establishment, thereby addressing the physiography in more detail. The draft scoping report, as well as other specialist studies, are attached as Annexures to this submission. No problems are anticipated in this regard.

2.2.2. SOIL/GEOLOGICAL CONDITIONS

The undertaking of a geotechnical investigation was required for the Opwag (Uitkoms) township establishment project. The Geological Report (Annexure G) concluded that the study area is intermediately suitable for normal township development, with the study area being classified under geotechnical zones I, II, III. IV & V. The geotechnical zone V is the only area of concern, however the planned layout does not extent on this ear. The other zones have intermediate development potential and the construction type thereof is ranges from normal to modified normal. No problems are expected in this regard.

2.2.3. FAUNA AND FLORA

The proposed Opwag (Uitkoms) township establishment project necessitated the completion of numerous specialist studies that inform the Environmental Impact Assessment. It is worth mentioning that the Botanical Assessment (See Annexure F) identified numerous protected species and proposes that a NFA permit, as well as a NCNCA permit be acquired for the removal of these species.

The final scoping report, as well as other specialist studies, are attached as Annexures to this submission. No problems are anticipated in this regard.

2.3. INTEGRATED PLANNING

The Spatial Planning and Land Use Management Act (Act 16 of 2013) stipulates that each Municipality must prepare a spatial development framework (SDF) that interprets and represents the spatial development vision of the competent Authority. All proposed developments, specifically pertaining to land use change applications within a municipality, must be measured against an approved Spatial Development Framework (SDF) of such a municipality, which may be seen as the spatial translation of the Integrated Development Plan (IDP). The planning legislation states that no land development decision can be made if the proposed development is inconsistent with the municipal spatial development framework. However, the District Municipal Planning Tribunal may depart from the provisions of the SDF only if site-specific circumstances justify a departure from the provisions of such SDF, as envisaged in §22 (2).

!KHEIS SPATIAL DEVELOPMENT FRAMEWORK:

The !Kheis SDF was revised in 2016 to align with the principles of the Spatial Planning and Land Use Management Act (Act 16 of 2013) and has since been a valid and weight bearing document for spatial guidance. The SDF of the !Kheis Municipality adheres to the basic SDF requirements as stipulated in the Spatial Planning and Land Use Management Act (Act 16 of 2013), therefore providing a potential investor with adequate information to plan a development according to the spatial vision of the municipality.

During the compilation of the !Kheis SDF in 2016, plenty of discussion went into the community of Opwag (Utikoms) with one of the points of discussion being the location on which the community will be formalised. A smaller community can be found to the south-east of Opwag (Uitkoms). At that stage it was assumed the area on which the smaller community is located will be subject to population growth and form the area for township establishment. Since 2016 the community of Opwag (Uitkoms) has continued to grow, whilst the smaller community remained unchanged. The proposed study area has basically chosen itself for township establishment and considering that the existing urban edge was determine on an assumption, the legality thereof can be questioned. A portion of the study area has been earmarked for low cost housing, but considering the current tempo of population growth a larger area has been identified for this township establishment project.

2.4. CHARACTER OF THE AREA

As mentioned throughout this report, the community of Opwag (Uitkoms) has a rural locate due to the farmworkers in the area decision to reside in close proximity to the surrounding farm land. The existing community of Opwag (Uitkoms) comprise of approximately 200 informal stands, a sport field and dirt roads. Electrical infrastructure and a water storage tank has been installed to provide in the basic needs of the community. This application will provide additional land uses to improve the livelihood of the community and promote sustainability.

2.5. INFRASTRUCTURE

2.5.1. WATER

BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow:

"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag (Uitkoms) 550 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag (Uitkoms) 550 Houses development. "

Kindly refer to the services report for more detail on the proposed upgrading of municipal infrastructure.

Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.

2.5.2. SEWERAGE

BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow:

"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag (Uitkoms) 550 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag (Uitkoms) 550 Houses development."

Kindly refer to the services report for more detail on the proposed upgrading of municipal infrastructure.

Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.

2.5.3. ELECTRICITY

BVI Consulting Engineering has been appointed to conduct a detailed services report (Annexure D) for Opwag (Uitkoms) formalisation and expansion project. The services report investigated the current bulk services capacity, determined the needed upgrades to accommodate the proposed expansion project and sought solutions to obtain the required funding to implement the necessary upgrades to the bulk services infrastructure. The findings of the services report for the provision of this service are as follow:

"In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. The infrastructure will have to be upgraded regardless of the implementation of the Opwag (Uitkoms) 550 houses development in order to meet current and expected future needs. The upgrading should be done in such a way as to take into consideration the Opwag (Uitkoms) 550 Houses development. "

Kindly refer to the services report for more detail on the proposed upgrading of municipal infrastructure.

Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.

2.5.4. STORM WATER

Storm water drainage will take place above ground, in natural furrows and along the streets of the proposed layout. The layout plan has been designed to accommodate all storm water furrows identified in the Freshwater Report, as well as align with the general topography of the development site. No Problems are expected in this regard.

2.5.5. ROAD NETWORK

The Opwag (Uitkoms) formalisation and expansion layout exhibits an extended internal road network that functionally link with the existing road network of Opwag (Uitkoms). The proposed residential development will effectively link with the existing road network of Opwag (Uitkoms) via numerous connections. The existing collector and arterial roads of Opwag (Uitkoms) will extent into the applicable portions of land, which forms the development site of this application. A hierarchy of road types have been designed throughout the planned town planning layout, in order to promote accessibility and mobility.

As per the attached layout plane (Figure 6) three direct accesses to the provincial roads that border Opwag (Uitkoms) to the north-west and north-east have been requested from DRPW. DRPW has been informed of the Opwag (Uitkoms) formalisation and expansion project, as well as the connections to the provincial roads, and their formal response will be furnished to the !Kheis Municipality and ZF Mgcawu District Municipality upon receipt thereof. It is anticipated that a traffic impact assessment and detail engineering plans will be upheld as conditions to approval.

2.6. SIZE, ZONINGS AND REGULATIONS

The development site pertains to portions of Portion 14 of the Farm Boegoeberg Settlement and Plot 2642, Boegoeberg, Kenhardt RD, !Kheis Municipality, Northern Cape Province. The involved properties area registered under ownership of the the !Kheis Local Municipality. This application has bearing on a 41ha portion of Portion 14 of the Farm Boegoeberg Settlement, No. 48 and a 11ha portion of Plot 2642, Boegoeberg Settlement.

The portions of land applicable to this submission have all been subject to informal housing, albeit to a lesser extent that the other !Kheis settlement, with almost all of these informal stands already provided with electricity by Eskom. The proposed Opwag (Uitkoms) township establishment project entails the proclamation of Opwag (Uitkoms), formalisation of existing informal properties, provision of additional erven for future population growth, as well as the provision of supportive land uses normally associated with a township, such as institutional uses, municipal uses and business premises. The township establishment of Opwag (Uitkoms) will facilitate the process of converting farmland to a township, during this process the proposed erven and zonings become valid. The proclamation of Opwag (Uitkoms) is furthermore needed, since no transfer of individual stands in the township will be allowed without proclamation.

The following land use changes have to be followed:

1. *SUBDIVISION: (See Figure 4):*
   1.1. *Subdivision of a 112ha portion of Plot 2642, Boegoeberg Settlement:*

2. *CONSOLIDATION (See Figure 4):*
   2.1. *Consolidation of the newly subdivided portions of land, as mentioned under §1.1, with Portion 14 of the Farm Boegoeberg Settlement, No. 48 into an individual land unit.*

3. *SUBDIVISION (See Figure 5):*
   3.1. *Subdivision of the newly consolidated land unit, into 771 individual cadastral land units.*

4. *REZONING (See Figure 6):*
   4.1. *Rezoning of the newly created properties, thereby allocating appropriate land use rights to each of the newly created individual erven suitable to their future purpose within the Opwag (Uitkoms) township establishment project. The proposed zonings, in terms of the newly adopted !Kheis Scheme Regulations, are as follow and should be read together with the final layout plan attached as Annexure E to this submission:*

Zoning	*Primary Use/s*	*Erven Amount*
Residential Zone I	*Residential House*	*730*
Business Zone I	*Business Premises*	*10*
Institutional Zone I	*Place of Instruction/ Educational*	*2*
Institutional Zone II	*Place of Worship*	*3*
Open Space Zone II	*Public Open Spaces*	*23*
Transport Zone I	*Public Street*	*1*
Authority Zone I	*Municipal Uses*	*1*
Total		*770*

5. *TOWNSHIP ESTABLISHMENT:*
   5.1. *The proclamation of Opwag (Uitkoms), in order to facilitate the conversion of farmland to a township and allow for the transfer of ownership of individual stands.*

The title deeds of the involved properties have been scrutinised to determine if there are any restrictive conditions that needs to be removed in order for the land use change processes to take place. No such restrictive title deed conditions have been found within the title deeds of the involved properties (Annexure A).

In order to achieve the objective of township establishment and providing sub-economic housing for the town of Opwag (Uitkoms), this formal land use change application, pertaining to township establishment, consolidation, subdivision & rezoning, is submitted to the !Kheis Local Municipality as municipality of first instance. This application for land use change is therefore submitted to the !Kheis Municipality in order to ensure legal compliance with the clear context of the Spatial Planning and Land use Management Act (Act 16 of 2013).

2.7. SUMMARY

During the consideration of the approval of this application, it is necessary to keep the following in mind:

a) *This application is in line with the principles set out in Chapter 2, §7 of the Spatial Planning and Land Use Management Act, Act 16 of 2013;*
b) *This application complies with the provisions of the !Kheis Land Use Management Scheme;*
c) *Addresses the backlog of housing as encountered within numerous settlements in the Northern Cape Province;*
d) *This application complies with the general principles as prescribed in Chapter 1 of the Spatial Planning and Land Use Management Act (Act 16 of 2013);*
e) *The proposed Opwag (Uitkoms) formalisation and expansion project aligns with the provisions of the !Kheis SDF;*

2.8. LAYOUT PRINCIPLES

LOW-COST HOUSING

The Opwag (Uitkoms) township establishment project will make provision for 730 sub economic properties, ranging between 300m² to 350m². A small fraction of the development scope will cater to middle-income housing, which will provide much needed income tax to the local municipality.

RELOCATION OF EXISITNG INFORMAL STANDS

Most of the existing informal stands will be accommodated within the proposed layout plan, however a few of the informal properties will have to the relocated. This is brought about by the position of informal stands within registered streets, as well as the formation of erven that doesn`t allow for a coherent town planning layout.

ESKOM INFRASTRUCTURE

A large amount of informal houses have been established on the involved portions of land, all of which have been provided with electricity by ESKOM. This electrical infrastructure determined the layout design, since the powerlines had to be accommodated within the road reserves of the planned formalisation and expansion project.

SUPPORTING LAND USES

The Opwag (Uitkoms) township establishment project proposes only a few additional land uses, as requested by the community during the community engagement with the !Kheis Local Municipality. These uses include ad hoc business premises on collector or arterial roads, religious properties and a municipal properties for uses such as a community hall.

STORM WATER FURROWS

The study area is being traverse by significant storm water furrows that have been adequately accommodated within the town planning layout, by means of the internal road network and public open spaces.

ROAD NETWORK

The Opwag (Uitkoms) formalisation and expansion layout exhibits an extended internal road network that functionally link with the existing road network of Opwag (Uitkoms). The proposed residential development will effectively link with the existing road network of Opwag (Uitkoms) via numerous connections. The existing collector and arterial roads of Opwag (Uitkoms) will extent into the applicable portions of land, which forms the development site of this application. A hierarchy of road types have been designed throughout the planned town planning layout, in order to promote accessibility and mobility.

As per the attached layout plane (Figure 6) three direct accesses to the provincial roads that border Opwag (Uitkoms) to the north-west and north-east have been requested from DRPW. DRPW has been informed of the Opwag (Uitkoms) formalisation and expansion project, as well as the connections to the provincial roads, and their formal response will be furnished to the !Kheis Municipality and ZF Mgcawu District Municipality upon receipt thereof. It is anticipated that a traffic impact assessment and detail engineering plans will be upheld as conditions to approval.

3. PROPOSED LAND USE CHANGE

3.1. PLANNING APPROACH

During the motivation of the project, the following objectives were kept in mind:

- *Addressing housing backlog and providing housing opportunity for the future population growth of Opwag (Uitkoms);*
- *The physiography, as evident by the findings of the geotechnical report, botanical Assessment report and the freshwater report, of the area is capable to accommodate the planned housing development;*
- *Convert Opwag (Uitkoms) from farmland to a township, through the process of township establishment.*
- *Formalising existing informal stands situated within the town of Opwag (Uitkoms);*
- *Providing supporting land uses that will contribute to a sustainable community;*
- *Incorporating land uses derived by community engagement with the !Kheis Municipality;*
- *Complying with any provisions that the Municipality may enforce on the application;*
- *The proposed layout complies with the findings and recommendations of the specialist studies.*

3.2. PUBLIC PARTICIPATION

As contemplated in SPLUMA, a land use change implies an amendment to the Scheme and where an amendment to a scheme is to be considered, according to §28(2), a public participation process must be undertaken to ensure that all affected parties have the opportunity to make representations on, object to and appeal the decision. For the purpose of land use applications in the !Kheis Municipality at this stage, we will be guided by the requirements of the municipality, and we anticipate this to include:

1. Notice placed in local print media, which will be followed by a limited period (30 days) within which any member of public may provide inputs and/or objections to this development at the offices of the local municipality. No late inputs will be considered relevant with the cut-off date being clearly indicated in the public notice.

2. The same notice published in the local print media will be placed at the entrance to the involved property, at the same time as publication, allowing an expanded audience to be reached by the notice.
3. The said notice will be forwarded to the surrounding land owners via registered mail or hand delivery, further expanding the audience for inputs.

Should any inputs be received at the offices of the !Kheis Municipality, it would be the responsibility of the receiving official to place the date stamp of the municipality on the received input, proving that it was acquired within the limited timeframe. Upon the closure of the public participation period, any inputs received must be forwarded to the applicant whereupon the applicant will have a maximum of 30 days to provide a written response to the inputs. The application will then be forwarded to the decision-making body for consideration.

3.3. PROPOSED LAND USES

After approval, the following land uses will be established on the study area in terms of the !Kheis Land Use Management Scheme – Please refer to Figure 7 for the layout plan with appropriate zoning notations:

Residential Zone I	Indication on map: colour	**Yellow**	
	Primary use/s	**Dwelling House / Residential House**	Means a building containing only one residential unit – a self-contained interlinking group of rooms for the accommodation and housing of a single family, or a maximum of four persons who do not satisfy the definition of a "family", together with such outbuildings as are ordinarily used therewith.

730 land units created will be given this zoning with the objective of addressing housing backlog, as well as make provision for future population growth.

Business Zone I	Indication on map: colour	**Red**	
	Primary use/s	**Business Building / Premises**	Means a site and/or building or part thereof used or intended to be used as shops and/or offices and it includes hotels, restaurants, dry-cleaners, financial institutions, professional offices, places of assembly, doctors consulting rooms, stock or product exchanges, put-put course, flats above ground floor and buildings for similar uses, but it excludes bottle stores, taverns, places of entertainment, a casino, adult entertainment, institutional buildings, funeral parlours, public garages, service stations, repairing or related replacing functions, industrial buildings, offensive industries, heavy vehicle overnight facilities or any wholesale business.

10 land units created will be given this zoning within the layout, providing economic prosperity to the residents of the proposed community.

Institutional Zone I	Indication on map: colour	**Light Blue**	
	Primary use/s	**Place of Instruction / Educational building**	Means a school (both primary, secondary, special and private schools), college, technical institute, academy, university, lecture hall or other centre of instruction, and includes a hostel appertaining thereto, and a convent, dormitory, public library, art gallery, museum, gymnasium, training centre and creche, but does not include a building used or intended to be used wholly or primarily as a certified reformatory or industrial school or as a school for the mentally handicapped;

2 land units created will be given this zoning within the layout, providing educational opportunities for the residents of the proposed community.

Institutional Zone II	Indication on map: colour	**Light Blue**	
	Primary use/s	**Place of Worship**	Means a church, synagogue, mosque, temple, chapel or other place for practising religion. This includes any building in connection therewith, for instance a hall, Sunday school classes or parsonage, but does not include funeral parlours (Office & Facility), including chapels forming part of such funeral parlours;

3 land units created will be given this zoning within the layout, providing religious properties for the residents of the proposed community.

Open Space Zone II	Indication on map: colour	**Green**	
	Primary use/s	**Public open space**	*Means any land which falls under, or is intended to come under the ownership of the local authority, which is not leased or intended to be leased on a long-term basis, and which is utilised by the public as an open space, park, garden, picnic site, square, playground or recreational site, whether it appears on an approved general plan or not.*

23 land units created will be given this zoning within the layout, accommodating storm-water furrows & site topography.

Transport Zone I	Indication on map: colour	**Light Grey**	
	Primary use/s	**Public Street**	Means any land indicated on a plan or diagram or is specified within this zoning scheme, reserved for street purposes and where the ownership as such vests in a competent authority and includes facilities for public transport.

1 land unit created will be given this zoning within the layout, accommodating the internal road network.

Authority Zone I	Indication on map: colour	Light Red	
	Primary use/s	Municipal Use	Means land/erven and buildings utilised by Local and District Municipality to carry out its mandatory functions, of which the extent thereof is of such nature that is cannot be classified or defined under any other usage in these regulations and include uses such as stores, warehouses, cemeteries, commonage, nursery, waste disposal site and water purification works, etc. The land/erven zoned for this purpose must be registered in the name of the Municipality.

1 land unit created will be given this zoning within the layout, providing community related uses.

4. RECOMMENDATION

It is thus evident from the previous discussions that this application for land use change (Township Establishment, Consolidation, Subdivision and Rezoning) for formalisation and expansion for Opwag (Uitkoms) is desirable for development within the !Kheis Local Municipality and should be positively considered for approval by the JMPT.

4.1. APPROVAL OF THE APPLICATION

The !Kheis Municipality is therefore requested to:

1. Give the go-ahead for advertising the application according to and in terms of the procedures adopted by themselves as part of their commitment to the provisions of the Spatial Planning and Land Use Management Act, Act 16 of 2013. The public participation process will be handled by this office and proof thereof will be sent to the Municipality.
2. Communicate the relevant Administrative fee to this office after accepting the application and stipulating its requirements.
3. Recommend the approval of this land use application to the JMPT after the closure of the public participation process.

The JMPT is therefore requested to:

1. Favourably consider this application for subdivision, consolidation and rezoning by means of approving it in terms of the recommendation from the office of the !Kheis Municipality.

Title:

Figure 4:Proposed Subdivision & Consolidation

Property Description:

PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT, NO. 48, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

PLOT 2642, BOEGOEBERG SETTLEMENT, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

Legend:

- 11ha portion of Plot 2642, Boegoeberg Settlement to be subdivided and consolidated with Ptn 14 of the Farm Boegoeberg Settlement, No. 48
- Newly Consolidated Land Unit

Ptn. 14 of the Farm Boegoeberg Settlement, No. 48

11ha Portion of Plot 2642, Boegoeberg Settlement to be subsivided and consolidated

Remainder of Plot 2642, Boegoeberg Settlement

Opwag

Municipality:

!Kheis Munisipaliteit Municipality

Private Bag X2,
Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Consultant:

MACROPLAN
TOWN & REGIONAL PLANNERS
YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES

054 332 3642
4A Murray Avenue, Upington 8801 macroplan@mweb.co.za
PO Box 987, Upington 8800 www.macroplan.info

Reference

{FIG6.TE.SUB.CON.REZ} 201023 Farm Boegoeberg Settlement, No. 48.14 & Plot 2642, Boegoeberg Settlement

Designed: JP Theron (A/2394/2016) Date: October 2020

Drawn: JP Theron (A/2394/2016) Scale: 1: 4500

Title:

Figure 5:Proposed Subdivision for Huising Project

Property Description:

PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT, NO. 48, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

PLOT 2642, BOEGOEBERG SETTLEMENT, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE;

Legend:

- Study Area
- Existing Cadastral
- Subdivision Lines

A total of 770 individual land units will be created

Opwag

Municipality:

!Kheis Munisipaliteit Municipality

Private Bag X2,
Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Consultant:

MACROPLAN
TOWN & REGIONAL PLANNERS
YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES
054 332 3642
4A Murray Avenue, Upington 8801 macroplan@mweb.co.za
PO Box 987, Upington 8800 www.macroplan.info

Reference

(FIG6.TE.SUB.CON.REZ) 201023 Farm Boegoeberg Settlement, No. 48.14 & Plot 2642, Boegoeberg Settlement

Designed: JP Theron (A/2394/2016) Date: October 2020

Drawn: JP Theron (A/2394/2016) Scale: 1: 4500

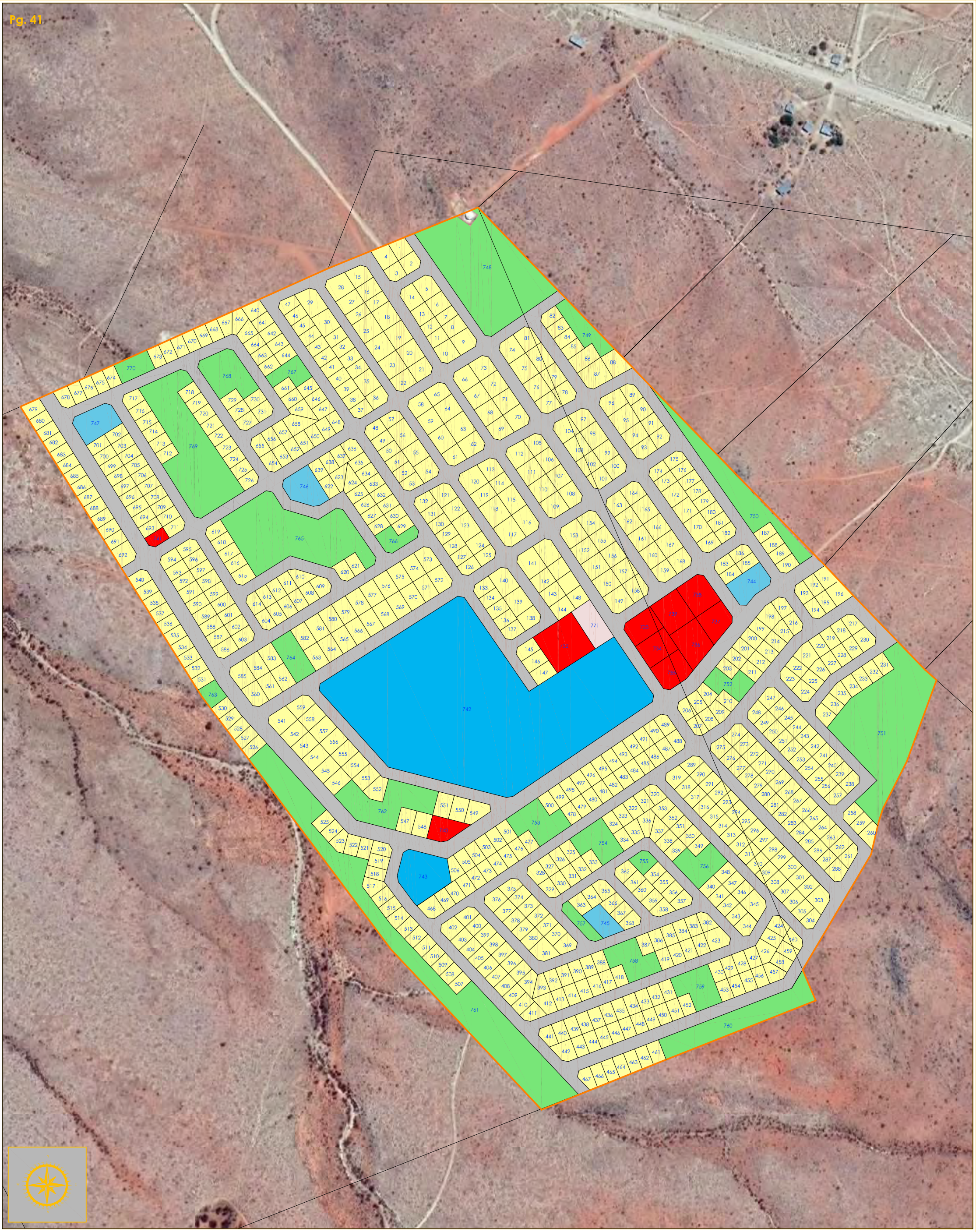


FIGURE 6: PROPOSED REZONING FOR HOUSING PROJECT

Design:	JP Theron (Pr. Pln. A/2394/2016)
Drawn:	JP Theron (Pr. Pln. A/2394/2016)
Date:	October 2020
Scale:	1:3600

Plan no:

(REZ) ITESUB CONUREA 201020 Farm Boegoeberg Settlement No. 46 (4 & Plot 2642, Boegoeberg Settlement

Proposed Land Uses in Terms of Land Use Management System

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	total area covered by land use	percentage of study area covered by use
	Open Space Zone I				
	Open Space Zone II	23			
	Open Space Zone III				
	Agricultural Zone I				
	Agricultural Zone II				
	Resort Zone II				
	Residential Zone I	730	355m²	26ha	
	Residential Zone II				
	Residential Zone III				
	Residential Zone IV				
	Residential Zone V				
	Residential Zone VI				
	Institutional Zone I	2			
	Institutional Zone II	3			
	Institutional Zone III				
	Authority Zone I	1			
	Authority Zone II				
	Special Zone				

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	total area covered by land use	percentage of study area covered by use
	Undetermined Zone				
	Business Zone I	10			
	Business Zone II				
	Business Zone III				
	Business Zone IV				
	Business Zone V				
	Business Zone VI				
	Industrial Zone I				
	Industrial Zone II				
	Industrial Zone IV				
	Industrial Zone IV				
	Utility Zone I				
	Utility Zone II				
	Utility Zone III				
	Transport Zone I	1			
	Transport Zone II				
	Transport Zone III				
	Total:	770		52ha	

Drawn by:
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Municipality:
!Kheis Municipality
Private Bag X2,
Groblershoop
8850
Tel: 054 833 9500
Fax: 054 833 9509

Client:
COGHSTA
Department:
CO-OPERATIVE GOVERNANCE
HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
NORTHERN CAPE

ANNEXURE A: COPY OF TITLE DEED

PROD DEEDS REGISTRATION SYSTEM - KIMBERLEY DATE : 20200721 TIME : 10:49:30.7 PAGE : 1
PREPARED BY : DRS05047 - BOSTRNDER JOSSLINE EDMIL

PROPERTY DETAILS PRINT FOR PORTION 0 (R/E)
ERF NO 2642
TOWNSHIP BOEGOEBERG SETT
REG DIV NOT AVAILABLE

PROVINCE NORTHERN CAPE
PREV DESCRIPTION
DIAGRAM DEED NO T37471/2015
EXTENT 15539
CLEARANCE EMTHANJENI MUNISIPALITEIT

FIRM NR : 999
FIRM NAME : AKTEKANTOOR KIMBERLEY
FILE NR : PREP
FEE AMOUNT: R .00

SUBDIVISION TO TOWN BOEGOEBERG SETT , ERF 2952 , PRTN 0

NO INTERDICTS

DOCUMENTS	HOLDER & SHARE	AMOUNT	O/P/A	SCAN/MICRO REF	MMDD
K624/2015SCTN					0707
K919/1992SCTN					
VA4119/2015CTN	T79244/2007CTN				0528
CONVERTED FROM CTN					
FROM-2628,2639,2635,	2636				

OWNER DETAILS

FULL NAME & SHARE	PURCH DATE	AMOUNT/REASON	O/P/A	IDENTITY	DATE OF BIRTH	TITLE DEED	MMDD	SCAN/MICRO REF
MUN KHEIS						T79244/2007CTN	1003	
	20070830	R12370204.00						

* O/P/A - O - MULTIPLE OWNER P - MULTIPLE PROPERTY A - MULTIPLE OWNER AND PROPERTY

** PLEASE NOTE : THE INFORMATION APPEARING ON THIS PRINTOUT IS FURNISHED FOR PURPOSES OF INFORMATION ONLY.
FOR MORE DETAILED INFORMATION, PLEASE REFER TO THE REGISTERED SOURCE DOCUMENTS.

* * * END OF REPORT * * *

FEE

R 1000,00

Prepared by me,

Conveyancer,
JJ GEYSER

Gesertifiseer 'n ware afskrif in terme van die bepalings van Regulasie 66 kragtens die Registrasies van Aktes Wet, No 47 of 1937
Certified a true copy in terms of the provisions of Regulation 66 under the Deeds Registries Act, no 47 of 1937

FOR INFORMATION ONLY
SLEGS VIR INLIGTING

Registrasiekantoor
Deeds Registry

2020 -07- 22

REGISTRATEUR VAN AKTES
REGISTRAR OF DEEDS

Datum/Date.....

T 000079244 / 2007

DEED OF TRANSFER

BE IT HEREBY MADE KNOWN

THAT **BEVERLY ELIZABETH-ANN RICHARDSON**

appeared before me, REGISTRAR OF DEEDS at CAPE TOWN the said Appearer being duly authorised thereto by a Power of Attorney signed at BRAKPAN on 30 AUGUST 2007 and granted by

ELJAVELO (PROPRIETARY) LIMITED
Registration No. 1982/011785/07

DATA / CAPTURE
02 NOV 2007
VAN WYK Z

DATA / VERIFY
13 NOV 2007
LARNEY E

GEYSER ATTORNEYS
ATTORNEYS
BRAKPAN, 1540

LEGALPERFECT Version 10.0.9
TRFDOT ALL.DOC 02-02-2007

2.0005751 (28)

AND the Appearer declared that the said Principal had truly and legally sold the undermentioned property on 30 August 2007 and that, the said Appearer in his/her capacity aforesaid, did by these presents, cede and transfer, to and on behalf of

I KHEIS MUNICIPALITY

its successors in title or assigns in full and free property

LOT 2642 BOEGOEBERGNEDERSETTING ADMINISTRATION DISTRICT KENHARDT, THE PROVINCE OF THE NORTHERN CAPE

In Extent 11129,2886 (ELEVEN THOUSAND ONE HUNDRED AND TWENTY NINE COMMA TWO EIGHT EIGHT SIX) hectares

First registered by Certificate of Consolidated Title T55555/1992, with diagram No.6871/1990 relating thereto and held by Deed of Transfer T33664/2001

I. INSOFAR as concerns the figure A.B.C.D.E.F.G.H.J.K.L.M.2A.2B.W.X.Y.Z. 1A.2C.2D.2E.2F.1G.1H.1J.1K.1L.1M.1N.2G.2H.IR.IS.IT.1U.1V on aforementioned Diagram No. 6871/90:

SUBJECT to the following servitude conditions contained in Notarial Deed of Servitude No. K919/92S and referred to the endorsement dated 3rd September 1992 on Certificate of Registered Title No. T55555/1992 which reads the follows:

"Die eiendom vermeld in Paragraaf 1 hierin is onderhewig aan die volgende serwitute ten gunste van die Publiek:

(a) 'n Padserwituut 10 meter wyd waarvan die oostelike grens aangetoon word deur die lyn J.z.;

(b) 'n Padserwituut 15 meter wyd waarvan die oostelike grens voorgestel word deur die lyn P.Q.;

(c) 'n Padserwituut soos aangetoon deur die figuur C.l.b.lc.ld.le.lC.lD.lf.lg.lh.lj.lk.lm.ln.lp.lq.lr.ls.lt.lu.lv.B.;

(d) 'n Padserwituut soos aangetoon deur die figuur lx.ly.lz.2a.2b.2c.2d.2e.2f.2g.2h.2j.2k.2m.2n.2p.2r.2s.2t.2u.2v.2w.2x.2y .2z.3a.3b.3c.3d.3e.3f.3g.3h.3j.3k.3m.3n.3p.3q.3r.3s.3t.3u.3v.3w.3x.3y. 3z.4a.4b.4c.4d.4e.4f.4g.4h.4j.4k.4m.4n.4p.4q.4r.4s.4t.4u.4v.4w.4x.4y. 4x.5a.5b.5c.5d.5e.5f.5g.5h 5j.5k.5m.5n.5p.5q.5r.5s.5t.5u.5v.5w.5x.5y. 5z.6a.6b.;

(e) 'n Padserwituur soos aangetoon deur die figuur 6c.1M.6d.;

(f) 'n Begraafplaasserwituut soos aangetoon deur die figuur 6v.6w.6x.6y.'

welke bovermelde serwitute verskyn op Kaart Nr 6868/90 hierby aangeheg."

and which servitudes are also respectively referred to by servitude notes Nos. 4,7,8,12,13 and 18 on aforesaid Diagram No 6871/90.

II. INSOFAR as concerns the figures 2A.N.P.Q.R.S.T.U.V.2B. on aforesaid Diagram No. 6871/90:

A. SUBJECT to the conditions referred to in Certificate of Consolidated Title No. T7083/1938.

B. ENTITLED to a road servitude referred to in the endorsement dated 3 April 1992 on Certificate of Registered Title No. T8210/1942 which reads as follows:

RESTANT
Kragtens Transportakte Nr, T20097/92 gedateer
Is binnegemelde restant eiendom geregtig op 'n padserwituut 5 meter wyd waarvan die suid-oostelike grens voorgestel word deur die lyn 2P.3X. op kaart Nr. 6981/90 daarby aangeheg oor Perseel 2627 Groot 8146,0781 Ha. daarkragtens oorgedra.

C. SUBJECT FURTHER to the following servitude contained in Notarial Deed of Servitude No. K919/92S and referred to in the endorsement dated 3rd September 1992 on Certificate of Registered Title No. T55555/92 which reads as follows:

"Die eiendom vermeld in Paragraaf 2 hierin is onderhewig aan die volgende serwitute ten gunste van die Publiek:

(a) 'n Padserwituut 15 meter wyd waarvan die westelike grens aangetoon word deur die lyn D.a.;

(b) 'n Padserwituut 15 meter wyd waarvan die oostelike grens aangetoon word deur die lyn J.K.;

(c) 'n Begraafplaasserwituut soos aangetoon deur die figuur a.f.g.h.j.;

welke bovermelde serwitute verskyn op kaart Nr 6883/90 hierby aangeheg."

and which servitudes are also respectively referred to as servitude notes Nos. 5,6 and 17 on aforesaid Diagram No. 6871/90.

III. INSOFAR as concerns the figure 2C.IB.IC.ID.IE.IF.2F.2E.2D en 2G.IP.IQ.2H.on aforementioned Diagram No. 6871/90:

A. SUBJECT to such conditions as are referred to in Certificate of Consolidated Title No. T7083/1938.

B. ENTITLED to a road servitude referred to in the endorsement dated 3 April 1992 on Certificate of Registered Title No. T8210/1942 which reads as follows:

RESTANT
Kragtens Transportakte Nr. T20097/92 gedateer
Is binnegemelde restant eiendom geregtig op 'n padserwituut 5 meter wyd waarvan die suid-oostelike grens voorgestel word deur die lyn 2P 3X. op kaart Nr. 6981/90 daarby aangeheg oor Perseel 2627 Groot 8146,0781 Ha Daarkragtens oorgedra

IV. INSOFAR as the whole property is concerned:

SUBJECT to the following conditions contained in Deed of Grant No. T55556/1992:-

1. ONDERHEWIG aan die voorbehoud ten gunste van die Staat van alle regte op edelgesteentes, edelmetale, onedele minerale en aardolie, soos in die Wet op Mynregte, 1967 (Wet 20 van 1967) omskryf.

2. ONDERHEWIG VERDER aan die serwituutreg ten gunste van die Staat of sy gevolmagtigde om sonder betalings van vergoeding enige materiaal soos sand, klip en gruis vanaf die gebiede voorgestel deur die figure 2A.N.P.Q.7a.r., M.2A.r.s.t.u.v.w., x.y.z.1a., 4r.4q.6p.6q., 6r.6s.3s.3r. en 4h.4g.6t.6u. op voormelde kaart Nr. 6871/90 te verwyder of te laat verwyder.

AND SUBJECT FURTHER to such conditions as are mentioned or referred to in the aforesaid Deeds.

WHEREFORE the Appearer, renouncing all the right and title which the said:

ELJAVELO (PROPRIETARY) LIMITED

heretofore had to the premises, did in consequence also acknowledge it to be entirely dispossessed of and disentitled to the same, and that by virtue of these presents, the said:

I KHEIS MUNICIPALITY

its successors in title or assigns, now is and henceforth shall be entitled thereto, conformably to local custom, the State, however, reserving its rights, and finally acknowledging the purchase price to be the sum of **R12,370,204.28 (TWELVE MILLION THREE HUNDRED AND SEVENTY THOUSAND TWO HUNDRED AND FOUR RAND TWENTY EIGHT CENTS)**

IN WITNESS WHEREOF I, the said Registrar, together with the Appearer, q.q. have subscribed to these presents and have caused the Seal of Office to be affixed thereto.

THUS DONE AND EXECUTED at the office of the **REGISTRAR OF DEEDS** at **CAPE TOWN**

on 3rd OCTOBER 2007

q.q.

In my presence,

REGISTRAR OF DEEDS

Property | Owner | Deed/Document | LPI Enquiry | Interdict | Document Request | Transfers | Bulk Properties | User Admin | Billing

Property Enquiry Details

Property enquiry results for "Kenhardt RD, 48, 14" in the Deeds Registry at "KIMBERLEY"

Property detail:

Deeds registry	KIMBERLEY
Property type	FARM
Farm name	BOEGOEBERG NEDERSETTING
Farm number	48
Portion	14
Province	NORTHERN CAPE
Registration division/Administrative district	KENHARDT RD
Local authority	DAWID KRUIPER MUNISIPALITEIT
Previous description	-
Diagram deed number	T16785/1977
Extent	82.9405 H
LPI Code	C03600000000004800014

Title Deeds detail:

Document	Registration date	Purchase date	Amount	Microfilm reference	Document copy?
T59309/2007CTN	20070726	20070601	R1.00	-	Not available

Owners detail:

Document	Full name	Identity Number	Share	Person Enquiry?
T59309/2007CTN	MUN KHEIS	-	-	Yes

Endorsements / Encumbrances:

Endorsement / Encumbrance	Holder	Amount	Microfilm reference	Document copy?
CONVERTED FROM CTN	-	-	-	Not available
FARM KE 48/14	-	-	-	Not available

History:

Document	Holder	Amount	Microfilm reference	Document copy?
T16785/1977CTN	REG SERVICES COUNCIL-BENEDE ORA	-	-	Not available

T11369/1994CTN	ADMIN-KAAP DIE GOEIE HOOP NIL	NIL	-	Not available
T11369/1994CTN	PROVINSIE VAN DIE NOORD-KAAP	END	-	Not available
T10756/2002CTN	PROVINSIE VAN DIE NOORD-KAAP	CRT	-	Not available
T2201/2003CTN	MUN SIYANDA	R10.00	-	Not available

Back to top of page

Requested by **40901** with user reference **JP** on: Wednesday, 29 January 2020 14:49

56 WALKERS INC.
Telephone (021) 464-1400

Opgestel deur my,
TRANSPORTBESORGER
DE VILLIERS P J de B

FEE
R 55.00

DATA / CAPTURE
23 AUG 2007
WILLIS J

MALAN & VENNOTE
Schroderstraat 25
Upington
8800
Docex 9, Upington

T0059309 / 2007

AKTE VAN TRANSPORT

HIERMEE WORD BEKEND GEMAAK

DAT **CHARL ANDRÉ THERON**

voor my die REGISTRATEUR VAN AKTES verskyn het te KAAPSTAD, die genoemde Komparant synde behoorlik daartoe gemagtig deur 'n Volmag aan hom/haar verleen deur

SIYANDA DISTRIK MUNISIPALITEIT

Gedateer 14 Junie 2007
en geteken te UPINGTON

DATA / VERIFY
29 AUG 2007
LARNEY E
LegalSuite / MALAN & VENNOTE

(DeedOfTransferConventional_A.rtf) Vorm E

EN genoemde Komparant het verklaar dat **SIYANDA DISTRIK MUNISIPALITEIT** die ondergemelde eiendom op **1 Junie 2007** waarlik en wettiglik per **Privaat Ooreenkoms** verkoop het en dat hy/sy in sy/haar voornoemde hoedanigheid hierby sedeer en transporteer aan en ten gunste van:

IKHEIS MUNISIPALITEIT

die ampsopvolgers in titel of regsverkrygendes in volkome en vrye eiendom:

GEDEELTE	**14 VAN DIE PLAAS BOEGOEBERG NEDERSETTING NR 48**
GELEE	**IN DIE MUNISIPALITEIT IKHEIS, AFDELING KENHARDT, PROVINSIE NOORD-KAAP**
GROOT	**82,9405 (TWEE EN TAGTIG KOMMA NEGE VIER NUL VYF) HEKTAAR**

EERSTE OORGEDRA kragtens Grondbrief Nr T16785/1977 met Kaart LG Nr 6668/1975 wat daarop betrekking het

EN GEHOU kragtens Akte van Transport T2201/2003

WESHALWE die Komparant afstand doen van al die regte en titel wat die gesegde **SIYANDA DISTRIK MUNISIPALITEIT** voorheen op genoemde eiendom gehad het en gevolglik ook erken dat hy geheel en al van die besit daarvan onthef en nie meer daartoe geregtig is nie, en dat, kragtens hierdie akte, bogenoemde

!KHEIS MUNISIPALITEIT,

die ampsopvolgers in titel of regsverkrygendes tans en voortaan daartoe geregtig is, ooreenkomstig plaaslike gebruik, behoudens die regte van die Staat en erken hy ten slotte dat die koopprys van die eiendom wat hiermee getransporteer word die bedrag van **R1.00 (EEN RAND)** is.

TEN BEWYSE WAARVAN EK, die genoemde Registrateur van Aktes, tesame met die Komparant hierdie Akte onderteken en dit met die Ampseël bekragtig het.

ALDUS GEDOEN EN VERLY op die kantoor van die REGISTRATEUR VAN AKTES te **KAAPSTAD** op 26 Julie 2007.

q.q. Handtekening van komparant

In my teenwoordigheid

Registrateur van Aktes

ANNEXURE B: AUTHORISING DOCUMENTATION

info@barzanigroup.co.za
www.barzanigroup.co.za

Gauteng (Head Office)

Tel: +27 12 881 0210
Fax: +27 86 476 7573

Building 9 Cambridge Office Park
5 Bauhinia Street, Highveld
Techno Park, Centurion, 0169

North West

Tel: +27 18 468 4876
Fax: +27 86 476 7573

52 Ian Street, Wilkoppies
Klerksdorp, 2571
(PO Box 6468 Flamwood, 2572)

Northen Cape

Tel: +27 53 831 3249
Fax: +27 86 476 7573

Sub Office: Agri Office Park
Building 2, Unit 1
South Kimberly, 8301

Eastern Cape

Tel: +27 43 050 0828
Fax: +27 86 476 7573

Leadwood House, Cedar Square
Bonza Bay Road
Beacon Bay, 5241

Kwazulu-Natal

Tel: +27 31 944 1635
Fax: +27 86 476 7573

Office 15, Ground Floor A Block
BCX Durban 1, 1 Frosterley Cresent
La Lucia Ridge, Umhlanga, 4091

Mpumalanga

Tel: +27 13 590 0952
Fax: +27 86 476 7573

2nd Floor, North Tower Suites 202, 1
Aqua Street, Riverside 1226

Amendment 1 to Appointment

Date : 28 May 2020

To **: Macroplan Town & Regional Planners (Pty) Ltd (Consultant)**
Represented by *: Len Fourie*

From **: Barzani Holdings (Employer)**
Represented by *: Roelof Van Den Berg & Ian Van Der Westhuizen*

Reference: NC/21/2018/PP (Opwag 730)

WHEREAS the Employer appointed the Consultant for town planning services at the Opwag 730 project.

AND WHEREAS the parties are desirous to change the Employer's name from Barzani Holdings (Pty) Ltd to Barzani Development (Pty) Ltd.

The Parties agree that the provisions of the Appointment will be amended as follows:

1. Amendment

The Parties agree that the Employer be changed to Barzani Development (Pty) Ltd with registration number 2009/001909/07. The signatories for the amended Employer remain the same and the Employer accordingly agrees

info@barzanigroup.co.za
www.barzanigroup.co.za

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Mpumalanga

Tel: +27 13 590 0952
Fax: +27 86 476 7573

2nd Floor, North Tower Suites 202, 1
Aqua Street, Riverside 1226

that the Consultant will by no means be prejudiced by the amendment in any possible way. The signatories wave all rights that Barzani Holdings (Pty) Ltd enjoyed with the original Appointment Letter.

2. General

Save for the amendments and additional provisions stipulated under this amendment, the balance of the provisions and interpretations of the Appointment Letter and all relevant contracts remain to be in full force and effect.

Roelof van den Berg: _____ **Date:** 28/05/2020
Director

Ian van der Westhuizen: _____ **Date:** 28/05/2020
Director

Herewith do we accept this appointment letter, together with all the terms and conditions

Date: 01-06-2020

Service Provider Representative: Len J Fourie

Signature: _____

ANNEXURE C: SG DIAGRAM

SYE METERS		RIGTINGS-HOEKE		KOÖRDINATE Y Stelsel L° 21° X	
		Konst.		t 0,00	+3100000,0
AB	944,75	245.50.35	A	-92557,92	+91340,42
BC	933,71	336.55.43	B	-93419,94	+90953,79
CD	872,54	68.27.19	C	-93785,84	+91812,82
DA	895,49	152.17.39	D	-92974,26	+92133,24
		(24) Sternham	▲	-94529,04	+93444,74
		(109) Brug	▲	-97858,75	+94148,73

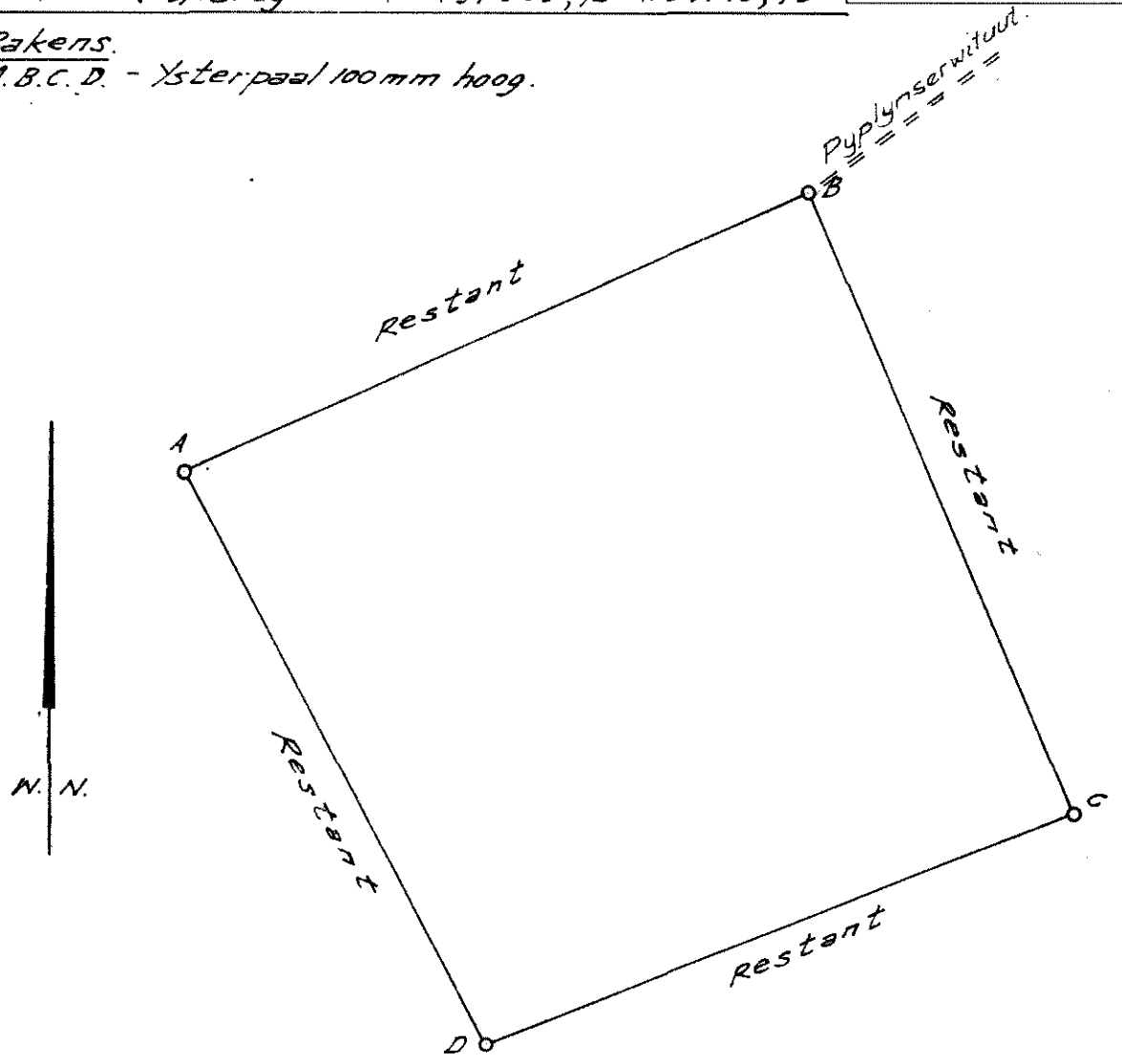
L.G. No. 6668/1975

Goedgekeur

Landmeter-generaal

21-12-1975.

Bakens.
A.B.C.D. - Ysterpaal 100mm hoog.



Skaal 1: 10 000

Die figuur A. B. C. D.

stel voor 82,9405 Hektaar grond, synde

Gedeelte 14 van die plaas Boegoeberg/Nedersetting Nº 48

geleë in Administratiewe Distrik

Kenhardt Provinsie Kaap die Goeie Hoop.

Opgemeet in Junie 1975

deur my, J.J. van Zyl Landmeter

Hierdie kaart is geheg aan No. G.B. 16785/77 gedateer t.g.v. Registrateur van Aktes	Die oorspronklike kaart is. No. 612/1932 geheg aan Transport/~~Grondbrief~~ No. 1938-129-7083	Lêer No. S/3945 M.S. No. E.1820/75 Komp. GK-BBDB (5635) GK-BBDB (5637)

48/14

13028 SHT 1

SYE		METER	RIGTINGS-HOEKE	KOÖRDINATE STELSEL Lo. 21° (voorlopig) KONSTANTES Y ±0,00 X + 3 100 000,00 Y METER		X
HOOFFIGUUR						
A	B	8388,30	231 36 22	A	-84 773,23	+101 140,76
B	C	36,13	232 11 10	B	-91 347,65	+ 95 931,09
C	D	922,75	232 03 50	C	-91 376,19	+ 95 908,94
D	E	3966,80	175 32 13	D	-92 103,95	+ 95 341,64
E	F	466,34	183 52 40	E	-91 795,27	+ 91 386,87
F	G	83,29	271 07 20	F	-91 826,81	+ 90 921,60
G	H	82,94	265 02 50	G	-91 910,08	+ 90 923,23
H	J	83,83	256 40 30	H	-91 992,71	+ 90 916,07
J	K	72,73	247 52 10	J	-92 074,28	+ 90 896,75
K	L	118,50	243 25 20	K	-92 141,65	+ 90 869,35
L	M	43,25	242 29 10	L	-92 247,63	+ 90 816,33
M	N	345,18	243 09 10	M	-92 285,99	+ 90 796,35
N	P	82,57	246 25 20	N	-92 593,97	+ 90 640,46
P	Q	69,95	253 13 20	P	-92 669,65	+ 90 607,43
Q	R	99,30	262 03 30	Q	-92 736,62	+ 90 587,24
R	S	79,78	270 51 20	R	-92 834,97	+ 90 573,52
S	T	104,42	278 27 50	S	-92 914,74	+ 90 574,71
T	U	123,39	280 36 20	T	-93 018,02	+ 90 590,08
U	V	113,61	286 09 50	U	-93 139,30	+ 90 612,79
V	W	557,80	26 39 20	V	-93 248,42	+ 90 644,42
W	X	462,50	65 50 40	W	-92 998,17	+ 91 142,93
X	Y	855,55	332 17 30	X	-92 557,92	+ 91 340,38
Y	Z	872,56	248 27 10	Y	-92 974,31	+ 92 133,24
Z	IA	927,78	156 55 50	Z	-93 785,89	+ 91 312,78
IA	IB	1967,59	315 57 25	IA	-93 422,32	+ 90 359,20
IB	IC	880,84	354 12 30	IB	-94 804,09	+ 92 387,92
IC	ID	725,45	7 39 00	IC	-94 893,00	+ 93 264,26
ID	IE	2029,48	356 03 22	ID	-94 796,44	+ 93 383,25
IE	IF	233,27	327 09 40	IE	-94 938,09	+ 96 037,85
IF	IG	326,61	63 17 40	IF	-95 064,59	+ 96 233,84
IG	IH	373,21	102 30 30	IG	-94 772,82	+ 96 380,62
IH	IJ	310,23	102 30 10	IH	-94 408,47	+ 96 299,79
IJ	IK	310,15	12 29 30	IJ	-94 105,60	+ 96 232,63
IK	IL	651,48	282 20 20	IK	-94 038,51	+ 96 535,44
IL	IM	60,14	192 20 30	IL	-94 714,02	+ 96 583,19
IM	IN	222,05	192 20 30	IM	-94 731,15	+ 96 304,90
IN	IP	325,72	243 17 50	IN	-94 778,61	+ 96 387,98
IP	IQ	432,74	327 09 40	IP	-95 069,60	+ 96 241,61
IQ	IR	1259,39	50 54 16	IQ	-95 304,27	+ 96 605,20
IR	IS	1856,50	27 42 23	IR	-94 326,86	+ 97 399,39
IS	IT	1921,06	316 04 37	IS	-93 463,70	+ 99 043,03
IT	IU	3005,30	276 15 01	IT	-94 803,26	+100 433,92
IU	IV	11200,18	22 44 41	IU	-97 790,70	+100 761,11
IV	A	13208,36	138 52 30	IV	-93 460,41	+111 990,32
TRIGONOMETRIESE BAKENS						
Δ 1 BUSHMANS HOEK			-93 451,21			+111 104,01
Δ 79 BULT			-78 330,52			+ 82 833,50
▲ 89 MONUMENT			-87 358,48			+ 97 749,15
Δ 94 OPWAG			-86 080,00			+ 93 242,92

PLAN No. 13028

DIE FIGUUR A B C D E F G H J K L M N P Q R S T U V W X Y Z IA IB IC ID IE IF IG IH IJ IK IL IM IN IP IQ IR IS IT IU IV STEL VOOR 11129,2886 HEKTAAR GROND, SYNDE PERSEEL 2642 BOEGOEBERGNEDERSETTING EN BEVAT KOMPONENTE 1 TOT 4 SOOS HIERONDER AANGEDUI

GELEË IN DIE ADMINISTRATIEWE DISTRIK : KENHARDT
PROVINSIE : KAAP DIE GOEIE HOOP

OPGEMEET IN OKTOBER TOT DESEMBER 1989 DEUR MY

G.O.L. Cross
PR. LANDMETER

KANTOORAFSKRIF

L.G. No. 6871/90

Goedgekeur.

nms. Landmeter-Generaal
1991 · 02 · 21

VEL 1 VAN 2 VELLE

DIE VOLGENDE AFTREKKINGS IS VAN HIERDIE KAART GEDOEN						
MEET-STUKKE	KAART No.	ONDERVER-DELING	GROOTTE HA./VK. M	AKTE No.	GEPARA-FEER	RESTANT

KOMPONENTE

1. DIE FIGUUR A B C D E F G H J K L M 2A 2B W X Y Z IA 2C 2D 2E 2F IG IH IJ IK IL IM IN 2G 2H IR IS IT IU IV STEL VOOR PERSEEL 2628 BOEGOEBERGNEDERSETTING VOLGENS KAART L.G. No. 6868/90 GEHEG AAN T/A No. 55554/92
2. DIE FIGUUR 2C IB IC ID IE IF 2F 2E 2D STEL VOOR PERSEEL 2636 BOEGOEBERGNEDERSETTING VOLGENS KAART L.G. No. 6879/90 GEHEG AAN T/A No. 55554/92
3. DIE FIGUUR 2G IP IQ 2H STEL VOOR PERSEEL 2635 BOEGOEBERGNEDERSETTING VOLGENS KAART L.G. No. 6878/90 GEHEG AAN T/A No. 55554/92
4. DIE FIGUUR 2A N P Q R S T U V 2B STEL VOOR PERSEEL 2639 BOEGOEBERGNEDERSETTING VOLGENS KAART L.G. No. 6883/90 GEHEG AAN T/A No. 55554/92

BAKENBESKRYWING

A IV . . . . . YSTERPAAL EN KLIPSTAPEL

IG IN . . . . . 15MM YSTERPEN

B C D E F G H J K L M N P Q R S T U V W X Y Z IA IB IC ID IE IF IH IJ IK IL IM IP IQ IR IU . . . . . YSTERPAAL

IS . . . . . 25MM PYP

IT . . . . . SWAAR YSTERPAAL IN BETON

SERWITUUTNOTAS

1. DIE FIGUUR 2A N P Q 7a r STEL VOOR 'N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6883/90 (PERSEEL 2639) T 55554/1992
2. DIE FIGUUR M 2A r s t u v w STEL VOOR 'N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
3. DIE FIGUUR x y z Ia STEL VOOR 'N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
4. DIE LYN J z STEL VOOR DIE OOSTELIKE GRENS VAN 'N PADSERWITUUT 10,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
5. DIE LYN 7a Q STEL VOOR DIE WESTELIKE GRENS VAN 'N PADSERWITUUT 15,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6883/90 (PERSEEL 2639) T 55554/1992
6. DIE LYN V 2B STEL VOOR DIE OOSTELIKE GRENS VAN 'N PADSERWITUUT 15,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6883/90 (PERSEEL 2639) T 55554/1992
7. DIE LYN 2B W STEL VOOR DIE OOSTELIKE GRENS VAN 'N PADSERWITUUT 15,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
8. DIE FIGUUR C Ib Ic Id Ie IK IL If Ig Ih Ij Ik Im In Ip Iq Ir Is It Iu Iv B STEL VOOR 'N PADSERWITUULTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
9. DIE FIGUUR 4r 4q 6p 6q STEL VOOR 'N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
10. DIE FIGUUR 6t 6s 3s 3r STEL VOOR N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
11. DIE FIGUUR 4h 4g 6t 6u STEL VOOR 'N SERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
12. DIE FIGUUR Ix Iy Iz 2a 2b 2c 2d 2e 2f 2g 2h 2j 2k 2m 2n 2p 2q 2r 2s 2t 2u 2v 2w 2x 2y 2z 3a 3b 3c 3d 3e 3f 3g 3h 3j 3k 3m 3n 3p 3q 3r 3s 3t 3u 3v 3w 3x 3y 3z 4a 4b 4c 4d 4e 4f 4g 4h 4j 4k 4m 4n 4p 4q 4r 4s 4t 4u 4v 4w 4x 4y 4z 5a 5b 5c 5d 5e 5f 5g 5h 5j 5k 5m 5n 5p 5q 5r 5s 5t 5u 5v 5w 5x 5y 5z 6a 6b STEL VOOR 'N PADSERWITULTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
13. DIE FIGUUR 6c IU 6d STEL VOOR 'N PADSERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994
14. ~~DIE LYN 6e 6~~ 6g 6h ~~STEL VOOR DIE MIDDELLYN VAN ELEKTRIESE KRAGLEIDING SERWITUUT 22,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628)~~
15. ~~DIE LYN 6j 6k 6m 6n STEL VOOR DIE MIDDELLYN VAN ELEKTRIESE KRAGLEIDING SERWITUUT 22,00 METER WYD, SOOS AANGETOON~~ VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628)
16. ~~DIE LYN 6h 7f STEL VOOR DIE MIDDELLYN VAN ELEKTRIESE KRAGLEIDING SERWITUUT 22,00 METER WYD, SOOS AANGETOON VOLGENS KAART L.G. No. 6878/90 (PERSEEL 2635)~~
17. DIE FIGUUR 7a 7b 7h 7g 7e STEL VOOR 'N BEGRAAFPLAASSERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6883/90 (PERSEEL 2639) T 55554/1992
18. DIE FIGUUR 7g 7h 7c 7d STEL VOOR 'N BEGRAAFPLAASSERWITUUTGEBIED, SOOS AANGETOON VOLGENS KAART L.G. No. 6868/90 (PERSEEL 2628) T 80845/1994

SERWITUUTNOTA ~~16/12/92~~ DEURGEHAAL SIEN KAART NO. bl 212

LANDMETER-GENERAAL
1991-11-25

Hierdie kaart is geheg aan Sertifikaat van Gekonsolideerde Titel No. Gedateer 55555/92. t.g.v Registrateur van Aktes	Die oorspronklike kaarte is I-4 hierbo aangehaal	Lêer No. Knhd M.F. M.S. No. E.2064/90 Komp. FK-2(5476, GL-7(5645), GK-8(5628), GK-8BDB(5635), GK-8BDD(5637), GK-8DBB(5638)

13028 SHT 2

KANTOORAFSKRIF

L.G. No. 6871/90

GOEDGEKEUR:

nms LANDMETER-GENERAAL

1991 · 02 · 21

PLAN No. 13028

PERSEEL 2642 BOEGOEBERGNEDERSETTING

VEL 2 VAN 2 VELLE

SKAAL 1: 25000

OPGEMEET IN OKTOBER TOT DESEMBER 1989 DEUR MY

G.O.L. Cross

PR. LANDMETER

X + 90000

Y - 95000

X + 95000

X + 100000

Y - 85000

X + 105000

X + 110000

RESTANT VAN DIE PLAAS BOEGOEBERGNEDERSETTING No. 48

SIEN INLAS 5

PAD

RESTANT 1018

PYPLYN SERWITUUT

BOEGOEBERGNEDERSETTING No. 48

GEDEELTE 14 VAN DIE PLAAS BOEGOEBERG NEDERSETTING No. 48

SIEN INLAS 1

SIEN INLAS 2

PERSEEL 2643

UPINGTON

GROBLERSHOOP

SIEN INLAS 3

GEDEELTE 17 VAN DIE PLAAS BOEGOEBERGNEDERSETTING No. 48

ERF 102

GEDEELTE 16 VAN DIE PLAAS BOEGOEBERGNEDERSETTING No. 48

SIEN INLAS 4

PERSEEL 1679

MARYDALE

DIE PLAAS BRULPAN No. 114

GEDEELTE 1 VAN DIE PLAAS VORENTOE WES No. 46

PUTSONDERWATER

GEDEELTE 2 (VORENTOE OOS) VAN DIE PLAAS UITKRAAI No. 44

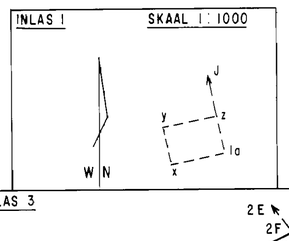
BOEGOEBERG WATERRESERWE No. 1

ADMINISTRATIEWE DISTRIK VAN PRIESKA

DIE PLAAS KEIKEMORAAI No. 2

INLAS 5 NIE VOLGENS SKAAL

INLAS 1 SKAAL 1: 1000



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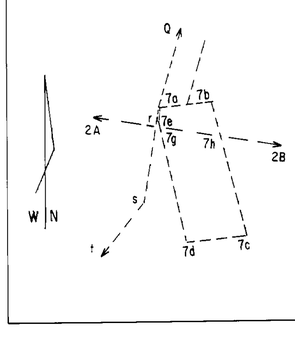

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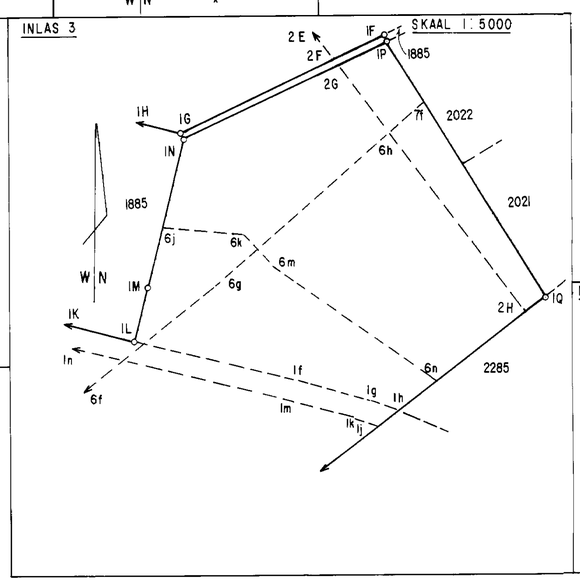

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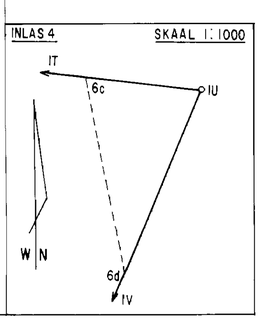

ANNEXURE D: SERVICES REPORT

OPWAG 730 – TOWNSHIP EXPANSION

Engineering Services Investigation Report

Investigation of the available and required bulk civil and electrical services for the Opwag village development in the !Kheis municipal area

OCTOBER 2020

Prepared for:
MACROPLAN

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bvi ENGINEERING PROCUREMENT MANAGEMENT

DOCUMENT CONTROL RECORD

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Project Number:	34167 – OPWAG
Report for:	MACROPLAN

REVISIONS:

Rev #	Date	Revision Details/Status	Prepared by / Author	Reviewed / Approved by
01	2020/10/21	Final report to be circulated to relevant parties.	L. Pretorius	F.D. Maritz (Pr.Eng)

APPROVAL:

Author signature		Approver signature	

EXECUTIVE SUMMARY

This report was compiled to investigate the bulk infrastructure serving the Opwag village and to determine whether the existing bulk infrastructure is adequate for the development of an additional 730 stands, through a low-cost housing development.

The bulk engineering services report includes the following categories:

- Bulk Water Infrastructure
- Bulk Sewer Infrastructure
- Bulk Road and Storm Water Infrastructure
- Bulk Electrical Infrastructure

After investigating the infrastructure, it was found that the existing bulk infrastructure is not sufficient to accommodate the Opwag 730 Houses project. The bulk services for each category that require attention before the project can commence is summarised below:

- **Bulk Water Infrastructure**

  Upgrading of the canal pump station and pressure line to the raw water storage reservoir
  Upgrading of the water treatment works
  New sectional steel reservoir
  New sectional steel elevated tower including lifting station and pressure line connecting the reservoir and elevated tower.

- **Bulk Sewer Infrastructure**

  Construction of one (1) new pump station (28 l/s).
  Construction of one new 250mm rising mains (0.34km) up to Oxidation Pond.
  Construction of a new 0.5ML/day waste water treatment works (Oxidation Pond);

- **Bulk Electrical Infrastructure**

  Upgrading and extension of the existing bulk electrical supply system is required by Eskom, the extension of the electrical system will not be a problem as the main sub-station in Groblershoop is currently being upgraded and will be commissioned in December 2020.

DESCRIPTION	AMOUNT TO REPAIR OF EXISTING INFRASTRUCTURE	AMOUNT NEW/UPGRADED INFRASTRUCTURE	TOTAL BULK INFRASTRUCTURE
Water Bulk Services	R 500 000.00	R 9 670 107.27	R 10 170 107.27
Bulk Sewer Services	R -	R 13 957 435.91	R 13 957 435.91
Roads and Access	R -	R -	R -
Electrical	R -	R -	R -
TOTAL CONSTRUCTION	**R 500 000.00**	**R 23 627 543.18**	**R 24 127 543.18**
10% Contingencies	R 50 000.00	R 2 362 754.32	R 2 412 754.32
SUB TOTAL	**R 550 000.00**	**R 25 990 297.50**	**R 26 540 297.50**
10% Professional fees	R 55 000.00	R 2 599 029.75	R 2 654 029.75
SUB-TOTAL	**R 605 000.00**	**R 28 589 327.25**	**R 29 194 327.25**
15% VAT	R 90 750.00	R 4 288 399.09	R 4 379 149.09
GRAND TOTAL	**R 750 750.00**	**R 35 476 756.09**	**R 36 227 506.09**

This report can be used both for business plans and funding applications from the various funding schemes available.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Terms of Reference

I. BVI Consulting Engineers was appointed by Macroplan to undertake this Bulk Engineering Services Study (Water, Sewer, Electricity and Roads & Storm Water) for the proposed Opwag 730 housing project. Opwag is one of six villages located close to the Orange river within the jurisdiction of !Kheis Local Municipality.

1.2 Site Location

I. The site is situated approximately 18 km to the north of Groblershoop in the Northern Cape (Figure 1 – Locality Plan).

II. The development is located at the following coordinates: 28°50'14.90"S; 21°57'24.58"E

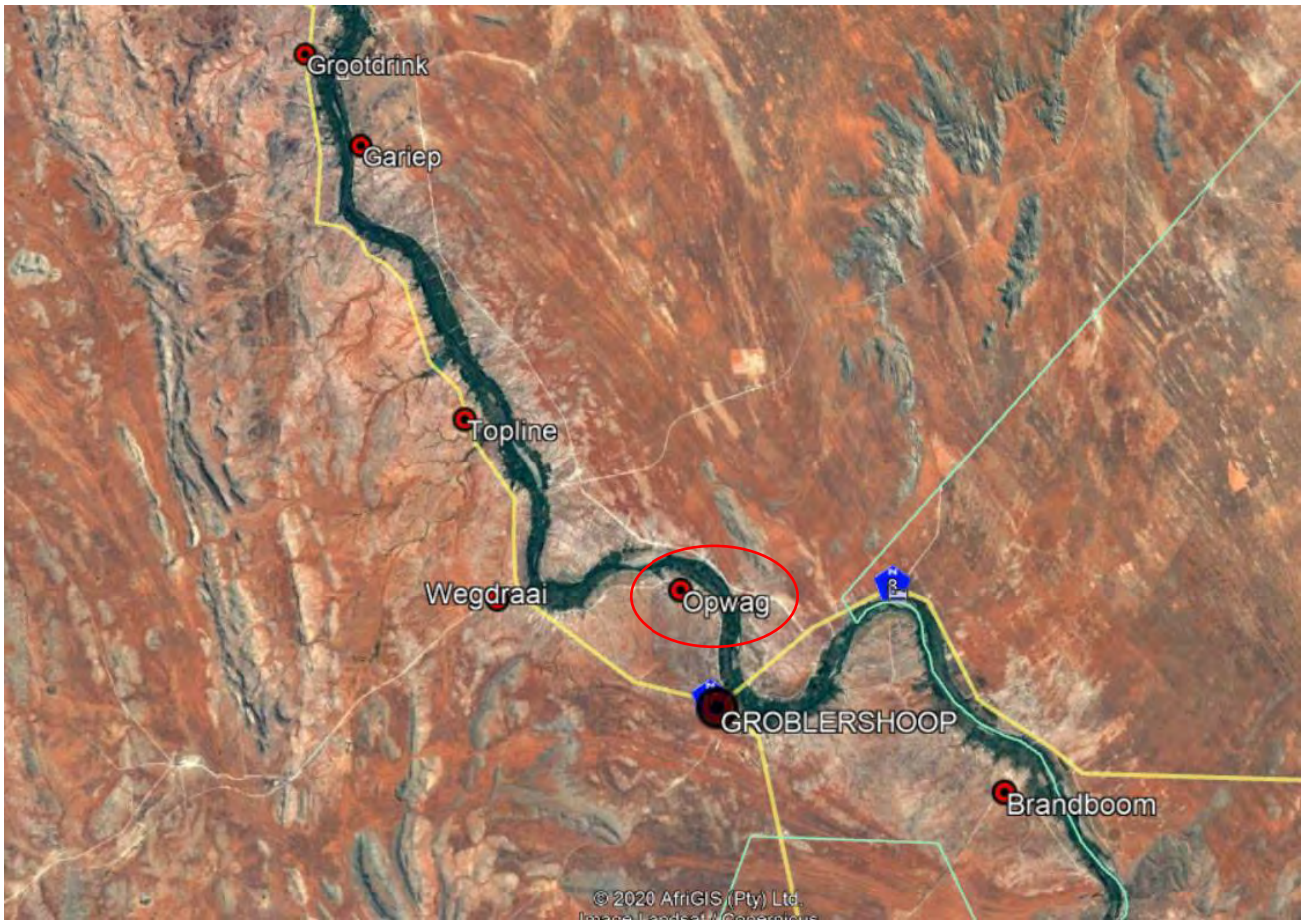


Figure 1: Opwag 730 Housing Development Locality Plan

II. The planned development consists of 730 low-cost houses next to the existing village (Figure 2: 730 Stands Development Area).

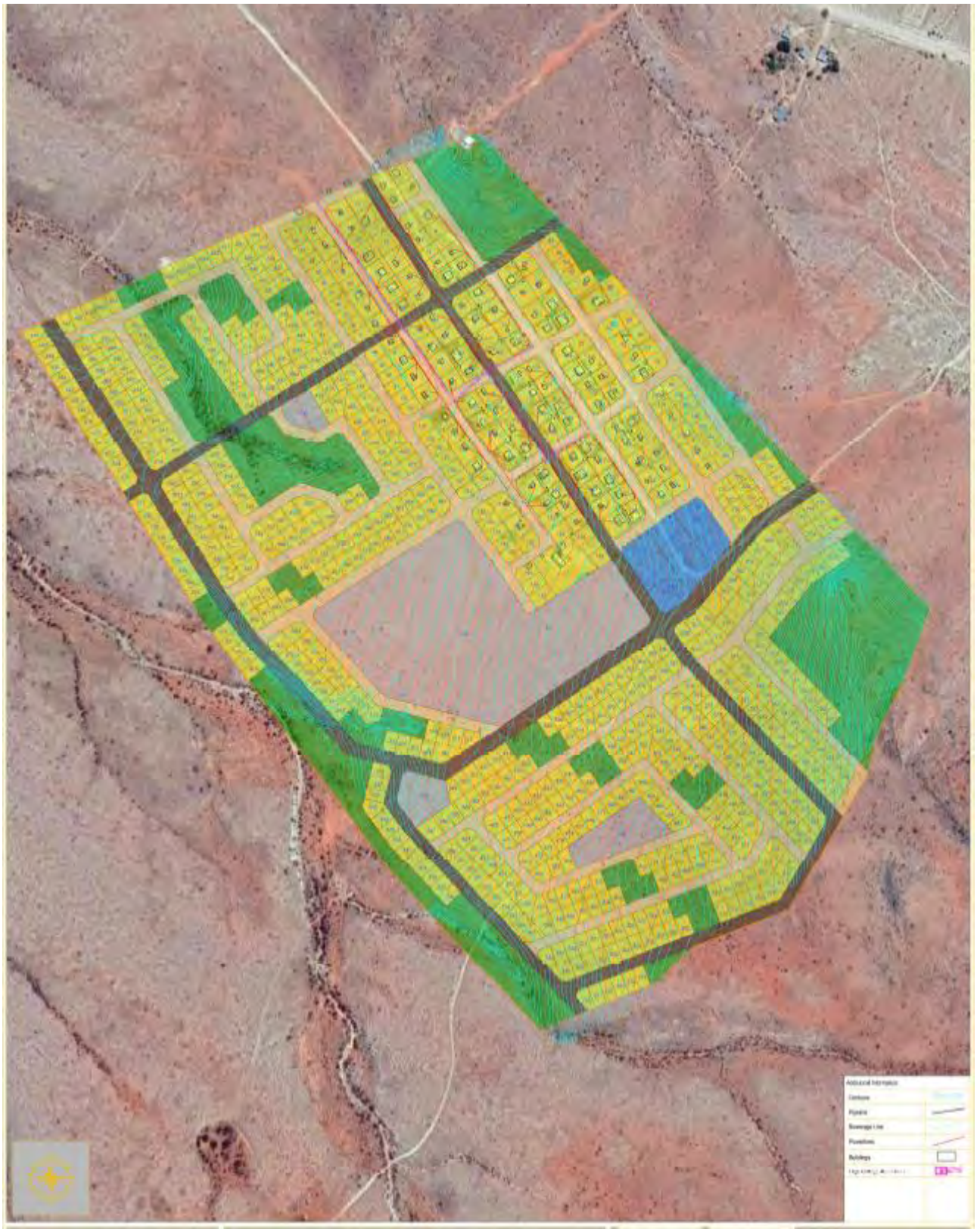


Figure 2: Opwag 730 Housing Development Locality Plan

III. The purpose of the Bulk Engineering Services Assessment is to determine the availability and capacity of existing bulk services to service the proposed development. This report presents the findings of a preliminary visual inspection and desktop investigation relating to bulk services and further sets out the criteria and standards for the internal services for the new development.

IV. The Bulk Engineering Services addressed in this report are the following:

- Water Supply
- Sewerage
- Roads and Access
- Storm Water Management
- Electricity Supply

2. TOPOGRAPHY

The physical characteristics of the site can be summarized as follows:

- Ground cover comprises mostly of natural veld with short grass;
- Topographically, the site has a relatively gentle sloping terrain from the village perimeter towards the north west. Kindly refer to Figure 3 below.
- Calcrete is close to the surface of the natural ground level, which makes excavations very hard.

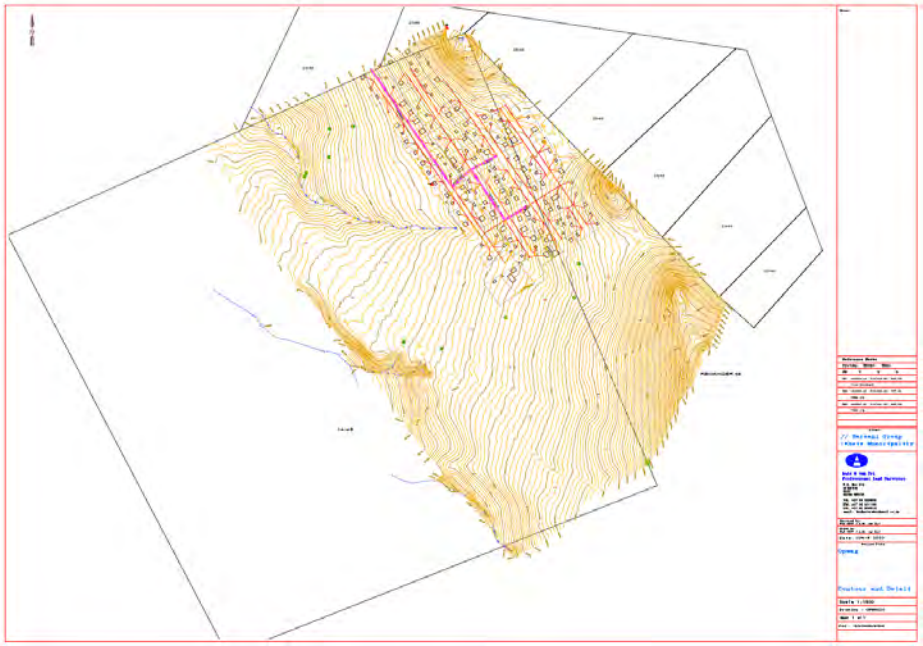


Figure 3: Opwag 730 Stands Contour Plan

3. WATER SUPPLY

3.1 Existing Water Infrastructure

Overview

The bulk water infrastructure supplying Opwag village with water can be summarised as follows:

- A raw water canal pump station delivering 6l/s to Water treatment plant.
- A 150mm long, 90mm diameter PVC raw water supply line between the canal and the water purification works.
- The water treatment works consisting of:
  - A 5000L raw water storage dam
  - A package type water treatment plant,
  - A high lift pump station
- A 545m long, 110mm diameter PVC potable water supply line between the Water treatment works and the potable storage in the village.
- A 128m^3 potable storage zinc reservoir located near the village.
- Distribution into the village via a 90mm PVC pipe up to five (5) stand pipes in the streets.

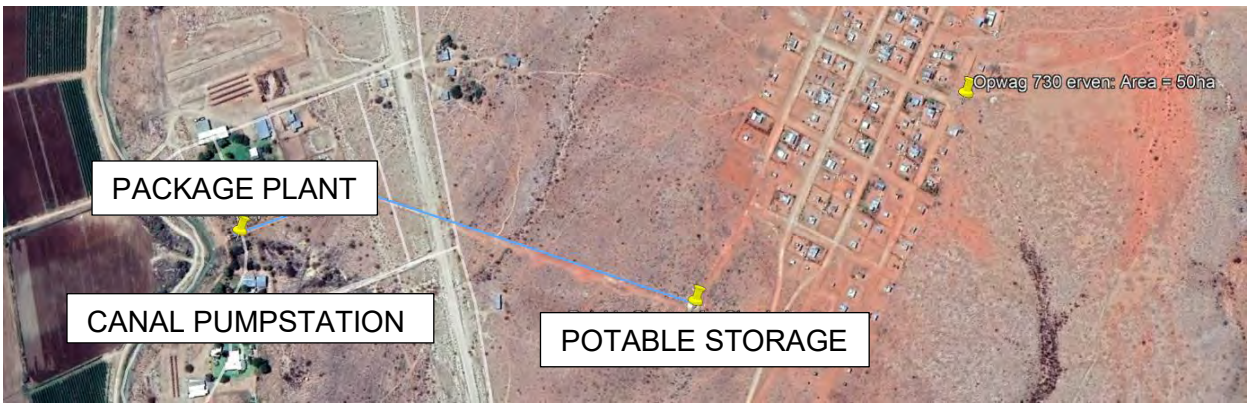


Figure 4: Existing Bulk Water Infrastructure

Raw Water Supply and Water Treatment Works

Water supplied to Opwag is extracted from the Canal by means of a mobile pump station. The pump station consists of one(1) pump that delivers 6l/s.

Raw water is pumped from the canal pump station to the purification plant, delivering a maximum flow rate of 6l/s through a 150m long, 90mm diameter PVC pipeline to a 5m^3 raw water storage JoJo Tank next to the Package Plant Water Treatment Works.

Storage site

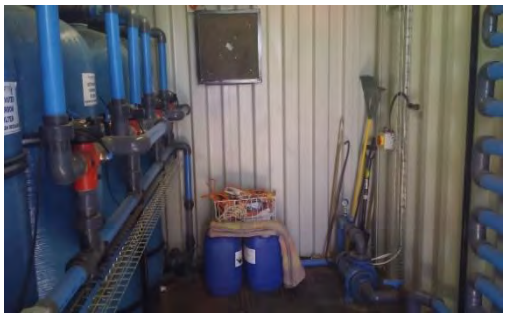
The purified water is thereafter pumped to the potable zinc reservoir located, approximately 545m towards the village. The potable storage reservoir is secured and in a good condition. The photo below, shows the 128m^3 potable zinc storage reservoir.

From here, it gravitates into the village. The village makes use of five (5) communal stand pipes.

Water Treatment Plant

The Package Plant Water Treatment Works (WTW) was constructed in 2008 to supply water at a rate of 2l/s.

Photo's below shows the settlement tank, as well as the filters inside the container:



Reticulation System

The reticulation system consists of communal stand pipes located within in the streets. There are five (5) stand pipes connected to a 90mm PVC ring feed.

Condition of the water supply system

Most of the elements of the water supply system are currently manually operated. These include the canal pump, the water treatment works, and the reservoir levels. Water is distributed to the village from the circular storage steel that stores potable water. Most of the water meters and pressure gauges are out of service.

3.2 Current water demands and capacity of the existing bulk water supply system

The Red Book was used as a basis for calculations of the theoretical capacity for the current bulk water supply system as well as required infrastructure.

The table blow shows factors capacities and operating hours used in the calculations:

FACTORS	1	Design Loss Factor Water treatment works (LFw)		10,0%	
	2	Design Loss Factor Total conveyance losses (LFr)		15,0%	
	3	Summer peak factor (SPF)		1,5	
	4	Peak factor reticulation (PFR) From Red Book (Instantenous Peak)		6	
OPERATING HOURS	1	Source Pump Station (SPSH)	(Maximum operating hours per day that required volume of	16	hours
	2	Water purification plant (WTPH)	(Maximum operating hours per day that required volume of	16	Hours
	3	Lifting Pump Station **(LPS%)**	(% of Instantanious peak flow)	150%	
STORAGE	1	Storage in elevated tanks	(Hours of Instantanous Peak Demand)	3	hours
	2	Potable Water Storage Reservoirs	(Hours of Annual Average Daily Demand*SPF)	48	hours
	3	Raw Water Storage Reservoirs	(Hours of Summer Average Daily Demand)	10	days

The table below and on the next page shows the current theoretical demands and capacity of the existing bulk water infrastructure:

	BULK AND CONNECTOR SERVICES CAPACITY CALCULATION : CURRENT				
	NO.	DESCRIPTION	UNITS	DEMAND PER UNIT	Criteria
GENERAL	1	Sub-Economical Houses (Existing)	135 Houses	600 l/ household per day	81 m^3/d
	2	Sub-Economical Houses (730 houses development)	0 Houses	600 l/ household per day	0 m^3/d
	4	Economical Houses (Existing)	0 Houses	1200 l/ household per day	0 m^3/d
	5	Economical Houses (730 houses development)	0 Houses	1200 l/ household per day	0 m^3/d
	7	Primary School Hostel	0 Learners	150 l/ Learner per day	0 m^3/d
	8	Schools	0 Learners	25 l/ Learner per day	0 m^3/d
	9	High School Hostel	0 Learners	150 l/ Learner per day	0 m^3/d
	10	High School	0 Learners	25 l/ Learner per day	0 m^3/d
	11	Clinics	0 m^2 x	500 l/100m^2 per day	0 m^3/d
	12	Businesses, Government and Municipal	0 m^2 x	400 l/100m^2 per day	0 m^3/d
	13	Developed Parks, Sportsgrounds and Day Cares	0,50 ha	5 mm water per day	25 m^3/d
		ANNUAL AVERAGE DAILY DEMAND (AADD)			106 m^3/d

THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	106,0 m^3/day	4,4 m^3/hour	1,2 l/s	CURRENT CAPACITY		
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	121,9 m^3/day	5,1 m^3/hour	1,4 l/s			
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	182,9 m^3/day	7,6 m^3/hour	2,1 l/s			
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR		26,5 m^3/hour	7,4 l/s			
	5	Storage Capacity Elevated Storage	hours*IPD			79,5 m^3	0,0 m^3	0%	
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD***LPS%**	119 mm dia	39,8 m^3/hour	11,0 l/s	10,0 l/s	91%	
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD			212,0 m^3	127,6 m3	60%	
	8	**Water Treatment Plant Capacity (WTPC)**	**SGDD*24/WTPH**	274,3 m3/day	11,4 m3/hour	3,2 l/s	2,0 l/s	63%	
	9	**Source Pump Station Capacity and Pipeline Flow**	**WTPC*(1+LFW)*24/SP**	83 mm dia	19,7 m3/hour	5,5 l/s	6,0 l/s	####	
	10	Raw Water Storage Capacity	Days*SGDD			1829,0 m^3	5,0 m3	0%	

It is clear from the table that the existing infrastructure is already under pressure to handle the demand. The biggest problems are with bulk and elevated storage.

3.3 Bulk Water Infrastructure Requirements

The table below compares the current infrastructure capacities with the capacity that is required for the 730 stands development.

	BULK AND CONNECTOR SERVICES CAPACITY CALCULATION : FUTURE					
	NO.	DESCRIPTION	UNITS		DEMAND PER UNIT	Criteria
GENERAL	1	Sub-Economical Houses (Existing)	0	Houses	600 l/ household per day	0 m^3/d
	2	Sub-Economical Houses (730 houses development)	730	Houses	600 l/ household per day	438 m^3/d
	4	Economical Houses (Existing)	0	Houses	1200 l/ household per day	0 m^3/d
	5	Economical Houses (730 houses development)	0	Houses	1200 l/ household per day	0 m^3/d
	7	Primary School Hostel	0	Learners	150 l/ Learner per day	0 m^3/d
	8	Schools	0	Learners	25 l/ Learner per day	0 m^3/d
	9	High School Hostel	0	Learners	150 l/ Learner per day	0 m^3/d
	10	High School	0	Learners	25 l/ Learner per day	0 m^3/d
	11	Clinics	0	m^2 x	500 l/100m^2 per day	0 m^3/d
	12	Businesses, Government and Municipal	0	m^2 x	400 l/100m^2 per day	0 m^3/d
	13	Developed Parks, Sportsgrounds and Day Cares	1,00	ha	5 mm water per day	50 m^3/d
		ANNUAL AVERAGE DAILY DEMAND (AADD)				**488 m^3/d**

							CURRENT CAPACITY	
THEORETICAL DEMANDS	1	Annual Average Daily Demand (AADD)	AADD	488,0 m^3/day	20,3 m^3/hour	5,6 l/s		
	2	Gross Annual Average Daily demand (GAADD)	(1+Lfr)*AADD	561,2 m^3/day	23,4 m^3/hour	6,5 l/s		
	3	Summer Gross Daily Demand (SGDD)	SPF*GAADD	841,8 m^3/day	35,1 m^3/hour	9,7 l/s		
	4	Instantanious Peak Demand (IPD) (Main supply pipeline to reticulation)	AADD*PFR		122,0 m^3/hour	33,9 l/s		
	5	Storage Capacity Elevated Storage	hours*IPD			366,0 m^3	0,0 m^3	0%
	6	Lifting Pump Station Capacity and Pipeline Flow between Main Storage and Elevated tank	IPD*LPS%	254 mm dia	183,0 m^3/hour	50,8 l/s	10,0 l/s	20%
	7	Potable Water Storage Capacity (Main Storage)	hours*AADD			976,0 m^3	127,6 m3	13%
	8	Water Treatment Plant Capacity (WTPC)	SGDD*24/WTPH	##### m3/day	52,6 m3/hour	14,6 l/s	2,0 l/s	14%
	9	Source Pump Station Capacity and Pipeline Flow	WTPC*(1+LFW)*24/SP	179 mm dia	90,8 m3/hour	25,2 l/s	6,0 l/s	24%
	10	Raw Water Storage Capacity	Days*SGDD			8418,0 m^3	5,0 m3	0%

Recommended upgrades to the Opwag bulk water infrastructure are as follows (shown on the drawing below):

- Construction of a new 25l/s canal pump station with a duty and standby pump.
- New 160mm diameter Class 9 PVC pipeline between the canal pump station and the water treatment works.
- Water Treatment Works to be re-allocated to proposed site and upgraded to deliver 24m^3/h potable water to the potable storage reservoirs.
- A new 848m^3 sectional steel reservoir in the proposed site.
- One (1) new 355 m^3 sectional steel pressure tower on the highest point in the village.
- A new 52l/s lifting pump station at the treatment works.
- A new 250mm pipeline between the lifting pump station and the pressure tower.

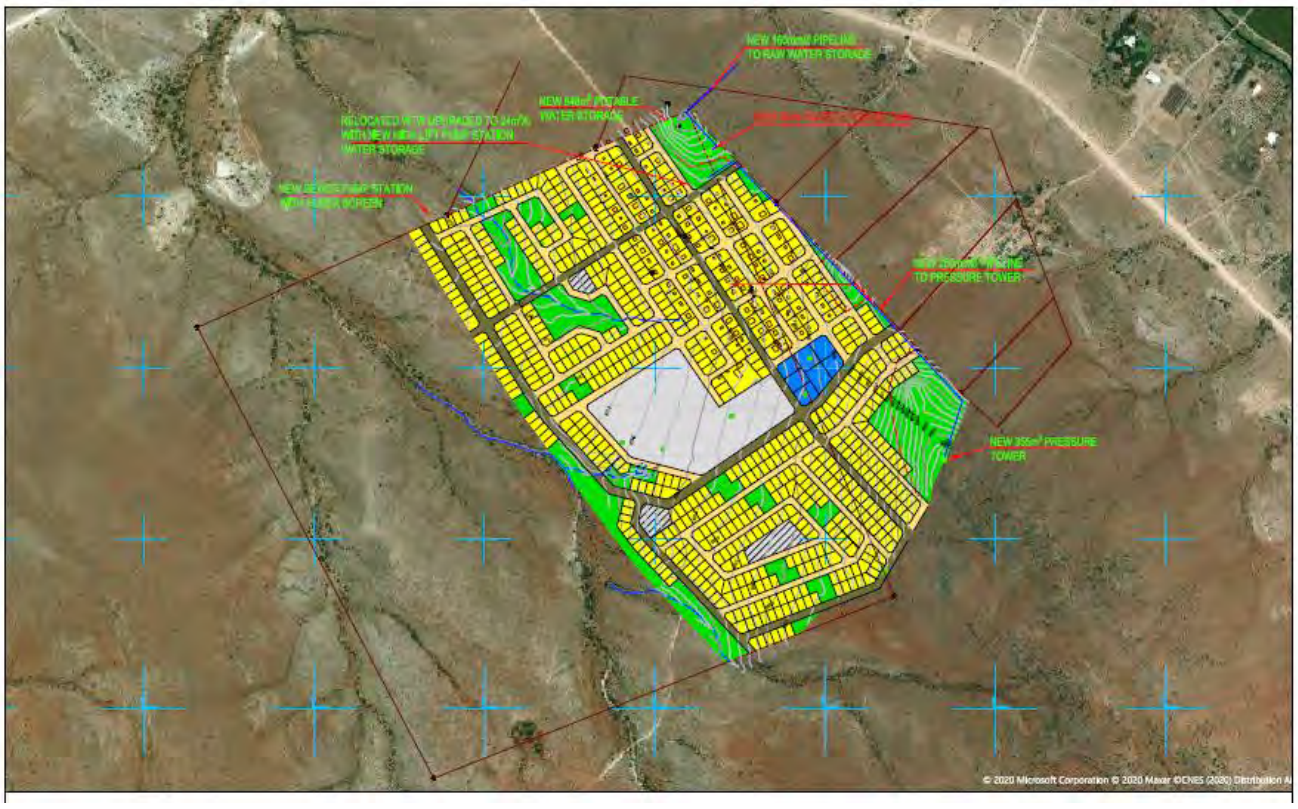


Figure 5: Proposed Water Bulk Infrastructure

3.4 Fire Fighting Requirements

Areas to be protected by a fire service should be classified according to a fire-risk category. The new development can be classified as a “Low risk – Group 4” according to the “Guidelines for Human Settlement Planning and Design”.

No specific provision for fire fighting water is required in water storage, or reticulation mains in these areas. Hydrants should, however, be located at convenient points in the area on all mains of 75 mm nominal internal diameter and larger, and in the vicinity of all schools, commercial areas and public buildings.

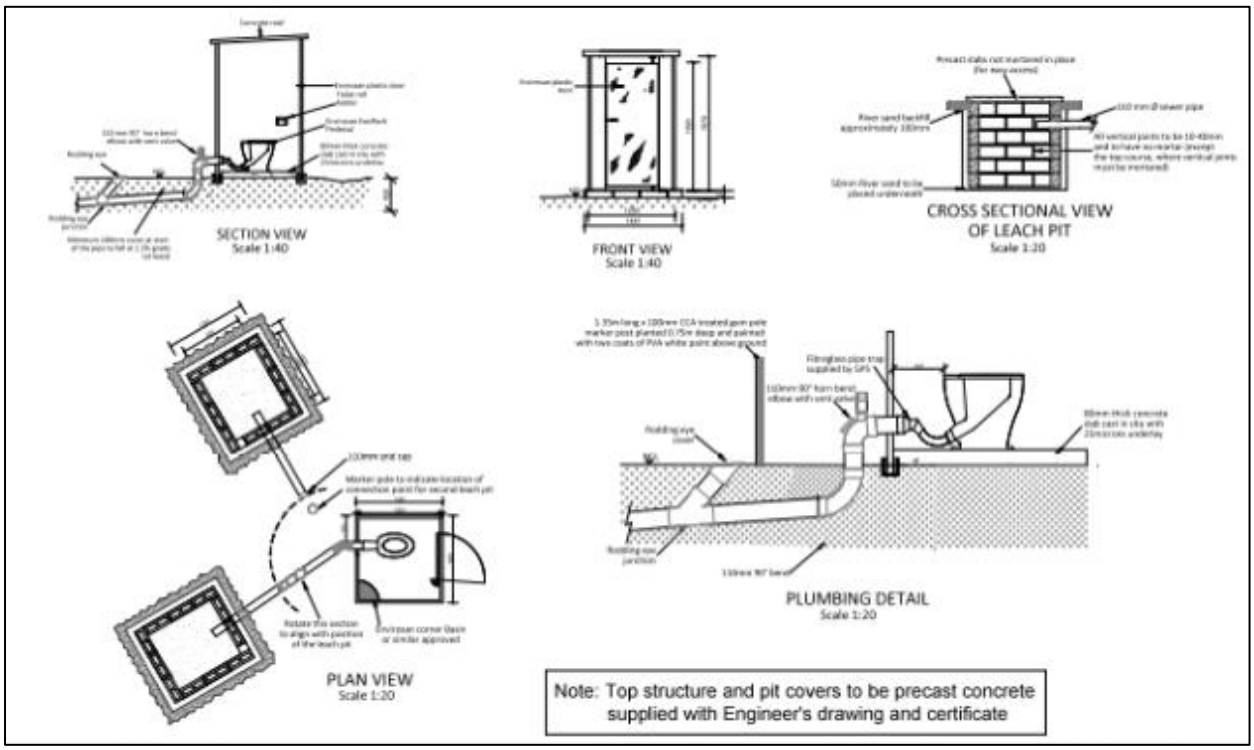
Fire fighting in areas zoned “Low-risk – Group 4” should generally be carried out using trailer-mounted water tanks or fire appliances that carry water, which can be replenished from the hydrants provided in the reticulation, if necessary.

4. SEWERAGE

4.1 Existing Sewage Infrastructure overview

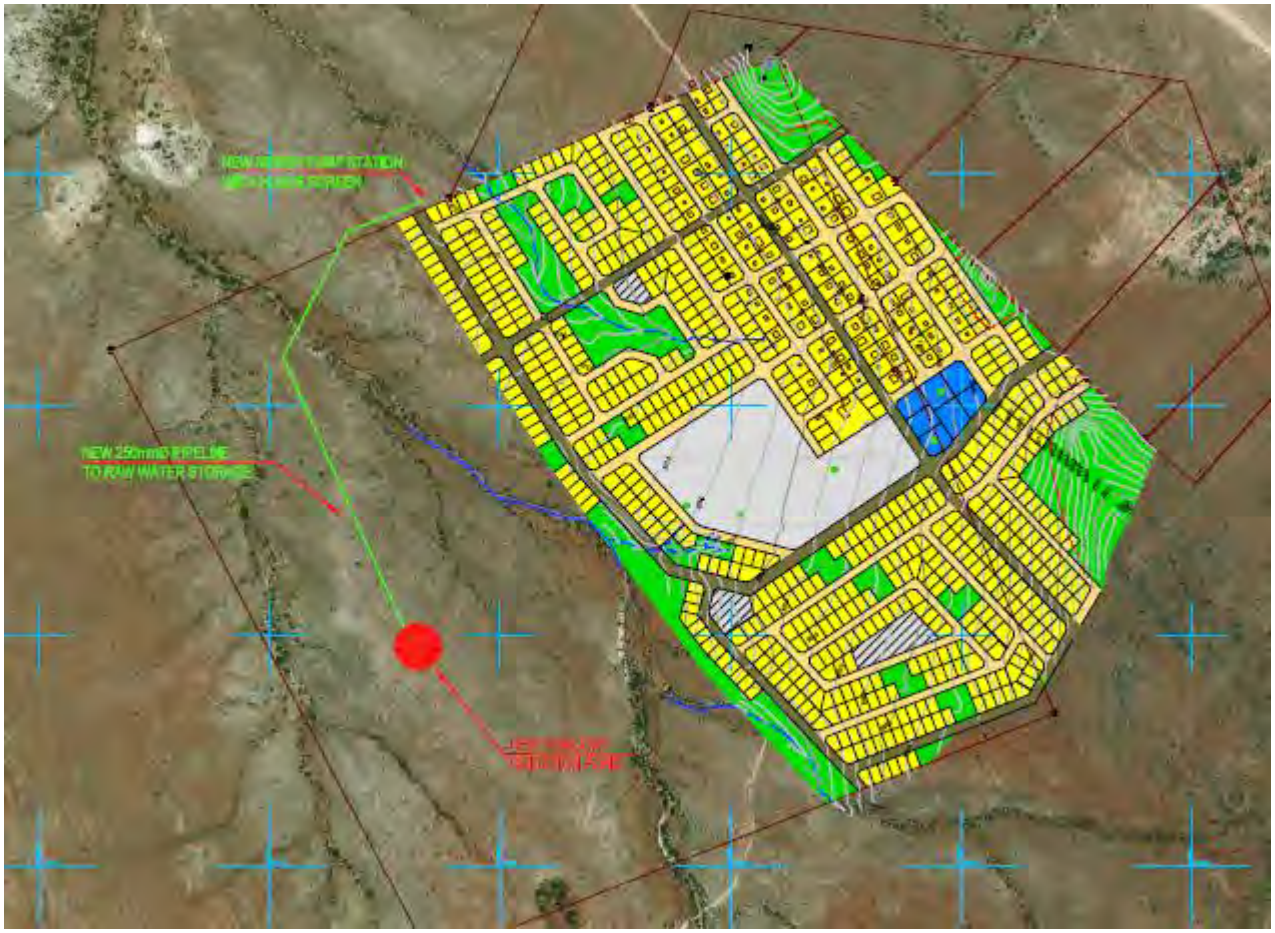
All the houses in the Opwag village currently consists of Pour Toilets with a Leach Pit. There is no sewer bulk infrastructure and would be recommended.

Kindly refer to the figure below, illustrating the toilets currently installed.



4.2 Bulk Sewer Infrastructure Requirements

If a full borne sewer sewerage system is required for the new 730 houses development, the associated bulk infrastructure will most possibly consist of a pump station, rising main pipeline and oxidation ponds as shown on the Google image below.



The total sewer flow is calculated as follows:

OPWAG TOTAL SEWER FLOW					
Sewer flow per day - Sub economical houses	730	sub economical houses @	500 l/day	365 000	l/day
Sewer flow per day - Economical houses	0	economical houses @	750 l/day	-	l/day
Sewer flow per day - Hostels	0	persons @	140 l/day	-	l/day
Sewer flow per day - Schools	0	persons @	20 l/day	-	l/day
Businesses and State Institutions	0	buildings	100 l/day	-	l/day
SEWER FLOW PER DAY - TOTAL				**365 000**	**l/day**

The sizes and capacities of the proposed pump stations and rising mains were calculated as follows:

PUMP STATION No 1 AND RISING MAIN				
Sewer flow per day - Sub economical houses	730	sub economical houses @	500 l/day	365000 l/day
Sewer flow per day - Economical houses		economical houses @	750 l/day	0 l/day
Sewer flow per day - Hostels	0	persons @	140 l/day	0 l/day
Sewer flow per day - Schools	0	persons @	20 l/day	0 l/day
Businesses and State Institutions	0	buildings	100 l/day	0 l/day
SEWER FLOW PER DAY - TOTAL				365000 l/day
Average sewer flow				4,2 l/s
Factor for inflow from other sources	15%			0,6 l/s
Sewer flow with inflow from other sources				4,9 l/s
PEAK NETWORK SEWER FLOW	4,9		3,5	17,0 l/s
FLOWRATE FROM OTHER PUMP STATIONS				0 l/s
TOTAL PEAK FLOW				17,00 l/s
ACTUAL PUMP ABILITY	1,63	times peak flow		27,7 l/s
Theoretical pump station capacity for normal pump operation	1	hours of peak flow		61 m^3
Theoretical pump station capacity for emergency storage	2	hours of normal flow		35 m^3
TOTAL REQUIRED THEORETICAL PUMP STATION CAPACITY				96 m^3
Pump details		Gorman Rupp V4		15 kW
Rising main diameter				225 mm
Rising main material				PVC
Rising main length				340 m
Static pump height				10 m
Friction losses				10 m
Total pump height				20 m

Recommended Opwag bulk sewer infrastructure construction (excluding internal sewer lines) are as follows (shown on the drawing above):

- Construction of one(1) new sewer pump stations capable of delivering 28 l/s direct to the Oxidation Ponds
- New 250mm diameter PVC pipelines (340m) between the pump stations and a new Waste Water Treatment Plant (oxidation ponds).
- Construction of a Waste Water Treatment Plant (oxidation ponds) with a capacity of 0.5Ml per day.

5. ROADS AND STORMWATER

5.1 Roads and Access

Access to the development will be from the existing Residential Collector Streets (Class 4b), as shown on the drawing below:

No problems are foreseen regarding roads and access.

5.2 Stormwater Management

The guiding principle underlying the storm water management strategy is that, where possible, the peak run-off from the post-developed site should not exceed that of the pre-developed site for the full range of storm return periods (1:2 to 1:50). Where possible, measures should be incorporated into the site development plan to attenuate the post-development flows to pre-development rates.

The storm water network must be designed to accommodate (flood frequencies as prescribed by "The Red Book") the minor storm event (1:5 year) in open channels or side drains of streets. The major storm (1:50 year) should be managed through controlled overland flows, above-ground attenuation storage (if required) and berms at the higher end of the site (if required). As no formal storm water system exists in the area, concentration of storm water must be avoided as far as possible. Earthworks on plots should therefore encourage free drainage of the area.

Opwag is a small village that generally drains from the center. Existing roads will be adequate for this purpose.

6. SOLID WASTE DISPOSAL

Solid waste disposal site will be upgraded to accommodate the future 730 stands.

7. ELECTRICAL SUPPLY

7.1 Electrical Demands and Availability

This section of the report covers the availability of the Bulk Electrical connection to the future 135 Community stands, an expected additional load of the proposed development will initially be 876 KVA as per INEP guidelines and the accommodation of this load will form the basis of this report. The community of Opwag falls directly under “Eskom Distribution” and the existing electrified homes in the community purchase electricity directly from Eskom and not through the Kheis local Municipality.

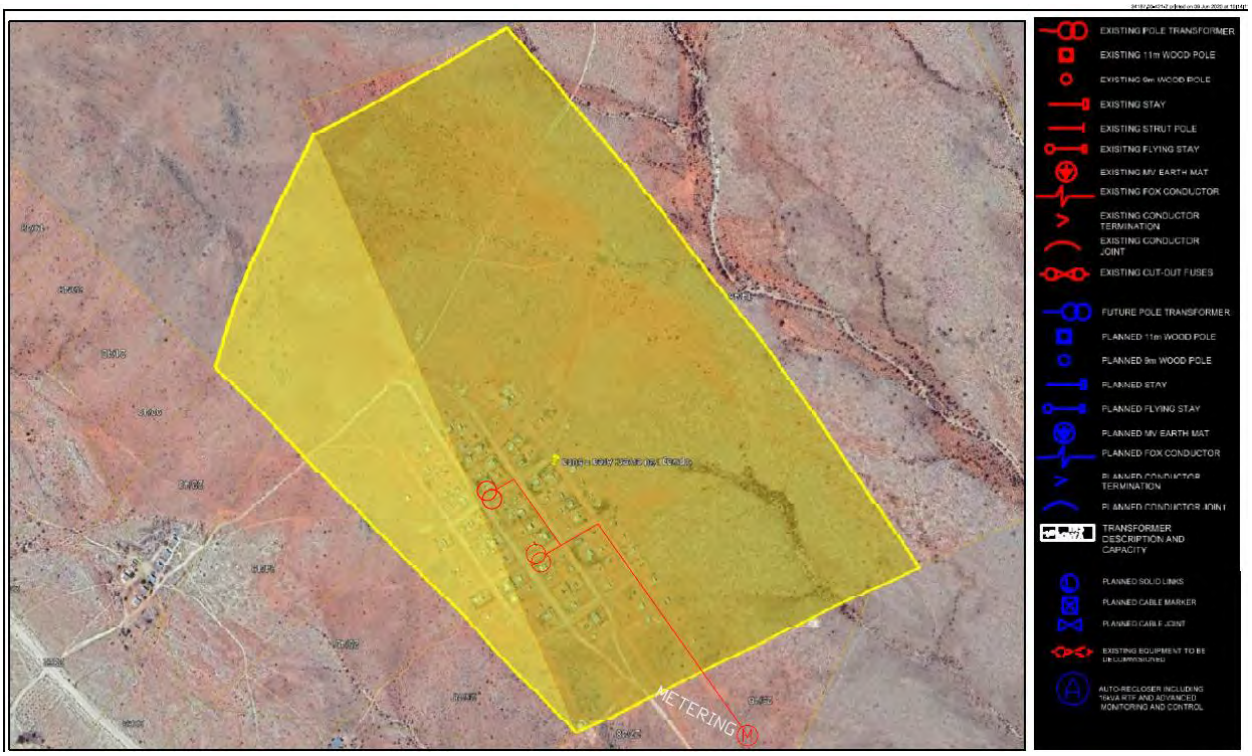
The bulk connection to the community / town is via a 22kV overhead line fed from the 10MVA Grobelershoop sub-station.

7.2 Existing Electrical Network

The bulk connection to the community / town is via a 22kV overhead line fed from the Eskom 10MVA Grobelershoop sub-station. This sub-station is currently in the process of being upgraded to 20MVA and will be commissioned in December 2020.

The existing MV electrical network in the Opwag area runs through the town via 22 KV overhead line feeder connecting to various pole mounted transformers (see figure 1 below). The existing overhead line feed is running through a section of the proposed development.

The existing feeder can easily handle the future additional 876 KVA load only after the upgraded Eskom Groblershoop sub-station is brought online as indicated by Eskom’s network planning department.



7.3 Electrical Network Extension

The internal electrical network extension in the Opwag community will only be done by Eskom after the formulation processes are completed as this area falls under the Eskom Distribution.

8. COST ESTIMATE

The cost estimate for the proposed activities are as provided below. The level of accuracy is commensurate with a concept level design.

DESCRIPTION			QUANTITY	QUANTITY UNIT	AMOUNT TO REPAIR OF EXISTING	AMOUNT NEW INFRASTRUCTURE	TOTAL
Water Bulk Services							
Source pump station - Canal			25.0	l/s		675 000	675 000
Pump line from source to raw water storage reservoir	160	mm dia	150.0	m		177 156	177 156
Water Treatment Works			0.5	Ml/day	500 000	3 312 000	3 812 000
Potable Water Storage - Sectional Steel Tank			900.0	m3		2 250 000	2 250 000
Potable water pump station - Building			20.0	sq.m		100 000	100 000
Potable water pump station - Mechanical			52.0	l/s		1 404 000	1 404 000
Pump line from storage reservoir to Pressure Tower	250	mm dia	100.0	m		151 952	151 952
Elevated Starage Tower - Sectional Steel			400.0	m3		1 600 000	1 600 000
Sub-Total (Water)					**500 000**	**9 670 107**	**10 170 107**
Bulk Sewer Services							
Sewer Pump Station No 1 - Civil/Structural			96.0	m3		768 000	768 000
Sewer Pump Station No 1 - Mechanical/Electrical/Control			96.0	m3		172 800	172 800
Pump Line from Sewer Pump Station No 1 to Treatment Works	250	mm dia	340.0	m		516 636	516 636
Treatment Works Oxidation Ponds			500.0	kl/day		12 500 000	12 500 000
Sub-Total (Sewer)					**-**	**13 957 436**	**13 957 436**
Roads and Access							
None						-	
Electrical							
None							
TOTAL CONSTRUCTION					**500 000**	**23 627 543**	**24 127 543**
10% Contingencies					50 000	2 362 754	2 412 754
SUB TOTAL					**550 000**	**25 990 297**	**26 540 297**
10% Professional fees					55 000	2 599 030	2 654 030
SUB-TOTAL					**605 000**	**28 589 327**	**29 194 327**
15% VAT					90 750	4 288 399	4 379 149
GRAND TOTAL					**750 750**	**35 476 756**	**36 227 506**

Notes:
Base date of the calculations is October 2020;
No provision was made for EIA, registration and/or land acquisition;
No allowance was made for institutional and/or social development.

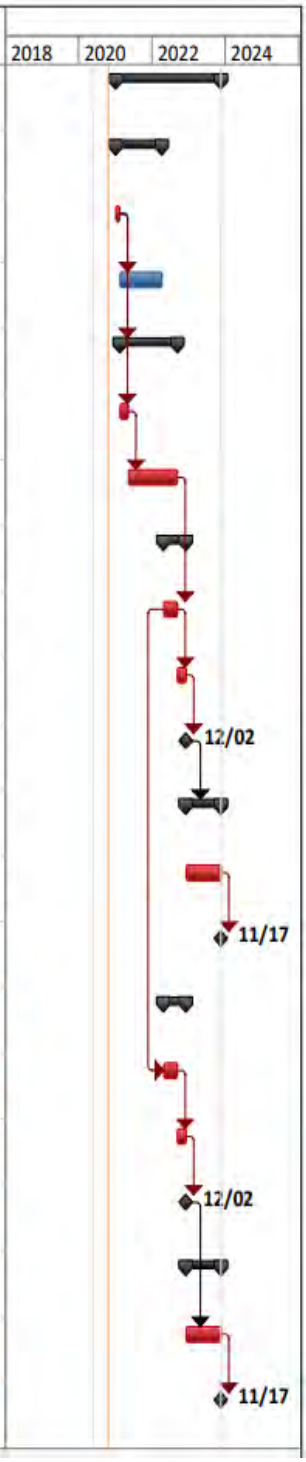
7.1 Funding

Funding can be applied for through the Municipal Infrastructure Grant (MIG) and Regional Bulk Infrastructure Grant (RBIG). For repair work at the water treatment works, the Water and Sanitation Infrastructure Grant (WSIG) can also be applied for.

This report can be used for funding application from the various schemes available.

9. PROJECT TIMELINE

ID	Task Mode	Task Name	Duration	Start	Finish
1		**BULK INFRASTRUCTURE TIMELINE**	**750 days**	**Mon 21/01/04**	**Fri 23/11/17**
2		**APPLICATION FOR FUNDS**	**330 days**	**Mon 21/01/04**	**Fri 22/04/08**
3		Application for RBIG & Mig funding	30 days	Mon 21/01/04	Fri 21/02/12
4		Approval of feasibility study & readyness re	300 days	Mon 21/02/15	Fri 22/04/08
5		**EIA PROCESS**	**410 days**	**Mon 21/02/15**	**Fri 22/09/09**
6		Appointment of EIA Specialist	60 days	Mon 21/02/15	Fri 21/05/07
7		EIA study	350 days	Mon 21/05/10	Fri 22/09/09
8		**DESIGN, DOCUMENTATION AND PROCUREMENT BULK SERVICES**	**160 days**	**Mon 22/04/25**	**Fri 22/12/02**
9		Design and documentation	100 days	Mon 22/04/25	Fri 22/09/09
10		Procurement	60 days	Mon 22/09/12	Fri 22/12/02
11		Contractor appointed	0 days	Fri 22/12/02	Fri 22/12/02
12		**CONSTRUCTION**	**250 days**	**Mon 22/12/05**	**Fri 23/11/17**
13		Construction period	250 days	Mon 22/12/05	Fri 23/11/17
14		Construction completed	0 days	Fri 23/11/17	Fri 23/11/17
15		**DESIGN, DOCUMENTATION AND PROCUREMENT INTERNAL SERVICES**	**160 days**	**Mon 22/04/25**	**Fri 22/12/02**
16		Design and documentation	100 days	Mon 22/04/25	Fri 22/09/09
17		Procurement	60 days	Mon 22/09/12	Fri 22/12/02
18		Contractor appointed	0 days	Fri 22/12/02	Fri 22/12/02
19		**CONSTRUCTION**	**250 days**	**Mon 22/12/05**	**Fri 23/11/17**
20		Construction period	250 days	Mon 22/12/05	Fri 23/11/17
21		Construction completed	0 days	Fri 23/11/17	Fri 23/11/17



10. CONCLUSION

Engineering services were assessed to determine spare capacity on the existing bulk infrastructure and compared to the estimated demand of the newly proposed Opwag 730 houses development.

The findings and conclusions in this report are based on a preliminary desktop study, as well as site visits.

- Bulk Water Infrastructure – The current capacity of the bulk water infrastructure is not enough to accommodate the proposed 730 houses development as is. It is proposed that the infrastructure should be upgraded.
- Bulk Sewage Infrastructure – There is currently no bulk sewer infrastructure.
- Roads and Access: No bulk infrastructure upgrading required on the roads.
- Storm Water Management: No bulk infrastructure upgrading required on the storm water.
- Electricity Supply – The existing feeder can easily handle the future additional 876 KVA load only after the upgraded Eskom Groblershoop sub-station is brought online as indicated by Eskom's network planning department.

In conclusion, the engineering services are not in place (water and sewer) to meet the standard requirements. Any upgrading should be done in such a way as to take into consideration the Opwag 730 Houses development.

ANNEXURE E: DETAIL LAYOUT

IKHEIS MUNICIPALITY

CONCEPT TOWNSHIP ESTABLISHMENT

Design:	JP Theron (Pr. Pln. A/2394/2016)
Drawn:	JP Theron (Pr. Pln. A/2394/2016)
Date:	August 2020
Scale:	1:1800 (A0)

Plan nr:

Concept Layout Plan (DWG.TE) 200825 Opwag

Proposed Land Uses in terms of Land Use Management System

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	Schedule of Sizes: total area covered by land use	Schedule of Sizes: percentage of study area covered by use
	Open Space Zone I				
	Open Space Zone II	23			
	Open Space Zone III				
	Agricultural Zone I				
	Agricultural Zone II				
	Resort Zone II				
	Residential Zone I	730	355m²	26ha	
	Residential Zone II				
	Residential Zone III				
	Residential Zone IV				
	Residential Zone V				
	Residential Zone VI				
	Institutional Zone I	2			
	Institutional Zone II	3			
	Institutional Zone III				
	Authority Zone I	1			
	Authority Zone II				
	Special Zone				

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	Schedule of Sizes: total area covered by land use	Schedule of Sizes: percentage of study area covered by use
	Undetermined Zone				
	Business Zone I	10			
	Business Zone II				
	Business Zone III				
	Business Zone IV				
	Business Zone V				
	Business Zone VI				
	Industrial Zone I				
	Industrial Zone II				
	Industrial Zone IV				
	Industrial Zone IV				
	Utility Zone I				
	Utility Zone II				
	Utility Zone III				
	Transport Zone I	1			
	Transport Zone II				
	Transport Zone III				
Total:		770		52ha	

Addisional Information:

Contours	
Pipeline	
Sewerage Line	
Powerlines	
Buildings	
High Voltage Powerlines	

Drawn:

MACROPLAN
TOWN & REGIONAL PLANNERS

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Municipality:

!Kheis
Munisipaliteit
Municipality

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Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Client:

COGHSTA
Department:
CO - OPERATIVE GOVERNANCE
HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
NORTHERN CAPE

ANNEXURE F: BOTANICAL ASSESSMENT

PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

OPWAG HOUSING PROJECT

PROPOSED FORMALIZATION AND DEVELOPMENT OF 730 NEW ERVEN ON PLOT 2642, BOEGOEBERG SETTLEMENT AND FARM BOEGOEBERG SETTLEMENT NO.48/16, OPWAG, !KHEIS LOCAL MUNICIPALITY,NORTHERN CAPE PROVINCE

16 July 2020

P.J.J. Botes (Pr.Sci.Nat: 400184/05)

Registered Professional Botanical, Environmental and Ecological Scientist

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7280

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EXECUTIVE SUMMARY

VEGETATION TYPE

Bushmanland Arid Grassland

Classified as "Least Threatened" (GN 1002, December 2011) although statutory conservation targets have not yet been met.

VEGETATION ENCOUNTERED

The activity is expected to result in a permanent transformation of approximately 50 ha of land, of which just more than 80% is still covered by indigenous vegetation in good condition. Although Bushmanland Arid Grassland is not known for its high plant diversity, the vegetation encountered was in exceptionally good condition considering the urban settlement and grazing practices.

CONSERVATION PRIORITY AREAS

According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA.

The site will not impact on any recognised centre of endemism.

CONNECTIVITY

The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.

LAND-USE

The footprint is on municipal land in close proximity to the town of Opwag. Portions of the footprint are already disturbed or settled by the local community. The main land-use (apart from housing) seems to be livestock grazing by the local community.

PROTECTED PLANT SPECIES

The most significant botanical aspect of this site is the presence of a 4 protected Sheppard trees (*Boscia albitrunca*) (refer to Table 2). A number of Northern Cape Nature Conservation Act, protected species were also observed (Refer to Table 3).

MAIN CONCLUSION

The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 50 ha of land, of which approximately 80%is still covered by indigenous vegetation in good condition. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, 4 protected Sheppard trees (*Boscia albitrunca*), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.

According to the impact assessment given in Table 6 the development is likely to result in a **Medium-Low** impact, which can be reduced to a **Low** impact with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity.

WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, WITH THE PROPOSED MITIGATION ACTIONS.

NO-GO OPTION

The No-Go option is not likely to result in a "no-impact" scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site.

There is also an urgent need for the establishment of additional residential erven in the !Kheis Municipality, which is likely to outweigh the No-Go option.

INDEPENDENCE & CONDITIONS

PB Consult is an independent entity with no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Mr Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTR and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity en environmental legal compliance audits.

During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes NEMA EIA applications, environmental management plans for various industries, environmental compliance audits, environmental control work as well as more than 70 biodiversity & botanical specialist studies.

Towards the end of 2017, Mr Botes started his own small environmental consulting business focusing on biodiversity & botanical assessments, biodiversity management plans and environmental compliance audits.

Mr Botes is a registered Professional Botanical, Environmental and Ecological Scientists at SACNASP (South African Council for Natural Scientific Professions) as required in terms of Section 18(1)(a) of the Natural Scientific Professions Act, 2003, since 2005.

DECLARATION OF INDEPENDENCE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Petrus, Jacobus, Johannes Botes, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, as amended, and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 13 of GN No. R. 326.

Note: The terms of reference must be attached.

Signature of the specialist:

PB Consult (Sole Proprietor)

Name of company:

16 July 2020

Date:

CONTENTS

LIST OF TABLES:

LIST OF PHOTOS:

1. INTRODUCTION

There is an urgent need for the establishment of additional residential erven in the sub-economical market in the !Kheis Local Municipality. Seven towns have been identified for the proposed development of a number of new erven at each town. They are:

- Boegoeberg: 550 erven;
- Gariep: 135 erven;
- Groblershoop: 1500 erven;
- Grootdrink: 370 erven;
- Opwag: 730 erven;
- Topline: 248 erven; and
- Wegdraai: 360 erven.

Macroplan has been appointed by the Barzani Group (on behalf of COGHSTA) as Town and Regional Planners to manage the town planning process in terms of SPLUMA (Act 16 of 2013).

The proposed project will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). As result EnviroAfrica was appointed to perform the NEMA EIA application and PB Consult was appointed to conduct a botanical assessment of the proposed sites, which, although disturbed in some areas, still supports natural vegetation.

This report refers to the proposed development of approximately 730 new erven on a 50 ha piece of land on, municipal land adjacent to Opwag.

The proposed footprint supports one vegetation type namely, Bushveld Arid Grassland (considered "Least Threatened" in terms of the National list of ecosystems that are threatened and in need of protection). Desktop studies suggest that the veld may still be in good condition, and it overlaps a terrestrial critical biodiversity area (CBA1) as identified in the 2017 Northern Cape Biodiversity Spatial Plan.

It must be mentioned that Opwag was probably the surprise of all the !Kheis housing projects, in that the veld was still in good condition, and the people really made an effort to keep their town clean. They should be commended for this.

1.1. TERMS OF REFERENCE

The terms of reference for this appointment were to:

- Evaluate the proposed site(s) in order to determine whether any significant botanical features will be impacted as a result of the proposed development.
- Determine and record the position of any plant species of special significance (e.g. protected tree species, or rare or endangered plant species) that should be avoided or that may require "search & rescue" intervention.
- Locate and record sensitive areas from a botanical perspective within the proposed development footprint that may be interpreted as obstacles to the proposed development.
- Make recommendations on impact minimization should it be required
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

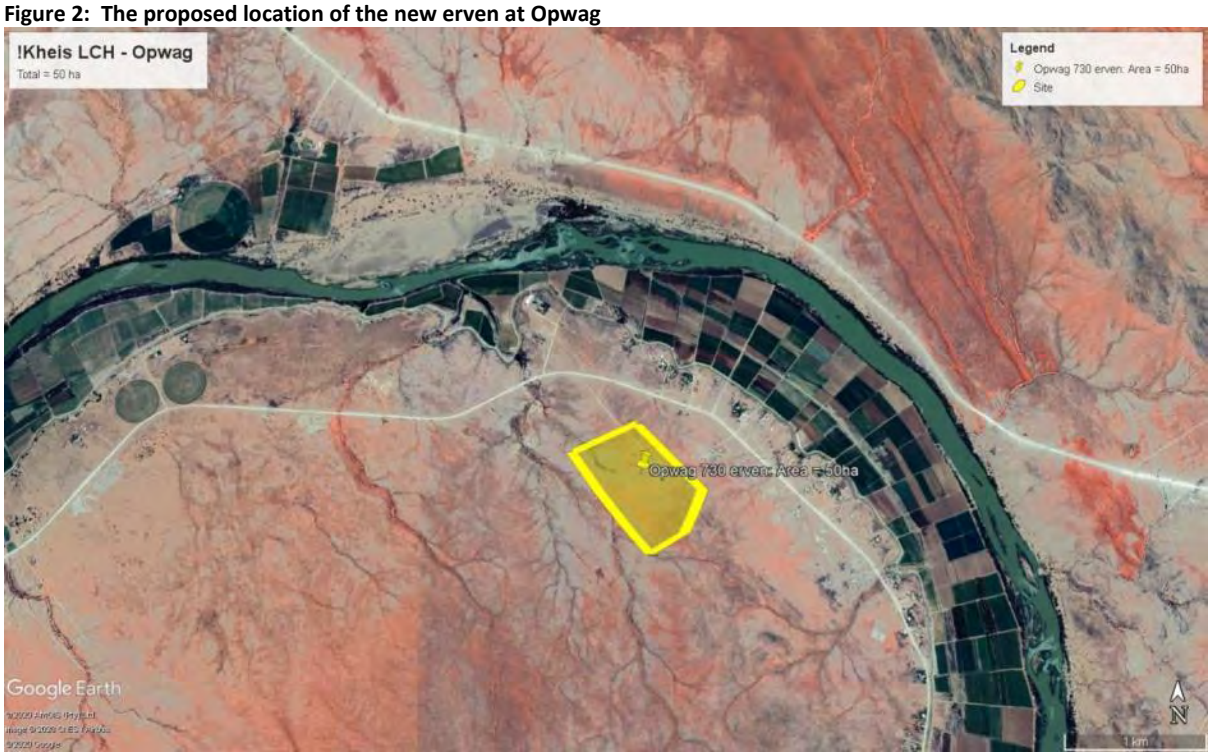
2. STUDY AREA

2.1. LOCATION & LAYOUT

Opwag is located just north of Groblershoop, about 1.6 km from the Orange River in the !Kheis Local Municipality of the Northern Cape Province (Figure 1). The proposed new erven will include the current settlement that has been established at Opwag, on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement No. 48 (GPS Coordinates 28° 50' 49.00"S; 21° 57' 34.10"E).

Figure 1: Map showing the location of Opwag in relation to Upington and Groblershoop in the Northern Cape Province

Figure 2: The proposed location of the new erven at Opwag



2.2. CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Opwag receives less than a 100 mm of rain per year, mainly in mid-summer December to March the highest (40 mm) in February/March, with its lowest rainfall (0 mm)during winter (June to August). It is also important to note that rainfall can be highly erratic and can vary significantly per annum on any specific location. Daily temperatures vary from 23°C – 37°C during the hot summer months (December / January) and drops down to between 8°C - 17°C during the colder winter months (June – July) (www.worldweatheronline.com).

2.3. TOPOGRAPHY & SOILS

The proposed Opwag settlement will be located on slightly undulating land characterised by small to medium ephemeral drainage lines. The land slopes slightly towards the southwest into a larger ephemeral drainage line, which drains towards the landscape towards the Orange River.

Figure 3: National soil map of South Africa, showing the town of Opwag and its immediate surroundings

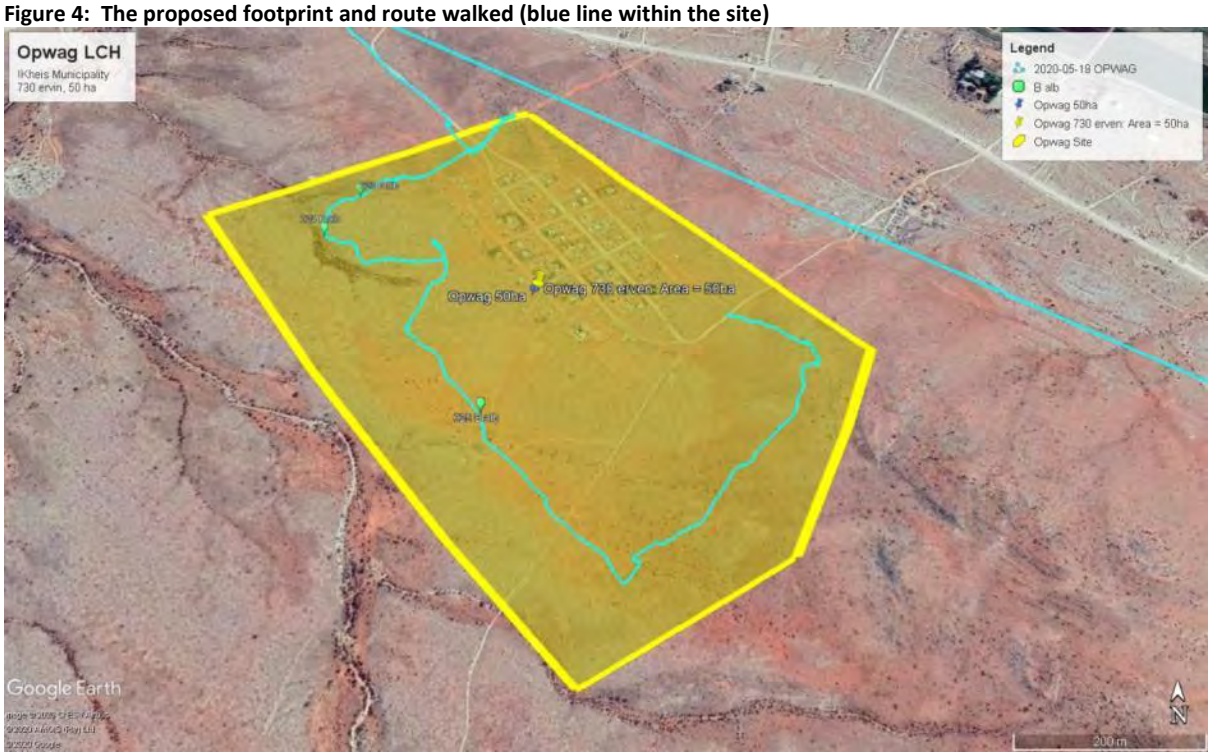
According to Mucina & Rutherford (2006), the geology for Bushmanland Arid Grassland vegetation is dominated by mudstones and shales of the Ecca Group (Prince Albert and Volksrust Formations) and Dwyka tillites, both of the early Karoo age. About 20% of rock outcrops are formed by Jurassic intrusive dolerite sheets and dykes. The soils are described as soils with minimal development, usually shallow on hard or weathering rock, Glenrosa and Mispah forms, with lime generally present in the entire landscape (Fc land type) and, to a lesser extent, red-yellow apedal, freely drained soils with a high base status and usually <15% clay (Ah and Ai land types) are also found. The salt content in these soils is very high. The soils on site were generally shallow on weathering rock with high quarts and calcrete content.

3. EVALUATION METHOD

Desktop studies coupled with a site visit were performed. The site visit was conducted on the 19th of May 2020. The timing of the site visit was reasonable in that, even though the veld was very dry, almost all perennial plants were identifiable.

However, it is important to note that the Northern Cape is currently in the midst of one of its worst drought periods in a long time, and although some summer rains had fallen (deducted from the presence of a number of grass species) it was not yet enough to really trigger a display of annual herbs.

Figure 4: The proposed footprint and route walked (blue line within the site)



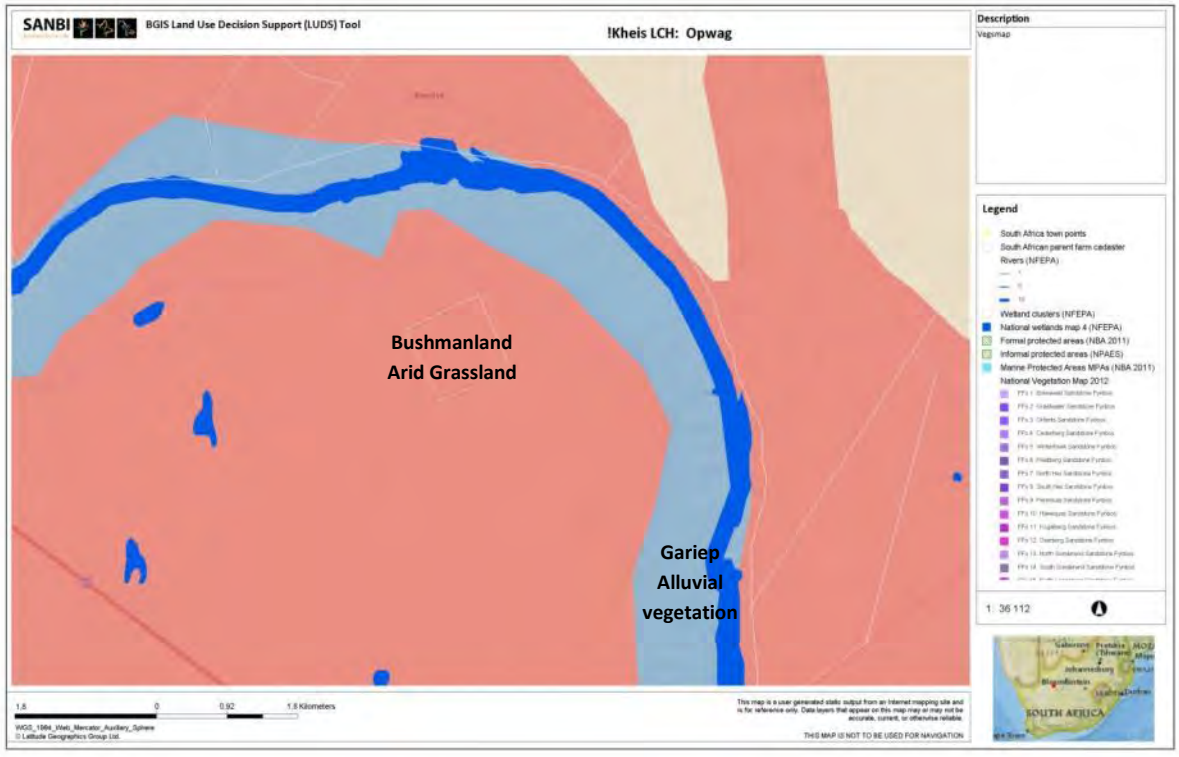
However, the author is confident that a fairly good understanding of the biodiversity status of the site was obtained. The survey was conducted by walking the site and examining, marking and photographing any area of interest. Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

4. THE VEGETATION

The Northern Cape contains about 3500 plant species in 135 families and 724 genera, with about 25% of this flora endemic to the region. It is also home to an exceptionally high level of insect and reptile endemism, with new species still being discovered. However, it must be noted that this remarkable diversity is not distributed evenly throughout the region, but is concentrated in many local centres of endemism. The Karoo used to support millions of antelope, mainly springbuck, but also numerous other larger antelope (and other grazing animal). These animals roamed the vast plains of the Karoo, utilizing different selections of plants and allowing for long "rest" periods as they move around, and as a result preventing overgrazing (Shearing, 1994).

The Opwag area would be classified as a desert region. In accordance with the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated in the 2012 beta version) only one broad vegetation type is expected within the proposed footprint, namely **Bushmanland Arid Grassland** (Figure 5). Both these vegetation types are classified as "Least Threatened" (GN 1002, December 2011) although statutory conservation targets have not yet been met.

Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the expected vegetation types



4.1. THE VEGETATION IN CONTEXT

4.1.1. Nama-Karoo Biome

Bushmanland Arid Grassland is part of the Nama-Karoo Biome, which is a large arid landlocked region on the central plateau of the western half of South Africa, extending into Namibia. It is flanked by the Succulent Karoo to the west and south, desert to the northwest, arid Kalahari Savanna to the north, Grassland to the northeast, Albany Thicket to the southeast and small parts of Fynbos to the south. In South Africa, only the Desert Biome has a higher variability in annual rainfall and only the Kalahari Savanna greater extremes in temperature. The Nama-Karoo receives most of its rainfall in summer, especially in late summer (Mucina *et. al*., 2006).

Climate is essentially continental and with almost no effect of the ameliorating influences of the oceans. Rainfall is low and unreliable, peaking in March. Droughts are unpredictable and often prolonged. Summers are hot and winters cold with temperature extremes ranging from -5°C in winter to 43°C in summer. However, rainfall intensity can be high (e.g. episodic thunderstorm and hail storm events). This coupled with the generally low vegetation cover associated with aridity and grazing pressure by domestic stock over the last two centuries, raises the potential for soil erosion. In semi-arid environments such as the Nama-Karoo, nutrients are generally located near the soil surface, making it vulnerable to sheet erosion (Mucina *et. al*., 2006). In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulent dominance (as in the Succulent Karoo). It is also too dry in summer for dominance by perennial grasses alone and the soils generally to shallow and rainfall too low for dominance by trees. But soil type, soil depth and local differences in moisture availability can cause abrupt changes in vegetation structure and composition (e.g. small drainage lines support more plant species than surrounding plains) (Mucina *et. al*., 2006).

4.2. VEGETATION ENCOUNTERED

The proposed development footprint is about 50 ha in size. About 10 ha of the proposed footprint had already been settled, but for the remainder the site was in excellent condition, with no illegal dumping or other disturbances encountered.

4.2.1. Existing disturbance footprint

Figure 6 gives an overview of the disturbed areas, which includes;

- Purple area: Area already settled or being settled, about 10 ha in size (Photo 1 – Photo 2).

Figure 6: An overview of the site, showing most significant disturbed areas

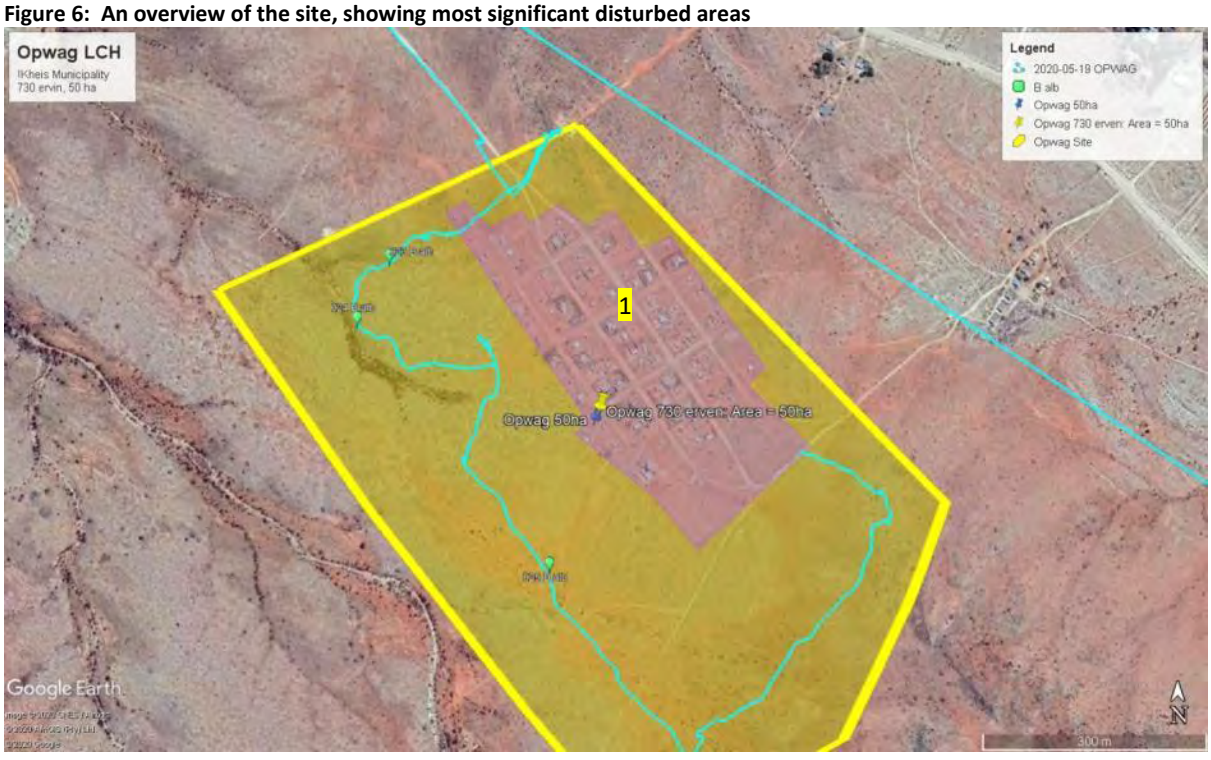


Photo 1: A view over the existing settlement at Opwag (Area 1 in Figure 6).

Photo 2: Another photo of the existing settlement at Opwag (Area 1 in Figure 6). Note the neat and tidy developments (especially the lack of general waste).

4.2.2. Remaining natural veld

Like most of the other sites six sites the remaining natural veld was covered by a low sparse shrubland. Again the footprint was characterised by shallow soils on weathering rock dominated by quartz (Photo 3 & Photo 4). Towards the south and southwest of the site slightly deeper reddish sands were encountered (with calcrete outcrops common), which supported a slightly denser and higher shrubland (Photo 5 & Photo 6). Although the Northern Cape are in the midst of a severe drought (the last 5 – 7 yeas), recent rains had brought some relieve, which can be seen in the display of some grasses and the new growth shown by many a plant (although it had not as yet trigger a display of annual or herbaceous species). Livestock grazing has left its mark on the vegetation but seemingly not as severe as at some of the other sites (e.g. palatable plants like *Pteronia* species were observed for the first time).

Photo 3: Typical low shrubland dominated by *Justicia australis* encountered in the north western portion of the footprint.

On the shallow soils the vegetation were mostly a low sparse shrubland, dominated by *Tetraena decumbens* with *Justicia australis (=Monechma)* and *Aptosimum spinescens* also very common (Photo 3 & Photo 4). The deeper sandy soils were dominated by *Senegalia mellifera* and white grasses. Many species (e.g. *Aloe claviflora*) were common in both vegetation types.

Photo 4: Most of the site supported a sparse dwarf shrubland on shallow soils (quarts / calcrete prominent).

To the northeast and southeast two small koppies were encountered, which harboured a couple of plants (mostly herbs) between its protective rocks, which were less common throughout the remainder of the site, including: *Barleria lichtensteiniana*, *Justicia spartioides*, *Leobordea* cf. *platycarpa*, *Monsonia angustifolia* and *Monsonia crassicaulis* (=*Sarcocaulon*).

Photo 5: Slightly deeper sandy soils encountered along the south and south western corner of the proposed footprint. *Boscia albitrunca* in picture (tree no. 023 in Table 2).

Photo 6: Deeper sandy soils encountered in the south western corner of the site. The vegetation dominated *Senegalia mellifera* and white grasses. *Aloe claviflora* (in picture) still very common.

The following plants were also observed, scattered throughout the footprint: *Aloe claviflora* (very common), *Asparagus* species, *Blepharis mitrata, Boscia albitrunca* (only 4 individuals)*, Cynanchum viminale, Euphorbia gariepina, Euphorbia spinea* (occasionally)*, Geigeria ornativa, Kleinia longiflora, Lacomucinaea lineata,*

Leucosphaera bainesii (occasionally), *Lycium cinereum, Monsonia salmoniflora, Pteronia* (2 x species), *Rhigozum trichotomum, Ruschia divaricata* and *Tetraena rigida.*

Photo 7: Denser stands of *Senegalia mellifera* associated with one of the drainage line (*Boscia albitrunca* no. 025 in picture – Refer to Table 2).

As is typical in the Bushmanland Grassland vegetation the ephemeral drainage lines are also associated with denser and higher shrub layer (Photo 7). In this case the vegetation associated with these water courses were dominated by Senegalia mellifera and larger shrubs like *Lycium cinereum* and *Phaeoptilum spinosum*. Other species not observed within the footprint by likely to be present in these streams includes *Parkinsonia africana* and *Ziziphus mucronata*.

4.3. CRITICAL BIODIVERSITY AREAS MAPS

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole (Holness & Oosthuysen, 2016). The 2016 Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province (including the Namakwa District Biodiversity Sector Plan, 2008). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

- **Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that

support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

Figure 7: The Northern Cape Critical Biodiversity Areas Map (2016) showing the proposed development

From a land-use planning perspective it is useful to think of the difference between CBA's and ESA's in terms of where in the landscape the biodiversity impact of any land-use activity action is most significant:

- For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).

- For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity).

According to the Northern Cape CBA map (Figure 7), the proposed development falls within a terrestrial CBA. However, it must be noted that there is no real alternative site within the Municipal town boundaries that is not located within the CBA.

4.4. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development will not impact on any recognised centre of endemism (Van Wyk & Smith, 2001).

4.5. FLORA ENCOUNTERED

Table 2 gives a list of the plant species encountered during this study. Because of the limitations (timing and a single site visit as well as the drought) it is likely that a number of annuals might have been missed.

Table 1: List of indigenous species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
1.	*Aloe claviflora*	ASPODELACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
2.	*Aptosimum spinescens*	SCROPHULARIACEAE	LC	
3.	*Asparagus* species	ASPARAGACEAE	LC	
4.	*Barleria lichtensteiniana*	ACANTHACEAE	LC	
5.	*Blepharis mitrata*	ACANTHACEAE	LC	
6.	*Boscia albitrunca*	BRASSICACEAE (CAPPARACEAE)	LC NFA protected species NCNCA, Schedule 2 Protected (all species of Boscia)	**Apply for a NFA Tree permit (DAFF)** **Apply for a NCNCA Flora permit (DENC)**
7.	*Cynanchum viminale (=Sarcostemma viminale)*	APOCYNACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
8.	*Euphorbia gariepina*	EUPHORBIACEAE	NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
9.	*Euphorbia spinea*	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
10.	*Geigeria ornativa*	ASTERACEAE	LC	
11.	*Justicia australis (=Monechma genistifolium)*	ACANTHACEAE	LC	
12.	*Justicia spartioides (=Monechma spartioides)*	ACANTHACEAE	LC	
13.	*Kleinia longiflora*	ASTERACEAE	LC	
14.	*Lacomucinaea lineata (=Thesium lineatum)*	SANTALACEAE	LC	
15.	*Leobordea platycarpa*	FABACEAE	LC	
16.	*Leucosphaera bainesii*	AMARANTHACEAE	LC	
17.	*Lycium cinereum*	SOLANACEAE	LC	
18.	*Monsonia angustifolia*	GERANIACEAE	LC	
19.	*Monsonia crassicaulis (=Sarcocaulon crassicaule)*	GERANIACEAE	LC	
20.	*Monsonia salmoniflora (=Sarcocaulon salmoniflorum)*	GERANIACEAE	LC	
21.	*Parkinsonia africana*	FABACEAE	LC	
22.	*Phaeoptilum spinosum*	NYCTAGINACEAE	LC	
23.	*Pteronia* species 1	ASTERACEAE		
24.	*Pteronia* species 2	ASTERACEAE		
25.	*Rhigozum trichotomum*	BIGONACEAE	LC	
26.	*Ruschia divaricata*	AIZOACEAE	Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
27.	*Senegalia mellifera (=Acacia mellifera)*	FABACEAE	LC	
28.	*Tapinanthus oleifolius*	LORANTHACEAE	LC	
29.	*Tetraena decumbens (=Zygophyllum decumbens)*	ZYGOPHYLLACEAE	LC	

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
30.	*Tetraena rigida (=Zygophyllum rigidum)*	ZYGOPHYLLACEAE	LC	
31.	*Ziziphus mucronata*	RHAMNACEAE	LC	

4.6. THREATENED AND PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora. Major threats to the South African flora are identified in terms of the number of plant taxa Red-Listed as threatened with extinction as a result of threats like, habitat loss (e.g. infrastructure development, urban expansion, crop cultivation and mines), invasive alien plant infestation (e.g. outcompeting indigenous plant species), habitat degradation (e.g. overgrazing, inappropriate fire management etc.), unsustainable harvesting, demographic factors, pollution, loss of pollinators or dispersers, climate change and natural disasters (e.g. such as droughts and floods). South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. However, due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction, but may nonetheless be of high conservation importance. As a result a SANBI uses an amended system of categories in order to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

In the Northern Cape, species of conservation concern are also protected in terms of national and provincial legislation, namely:

- The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "*Lists of critically endangered, endangered, vulnerable and protected species*" (GN. R. 152 of 23 February 2007).
- National Forest Act, Act 84 of 1998, provides for the protection of forests as well as specific tree species through the "*List of protected tree species*" (GN 908 of 21 November 2014).
- Northern Cape Nature Conservation Act, Act of 2009, provides for the protection of "*specially protected species*" (Schedule 1), "*protected species*" (Schedule 2) and "*common indigenous species"* (Schedule 3).

4.6.1. Red list of South African plant species

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa's indigenous plants (SANBI, 2015).

- **No red-listed species** was observed.

4.6.2. NEM: BA protected plant species

The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "Lists of critically endangered, endangered, vulnerable and protected species" (GN. R. 152 of 23 February 2007).

- **No NEM: BA protected species was observed.**

4.6.3. NFA Protected plant species

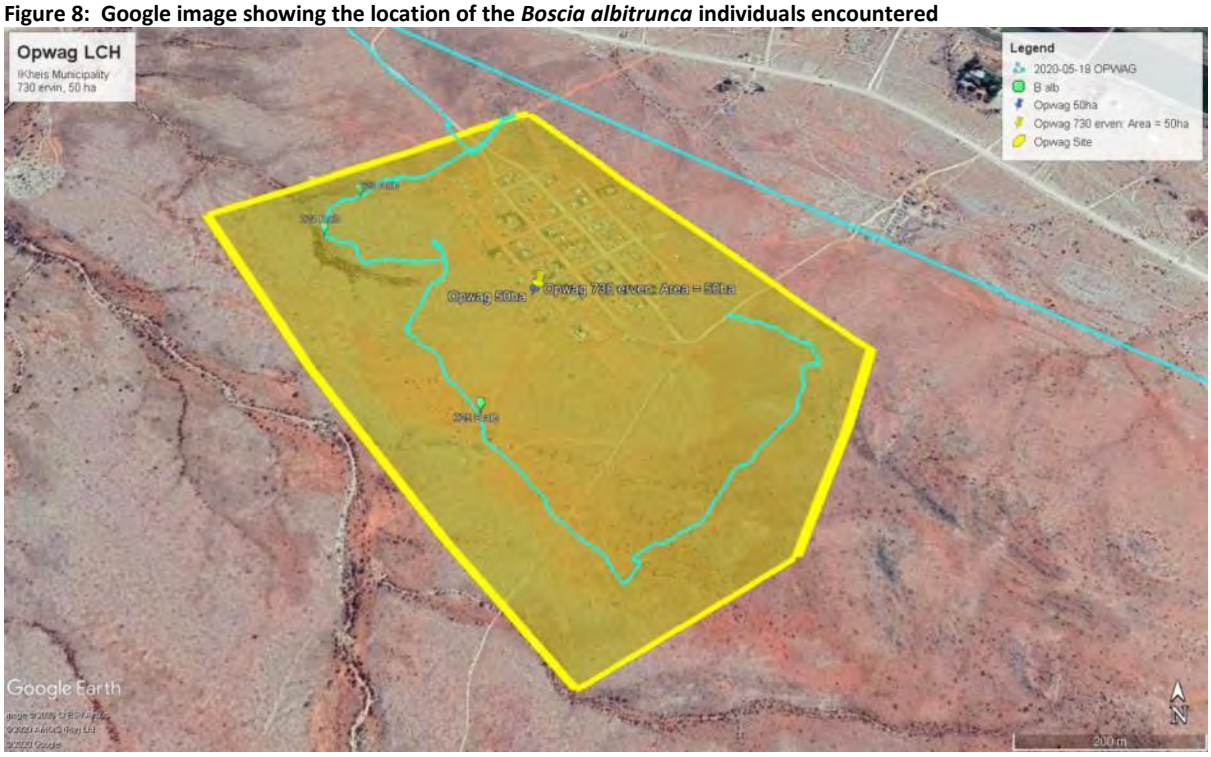
The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (as updated).

- **One species protected in terms of the NFA** was observed, namely ***Boscia albitrunca***. The following table give locations for each tree as well as recommendations for impact minimisation. A NFA permit as well as a NCNCA permit will be required for the removal of these plants.

Table 2: Location of NFA protected trees observed within or near the footprint

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
023 B alb	*Boscia albitrunca* S28° 50' 08.4" E21° 57' 14.3"		Small shrub in good condition (0.5 m tall). **Permits will be needed in terms of both the NFA and the NCNCA if this plant needs to be removed.**
024 B alb	*Boscia albitrunca* S28° 50' 11.1" E21° 57' 12.7"	Refer to Photo 5.	2 x Medium size trees, relative good condition (2.1 m tall) Retain if possible. **Permits will be needed in terms of both the NFA and the NCNCA if this plant needs to be removed.**
025 B alb	*Boscia albitrunca* S28° 50' 21.7" E21° 57' 22.2"	Refer to Photo 7.	Large sized shrub in relative good condition (1.8 m tall). Retain if possible. **Permits will be needed in terms of both the NFA and the NCNCA if this plant needs to be removed.**

Figure 8: Google image showing the location of the *Boscia albitrunca* individuals encountered



4.6.4. NCNCA protected plant species

The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, and also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance

with this act. NB. Please note that all indigenous plant species are protected in terms of Schedule 3 of this act (e.g. any work within a road reserve).

- The following species protected in terms of the NCNCA were encountered. Recommendations on impact minimisation also included.

Table 3: Plant species protected in terms of the NCNCA encountered within the study area

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
1.	*Aloe claviflora* **Schedule 2 protected**		Very common plant in this area.
2.	*Boscia albitrunca* **Schedule 2 protected**		Refer to Table 2.
3.	*Cynanchum viminale* **Schedule 2 protected**	Occasionally observed within the footprint.	Larger *Cynanchum* plants are expected to transplant poorly. Species protection through topsoil conservation.
4.	*Euphorbia gariepina* **Schedule 2 protected**		Occasionally observed. Larger *Euphorbia* tends to transplant very poorly. Species protection through topsoil conservation.
5.	*Euphorbia spinea* **Schedule 2 protected**		**Search & rescue:** Occasionally observed. Individuals within footprint to be transplanted to surrounding area.
6.	*Ruschia divaricata* **Schedule 2 protected**		**Search & rescue:** Occasionally observed. Individuals within footprint to be transplanted to surrounding area.

5. IMPACT ASSESSMENT METHOD

The objective of this study was to evaluate the botanical diversity of the property area in order to identify significant environmental features which might have been impacted as a result of the development. The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), were used to evaluate the botanical significance of the property with emphasis on:

- Significant ecosystems
  - Threatened or protected ecosystems
  - Special habitats
  - Corridors and or conservancy networks
- Significant species
  - Threatened or endangered species
  - Protected species

5.1. DETERMINING SIGNIFICANCE

Determining impact significance from predictions of the nature of the impact has been a source of debate and will remain a source of debate. The author used a combination of scaling and weighting methods to determine significance based on a simple formula. The formula used is based on the method proposed by Edwards (2011). However, the criteria used were adjusted to suite its use for botanical assessment. In this document significance rating was evaluated using the following criteria (Refer to Table 4).

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (Edwards 2011)

Table 4: Categories and criteria used for the evaluation of the significance of a potential impact

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
CONSERVATION VALUE Refers to the intrinsic value of an attribute or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and	The attribute is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with	The attribute is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare &	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
fragmentation or its value in terms of the protection of habitat or species			unlikely possibility of species loss.	endangered species.	
LIKELIHOOD Refers to the probability of the specific impact occurring as a result of the proposed activity	Under normal circumstances it is almost certain that the impact will not occur.	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.	The likelihood of the impact occurring, under normal circumstances is 50/50, it may or it may not occur.	It is very likely that the impact will occur under normal circumstances.	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.
DURATION Refers to the length in time during which the activity is expected to impact on the environment.	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).	Impact is medium-term and reversible with mitigation, but will last for some time after construction and may require on-going mitigation. Rehabilitation time is expected to be longer (5-15 years).	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and is likely to require on-going mitigation. Rehabilitation time is expected to be longer (15-50 years).	The impact is expected to be permanent.
EXTENT Refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur.	Under normal circumstances the impact will be contained within the construction footprint.	Under normal circumstances the impact might extent outside of the construction site (e.g. within a 2 km radius), but will not affect surrounding properties.	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding land owners or –users, but still within the local area (e.g. within a 50 km radius).	Under normal circumstances the impact might extent to the surrounding region (e.g. within a 200 km radius), and will regional land owners or –users.	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).
SEVERITY Refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur.	It is expected that the impact will have little or no affect (barely perceptible) on the integrity of the surrounding environment. Rehabilitation not needed or easily achieved.	It is expected that the impact will have a perceptible impact on the surrounding environment, but it will maintain its function, even if slightly modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have an impact on the surrounding environment, but it will maintain its function, even if moderately modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have a severe impact on the surrounding environment. Functioning may be severely impaired and may temporarily cease. Rehabilitation will be needed to restore system integrity.	It is expected that the impact will have a very severe to permanent impact on the surrounding environment. Functioning irreversibly impaired. Rehabilitation often impossible or unfeasible due to cost.

5.2. SIGNIFICANCE CATEGORIES

The formal NEMA EIA application process was developed to assess the significance of impacts on the surrounding environment (including socio-economic factors), associated with any specific development proposal in order to allow the competent authority to make informed decisions. Specialist studies must advise the environmental assessment practitioner (EAP) on the significance of impacts in his field of specialty. In order to do this, the specialist must identify all potentially significant

environmental impacts, predict the nature of the impact and evaluate the significance of that impact should it occur. Potential significant impacts are evaluated, using the method described above, in order to determine its potential significance. The potential significance is then described in terms of the categories given in Table 5.

Table 5: Categories used to describe significance rating (adjusted from DEAT, 2002)

SIGNIFICANCE	DESCRIPTION
Insignificant or Positive (4-22)	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or the impact may be positive.
Low (23-36)	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium Low (37-45)	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Social, cultural and economic activities can continue unchanged, or impacts may have medium to short term effects on the social and/or natural environment within site boundaries.
Medium (46-55)	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. Social, cultural and economic activities of communities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long term effect on the social and/or natural environment, within site boundary.
Medium high (56-63)	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. Social, cultural and economic activities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long-term effect on the social and/or natural environment, beyond site boundary within local area.
High (64-79)	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted and may come to a halt. These impacts will usually result in long-term change to the social and/or natural environment, beyond site boundaries, regional or widespread.
Unacceptable (80-100)	An impact of the highest order possible. There is no possible mitigation that could offset the impact. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

6. DISCUSSING BOTANICAL SENSITIVITY

The aim of impact assessment is to determine the vulnerability of a habitat to a specific impact. In order to do so, the sensitivity of the habitat should be determined by identifying and assessing the most significant environmental aspects of the site against the potential impact(s). For this development the following biodiversity aspects was considered:

- **Location**: The proposed development footprint is located on Municipal property, next to the existing town. Portions of the proposed footprint had already been settled.
- **Activity**: The proposed activity is expected to result in a permanent transformation of approximately 50 ha of land, of which more than 80% is still covered by indigenous vegetation in relatively good condition.
- **Geology & Soils**: No special features such as true quarts patches or heuweltjies were observed in or near to the larger footprint area that may result in specialised plant habitat.
- **Land use and cover**: The footprint is on municipal land in close proximity to the town of Opwag. Portions of the footprint is disturbed or already settled. The area is grazed by livestock, but the vegetation cover is still in fairly good shape.
- **Vegetation status**: The vegetation is not considered a threatened vegetation type, but conservation targets have not yet been met.
- **Conservation priority areas:** According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA. The site will not impact on any recognised centre of endemism.
- **Connectivity**: The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.
- **Watercourses and wetlands**: Not evaluated in this study as a separate freshwater impact assessment has been commissioned as part of the NEMA EIA process.
- **Protected or endangered plant species**: The most significant botanical aspect of this site is the presence of a 4 protected Sheppard trees (*Boscia albitrunca*) (refer to Table 2) and a number of Northern Cape Nature Conservation Act, protected species (Refer to Table 3).
- **Alien and Invasive Plant species**: No significant invasive alien species observed.

6.1. IMPACT ASSESSMENT

Table 6 rates the significance of environmental impacts associated with the proposed development. It also evaluates the expected accumulative effect of the proposed development as well as the No-Go option.

Table 6: Impact assessment associated with the proposed development

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Geology & soils: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	2	1	5	2	1	18	No special habitats observed.
	With mitigation	2	1	3	1	1	12	Protect all significant indigenous tree species (even if it have to be incorporated within the development).
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	3	5	1	2	22	Permanent transformation of approximately 50 ha of indigenous vegetation used for livestock grazing.
	With mitigation	2	2	3	1	1	14	Potential beneficial socio-economic impact (much needed housing project).
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	3	3	5	2	2	36	Permanent transformation of 50 ha of slightly disturbed Bushmanland Arid Grassland (Least Threatened).
	With mitigation	2	2	3	1	1	14	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	5	2	3	39	The development will impact on a proposed CBA. However, there is no alternative location on the property that will not impact on the same CBA.
	With mitigation	2	2	3	1	2	16	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	2	3	5	2	2	24	The transformation will destroy connectivity within the site, but will not result in a significant impact on the surrounding area, where connectivity is still excellent
	With mitigation	2	2	3	2	2	18	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Watercourses and wetlands: Potential impact on natural water courses and it's ecological support areas.	Without mitigation						0	N/a (Refer to the Freshwater specialist report).
	With mitigation						0	
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	3	3	5	2	2	36	A number of protected species were observed, most notably a number of nationally protected tree species.
	With mitigation	2	2	3	1	1	14	Protect all significant indigenous tree species and search & rescue other potentially significant protected plant species.
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation						0	No alien invasive plants observed
	With mitigation						0	

Veld fire risk: Potential risk of veld fires as a result of the activities.	Without mitigation	1	2	3	2	2	9	Veld fire risk low.
	With mitigation	1	1	1	1	1	4	Address fire danger throughout construction.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	3	5	2	3	39	Permanent transformation of approximately 50 ha of natural veld for urban development.
	With mitigation	2	2	3	2	2	18	Refer to all the mitigation recommendations above.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	3	4	2	2	33	Slow degradation of natural veld as a result of illegal dumping, physical disturbances and grazing practices.
	With mitigation						0	

According Table 6, the main impacts associated with the proposed development will be:

- The transformation of 50 ha of indigenous vegetation within a proposed CBA; and
- The potential impact on a number of nationally protected trees as well as provincially protected plant species.

However, there is no logical alternative site, located on Municipal land that will not impact on the same CBA. In this case, about 20% of the proposed footprint is already impacted as result of existing settlement.

The No-Go option is not likely to result in a “no-impact” scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site.

The cumulative impact (even without mitigation) is expected to be **Medium-Low**, which can be reduced to **Low** through mitigation.

7. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 50 ha of land, of which approximately 80% is still covered by indigenous vegetation in good condition. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, 4 protected Sheppard trees (*Boscia albitrunca*), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.

According to the impact assessment given in Table 6 the development is likely to result in a **Medium-Low** impact, which can be reduced to a **Low** impact with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity.

7.1. MITIGATION ACTIONS

The following mitigation actions should be implemented to ensure that the proposed development does not pose a significant threat to the environment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must include the recommendations made in this report.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and any other conditions pertaining to specialist studies.
- **Before any work is done** protected tree species must be marked and demarcated (Refer to Table 2).
- **Before any work is done** search & rescue as discussed in Table 3 must be completed.
- Lay-down areas or construction sites must be located within the construction footprint.
- No clearing of any area outside of the construction footprint may be allowed.
- An integrated waste management approach must be implemented during construction.
    - Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
- Alien invasive *Prosopis* plants within the footprint (and immediate surroundings) must be removed in a responsible way (to ensure against regrowth).
- The Municipality must ensure that adequate waste and sewerage facilities and or services are established to service this community.

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APPENDIX 1: COMPLIANCE WITH APPENDIX 6 OF GN. NO. 982 (4 DECEMBER 2014)

Specialist reports

1. A specialist report prepared in terms of these regulations must contain -	
a) Details of –	**Refer to:**
(i) The specialist who prepared the report; and	Refer to Page ii & Appendix 2
(ii) The expertise of the specialist to compile a specialist report including a curriculum vitae;	Refer to Appendix 2
b) A declaration that the specialist is independent in a form as may be specified by the competent authority;	Refer to Page ii
c) An indication of the scope of, and the purpose for which the report was prepared;	Refer to Heading 1.1
d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Refer to Heading 3
e) A description of the methodology adopted in preparing the report or carrying out the specialist process inclusive of equipment and modelling used;	Refer to Heading 3
f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructures, inclusive of a site plan identifying site alternatives;	Refer to Headings 4.1, 4.2, 4.3, 4.4, 4.6.
g) An identification of any areas to be avoided, including buffers;	Refer to Figure 8
h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Figure 8
i) A description of any assumptions made and any uncertainties or gaps of knowledge;	Refer to Heading 3
j) A description of the findings and potential implications of such findings on the impact of the proposed activity, [including identified alternatives on the environment] or activities;	Refer to Heading 6
k) Any mitigation measures for inclusion in the EMPr;	Refer to Heading 7.1
l) Any conditions for inclusion in the environmental authorization;	None
m) Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Refer to Heading 7.1
n) A reasoned opinion -	
(i) [as to] whether the proposed activity, activities or portions thereof should be authorized;	Refer to the "*Main conclusion*" within the executive summary (Page i)
(iA) regarding the acceptability of the proposed activity or activities; and	
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable the closure plan;	Refer to Heading 7.1
o) A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/a
p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/a
q) Any information requested by the competent authority.	N/a
2. Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

Curriculum Vitae: Peet JJ Botes

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Nationality:	South African
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Profession:	Environmental Consultant & Auditing
Specializations:	Botanical & Biodiversity Impact Assessments
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	Environmental Impact Assessment
	Environmental Management Systems
Qualifications:	**BSc** (Botany & Zoology), with Nature Conservation III & IV as extra subjects; Dept. of Natural Sciences, Stellenbosch University 1989.
	Hons. BSc (Plant Ecology), Stellenbosch University, 1989
	More than 20 years of experience in the Environmental Management Field (Since 1997 to present).
Professional affiliation:	Registered Professional Botanical, Environmental and Ecological Scientist at SACNASP (South African Council for Natural Scientific Professions) since 2005.
SACNAP Reg. No.:	400184/05

BRIEF RESUME OF RELEVANT EXPERIENCE

1997-2005: Employed by the Overberg Test Range (a Division of Denel), responsible for managing the environmental department of OTB, developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

2005-2010: Joined Enviroscientific, as an independent environmental consultant specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and

strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity and environmental legal compliance audits.

2010-2017: Joined EnviroAfrica, as an independent Environmental Assessment Practitioner and Biodiversity Specialist, responsible for Environmental Impact Assessments, Biodiversity & Botanical specialist reports and Environmental Compliance Audits. During this time Mr Botes compiled more than 70 specialist Biodiversity & Botanical impact assessment reports ranging from agricultural-, pipelines- and solar developments.

2017-Present: Establish a small independent consultancy (PB Consult) specialising in Environmental Audits, Biodiversity and Botanical specialist studies as well as Environmental Impact Assessment.

LIST OF MOST RELEVANT BOTANICAL & BIODIVERSITY STUDIES

Botes. P. 2007: Botanical assessment. Schaapkraal, Erf 644, Mitchell's Plain. A preliminary assessment of the vegetation in terms of the Fynbos Forum: Ecosystem guidelines. 13 November 2007.

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Botes, P. 2018(f): Wagenboom Weir & Pipeline – Construction of a new pipeline and weir with the Snel River, Breede River Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 7 August 2018.

Botes, P. 2018(g): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.

Botes, P. 2018(h): Tripple D farm agricultural development – Development of a further 60 ha of vineyards, Erf 1178, Kakamas, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.

Botes, P. 2018(i): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.

Botes, P. 2019(a): Lethabo Park Extension – Proposed extension of Lethabo Park (Housing Development) on the remainder of the Farm Roodepan No. 70, Erf 17725 and Erf 15089, Roodepan Kimberley. Sol Plaaitje Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint (with biodiversity inputs). 15 May 2019.

Botes, P. 2019(b): Verneujkpan Trust agricultural development – The proposed development of an additional ±250 ha of agricultural land on Farms 1763, 2372 & 2363, Kakamas, Northern Cape Province. 27 June 2019.

ANNEXURE G: GEOTECHNICAL REPORT

GEOTECHNICAL CONDITIONS ON PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48: A REPORT FOR THE EXPANSION AND FORMALISATION OF OPWAG COMMUNITY

2020/J09/MCP_01

ON BEHALF OF : MACROPLAN

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EXECUTIVE SUMMARY

1 INTRODUCTION

It is envisaged to develop some 50 hectare of land on Plot 2642 of Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement 48 as an expansion and formalization of the existing Opwag community. For this purpose Cedar Land Geotechnical Consult (Pty) Ltd was appointed as subconsultant to Macroplan to conduct a geotechnical investigation on the property.

2 SITE DESCRIPTION

2.1 Site Location

The village of Opwag is located directly to the west of the Orange River and the local access road to the irrigation canal. It is some 6 km north of Groblershoop. The area of investigation consisting of Plot 2642 of Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement 48, is located on the perimeter of the village, on the western, eastern and southern sides thereof. The size of the property is 50 hectare.

2.2 Topography and Drainage

The land investigated is located between 903,0mamsl and 869,0mamsl. Topographical it can be described as the foot slope and plain of a ridge striking virtually due south-east to north-west, with the ridge present on the north eastern perimeter of the site. The slope of the south western flank of the ridge is approximately 10,3%, reducing to 2,2% on the low-lying area.

Drainage takes place by means of surface sheetwash. The sheetwash is disposed of into three small, non-perennial water courses. The drainage courses are contained in narrow, shallow sloping and well defined gullies.

2.3 Vegetation and Landscape

The area of investigation is referred to as Bushmanland Arid Grassland. The landscape features are described as consisting of extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses giving this vegetation type the character of semi-desert steppe. In places low shrubs change the vegetation structure. On site it was found that in the areas where natural vegetation is present it consists of a sparse stand of Acacia melliflora and prosopis glandulosa. Large stands of aloe claviflora are present and a few examples of aloe gariepensis.

2.4 Climatic Conditions

The area is located in a summer-rainfall region with mean annual precipitation between 70mm to 200mm ; mean maximum summer temperature of 38°C and mean minimum winter temperature of -0,6°C. Frost incidence varies between 10 and 35 days per year. The development of whirl winds are common on hot summer days. The Thornthwaithe moisture index is less than -40 ; and the Weinert N value approximately 35. The climate can thus be described as arid.

2.5 Existing Facilities

2.5.1 Informal Housing

Informal housing consisting of galvanized iron structures and some reed structures is present in the northern parts of the site, forming the existing village. Electricity is provided by overhead power lines. Water is provided by a pipeline originating at a reservoir located on the northern most part of the ridge.

2.5.2 Vacant Land

Vacant, undeveloped land extends from the existing village to the limits of the area of investigation in all directions.

3 NATURE OF INVESTIGATION

3.1 Test Pitting

Test pitting was conducted to provide applicable geotechnical information. On 8 and 9 July 2020 33 test pits were excavated with a Bell 315SK TLB on hire from ALS Plant Rentals. The TLB was equipped with a 600mm wide bucket. All test pits were excavated to refusal. The test pits were profiled by a professionally registered geotechnical engineer.

3.2 Materials Testing

Soil testing was undertaken by Roadlab in Upington. Due to general limited vertical extent of the soil profile and coarse nature thereof, it was not feasible to retrieved undisturbed samples to determine properties of settlement or collapse fairly accurately.

Soil testing consisted of the following :

- Conductivity and pH determinations on five samples of the in-situ materials to determine the corrosivity thereof.

- *Foundation indicator testing on ten samples of the in-situ materials to determine possible conditions of heave or settlement.*
- *CBR and road indicator testing on three samples to determine the suitability of the in-situ materials to be utilized as road layerworks.*

4 GEOLOGY, PEDOLOGY AND GROUNDWATER

4.1 Stratigraphy

The available information shows that the area of investigation is located on a subduction zone dating approximately 1000 million years old. The zone is located between the lithology of the Kaapvaal Craton and the Namaqua-Natal mobile belt. The remains of the original geology in the area are referred to as the Kaaien Terrane and the site is located on the Groblershoop Formation of the Brulpan Group. Bedrock on site occurs as grey brown quartzite becoming light grey quartzite of the Groblershoop Formation, Brulpan Group. Occasionally the quartzite tends to be muscovite-rich. The possibility that bedrock in western low-lying part of the site may consist of quartz-muscovite schist cannot not be excluded. However, it could not be confirmed due to the very dense, impenetrable barrier formed by the hardpan calcrete.

4.2 Soil Profile

4.2.1 Alluvium

Alluvium in the form of alluvial sand and minor deposits of river terrace gravels were encountered close to the southwestern and southeastern perimeters of the area of investigation. These deposits vary from dark brown and light red, loose, fine sand to medium dense, gravels of quartz and lesser content of banded ironstone contained in a sandy matrix. The presence of banded ironstone shows that these deposits can by associated with an earlier course of the Orange River. The thickness of the horizon varied between 200mm and 300mm in the test pits.

4.2.2 Colluvium

4.2.2(i) Gravelly Colluvium

Gravelly colluvium as surface deposit was found in the intermediate land between the low-lying area close to the water courses and the quartzite ridge. The colluvium is a homogenous material, consisting light brown fine sand and clasts of gravels and cobbles of quartz and some calcrete. The consistency of the gravelly colluvium is medium dense and the soil matrix intact. The horizon of colluvium was between 100mm and 200mm thick in the test pits.

4.2.2(ii) Coarse Colluvium

The coarse colluvium is present in the high-lying land on site, associated with transported material originating from bedrock of quartzite. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of light red brown fine sand. The consistency of the coarse colluvium varies from medium dense to very dense. The horizon of colluvium was between 300mm and 700mm thick in the test pits.

4.2.3 Residual Quartzite

On site residual quartzite was encountered as surface material or underlying the gravelly colluvium. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of dirty white, calcareous cemented sand. The soil matrix is very dense. The horizon of residual quartzite extended to a depth of 600mm in the test pits.

4.2.4 Mokalanen Formation

Calcrete was encountered as the dominant lithic material on site, in virtually a continuous cover over the quartzite, with the latter outcropping only in the high-lying ridge of outcrops. The calcrete is present as very dense hardpan calcrete. The calcrete is present as outcrops ; or underlies the transported materials, occurring from depths between 100mm and 300mm minimum, extending to 100mm to 600mm maximum, at which stage refusal of excavation occurred or bedrock of quartzite was encountered. It is described as dirty white to dirty light yellow white, very fine grained, very dense calcrete. Some fine sand may occasionally be contained in voids in the matrix of the calcrete.

4.3 Groundwater

4.3.1 Perched Water

Perched groundwater was not encountered in any of the test pits excavated for this investigation.

4.3.2 Permanent Groundwater

The probability for drilling successfully for water in the area is between 40% and 60%, and the probability that such a borehole will yield more than 2l/s is between 10% and 20%. Groundwater is expected to occur at depths less than 15 meters in compact, argillaceous strata.

5 SITE CLASS DESIGNATION

5.1 Geotechnical Zone I

The zone is classed as R, meaning that the proposed horizon for founding is stable and negligible soil movement is expected. The distribution thereof encompasses 65% of the proposed area for development. Slope across the land is approximately between 2% and 6%. The use of slab-on-the-ground foundations will require additional works in the form of the construction of an engineered fill or cutting to establish a level platform for construction. The more viable foundation alternative therefore remains founding by conventional strip foundations.

5.2 Geotechnical Zone II

The zone is classed as R, meaning that the proposed horizon for founding is stable and negligible soil movement is expected. The distribution thereof encompasses 4% of the proposed area for development. Slope across the land is less than 2%. Considering the limited slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or slab-on-the-ground foundations placed directly on bedrock or very dense pedocrete. The latter option is regarded as the better solution of the two alternatives.

5.3 Geotechnical Zone III

The zone is classed as S, meaning that the proposed horizon for founding is slightly compressible and rapid settlement less than 10mm is expected. The distribution thereof encompasses 22% of the proposed area for development. Slope across the land is between 2% and 6%. Considering the limited slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or slab-on-the-ground foundations placed directly on medium dense terrace gravels. The more viable foundation alternative therefore remains founding by conventional strip foundations.

5.4 Geotechnical Zone IV

The zone is classed as S, meaning that the proposed horizon for founding is slightly compressible and rapid settlement less than 10mm is expected. The distribution thereof encompasses 7% of the proposed area for development. Slope across the land is between 6% and 10%. Considering the slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or landscaping by cut-to-fill operations to prepare level surfaces for slab-on-the-ground foundations. The construction of a cut-and-fill terrace and foundation design associated with such an operation shall be done according to a professional design.

5.5 Geotechnical Zone V

Slope across this zone exceeds 10% and the presence of outcrops of hard rock dominates the land surface. It is thus zoned as P(Slope/rock outcrops). The distribution thereof encompasses 2% of the proposed area for development. The combination of these conditions reduces the suitability of the zone for low cost and affordable housing. The area is better suited to be set aside as public open space.

6 CONDITIONS OF EXCAVATION

On average over the entire site bedrock or refusal of excavation on very dense hardpan calcrete, boulders or bedrock quartzite was encountered at depths between 100mm minimum and 800mm maximum, averaging 410mm deep. The implication of this is that should trenches require excavated depths to 1000mm, 59% of the excavation may be classified as hard, requiring drilling and blasting. Should the required depth of excavation increase to 1500mm, 73% of the excavation may be classified as hard.

Conditions of Boulder Class A excavation are limited to the slopes and the quartzite ridge on the northeastern boundary of the area of investigation. Such conditions were encountered in TP's 16, 20, 21, 26, 30 and 33. It was possible to penetrate between 300mm and 800mm into the boulder layers, averaging 530mm, prior to encountering hard rock excavation or very tightly packed boulders that could not be removed by the TLB. The implication of this is that should trenches require excavated depths to 1000mm, 53% of the excavation may be classified as Boulder Class A excavation. Should the required depth of excavation increase to 1500mm, 35% of the excavation may be classified as Boulder Class A excavation.

7 LAND SLOPE

The average slope across 87% of the land is between 2% and 6% ; over 4% it is less than 2% ; over 7% it is between 6% and 10% ; and over 2% of the land the slope exceeds 10%.

The slope of less than 2% has a detrimental influence on especially the design of a stormwater disposal system depending on gravity to dissipate of the surface water due to downpours. The land slope also affects the design of the sewerage disposal but to a lesser extent as the gradient of the pipes can be adjusted according to design requirements. The land surface of the area subject to the slope exceeding 10% is covered by rock outcrops and do not represent conditions of unstable faces subject to slip failures. However, the slope reduces the potential of the land for the development of affordable and low cost housing.

8 AREAS SUBJECT TO FLOODING

The non-perennial water courses on site are contained in well-defined, narrow gullies and may be regarded as being of lesser importance, requiring no additional precautionary measures to ensure the safety of the population against flooding.

9 MATERIALS UTILIZATION

- *Trench Backfilling : None of the materials are suitable for selected fill or pipe bedding. With exception of the hardpan calcrete all materials can be used for normal backfill.*
- *Layerworks for Paved or Segmental Block Paving : The hardpan calcrete is of G6 quality and hence suitable for the construction of layerworks up to subbase and base course level for lightly trafficked roads.*
- *Wearing Course for Gravel Roads in Urban Areas : None of the soil materials are 100% suitable for this purpose. The use of these materials will generally result in a road surface subject to raveling and corrugations.*

10 OTHER CONSIDERATIONS

- *Undermining : The area is not subject to undermining.*
- *Seismic Activity : The Peak Ground Acceleration expected in 50 years is 0,05g. A low risk for the development of earth tremors therefore exist.*
- *Soil Corrosivity : The in-situ soils and pedocretes are not corrosive due to acidic properties. All soil materials can be regarded as corrosive due to high soluble salt contents.*
- *Dolomite : The area of investigation is not subject to any restrictions due to the presence of dolomite. Bedrock of dolomite does not occur in the area of investigation.*

GEOTECHNICAL CONDITIONS ON PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48: A REPORT FOR THE EXPANSION AND FORMALISATION OF OPWAG COMMUNITY

2020/J09/MCP_01

INDEX

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GEOTECHNICAL CONDITIONS ON PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48 : A REPORT FOR THE EXPANSION AND FORMALISATION OF OPWAG COMMUNITY

1 INTRODUCTION

It is envisaged to develop some 50 hectare of land on Plot 2642 of Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement 48 as an expansion and formalization of the existing Opwag community. For this purpose Cedar Land Geotechnical Consult (Pty) Ltd was appointed as subconsultant to Macroplan as per the minutes of the start-up meeting of the project held in the offices of Macroplan on 20 May 2020 to conduct a geotechnical investigation on the property.

2 TERMS OF REFERENCE

The requirements of the following documents were adhered to in the conduct of the investigation and reporting of the project :

- The document *Geotechnical Site Investigations for Housing Developments (Generic Specification GFSH-2)*, issued by the National Department of Housing in September 2002.
- The document *SANS 634-1 : Geotechnical Investigations for Township Development*, issued by SABS in February 2012.

3 AVAILABLE INFORMATION

The following source of available information recording available data obtained in the larger Upington to Groblershoop area have been consulted for background information :

- *Breytenbach FJ* : Contract NRA N010-110-2012/1F : Geotechnical Investigation for Four Bridge Widenings on the National Route 10 Section 11 between Groblershoop (km 0,0) and Lambrechtsdrift (km 61,1), issued by Soilkraft cc on behalf of Bvi Engineers on 8 March 2012.

4 SITE DESCRIPTION

4.1 Site Location

The village of Opwag is located directly to the west of the Orange River and the local access road to the irrigation canal. It is some 6 km north of Groblershoop. The area of investigation consisting of Plot 2642 of Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement 48, is located on the perimeter of the village, on the western, eastern and southern sides thereof. The size of the property is 50 hectare.

Refer to the attached Figure 1 : Locality Plan.

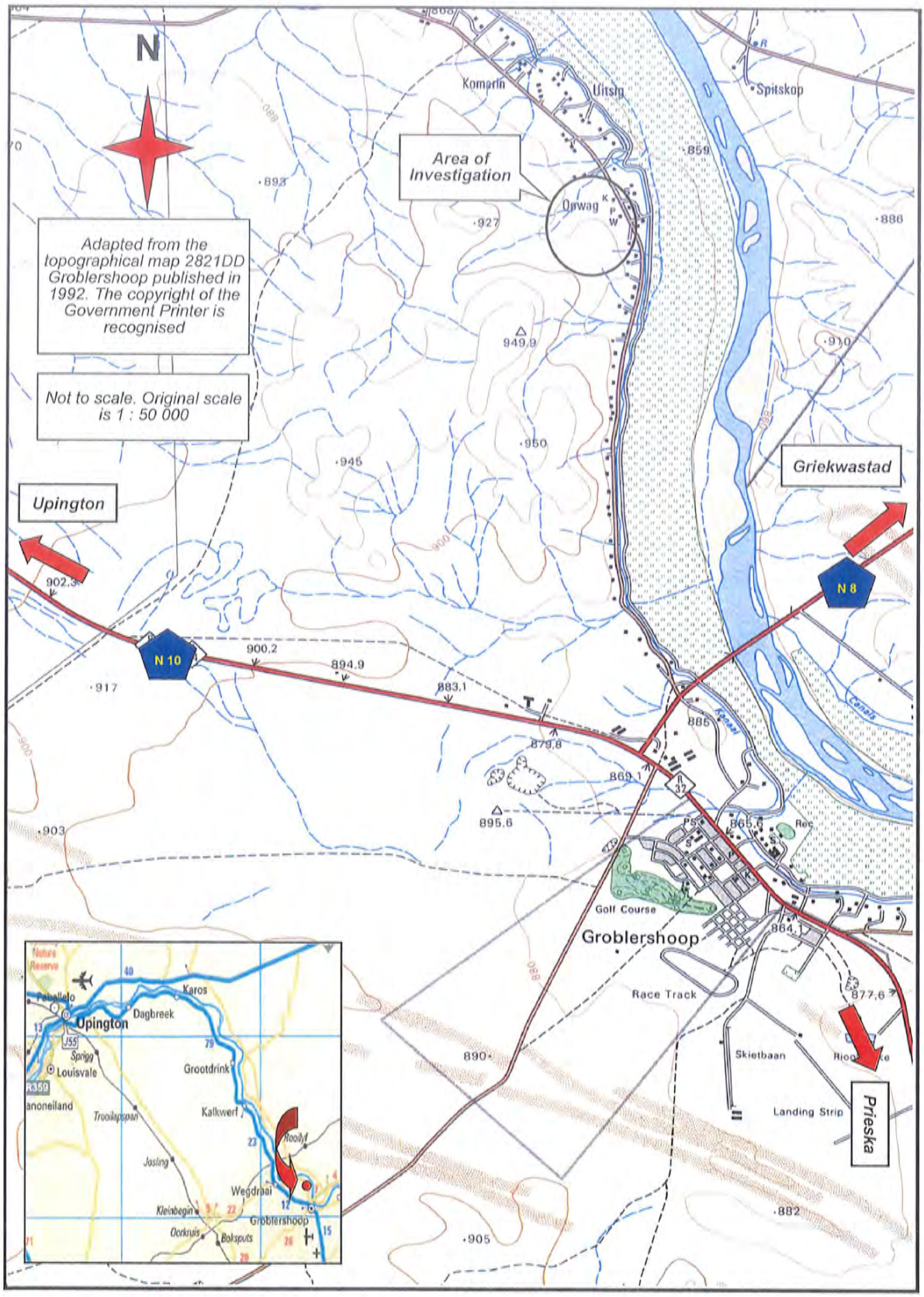
4.2 Topography and Drainage

The land investigated is located between 903,0mamsl and 869,0mamsl. Topographical it can be described as the foot slope and plain of a ridge striking virtually due south-east to north-west, with the ridge present on the north eastern perimeter of the site. The slope of the south western flank of the ridge is approximately 10,3%, reducing to 2,2% on the low-lying area.

Drainage takes place by means of surface sheetwash. The sheetwash is disposed of into three small, non-perennial water courses. The drainage courses are contained in narrow, shallow sloping and well defined gullies.

4.3 Vegetation and Landscape

Based on the work done by Mucina[Reference 14.1] the area of investigation is referred to as Bushmanland Arid Grassland. The landscape features are described as consisting of extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses giving this vegetation type the character of semi-desert steppe. In places low shrubs change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected. On site it was found that in the areas where natural vegetation is present it consists of a sparse stand of Acacia melliflora and prosopis glandulosa. Large stands of aloe claviflora are present and a few examples of aloe gariepensis.



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LOCALITY PLAN

FIGURE 1

4.4 Climatic Conditions

The area is located in a summer-rainfall region with mean annual precipitation between 70mm to 200mm ; mean maximum summer temperature of 38°C and mean minimum winter temperature of -0,6°C. Frost incidence varies between 10 and 35 days per year. The development of whirl winds are common on hot summer days. The Thornthwaithe moisture index is less than -40 ; and the Weinert N value approximately 35. The climate can thus be described as arid. The importance of this is that mechanical breakdown of bedrock will take place rather than chemical decomposition, limiting the formation of secondary minerals such as expansive montmorillonite clay.

4.5 Existing Facilities

Site conditions are illustrated on Photo 1 : Site Conditions.

The area can be divided into two zones as follows :

4.5.1 Informal Housing

Informal housing consisting of galvanized iron structures and some reed structures is present in the northern parts of the site, forming the existing village. Electricity is provided by overhead power lines. Water is provided by a pipeline originating at a reservoir located on the northern most part of the ridge. Some residents have created small vegetable and flower gardens on the stands.

4.5.2 Vacant Land

Vacant, undeveloped land extends from the existing village to the limits of the area of investigation in all directions.

5 NATURE OF INVESTIGATION

5.1 Test Pitting

In compliance with the requirements of SANS 634 and GFSH-2 test pitting was conducted to provide applicable geotechnical information. On 8 and 9 July 2020 33 test pits were excavated with a Bell 315SK TLB on hire from ALS Plant Rentals. The TLB was equipped with a 600mm wide bucket. All test pits were excavated to refusal.

PHOTO 1: VIEW OF AREA BETWEEN VILLAGE AND QUARTZITE RIDGE TO THE NORTH EAST THEREOF. SURFACE SOILS OF COLLUVIAL SANDS.

PHOTO 2: VIEW OF AREA BETWEEN VILLAGE AND QUARTZITE RIDGE TO THE NORTH EAST THEREOF. SURFACE DEPOSITS OF QUARTZITE BOULDERS AND OUTCROPS OF QUARTZITE

PHOTO 3 : VIEW IN LOW-LYING AREA TO THE SOUTH AND SOUTH WEST OF THE VILLAGE. NOTE VEGETATED NON -PERENNIAL STREAM ON SOUTHERN PERIMETER OF THE SITE.

PHOTO 4 : VIEW IN LOW-LYING AREA TO THE SOUTH AND SOUTH WEST OF THE VILLAGE FACING NORTH. NOTE COLLUVIAL GRAVELS OF WHITE QUARTZ.

PHOTO 5 : CONDITIONS IN THE VILLAGE OF OPWAG

C.L.G.C.

CONDITIONS IN OPWAG VILLAGE

PHOTO 1

The test pits were profiled by a professionally registered geotechnical engineer. For the benefit of the non-geotechnical reader of this document, the guidelines for test pit profiling are summarized in the attached Table 1 : Soil Profiling Parameters. The profiles of the test pits may be found in Addendum A to this report. The positions of the test pits are indicated on the attached Figure 2 : Site Plan. Provisional co-ordinates for property beacons A to L are indicated on this figure.

5.2 Materials Testing

Soil testing was undertaken by Roadlab in Upington. As a matter of quality control duplicate samples were sent to the Roadlab branch in Germiston for independent testing to verify the results. Due to general limited vertical extent of the soil profile and coarse nature thereof, it was not feasible to retrieved undisturbed samples to determine properties of settlement or collapse fairly accurately.

Soil testing consisted of the following :

- Conductivity and pH determinations on five samples of the in-situ materials to determine the corrosivity thereof.
- Foundation indicator testing on ten samples of the in-situ materials to determine possible conditions of heave or settlement.
- CBR and road indicator testing on three samples to determine the suitability of the in-situ materials to be utilized as road layerworks.

The results of the soil testing may be found in Addendum B. However, for easy reference, these results are summarized in the attached Table 2 : Summary of Soil Testing. The data sheets contained in Addendum B are copies of the originals, which are available from Roadlab.

6 SITE GEOLOGY AND GEOHYDROLOGY

The geology of the area between Upington and Groblershoop appears to consist of granitoid rock in the north, grading into metamoprphic rocks towards Groblershoop, but it is in fact highly complex and from a stratigraphical viewpoint provides complicated formation. As a background to the site geology an effort is made in this subparagraph to provide a simplified explanation of the regional geology of the area. For this purpose publications by McCarthy[Reference 14.2], Cornell[Reference 14.3] and Moen[Reference 14.4] were consulted. Of these three references, the latter two can be regarded as site specific. However, there is disagreement between the two sources regarding the stratigraphic classification of the major subdivisions of

TABLE 1 : SOIL PROFILING PARAMETERS

CONSISTENCY : GRANULAR SOILS

SPT N	GRAVELS & SANDS Generally free draining soils		DRY DENSITY (kg/m^3)
<4	Very loose	Crumbles very easily when scraped with geological pick. Requires power tools for	<1450
4-10	Loose	Small resistance to penetration by sharp pick point. requires many blows by pick point	1450-1600
10-30	Medium dense	Considerable resistance to penetration by sharp pick point.	1600-1750
30-50	Dense	Very high resistance to penetration by sharp pick point. Requires many blows by pick point for excavation.	1750-1925
>50	Very dense	High resistance to repeated blows of geological pick. Requires power tools for excavation.	>1925

CONSISTENCY : COHESIVE SOILS

SPT N	SILTS & CLAYS and combinations with SANDS Generally slow draining soils		UCS (kPa)
<2	Very soft	Pick point easlily pushed in 100mm. Easily moulded by fingers.	<50
2-4	Soft	Pick point easlily pushed in 30mm to 40mm. Moulded by fingers with some pressure.	50-125
4-8	Firm	Pick point penetrates to 10mm. Very difficult to mould with fingers.	125-250
8-15	Stiff	Slight indentation by pick point. Cannot be moulded by fingers. Penetrated by thumb nail.	250-500
15-30	Very stiff	Slight indentation by blow of pick point. Requires power tools for excavation.	500-1000

SOIL TYPE

SOIL TYPE	PARTICLE SIZE(mm)
Clay	<0,002
Silt	0,002-0,06
Sand	0,06-2,0
Gravel	2,0-60,0
Cobbles	60,0-200,0
Boulders	>200,0

MOISTURE CONDITION

Dry	No water detectable
Slightly moist	Water just discernable
Moist	Water easily discernable
Very moist	Water can be squeezed out
Wet	Generally below water table

COLOUR

Speckled	Very small patches of colour <2mm
Mottled	Irregular patches of colour 2-6mm
Blotched	Large irregular patches 6-20mm
Banded	Approximately parallel bands of varying colours
Streaked	Randomly orientated streaks of colour
Stained	Local colour variations : Associated with discontinuity surfaces

SOIL STRUCTURE

Intact	No structure present.
Fissured	Presence of discontinuities, possibly cemented.
Slickensided	Very smooth, glossy, often striated discontinuity planes.
Shattered	Presence of open fissures. Soil break into gravel size blocks.
Micro shattered	Small scale shattering, very closely spaced open fissures. Soil breaks into sand size crumbs.
Residual structures	Residual bedding, laminations, foliations etc.

ORIGIN

Transported	Alluvium, hillwash, talus etc.
Residual	Weathered from parent rock, eg residual granite
Pedocretes	Ferricrete, silcrete, calcrete etc.

DEGREE OF CEMENTATION OF PEDOCRETES

TERM	DESCRIPTION	UCS (MPa)
Very weakly cemented	Some material can be crumbled between finger and thumb. Disintegrates under knife blade to a friable state.	0,1-0,5
Weakly cemented	Cannot be crumbled between strong fingers. Some material can be crumbled by strong pressure between thumb and hard surface. Under light hammer blows disintegrate to a friable state.	0,5-2,0
Cemented	Material crumbles under firm blows of sharp pick point. Grains can be dislodged with some difficulty by a knife blade.	2,0-5,0
Strongly cemented	Firm blows of sharp pick point on hand-held specimen show 1-3mm indentations. Grains cannot be dislodged by knife blade.	5,0-10,0
Very strongly cemented	Hand-held specimen can be broken by single firm blow of hammer head. Similar appearance to concrete.	10,0-25

the Namaqua-Natal province. As the work produced by Cornell is regarded as the reference document, his approach is adopted for this report.

Some concepts must be identified :

- *Craton* : A craton is a block of ancient crust, formed 3000 million years ago and its rocks have essentially remained unchanged. Cratons form the larger parts of the land-building mass.
- *Province* : A tectono-stratigraphic province is defined as a large area of contiguous structural fabric with well-defined boundaries which formed during a particular, geochronologically defined, tectono-metamorphic event. A province is further subdivided in sub-provinces and sub-provinces into terranes.

FIGURE 2 :
SITE PLAN

Adapted from Project : Opwag, Dated June 2020.
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0m 60m 120m 180m 240m 300m

N

LEGEND

- TP1 — TEST PIT POSITION
- BOSCIA ALBITRUNCA (TO BE CONSERVED)
- VERY ROCKY

Access to Canal Road

TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27 TP28 TP29 TP30 TP31 TP32 TP33

VERY ROCKY

27/48 26/48 28/48 25/48 24/48 23/48 22/48 14/48 REMAINDER 48

A B C D E F G H J K L

X 3191400 Y -92700 | X 3191400 Y -93000 | X 3191400 Y -93600 | X 3191400 Y -93900
X 3191700 Y -93000 | X 3191700 Y -93600
X 3192000 Y -93000 | X 3192000 Y -93300
X 3192300 Y -93000 | X 3192300 Y -93600 | X 3192300 Y -93900

COORDINATES – OPWAG		
System: WGS84 WG21		
Point	Y	X
A	-92933.796	3191431.553
B	-93437.665	3192213.387
C	-93721.563	3192101.399
D	-93903.815	3191804.059
E	-93839.048	3191745.192
F	-93762.602	3191666.075
G	-93731.138	3191632.727
H	-93615.278	3191513.705
J	-93514.409	3191409.532
K	-93358.006	3191247.802
L	-93196.700	3191313.417

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TAAK: / JOB NAME: Expansion and Formalisation of Opwag Community

LIGGING: / SITE: Plot 2642 Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement No 48

KLIENT: / CLIENT: !Kheis Municipality

TEKENING NO: / DRAWING NO: Figure 2 : Site Plan

DATUM: / DATE: 14 September 2020

TABLE 2 : SUMMARY OF SOIL TESTING

TEST PIT NO	SAMPLE NO (CLG)	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	GM	PI	LL	ACTIVITY	pH	CONDUCTIVITY (Sm^{-1})	% < 0,002mm	OMC	MDD	SOIL CLASS		
														COLTO	PRA	UNIFIED
1	U9277	200-600	Hardpan calcrete	Sandy gravel	2,40	2,0	28	Low			0,8	10,9	1906	G6	A-1-a(0)	GW-GM
5	U9278	0-300	Hardpan calcrete	Sandy gravel	2,30	2,0	19	Low	8,49	0,10	1,1				A-1-a(0)	GC
11	U9279	0-200	Hardpan calcrete	Sandy gravel	2,20	3,0	27	Low			0,6				A-1-a(0)	GM
12	U9280	0-300	Colluvium	Fine sand	1,00	5,0	29	Low	7,75	0,06	1,2				A-4(0)	SM
15	U9280	0-300	Hardpan calcrete	Sandy gravel	2,30	3,0	21	Low			0,8	7,4	1895	G6	A-1-a(0)	GW-GC
18	U9288	100-300	Hardpan calcrete	Sandy gravel	2,30	2,0	20	Low	7,83	0,13	0,5				A-1-a(0)	GW-GC
21	U9289	0-400	Coarse Colluvium	Cobbles and gravels	2,10	2,0	17	Low	7,69	0,09	0,7				A-1-b(0)	GC
22	U9290	100-300	Hardpan calcrete	Sandy gravel	2,00	3,0	22	Low	7,83	0,10	0,6				A-1-b(0)	GC
28	U9291	0-500	Hardpan calcrete	Sandy gravel	2,00	2,0	20	Low			0,8	5,8	2160	G6	A-1-b(0)	GC
33	U9292	0-400	Residual quartzite	Sandy gravel	2,00	2,0	19	Low	7,21	0,10	0,4				A-1-b(0)	GC

- *Terrane* : A terrane is a term for a tectonostratigraphic unit, which is a fragment of crustal material formed on, or broken off from, one tectonic plate and accreted or "sutured" to crust lying on another plate. The crustal block or fragment preserves its own distinctive geologic history, which is different from that of the surrounding areas.

6.1 Regional Geology

The geological processes by which the area under consideration was shaped, initiated some 1000 million years ago with the formation of the supercontinent Rodinia. A mountain chain of global extent formed along the boundaries, underlain by metamorphic rocks that have since then been exposed due to erosion. Metamorphic rocks of this age formed across South Africa to the south and west of the Kaapvaal Craton, known as the Namaqua-Natal Province. The Namaqua-Natal Province can be divided into five tectonostratigraphic subprovinces and terranes, based on marked changes in the lithostratigraphy across structural discontinuities. The five domains so recognized are the Richtersveld Subprovince, the Bushmanland Terrane, Kakamas Terrane, Areachap Terrane and Kaaien Terrane. The tectonic subdivision as proposed on Figure 2 (Cornell) is reproduced in this document as Figure 3.

The process of landforming can be described as compatible to the modern concept of plate tectonics. In this case the Namaqua plate became buried beneath the Kaapvaal Craton in a subduction zone. Considering the forces involved it can be regarded as a violent process, resulting in the breaking up of the landmass into the five domains as described above, associated with the intrusion of recycled rock material from the subduction zone. What is important for this report is that in the case of the Kaaien terrane, the formation of metaquartzites, deformed early Namaquan volcano-sedimentary rocks and deformed, but thermally metamorphosed bimodal volcanic rocks resulted, amongst others. These rocks are at present referred to amongst others as the Brulpan Group, on which Opwag is located. There is controversy about the age of the Brulpan Group, but is estimated between 1710Ma to 1780Ma, underlying the Wilgenhoutsdrif Group.

The regional geology is indicated on Figure 4 : Regional Geology.

6.2 Site Geology

The site geology is illustrated on Figure 5. The soil and pedocretes form an ubiquitous cover over bedrock with only localized exposures in areas of thin and less dense pedocretic cover, thus hampering field investigations. The inferred material boundaries must be accepted as indicative of the actual conditions only.

Bedrock on site occurs as grey brown quartzite becoming light grey quartzite of the Groblershoop Formation, Brulpan Group. In TP's 30 and 33 the quartzite tended to be muscovite-rich. The possibility that bedrock in western low-lying part of the site may consist of quartz-muscovite schist cannot not be excluded. However, it could not be confirmed due to the very dense, impenetrable barrier formed by the hardpan calcrete. It is accepted that the presence of the non-perennial stream may induce seasonal weathering of the calcrete, thus reducing the strength thereof. The strata of the Groblershoop Formation dip at 50° to the east-northeast in the area of investigation.

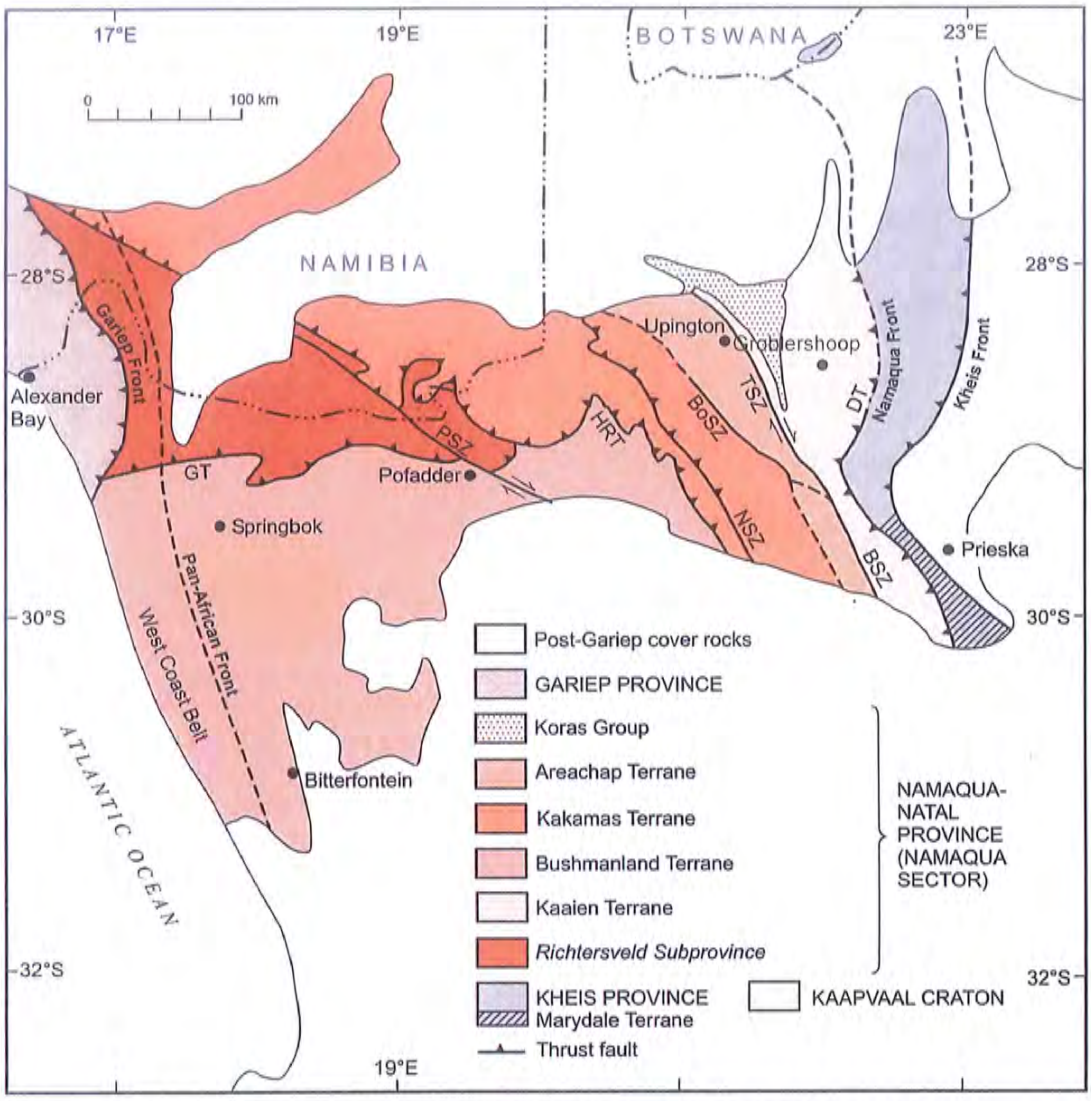
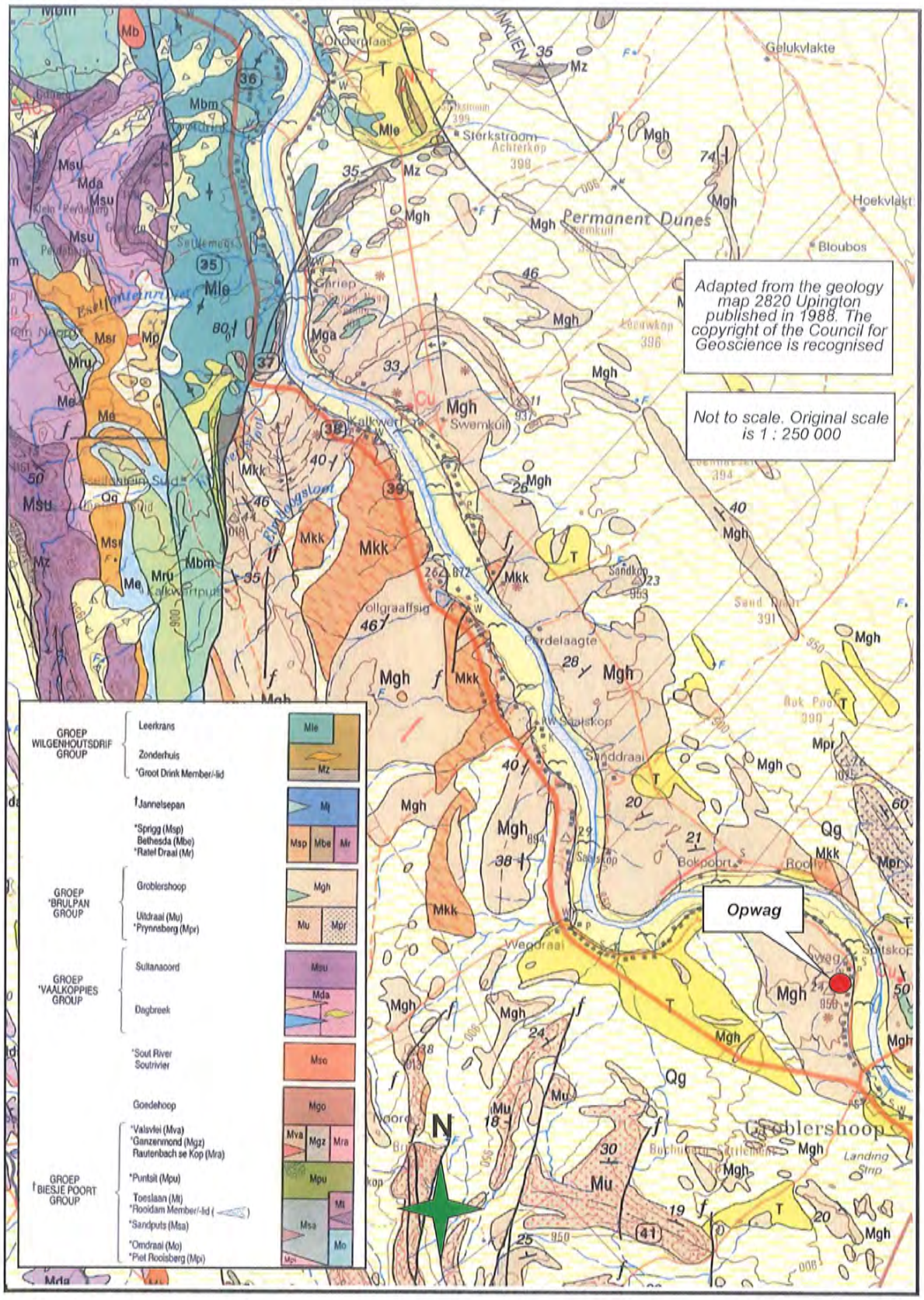


FIGURE 3 : TECTONIC SUBDIVISION OF THE NAMAQUA SECTOR

The pedocrete cover terminates in the eastern part of the site as the slope of the land becomes steeper, exposing the quartzite. On the eastern perimeter of the site the quartzite is present as outcrops of light grey, very hard rock, forming three very distinct hills.



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OPWAG : REGIONAL GEOLOGY

FIGURE 4

Adapted from Project : Opwag, Dated June 2020.
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60m 180m 300m
0m 120m 240m

N

Access to Canal Road

TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27 TP28 TP29 TP30 TP31 TP32 TP33

VERY ROCKY

27/48 26/48 25/48 24/48 23/48 22/48 14/48 REMAINDER 48

Lithology		Formation	Group
C	Calcrete	Mokolanen	Kalahari
Q	Quartzite	Groblershoop	Brulpan

FIGURE 5 :
SITE GEOLOGY

LEGEND

- TP1 — TEST PIT POSITION
- BOSCIA ALBITRUNCA (TO BE CONSERVED)
- VERY ROCKY
- INFERRED MATERIAL BOUNDARY

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KLIËNT/CLIENT: !Kheis Municipality

TEKENING NO/DRAWING NO: Figure 5 : Site Geology

DATUM/DATE: 14 September 2020

6.3 Soil Profile

6.3.1 Alluvium

Alluvium in the form of alluvial sand and minor deposits of river terrace gravels were encountered close to the southwestern and southeastern perimeters of the area of investigation in TP's 12, 17, 28, 31 and 32. These deposits vary from dark brown and light red, loose, fine sand to medium dense, gravels of quartz and lesser content of banded ironstone contained in a sandy matrix. The thickness of the horizon varied between 200mm and 300mm in the test pits. The presence of banded ironstone shows that these deposits can by associated with an earlier course of the Orange River.

6.3.2 Colluvium

On site colluvium was encountered in all the test pits except TP's 1, 7, 10, 11, 12, 15, 17, 28, 31 and 32. Distinction must be made between two types of colluvial deposits :

6.3.2(i) Gravelly Colluvium

Gravelly colluvium as surface deposit was found in TP's 2 to 6, 8, 9, 13, 14, 18, 19, 22 to 25 and 27. The colluvium is a homogenous material, consisting light brown fine sand and clasts of gravels and cobbles of quartz and some calcrete. The consistency of the gravelly colluvium is medium dense and the soil matrix intact. The horizon of colluvium was between 100mm and 200mm thick in the test pits.

6.3.2(ii) Coarse Colluvium

Coarse colluvium as surface deposit was found in TP's 16, 20, 21, 26, 29, 30 and 33. The coarse colluvium is present in the high-lying land on site, associated with transported material originating from bedrock of quartzite. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of light red brown fine sand. The consistency of the coarse colluvium varies from medium dense to very dense. The horizon of colluvium was between 300mm and 700mm thick in the test pits.

6.3.3 Residual Quartzite

On site residual quartzite was encountered in TP's 3 and 7 as surface material or underlying the gravelly colluvium. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of dirty white, calcareous cemented sand. The soil matrix is very dense. The horizon of residual quartzite extended to a depth of 600mm in the test pits,

prior to encountering very dense, very tightly packed quartzite boulders and refusal of excavation.

6.3.4 Mokalanen Formation

Calcrete of the Mokalanen Formation, Kalahari Group, is present as an ubiquitous surface duricrust on site. Again there is a difference in opinion between Moen (Reference 14.4 page147) and Partridge[Reference 14.5] regarding the origin of the calcrete. Moen regards the calcrete as being of Tertiary age, but some doubt whether the outcrops are of the same age and in some localities it may still be in the process of forming. Partridge describes the age of the calcrete as straddling the boundary between the Pliocene and Quaternary, making it some 2,6 to 2,8 million years old. It was deposited under arid conditions and possibly reflects a climatic interval of global aridification.

The engineering properties of calcrete may differ widely for samples taken from the same locality. It is therefore important to provide some background in this regard to aid in the understanding of these conditions.

Brink[Reference 14.6] states that during pedocrete development, clay and silt become flocculated and cemented into larger silt to gravel-sized complexes of varying strength and porosity. These particles and aggregations may or may not break down during laboratory testing and under compaction. The mineralogy of the cementing material and of the clay fraction is different from those of normal, temperate zone soils on which current specifications for soil testing and classification is based. Calcrete can therefore be expected to exhibit differences in behaviour from those of traditional soil materials.

Whereas in traditional soil mechanics it is assumed that all the water is outside the particles, calcrete aggregates retain moisture and this affects conventional moisture content and Atterberg limit determinations. Palygorskite which is the dominant clay in calcrete has approximately the same plasticity index as some smectites, which can be regarded as highly expansive. However, the palygorskite has a non-expansive lattice and a hollow, needle-like shape instead of the usual flaky particle shape of most other clays. It has the lowest shrinkage limit and dry density and the highest optimum moisture content and shear strength of all clays.

Be it as it may, calcrete was encountered as the dominant lithic material on site, in virtually a continuous cover over the quartzite, with the latter outcropping only in the high-lying ridge of outcrops. The calcrete is present as very dense hardpan calcrete and was encountered in TP's 1, 2, 4 to 6, 8 to 15, 17 to 19, 22 to 28, 31 and 32. Only in TP 1 was a minor layer of nodular calcrete encountered as nodular calcrete overlying the hardpan calcrete. The calcrete

is present as outcrops ; or underlies the transported materials, occurring from depths between 100mm and 300mm minimum, extending to 100mm to 600mm maximum, at which stage refusal of excavation occurred or bedrock of quartzite was encountered. Moen reports the calcrete to be up to five meters thick in the area. Minor outcrops of calcrete are present randomly across the site. It is described as dirty white to dirty light yellow white, very fine grained, very dense calcrete. Some fine sand may occasionally be contained in voids in the matrix of the calcrete.

6.4 Groundwater

6.4.1 Perched Water

Perched groundwater was not encountered in any of the test pits excavated for this investigation. Considering the climate of the area and the nature of in situ materials, it is anticipated that perched water will generally not prove problematic on the site, except in the lesser drainage courses of the site after events of inundation. Even if it did occur, the grading of in-situ materials is such that dispersal will take place fairly rapidly. Furthermore, it is expected that perched water and/or surface seepage may occur shortly after precipitation events and in years of excessive rain only.

6.4.2 Permanent Groundwater

Vegter[Reference 14.7] indicates the probability for drilling successfully for water in the area to be between 40% and 60%, and the probability that such a borehole will yield more than 2l/s is between 10% and 20%. Groundwater is expected to occur at depths less than 15 meters in compact, argillaceous strata.

7 GEOTECHNICAL EVALUATION

The engineering properties of the in-situ materials are summarized in Table 3 : Summary of Engineering Properties. The characterizations have been derived based on the Unified materials classifications as reported by literature studies.

7.1 Engineering and Material Characteristics

7.1.1 Properties of Heave

The results of the materials testing as reported in Table 2 indicate the in-situ materials are not expansive. Any future structures will thus not be subject to heave. The content of active clay,

TABLE 3 : SUMMARY OF ENGINEERING PROPERTIES

TEST PIT NO	SAMPLE NO	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	SOIL CLASS		COHESION[1] (kNm^{-2})	FRICTION ANGLE (°)[1]	COMPRESSIBILITY[2]	EROSION RESISTANCE[2,5]	PERMEABILITY[2] k (cms^{-1})	SPECIFICATIONS FOR UNPAVED ROADS[3]					SUITABILITY FOR ROAD CONSTRUCTION[4]	
					PRA	UNIFIED						MAXIMUM SIZE	OVERSIZE INDEX (I_o)	GRADING COEFFICIENT(G_c)	SHRINKAGE PRODUCT(S_p)	CBR @ 95% MOD	PAVED	UNPAVED
1	U9277	200-600	Hardpan calcrete	Sandy gravel	A-1-a(0)	GW-GM	<5	30° to 40°	Negligible	1 to 4	$(2,7\pm1,3)X10^{-2}$	50,0	8	16,5	33,0	27		Corrugates and ravels
5	U9278	0-300	Hardpan calcrete	Sandy gravel	A-1-a(0)	GC	<5	28° to 35°	Very low	3	$>3X10^{-7}$	37,5	12	15,2	27,0			Corrugates and ravels
11	U9279	0-200	Hardpan calcrete	Sandy gravel	A-1-a(0)	GM	<5	30° to 40°	Negligible	4	$>3X10^{-7}$	37,5	15	15,6	60,0			Corrugates and ravels
12	U9280	0-300	Colluvium	Fine sand	A-4(0)	SM	20 to 22	32° to 35°	Low	8	$(7,5\pm4,8)X10^{-6}$	14,0	0	10,4	154,0			Erodible
15	U9280	0-300	Hardpan calcrete	Sandy gravel	A-1-a(0)	GW-GC	0 to 20	28° to 40°	Negligible to very low	1 to 3	Highly variable	63,0	10	16,4	42,0	43		Corrugates and ravels
18	U9288	100-300	Hardpan calcrete	Sandy gravel	A-1-a(0)	GW-GC	0 to 20	28° to 40°	Negligible to very low	1 to 3	Highly variable	37,5	6	16,0	39,0			Corrugates and ravels
21	U9289	0-400	Coarse Colluvium	Cobbles and gravels	A-1-b(0)	GC	<5	28° to 35°	Very low	3	$>3X10^{-7}$	37,5	11	23,5	35,0			Corrugates and ravels
22	U9290	100-300	Hardpan calcrete	Sandy gravel	A-1-b(0)	GC	<5	28° to 35°	Very low	3	$>3X10^{-7}$	50,0	6	17,4	76,0			Corrugates and ravels
28	U9291	0-500	Hardpan calcrete	Sandy gravel	A-1-b(0)	GC	<5	28° to 35°	Very low	3	$>3X10^{-7}$	75,0	6	10,1	39,0	28		Corrugates and ravels
33	U9292	0-400	Residual quartzite	Sandy gravel	A-1-b(0)	GC	<5	28° to 35°	Very low	3	$>3X10^{-7}$	37,5	11	15,8	64,5			Corrugates and ravels

1 Obrzud RF and Truty A : The Hardening Soil Model - A Practical Guidebook, 2018 edition, revised 21 October 2018.

2 Brink ABA et al : Soil Survey for Engineering, published in 1982.

3 The Structural Design, Construction and Maintenance of Unpaved Roads (Draft TRH 20), Committee of State Road Authorities 1990.

4 Structural Design of Flexible Pavements for Interurban and Rural Roads (Draft TRH 4), Committee of State Road Authorities 1996.

5 Erosion resistance : 1 is best 10 is poor.

that is the material smaller than 0,002mm in diameter, was less than 1,5% for all the samples tested.

7.1.2 Properties of Settlement

7.1.2(i) Colluvium

Gravelly colluvium was found in TP's 2 to 6, 8, 9, 13, 14, 18, 19, 22 to 25 and 27. It consists of light brown fine sand and clasts of gravels and cobbles of quartz and some calcrete. The consistency of the gravelly colluvium is medium dense and the soil matrix intact. The horizon of colluvium was between 100mm and 200mm thick in the test pits. The properties of the gravelly colluvium are thus such that it does not tend to excessive settlement.

Coarse colluvium was found in TP's 16, 20, 21, 26, 29, 30 and 33. The coarse colluvium consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of light red brown fine sand. The consistency of the coarse colluvium varies from medium dense to very dense. The horizon of colluvium was between 300mm and 700mm thick in the test pits. The properties of the gravelly colluvium are thus such that it does not tend to excessive settlement. However, foundations spanning a boulder of quartzite may be subject to stress concentrations and/or differential settlement. .

7.1.2(ii) Alluvium

Alluvium in the form of alluvial sand and minor deposits of river terrace gravels were encountered in TP's 12, 17, 28, 31 and 32. These deposits vary from dark brown and light red, loose, fine sand to medium dense, gravels of quartz and banded ironstone contained in a sandy matrix. The thickness of the horizon varied between 200mm and 300mm in the test pits. The properties of the alluvium are thus such that it does not tend to excessive settlement.

7.1.2(iii) Pedocretes

Very dense hardpan calcrete was encountered in TP's 1, 2, 4 to 6, 8 to 15, 17 to 19, 22 to 28, 31 and 32. Only in TP 1 was a minor layer of nodular calcrete encountered as nodular calcrete overlying the hardpan calcrete. The calcrete is present as outcrops ; or underlies the transported materials, occurring from depths between 100mm and 300mm minimum, extending to 100mm to 600mm maximum, at which stage refusal of excavation occurred or bedrock of quartzite was encountered. It can thus accommodate stresses imposed by conventional housing structures without undue settlement. Only limited – if any –settlement can thus be expected for structures such as single storey units of masonry construction.

7.1.2(iv) Residual Quartzite

Residual quartzite was encountered in TP's 3 and 7 as surface material or underlying the gravelly colluvium. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of dirty white, calcareous cemented sand. The soil matrix is very dense. The horizon of residual quartzite extended to a depth of 600mm in the test pit, prior to encountering very dense, very tightly packed quartzite boulders and refusal of excavation. The properties of the residual quartzite are thus such that it does not tend to excessive settlement.

7.1.3 Corrosivity

When discussing soil corrosivity, it is applicable to consider the guidelines as proposed by EvansReference [14.8]. The corrosivity of a soil towards buried, exposed, metallic surfaces is dependent on the following properties of the soil :

- Electrical conductivity.
- Chemical properties of the soil.
- Ability of the soil to support sulphate reducing bacteria.
- Heterogeneity of the soil.

The tests carried out for the compilation of this report must be considered as indicative of the corrosivity of the soils only. The pH of a soil gives an indication of potential acid related problems. Should the soil pH be less than 6,0, corrosion may take place ; and should the pH be less than 4,50, the problem of corrosion may be serious. If the conductivity of the soil is less than $0,01Sm^{-1}$, corrosiveness is generally not a problem. However, the potential for corrosivity of the soil increases with an increase in conductivity. Should the conductivity of the soil exceed $0,05Sm^{-1}$, the soil can be regarded as very corrosive. Should exposed metal pipes pass from argillaceous soils to arenaceous soils or vice versa, electrochemical cells are set up due to the different rates of oxygen diffusion of the soils. Sulphate reducing bacteria is usually present under anaerobic conditions, that is, typically saturated or waterlogged clays.

The results of the chemical testing carried out for this report indicate the following :

- *Acidity* : The pH of the samples of material tested varied between 7,58 and 7,87. The soils are thus regarded as not corrosive due to the acidity there of.
- *Water Soluble Salts Content* : The conductivity of the samples of material tested varied between $0,06Sm^{-1}$ for the colluvium to $0,13Sm^{-1}$ for the calcrete. All soils can therefore be regarded as corrosive due to their high soluble salt contents.

Other considerations are :

- *Heterogeneity of the Soil* : Conditions of corrosive soils due to a heterogeneous soil profile do not occur on the property.
- *Water Logged Soils* : Conditions of water logged soils were encountered in TP's 3 and 35 in the unlined stormwater course.

7.1.4 Materials Utilisation

7.1.4(i) Backfilling of Service Trenches

The hardpan calcrete and coarse colluvium are not suitable to be used for any type of backfill due to its tendency to break into boulder and cobble sized fragments on excavation. Such fragments cannot be compacted properly on backfilling.

The gravelly colluvium can be used for normal backfilling of services trenches. However, due to the coarse granular composition thereof, these materials are not suitable for pipe bedding or selected backfill around pipes.

7.1.4(ii) Construction of Paved or Segmental Block Streets

Only provisional indicators for future guidance of development are provided as far as material quality for road construction is concerned, complying with the requirements applicable to the level of investigation.

The results of the compaction testing on soil samples show the in-situ materials to be generally of G6 quality. These materials are thus suitable for purposes of paved road or segmental block paving construction. This type of construction is applicable to access roads to townships. The soil materials are therefore suitable for the construction of base and subbase course construction of lightly trafficked roads.

7.1.4(iii) Wearing Course for Urban Gravel Roads

The properties to provide guidance for the use of soil materials for the structural design of a wearing course for urban gravel roads are contained in the various sub-columns of the column "Specifications for Unpaved Roads" in Table 3. The various parameters are colour-coded : Green = suitable ; red = unsuitable. The two sub-columns with a light yellow-brown background contain the parameters on which the physical behaviour of the wearing is course is determined.

From the table it is clear that none of the in-situ materials comply in all aspects to the requirements for a gravel wearing course. In most cases the use of these materials will result in a wearing course subject to raveling and corrugations. This can be attributed the non-cohesive character of most of the materials. In contradiction to the construction of paved roads, calcrete appears to be the material more suitable for gravel wearing course construction, although experience has taught that if a calcrete with a high PI is used for this purpose, the road surface can become slippery in wet conditions.

7.1.5 Other Considerations

The properties discussed in this subsection of the report were obtained from literature reported values based on studies done by the US Army Corps of Engineers as reported by Brink[Reference 14.9] for compacted material. This approach is followed as the arenaceous character of the in-situ materials that did not allow the retrieval of undisturbed sampling. The typical soil properties associated with the Unified classifications of the materials are thus reported.

7.1.5(i) Compressibility

The compressibility of the material can be regarded as a necessary input to pavement design as well as lesser important supporting information for geotechnical classification for site class designation.

- *Colluvium* : The colluvium is regarded as very low to low compressible with cohesion (c_0) of less than 5,0kNm^{-2} to 22Nm^{-2} and the effective stress envelope approximately 28° to 35°.
- *Hardpan Calcrete* : The hardpan calcrete is regarded as negligible to very low compressible with cohesion (c_0) of less than 5,0kNm^{-2} to 20Nm^{-2} and the effective stress envelope approximately 28° to 40°.
- *Residual Quartzite* : The residual quartzite is regarded as very low compressible with cohesion (c_0) of less than 5,0kNm^{-2} and the effective stress envelope approximately 28° to 35°.

7.1.5(ii) Permeability

Permeability is an important parameter in the design of surface drainage and seepage drains. As such indicators in this regard are provided.

- *Colluvium* : The colluvium is regarded as semi-pervious to impervious. The soil permeability coefficient varies between 2,7X10^{-6}cms^{-1} to >3,0X10^{-7}cms^{-1}.

- *Hardpan Calcrete* : The permeability of the hardpan calcrete is highly variable depending on the mode of deposition and regarded as pervious to impervious. The soil permeability coefficient varies between more permeable than $1,5X10^{-2}cms^{-1}$ to $>3,0X10^{-7}cms^{-1}$.
- *Residual Quartzite* : The residual quartzite is regarded as impervious. The soil permeability coefficient exceeds $3X10^{-7}cms^{-1}$.

7.1.5(iii) Erosion Potential

All soil materials encountered during the investigation can be regarded as moderately to highly resistant against erosion. The net result of these properties is favourable founding conditions on the horizons of calcrete.

7.2 Properties of Bedrock

The TLB used to excavate the test pits did not penetrate hardpan calcrete or bedrock of quartzite to any significant extent and refusal of excavation occurred within millimeters after encountering these materials. It is not customary to penetrate bedrock in the case of a geotechnical investigation for purposes of a residential development. Refusal of excavation on hard rock is accepted as suitable. One can thus accept bedrock to be hard tending to very hard once refusal of excavation was encountered.

7.2.1 Calcrete

Voided matrices were not encountered in the hardpan calcrete during the investigation. The results of the materials testing on samples of the hardpan calcrete approach that of sandy gravel. However, it must be borne in mind that in in-situ conditions the properties of hardpan calcrete approaches that of hard rock rather than a gravelly sand. The grading modulus of the sample of hardpan calcrete fragments tested as 2,0 to 2,4 ; plasticity index as two to three ; and clay content less than 1,1%. The activity of the hardpan calcrete is described as low. The PRA classification of the calcrete is A-1-a(0) to A-1-b(0) ; and the Unified classification is GW to GC. Based on these properties and material classification the hardpan calcrete is regarded as non-expansive and no consolidation settlement and no collapse settlement can thus be expected for structures such as single storey units of masonry construction.

The test results of the samples of the hardpan calcrete reflect the properties of excavated fragments of material and not the intact mass of hardpan calcrete. It is therefore accepted that the properties of the very dense calcrete can be considered as tending towards soft rock to hard rock, limestone.

Brink (Reference 14.6) reports an average UCS of 32MPa for intact samples of hardpan calcrete from the Kalahari region. Using this as input to parametric calculations with Roclab software results for very dense calcrete tending to widely jointed, slightly weathered, medium hard rock, limestone result in the following properties :

- Cohesion : 1,08MPa
- Friction Angle : 24°
- Tensile Strength : 0,018MPa
- Uni-axle Compressive Strength : 550kPa
- Young's Modulus : 2340MPa

All which show a sound pedocrete, not compressible, not permeable nor subject to erosion.

7.2.2 Quartzite

Parametric calculations with Roclab software results for unweathered, jointed, very hard rock result in the following properties :

- Cohesion : 11,0MPa
- Friction Angle : 36,6°
- Tensile Strength : 0,35MPa
- Uni-axle Compressive Strength : 14,1MPa
- Young's Modulus : 21435MPa

All which show a sound, very hard and durable rock.

7.3 Excavation Classification with Respect to Services

7.3.1 Hand Excavation

7.3.1(i) Alluvium

The alluvium can be considered as suitable to be excavated by swing tools.

7.3.1(ii) Gravelly Colluvium

The gravelly colluvium can be considered as suitable to be excavated by swing tools.

7.3.1(iii) Coarse Colluvium

The coarse colluvium is of dense to very dense consistency containing boulders of quartzite. Such material cannot be considered as suitable to be manually excavated and may as minimum require the use of a 55kW TLB, but preferably a 30 ton excavator to remove it on an economical basis.

7.3.1(iv) Pedogenic Deposits

The nodular and hardpan calcrete are of dense to very dense consistency. Such material cannot be considered as suitable to be manually excavated and may as minimum require the use of a 55kW TLB, but preferably a 30 ton excavator to remove it on an economical basis.

7.3.1(v) Residual Quartzite

The residual quartzite is of dense to very dense consistency containing boulders of quartzite. Such material cannot be considered as suitable to be manually excavated and may as minimum require the use of a 55kW TLB, but preferably a 30 ton excavator to remove it on an economical basis.

7.3.1(vi) Bedrock

Bedrock of quartzite cannot be excavated manually successfully.

7.3.2 Classification of Material for Machine Excavation

In terms of Table 5 of SANS 634 : 2012 the following is applicable :

7.3.2(i) Restricted Excavation

- *Soft Excavation* : The alluvium, terrace gravels and gravelly colluvium can be regarded as soft excavation. The thickness of these strata varied between 100mm and 400mm in the test pits, averaging 180mm prior to encountering conditions of intermediate or hard rock excavation.
- *Intermediate Excavation* : Refusal of excavation with a TLB occurred in most cases once very dense, hardpan calcrete or slightly weathered to unweathered rock was encountered. However, some penetration into the hardpan calcrete or quartzite was possible and can be regarded as intermediate excavation. It was possible to penetrate between 100mm and 700mm into the hardpan calcrete and quartzite, averaging 160mm thick, prior to encountering hard rock excavation.

- *Boulder Class A Excavation* : Conditions of Boulder Class A excavation are limited to the slopes and the quartzite ridge on the northeastern boundary of the area of investigation. Such conditions were encountered in TP's 16, 20, 21, 26, 30 and 33. As a guideline in this regard the area of quartzite indicated on Figure 5 must be regarded as subject to Boulder Class A excavation. Such boulders that do occur originate from coarse colluvium and residual quartzite. It was possible to penetrate between 300mm and 800mm into the boulder layers, averaging 530mm thick, prior to encountering hard rock excavation or very tightly packed boulders that could not be removed by the TLB.
- *Hard Rock Excavation :* Refusal of excavation occurred on conditions of hard rock excavation in all the test pits at depths varying between 100mm and 800mm, averaging 410mm.

From the above it is clear that the transition of conditions of excavation occurs over a 250mm and can be regarded as rapid.

7.3.2(ii) Non-restricted Excavation

The classification as per subparagraph 7.3.2(i) : Restricted Excavation as above is also applicable for non-restricted excavation.

7.4 Seismicity

A 10% probability of an event with magnitude less than 100cms^{-2} to take place once in 50 years is regarded as favourable ; and a natural seismic activity with magnitude exceeding 100cms^{-2} is regarded as unfavourable. Based on a report compiled by Kijko[Reference 14.10] a 10% probability exists that an earthquake with Peak Ground Acceleration exceeding of 0,05g may take place once in 50 years in Opwag.

The closest source of seismic measurements to Opwag under control of the Council for Geoscience is Tontelbos at 31° 10' 12"S and 20' 30' 00"E.

- The annual probability for an earthquake with intensity of 4,5 on the Modified Mercalli Scale to occur in the area is less than $10^{-0,7}$; and with an intensity of 8,5 to occur the probability is $10^{-3,8}$.
- The annual probability for an earthquake with an acceleration of $10^{-1,9}$g to occur in the area is less than $10^{-0,7}$; and with an acceleration of $10^{-0,75}$g to occur in the area is less than $10^{-3,8}$.

To put the above information into perspective, Table 4 : Earthquake and Magnitude and Intensity, is attached to this report.

TABLE 4 : EARTHQUAKE MAGNITUDE AND INTENSITY

MODIFIED MERCALLI INTENSITY SCALE	INTENSITY	DESCRIPTION	RICHTER SCALE MAGNITUDE	RADIUS OF PERCEPTIBILITY (km)
I	Instrumental	Detected only by seismography		
II	Feeble	Noted only by sensitive people	3.5 to 4.2	3 to 24
III	Slight	Like the vibrations due to a passing lorry. Felt by people at rest, especially on upper floors		
IV	Moderate	Felt by people while walking. Rocking of loose objects, including vehicles	4.3 to 4.8	24 to 48
V	Rather strong	Felt generally ; most sleepers are awakened and bells ring		
VI	Strong	Trees sway and suspended objects swing ; damage by overtuming and filling of loose objects	4.9 to 5.4	48 to 112
VII	Very strong	General public alarm ; walls crack ; plaster falls	5.5 to 6.1	110 to 200
VIII	Destructive	Car drivers seriously disturbed; masonry fissured ; buildings damaged	6.2 to 6.9	200 to 400
IX	Ruinous	Houses collapse ; pipes break		
X	Disasterous	Ground cracks badly ; buildings destroyed ; railway lines bent ; landslides on steep slopes	7.0 to 7.3	400 to 700
XI	Very disasterous	Few buildings remain standing; bridges destroyed ; all services out of action ; great landslides and floods	7.4 to 8.1	400 to 700
XII	Catastrophic	Total destruction ; objects thrown into the air; ground rises and falls in waves	>8.1	400 to 700

7.5 Undermining

The area of investigation is not undermined.

7.6 Dolomite Stability

The area of investigation is not subject to dolomite related instabilities.

8 SITE CLASS DESIGNATIONS

Based on the above discussions the property can be divided into five zones as per the guidelines posted by SANS 10400 : Section H[Reference 14.11] . The zonation is indicated on Figure 6 : Site Class Designation.

8.1 Geotechnical Zone I

This zone comprises 65% of the area investigated. It is characterized by the materials profiles of TP's 2, 5, 6, 9 to 11, 13 to 15, 17 to 19, 22 to 25, 27, 28 and 31 to 33. It covers the larger part of the area of investigation on a continuous basis. It consists of a superficial horizon less than 400mm thick comprising of colluvium, alluvium, terrace gravels and very dense calcrete overlying bedrock of quartzite. Several outcrops of calcrete occur in the area. Slope across the land is approximately between 2% and 6%. Foundation stresses induced by conventional strip foundations for single and double storey structures will result in almost negligible settlement if founded directly on the slightly weathered and unweathered hard rock to very hard rock, or on the very dense calcrete. The area is thus zoned as "R" and regarded as stable.

8.2 Geotechnical Zone II

This zone comprises 4% of the area investigated. It is characterized by the materials profiles of TP's 8 and 12. It is present along the western boundary of the site between the two drainage courses. It consists of a superficial horizon less than 400mm thick comprising of colluvium less than 400mm thick overlying very dense hardpan calcrete and bedrock of quartzite. Slope across the land is less than 2%. Foundation stresses induced by conventional strip foundations for single and double storey structures will result in almost negligible settlement if founded directly on the slightly weathered and unweathered hard rock to very hard rock, or on the very dense calcrete. The area is thus zoned as "R" and regarded as stable.

8.3 Geotechnical Zone III

This zone comprises 22% of the area investigated. The zone is present in two separate areas on the property as follows :

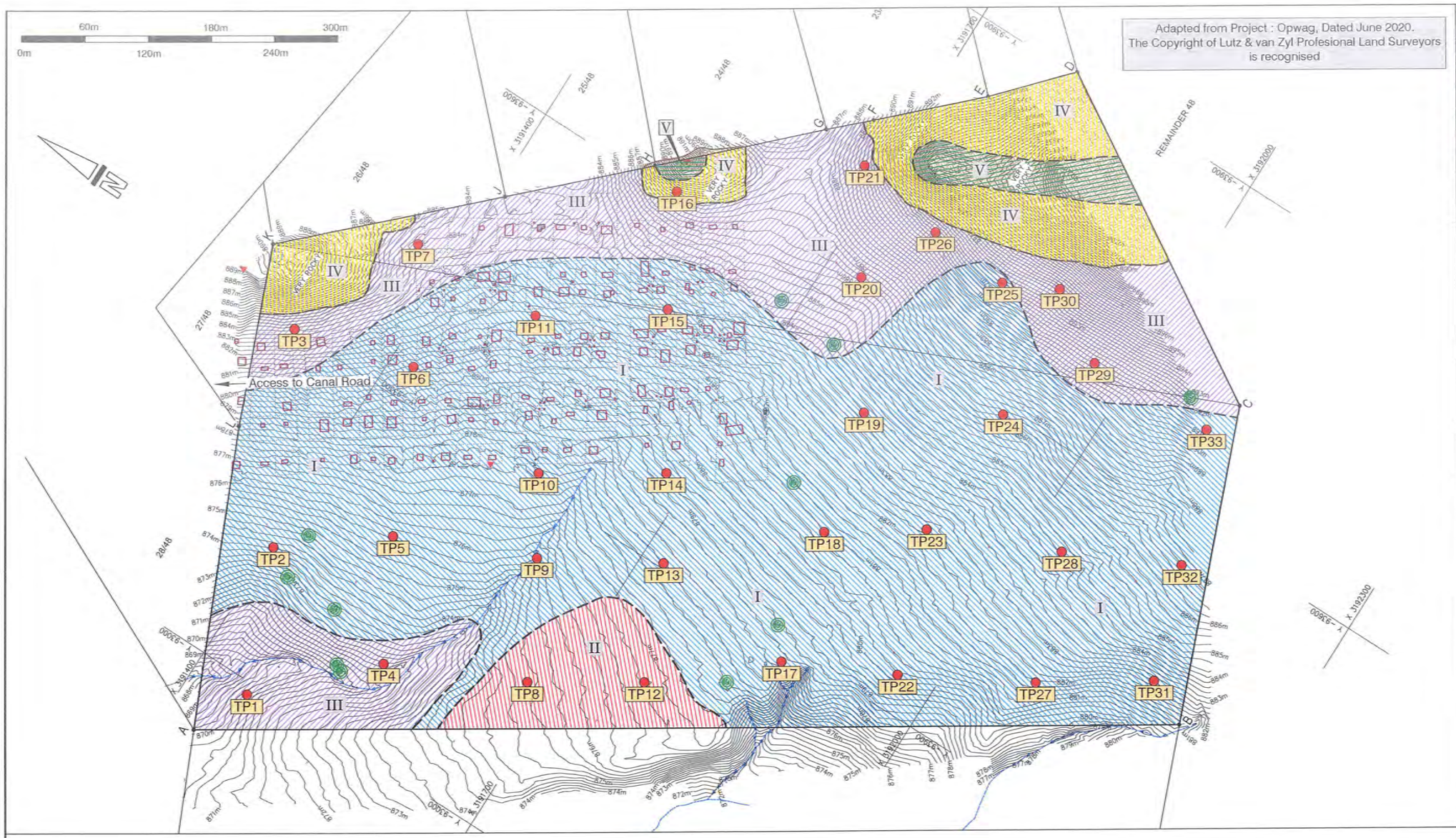

FIGURE 6 :
SITE CLASS DESIGNATION

LEGEND

- TP1 — TEST PIT POSITION
- BOSCIA ALBITRUNCA (TO BE CONSERVED)
- VERY ROCKY
- INFERRED MATERIAL BOUNDARY

FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES

AREA	AREA OF PROPERTY (%)	GEOTECHNICAL CLASS	ESTIMATED SOIL MOVEMENT(mm)	SOIL PROFILE	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS	DEVELOPMENT POTENTIAL
I	64,83	R	Negligible	Less than 400mm of colluvium, terrace gravels and alluvium overlying bedrock and very dense pedogenic deposits	Normal	Normal construction (strip footing or slab-on-the-ground) foundation. Founding to take place on very dense pedocretes or bedrock	Conditions of hard rock excavation. Landslope less than 2% and 6% favours strip footing foundations.	Intermediate
II	4,12	R	Negligible	Less than 400mm of colluvium and dense pedocretes overlying bedrock and very dense pedogenic deposits	Normal	Normal construction (strip footing or slab-on-the-ground) foundation. Founding to take place on very dense pedocretes or bedrock	Conditions of hard rock excavation. Landslope less than 2% favours slab-on-the-ground foundations.	Intermediate
III	22,09	S	0mm to 10mm compression settlement	More than 400mm of colluvial cobbles and boulders overlying bedrock of quartzite	Modified normal	Deep strip foundations placed directly on bedrock of quartzite Floorslabs to be mesh reinforced. Good site drainage	Conditions of boulder class A excavation Landslope between 2% and 6%	Intermediate
IV	7,29	S	0mm to 10mm compression settlement	More than 400mm of colluvial cobbles and boulders overlying bedrock of quartzite	Modified normal	Deep strip foundations placed directly on bedrock of quartzite Floorslabs to be mesh reinforced. or Strip footings or slab-on-the-ground foundations placed on engineered fill. Foundation system to be designed by engineer.	Conditions of boulder class A excavation Landslope between 6% and 10%	Intermediate
V	1,67	P (Slope/ Rock outcrops)	N/A	Outcrops of very hard rock, quartzite	N/A	Steep topography and outcrops of rock reduced the suitability of the land for low cost residential development. Set aside for public open space	Conditions of hard rock excavation. Landslope exceeds 10%	Poor

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TAAK/JOB NAME: Expansion and Formalisation of Opwag Community
LIGGING/SITE: Plot 2642 Boegoeberg Settlement and Portion 14 of the farm Boegoeberg Settlement No 48
KLIENT/CLIENT: !Kheis Municipality
TEKENING NO/DRAWING NO: Figure 6 : Site Class Designation
DATUM/DATE: 14 September 2020

8.3.1 Northwestern Section

This area is characterized by the materials profiles of TP's 1 and 4. It consists of a horizon of calcrete that is less dense than over the remainder of the site. This deterioration in the quality may possibly be due to the action of surface water from the water course in the area. Isolated surface deposits of colluvial gavel may cover the calcrete. The thickness of the overburden exceeds 400mm and it overlies very dense calcrete and bedrock of quartzite at depth. Slope across the land is between 2% and 6%. Foundation stresses induced by conventional strip foundations for single and double storey structures will result in limited compression settlement less than 10mm if founded directly on the calcrete. As per the materials profile encountered in the test pits the thickness of the horizon of calcrete soil is sufficient to dissipate the stresses induced by the foundations effectively. The area is thus zoned as "S" and the materials strata can be regarded as compressible to a maximum of 10mm.

8.3.2 Eastern Section

This area is characterized by the materials profiles of TP's 3, 7, 20, 21, 26, 29 and 30. It consists of a horizon of medium dense to very dense coarse colluvium prior to encountering bedrock of quartzite. The coarse colluvium consists almost exclusively of boulders and cobbles of quartzite in a sandy matrix. The thickness of the overburden exceeds 400mm. Slope across the land is between 2% and 6%. Foundation stresses induced by conventional strip foundations for single and double storey structures will result in limited compression settlement less than 10mm if founded on the coarse overburden. As per the materials profile encountered in the test pits the thickness of the horizon of coarse colluvium is sufficient to dissipate the stresses induced by the foundations effectively. The area is thus zoned as "S" and the materials strata can be regarded as compressible to a maximum of 10mm.

8.4 Geotechnical Zone IV

This zone comprises 7% of the area investigated. Due to the steep slope and abundant presence of surface boulders of quartzite, health and safety precautions indicated test pitting in this area to be an unacceptable risk in terms of stability of the excavation equipment. TP 16 only was thus excavated in the area. A thorough walkover survey was conducted to supplement the information obtained from the test pit.

The soil profile consists of a horizon of dense coarse colluvium prior to encountering bedrock of quartzite. The coarse colluvium consists almost exclusively of boulders and cobbles of quartzite in a sandy matrix. The thickness of the overburden was 600mm in the test pit. Slope across the land is between 6% and 10%. Foundation stresses induced by conventional strip foundations for single and double storey structures will result in limited compression

settlement less than 10mm if founded on the coarse overburden. As per the materials profile encountered in the test pits the thickness of the horizon of coarse colluvium is sufficient to dissipate the stresses induced by the foundations effectively. The area is thus zoned as "S" and the materials strata can be regarded as compressible to a maximum of 10mm.

8.5 Geotechnical Zone V

This zone comprises 2% of the area investigated. Two small areas complying to the properties of this zonation are present enclaved by the Geotechnical IV zonation. There is virtually no soil profile in these two areas as they consist almost exclusively of quartzite outcrops. Slope across the land exceeds 10%. While constructing residential units on such land may be a viable proposition if costs are not a factor, financial constraints may dictate construction of low cost and affordable housing not to be viable in this zone. The area is thus zoned P(Slope/Rock outcrops).

9 FOUNDATION RECOMMENDATIONS AND SOLUTIONS

The foundation design alternatives and ancillary issues as discussed in subparagraphs 9.1 and 9.5 below are summarized in Table 5 : Foundation Design, Building Procedures and Precautionary Measures. In some cases more than one foundation solution is offered in the discussion below. Whichever option is used, the design must adhere strictly on the proposals of SANS 10400H. As geotechnical conditions favour the use of both alternatives, the decision of which option to use must be based on financial and practical considerations. In all cases service trenches shall not be excavated parallel to buildings within 1500mm of the building perimeter.

9.1 Geotechnical Zone I

The zone is classed as R, meaning that the proposed horizon for founding is stable and negligible soil movement is expected. The slope across the land varies between approximately 2% and 6%. Two founding alternatives can be considered :

9.1.1 Strip Foundations

The preferable founding alternative is foundations of 400mm wide strip footings placed directly on very dense hardpan calcrete or bedrock of quartzite. Should the areas of the proposed dwellings not exceed 200m^2 foundations for internal non-loadbearing walls may consist of thickened floorslabs. Should this option be adopted the floorslabs shall be reinforced steel mesh.

TABLE 5 : FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES

AREA	AREA OF PROPERTY (%)	GEOTECH NICAL CLASS	ESTIMATED SOIL MOVEMENT (mm)	SOIL PROFILE	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES	ASSOCIATED PROBLEMS	DEVELOPMENT POTENTIAL
I	65	R	Negligible	Less than 400mm of colluvium, terrace gravels and alluvium overlying bedrock and very dense pedogenic deposits	Normal	Normal construction (strip footing or slab-on-the-ground) foundation. Founding to take place on very dense pedocretes or bedrock	Conditions of hard rock excavation Landslope between 2% and 6% favours strip footing foundations	Intermediate
II	4	R	Negligible	Less than 400mm of colluvium and dense pedocretes overlying bedrock of andvery dense pedogenic deposits	Normal	Normal construction (strip footing or slab-on-the-ground) foundation. Founding to take place on very dense pedocretes or bedrock	Conditions of hard rock excavation. Landslope less than 2% favours slab-on-the-ground foundations.	Intermediate
III	22	S	0mm to 10mm compression settlement	More than 400mm of colluvial cobbles and boulders overlying bedrock of quartzite.	Modified normal	Deep strip foundations placed directly on bedrock of quartzite Floorslabs to be mesh reinforced. Good site drainage	Conditions of boulder class A excavation Landslope between 2% and 6%	Intermediate
IV	7	S	0mm to 10mm compression settlement	More than 400mm of colluvial cobbles and boulders overlying bedrock of quartzite.	Modified normal	Deep strip foundations placed directly on bedrock of quartzite Floorslabs to be mesh reinforced. or Strip footings or slab-on-the-ground foundations placed on engineered fill. Foundation system to be designed by engineer.	Conditions of boulder class A excavation Landslope between 6% and 10%	Intermediate
V	2	P(Slope/ Rock outcrops)	N/A	Outcrops of very hard rock, quartzite	N/A	Steep topography and outcrops of rock reduce the suitability of the land for low cost residential development. Set aside for public open space.	Conditions of hard rock excavation. Landslope exceeds 10%	Poor

9.1.2 Slab-on-the-ground Foundations

Considering the slope across the land of approximately 2% to 6% the use of slab-on-the-ground foundations may require additional works in the form of the construction of an engineered fill or cutting to establish a level platform for construction, but it still remains a viable alternative. This latter option of additional earthworks may be costly and hence is regarded as less attractive than conventional strip footings.

9.2 Geotechnical Zone II

The zone is classed as R, meaning that the proposed horizon for founding is stable and negligible soil movement is expected. Considering the limited slope across the land of less than 2% only and the favourable geotechnical site classification as per Section 8 above, two foundation design alternatives are applicable to the zone.

The two options can be discussed as follows :

9.2.1 Strip Foundations

Foundations of 400mm wide placed directly on the very dense hardpan calcrete may be used. Should the areas of the proposed dwellings not exceed 200m^2 foundations for internal non-loadbearing walls may consist of thickened floorslabs. Should this option be adopted the floorslabs shall be reinforced steel mesh.

9.2.2 Slab-on-the-ground Foundations

This is the preferred method of founding. The solution of slab-on-the-ground foundations may only be used for dwellings less than 200m^2 in area. Edge beams shall be placed directly on the very dense hardpan calcrete.

Foundations for internal non-loadbearing walls shall consist of thickened floorslabs. The foundations shall not contain any changes in surface levels with steps exceeding 400mm and do not support any chimneys or walls which support concrete roofs.

9.3 Geotechnical Zone III

The zone is classed as S, meaning that less than 10mm of compression settlement may occur. Considering the slope across the land of approximately 2% to 6% and the presence of boulders and cobbles of quartzite in the soil matrix, it is proposed that structures be founded by deep strip foundations.

Foundations of 400mm wide can be placed directly on bedrock of quartzite. The founding of structures on the cobbles and boulders of quartzite is not advised as this may lead to tension concentrations in the foundations, resulting in structural damage. Floorslabs shall be reinforced with steel mesh. Should the areas of the proposed dwellings not exceed 200m^2 foundations for internal non-loadbearing walls may consist of thickened floorslabs.

9.4 Geotechnical Zone IV

The zone is classed as S, meaning that less than 10mm of compression settlement may occur. The land slopes at approximately 6% to 10% and boulders and cobbles of quartzite are present in the soil matrix. The combination of these two properties, that is the fairly steep slope and very coarse soil overburden presents some issues that need to be addressed by foundation design and construction. Two options for foundation design may therefore be considered :

9.4.1 Deep Strip Foundations

The implementation of deep strip foundations, will require foundations of 400mm wide placed directly on bedrock of quartzite. The founding of structures on the cobbles and boulders of quartzite is not advised as this may lead to tension concentrations in the foundations, resulting in structural damage. Floorslabs shall be reinforced with steel mesh. Should the areas of the proposed dwellings not exceed 200m^2 foundations for internal non-loadbearing walls may consist of thickened floorslabs.

However, the use of strip foundations need to be seen against the dimensions of the proposed housing units. Should the length of a load bearing wall placed directly parallel with the slope of the land be 5000mm, the maximum height of the plinth will be three courses of brick plus 300mm for landslope of 6% ; increasing to three bricks plus 500mm for landslope of 10%. At some stage the combination of the height of the plinth, land slope and dimension of the house will require an additional skin of bricks to be used for plinth construction.

Should the length of a load bearing wall placed directly parallel with the slope of the land be increased to 6000mm, the maximum height of the plinth will be three courses of brick plus 360mm for landslope of 6% ; increasing to three bricks plus 600mm for landslope of 10% - that is a total of approximately 850mm. At some stage the combination of the height of the plinth, land slope and dimension of the house will require an additional skin of bricks to be used for plinth construction, increasing the costs of the foundations. Under such conditions it may be more economical to consider another method of founding, as discussed in the following subparagraph.

9.4.2 Founding on an Engineered Fill

The site shall be cut and filled (terraced) with engineered fill to receive a slab-on-the-ground foundation or strip footing. The fill shall continue past the edge of the foundation wall/edge beam by at least 1000mm and have a batter of not more than 1(V) : 2(H). The interior of the slab shall be founded on natural soil or engineered fill and the edge beam or strip footing shall be founded on natural soil or engineered fill. If the interior of the slab or the footing are placed on natural soil, the slab shall be fabric reinforced and the strip footing steel reinforced.

9.5 Geotechnical Zone V

The zone is classed as P(Slope/Rock outcrops). The slope of the land exceeds 10% and large, very prominent rock outcrops are present. Surface deposits are typical coarse colluvium consisting of cobbles and boulders of quartzite. Due to these conditions the estimation of soil settlement is meaningless. It is possible to engineer structural and geotechnical designs suitable for conditions like these. However, such designs are costly and only suitable for high cost exclusive residential development, usually individual houses. It is therefore recommended that this area be set aside as public open space.

10 DRAINAGE

The water courses on site are contained in narrow and well-defined gullies of such extent that they do not influence the various geotechnical site class designations. They are therefore not zoned separately. However, the presence of these water courses must be taken into account and infrastructure established only in a safe distance from these features.

The slope of less than 2% in certain areas of the land is regarded as marginal and may result in problems with the design of stormwater and sewerage disposal systems depending on dissipation by gravity.

11 SPECIAL PRECAUTIONARY MEASURES

No extraordinary features requiring special precautionary measures to decrease the impact thereof are present on site.

12 CONCLUSIONS

Excluding Geotechnical Zone V, the property is regarded as being of intermediate suitability for residential development. Founding conditions can be defined as R and S. The factors that reduce the suitability of the land for development are :

- The presence of hard rock and very dense hardpan calcrete close to the surface. The presence thereof will result in conditions of hard excavation. On the other hand it provides conditions favouring conventional methods of founding.
- The limited slope of less than 2% in Geotechnical Zones II and IV will have a detrimental influence on the design of stormwater disposal systems and sewerage reticulation.
- Conditions of Boulder Class A excavation in Geotechnical Zone IV.
- Land slope exceeding 6% in Geotechnical Zones IV and V reduces the availability of land available for residential development and increases the costs of construction.
- The presence of waste material need to be addressed.

The conclusions as based on the site conditions are summarized in Table 6 : Influence of Constraints per Geotechnical Zoning. This classification is based on the proposals of the document *Geotechnical Site Investigations for Housing Developments (Generic Specification GFSH-2)*, issued by the National Department of Housing in September 2002.

12.1 Stratigraphy

The available information shows that the area of investigation is located on a subduction zone dating approximately 1000 million years old. The zone is located between the lithology of the Kaapvaal Craton and the Namaqua-Natal mobile belt. The remains of the original geology in the area are referred to as the Kaaien Terrane and the site is located on the Groblershoop Formation of the Brulpan Group. Bedrock on site occurs as grey brown quartzite becoming light grey quartzite of the Groblershoop Formation, Brulpan Group. Occasionally the quartzite tends to be muscovite-rich. The possibility that bedrock in western low-lying part of the site may consist of quartz-muscovite schist cannot not be excluded. However, it could not be confirmed due to the very dense, impenetrable barrier formed by the hardpan calcrete.

12.2 Soil Profile

12.2.1 Alluvium

Alluvium in the form of alluvial sand and minor deposits of river terrace gravels were encountered close to the southwestern and southeastern perimeters of the area of investigation. These deposits vary from dark brown and light red, loose, fine sand to medium dense, gravels of quartz and lesser content of banded ironstone contained in a sandy matrix. The presence of banded ironstone shows that these deposits can by associated with an earlier course of the Orange River. The thickness of the horizon varied between 200mm and 300mm in the test pits.

TABLE 6 : INFLUENCE OF CONSTRAINTS PER GEOTECHNICAL ZONING

	KEY TO CLASSIFICATION			CLASSIFICATION PER GEOTECHNICAL ZONE				
CONSTRAINT	MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)	I	II	III	IV	V
Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750mm in thickness	Any collapsible horizon or consecutive horizons with a depth of more than 750mm in thickness	A least favourable situation for this constraint does not occur					
Seepage	Permanent or perched water table more than 1,5m below ground surface	Permanent or perched water table less than 1,5m below ground surface	Swamps and marshes					
Active soil	Low soil heave potential anticipated	Moderate soil heave potential anticipated	High soil heave potential anticipated					
Highly compressible soil	Low soil compressibility anticipated	Moderate soil compressibility anticipated	High soil compressibility anticipated					
Erodibility of Soil	Low	Intermediate	High					
Difficulty of excavation to 1,5m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10% and 40% of the total volume	Rock or hardpan pedocretes more than 40% of the total volume					
Undermined ground	Undermining at a depth greater than 240m below surface, except where total extraction mining has not occurred	Old undermined areas to a depth of 90m to 240m below surface where stope closure has ceased	Mining within less than 90m to 240m of surface or where total extraction mining has taken place					
Dolomite and limestone stability	Possibly stable. Areas of dolomite overlain by Karroo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated Inherent Risk Class 1	Potentially characterised by instability. Anticipated Inherent Risk Classes 2 to 5	Known sinkholes and dolines Anticipated Inherent Risk Classes 6 to 8					
Steep slopes*	Between 2° and 6° in all regions	Slopes between 6° and 18° and less than 2° (Natal and Western Cape) Slopes between 6° and12° and less than 2° (all other regions)	More than 18° (Natal and Western Cape) More than 12° (all other regions)					
Areas of unstable natural slopes*	Low risk	Intermediate risk	High risk (Especially in areas subject to seismic activity)					
Areas subject to seismic activity	10% probability of an event less than $100cms^{-2}$ within 50 years	Mining induced seismic activity more than $100cms^{-2}$	Natural seismic activity more than $100cms^{-2}$					
Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas with a known drainage channel or floodplain					

12.2.2 Colluvium

Distinction must be made between two types of colluvial deposits :

12.2.2(i) Gravelly Colluvium

Gravelly colluvium as surface deposit was found in the intermediate land between the low-lying area close to the water courses and the quartzite ridge. The colluvium is a homogenous material, consisting light brown fine sand and clasts of gravels and cobbles of quartz and some calcrete. The consistency of the gravelly colluvium is medium dense and the soil matrix intact. The horizon of colluvium was between 100mm and 200mm thick in the test pits.

12.2.2(ii) Coarse Colluvium

The coarse colluvium is present in the high-lying land on site, associated with transported material originating from bedrock of quartzite. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of light red brown fine sand. The consistency of the coarse colluvium varies from medium dense to very dense. The horizon of colluvium was between 300mm and 700mm thick in the test pits.

12.2.3 Residual Quartzite

On site residual quartzite was encountered as surface material or underlying the gravelly colluvium. It consists of cobbles and boulders of quartzite with diameter larger than 300mm contained a matrix of dirty white, calcareous cemented sand. The soil matrix is very dense. The horizon of residual quartzite extended to a depth of 600mm in the test pits.

12.2.2 Mokalanen Formation

Calcrete was encountered as the dominant lithic material on site, in virtually a continuous cover over the quartzite, with the latter outcropping only in the high-lying ridge of outcrops. The calcrete is present as very dense hardpan calcrete. The calcrete is present as outcrops ; or underlies the transported materials, occurring from depths between 100mm and 300mm minimum, extending to 100mm to 600mm maximum, at which stage refusal of excavation occurred or bedrock of quartzite was encountered. It is described as dirty white to dirty light yellow white, very fine grained, very dense calcrete. Some fine sand may occasionally be contained in voids in the matrix of the calcrete.

12.3 Groundwater

12.3.1 Perched Water

Perched groundwater was not encountered in any of the test pits excavated for this investigation. It is anticipated that perched water will generally not prove problematic on the site.

12.3.2 Permanent Groundwater

The probability for drilling successfully for water in the area is between 40% and 60%, and the probability that such a borehole will yield more than 2l/s is between 10% and 20%. Groundwater is expected to occur at depths less than 15 meters in compact, argillaceous strata.

12.4 Conditions of Excavation

On average over the entire site bedrock or refusal of excavation on very dense hardpan calcrete, boulders or bedrock quartzite was encountered at depths between 100mm minimum and 800mm maximum, averaging 410mm deep. The implication of this is that should trenches require excavated depths to 1000mm, 59% of the excavation may be classified as hard, requiring drilling and blasting. Should the required depth of excavation increase to 1500mm, 73% of the excavation may be classified as hard.

Irrespective of which method of excavation is considered, the most important issue is that across the entire site the depth to bedrock and hardpan calcrete that can be regarded as hard rock excavation is highly variable as follows :

12.4.1 Geotechnical Zones I and II

These zones are classified as R. The average depth to bedrock or very dense pedocrete is 170mm. Refusal of excavation occurred at an average depth of 310mm. The implication of this is that should trenches require excavated depths to 1000mm, 69% of the excavation may be classified as hard, requiring drilling and blasting. Should the required depth of excavation increase to 1500mm, 79% of the excavation may be classified as hard.

12.4.2 Geotechnical Zone III and IV

These zones are classified as S. Differentiation must be made between conditions of Boulder Class A excavation and hard rock excavation.

12.4.2(i) Boulder Class A Excavation

Conditions of Boulder Class A excavation are limited to the slopes and the quartzite ridge on the northeastern boundary of the area of investigation. Such conditions were encountered in TP's 16, 20, 21, 26, 30 and 33. It was possible to penetrate between 300mm and 800mm into the boulder layers, averaging 530mm, prior to encountering hard rock excavation or very tightly packed boulders that could not be removed by the TLB. The implication of this is that should trenches require excavated depths to 1000mm, 53% of the excavation may be classified as Boulder Class A excavation. Should the required depth of excavation increase to 1500mm, 35% of the excavation may be classified as Boulder Class A excavation.

12.4.2(ii) Hard Rock Excavation

The average depth to bedrock is 520mm. Refusal of excavation occurred at an average depth of 650mm. The implication of this is that should trenches require excavated depths to 1000mm, 65% of the excavation may be classified as soft, suitable for TLB excavation. Should the required depth of excavation increase to 1500mm, 57% of the excavation may be classified as hard, requiring drilling and blasting.

12.5 Site Class Designation

It is concluded that the area is regarded as suitable for residential development as follows :

12.5.1 Geotechnical Zone I

The zone is classed as R, meaning that the proposed horizon for founding is stable and negligible soil movement is expected. The distribution thereof encompasses 65% of the proposed area for development. Slope across the land is approximately between 2% and 6%. The use of slab-on-the-ground foundations will require additional works in the form of the construction of an engineered fill or cutting to establish a level platform for construction. The more viable foundation alternative therefore remains founding by conventional strip foundations.

Geotechnical conditions related to foundation design can be regarded as favourable, but the conditions of hard rock excavation close to the surface detracts from the ease suitability of establishing services and overall the development potential is regarded as intermediate only.

12.5.2 Geotechnical Zone II

The zone is classed as R, meaning that the proposed horizon for founding is stable and

negligible soil movement is expected. The distribution thereof encompasses 4% of the proposed area for development. Slope across the land is less than 2%. Considering the limited slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or slab-on-the-ground foundations placed directly on bedrock or very dense pedocrete. The latter option is regarded as the better solution of the two alternatives.

Geotechnical conditions related to foundation design can be regarded as favourable, but the conditions of hard rock excavation close to the surface and slope less than 2% detract from the ease suitability of establishing services and overall the development potential is regarded as intermediate only.

12.5.3 Geotechnical Zone III

The zone is classed as S, meaning that the proposed horizon for founding is slightly compressible and rapid settlement less than 10mm is expected. The distribution thereof encompasses 22% of the proposed area for development. Slope across the land is between 2% and 6%. Considering the limited slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or slab-on-the-ground foundations placed directly on medium dense terrace gravels. The more viable foundation alternative therefore remains founding by conventional strip foundations.

Geotechnical conditions related to foundation design can be regarded as favourable, but the conditions of hard rock excavation close to the surface detracts from the ease suitability of establishing services and overall the development potential is regarded as intermediate only.

12.5.4 Geotechnical Zone IV

The zone is classed as S, meaning that the proposed horizon for founding is slightly compressible and rapid settlement less than 10mm is expected. The distribution thereof encompasses 7% of the proposed area for development. Slope across the land is between 6% and 10%. Considering the slope and the favourable geotechnical site classification, two foundation design alternatives are applicable to the zone, namely conventional strip foundations or landscaping by cut-to-fill operations to prepare level surfaces for slab-on-the-ground foundations. The construction of a cut-and-fill terrace and foundation design associated with such an operation shall be done according to a professional design.

Geotechnical conditions related to foundation design can be regarded as favourable, but the conditions of hard rock excavation close to the surface and slope between 6% and 10%

detract from the ease suitability of establishing services and overall the development potential is regarded as intermediate only.

12.5.5 Geotechnical Zone V

Slope across this zone exceeds 10% and the presence of outcrops of hard rock dominates the land surface. It is thus zoned as P(Slope/rock outcrops). The distribution thereof encompasses 2% of the proposed area for development. The combination of these conditions reduces the suitability of the zone for low cost and affordable housing. The area is better suited to be set aside as public open space.

12.6 Land Slope

The average slope across 87% of the land is between 2% and 6% ; over 4% it is less than 2% ; over 7% it is between 6% and 10% ; and over 2% of the land the slope exceeds 10%.

The slope of less than 2% has a detrimental influence on especially the design of a stormwater disposal system depending on gravity to dissipate of the surface water due to downpours. The land slope also affects the design of the sewerage disposal but to a lesser extent as the gradient of the pipes can be adjusted according to design requirements. The land surface of the area subject to the slope exceeding 10% is covered by rock outcrops and do not represent conditions of unstable faces subject to slip failures. However, the slope reduces the potential of the land for the development of affordable and low cost housing.

12.7 Areas Subject to Flooding

The non-perennial water courses on site are contained in well-defined, narrow gullies and may be regarded as being of lesser importance, requiring no additional precautionary measures to ensure the safety of the population against flooding.

12.8 Materials Utilization

- *Trench Backfilling* : None of the materials are suitable for selected fill or pipe bedding. With exception of the hardpan calcrete all materials can be used for normal backfill.
- *Layerworks for Paved or Segmental Block Paving* : The hardpan calcrete is of G6 quality and hence suitable for the construction of layerworks up to subbase and base course level for lightly trafficked roads.
- *Wearing Course for Gravel Roads in Urban Areas* : None of the soil materials are 100% suitable for this purpose. The use of these materials will generally result in a road surface subject to raveling and corrugations.

12.9 Other Considerations

- *Undermining* : The area is not subject to undermining.
- *Seismic Activity* : The Peak Ground Acceleration expected in 50 years is 0,05g. A low risk for the development of earth tremors therefore exist.
- *Soil Corrosivity* : The in-situ soils and pedocretes are not corrosive due to acidic properties. All soil materials can be regarded as corrosive due to high soluble salt contents.
- *Dolomite* : The area of investigation is not subject to any restrictions due to the presence of dolomite. Bedrock of dolomite does not occur in the area of investigation.

13 RECOMMENDATIONS

13.1 Foundation and Structural Design

Section 9 of this document provides guidelines for foundation and structural design. These guidelines are based strictly on the contents of SANS 10400H and the NHBRC Home Owners Manual published in 2015. It is recommended that development take place strictly according to these guidelines. More than one founding solution is applicable on the site, and the property developer can base his choice on financial constraints.

13.2 Materials Utilization

- *Trench Backfill* : With exception of the hardpan calcrete, the in-situ materials may be used for normal backfill of trenches. The hardpan calcrete shall be spoilt and not used at all for this purpose. Material for pipe bedding and selected backfill shall be obtained from commercial sources.
- *Layerworks for Paved or Segmental Block Paving* : The hardpan calcrete is of G6 quality and hence suitable for the construction of layerworks up to subbase and base course level for lightly trafficked roads. It is recommended that a centerline investigation consisting of test pitting and soil sampling be conducted to allow the consulting engineer to produce suitable pavement designs for the project.
- *Wearing Course for Gravel Roads in Urban Areas* : Material for the construction of a gravel wearing course shall be obtained from stockpiled or calcrete from a licensed borrow pit.

13.4 Conditions of Excavation

Although manual excavation is possible through the colluvium, residual soil and to some extent through the calcrete, it is considered as not an economic proposition, mostly due to the consistency and composition of the soil. Excavation through these soils shall require the use of a TLB rated at 55kW minimum, or preferably a 30 ton excavator of the very dense

pedocretes need to be removed. It is recommended that adequate provision be made for hard rock excavation.

13.5 Land Slope

The average slope across 87% of the land is between 2% and 6%, which is regarded as favourable for residential development. Over 4% it is less than 2%, which will require careful consideration of the design of wet services due to possible reduced flow rates of liquids. Over 7% of the land the slope is between 6% and 10% which will require careful consideration of the design of wet services due to possible accelerated flow rates of liquids and increase the difficulty of founding and hence increase the costs of building houses. Over 2% of the land the slope exceeds 10%. This slope is regarded as not desirable for low cost housing.

14 SOURCES OF REFERENCE

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FJ Breytenbach, Pr Eng 15 September 2020
For Cedar Land Geotechnical Consult (Pty) Ltd

GEOTECHNICAL CONDITIONS ON PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48: A REPORT FOR THE EXPANSION AND FORMALISATION OF OPWAG COMMUNITY

2020/J09/MCP_01

ADDENDUM A: TEST PIT PROFILES

TRIAL HOLE: 1

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'09,3" S 21°57'10,1" E*

Cedar Land Geotechnical Consult (Pty) Ltd
P O Box 607
Ceres
6835
Cell: 082 570 2767
Email:
cedarland.frans@breede.co.za

Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, fine, rounded *CALCRETE* nodules in a matrix of dry, light grey brown, fine sand. Pedogenic deposits.				1 Refusal of excavation at 600 mm on very dense hardpan calcrete.
0.20		Lenses (± 10 mm wide) of dirty white, very fine grained, very dense, hardpan *CALCRETE*. Joints between lenses are open, smooth and filled with light brown, fine sand. Pedogenic deposits.				
0.40			U9277	0,2-0,6	●	
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 1

FIGURE: A1

TRIAL HOLE: 2

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'07,5" S 21°57'14,9" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ▽ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 2

FIGURE: A2

TRIAL HOLE: 3

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'04,4" S 21°57'21,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Colluvium.				1 Refusal of excavation at 600 mm on tightly packed quartzite boulders.
0.20		Abundant, clast supported, angular *COBBLES* and *BOULDERS* (> 300 mm) of quartzite contained in a matrix of dirty white, calcareous and cemented sand. Overall consistency is very dense. Residual quartzite.				
0.40						
0.60						
0.80						
1.00						Water encountered Water level Bottom of hole Approximate material change Disturbed sample Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 3

FIGURE: A3

TRIAL HOLE: 4

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'12,3" S 21°57'13,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Colluvium.				1 Refusal of excavation at 800 mm on very hard rock, quartzite.
0.20		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60		Light grey brown, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Discontinuities are open, smooth and filled with light red sand.				
0.80						
1.00						Water encountered Water level Bottom of hole Approximate material change Disturbed sample Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 4

FIGURE: A4

TRIAL HOLE: 5

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'10,4" S 21°57'17,5" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
			U9278	0-0,3	●	
0.20		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⊥ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 5

FIGURE: A5

TRIAL HOLE: 6

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'08,1" S 21°57'22,8" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Colluvium.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
0.20		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 6

FIGURE: A6

TRIAL HOLE: 7

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'06,2" S 21°57'26,4" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular *COBBLES* and *BOULDERS* (> 300 mm) of quartzite contained in a matrix of dirty white, calcareous and cemented sand. Overall consistency is very dense. Residual quartzite.				1 Refusal of excavation at 600 mm on very hard rock, quartzite.
0.20						
0.40						
0.60		Light grey brown, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Discontinuities are open, smooth and filled with light red sand.				
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 7

FIGURE: A7

TRIAL HOLE: 8

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'07,5" S 21°57'14,9" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty white mottled light pink, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						Water encountered Water level Bottom of hole Approximate material change Disturbed sample Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 8

FIGURE: A8

TRIAL HOLE: 9

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'14,5" S 21°57'19,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, subrounded and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Colluvium.				1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⊥ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 9

FIGURE: A9

TRIAL HOLE: 10

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'13,1" S 21°57'22,1" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dirty yellow white, fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				1 Refusal of excavation at 100 mm on very dense hardpan calcrete.
0.20						
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 10

FIGURE: A10

TRIAL HOLE: 11

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *8/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'10,4" S 21°57'26,6" E*

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Cell: 082 570 2767
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				
		Dirty yellow white, fine grained, very dense, voided hardpan *CALCRETE* containing fine, light brown sand in the voids. Pedogenic deposits.	U9279	0-0,2	●	NOTES: 1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20						
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
Bottom of hole
--- Approximate material change
▪ Disturbed sample
■ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 8/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 11

FIGURE: A11

TRIAL HOLE: 12

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'19,3" S 21°57'18,0" E*

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Cell: 082 570 2767
Email:
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dry, dark brown, loose, intact, fine *SAND*. Alluvium.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
			U9287	0-0,3	●	
0.20						
		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 12

FIGURE: A12

TRIAL HOLE: 13

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'17,8" S 21°57'21,8" E*

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Email:
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, angular and subangular, *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 13

FIGURE: A13

TRIAL HOLE: 14

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'16,4" S 21°57'24,5" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, angular and subangular, *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 14

FIGURE: A14

TRIAL HOLE: 15

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'13,7" S 21°57'29,3" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dirty yellow white, fine grained, very dense, voided hardpan *CALCRETE* containing fine, light brown sand in the voids. Pedogenic deposits.	U9280	0-0,3	●	1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20						
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⌐ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 15

FIGURE: A15

TRIAL HOLE: 16

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'12,0" S 21°57'32,9" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, angular and subangular *COBBLES* and *BOULDERS* (300 mm - 500 mm in diameter) of quartzite in a matrix of dry, light red brown, fine sand. Overall consistency is dense. Colluvium.				1 Refusal of excavation at 700 mm on hard rock, quartzite.
0.20						
0.40						
0.60		Light yellow brown, medium jointed, fine grained, hard rock, *QUARTZITE*. Discontinuities are closed, smooth and clean.				
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 16

FIGURE: A16

TRIAL HOLE: 17

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'22,5" S 21°57'21,2" E*

Cedar Land Geotechnical Consult (Pty) Ltd
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Ceres
6835
Cell: 082 570 2767
Email:
cedarland.frans@breede.co.za

Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dry, dark brown, loose, intact, fine *SAND* and matrix supported, medium coarse, angular gravels of calcrete. Alluvium.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
0.20						
		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposit.				
0.40						
0.60						
0.80						
1.00						Water encountered Water level Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 17

FIGURE: A17

TRIAL HOLE: 18

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'21,4" S 21°57'25,8" E*

Cedar Land Geotechnical Consult (Pty) Ltd
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Email:
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, angular and subangular, *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposit.	U9288	0,1-0,3	●	
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⌐ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 18

FIGURE: A18

TRIAL HOLE: 19

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'20,5" S 21°57'30,0" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse, angular and subangular, *GRAVELS* of quartz in a matrix of dry, light brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposit.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 19

FIGURE: A19

TRIAL HOLE: 20

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'18,2" S 21°57'33,9" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular and subangular *COBBLES* and *BOULDERS* (< 500 mm in diameter) of quartzite in a matrix of dry, light red brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 800 mm on very hard rock, quartzite.
0.20						
0.40						
0.60						
0.80		Light blue grey, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Joints are closed, smooth and clean.				
1.00						
1.20						

Water encountered
Water level
Bottom of hole
Approximate material change
Disturbed sample
Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 20

FIGURE: A20

TRIAL HOLE: 21

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'16,4" S 21°57'37,2" E*

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Email:
cedarland.frans@breede.co.za

Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular and subangular *COBBLES* and *BOULDERS* (< 500 mm in diameter) of quartzite in a matrix of dry, light red brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 500 mm on very hard rock, quartzite.
0.20			U9289	0-0,4	●	
0.40		Light blue grey, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Joints are closed, smooth and clean.				
0.60						
0.80						
1.00						
1.20						

Water encountered
Water level
Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 21

FIGURE: A21

TRIAL HOLE: 22

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'25,7" S 21°57'23,0" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse angular and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE.* Pedogenic deposits.	U9290	0,1-0,3	●	
0.40						
0.60						
0.80						
1.00						
1.20						

Water encountered
Water level
Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 22

FIGURE: A22

TRIAL HOLE: 23

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'24,0" S 21°57'27,8" E*

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Email:
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse angular and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 23

FIGURE: A23

TRIAL HOLE: 24

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'24,1" S 21°57'32,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse angular and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 300 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 24

FIGURE: A24

TRIAL HOLE: 25

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'21,9" S 21°57'36,4" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse angular and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 200 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⌐ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 25

FIGURE: A25

TRIAL HOLE: 26

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'19,3" S 21°57'36,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular *COBBLES* and *BOULDERS* (< 500 mm in diameter) of quartzite contained in a matrix of dry, light red brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 800 mm on very hard rock, quartzite.
0.20						
0.40						
0.60						
0.80		Light blue grey, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Joints are closed, smooth and clean.				
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 26

FIGURE: A26

TRIAL HOLE: 27

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'29,4" S 21°57'25,4" E*

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Cell: 082 570 2767
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, medium coarse angular and subangular *GRAVELS* of quartz in a matrix of dry, light brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						Water encountered Water level Bottom of hole Approximate material change Disturbed sample Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 27

FIGURE: A27

TRIAL HOLE: 28

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'27,9" S 21°57'29,7" E*

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6835
Cell: 082 570 2767
Email:
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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dry, light red brown, loose, fine *SAND*. Alluvium.				1 Refusal of excavation at 500 mm on very dense hardpan calcrete.
0.20			U9291	0-0,5	●	
		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						
1.20						

▽ Water encountered
▼ Water level
⌐ Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 28

FIGURE: A28

TRIAL HOLE: 29

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'25,6" S 21°57'35,8" E*

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cedarland.frans@breede.co.za

Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular and subangular *COBBLES* of quartzite in a matrix of dry, light red brown fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 500 mm on very hard rock, quartzite.
0.40		Light blue grey, medium jointed, fine grained, unweathered, very hard rock, *QUARTZITE*. Joints are closed, smooth and clean.				
0.60						
0.80						
1.00						
1.20						

Water encountered
Water level
Bottom of hole
--- Approximate material change
• Disturbed sample
▪ Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 29

FIGURE: A29

TRIAL HOLE: 30

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'23,5" S 21°57'37,3" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Abundant, clast supported, angular and subangular *COBBLES* and *BOULDERS* (< 500 mm in diameter) of quartzite in a matrix of dry, light red brown, fine sand. Overall consistency is medium dense. Colluvium.				1 Refusal of excavation at 600 mm on hard rock, quartzite.
0.20						
0.40						
0.60		Light grey, very closely jointed, fine grained, slightly weathered, hard rock, micaceous *QUARTZITE*. Joints are closed, smooth and clean.				
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 30

FIGURE: A30

TRIAL HOLE: 31

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'32,4" S 21°57'27,7" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dry, light red brown, medium dense, intact, fine *SAND* and matrix supported, subrounded, medium coarse gravels of quartz and banded ironstone. Terrace gravels.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
0.20						
		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⊥ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 31

FIGURE: A31

TRIAL HOLE: 32

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'31,2" S 21°57'31,6" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES:
		Dry, light red brown, medium dense, intact, fine *SAND* and matrix supported, subrounded, medium coarse gravels of quartz and banded ironstone. Terrace gravels.				1 Refusal of excavation at 400 mm on very dense hardpan calcrete.
0.20		Dirty white stained light yellow, very fine grained, very dense, hardpan *CALCRETE*. Pedogenic deposits.				
0.40						
0.60						
0.80						
1.00						▽ Water encountered ▼ Water level ⌐ Bottom of hole --- Approximate material change • Disturbed sample ▪ Undisturbed sample
1.20						

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 32

FIGURE: A32

TRIAL HOLE: 33

PROJECT: *EXPANSION AND FORMALISATION OF THE OPWAG COMMUNITY*

LOGGED BY: *FJB*

SITE: *PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48*

DATE LOGGED: *9/7/2020*

CLIENT: *!KHEIS MUNICIPALITY*

LOCATION: *28°50'29,6" S 21°57'36,0" E*

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Depth (m)	Legend	PROFILE	SAMPLE Number	SAMPLE Type	SAMPLE Symbol	Remarks
0.00		Ground Surface				NOTES: 1 Refusal of excavation at 400 mm on hard rock, quartzite.
		Abundant, clast supported, angular and subangular *COBBLES* and *BOULDERS* (< 500 mm in diameter) of quartzite in a matrix of dry, light red brown, fine sand. Overall consistency is medium dense. Colluvium.				
0.20			U9292	0-0,4	●	
		Light grey, very closely jointed, fine grained, slightly weathered, hard rock, micaceous *QUARTZITE*. Joints are closed, smooth and clean.				
0.40						
0.60						
0.80						
1.00						
1.20						

Water encountered
Water level
Bottom of hole
Approximate material change
Disturbed sample
Undisturbed sample

Contractor: ALS Plant Hire
Date Drilled: 9/7/2020
Machine: Bell 315SK

Hole Diameter: 600 mm
Water Depth:
Sheet: 1 of 1

SOIL PROFILE: TEST PIT 33

FIGURE: A33

GEOTECHNICAL CONDITIONS ON PLOT 2642 BOEGOEBERG SETTLEMENT AND PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT 48: A REPORT FOR THE EXPANSION AND FORMALISATION OF OPWAG COMMUNITY

2020/J09/MCP_01

ADDENDUM B: RESULTS OF MATERIALS TESTING

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Job Request No.: RU3525
Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
Ceres
6835

Attention : Frans Breytenbach

Date Reported : 2020-07-17

Project : Opwag Infrastructure Upgrade

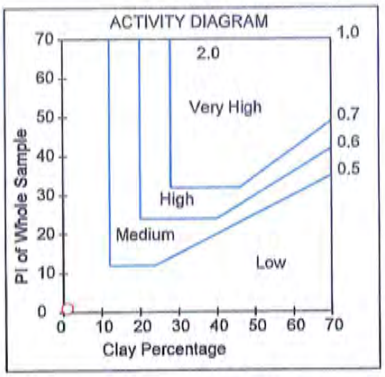
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

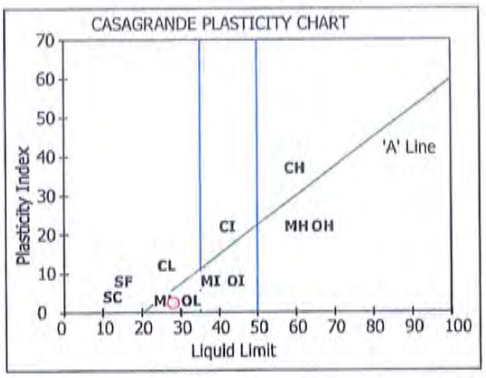
Sample No.	: U9277
Position	: TP 1
Layer Type	: 200-600mm
Sample Colour	: Light Brown Gravel
Sample Type	: Mix Calcrete+Quartz

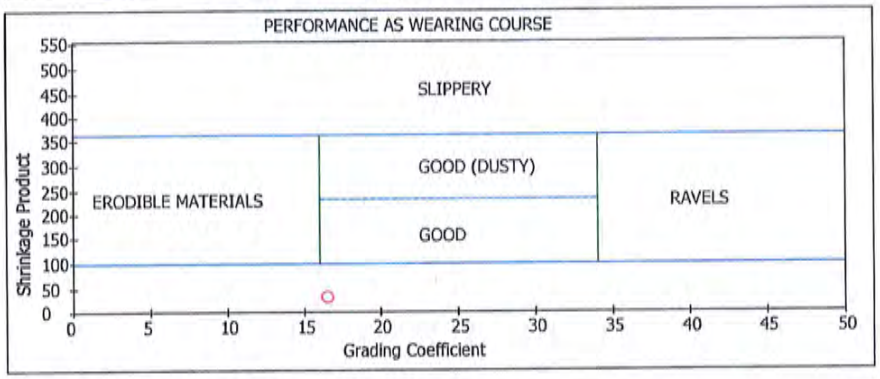
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	97
37.50	89
28.00	76
20.00	67
14.00	57
5.000	33
2.000	26
0.425	22
0.250	20
0.150	16
0.075	11
0.060	3,1
0.050	2,9
0.020	1,8
0.005	1,1
0.002	0,8

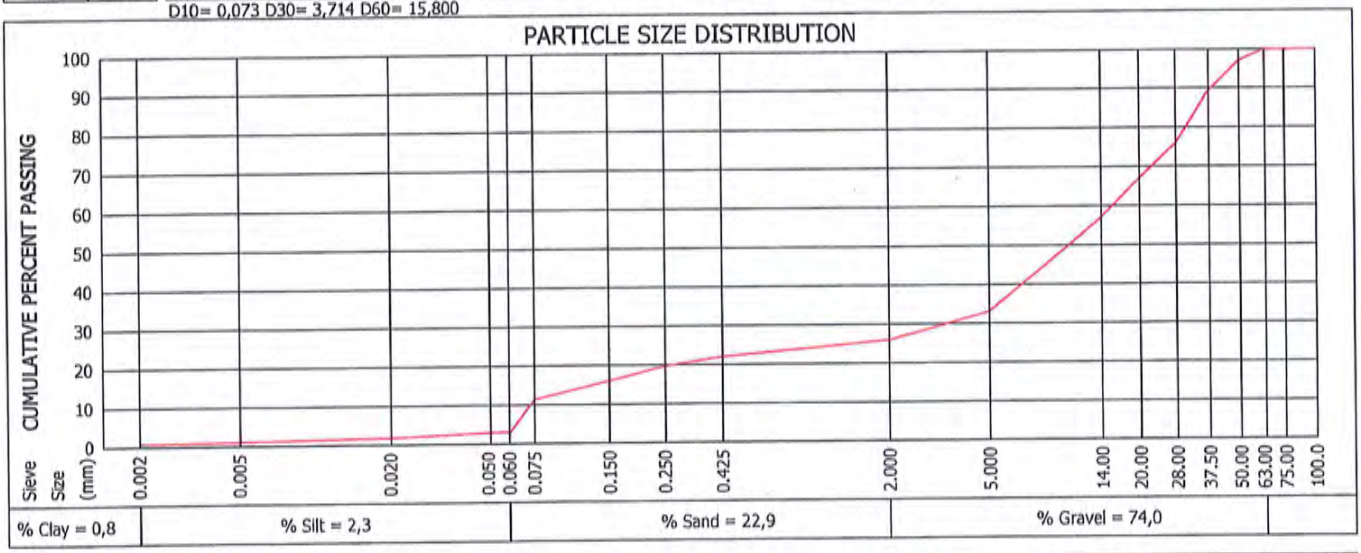
Soil Mortar	2.000 - 0.425	18
	0.425 - 0.250	7
	0.250 - 0.150	14
	0.150 - 0.075	20
	< 0.075	42
Effective Size		0,073
Uniformity Coefficient		216,4
Curvature Coefficient		12,0
Oversize Index		8,0
Shrinkage Product		33,0
Grading Coefficient		16,5
Grading Modulus		2,40
Atterberg Limits	Liquid Limit	28
	Plasticity Index	2,0
	Linear Shrinkage	1,5
	PI < 0.075	
Unified Soil Classification		GW-GM
US Highway Classification		A-1-a(0)

D10= 0,073 D30= 3,714 D60= 15,800









% Clay = 0,8	% Silt = 2,3	% Sand = 22,9	% Gravel = 74,0

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Report compiled by : Juraine Okkies

sanas Testing Laboratory
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Date Reported : 2020-07-24

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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

Determination of the California Bearing Ratio Test Report SANS 3001 - GR1 / GR2 / GR10 / GR20 / GR30 / GR40 / PR5

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.	U9277			
HOLE NO./ Km / CHAINAGE	TP1			
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2	S28° 50' 09,3" E21° 57' 10,1"			
LAYER TESTED/SAMPLED	200-600mm			
SAMPLE DEPTH	200-600mm			
DATE SAMPLED	2020-07-09			
COLOUR OF SAMPLE	Light Brown			
TYPE OF SAMPLE	Mix Calcretestone			

SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)

SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm				
	75.0 mm				
	63.0 mm	100			
	50.0 mm	97			
	37.5 mm	89			
	28.0 mm	76			
	20.0 mm	67			
	14.0 mm	57			
	5.0 mm	33			
	2.0 mm	26			
	0.425 mm	22			
	0.075 mm	11			
GM %		2,4			

SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)

COARSE SAND	2.000 - 0.425	18			
COARSE FINE SAND	0.425 - 0.250	7			
MEDIUM FINE SAND	0.250 - 0.150	14			
FINE FINE SAND	0.150 - 0.075	20			
SILT CLAY	0.075	42			

ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)

ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	28			
	PLASTICITY INDEX	2.4			
	LINEAR SHRINKAGE	1.5			
CLASSIFICATION	H.R.B.	A-1-a(0)			
	COLTO	G6			
	TRH 14	G7			

CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)

SANS GR30 MAX. DRY DENSITY	OMC %	10,9			
	MDD (kg/m³)	1906			
	COMP MC %	10,8			
SWELL % @	MOD | NRB | PRO	0,01 | 0,03 | 0,05			
C.B.R. SANS GR40	100 %	75			
	98 %	50			
	97 %	41			
	95 %	27			
	93 %	18			
	90 %	10			

STABILISER IN LAB	Not Applicable			
TEST TYPE	CBR			
SAMPLING METHOD	TMH 5			
WEATHER WHEN SAMPLED	Cold			

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

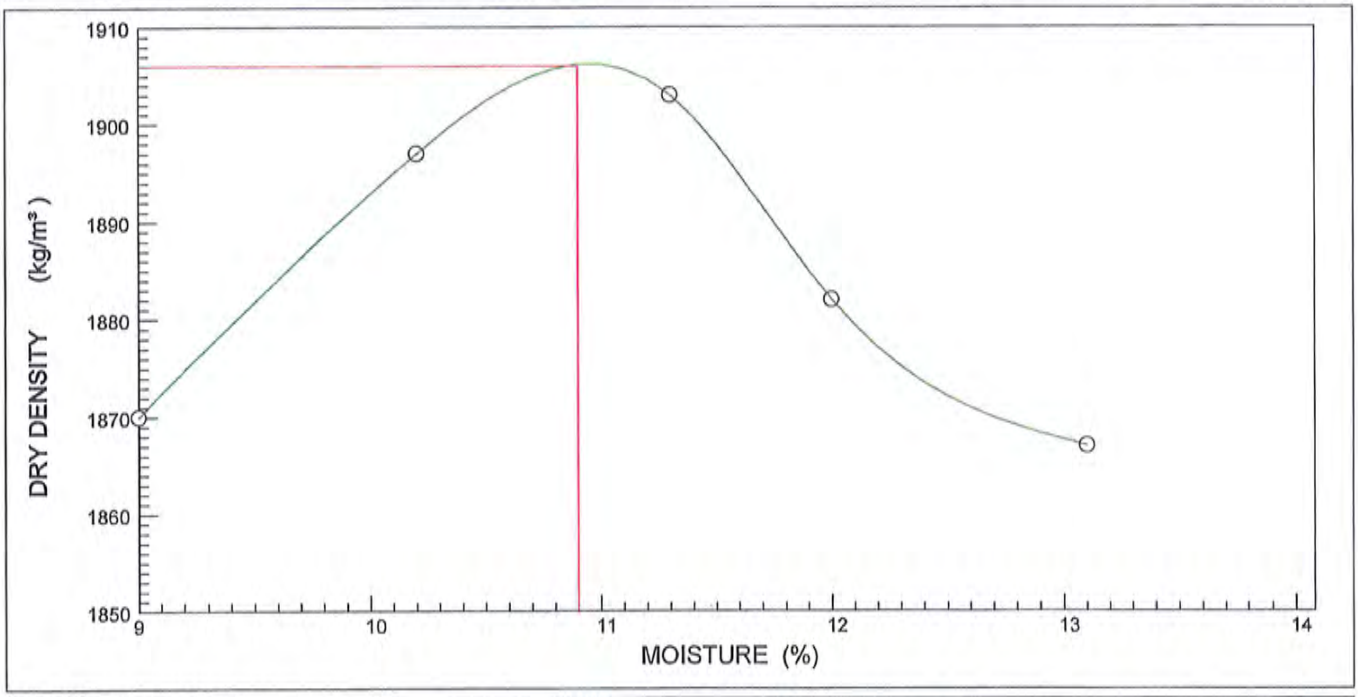
Determination Maximum Dry Density & Optimum Moisture Content Test Report

SANS 3001 - GR20/GR30

SAMPLE NO.	U9277
CONTAINER FOR SAMPLING	Black Bags
SIZE / APPROX. MASS OF SAMPLE	98kg
MOISTURE CONDITION OF SAMPLE	Moist
LAYER TESTED / SAMPLED FROM	200-600mm
MATERIAL DESCRIPTION	Mix Calcrete
HOLE NO./ km / CHAINAGE	TP1
ROAD NO.	Not Specified
DATE RECEIVED	2020-07-09
DATE SAMPLED	2020-07-09
CLIENT MARKING	S28° 50' 09,3"; E21° 57' 10,1"
COLOUR AND TYPE	Light Brown Gravel

POINT NO.	1	2	3	4	5			
DRY DENSITY (kg/m³)	1870	1897	1903	1882	1867			
MOISTURE (%)	9,0	10,2	11,3	12,0	13,1			

MAXIMUM DRY DENSITY (kg/m³) : 1906	OPTIMUM MOISTURE CONTENT (%) : 10,9



Deviation from Test Method :
Remarks and Notes :

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Date Reported : 2020-08-05

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Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

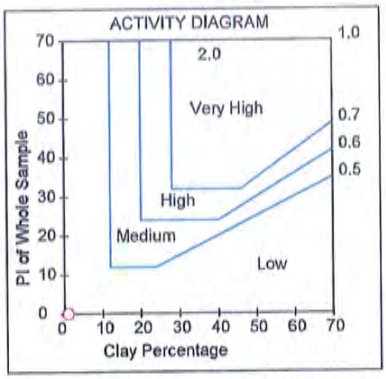
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

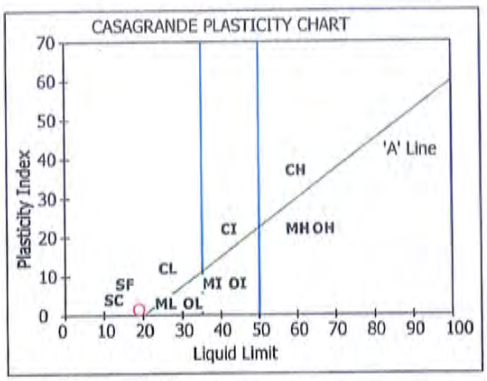
Sample No.	: U9278
Position	: TP 5
Layer Type	: 0-300mm
Sample Colour	: Dark Brown Gravel
Sample Type	: Mix Calcerete+Quartz

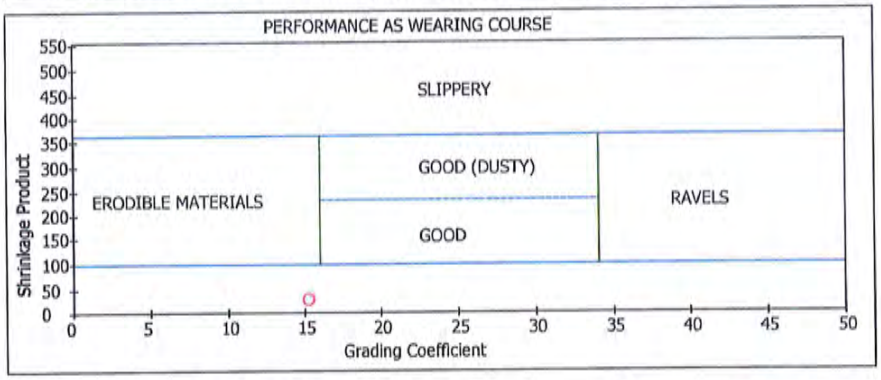
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	88
28.00	78
20.00	66
14.00	55
5.000	31
2.000	29
0.425	27
0.250	27
0.150	22
0.075	14
0.060	4,5
0.050	4,2
0.020	2,7
0.005	1,6
0.002	1,1

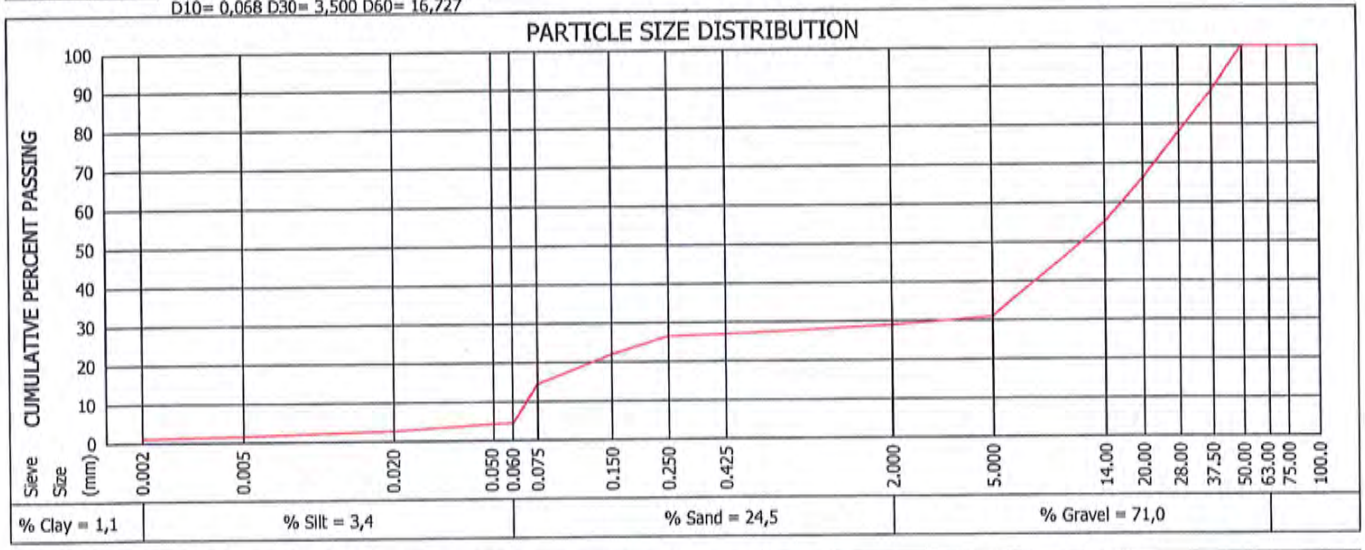
Soil Mortar	2.000 - 0.425	4
	0.425 - 0.250	3
	0.250 - 0.150	16
	0.150 - 0.075	28
	< 0.075	49
Effective Size		0,068
Uniformity Coefficient		246,0
Curvature Coefficient		10,8
Oversize Index		12,0
Shrinkage Product		27,0
Grading Coefficient		15,2
Grading Modulus		2,30
Atterberg Limits	Liquid Limit	19
	Plasticity Index	2,0
	Linear Shrinkage	1,0
	PI < 0.075	
Unified Soil Classification		GC
US Highway Classification		A-1-a(0)

D10= 0,068 D30= 3,500 D60= 16,727









Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 8.49 [SANS 5854] & Conductivity = 0.10 S/m [SANS 6240]

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
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Date Reported : 2020-08-06

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Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

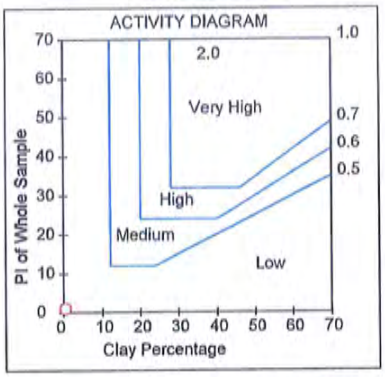
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

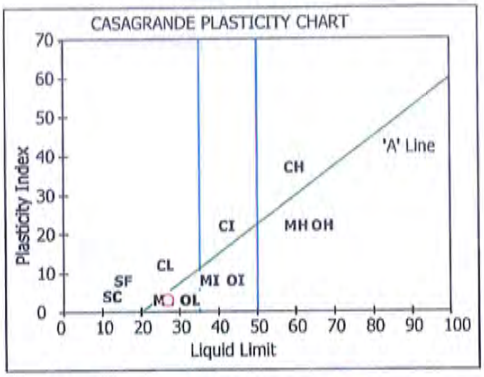
Sample No.	: U9279
Position	: TP 11
Layer Type	: 0-200mm
Sample Colour	: Brown Gravel
Sample Type	: Mix Calcretestone

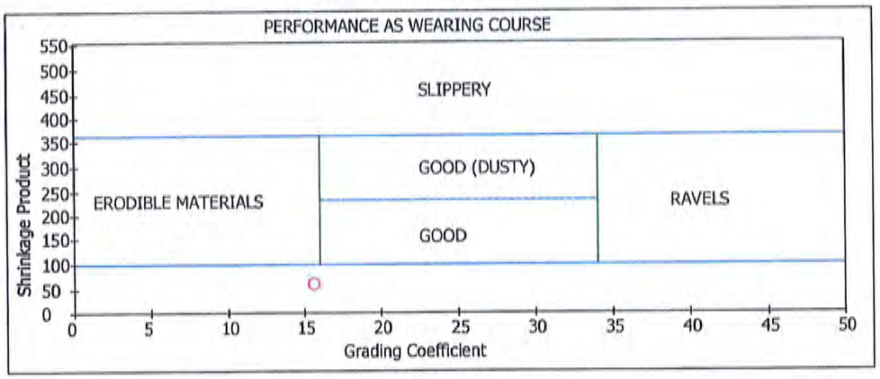
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	85
28.00	74
20.00	62
14.00	56
5.000	39
2.000	34
0.425	30
0.250	28
0.150	21
0.075	13
0.060	3,9
0.050	3,5
0.020	2,2
0.005	1,8
0.002	0,6

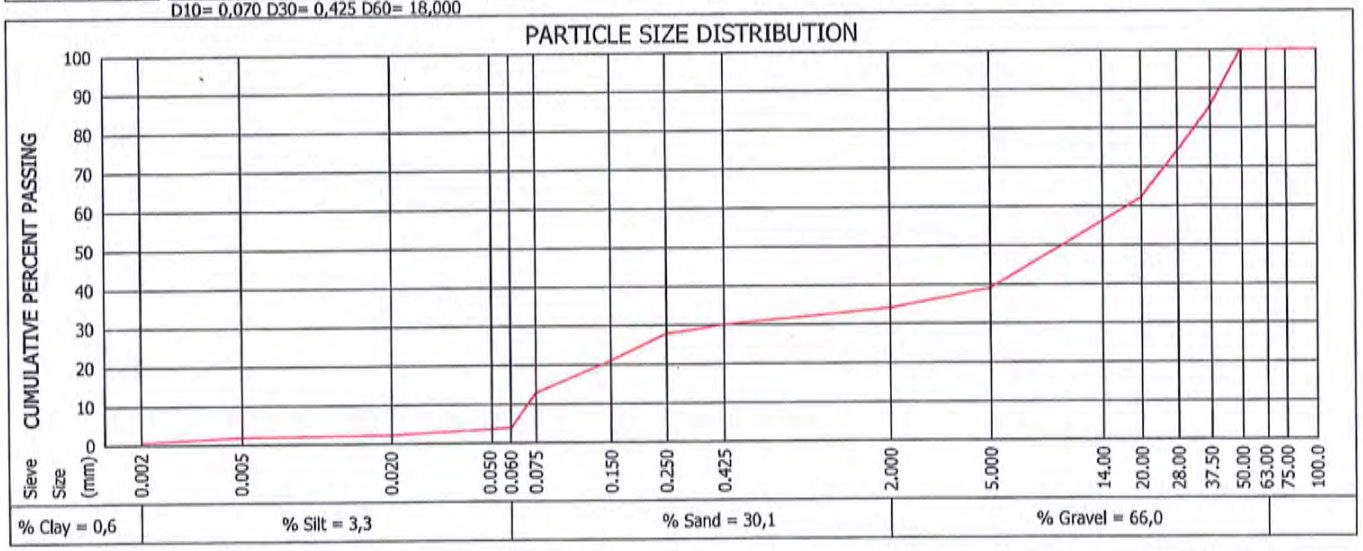
Soil Mortar	2.000 - 0.425	12
	0.425 - 0.250	6
	0.250 - 0.150	20
	0.150 - 0.075	24
	< 0.075	39
Effective Size		0,070
Uniformity Coefficient		257,1
Curvature Coefficient		0,1
Oversize Index		15,0
Shrinkage Product		60,0
Grading Coefficient		15,6
Grading Modulus		2,20
Atterberg Limits	Liquid Limit	27
	Plasticity Index	3,0
	Linear Shrinkage	2,0
	PI < 0.075	
Unified Soil Classification		GM
US Highway Classification		A-1-a(0)

D10= 0,070 D30= 0,425 D60= 18,000









% Clay = 0,6	% Silt = 3,3	% Sand = 30,1	% Gravel = 66,0

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Date Reported : 2020-08-12

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Project : Opwag Infrastructure Upgrade

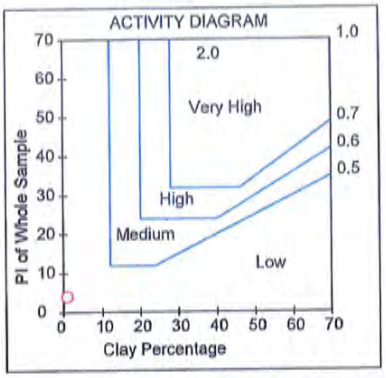
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

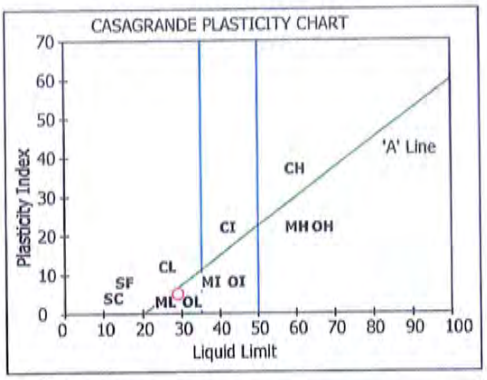
Sample No.	: U9287
Position	: TP 12
Layer Type	: 0-300mm
Sample Colour	: Orange Brown Sand
Sample Type	: Mix Quartzstone

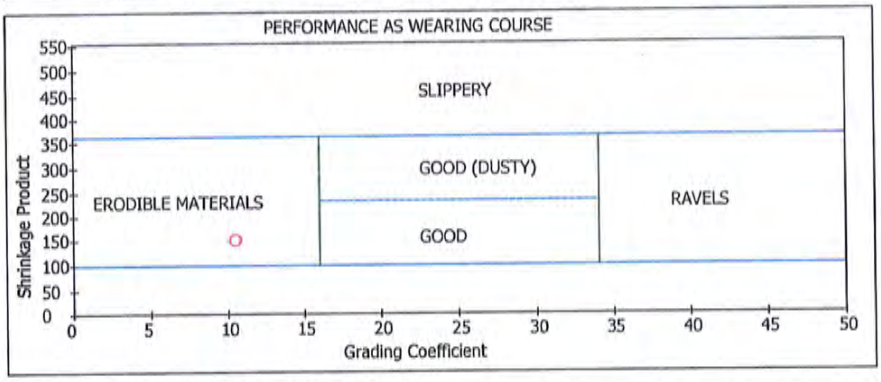
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	100
28.00	100
20.00	100
14.00	99
5.000	95
2.000	89
0.425	77
0.250	71
0.150	57
0.075	36
0.060	9,3
0.050	8,2
0.020	5,4
0.005	3,4
0.002	1,2

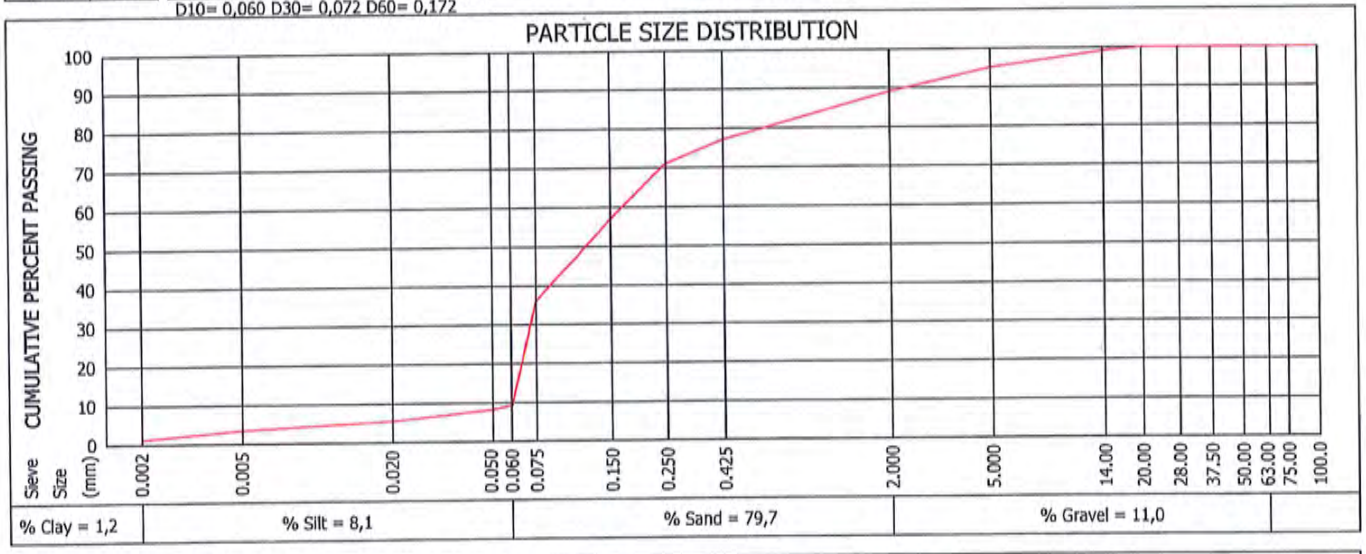
Soil Mortar	2.000 - 0.425	14
	0.425 - 0.250	7
	0.250 - 0.150	16
	0.150 - 0.075	24
	< 0.075	40
Effective Size		0,060
Uniformity Coefficient		2,9
Curvature Coefficient		0,5
Oversize Index		0,0
Shrinkage Product		154,0
Grading Coefficient		10,4
Grading Modulus		1,00
Atterberg Limits	Liquid Limit	29
	Plasticity Index	5
	Linear Shrinkage	2.0
	PI < 0.075	
Unified Soil Classification		SM
US Highway Classification		A-4(0)

D10= 0,060 D30= 0,072 D60= 0,172









% Clay = 1,2	% Silt = 8,1	% Sand = 79,7	% Gravel = 11,0

Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 7.75 [SANS 5854] & Conductivity = 0.06 S/m [SANS 6240]

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Job Request No.: RU3525

Date Reported : 2020-07-17

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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

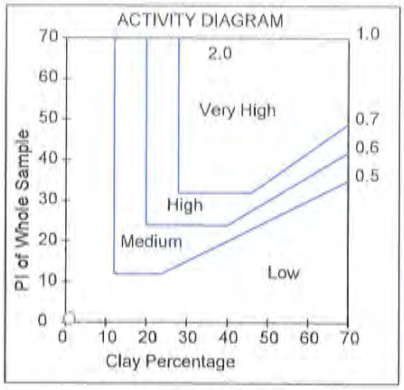
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

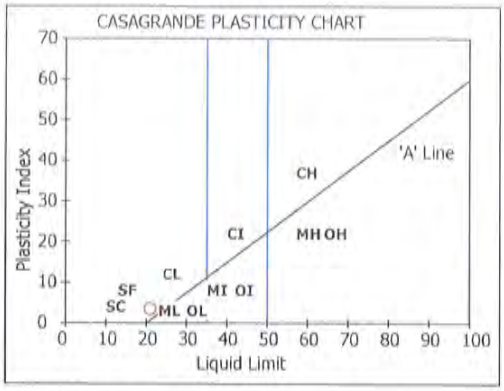
Sample No.	: U9280
Position	: TP 15
Layer Type	: 0-300mm
Sample Colour	: Brown Gravel
Sample Type	: Mix Calcretestone

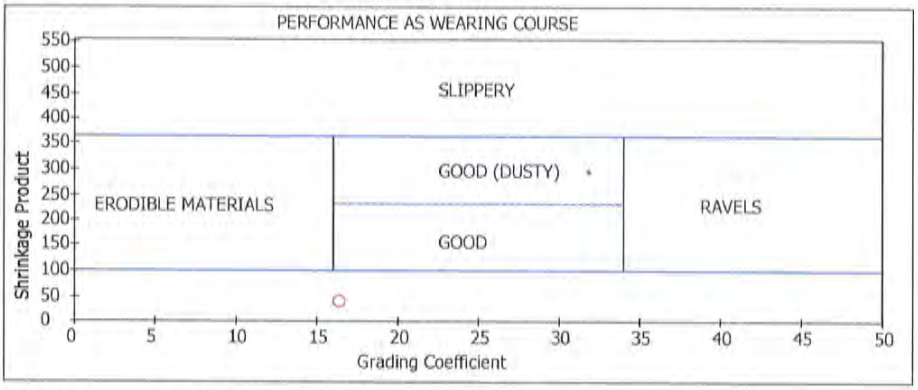
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	98
50.00	96
37.50	86
28.00	76
20.00	65
14.00	57
5.000	39
2.000	34
0.425	28
0.250	26
0.150	19
0.075	11
0.060	3,5
0.050	3,3
0.020	2,1
0.005	1,4
0.002	0,8

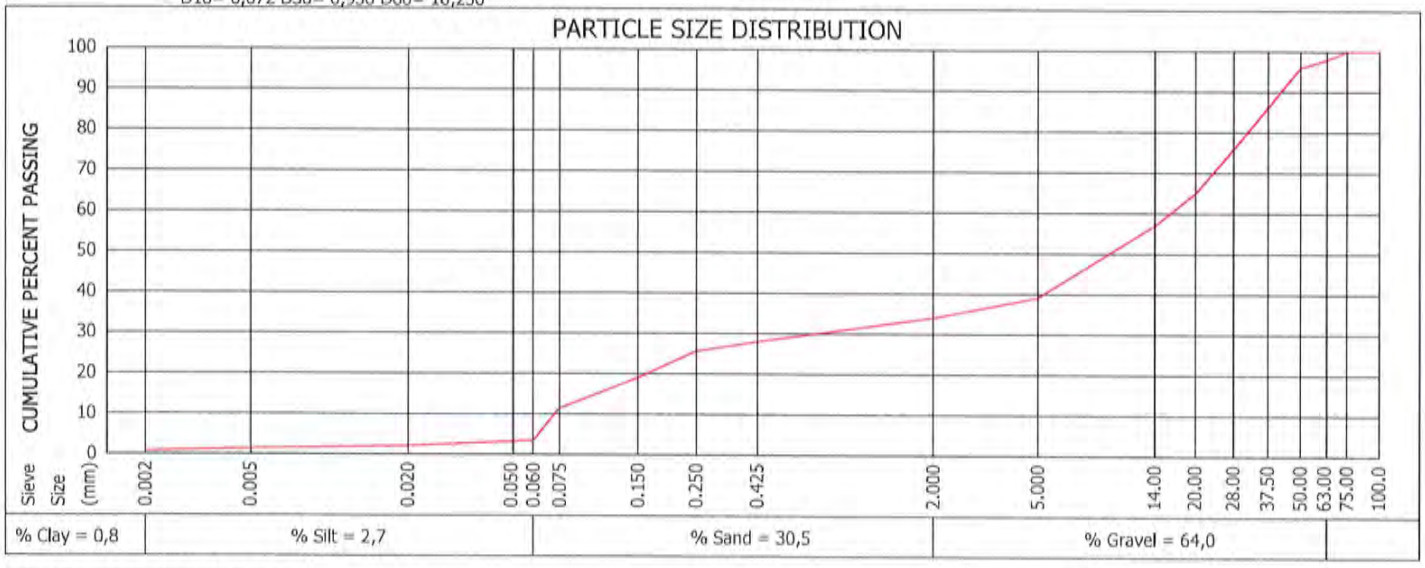
Soil Mortar	2.000 - 0.425	16
	0.425 - 0.250	8
	0.250 - 0.150	20
	0.150 - 0.075	24
	< 0.075	33
Effective Size		0,072
Uniformity Coefficient		225,7
Curvature Coefficient		0,8
Oversize Index		10,0
Shrinkage Product		42,0
Grading Coefficient		16,4
Grading Modulus		2,30
Atterberg Limits	Liquid Limit	21
	Plasticity Index	3.0
	Linear Shrinkage	1.5
	PI < 0.075	
Unified Soil Classification		GW-GC
US Highway Classification		A-1-a(0)

D10= 0,072 D30= 0,950 D60= 16,250









% Clay = 0,8	% Silt = 2,7	% Sand = 30,5	% Gravel = 64,0

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Report compiled by : Juraine Okkies

sanas Testing Laboratory
Accreditation No. T0296
Prog.ver 10.7 (2019/11/07)

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Job Request No.: RU3525

Date Reported : 2020-07-24

Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

Determination of the California Bearing Ratio Test Report SANS 3001 - GR1 / GR2 / GR10 / GR20 / GR30 / GR40 / PR5

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.	U9280			
HOLE NO./ Km / CHAINAGE	TP15			
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2	S28° 50' 13,7" E21° 57' 29,3"			
LAYER TESTED/SAMPLED	0-300mm			
SAMPLE DEPTH	0-300mm			
DATE SAMPLED	2020-07-08			
COLOUR OF SAMPLE	Brown			
TYPE OF SAMPLE	Mix Calcretestone			

SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)

SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm				
	75.0 mm	100			
	63.0 mm	98			
	50.0 mm	96			
	37.5 mm	86			
	28.0 mm	76			
	20.0 mm	65			
	14.0 mm	57			
	5.0 mm	39			
	2.0 mm	34			
	0.425 mm	28			
	0.075 mm	11			
GM %		2,3			

SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)

COARSE SAND	2.000 - 0.425	16			
COARSE FINE SAND	0.425 - 0.250	8			
MEDIUM FINE SAND	0.250 - 0.150	20			
FINE FINE SAND	0.150 - 0.075	24			
SILT CLAY	0.075	33			

ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)

ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	21			
	PLASTICITY INDEX	3,3			
	LINEAR SHRINKAGE	1,5			
CLASSIFICATION	H.R.B.	A-1-a(0)			
	COLTO	G6			
	TRH 14	G6			

CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)

SANS GR30 MAX. DRY DENSITY	OMC %	7,4			
	MDD (kg/m³)	1895			
	COMP MC %	7,2			
SWELL % @	MOD | NRB | PRO	0,00 | 0,02 | 0,04			
C.B.R. SANS GR40	100 %	103			
	98 %	72			
	97 %	61			
	95 %	43			
	93 %	30			
	90 %	18			

STABILISER IN LAB	Not Applicable			
TEST TYPE	CBR			
SAMPLING METHOD	TMH 5			
WEATHER WHEN SAMPLED	Cold			

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
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Report compiled by : Juraine Okkies

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Job Request No.: RU3525

Date Reported : 2020-07-17

Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

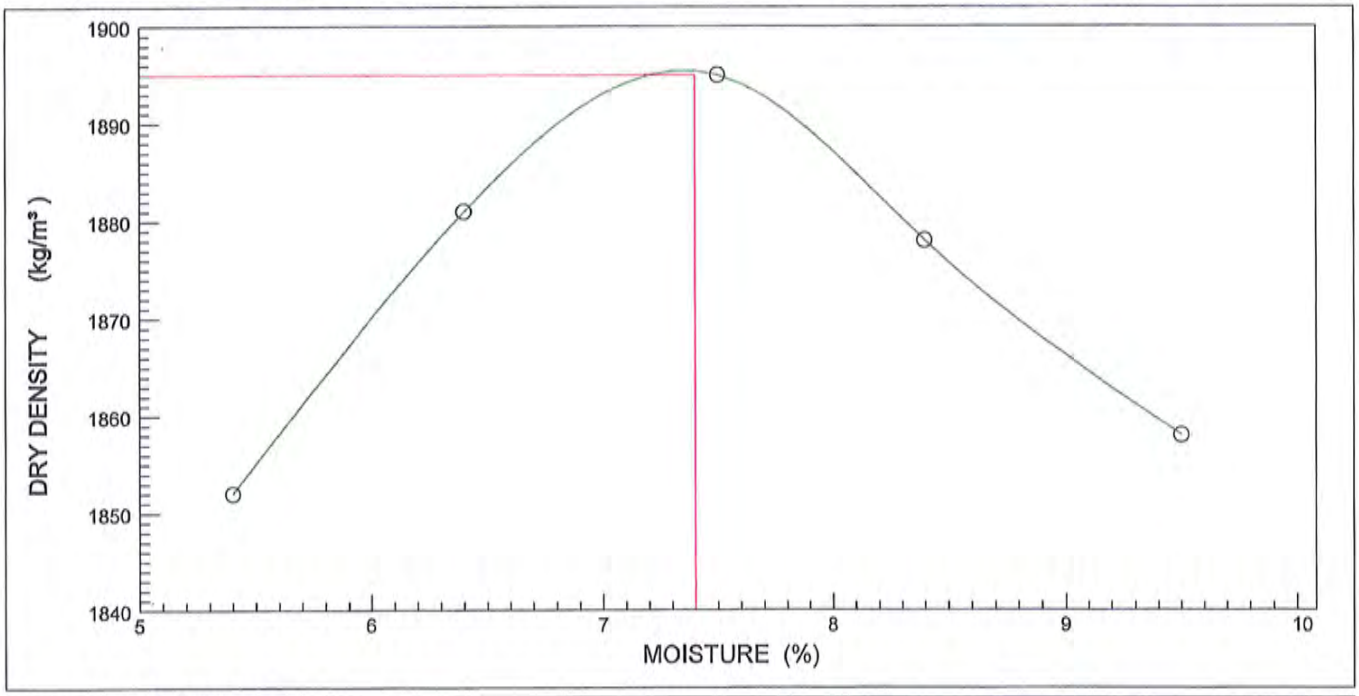
Determination Maximum Dry Density & Optimum Moisture Content Test Report

SANS 3001 - GR20/GR30

SAMPLE NO.	U9280
CONTAINER FOR SAMPLING	Black Bags
SIZE / APPROX. MASS OF SAMPLE	96kg
MOISTURE CONDITION OF SAMPLE	Moist
LAYER TESTED / SAMPLED FROM	0-300mm
MATERIAL DESCRIPTION	Mix Calcretestone
HOLE NO./ km / CHAINAGE	TP15
ROAD NO.	Not Specified
DATE RECEIVED	2020-07-09
DATE SAMPLED	2020-07-08
CLIENT MARKING	S28° 50' 13,7"; E21° 57' 29,3"
COLOUR AND TYPE	Brown Gravel

POINT NO.	1	2	3	4	5			
DRY DENSITY (kg/m³)	1852	1881	1895	1878	1858			
MOISTURE (%)	5,4	6,4	7,5	8,4	9,5			

MAXIMUM DRY DENSITY (kg/m³) : 1895	OPTIMUM MOISTURE CONTENT (%) : 7,4



Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Prog.ver 10.7 (2019/11/07)

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Job Request No.: RU3525

Date Reported : 2020-08-06

Ceder Land Geotechnical Consult (Pty) Ltd
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Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

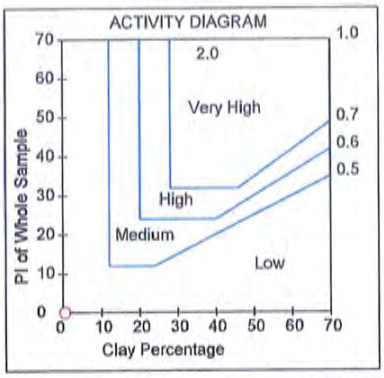
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

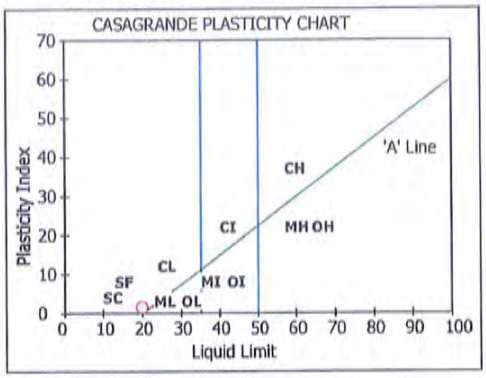
Sample No.	: U9288
Position	: TP 18
Layer Type	: 100-300mm
Sample Colour	: Brown Gravel
Sample Type	: Mix Calcrete+ OCC Qu

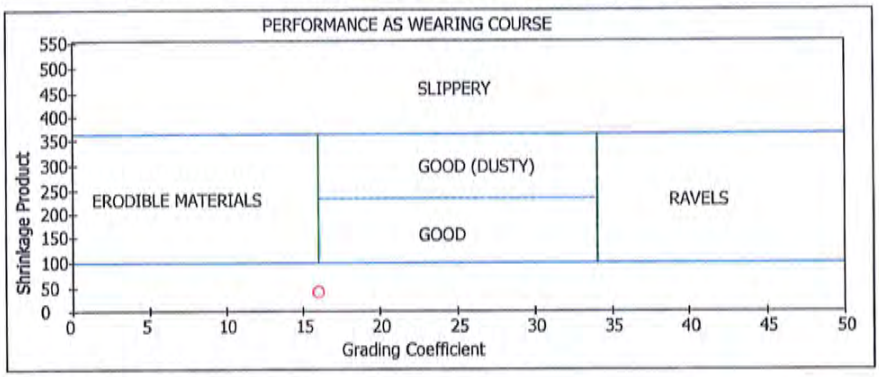
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	94
28.00	78
20.00	64
14.00	50
5.000	32
2.000	28
0.425	26
0.250	24
0.150	19
0.075	11
0.060	3,8
0.050	3,4
0.020	2,0
0.005	1,4
0.002	0,5

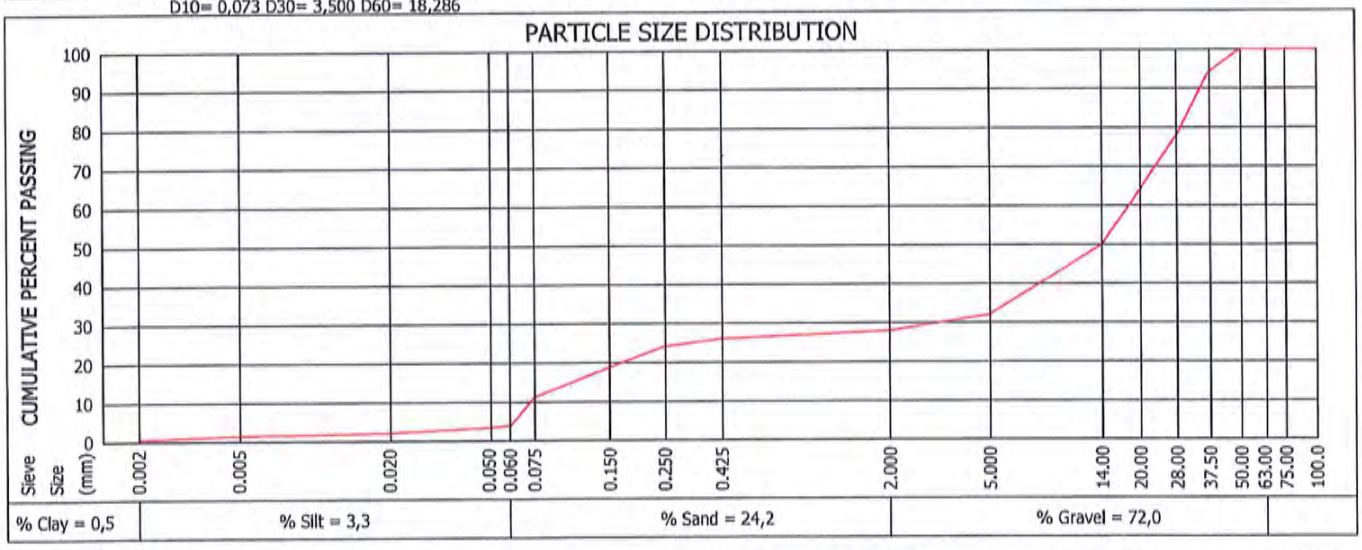
Soil Mortar	2.000 - 0.425	9
	0.425 - 0.250	7
	0.250 - 0.150	19
	0.150 - 0.075	27
	< 0.075	39
Effective Size		0,073
Uniformity Coefficient		250,5
Curvature Coefficient		9,2
Oversize Index		6,0
Shrinkage Product		39,0
Grading Coefficient		16,0
Grading Modulus		2,30
Atterberg Limits	Liquid Limit	20
	Plasticity Index	2.0
	Linear Shrinkage	1.5
	PI < 0.075	
Unified Soil Classification		GW-GC
US Highway Classification		A-1-a(0)

D10= 0,073 D30= 3,500 D60= 18,286









% Clay = 0,5	% Silt = 3,3	% Sand = 24,2	% Gravel = 72,0

Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 7.83 [SANS 5854] & Conductivity = 0.13 S/m [SANS 6240]

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Report compiled by : Juraine Okkies

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Accreditation No. T0296
Prog.ver 10.7 (2019/11/07)

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Date Reported : 2020-08-06

Job Request No.: RU3525
Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
Ceres
6835

Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

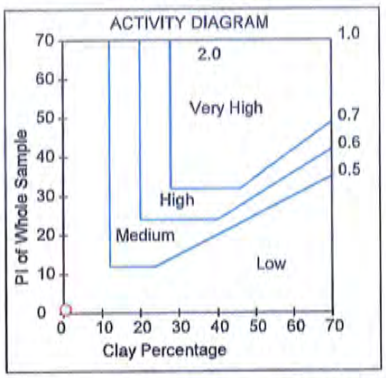
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

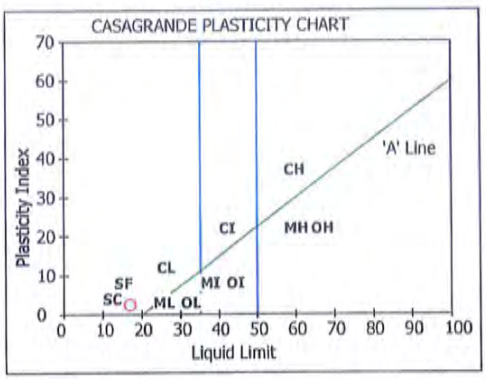
Sample No.	: U9289
Position	: TP 21
Layer Type	: 0-400mm
Sample Colour	: Reddish Brown Gravel
Sample Type	: Mix Calcrete+Quartzs

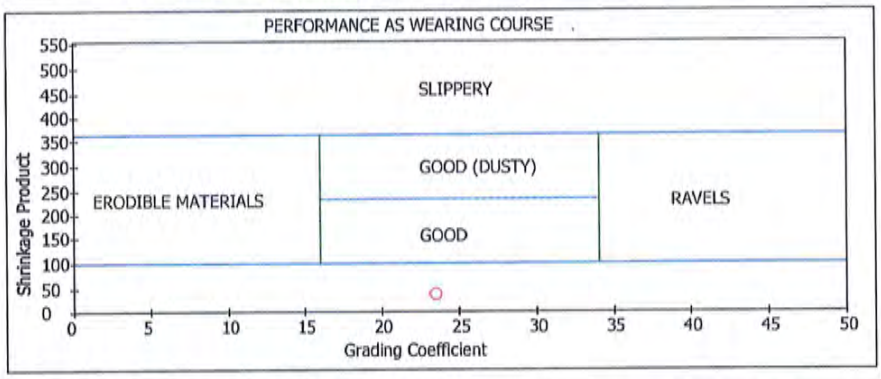
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	89
28.00	88
20.00	83
14.00	76
5.000	49
2.000	40
0.425	35
0.250	32
0.150	23
0.075	13
0.060	3,1
0.050	2,8
0.020	2,1
0.005	1,5
0.002	0,7

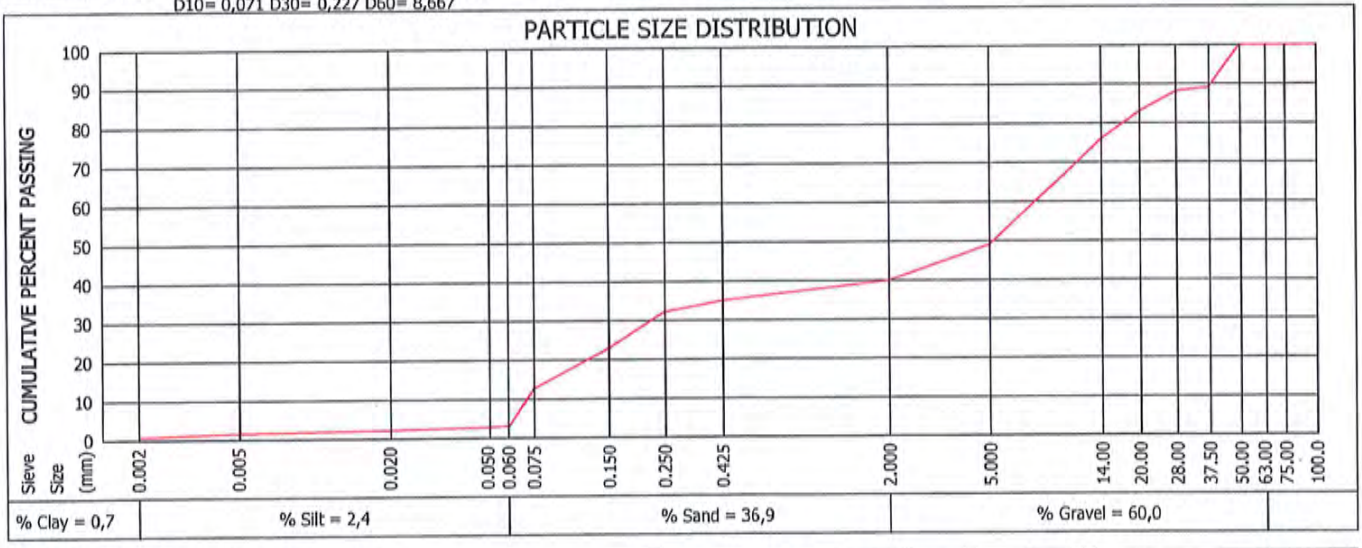
Soil Mortar	2.000 - 0.425	14
	0.425 - 0.250	6
	0.250 - 0.150	23
	0.150 - 0.075	25
	< 0.075	32
Effective Size		0,071
Uniformity Coefficient		122,1
Curvature Coefficient		0,1
Oversize Index		11,0
Shrinkage Product		35,0
Grading Coefficient		23,5
Grading Modulus		2,10
Atterberg Limits	Liquid Limit	17
	Plasticity Index	2,0
	Linear Shrinkage	1,0
	PI < 0.075	
Unified Soil Classification		GC
US Highway Classification		A-1-b(0)

D10= 0,071 D30= 0,227 D60= 8,667









% Clay = 0,7	% Silt = 2,4	% Sand = 36,9	% Gravel = 60,0

Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 7.69 [SANS 5854] & Conductivity = 0.09 S/m [SANS 6240]

Report compiled by : Juraine Okkies

sanas Testing Laboratory
Accreditation No. T0296
Prog.ver 10.7 (2019/11/07)

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Date Reported : 2020-08-06

Job Request No.: RU3525
Ceder Land Geotechnical Consult (Pty) Ltd
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Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

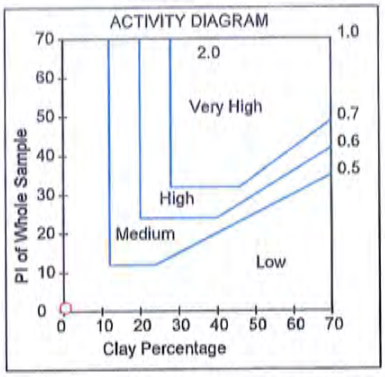
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

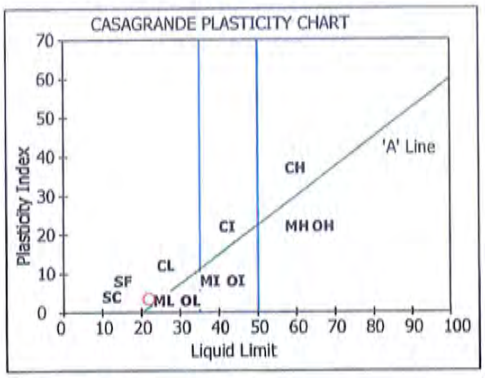
Sample No.	: U9290
Position	: TP 22
Layer Type	: 100-300mm
Sample Colour	: Brown Gravel
Sample Type	: Mix Calcretestone

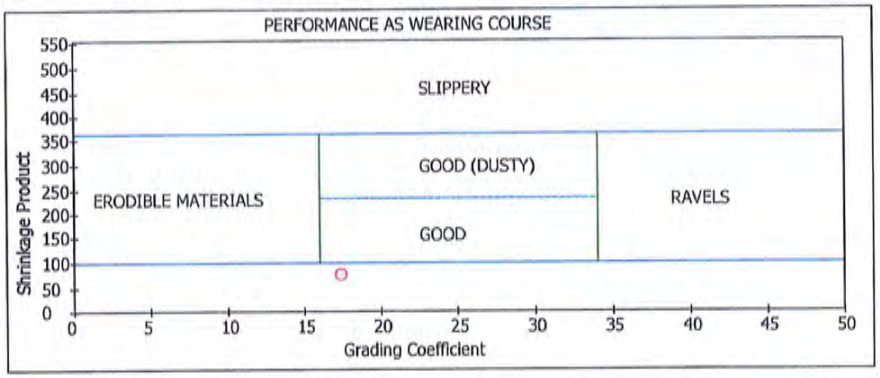
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	93
37.50	87
28.00	78
20.00	71
14.00	64
5.000	47
2.000	41
0.425	38
0.250	36
0.150	30
0.075	19
0.060	6,5
0.050	5,6
0.020	3,3
0.005	1,7
0.002	0,6

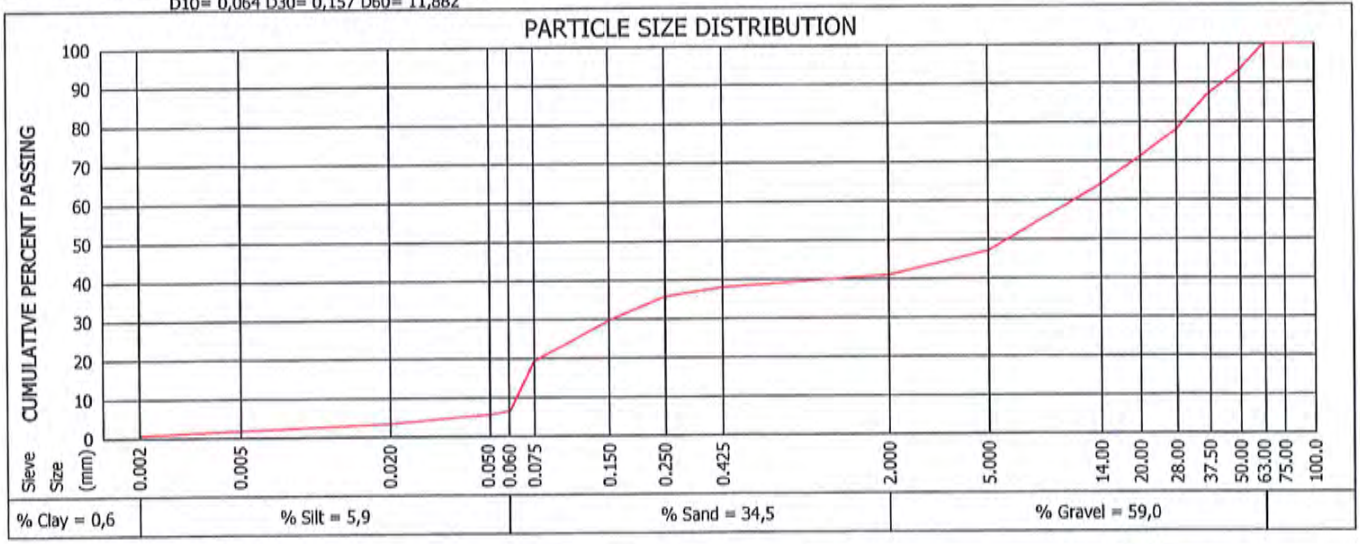
Soil Mortar	2.000 - 0.425	9
	0.425 - 0.250	4
	0.250 - 0.150	15
	0.150 - 0.075	26
	< 0.075	46
Effective Size		0,064
Uniformity Coefficient		185,7
Curvature Coefficient		0,0
Oversize Index		6,0
Shrinkage Product		76,0
Grading Coefficient		17,4
Grading Modulus		2,00
Atterberg Limits	Liquid Limit	22
	Plasticity Index	3.0
	Linear Shrinkage	2.0
	PI < 0.075	
Unified Soil Classification		GC
US Highway Classification		A-1-b(0)

D10= 0,064 D30= 0,157 D60= 11,882









% Clay = 0,6	% Silt = 5,9	% Sand = 34,5	% Gravel = 59,0

Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 7.83 [SANS 5854] & Conductivity = 0.10 S/m [SANS 6240]

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
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Report compiled by : Juraine Okkies

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Web: www.roadlab.co.za

Date Reported : 2020-08-06

Job Request No.: RU3525
Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
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Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

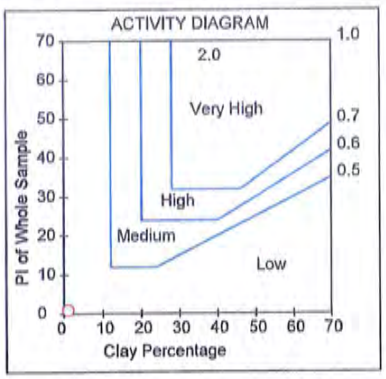
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

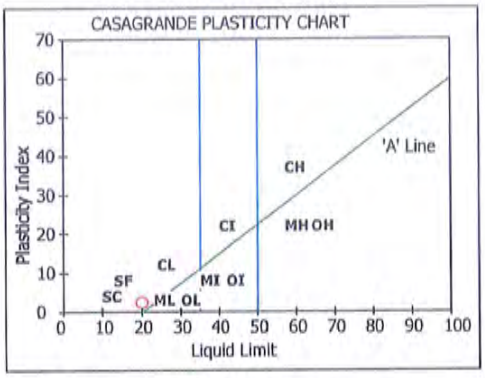
Sample No.	: U9291
Position	: TP 28
Layer Type	: 0-500mm
Sample Colour	: Orange Brown Gravel
Sample Type	: Mix Quartz

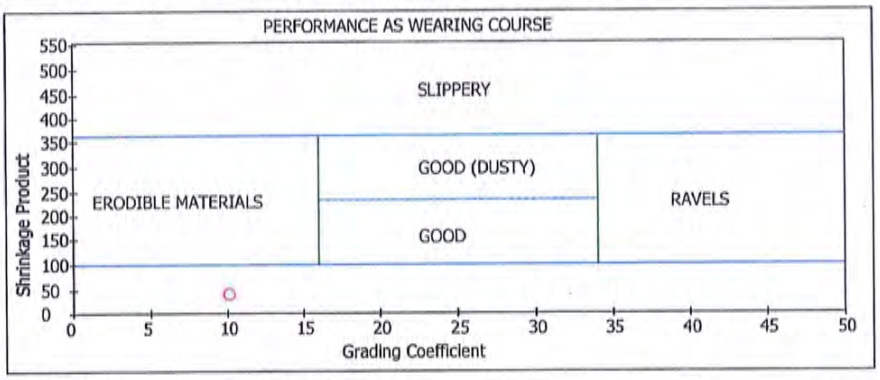
Sieve Size(mm)	% Passing
100.0	100
75.00	94
63.00	88
50.00	80
37.50	74
28.00	66
20.00	61
14.00	56
5.000	48
2.000	45
0.425	39
0.250	35
0.150	25
0.075	15
0.060	3,9
0.050	3,3
0.020	1,9
0.005	1,2
0.002	0,8

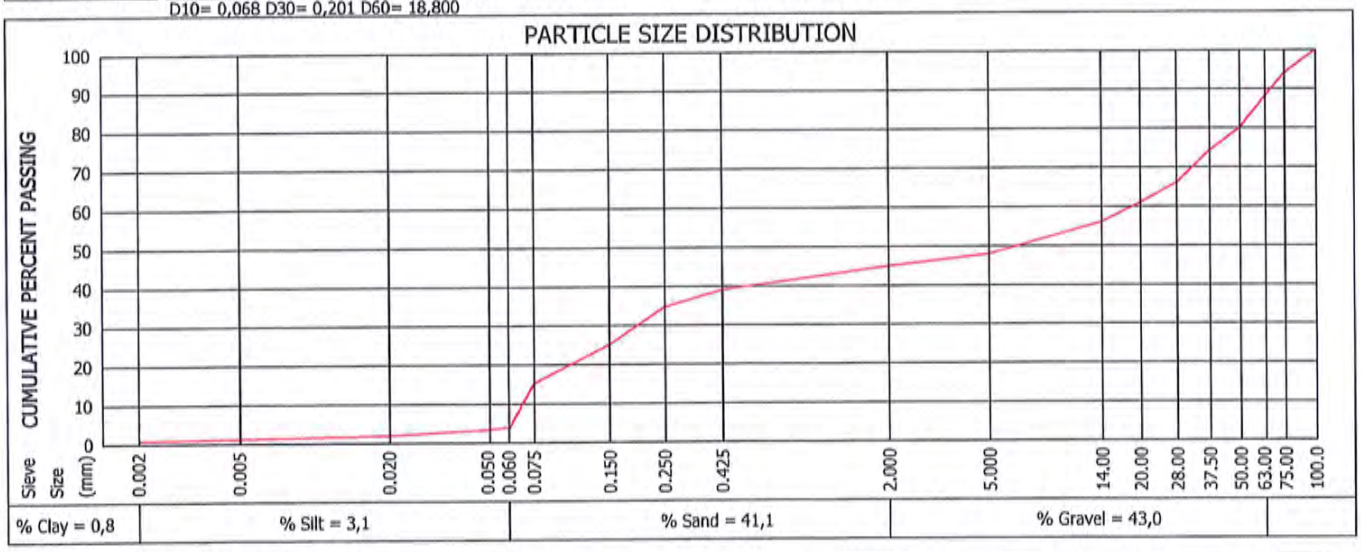
Soil Mortar	2.000 - 0.425	13
	0.425 - 0.250	10
	0.250 - 0.150	21
	0.150 - 0.075	23
	< 0.075	33
Effective Size		0,068
Uniformity Coefficient		276,5
Curvature Coefficient		0,0
Oversize Index		6,0
Shrinkage Product		39,0
Grading Coefficient		10,1
Grading Modulus		2,00
Atterberg Limits	Liquid Limit	20
	Plasticity Index	2.0
	Linear Shrinkage	1.0
	PI < 0.075	
Unified Soil Classification		GC
US Highway Classification		A-1-b(0)

D10= 0,068 D30= 0,201 D60= 18,800









% Clay = 0,8	% Silt = 3,1	% Sand = 41,1	% Gravel = 43,0

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
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Report compiled by : Juralne Okkies

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Job Request No.: RU3525

Date Reported : 2020-08-06

Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
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Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

Determination of the California Bearing Ratio Test Report SANS 3001 - GR1 / GR2 / GR10 / GR20 / GR30 / GR40 / PR5

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.	U9291			
HOLE NO./ Km / CHAINAGE	TP28			
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2	S28° 50' 27,9" E21° 57' 29,7"			
LAYER TESTED/SAMPLED	0-500mm			
SAMPLE DEPTH	0-500mm			
DATE SAMPLED	2020-07-09			
COLOUR OF SAMPLE	Orange Brown			
TYPE OF SAMPLE	Mix Quartz			

SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)

SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm	100			
	75.0 mm	99			
	63.0 mm	98			
	50.0 mm	97			
	37.5 mm	96			
	28.0 mm	95			
	20.0 mm	94			
	14.0 mm	89			
	5.0 mm	82			
	2.0 mm	79			
	0.425 mm	73			
	0.075 mm	28			
GM %		1,2			

SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)

COARSE SAND	2.000 - 0.425	7			
COARSE FINE SAND	0.425 - 0.250	11			
MEDIUM FINE SAND	0.250 - 0.150	22			
FINE FINE SAND	0.150 - 0.075	24			
SILT CLAY	0.075	36			

ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)

ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	20			
	PLASTICITY INDEX	2,3			
	LINEAR SHRINKAGE	1.0			
CLASSIFICATION	H.R.B.	A-2-4(0)			
	COLTO	G6			
	TRH 14	G7			

CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)

SANS GR30 MAX. DRY DENSITY	OMC %	5,8			
	MDD (kg/m³)	2160			
	COMP MC %	6,2			
SWELL % @	MOD | NRB | PRO	0,01 | 0,04 | 0,06			
C.B.R. SANS GR40	100 %	54			
	98 %	41			
	97 %	36			
	95 %	28			
	93 %	21			
	90 %	14			

STABILISER IN LAB	Not Applicable			
TEST TYPE	CBR			
SAMPLING METHOD	TMH 5			
WEATHER WHEN SAMPLED	Cold			

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
The test results reported relate to the samples tested.
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Report compiled by : Juraine Okkles

sanas Testing Laboratory
Accreditation No. T0296
Prog.ver 10.7 (2019/11/07)

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Technical Signatory

Roadlab Germiston
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Email: info@roadlab.co.za
Web: www.roadlab.co.za

Job Request No.: RU3525

Date Reported : 2020-07-28

Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
Ceres
6835

Project : Opwag Infrastructure Upgrade

Attention : Frans Breytenbach

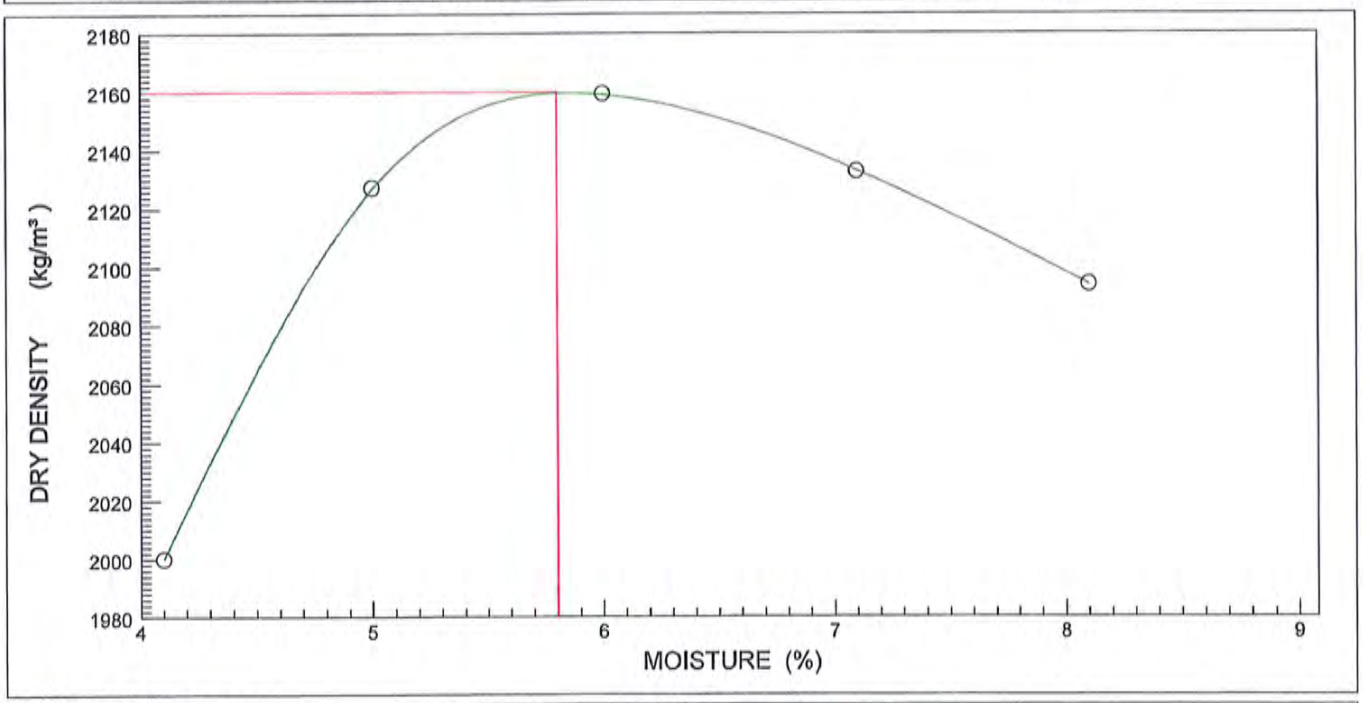
Determination Maximum Dry Density & Optimum Moisture Content Test Report

SANS 3001 - GR20/GR30

SAMPLE NO.	U9291
CONTAINER FOR SAMPLING	Black Bags
SIZE / APPROX. MASS OF SAMPLE	101kg
MOISTURE CONDITION OF SAMPLE	Moist
LAYER TESTED / SAMPLED FROM	0-500mm
MATERIAL DESCRIPTION	Mix Quartz
HOLE NO./ km / CHAINAGE	TP28
ROAD NO.	Not Specified
DATE RECEIVED	2020-07-10
DATE SAMPLED	2020-07-09
CLIENT MARKING	S28° 50' 27,9"; E21° 57' 29,7"
COLOUR AND TYPE	Orange Brown Gravel

POINT NO.	1	2	3	4	5			
DRY DENSITY (kg/m³)	2000	2127	2159	2133	2094			
MOISTURE (%)	4,1	5,0	6,0	7,1	8,1			

MAXIMUM DRY DENSITY (kg/m³) : 2160	OPTIMUM MOISTURE CONTENT (%) : 5,8



Deviation from Test Method :
Remarks and Notes :

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The test results reported relate to the samples tested.
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Report compiled by : Juralne Okkies

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Date Reported : 2020-08-06

Job Request No.: RU3525
Ceder Land Geotechnical Consult (Pty) Ltd
PO Box 607
Ceres
6835
Attention : Frans Breytenbach

Project : Opwag Infrastructure Upgrade

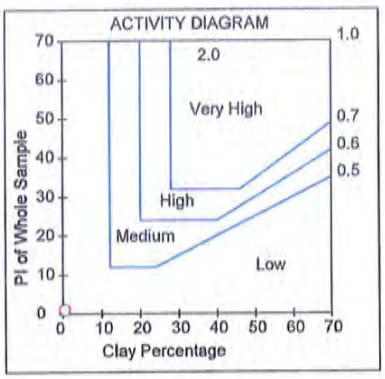
Foundation Indicator Test Report SANS 3001 - GR1 / GR3 / GR10

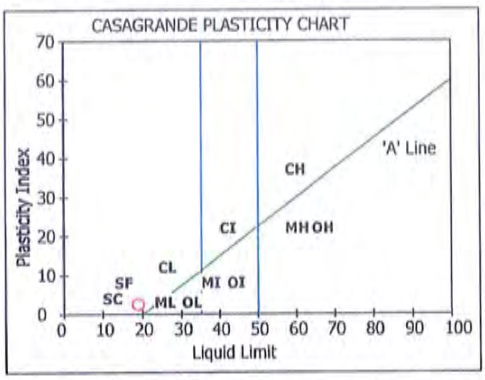
Sample No.	: U9292
Position	: TP 33
Layer Type	: 0-400mm
Sample Colour	: Reddish Brown Gravel
Sample Type	: Mix Calcrete+Quartz

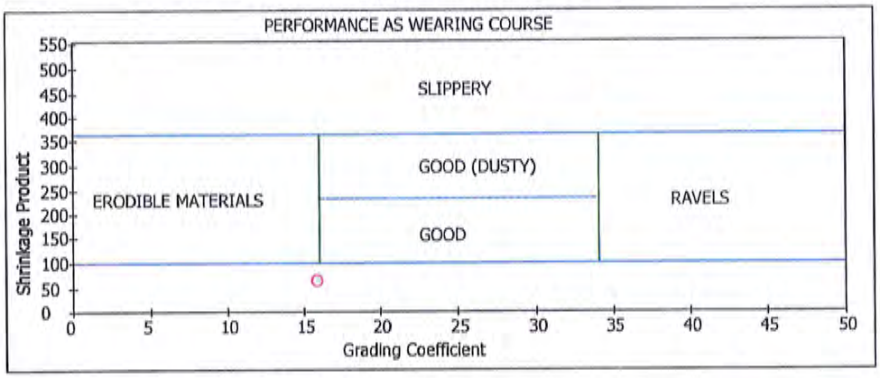
Sieve Size(mm)	% Passing
100.0	100
75.00	100
63.00	100
50.00	100
37.50	89
28.00	78
20.00	72
14.00	66
5.000	48
2.000	45
0.425	43
0.250	40
0.150	27
0.075	14
0.060	4,8
0.050	4,1
0.020	2,3
0.005	1,5
0.002	0,4

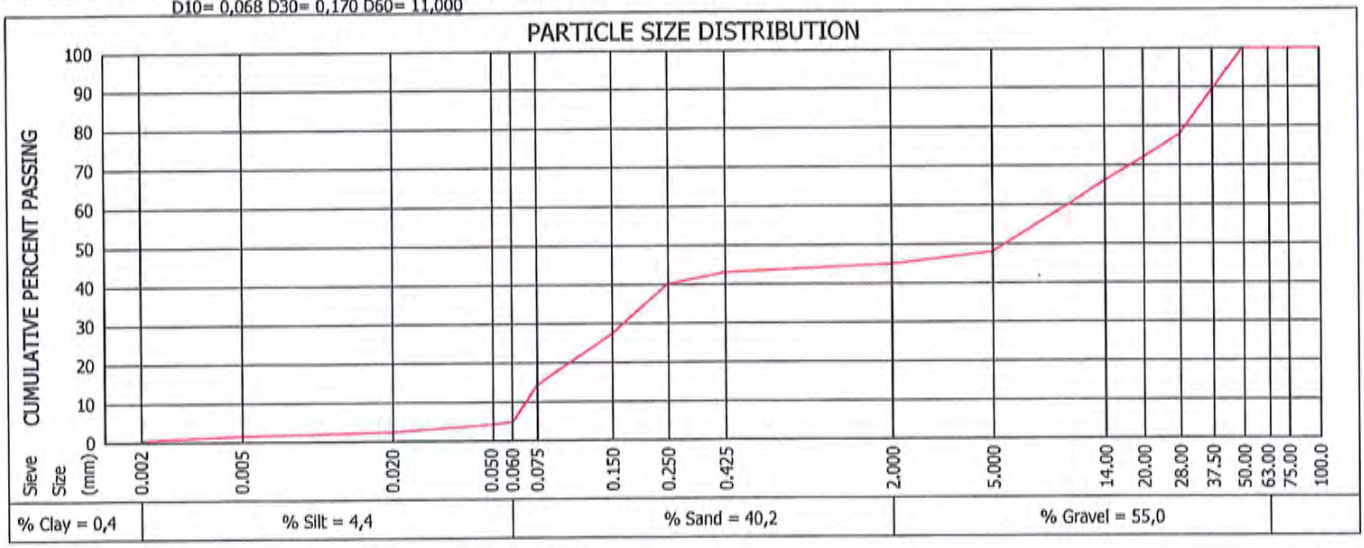
Soil Mortar	2.000 - 0.425	4
	0.425 - 0.250	7
	0.250 - 0.150	28
	0.150 - 0.075	30
	< 0.075	31
Effective Size		0,068
Uniformity Coefficient		161,8
Curvature Coefficient		0,0
Oversize Index		11,0
Shrinkage Product		64,5
Grading Coefficient		15,8
Grading Modulus		2,00
Atterberg Limits	Liquid Limit	19
	Plasticity Index	2.0
	Linear Shrinkage	1.5
	PI < 0.075	
Unified Soil Classification		GC
US Highway Classification		A-1-b(0)

D10= 0,068 D30= 0,170 D60= 11,000









% Clay = 0,4	% Silt = 4,4	% Sand = 40,2	% Gravel = 55,0

Deviation from Test Method :
Remarks and Notes : Chemistry: pH = 7.21 [SANS 5854] & Conductivity = 0.10 S/m [SANS 6240]

Opinions and interpretations are not included in our scope of works. (T0296)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM).
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D Juckers
Technical Signatory

ANNEXURE H: HERITAGE ASSESSMENT

PHASE 1 HIA REPORT !KHEIS TOWNSHIP EXPANSION OPWAG NORTHERN CAPE

PROPOSED TOWNSHIP EXPANSION ON PLOT 2642 BOEGOEBERG SETTLEMENT (KENHARDT), AND PORTION 14 FARM BOEGOEBERGNEDERSETTING RE/48, !KHEIS LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE.

REFERENCE: NC/21/2018/PP (OPWAG 730)/BH0068

PREPARED FOR:
ENVIROAFRICA

PREPARED BY:
HEIDI FIVAZ & JAN ENGELBRECHT
UBIQUE HERITAGE CONSULTANTS

29 JUNE 2020

Web: www.ubiquecrm.com **Mail**: info@ubiquecrm.com
Office: (+27)0721418860 **Address:** P.O. Box 5022 Weltevredenpark 1715
CSD Supplier Number MAAA0586123

Client: EnviroAfrica CC.

P.O. Box 5367, Helderberg, 7135
Fax: 086 512 0154 / Tel: 021 8511616 /
Email: admin@enviroafrica.co.za

Contact Person: Bernard de Witt
Email: bernard@enviroafrica.co.za

Heritage Consultant: UBIQUE Heritage Consultants

Contact Person: Jan Engelbrecht (archaeologist and lead CRM specialist)
Member of the Association of Southern African Professional Archaeologists: Member number: 297
Cell: (+27) 0828456276
Email: jan@ubiquecrm.com

Heidi Fivaz (archaeologist)
Member of the Association of Southern African Professional Archaeologists: Member number: 433
Cell: (+27) 0721418860
Email: heidi@ubiquecrm.com

For this project, Mr Engelbrecht was responsible for the field survey of the development footprint, identification of heritage resources, and recommendations. Ms Fivaz was responsible for research and report compilation. The desktop study was conducted by Sky-Lee Fairhurst and the PIA was completed by Elize Butler.

Declaration of independence:

We, Jan Engelbrecht and Heidi Fivaz, partners of UBIQUE Heritage Consultants, hereby confirm our independence as heritage specialists and declare that:

- we are suitably qualified and accredited to act as independent specialists in this application;
- we do not have any vested interests (either business, financial, personal or other) in the proposed development project other than remuneration for the heritage assessment and heritage management services performed;
- the work was conducted in an objective and ethical manner, in accordance with a professional code of conduct and within the framework of South African heritage legislation.

Signed: **Date: 2020-06-29**

J.A.C. Engelbrecht & H. Fivaz

UBIQUE Heritage Consultants

JAN ENGELBRECHT

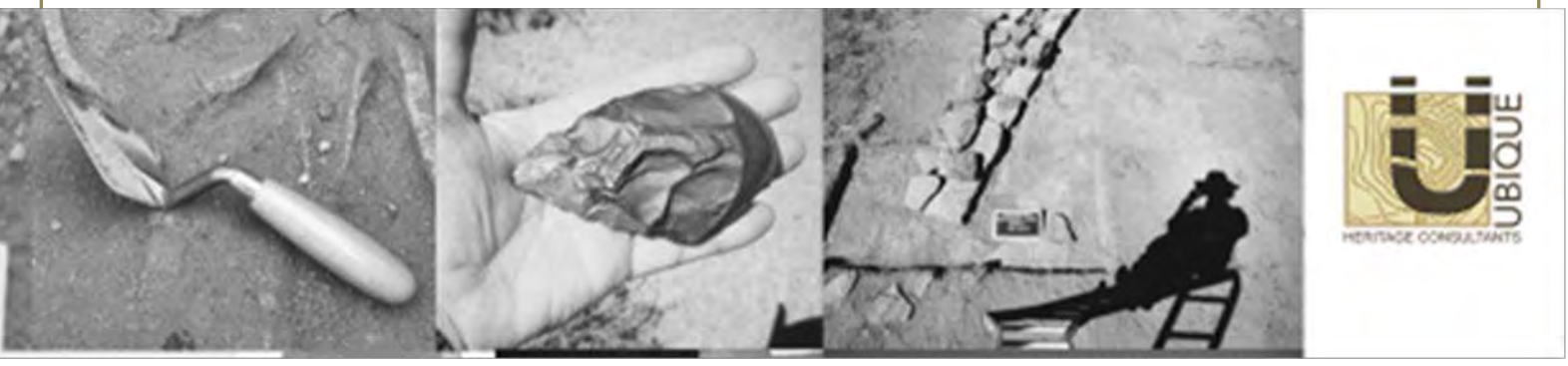
CRM ARCHAEOLOGIST

Jan Engelbrecht is accredited by the Cultural Resources Management section of the Association of Southern African Professional Archaeologists (ASAPA) to undertake Phase1 AIAs and HIAs in South Africa. He is also a member of the Association for Professional Archaeologists (ASAPA). Mr Engelbrecht holds an honours degree in archaeology (specialising in the history of early farmers in southern Africa (Iron Age) and Colonial period) from the University of South Africa. He has 12 years' experience in heritage management. He has worked on projects as diverse as the Zulti South HIA project of Richards Bay Minerals, research on the David Bruce heritage site at Ubombo in Kwa-Zulu Natal, and various archaeological excavations and historical projects. He has worked with many rural communities to establish integrated heritage and land use plans and speaks Zulu fluently. Mr Engelbrecht established Ubique Heritage Consultants during 2012. The company moved from KZN to the Northern Cape and is currently based at Askham in the Northern Cape within the Dawid Kruiper Local Municipality in the Kgalagadi region. He had a significant military career as an officer, whereafter he qualified as an Animal Health Technician at Technikon RSA and UNISA. He is currently studying for his MA Degree in Archaeology.

HEIDI FIVAZ

ARCHAEOLOGIST & OBJECT CONSERVATOR

Heidi Fivaz has been a part of UBIQUE Heritage Consultants since 2016 and is responsible for research and report compilation. She holds a B.Tech. Fine Arts degree (2000) from Tshwane University of Technology, a BA Culture and Arts Historical Studies degree (2012) from UNISA and received her BA (Hons) Archaeology in 2015 (UNISA). She has received extensive training in object conservation from the South African Institute of Object Conservation and specialises in glass and ceramics conservation. She is also a skilled artefact and archaeological illustrator. Ms Fivaz is currently completing her MA Archaeology at the University of South Africa (UNISA), with a focus on historical and industrial archaeology. She is a professional member of the Association of South African Archaeologists and has worked on numerous archaeological excavation and surveying projects over the past ten years.



EXECUTIVE SUMMARY

Project description

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA), to conduct a cultural heritage assessment to determine the impact of the proposed township expansion on Plot 2642 Boegoeberg Settlement (Kenhardt), and Portion 14 of the Farm Boegoebergnedersetting RE/48, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape, on any sites, features, or objects of cultural heritage significance.

Findings and Impact on Heritage Resources

Eighteen incidences of ESA/MSA lithic material were recorded across the development footprint. These include a few formal tools like scrapers, blades, and a Fauresmith hand axe, but the lithic assemblage predominantly consists of informal tools and knapping debris. The majority of the lithics are banded ironstone formation (BIF), with some cryptocrystalline silicates (CCS) and quartzite pieces. The material was documented as widely dispersed surface scatters, with no archaeological context. The resources will be affected negatively by the proposed development, but due to the low significance of the material, the impact is negligible.

The proposed development is underlain by sediments of the Groblershoop Formation (Brulpan Group). Underlying these rocks are deposits of the Precambrian Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant. Although the Palaeontological Sensitivity of the underlying Transvaal Supergroup is moderate, the cherts, dolomites and iron formations are too deeply buried to affect the proposed development. It is therefore recommended that the project be exempt from further palaeontological studies (Butler 2020).

Recommendations

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. No significant heritage sites or features were identified within the surveyed sections of Opwag (Uitkoms) township, Plot 2642 Boegoeberg Settlement, and Portion 14 Farm Boegoebergnedersetting RE/48. The Early/Middle Stone Age cultural material identified is not conservation worthy. No further mitigation is recommended with regards to these resources. Therefore, from a heritage point of view, we recommend that the proposed development can continue.

2. The Opwag cemetery is situated well outside the development footprint. This site is graded as IIIB and is of High Local Significance. No further mitigation is recommended with regards to these resources. No graves were identified within the development footprint.

3. Due to the zero to low palaeontological significance of the area, no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required. It is considered that the development of the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area as the igneous rocks underlying the site are not fossiliferous. It is therefore recommended that the project be exempt from a full Paleontological Impact Assessment (Butler 2020).

4. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred as a result of such oversights.

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ABBREVIATIONS

AIA:	Archaeological Impact Assessment
ASAPA:	Association of South African Professional Archaeologists
BIA:	Basic Impact Assessment
CRM:	Cultural Resource Management
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment*
EIA:	Early Iron Age*
EMP:	Environmental Management Plan
ESA:	Earlier Stone Age
GPS:	Global Positioning System
HIA:	Heritage Impact Assessment
LIA:	Late Iron Age
LSA:	Later Stone Age
MEC:	Member of the Executive Council
MIA:	Middle Iron Age
MPRDA:	Mineral and Petroleum Resources Development Act
MSA:	Middle Stone Age
NEMA:	National Environmental Management Act
NHRA:	National Heritage Resources Act
OWC:	Orange River Wine Cellars
PRHA:	Provincial Heritage Resource Agency
SADC:	Southern African Development Community
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations it must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological: material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;

- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and is older than 100 years (as defined and protected by the National Heritage Resources Act (NHRA) (Act No. 25 of 1999) including any area within 10 m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which were wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated

therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history, which are older than 75 years and the sites on which they are found.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Earlier Stone Age: >2 000 000 - >200 000 years ago
Middle Stone Age: <300 000 - >20 000 years ago
Later Stone Age: <40 000 - until the historical period

Iron Age: (Early Farming Communities). Period covering the last 1800 years, when immigrant African farmer groups brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.
Early Iron Age: AD 200 - AD 900
Middle Iron Age: AD 900 - AD 1300
Later Iron Age: AD 1300 - AD 1850

Historic: Period of arrival of white settlers and colonial contact.
AD 1500 to 1950

Historic building: Structures 60 years and older.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (historic places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources: These mean any place or object of cultural significance, tangible or intangible.

Holocene: The most recent geological period that commenced 10 000 years ago.

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site that contains such fossilised remains or traces

Cumulative impacts: “Cumulative Impact”, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Mitigation: Anticipating and preventing negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

A 'place': a site, area or region;

- a building or other structure which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure;
- a group of buildings or other structures which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures;
- an open space, including a public square, street or park; and
- in relation to the management of a place, includes the immediate surroundings of a place.

'Public monuments and memorials': mean all monuments and memorials—

- erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or
- which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual;

'Structures': any building, works, device or other facility made by people and which are fixed to land, and include any fixtures, fittings and equipment associated therewith.

1. INTRODUCTION

1.1 Scope of study

The project involves the expansion of the Opwag township on Plot 2642 Boegoeberg Settlement (Kenhardt), and Portion 14 of the Farm Boegoebergnedersetting RE/48 in the !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape. UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with the National Environmental Management Act 107 of 1998 (NEMA), and in compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA), to conduct a cultural heritage assessment (AIA/HIA) of the development area.

The assessment aims to identify and report any heritage resources that may fall within the development footprint; to determine the impact of the proposed development on any sites, features, or objects of cultural heritage significance; to assess the significance of any identified resources; and to assist the developer in managing the documented heritage resources in an accountable manner, within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

South Africa's heritage resources are both rich and widely diverse, encompassing sites from all periods of human history. Resources may be tangible, such as buildings and archaeological artefacts, or intangible, such as landscapes and living heritage. Their significance is based upon their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a time or group; their rarity; and their sphere of influence.

The integrity and significance of heritage resources can be jeopardised by natural (e.g. erosion) and human (e.g. development) activities. In the case of human activities, a range of legislation exists to ensure the timeous and accurate identification and effective management of heritage resources for present and future generations.

The result of this investigation is presented within this heritage impact assessment report. It comprises the recording of heritage resources present/ absent and offers recommendations for the management of these resources within the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, taking into account any proposed mitigation measures.

1.2 Assumptions and limitations

It is assumed that the description of the proposed project, as provided by the client, is accurate. Furthermore, it is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is comprehensive and does not have to be repeated as part of the heritage impact assessment.

The significance of the sites, structures and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are not mutually exclusive, and the evaluation of any site is done with reference to any number of these aspects. Cultural significance is site-specific and relates to the content and context of the site.

All possible care has been taken during the comprehensive field survey and intensive desktop study to identify sites of cultural importance within the development areas. However, it is essential to note that some heritage sites may have been missed due to their subterranean nature, or due to dense vegetation cover. No subsurface investigation (i.e. excavations or sampling) were undertaken since a permit from SAHRA is required for such activities. Therefore, should any heritage features and/or objects such as architectural features, stone tool scatters, artefacts, human remains, or fossils be uncovered or observed during construction, operations must be stopped, and a qualified archaeologist contacted for an assessment of the find. Observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to assess the significance of the site (or material) in question.

2. TERMS OF REFERENCE

An HIA/ AIA must address the following key aspects:

- the identification and mapping of all heritage resources in the area affected;
- an assessment of the significance of such resources in terms of heritage assessment criteria set out in regulations;
- an assessment of the impact of the development on heritage resources;
- an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- plans for mitigation of any adverse effects during and after completion of the proposed development.

In addition, the HIA/AIA should comply with the requirements of NEMA, including providing the assumptions and limitations associated with the study; the details, qualifications and expertise of the person who prepared the report; and a statement of competency.

2.1. Statutory Requirements

2.1.1 General

The Constitution of the Republic of South Africa Act 108 of 1996 is the source of all legislation. Within the Constitution the Bill of Rights is fundamental, with the principle that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels the following legislation may be relevant:

- Physical Planning Act 125 of 1991
- Municipal Structures Act 117 of 1998
- Municipal Systems Act 32 of 2000
- Development Facilitation Act 67 of 1995 (DFA)

The identification, evaluation and management of heritage resources in South Africa are required and governed by the following legislation:

- National Environmental Management Act 107 of 1998 (NEMA)
- KwaZulu-Natal Heritage Act 4 of 2008 (KZNHA)
- National Heritage Resources Act 25 of 1999 (NHRA)
- Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA)

2.1.2 National Heritage Resources Act 25 of 1999

The NHRA established the South African Heritage Resources Agency (SAHRA) together with its Council to fulfil the following functions:

- coordinate and promote the management of heritage resources at national level;

- set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- provide for the protection and management of conservation-worthy places and areas by local authorities.

2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments

Section 38(1) of the NHRA of 1999 requires **the responsible heritage resources authority to notify the person who intends to undertake a development that fulfils the following criteria to submit an impact assessment report if there is reason to believe that heritage resources will be affected by such event**:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity that will change the character of a site—
    - exceeding 5000m² in extent; or
    - involving three or more existing erven or subdivisions thereof; or
    - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- the rezoning of a site exceeding 10 000m² in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

2.1.4 Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance, i.e. of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. These include, but are not limited to, the following wide range of places and objects:

- living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);
- Ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;

- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

Furthermore, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.

2.1.5 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983.

- **Graves older than 60 years, situated outside a formal cemetery administered by a local Authority are** protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

The **protocol for the management of graves older than 60 years situated outside a formal cemetery administered by a local authority** is detailed in Section 36 of the NHRA:

> (3) *(a)* No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
(c) bring onto or use at a burial ground or grave referred to in paragraph *(a)* or *(b)* any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)*(a)* unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)*(b)* unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—

(a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and
(b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in cooperation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and
(b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.

3. STUDY APPROACH AND METHODOLOGY

3.1 Desktop study

The first step in the methodology was to conduct a desktop study of the heritage background of the area and the site of the proposed development. This entailed the scoping and scanning of historical texts/records as well as previous heritage studies and research around the study area.

By incorporating data from previous CRM reports done in the area and an archival search, the study area is contextualised. The objective of this is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves in the area.

No archaeological site data was available for the project area. A concise account of the archaeology and history of the broader study area was compiled (sources listed in the bibliography).

3.1.1 Literature review

A survey of the literature was undertaken to obtain background information regarding the area. Through researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that several other archaeological or historical studies had been performed within the broader vicinity of the study area. Sources consulted in this regard are indicated in the bibliography.

3.2 Field study

Phase 1 (AIA/HIA) requires the completion of a field study to establish and ensure the following:

3.2.1 Systematic survey

A systematic survey of the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest, was completed.

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas on 22 and 25 May 2020 and completed a controlled-exclusive, pre-planned, pedestrian survey. We conducted an inspection of the surface of the ground, wherever the surface was visible. This was done with no substantial attempt to clear brush, sand, deadfall, leaves or other material that may cover the surface and with no effort to look beneath the surface beyond the inspection of rodent burrows, cut banks and other exposures fortuitously observed.

The survey was tracked with a handheld Garmin global positioning unit (Garmin eTrex 10).

3.2.2 Recording significant areas

GPS points of identified significant areas were recorded with a handheld Garmin global positioning unit (Garmin eTrex 10). Photographs were taken with a Canon IXUS 185 20-megapixel camera. Detailed field notes were taken to describe observations. The layout of the area and plotted GPS points, tracks and coordinates, were transferred to Google Earth and QGIS and maps were created.

3.2.3 Determining significance

Levels of significance of the various types of heritage resources observed and recorded in the project area will be determined to the following criteria:

Cultural significance:

- Low	A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.
- Medium	Any site, structure or feature being regarded less important due to several factors, such as date and frequency. Likewise, any important object found out of context.
- High	Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorised as of a high importance. Likewise, any important object found within a specific context.

Heritage significance:

- Grade I	Heritage resources with exceptional qualities to the extent that they are of national significance
- Grade II	Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate
- Grade III	Other heritage resources of local importance and therefore worthy of Conservation

Field ratings:

i.	National Grade I	significance should be managed as part of the national estate
ii.	Provincial Grade II	significance should be managed as part of the provincial estate
iii.	Local Grade IIIA	should be included in the heritage register and not be mitigated (high significance)
iv.	Local Grade IIIB	should be included in the heritage register and may be mitigated (high/ medium significance)

v. General protection A (IV A) site should be mitigated before destruction (high/ medium significance)

vi. General protection B (IV B) site should be recorded before destruction (medium significance)

vii. General protection C (IV C) phase 1 is seen as sufficient recording and it may be demolished (low significance)

Heritage value, statement of significance:

a. its importance in the community, or pattern of South Africa's history;

b. its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

c. its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

d. its importance in demonstrating the principal characteristics of a particular class of south Africa's natural or cultural places or objects;

e. its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

f. its importance in demonstrating a high degree of creative or technical achievement at a particular period;

g. its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;

h. its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and

i. sites of significance relating to the history of slavery in South Africa.

3.2.4 Assessment of development impacts

A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource, by minimising natural site erosion or facilitating non-destructive public use, for example. More commonly, development impacts are of an adverse nature and can include:

- destruction or alteration of all or part of a heritage site;
- isolation of a site from its natural setting; and / or
- introduction of physical, chemical or visual elements that are out of character with the heritage resource and its setting.

Beneficial and adverse impacts can be direct or indirect, as well as cumulative, as implied by the examples. Although indirect impacts may be more difficult to foresee, assess and quantify, they must form part of the assessment process. The following assessment criteria have been used to assess the impacts of the proposed development on possible identified heritage resources:

Criteria	Rating Scales	Notes
Nature	Positive	An evaluation of the type of effect the construction, operation and management of the proposed development would have on the heritage resource.
	Negative	
	Neutral	
Extent	Low	Site-specific affects only the development footprint.
	Medium	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius);
	High	Regional (beyond a 10 km radius) to national.
Duration	Low	0-4 years (i.e. duration of construction phase).
	Medium	5-10 years.
	High	More than 10 years to permanent.
Intensity	Low	Where the impact affects the heritage resource in such a way that its significance and value are minimally affected.
	Medium	Where the heritage resource is altered, and its significance and value are measurably reduced.
	High	Where the heritage resource is altered or destroyed to the extent that its significance and value cease to exist.
Potential for impact on irreplaceable resources	Low	No irreplaceable resources will be impacted.
	Medium	Resources that will be impacted can be replaced, with effort.
	High	There is no potential for replacing a particular vulnerable resource that will be impacted.
Consequence, (a combination of extent, duration, intensity, and the potential for impact on irreplaceable resources).	Low	A combination of any of the following: - Intensity, duration, extent and impact on irreplaceable resources are all rated low. - Intensity is low and up to two of the other criteria are rated medium. - Intensity is medium and all three other criteria are rated low.
	Medium	Intensity is medium and at least two of the other criteria are rated medium.

Criteria	Rating Scales	Notes
	High	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration. Intensity is rated high, with all the other criteria being rated medium or higher.
Probability (the likelihood of the impact occurring)	Low	It is highly unlikely or less than 50 % likely that an impact will occur.
	Medium	It is between 50 and 70 % certain that the impact will occur.
	High	It is more than 75 % certain that the impact will occur, or it is definite that the impact will occur.
Significance (all impacts including potential cumulative impacts)	Low	Low consequence and low probability. Low consequence and medium probability. Low consequence and high probability.
	Medium	Medium consequence and low probability. Medium consequence and medium probability. Medium consequence and high probability. High consequence and low probability.
	High	High consequence and medium probability. High consequence and high probability.

3.3 Oral history

Where possible, people from local communities would be interviewed to obtain information relating to the surveyed area.

3.4 Report

The results of the desktop research and field survey are compiled in this report. The identified heritage resources and anticipated direct, indirect, and cumulative impacts that the development of the proposed project may have on the identified heritage resources will be presented objectively. Alternatives, should any significant sites be impacted adversely by the proposed project, are offered. All effort will be made to ensure that all studies, assessments, and results comply with the relevant legislation and the code of ethics and guidelines of the Association of South African Professional Archaeologists (ASAPA). The report aims to assist the developer in managing the documented heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999).

4. PROJECT OVERVIEW

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA), to conduct a cultural heritage assessment to determine the impact of the proposed development of Opwag (Uitkoms) township, Plot 2642 Boegoeberg Settlement (Kenhardt), and Portion 14 of the Farm Boegoebergnedersetting RE/48 in the !Kheis Local Municipality, on any sites, features, or objects of cultural heritage significance.

The project entails the establishment of the Opwag (Uitkoms) community as a new town. A total of 730 new erven will be created. The project includes the formalisation of the existing informal houses located in the area. The size of the study area is 50 ha. Opwag is located on the western bank of the Orange River, approximately 6 km north of Groblershoop.

4.1 Technical information

Project description	
Project name	!KHEIS LOCAL MUNICIPALITY TOWNSHIP EXPANSION: OPWAG
Description	The expansion and upgrade of housing and infrastructure at Opwag township in the !Kheis Local Municipality and within the ZF Mgcawu District Municipality in the Northern Cape Province. Reference: NC/21/2018/PP
Developer	
!Kheis Local Municipality in cooperation with the Barzani group and Macroplan Regional and Town Planners	
Contact information	Opwag Community, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.
Development type	Housing (Township expansion)
Landowner	
!Kheis Local Municipality	
Contact information	054-332 3642 or 054- 833 9500
Consultants	
Environmental	EnviroAfrica cc.
Heritage and archaeological	UBIQUE Heritage Consultants
Paleontological	Banzai Environmental
Property details	
Province	Northern Cape
District municipality	ZF Mgcawu
Local municipality	!Kheis
Topo-cadastral map	1:50 000 2821DD
Farm name	Plot 2642 Boegoeberg Settlement Portion 14 of the Farm Boegoeberg Settlement, No. 48
Closest town	Groblershoop
GPS Co-ordinates	28°50'22.29"S; 21°57'15.43"E
Property size	
Development footprint size	50 ha
Land use	
Previous	Agriculture

Current	Agriculture and limited informal houses.
Rezoning required	Yes
Sub-division of land	Yes (730 erven)

Development criteria in terms of Section 38(1) NHRA	Yes/No
Construction of a road, wall, power line, pipeline, canal or other linear forms of development or barrier exceeding 300m in length.	Yes
Construction of bridge or similar structure exceeding 50m in length.	No
Construction exceeding 5000m ².	Yes
Development involving three or more existing erven or subdivisions.	Yes
Development involving three or more erven or divisions that have been consolidated within the past five years.	Yes
Rezoning of site exceeding 10 000m ².	Yes
Any other development category, public open space, squares, parks, recreation grounds.	No

Figure 1 *Proposed township expansion at Opwag (Uitkoms), !Kheis Local Municipality. Image provided by Macroplan.*

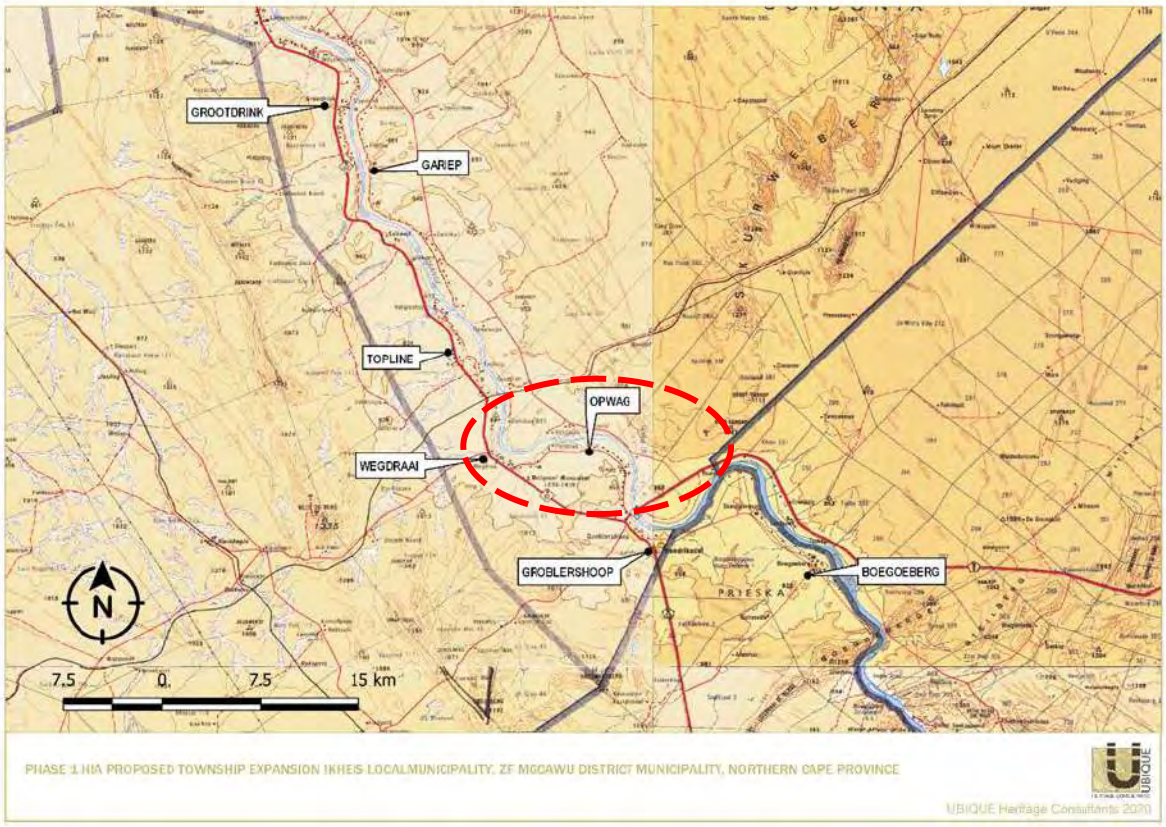

Figure 2 *Regional locality of the development footprint, Opwag (Uitkoms), !Kheis Local Municipality indicated on 1: 250 000 WGS2820-2920.*

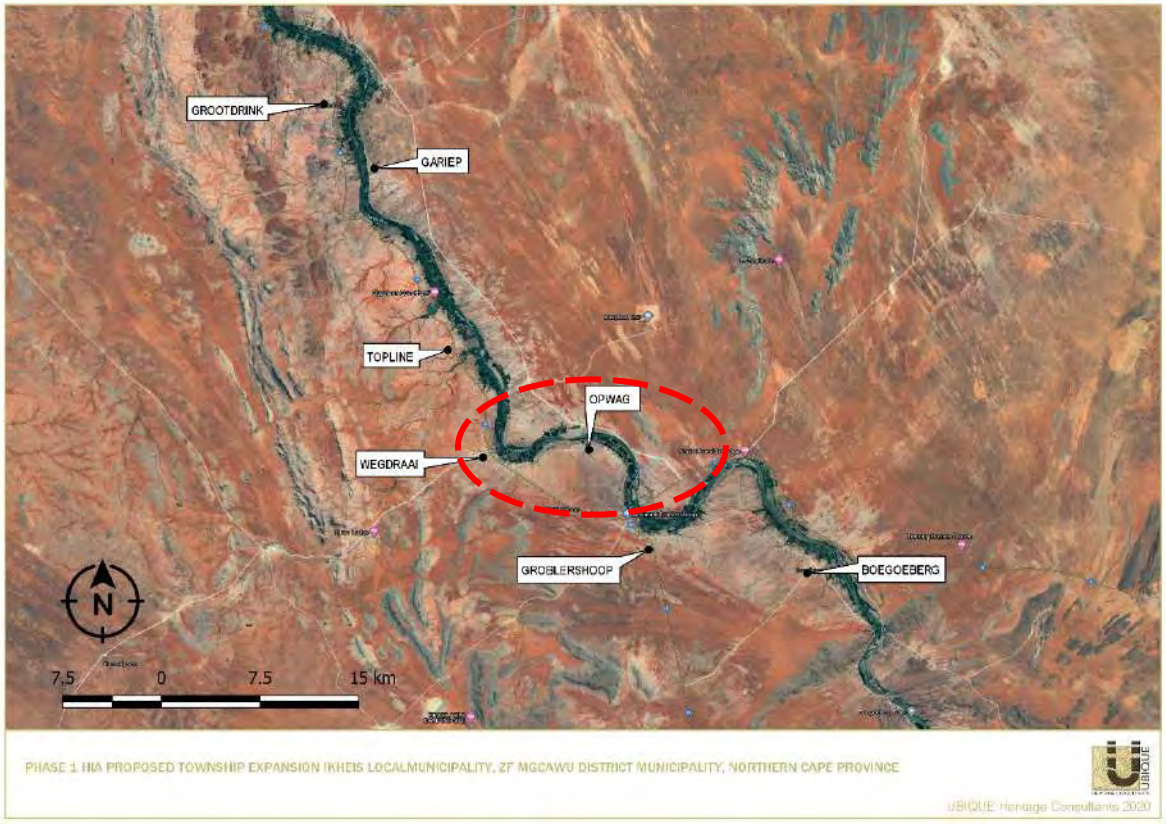

Figure 3 *Regional locality of the development footprint, Opwag (Uitkoms), !Kheis Local Municipality indicated on Google Earth Satellite imagery.*

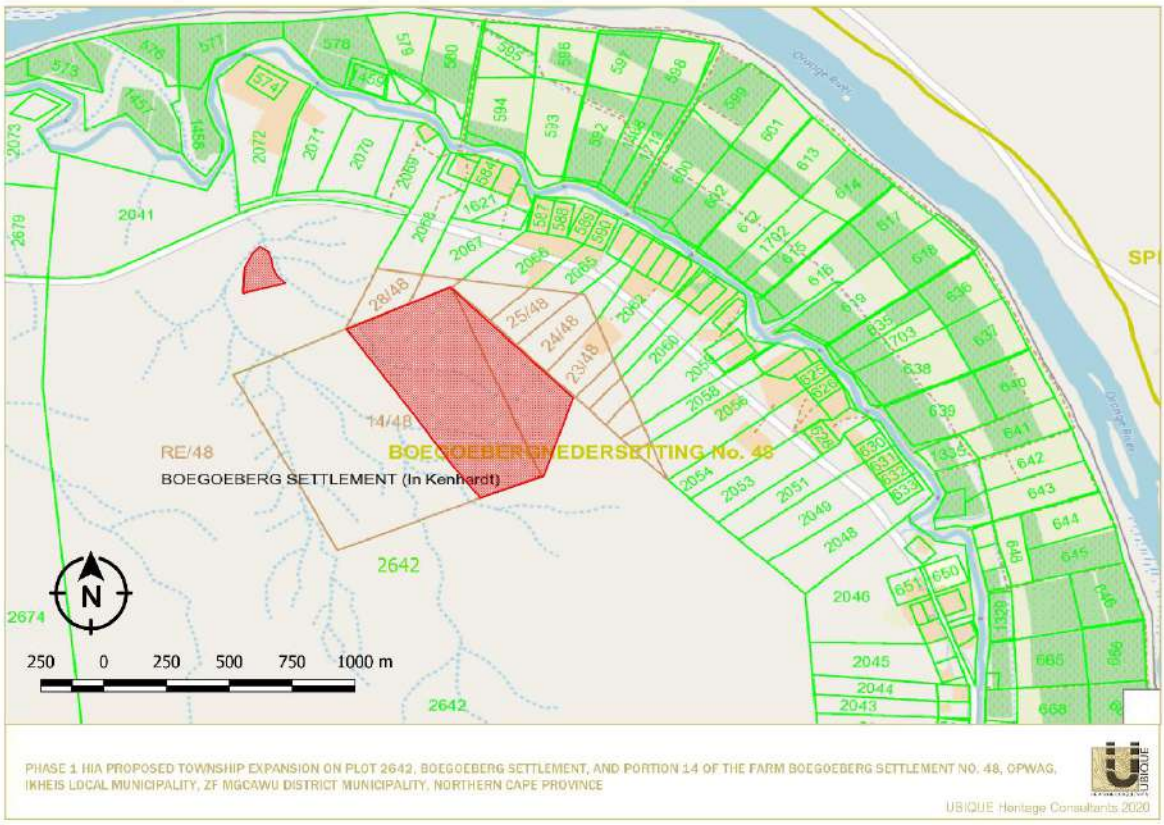

Figure 4 Locality of the development footprint, Opwag (Uitkoms), !Kheis Local Municipality indicated on Chief Surveyor-General ArcGIS Web Map (source https://csg.esri-southafrica.com/)

Figure 5 Locality of the development footprint Opwag (Uitkoms), !Kheis Local Municipality indicated on Google Earth Satellite imagery.

4.2 Description of the affected environment

The development area falls within Bushmanland Arid Grassland. It is characterised by extensive to irregular plains on a slightly sloping plateau. The white grass (*Stipagrostis* species) dominated grassland gives this vegetation type the character of semidesert 'steppe'. In places, low shrubs of *Salsola* change the vegetation structure. Vegetation identified in the development footprint includes camel thorn trees *(Acacia erioloba*), blackthorn trees (*Acacia mellifera*), silky bushman grass (*Stipagrostis uniplumis*), three thorn/driedoring (*Rhigozum trichotomum*), skaapbossie (*Aizoon schellenbergii*), shepherd tree (*Boscia albitrunca*), suurgras (*Enneapogon desvauxii*), tall bushman grass (*Stipagrostis hirtigluma*), silky bushman grass (*Stipagrostis uniplumis*), kortbeen boesmangras (*Stipagrostis obtuse*), pencil milkbush (*Euphorbia lignose*), *Aloe (Aloe argenticuada), and* Prosopis (*Prosopis glandulosa)*. The soils of the area are mostly red-yellow freely drained apedal soils (Mucina & Rutherford 2006). There are deposits of banded ironstone formation (BIF), calcrete, quartz and quartzite on the surface.

The study area consists of flat open vacant fields with a few trees scattered throughout the footprint. The entire terrain slightly slopes towards the west, in the direction of a dry waterway. The development footprint is bounded in the north by vacant (servitude) land, in the south and east koppies and a secondary road, and in the west by dry riverine. At least three dry riverine flow from west to east, and from the northwest and the southwest, through the development footprint. Some of the dry riverine eroded into large furrows, especially in the west and northwestern parts of the footprint. Several areas have minor damage due to water erosion. Abandoned houses and cement foundations are present in the southeast, while informal housing is prevalent on parts of the development footprint.

Figure 6 *Views of the affected development area.*



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5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

5.1 Region

The Northern Cape is rich in archaeological sites and landscapes that reflect the complex South African heritage from the Stone Age to Colonial history.

5.1.1 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996). In South Africa, the Stone Age can be divided into three periods. It is, however, important to note that dates are relative and only provide a broad framework for interpretation. The division of the Stone Age, according to Lombard et al. (2012) is as follows:

Earlier Stone Age: >2 000 000 - >200 000 years ago
Middle Stone Age: <300 000 - >20 000 years ago
Later Stone Age: <40 000 - until the historical period.

In short, the Stone Age refers to humans that mainly utilised stone as their technological marker. Each of the sub-divisions represents a group of industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes produced from pebbles, cobbles, and percussive tools, as well as objects created later during this period such as large hand axes, cleavers, and other bifacial tools (Klein 2000). The MSA is associated with small flakes, blades, and points. The aforementioned are commonly inferred to have been made and utilised for hunting activities and had numerous functions (Wurz 2013). Lastly, the LSA is characterised by microlithic stone tools, scrapers, and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. Numerous LSA rock art sites, mainly in the form of rock engravings and paintings have been identified in the Northern Cape (Beaumont 2008; Kruger 2018; Morris 1988). These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in riverbeds (Kruger 2018). Banded ironstone occurs on several sites throughout the Northern Cape and appears to have been a favoured raw material for making stone tools due to its superior flaking qualities (Morris 2012). Prominent sites that exemplify these periods in the Nama-Karoo Biome are Rooidam and Bundu Farm (Earlier Stone Age and Middle Stone Age), and Biesje Poort 2, Bokvasmaak 3, Melkboom 1, Vlermuisgat, and Jagtpan 7 (Later Stone Age) (Lombard et al. 2012).

Within the region, Stone Age sites and complexes have been, and are still being investigated in some detail. For instance, in the Kathu landscape, the longest preserved lithostratigraphic and archaeological sequence of human occupation has been documented and excavated. Evidence of 500 000-year-old hafted stone points, ancient specularite working (and mining), and associated Ceramic Later Stone Age material have been recorded on the eastern side of Postmasburg and Doornfontein. Older transitional ESA/MSA Fauresmith sites at Lyly Feld, Demaneng, Mashwening, King, Rust & Vrede, Paling, Gloucester and Mount Huxley have been recorded (Beaumont 2004; Beaumont 2013; Beaumont & Morris 1990; Beaumont & Vogel 2006; Morris 2005; Morris & Beaumont 2004; Porat et al. 2010; Thackeray et al. 1983; Walker et al. 2014; Wilkins et al. 2012).

Beaumont et al. (1995) commented that thousands of square kilometres of Bushmanland are covered by low-density lithic scatters. It is therefore not surprising that Stone Age sites and lithic scatters were identified by CRM practitioners between the Garona substation and the Gariep/Orange River in numerous surveys conducted during the recent years. Scatters of MSA material have been recorded close to Griekwastad, Hotazel. Postmasburg and Kenhardt, Pofadder, Marydale, and in the Upington district (Dreyer 2006, 2012, 2014; Pelser & Lombard 2013; PGS Heritage 2009, 2010; Webley 2013). MSA and LSA tools, as well as rock engravings, were also found at Putsonderwater, Beeshoek and Bruce (Morris 2005; Snyman 2000; Van Vollenhoven 2012b; Van Vollenhoven 2014).

Archaeological surveys have shown that rocky outcrops, hills, drainage lines, riverbanks, and confluences, are prime localities for archaeological finds (Lombard 2011). Sites can likewise be found close to local sources of highly prized raw materials such as previously mentioned banded iron formations (BIF), as well as jasperlite and specularite (Morris 2012; Kruger 2015; 2018). If any such features occur in the study area, Stone Age manifestations can be anticipated.

5.1.2 Iron Age

The Iron Age (IA) is characterised by the use of metal (Coertze & Coertze 1996: 346). There is some controversy about the periods within the IA. Van der Ryst & Meyer (1999) have suggested that there are two phases within the IA, namely:

- Early Iron Age (EIA) 200 – 1000 AD
- Late Iron Age (LIA) 1000 – 1850 AD

However, Huffman (2007) suggests instead that there are three periods within the Iron Age; these periods are:

- Early Iron Age (EIA) 250 – 900 AD
- Middle Iron Age (MIA) 900 – 1300 AD
- Late Iron Age (LIA) 1300 – 1840 A.D

Thomas Huffman believes that a Middle Iron Age should be included within this period. His dates have been widely accepted in the IA field of archaeology.

The South African Iron Age consists of farming communities who had domesticated animals, cultivated plants, manufactured, and made use of ceramics and beads, smelted iron for weapons and manufactured tools (Hall 1987). Iron Age people were often mixed farmers/agropastoralists. These agropastoralists generally chose to live in areas with sufficient water for domestic use along with arable soil that could be cultivated with an iron hoe. Most Iron Age (IA) settlements were permanent settlements, consisting of features such as houses, raised grain bins, storage pits and animal kraals/byres this is in contrast to the temporary camps of pastoralists and hunter-gatherers (Huffman 2007). It is evident in the archaeological record that IA groups had migrated with their material culture (Huffman 2002).

The majority of the IA groups in southern Africa preferred to occupy the central and eastern parts of southern African from about 200 AD. The San and Khoi remained in the western and southern parts (Huffman 2007; Van Vollenhoven 2014). IA sites are scarce, but not unheard-of in the Northern Cape. IA sites have predominantly been recorded in the northeastern part of the province. Kruger (2018) suggested that environmental factors delegated the spread of IA farming westwards during the 17th century. Settlement in the Northern Cape was constrained mainly to the areas east of the Langeberg Mountains. The Later Iron Age (LIA) was accompanied by extensive stone walled settlements, such as the Thlaping capital Dithakong, approximately 40 km north of Kuruman (De Jong 2010). The Sotho-Tswana and Nguni speaking societies, who are the descendants of the LIA mixed farming communities, moved into a region already sparsely inhabited by LSA Khoisan groups. De Jong (2010) commented that LIA communities eventually assimilated many LSA Khoisan groups, and only a few had managed to survive independently. Some of the surviving groups included the Koranna and the Griqua. This period of contact has often been referred to as the Ceramic LSA. It is represented by sites such as the earlier mentioned Blinkklipkop specularite mine near Postmasburg and Kathu Pan (De Jong 2010). LIA people briefly utilised the area close to the Orange River in the Northern Cape, mining copper, and there is even evidence of an IA presence as far as the Upington area in the 18th century (Kruger 2018; Van Vollenhoven 2014).

5.1.3 Historical period

The historical period within the region coincides with the incursion of white traders, hunters, explorers, and missionaries into the interior of South Africa. Buildings and structures associated with the early missionaries, travellers, and traders such as PJ Truter's and William Somerville (arriving in 1801), Donovan, Burchell and Campbell, James Read (arriving around 1870) William Sanderson, John Ryan and John Ludwig's (De Jong 2010; Snyman 2000) arrival during the 19th century, and the settlement of the first white farmers and towns, are still evident in the Northern Cape. Numerous heritage reports that provide a synthesis of the incursions of travellers, missionaries and the early European settlers have been captured on the SAHRIS database.

San hunter-gatherer groups utilised the landscape for thousands of years, and Khoi herders moved into South Africa with their cattle and sheep approximately 2000 years ago. With the arrival of the Dutch settlers in the Cape in the mid-17th century, clashes between the Europeans and Khoi tribes in the Cape Peninsula resulted in the Goringhaiqua and Goraxouqua migrating north towards the Gariep/Orange River in 1680. These tribes became collectively known as the Korannas, living as small tribal entities in separate areas (Penn 2005).

Because of its distance from the Cape Colony, this arid part of South Africa's interior was generally not colonised until relatively recent. According to history, the remote northern reaches of the Cape Colony were home to cattle rushers, gunrunners, river pirates and various manner of outlaws. Distribution of land to colonial farmers only occurred from the 1880s onwards when Government-owned land was surveyed, divided into farms, and transferred to farmers. More permanent large-scale settlement however only started in the late 1920s, and the first farmsteads were possibly built during this period. The region remained sparsely populated until the advent of the 20th century (De Jong 2010, Penn 2005).

The region has been the backdrop to various incidents of conflict. Numerous factors such as population growth, increasing pressure on natural resources, the emergence of power blocs, attempts to control trade, and the emergence of the Griquas, and penetration of the Koranna and early white communities from the south-west resulted in a period of instability in the Northern Cape. With the introduction of loan farms, in the second half of the 18th century, an influx of newcomers such as trekboers, European game hunters and livestock thieves contributed to the volatility and sociocultural stress and transformation in the region (Mlilo 2019).

The *Difaqane/Mfecane*, which began in the late-18th century, affected the Northern Cape Province around 1820, which was much later than the rest of southern Africa (De Jong 2010; Mlilo 2019). During this time, there was an incursion of displaced refugees associated with the Fokeng, Tlokwa, Hlakwana and Phuting groups into the northeast (De Jong 2010). The arrival of large numbers of Great Trek Boers from the Cape Colony to the borders of Bechuanaland and Griqualand West in 1836 caused friction with many Tswana groups and the missionaries of the London Mission Society. The conflict between Boer and Tswana communities escalated in the 1860s and 1870s when the Koranna and Griqua communities and the British government became involved. The Koranna wars took place during 1879-1880.

According to Breutz (1953, 1954), and Van Warmelo (1935), several Batswana tribes, including the different Thlaping and Thlaro sections as well as other smaller groups, take their 18th and 19th-century roots back to the area around Groblershoop, Olifantshoek, the Langeberg (Majeng) and Korannaberg ranges in the western part of the region. After Britain annexed Bechuanaland in 1885, the land of the indigenous inhabitants was limited to a few reserves. After the failed Tswana revolt in 1895, the British continued to divide the Tswana land up, and grant it to settling colonial farmers.

The Northern Cape was critical in the Anglo-Boer War (1899-1902), and significant battles took place within 120 km of Kimberley, including the battle of Magersfontein. Boer guerrilla forces roamed the entire Northern Cape region and skirmishes between Boer and Brits were regular occurrences. Furthermore, many graves in the region tell the story of battles fought during the 1914 Rebellion (Hopkins 1978).

5.2 Local

During 1778, Swedish-born traveller and explorer Hendrik Wikar reached the middle and lower reaches of the Orange River after a long land journey that started in Cape Town. As a deserter from the service of the Dutch East India Company, Wikar spent several years within the area and compiled a report of his experiences in exchange for a pardon (Ross 1975). He documented his encounters with Khoisan communities who called themselves the *Einiqua*, or *River People*. The *Einiqua* were divided into three “kraals”: the *Namnykoa* near the Augrabies Falls, the *Kaukoa* on islands west of Keimoes, and the *Aukokoa* of Kanoneiland and other islands to the east. Their kraals consisted of a considerable amount of sheep and cattle, and they collected plants, hunted game, and cultivated dagga but no other crops, according to Wikar (Ross 1975). Amongst the

pastoralist communities living on the islands were the *Anoe eis* people whom Wikar characterised as “Bushmen”. They possessed no domesticated stock, subsisted by fishing, game-trapping, hunting and the gathering of plant foods (Morris & Beaumont 1991). Colonel Robert Jacob Gordon who visited the area in 1779, however, remarked that they were actually *Einiqua* (i.e. Khoi) who had "lost their cattle as a result of an argument with the *Namneiqua* village (Morris & Beaumont 1991). The San and Khoekhoe hunter-gatherers in the region had reached a form of stability by the early 18th century (Mlilo 2019). The area west of the Langeberg and east of Upington was occupied by IA groups such as the BaTlaping. Their influence had reached as far down the river as Upington (Morris 1992).

By the 18th century, the *Basters* had focused on the Orange River (and Namaqualand) as destinations of sanctuary from colonial rule and social oppression present in the Cape Colony (Mlilo 2019; Van der Walt 2015). The term "*Baster*" characterises a group of people of mixed percentage (white and Khoekhoe or slave and Khoekhoe) who possessed property and who was culturally European. In 1882, the first 81 farms north of the Gariep/Orange River between Groblershoop and the Augrabies Falls were allocated almost exclusively to *Basters* (Morris 1992). During the late 19th century, more white people started moving to the Gordonia area, and by the turn of the century, some 13 Afrikaner families had settled at Keimoes (De Beer 1992; Van der Walt 2015). The aftermath of the scorched earth policy of the South African War (Anglo-Boer War), resulted in many farmers moving to new areas, in search of greener pastures, and settlement next to the Gariep/Orange River provided ample irrigation for one‘s crops.

Since the 1880s, the irrigation of the Orange River played a central role in the economic advancement of the area around Upington (Legassick 1996). The development of the canal systems was integral in irrigating extensive vineyards and orchards and the expansion of substantial agricultural enterprises within the area (Engelbrecht & Fivaz 2018). Dutch Reformed Church missionary Reverend C.H.W. Schröder and Special Magistrate for the Northern Border John H. Scott, are credited with formalising and extending the irrigation system. However, when Schröder first came to Upington in July 1883, there were already people in the area of Keimoes that used irrigation and planted fields. Moolman (1946) and Legassick (1996) mentions how the *Baster* farmers diverted river water to their gardens, albeit crudely. The *Basters*’ irrigation scheme has been attributed to the ingenuity of Abraham September. Legassick (1996) commented that "the small, white-painted, stone house where Abraham September lived when he undertook this work survives to this day, though the house and the land upon which it stands have long passed from the hands of the September family".

The early Portuguese sailors referred to the Gariep/Orange River as the St Anthonio, and Simon van der Stel marked it as the Vigiti Magna on maps from 1685. The elephant hunter Jacobus Coetzee called it the “*de Groote Rivier*” (the Great River) in 1760 and land-surveyor Carel Brink noted in 1761 that the river is known to the local island inhabitants as the Tyen Gariep (*Our River*). The missionary Campell also spoke of the Gariep, Gareeb, and Garib, as the name the Korannas used. On the evening of 17 August 1779, Robert Gordon took his rowboat out to the middle of the river, raised, and toasted the Netherland’s flag, and proclaimed the river in the name of the Prince van Oranje. Maps from this date forward name the river as the Orange River (Oranjeriver), but colloquially it is still known as the Gariep or Grootrivier. !Kheis Municipality is named in recognition

of the first permanent residents of the area. !Kheis is a Khoi name meaning "a place where you live", or "a home".

De Jong (2010) classifies the cultural landscape along the Gariep/Orange River as predominantly historic farmland. In the Lower Orange River environment, farms display heritage features that typically occur in the district, such as their large size, irrigation furrows and pipelines, fences, tracks, farmsteads, and irrigated fields. Farmsteads are clustered close to rivers and primary roads (De Jong 2010). According to De Jong (2010), this class of landscape is of relatively low heritage sensitivity because it can absorb adverse effects of new development through some mitigation.

5.3 Topline (Saalskop), Wegdraai, Opwag, Groblershoop, Boegoeberg (Brandboom)

Various HIA and AIA reports have been conducted in and around the vicinity of Groblershoop, Boegoeberg, Opwag, Topline and Wegdraai study areas. These include, but are not limited to, the farms situated around the study areas. These farms include Buchuberg 263, Farm 292, Farm 387 Sanddraai 391, Bokpoort 390 and Kleinbegin 115.

5.3.1 Stone Age

The distribution of archaeological sites in the area has been characterised by Morris (2012) as stone artefacts along the Orange River; stone artefacts situated on the calcrete plain east of the Orange River; stone artefact scatters between dunes. Scatters of stone artefacts in and around the Groblershoop- Boegoeberg area have been reported by Beaumont (2008), Engelbrecht & Fivaz (2019) Dreyer (2006, 2012, 2013, 2015), Morris (2006, 2007, 2012, 2014), Orton & Webley (2013), Van der Walt (2012); Van Ryneveld (2007), Van Schalkwyk (2011, 2020), Van Vollenhoven (2014), and Webley (2013). The lithics that have in the area have been attributed to the ESA, MSA, and the LSA. Raw materials include chalcedony, jasperlite, quartzite and banded ironstone formation (BIF), as well as meta-quartzite. These scatters of lithics generally have little to no context. Predominantly heritage reports describe the recorded stone artefacts in the area to be of poor preservation and with limited heritage significance.

During his survey on the Farms Sanddraai and Bokpoort, situated in the vicinity of Saalskop (Topline) and Wegdraai, Morris (2012) reported MSA materials scattered amongst the calcrete surface deposits at the edges of borrow pits along the Loop 16 on the Sishen-Saldanha railway line. Dreyer's (2012) survey documents a single scatter of worked chalcedony, BIF, quartz and meta-quartz artefacts near a calcrete outcrop, with a substantial collection of flakes on the slopes along the River at Sanddraai.

Engelbrecht & Fivaz (2019) documented several MSA and LSA scatters on Farm 387, Portion 18, Groblershoop. Apart from low-density MSA and LSA artefact scatters, they documented moderate to high densities of MSA/LSA open lithic scatters with flakes, scrapers, cores, microliths and

incidences of local ceramics. Two sites recorded next to the Orange/Gariep River are probable hunter/herder sites, while five sites located on the dunes are believed to be knapping sites (Engelbrecht & Fivaz 2019). On the Farm 292 located near Groblershoop, Beaumont (2008) found low densities of Stone Age artefacts. On a section of Farm 387 Webley (2013) recorded background scatters of MSA artefacts of quartzite and BIF cobbles throughout the study area.

The majority of the artefacts across the landscape are randomly scattered. Nevertheless, it has been found that dense scatters of artefacts appear on and around small koppies. Several MSA and LSA stone artefact scatters have been identified on the eastern margins of the Orange River, Groblershoop (Webley 2013). The informally flaked hornfels cobbles and quartz flakes recorded along the shore may indicate the presence of LSA occupations (Webley 2013). The LSA scatters on the eastern shore, are believed to be of medium significance as they can potentially inform us “on hunter-gatherer and pastoralist settlement patterns along the River" (Webley 2013).

In Orton & Webley's (2013) report for the proposed Boegoeberg Hydropower station approximately 14.6 - 24 km south/southeast from the Brandboom/Boegoeberg study area, they mention several exciting finds. They found a small ephemeral archaeological Later Stone Age site on the sandy floodplain just downstream of the Boegoeberg Dam/Weir. This site consisted of a scatter of rocks that may likely have been used to anchor a hut, in association with two artefacts and one fragment of OES (Orton & Webley 2013). Orton & Webley (2013) recorded a cluster of stone walls on the south side of the river and the mountain slope close to the power line crossing point. The presence of pre-colonial stonewalling in the Groblershoop and Boegoeberg study areas is rare. This archaeological site is approximately 17 km from the Brandboom/Boegoeberg study area. The features included straight walls, semi-circles, L-shapes, and small mounds of rocks. Very little associated archaeological material was discovered on the surface. They note in the report that these stone walls are typical of pre-colonial walling from the Karoo and some may have been hunting blinds. They also documented scatters of MSA stone artefacts above the cliff at Boegoeberg Weir/Dam, and a few LSA grindstones and other isolated artefacts in the area.

5.3.2 Historical period

It was around 1870 that the first Colonial farmers had settled in the Groblershoop area (Orton & Webley 2013). The town of Groblershoop originally developed on the farm Uitdraai (Engelbrecht & Fivaz 2019). Military topographic maps from 1908 and 1913 show a sparsely populated area, with numerous tracks across the sandy plains. There were halts situated at Zaalskop, Wegdraai, Uitdraai, Winstead and a hotel at Dabep. Access to water at Wegdraai was via a steep and narrow approach, at Uitdraai, there were a large well and tank situated underneath the house and a store where a supply of forage could be obtained. A weir was constructed across the Orange River at Buchuberg, with a turbine historic water turbine driven by solid-oak gears in the Orange River on the Farm Winstead. This historic water turbine was built in 1913 (Engelbrecht & Fivaz 2019). All along the eastern shore of the Orange River, locations of “native huts and kraals” are indicated.

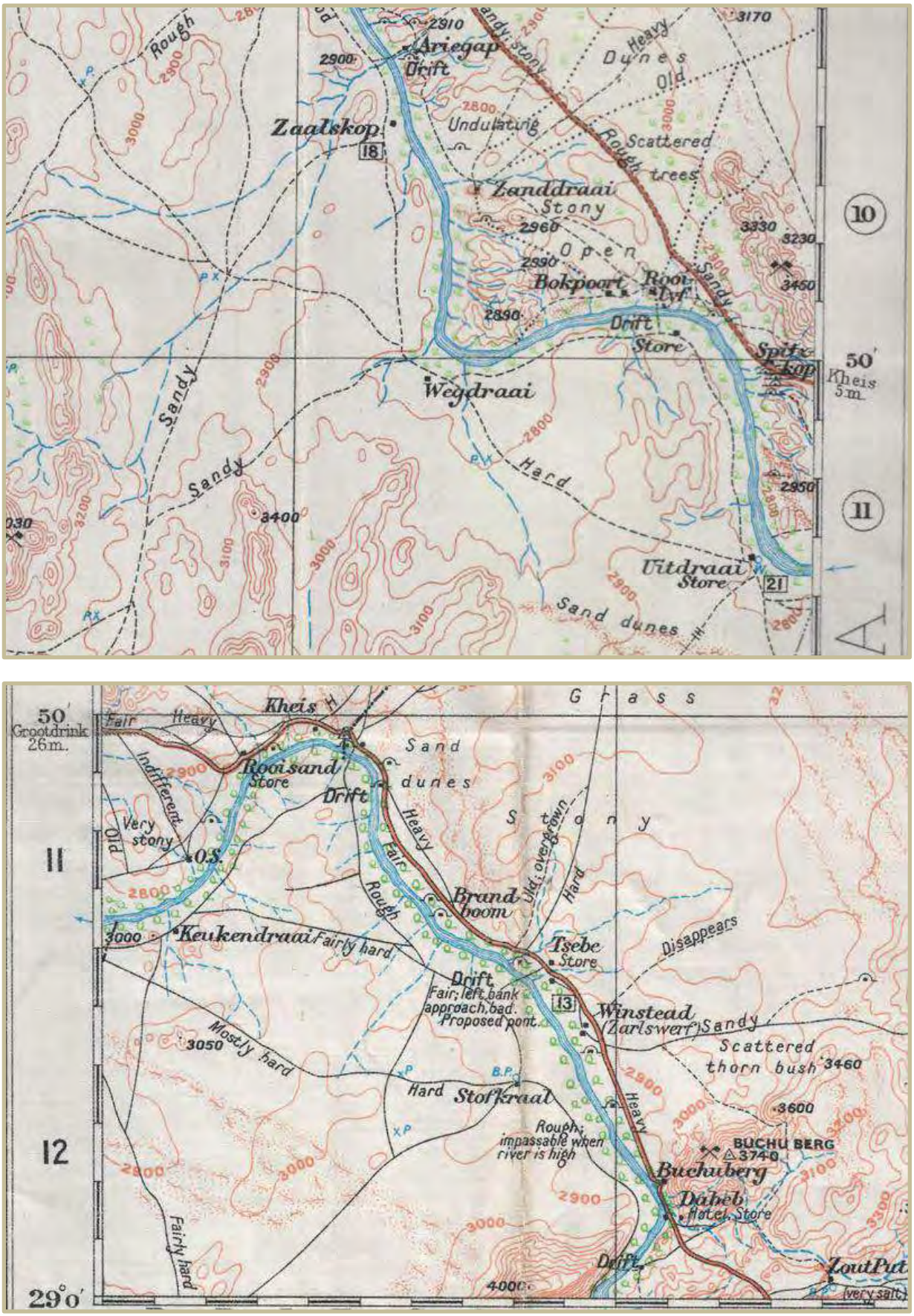

Figure 7 Detail of 1913 Topographical map of Upington, and detail of 1914 topographical map of Langeberg, available at https://digitalcollections.lib.uct.ac.za/

Groblershoop developed as a result of the development of the Boegoeberg Dam and water channels in 1929 (Van Schalkwyk 2019; 2020). The town was initially known as Sternham, with the first house dating to 1912. In 1935, the town was renamed to Groblershoop, after a former Minister of Agriculture: Mr PGW Grobler. Mr Grobler assisted in the development of the Boegoeberg Dam and the irrigation project in 1929. He had played a substantial role in this development and creating employment for the poor-white community and boosting progress in the region (Engelbrecht & Fivaz 2019). The idea for the construction of the weir and irrigation canal was first considered in 1872. Proposals for the project was rejected in 1896, and again in 1907, for being too expensive (Orton & Webley 2013). After about 20 years of preparatory work, the construction of the Boegoeberg Dam began in May 1929. The dam was completed in 1932, and the canal in 1934. Even children as young as nine years old were employed to work on the construction of the dam and irrigation canals. It is believed that about 50 people (39 being children) died during the construction of the project (Orton & Webley 2013). The Boegoeberg Dam itself is a significant heritage structure (Orton & Webley 2013).

Minimal artefacts and structures dating to the historical/colonial period have been recorded on sites in the vicinity of the Groblershoop and Brandboom/Boegoeberg study areas or on the farms surrounding Topline (Saalskop), Wegdraai, and Opwag. Nevertheless, AIA and HIA reports state that it is not uncommon to find colonial-era builds/artefacts in the area. Morris (2012) noted colonial-era traces such as the agricultural modification of the riverbank, a railway bridge, and a stone structure, close to the Orange River, on the farms of Sanddraai 391 and Bokpoort 390. During Webley's (2013) survey for the proposed construction of the Eskom Groblershoop Substation and the Garona-Groblershoop 132 kV powerline, she found a stone reservoir (25m x 25m) lined with plaster, with a gutter made of stone running around the margins to collect water. She notes that there were various rusted farm implements nearby (Webley 2013). Orton & Webley (2013) have noted that there are a few farm buildings in the area, such as a house dating to the late-19th or early-20th century, considered to be of high heritage significance. Another structure, built with traditional materials like sun-dried bricks, mud and mortar, plastered in modern cement in 1956 (date inscribed by the entrance steps) was documented.

5.2.3 Graves and Burials

During the construction of the Boegoeberg Dam, severe gastroenteritis and malaria resulted in the deaths of many children. Most of the headstones in the cemetery at the dam mark children's graves (https://graves-at-eggsa.org). Orton & Webley (2013) recorded an informal graveyard alongside the access road to Zeekoebaart. An isolated grave about one metre off the edge of the road, as well as two isolated graves in the sandy floodplain just downstream of the weir was also documented (Orton & Webley 2013). Several graves dating to the Second Anglo Boer War (1899-1902), belonging to the Dragoon mounted infantry unit, are present in the area (Van Vollenhoven 2014). Seven graves dating to the 1914 Rebellion have been recorded about 25 km from Groblershoop on the road to Griquastad (Webley 2013).

In 1956 Senator A. S. Brink of Keimoes had donated archaeological objects to the South African Museum in Cape Town. Rudner (1971) wrote that the majority of the objects were found in 1934

on the former farm Grootdrink, between Upington and Prieska, during the construction of an irrigation canal from the Boegoeberg Dam. On the southern bank of the river, the flooding of the canal exposed old burials. The human remains were buried in a squatting (crouching) position with their arms folded in front of the legs. Along with the graves, several ostrich eggshell (OES) flasks, one filled with powdered specularite iron, OES beads and bored stone (one of them heart-shaped), several pots and other objects were discovered (Rudner 1971).

5.2.4 Oral history

No interviews with locals were conducted regarding the history of the area.

6. IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT

6.1 Surveyed area

The area surveyed for the impact assessment was dictated by the Google Earth map of the development footprints provided by the client.

The pedestrian survey was conducted in predominantly 40-50 m transects. Areas that have been severely disturbed were surveyed in wider transects or only scoped. The survey extended beyond the development footprints to take into consideration the full impact of the development by investigating probable areas on the landscape adjacent to the development footprints that may contain heritage.

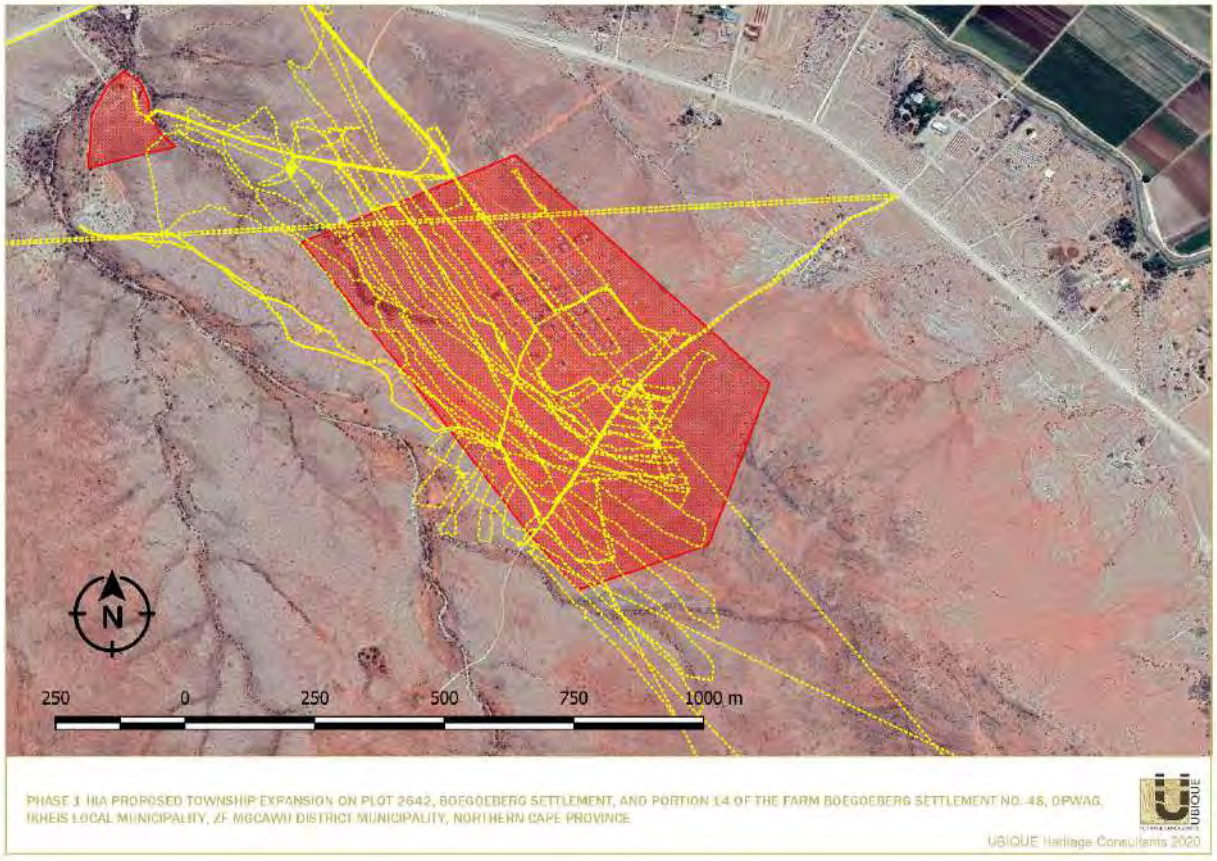

Figure 8 *Survey tracks across the development footprint.*

6.2 Identified heritage resources

HERITAGE RESOURCES RECORDING

Historical Period Resources Identified

Point ID & Site Name	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
WP 045 OPW002 Boegoeberg Settlement RE/48/14	Type of feature	Chunks, cores and flakes	ESA/ MSA	**28° 50' 23.7" S 21° 57' 24.8" E**	Field Rating IV C Low significance No Mitigation Required
	Material	BIF and Quartzite			
	N in m².	8/200m²			
	Context	Scatter. No context			
	Additional				
WP 046 OPW003 Boegoeberg Settlement RE/48/2642	Type of feature	Chunks, flakes and blade	ESA/ MSA	**28° 50' 03.3" S 21° 57' 07.7" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	6/100m²			
	Context	Scatter. No context			
	Additional				
WP 047 OPW004 Boegoeberg Settlement RE/48/2642	Type of feature	Flakes, chunks and core	ESA/ MSA	**28° 50' 03.0" S 21° 57' 11.0" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	6/100m²			
	Context	Scatter. No context			
	Additional				
WP 048 OPW005 Boegoeberg Settlement RE/48/14	Type of feature	Flakes, chips, scraper and core	ESA/ MSA	**28° 50' 06.0" S 21° 57' 15.2" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	6/200m²			
	Context	Scatter. No context			
	Additional				
WP 049 OPW006 Boegoeberg Settlement RE/48/14	Type of feature	Flakes, chunk, scraper and core	ESA/ MSA	**28° 50' 16.0" S 21° 57' 22.7" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	7/200m²			
	Context	Scatter. No context			
	Additional				
WP 050 OPW007 Boegoeberg Settlement RE/48/14	Type of feature	Flakes, chunks and blade	ESA/ MSA	**28° 50' 21.1" S 21° 57' 27.8" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	6/200m²			
	Context	Scatter. No context			
	Additional				
WP 051 OPW008 Boegoeberg Settlement RE/48/2642	Type of feature	Flakes, chips and chunks	ESA/ MSA	**28° 50' 18.3" S 21° 57' 35.6" E**	Field Rating IV C Low significance No mitigation
	Material	BIF and CCS			
	N in m².	5/200m²			
	Context	Scatter. No context			
	Additional				
WP 052 OPW009 Boegoeberg Settlement RE/48/14	Type of feature	Flakes and chunk	ESA/ MSA	**28° 50' 19.2" S 21° 57' 27.8" E**	Field Rating IV C Low significance No mitigation
	Material	BIF and CCS			
	N in m².	4/100m²			
	Context	Scatter. No context			
	Additional				
WP 053 OPW010	Type of feature	Flakes, scrapers and chunk	ESA/ MSA	**28° 50' 16.7" S**	Field Rating IV C

Boegoeberg Settlement RE/48/2642	Material	BIF		**21° 57' 33.6" E**	Low significance No mitigation
	N in m².	9/200m²			
	Context	Scatter. No context			
	Additional				
WP 054 OPW011 Boegoeberg Settlement RE/48/2642	Type of feature	Flakes, scraper and chunks	ESA/ MSA	**28° 50' 19.4" S 21° 57' 33.2" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	4/200m²			
	Context	Scatter. No context			
	Additional				
WP 055 OPW012 Boegoeberg Settlement RE/48/14	Type of feature	Core, chunk, scraper	ESA/ MSA	**28° 50' 21.8" S 21° 57' 32.8" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	3/200m²			
	Context	Scatter. No context			
	Additional				
WP 056 OPW013 Boegoeberg Settlement RE/48/14	Type of feature	Chunks, core, scraper and small axe/cleaver	ESA/ MSA	**28° 50' 14.7" S 21° 57' 09.6" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	5/100m²			
	Context	Scatter. No context			
	Additional				
WP 083 OPW014 Boegoeberg Settlement RE/48/14	Type of feature	Scraper, flakes and chunk	ESA/ MSA	**28° 50' 22.0" S 21° 57' 18.3" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	3/500m²			
	Context	Scatter. No context			
	Additional				
WP 084 OPW015 Boegoeberg Settlement RE/48/14	Type of feature	Scrapers, chunks, flakes, cores, chips and 2 x chisels/ hammers	ESA/ MSA	**28° 50' 25.2" S 21° 57' 19.8" E**	Field Rating IV C Low significance No mitigation
	Material	BIF and Quartzite			
	N in m².	15/50m²			
	Context	Scatter. No context. Alluvial displacement by water stream and deposited at end of stream/furrow. High concentration of deposit, but random.			
	Additional				
WP 085 OPW016 Boegoeberg Settlement RE/48/14	Type of feature	Scraper and flakes	ESA/ MSA	**28° 50' 25.5" S 21° 57' 29.5" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	7/300m²			
	Context	Scatter. No context			
	Additional				
WP 086 OPW017 Boegoeberg Settlement RE/48/14	Type of feature	Scraper, blade and cores/chunks	ESA/ MSA	**28° 50' 28.1" S 21° 57' 29.8" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	5/500m²			
	Context	Scatter. No context			
	Additional				
WP 087 OPW018 Boegoeberg Settlement RE/48/14	Type of feature	Scraper and flakes	ESA/ MSA	**28° 50' 31.1" S 21° 57' 30.4" E**	Field Rating IV C Low significance No mitigation
	Material	BIF			
	N in m².	5/300m²			
	Context	Scatter. No context			
	Additional				
WP 088 OPW019 Boegoeberg Settlement RE/48/14	Type of feature	Flakes, chips and chunks	ESA/ MSA	**28° 50' 31.1" S 21° 57' 27.9" E**	Field Rating IV C Low significance No mitigation
	Material	BIF and CCS			
	N in m².	5/200m²			
	Context	Scatter. No context			
	Additional				

Graves Identified

Point ID & Site Name	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
WP 043 OPW001 Boegoeberg Settlement RE/48/2642	Grave markers	Cemetery	1980's to current	**28° 49' 59.0" S 21° 56' 56.8" E**	Field Rating of Local Grade IIIB High/medium significance Mitigation Required fencing and no development on cemetery. Out of bounds.
	Inscription	Cemetery			
	Graves' Orientation	East/West			
	Dimensions/ Extent	Approximately 1-2 ha. Outside development footprint.			
	Additional	Opwag official cemetery			

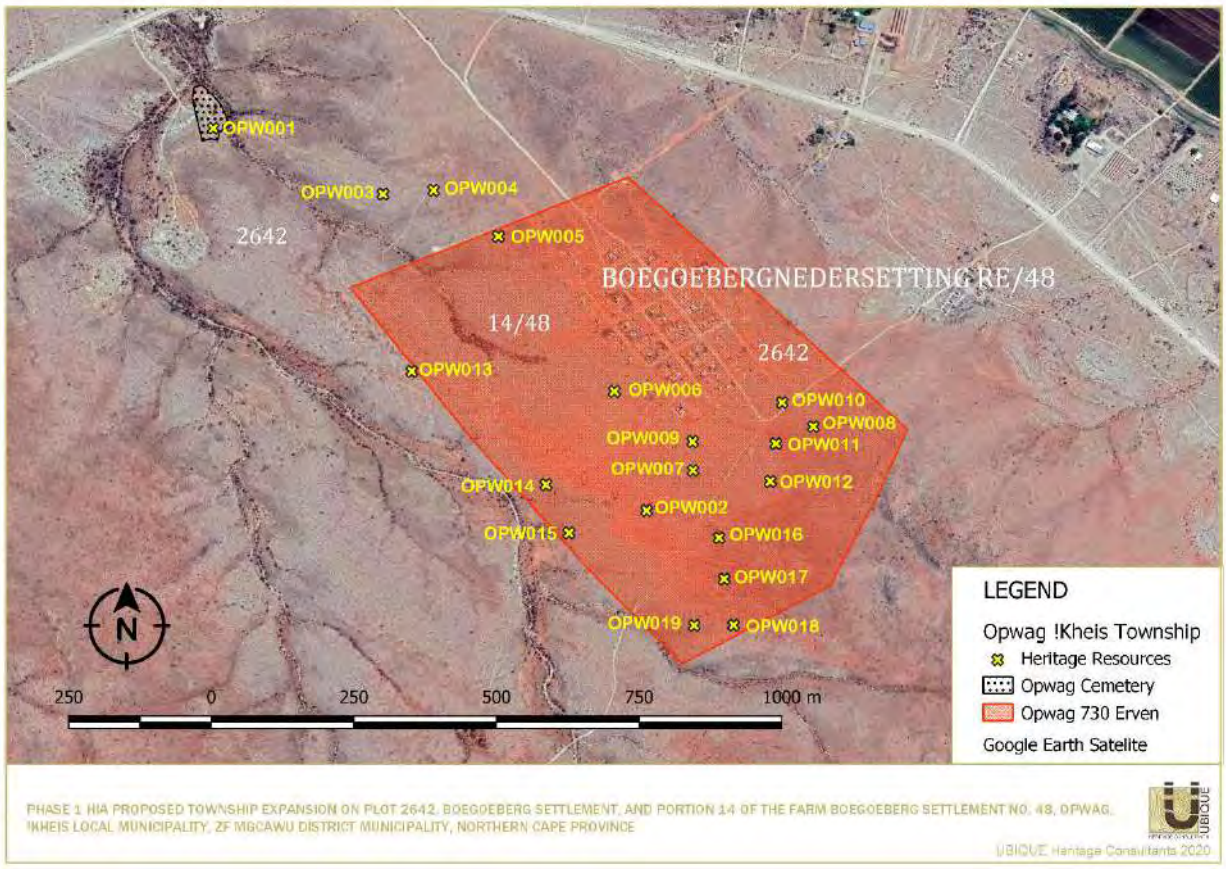

Figure 9 *Distribution of identified heritage resources across Opwag (Uitkoms) township, Farm Boegoebergnedersetting No. 48.*

6.3 Discussion

6.3.1 Archaeological features

A total of eighteen occurrences of background scatter lithic material was found across the surveyed area. Thirteen low-density scatters were recorded across Portion 14 of Farm Boegoebergnedersetting RE/48. Three incidences of lithic material were recorded in the southeastern section of the development footprint on Plot 2642, and two low-density scatters were found to the north of the development footprint on Plot 2642. The lithic assemblages consist predominantly of informal tools such as knapping debitage like chunks, chips and flakes. However, some cores, a few scrapers, blades, and possible retouched flakes are present. A small potential Fauresmith bifacial hand axe, a lithic indicative of the transition between the Earlier and Middle Stone Ages, was recorded at OPW013 (Lotter *et al*. 2016; Underhill 2011; Dr Van der Ryst pers. comm 2020). The majority of the lithic scatters were concentrated within micro basins formed by small waterways, deposited by decades of rainwater running from the surface towards lower areas. The identified archaeological sample is small, of low significance, and therefore of little scientific value. The cultural material may either be a representation of the transition between ESA and MSA, or a mere mixture of ESA and MSA artefacts (Lotter *et al*. 2016; Underhill 2011). The raw material, banded ironstone formation (BIF), is readily available throughout the area. A couple of lithics made from cryptocrystalline silicates (CCS) and quartzite debris are also present. The found lithic material shows various degrees of weathering and are without substantial archaeological context or matrix, and are therefore deemed of minor scientific importance, and not conservation worthy (NCW).

These sites are given a 'General' Protection C (Field Rating IV C). This means these sites have been sufficiently recorded (in Phase 1). It requires no further action.

6.3.2 Graves

The formal Opwag (Uitkoms) cemetery is situated to the northwest of the development footprint. No other graves were found within the study area.

These sites are given a 'Local Grade IIIB" rating. This means the graves should be included in the heritage register and may be mitigated (high/ medium significance).

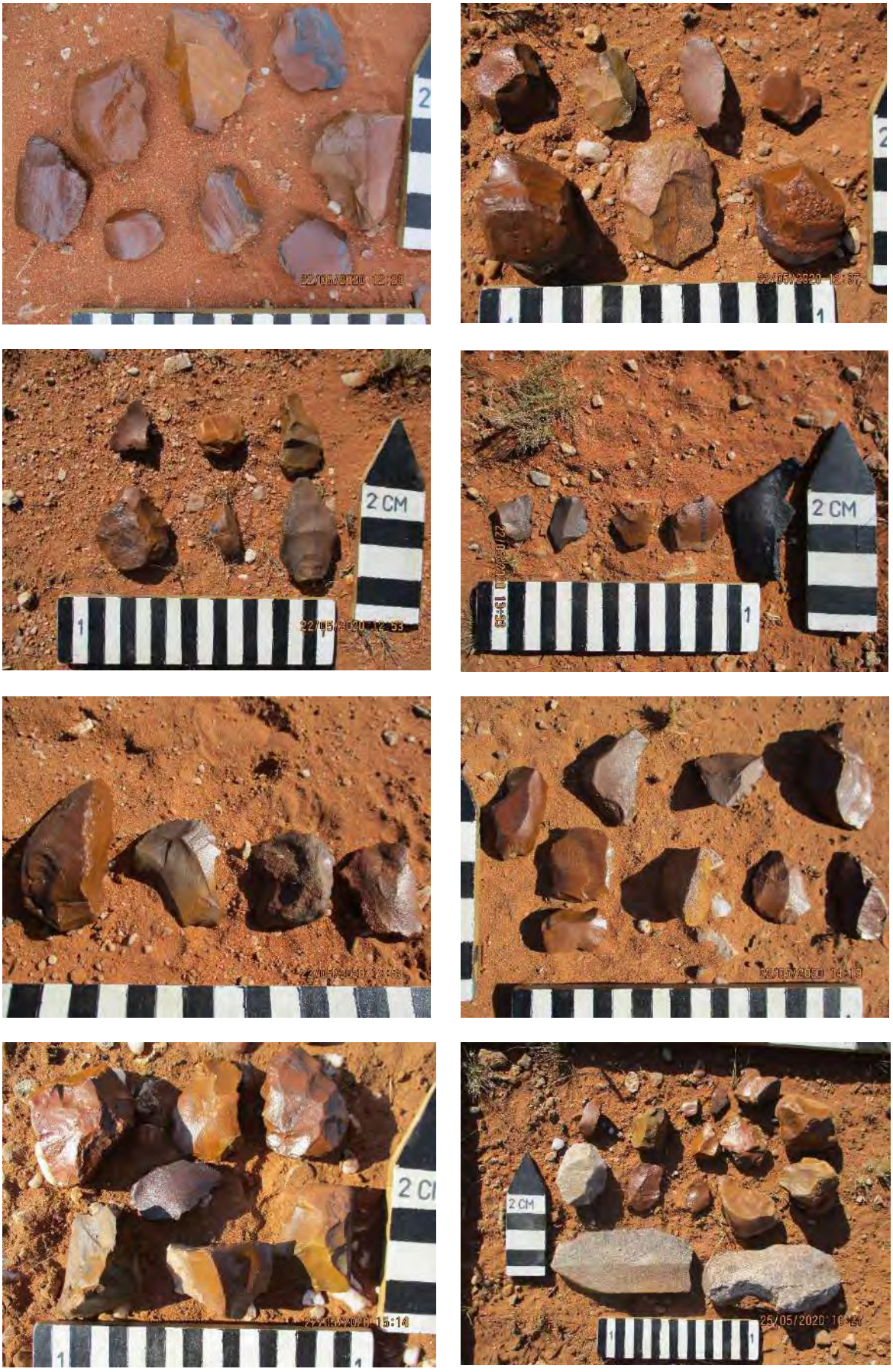

Figure 10 *Photographic selection of archaeological material recorded.*

Figure 11 *Selection of photographs of the Opwag (Uitkoms) town cemetery.*

6.3.3 Palaeontological resources

The Opwag study area is underlain by sediments of the Groblershoop Formation (Brulpan Group). Underlying these rocks are Precambrian Transvaal Supergroup deposits. According to the SAHRIS PalaeoMap, the Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant as these rocks are igneous in origin or too highly metamorphosed to contain fossils (Almond & Pether 2008). Although the Palaeontological Sensitivity of the underlying Transvaal

Supergroup is moderate, the cherts, dolomites and iron formations are too deeply buried to affect the proposed development. The proposed development is not fossiliferous and will not lead to detrimental impacts on palaeontological resources (Butler 2020). Elize Butler from Banzai Environmental, therefore, recommends an exemption from further palaeontological studies for this project (see Appendix 1).

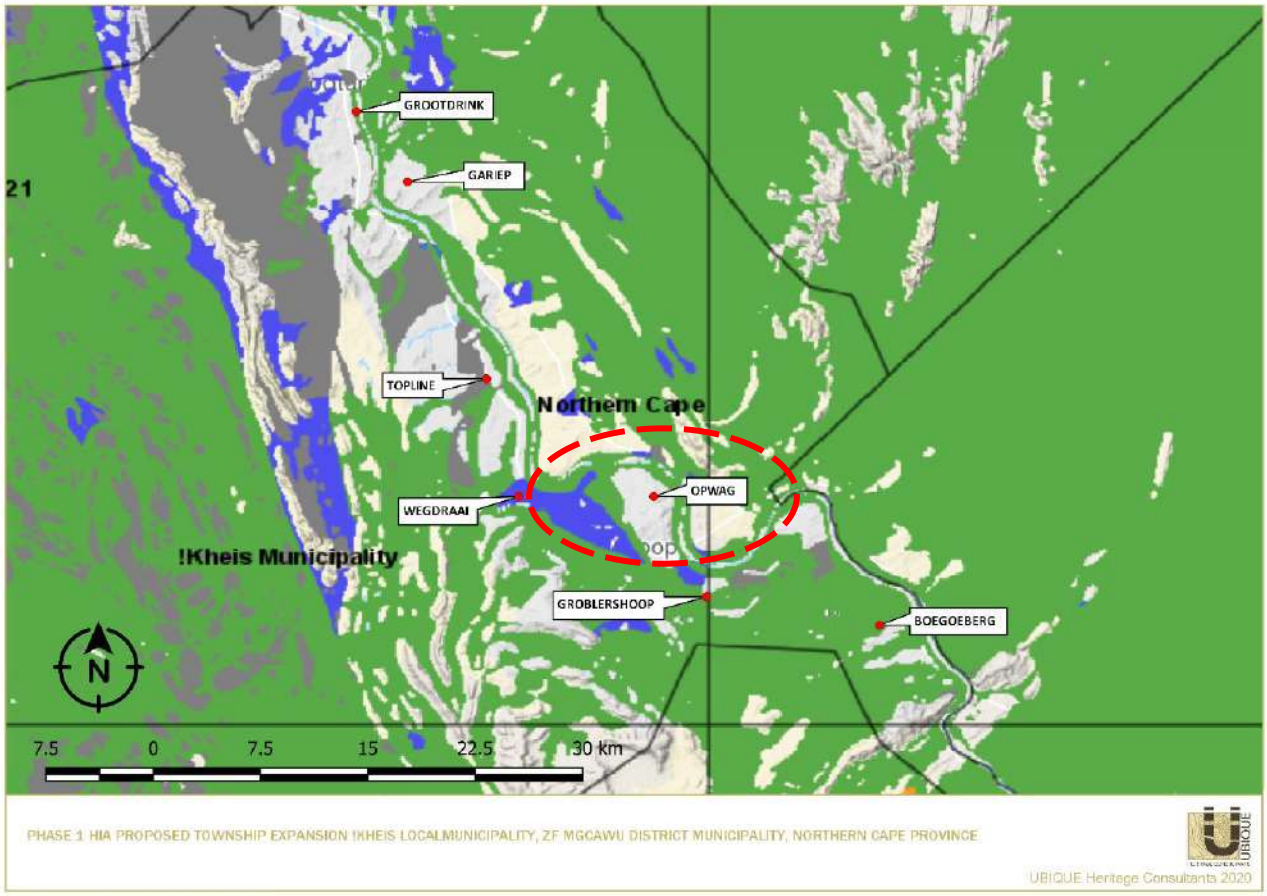

Figure 12 SAHRIS PalaeoSensitivity Map, indicating Moderate (green), Low (blue), Insignificant/Zero (grey), and Unknown (clear) palaeontological significance in the study area (https://sahris.sahra.org.za/map/palaeo).

7. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

Description	Development Impact		Mitigation	Field rating/ Significance
Archaeological				
1. The eighteen occurrences of ESA/MSA surface scatters across the development footprint.	Nature	Negative	No mitigation required.	Field Rating IV C Low significance
	Extent	Low		
	Duration	High		
	Intensity	High		
	Potential of impact on irreplaceable resource	High		
	Consequence	High		
	Probability of impact	High		
	Significance	High		
Graves				
2. The formal Opwag cemetery.	Nature	Neutral	No mitigation required.	Field Rating of Local Grade IIIB high significance
	Extent	Low		
	Duration	Low		
	Intensity	High		
	Potential of impact on irreplaceable resource	Low		
	Consequence	Low		
	Probability of impact	Low		
	Significance	Low		
Paleontological				
3. The Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant, and the underlying Transvaal Supergroup is moderate.	Nature	Neutral	No mitigation required.	N/A
	Extent	Low		
	Duration	High		
	Intensity	Low		
	Potential of impact on irreplaceable resource	Low		
	Consequence	Low		
	Probability of impact	Low		
	Significance	Low		

The impact of the development will have a negative impact on the identified heritage resources on Plot 2642 and Portion 14 of the Farm Boegoebergnedersetting RE/48. The lithic material is without any substantial archaeological context and deemed not conservation worthy. The negative impact is, therefore, negligible. The cemetery OPW001 is well outside the development footprint and should not be affected by the proposed project. The probability of the development impacting on palaeontological heritage during the construction phase is regarded as minimal to zero, and the significance of the impact occurring, low.

8. RECOMMENDATIONS

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. No significant heritage sites or features were identified within the surveyed sections of Opwag (Uitkoms) township, Plot 2642, Boegoeberg Settlement, and Portion 14 of the Farm Boegoebergnedersetting RE/48. The Early/Middle Stone Age cultural material identified is not conservation worthy. No further mitigation is recommended with regards to these resources. Therefore, from a heritage point of view, we recommend that the proposed development can continue.

2. The Opwag cemetery is situated well outside the development footprint. This site is graded as IIIB and is of High Local Significance. No further mitigation is recommended with regards to these resources. No graves were identified within the development footprint.

3. Due to the zero to low palaeontological significance of the area, no further palaeontological heritage studies, ground-truthing and/or specialist mitigation are required. It is considered that the development of the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area as the igneous rocks underlying the site are not fossiliferous. It is therefore recommended that the project be exempt from a full Paleontological Impact Assessment (Butler 2020).

4. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred as a result of such oversights.

9. CONCLUSION

This HIA has identified no significant heritage resources that will be impacted negatively by the proposed development. The proposed expansion of the Opwag (Uitkoms) township, on Plot 2642 and Portion 14, Boegoeberg Settlement, Farm Boegoebergnedersetting RE/48 in the !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape, may continue, provided the recommendations stipulated within this report, and the subsequent decision by SAHRA, are followed.

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http://www.sahra.org.za/sahris

https://www.sahistory.org.za/article/kora

https://csg.esri-southafrica.com/portal/apps/webappviewer

APPENDIX A

PALAEONTOLOGICAL EXEMPTION LETTER FOR THE PROPOSED OPWAG TOWNSHIP EXPANSION, !KHEIS LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

PALAEONTOLOGICAL EXEMPTION LETTER FOR THE PROPOSED OPWAG TOWNSHIP EXPANSION, !KHEIS LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Reference: NC/21/2018/PP
(Opwag 730) / BH0068

Issue Date: **13 June 2020**
Client: **UBIQUE Heritage Consultants**

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: 

EXECUTIVE SUMMARY

Banzai Environmental was commissioned by UBIQUE Heritage Consultants to write a Palaeontological Exemption Letter for the proposed Opwag Township Expansion in !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

The proposed development is underlain by sediments of the Groblershoop Formation (Brulpan Group). Underlying these rocks are rocks of the Precambrian Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System, the Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant as these rocks are igneous in origin or too highly metamorphosed to contain fossils (Almond & Pether 2008). Although the Palaeontological Sensitivity of the underlying Transvaal Supergroup is moderate, the cherts, dolomites and iron formations are too deeply buried to affect the proposed development.

This is a recommended exemption from further Palaeontological studies as the proposed development is unfossiliferous and will not lead to detrimental impacts on the palaeontological resources.

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- **INTRODUCTION**

The Barzani Group appointed Macroplan Town and Regional Planners to proceed with the completion of the Town Planning process for the proposed Opwag Township Expansion on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement no 48, Opwag, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province (Figure 1-2). UBIQUE Heritage Consultants was appointed to conduct the Heritage Impact Assessment while Banzai Environmental was in turn appointed to conduct the Palaeontological Exemption Letter.

The proposed Opwag Township Expansion comprises of the creation of new erven, as well as the formalisation of the existing informal houses that are located around the town. The Opwag Township Expansion will accommodate 730 erven on 50 Ha. This project will fill an urgent need for residential erven in the sub-economic market.

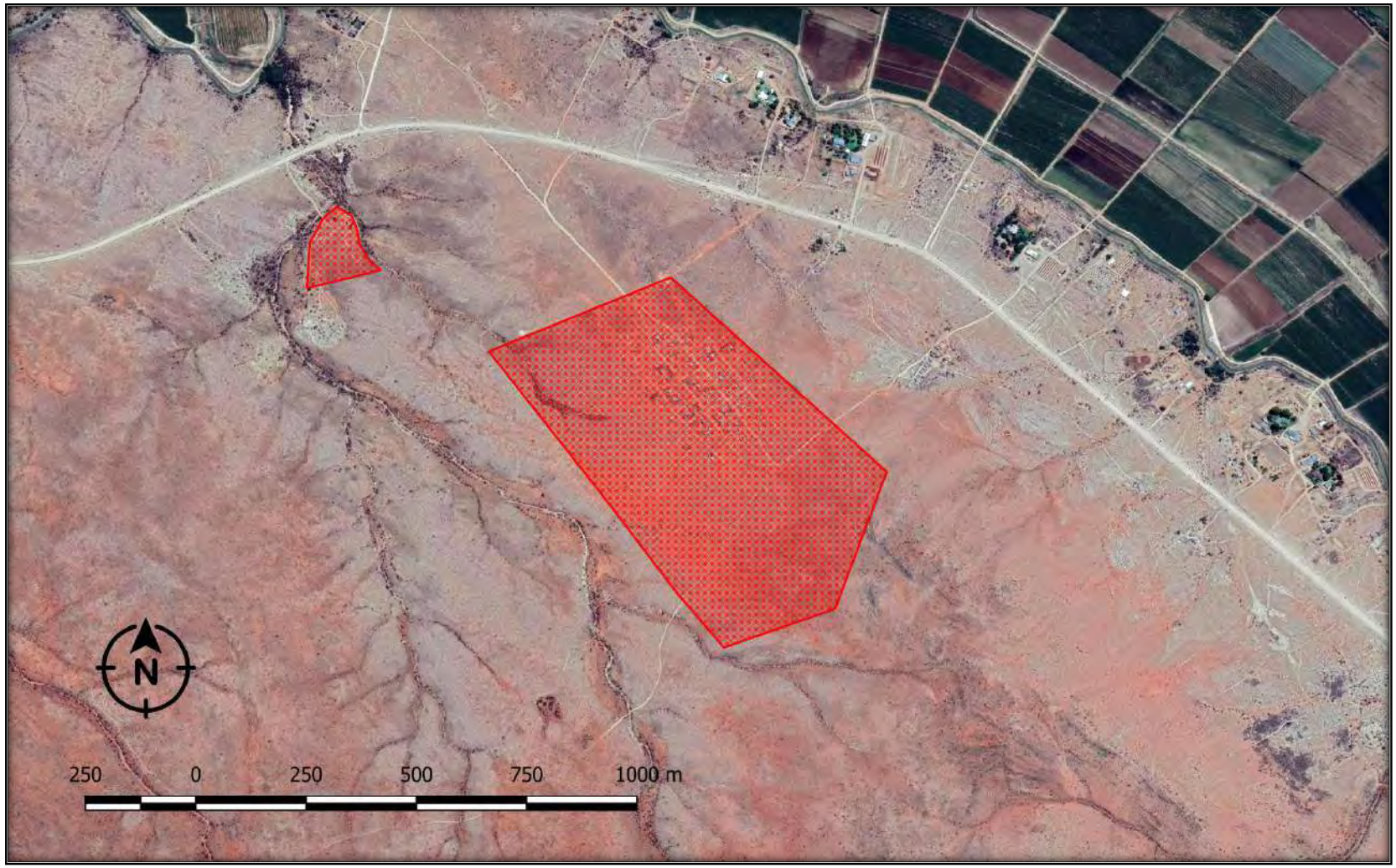

***Figure 13**: Google Earth Image of the proposed Opwag Township Expansion on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement no 48, Opwag, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province, Northern Cape Province. Map modified from Ubique Consultants.*

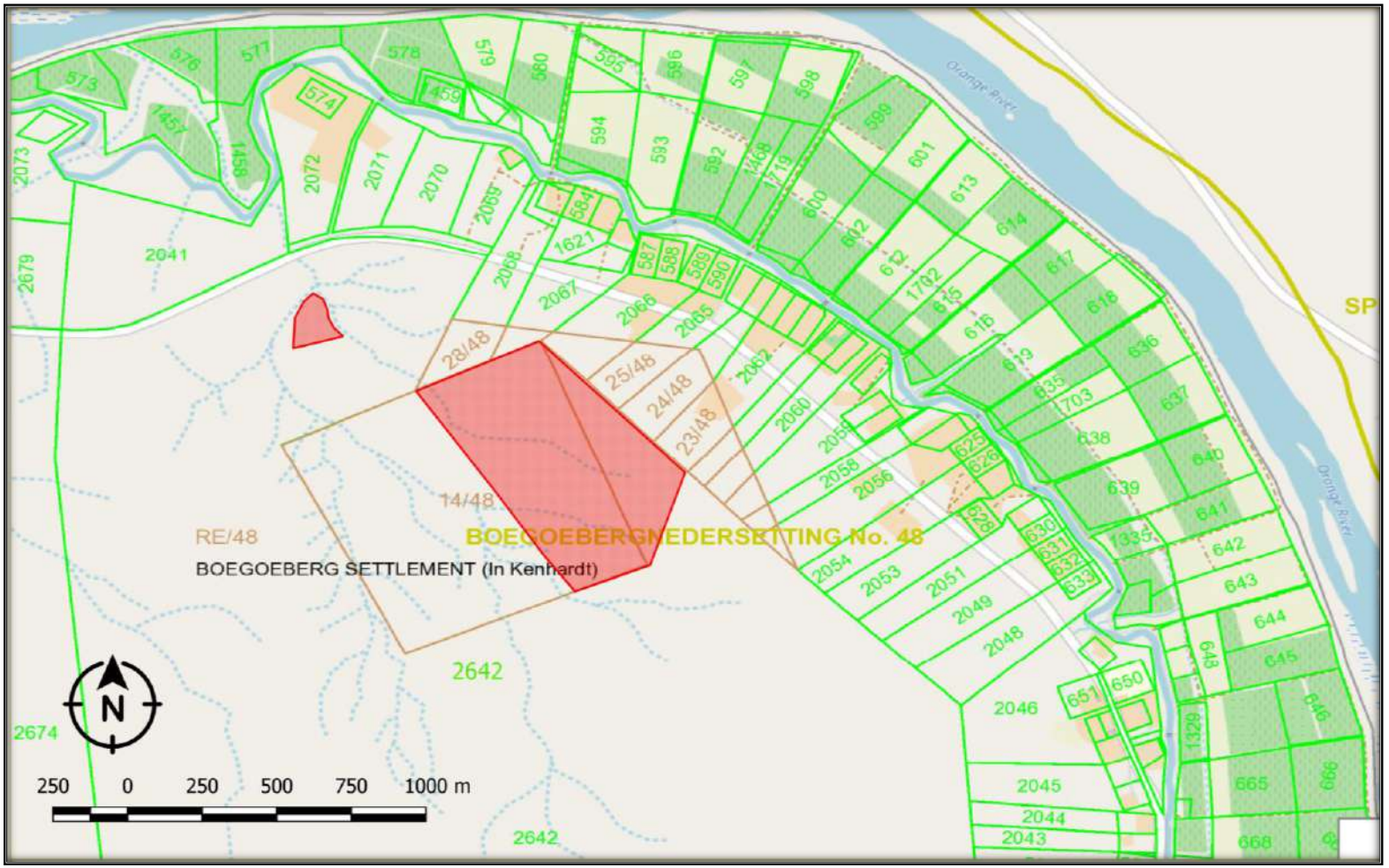

Figure 14: *Topographical map indicating the locality of the proposed Opwag Township Expansion on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement no 48, Opwag, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Map modified from Ubique Consultants.*

- **QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR**

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 12 years. She has been conducting PIAs since 2014.

- **LEGISLATION**

  - **National Heritage Resources Act (25 of 1999)**

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, moved, broken or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Desktop Assessment forms part of the Heritage Impact Assessment (HIA) and adheres to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

the construction of a bridge or similar structure exceeding 50 m in length;

any development or other activity which will change the character of a site—

(exceeding 5 000 m^2 in extent; or

involving three or more existing erven or subdivisions thereof; or

involving three or more erven or divisions thereof which have been consolidated within the past five years; or

the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority

the re-zoning of a site exceeding 10 000 m^2 in extent;

or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

- **GEOLOGICAL AND PALAEONTOLOGICAL HISTORY**

The proposed Opwag Township Expansion on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement no 48, Opwag, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province is depicted on the 1:250 000 Upington Geological Map (Council of Geoscience, Pretoria). The proposed development is underlain by sediments of the Groblershoop Formation (Mgh) (Brulpan Group). Underlying these rocks are rocks of the Precambrian Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System, the Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant as these rocks are igneous in origin or too highly metamorphosed (Almond & Pether 2008) to contain fossils.

The cherts, dolomites and iron formations of the underlying Transvaal Supergroup are too deep to affect the proposed development. The Groblershoop Formation of Brulpan Group consists of Quartz-muscovite schist, quartzite and quartz-amphibole schist.

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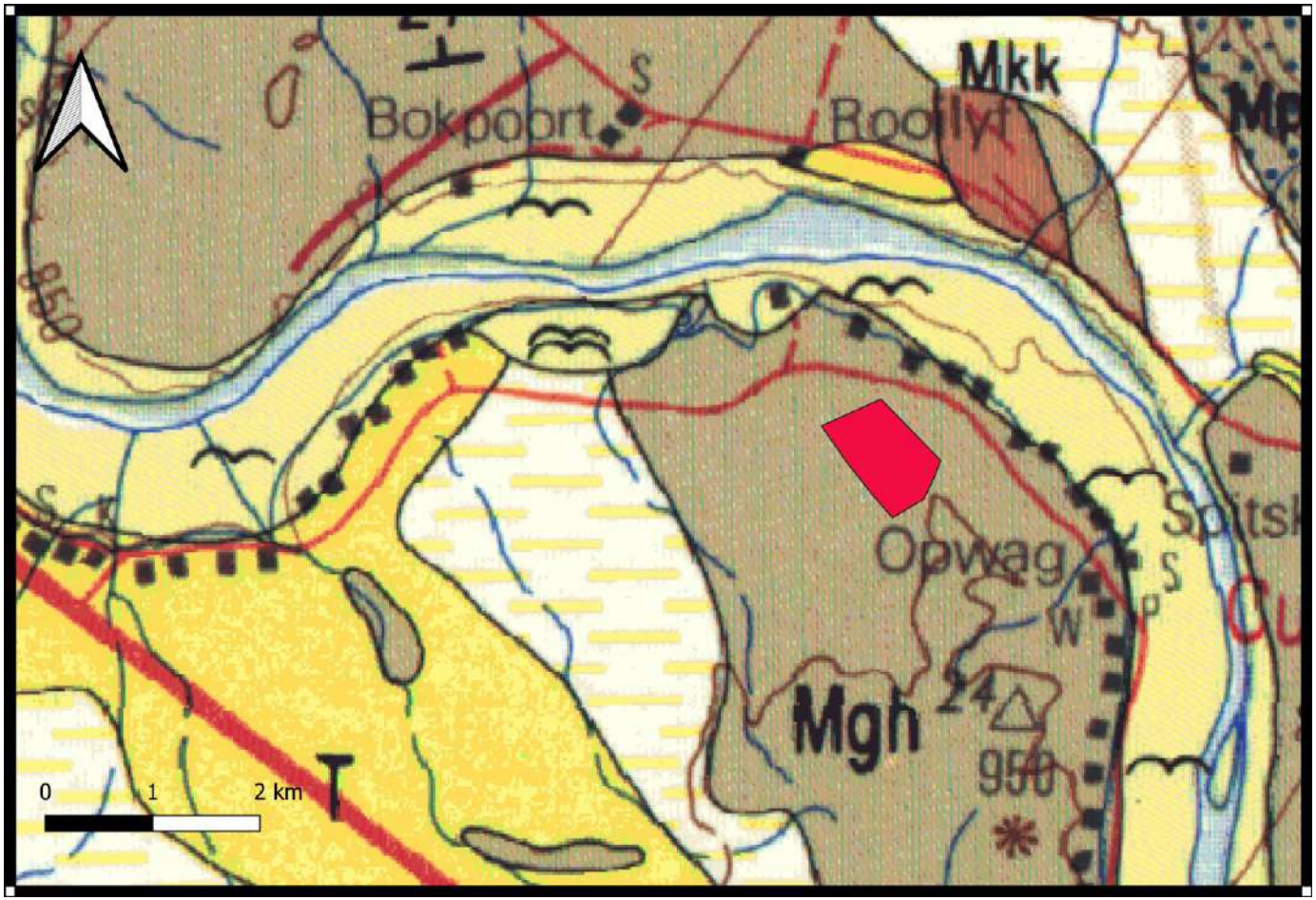

Figure 15: *Extract of the 1:250 000 2820 Upington geological map indicating the surface geology of the proposed Opwag Township Expansion on Plot 2642, Boegoeberg Settlement and Portion 14 of the Farm Boegoeberg Settlement no 48, Opwag, !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.*

Legend to Map and short explanation.

Mgh – Groblershoop Formation, Brulpan Group- Quartz-muscovite schist, quartzite, quartz-amphibole schist.

T-Tertiary

- **GEOGRAPHICAL LOCATION OF THE SITE**

The Opwag Township Extension is located about 6 km north of Groblershoop within the !Kheis Local Municipality, ZF Mgcawu District Municipality.

No.	Town	Total Size of the study area	Total Erven	Property Descriptions	Title Deed Numbers	Coordinates	Ownership
5	Opwag	50ha	730	Plot 2642, Boegoeberg Settlement	T79244/2007	28°50'16.49"S; 21°57'34.10"E	!Kheis Local Municipality
				Portion 14 of the Farm Boegoeberg Settlement, No. 48	T59309/2007	28°50'22.29"S; 21°57'15.43"E	!Kheis Local Municipality

- **FINDINGS AND RECOMMENDATIONS**

The proposed development is underlain by sediments of the Groblershoop Formation (Brulpan Group). Underlying these rocks are rocks of the Precambrian Transvaal Supergroup. According to the PalaeoMap of South African Heritage Resources Information System, the Palaeontological Sensitivity of the Groblershoop Formation (Brulpan Group) is insignificant as these rocks are igneous in origin. The cherts, dolomites and iron formations of the underlying Transvaal Supergroup are too deep to affect the proposed development, although the Palaeontological Sensitivity of this Group is moderate.

This is a recommended exemption from further Palaeontological studies as the proposed development is unfossiliferous and will not lead to detrimental impacts on the palaeontological resources.

- **REFERENCES**

ALMOND, J.E. and PETHER, J. 2009. SAHRA Palaeotechnical Report: Palaeontological Heritage of the Northern Cape Province. South African Heritage Resources Agency, Pp 1-143.

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences.

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VISSER, D.J.L. (ed) 1984. Geological Map of South Africa 1:100 000. South African Committee for Stratigraphy, Council for Geoscience, Pretoria.

VISSER, D.J.L. (ed) 1989. *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland*. South African Committee for Stratigraphy. Council for Geoscience, Pretoria, Pp 494.

ANNEXURE I: FRESH WATER REPORT

WATER USE LICENSE APPLICATION
FOR THE PROPOSED URBAN DEVELOPMENT AT OPWAG, NORTHERN CAPE

FRESH WATER REPORT

A REQUIREMENT IN TERMS OF SECTION 21 OF THE NATIONAL WATER ACT
MAY 2020

Index

Abbreviations

Northern Cape Department: Co-Operative Governance, Human Settlements and Traditional Affairs	COGHSTA
Critical Biodiversity Area	CBA
Department of Water and Sanitation	DWA
Ecological Importance	EI
Ecological Sensitivity	ES
Ecological Support Area	ESA
Environmental Impact Assessment	EIA
Electronic Water Use License Application (on-line)	eWULAA
Government Notice	GN
Hectares	ha
Legal water use	LWU
Metres Above Sea Level	masl
National Environmental Management Act (107 of 1998)	NEMA
National Freshwater Environment Priority Area	NFEPA
National Water Act (36 of 1998)	NWA
Non-government organization	NGO
Present Ecological State	PES
South Africa National Biodiversity Institute	SANBI
Section of an Act of Parliament	S
Water Use License Application	WULA

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!KHEIS LOCAL MUNICIPALITY **ENVIROAFRICA CC**

NEMA PUBLIC PARTICIPATION PROCESS

PROPOSED TOWNSHIP DEVELOPMENT ON PLOT 2642 AND PORTION 14 OF FARM BOEGOEBERG NO. 48, OPWAG, !KHEIS LOCAL MUNICIPALITY

Notice is hereby given of the intention to submit a NEMA application and a Water Use License Application (WULA), and the availability of the Draft Scoping Report for viewing and comment as part of the public participation process, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended ("NEMA"), Environmental Impact Assessment Regulations 2014 and the National Water Act, 1998 (Act No. 36 of 1998). The proposed township development on Plot 2642 and Portion 14 of Farm Boegoeberg No. 48, Opwag includes activities listed in terms of the NEMA EIA Regulations 2014.

EnviroAfrica cc has been appointed by the !Kheis Local Municipality to undertake the NEMA Application for Environmental Authorisation process.

Application for environmental authorization to undertake the following activities in terms of NEMA EIA Regulations 2014:

- Government Notice R327 (Listing Notice 1): Activity No. **12, 19, 24, 27, 56**
- Government Notice R325 (Listing Notice 2): Activity No. **15**
- Government Notice R324 (Listing Notice 3): Activity No. **4, 12, 14**

**Please note that the listed activities above may change during the course of the NEMA Application process. Registered I&APs will be notified of any changes.*

Project Description & Location:

The !Kheis Local Municipality is proposing that a new township development, consisting of approximately 730 erven and associated infrastructure on Plot 2642 and Portion 14 of Farm Boegoeberg No. 48Opwag. Opwag is located 7km north-west of Groblershoop in the !Kheis Local Municipality.
The proposed project entails the development of approximately 730 low income erven, including associated infrastructure such as roads, water, stormwater, effluent and electricity reticulation. The total area to be developed measures approximately 50 hectares.

Site co-ordinates: 28° 50' 14.90" S, 21° 57' 24.58" E.

Public Participation:
Interested and Affected Parties (I&APs) are hereby notified of the application and invited to register (in writing) and/or provide comments and identify any issues, concerns or opportunities relating to this project to the contact details provided below, on or before **03 July 2020**. In order to register or submit comment, I&APs should refer to the project name, and provide their name, address & contact details (*indicating your preferred method of notification)* and an indication of any direct business, financial, personal, or other interest which they have in the application. Please note that future correspondence will only be sent to registered Interested and Affected Parties.

Please note that only Registered I&APs will be notified of the availability of reports and other written submissions made (or to be made) to the Department by the applicant, and be entitled to comment on these reports and submissions; will be notified of the outcome of the application, the reasons for the decision, and that an appeal may be lodged against a decision; and will be notified of the applicant's intention to appeal the decision of the competent authority, together with an indication of where and for what period the appeal submission will be available for inspection.

You are also requested to pass this information to any person you feel should be notified. The Draft Scoping Report will be available for viewing at the Kheis Municipal offices (97 Oranje Str, Groblershoop) and at the following website: https://enviroafrica.co.za/projects/for-public-participation/

Consultant: EnviroAfrica CC. P.O. Box 5367, Helderberg, 7135 / Fax: 086 512 0154 / Tel: 021 8511616 / E-mail: clinton@enviroafrica.co.za

Figure 1 Public participation

1 Introduction

On 14 May 2020, an email message was received from Mr Len Fourie, director at Macroplan of Upington:

"The appointment of Gobetla Beplannings Dienste TA Macroplan by the Barzani Group (on behalf of COGHSTA) received on the 17th of April 2020 and the attached documentation have reference.

"We hereby confirm that Macroplan has been appointed as Town and Regional Planners to handle the formal Town Planning Process in accordance with the SPLUMA legislation (Act 16 of 2013). The mentioned process is for the provision of much needed residential erven in the sub-economic market that is of National and Provincial interest for towns in the !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

"Macroplan and all sub-consultants were requested to proceed with site verification, site visits, contour mapping, specialists environmental studies, geotechnical studies, as well as civil and engineering investigations for the mentioned project asap due to the importance of continued service delivery in the !Kheis Local Municipal area. Your firm as a sub-consultant of Macroplan is hereby requested to proceed with organising the site visits to the following areas that is located within the !Kheis Local Municipality."

This adequately explains the situation.

Enviro Africa of Somerset West was subsequently appointed to carry out the EIA, in terms of NEMA, together with the public participation process (Figure 1).

Likewise, WATSAN Africa was appointed to produce the Fresh Water Report and carry out the WULA in terms of the NWA. The required site visits were conducted on 20 and 21 May 2020.

The Fresh Water Report must contain adequate information to allow for informed decision-making. The decision to approve the proposed urban development rests with DWS officials, in terms of S21 of the NWA. The Fresh Water Report must contain specified information according to a set profile, which has been developed over a number of years over many such reports and in accordance with GN509. A Risk Matrix is to be completed, as published on the DWA webpage.

This then is the third of 7 reports. For each of these reports, the issues are very much the same, with a similar terrain and social-economic circumstances. Consequently, the reports are the same, being mirror images of one another, but adapted to the specific localities and specific issues for each of the townships.

2 Seven Townships

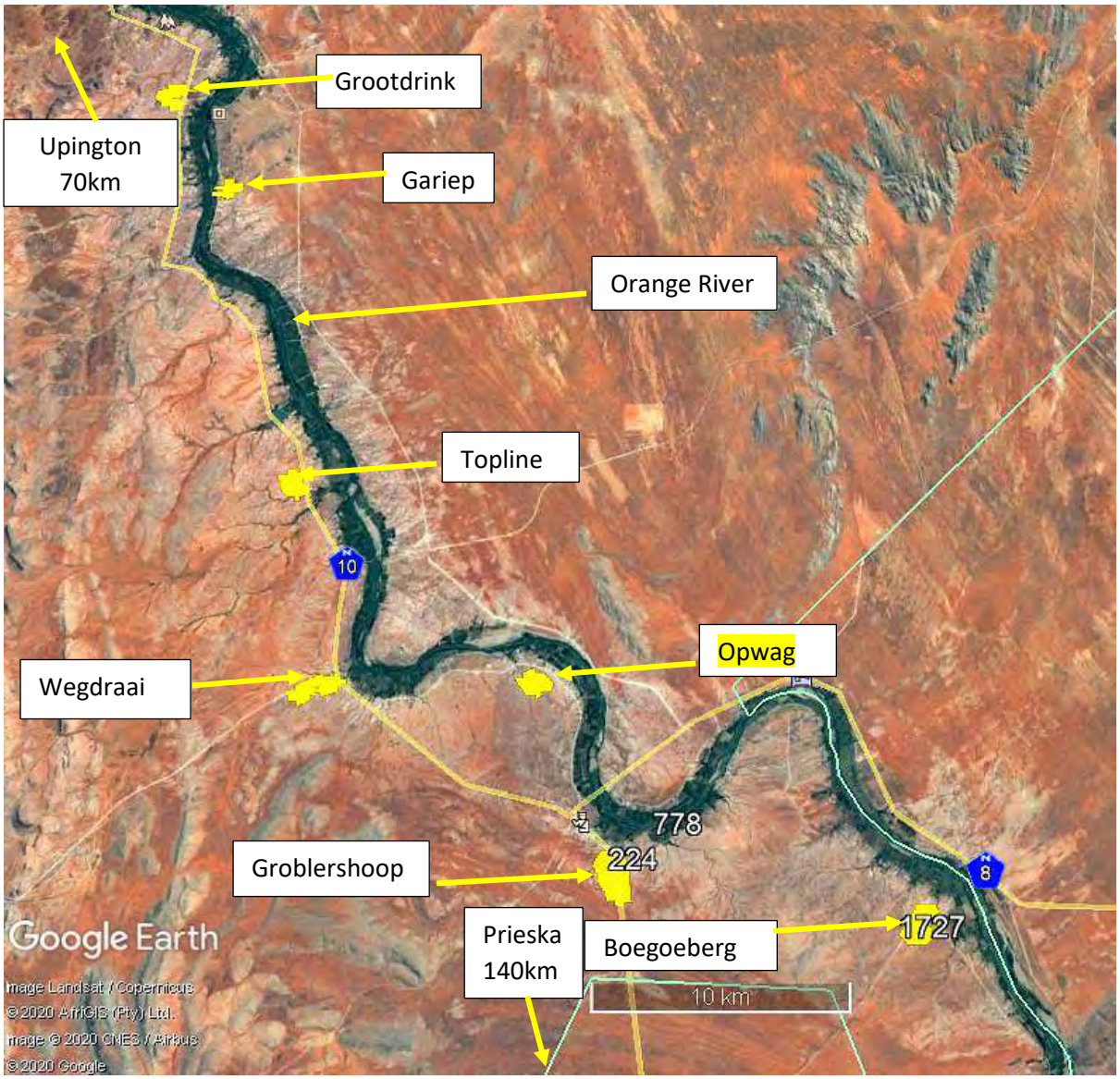


Figure 2 Seven townships

The seven townships that are being considered for extension are depicted in Figure 2. Opwag is highlighted in yellow and is the subject of this Fresh Water Report.

3 Legal Framework

The proposed development "triggers" sections of the National Water Act. These are the following:

S21 (c) *Impeding or diverting the flow of a water course*

The proposed development is spanning the banks of a drainage line. A drainage line would be altered, should the development go ahead.

S21 (i) *Altering the bed, bank, course of characteristics of a water course.*

Some part of the proposed development will alter the characteristics of the banks of a drainage line.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

The Risk Matrix as published on the DWS official webpage must be completed and submitted along with the Water Use Licence Application (WULA). The outcome of this risk assessment determines if a letter of consent, a General Authorization or a License is required.

Government Notice 509 of 26 August 2016

An extensive set of regulations that apply to any development in a water course is listed in this government notice in terms of Section 24 of the NWA. No development take place within the 1:100 year-flood line without the consent of the DWS. If the 1:100-year flood line flood line is not known, no development may take place within a 100m from a water course without the consent of the DWS. The development is adjacent to drainage lines, which are defined as legitimate water resources.

Likewise, the development triggers a part of the National Environmental Management Act, NEMA, 107 of 1998).

The EIA Regulations of 2014 No.1 Activity 12 states that no development may take place within 32m of a water course without the consent of the Department of Environmental Affairs and its provincial representatives. A part of the development is adjacent to drainage lines. Consequently, this regulation is relevant to this application.

This Fresh Water Report is exclusively focussed in S21 (c) and (i) of the NWA

4 !Kheis Municipality Overview

Figure 3 !Kheis Municipality

According to available information

(municipalities.co.za/1181/kheis-local-municipality)

Area	11 107km^2
Population	16 566 (2016)
Households	4344

The municipal offices are located in Groblershoop.

Only 59% of the houses were listed as formal dwellings, 41% were connected to the urban sewerage system, 62% had formal refuse removal, 21% had piped water and 74% had electricity. As from the year 2020, 500 more households were provided with solar panels and batteries to provide electricity.

The average fertility rate over the past 5 years was 2.67%

(https://irr.org.za/reports/freefacts/files/00-2014-freefacts-2014-february-2020-draft.pdf)

This means, according to available demographic data, that currently at least 116 new houses are required every year.

To address any backlog and to make provision for future housing requirements, new plots are demarcated in the following locations:

Groblershoop	1500
Boegoeberg	550
Opwag	730
Wegdraai	360
Topline	248
Grootdrink	370
Gariep	135

Urban development is specifically required along the Orange River, where large-scale and labour-intensive farming of vineyards under irrigation sparks human settlements.

The municipality appointed the town and regional planning company Macroplan of Upinton to lay out the new plots in these 7 townships.

5 Climate Groblershoop

http://www.saexplorer.co.za/south-africa/climate/groblershoop_climate.asp

Groblershoop is the closest locality to Opwag for which climate data is available and normally receives about 108mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (Figure 4, lower left) shows the average rainfall values for Groblershoop per month. It receives the lowest rainfall (0mm) in June and the highest (32mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Groblershoop range from 19°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures.

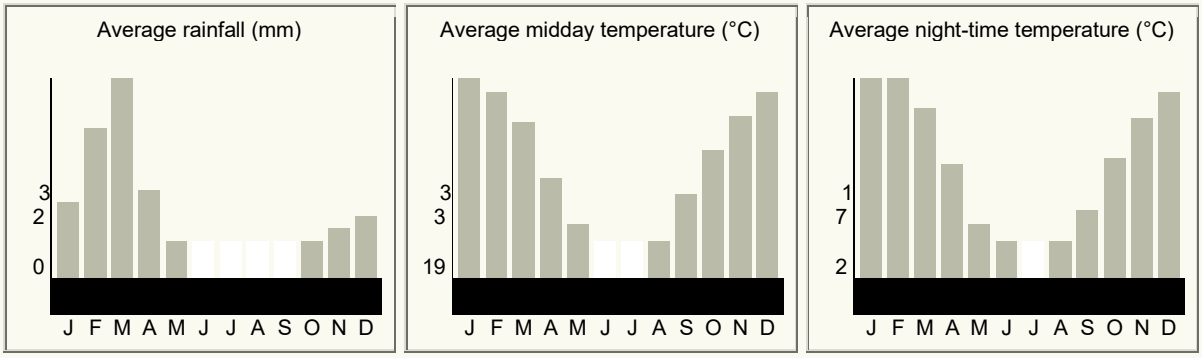


Figure 4 Climate Groblershoop

Groblershoop and surrounds is located in the Nama Karoo, which is from all points of view an arid area. For 4 months of the year there is no rainfall at all.

According to

https://weatherspark.com/y/86570/Average-Weather-in-Groblershoop-South-Africa-Year-Round

the dry season at Groblershoop lasts up to 6.4 months from April to November.

The evaporation rate in the nearby Upington, 70km to the north, is more than 2500mm per year. This is 27 times more than the annual precipitation.

http://www.dwaf.gov.za/orange/Low_Orange/upington.aspx

The local economy (agriculture) is entirely dependent on irrigation out of the Orange River.

6 Vegetation

The South African National Biodiversity Institute (SANBI) indicated the vegetation type on the property as Bushmanland Arid Grassland. The vegetation around the river is indicated as Lower Gariep Alluvial Vegetation. The Orange River is a National Freshwater Ecosystem Priority Area (NFEPA). The riparian area is indicated as Nama Karoo Bushmanland_Floodplain Wetland, despite that most of it today is manicured agriculture.

7 Quaternary Catchment

Opwag is in the D73D quaternary catchment.

8 Drainage Lines

The landscape around much of the Lower Orange River and the Sak River is dominated by a dense succession of drainage lines, each with their own sub-catchment. The drainage lines spread along the river with many smaller tributaries to cover the entire area. The iron oxides in the sands renders a red hue that is visible from space on the Google Earth images. These reds are concentrated in the drainage lines, making them even more visible (Figure 5).

The drainage lines are mostly dry, with water only during rains and perhaps shortly thereafter. During the odd thunder storm, drainage lines can come down in flood. These floods maintain the drainage line's morphological integrity, as sediments are moved and these water ways are scoured out.

Because rainfall events are far apart, the drainage lines must have been formed over millennia, even since geological times.

The vegetation in these arid parts is sparse, with a low diversity op plant species and a limited habitat variability. Drainage lines are often overgrown with a mature stand of sweet thorn *Vachellia karoo*, together with some other scrub and low trees such as *Searsia* species. In other parts the dominant tree is swarthaak *Senegalia mellifera.* This considerably adds to the habitat variability of the region. These tree lines stretch over the otherwise barren landscape and provide a linear connected habitat that would have been entirely absent if it was not for the shallow ground water in the unconfined aquifer in the drainage line's alluvium. Likewise, these tree lines provide habitat and nourishment to a variety of fauna that would have been entirely absent, was it not for the gradual migration of shallow ground water along the drainage lines.

All over the arid and semi-arid landscape of the western half of South Africa, these tree lines are considered to have a special and high conservation value.

Around the Orange River and even the Sak and Hartbees River, large-scale agriculture has changed the drainage lines into drainage channels among the vineyards and orchards. The upper reaches away from the rivers are less impacted,

even near-pristine, as intense agriculture is not possible, apart from those areas where water is piped over long distances from the Orange River.

The conservation of drainage lines along the Lower Orange River deserves and demands attention by decision-making authorities, environmental practitioners, the conservation and farming community alike. As more of these drainage lines are impacted upon, and because impacts are radical by nature, because sections of drainage lines are replaced by vineyards or other forms of agriculture, or transformed into return flow infrastructure, the necessity for a widely accepted conservation policy becomes urgent as development escalates.

Figure 5 Drainage Lines

9 The Opwag Housing Project

Figure 6 Opwag Housing (Macroplan)

The area on which the housing is going to be built is depicted in Figure 6. It is 50 hectares is size.

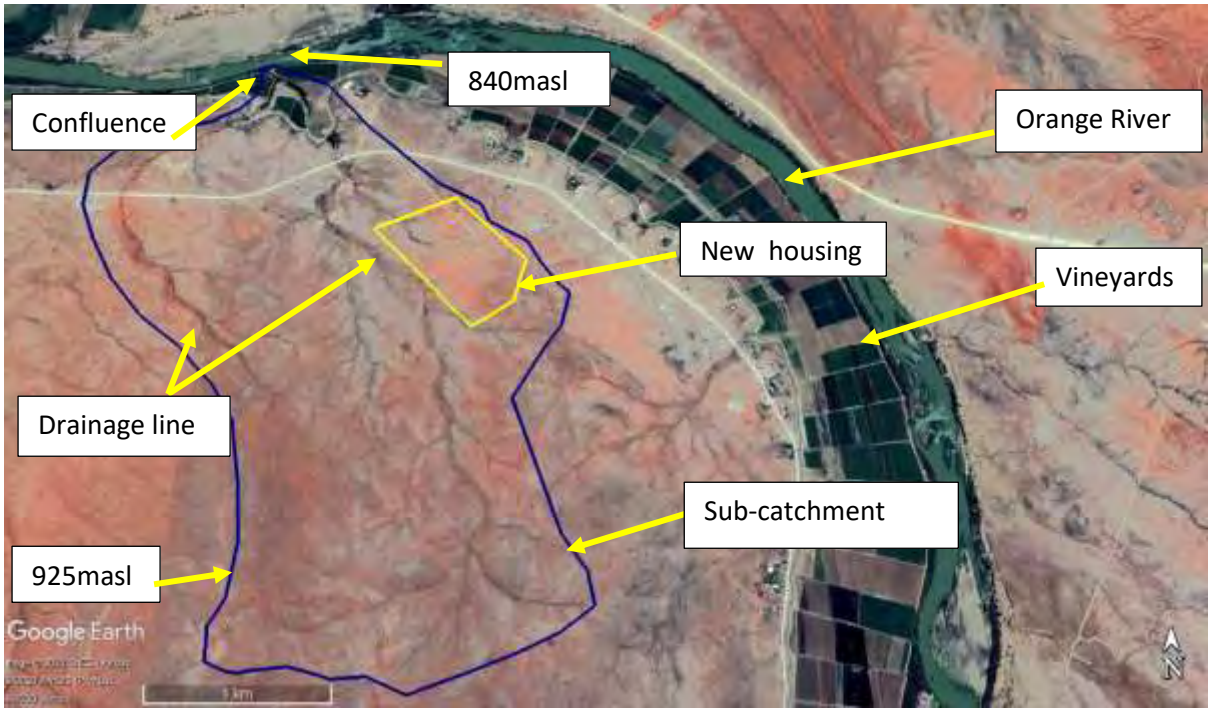


Figure 7 Opwag housing and drainage line

10 Opwag housing drainage line

The sub-catchment of the drainage line is 828 hectares, with a circumference of 12.7km.

Figure 8 Tree line

Figure 9 Drainage line tributaries

The drainage line splits into two tributaries close to the confluence with the Orange River. These are both prominent tributaries, incised, each with a tree and scrub-clad riparian zone (Figure 8). The eastern tributary (Figure 9) is the one that closely passes the proposed housing scheme, with some of it actually onto the housing area (Figure 7). This triggered the need for a WULA.

The highest point in the sub-catchment is 925masl. The confluence with the Orange River is at 840masl. This represents a mean drop in elevation of 2 vertical metres over 100 horizontal metres. This is a gentle slope, but still steep enough to for water to flow fast during a severe thunder storm, giving rise to a substantial erosion potential.

This is one of a few drainage lines of which the last reach onto the Lower Orange River has not entirely been replaced with irrigation return canals. It still bears a semblance to natural conditions, more so than elsewhere among the vineyards along the Lower Orange River, with at least some conservation value, despite of the adjacent vineyards.

This is quite a substantial drainage line with a substantial runoff during the odd storm event, judging from the storm-damaged culvert on the dirt road. The two pipes of the

culvert are evidently under-designed to deal with flood conditions (Figure 10), with much of the supporting foundation material washed away. Some of the road shoulder was washed away as well (Figure 11).

Figure 10 Culvert

Figure11 Road

Figure 12 Downstream of the culvert

The drainage line bed is rocky, with the topsoil washed away (Figure 12). The riparian zone is overgrown with trees such as swarthaak *Senegalia mellifera,* camel thorn *Vachellia erioloba* and some *Prosopis*.

Figure 13 Upper drainage line

The drainage lines higher up the sub-catchment are well-defined, with vegetated riparian zones and with a substantial conservation value (Figure 13).

Figure 14 Existing dwellings

Figure 15 Opwag streets

During the site visit on 21 May 2020 there was already dwellings on the proposed housing site (Figure 14), arranged on four streets (Figure 15), while new dwellings were continually added by new arrivals to the 100 existing ones.

Figure 16 Farm animals

The catchment is utilized as grazing for farm animals (Figure 16).

Figure 17 Graves

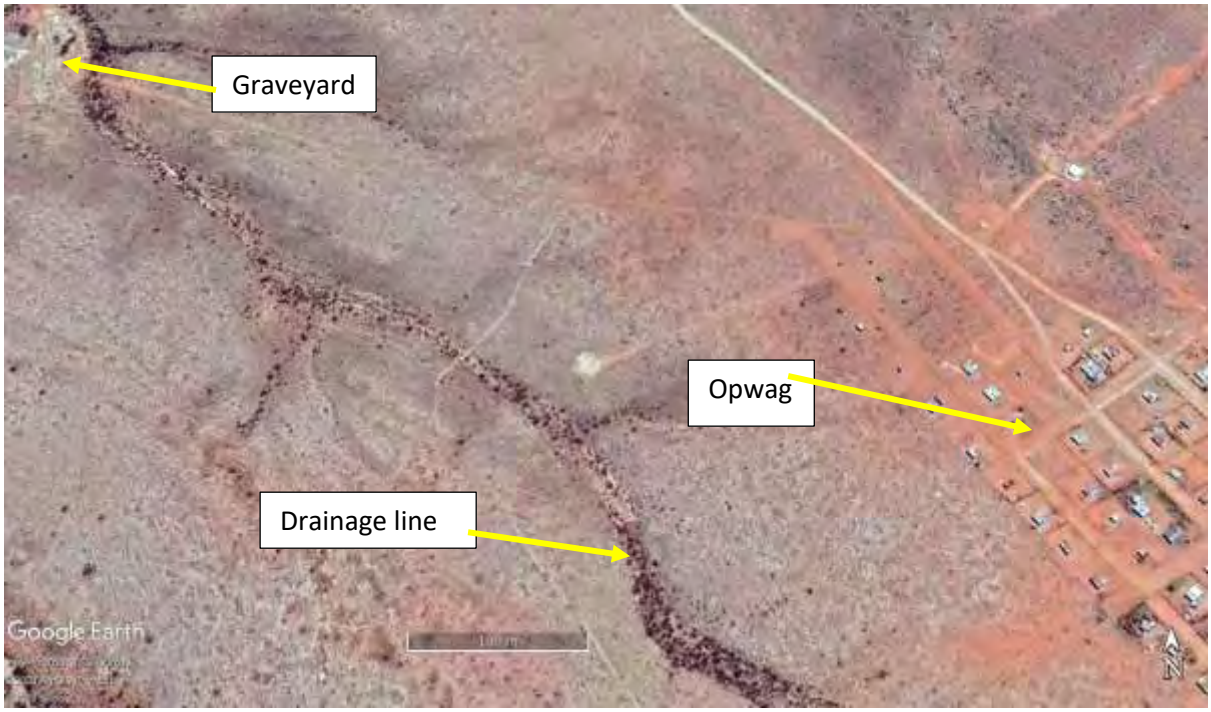


Figure 18 Graveyard location

There is a graveyard right on the banks of the drainage line (Figure 17 and 18).

Aloes (*Aloe claviflora*) is plentiful in the area and at the time of the site visit were removed in relatively large quantities to make way for new dwellings (Figure 19).

Figure 19 Uprooted aloes

11 Biomonitoring the Lower Orange River

The biomonitoring was carried out according to the description of Dickens & Graham (2002).

Biomonitoring was carried out on the Lower Orange River during site visits for successive WULAs. So far 12 samples have been analyzed at 11 localities (Table 1). The site furthest east was at Hopetown and furthest west at Augrabies, with Upington in the middle. All of these are located upstream of the Augrabies Falls.

Another sample was analyzed at Styerkraal just east of the border post of Onseepkans downstream of the Augrabies Falls.

The river is mostly braided, with many smaller streams and with islands in the middle. The river sports many rapids and riffles, but also pool-like features where the river is broad and slower flowing.

The bottom is mainly muddy, with some large rocky outcrops in the middle of the river.

12 Impacts on the Lower Orange River

The river is heavily utilized for agriculture, with the banks entirely modified into cultured vineyards. A multitude of large electric water pumps have been placed in the river for abstracting large volumes of water for irrigation. Abstraction significantly lowers the flow in the river.

Berms for the purpose of flood protection have been constructed on the banks of the river for most of its length. These berms have been constructed by the Department of Water Affairs and now have been a feature of the landscape for many decades. The berms keep flood water out of adjacent agricultural land and has denaturalised the riparian zone.

The single most impact on the Orange River are the two very large dams, The Gariep Dam and the Vanderkloof Dam. The river flow has been modified to a much more even regime, different from the varied flown with high peak flows and low drought flows.

The Lower Orange River is lined with a dense system of mostly dry drainage lines. These drainage lines only flow during and shortly after heavy rains. Their contribution to the flow of the Orange River is insignificant. Most of the flow comes from the Lesotho Highlands and some from the Vaal River. However, many of these drainage lines have been transformed into engineered agricultural return flow furrows that carries the excess of over irrigation back to the Orange River. Agricultural return flow adds much to the nutrient load of the Orange River because runoff contains fertilizer. Nitrogen is added in large quantities. Since phosphorus readily binds to the soil, not much phosphorus is added.

Return flow can contain a heavy silt load, thereby elevating turbidity in the river.

It is suspected that pesticides in agricultural return flow have a heavy impact on biomonitoring results, significantly reducing the SASS5 score.

The banks of the Orange River in the area is densely overgrown with Spaanse Riet (*Arundo donax*). This is classified as an aggressive and exotic invasive plant, which effectively prevents access to the river. The reeds result in a homogeneous aquatic habitat. This lack of variation supresses the SASS5 score, with only a limited number of aquatic macroinvertebrate species present in this habitat.

13 Lower Orange River Biomonitoring Results

The biomonitoring results have been captured in Table 1 and depicted in Figure 20.

The classes from A to F in Figure 20 has been assigned for mature rivers on flood plains such as the Lower Orange River.

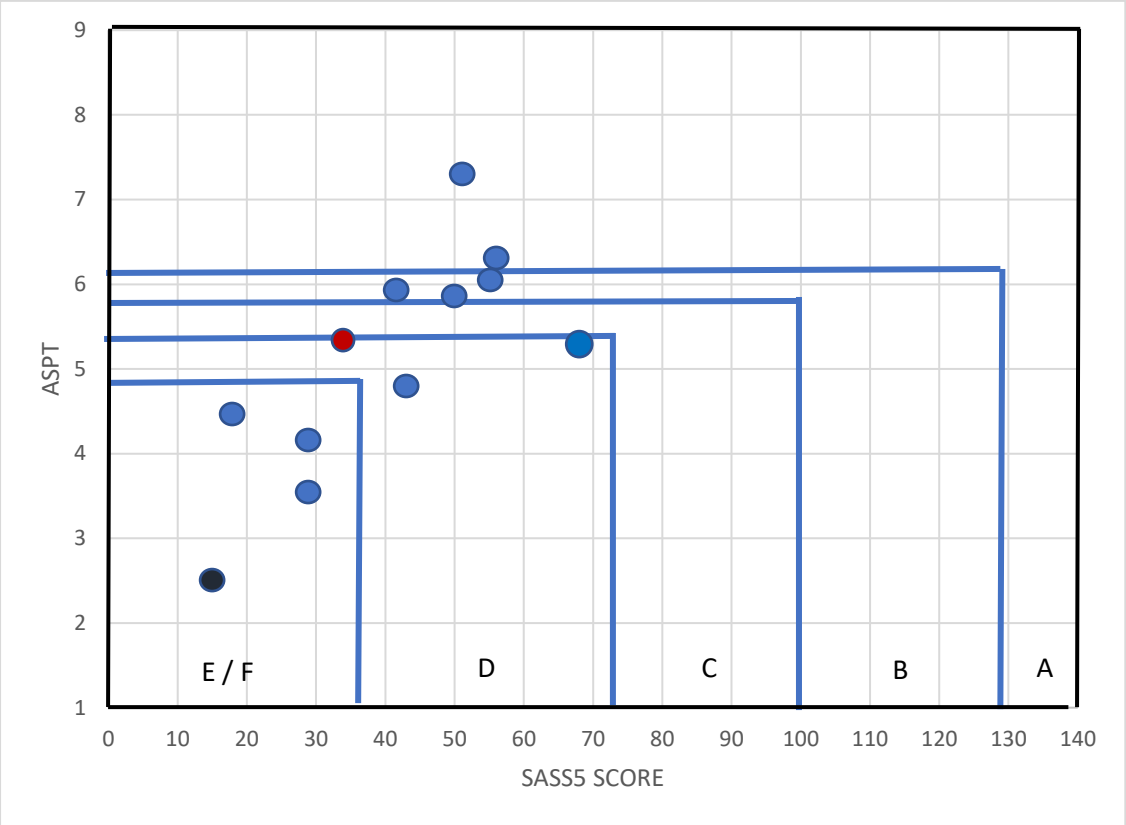
Only 2 of the samples were classified a good and relatively unimpacted (Class A). Four were in Class B and C, which can be regarded as acceptable under the circumstances of an impacted river reach. These classes can possible be labelled as the ideal, a compromise between agriculture and aquatic ecological functioning.

Four samples were poor (Classes E and F), an undesirable state of affairs.

The one sample downstream of the Augrabies Falls was extremely poor.

Table 1 Biomonitoring in the Lower Orange River

Locality	Coordinates	Date	SASS 5	No Taxa	ASPT
Augrabies Lair trust	28°38'41.53S 20°26'08.49E	5/09/17	18	4	4.5
Augrabies Lair Trust	28°38'41.53S 20°26'08.49E	5/10/17	43	9	4.8
Groblershoop	28°52'31.80S 21°59'13.49E	14/8/18	41	7	5.9
Kakamas Triple D	28°45'08.37S 20°35'06.16E	15/8/18	50	9	5.6
Hopetown Sewer	29°36'05.07S 24°06'05.00E	7/10/18	29	7	4.1
Hopetown Sewer	29°36'08.06S 24°21'06.16E	7/10/18	29	8	3.6
Keimoes Housing	28°42'37.12S 20°55'07.81E	8/02/19	51	7	7.3
Upington Erf 323	28°27'11.91S 21°16'14.02E	12/2/19	56	9	6.2
Upington Affinity	28°27'11.91S 21°16'14.02E	20/5/19	54	9	6
Styerkraal	28°27'25.28S 21°15'01.87E	21/5/19	15	6	2.5
Grootdrink Bridge	28°17'15.30S 21°03'50.87E	17/5/20	34	7	5.3
Turksvy Dam	28°27'09.21S 21°17'20.72E	17/5/20	69	13	5.3



Integrity Class	Description
A	Pristine; not impacted
B	Very Good; slightly impacted
C	Good; measurably impacted with most ecological functioning intact
D	Fair; impacted with some loss of ecological functioning
E	Poor; loss of most ecological function
F	Very Poor; loss of all ecological function

Figure 20 Lower Orange River Biomonitoring Results

The red dot on the graph represents the result at the Grootdrink Bridge. All of the other dots represent previous sampling.

14 Sampling Site

Figure 21 Sampling Site

Figure 22 Orange River at Sampling Point

The sampling point (Figure 21, Figure 22) was chosen downstream as far as possible in order to pick up the combined impact of all of the housing projects along the reach of the Orange River from Boegoeberg to Grootdrink. This, of course, is not a realistic view, because the impact of agriculture would dwarf any other, if it could be separated, which is not possible. So, the reasoning is rather theoretical, not entirely realistic, but nevertheless required in terms of the WULA requirements.

However, if the cumulative impact of raw sewage from the many townships in the Orange River would ever realize as a threat, a biomonitoring result at this location would be of great benefit to assess the situation.

Moreover, sewage and its concomitant microbiological contamination would be a serious threat to the grape, other fruit and food export industry.

The sampling point was chosen because of accessibility. The dense stand of reeds renders most of the river's banks out of reach. There was a break in the reeds, probably kept open by local fishermen.

The available habitat was emerging vegetation (reeds), submerged vegetation (a single strand of parrot's feather), bedrock and muddy bottom.

The SASS5 score was only 34, which low and can be attributed to the limited available habitat. The ASPT came to 5.3, which can be expected for a mature river reach such as the Orange River at Grootdrink Bridge. The score indicated a "fair" rating, with some if it lost but with most ecological functioning still intact.

15 **Present Ecological State** (PES)

Table 2 Habitat Integrity according to Kleynhans, 1999

A	Unmodified, natural	90 – 100
B	Largely natural with few modifications. A small change in natural habitats and biota, but the ecosystem function is unchanged	80 – 89
C	Moderately modified. A loss and change of the natural habitat and biota, but the ecosystem function is predominantly unchanged	60 – 79
D	Largely modified. A significant loss of natural habitat, biota and ecosystem function.	40 – 59
E	Extensive modified with loss of habitat, biota and ecosystem function	20 – 39
F	Critically modified with almost complete loss of habitat, biota and ecosystem function. In worse cases ecosystem function has been destroyed and changes are irreversible	0 - 19

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 2 and 3) in 1999 of the then DWAF to assess river reaches. The PES is one of the evaluations that is prescribed for S21 (c) and (i) WULA's. The scores given are solely that of the practitioner and are based on expert opinion.

Both tributaries of the drainage line are still in a reasonably unimpacted state. The last reach before the confluence with the Orange River is modified. The culverts underneath the dirt road is a flow impediment. The upper reaches are impacted by grazing farm animals. Goats and sheep were regarded as exotic fauna.

It is always challenging to come up with a realistic and representative score for the entire drainage line where to upper parts are in a near-pristine state and the lower part is heavily impacted. Nevertheless, this is what the WULA requires; the best effort.

Table 3 Present Ecological State of the Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	24	14	336	350
Flow modification	19	13	247	325
Bed modification	21	13	273	325
Channel modification	20	13	260	325
Water quality	19	14	266	350
Inundation	22	10	220	250
Exotic macrophytes	20	9	180	225
Exotic fauna	17	8	136	200
Solid waste disposal	21	6	126	150
Total		100	2044	2500
% of total			81.8	
Class			B	
Riparian				
Water abstraction	24	13	312	325
Inundation	22	11	242	275
Flow modification	19	12	228	300
Water quality	19	13	247	325
Indigenous vegetation removal	24	13	312	325
Exotic vegetation encroachment	20	12	240	300
Bank erosion	23	14	322	350
Channel modification	19	12	228	300
Total			2131	2500
% of total			85.2	
Class			C	

Both the instream and riparian habitat score a “B”, with just about all of the of the ecological functioning still intact.

Much has been published on the ecological state of South African rivers and the Orange River is no exception. In fact, it seems somewhat arrogant to assess the Lower Orange River, even at the sampling point, with a team of one and with the financial backing of a single WULA. This is a large undertaking that is to be contemplated by a team of experts. Nevertheless, this is what the WULA requires.

The river at the Grootdrink sampling point, as elsewhere, has been impacted by major dams, large-scale water abstractions, an influx of agricultural chemicals, encroachment of reeds and exotic macrophytes, translocated and exotic fish, levees, bridges and many other infarctions.

Table 4 Present Ecological State Orange River

Instream	Score	Weight	Product	Maximum score
Water abstraction	15	14	210	350
Flow modification	15	13	195	325
Bed modification	20	13	260	325
Channel modification	22	13	286	325
Water quality	15	14	210	350
Inundation	12	10	120	250
Exotic macrophytes	18	9	162	225
Exotic fauna	15	8	120	200
Solid waste disposal	20	6	120	150
Total		100	1593	2500
% of total			63.7	
Class			C	
Riparian				
Water abstraction	15	13	195	325
Inundation	14	11	154	275
Flow modification	15	12	180	300
Water quality	15	13	195	325
Indigenous vegetation removal	15	13	195	325
Exotic vegetation encroachment	15	12	180	300
Bank erosion	20	14	280	350
Channel modification	18	12	216	300
Total			1595	2500
% of total			63.8	
Class			C	

However, the river at Grootdrink was less impacted than further downstream, as at Kakamas. The river at Grootdrink was stronger flowing, with much more water. The condition of the river gradually deteriorates as water abstraction and return flows increases downstream.

Hence the river was scored a C (Table 4), which signifies that it has been impacted, but despite these impacts still exhibits appreciable ecological functioning. The riparian zone scores a C as well.

There is a good chance that other practitioners would score the river very much the same.

Importantly, the proposed development at Opwag is not about to change the PES of the Orange River at Grootdrink.

16 Ecological Importance

The Ecological Importance (EI) is based on the presence of especially fish species that are endangered on a local, regional or national level (Table 5).

There are no fish in the drainage line, as there is no permanent water. According to this assessment, which is prescribed for WULA's, the drainage line is not important.

No other endangered species, either plant or animal, were detected in or near the drainage line. Apart from camel thorn trees, which are protected.

Table 5 Ecological Importance according to endangered organisms (Kleynhans,1999).

Category	Description
1	One species or taxon are endangered on a local scale
2	More than one species or taxon are rare or endangered on a local scale
3	More than one species or taxon are rare or endangered on a provincial or regional scale
4	One or more species or taxa are rare or endangered on a national scale (Red Data)

As has been stated before, the higher vegetation in and around the drainage lines are of particular importance in these arid regions and add significantly to biodiversity. These should be considered as ecologically important.

The Orange River is most important, according to this assessment.

According to Skelton (1993) 12 species of indigenous fish occur in the Lower Orange River. Since 2011 another one was added, as well as 3 exotic species. These are the following:

Barbus trimaculatus
B paludinosus

B. hospus
Labeobarbus kimberleyensis (Near threatened)
L aenus
Labeo umbratus
L capensis
Austroglanis sclateri (Widespread elsewhere)
Clarias gariepinus
Pseudocrenilabrus philander (Threatened locally but abundant elsewhere)
Pseudobarbus quathlabae
Mesobola brevianalis (critically endangered)

Exotic and translocated fish:

Cyprinus carpio
Tilapia sparrmanii
Oreochromus mossambicus

Those in blue are endangered to a varying extent. Those indicated in red are exotic or translocated fish.

The only one that causes real concern in the largemouth yellow-fish *Labeobarbus kimberleyensis*. It is endemic to the Orange River system and hence is threatened not only on a local scale, but on a national scale as well. This puts the Lower Orange in category 4. This renders the Orange River as important.

According to the owners of the Kalahari River and Safari Co. along the northern bank of the Orange River on the Riemvasmaak Road, mature blue kurper *Oreochromus mossambicus* are regularly captured in increasing numbers. It now takes at least 4 man-days to capture a single yellow fish.

Yellow fish are generally infected with cestode bladder worms, while darters (*Anhinga rufa*) that predate on these fish are heavily infected with tape worms. It seems as if the translocated Tilapia are not affected by these parasites.

According to Mr Chris van der Post, a renown angling guide and the owner of the Gkhui Gkhui River Lodge near Hopetown, there are still many smallmouth-yellow fish around, but largemouth yellow-fish are scarce.

17 Ecological Sensitivity

Ecological Sensitivity (ES) is often described as the ability of aquatic habitat to assimilate impacts. It is not sensitive if it remains the same despite of the onslaught of impacts. Put differently, sensitive habitat changes substantially, even under the pressure of slight impacts.

The Ecological Sensitivity also refers to the potential of aquatic habitat to bounce back to an ecological condition closer to the situation prior to human impact. If it recovers, it is not regarded as sensitive.

17.1 Ecological Sensitivity Drainage Line

The question arises**,** according to the ES definition, if the drainage lines would recover to its original ecological state prior to any human impact. If the roads and vineyards, would the drainage line recover? The answer is probably yes, even though the drainage lines would find new routes and even though it would take many decades, perhaps more than a century, in this semi-arid region where re-growth of vegetation can take a long time. However, this is not a realistic scenario. Development is here to stay, together with its impacts. From this point of view the drainage line can be considered as ecologically sensitive.

17.2 Ecological Sensitivity Orange River

The Lower Orange River has absorbed numerous and deep-cutting human impacts. Yet is still functions as an aquatic ecosystem. In the highly improbable event of ceased human impact, the river here would probably bounce back to its previous glory. In this respect the river cannot be categorised as sensitive. It is dreaded among conservation minded people that the Lower Orange River might have some more capacity to absorb further impact.

18 Probable Impacts

The part of the drainage line that runs past the northern boundary of the proposed development is prone to trampling, littering and over-grazing, once the houses have been built.

The proposed impact of this development on the Orange River is insignificant. However, the cumulative impact of all developments along the Orange River in the !Kheis municipality can be substantial.

19 Mitigation Measures

Measures should be taken to prevent the accumulation of household waste and other trash in the drainage line through proper urban solid waste management. It is going to be hard, if not impossible, to keep children from playing in the drainage line. It would only be a small section of the drainage line that would be impacted. Likewise, it is

going to be hard to limit the number of farm animals in the growing township, but it should be attempted if the drainage lines are going to be saved.

Opwag is still small, which leaves the opportunity to establish proper municipal service right from the start. It should not be allowed to deteriorate, as is the case in some of the other townships along the Lower Orange River

20 Impact Assessment

Table 6 Impact Assessment

Description of impact Household waste ending up in the drainage line and Orange River **Mitigation measures** Establish and maintain proper municipal services.								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Regional	Medium	Long term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Long term	Low	Probable	Sure	Reversible	Replaceable

Description of impact Trampling and over grazing **Mitigation measures** Limit number of farm animals.								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Regional	Medium	Long term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Long term	Low	Probable	Sure	Reversible	Replaceable

Some of the decision-making authorities prescribe an impact assessment according to a premeditated methodology (Table 23.1, Appendix).

The main benefit of this exercise is that it allows for the evaluation of mitigation measures. Later follows the Risk Matrix. This is different from the Impact Assessment as it does not attempt to weigh the success of mitigation measures.

The assessment indicates that the impacts are acceptable, provided that the mitigation measures are adequate to contain these impacts (Table 6).

21 Risk Matrix

The purpose of the Risk Matrix is to determine if a General Authorisation of a License is applicable.

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 7 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 7 (continued) represent the same activities as in Table 7, with sub-activities added.

The methodology is tabled in the Appendix.

This risks of a short reach of the drainage line being contaminated with household waste and being trampled by too many people and livestock is on a very local nature, with by far most of the drainage line and its sub-catchment left the way it is now.

At the moment sewage does not seem to be a problem, but may well develop into a threat as the township grows and treatment facilities do not keep pace with the demand.

Loose sand and sediments because of building activities do not seem to be a problem because the drainage line adjacent to the downstream is up the incline and not downstream as with the other townships.

The risk increases because of the cumulative risks posed by the various developments along the reach of the Orange River.

It is supposed that if the contamination in the river rises and the farming community becomes aware of it, that there would be a strong reaction, leading to curbing or ending the problem. This assumption influenced the score for “duration”, as the problem was perceived not to continue.

The Risk Matrix indicates that the risks to the aquatic environment are low. A General Authorisation should be in order for this application and a License is deemed not to be the indicated level of authorisation.

Table 7 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Waste ending up in the drainage line and in the Orange River	Waste in the drainage line and Orange River	Contamination of the drainage line and Orange River	52.5	Low
2	People and animals in drainage	Trampling of drainage line	Habitat destruction	36	Low

Table 7 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1 2	1 1	1 1	2 1	1 1	1.25 1	1 1	3 2	5.25 3

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Risk Rating
1 2	2 3	2 3	5 5	1 1	10 12	52.5 36	Low Low

22 Resource Economics

Table 8. Goods and Services

Goods & Services	Score
Flood attenuation	4
Stream flow regulation	4
Sediment trapping	4
Phosphate trapping	2
Nitrate removal	2
Toxicant removal	2
Erosion control	4
Carbon storage	3
Biodiversity maintenance	5
Water supply for human use	0
Natural resources	0
Cultivated food	1
Cultural significance	0
Tourism and recreation	0
Education and research	0

0	Low
5	High

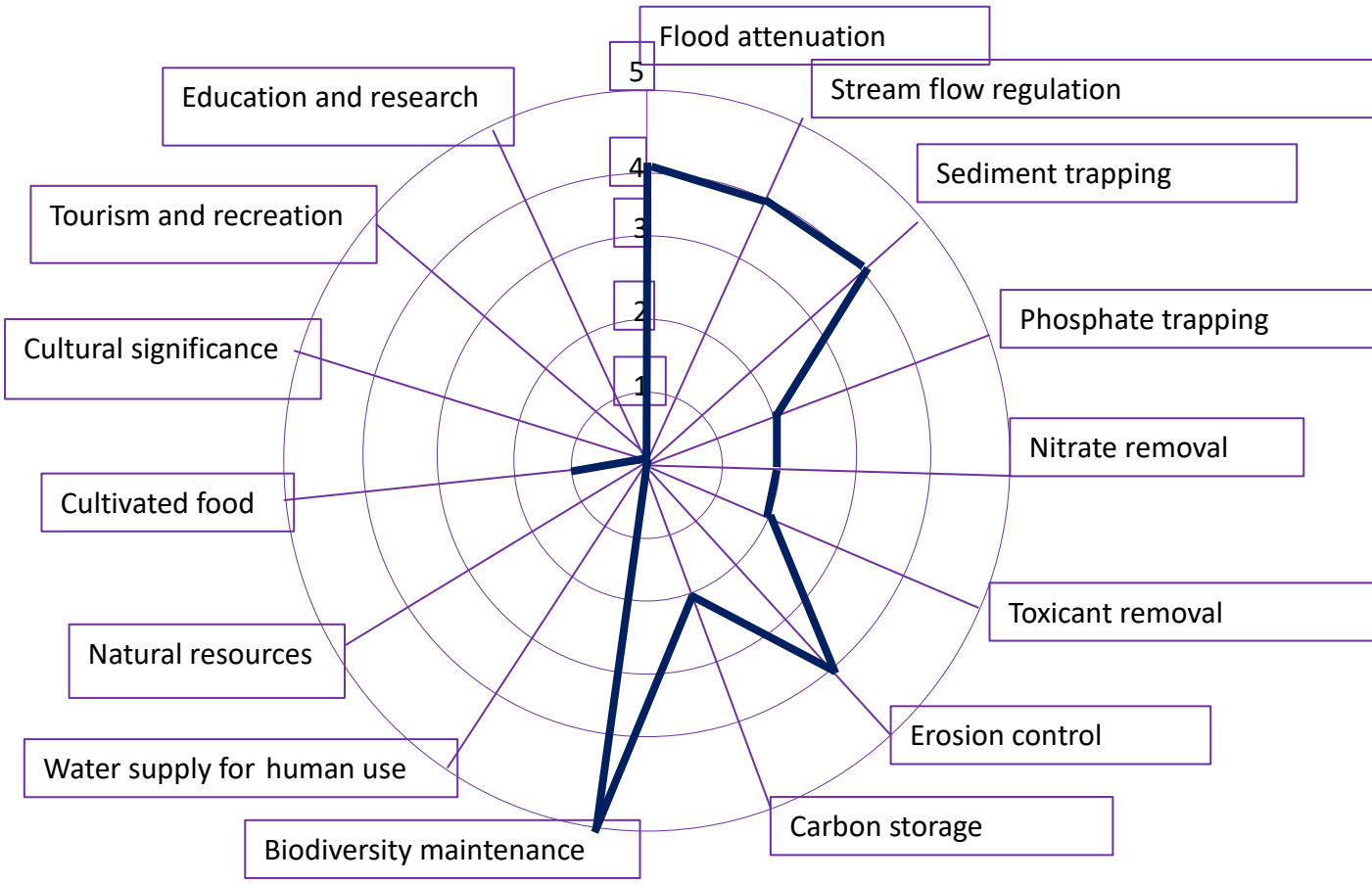


Figure 23. Resource Economics Footprint of the Drainage Line

The goods and services delivered by the environment, in this case the drainage line at the new Opwag housing development, is a Resource Economics concept as adapted by Kotze *et al* (2009). The methodology was designed for the assessments of wetlands, but in the case of the drainage line the goods and services delivered are particularly applicable and important, hence it was decided to include it in the report.

The diagram (Figure 23) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 8.

The size of the star shape attracts the attention of the decision-makers. This shape (spider diagram, Figure 23) depressed on the left-hand side, but surely contributes towards biodiversity and also attenuation and erosion control. It is therefore valuable, or at least more valuable than some of the smaller drainage lines in other similar townships. It would be important, to some degree, that the goods and services are protected as the Opwag township develops.

23 Site Visits: General Observations

Pertaining to Fresh Water Reports in general, urban wastewater is of importance because untreated waste ends up in water ways, which rebels against the NWA and other contemporary South African environmental legislation. Photographic evidence is presented in several of the seven !Kheis townships where anaerobic pond systems for the treatment of sewage lie idle and are not being utilized for the treatment of urban sewage. Instead raw sewage is dumped in drainage lines. Likewise, several sewage pump stations are dysfunctional, overflowing, with large quantities of raw sewage flowing down drainage lines.

Household solid waste is not collected and removed according to standard municipal operating procedures. Very large quantities of waste accumulate in the townships and the streets. Large quantities of waste end up in the drainage lines as well.

These two aspects are crucial to the WULA and environmental authorisation of any further urban development. If these malpractices are allowed to continue and if the normal municipal services continue to be absent, this untenable situation would become worse when these townships expand.

It should be noted that functional municipal services are part and parcel of the !Kheis Municipality's Technical Director's KPA's, stated in his published service contract. However, wastewater and solid waste management are not pertinently mentioned in this contract, which may explain why these services are not satisfactory.

This is not only a tangible threat to human health and human well-being at !Kheis, but in many South African municipalities, as well as in cities elsewhere in the world where WATSAN Africa concluded contracts.

It must be noted that Opwag differs from some of the other townships along the Lower Orange River because there is no sewage and urban waste problem yet. Municipal services should develop along with Opwag's growth to prevent the onset of these problems.

In a number of the townships, graveyards are illegally located right in drainage lines or within the 32m buffer zone from drainage lines.

There is no shortage of the aloe *Aloe claviflora* (Figure 24) in the district. They are plentiful and not endangered in any way, although aloes are protected plants in terms of legislation. These aloes are cleared from plots where people are putting up their houses. There will be a major clearance once the new housing schemes are launched. These aloes have a considerable monetary value if sold in cities such as Pretoria, Johannesburg and Cape Town. A formal scheme should be devised to collect and sell these aloes, the proceeds could be transferred to a reputable NGO, for community-based projects, such as building class rooms or additions to clinics.

From a Fresh Water Report perspective, a Licence or General authorisation should probably not be granted until the sewage and waste issues are satisfactory and sustainably resolved. But then this is entirely the prerogative of the DWS and its officials.

Figure 24 *Aloe claviflora*

24 Conclusions

Figure 25 has been adapted from one of the most recent DWS policy documents.

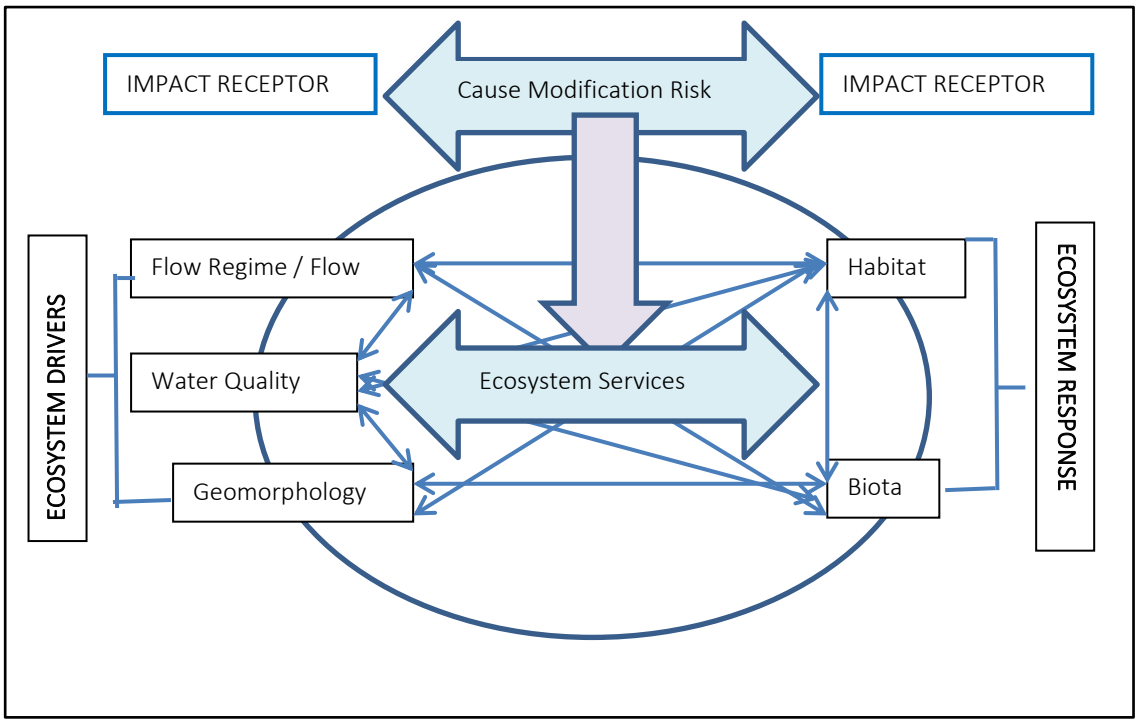


Figure 25 Minimum Requirements for a S21(c) and (i) Application

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all of the other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 25). The WULA and the EAI must provide mitigation measured for these impacts.

The driver of the drainage lines is the occasional flood that follows sudden and intense rainfall events. This is followed by prolonged droughts and intense summer heat that prevents the development of any viable aquatic habitat. This is apart from shallow ground water that explains the growth of a somewhat more prolific vegetation along the drainage lines.

The findings of this Fresh Water Report indicate that a general Authorization would be in order for the development of an urban housing scheme at Opwag.

25 References

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26 Declaration of Independence

I, Dirk van Driel, as the appointed independent specialist hereby declare that I:

- Act/ed as the independent specialist in this application
- Regard the information contained in this report as it relates to my specialist input/study to be true and correct and;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management act;
- Have and will not have vested interest in the proposed activity;
- Have disclosed to the applicant, EAP and competent authority any material information have or may have to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the environmental Impact Assessment Regulations, 2010 and any specific environmental management act.
- Am fully aware and meet the responsibilities in terms of the NEMA, the Environmental Impacts Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R543) and any specific environmental management act and that failure to comply with these requirements may constitute and result in disqualification;
- Have ensured that information containing all relevant facts on respect of the specialist input / study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties facilitated in such a manner that all interested and affected parties were provided with reasonable opportunity to participate and to provide comments on the specialist input / study;
- Have ensured that all the comments of all the interested and affected parties on the specialist input were considered, recorded and submitted to the competent authority in respect of the application;
- Have ensured that the names of all the interested and affected parties that participated in terms of the specialist input / study were recorded in the register of interested and affected parties who participated in the public participation process;
- Have provided the competent authority with access to all information at my disposal regarding the application, weather such information is favourable or not and;
- Am aware that a false declaration is an offence in terms of regulation 71 of GN No. R543.

Signature of the specialist:  30 May 2020

27 Résumé

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Water Scientist

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Experience

WATSAN Africa, Cape Town. Scientist **2011 - present**

USAID/RTI, ICMA & Chemonics. Iraq & Afghanistan **2007 -2011**
Program manager.

City of Cape Town **1999-2007**
Acting Head: Scientific Services, Manager: Hydrobiology.

Department of Water & Sanitation, South Africa **1989 – 1999**
Senior Scientist

Tshwane University of Technology, Pretoria **1979 – 1998**
Head of Department

University of Western Cape and Stellenbosch University 1994- 1998 part-time

- Lectured post-graduate courses in Water Management and Environmental Management to under-graduate civil engineering students
- Served as external dissertation and thesis examiner

Service Positions

- Project Leader, initiator, member and participator: Water Research Commission (WRC), Pretoria.
- Director: UNESCO West Coast Biosphere, South Africa
- Director (Deputy Chairperson): Grotto Bay Home Owner's Association
- Member Dassen Island Protected Area Association (PAAC)

Membership of Professional Societies

- South African Council for Scientific Professions. Registered Scientist No. 400041/96
- Water Institute of South Africa. Member

Reports

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
- Fresh Water and Estuary Report Erf 77 Elands Bay
- Ground Water Revision, Moorreesburg Cemetery
- Fresh Water Report Delaire Graff Estate, Stellenbosch
- Fresh Water Report Quantum Foods (Pty) Ltd. Moredou Poultry Farm, Tulbagh
- Fresh Water Report Revision, De Hoop Development, Malmesbury
- Fresh Water Report, Idas Valley Development Erf 10866, Stellenbosch
- Wetland Delineation Idas Valley Development Erf 10866, Stellenbosch
- Fresh Water Report, Idas Valley Development Erf 11330, Stellenbosch
- Fresh Water Report, La Motte Development, Franschhoek
- Ground Water Peer Review, Elandsfontein Exploration & Mining
- Fresh Water Report Woodlands Sand Mine Malmesbury
- Fresh Water Report Brakke Kuyl Sand Mine, Cape Town
- Wetland Delineation, Ingwe Housing Development, Somerset West
- Fresh Water Report, Suurbraak Wastewater Treatment Works, Swellendam
- Wetland Delineation, Zandbergfontein Sand Mine, Robertson
- Storm Water Management Plan, Smalblaar Quarry, Rawsonville
- Storm Water Management Plan, Riverside Quarry
- Water Quality Irrigation Dams Report, Langebaan Country Estate
- Wetland Delineation Farm Eenzaamheid, Langebaan
- Wetland Delineation Erf 599, Betty's Bay
- Technical Report Bloodhound Land Speed Record, Hakskeenpan
- Technical Report Harkerville Sand Mine, Plettenberg Bay
- Technical Report Doring Rivier Sand Mine, Vanrhynsdorp
- Rehabilitation Plan Roodefontein Dam, Plettenberg Bay
- Technical Report Groenvlei Crusher, Worcester
- Technical Report Wiedouw Sand Mine, Vanrhynsdorp
- Technical Report Lair Trust Farm, Augrabies
- Technical Report Schouwtoneel Sand Mine, Vredenburg
- Technical Report Waboomsrivier Weir Wolseley
- Technical Report Doornkraal Sand Mine Malmesbury
- Technical Report Berg-en-Dal Sand Mine Malmesbury
- Wetland Demarcation, Osdrif Farm, Worcester
- Technical Report Driefontein Dam, Farm Agterfontein, Ceres
- Technical Report Oewerzicht Farm Dam, Greyton
- Technical Report Glen Lossie Sand Mine, Malmesbury
- Preliminary Report Stellenbosch Cemeteries
- Technical Report Toeka & Harmony Dams, Houdenbek Farm, Koue Bokkeveld
- Technical Report Kluitjieskraal Sand & Gravel Mine, Swellendam
- Fresh Water Report Urban Development Witteklip Vredenburg
- Fresh Water Report Groblershoop Resort, Northern Cape
- Fresh Water Report CA Bruwer Quarry Kakamas, Northern Cape
- Fresh Water Report, CA Bruwer Sand Mine, Kakamas, Northern Cape
- Fresh Water Report, Triple D Farms, Agri Development, Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Hopetown

- Fresh Water Report Hopetown Sewer
- Fresh Water Report Hoogland Farm Agricultural Development, Touws River
- Fresh Water Report Klaarstroom Waste Water Treatment Works
- Fresh Water Report Calvinia Sports Grounds Irrigation
- Fresh Water Report CA Bruwer Agricultural Development Kakamas
- Fresh Water Report Zwartfontein Farm Dam, Hermon
- Statement Delsma Farm Wetland, Hermon
- Fresh Water Report Lemoenshoek Farms Pipelines Bonnyvale
- Fresh Water Report Water Provision Pipeline Brandvlei
- Fresh Water Report Erf 19992 Upington
- Botanical Report Zwartejongensfontein Sand Mine, Stilbaai
- Fresh Water Report CA Bruwer Feldspath Mine, Kakamas
- Sediment Yield Calculation, Kenhardt Sand Mine
- Wetland Demarcation, Grabouw Traffic Center
- Fresh Water Report, Osdrift Sand Mine, Worcester
- Fresh Water Report, Muggievlak Storm Water Canal, Vredenburg
- Fresh Water Report, Marksman's Nest Rifle Range, Malmesbury
- Biodiversity Report, Muggievlak Storm Water Canal, Vredenburg
- Strategic Planning Report, Sanitation, Afghanistan Government, New Delhi, India
- Fresh Water Report, Potable Water Pipeline, Komaggas
- Fresh Water Report, Wastewater Treatment Works, Kamieskroon
- Fresh Water Report Turksvy Farm Agricultural Development, Upington

28 Appendix

28.1 Biomonitoring Score Sheet

SASS5 Score Sheet										
Date	17 May 20	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Orange River	Porifera	5		**Hemiptera**			**Diptera**		
	Grootdrink Bridge	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1		Gerridae	5		Ceratopogonidae	5	
Coordinates	28°27' 15.30"	Huridinea	3		Hydrometridae	6		Chironomidae	2	2
	21°17'03.50"	**Crustacea**			Naucoridae	7		Culicidae	1	
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	8.6	Potamonautidae	3		Notonectidae	3	3	Empididae	6	
Temperature °C	17.2	Atyidae	8	8	Pleidae	4	4	Ephydridae	3	
pH	7.15	Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m	33	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	34	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	7	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	5.3	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4	4	Ecnomidae	8		**Gastropoda**		
Other Biota	Tadpoles	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		**Cased Caddis**			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		**Pelecipoda**		
		Teloganodidae	12		Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		**Coleoptera**					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				12			15			7

28.2 Methodology used in determining significance of impacts

The methodology to be used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives is provided in the following tables:

Table 28.2.1 Nature and type of impact

Nature and type of impact	Description
Positive	An impact that is considered to represent an improvement to the baseline conditions or represents a positive change
Negative	An impact that is considered to represent an adverse change from the baseline or introduces a new negative factor
Direct	Impacts that result from the direct interaction between a planned project activity and the receiving environment / receptors
Indirect	Impacts that result from other activities that could take place as a consequence of the project (e.g. an influx of work seekers)
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future activities) to affect the same resources and / or receptors as the project

Table 28.2.2 Criteria for the assessment of impacts

Criteria	Rating	Description
Spatial extent of impact	National	Impacts that affect nationally important environmental resources or affect an area that is nationally important or have macro-economic consequences
	Regional	Impacts that affect regionally important environmental resources or are experienced on a regional scale as determined by administrative boundaries or habitat type / ecosystems
	Local	Within 2 km of the site
	Site specific	On site or within 100m of the site boundary
Consequence of impact/ Magnitude/ Severity	High	Natural and / or social functions and / or processes are severely altered
	Medium	Natural and / or social functions and / or processes are notably altered
	Low	Natural and / or social functions and / or processes are slightly altered
	Very Low	Natural and / or social functions and / or processes are negligibly altered
	Zero	Natural and / or social functions and / or processes remain unaltered
Duration of impact	Temporary	Impacts of short duration and /or occasional
	Short term	During the construction period
	Medium term	During part or all of the operational phase
	Long term	Beyond the operational phase, but not permanently
	Permanent	Mitigation will not occur in such a way or in such a time span that the impact can be considered transient (irreversible)

Table 28.2.3 Significance Rating

Significance Rating	Description
High	High consequence with a regional extent and long-term duration High consequence with either a regional extent and medium-term duration or a local extent and long-term duration Medium consequence with a regional extent and a long-term duration
Medium	High with a local extent and medium-term duration High consequence with a regional extent and short-term duration or a site-specific extent and long-term duration High consequence with either local extent and short-term duration or a site-specific extent with a medium-term duration Medium consequence with any combination of extent and duration except site-specific and short-term or regional and long term Low consequence with a regional extent and long-term duration
Low	High consequence with a site-specific extent and short-term duration Medium consequence with a site-specific extent and short-term duration Low consequence with any combination of extent and duration except site-specific and short-term Very low consequence with a regional extent and long-term duration
Very low	Low consequence with a site-specific extent and short-term duration Very low consequence with any combination of extent and duration except regional and long term
Neutral	Zero consequence with any combination of extent and duration

Table 28.2.4 Probability, confidence, reversibility and irreplaceability

Criteria	Rating	Description
Probability	Definite	>90% likelihood of the impact occurring
	Probable	70 – 90% likelihood of the impact occurring
	Possible	40 – 70% likelihood of the impact occurring
	Unlikely	<40% likelihood of the impact occurring
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially affecting the impact
	Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact
	Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact
Reversibility	Reversible	The impact is reversible within 2 years after the cause or stress is removed
	Irreversible	The activity will lead to an impact that is in all practical terms permanent
Irreplaceability	Replaceable	The resources lost can be replaced to a certain degree
	Irreplaceable	The activity will lead to a permanent loss of resources.

28.3 Risk Matrix Methodology

RISK ASSESSMENT KEY (Referenced from DWA RISK-BASED WATER USE AUTHORISATION APPROACH AND DELEGATION GUIDELINES)

Negative Rating

TABLE 1- SEVERITY

How severe does the aspects impact on the environment and resource quality characterisitics (flow regime, water quality, geomorfology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5

Where "or wetland(s) are involved" it means

TABLE 2 – SPATIAL SCALE

How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catch	3
National (impacting beyond seconday catchment or provinces)	4
Global (impacting beyond SA boundary)	5

TABLE 3 – DURATION

How long does the aspect impact on the environment and resource quality?

One day to one month, PES, EIS and/or REC not impacted
One month to one year, PES, EIS and/or REC impacted but no change in status
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation
Life of the activity, PES, EIS and/or REC permanently lowered
More than life of the organisation/facility, PES and EIS scores, a E or F

TABLE 4 – FREQUENCY OF THE ACTIVITY

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT

How often does the activity impact on the environment?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

TABLE 6 – LEGAL ISSUES

How is the activity governed by legislation?

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5

Located within the regulated areas

TABLE 7 – DETECTION	
How quickly can the impacts/risks of the activity be observed on the environment (water resourc	
Immediately	
Without much effort	
Need some effort	
Remote and difficult to observe	
Covered	

TABLE 8: RATING CLASSES		
RATING	**CLASS**	**MANAGEMENT DESCRIPTION**
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale
A low risk class must be obtained for all activities to be considered for a GA		

TABLE 9: CALCULATIONS

Consequence = Severity + Spatial Scale + Duration
Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection
Significance \Risk= Consequence X Likelihood

ANNEXURE J: FINAL SCOPING REPORT

EnviroAfrica
Environmental Management and Impact Assessment | Omgewingsbestuur en Impakbeoordeling

PROPOSED TOWNSHIP DEVELOPMENT ON ERF 2642 AND PORTION 14 OF FARM 48, OPWAG, !KHEIS LOCAL MUNICIPALITY

SEPTEMBER 2020

!KHEIS LOCAL MUNICIPALITY

PROPOSED TOWNSHIP DEVELOPMENT ON ERF 2642 AND PORTION 14 OF FARM 48, OPWAG, !KHEIS LOCAL MUNICIPALITY

PREPARED FOR:
!Kheis Local Municipality

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Tel: 054 833 9500

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EnviroAfrica

P.O. Box 5367
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Tel: 021 – 851 1616
Fax: 086 – 512 0154

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ACRONYMS

BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Programme
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NID	Notice of Intent to Develop
NWA	National Water Act
OESA	Other Ecological Support Area
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
WULA	Water Use Licence Application

1. INTRODUCTION

1.1 BACKGROUND

Consideration is being given to the development of a new township, consisting of approximately 730 erven, including associated infrastructure, on Erf 2642 and Portion 14 of Farm 48, Opwag, !Kheis Local Municipality.

The applicant is !Khosi Local Municipality who will undertake the activity should it be approved. EnviroAfrica CC has been appointed as the independent environmental assessment practitioner (EAP) responsible for undertaking the relevant EIA and the Public Participation Process required in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA).

This Scoping Report, which will be submitted to the Department of Environment and Nature Conservation (DE&NC) for consideration, forms part of the EIA process.

The purpose of this Draft Environmental Scoping Report is to describe the proposed project, the process followed to date, to present alternatives and to list issues identified for further study and comment by specialists.

Should the EIA process be authorised by DE&NC, the Specialist Studies (noted in Section 8) will be undertaken and the significant issues (noted in Section 6) will be investigated and assessed during the next phase of this application.

1.2 DESCRIPTION OF THE PROPOSED ACTIVITY

The !Kheis Local Municipality is proposing that a new township development, consisting of approximately 730 erven and associated infrastructure on Erf 2642 and Portion 14 of Farm 48, Opwag, !Kheis Local Municipality.

The proposed project entails the development of approximately 730 erven including associated infrastructure such as roads, and water, stormwater, effluent, and electricity reticulation. The total area for housing to be developed measures 50 (fifty) hectares (housing). The proposed site is located approximately 79km south-east of Upington, 5km north of Groblershoop and 1km south of the Orange River. The proposed site is located within Ward 3 of the !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape. The proposed site for the Opwag Housing development are located at 28°50'14.90"S; 21°57'24.58"E and 28°50'0.82"S; 21°56'54.08"E, respectively.

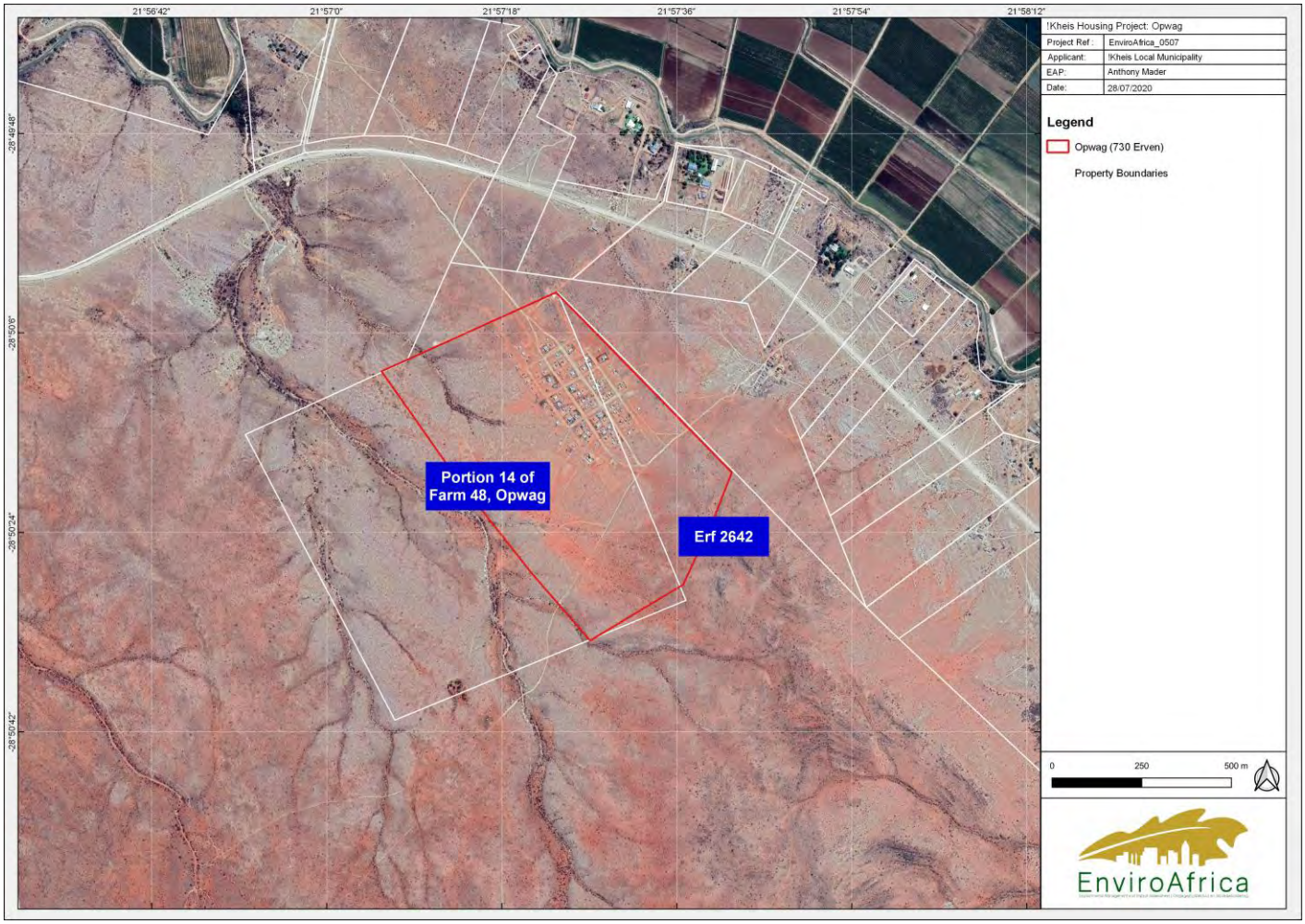


Figure 1: Map showing proposed site for the Opwag Housing development. Source: QGIS, version 3.10.

2. NEED AND DESIRABILITY

In terms of the National Environmental Management Act, as amended, EIA 2014 regulations the Scoping/EIA report must provide a description of the need and desirability of the proposed activity. The consideration of "need and desirability" in EIA decision-making requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest.

While the concept of need and desirability relates to the *type* of development being proposed, essentially, the concept of need and desirability can be explained in terms of the general meaning of its two components in which *need* refers to *time* and *desirability* to *place* – i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed? Need and desirability can be equated to *wise use of land* – i.e. the question of what is the most sustainable use of land.

2.1 NEED

Housing is a national need, including in the !Kheis Local Municipality.

The !Kheis Local Municipality's aims to promote socioeconomic development through the eradication of backlogs associated with water and sanitation, electricity, and housing, as well as improve basic services within Opwag. In order to meet the needs of the community within Opwag, the Council resolved that a project business plan be submitted to Co-operative Governance, Human Settlements and Traditional Affairs (COGHSTA) as well as the construction of 730 erven in Opwag over the short to medium term, along with associated infrastructure. As per the !Kheis Integrated Development Plan (IDP) 2019/2020, a key performance indicator includes the provision of infrastructure and basic service through securing suitable land for human settlement projects, where suitable land was previously identified in Opwag, Topline, Wegdraai, Grootdrink, Gariep, and Opwag. The provision of affordable housing units remains a high priority for the Municipality which will restore the dignity of poor people by providing shelter and access to basic human rights as enshrined in the Constitution of South Africa.

The proposed !Kheis housing development falls in line with the !Kheis IDPs key strategic and development objectives of the KLM, to improve and maintain basic service delivery through specific infrastructural projects including human settlements, water, sanitation, electricity, as well as streets and storm water management. The demographic profile of the KLM includes the total population of 16 637 individuals in 2011 with a total number of 4 145 households. This community requires formalized, state-instituted housing, and associated, infrastructure. The proposed development will distribute the density of the population, improve community member's standard of living, as well as access to essential services including roads, electricity, water supply, appropriate sewage disposal infrastructure, and environmental health in the area. Therefore, the proposed development will enable adequate housing to be constructed, thereby promoting access to basic service delivery as well as socioeconomic development in Boegoeberg and its surroundings.

The proposed Opwag Housing development is in line with the !Kheis IDPs key strategic and development objectives, namely to improve and maintain basic service delivery through specific infrastructural projects including human settlements and basic services, in the poverty-stricken Opwag Township. The Opwag community requires formalized, state-instituted housing, and associated, infrastructure. The proposed development will distribute the density of the population, improve community member's standard of living, as well as access to essential services including roads, electricity, water supply, appropriate sewage disposal infrastructure, and environmental health in the area. Therefore, the proposed development will enable adequate housing to be constructed, thereby promoting access to basic service delivery as well as

socioeconomic development in the Opwag Township and its surroundings. !Kheis Local Municipality is committed to the vision of the National Government of which it committed itself towards accelerating shared growth to halve poverty and unemployment and promote social inclusions. Housing is one of the social inclusions in this vision.

The majority of the KLM population is located in five settlements, namely: Grootdrink, Topline, Wegdraai, Groblershoop and Boegoeberg, with the largest of those settlements being Groblershoop, Grootdrink and Wegdraai. With regards to the functional age groups, 60% of KLM's population is of working age (15---64). Grootdrink (40%) and Boegoeberg (40%) have the highest percentages of population aged between 0 and 14, which is decidedly higher than the district percentage of 28%. Education levels and school attendance have increased in KLM. Grootdrink has the lowest percentage individuals with Gr.12 at 9,1%, while Topline has the highest percentage of individuals with 'no schooling' at 17,5%. In comparison Groblershoop has the highest percentage of individuals with Gr.12 (18,5%) and individuals with higher education (1,7%).

2.2 DESIRABILITY

The following factors determine the desirability of the area for the proposed development.

2.2.1 Location and Accessibility

The proposed location is considered to be a viable option. The proposed site is adjacent to the existing residential area of Opwag with some associated infrastructure. The proposed site for development is located approximately 4km off the N10 and approximately 5km from the N8, allowing accessibility and linking to the existing services infrastructure. Any upgrades or additional services infrastructure that will be required will be investigated, and included in the Environmental Impact Report (EIR).

The desirability and location of the proposed development will be further investigated in the Environmental Impact Report, and the town planning motivational report.

2.2.2 Compatibility with the Surrounding Area

The proposed site is adjacent to the existing residential area of Opwag. As stated above, this would provide accessibility and allow the proposed development to link to the existing services infrastructure.

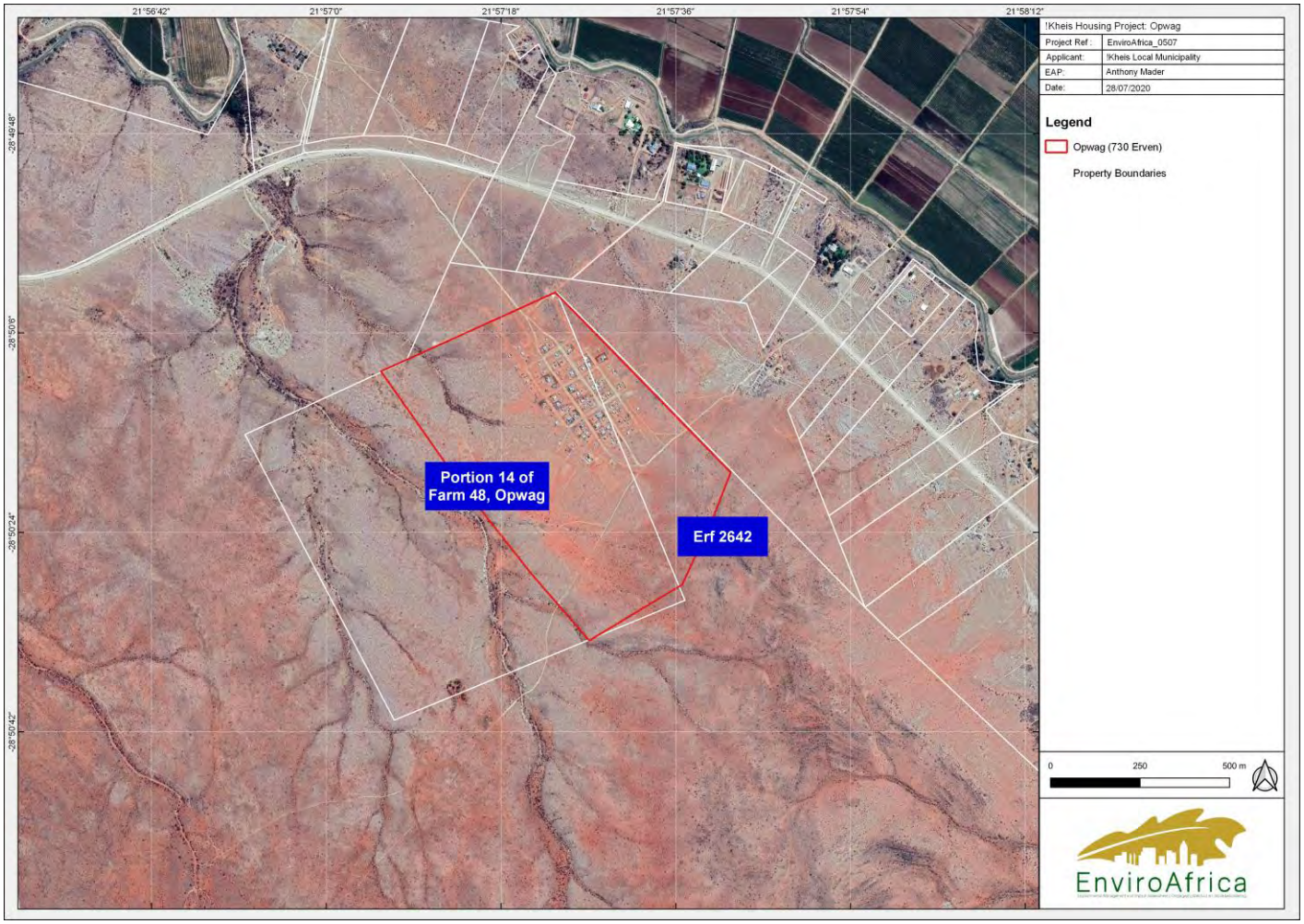


Figure 2: Map showing the surrounding landscape, as well as the location of the proposed development in location with the existing residential areas. QGIS, version 3.10.

3. LEGAL REQUIREMENTS

The current assessment is being undertaken in terms of the National Environmental Management Act (Act 107 of 1998, NEMA), to be read with section 24 (5): NEMA EIA Regulations 2014. However, the provisions of various other Acts must also be considered within this EIA.

The legislation that is relevant to this study is briefly outlined below.

3.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The Constitution of the Republic of South Africa (Act 108 of 1996) states that everyone has a right to a non-threatening environment and that reasonable measure are applied to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development.

3.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act (Act 107 of 1998) (NEMA), as amended, makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the relevant authorities based on the findings of an environmental assessment. NEMA is a national act, which is enforced by the Department of Environmental Affairs (DEA). These powers are delegated in the Northern Cape to the Department of Environment and Nature Conservation (DE&NC).

On the 04 December 2014 the Minister of Water and Environmental Affairs promulgated regulations in terms of Chapter 5 of the NEMA, namely the EIA Regulations 2014. These were amended on 07 April 2017 (GN No. 326, No. 327 (Listing Notice 1), No. 325 (Listing Notice 2), No. 324 (Listing Notice 3) in Government Gazette No. 40772 of 07 April 2017). Listing Notice 1 and 3 are for a Basic Assessment and Listing Notice 2 for a full Environmental Impact Assessment.

According to the regulations of Section 24(5) of NEMA, authorisation is required for the following listed activities for the proposed agricultural development:

Government Notice R327 (Listing Notice 1) listed activities:

12 *The development of;*

(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres;

(ii) infrastructure or structures with a physical footprint of 100 square metres or more;

where such development occurs;

(a) within a watercourse;

(b) in front of a development setback; or

(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;

19 *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*

(a) will occur behind a development setback;

(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or

(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.

24 The development of a road;

(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or

(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;

but excluding a road;

(a) which is identified and included in activity 27 in Listing Notice 2 of 2014; or

(b) where the entire road falls within an urban area; or

(c) which is 1 kilometre or shorter

27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for;

(i) the undertaking of a linear activity; or

(ii) maintenance purposes undertaken in accordance with a maintenance management plan.

56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre;

(i) where the existing reserve is wider than 13,5 meters; or

(ii) where no reserve exists, where the existing road is wider than 8 metres;

excluding where widening or lengthening occur inside urban areas.

Government Notice **R325** (Listing notice 2) listed activities:

15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for;

(i) the undertaking of a linear activity; or

(ii) maintenance purposes undertaken in accordance with a maintenance management plan.

Government Notice **R324** (Listing notice 3) listed activities:

4 The development of a road wider than 4 metres with a reserve less than 13.5 metres

12 The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.

14 The development of;

(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 10 square metres;

(ii) infrastructure or structures with a physical footprint of 10 square metres or more;

where such development occurs;

(a) within a watercourse;

(b) in front of a development setback; or

(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;

Excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;

An Application Form will be submitted to DE&NC. On acknowledgment from DE&NC this Scoping Process is being undertaken to identify potential issues.

The principles of environmental management as set out in section 2 of NEMA have been taken into account. The principles pertinent to this activity include:

- People and their needs will be placed at the forefront while serving their physical, psychological, developmental, cultural and social interests. The activity seeks to provide additional employment and economic development opportunities, which are a local and national need – *the proposed activity is expected to have a beneficial impact on people, especially developmental and social benefits, as well providing additional employment and economic development opportunities.*
- Development will be socially, environmentally and economically sustainable. Where disturbance of ecosystems, loss of biodiversity, pollution and degradation, and landscapes and sites that constitute the nation's cultural heritage cannot be avoided, are minimised and remedied. The impact that the activity will potentially have on these will be considered, and mitigation measures will be put in place - *potential impacts have been identified and considered, and any further potential impacts will be identified during the public participation process. Mitigation measures will be included in the EMP*.
- Where waste cannot be avoided, it will be minimised and remedied through the implementation and adherence of the Environmental Management Programme (EMP) – *this will be included in the EIR*.
- The use of non-renewable natural resources will be responsible and equitable.
- The negative impacts on the environment and on people's environmental rights will be anticipated, investigated and prevented, and where they cannot be prevented, will be minimised and remedied.
- The interests, needs and values of all interested and affected parties will be taken into account in any decisions through the Public Participation Process.
- The social, economic and environmental impacts of the activity will be considered, assessed and evaluated, including the disadvantages and benefits.
- The effects of decisions on all aspects of the environment and all people in the environment will be taken into account, by pursuing what is considered the best practicable environmental option.

3.3 NATIONAL HERITAGE RESOURCES ACT

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999). South African National Heritage Resources Agency (SAHRA) is the enforcing authority.

In terms of Section 38 of the National Heritage Resources Act, SAHRA will require a Heritage Impact Assessment (HIA) where certain categories of development are proposed. Section 38(8) also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that if such an assessment is found to be adequate, a separate HIA is not required.
The National Heritage Resources Act requires relevant authorities to be notified regarding this proposed development, as the following activities are relevant:

- *any development or other activity which will change the character of a site exceeding 5 000 m² in extent;*
- *the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length*

Furthermore, in terms of Section 34(1), no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the SAHRA, or the responsible resources authority. Nor may anyone destroy, damage, alter, exhume or remove from its original position, or otherwise disturb, any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority, without a permit issued by the SAHRA, or a provincial heritage authority, in terms of Section 36 (3). In terms of Section 35 (4), no person may destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object, without a permit issued by the SAHRA, or the responsible resources authority.

3.4 EIA GUIDELINE AND INFORMATION DOCUMENT SERIES

The following are the latest guidelines and information Documents that have been consulted:

- Department of Environmental Affairs and Development Planning's (DEA&DP) *Environmental Impact Assessment Guideline and Information Document Series (Dated: March 2013)*:
  - ✓ *Guideline on Transitional Arrangements*
  - ✓ *Generic Terms of Reference for EAPs and Project Schedules*
  - ✓ *Guideline on Alternatives*
  - ✓ *Guideline on Public Participation*
  - ✓ *Guideline on Exemption Applications*
  - ✓ *Guideline on Appeals*
  - ✓ *Guideline on Need and Desirability*

- Department of Environmental Affairs and Tourism (DEAT*) Integrated Environmental Management Information Series*

3.5 NATIONAL WATER ACT

Besides the provisions of NEMA for this EIA process, the proposed development may also require authorizations under the National Water Act (Act N0. 36 of 1998). The Department of Water and Sanitation, who administer that Act, will be a leading role-player in the EIA.

If, and as required by the Department of Water and Sanitation, a Water Use Licence Application (WULA) may be compiled and submitted.

3.6 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) is part of a suite of legislation falling under NEMA, which includes the Protected Areas Act, the Air Quality Act, the Integrated Coastal Management Act and the Waste Act. Chapter 4 of NEMBA deals with threatened and protected ecosystems and species and related threatened processes and restricted activities. The need to protect listed ecosystems is addressed (*Section 54*).

3.7 NATIONAL FORESTS ACT

The National Forests Act, 1998 (Act 84 of 1998) (NFA) makes provisions for the management and conservation of public forests.

In terms of section 15(1) of the National Forests Act, 1998, no person may

(a) cut, disturb. damage or destroy any protected tree; or

(b) posses, collect. remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except

  (i) under a license granted by the Minister; or

  (Ii) in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.

3.8 NORTHERN CAPE CONSERVATION ACT, ACT 09 OF 2009

On the 12th of December 2011, the new Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect, which provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the Act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. The NCNCA is a very important Act in that it put a whole new emphasis on a number of species not previously protected in terms of legislation.

It also put a new emphasis on the importance of species, even within vegetation classified as “Least Threatened” (in accordance with GN 1002 of 9 December 20011, promulgated in terms of the National Environmental Management Biodiversity Act 10 of 2004). Thus, even though a project may be located within a vegetation type or habitat previously not considered under immediate threat, special care must still be taken to ensure that listed species (fauna & flora) are managed correctly.

3.9 THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT (ACT 16 OF 2013)

The subject area falls under the jurisdiction of the local municipality and the appropriate zoning and subdivision would need to be allocated in order to permit the development of the land for the intended purpose.

4. ALTERNATIVES

Alternatives to the proposed development are very limited and have therefore not been considered for the following reasons described below.

4.1 SITE ALTERNATIVES

The proposed site is the only viable site available at this stage and the only one that will be investigated in this application. Housing is a constant need in the municipality, with other sites possibly earmarked for residential development that will not form part of this application. These will be addressed in the Environmental Impact Report.

4.2 ACTIVITY ALTERNATIVES

Activity alternatives are also very limited with no feasible alternatives besides residential development to assess. Due to the need for housing in the !Kheis Local Municipality, the housing development and associated infrastructure on the property is therefore the only activity considered.

The development may include a number of different land-uses however, besides just residential opportunities, to be incorporated into the layout. These will be investigated during the Environmental Impact Report phase.

4.3 LAYOUT ALTERNATIVES

Various layout alternatives will be investigated during the Environmental Impact Report. These will be compiled with input from the municipality and its requirements, as well as input and/or recommendations of the various specialists, as well as input from Interested and Affected Parties, including the community

4.4 NO-GO ALTERNATIVE

This is the option of not developing the proposed residential development.

Although the no-go development might result in no potential negative environmental impacts, the direct and indirect socio-economic benefits of not constructing the residential development will not be realised. The need for additional housing opportunities in the !Kheis Local Municipality will not be realised. These potential negative and/or positive environmental impacts will be assessed in the Environmental Impact Report.

5. SITE DESCRIPTION

5.1 LOCATION

The proposed site is located approximately 78km south east of Upington (as the crow flies), and is located north of the N10 and south of the Orange River. The proposed site is situated within Ward 3 of the !Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape. The proposed site for the Opwag housing development is located at 28°50'0.82"S; 21°56'54.08"E.

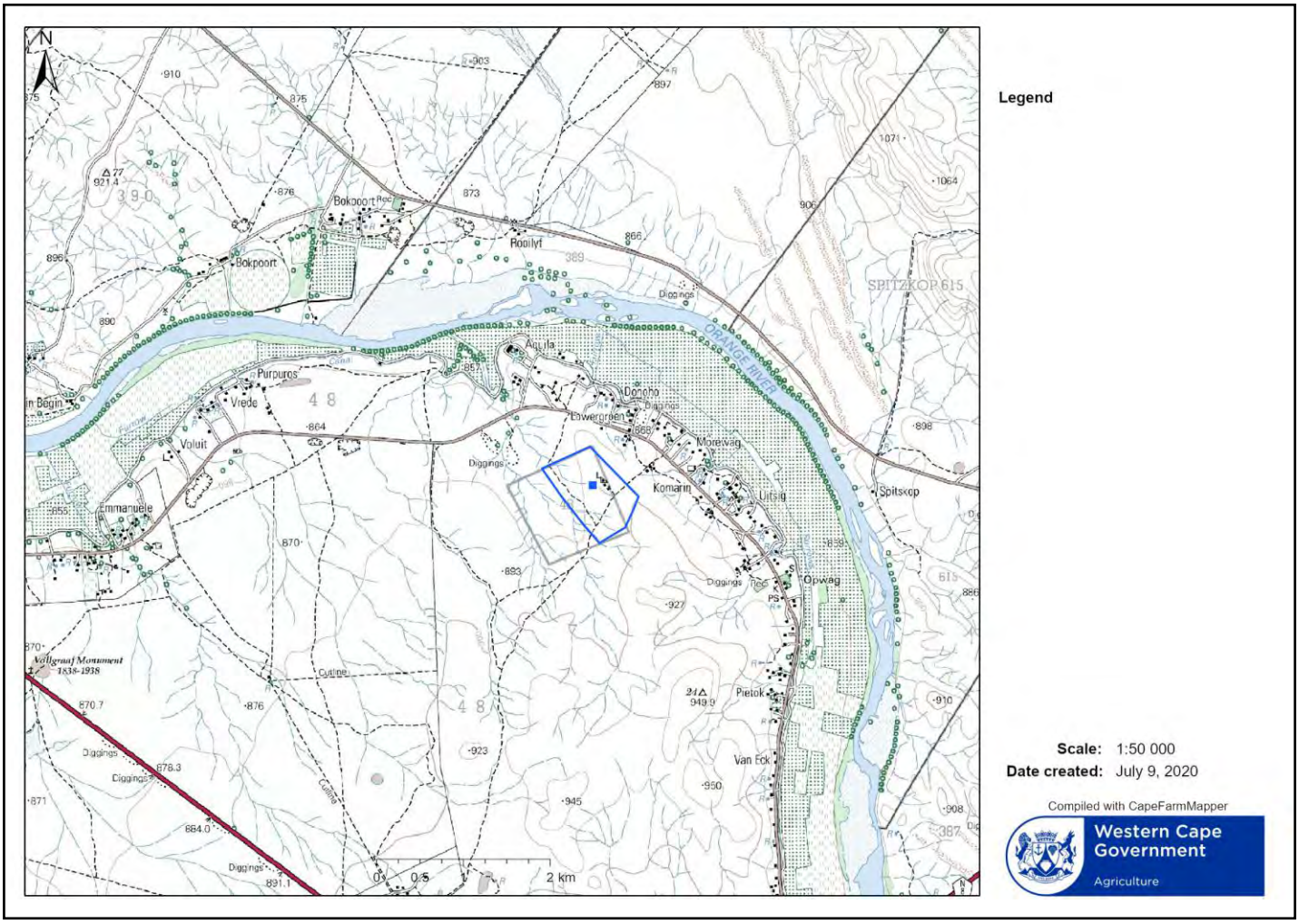


Figure 3: Locality map (1: 50 000) showing location of the proposed Opwag Housing development.

5.2 VEGETATION

The proposed site of the residential development is generally undeveloped, fallow and generally near natural. The edges of the site, especially adjacent to the existing residential areas, are disturbed. Informal households have encroached along the eastern and north-eastern boarders of the developmental footprint.

According to the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated in the 2012 beta version) only one broad vegetation type is expected on the majority of the proposed site, namely Bushmanland Arid Grassland (Least Threatened). The Lower Gariep Alluvial Vegetation type, located east of the proposed site for development, is an Endangered ecosystem type associated with the Orange River.

The Bushmanland Arid Grassland vegetation type is distributed throughout the Northern Cape Province, spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the northwest this vegetation unit borders on desert vegetation (northwest of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. The altitude throughout this vegetation type ranges from 600–1 200 m[1].

The vegetation component comprises of extensive-to-irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* spp) giving this vegetation type the character of semidesert ‘steppe’. In certain places, low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected. From a conservation perspective, the vegetation type is categorized as Least Threatened (LT) with a conservation target of 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. Erosion is very low (60%) and low (33%)[2].

[1] Mucina and Rutherford, (2006). The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia*, 19.

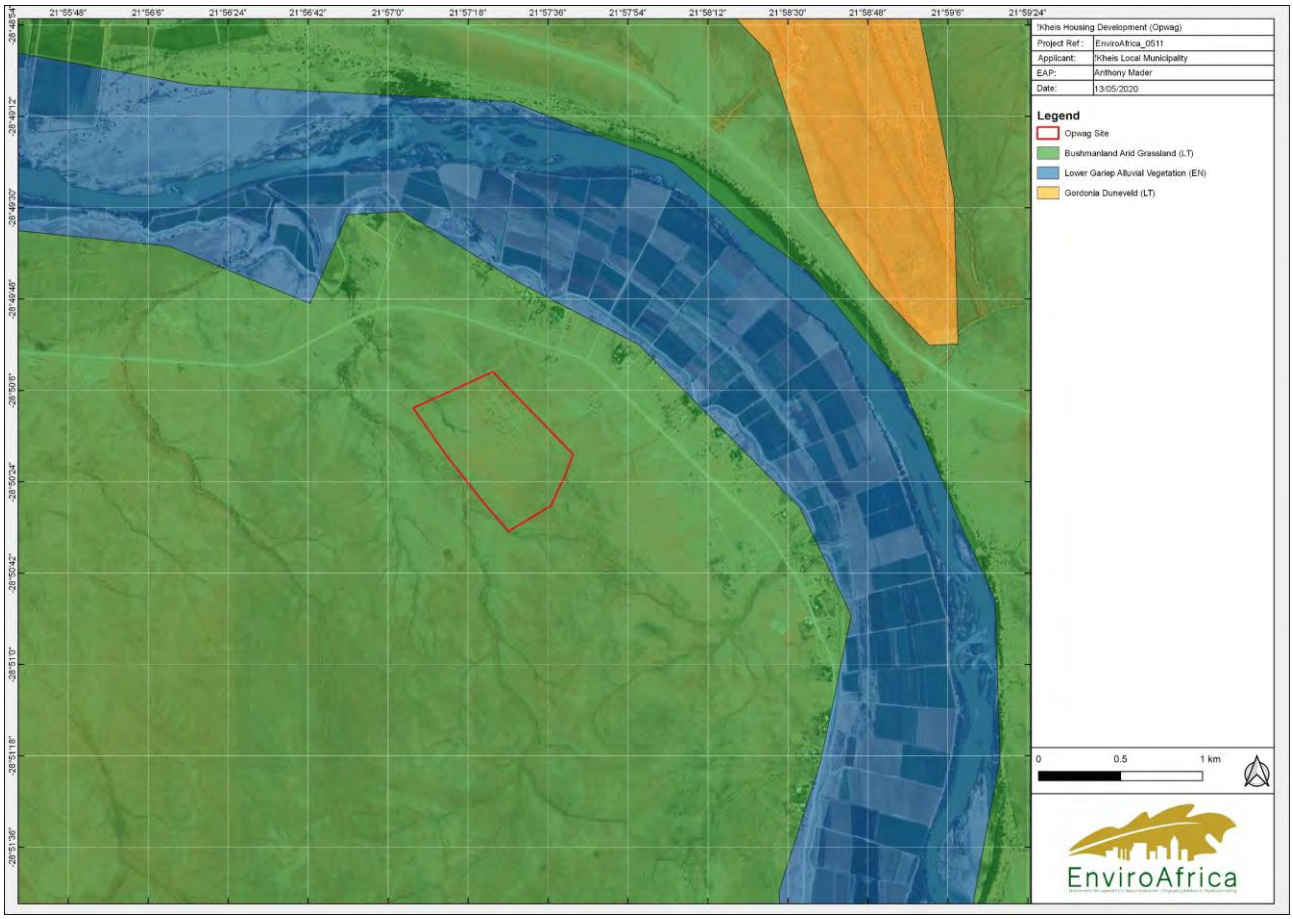


Figure 4: Vegetation types associated with the proposed Opwag Housing development. Source: QGIS, version 3.10.

According to the Northern Cape Critical Biodiversity Areas (CBA) maps the proposed site falls within a CBA area (Figure 6). However, there is no alternative on Municipal land that will not impact on the CBA. The 2016, Northern Cape CBA Map (Figure 5) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole (Holness & Oosthuysen, 2016). The 2016 Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province (including the Namakwa District Biodiversity Sector Plan, 2008). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Figure 5: CBA associated with the proposed Opwag site for development. Source: BGIS.

5.3 FRESHWATER

From the SANBI National Freshwater Ecosystem Priority Areas map (see Figure 6 below), no NFEPA wetlands were identified during the desktop study. Two drainage lines run through the site.

The source and nature of this water is to be investigated during the Scoping Phase, and if these are determined to be natural watercourses/wetlands, the impact of the proposed development on these watercourses are to investigated in the Environmental Impact Report. The Orange River is also located approximately 1km east of the site.

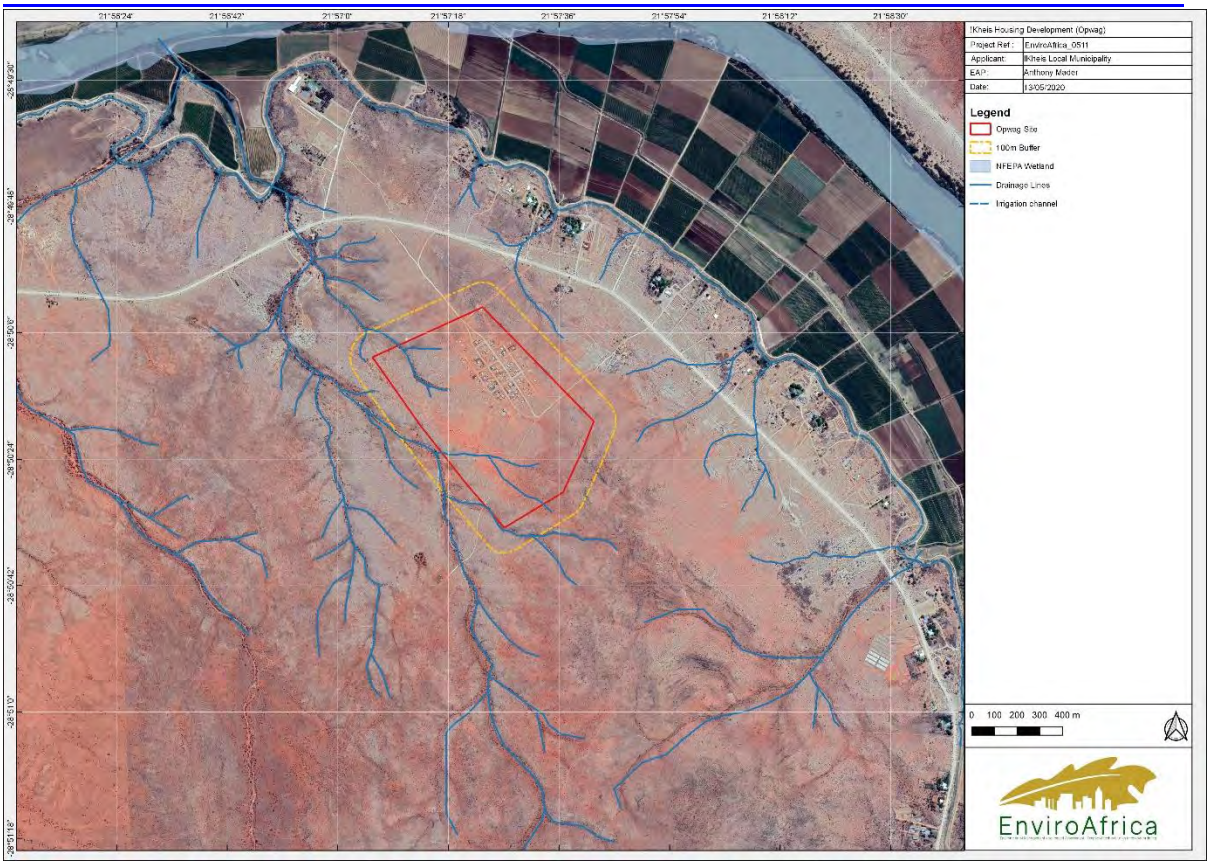


Figure 6: Identification of NFEPA wetlands and watercourses, with associated 100m buffer, during the desktop study.

5.4 CLIMATE

Climate data for Upington will be used, the nearest town (approximately 90km from Groblershoop) with reliable data. The Upington area is regarded as an arid area (regions with a rainfall of less than 400 mm per year are regarded as arid). This area normally receives about 180 mm of rain per year, with rainfall largely in summer. It receives the least amount of rain in winter (July), and the most amount during March.

The average annual temperature is 19.3^{0}C, with an average of 26.2^{0}C in January, and 11.5^{0}C in July.

5.5 SOCIO-ECONOMIC CONTEXT

Housing is a national need, including in the !Kheis Local Municipality.

The !Kheis Local Municipality's aims to promote socioeconomic development through the eradication of backlogs associated with water and sanitation, electricity, and housing, as well as improve basic services within Opwag. In order to meet the needs of the community within Opwag, the Council resolved that a project business plan be submitted to Co-operative Governance, Human Settlements and Traditional Affairs (COGHSTA) as well as the construction of 730 erven in Opwag over the short to medium term, along with associated infrastructure. As per the !Kheis Integrated Development Plan (IDP) 2019/2020, a key performance indicator includes the provision of infrastructure and basic service through securing suitable land for human settlement projects, where suitable land was previously identified in Opwag,

Topline, Wegdraai, Grootdrink, Gariep, and Opwag. The provision of affordable housing units remains a high priority for the Municipality which will restore the dignity of poor people by providing shelter and access to basic human rights as enshrined in the Constitution of South Africa.

The proposed !Kheis housing development falls in line with the !Kheis IDPs key strategic and development objectives of the KLM, to improve and maintain basic service delivery through specific infrastructural projects including human settlements, water, sanitation, electricity, as well as streets and storm water management. The demographic profile of the KLM includes the total population of 16 637 individuals in 2011 with a total number of 4 145 households. This community requires formalized, state-instituted housing, and associated, infrastructure. The proposed development will distribute the density of the population, improve community member's standard of living, as well as access to essential services including roads, electricity, water supply, appropriate sewage disposal infrastructure, and environmental health in the area. Therefore, the proposed development will enable adequate housing to be constructed, thereby promoting access to basic service delivery as well as socioeconomic development in Boegoeberg and its surroundings.

The proposed Opwag Housing development is in line with the !Kheis IDPs key strategic and development objectives, namely to improve and maintain basic service delivery through specific infrastructural projects including human settlements and basic services, in the poverty-stricken Opwag Township. The Opwag community requires formalized, state-instituted housing, and associated, infrastructure. The proposed development will distribute the density of the population, improve community member's standard of living, as well as access to essential services including roads, electricity, water supply, appropriate sewage disposal infrastructure, and environmental health in the area. Therefore, the proposed development will enable adequate housing to be constructed, thereby promoting access to basic service delivery as well as socioeconomic development in the Opwag Township and its surroundings. !Kheis Local Municipality is committed to the vision of the National Government of which it committed itself towards accelerating shared growth to halve poverty and unemployment and promote social inclusions. Housing is one of the social inclusions in this vision.

The majority of the KLM population is located in five settlements, namely: Grootdrink, Topline, Wegdraai, Groblershoop and Boegoeberg, with the largest of those settlements being Groblershoop, Grootdrink and Wegdraai. With regards to the functional age groups, 60% of KLM's population is of working age (15---64). Grootdrink (40%) and Boegoeberg (40%) have the highest percentages of population aged between 0 and 14, which is decidedly higher than the district percentage of 28%. Education levels and school attendance have increased in KLM. Grootdrink has the lowest percentage individuals with Gr.12 at 9,1%, while Topline has the highest percentage of individuals with 'no schooling' at 17,5%. In comparison Groblershoop has the highest percentage of individuals with Gr.12 (18,5%) and individuals with higher education (1,7%).

5.6 HERITAGE FEATURES

Due to the nature and size of the proposed development, potential heritage resources may be affected by the development. Heritage resources include any of the following, as defined by the National Heritage Resources Act (Act 25 of 1999):

- living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);

- Ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

6. SERVICES

Due to the scale of the development, the availability of bulk services for the development will need to be investigated. The !Kheis Local Municipality will more than likely be the service provider for the bulk services.

BVi Engineers will prepare the Bulk Engineering Services Reports on the external services for the proposed development.

6.1 WATER

The water source, upgrades to existing water reticulation infrastructure and connection with the proposed internal water network will need to be determined. Back-up storage will also need to be investigated.

The availability and confirmation that sufficient capacity exists to service the proposed development will need to be addressed, and confirmation received from the engineers and/or municipality.

6.2 SEWER

The availability of sewer services, the potential upgrades to existing infrastructure or the potential development of new infrastructure to adequately service the proposed development will need to be investigated.

The availability and confirmation that sufficient capacity exists to service the proposed development will need to be addressed and confirmed by the engineers and/or the municipality.

6.3 ROADS

The internal road network and design standards, including any access roads, will need to be determined in line with the proposed layout design. The main entrance to the development is expected to be from an unnamed access road off the N10.

A Traffic Impact Assessment will be conducted to determine the design of the internal roads, including any upgrades that will be required to existing roads to provide adequate access to the site, or if new access points will be needed.

6.4 STORMWATER

The internal stormwater network and links and upgrades to the existing external stormwater network, will need to be determined and addressed in the Bulk Engineering Services Reports. This will be determined once a conceptual site layout plan has been developed.

6.5 SOLID WASTE (REFUSE) REMOVAL

Refuse removal will be via the Municipal waste stream and disposed of at the nearest municipal bulk solid waste disposal site. Sufficient capacity to adequately service the proposed development will need to be confirmed by the engineers and municipality.

6.6 ELECTRICITY

The proposed internal electrical network, electrical infrastructure requirements, upgrades to the existing external electrical network, including the provider and confirmation of sufficient capacity will need to be determined and addressed in the Bulk Engineering Services Reports.

7. ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

Environmental issues were raised through informal discussions with the project team, specialists and authorities. All issues raised will be assessed in the specialist reports and will form part of the Environmental Impact Report. Additional issues raised during the public participation will be listed in the Final Scoping Report.

The following potential issues have been identified:

7.1 BOTANICAL

A botanical impact assessment will be conducted to determine if there is any sensitive or endangered vegetation on the proposed site. Due to the size of the development (approximately 50ha), there will be a loss of vegetation during the construction phase of the project.

A Botanical Impact Assessment will be conducted, which will describe and assess the botanical sensitivity of the area. The terms of reference for this study required a baseline analysis of the flora of the property, including the broad ecological characteristics of the site.

The botanical assessment will include the following:

- The significance of the potential impact of the proposed project, alternatives and related activities – with and without mitigation – on biodiversity pattern and process at the site, landscape and regional scales.
- Recommended actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts.

7.2 FRESHWATER

Freshwater ecosystems were identified on desktop analysis, and due to the size and nature of the development and the unknown source of standing water within the development site, a freshwater impact assessment will be conducted. Any potential impacts to the Orange River will also be investigated.

The terms of reference for the Freshwater assessment are as follows:

- Literature review and assessment of existing information
- Site Assessment of the proposed activities and impact on the associated freshwater systems. This will include an assessment of the freshwater ecological condition, using river health indices such as in-stream and riparian habitat integrity, aquatic macro-invertebrates and riparian vegetation to determine set back lines and geomorphological condition of the streams, which will then determine the overall Ecostatus of the streams and provide data that will inform the Water Use Licence Application of the project.
- Describe ecological characteristics of freshwater systems and compile report based on the data and information collected in the previous two tasks, describe ecological characteristics of the freshwater systems, comment on the conservation value and importance of the freshwater systems and delineate the outer boundary of the riparian zones/riverine corridors.
- Evaluate the freshwater issues on the site and propose mitigation measures and measures for the rehabilitation of the site as well as setback lines for future development.

- Compilation of the documentation for submission of the water use authorisation application (WULA) to the Department of Water and Sanitation (if deemed necessary).

7.3 HERITAGE

The possible impact on heritage resources has been identified as a possible environmental impact as a result of the development.

A Heritage Impact Assessment will be conducted on the site.

The terms of reference for the heritage and archaeological study are as follows:

- To determine whether there are likely to be any important archaeological sites or remains that might be impacted by the proposed development;
- To identify and map archaeological sites/remains that might be impacted by the proposed development;
- To assess the sensitivity and conservation significance of archaeological sites/remains in the inundation area;
- To assess the status and significance of any impacts resulting from the proposed development, and
- To identify measures to protect any valuable archaeological sites/remains that may exist within the estimated inundation area.

x

7.4 VISUAL IMPACT

The potential impact on the sense of place of the proposed development will also be considered. However, due to the nature of the activity, the surrounding land-uses, and that the sense of place is not expected to be significantly altered by the proposed development, no further studies are suggested.

7.5 OTHER ISSUES IDENTIFIED

Any further issues raised during the public participation process or by the Competent Authority not mentioned in this section, will be dealt with during the EIA phase.

8. DETAILS OF THE PUBLIC PARTICIPATION PROCESS

Potential Interested and Affected Parties (I&APs) have been and will be identified throughout the process. Landowners adjacent to the proposed site, relevant organs of state, organizations, ward councillors and the Local and District Municipality were added to this database. A complete list of organisations and individual groups identified to date is shown in **Appendix 1.**

Public Participation will be conducted for the proposed development in accordance with the requirements outlined in Regulation 41 of the NEMA EIA Regulations 2014. The issues and concerns raised during the scoping phase will be dealt with in the EIA phase of this application.

As such each subsection of Regulation 41 contained in Chapter 6 of the NEMA EIA Regulations 2014 will be addressed separately to thereby demonstrate that all potential Interested and Affected Parties (I&AP's) were notified of the proposed development.

R54 (2) (a):

R41 (2) (a) (i): The site notices (A2 and A3 sizes) were placed at different locations around the project site as well as at the municipality office in town.

The posters contained all details as prescribed by R41(3) (a) & (b) and the size of the on-site poster was at least 60cm by 42cm as prescribed by section R41 (4) (a).

R41 (2) (a) (ii): N/A. There is no alternative site.

R41 (2) b):

R41 (2) (b) (i): N/A. The Applicant is the landowner

R41 (2) (b) (ii): Notification letters will be circulated to residents adjacent to/within close proximity of the project site. **Appendix 1C**

R41 (2) (b) (iii): An initial notification letter will be sent to the municipal Ward councillor at the !Kheis Local Municipality, for the ward in which the site is situated.

R41 (2) (b) (iv): No notification letter will be sent to the !Kheis Local Municipality as the municipality is the Applicant

R54 (2) (b) (v): The Draft Scoping Report and notification letters will be sent to the following organs of state having jurisdiction in respect of any aspect of the activity:

- Department of Water and Sanitation
- Department of Agriculture and Land Reform
- Department of Roads and Public Works
- Department of Agriculture, Forestry and Fisheries
- Department of Cooperative Governance, Human Settlements and Traditional Affairs
- SANRAL
- Department of Environment and Nature Conservation

- South African Heritage Resources Agency

R41 (2) (c) (i): An advertisement was placed in the local newspaper.

R41 (2) (d): N/A

R41 (6):
R41 (6) (a): All relevant facts in respect of the application were made available to potential I&AP's.

R41 (6) (b): I&AP's will be given more than 30-days to register and/or comment on the Draft Scoping Report.

R42 (a), (b), (c) and R43(2): A register of interested and affected parties was opened, maintained and is available to any person requesting access to the register in writing.

Please find attached in **Appendix 1**:

- Proof of Notice boards, advertisements and notices that were sent out
- List of potential interested and affected parties
- Summary of issues raised by interested and affected parties

9. PLAN OF STUDY FOR THE EIA

9.1.1 TASKS TO BE UNDERTAKEN

Due to the nature of the proposed development there are a number of activities that will still need to be undertaken during the next phase of the project. The proposed process is as described as follows (This follows from a Scoping process to be accepted by the D:E&NC):

The NEMA Application Form will be submitted to D:E&NC along with the Draft Scoping Report which will be available for a 60-day comment period starting from the **03 August 2020 to 07 October 2020**. Comments received during the Public Participation Process will be incorporated into the Final Scoping Report, to be submitted to D:E&NC for a decision.

The following is a list of tasks to be performed as part of the EIA Process. Should the process be modified significantly, changes will be copied to D:E&NC.

Table 1: Detailed Project Plan as per NEMA Scoping and EIA Regulations 2014 (as amended): !Kheis Housing Development: Opwag Housing

No.	Action		Timeline
1	Clarification meeting with client and appointment of environmental assessment practitioner (EAP) for EIA and environmental authorisation (EA) application		17th April 2020
2	Appointment of specialists for EIR assessments	Botanical Specialist	7th May 2020
		Freshwater Specialist	
		Archaeological Specialist	
3	Draft Scoping Report compilation		10-14th May 2020
4	EAP site visit		19th May 2020
5	Public participation (PP): - Letter drops (Adjacent Landowner Notification); - Poster placement (Public notice board at the !Kheis Local Municipality, public notice board of AgriMark (Groblershoop), local Clinic, different conspicuous locations along the boundary of the proposed site for development (with a lot of foot traffic), and three tuckshops/ stores. - Advertisement publication (*published on 11th June 2020*) PP comment period must be a minimum of 60 days[2]		19th May 2020
6	Specialist site visits	Botanical Assessment (Mr Peet Botes)	18-22nd May 2020
		Freshwater Assessment (Dr Dirk Van Driel)	18-22nd May 2020
		Archaeological Assessment (Mr Jan Engelbrecht)	18-31st May 2020
7	Advert comment period ends (*60-day comment period as per new directions*)		14th August 2020
Application and Scoping Phase			

[2]As per section 4 of the 'Directions Regarding Measures to Address, Prevent and Combat the Spread of COVID-19 Relating to National Environmental Management Permits and Licenses', published on the 5th June 2020 by the Department of Environment, Forestry and Fisheries (DEFF). These new directions state that any notice given after the 5th June 2020 requires an extended 30-day comment period in addition to the legislated 30-day comment period (total of 60-day comment period). If PP was conducted before the 27th March 2020, the formal comment period between 27th March and 5th June 2020 are null and void and therefore, restarted on the 6th June 2020. The initial comment period must be extended by additional 21 days (total of 51 day). Please note that we are still waiting for directives from DEFF on application timelines. These Directives published on the 5th June 2020 apply to Level 3 Lockdown Period and are subject to change. Please note: the dates above may be subject to change should the Department of Environmental Affairs, Forestry and Fisheries (DEFF) and the Department of Environment and Nature Conservation (DENC) issue any new directives and legislated timeframes. The final decision (No. 18) may be expedited on request by the applicant.

8	Application Form Compilation and Submission (Competent Authority have 10 days to respond)	7 days
9	EAP to compile the draft Scoping Report (SR) (incl. the Plan of Study for EIA) and submit with Application Form	
10	If in order, the Department to acknowledge the application.	10 days
11	EAP to notify I&APs (incl. the State departments) EAP to notify the registered I&APs (incl. the State departments) of the availability of the draft SR.	7 days
12	Commenting period of 30 days + 30days for I&APs and State departments to comment.	60 days
13	EAP to consider the comments received and complete the final SR.	3 days
14	Following the commenting period the EAP to submit the Final SR together with any comments received on the final SR to the Department (within 74 days of submission of the Application Form)	7 days
15	Department to acknowledge SR & Plan of Study for EIA.	10 days
16	If in order, the Department to accept the SR & Plan of Study for EIA (within 43 days + 30 days of receipt of Final SR)	73 days
Application and Scoping Phase		
17	EAP to undertake the EIA and compile the draft EIA Report ("EIAR") (including the draft EMP)	40 days
18	EAP to notify registered I&APs (incl. the State departments) of the availability of the draft EIAR for comment.	7 days
19	Commenting period of 60 days for I&APs and State departments.	60 days
20	EAP to consider the comments received and complete the final EIAR.	7 days
21	Following the commenting period the EAP to submit the final EIR together with any comments received on the final EIR to the Department.	7 days
22	Department to acknowledge EIR.	10 days
23	After having received the EIR, the Department to decide whether or not to grant or refuse Environmental Authorisation (within 107 days)	137 days
24	Applicant/EAP to notify I&APs of outcome and if authorised may only commence 20 days after the date of the authorisation.	20 days

EIA PROCESS	
TASK	TIMEFRAMES
Submit NEMA Application and Draft Scoping Report (FSR) and Plan of Study for EIA to D:E&NC and distribute to registered I&APs for comment	July 2020
Submit Final Scoping Report and Plan of Study to D:E&NC for a decision	October 2020
Receive approval for the FSR and the Plan of Study for EIA.	December 2020
Compile the Draft Environmental Impact Report (EIR) for public comment based on specialist information.	December 2020
Submit Draft EIR for public comment.	January 2021
Receive responses to the Draft EIR.	March 2021
Preparation of a FINAL EIR and submission to D:E&NC.	April 2021

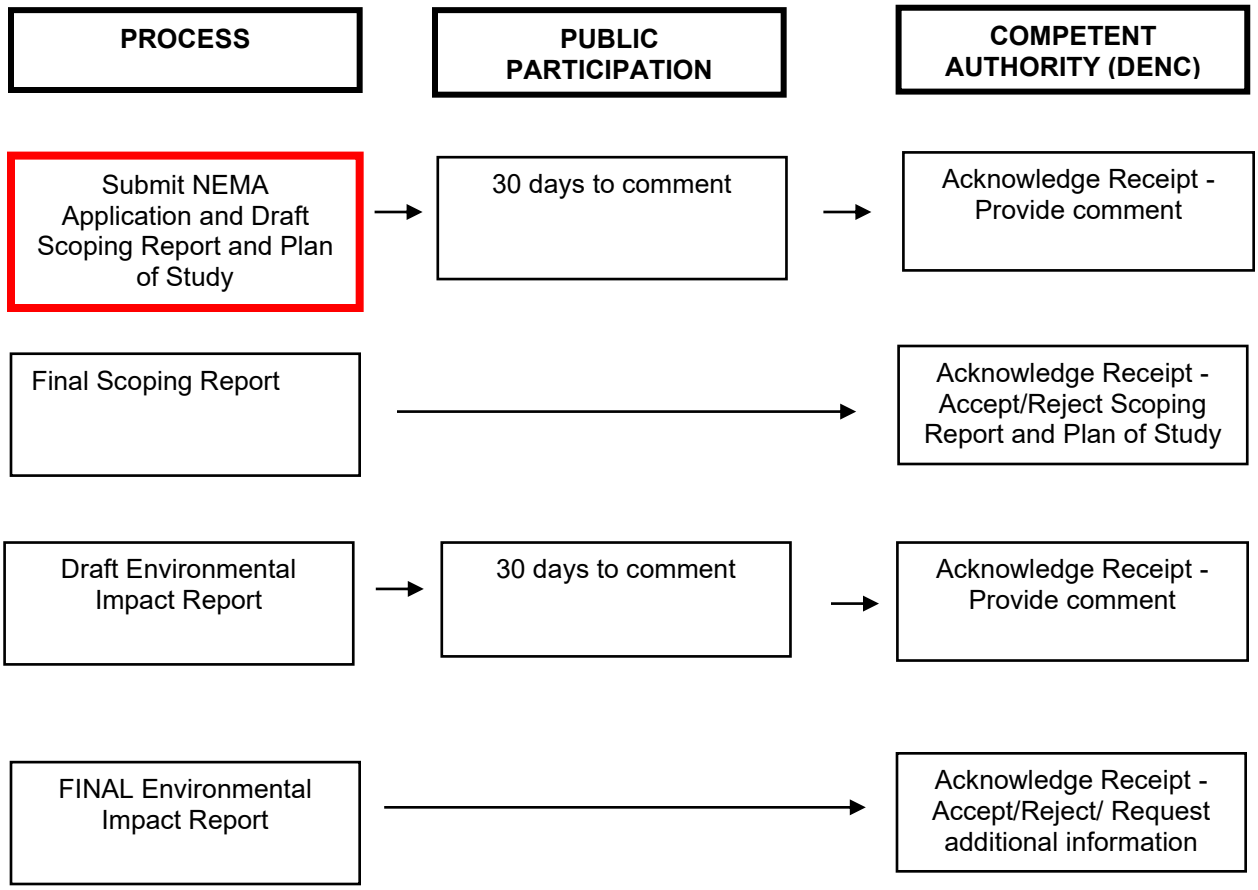


Figure 7. Summary of the EIA process and public participation process. The red indicates the stages where the competent authority will be consulted during the process.

9.2 PUBLIC PARTICIPATION AND INTERESTED AND AFFECTED PARTIES

Please refer to Figure 6 to see where the public participation process is present in the environmental impact assessment. The Interested and Affected Parties will have a chance to view and comment on all the reports that are submitted. The figures also indicated what timeframes are applicable to what stage in the process. If required, meetings with key stakeholders will be held.

At the end of the comment period, the EIR will be revised in response to feedback received from I&APs. All comments received and responses to the comments will be incorporated into the Final Environmental Impact Report (EIR). The Final EIR will then be submitted to D:E&NC for consideration and decision-making.

Correspondence with I&APs will be via post, fax, telephone, email and newspaper advertisements.

Should it be required, this process may be adapted depending on input received during the on-going process and as a result of public input. D:E&NC will be informed of any changes in the process.

9.3 CRITERIA FOR SPECIALIST ASSESSMENT OF IMPACTS

As a result of the environmental issues and potential impacts identified in *Section 6*, the need for the following specialist studies has been identified:

- Biodiversity Assessment
- Freshwater Assessment
- Heritage Impact Assessment

The impacts of the proposed activity on the various components of the receiving environment will be evaluated in terms of duration (time scale), extent (spatial scale), magnitude and significance as outlined in Table 1. These impacts could either be positive or negative.

The magnitude of an impact is a judgment value that rests with the individual assessor while the determination of significance rests on a combination of the criteria for duration, extent and magnitude. Significance thus is also a judgment value made by the individual assessor.

Table 2: Criteria used for evaluating impacts

Criteria	Category
Nature of impact	This is an evaluation of the effect that the construction, operation and maintenance of a proposed dam would have on the affected environment. This description should include what is to be affected and how.
Duration (Predict whether the lifetime of the Impact will be temporary (less than 1 year) short term (0 to 5 years); medium term (5 to 15 years); long term (more than 15 years, with the Impact ceasing after full implementation of all development components with mitigations); or permanent.	**Temporary:** < 1 year (not including construction) **Short-term:** 1 – 5 years **Medium term:** 5 – 15 years **Long-term:** >15 years (Impact will stop after the operational or running life of the activity, either due to natural course or by human interference) **Permanent:** Impact will be where mitigation or moderation by natural course or by human interference will not occur in a particular means or in a particular time period that the impact can be considered temporary
Extent (Describe whether the impact occurs on a scale limited to the site area; limited to broader area; or on a wider scale)	**Site Specific:** Expanding only as far as the activity itself *(onsite)* **Small:** restricted to the site's immediate environment within 1 km of the site *(limited)* **Medium:** Within 5 km of the site *(local)* **Large:** Beyond 5 km of the site *(regional)*
Intensity (Describe whether the magnitude (scale/size) of the Impact is high; medium; low; or negligible. The specialist study must attempt to quantify the magnitude of impacts, with the rationale used explained)	**Very low:** Affects the environment in such a way that natural and/or social functions/processes are not affected **Low:** Natural and/or social functions/processes are slightly altered **Medium:** Natural and/or social functions/processes are notably altered in a modified way **High:** Natural and/or social functions/processes are severely altered and may temporarily or permanently cease
Probability of occurrence Describe the probability of the Impact actually occurring as definite (Impact will occur regardless of mitigations	**Improbable:** Not at all likely **Probable:** Distinctive possibility **Highly probable:** Most likely to happen **Definite:** Impact will occur regardless of any prevention measures

Status of the Impact Describe whether the Impact is positive, negative (or neutral).	**Positive:** The activity will have a social/ economical/ environmental benefit **Neutral:** The activity will have no affect **Negative:** The activity will be socially/ economically/ environmentally harmful
Degree of Confidence in predictions State the degree of confidence in predictions based on availability of information and specialist knowledge	**Unsure/Low:** Little confidence regarding information available (<40%) **Probable/Med:** Moderate confidence regarding information available (40-80%) **Definite/High:** Great confidence regarding information available (>80%)
Significance (The impact on each component is determined by a combination of the above criteria and defined as follows) The significance of impacts shall be assessed with and without mitigations. The significance of identified impacts on components of the affected biophysical or socio-economic environment (and, where relevant, with respect to potential legal requirement/s) shall be described as follows:	**No change:** A potential concern which was found to have no impact when evaluated **Very low:** Impacts will be site specific and temporary with no mitigation necessary. **Low:** The impacts will have a minor influence on the proposed development and/or environment. These impacts require some thought to adjustment of the project design where achievable, or alternative mitigation measures **Moderate:** Impacts will be experienced in the local and surrounding areas for the life span of the development and may result in long term changes. The impact can be lessened or improved by an amendment in the project design or implementation of effective mitigation measures. **High:** Impacts have a high magnitude and will be experienced regionally for at least the life span of the development, or will be irreversible. The impacts could have the no-go proposition on portions of the development in spite of any mitigation measures that could be implemented.

In addition to determining the individual impacts against the various criteria, the element of mitigation, where relevant, will also be brought into the assessment. In such instances the impact will be assessed with a statement on the mitigation measure that could/should be applied. An indication of the certainty of a mitigation measure considered, achieving the end result to the extent indicated, is given on a scale of 1-5 (1 being totally uncertain and 5 being absolutely certain), taking into consideration uncertainties, assumptions and gaps in knowledge.

Table 3: The stated assessment and information will be determined for each individual issue or related groups of issues and presented in descriptive format in the following table example or a close replica thereof.

Impact Statement:		
Mitigation:		
Ratings	Duration	
	Extent	
	Intensity	
	Probability of impact	
	Status of Impact (Positive/negative)	
	Degree of confidence	
Significances	Significance **without** Mitigation	
	Significance ***WITH*** Mitigation	
Indication of the certainty of a mitigation measure considered, achieving the end result to the extent indicated, is given on a scale of 1-5 (1 being totally uncertain and 5 being absolutely certain), taking into consideration uncertainties, assumptions and gaps in knowledge		
Legal Requirements (Identify and list the specific legislation and permit requirements which are relevant to this development):		

10. CONCLUSION AND RECOMMENDATIONS

A scoping exercise is being undertaken to present the proposed activities to the I&APs and to identify environmental issues discussed in this report and concerns raised as a result of the proposed development alternatives to date. The issues and concerns were raised by I&APs, authorities, the project team as well as specialist input, based on baseline studies undertaken.

This Draft Scoping Report, being undertaken in terms of NEMA, summarises the process undertaken, the alternatives presented, and the issues and concerns raised.

As a result of the above, the need for the following specialist studies, have been identified:

- Biodiversity Assessment
- Freshwater Assessment
- Heritage Impact Assessment

Any further issues raised as a result of the Public Participation Process will be dealt with during the EIA phase.

The significance of the impacts associated with the alternatives proposed will be assessed in these specialist studies, as part of the EIA. Once the specialist studies have been completed, they will be summarised in an Environmental Impact Report (EIR), which integrates the findings of the assessment phase of the EIA.

Based on the significance of the issues raised during the ongoing Public Participation Process and Scoping Phase, it is evident that an Environmental Impact Assessment (EIA) is required. ***It is therefore recommended that authorisation for the commencement of an EIA for the proposed development is granted.*** Should the EIA process be authorised, the significant issues raised in the process to date will be addressed and the specialist studies noted in this report, will be undertaken.

11. DETAILS AND EXPERTISE OF THE EAP

This Draft Scoping Report was prepared by Clinton Geyser who has a MSc. Degree in Environmental Management. He has been working as an Environmental Assessment Practitioner since 2009 and is currently employed at EnviroAfrica CC.

Report compiled by Clinton Geyser -
Qualifications:

- BSc. Earth Sciences, Majors in Geology and Geography and Environmental Management (1998 – 2000) and;
- BSc. (hons): Geography and Environmental Management (2001) and;
- MSc. Geography and Environmental Management (2002), all from the University of Johannesburg.

Expertise:
Clinton Geyser has over ten years' experience in the environmental management field as an Environmental Assessment Practitioner and as an Environmental Control Officer, having worked on a variety of projects in the Western, Eastern and Northern Cape. Previous completed applications include, but not limited to:

- Civil engineering infrastructure including pipelines, Wastewater Treatment Works, and roads in the Western and Northern Cape.
- Agricultural developments, including reservoirs and dams, in the Western and Northern Cape.
- Telecommunications masts in the Western and Eastern Cape
- Housing Developments in the Western and Northern Cape.
- Resort developments in the Western and Northern Cape.
- Cemeteries in the Western Cape
- Waste Management Licences in the Western Cape

Employment:
Previous employment as an EAP: Doug Jeffery Environmental Consultants (2009 – 2012)
Current employment: EnviroAfrica cc (2012 – present).

The whole process and report was supervised by Bernard de Witt who has more than 20 years' experience in environmental management and environmental impact assessments.

(----------END----------)

ANNEXURE K: DRPW NO-OBJECTION

MACROPLAN TOWN & REGIONAL PLANNERS

• 4A MURRAY AVENUE • P.O.BOX 987 • UPINGTON • 8800 • [T] 054 332 3642 • [F] 054 332 4283 • WWW.MACROPLAN.INFO • GOBETLA BEPLANNINGSDIENSTE CC •
• CC REG. NO. 2006/017796/23 • VAT NO. 4070226610 • CENTRAL SUPPLIER DATABASE SUPPLIER NUMBER: MAAA0235531 •

Reference: (ENQ.PC.DRPW) 201008 Opwag/Uitkoms Township Establishment Project

Date: 08 October 2020

Head of the Department of Roads and Public Works
PO Box 3132
Squarehill Park
Kimberley
8300

Attention: Menelisi Sithole

PROJECT: OPWAG TOWNSHIP ESTABLISHMENT PROJECT

INVOLVED PROPERTIES SUMMARY:

- **PLOT 2642, BOEGOEBERG SETTLEMENT, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE**
- **PORTION 14 OF THE FARM BOEGOEBERG SETTLEMENT, NO. 48, KENHARDT RD, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE**

The above mentioned matter, as well as the attached documentation, refer.

Our office, Macroplan Town and Regional Planners, has been appointed by Barzani Development on behalf of the Department of Cooperative Governance, Human Settlements and Traditional Affairs (hence referred to as COGHSTA), to facilitate the needed town planning procedures involved with the **township establishment of Opwag/ Uitkoms**. Opwag/Uitkoms is not a proclaimed township at present, since none of the estimated 150 properties, which form this informal town, are registered at the office of the Chief Surveyor General or the Deeds Office. The informal town of Opwag/ Uitkoms has been created by the farmworkers that work on the surrounding farmland. The informal town of Uitkoms has now grown to a point where formalisation is needed as well as the provision of supporting land uses, such as schools, businesses, municipal infrastructure, recreational areas etc. The !Kheis Local Municipality has secured the properties on which the community of Opwag/ Uitkoms are established with the goal of registering this town as a formal proclaimed township. The recent commitment by COGHSTA to address the **housing backlog** within the Northern Cape, presented the !Kheis Local Municipality with the ideal opportunity to undergo the necessary town planning processes to register Uitkoms as a proclaimed township, with registered properties that can be allocated to individual ownership.

In terms of the Spatial Planning and Land Use Management Act, No. 16 of 2013, approval / input from any state or semi-state department is required for any development that can directly or indirectly impact on the general functioning of said departments (in this instance the Department of Roads and Public Works, from here on referred to as DRPW). The development site, which comprises of portions of two registered land units, border to a provincial road (name unknown), as such approval in terms of the Advertising on Roads and Ribbon Development Act, 21 of 1940, is required for this proposed township establishment project. In the case of the land portions involved, the objective is to have the properties subdivided and rezoned, in terms of the Spatial Planning and Land Use Management Act, No. 16 of 2013, as part of the township proclamation of Uikoms/ Opwag. It should furthermore be noted that the community of Opwag/ Uitkoms currently receives access from the involved provincial road and this submission seeks the formalisation/ approval thereof.

UITKOM/ OPWAG TOWNSHIP ESTABLISHMENT PROJECT DESCRIPTION:

The undertaking of the township establishment project, consisting of 730 residential erven & supporting land uses, for the Opwag/ Uitkoms community by Macroplan derives from an indirect appointment by COGHSTA and is therefore a project of national and provincial importance. The development site comprises the entire extent of Plot 2642, Boegoeberg Settlement and a section of Portion 18 of the Farm Boegoeberg Settlement, No. 48, with both of these properties being held under the ownership of the !Kheis Municipality. The proposed township establishment project will provide sub-economic housing with the end goal of securing ownership of land for the current residents. An estimate of 150 informal stands currently exists in the informal town of Uitkoms/ Opwag, with a further 580 erven planned for future population growth of the involved settlement. Since the objective is to create a new sustainable town other land uses normally associated with urban centres such as business premises, schools, recreational areas, municipal infrastructure, municipal uses and similar uses are also being planned. The Uitkoms/ Opwag township establishment project entails the design of a formal coherent town planning layout through a SPLUMA process, which is informed by numerous specialist studies. At this stage the project has progressed to a point where a concept layout (Annexure D) has been prepared that may be subject to minor alterations to comply with the findings of the specialist studies, but the general layout and functioning thereof should be maintained. One of the main instructions from COGHSTA and the local municipality, was to accommodate the existing informal houses as best possible, but fortunately the area identified for the proclamation of Uitkom/ Opwag is situated more than 250m from the involved provincial road. It should, however, be noted that the involved community receives access from the provincial road via two existing access points and this application includes the formalisation of these accesses.

The latest concept layout has been designed to formalise the informal town of Uitkom/ Opwag, make provision for residential expansion, and incorporate land uses such as business, institutional (churches) and recreational uses, whilst providing a coherent internal road network that promotes easy and accessible movement throughout.

INFORMATION CONCERNING DRPW:

The township establishment project for Uitkoms/ Opwag pertains to one provincial road (road unknown), with this road clearly indicated in red on the planning diagram that is attached as Annexure E to this submission. The provincial road that borders the study area runs parallel to the eastern and northern boundary of the development site, albeit the nearest distance between the development site and the provincial road is ±250m. The input and approval from DRPW is a requirement before the approval for the process can be sought from the ZF Mgcawu Planning Tribunal on the proposed SPLUMA land use change application. The following aspects may be highlighted and feedback from DRPW in this regard is of utmost importance:

- SPLUMA Process: The township establishment project for Uitkoms/ Opwag is a legal process guided by the Spatial Planning and Land Use Management Act (Act 16 of 2013) and this legislation clearly states that all state and semi-state departments need to be informed of any developments that may directly or indirectly impact on the general functioning of said departments. The properties that comprise the study area will impact on one provincial road, as such, DRPW needs to be informed of the planned township establishment project and an approval/ no-objection, in terms of the Advertising on Roads and Ribbon Development Act, 21 of 1940, is needed before the land use change application can be submitted to the local authority.
- Distance from Provincial Roads: As per SPLUMA requirements, input from DRPW should be obtained if a provincial road is being impacted on or bordering to a proposed development. In the case of the Uitkoms / Opwag Township establishment project, a provincial road (indicated in red on the planning diagram – Annexure E) runs parallel to the eastern and northern boundary of the development site, but the nearest point between the development site and the provincial road is ±250m. Therefore, the development site is not within a distance of 95 meters from the centreline of any building restrictions or within 5 meters from the statutory boundary of any public road. No problems are expected in this regard.

- **Proposed access points:** The informal community of Uitkom/ Opwag currently receives access from the provincial road via two separate access points (marked with red circles on the planning diagram – Annexure E). These are the only two access points that provide access to the community of Uitkoms/ Opwag, as such this submission also seeks the formalisation (if not already approved accesses) of these access points.

  The requested approval must provide a no-objection towards the processes of subdivision and rezoning, as well as any other land use changes that the planned township establishment may require. This inclusion of a no-objection towards the processes of subdivision and rezoning is needed in order to proceed with the submission of the formal land use change application at the local municipality.

The objectives of this letter are as follow:

1. To notify DRPW of the proposed township establishment project;
2. To obtain a no-objection for the land use changes (subdivision and rezoning), in terms of the Spatial Planning Land Use Management Act (Act 16 of 2013), that need to be followed for the planned township establishment;
3. To obtain approval in terms of the Advertising on Roads and Ribbon Development Act, 21 of 1940;
4. To obtain approval for the existing access points.

In order to supplement this letter, please find the following documents attached:

A. Wayleave application
B. Copy of Title Deed
C. Locality Map
D. Preferred Township Establishment Layout
E. Planning Diagram indicating proposed development in relation to provincial roads

Kindly take note that this submission is lodged in accordance to the provision of the !Kheis Final SPLUMA By-Laws and according to §32.(1) of this policy, if an organ of state fails to comment or provide information within 60 days from the date of which this notification letter has been furnished, that organ of state is deemed to have no comment or information to furnish.

Please let us know if this letter for an approval meets your requirements and if any additional information needs to be provided. We trust that you will find these matters to be in order and if there are any additional components we can assist you with, please do not hesitate to request such information

We look forward to your inputs in this regard. Please feel free to contact our office in the case of any further enquiries.

Yours Sincerely,

Justus Petrus Theron Pr.Pln. A/2394/2016

M +27 82 821 1024
T +27 54 332 3642
E jptheron@mweb.co.za

The DR&PW

DEPARTMENT : ROADS & PUBLIC WORKS

NORTHERN CAPE PROVINCE

REPUBLIC OF SOUTH AFRICA

APPLICATION DATE		
DAY	MONTH	YEAR
10	10	2020

WAYLEAVE / ENCROACHMENT APPLICATION

Any work undertaken within the statutory width or within a distance of 95 meters from the centreline of any building restriction road (Advertising on Roads and Ribbon Development Act, No. 21 of 1940) or within the statutory width or within 95 meters from the statutory boundary of any public road (Road Ordinance, 19 of 1976).

SERVICE OWNER / APPLICANT DETAILS

Service Owner:	**Barzani Development**	Applicant:	**Macroplan**
Physical Address:	**9 Cambridge Office Park**	Address:	**P.O. Box 987**
5 Bauhinia Street, Highveld, Techno Park Centurion		**Upington**	
	Postal Code **169**		Postal Code **8800**
Contact Person:	**Marike Joubert**	Contact Person:	**JP Theron**
Telephone:	**o12 881 0210**	Telephone:	**543 323 642**
Cellphone:	**N/A**	Cellphone:	**828 211 024**
Email:	Marike@Barzanigroup.co.za	Email:	jptheron@mweb.co.za

PURPOSE OF APPLICATION/SUBJECT

The objectives of this wayleave application are as follow:

1. To notify DRPW of the proposed township establishment project;

2. To obtain a no-objection for the land use changes (subdivision and rezoning), in terms of the Spatial Planning Land Use Management Act (Act 16 of 2013), that need to be followed for the planned township establishment;

3. To obtain approval in terms of the Advertising on Roads and Ribbon Development Act, 21 of 1940;

4. To obtain approval for the existing access points.

SERVICE DETAILS

Fully describe, type of service, and work to be undertaken in the road reserve or building restriction area indicating clearly the location and position related to the km marker boards and road reserve boundary

DESCRIPTION

TYPE OF SERVICE

			Mark With X
Access	X	Power Line	
Pipeline (Water, sewer, etc)		Communication Line	
Undertaking of works outside of the abovementioned within the stautory road reserve or within 95m of the centreline of a Provincial road			

Other:	X	If Other, Specify: Land Use Changes	

Land use change application, in terms of the Spatial Planning and Land Use Management Act (Act 16 of 2013), which includes Subdivision & rezoning.

GPS CO-ORDINATES:

LATITUDE	28 ° 50 ' 13.56 " S	LONGITUDE:	21 ° 57 ' 23.49 " E

*If Encroachment is parrallel to a Provincial Road, Provide Start and End Co-ordinates

Start Co-ordinates		**End Co-ordinates**	
LATITUDE	' " S	LATITUDE:	° ' " E
LONGITUDE:	' " S	LONGITUDE:	° ' " E

***Note:** your application will not be proccessed if the GPS Co-ordinates have not been provided

REQUIRED DRAWINGS

Drawings to be produced by an ECSA Register Engineer			**Mark with X**
Detailed Designs		Cross Section	
Locality Plan	X	Other	

If Other, Specify: Location, planning diagrams & Preferred Layout

***Note:** Referencing of drawings must be in relation to the Centreline of the road

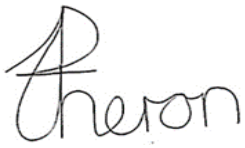
****Note:** Your application will not be proccessed if required drawings have not been provided

DECLARATION FOR AND ON BEHALF OF SERVICE OWNER:

I ACCEPT ALL CONDITIONS IMPOSED IN TERMS OF ANY AGREEMENT BETWEEN THE DEPARTMENT OF ROADS AND PUBLIC WORKS AND OUR FIRM AS THE SERVICE OWNER AND ALL CONDITIONS IMPOSED ON THIS APPLICATION. I AM AUTHORISED TO SIGN ON BEHALF OF THE SERVICE OWNER

JP Theron

NAME (PRINT)



SIGNATURE

08/10/2020

DATE

COMPLETED FORM TO BE RETURNED TO

DIRECTOR ROADS: Mr. J. Roelofse

Enquires: C. Ndubula / V. Ngcobo

Postal Address

P.O. BOX 3132
KIMBERLEY
8300

Street Address

9-11 Stokroos Street
Squarehill Park
KIMBERLEY
8301

TEL: 053 861 9600/62

FAX: 053 861 9626

EMAIL: ncrwayleaves@gmail.com

PROD DEEDS REGISTRATION SYSTEM - KIMBERLEY DATE : 20200721 TIME : 10:49:30.7 PAGE : 1
PREPARED BY : DRS05047 - BOSTRNDER JOSSLINE EDMIL

PROPERTY DETAILS PRINT FOR PORTION 0 (R/E)
ERF NO 2642
TOWNSHIP BOEGOEBERG SETT
REG DIV NOT AVAILABLE

PROVINCE NORTHERN CAPE
PREV DESCRIPTION
DIAGRAM DEED NO T37471/2015
EXTENT 15539
CLEARANCE EMTHANJENI MUNISIPALITEIT

FIRM NR : 999
FIRM NAME : AKTEKANTOOR KIMBERLEY
FILE NR : PREP
FEE AMOUNT: R .00

SUBDIVISION TO TOWN BOEGOEBERG SETT , ERF 2952 , PRTN 0

NO INTERDICTS

DOCUMENTS	HOLDER & SHARE	AMOUNT	O/P/A	SCAN/MICRO REF	MMDD
K624/2015SCTN					0707
K919/1992SCTN					
VA4119/2015CTN	T79244/2007CTN				0528
CONVERTED FROM CTN					
FROM-2628,2639,2635,	2636				

OWNER DETAILS

FULL NAME & SHARE	PURCH DATE	AMOUNT/REASON	O/P/A	IDENTITY	DATE OF BIRTH	TITLE DEED	MMDD	SCAN/MICRO REF
MUN KHEIS						T79244/2007CTN	1003	
	20070830	R12370204.00						

* O/P/A - O - MULTIPLE OWNER P - MULTIPLE PROPERTY A - MULTIPLE OWNER AND PROPERTY

** PLEASE NOTE : THE INFORMATION APPEARING ON THIS PRINTOUT IS FURNISHED FOR PURPOSES OF INFORMATION ONLY.
FOR MORE DETAILED INFORMATION, PLEASE REFER TO THE REGISTERED SOURCE DOCUMENTS.

* * * END OF REPORT * * *

FEE

R 1000,00

Prepared by me,

Conveyancer,
JJ GEYSER

Gesertifiseer 'n ware afskrif in terme van die bepalings van Regulasie 66 kragtens die Registrasies van Aktes Wet, No 47 of 1937
Certified a true copy in terms of the provisions of Regulation 66 under the Deeds Registries Act, no 47 of 1937

FOR INFORMATION ONLY
SLEGS VIR INLIGTING

Registrasiekantoor
Deeds Registry

2020 -07- 22

REGISTRATEUR VAN AKTES
REGISTRAR OF DEEDS

Datum/Date.....

T 000079244 / 2007

DEED OF TRANSFER

BE IT HEREBY MADE KNOWN

THAT **BEVERLY ELIZABETH-ANN RICHARDSON**

appeared before me, REGISTRAR OF DEEDS at CAPE TOWN the said Appearer being duly authorised thereto by a Power of Attorney signed at BRAKPAN on 30 AUGUST 2007 and granted by

ELJAVELO (PROPRIETARY) LIMITED
Registration No. 1982/011785/07

DATA / CAPTURE
02 NOV 2007
VAN WYK Z

DATA / VERIFY
13 NOV 2007
LARNEY E

GEYSER ATTORNEYS
ATTORNEYS
BRAKPAN, 1540

LEGALPERFECT Version 10.0.9
TRFDOT ALL.DOC 02-02-2007

2.0005751 (28)

AND the Appearer declared that the said Principal had truly and legally sold the undermentioned property on 30 August 2007 and that, the said Appearer in his/her capacity aforesaid, did by these presents, cede and transfer, to and on behalf of

I KHEIS MUNICIPALITY

its successors in title or assigns in full and free property

LOT 2642 BOEGOEBERGNEDERSETTING ADMINISTRATION DISTRICT KENHARDT, THE PROVINCE OF THE NORTHERN CAPE

In Extent 11129,2886 (ELEVEN THOUSAND ONE HUNDRED AND TWENTY NINE COMMA TWO EIGHT EIGHT SIX) hectares

First registered by Certificate of Consolidated Title T55555/1992, with diagram No.6871/1990 relating thereto and held by Deed of Transfer T33664/2001

I. INSOFAR as concerns the figure A.B.C.D.E.F.G.H.J.K.L.M.2A.2B.W.X.Y.Z. 1A.2C.2D.2E.2F.1G.1H.1J.1K.1L.1M.1N.2G.2H.IR.IS.IT.1U.1V on aforementioned Diagram No. 6871/90:

SUBJECT to the following servitude conditions contained in Notarial Deed of Servitude No. K919/92S and referred to the endorsement dated 3rd September 1992 on Certificate of Registered Title No. T55555/1992 which reads the follows:

"Die eiendom vermeld in Paragraaf 1 hierin is onderhewig aan die volgende serwitute ten gunste van die Publiek:

(a) 'n Padserwituut 10 meter wyd waarvan die oostelike grens aangetoon word deur die lyn J.z.;

(b) 'n Padserwituut 15 meter wyd waarvan die oostelike grens voorgestel word deur die lyn P.Q.;

(c) 'n Padserwituut soos aangetoon deur die figuur C.l.b.lc.ld.le.lC.lD.lf.lg.lh.lj.lk.lm.ln.lp.lq.lr.ls.lt.lu.lv.B.;

(d) 'n Padserwituut soos aangetoon deur die figuur lx.ly.lz.2a.2b.2c.2d.2e.2f.2g.2h.2j.2k.2m.2n.2p.2r.2s.2t.2u.2v.2w.2x.2y .2z.3a.3b.3c.3d.3e.3f.3g.3h.3j.3k.3m.3n.3p.3q.3r.3s.3t.3u.3v.3w.3x.3y. 3z.4a.4b.4c.4d.4e.4f.4g.4h.4j.4k.4m.4n.4p.4q.4r.4s.4t.4u.4v.4w.4x.4y. 4x.5a.5b.5c.5d.5e.5f.5g.5h 5j.5k.5m.5n.5p.5q.5r.5s.5t.5u.5v.5w.5x.5y. 5z.6a.6b.;

(e) 'n Padserwituur soos aangetoon deur die figuur 6c.1M.6d.;

(f) 'n Begraafplaasserwituut soos aangetoon deur die figuur 6v.6w.6x.6y.'

welke bovermelde serwitute verskyn op Kaart Nr 6868/90 hierby aangeheg."

and which servitudes are also respectively referred to by servitude notes Nos. 4,7,8,12,13 and 18 on aforesaid Diagram No 6871/90.

II. INSOFAR as concerns the figures 2A.N.P.Q.R.S.T.U.V.2B. on aforesaid Diagram No. 6871/90:

A. SUBJECT to the conditions referred to in Certificate of Consolidated Title No. T7083/1938.

B. ENTITLED to a road servitude referred to in the endorsement dated 3 April 1992 on Certificate of Registered Title No. T8210/1942 which reads as follows:

RESTANT
Kragtens Transportakte Nr, T20097/92 gedateer
Is binnegemelde restant eiendom geregtig op 'n padserwituut 5 meter wyd waarvan die suid-oostelike grens voorgestel word deur die lyn 2P.3X. op kaart Nr. 6981/90 daarby aangeheg oor Perseel 2627 Groot 8146,0781 Ha. daarkragtens oorgedra.

C. SUBJECT FURTHER to the following servitude contained in Notarial Deed of Servitude No. K919/92S and referred to in the endorsement dated 3rd September 1992 on Certificate of Registered Title No. T55555/92 which reads as follows:

"Die eiendom vermeld in Paragraaf 2 hierin is onderhewig aan die volgende serwitute ten gunste van die Publiek:

(a) 'n Padserwituut 15 meter wyd waarvan die westelike grens aangetoon word deur die lyn D.a.;

(b) 'n Padserwituut 15 meter wyd waarvan die oostelike grens aangetoon word deur die lyn J.K.;

(c) 'n Begraafplaasserwituut soos aangetoon deur die figuur a.f.g.h.j.;

welke bovermelde serwitute verskyn op kaart Nr 6883/90 hierby aangeheg."

and which servitudes are also respectively referred to as servitude notes Nos. 5,6 and 17 on aforesaid Diagram No. 6871/90.

III. INSOFAR as concerns the figure 2C.IB.IC.ID.IE.IF.2F.2E.2D en 2G.IP.IQ.2H.on aforementioned Diagram No. 6871/90:

A. SUBJECT to such conditions as are referred to in Certificate of Consolidated Title No. T7083/1938.

B. ENTITLED to a road servitude referred to in the endorsement dated 3 April 1992 on Certificate of Registered Title No. T8210/1942 which reads as follows:

RESTANT
Kragtens Transportakte Nr. T20097/92 gedateer
Is binnegemelde restant eiendom geregtig op 'n padserwituut 5 meter wyd waarvan die suid-oostelike grens voorgestel word deur die lyn 2P 3X. op kaart Nr. 6981/90 daarby aangeheg oor Perseel 2627 Groot 8146,0781 Ha Daarkragtens oorgedra

IV. INSOFAR as the whole property is concerned:

SUBJECT to the following conditions contained in Deed of Grant No. T55556/1992:-

1. ONDERHEWIG aan die voorbehoud ten gunste van die Staat van alle regte op edelgesteentes, edelmetale, onedele minerale en aardolie, soos in die Wet op Mynregte, 1967 (Wet 20 van 1967) omskryf.

2. ONDERHEWIG VERDER aan die serwituutreg ten gunste van die Staat of sy gevolmagtigde om sonder betalings van vergoeding enige materiaal soos sand, klip en gruis vanaf die gebiede voorgestel deur die figure 2A.N.P.Q.7a.r., M.2A.r.s.t.u.v.w., x.y.z.1a., 4r.4q.6p.6q., 6r.6s.3s.3r. en 4h.4g.6t.6u. op voormelde kaart Nr. 6871/90 te verwyder of te laat verwyder.

AND SUBJECT FURTHER to such conditions as are mentioned or referred to in the aforesaid Deeds.

WHEREFORE the Appearer, renouncing all the right and title which the said:

ELJAVELO (PROPRIETARY) LIMITED

heretofore had to the premises, did in consequence also acknowledge it to be entirely dispossessed of and disentitled to the same, and that by virtue of these presents, the said:

I KHEIS MUNICIPALITY

its successors in title or assigns, now is and henceforth shall be entitled thereto, conformably to local custom, the State, however, reserving its rights, and finally acknowledging the purchase price to be the sum of **R12,370,204.28 (TWELVE MILLION THREE HUNDRED AND SEVENTY THOUSAND TWO HUNDRED AND FOUR RAND TWENTY EIGHT CENTS)**

IN WITNESS WHEREOF I, the said Registrar, together with the Appearer, q.q. have subscribed to these presents and have caused the Seal of Office to be affixed thereto.

THUS DONE AND EXECUTED at the office of the **REGISTRAR OF DEEDS** at **CAPE TOWN**

on 3rd OCTOBER 2007

q.q.

In my presence,

REGISTRAR OF DEEDS

Property | Owner | Deed/Document | LPI Enquiry | Interdict | Document Request | Transfers | Bulk Properties | User Admin | Billing

Property Enquiry Details

Property enquiry results for "Kenhardt RD, 48, 14" in the Deeds Registry at "KIMBERLEY"

Property detail:

Deeds registry	KIMBERLEY
Property type	FARM
Farm name	BOEGOEBERG NEDERSETTING
Farm number	48
Portion	14
Province	NORTHERN CAPE
Registration division/Administrative district	KENHARDT RD
Local authority	DAWID KRUIPER MUNISIPALITEIT
Previous description	-
Diagram deed number	T16785/1977
Extent	82.9405 H
LPI Code	C03600000000004800014

Title Deeds detail:

Document	Registration date	Purchase date	Amount	Microfilm reference	Document copy?
T59309/2007CTN	20070726	20070601	R1.00	-	Not available

Owners detail:

Document	Full name	Identity Number	Share	Person Enquiry?
T59309/2007CTN	MUN KHEIS	-	-	Yes

Endorsements / Encumbrances:

Endorsement / Encumbrance	Holder	Amount	Microfilm reference	Document copy?
CONVERTED FROM CTN	-	-	-	Not available
FARM KE 48/14	-	-	-	Not available

History:

Document	Holder	Amount	Microfilm reference	Document copy?
T16785/1977CTN	REG SERVICES COUNCIL-BENEDE ORA	-	-	Not available

T11369/1994CTN	ADMIN-KAAP DIE GOEIE HOOP NIL	NIL	-	Not available
T11369/1994CTN	PROVINSIE VAN DIE NOORD-KAAP	END	-	Not available
T10756/2002CTN	PROVINSIE VAN DIE NOORD-KAAP	CRT	-	Not available
T2201/2003CTN	MUN SIYANDA	R10.00	-	Not available

Back to top of page

Requested by **40901** with user reference **JP** on: Wednesday, 29 January 2020 14:49

56 WALKERS INC.
Telephone (021) 464-1400

Opgestel deur my,
TRANSPORTBESORGER
DE VILLIERS P J de B

FEE
R 55.00

DATA / CAPTURE
23 AUG 2007
WILLIS J

MALAN & VENNOTE
Schroderstraat 25
Upington
8800
Docex 9, Upington

T0059309 / 2007

AKTE VAN TRANSPORT

HIERMEE WORD BEKEND GEMAAK

DAT **CHARL ANDRÉ THERON**

voor my die REGISTRATEUR VAN AKTES verskyn het te KAAPSTAD, die genoemde Komparant synde behoorlik daartoe gemagtig deur 'n Volmag aan hom/haar verleen deur

SIYANDA DISTRIK MUNISIPALITEIT

Gedateer 14 Junie 2007
en geteken te UPINGTON

DATA / VERIFY
29 AUG 2007
LARNEY E
LegalSuite / MALAN & VENNOTE

(DeedOfTransferConventional_A.rtf) Vorm E

EN genoemde Komparant het verklaar dat **SIYANDA DISTRIK MUNISIPALITEIT** die ondergemelde eiendom op **1 Junie 2007** waarlik en wettiglik per **Privaat Ooreenkoms** verkoop het en dat hy/sy in sy/haar voornoemde hoedanigheid hierby sedeer en transporteer aan en ten gunste van:

IKHEIS MUNISIPALITEIT

die ampsopvolgers in titel of regsverkrygendes in volkome en vrye eiendom:

GEDEELTE	**14 VAN DIE PLAAS BOEGOEBERG NEDERSETTING NR 48**
GELEE	**IN DIE MUNISIPALITEIT IKHEIS, AFDELING KENHARDT, PROVINSIE NOORD-KAAP**
GROOT	**82,9405 (TWEE EN TAGTIG KOMMA NEGE VIER NUL VYF) HEKTAAR**

EERSTE OORGEDRA kragtens Grondbrief Nr T16785/1977 met Kaart LG Nr 6668/1975 wat daarop betrekking het

EN GEHOU kragtens Akte van Transport T2201/2003

WESHALWE die Komparant afstand doen van al die regte en titel wat die gesegde **SIYANDA DISTRIK MUNISIPALITEIT** voorheen op genoemde eiendom gehad het en gevolglik ook erken dat hy geheel en al van die besit daarvan onthef en nie meer daartoe geregtig is nie, en dat, kragtens hierdie akte, bogenoemde

!KHEIS MUNISIPALITEIT,

die ampsopvolgers in titel of regsverkrygendes tans en voortaan daartoe geregtig is, ooreenkomstig plaaslike gebruik, behoudens die regte van die Staat en erken hy ten slotte dat die koopprys van die eiendom wat hiermee getransporteer word die bedrag van **R1.00 (EEN RAND)** is.

TEN BEWYSE WAARVAN EK, die genoemde Registrateur van Aktes, tesame met die Komparant hierdie Akte onderteken en dit met die Ampseël bekragtig het.

ALDUS GEDOEN EN VERLY op die kantoor van die REGISTRATEUR VAN AKTES te **KAAPSTAD** op 26 Julie 2007.

q.q. Handtekening van komparant

In my teenwoordigheid

Registrateur van Aktes

GROOTDRINK

GARIEP

TOPLINE

WEGDRAAI

OPWAG

GROBLERSHOOP

BOEGOEBERG

N10

Date:

Title:

Figure 1:
Locality Map: Region

Property Description:

Plot 2642, Boegoeberg Settlement & Portion 14 of the farm Boegoeberg Settlement, No. 42, !Kheis Municipality, Northern Cape Province.

Legend

- Opwag
- National Roads
- Regional Roads
- Railway Line
- Municipal Boundary

Municipality:

T. 054 833 9500

F. 054 883 9509

E. davyj@kheis.co.za

W. www.kheis.co.za

!Kheis Munisipaliteit Municipality

Consultant:

MACROPLAN

TOWN & REGIONAL PLANNERS

YOUR PARTNERS IN PROFESSIONAL PLANNING SERVICES

054 332 3642

4A Murray Avenue, Upington 8801 macroplan@mweb.co.za

PO Box 987, Upington 8800 www.macroplan.info

Reference: (FIG1) 200806 Opwag Township Establishment

Designed	Date
JP Theron	August 2020
Drawn	Scale
JP Theron	1: 175 000

Date:

Title:

Figure 2: Locality Map: Local

Property Description:

Plot 2642, Boegoeberg Settlement & Portion 14 of the farm Boegoeberg Settlement, No. 42, !Kheis Municipality, Northern Cape Province.

Legend

- Study Area
- National Roads
- Regional Roads
- Urban Edge

Cadastral Information:

- Registered Erven
- Surveyed Erven

Municipality:

T. 054 833 9500

F. 054 883 9509

E. davyj@kheis.co.za

W. www.kheis.co.za

!Kheis Munisipaliteit Municipality

Consultant:

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4A Murray Avenue, Upington 8801 macroplan@mweb.co.za
PO Box 987, Upington 8800 www.macroplan.info

Reference	
(FIG2) 200806 Opwag Township Establishment	
Designed: JP Theron	Date: August 2020
Drawn: JP Theron	Scale: 1: 6000

IKHEIS MUNICIPALITY

CONCEPT TOWNSHIP ESTABLISHMENT

Design:	JP Theron (Pr. Pln. A/2394/2016)
Drawn:	JP Theron (Pr. Pln. A/2394/2016)
Date:	August 2020
Scale:	1:1800 (A0)

Plan nr:

Concept Layout Plan (DWG.TE) 200825 Opwag

Proposed Land Uses in terms of Land Use Management System

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	Schedule of Sizes: total area covered by land use	Schedule of Sizes: percentage of study area covered by use
	Open Space Zone I				
	Open Space Zone II	23			
	Open Space Zone III				
	Agricultural Zone I				
	Agricultural Zone II				
	Resort Zone II				
	Residential Zone I	731			
	Residential Zone II				
	Residential Zone III				
	Residential Zone IV				
	Residential Zone V				
	Residential Zone VI				
	Institutional Zone I	2			
	Institutional Zone II	3			
	Institutional Zone III				
	Authority Zone I	1			
	Authority Zone II				
	Special Zone				

Colour & Numbers	Land Use Description	Total Units	Schedule of Sizes: average size per erf	Schedule of Sizes: total area covered by land use	Schedule of Sizes: percentage of study area covered by use
	Undetermined Zone				
	Business Zone I	10			
	Business Zone II				
	Business Zone III				
	Business Zone IV				
	Business Zone V				
	Business Zone VI				
	Industrial Zone I				
	Industrial Zone II				
	Industrial Zone IV				
	Industrial Zone IV				
	Utility Zone I				
	Utility Zone II				
	Utility Zone III				
	Transport Zone I				
	Transport Zone II				
	Transport Zone III				
Total:		770			

Addisional Information:

- Contours
- Pipeline
- Sewerage Line
- Powerlines
- Buildings
- High Voltage Powerlines

Drawn:

MACROPLAN
TOWN & REGIONAL PLANNERS

JP THERON
PR.PLN A/2394/2016
T: 054 332 3642 • C: 082 821 1024
E: jptheron@mweb.co.za
Head Office:
4A Murray Avenue, Upington 8801
Kimberley Office:
4 Hemming Way, Kimberley 8301

Checked:

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TOWN & REGIONAL PLANNERS

LEN J FOURIE
PR.PLN A/1322/2006
T: 054 332 3642 • C: 082 821 1025
E: macroplan@mweb.co.za
Head Office:
4A Murray Avenue, Upington 8801
Kimberley Office:
4 Hemming Way, Kimberley 8301

Municipality:

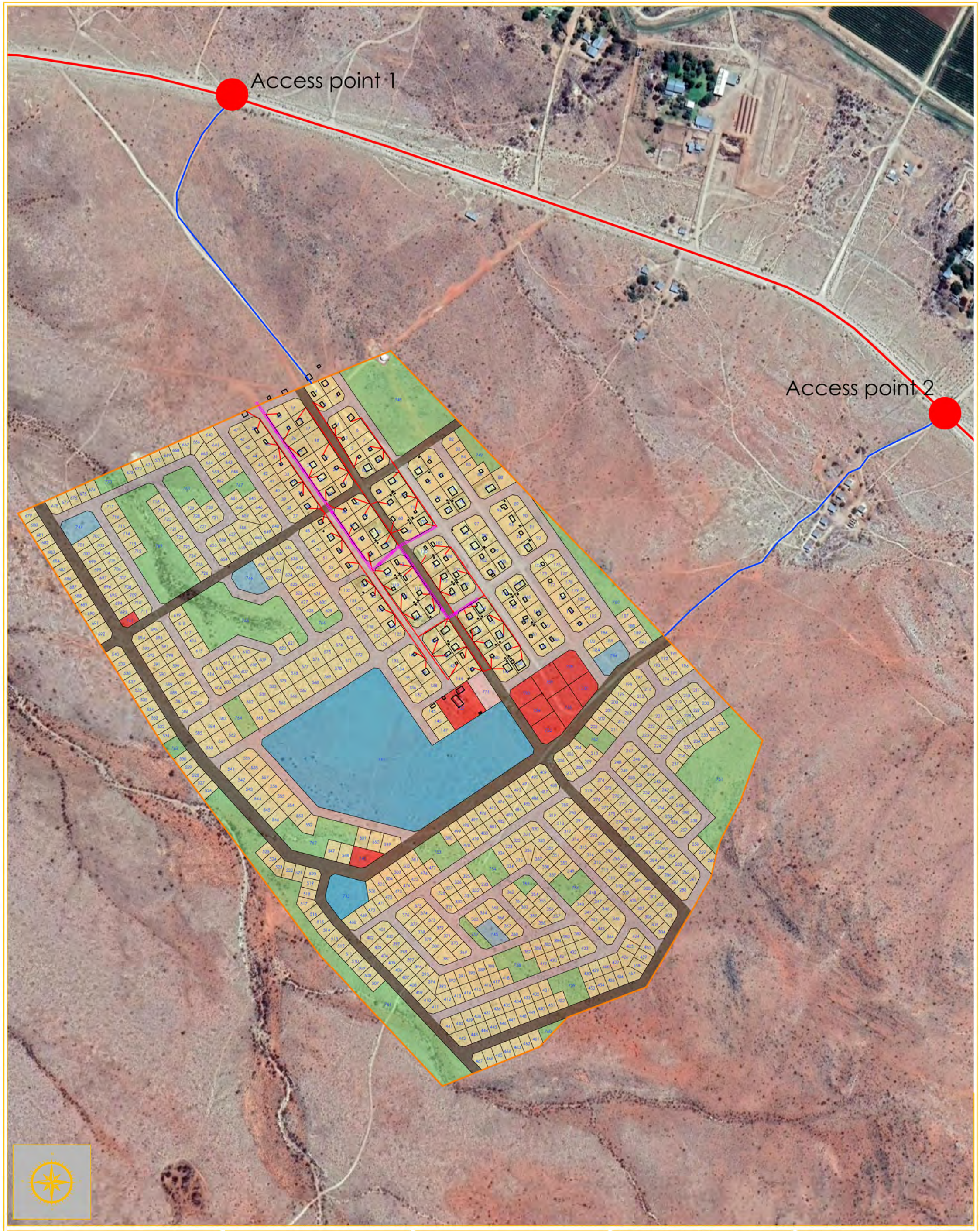
!Kheis
Munisipaliteit
Municipality

Private Bag X2,
Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Client:

COGHSTA
Department:
CO - OPERATIVE GOVERNANCE
HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
NORTHERN CAPE



IKHEIS MUNICIPALITY CONCEPT TOWNSHIP ESTABLISHMENT LAYOUT: INFORMATION CONCERNING DRPW

Design:	JP Theron (Pr. Pln. A/2394/2016)
Drawn:	JP Theron (Pr. Pln. A/2394/2016)
Date:	August 2020
Scale:	1:4500 (A3)

Plan nr:

Concept Layout Plan
(DWG.TE) 200525 Opwag

Legend:

- Study Area
- Provincial Roads
- Access Routes
- Existing Accesses

NOTES:

Drawn:

MACROPLAN
TOWN & REGIONAL PLANNERS

JP THERON
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Checked:

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Head Office
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Kimberley Office
4 Hemming Way, Kimberley 8301

Municipality:

!Kheis
Munisipaliteit
Municipality

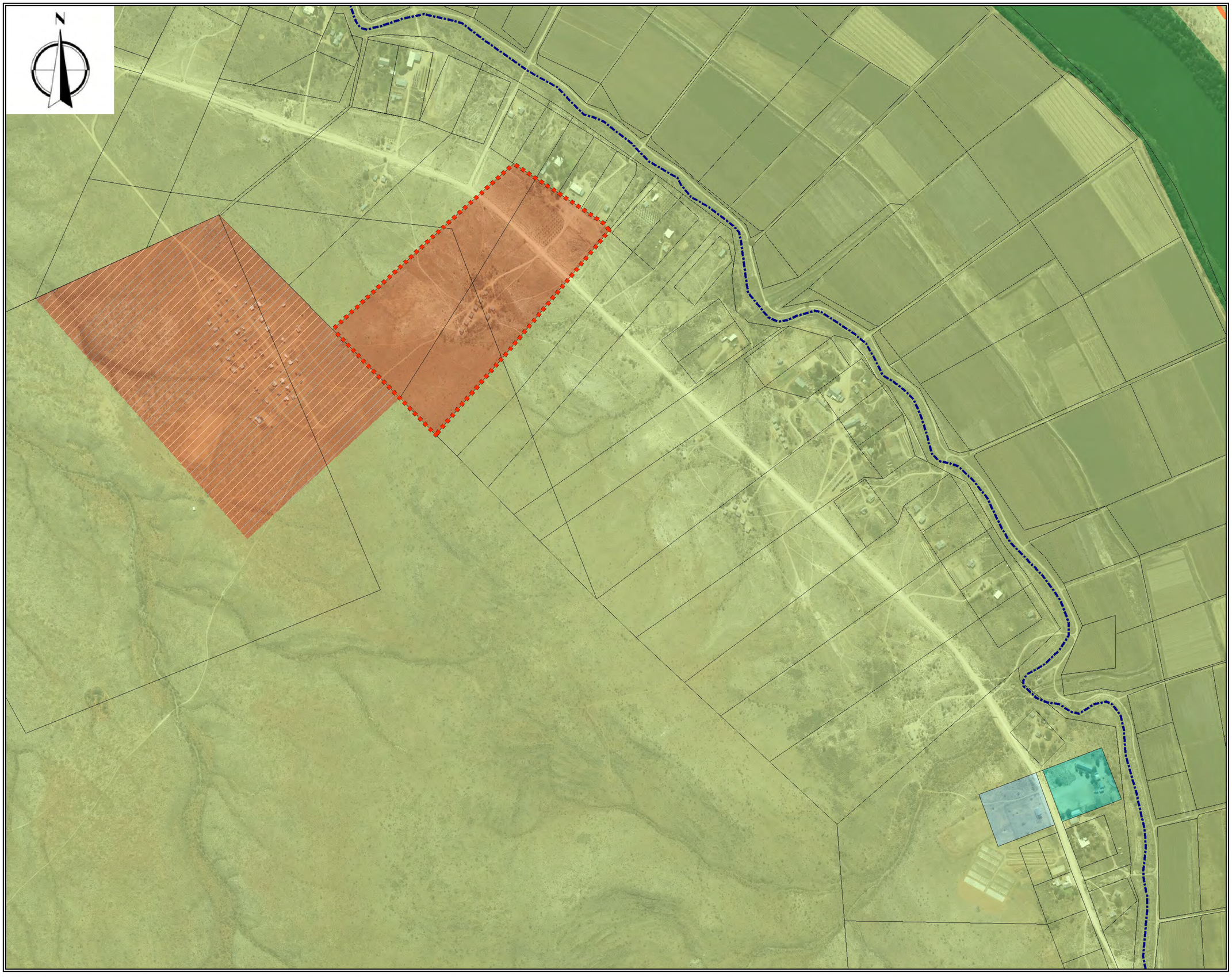
Private Bag X2
Groblershoop
8850

Tel: 054 833 9500
Fax: 054 833 9509

Client:

COGHSTA
Department:
CO - OPERATIVE GOVERNANCE
HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS
NORTHERN CAPE

ANNEXURE L: SDF MAP



Project:

!Kheis Local Municipality Land USe Proposal

Map Title:

Spatial Vision: Opwag

!Kheis
Munisipaliteit
Municipality

Legend:

SDF Spatial Planning Categories

- B.b.2. Rivers or Riverbeds
- B.b.3. Other Natural Areas
- B.c.2. Landscaped Areas
- B.c.2. Public Park
- C.a.1. Agriculture
- C.a.2. Agricultural Industry
- D.f.1. Place of Instruction
- D.f.2. Place of Worship
- D.g. Authority Areas
- D.h. Residential Areas
- D.h.1. Single Residential
- D.h.2. Group Housing
- D.h.3. Flats
- D.h.4. Accommodation Facilities
- D.h.5. Low Cost Housing
- D.h.6. Informal Housing
- D.i. Business Areas
- D.m. Mixed Use Development Areas
- D.n. Cemeteries
- D.o. Sports Fields & Infrastructure
- E.c. Light Industry
- E.d. Heavy Industry
- F.a. National Roads
- F.a. National Roads (Outside of Urban Edge)
- F.c. Minor Roads
- F.c. Minor Roads (Outside of Urban Edge)
- F.d. Public Streets
- F.d. Public Streets (Formalisation Proposed)
- F.g. Power Lines & Associated Infrastructure
- F.h. Telecommunications Infrastructure
- F.i. Renewable Energy Structures
- F.j.1. Minor Dams & Reservoirs
- F.j.2. Major Dams & Reservoirs
- F.l. Sewerage Plants & Refuse Areas
- Proposal

SDF Structuring Elements

- Hospitality Zone
- Canals
- Central Business District
- Corridors
- Nodes
- Potential Surface Water
- Risks_WWTW_1000m
- Risks_WWTW_500m
- Urban Edge

MACROPLAN
TOWN & REGIONAL PLANNERS
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PO Box 987, Upington 8800 www.macroplan.info
054 332 3642

Map No:

Map 07

Date:

November 2016

Drawn by:

Justus Petrus Theron Pr.Pln. A /2394/2016

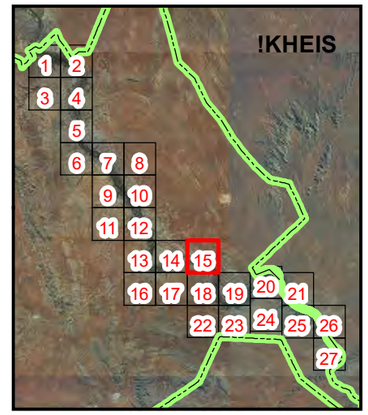
Scale:

0 50 100 150 200 250 m

ANNEXURE M: ZONING MAP

MUNICIPAL CODE: NC084 — !KHEIS LOCAL MUNICIPALITY LAND USE SCHEME — 2019 — ZOOM MAP 15

N



LAND USE ZONES:

- Agricultural Zone I
- Agricultural Zone II
- Authority Zone I
- Authority Zone II
- Business Zone I
- Business Zone II
- Business Zone III
- Business Zone IV
- Business Zone V
- Business Zone VI
- Industrial Zone I
- Industrial Zone II
- Industrial Zone III
- Industrial Zone IV
- Institutional Zone I
- Institutional Zone II
- Institutional Zone III
- Open Space Zone I
- Open Space Zone II
- Open Space Zone III
- Residential Zone I
- Residential Zone II
- Residential Zone III
- Residential Zone IV
- Residential Zone V
- Residential Zone VI
- Resort Zone I
- Special Zone
- Transport Zone I
- Transport Zone II
- Transport Zone III
- Undetermined
- Utility Zone I
- Utility Zone II
- Utility Zone III

KEY:

- Reservoirs
- Substations
- Railway
- Main Roads
- National Roads
- Proposed HV Line
- Eskom HV Lines
- Eskom HV Lines 15m Buffer
- !Kheis
- Settlement Boundary
- 20m Contours
- Rivers
- Rivers 50m Buffer
- Secondary Roads
- Main Dams
- Wetlands
- Game Farm

0 0.25 0.5 1 Km

!Kheis Municipality

MVD Kalahari

ANNEXURE N: SACPLAN REGISTRATION CERTIFICATES

The South African Council for Planners
SACPLAN

REGISTRATION CERTIFICATE

Issued in terms of Section 13(4) of the Planning Profession Act, 2002
(Act 36 of 2002)

This is to Certify that

Justus Petrus Theron

ID number: 9106135096085

is registered as a

Professional Planner

in terms of the Planning Profession Act, 2002 and is authorised to act as such in accordance with the said Act and the Rules prescribed thereunder.

Issued under the Seal of the Council

SACPLAN PROFESSIONAL PLANNER

CHAIRPERSON

REGISTRAR

REGISTRATION NUMBER:
A/2394/2016

Date of Issue: 23-10-2020

The registered person remains in good standing with SACPLAN for the period ending as stipulated herein.

This certificate is valid until: **30-06-2021**

Verification Number: f794dceabbb603d5d727899ffbba78f8

The South African Council for Planners
SACPLAN

REGISTRATION CERTIFICATE

Issued in terms of Section 13(4) of the Planning Profession Act, 2002
(Act 36 of 2002)

This is to Certify that

Len Jacobus Fourie

ID number: 7411095141083

is registered as a

Professional Planner

in terms of the Planning Profession Act, 2002 and is authorised to act as such in accordance with the said Act and the Rules prescribed thereunder.

Issued under the Seal of the Council

SACPLAN PROFESSIONAL PLANNER

CHAIRPERSON

REGISTRAR

REGISTRATION NUMBER:
A/1322/2006

Date of Issue: 22-10-2020

The registered person remains in good standing with SACPLAN for the period ending as stipulated herein.

This certificate is valid until: **30-06-2021**

Verification Number: fc65d50d229c61f2d0af96e3196a8d74