

CIVIL ENGINEERING SERVICES REPORT

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PROVISION OF MUNICIPAL SERVICES TO KHALINKOMO INFORMAL SETTLEMENT



human settlements

Department of
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FREE STATE PROVINCE

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EXECUTIVE SUMMARY

Free State Department of Human Settlement has identified a need to assist Nala Local Municipality with the technical capacity to address some of the key function of local government. This include the establishment of Township in Wesselbron with Khalinkomo being the targeted spatial location. These proposed township is located in close proximity within a rich of Monyakeng Township. Essentially, it not far reach to regard it as an extension of Monyakeng township.

As part of the development of this township establishment and to commence with the process of establishing of such developments, Free State Department of Human Settlements has commissioned Vexocom (Pty) Ltd to commence with a study to determine the feasibility thereof.

This report is part of the series of studies which address the infrastructure needs and capacity within the municipality which have a bearing on the establishment of the proposed townships. The report addresses civil and electrical related infrastructure regarding supply and demand for residential, industrial and business with regards to electrical, water and sanitation (sewer network) as well as future capacity pertaining to the proposed development within NLM. Essentially, it attempts to answer whether the current civil and electrical infrastructure would be adequate to cater for the fully developed of the proposed Khalinkomo residential area.

Table of Contents

1. Introduction.....	6
2. Background	6
3. Site location.....	7
4. Design Criteria.....	8
5. Bulk Services.....	9
5.1 Bulk Water Supply	9
5.1.1 Estimated Water Demand.....	9
5.1.2 Internal Water Supply	10
5.2 Bulk Sanitation.....	10
5.2.1 Sewerage Flow	11
5.2.2 Sewerage Infrastructure	11
5.3 Stormwater Management	12
5.4 Roads and Access.....	12
6. Conclusion.....	15

List of Tables

Table 1: Water Demand Calculation for the Khalinkomo Development.....	9
Table 2: Estimated Sewer Discharge for the Khalinkomo Development.....	11
Table 3: Water Demand Calculation for the Khalinkomo Park Development.....	14

List of Figures

Figure 1: Locality Map of Khalinkomo and Vergenoeg.....	7
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List of acronyms and abbreviations

WWTP	Waste-Water Treatment Plant
WSDP	Water Services Development Plan
AADD	Average Annual Daily Demand

1. Introduction

The proposed area of development consists of approximately 562 erfs in total, which are made up of 359 in Vergenoeg and 562 erfs in Khalinkomo.

The erfs are distributed as follows;

- Khalinkomo (553 residential, 2 businesses, 2 crèches, 2 churches and 3 open public spaces).
- Vergenoeg (350 residential, 2 businesses, 2 community facilities, 3 churches and 2 open public spaces).

The purpose of the civil engineering services assessment is to determine the availability and capacity of existing bulk services with a view to servicing the proposed development. This report presents the findings of a preliminary desktop investigation relating to bulk services, and further sets out the criteria and standards for the internal services.

The engineering services addressed in this report are the following:

- Potable water
- Sanitation
- Roads
- Stormwater management
- Electricity

2. Background

Khalinkomo is an informal settlement in Wesselbron that has sprouted over the years due to the shortage of housing. It is in the peripheral of Wesselbron town, and in Monyakeng Township in particular. Nala Local Municipality has taken the executive decision to formalise this area and provide municipal services to the residents in this area despite failed attempts in the past. In this regard the provincial government through the Department of Human Settlements has made an initiative to assist the municipality to accelerate and finalise process. As such Vexocom (Pty) Ltd was appointed by Department of Human

Settlements to undertake the preliminary assessment of the potential to provide services to this development.

3. Site location

The Nala Local Municipality Offices are situated in Bothaville, in the northern part of the Lejweleputswa District Council of Free State Province. Wesselbron is a small maize farming town 75 kilometres south of Bothaville in Free State province of South Africa. It is 32 km east of Hoopstad and 48 km north-west of Welkom.

The geographical co-ordinates for the proposed township are as follows:

Khalinkomo Latitude: 27° 49' 36.9646" S

Longitude: 26° 23' 06.0882" E

Figure 1 below shows the proposed township.

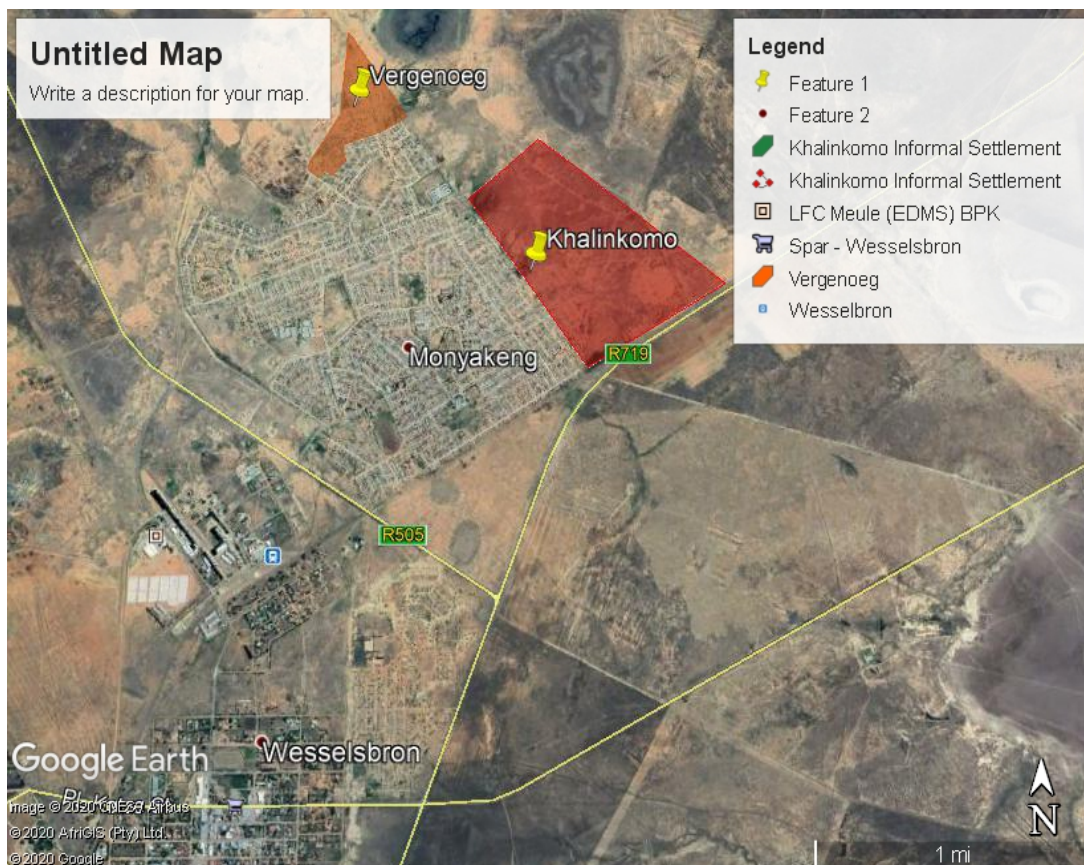


Figure 1: Locality Map of Khalinkomo and Vergenoeg

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

- The area of the site is approximately 22 hectares.
- The site is currently occupied by informal settlements which need to be formalised for the dwellers.
- A geotechnical investigation has revealed that the area is characterised by Karoo supergroup rocks which includes mudstone, siltstone and shale of the volksrust formation belonging to Ecca group of the Karoo Supergroup.
- Topographically, the site is a flatland

4. Design Criteria

The following guidelines and references were used as the basis for the assessment of roads, storm water, water, sewage and solid waste services for the development:

- The "Guidelines for Human Settlement Planning and Design compiled under patronage of the Department of Housing by CSIR Building and Construction Technology" and the Municipality's generally applied standards, or any such standards as may be required by a provincial or national authority where applicable.", both hereinafter referred to as "The Guidelines".
- SANRAL drainage Manual, 6th Edition (October 2013).
- "Guidelines for Human Settlement, Planning and Design" (Red Book), published by the Building and Construction Technology Division of the CSIR; and
- South African Bureau of Standard (SANS1200) – Standardized Specialization for Civil Engineering Construction.
- Technical Recommendations for Highways (TRH4) – Structural Design of Flexible Pavements for Interurban and Rural Roads

5. Bulk Services

The availability of bulk services is governed by various factors. The main factors relate to future demand and actual implementation dates of approved land-uses. The sourcing of sufficient funding to finance bulk infrastructure for low cost housing projects poses an ongoing challenge. The implication is that even though Council may have approved a particular land use application, a Services Agreement must be concluded between the Nala Local Municipality and the Developer that sets out the services requirements in detail, responsibilities for the provision of the various services, the implementation and funding thereof. Please note that information on bulk and link services may change during a long application and approval process.

However, no development may connect to the municipal system unless the necessary bulk and link services are in place.

5.1 Bulk Water Supply

5.1.1 Estimated Water Demand

The estimated Annual Average Daily Demand (AADD) for the proposed development is based on the design criteria from the Red Book Vol 2, as follows in Table 1:

Table 1: Water Demand Calculation for the Khalinkomo Development

Estimated Demand for Khalinkomo						
Type of Development	Unit	Demand (l/day)	Total demand (l/day)	Total demand (kl/day)	Total demand (l/day)	
Residential	1476	600	885600	885,60	0,886	
Business	19	400	7600	7,60	0,008	
Creche	1	1000	1000	1,00	0,001	
Church	2	2000	4000	4,00	0,004	
OPS	6	15000	90000	90,00	0,090	
Total			988200	988,2	0,9882	

5.1.2 Internal Water Supply

It is proposed that the new networks will be connected to the closest existing bulk line if there is enough pressure at the connecting point. Alternatively, a new bulk line where there is an existing 160mm municipal main water line that passes near the area.

It is recommended that the internal water supply system should comply with the following criteria:

- Metered connection to each unit.
- AADD: 600 l/d per unit for the residential areas.
- Internal pipes will be sized to cater for the instantaneous peak demand and fire flow. The relevant peak factor is dependent upon the number of units served.
- Network: Minimum 50mm uPVC pipe.
- Minimum residual pressure: 2.5bar for fire and 1.5bar for stand pipes and units.
- Pipe materials: Mains – uPVC/12 or similar; Erf connections – 20 mm Class 16
- Pipe class (pressure rating): dictated by static water pressure (likely class 12).
- Isolating valves – Position and type to comply with municipal standards.
- No valve to be installed in road surfaces.
- Fire flow: Fire hydrants, spaced maximum 240m apart.
- Minimum flow rate = 8.33 l/s per hydrant.
- Minimum residual head = 6m.

5.2 Bulk Sanitation

Sewage from the proposed development will be treated at the nearby WWTP. It was confirmed that there is a recently upgraded WWTP that will accommodate the additional flow generated by the development.

5.2.1 Sewerage Flow

Sewer flows are based on the design criteria from the Red Book Vol 2 as 500l/day/du for low-income housing.

Table 2: Estimated Sewer Discharge for the Khalinkomo Development

Guidelines for Human Settlement (Sewerage) Treatment Plant	
Daily Water Demand for Khalinkomo = 275(Ml/day) x 90%	247.50
Add 15% Allowance for Extraneous Flow (l/day) = 247.50 x 1.15	284.63
Estimated Extra Daily Sewerage Flow to Treatment Plant (Ml/day)	540

The following criteria were used in arriving at the figures as outlined above, namely:

- 90% of water usage transformed into sewerage.
- 15% added for extraneous flow

5.2.2 Sewerage Infrastructure

No existing bulk sewer services exist for the site. The development will therefore require the construction of gravity sewer links. These lines will be combined with existing line drains to the Wesselsbron WWTP.

It is recommended that the sewerage system should comply with the following criteria:

- Design flow: 500l/d/du
- Pipe material: uPVC
- Pipe sizes: Network - Minimum 160mm dia.
- Erf connections: 110mm diameter
- Minimum gradients: Drains (erf connections) - 1:120 Sewers - 1: 200
- Pipe lengths: Maximum 100m between manholes.
- Pipe cover: 1.4m below roadways / footways; 0.6m elsewhere.

5.3 Stormwater Management

The guiding principle underlying the stormwater management strategy is that, where possible, the peak runoff 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.

Stormwater concentration will be avoided at all costs using a surface drainage mechanism. It is proposed that these developments will have surface drainage from the roads with slopes similar to that of the receiving ground. Stormwater from the road will be guided by cross fall and longitudinal slope toward a discharge point, catered for by dropping the kerb as required.

Underground stormwater pipe system will only be considered as a worst case if the ground slopes and the urban plan do not allow for ground drainage. If required, the system will have to collect water from all the streets and direct it to the lowest point of the whole development where it will then be sent to the nearest stream.

It is recommended that the stormwater system should comply with the following criteria:

- Return Periods: 1:2 to 1:100
- Pipe material: Concrete
- Pipe sizes: Network - Minimum 450mm dia.

5.4 Roads and Access

Khalinkomo have gravel roads. It is proposed that the roads be upgraded to cater for the residents in the area as well as provision of public transport facilities. There is also a need to create main access roads that will link the

development's road network to the main roads (R505 and R719) and also connecting roads to the Monyakeng area.

It is recommended that the internal roads should comply with the following criteria:

- Min centreline radius: 15m (widening at bends where appropriate).
- Min kerb radius: 8 – 10m.
- Longitudinal gradients: 0.5% (min) and 12 – 16% (max).
- Vertical curve min length 20m.
- Cross fall / camber: 2 – 4%.
- Road width: 6m (3m lane in each direction)
- Design speed: 40km/h
- Surfacing: Concrete Block paving (Subject to municipal approval).
- Layer works: Dictated by geotechnical investigation and municipal standards.
- Provision for public transport infrastructure and amenities as required by the municipal bus public transport service

5.5 Electrical

The total demand required for the entire development is 8156,1 KWh. The residential contribute the larger proportion of this with the total demand of 7795,2 kWh followed in second distance by Public Open Space with the total demand of 90,7 kWh.

On the supply side, the areas is supplied by Eskom which has indicated that it has sufficient capacity to supply this proposed development. The evidence on this is provided in Appendix 1.

Table 3: Water Demand Calculation for the Khalinkomo Park Development

Building Type	QTY	Load (Per Unit kWh)	Total Allocation in kWh
Residential			
<i>Standalone Homes</i>	1524	4,8	7315,2
<i>Highrise Units</i>	100	4,8	480,0
Business Erf	5	15,1	75,6
Schools	3	15,1	45,4
Churches	3	15,1	45,4
Municipal	1	15,1	15,1
Sports & Recreation	1	15,1	15,1
Street Lights (500 units estimated)	500	0,1	58,5
Special	1	15,1	15,1
P.O.S	6	15,1	90,7
Estimate Total Consumption			8156,1

6. Conclusion

The report serves the purpose of providing, to the Client, the status quo regarding bulk water supply, bulk sanitation, stormwater management and roads and electricity around the Khalinkomo Informal settlement as well as future water, sanitation demands with its subsequent influence on existing infrastructure resources.

Wesselbron/Monyakeng has two (2) ground reservoirs and three (3) elevated reservoirs with a total storage capacity of 6.954MI (mega liters). Wesselbron and Monyakeng have a current estimated demand of 5235kl which means that it can still accommodate 1719kl (1.719MI). The proposed Khalinkomo developments have an estimated demand of 383.6kl.

Wesselbron/Monyakeng has an existing WWTW, the plant has a capacity of 5MI/day and the area has a current contribution of 4134.4kl/day (4.134.4MI/day), so the plant can still accommodate 865.6kl/day. The proposed Khalinkomo developments has an estimated contribution of 540kl/day.

There is sufficient capacity to accommodate the development. For an acceptable level of service for the residents of Khalinkomo, it is recommended that the services mentioned in the report be provided. Thus, the proposed township establishment can be accommodated through existing bulk infrastructure in the municipality.

Appendix 1: Conformation of Availability of Supply