CIVIL ENGINEERING SERVICES REPORT

FOR

PROJECT NO: ……

PROVISION OF MUNICIPAL SERVICES TO WESSELBRON TOWNSHIPS, KHALINKOMO AND VERGENOEG

8 FEBRUARY 2019

CLIENT:

NALA LOCAL MUNICIPAILITY

PREPARED BY:

HOXANA CONSULTING ENGINEERS

Hoxana Consulting Engineers Project no: XXX	**Issue Date: 8 FEBRUARY 2019**
CONSULTING ENGINEERS: **Hoxana Consulting (Pty) Ltd** Physical Address: Unit 3 Ground Floor Left Berkeley Office Park 8 Bauhinia Street Techno Park Centurion Postal Address: Unit 3 Ground Floor Left Berkeley Office Park Techno Park Centurion Telephone : +27(0) 87 095 1643 Fax : +27(0)12 633 1259	**COMMISSION BY (CLIENT):** **Nala Local Municipality** Physical Address: 8 Preller Street Bothaville Postal Address: Private Bag X 15 Bothaville 9660 Tel: +27(0) 56 514 9200 Fax: +27(0) 56 515 3922
AUTHOR: Livingstone Mashele Pr Tech. Eng.	**CLIENT: Mota Moleko (Project Manager)**
DISCIPLINE: Civil Engineering / Geometric Design	
HOXANA CONSULTING ENGINEERS	
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Verification	Capacity	Name	Signature	Date
Compiled:	Project Manager	Thabani Vundla and Livingstone Mashele Pr Eng.		
Reviewed:	Project Director	Livingstone Mashele Pr Eng.		
Accepted:	Client Authorised Represented	Mota Moleko		

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Abbreviations and acronyms

ABBREVIATIONS OR ACRONYMS	
HCE	Hoxana Consulting Engineers
EIA	Environmental Impact Assessment
MODAASHTO	Modified American Association of State Highway and Transportation Officials.
CSIR	Council for Scientific and Industrial Research
DDR	Detailed Design Report
PDR	Preliminary Design Report
ECSA	Engineering Council of South Africa
CLO	Community Liaison Officer
WWTW	Waste Water Treatment Works

1. TERMS OF REFERENCE

Hoxana Consulting Engineers have been appointed by the Nala Local Municipality (NLM) to undertake the planning, design and construction monitoring for the implementation of engineering services in Khalinkomo and Vergenoeg in Wesselbron. This appointment included preliminary assessment of the potential to provide services in the two areas.

Hoxana Consulting Engineers met with officials from Nala Local Municipality Technical Services to discuss the existing and proposed engineering services for the development.

This report provides an overview of the engineering services to be constructed in the proposed Khalinkomo and Vergenoeg residential areas in Wesselbron.

2. INTRODUCTION

The proposed area of development consist of approximately 966 erfs in total, 562 erfs in Khalinkomo (553 residential, 2 businesses, 2 crèches, 2 churches and 3 open public spaces) and 404 erfs in Vergenoeg (398 residential, 1 business, 2 community facilities 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

2.2 PROJECT BACKGROUND

Khalinkomo and Vergenoeg are two informal settlements in Wesselbron that have sprouted over the years due to the shortage of housing. Both are in the peripheral of Wesselbron town. Nala Local Municipality has taken the executive decision to formalise these two areas and provide municipal services to the residents in this area despite failed attempts in the past.

Hoxana Consulting Engineers was appointed by Nala Local Municipality to undertake the design and implementation of all municipal services. Hoxana Consulting Engineers appointed Alex van Breda Planning Alternatives to undertake the town planning of the two areas as well as registering the two townships with the Municipal Tribunal. Joynt Geomatics was appointed to conduct a land survey and come up with a layout showing the topographical layout of the two areas and presence and levels of existing services.

3. PROJECT DETAILS

3.1 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 townships are as follows:

Vergenoeg	**Latitude:**	**27^0 48’ 42.8458’’ S**
	Longitude:	**26^0 22’ 14.8404’’ E**
Khalinkomo	**Latitude:**	**27^0 49’ 36.9646’’ S**
	Longitude:	**26^0 23’ 06.0882’’ E**

Figure 1 below shows the two proposed townships.

Figure 1: Locality Map of Khalinkomo (bottom left) and Vergenoeg (top)

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 not been undertaken yet so the geology of the site is not known determined.
- Topographically, the site is a flatland

The proposed layouts for the townships are presented in Figure 2 and Figure 3.

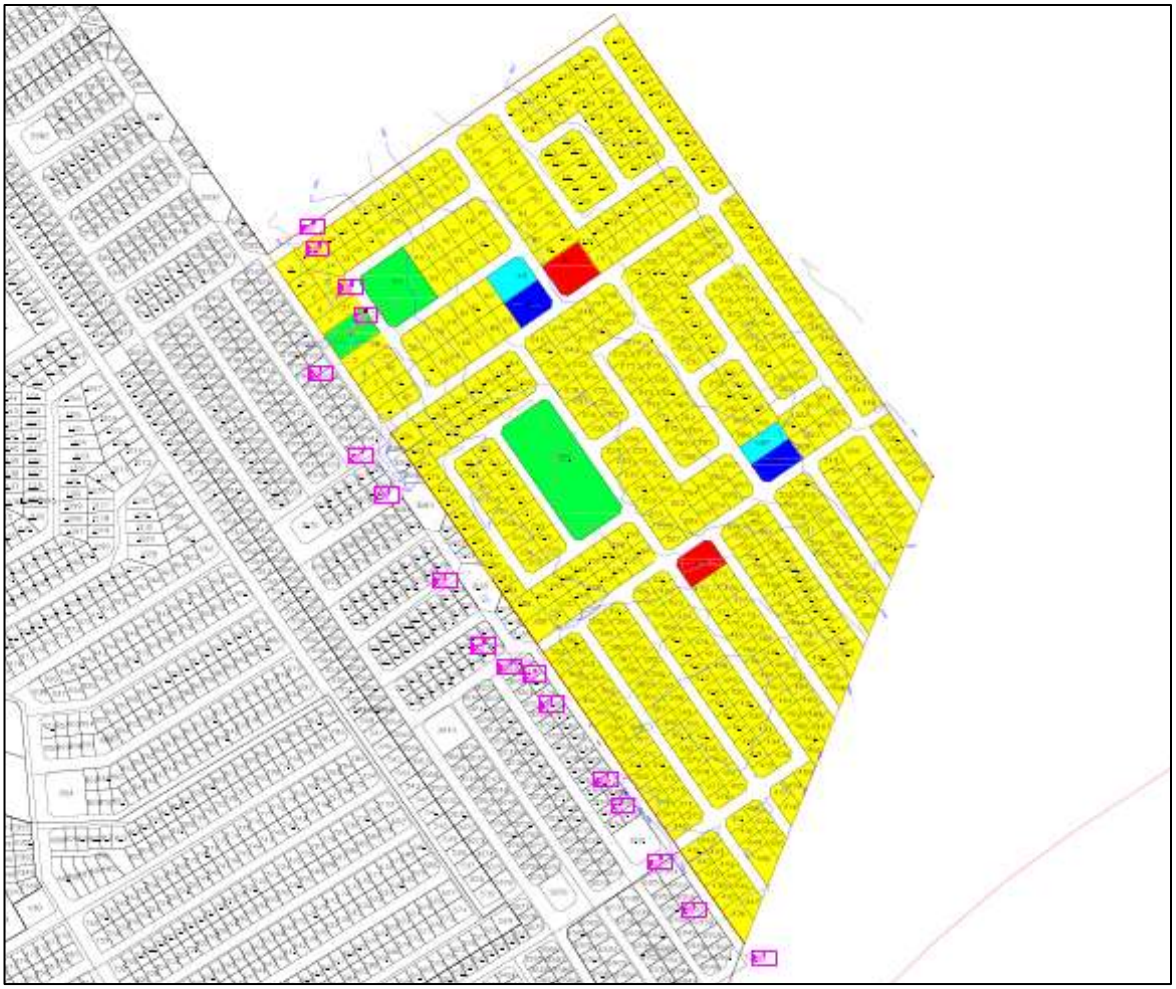


Figure 2: Proposed Layout for Khalinkomo

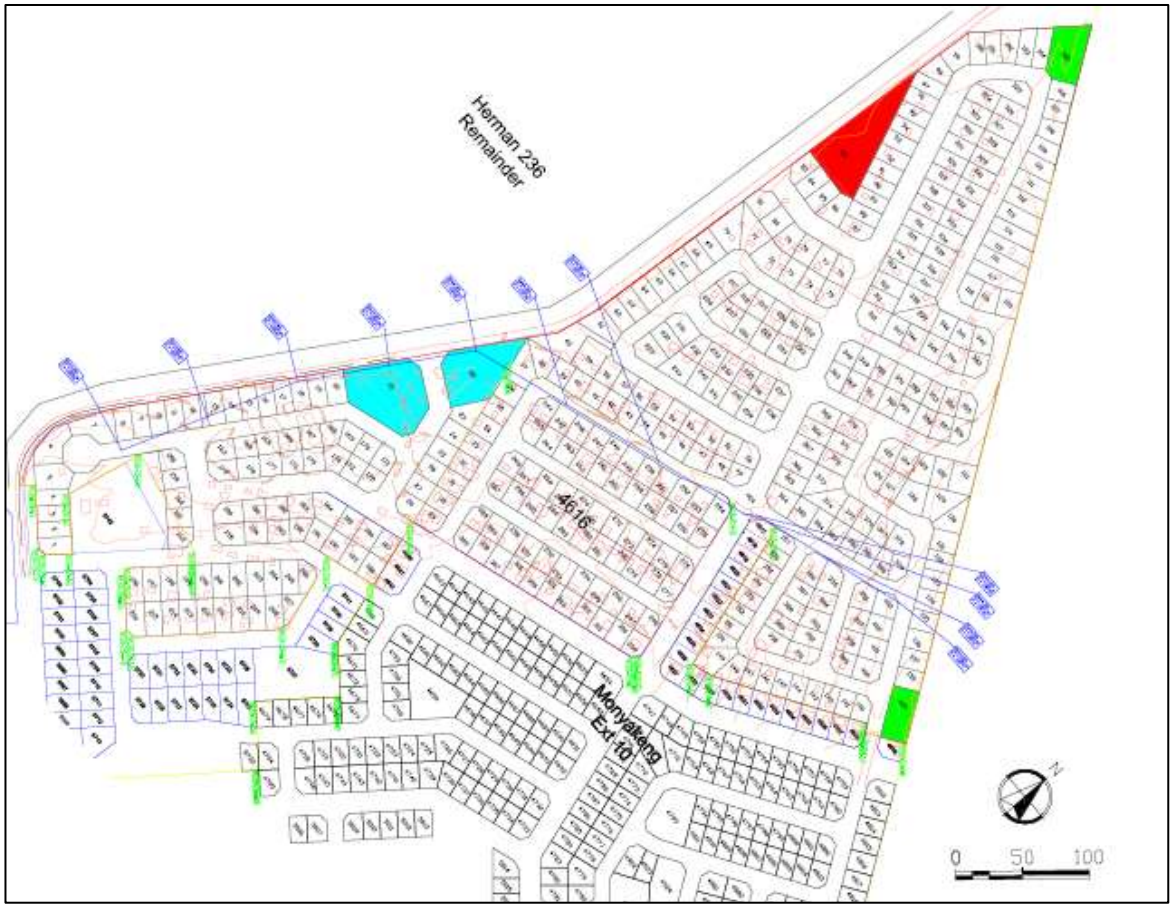


Figure 3: Proposed Layout for Vergenoeg

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, 5th Edition (October 2007).

- "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
- Technical Methods for Highways (TMH1) – Sampling Methods for Roads Constructions Materials

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 and Table 2:

Table 1: Water Demand Calculation for Khalinkomo

KHALINKOMO				
	Units	l/d/u	l/d	kl/d
Residential	553	600	331800	331.8
Business	2	400	800	0.8
Crèche	2	1000	2000	2
Church	2	2000	4000	4
OPS	3	15000	45000	45
TOTAL			383600	**383.6**

Table 2: Water Demand Calculation for Vergenoeg

VERGENOEG				
	Units	l/d/u	l/d	kl/d
Residential	398	600	238800	238.8
Business	1	400	400	0.4
Community Facility	2	4500	9000	9
Church	2	2000	4000	4
OPS	1	15000	15000	15
TOTAL			267200	**267.2**

5.1.2 Water supply Infrastructure

The proposed water supply infrastructure for the two areas are presented in Figure 4 and Figure 5 **(see also Appendix A, Drawing No. NLM 2019/20 – KNM – 001 and Drawing No. NLM 2019/20 – VGN – 002 respectively)**. 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 will be constructed directly from the new reservoir to service the two areas.

Hoxana Consulting Engineers is still to confirm if the existing 160 mm water main has sufficient capacity to service the proposed development.

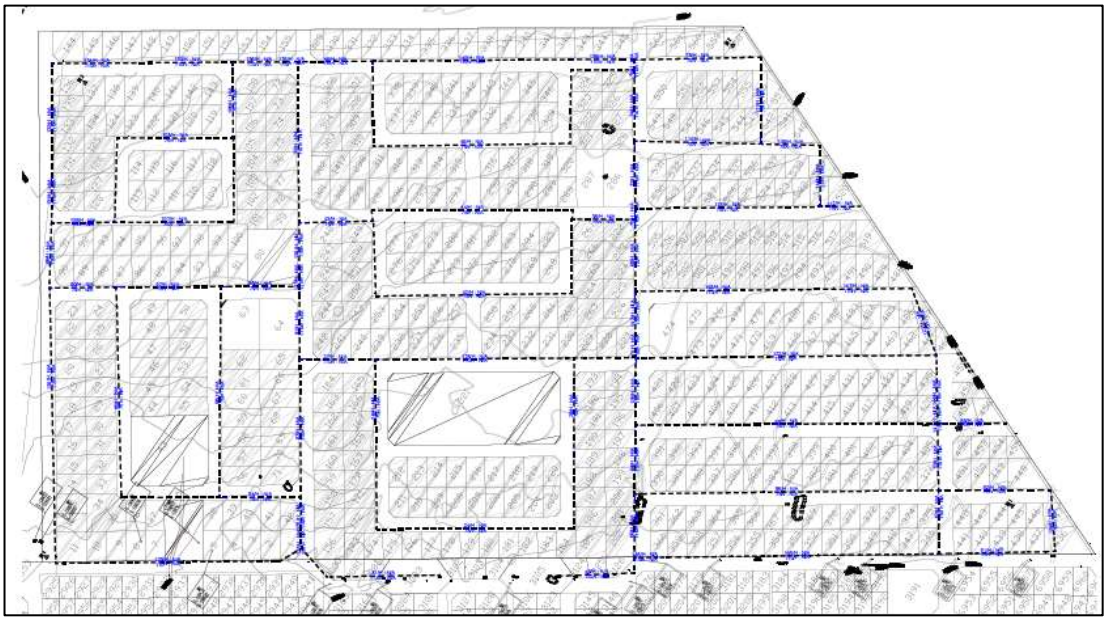


Figure 4: Proposed water network for Khalinkomo

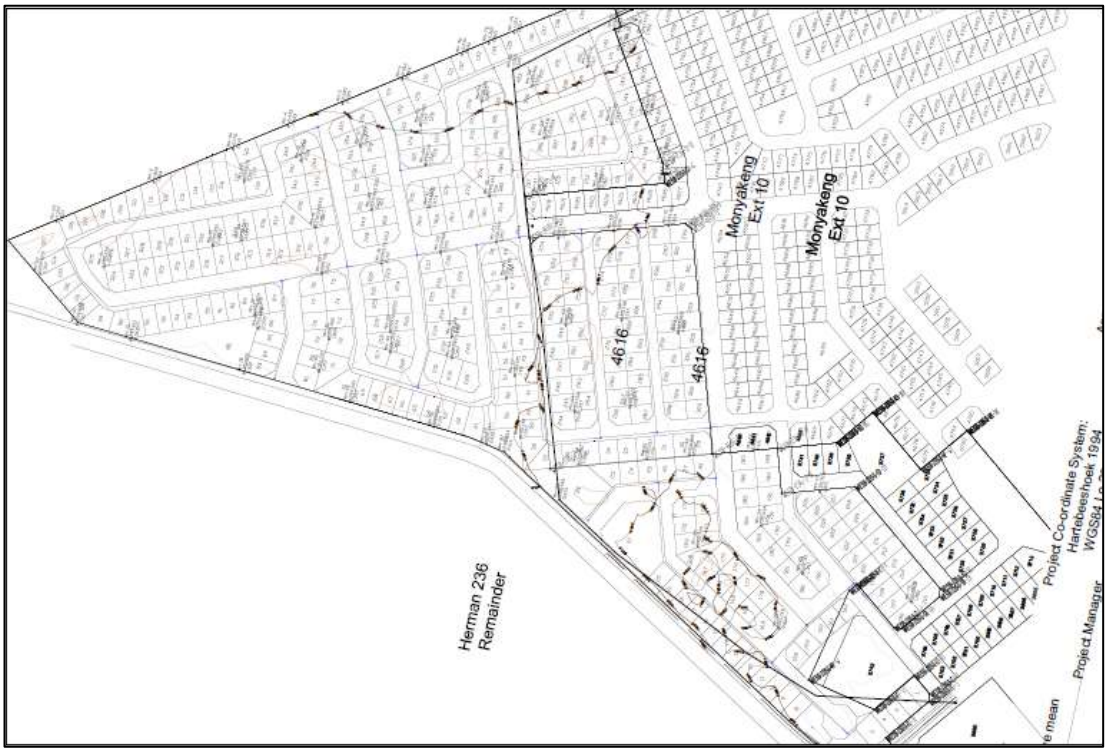


Figure 5: Proposed water network for Vergenoeg

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 75mm uPVC pipe.
- Minimum residual pressure: 8m (peak flow) and 6m (peak + fire flow).
- 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 SEWERAGE

Sewage from the proposed development will be treated at the nearby WWTW. Officials from the Nala Local Municipality confirmed that the WWTW could accommodate the additional flow generated by the development as it was recently upgraded.

5.2.1 Sewage Flow

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

5.2.1 Sewage 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 WWTW in Wesselbron. Figure 6 and Figure 7 show the preliminary design of these link services **(see also Appendix A, Drawing No. NLM**

2019/20 – KNM – 000 and NLM 2019/20 – VGN – 001 respectively). The preliminary design is based on the best available survey information which is currently available.

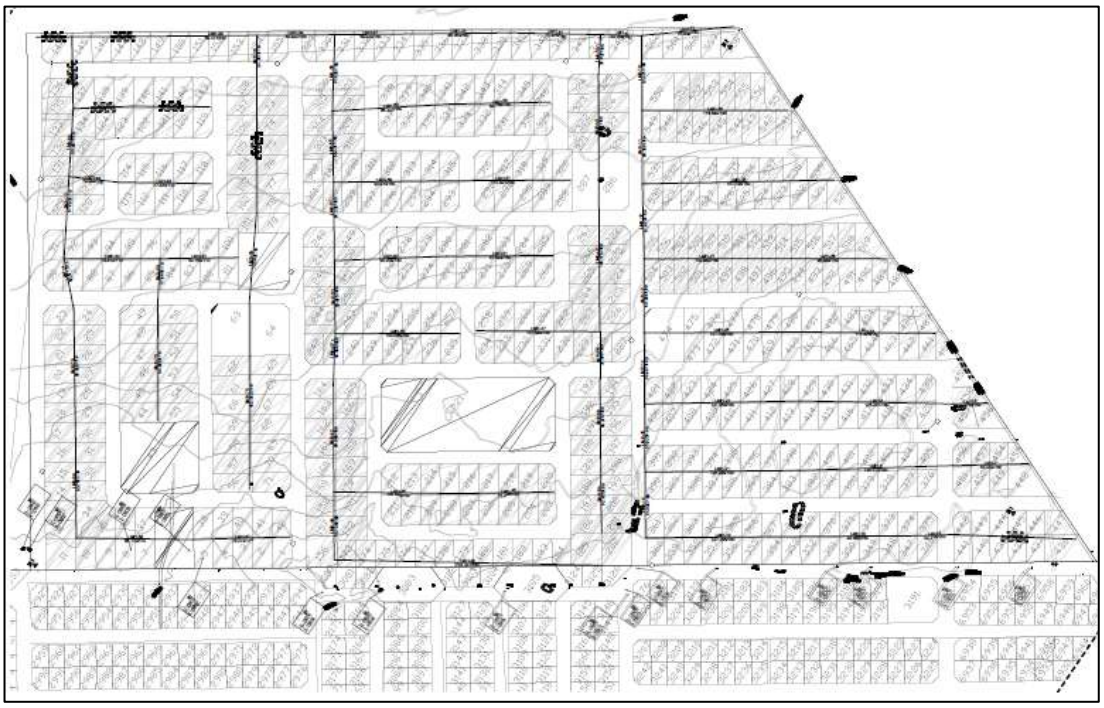


Figure 6: Proposed Sewer Network in Khalinkomo

Figure 7: Proposed Sewer Network in Vergenoeg

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: 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.

5.4 ROADS AND ACCESS

Khalinkomo and Vergenoeg both 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. Figure 8 and Figure 9 show the proposed layout for the roads of Khalinkomo and Vergenoeg respectively **(see also Appendix A, Drawing No. NLM 2019/20 – KNM – 002 and NLM 2019/20 – VGN – 000 respectively).**

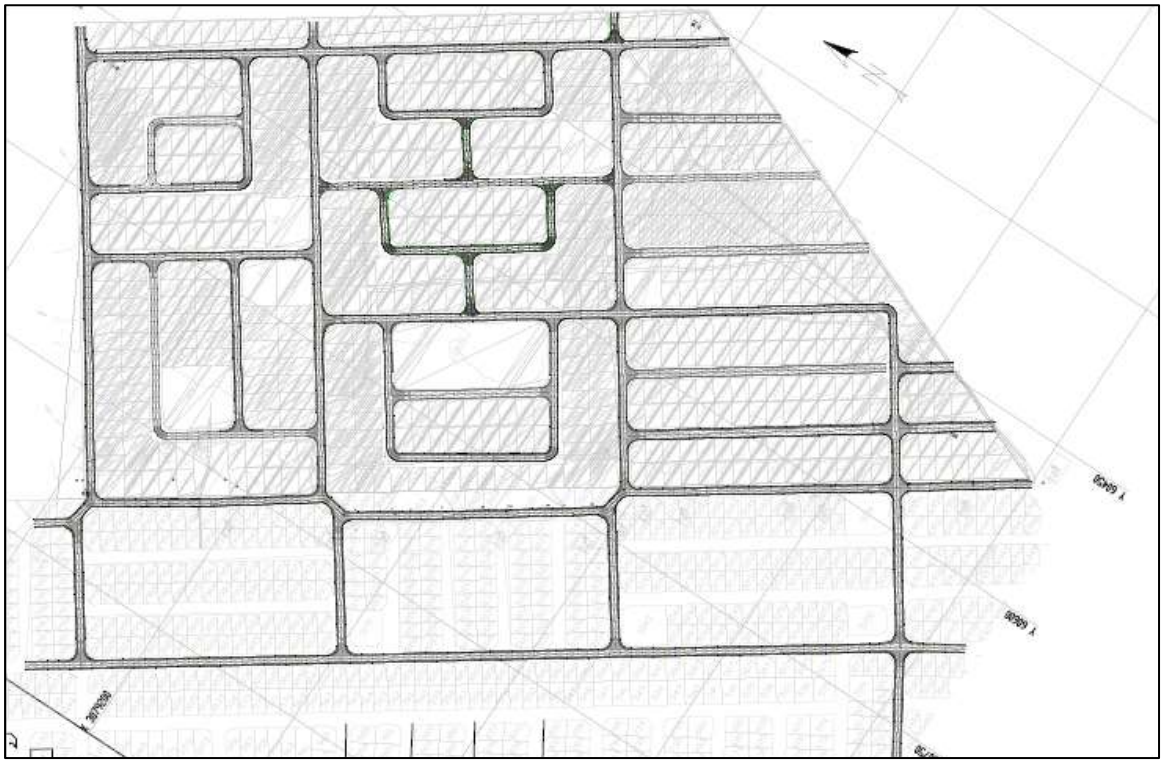


Figure 8: Road Layout for Khalinkomo

Figure 9: Road Layout for Vergenoeg

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

6. CONCLUSION

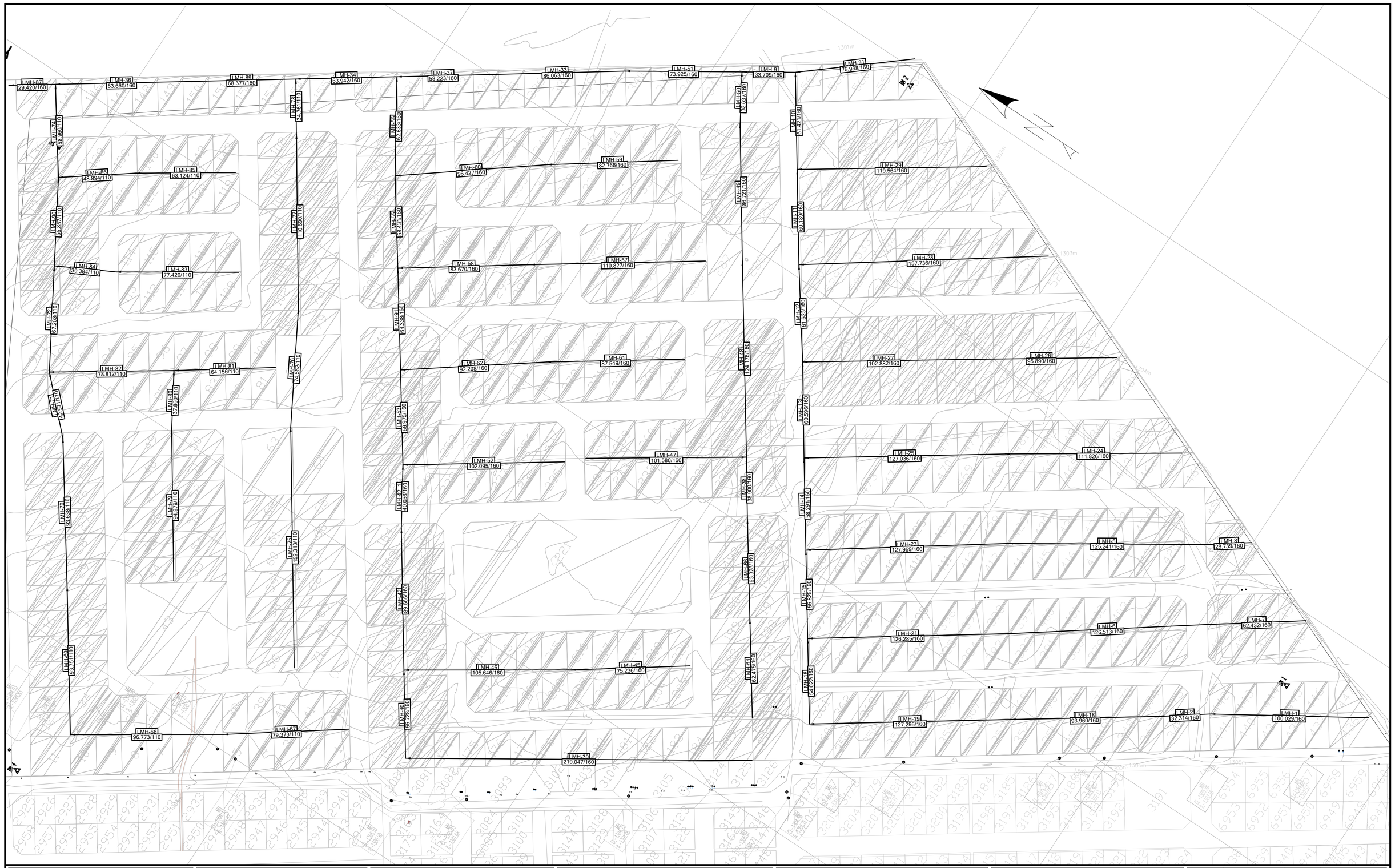
For an acceptable level of service for the residents of Khalinkomo and Vergenoeg, it is recommended that the services mentioned in the report be provided.

The budget for the provision of the services is summarized in Table 3.

Table 3: Budget Summary

PROJECT	ESTIMATED BUDGET
KHALINKOMO	
Provision of Bulk Water	**R 14 326 543.48**
Provision of Bulk Sewerage	**R 7 754 633.52**
Provision of Roads and Associated Stormwater	**R 48 740 047.13**
TOTAL 1	**R 70 821 224.13**
VERGENOEG	
Provision of Bulk Water	**R 10 590 196.52**
Provision of Bulk Sewerage	**R 6 468 984.86**
Provision of Roads and Associated Stormwater	**R 38 287 308.31**
TOTAL 2	**R 55 346 489.69**
TOTAL (INCL. VAT)	**R 126 167 713.82**

APPENDIX A: DRAWINGS



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HOXANA CONSULTING ENGINEERS
No. 8 Bauhinia Street
Berkley Office Park
Highveld Technopark
0157

Tel: +27(0) 12 665 0879
Fax: 086 663 1259

PROJECT TITLE:

WESSELSBRON:
PROVISION OF MUNICIPAL SERVICES
IN KHALINKOMO
SEWER RETICULATION

DRAWING TITLE:

SEWER NETWORK LAYOUT

NALA LOCAL MUNICIPALITY
No. 8 Preller Street,Bothaville,Free state
P.O. Box 12,Bothaville 9660

Tel: +27(56) 514 9200
Fax: +27(56) 515 3922

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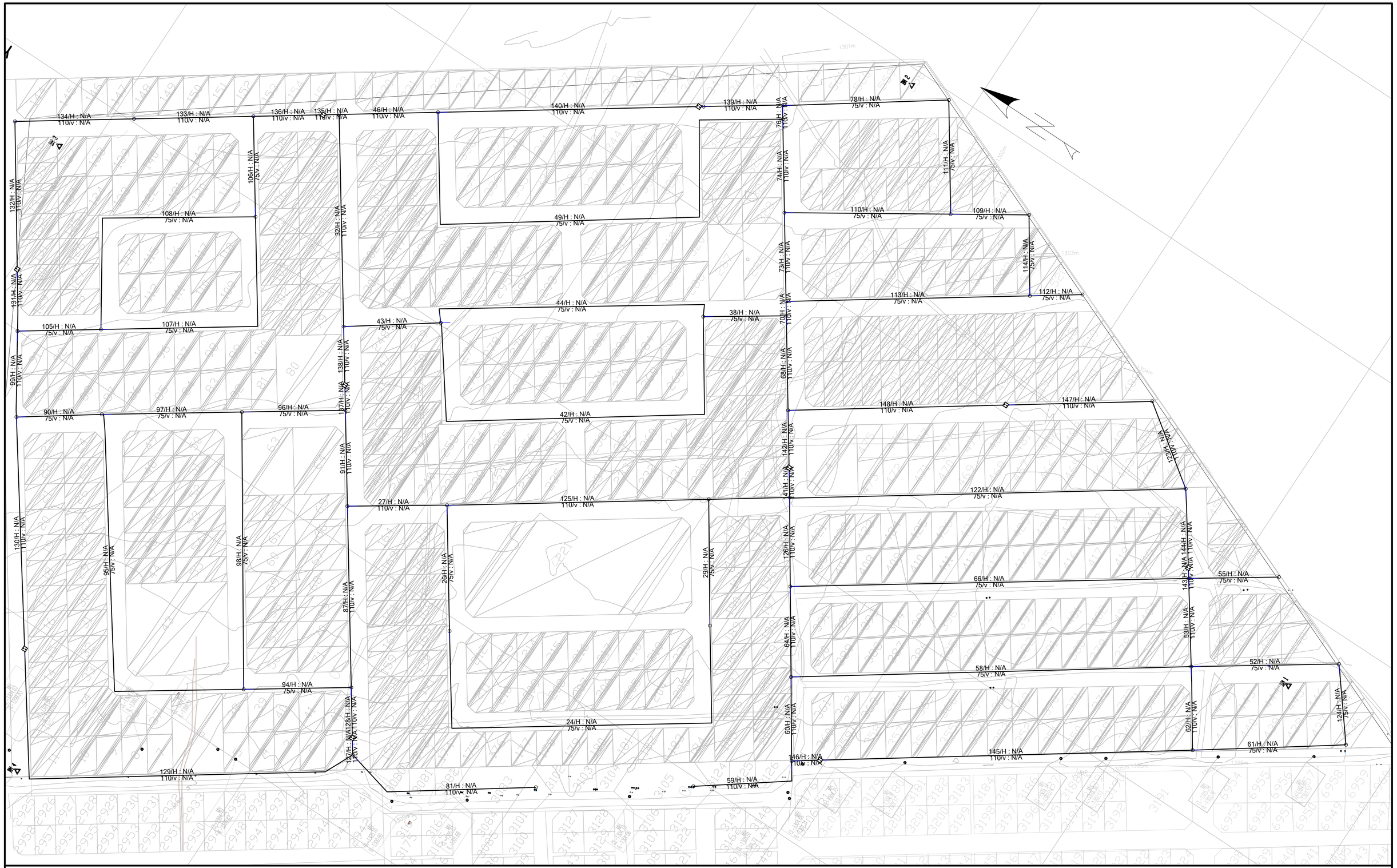

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HOXANA CONSULTING ENGINEERS
No. 8 Bauhinia Street
Berkley Office Park
Highveld Technopark
0157

Tel: +27(0) 12 665 0879
Fax: 086 663 1259

PROJECT TITLE:

WESSELSBRON:
PROVISION OF MUNICIPAL SERVICES
IN KHALINKOMO
WATER NETWORK

DRAWING TITLE:

WATER LAYOUT

NALA LOCAL MUNICIPALITY
No. 8 Preller Street,Bothaville,Free state
P.O. Box 12,Bothaville 9660

Tel: +27(56) 514 9200
Fax: +27(56) 515 3922

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No. 8 Bauhinia Street
Berkley Office Park
Highveld Technopark
0157

Tel: +27(0) 12 665 0879
Fax: 086 663 1259

PROJECT TITLE:
WESSELSBRON:
PROVISION OF MUNICIPAL SERVICES
IN VERGENOEG
SEWER RETICULATION

DRAWING TITLE:
SEWER RETICULATION

NALA LOCAL MUNICIPALITY
No. 8 Preller Street,Bothaville,Free state
P.O. Box 12,Bothaville 9660

Tel: +27(56) 514 9200
Fax: +27(56) 515 3922

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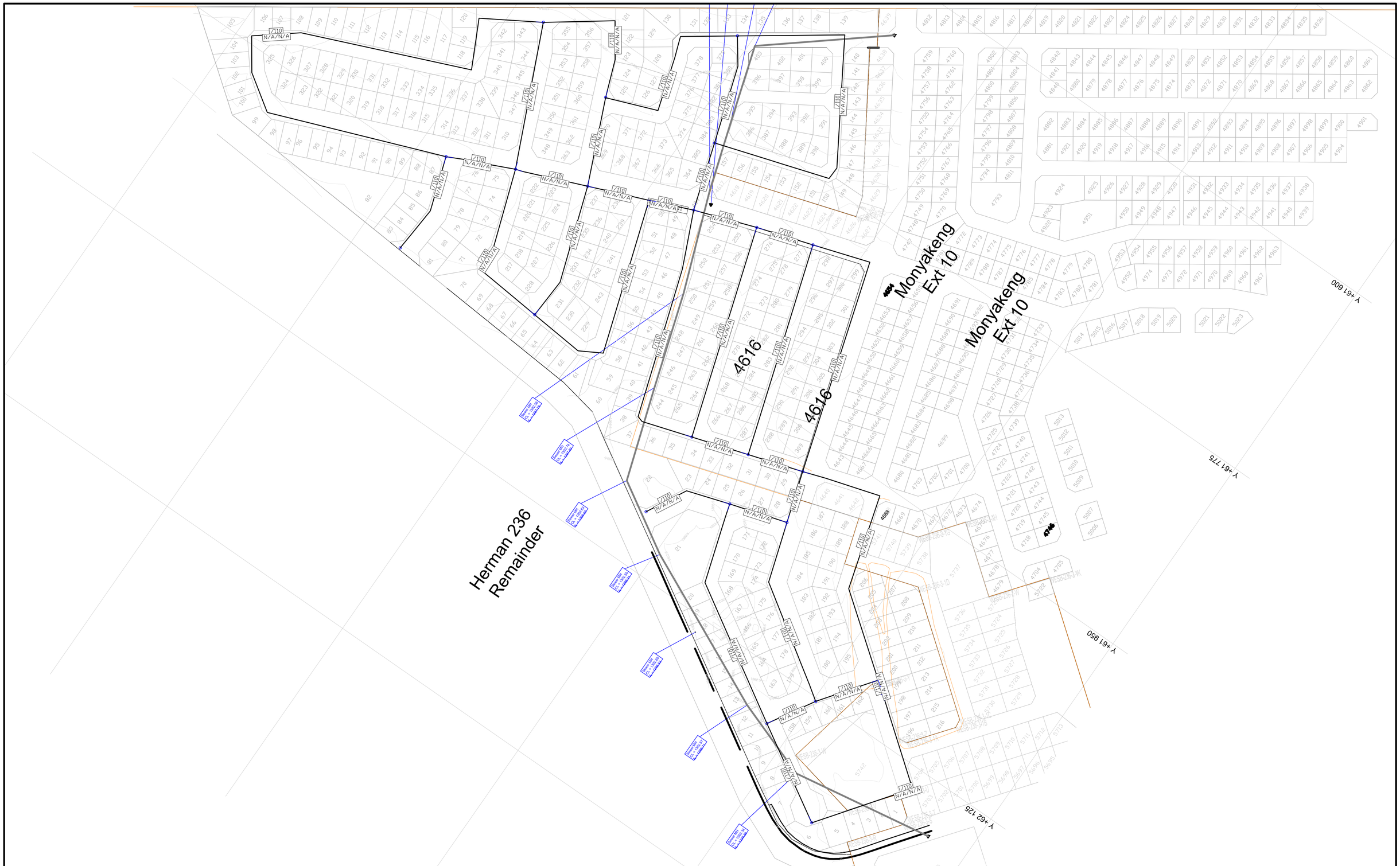

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HOXANA CONSULTING ENGINEERS
No. 8 Bauhinia Street
Berkley Office Park
Highveld Technopark
0157

Tel: +27(0) 12 665 0879
Fax: 086 663 1259

PROJECT TITLE:
WESSELSBRON:
PROVISION OF MUNICIPAL SERVICES
IN VERGENOEG
WATER NETWORK

DRAWING TITLE:
WATER NETWORK

NALA LOCAL MUNICIPALITY
No. 8 Preller Street,Bothaville,Free state
P.O. Box 12,Bothaville 9660

Tel: +27(56) 514 9200
Fax: +27(56) 515 3922

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