PROPOSED TOWNSHIP ESTABLISHMENT ON PORTION OF THE FARM DE PUT 298, MATWABENG, FREE STATE PROVINCE

BULK ENGINEERING SERVICES REPORT

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Abbreviations

AADD	-	Average Annual Daily Demand
ADWF	-	Average Dry Weather Flow
DWS	-	Department of Water and Sanitation
FAR	-	Floor Area Ratio
IDP	-	Infrastructure Development Plan
kℓ	-	Kilo Litres
kℓ/day	-	Kilo Litres per day
ℓ/s	-	Litres per second
m^3	-	cubic metre
MAP	-	Mean Annual Precipitation
Mℓ /day	-	Mega litres per day
PSC	-	Project Steering Committee
RWS	-	Regional Water Scheme
SANRAL	-	South African National Roads Authority Limited
StatsSA	-	Statistics South Africa
VIP toilet	-	Ventilated Improved Pit toilet
WC	-	Water Committee

1 INTRODUCTION

Dalimede Projects (PTY) LTD was appointed by Skotane Development Consultants to prepare the bulk engineering services report for the proposed township establishment on portion of the Farm De Put 298, Matwabeng, Free State Province.

This report outlines the engineering services existing needed for the township, i.e. roads, water, sewer and electricity.

2 LOCALITY

The proposed township is situated in Matwabeng, Senekal town, in the Free State province, South Africa. Senekal town is 85km north from Fickburg town, along the R70 highway. The area is administered by Setsoto Local Municipality, under the Thabo Mofutsanyana District Municipality. GPS coordinates of site are 28°20'41.85"S 27°38'21.69"E.

The locality map is shown on the figures below.

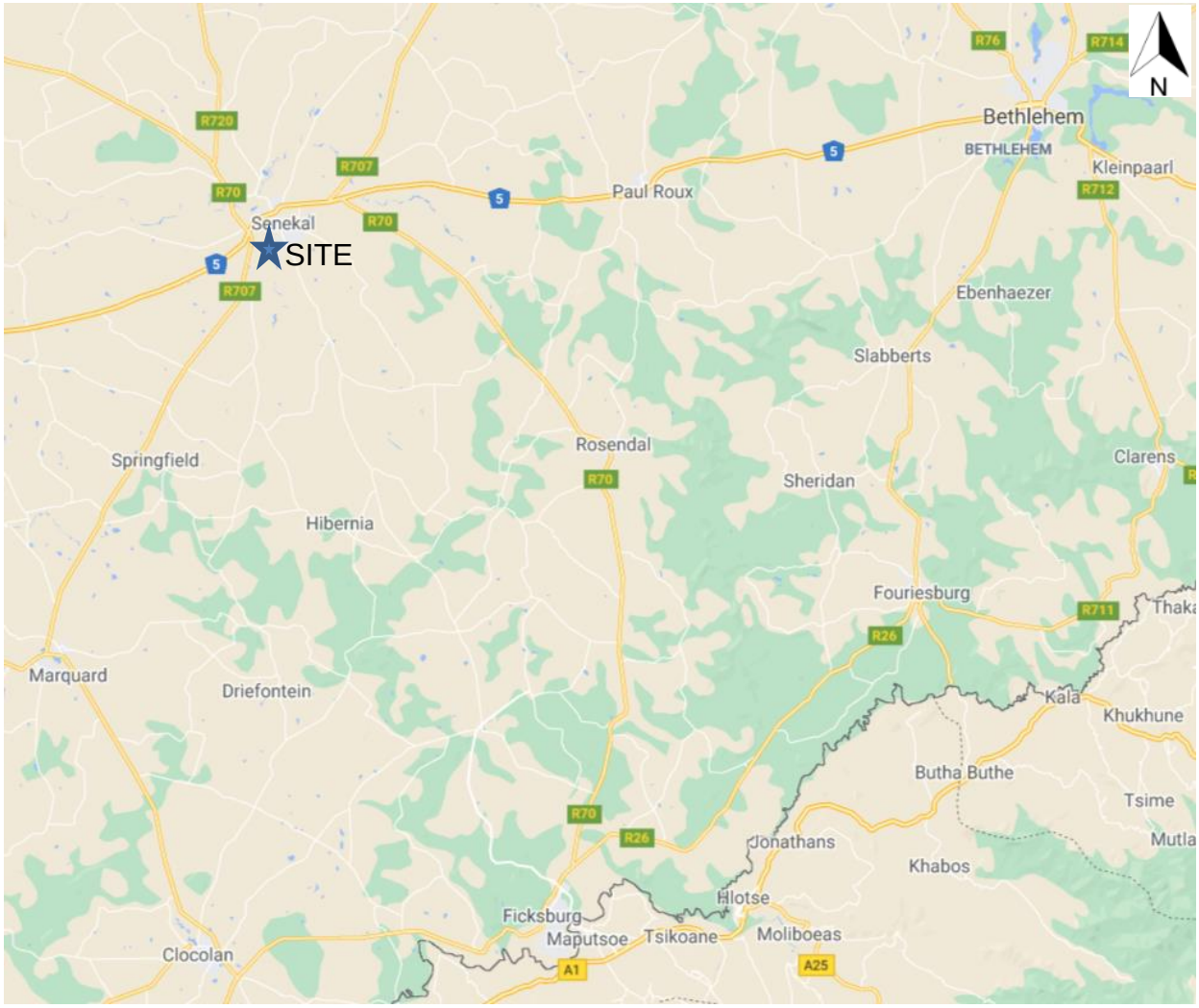

Figure 1 Locality plan

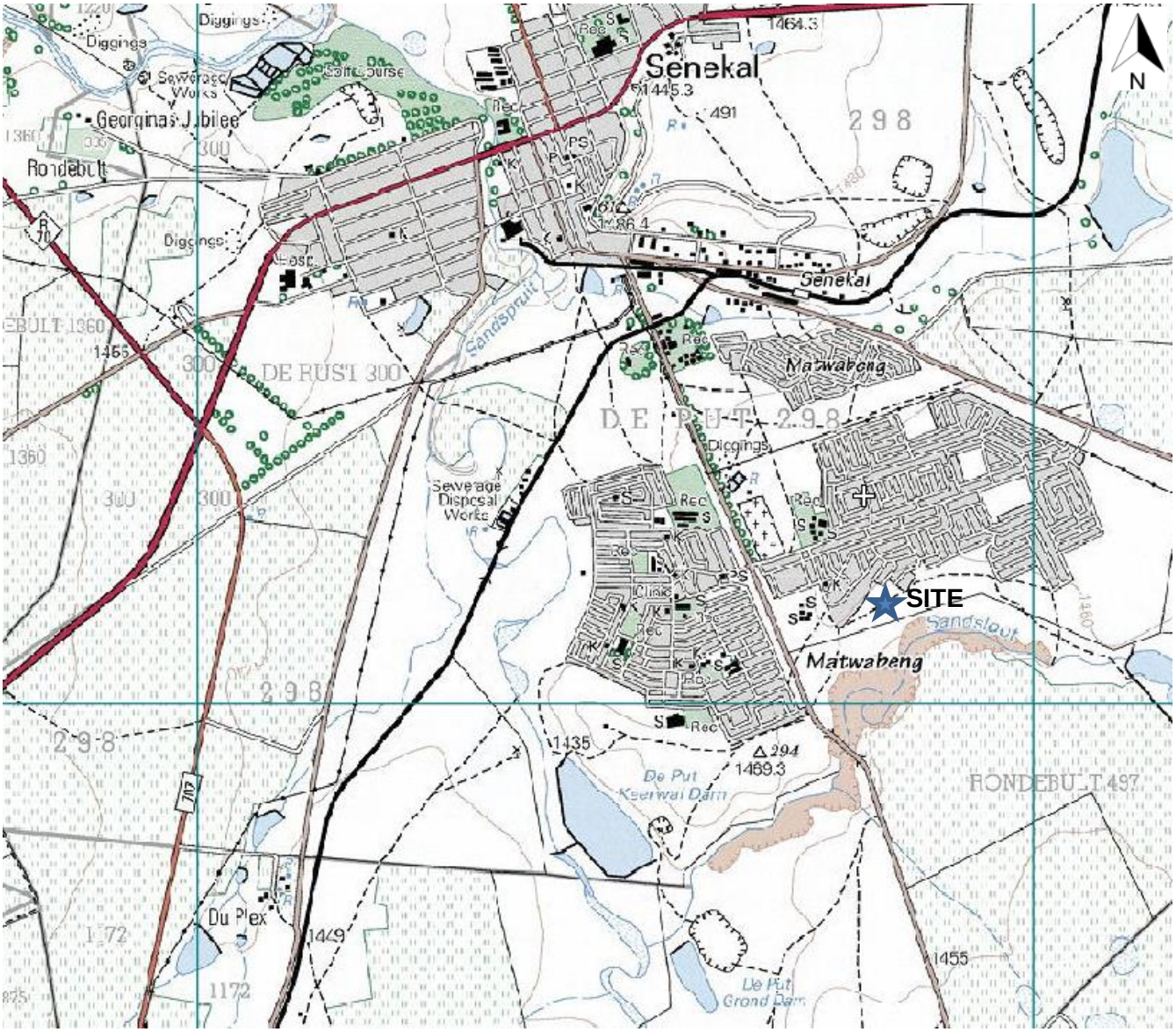

Figure 2 Project site

The site is locally known by the following names; Thambo section / Alexandra.

3 TOWN PLANNING

Township is to be of mixed land use but will be mainly for residential purposes.

The site is to be developed to land uses shown in the table below.

Table 1 Land use

LAND USE					
ZONING	**LAND USE DESCRIPTION**		**NO, OF STANDS**	**AREA (HA)**	**%**
RESIDENTIAL	RESIDENTIAL		345	10.2	70.3
STREET	STREET		*	4.3	29.7
TOTAL			345	14.5	100

The proposed land use layout is shown in the figure on the next page.

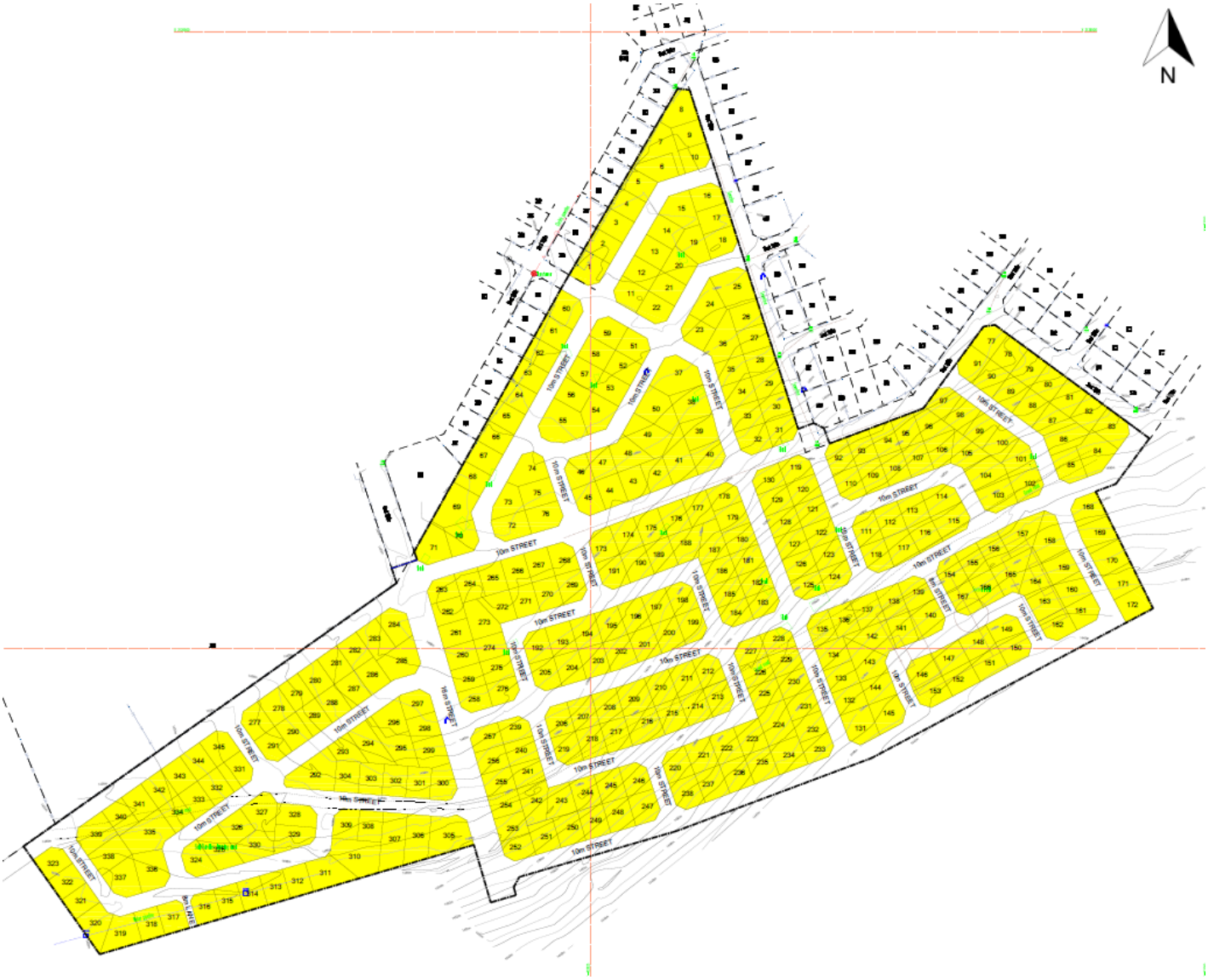

Figure 3 Proposed SDP

4 TOPOGRAPHY AND ACCESS

The site topography is generally flat (89% of site) to hilly (11% of site).

The site can be accessed from the existing internal streets in Matwabeng.

Figure 4 Site view

See the figure below.

Figure 5 Site access

5 WATER SERVICE

The Matwabeng settlement, within Senekal town, has existing municipal infrastructure for water, sewer, electricity, roads and stormwater.

5.1 Water source

The site is within the Senekal Water Scheme.

The water scheme area abstracts raw water from the following sources:

- Raw water is extracted from the Cyferfontein dam / river weir in the Sand River and stored in the Cyferfontein off-channel storage dam.
- Raw water is extracted from the Sandspruit River and stored in De Put / Matwabeng / Sekekal off-channel storage dam.
- Boreholes

Raw water is then conveyed to the following water treatment works (WTW):

- De Put WTW, with a design capacity of 2.3 Mℓ/day. GPS 28°19'38.87"S 27°37'29.11"E. The plant receives raw water from De Put Dam.
- New Cyferfontein WTW, with a design capacity of 3.3 Mℓ/day. The plant receives raw water from the Sand River and Cyferfontein Catchment Dam.
- Old Cyferfontein WTW, with a design capacity of 3.4 Mℓ/day. GPS 28°14'39.94"S 27°39'17.31"E. The plant receives raw water from the Sand River and Cyferfontein Catchment Dam.

The actual capacity of the existing WTW’s could not be confirmed.

The boreholes yields could not be obtained.

Bulk meter water supply records could not be obtained.

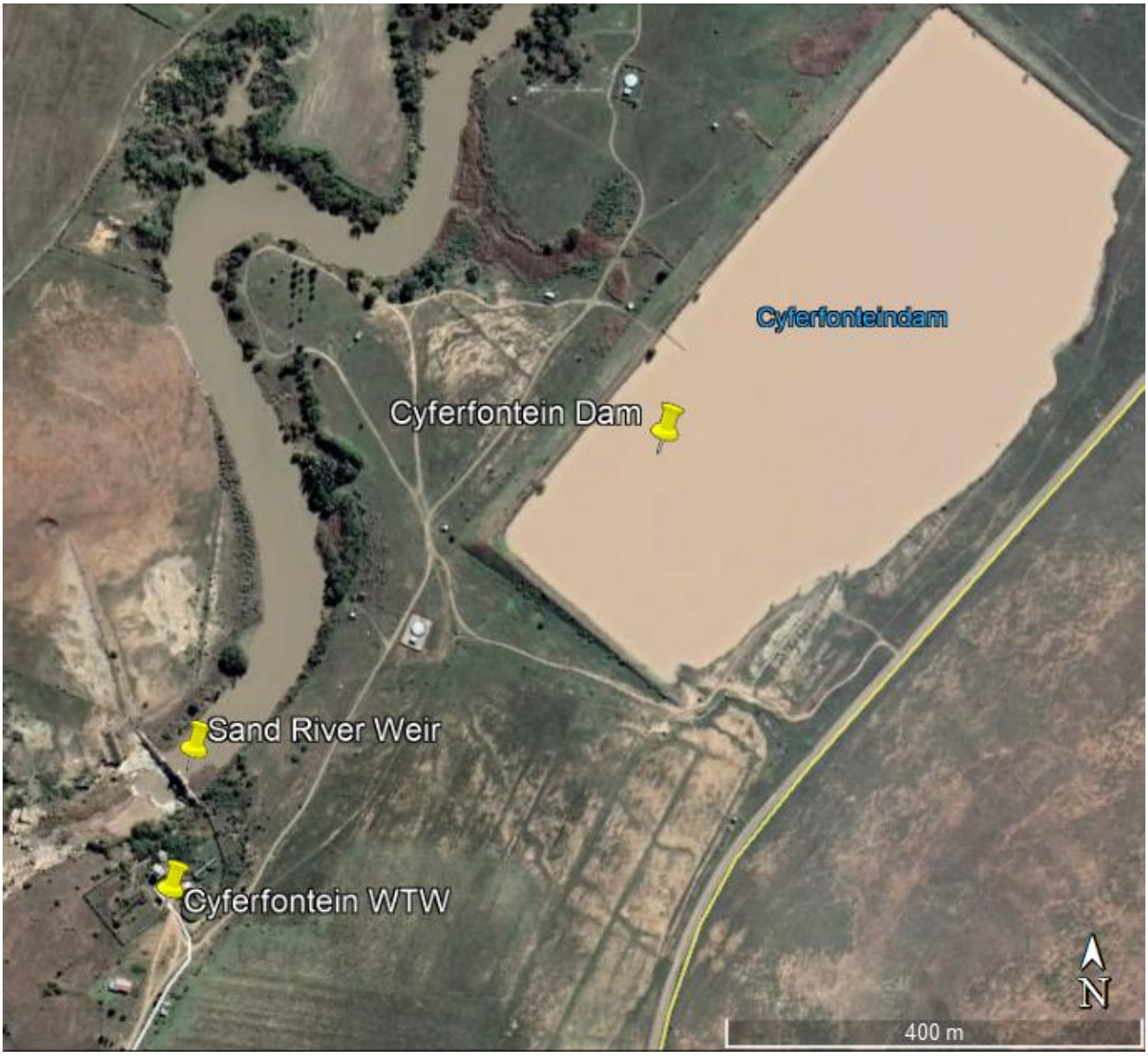

Figure 6 Cyferfontein Dam site

Figure 7 De Put / Matwabeng / Sekekal off-channel storage dam


Figure 8 De Put / Matwabeng / Sekekal off-channel storage dam view

Figure 9 De Put WTW


Figure 10 De Put WTW view

5.2 Storage Reservoirs / Tanks

The purified water from the three water treatment works is pumped to and distributed through service reservoirs in Senekal town, viz;

- 2 x 2.27 Mℓ, at GPS 28°19'21.55"S 27°37'35.06"E, and
- 5 Mℓ, at GPS 28°19'10.15"S 27°37'44.96"E.
- 11 Mℓ, at GPS 28°19'10.04"S 27°37'47.00"E. Under construction, now roofed.

The town storages, as shown in the figure below.

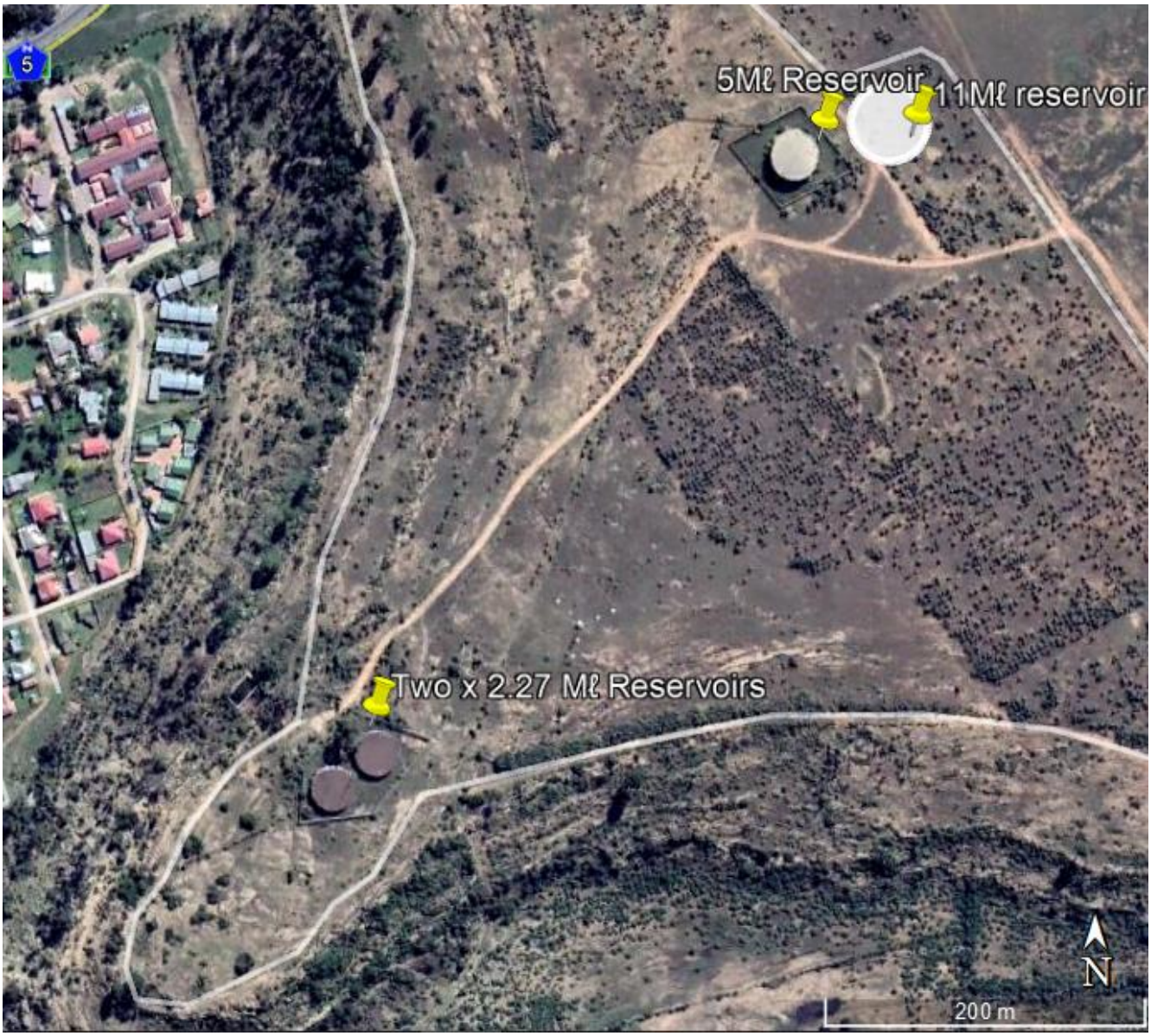

Figure 11 Water storage

Figure 12 11 Mℓ Reservoir under construction

5.3 Water Reticulation

The developed area adjacent to the proposed development has an existing water network fed by the reservoirs shown in the figure above.

An existing water pipeline onsite is shown in the survey extract below.

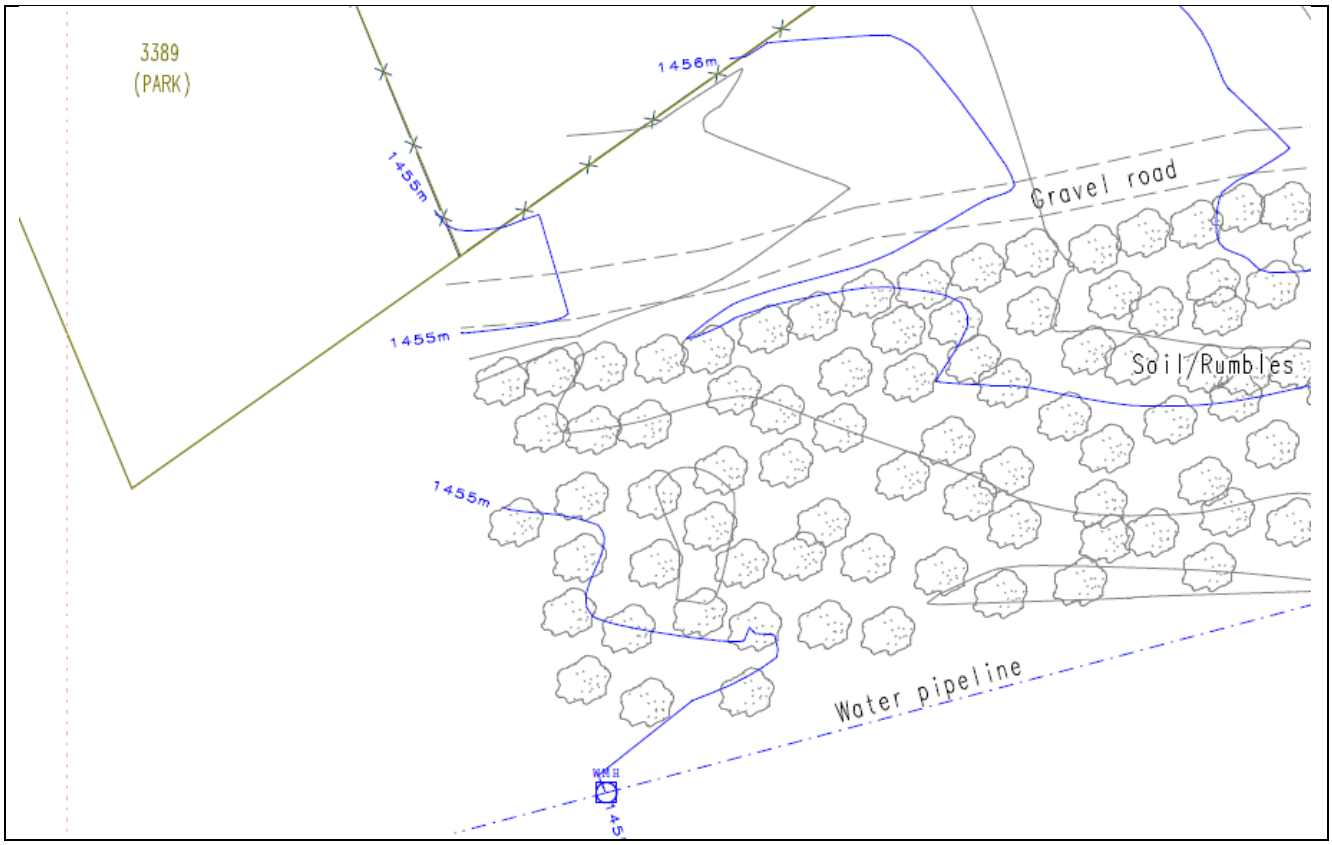

Figure 13 Water pipeline onsite

Figure 14 Existing water pipelines onsite

Figure 15 Exposed water pipeline repaired

Figure 16 Capped water standpipe on existing pipeline

Figure 17 Water valve onsite 28°20'46.56"S 27°38'17.38"E

5.4 Water design criteria

The water design criterion to be used is listed in the table below. The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 2 The water design criteria

Item	Design element	Criteria
i.	Average Annual Daily Demand (AADD), for Residential 1	0.6kℓ/c/day
ii.	Group / cluster housing, Medium density	0.5kℓ/unit/day
iii.	Business / commercial, FAR = 0.4	0.65kℓ/100m2
iv.	Park	12kℓ/hectare
v.	Municipal, FAR = 0.4	0.6kℓ/100m2
vi.	Institutional, FAR = 0.4	0.6kℓ/100m2
vii.	Educational, FAR = 0.4	0.6kℓ/100m2
viii.	Industrial, FAR = 0.4	0.4kℓ/100m2
ix.	Taxi Rank	0.3kℓ/100m^2
x.	School, crèche, educational buildings	60 ℓ/student
xi.	Hospital, building according to Floor Area Ratio (FAR)	1.2 kℓ/100m^2
xii.	Church buildings	0.3 kℓ/100m^2
xiii.	Church grounds	1.2 kℓ/Ha
xiv.	School, crèche, educational buildings	60 ℓ/student
xv.	School, crèche, educational grounds	12 kℓ/Ha
xvi.	Institutional, FAR = 0.4	0.6 kℓ/100m^2
xvii.	Sport grounds / Recreational	40 kℓ/Ha
xviii.	Residential stands; High density, small sized, with 20 to 12 units/Ha	11 kℓ/Ha/day
xix.	Flats, High density	0.35 kℓ/unit/day
xx.	Stadium: Buildings only	1.5 kℓ/1000seats
xxi.	Stadium: Grounds only	12 kℓ/Ha/day
xxii.	Hotels	0.2 kℓ/person
xxiii.	Gross Average Annual Daily Demand (GAADD)	Allow 10% losses
xxiv.	Daily Instantaneous Peak Factor (DIPF)	1.5
xxv.	Design Peak Flow Rate (DPFR) for domestic flows.	25ℓ/s
xxvi.	Maximum static head	90m
xxvii.	Minimum residual head under conditions of domestic peak flow	10m
xviii.	Maximum linear flow velocity under conditions of domestic peak flow	3m/s
xxix.	Pipe type	uPVC
xxx.	Minimum pipe class	9
xxxi.	Fire flow at any one hydrant under the conditions of domestic peak flows (one hydrant at a time)	15 ℓ/s
xxxii.	Minimum residual head (fire plus domestic peak flow)	25m
xxiii.	Maximum linear flow velocity under conditions of fire-fighting	3m/s
xxiv.	DWS storage reservoirs sizing criteria: 48 Hrs x AADD Pumped from One Source 36 Hrs x AADD Pumped from Multiple Sources 24 Hrs x AADD Gravity Source	

5.5 Water demands

The estimated water demand for the proposed development is shown in table below. As per the table below, the water demand calculations indicate that the township will require 207kℓ/d AADD and 227.7kℓ/d Gross Average Annual Daily Demand.

Table 3 Water demand

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Residential (Residential)	345	10.2	345		0.6	kℓ/erf/day	207.0	kℓ/d
Street		4.3						
Totals	345	14.5						
Sub-total Average Annual Daily Demand (AADD)							207.0	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							227.7	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							2.6	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	341.6	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	4.0	ℓ/s

The Fire flows are shown in the table below.

Table 4 Fire flow demands

RISK CLASSIFICATION	Total Fire Flow (l/s)	Duration of Fire flow (h)	Minimum Flow at one hydrant (l/s)
Low risk: Single residential housing	15	1	15

5.6 Water infrastructure proposed

The Setsoto Local Municipality is currently implemeting a project for upgrading of bulk water supply in Senekal. The project comprises of the following:

- The proposed construction of a 10.7 Mℓ/day capacity Central Water Treatment Works to be located in Senekal town next to the existing 5Mℓ reservoir, at GPS coordinates 28°19'13.84"S 27°37'45.37"E.
- The construction of a 500mm diameter bulk water transfer pipeline from the Cyferfrontein dam to the Senekal town Central WTW.
- The construction of a 11 Mℓ reservoir next to the existing 5Mℓ reservoir in Senekal town. The reservoir has been roofed and being finished.

Figure 18 Reservoir 11 Mℓ under construction sign board

Figure 19 Proposed Central WTW site

The pipeline part of the project is under implementation. This project will ensure that water supply to the Senekal water scheme is largely improved.

Since the proposed Matwabeng township is within this water scheme, more reliable water services are expected on completion of the water scheme project.

The proposed township will hence be connected to the existing internal reticulation of Matwabeng.

Figure 20 Water tap-off proposed

6 SEWER SERVICE

6.1 Existing wastewater treatment plant

The Senekal town is serviced by the following WWTW's:

- Senekal WWTW, GPS 28°19'0.30"S 27°36'14.26"E. The facility is an activated sludge plant. The design capacity of the WWTW is 3 Mℓ/day.
- Matwabeng oxidation ponds, GPS 28°20'20.82"S 27°37'7.68"E. The design capacity of the ponds is 1.5 Mℓ/day.

The actual sewer flows at the WWTW's are yet to be established.

The plant treats the wastewater generates from the town, covering business, industrial and domestic.

Figure 21 WasteWater Treatment Works (WWTW)

6.2 Bulk sewer

Sewer bulklines in the town flow to the existing wastewater treatment works. The proposed development is within the sewer basin of the sewerage of the town.

Currently in the vicinity of site, there is an ongoing project for the following:

- Sewer sump and pumpstation.
- 200mm diameter sewer pumping main.
- Manhole for gravity flow from the sewer pumping main
- 315mm diameter gravity sewer pipeline.

Figure 22 Sewer project

Figure 23 Sewer sump and pumpstation under construction

Figure 24 Manhole for gravity under construction

6.3 Sewer flows

The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 5 Sewer design flow

Land Use	**No. of Erven**	**Area (Ha)**	**Water Demand**		**Sewer Return**	**Sewer Flow**	
Residential (Residential)	345	10.20	207.0	kℓ/d	85%	176.0	kℓ/d
Street		4.30		kℓ/d	85%	0	kℓ/d
Totals							
Sub-total Sewer ADWF						**176.0**	**kℓ/d**
15% Extraneous flow						26.4	kℓ/d
Gross Sewer						202.3	kℓ/d
Gross Sewer Flow						2.3	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						5.9	ℓ/s

The new development will have an estimated sewer ADWF of 176kℓ/d and a gross sewer flow of 202.3kℓ/d.

6.4 Sewer reticulation

The adjacent properties are currently serviced by an existing sewer pipeline. The sewer diameter and capacity is yet to be established.
See the survey extract below showing the existing sewer reticulation.

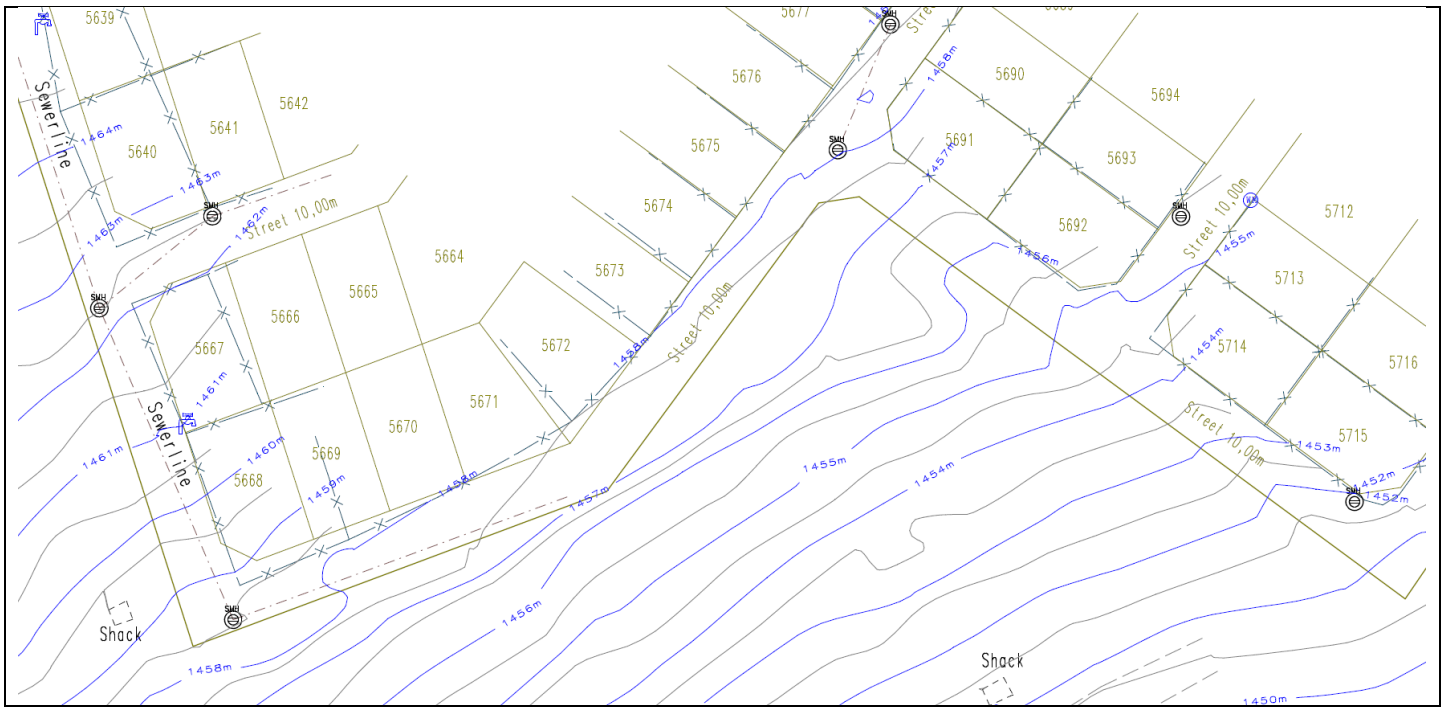

Figure 25 Sewer line existing

6.5 Sewer proposed

The township is to have a sewer reticulation. The lowest positioned stands in the proposed township.

A 500m long sewer outfall will have to start from the stands with the lowest elevation and conveyed to the sewer pumpstation under construction currently.

7 ELECTRICITY

There is existing electricity supply infrastructure in the town and adjacent to the site. This can be utilised to supply the development, subject to approval from the power authority.

8 TOWNSHIP ROADS

There is an existing functioning road network that can be used to access the proposed development.

Figure 26 Gravel road internal street

Figure 27 Block paved main street access

The road infrastructure to internally service the development will be the standards of the Red Book, TMH, TRH books and the local municipality.

8.1 Classification of roads

Table 6 Classification of roads

Description	**Class no.**	**Function**	**Reserve width**	**Roadway width**
Access Road	5d	Access from existing bounding road	16m	7.4m
Internal Service Road	5f	Internal Road	13	6m
Internal Service Road	5f	Internal Road	10	6m

8.2 Geometric Design Standards

Table 7 Class 5d – Access road

Design speed	60km/h
Minimum centre line radii	50m
Minimum gradient	0.5%
Favoured maximum gradient	10%
Maximum grade/grade length	12.5% over 70m
Maximum K-value : Crest	16
: Sag	16

Table 8 Class 5f – Internal roads

Design speed	30km/h
Minimum centre line radii	30m
Minimum gradient	0.5%
Favoured maximum gradient	12%
Maximum grade/grade length	16% over 50m
Maximum K-value : Crest	6
: Sag	8

8.3 Pavement Design

The proposed pavement designs are based on anticipated traffic volumes and ground conditions, a detailed pavement design will require a geotechnical centreline investigation report.

The table below shows the proposed pavement design for the development.

Table 9 Proposed pavement design

Design	Description
Pavement	25mm Premix Asphalt / 80mm paving
Base	150mm Thick natural gravel stabilised with Cement to create C4 material compacted to 97% of Mod AASHTO
Subbase	150mm Thick natural gravel G7 material compacted to 97% of Mod AASHTO
Upper Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Lower Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Roadbed & Fill (where required)	150mm Thick layers compacted to 90% of Mod AASHTO Density. Minimum CBR= 3 at 90% of Mod AASHTO Density- G9

9 STORMWATER DRAINAGE

The town has a functioning stormwater system. Stormwater generated onsite can be channelled to follows the natural slope of the ground, to the lowest point. It is envisioned to use Sustainable Urban Drainage Systems (SuDS) to manage stormwater runoff from the site. A stormwater management plan will need to be submitted to the municipality before construction starts. Extraneous stormwater from above the site will be accommodated over the site.

9.1 Stormwater systems

Stormwater runoff onsite will be handled through an internal stormwater system that will be provided to drain the site in a safe and efficient way. It is proposed to make use of SuDS to manage the stormwater runoff before being discharged into the natural water courses. The stormwater can be discharged into the Sandsloot river.

Stormwater discharge control will be applied in order to reduce the damaging effect of the increase in runoff due to densification.

9.2 Hydrology

The hydrological data used in the design of the stormwater drainage system is shown in the table below.

Table 10 Hydrological data

Hydrological Data	
a) Flood return period	1: 2 years for storm water pipe system. 1: 5 years for the combined storm water Pipe and road systems
b) Average yearly rainfall	600mm
c) Minimum time of concentration and run	As per Local Municipality Guidelines
d) Design Method	Rational method

9.3 Design Standards

The table below lists the standards to be used in the design of the stormwater drainage system:

Table 11 Stormwater design standard

Design Element	**Specification**
a) Minimum pipe size	600 concrete
b) Minimum pipe gradient	0.67%
c) Storm water details	Local Municipal Standard Details

10 SOLID WASTE

A regional landfill situated nearest the site is to be used to dispose solid waste. The local municipality is responsible for connecting and disposing the solid waste. If the municipality is not able to provide this service, then a private company will need to be appointed by the development owners for the service.

A refuse area with bins will be done onsite and solid waste will be disposed of at the municipal dump site as per the municipal health bylaws.

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

The solid waste generation range from 0.41 kg per capita per day in the poor areas, to 1.29 kg per capita per day.

The lower rate of 0.41kg/c/d was adopted for the township. Solid waste will be generated by the development.

Population estimate = 345 residential units x 4 people per unit = 1380 people

- Solid waste = 0.41kg/per person/day or (0.41kgx365 days)
- Waste generated per day = 0.41x 1380 = 566kg = 0.57 tonne
- Waste generated per annum = 0.57x365 = 207 tonne

11 CONCLUSION

The proposed development will contribute towards improving the service delivery of the area and general livelihood of the residents.

Signature:

Signed by: Litmos Mthunzi
PR No.: ECSA 201770075
For Dalimede Projects (PTY) Ltd

ANNEXURES

ANNEXURE 1 Layout Plan