KURUMAN ERF 4440

Engineering Services Report

Investigation of the available and required civil and electrical services for the development of Erf 4440, Kuruman

November 2020

Prepared for:
MACROPLAN

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EXECUTIVE SUMMARY

Engineering services were assessed to determine spare capacity on the existing infrastructure and compared to the estimated demand of the newly proposed Erf 4440 development.

The findings and conclusions in this report are based on a preliminary desktop study, relying on the information received from a previous master plan conducted in November 2019 for the municipality, as well as site visits.

The engineering services report includes the following categories:

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

After investigating the infrastructure, it was found that all the internal services are in place to accommodate the development of Erf 4440. A summary of the services for each category is provided below:

Water Infrastructure

- Two water lines run next to the development, a 50mm pipe to the western side and 110mm pipe to the north. It is recommended that a connection be made on the 110mm pipe (with the approval by the municipality).

Sewer Infrastructure

- There are no sewer lines running directly next to the site. The closest point for connection is in Seodin Street, to the west of the site (see Figure 6). A 160mm diameter line will therefore have to be constructed (with the approval by the municipality).
- Another Option for connection is also presented in the report

Stormwater Infrastructure

- On-site stormwater attenuation is recommended.
- Additionally, the construction of a stormwater berm on the high side of the development is also recommended.

Electrical Infrastructure

- Existing Medium- and Low Voltage (MV and LV) overhead lines and run through the property. There is also a transformer feeding the street lights on the property. From the development layout provided by the client (see Figure 1), no re-routing of these lines is needed. However, if the rest of the property is to be developed or the there are changes to the layout, the overhead lines and transformer might have to be relocated.
- The existing feeder can easily handle the future additional 150kVA.

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1. INTRODUCTION

1.1 Terms of Reference

I. BVI Consulting Engineers was appointed by Macroplan to undertake this engineering services study (Water, Sewer, Electricity and Roads & Storm Water) for the proposed development of Erf 4440, located in the area of Kuruman, within the jurisdiction of the Ga-Segonyana Local Municipality.

1.2 Scope

I. The purpose of the Engineering Services Investigation is to determine the availability and capacity of existing internal civil and electrical services with a view to servicing the proposed development.

II. This report presents the findings of a high-level 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.

III. A recent fire has burnt the Kuruman municipal offices down and along with it civil infrastructure as-built information. As a result, this report relies heavily on the findings of a master plan compiled for the municipality in November 2019 by GLS. Ga-Segonyana Local Municipality has given permission to BVi Consulting Engineers to use the master plan for this study.

IV. The scope of this report excludes bulk civil infrastructure (water and waste water treatment plants, reservoirs, elevated towers, etc.) and distribution systems to reservoirs and any infrastructure upstream of the reservoirs. It also excludes any bulk storm water systems, including major underground systems and attenuation ponds.

1.3 Site Location

I. The site is situated on the corner of Seodin Road and Cunningham Avenue in Kuruman, Northern Cape,

II. The site is located at the following co-ordinates: 27°27'07" S; 23°26'12" E.

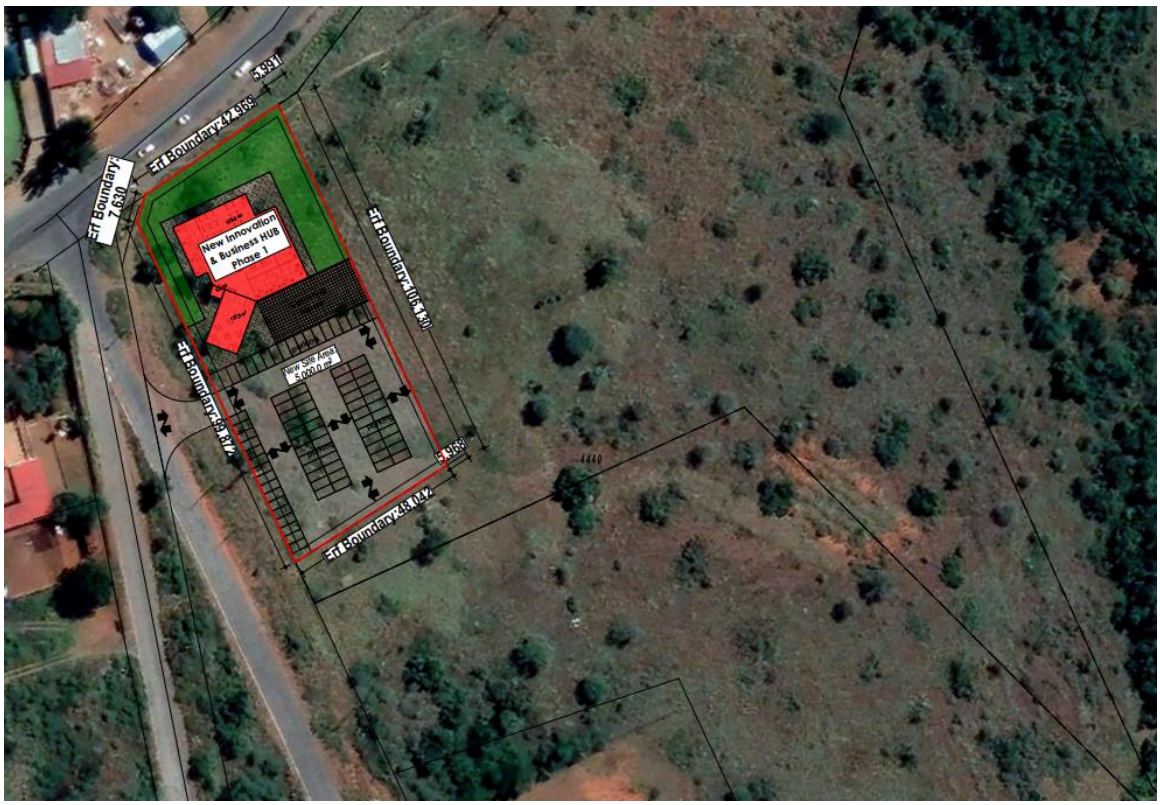

Figure 1: Erf 4440 Locality Plan

2. TOPOGRAPHY

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

- Ground cover consists mostly of grass cover;
- Topographically, the site slopes from east to west.

3. WATER SUPPLY

3.1 Existing Water Infrastructure

Overview

The water infrastructure of Kuruman relevant to Erf 4440 can be summarised as follows:

- Four boreholes supplying water to the Kuruman Reservoir;
- 250mm to 450mm diameter raw water supply lines between the boreholes and the reservoir;
- A 6 ML storage reservoir (Kuruman Reservoir);
- Two elevated towers, both 62 kL;
- A reticulation system with pipe diameters ranging from 50mm to 450mm.

This report will only consider the internal reticulation system.

Reticulation System

The water is circulated through the water supply network via pipes ranging from 50mm to 450mm diameter.

Figures 2 and 3 show the existing water reticulation system layout for Kuruman.

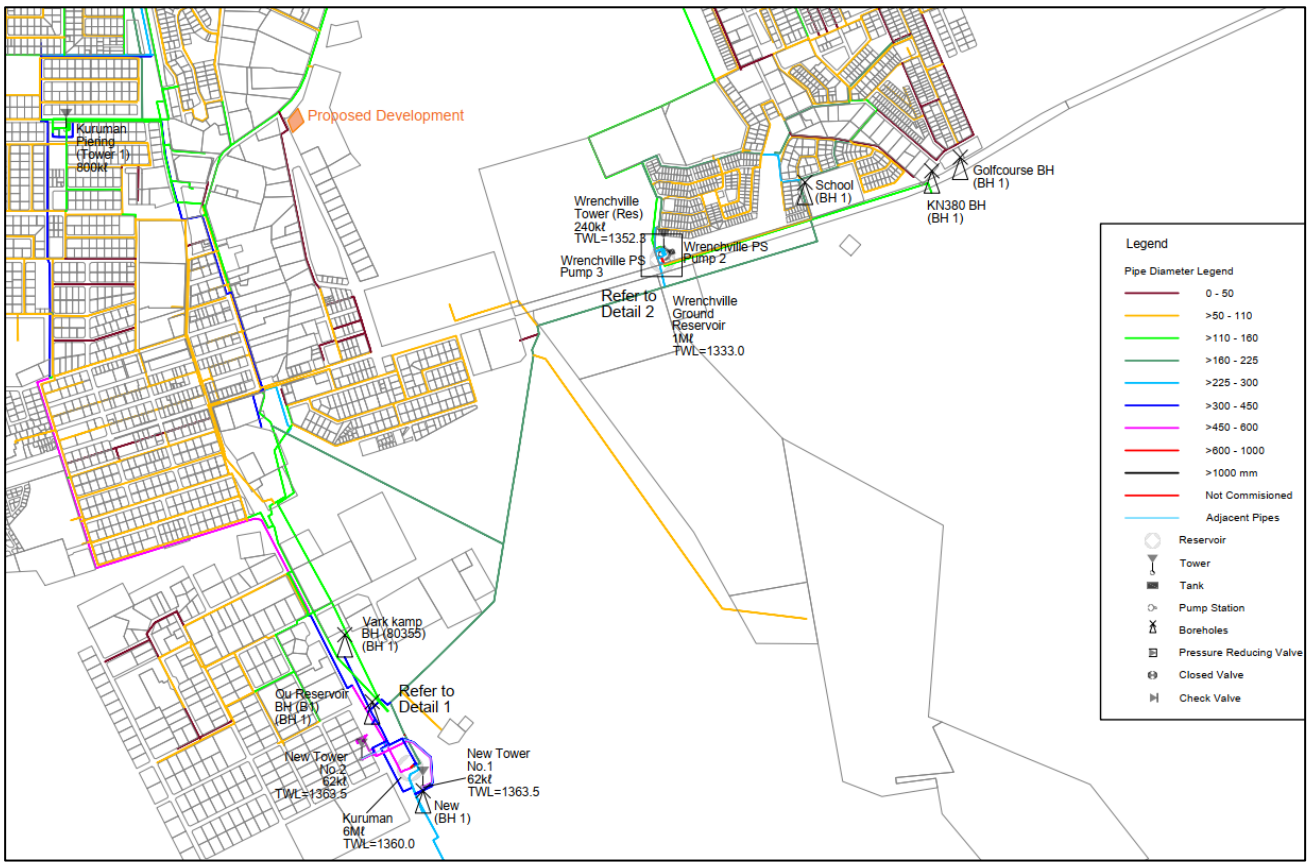

Figure 2: Existing Water Reticulation (Overview)

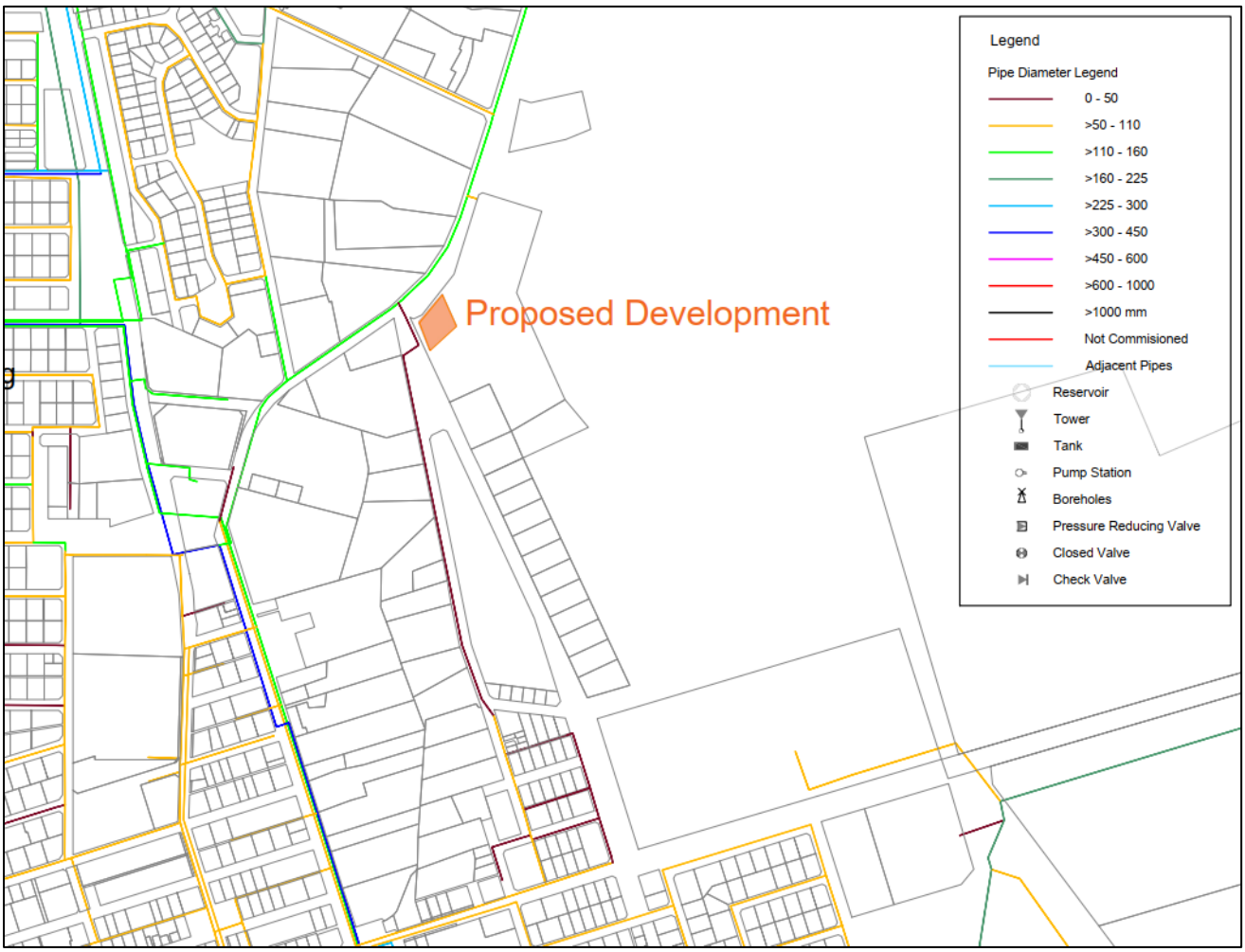

Figure 3: Existing Water Reticulation

3.2 Existing Capacity

The existing capacity on the water reticulation was obtained from the November 2019 GLSM report. It was assumed for this study that the capacities are accurate and that no additional demands have been added to the system since the compiling of the 2019 GLSM report.

Two water lines are present next to the proposed site location, shown in Figure 3 above, one in Seodin Road and one in Cunningham Avenue. The sizes and capacities are shown in the table below.

Water Reticulation Pipes Next to Erf 4440

Description	Ø Size* (mm)	Velocity (m/s)	Static Pressure (m)	Residual Pressure (m)
Seodin Road	110-160	< 1	40-50	16-25
Cunningham Avenue	50	< 1	40-50	16-25

*For Seodin Road, the pipe size was assumed to be 110mm in diameter.

3.3 Development Water Demands

The future demands for the proposed development was estimated using the Neighborhood Planning and Design Guidelines, 2019. The land use was taken to be that of a business/commercial site.

A Peak Flow Factor (PF) of 3.3 was used, which corresponds to a typical business or commercial type stand.

The table below shows the summary of the estimated water demands:

Land Use	Measured per	AADD (kL/d)	Peak Flow (l/s)
Business/Commercial	Ha	2.1	1.54
Business/Commercial	unit	0.65	0.6

The more conservative value of 1.54 l/s was assumed to be the future Peak Flow of the site.

3.4 Water Reticulation Requirements

The current capacities of the existing pipe lines were determined by assuming a velocity of 1 m/s (from the 2019 GSLM report) and calculating the flow using the *volumetric flow rate* formula. The total capacity was determined by assuming a maximum capacity of 1.5 m/s (from the Neighborhood Planning and Design Guideline, 2019) and applying the same formula.

For a more detailed account of the development's effect on the existing water reticulation system, a detailed model of the entire system will have to be computed, which is outside the scope of this report. The existing available pressures on the system are adequate and the development is unlikely to affect the residual pressure substantially.

The table below compares the current infrastructure capacities with the required capacity for the development. Cells highlighted in red indicate that the infrastructure will not be able to accommodate the expected demands.

Water Infrastructure	Total Capacity (l/s)	Existing Required (l/s)	Future Required (l/s)
Seodin Road Pipeline	14.25	9.50	11.04
Cunningham Avenue Pipeline	2.95	1.96	3.50

The recommended connection point for the proposed development is on the water pipeline running through Seodin Road. The development is unlikely to have any major effect on the current system and should be able to connect to the existing system without any problems.

Connecting to the municipal water reticulation remains subject to approval by the municipality.

Fire Fighting Requirements

Areas to be protected by a fire service should be classified according to a fire-risk category. The proposed development can be classified as a “Moderate Risk 1” according to the “Neighborhood Planning and Design Guidelines, 2019”.

Firefighting requirements are specified as 50 l/s (two hydrants, 25 l/s each) and 15m pressure at each hydrant. Hydrants should be located at convenient points within 100m of the site, 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.

From the information available, it is unlikely that the municipal water reticulation will be able to provide the above specified requirements. It is therefore recommended that the on-site fire fighting requirements are met, as specified in the relevant building codes. This will typically be in the form of an on-site booster pump

For a more detailed analysis of the development’s effect on the existing water reticulation system, a complete model of the entire system will have to be analysed, which is outside the scope of this report.

4. SEWERAGE

4.1 Existing Sewage Infrastructure

Overview

The sewer infrastructure of Kuruman relevant to Erf 4440 can be summarised as follows:

- One Waste Water Treatment Works (WWTW);
- 12 Pump Systems within the whole system, with only one, Barnard Street pump station, being relevant to Erf 4440;
- A system of pipes gravitating to the various pump stations before being pumped via rising mains towards the WWTW.

This report will only consider the internal sewer network.

Internal Sewer Network

The sewer network relevant to Erf 4440 comprises of pipes from 160mm to 450mm in diameter, draining to the Baranard Street pump station.The pump station has a current capacity of 50 l/s.

Figure 4 shows the existing sewer system layout for Kuruman

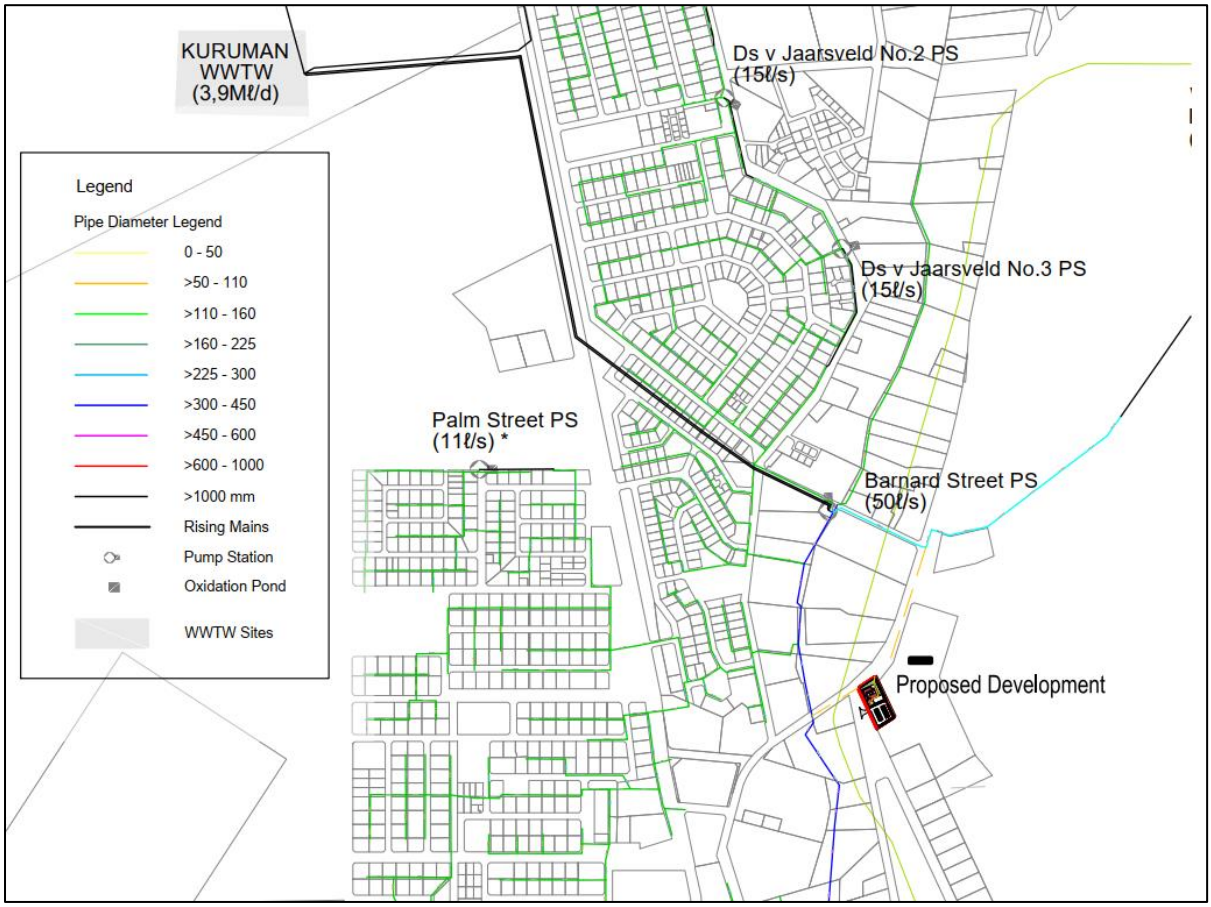

Figure 4: Existing Sewer Network (Overview)

Figure 5: Existing Sewer Network

4.2 Existing Capacity

No sewer lines are present directly next to the proposed site location, according to the information from the 2019 GSLM report. The closest sewer line is 450mm diameter Fibre Cement gravity line crossing Seodin Road, 120m to the west of the development (Option 2). Another option is to connect to a 300mm diameter PVC pipe in Baranard Avenue, 330m to north of the development (Option 1).

The sizes and capacities for both options are shown in the table below.

A conservative approach was followed assuming 45% spare capacity available and full flow velocity of 1 m/s for the 450mm diameter pipe and 2 m/s for the 300mm diameter pipe. The estimated current peak flow shown in the last column is the worst case, according information available.

Description	Relative Spare Capacity	Full Flow Velocity (m/s)	Estimated Current Peak Flow (l/s)
450mm Ø FC Pipe (Option 2)	> 45%	1 - 2	203
300mm Ø PVC Pipe (Option 1)	> 45%	2 - 3	40

4.3 Development Sewer Outflows

To estimate the sewage effluent generated by the development, the following assumptions were made:

The sewer flows were calculated assuming 80% of the AADD water consumption, as calculated in Section 3.3 and described in the *Neighborhood Planning and Design Guide*.

A peak day factor of 1.5 was used for the estimate.

Description	ADWWF (l/s)	Peak Flow (l/s)
Erf 4440 (Business/Commercial)	0.37	0.56

Business development peak flows are unlikely to correspond to normal residential peak flows and are therefore not generally added to a residential network when analysing the capacity. By adding the proposed development's flow to the system peak flow, a conservative approach is being followed.

4.4 Sewer Infrastructure Requirements

Adding the generated flow from the proposed development to the current estimated peak flows, the spare capacity available decreases from 45% to between 44.2 and 44.8% for each option, which is more than the recommended minimum spare capacity of 30%. No upgrading to the existing internal network will be required with regards to capacity and the development can theoretically connect to either options.

In order to connect to the network, a new sewer line will have to be constructed.

It is recommended that the installed line should be a 160mm nominal diameter pipe to reduce the risk of blockages and to make provision for other stands that might want to connect to the line in future. uPVC pipes are recommended.

Two options were presented for possible connection points. The recommended connection point is the sewer line crossing Seodin Road (Option 2), due to the shorter pipe length required. Any connections to the municipal sewer system remain subject to approval by the municipality.

Figure 6 below indicates the position of the two possible connection points.

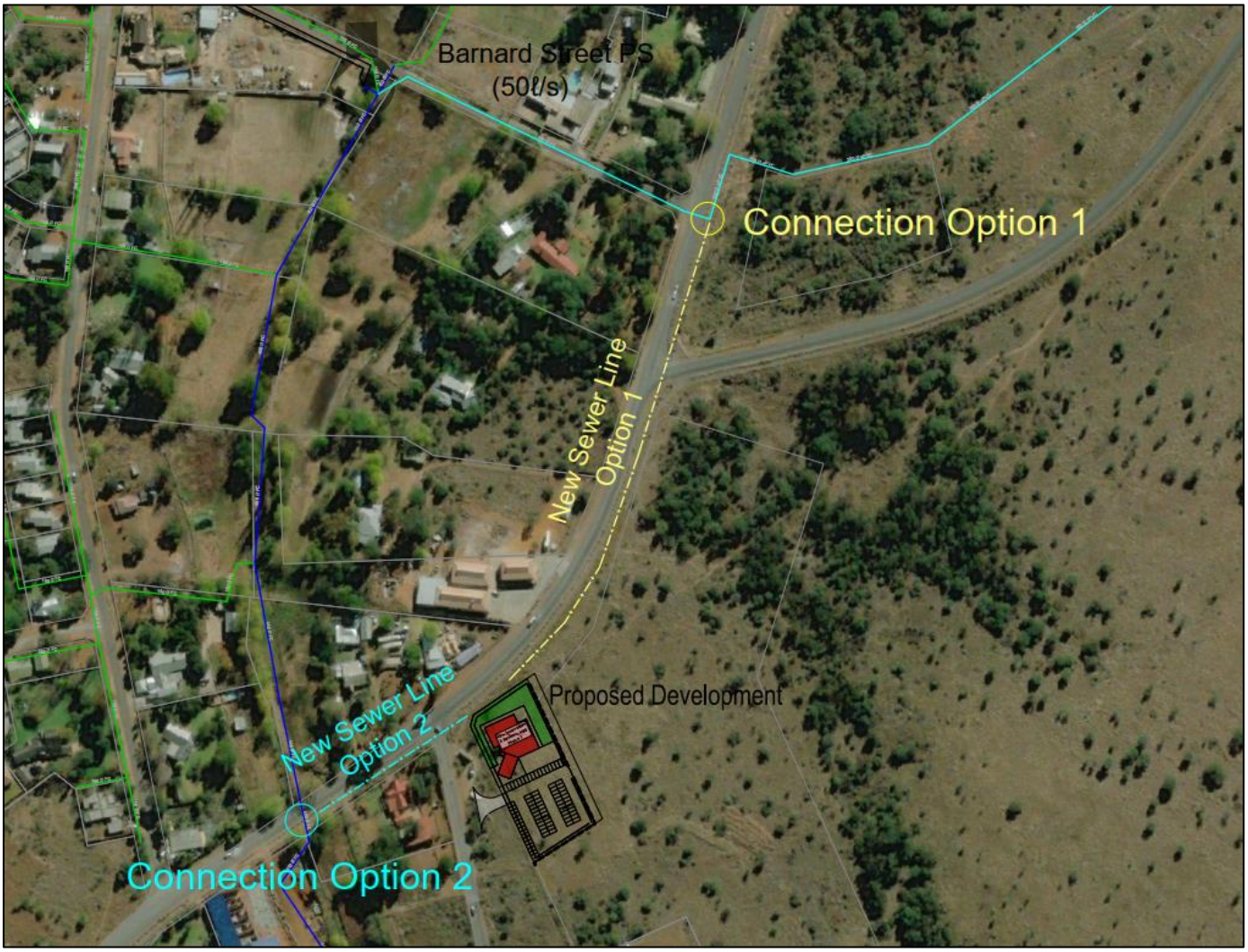

Figure 6: Possible Sewer Connection Points

5. ROADS AND STORMWATER

5.1 Roads and Access

The development borders on twp existing Residential Collector Streets (Class 4b), as listed below:

- Seodin Road
- Cunningham Avenue (Access to development from this road)

Refer to Traffic Impact Assessment for further detail regarding access to the site.

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 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. Although the Flood Delineation Report indicates that flooding from the 1:100 flood is unlikely, a storm water berm on the high side of the site development would be prudent due to the topology of the site which slopes towards the development. 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.

Areas of erosion should be identified at detail design stage of the storm water system and suitable erosion protection (lined channels, grass blocks, 'Hyson cells' etc.) measures implemented.

6. ELECTRICAL SUPPLY

6.1 Electrical Demands and Availability

This section of the report covers the availability of the Bulk Electrical connection to the development (Portion A) only. An expected additional load for the proposed office block will initially be 200 KVA. The development area falls directly under the Local Municipality.

The table below shows the summary of the estimated electrical demands for the proposed office block to be constructed on Erf 4440:

Load Description	Unit (kW)
Lighting & S.S.O's	30
HVAC	60
Total	**90**

6.2 Existing Electrical Network

There is currently a section of the town's medium voltage electrical network (a 11 KV overhead line) that runs through the property which connects to a 16 KVA 11kV/420V pole mounted transformer. The transformer supplies a 420V ABC overhead line for street lighting.

The existing feeder can easily handle the future additional 150kVA.

6.3 Proposed Electrical Network Changes

Existing Medium- and Low Voltage (MV and LV) overhead lines and run through the property. There is also a transformer feeding the street lights on the property. From the development layout provided by the client (see Figure 1), no re-routing of these lines is needed.

However, if the rest of the property is to be developed or the there are changes to the layout, the overhead lines and transformer might have to be relocated.