



OUTLINE SCHEME REPORT IN SUPPORT OF THE PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

JB MARKS LOCAL MUNICIPALITY



OUTLINE SCHEME REPORT OCTOBER 2025

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Quality Control

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Certification

It is herewith certified that this Outline Scheme Report has been prepared according to requirements of the Neighbourhood Planning and Design Guide as well as the design requirements of the JB Marks Local Municipality.

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Contents

1	Introduction	7
1.1	Purpose of Report	7
1.2	Background	8
2	Site Description	9
2.1	Location	9
2.2	Extent of Development	11
2.3	Terrain	12
2.4	Climate	12
3	Information Available	13
3.1	Architect's Layout	13
3.2	Topographic Survey	13
3.3	Traffic Impact Assessment	13
4	Design Methodology and Standards	14
4.1	Bulk Earthworks	14
4.1.1	Existing Ground Conditions	14
4.1.2	Site Location & Topography	14
4.1.3	Site Geology & Soils	14
4.1.4	Surface soils:	14
4.1.5	Hydrogeology & Groundwater	15
4.1.6	Karst, Sinkholes & Stability Risks	15
4.1.7	Climate & Ground Conditions	15
4.1.8	Summary of the Aquatic Study Report	16
4.1.9	Design Standards	17
4.2	Roads	18
4.2.1	Proposed Access Road	18
4.2.2	Stormwater	18
4.2.3	Existing Information	18
4.2.4	Design Standards	18
4.2.5	Hydrology	19
4.2.6	Estimated Stormwater Runoff	19
4.2.7	Proposed Stormwater System	21
4.3	Water Supply	22
4.3.1	Water Ownership & Institutional Context	22
4.3.2	Raw Water Sources & Catchment Hydrology	22



4.3.3 Water Network (Treatment, Storage & Distribution)	23
4.3.4 Water Treatment Works	23
4.3.5 Reservoirs & Pumping Stations	23
4.3.6 Water Pumping Stations	24
4.3.7 Storage Facilities	24
4.3.8 Design Standards	24
4.3.9 Estimated Water Demand	26
4.3.10 Water Supply Demand	27
4.4 Proposed Fire Services	28
4.4.1 Fire Flow and Pressure	28
4.4.2 Fire Hydrants	28
4.4.3 Fire Hose Reels	28
4.4.4 Fire Pipe Size and Material	28
4.4.5 Fire Flow Storage	28
4.5 Sewerage	29
4.5.1 Existing Information	29
4.5.2 Design Standards	32
4.5.3 Estimated Sewerage Demand	33
4.5.4 Sewer System	34
5 Conclusions and Recommendations	35
6 References	38



List of Figures

Figure 1: Locality plan	9
Figure 2: Aerial image of the site	10
Figure 3: Flood Hydrograph for the 1:50 Year Return Period Storm for Catchment A.	20
Figure 4: Flood Hydrograph for the 1:50 Year Return Period Storm Catchment B.	21
Figure 5: Water Reticulation in relation to the proposed development.	27
Figure 6: Existing Pump station near the site.	31

List of Tables

Table 1: Rational method summary of factors and variables Catchment	19
Table 2: Summary of Detention Required for Catchment A	19
Table 3: Water design Standards.....	25
Table 4: Estimated water demand for Farm Elandsheuwel 436 IQ	26
Table 5: Fire Flow Demand for Farm Elandsheuwel 436 IQ.....	28
Table 6: Sewer design standards.....	32
Table 7: Estimated sewer demand for Farm Elandsheuwel 436 IQ	33
Table 8: Summary of investigation and information required	35



Appendix A

- Civil Engineering Services Drawings

Appendix B

- Site Development Plan

Appendix C

- Traffic Impact Assessment

Appendix D

- Survey

Appendix E

- Aquatic Study Report for the Grimbeek Park Township Establishment Project

Appendix F

- JB Marks Water and Sewer Master Plan



1 Introduction

1.1 PURPOSE OF REPORT

CHRISEN CONSULTING (PTY) LTD Civils Engineers has been appointed by to undertake an Outline Scheme Report (OSR) in support the Proposed Township Establishment on the Remaining Extent of Portion 46, Portion 58 And 59 of the Farm Elandsheuwel 436. The site is located near Grimbeek Park area, southwestern of R53 and falls within the JB Marks Local Municipality area of jurisdiction.

Farm Elandsheuwel 436 is currently zoned as "Business 1", comprising of an extent of 85,2225 hectares and is currently vacant land. The site is surrounded by residential land uses to the north and vacant land to the south, west and east. The intention of the client is to establish a township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ which will comprises of a mixed-use development that consists of "Residential 1," "Residential 2," "Residential 3," "Institutional," "Business 1," "Business 2," "Municipal," "Public Open Space" and "Public Roads" land uses.

The purpose of this services report is to address the full scope of works required for Civil Engineering Services for the Proposed Rezoning/Formalization of Remaining Extent of Portion 46, Portion 58 And 59 of the Farm Elandsheuwel 436. This report will address and provide input on the following:

- Proposed Sewer
- Proposed Stormwater
- Proposed Water
- Assumptions made
- Design methodology and standards to be followed



1.2 BACKGROUND

The project entails the development of the Proposed Township Establishment on Holding 436 of Elandsheuwel (hereinafter referred to as “the site”). The site has an extent of approximately 85,2225 hectares and is currently vacant. Holding 436 Elandsheuwel is located within the JB Marks Local Municipality area of jurisdiction. The intention of the client is to establish a township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ. *CHRISEN CONSULTING (PTY) LTD* Civil Engineers will undertake the provision of infrastructure services including bulk earthworks, roads, sewer, water and stormwater.



2 Site Description

2.1 LOCATION

The aerial picture below depicts the site location and immediate surrounds. The site co-ordinates are Latitude: 26°44'2.56"S and Longitude: 27°6'28.27"E. The site locality plan is illustrated on **Figures 1**.



Figure 1: Locality plan



Figure 2: Aerial image of the site



2.2 EXTENT OF DEVELOPMENT

Farm Elandsheuwel 436 has a site area of 852 015 m² and is located on the south-west of Grimbeek Park in and falls under the JB Marks Local Municipality area of jurisdiction. The intention of the client is to establish a Township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ which comprises of the following:

- Site Extent = 85,2225 ha
 - Residential 1
 - Single Dwelling Units = 409 units
 - Residential 2
 - Townhouse = 119 units
 - Residential 3
 - Flats = 737 units
 - Institutional
 - Creche / Day Care Centre = 100 Students
 - Place of Worship = 100 Seats
 - Primary School = 700 students
 - Secondary School = 600 Students
 - Business 1
 - Shops = 1500 m²
 - Business 2
 - Medical Centre = 3000 m²
 - Municipal
 - Multipurpose Centre = 3700 m²
 - Public Open Space
 - Public Roads



2.3 TERRAIN

The site is moderately sloped with gradients varying between 1.2% to 2% and 0.98% to 2%. The site has two catchments; catchment A naturally drains easterly and catchment B naturally drains westerly. The site is mostly covered with lightly grassed areas and a mix of significant bush.

2.4 CLIMATE

Farm Elandsheuwel 436, located in the JB Marks Local Municipality in North West Province, South Africa, experiences a semi-arid climate characterised by:

1. Hot summers:
 - Temperatures in summer (November to March) typically range from 26°C to 34°C, occasionally rising above 35°C.
 - Afternoon thunderstorms are common during this time, contributing the majority of the region's annual rainfall.
2. Mild to cool winters:
 - Winters (May to August) are dry and generally cool, with daytime temperatures ranging from 16°C to 23°C.
 - Night-time temperatures can fall to between 2°C and 7°C, and occasional light frost may occur.
3. Rainfall:
 - Most rainfall occurs during the summer months, with an annual average of around 450 to 600 mm.
 - Rain typically falls in short, intense thunderstorms.
4. Dry season:
 - The dry season spans from May to September, with little to no rainfall.

This climate supports Highveld vegetation, including grasslands and scattered shrubs. The region's climatic conditions are suitable for mixed farming, particularly livestock grazing and the cultivation of crops such as maize and sunflowers.



3 Information Available

3.1 ARCHITECT'S LAYOUT

The latest architectural layout for the Proposed Township Establishment on Holding 436 of Elandsheuwel (Drawing Number: Grim/001 Rev1) has been used to develop a preliminary design. No detailed plans, sections or elevations have been provided to date.

3.2 TOPOGRAPHIC SURVEY

A topographic survey has been provided by CDJ Land Surveyors. The survey includes contour information at 500 mm intervals. The survey also contains existing features, their location in the site, the existing infrastructures and levels as indicated in the Topographic Survey. The Topographic survey is attached as **Appendix E**.

3.3 TRAFFIC IMPACT ASSESSMENT

CHRISEN CONSULTING (PTY) LTD Traffic and Transportation Engineers undertook a Traffic Impact Assessment dated 19 June 2025 which covered the following:

- Evaluation of the impact of the development on the adjacent road network.
- Site access, including ingress and egress lane configuration.
- Access configuration.
- Comment on existing traffic conditions.
- Address pedestrian activities.
- Assess public transport facilities along the road network within the proposed township.
- Identify possible mitigation measures to address concerns and improve road user safety for pedestrians, public transport facilities, and private vehicle users.
- Conclusions and Recommendations

Refer to the **Traffic Impact Assessment** attached as **Appendix C**.



4 Design Methodology and Standards

4.1 BULK EARTHWORKS

4.1.1 Existing Ground Conditions

4.1.2 Site Location & Topography

- Coordinates place the site just west of central Potchefstroom, within the Mooi River basin
- Elevation: approximately 1,340 m above sea level.
- Terrain: gently sloping towards the Mooi River, with gradients likely between 2–5%, typical of the local river valley morphology.

4.1.3 Site Geology & Soils

- Underlying geological formations:
 - The site is situated on the Transvaal Supergroup rocks—Witwatersrand & Ventersdorp systems—and local granites (Roodekraal Igneous Complex)
 - Immediately below lies the Boskop–Turffontein dolomite compartment, part of a larger dolomitic aquifer system [en.wikipedia.org+1repository.nwu.ac.za+1](https://en.wikipedia.org/wiki/Boskop-Turffontein_dolomite_compartment).
 - Historic studies confirm igneous outcrops (norite, granite) in the district.

4.1.4 Surface soils:

- Residual soils atop bedrock vary from sandy to clayey types, with patchy gravel—consistent with the diversity of parent rock materials [koedoe.co.za](https://www.koedoe.co.za).
- Dolomitic areas may feature shallow soil over karstified rock, impacting engineering design.



4.1.5 Hydrogeology & Groundwater

- Aquifers & water movement:
 - Fractured and karstic dolomite provides secondary groundwater storage; flow is primarily along fractures/cavities.
 - The nearby Gerhardminnebron spring discharges ~ 60,000–80,000 m³/day—highlighting a high-flow groundwater system en.wikipedia.org.
- Surface water & drainage:
 - Drainage trends towards the Mooi River, with potential subsurface linkage between perched zones and river-fed aquifers.
 - Stormwater infiltration and seasonal wetness may create perched water tables above less permeable strata.

4.1.6 Karst, Sinkholes & Stability Risks

- The dolomitic nature of local geology implies sinkhole hazard potential, especially where groundwater fluctuates (e.g. mining dewatering, heavy rainfall, irrigation).
- The Potchefstroom area has documented sinkhole risk due to gypsum/dolomite interactions—similar to those studied at Ikageng.

4.1.7 Climate & Ground Conditions

- Rainfall: Estimated mean annual precipitation 640–700 mm, mostly in summer thunderstorms (November–March) —common regional pattern.
- Ground response: Rain spikes can cause seepage and perched moisture zones, potentially reduce foundation-bearing capacity and require mitigation.

The finding presented in these sections was extracted from previous studies conducted in the area, a more detailed geotechnical study will need to be undertaken to determine all existing conditions prior to detail design be conducted.



4.1.8 Summary of the Aquatic Study Report

Executive Summary Key Points

- Location: The project site is located in the JB Marks Local Municipality, Potchefstroom, adjacent to the Mooi River and Loop Spruit.
- Purpose: The study assesses aquatic biodiversity, identifies wetlands, and evaluates ecological risks to inform township development planning.
- Date of Site Visit: 15 April 2025 (late summer assessment).
- Consultant: Africa Ecological Services, prepared by Mr. Munzhelele HE and reviewed by Mr. Mugwabana FH (SACNASP registered specialists).

Environmental and Ecological Context

Geology & Soils:

- The site is underlain by Diabase, a type of igneous rock.
- Soils: Rhodic Lixisols – red, well-drained loamy clays, with no hydric characteristic's indicative of wetland saturation.

Aquatic Features:

- No permanent wetlands identified.
- The area includes a floodplain with a delineated 50 m buffer zone.
- Main watercourses: Mooi River and Loop Spruit, both contributing to the Middle Vaal Water Management Area.

Vegetation & Biodiversity:

- Dominated by Rand Highveld Grassland.
- Vegetation disturbed by alien invasives, grazing, and veld fires.
- Aquatic flora includes species like *Sporobolus africanus* and *Typha capensis*.
- No sensitive aquatic fauna (frogs or birds of conservation concern) was recorded.
- Macroinvertebrates recorded are generalist species indicative of moderate water quality (e.g., water boatmen, midges, pond snails).



Ecological Condition Assessment

Present Ecological Status (PES):

- Mooi River: C/D Category → Moderately to largely modified, mostly from mining and agricultural runoff.

Ecological Importance and Sensitivity (EIS):

- The river and associated floodplain are considered to have moderate to high ecological importance.
- The floodplain functions as an Ecological Support Area (ESA 2) requiring protection.

Key Impacts & Risks

Construction and Operational Impacts:

- Risks: Waste dumping, erosion, floodplain encroachment, and stormwater runoff impacts.
- Permanent wetlands absent, but floodplain is vulnerable to degradation from unregulated development.
- Mitigation Measures:
 1. Enforce 50 m buffer zone from the floodplain.
 2. Prohibit any construction/sand mining within aquatic zones or buffers.
 3. Implement stormwater management using permeable surfaces and swales.
 4. Educate local communities about wetland and aquatic resource conservation.
 5. Enforce waste control and alien invasive removal.
- Final Recommendation

The site is suitable for development, provided that all mitigation and buffer measures are strictly implemented. The development must not encroach into identified no-go areas (floodplain and riparian buffer), and environmental monitoring should be maintained.

Refer to a copy of the **Aquatic Study Report for the Grimbeek Park Township Establishment Project** attached as **Appendix F**.

4.1.9 Design Standards

The design of Bulk Earthworks will be in accordance to SANS 1200 DM.



4.2 ROADS

4.2.1 Proposed Access Road

The Traffic Study provides a framework and ensures that the proposed development is sustainable from a traffic engineering point of view. The proposed development will have various access points off the external road network. The following access points will be provided:

- Herman Street Access: the proposed development will take access off this road approximately 800 m west of the intersection of Herman Street and Erica Street.

Refer to Drawings CC01 - CC02 illustrating the proposed access position.

Refer to a copy of the **Traffic Impact Assessment** attached as **Appendix C**.

4.2.2 Stormwater

4.2.3 Existing Information

There is no formal stormwater channels or pipes around the site but there are rivers on the east and west side of the development.

4.2.4 Design Standards

The basic principle which will be applied throughout the stormwater drainage design is that the natural flow direction of stormwater will not be unnecessarily altered. The use of stormwater channels will be utilised for on surface sheet flow of stormwater. The design will take cognisance of the following:

Bulk drainage is achieved by a network of grid inlets, catchpits and reticulation pipework. The proposed roadways shall be drained by catchpit inlets (Type S2, D3) situated at road edge. The forecourt area shall be drained by grid inlet manholes.

Bulk stormwater pipes shall be Spigot and Socket Concrete Pipes with rolling rubber rings to ensure watertightness. The intercepted flows are reticulated to a nearby river and then the allowed flow is then discharged to the existing stormwater network. For ease of maintenance the minimum concrete pipe size is 300 mm dia. The concrete pipe sizes vary from 300 mm dia. up to 600 mm dia. depending on the flow accumulation and the minimum requirements as set forth by the municipality.



4.2.5 Hydrology

Table 1: Rational method summary of factors and variables Catchment

RAIN STATION: Depth-Duration-Frequency			
Latitude, Longitude	26°44'S, 28°27'E		
Region	Inland		
MAP	626 mm		
Elevation	1323 msl		
Duration(minutes)	Rainfall (mm) per Return Period		
	5 Year	20 Year	50 Year
15	26	34.9	40.6
30	32.8	43.9	51.2
45	37.5	50.3	58.6
60	41.3	55.3	64.5
90	47.3	63.3	73.8

4.2.6 Estimated Stormwater Runoff

In order to estimate the envisaged stormwater runoff from the development, a calculation was carried out using the Rational Method. The site as a whole was split into 2 catchments, as can be seen in **Appendix B** and Peak flow rates were determined 20-year and 50-year storm return period. The table below shows the results of the calculations

Table 2: Summary of Detention Required for Catchment A

	Detention Volume Required Summary		
Return Period	1:5 year	1:20 year	1:50 year
Volume	3 433,867m ³	4 602,103m ³	6 007,266m ³
Flow Rate	3,608m ³ /s	4,837m ³ /s	5,633m ³ /s

The following hydrograph contrasts the pre and post development runoffs.

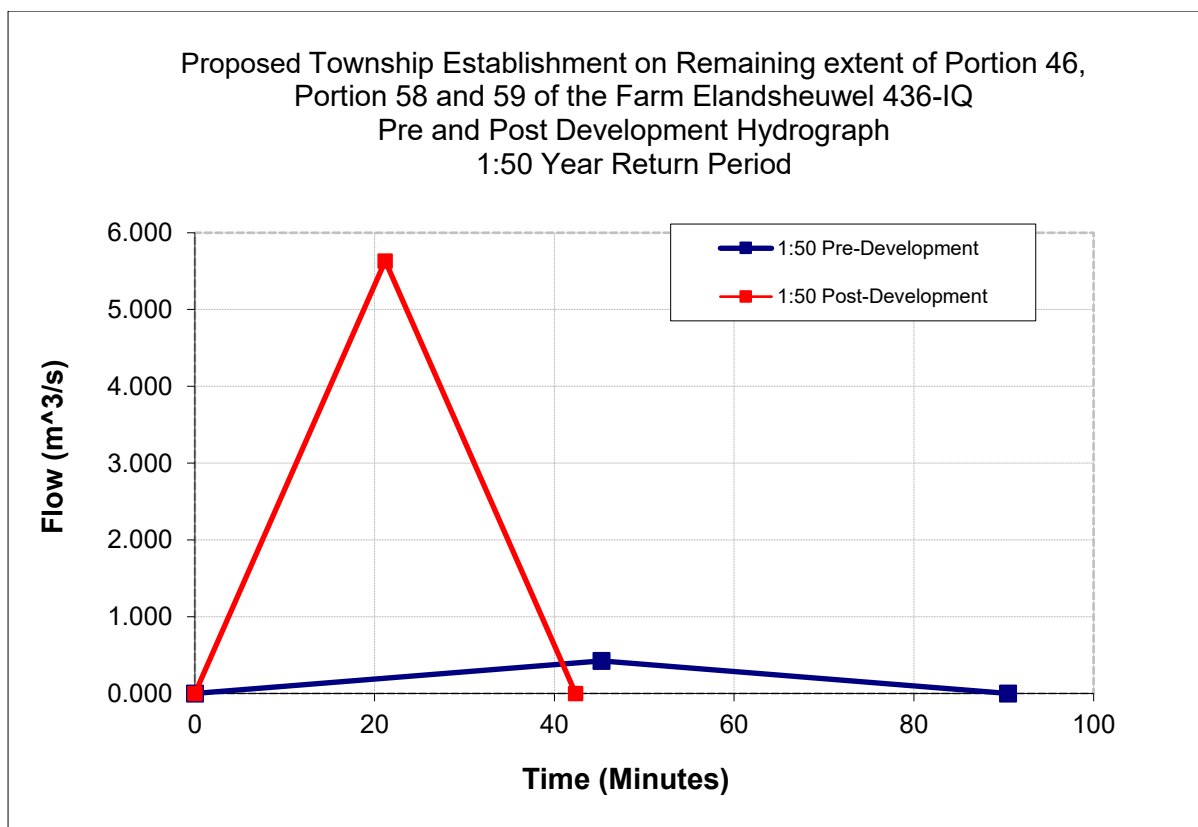


Figure 3: Flood Hydrograph for the 1:50 Year Return Period Storm for Catchment A.

The area by which the post development hydrograph exceeds the pre-development yields the attenuation volume required. From the above graph, in the 1:50 year rain event, **the minimum stormwater attenuation volume required = 6 007,266m³.**

Table 3: Summary of Detention Required for Catchment B

	Detention Volume Required Summary		
Return Period	1:5 year	1:20 year	1:50 year
Volume	6 802,634 m³	9 132,930m³	10 635,184m³
Flow Rate	3,991m³/s	5,352m³/s	6,236m³/s

The following hydrograph contrasts the pre and post development runoffs.

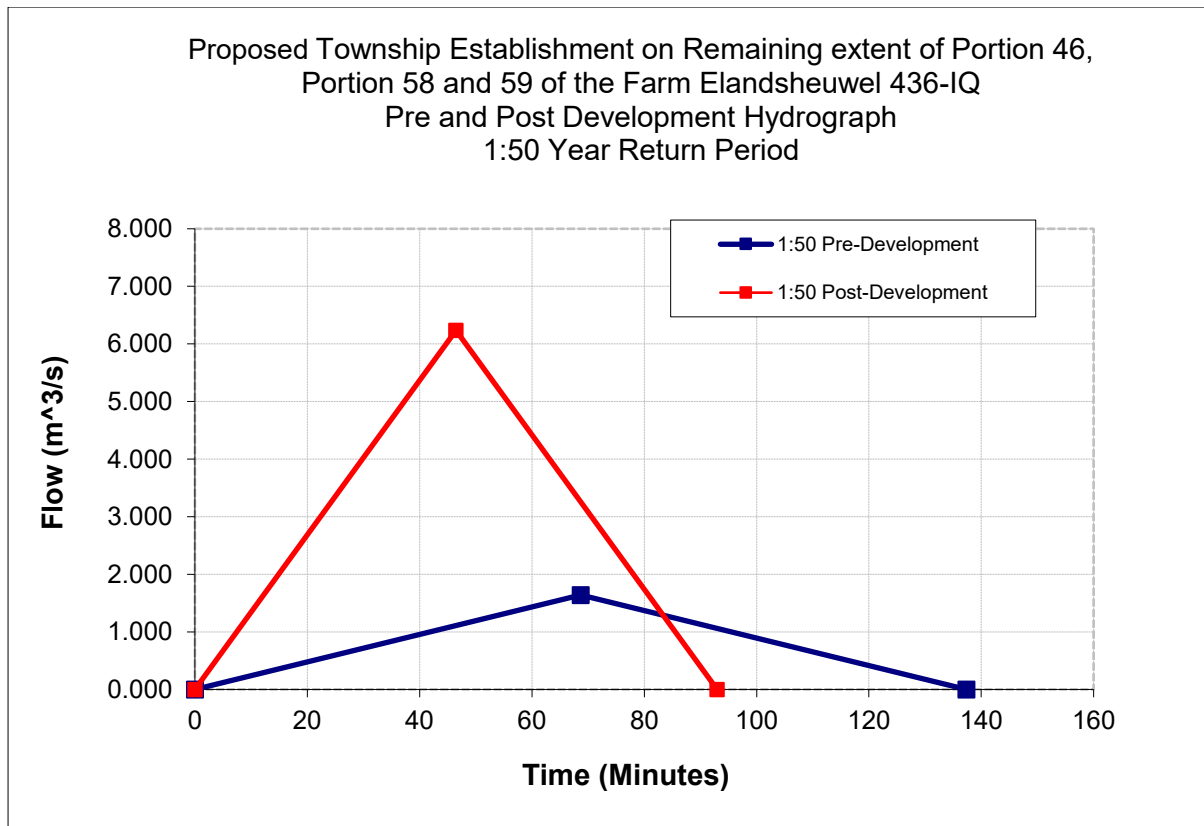


Figure 4: Flood Hydrograph for the 1:50 Year Return Period Storm Catchment B.

The area by which the post development hydrograph exceeds the pre-development yields the attenuation volume required. From the above graph, in the 1:50 year rain event, **the minimum stormwater attenuation volume required = 10 635,184m³.**

4.2.7 Proposed Stormwater System

Preliminary investigation has determined that the development will not require an attenuation pond because there is a river on the east and west of the development.

For larger plots, stormwater attenuation shall be provided at the lowest point of each site. The exact position and layout of these attenuation facilities will be confirmed upon submission of the final Site Development Plan (SDP). The proposed development consists of plots both smaller and larger than **4 000 m²**. In accordance with stormwater management guidelines, plots smaller than **4 000 m²** may discharge their stormwater runoff directly into the proposed stormwater line through kerb inlets or other approved junctions. Conversely, plots exceeding **4 000 m²** are required to provide **on-site attenuation facilities**, such as detention ponds or tanks, with **controlled outlet structures** to regulate discharge and ensure progressive release of runoff into the municipal system. This approach aligns with the principles outlined in the **CSIR Guidelines for Human Settlement Planning and Design (Red Book, 2019)** and the **Department of Water and**



Sanitation's (DWS) Urban Stormwater Management Framework (2018), which emphasize sustainable stormwater management and protection of downstream infrastructure

For the bigger plots, attenuation to be provided at the lowest point, position and final layout to be confirmed once final SDP is submitted.

Refer to the **Civil Engineering Services Drawing** attached as **Appendix A**.

4.3 WATER SUPPLY

4.3.1 Water Ownership & Institutional Context

The municipality serves both as the **Water Service Provider (WSP)** and **Water Service Authority (WSA)** for the area. As WSA, it is legally mandated to develop a **Water Service Development Plan (WSDP)** that ensures access to water services in an effective, efficient, affordable, and sustainable manner. The WSDP must align with higher-level water resource management strategies (e.g. catchment management plans) and integrate with the municipal Master Plan (Existing System Draft Report, 2016).

4.3.2 Raw Water Sources & Catchment Hydrology

Potchefstroom's primary source of raw water is the **Mooi River** system. The catchment includes major tributaries such as the **Wonderfontein Spruit** (north-eastern reach) and, to a lesser extent, the **Loop Spruit** (which joins downstream of the city).

Three key dams in the system store and regulate water:

- **Klerkskraal Dam** (~8 million m³)
- **Boskop Dam** (~21 million m³)
- **Potchefstroom Dam** (~2 million m³)

Groundwater and karst springs also contribute significantly. For example, **Gerhardminnebron** is a major spring in the region and yields between 60,000 and 80,000 m³/day.

From Boskop Dam, raw water is delivered via open, concreted **canals** along the banks of the river (West Bank and East Bank canals). The Western canal is the principal supply route to the potable water works, while the Eastern canal primarily supports agricultural irrigation further downstream.



Because the area is underlain by dolomitic (karst) geology, seepage, canal deterioration, and loss of water through fractures in the substrate are known concerns.

4.3.3 Water Network (Treatment, Storage & Distribution)

Potchefstroom's water system comprises:

- 2 raw-water abstraction pumping stations
- 2 Water Treatment Works (WTWs)
- 8 storage reservoirs
- 6 distribution pumping stations

4.3.4 Water Treatment Works

- **Lakeside WTW** (Phase 1 & 2) is the larger plant, with a theoretical capacity of 60 MI/day; actual capacity is estimated at 50–55 MI/day. Raw water is delivered via Ø450 mm and Ø250 mm lines in Phase 1, and Ø450 mm in Phase 2; treated water is delivered via Ø675 mm and Ø450 mm pumps to downstream reservoirs. (Master Plans – Existing System Draft Report, 2016)
- **Old WTW** (constructed 1924, expanded 1954) has a theoretical capacity of ~13.5 MI/day, though current capacity is somewhat lower. Its catchment sources and reticulation target north/central areas of the municipality.

4.3.5 Reservoirs & Pumping Stations

Water is stored in multiple reservoirs, which feed zones of the city:

- Vyfhoek Reservoirs
- Ventersdorp Road Reservoirs
- Other smaller reservoirs associated with pumping stations

Distribution pumping stations convey water through the network, controlling pressure, flow, and peak demand; raw water pumps supply the WTW, while distribution pumps move treated water into the reticulation zones.

The distribution network comprises pipes ranging from Ø50 mm up to Ø800 mm. The majority (≈ 88 %) is uPVC; older materials (e.g. asbestos-cement) remain, and are being gradually replaced. The total pipe length is given as 590,538.54 km.



For the proposed development, water will be supplied from the **Vyfhoek Reservoirs** to the Grimbreek Park (at high pressure), and from the Town Reservoir to the development's eastern side (lower pressure).

4.3.6 Water Pumping Stations

Raw water abstraction is handled by two primary pumping stations. On the distribution side, six pumping stations operate to manage pressurized delivery across zones: Ventersdorp PS, Vyfhoek PS, Ikageng PS, and others linked to the Lakeside WTW in its two phases.

4.3.7 Storage Facilities

The municipality uses eight storage reservoirs or reservoirs associated with pumping stations, collectively holding about **99.3 MI** of water. The storage facilities include:

- Vyfhoek Reservoirs
- Promosa Reservoirs
- Ikageng PS / Reservoirs
- Ikageng West Reservoirs
- Eersterantjies Reservoirs
- Mohadin Reservoirs
- Old WTW Reservoirs

4.3.8 Design Standards

The standards used in the design of the water, fire and sewer bulk services are the “Neighbourhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements, July 2019”.



The following parameters will be used in the design:

Table 3: Water design Standards

Water Design Standards	
Average Annual Daily Demand (AADD) for Business/Commercial	750 l/100 m ² /day
Gross Average Annual Daily Demand (GAADD)	Allow 10% losses
Maximum static Head	60 m
Minimum residual head under peak flow conditions	30 m
Maximum linear flow velocity under conditions of domestic peak flows	1.5 m/sec
Maximum linear flow velocity under conditions of domestic peak flows (Dia. ≤ 150mm)	1.0 – 1.5 m/sec
Pipe type (Refer to SANS 4427)	HDPE pipe
Minimum pipe class	PN 12,5
Hydrant Spacing	180m Maximum
Fire flow	100 l/sec
Minimum residual head (fire plus domestic peak flow)	15 m
Maximum linear flow velocity under conditions of fire fighting	2,2 m/sec
Minimum pipe diameter	75 mm
Minimum cover to pipes	0,6 m
On Side Walks	1,0 m
At Road Crossings	1,1 m



4.3.9 Estimated Water Demand

The estimated water demand for the development is as follows:

Table 4: Estimated water demand for Farm Elandsheuwel 436 IQ

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PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION

46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

WATER DEMAND CALCULATIONS

Zoning	Land Use	Size (m ²) GLA	Size (Ha)	No. of	Unit	Unit of Measurement	The Neighbourhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements						
							RATE		WATER DEMAND		PEAK FACTOR	PEAK DEMAND	
							k/d	k/day	l/sec	k/day		l/sec	
Residential 1	Subsized Dwelling Units	63362.50	15.04	409.00	Units	633.53	KL/Unit/d	0.40	163.60	1.89	1.8	294.48	3.41
Residential 2	Social Housing	47791.50	5.11	488.00	Units	477.92	KL/Unit/d	0.30	145.80	1.69	1.8	262.44	3.04
Residential 3	Flats/ Apartments	60452.00	9.32	941.00	Units	604.52	KL/Unit/d	0.30	282.30	3.27	1.8	508.14	5.88
Institutional	Creche/Day Care Centre	1831.50	0.39	100.00	Students	18.32	KL/Student	0.06	6.00	0.07	1.6	9.60	0.11
Institutional	Place of Worship	638.50	0.15	100.00	Seats	6.40	KL/100 m ² GLA	0.30	1.92	0.02	1.6	3.07	0.04
Institutional	Primary School	9675.00	2.27	700.00	Students	96.75	KL/Student	0.06	42.00	0.49	1.6	67.20	0.78
Institutional	Secondary School	19498.50	4.63	600.00	Students	194.99	KL/Student	0.06	36.00	0.42	1.6	57.60	0.67
Business 1	Shops/Retail	2163.50	0.51			21.64	KL/100 m ² GLA	0.65	14.06	0.16	1.6	22.50	0.26
Business 2	Medical Centre	3967.50	0.94			39.68	KL/100 m ² GLA	0.65	25.79	0.30	1.6	41.26	0.48
Municipal	Multi-purpose Centre	3797.50	0.90			37.98	KL/100 m ² GLA	0.40	15.19	0.18	1.6	24.30	0.28
Public open Space	Recreational	150182.00	35.67			1 501.82	KL/ha	12.00	428.04	4.95	1.5	642.06	7.43
Total:								1160.70	13.43			1932.66	22.37



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4.4 PROPOSED FIRE SERVICES

4.4.1 Fire Flow and Pressure

The following **Table 5** indicates the Fire water demand of the proposed facilities.

Table 5: Fire Flow Demand for Farm Elandsheuwel 436 IQ

Fire Risk Category	Total Fire Flow (L/s)	Min. Flow for Each Hydrant (L/s)	Duration of Fire (Hours)	Minimum Residual Pressure (m)
Moderate Risk 1	50	25	4	15

4.4.2 Fire Hydrants

Ten (10 no.) fire hydrants are proposed which should have a maximum spacing of 180,0 m. The minimum pipe diameter to service the fire hydrants should be 110 mm.

4.4.3 Fire Hose Reels

It is proposed that each building be fitted with fire hose reels. The fire reticulation pipes to feed the hose reels should have a pipe diameter of 40 mm.

4.4.4 Fire Pipe Size and Material

Fire pipe size to fire hydrant

- Use 110 mm dia. CI16 uPVC

Fire pipe size to hose reels

- Use 40 mm dia. CI16 uPVC

Construction shall be in accordance with the guidelines of the JB Marks Local Municipality and the relevant SANS1200 guidelines. Refer to **Drawing C1584-WSEW-LO-01 Rev A** illustrating the fire reticulation layout.

4.4.5 Fire Flow Storage

Fire flow storage capacity to be specified later on during design stage.



4.5 SEWERAGE

4.5.1 Existing Information

There is existing sewer infrastructure in the vicinity of the site. Line to be tested and municipality to specify the existing line can accommodate the proposed demand or the line will need to be upgraded to incorporate the additional discharge generated by the proposed development.

According to the Master Plan, an existing bulk sewer infrastructure pipeline traverses the eastern portion of the proposed development site, providing a suitable connection point for the planned internal reticulation network. The proposed development will discharge into the **Ailanto 2 P/S or Ailanto P/S** as shown in Figure 6 below the which conveys flows to either the **Potchefstroom Wastewater Treatment Plant (WWTP)** or the **Tlokwe WWTP**. The Ailanto 2 P/S or Ailanto P/S is located approximately **2.096 km** from the proposed development site.

The internal sewer reticulation system within the development will be designed to follow the natural topography, allowing gravity flow towards the existing **600 mm diameter gravity outfall sewer from Ikageng**. The estimated total daily sewer discharge into the municipal system is **2,627 kL/day**.

The **Potchefstroom Wastewater Treatment Works** currently has a design capacity of **45 ML/day**, with municipal plans in place to upgrade the facility by an additional **15 ML/day** to accommodate future development demands. The WWTP was last upgraded in **2012** to enhance treatment capacity and improve environmental compliance. Furthermore, the **Integrated Development Plan (IDP)** highlights the municipality's commitment to prioritizing upgrades to the main outfall sewers to ensure a safe and hygienic environment for residents.

The **Tlokwe Wastewater Treatment Plant (WWTP)**, now operating under the **JB Marks Local Municipality**, serves the city of Potchefstroom and surrounding areas. It is situated on the southern side of Potchefstroom, as indicated in the pre-feasibility studies conducted by Energo Power Solutions.

The Tlokwe WWTP is classified as a **Class A plant**, designed to handle a significant volume of wastewater. While the exact design capacity is not specified in the available sources, it is noted that the plant services both domestic and industrial wastewater from the surrounding areas, including Potchefstroom and potentially other nearby regions. The plant's capacity and service area are crucial for planning future developments and ensuring adequate wastewater treatment infrastructure.

Sewerage Infrastructure

The Tlokwe WWTP receives wastewater from various **sewer pump stations** within its service area. These pump stations collect and transport sewage to the treatment plant for processing. The



specific pipelines and their routes are part of the municipal infrastructure network, which is managed and maintained by the JB Marks Local Municipality.

For the Tlokwe WWTP, certain information such as its exact capacity, service area, and details of the associated sewerage infrastructure are not available from existing sources. These details will need to be **confirmed by the JB Marks Local Municipality** to ensure accurate planning and integration of the proposed development into the municipal sewer network.

The final outfall sewer location and depth will depend on the proposed outfall as determined by the municipality during consultation. The exact depth will be **verified during detailed surveys and design stages**, following township approval. This suggests that, in principle, pumping of sewage from the site may not be necessary.

The **Botha Pump Station** plays a critical role in the overall sewer system, as it conveys approximately **70% of Potchefstroom's sewage flow** to the WWTP. However, there is a noted **need for refurbishment and capacity restoration** of the pump station to ensure it operates at its original design efficiency. This may include:

- Replacement of existing pumps;
- Structural integrity assessment to identify potential damage caused by sewer ingress;
- Restoration of electrical panels and control systems to enable full operational capacity.

A number of other sewer pump stations serve the broader Potchefstroom area, including but not limited to:

- Promosa x4 P/S
- Baipei-Promosa P/S
- Promosa Cem P/S
- Promosa P/S
- Robert Ave P/S
- Potch Dam P/S
- Waterberry P/S
- Maree P/S
- Stasieweg P/S
- Old Cemetery (Read Street) P/S
- Opaal P/S
- Ross IND P/S
- Ross Curlewis P/S
- Forsman P/S
- Ross Gainsfort P/S
- Dyer P/S



- Chris Hani P/S
- Eland P/S
- Uitsig P/S
- Tlokwe WWTP
- Ailanto 2 P/S (closest to Elandsheuwel 436 -IQ, proposed development)
- Ailanto P/S
- Ditedu Ave P/S
- Baillie Park x47 P/S
- Erika P/S
- Golf Course P/S
- Lupini P/S
- Willow De La Mooi P/S
- Modderdam Pad P/S
- Kanaal P/S
- Klinkersberg P/S

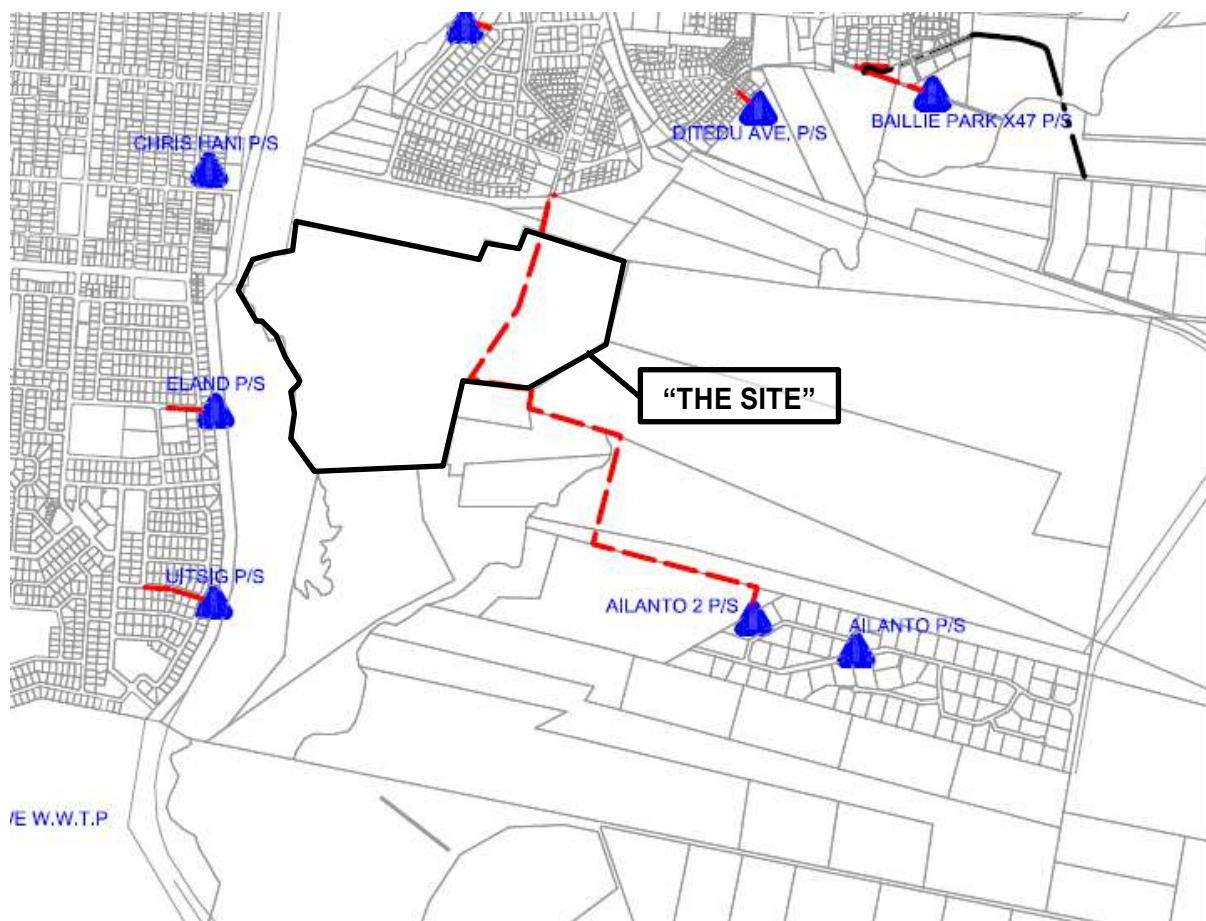


Figure 6: Existing Pump station near the site.



The Master Plan provides an estimated range for the size of the existing pipe crossing the site. According to the Master Plan (Figure 6), a bulk water pipeline runs along the eastern portion of the **Remaining Extent of Portion 46, Portion 58, and Portion 59 of the Farm Elandsheuwel 436**, which forms part of the proposed development site. The pipeline diameter, as indicated in the Master Plan, however, the exact size will need to be verified with municipal officials. Should the pipeline capacity be deemed sufficient, no upgrades will be required for the site.

4.5.2 Design Standards

The standards used in the design of the water, fire and sewer bulk services are the “Neighbourhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements, July 2019”

The following parameters will be used in the design:

Table 6: Sewer design standards

Sewer Design Standards	
Average Daily Demand (ADD)	80% of Water Demand
Peak Factor	1,7
Peak Dry Weather Flow (PDWF)	ADF X Peak Factor
Peak Wet Weather Flow (PWWF)	PDWF X 15% Stormwater Infiltration
Capacity of Sewer	To flow 80% full
Sewer pipe	HDPE PE 100, PN 10 SDR 17 (Refer to SANS 4427)
Minimum Velocity	0.7 m/s
Maximum Velocity	3 m/s
Minimum pipe diameter	160 mm diameter
Minimum gradient (for 160mm dia)	1 in 140
Minimum depth of cover	1.2 m
In trafficked areas	1.4 m
Other areas	1,0 m
Maximum manhole spacing	80 m
Manhole diameters	HDPE Manholes up to 3m – 1000 dia. Wall thickness not less than 65mm.
	HDPE Manholes deeper than 3m – 1500mm dia. Wall thickness not less than 85mm.
Manhole cover and frame	Concrete cover of 560mm / 750mm



	Medium duty elsewhere.
	Medium duty elsewhere.
Manhole step irons	Step irons shall be Calcamite steel-plastic-coated or Copolymer Polypropylene, fixed to structure with suitable epoxy adhesive.
Fall Through Manhole	For pipe diameters 150mm-300mm min. fall of 50mm through manhole
Pipe anchor blocks	Pipe at gradients between 1:6 and 1:12.
Junctions of sewer	Soffit to soffit.
Manhole step irons	Step irons shall be Calcamite steel-plastic-coated or Copolymer Polypropylene, fixed to structure with suitable epoxy adhesive.
Fall Through Manhole	For pipe diameters 150mm-300mm min. fall of 50mm through manhole

4.5.3 Estimated Sewerage Demand

The estimated sewer demand for the development is as follows:

Table 7: Estimated sewer demand for Farm Elandsheuwel 436 IQ

Project No.: C1584-251124

2025/10/14 15:14

Prepared by:

Mr A. Ally

PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

SEWER DISCHARGE CALCULATIONS

Zoning	Land Use	Size (m ²) GLA	Size (Ha)	No. of	Unit	Unit of Measurement	The Neighbourhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements (VOLUME 2, CHAPTER 9)								
							RATE	WATER DEMAND		PEAK FACTOR	PEAK DEMAND		15% ALLOWANCE FOR INFILTRATION		
							k/l/d	k/l/day	l/sec		k/l/day	l/sec	k/l/day	l/sec	
Residential 1	Subsized Dwelling Units	83352.50	15.04	409.00	Units	833.53	KL/Unit/d	0.56	229.04	2.65	2.0	458.08	5.30	526.79	6.10
Residential 2	Social Housing	47791.50	5.11	488.00	Units	477.92	KL/Unit/d	0.36	174.96	2.03	2.0	349.92	4.06	402.41	4.66
Residential 3	Flats/ Apartments	60452.00	9.32	941.00	Units	604.52	KL/Unit/d	0.29	272.89	3.16	2.0	545.78	6.32	627.65	7.26
Institutional	Nursery/Day-Care Centre	1831.50	0.39	100.00	Students	18.32	KL/Unit/d	0.48	7.93	0.09	2.5	19.58	0.23	22.51	0.26
Institutional	Place of Worship	639.50	0.15	100.00	Seats	6.40	KL/Unit/d	0.48	3.07	0.04	2.5	7.67	0.09	8.83	0.10
Institutional	Primary School	9575.00	2.27	700.00	Students	95.75	KL/Unit/d	0.48	45.96	0.53	2.5	114.90	1.33	132.14	1.53
Institutional	Secondary School	19498.50	4.63	600.00	Students	194.99	KL/Unit/d	0.48	93.59	1.08	2.5	233.98	2.71	269.08	3.11
Business 1	Shops/Retail	2163.50	0.51			21.64	KL/100 m² GLA	0.52	11.25	0.13	1.4	15.75	0.18	18.11	0.21
Business 2	Medical Centre	3967.50	0.94			39.68	KL/100 m² GLA	0.52	20.63	0.24	1.4	28.88	0.33	33.22	0.38
Municipal	Multi-purpose Centre	3797.50	0.90			37.98	KL/100 m² GLA	0.48	18.23	0.21	1.4	25.52	0.30	29.35	0.34
Public open Space	Recreational	150182.00	35.67			1 501.82	KL/ha								
Total:								877.45	10.16			1800.07	20.83	2070.08	23.96



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4.5.4 Sewer System

The required minimum pipe size is 160mm diameter with a capacity calculated at 67% of depth of flow. The minimum gradient is 1:140 with a minimum full flow velocity of 0.7m/s. For these constraints the following is applicable:

- Capacity of the 160mm dia. pipe = 12,1 l/s (greater than peak design sewer flow of 2,73 l/s)
- Velocity in pipe at capacity flow = 0,96 m/s (greater than minimum full flow velocity of 0,7m/s)

Hence it is recommended to use a 160mm diameter uPVC Heavy Duty Class 34 sewer pipe.

Inside the property pipe sizes will vary from 160 mm to a maximum size being a 225 mm diameter uPVC Heavy Duty Class 34 sewer pipe

- Capacity of the 300mm dia. pipe = 35,4 l/s (greater than peak design sewer flow of 23,96 l/s which is the capacity of a 226 mm diameter uPVC Heavy Duty Class 34 sewer pipe at 67 % capacity)
- Velocity in pipe at capacity flow = 0,80 m/s (greater than minimum full flow velocity of 0,7m/s)

Sewer Connection to the new site is proposed to be obtained by the following:

- The sewer flow shall be reticulated either to the existing services that are running along the Eastern portion of the site, the municipality need to determine if the existing sewer line is or to a Wastewater Package plant that will be designed to contain sewer discharge for at least 7 days before being emptied.
- Applications have been sent to relevant departments for water and sewer capacity examination to determine the most suitable connection that can accommodate the proposed development.

Construction shall be in accordance with the Neighbourhood Planning and Design Guide (Red Book): Creating Sustainable Human Settlements, July 2019 guidelines and the relevant SANS 1200 LD - Sewers guidelines.



5 Conclusions and Recommendations

The following table summarises the information required in order to proceed with detailed design:

Table 8: Summary of investigation and information required

Summary of Information / Investigations Required	
Survey	A Survey has been conducted by CDJ Land Surveyors.
Bulk Earthworks	An Aquatic Special Assessment Report have been conducted by Africa Ecological Service and comprehensive Geotechnical Investigation will need to be conducted prior to the Detail design phase.
Roads	The Traffic Study provides a framework and ensures that the proposed development is sustainable from a traffic engineering point of view. The proposed development will have various access points off the external road network. The following access points will be provided: Herman Street Access: the proposed development will take access off this road approximately 800 m west of the intersection of Herman Street and Erica Street. Refer to Drawings CC01 - CC02 illustrating the proposed access position.
Stormwater	Bulk stormwater pipes shall be spigot and socket concrete pipes with rolling rubber rings to ensure watertightness. The intercepted flows are reticulated to the Proposed Parking attenuation Area. The concrete pipe sizes vary from 300 mm dia. up to 750 mm dia. depending on the flow accumulation. For larger plots, stormwater attenuation shall be provided at the lowest point of each site. The exact position and layout of these attenuation facilities will be confirmed upon submission of the final Site Development Plan (SDP). The proposed development consists of plots both smaller and larger than 4 000 m². In accordance with stormwater management guidelines, plots smaller than 4 000 m² may discharge their stormwater runoff directly into the proposed stormwater line through kerb inlets or other approved junctions. Conversely, plots exceeding 4 000 m² are required to provide on-site attenuation facilities, such as detention ponds or tanks, with controlled outlet structures to regulate discharge and ensure progressive release of runoff into the



	municipal system. This approach aligns with the principles outlined in the CSIR Guidelines for Human Settlement Planning and Design (Red Book, 2019) and the Department of Water and Sanitation's (DWS) Urban Stormwater Management Framework (2018), which emphasize sustainable stormwater management and protection of downstream infrastructure. Special attention needs to be taken care to make sure that we do not discharge anything other than stormwater in the rivers hence oil and grease traps are recommended to prevent any spillage or contamination in the river. For the bigger plots, attenuation to be provided at the lowest point, position and final layout to be confirmed once final SDP is submitted.
Water Supply	- For the Proposed Residential units, Recreation facilities and a Garden of Remaining Extent of Portion 46, Portion 58 And 59 Of the Farm Elandsheuwel 436, potable water will be required to service the site. - According to the Master Plan (Figure 5), a bulk water pipeline runs along the eastern portion of the Remaining Extent of Portion 46, Portion 58, and Portion 59 of the Farm Elandsheuwel 436, which forms part of the proposed development site. The pipeline diameter, as indicated in the Master Plan, ranges from 200 mm to 800 mm; however, the exact size will need to be verified with municipal officials. Should the pipeline capacity be deemed sufficient, no upgrades will be required for the site.
Fire Supply	- The proposed development would make use of the existing water line to supplement or complement their Fire provision. - Proposed water connection to the Proposed development is to be determine later after existing line is tested for both flow and pressure to determine adequacy to carry the fire flow. - Fire Storage Capacity to be specified during design phase.
Sewer	Based on the existing sewer infrastructure and the proposed development layout, connection to the Ross Gainsfort Pump Station and the municipal sewer system is feasible, with gravity-based internal sewer lines expected to minimize the need for pumping. It is recommended that the following actions be undertaken:



	- Capacity verification study for the Ailanto 2 P/S, Ailanto P/S, and the existing outfall sewer to confirm they can accommodate the proposed development flows. - Detailed survey and design to confirm final sewer alignments, outfall locations, and depths. Municipal consultation to confirm the Tlokwe WWTP capacity, service area, and associated sewer network details. Structural and operational assessment of the Botha Pump Station to restore design capacity and identify potential defects. - These measures will ensure that the development's sewer reticulation is fully integrated into the municipal system while supporting a safe and hygienic environment for residents.
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6 References

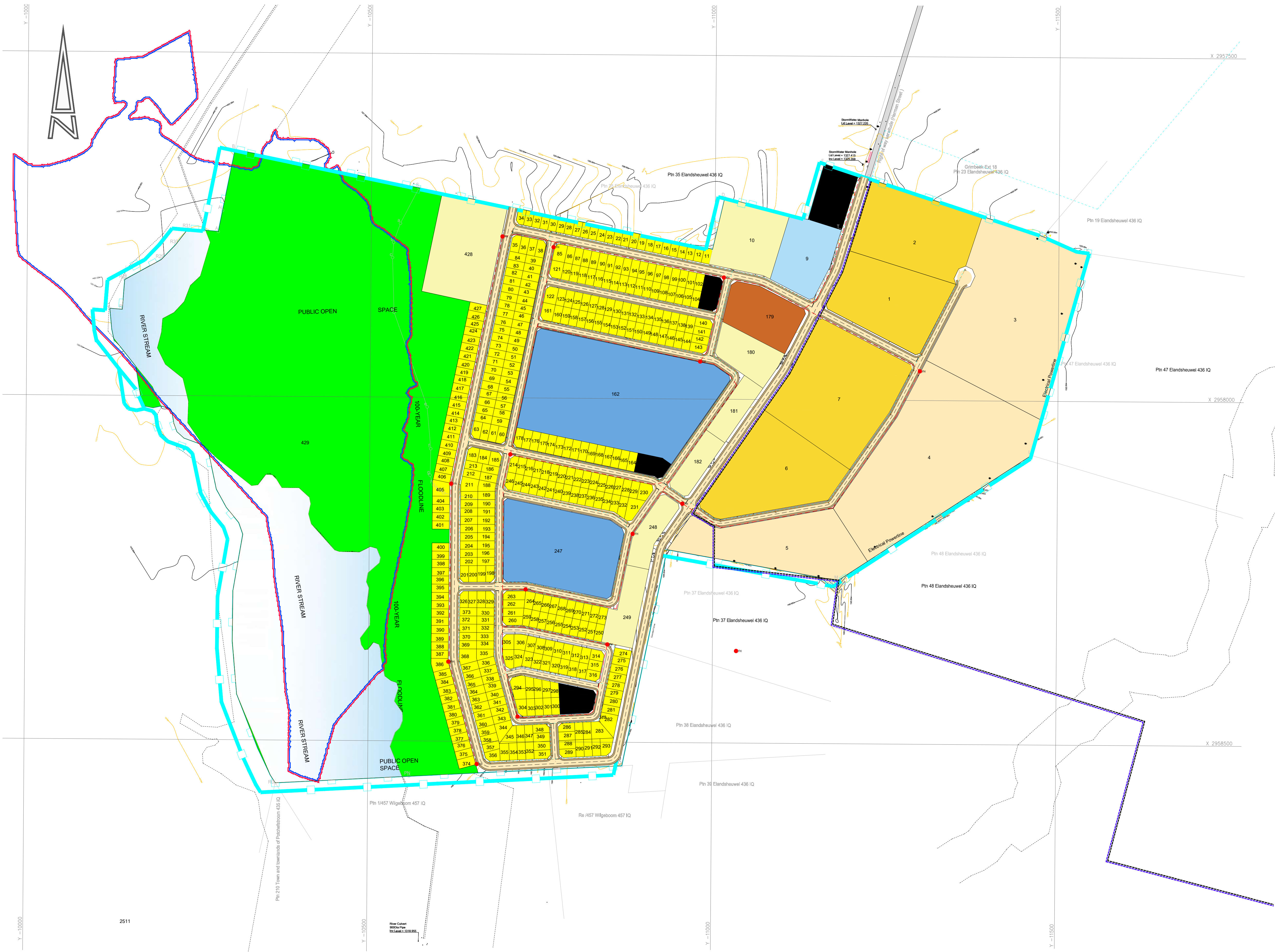
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7. SANRAL; (2013); 'The South African National Roads Agency SOC Limited Drainage Manual Application Guide' 6th Edition, Fully Revised and Extended, SANRAL Publication.



Appendix A

- Civil Engineering Services Drawings

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LEGEND

- ROAD RESERVES
- SITE BOUNDARY
- EXISTING WATER PIPE
(200 Ø -800Ø mm)
- EXISTING SEWER PIPE
(200 Ø -800Ø mm)
- 75mm Ø 12.5 uPVC
WATER PIPE
- 40mm Ø 12.5 uPVC
WATER PIPE
- 75 mm Ø FLANGED GATE
VALVE (RSV)
- 110 mm Ø uPVC CL 16
FIRE PIPE
- STANDARD FIRE HYDRANT
- CL 34 uPVC
SEWER PIPE
- 110 mm Ø CL 34 uPVC
SEWER PIPE
- 1250 Ø CIRCULAR SEWER
MANHOLE
- CLEANING EYES
- SAND,OIL AND GREASE TRAP
- FH
- SEW
- CE

A	2025/10/13	K.N	FOR_INFORMATION	C.N	-
REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:			FOR INFORMATION		

CLIENT:

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PROJECT:

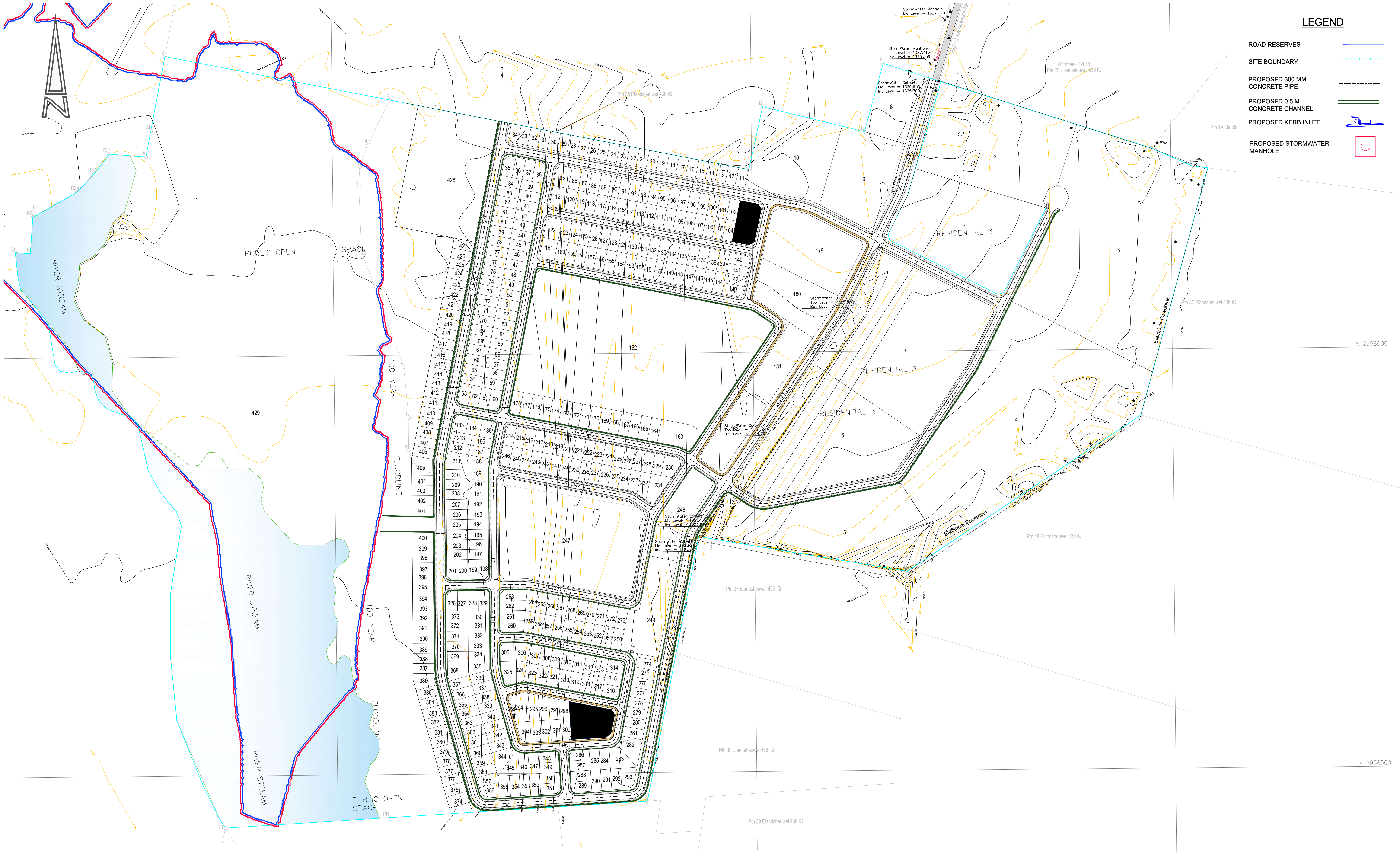
PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

TITLE:

PROPOSED WATE AND SEWER LAYOUT

SCALE @ A1: 1:500	CHECKED: C.NAIR	APPROVED: -
DESIGN: C.NAIR/S.DIKAMABA	DRAWN: K.NAIDU	PR No.: ### DATE: 2025/10/13
PROJECT No: C1584-251124	DRAWING No: C1584-SEW-LO-01	REV: A
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DRAWING STATUS:			FOR INFORMATION		

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PROJECT:

PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

TITLE:

PROPOSED STORMWATER MANAGEMENT PLAN

SCALE @ A1:	1:500	CHECKED:	C.NAIR	APPROVED:	-
DESIGN:	C.NAIR/S.DIKAMABA	DRAWN:	K.NAIDU	PR No.: ###	DATE: 2025/10/13
PROJECT No:	C1584-181124	DRAWING No:	C1584-SWMP-LO-01	REV:	A
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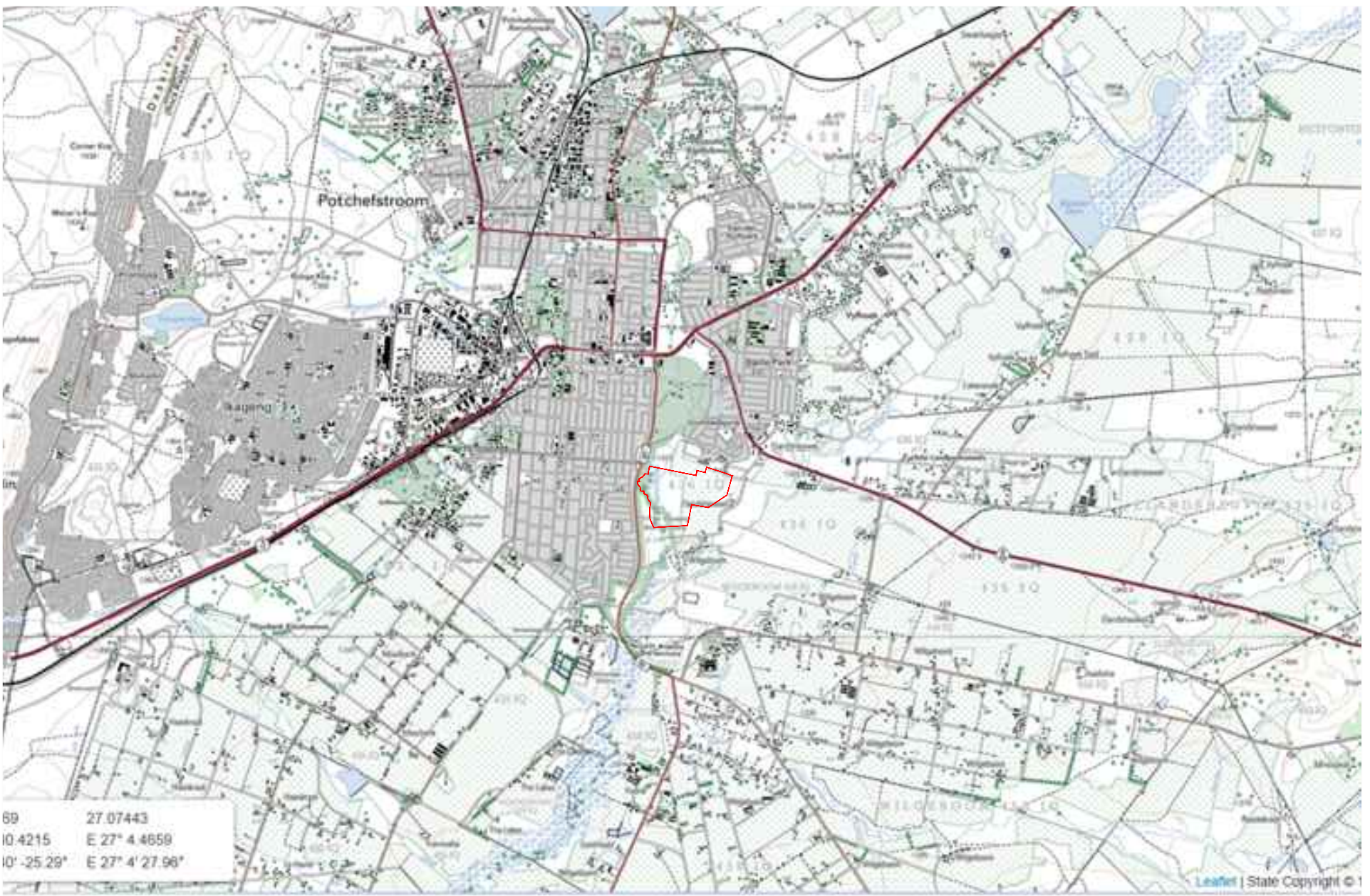
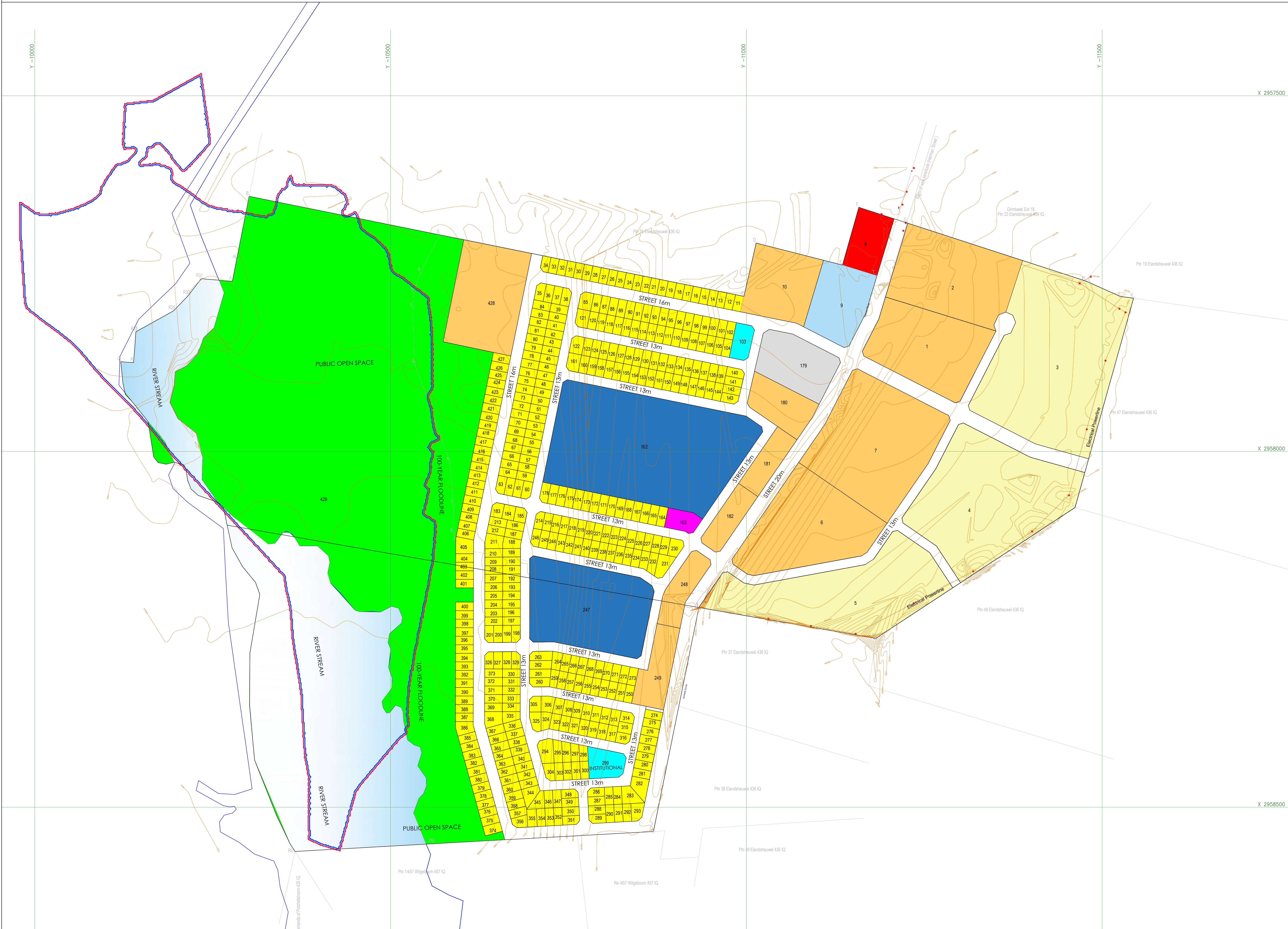


Appendix B

- Site Development Plan

Proposed Township Layout Plan

LOCALITY MAP



LAND USE TABLE

ZONING	LAND USES	NO. OF ERVEN	AREA (HA)	AREA (%)	NOTATION
Residential 1	Single Dwelling Units	409	12.6705	15.04	
Residential 2	Townhouse/Semi detached	3 (approx. 119 units @25 per ha)	9.5583	11.34	
Residential 3	Flats/Apartments	11 (approx. 737 units @122 per ha)	12.0904	14.35	
Institutional	Creche/Day Care Centre	2	0.3263	0.39	
Institutional	Places of Worship	1	0.1279	0.15	
Institutional	Primary School	1	1.9150	2.27	
Institutional	Secondary School	1	3.8997	4.63	
Business 1	Shops/Retail	1	0.4327	0.51	
Business 2	Medical Centre	1	0.7935	0.94	
Municipal	Multi-purpose Centre	1	0.7595	0.90	
Public Open Space	Recreational	1	30.7524	36.51	
Public Roads	Streets		11.6163	13.79	

TOTAL DEVELOPABLE AREA	429	84.2225	100	
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LEGEND

Proposed Erven
Project Area Boundary
Subject Farm Portions

SCALE

1: 2000 (A0 Format)
1: 4000 (A1 Format)
1: 8000 (A2 Format)
1: 16000(A3 Format)

PREPARED BY:
Vhuluvhi Group

PREPARED FOR:
HDA

MUNICIPAL APPROVAL	GEOTECHNICAL CERTIFICATION	FLOODLINE CERTIFICATION	SURVEY CERTIFICATION & DETAILS
Approved By: Signature..... Director: Signature..... Date:..... Stamp:	It is hereby certified that the Phase 1 Geotechnical investigation for the project area was undertaken by a qualified Geotechnical Engineer in line with the NHBRC Guidelines: Name Registration No Signature Date	In terms of Section 114 of the National Water Act, the project area is affected by flood water within the 1:100 year period from the streams/rivers as indicated in the floodline report. As a result development must be done outside the identified floodlines: Name Registration No Signature Date	Contour Intervals: 0.5m Coordinate Reference System: World Geodetic System 1984 Name Registration No Signature Date

Designed By (Town Planner): Professional Reg. No: Signature:.....	Date: 06 October 2025 Drawing No: Grim/001Rev2
---	---



Appendix C

- Traffic Impact Assessment



TRAFFIC IMPACT ASSESSMENT IN SUPPORT OF THE PROPOSED TOWNSHIP ESTABLISHMENT ON THE REMAINING EXTENT OF PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

JB MARKS LOCAL MUNICIPALITY



TRAFFIC IMPACT ASSESSMENT (TIA) - DRAFT

October 2025

Submission Details			PREPARED BY:
JB Marks Local Municipality	Prepared By:	Prepared By:	 CHRISEN CONSULTING CIVIL • STRUCTURAL • TRANSPORT • ENGINEERS CHRISEN CONSULTING (PTY) LTD Reg.No.: 2016 / 291392 / 07 Unit 1, Ground Floor , Cambridge Office Park 5 Bauhinia Street, Highveld Technopark Centurion, South Africa, 0157 Cell: +27 0(78) 800 0369 Tel: +27 0(12) 663 3008 e-mail: chris@chrissen.com / info@chrissen.com website: www.chrissen.com
			



Quality Control

Issue/revision	Issue 2 - DRAFT	
Remarks	Version 1.2	
Date	15 October 2025	
Prepared by	Mothepana Mofokeng Snr. Traffic Engineering Technician Christopher E Nair Pr. Eng. MEng. BSc Managing Director	
Signature		
Checked by	Christopher E Nair Pr. Eng. MEng. BSc Managing Director	
Signature		
Authorised by	Christopher E Nair Pr. Eng. MEng. BSc Managing Director	
Signature		
Project number	C1584-251124	
File reference	X:\C1584-251124 - Rem Ext of Ptn 46, Ptn 58 & 59 Elandsheuwel 436 IQ\2. TRAFFIC\06 Reports	

Certification

It is herewith certified that this Traffic Impact Assessment has been prepared according to requirements of the South African Traffic Impact and Site Traffic Assessment Manual.

Signatory : Date : 15 October 2025 ECSA no: 20170023

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Quality checklist

Items	Initial
Project take on form	✓
Report & Figures reviewed	✓
Authorisation for distribution	✓



Contents

1	Introduction	6
1.1	Background and Site Location	6
1.2	Purpose of the Report	6
1.3	Approval of Submission	6
2	Study Area and Surrounding Road Network	7
2.1	Study Area	7
2.2	Existing Surrounding Road Network	7
3	Approach and Methodology	8
3.1	General	8
3.2	Relevant Peak Hours	8
3.3	Data Collection	8
3.4	Analysis Scenarios	9
3.5	Trip Distribution and Assignment	9
4	Existing Traffic Volumes	10
4.1	General	10
4.2	Herman Street and Papawer Street (Intersection 1)	10
4.3	Herman Street and Erica Street (Intersection 2)	10
4.4	R53 and Road A (Intersection 3)	10
5	Extent of the Development	11
6	Development Trip Generation	12
6.1	Adjustment Factors	12
6.2	Trip Summary	13
6.3	Growth Rate	14
6.4	Traffic Volume Scenarios	15
7	Site Accesses	16
7.1	Proposed access road	16
8	Traffic Impact and Capacity Analyses	17
8.1	Scenarios Analysed	17
8.2	Capacity Analysis	17
9	Non-motorised and Public Transport	18
9.1	Background	18
9.2	Existing Public Transport Services	18
9.3	Proposed / New Transport Facilities	18



10	Proposed Road Improvements / Upgrades	19
10.1	General	19
10.2	Proposed / New Transport Facilities	19
10.3	Proposed Road Upgrades	19
11	Conclusions and Recommendations	21
12	References	23



Figures

Figure 1a Locality plan

Figure 1b Locality plan

List of Tables

Table 1 Adjustment Factors Applied for Trip Reductions

Table 2a Expected Development Generated Trips

Table 2b Expected development generated trips (considering Trip Reduction Factors and
Size Adjustment Factors)

Table 3 Typical traffic growth rates

Drawings

Drawing CC01 Proposed Site Access Layout Plan

Drawing CC02 Proposed Site Access Layout Plan (Without Image)

Drawing CC03 Existing Intersection



Appendices

Appendix A

- North West Province GIS Road Network Map

Appendix B

- Site Development Plan
- SG Diagrams

Appendix C

- Trip Generation Table

Appendix D

- SIDRA Analysis Results



1 Introduction

1.1 BACKGROUND AND SITE LOCATION

CHRISEN CONSULTING (PTY) LTD Traffic and Transportation Engineers has been appointed to undertake a Traffic Impact Assessment in support of the proposed Township Establishment on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ. The study site is located southwest of the R53 on Herman Street and falls within the JB Marks Local Municipality area of Jurisdiction.

Remaining extent of Portion 46, Portion 58 and 59 have a combined extent of 85,2225 hectares, currently vacant land and are surrounded by residential land uses to the north and vacant land to the south, west and east. The intention of the client is to establish a township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ which will comprises of a mixed-use development that consists of "Residential 1," "Residential 2," "Institutional," "Business 1," "Business 2," "Municipal," "Public Open Space" and "Public Roads" land uses. Refer to **Appendix A** containing the Site Development Plan and **Figures 1a and 1b** illustrating the site locality plan.

1.2 PURPOSE OF THE REPORT

The purpose of this Traffic Impact Assessment is to illustrate the proposed developments' impact on the surrounding road network and possible mitigation of the anticipated traffic impact. This report also comments on the proposed site accesses, non-motorised and public transport aspects. Individual traffic impact assessments will be done for each development during the site development stage.

1.3 APPROVAL OF SUBMISSION

This report will be submitted to the following road authorities for their comments and approval:

- JB Marks Local Municipality



2 Study Area and Surrounding Road Network

2.1 STUDY AREA

In determining the site area TMH 16 volume 1 recommends the following:

- *“Class 4 and 5 roads in the vicinity of the development up to the first Class 1 to 3 roads that can be reached by the Class 4 and 5 road networks from the development, up to and including the first connection(s) on the Class 1 to 3 roads.*
- *The elements shall be restricted to those within a maximum distance of 1.5km from the accesses to the site, measured along the shortest routes to the accesses, provided that there is at least one intersection within this distance. Where there is no such intersection, the distance will be extended to include at least one intersection.”*

TMH 16 also states that judgement should be used in selecting the intersections considered and therefore specific elements like extent of the development were also considered. A larger development will by its nature require a wider study area to be considered while for a smaller development the opposite will be true.

2.2 EXISTING SURROUNDING ROAD NETWORK

The following roads bordering the application site are regarded as relevant to this study:

- **N12:** This road is classified as a Class 1 dual carriageway road with two lanes in each direction that runs in a west-east alignment north of the site.
- **R53:** This road is classified as a Class 2 single carriageway road with one lane in each direction that runs in a north-south alignment northeast of the site.
- **Erica Street:** This road is classified as a Class 4 road with one lane in each direction that runs in a north-south alignment north of the site.
- **Herman Street:** This road is classified as a Class 5 road with one lane in each direction that runs in a north-south alignment towards the site. Herman Street will provide access to the development site.

The North West Province GIS Road Network Map in relation to the site is attached as **Appendix A**.



3 Approach and Methodology

3.1 GENERAL

The application will be undertaken according to the South African Traffic Impact and Site Traffic Assessment Manual (TMH 16, 2012). This assessment also discusses non-motorised and public transport and provides the necessary requirements. The horizon year for the purpose of the assessment for the impact on the transport system is 2025 and 2030.

3.2 RELEVANT PEAK HOURS

From the observation of existing traffic and trip generation volumes, the Weekday AM and PM peak hour that is critical for capacity analysis purposes will be determined following the traffic data collection. This will be when the existing network background traffic together with the development traffic will represent a worst-case scenario in terms of critical traffic flow.

3.3 DATA COLLECTION

3.3.1 Site Visit

During June 2024, a site visit was undertaken for this study and the following was confirmed:

- Layouts of intersections considered in the study
- Appropriateness of recommended site accesses
- Intersection control for relevant intersections
- Presence of existing public transport and non-motorised transport facilities

3.3.2 Traffic Count Data

A three (3) hour classified morning (06:00 – 09:00) and three (3) hour classified afternoon (15:00 – 18:00) vehicle survey was commissioned by CHRISEN on Tuesday 3rd June 2025 at the following intersections:

- Herman Street and Papawer Street (Intersection 1)
- Herman Street and Erica Street (Intersection 2)
- R53 and Road A (Intersection 3)



From the traffic count, a common peak hour will be determined (as the busiest hour) for each counted period.

3.4 ANALYSIS SCENARIOS

The Weekday AM and PM peak hour trip generation of the development was analysed. The critical peak hour analysis was considered for the following scenario:

- Scenario 1: 2025 peak hour traffic volumes
- Scenario 2: 2025 background plus development generated peak hour traffic volumes
- Scenario 3: 2030 background plus development generated peak hour traffic volumes

This is in line with the TMH 16 requirement for scenarios to be considered in a Traffic Impact Assessment.

3.5 TRIP DISTRIBUTION AND ASSIGNMENT

Assumptions with respect to the expected trip distribution were based on the location of the site access in relation to the surrounding road network; the existing traffic volumes, travel patterns as well as the land use nature of the proposed development.



4 Existing Traffic Volumes

4.1 GENERAL

From the traffic count a common peak hour will be determined (the busiest hour) for each counted period. The existing intersection layouts are attached in **Appendix C**.

4.2 HERMAN STREET AND PAPAWE STREET (INTERSECTION 1)

This intersection comprises of a Two-Way Stop control intersection has approximately TBC vph and TBC vph during the AM and PM Peak hours respectively.

4.3 HERMAN STREET AND ERICA STREET (INTERSECTION 2)

This intersection comprises of a Two-Way Stop control T-junction intersection has approximately TBC vph and TBC vph during the AM and PM Peak hours respectively.

4.4 R53 AND ROAD A (INTERSECTION 3)

This intersection comprises of a Two-Way Stop control T-junction intersection has approximately TBC vph and TBC vph during the AM and PM Peak hours respectively.



5 Extent of the Development

The intention of the client is to establish a township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ which comprises of the following:

- Site Extent = 85,2225 ha
 - Residential 1
 - Single Dwelling Units = 409 units
 - Residential 2
 - Townhouse = 119 units
 - Residential 3
 - Flats = 737 units
 - Institutional
 - Creche / Day Care Centre = 100 Students
 - Place of Worship = 100 Seats
 - Primary School = 700 students
 - Secondary School = 600 Students
 - Business 1
 - Shops = 1500 m²
 - Business 2
 - Medical Centre = 3000 m²
 - Municipal
 - Multipurpose Centre = 3700 m²
 - Public Open Space
 - Public Roads

The Site Plan is contained in **Appendix B**.



6 Development Trip Generation

6.1 ADJUSTMENT FACTORS

Various trip adjustment factors have been introduced into the COTO document to allow for trip reductions. These adjustment factors are discussed briefly below.

6.1.1 Mixed Use Development (Mud)

According to the COTO manual “mixed use developments are defined as developments in an area that consist of two or more single-use developments between which trips can be made by means of non-motorised modes of transport (such as walking). This has the net effect of reducing the vehicle trip generation in the area.” A mixed-use reduction factor has been applied, See **Table 1** below. Note, P_m = Reduction factor for mixed-use development.

6.1.2 Low Vehicle Ownership (LVO)

According to COTO “the vehicle ownership in areas with high levels of vehicle ownership varies between one or two per household. In areas with a low level of vehicle ownership, the majority of households (more than 50%) does not own a vehicle and relies on public transport for transportation. In areas with very low level of vehicle ownership, nearly all households (more than 90%) do not own a vehicle and rely on public transportation.”

A very low vehicle ownership reduction factor has been applied, see **Table 1** below. Note, P_v = Reduction factor for vehicle ownership.

Table 1: Adjustment factors applied for trip reductions

TRIP CODE	LAND USE	P_m	P_v	P_T
210	Single Dwelling Units	10%	40%	0%
220	Apartments and Flats	15%	30%	0%
231	Townhouses	15%	30%	0%
520	Public Primary School	0%	50%	0%
530	Public Secondary School	0%	50%	0%
560	Places of Public Worship	10%	0%	0%
565	Pre-School (Day Care Centre)	0%	50%	0%
710	Offices	20%	30%	0%
720	Medical Centre	10%	0%	0%
820	Shopping Centre	10%	0%	0%



6.2 TRIP SUMMARY

6.2.1 Development Generated trips

The South African Trip Data Manual, (TMH17 version 1.01, September 2013) was used to estimate the trip generation for the proposed township. The TMH17 document recommends the following trip generation and splits in **Table 2a** below.

Table 2a: Trip Generation Rates

TMH 17 CODE	Land Use	Unit	Trip rates				Split	
			AM Rate	PM Rate	AM Rate (Reduced)	PM Rate (Reduced)	AM IN : OUT	PM IN : OUT
210	Single Dwelling Units	1 D/Unit	1,00	1,00	0,60	0,60	25:75	70:30
220	Apartments & Flats	1 D/Unit	0,65	0,65	0,46	0,46	25:75	70:30
231	Townhouses	1 D/Unit	0,85	0,85	0,60	0,60	25:75	70:30
520	Public Primary School	1 Student	0,85	0,30	0,43	0,15	50:50	50:50
530	Public Secondary School	1 Student	0,75	0,25	0,38	0,13	50:50	50:50
560	Place of Worship (wknd)	1 Seat	0,05	0,05	0,05	0,05	50:50	50:50
565	Pre-School (Day Care Centre)	1 Student	1,00	0,80	0,50	0,40	50:50	50:50
710	Offices	100 m ² GLA	2,10	2,10	1,18	1,18	85:15	20:80
720	Medical Consulting Rooms	100 m ² GLA	8,00	8,00	7,20	7,20	55:45	45:55
820	Shopping Centre	100 m ² GLA	0,60	3,40	2,81	3,06	65:35	50:50

The analysis will be conducted for the weekday AM and PM peak hours. The expected development generated trips for the weekday AM and PM peak hours are indicated in **Table 2b** below. **Table 2b** shows that the proposed development is expected to generate approximately **2117 trips** and **1398 trips** during the weekday AM and PM peak hours respectively. The trips are based on the reduced factors applied together with the ***Peak Hour Factor (PHF)**. The PHF is applicable to the Public Primary School, Public Secondary School and The Pre-School (Day Care Centre). The detailed trip generation calculation is contained in **Appendix C**.



Table 2b: Expected development generated trips (considering Trip Reduction Factors)

TMH 17 CODE	Land Use	Extent	AM PEAK			PM PEAK		
			In	Out	Total	In	Out	Total
210	Single Dwelling Units	409 Units	92	276	368	258	110	368
220	Apartments & Flats	737 Units	102	305	407	285	122	407
231	Townhouses	119 Units	21	64	86	60	26	86
*520	Public Primary School	700 Students	270	270	541	53	53	105
*530	Public Secondary School	500 Students	170	170	341	31	31	63
560	Place of Worship (wknd)	300 Seats	7	6	14	7	7	14
*565	Pre-School (Day Care Centre)	100 Students	29	29	59	25	25	50
710	Offices	3700 m ²	37	7	44	9	35	44
720	Medical Consulting Rooms	3000 m ²	119	97	216	97	119	216
820	Shopping Centre	1500 m ²	27	15	42	23	23	46
<u>TOTAL</u>			876	1241	<u>2117</u>	<u>847</u>	<u>550</u>	<u>1398</u>

6.3 GROWTH RATE

TMH 16 Volume 1 requires that a five-year horizon be considered for developments that generate more than 50 trips. TMH 17 recommends growth rates for developments as shown in **Table 3**.

Table 3: Typical traffic growth rates

DEVELOPMENT AREA	GROWTH RATES
Low growth areas	0 – 3%
Average growth areas	3 – 4%
Above average growth areas	4 – 6%
Fast growing areas	6 – 8%
Exceptionally high growth areas	>8%

To determine the 2030 background traffic volumes, a growth rate of 3,0% per annum will be applied to the 2025 weekday traffic volumes.



6.4 TRAFFIC VOLUME SCENARIOS

The existing 2025 peak hour traffic volumes (see **Figure 2**) were thus subjected to a 3,0% growth rate over five years; this is in line with the average growth rate as given in **Table 3**. The 2030 background peak hour traffic volumes are presented on **Figure 3**.

The following scenarios will be analysed in this study:

- Scenario 1: 2025 peak hour traffic volumes
- Scenario 2: 2025 background plus development generated peak hour traffic volumes
- Scenario 3: 2030 background plus development generated peak hour traffic volumes



7 Site Accesses

7.1 PROPOSED ACCESS ROAD

The Traffic Study provides a framework and ensures that the proposed development is sustainable from a traffic engineering point of view. The proposed development will have one access point off the external road network. The following access points will be provided:

- **Herman Street Access:** the proposed development will take access off this road approximately 800 m west of the intersection of Herman Street and Erica Street.

Refer to **Drawings CC01 - CC02** illustrating the proposed access position.



8 Traffic Impact and Capacity Analyses

8.1 SCENARIOS ANALYSED

The weekday AM and PM peak hour trip generation of the development will be analysed. The critical peak hour analysis will be considered for the following scenarios:

- Scenario 1: 2025 Existing peak hour traffic volumes
- Scenario 2: 2025 background plus development generated peak hour traffic volumes
- Scenario 3: 2030 background plus development generated peak hour traffic volumes

This is in line with TMH16 document requirement for scenarios to be considered in a Traffic Impact Assessment. The SIDRA analysis results are attached as **Appendix D**.

8.2 CAPACITY ANALYSIS

The capacity analysis results will be updated following analysis of the traffic data to be received.



9 Non-motorised and Public Transport

9.1 BACKGROUND

In terms of the National Land Transport Act 5 of 2009, Section 38, it is a requirement that an assessment of the public transport be included in a Traffic Study.

9.2 EXISTING PUBLIC TRANSPORT SERVICES

9.2.1 Existing Public Transport Modes used within the Study Area

Minibus taxis and buses were observed operating along the surrounding road network.

9.2.2 Existing Public Facilities within the Study Area

The study area is located within an agricultural area and no public transport facilities within the study area are provided. There is a taxi rank in Potchefstroom CBD which is approximately 3,5 km northwest of the study site.

9.3 PROPOSED / NEW TRANSPORT FACILITIES

9.3.1 Paved Sidewalks:

In order to ease and formalise the movement of pedestrians, it is proposed that 2,0 m wide paved (or dust free) sidewalks be constructed along both sides of the internal roads within the proposed development. Refer to **Drawings CC01** and **CC02** illustrating the proposed sidewalks.



10 Proposed Road Improvements / Upgrades

10.1 GENERAL

The proposed Road improvements and Upgrades are in accordance to the *Department of Transport: Non-Motorised Transport Facility Guideline, 2014* and the *National Land Transport Strategic Framework Notice 823 of 2015, Sections 5.4 and 5.5*.

10.2 PROPOSED / NEW TRANSPORT FACILITIES

10.2.1 Paved Sidewalks:

In order to ease and formalise the movement of pedestrians, it is proposed that 2,0 m wide paved (or dust free) sidewalks be constructed along both sides of the internal roads within the proposed development.

Refer to **Drawings CC01** and **CC02** illustrating the proposed facilities within the proposed development

10.3 PROPOSED ROAD UPGRADES

In order to improve vehicle movement along Herman Street, it is proposed that the 360 m section of Herman Street from the development access be widened to accommodate two lanes, allowing for bidirectional traffic flow. Refer to Image 1 below indicating the section of Herman Street to be upgraded.



Image 1: Section of Herman to be upgraded to Two-lanes



11 Conclusions and Recommendations

The following conclusions and recommendations can be made based on the findings of this report:

- This report pertains to the Traffic Impact Assessment in support of the proposed Township Establishment on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ. The study site is located southwest of the R53 on Herman Street and falls within the JB Marks Local Municipality area of Jurisdiction.
- Remaining extent of Portion 46, Portion 58 and 59 have a combined extent of 85,2225 hectares, currently vacant land and are surrounded by residential land uses to the north and vacant land to the south, west and east.
- The intention of the client is to establish a township on the Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ which will comprises of “Residential 1,” “Residential 2,” “Institutional,” “Business 1,” “Business 2,” “Municipal.” “Public Open Space” and “Public Roads” land uses.
 - Site Extent = 85,2225 ha
 - Residential 1
 - Single Dwelling Units = 409 units
 - Residential 2
 - Flats = 737 units
 - Townhouse = 119 units
 - Institutional
 - Creche / Day Care Centre = 80 Students
 - Place of Worship = 100 Seats
 - Primary School = 700 students
 - Secondary School = 600 Students
 - Business 1
 - Shops = 1500 m²
 - Business 2
 - Medical Centre = 3000 m²



- Municipal
 - Multipurpose Centre = 3700 m²
 - Public Open Space
 - Public Roads
- The proposed development is expected to generate approximately **2117 trips and 1398 trips** during the weekday AM and PM peak hours respectively.
- The Traffic Study provides a framework and ensures that the proposed development is sustainable from a traffic engineering point of view. The proposed development will have various access points off the external road network, refer to **Drawings CC01 - CC03** illustrating the proposed access positions.
- Minibus taxis and busses were observed operating along surrounding roads in relation to the development site.
- In order to ease and formalise the movement of pedestrians, it is proposed that 2,0 m wide paved (or dust free) sidewalks be constructed along both sides of the internal roads within the proposed development.
- In order to improve vehicle movement along Herman Street, it is proposed that the 360 m section of Herman Street from the development access be widened to accommodate two lanes, allowing for bidirectional traffic flow.

It is therefore recommended that the Township Establishment on Remaining extent of Portion 46, Portion 58 and 59 of the Farm Elandsheuwel 436-IQ be approved from a traffic engineering point of view.



12 References

1. TMH 16 Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual, Version 1.0, Committee of Transport Officials (COTO) August 2012.
2. TMH 17 Volume 1, South African Trip Data Manual, Version 1.01, Committee of Transport Officials (COTO) September 2013.
3. TRH 26, South African Road Classification and Access Management Manual, Version 1.0, Committee of Transport Officials (COTO) August 2012.



Figures

Figure 1a Locality plan

Figure 1b Locality plan



CHRISEN CONSULTING
CIVIL • STRUCTURAL • TRANSPORT • ENGINEERS

Project: C1584-251124

PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF PORTION 46,
PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL 436-IQ

Figure Description:

LOCALITY PLAN

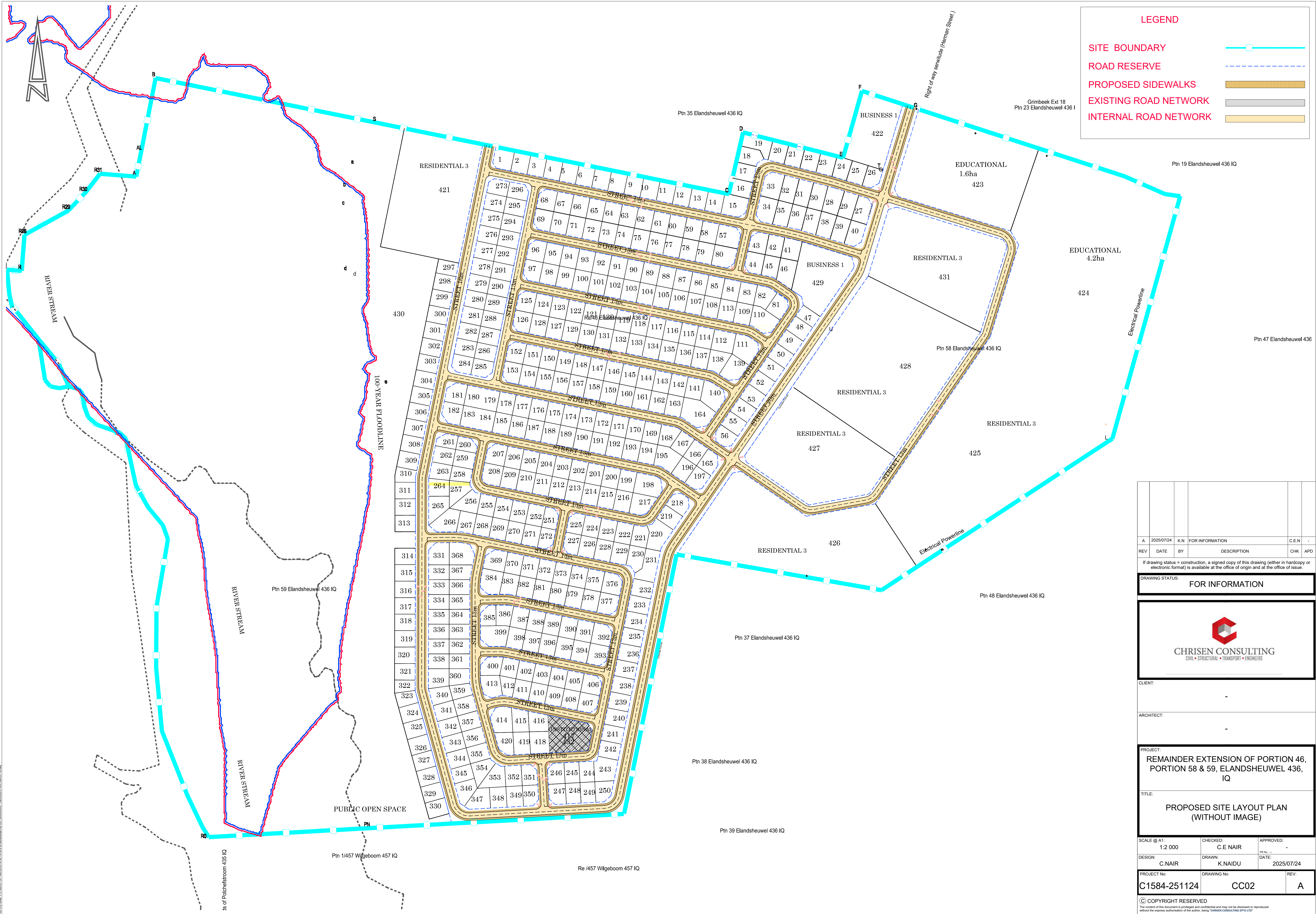
1a





Drawings

- Drawing CC01 Proposed Site Access Layout Plan
- Drawing CC02 Proposed Site Access Layout Plan (Without Image)
- Drawing CC03 Existing Intersection



LEGEND

- SITE BOUNDARY
- ROAD RESERVE
- PROPOSED SIDEWALKS
- EXISTING ROAD NETWORK
- INTERNAL ROAD NETWORK

A	2025/07/24	K.N	FOR INFORMATION	C.E.N	-
REV	DATE	BY	DESCRIPTION	CHK	APD

If drawing status = construction, a signed copy of this drawing (either in hardcopy or electronic format) is available at the office of origin and at the office of issue.

DRAWING STATUS: FOR INFORMATION



CLIENT:

ARCHITECT:

PROJECT:
REMAINDER EXTENSION OF PORTION 46,
PORTION 58 & 59, ELANDSHEUWEL 436,
IQ

TITLE:
PROPOSED SITE LAYOUT PLAN
(WITHOUT IMAGE)

SCALE @ A1:
1:2 000

CHECKED:
C.E NAIR

DESIGN:
C.NAIR

PROJECT No:
C1584-251124

DRAWING No:
CC02

APPROVED:
-
DATE:
2025/07/24

REV:
A

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LEGEND

SERVE

ROAD NETWORK

[illegible]

DRAWING STATUS: **FOR INFORMATION**



CLIENT:

ARCHITECT:

PROJECT:
REMAINDER EXTENSION OF PORTION 46,
PORTION 58 & 59, ELANDSHEUWEL 436,
IQ

TITLE:

EXISTING INTERSECTION

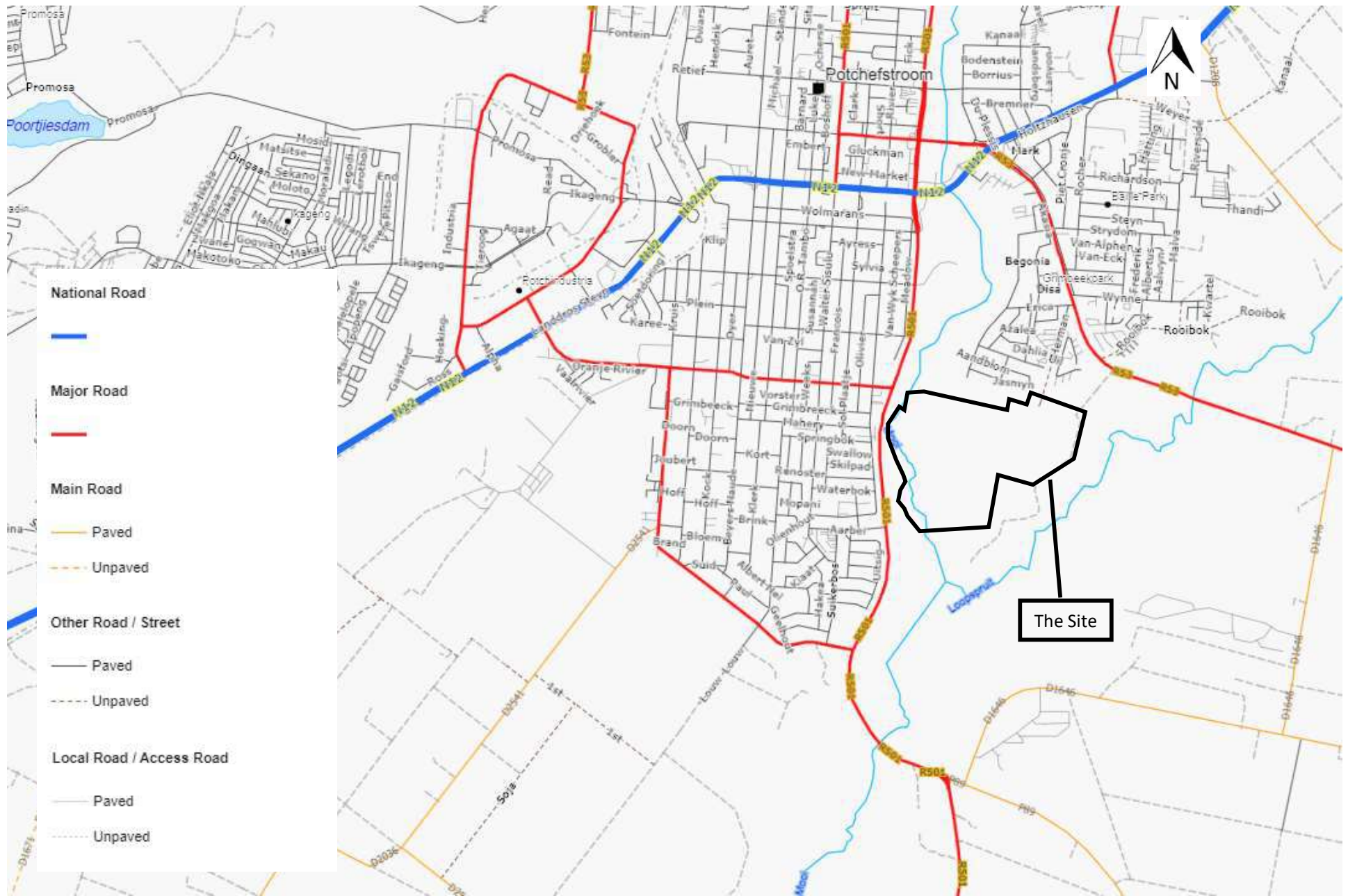
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DESIGN: C.NAIR	DRAWN: K.NAIDU	DATE: 2025/07/24
PROJECT No: C1584-251124	DRAWING No: CC03	REV: A

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Appendix A

- North West Province GIS Road Network Map



Appendix A: North West Province GIS Road Network Map

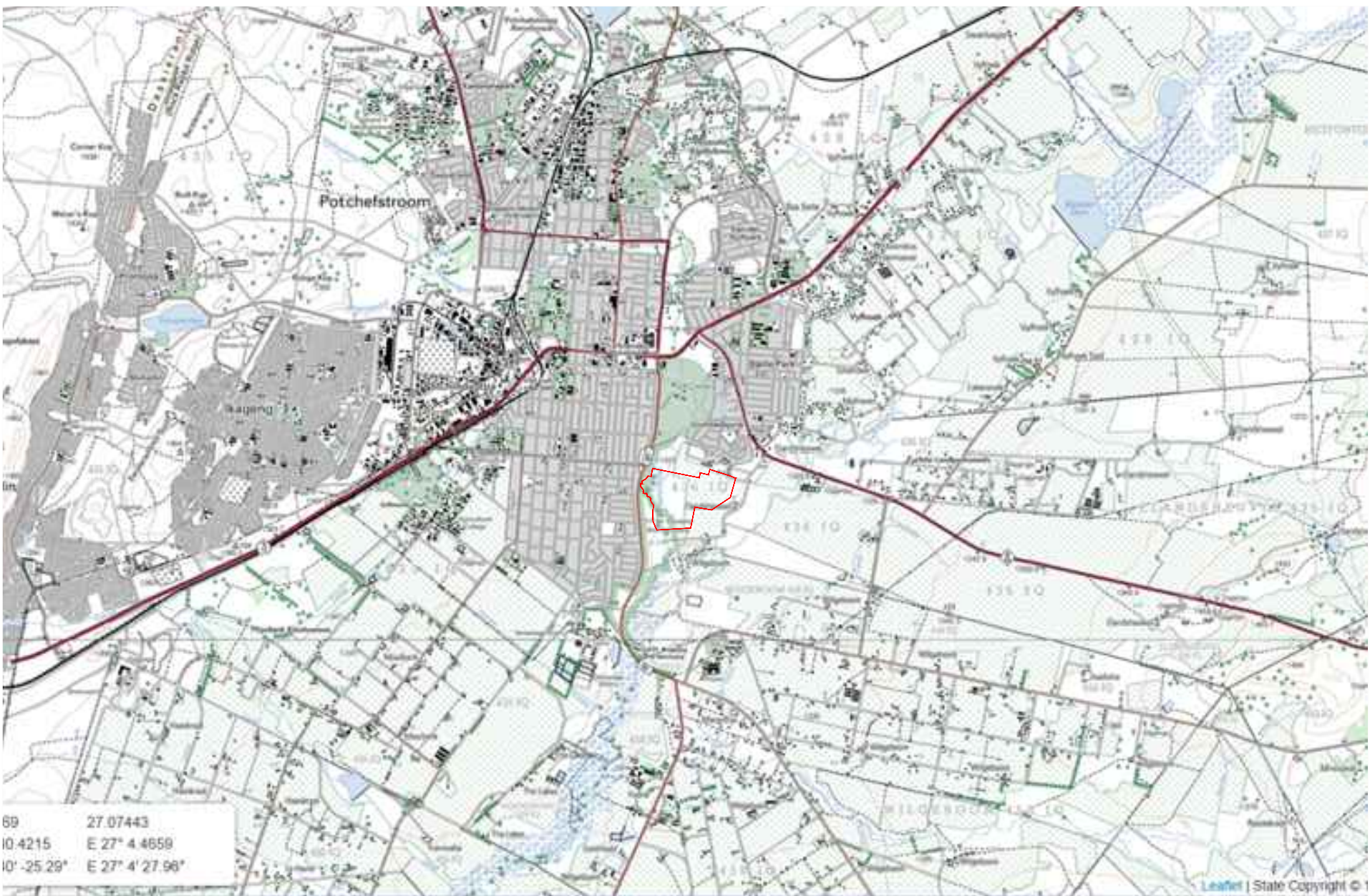


Appendix B

- Site Development Plan
- SG Diagrams

Proposed Township Layout Plan

LOCALITY MAP



LAND USE TABLE

ZONING	LAND USES	NO. OF ERVEN	AREA (HA)	AREA (%)	NOTATION
Residential 1	Single Dwelling Units	409	12.6705	15.04	
Residential 2	Townhouse/Semi detached	3 (approx. 119 units @25 per ha)	9.5583	11.34	
Residential 3	Flats/Apartments	11 (approx. 737 units @122 per ha)	12.0904	14.35	
Institutional	Creche/Day Care Centre	2	0.3263	0.39	
Institutional	Places of Worship	1	0.1279	0.15	
Institutional	Primary School	1	1.9150	2.27	
Institutional	Secondary School	1	3.8997	4.63	
Business 1	Shops/Retail	1	0.4327	0.51	
Business 2	Medical Centre	1	0.7935	0.94	
Municipal	Multi-purpose Centre	1	0.7595	0.90	
Public Open Space	Recreational	1	30.7524	36.51	
Public Roads	Streets		11.6163	13.79	

TOTAL DEVELOPABLE AREA	429	84.2225	100	
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LEGEND

Proposed Erven
Project Area Boundary
Subject Farm Portions

SCALE

1: 2000 (A0 Format)
1: 4000 (A1 Format)
1: 8000 (A2 Format)
1: 16000(A3 Format)

PREPARED BY: Vhuluvhi Group	PREPARED FOR: HDA
---------------------------------------	-----------------------------



Designed By (Town Planner): Professional Reg. No: Signature:.....	Date: 06 October 2025 Drawing No: Grim/001Rev2
---	---

MUNICIPAL APPROVAL	GEOTECHNICAL CERTIFICATION	FLOODLINE CERTIFICATION	SURVEY CERTIFICATION & DETAILS
Approved By: Signature..... Director: Signature..... Date:.....	It is hereby certified that the Phase 1 Geotechnical investigation for the project area was undertaken by a qualified Geotechnical Engineer in line with the NHBRC Guidelines: Name Registration No Signature Date	In terms of Section 114 of the National Water Act, the project area is affected by flood water within the 1:100 year period from the streams/rivers as indicated in the floodline report. As a result development must be done outside the identified floodlines: Name Registration No Signature Date	Contour Intervals: 0.5m Coordinate Reference System: World Geodetic System 1984 Name Registration No Signature Date



Appendix C

- Trip Generation Table

PROPOSED TOWNSHIP ESTABLISHMENT ON REMAINING EXTENT OF
PORTION 46, PORTION 58 AND 59 OF THE FARM ELANDSHEUWEL
DEVELOPMENT TRIP GENERATION TABLE

Trip Code	Land Use	Development	Size (m ²)	Unit of Measurement	COTO Peak Hour Base Trip Generation Rates (veh/h)						Trip Reduction Factors (%)				Adjusted Peak Hour Trip Rate (veh/h)		Total Expected Peak Hour Trip Generation (Veh/h)						
					AM PEAK	SPLIT		PM PEAK	SPLIT		Mixed-use (Pm)	Vehicle Ownership (Pv)	Transit Nodes or Corridors (Pt)	Total (Pc)	AM PEAK	PM PEAK	AM PEAK			PM PEAK			
						IN	OUT		IN	OUT							In	Out	TOTAL	In	Out	TOTAL	
210	Single Dwelling Units	Single Dwelling Units		409	1 D/Unit	1,00	25%	75%	1,00	70%	30%	10%	0%	0%	10,0%	0,90	0,90	92	276	368	258	110	368
220	Apartments & Flats	Apartments & Flats		737	1 D/Unit	0,65	25%	75%	0,65	70%	30%	15%	0%	0%	15,0%	0,55	0,55	102	305	407	285	122	407
231	Townhouses (Simplex/Duplex)	Townhouses (Simplex/Duplex)		119	1 D/Unit	0,85	25%	75%	0,85	70%	30%	15%	0%	0%	15,0%	0,72	0,72	21	64	86	60	26	86
520	Public Primary School	Public Primary School		700	1 Student	0,85	50%	50%	0,30	50%	50%	0%	50%	0%	50,0%	0,43	0,15	270	270	541	53	53	105
530	Public Secondary School	Public Secondary School		500	1 Student	0,75	50%	50%	0,25	50%	50%	0%	50%	0%	50,0%	0,38	0,13	170	170	341	31	31	63
560	Places of Public Worship (Wknd)	Places of Public Worship (Wknd)		300	1 Seat	0,05	55%	45%	0,05	50%	50%	10%	0%	0%	10,0%	0,05	0,05	7	6	14	7	7	14
565	Pre-School (Day Care Centre)	Pre-School (Day Care Centre)		100	1 Student	1,00	50%	50%	0,80	50%	50%	0%	50%	0%	50,0%	0,50	0,40	29	29	59	25	25	50
710	Offices		3700,00	37	100m² GLA	2,10	85%	15%	2,10	20%	80%	20%	30%	0%	44,0%	1,18	1,18	37	7	44	9	35	44
720	Medical Consulting Rooms	Medical Consulting Rooms	3000,00	30	100m² GLA	8,00	55%	45%	8,00	45%	55%	10%	0%	0%	10,0%	7,20	7,20	119	97	216	97	119	216
820	Shopping Centre	Shopping Centre	1500,00	15	100m² GLA	0,60	65%	35%	3,40	50%	50%	10%	0%	0%	10,0%	2,81	3,06	27	15	42	23	23	46
TOTAL DEVELOPMENT GENERATED TRIPS:																		876	1241	2117	847	550	1398



Appendix D

- SIDRA Analysis Results



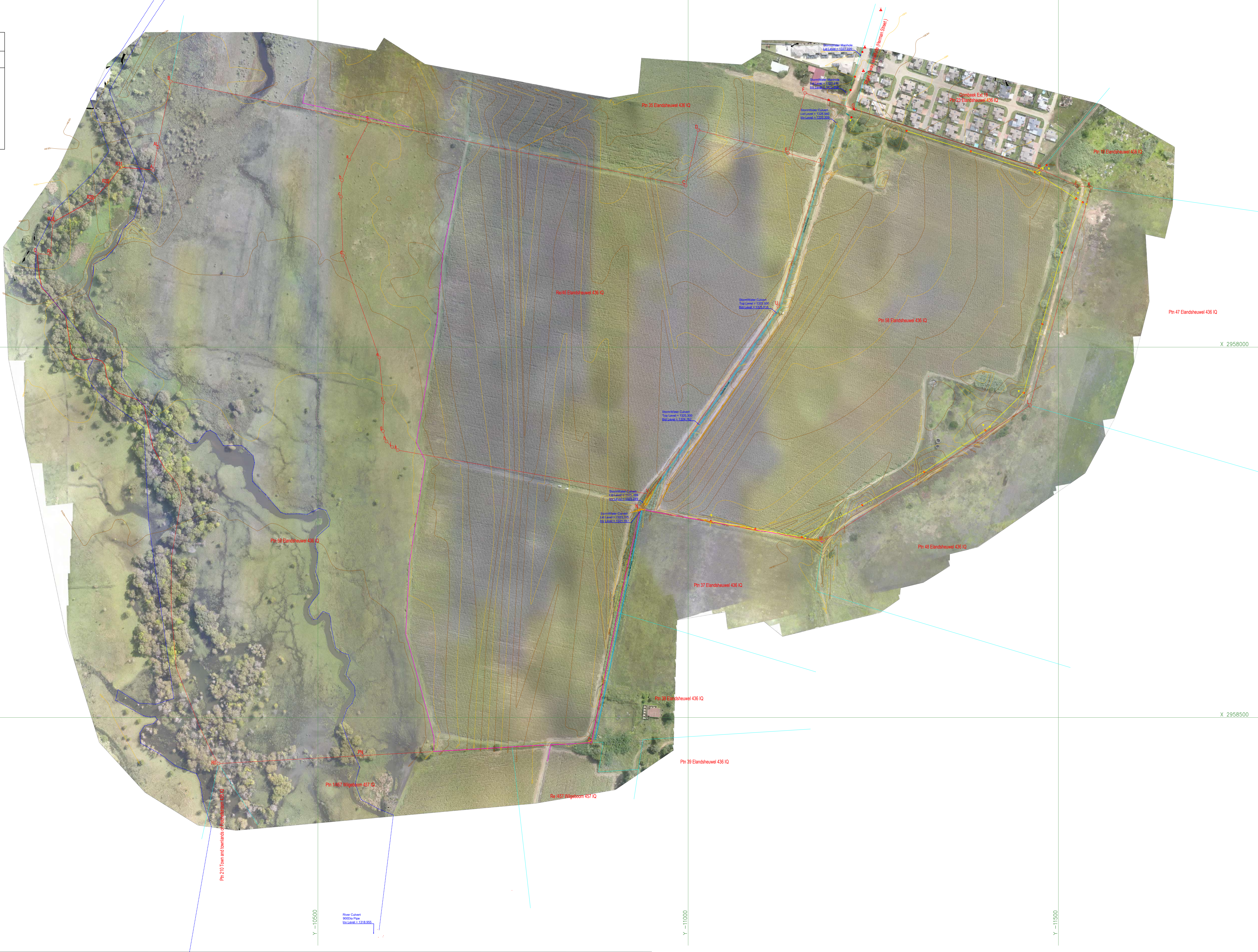
Appendix D

- Survey

BENCHMARKS (WG27)				
Name	Y	X	Z	Description
GLG1	-11236.57	2957627.24	1326.244	12mm Peg
GLG2	-11238.56	2957595.48	1327.042	12mm Peg
GLG3	-11260.19	2957545.12	1327.362	12mm Peg

PROPERTY NOTES:
1. The figure A,B,S,a,b,c,d,e,f,g,h,j,k,V,N,O,PN,R0,center line river, Q,R, R28, R29, R30, R31,A represents PTN 59 Elandsheuwel 436 IQ, Vide diagram SG No. 820/2014
2. The figure S,C,D,E,T,U,V,k,j,h,g,f,e,d,c,b,a,S represents Re 46 Elandsheuwel 436 IQ, Vide diagram SG No. 3697/1971.
3. The figure E,F,G,H,J,K,L,M,N,V,U,T,E represents PTN 58 Elandsheuwel 436 IQ, Vide diagram SG No. 819/2014

LEGEND	
	Benchmark
	Sewer Manhole
	Storm water Manhole
	Electricity Box
	Electrical Manhole
	Fire Hydrant
	Lamp Post
	Valve
	Water Meter
	Sign Board
	Stay anchor
	Inspection Eye
	Electricity Pole
	Telkom Box

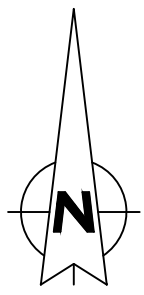


TOPOGRAPHICAL PLAN
OF
Elandsheuwel 438
OF
Grimbeek Park

NOTES:

1. Heights are i.t.o MSL.
2. Contour intervals are 0.5m.
3. Survey based on WGS 84 Lo 29 system.
4. Areas and dimensions are subject to final survey.

Surveyor:	Glenn Gover
Draftsman:	Glenn Gover
Date Drawn:	1 April 2025
Date Surveyed:	24-31 April 2025
Client:	Luthada Olympus (Vhuluvhi Group)
File:	F2709



SCALE 1 : 2000 (A0)

AMENDMENTS TO PREVIOUS REVISION:	
No.	DATE

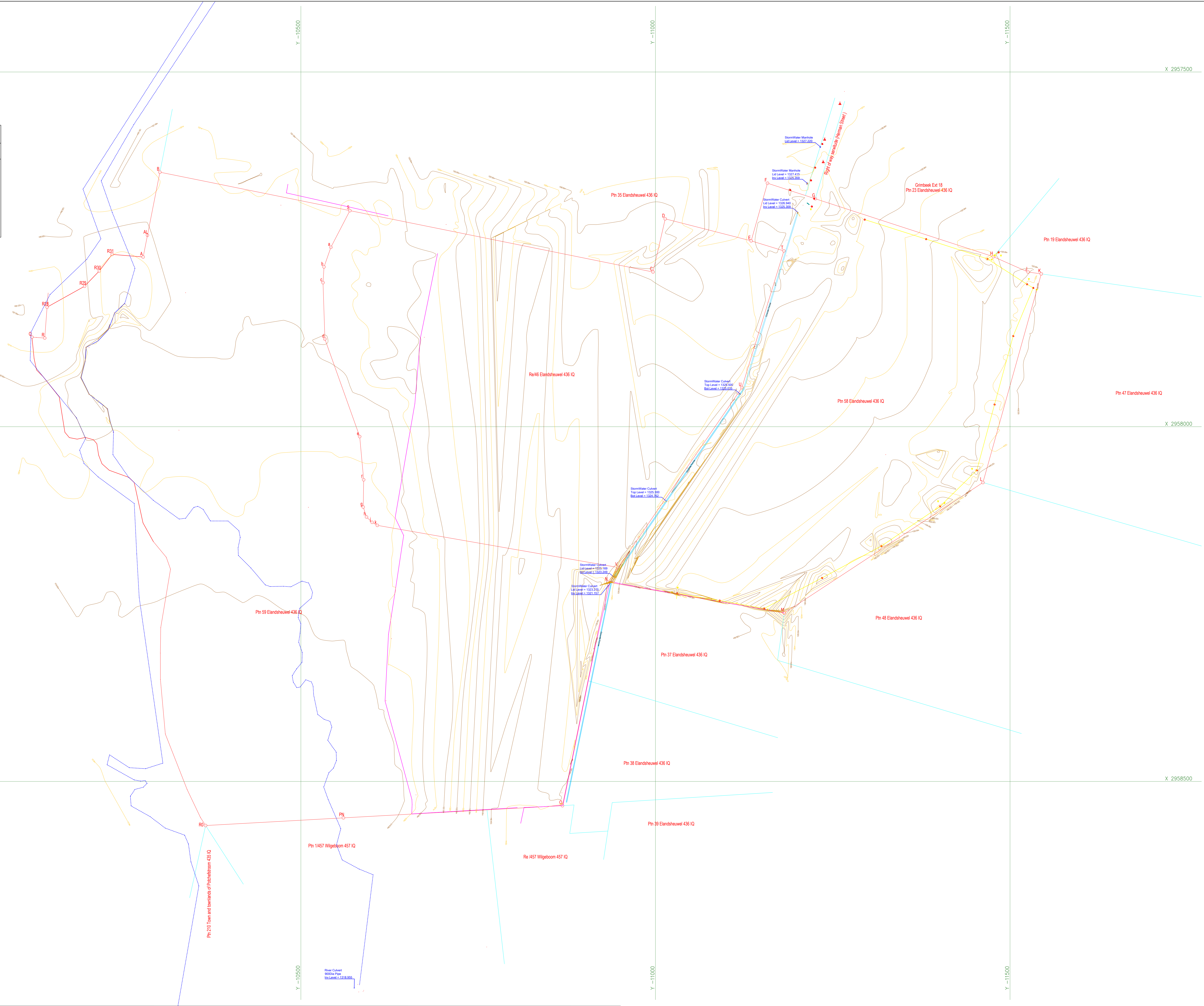


Tel: (011) 768 1233
www.cdj.co.za/info@cdj.co.za

BENCHMARKS (WG27)				
Name	Y	X	Z	Description
GLG1	-11236.57	2957627.24	1326.244	12mm Peg
GLG2	-11238.56	2957595.48	1327.042	12mm Peg
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3. The figure E,F,G,H,J,K,LM,N,V,U,T,E represents PTN 58 Elandsheuwel 436 IQ, Vide diagram SG No. 819/2014

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	Water Meter
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	Electricity Pole
	Telkom Box

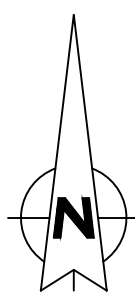


TOPOGRAPHICAL PLAN
OF
Elandsheuwel 438
OF
Grimbeek Park

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File:	F2709



SCALE 1 : 2000 (A0)

AMENDMENTS TO PREVIOUS REVISION:	
No.	DATE
DESCRIPTION:	



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Appendix E

- Aquatic Study Report for the Grimbeek Park Township Establishment Project



(EIA) AQUATIC SPECIALIST ASSESSMENT REPORT
Proposed Grimbeek park township establishment-JB Marks local
Municipality-in Potchefstroom



Report number	AfrgriembeekbiodAQR2025
Project Title	Grimbeek park township establishment.
Client	Vhuluvhi group

The specialist who prepared the report	Mr Munzhelele HE Master of Science in Natural Sciences, University of Venda (2013). Bachelor of Science Honors in Natural Sciences, University of Venda (2005). Bachelor of Science Degree in Aquatic Biology, University of Venda (2004). SACNASP Pr No 100011/11
Reviewed and approved by	Mr Mugwabana FH SACNASP Registered scientist(Pr No 114263), Ecological science professional scientist

Declaration by specialist

I Mugwabana Fhatuwani Hendrick declare that: this report is certified correct and represents the findings on the proposed site capability and suitability to support intended development. I declare that this report reflects a true reflection of what exists on site, and we have no conflict of interest in the project proposed. I act as the independent specialist in this application.

I will perform the work relating to the application objectively, even if this results in views and findings that are not favorable to the applicant.

I declare that there are no circumstances that may compromise my objectivity in performing such work.

I have expertise in conducting the specialist report relevant to this application, 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 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 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; all the particulars furnished by me in this form are true and correct; and

I realize that a false declaration is an offense in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signed: 

Date: 30/04/2025

Contents table		
0	Executive summary	3
1.	Introduction	5
1.1	Aim, scope and objectives of the study.	7
1.2	Assumptions and limitations.	7
1.3	Definitions and legislative framework.	7
2.	Study area.	8
2.1	Visual characteristics and topography Geographic area.	8
2.2	Catchment Assessment.	10
2.2.1	Climate, hydrology, geology and geohydrology.	10
2.3	Aquatic vegetation type and indicator species and their conservation value.	12
2.4	Aquatic features, Fauna biodiversity, ecological health, importance, sensitivity.	12
2.4.1	Aquatic macroinvertebrates.	12
2.4.2	Bird species diversity in the study area.	12
2.4.3	Description of aquatic features.	13
2.4.4	River characteristics and resource quality objectives for instream and riparian	13
2.4.5	Index of habitat integrity.	14
2.4.6	Ecological importance, CBA and aquatic sensitivity.	14
2.5	Anurans or amphibians that were identified from the wetland site.	16
2.5.1	List of frogs that are commonly found on wetland sites.	16
2.5.2		16
2.5.3		16
3.	Methodology for assessment.	18
3.1	Field assessment and observations	19
3.2	Wetland delineation.	20
3.3	Wetland functional assessment and River health assessment.	20
3.4	Determination of the present ecological status (PES).	21
3.5	Determination of ecological importance and sensitivity (EIS).	22
3.6	Determination of buffer requirements.	21
3.7	Results and discussion.	23
3.7.1	Functions and value of wetlands.	23
3.8	Status of the study area's wetlands.	23
3.9	Wetland delineation results while using different techniques.	23
3.9.1	Wetland soil (wetness and soil form).	23
3.9.2	Hydric soil indicators of saturation.	24
3.10	Description of wetland type; hydrology and catchment characteristics.	24
3.11	Present ecological status of wetlands in the study area.	24
3.12	The ecological health assessment.	25
3.13	The EIS of the remaining wetland area.	26
3.14	Buffer requirements.	26
4	Impact assessment and significance.	26
4.1	Impact mitigation measures.	26
4.2	Nature of impacts on aquatic resources associated with land and water use.	27
4.2.1	Impact assessment.	27
4.3	Impact assessed in the aquatic environment including wetlands.	27
4.4	Associated mitigation measures.	27
4.5	Impact rating matrix after mitigation measures.	27
5.	Recommendations.	29
6.	Conclusion.	30

7.	Photos.	31
8.	References.	35
Tables and figures		
T1	Wetland assessment review	10
T2	List of aquatic macroinvertebrates species commonly found in wetlands.	17
T3	List of birds recorded on site during field survey.	17
T4	List of frogs found on wetland site.	17
T5	The present ecological status (PES) categories and descriptions for wetland health.	21
T6	Ecological Importance and Sensitivity rating scale used for the estimation of scores.	22
T7	The significance scoring technique used for scoring each potential impacts.	26
T8	The impact significance rating used.	26
T9.	Impacts assessed in the study area.	27
T10	The impact assessment matrix.	28

Executive Summary

The proposed township development falls within JB Marks Local Municipality, North west Province. This appointment includes providing aquatic biodiversity study undertaken by Africa Ecological services to compile a supporting the proposed township development. This aquatic biodiversity report has evaluated the extent to which the aquatic environment is likely to be impacted; and analyzed the current existing environmental impacts and recommended the preventative and control measures.

The focus of the study was to map; survey and assess aquatic systems and associated resources impacts within the existing site of the proposed development footprint and 200-meter radius boundaries of the development proposed. The study also required Wetland delineation and relevant buffers to be applied where applicable.

Township establishment can have significant impacts on aquatic vegetation in various ways. These include direct vegetation clearance or removal, introduction of alien plants, alteration of microhabitats, soil erosion and compaction. Although township establishment is necessary for the development that entails homes and work opportunities, it requires careful consideration of environmental impacts on aquatic vegetation and ecosystems.

A site visit was conducted on the 15th of April 2025, and this constituted a later summer season survey. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling them to take an informed decision. Authorization for the proposed development will be dependent on the specialist's recommendations which are aligned to the findings. Should the development be undertaken with the ignorance of the indicated measures and

recommendations any post damage or negative impacts will remain the responsibility of the developer.

According to the surveys undertaken, the study site is in an area that is currently used for grazing; the other farm portions are being used for the ploughing of crops.

The sensitivity study which was done revealed that the site is covered by 50m buffer flood plain that forms part of the Mooi river Perennial River and falls within Rand highveld grassland.

The aquatic sensitivity of the site is very high. Hydropedology assessment was done and confirmed the site water flow to be subsurface water flow mostly influenced by rainfall recharge. The plan designs must avoid the indicated protected areas that are no-go areas together with the irreplaceable areas indicated on the sensitivity map and other google based maps that have clear background.

During the site survey, no aquatic faunal species of conservation concern were encountered on site. Their absence could be explained by the habitat fragmentation and daily presence of humans in the area and grazing. A vegetation survey revealed that the site has been exposed to continuous disturbance from uncontrolled veld fires, grazing and alien invasion. Rand Highveld Grassland is the one that occupies the geographic area with it being made up of mixed secondary vegetation and invasive alien plants that require eradication.

The Mooi River is currently classified as a class III water resource, meaning it is heavily impacted by human activity but nevertheless ecologically sustainable. The recommended ecological category for the Mooi River is C/D, indicating it is moderately to largely modified (DWA, 2016). The Mooi River is mainly impacted on by mining and agricultural activities that are being taking place in the catchment.

It is the opinion of the specialist that this application should be considered, provided that all recommendations and mitigations are strictly adhered to and any further additional measures that might arise also get the involvement or seek continuous advice from the specialist.

1 Introduction

Aquatic studies are referred to or defined as a study that focuses on fauna and flora that are living in or near water. It is further explained as the natural environment that is characterized by visible or surface water, flowing river, wetlands and stream. The term "wetland" is a generic term for all the different kinds of habitats where the land is wet for some period each year, but not necessarily permanently wet. Wetlands are found where the landform (topography) or geology slows down or obstructs the movement of water through the catchment, or where the groundwater surfaces causing the soil layers in the area to be temporarily, seasonally or permanently wet. This provides an environment where plants (hydrophytes) that are adapted to wet conditions tend to grow in abundance. The plants in turn affect the soil and hydrology by further slowing down the movement of water (e.g. reed beds) or by producing organic matter that may accumulate in the soil.

Wetlands are important because of the functions and values that they provide which benefit mankind. These benefits can be either direct or indirect benefits. Until very recently the benefits of wetlands to society were often not recognized, and many wetlands have been destroyed, or poorly managed. Wetland benefits refer to: "those functions, products, attributes, and services provided by the ecosystem that have value to humans in terms of worth, merit, quality or importance. These benefits may derive from outputs that can be consumed directly; indirect uses which arise from the functions or attributes occurring within the ecosystem; or possible future direct outputs or indirect uses" (Howe et al., 1991 in Kotze et al., 2005).

.

The functioning of aquatic resources is also affected by other factors, many of which result from the activities of people. These include "off-site" factors that take place in the surrounding catchment (e.g. a change in land cover from natural grassland to a gum tree plantation which would decrease the amount of water reaching the wetland) and "on-site" factors that take place at the wetland (e.g. fire, draining, damming, etc.).

A wetland delineation study was conducted on the study site to determine the presence and extent of wetland habitat for a proposed development accepting environment. The study area and its surroundings were surveyed, and it was found that no permanent wetlands are not present on the study area footprint where proposed development is intended. Vegetation indicators played a major role in determining the non-existence of wetland within the area.

Sensitivity assessment was done to investigate and determine the existence of wetlands in the study area. The intensive investigations that entailed both indicators for wetlands were used and for vegetation indicators the ones found were those that grown in non-wetland and wetland environments.

The sampling and analysis undertaken confirmed that there is no wetland within the floodplain which was inundated by water. Visual indicators confirmed that the affected area has large part covered by a flood plain was flowing water; water logged soil and maize that shows effects of water logging.



The aquatic ecology of the study area is affected by previously constituted agricultural practices and mining activities on the upper catchment.

1.1 Aim, scope, and objectives of the study.

The aims of the study were to:

- Verify the occurrence and typology of wetlands on the study site as delineated through desktop methods, and correct the delineation based on field-based assessment, thus enabling all wetlands on the study site to be mapped.
- Assess all wetland areas on the study site in the field.
- Based on the field assessment gain an understanding of the characteristics of the wetland, including hydrology, vegetation, soils, and geomorphology.
- Assess the possible impacts of the proposed developments on the wetlands, and suggest suitable mitigation measures, if relevant, to ameliorate or rehabilitate the damaged wetlands.
- Conduct Wet-Health for the determination of the Present Ecological State (PES) of the wetland.
- Conduct Wet-Eco Services for determination of ecosystem services. (Assessment of individual wetland ecosystem services.
- Assess the magnitude of impacts that could have occurred.
- Delineate wetland buffers as per the outcome of the field assessment.

1.2 Assumptions and Limitations

Detailed investigations were done through desktop surveys and field surveys for the affected area and the surrounding habitats to determine the wetland existence. The wetland survey was undertaken in the summer season (15th April 2025). This entails that the site was assessed during the summer season. All vegetation was green, vegetation gave a high confidence in the determination of a need for delineation or not as the wetland delineation is also based on primarily the analysis of soil-based indicators, terrain unit indicators, hydromorphic unit indicators, and water table and zonation. The predominantly grassy vegetation still displayed sufficient inflorescences to broadly identify the vegetative composition within the study area.

The primary aim of this aquatic study was the identification of human-driven impacts on the wetland, and determination of the buffer surrounding the wetland, in line with the stipulations of the Department of Water Affairs (DWAF) (DWAF, 2005), as well as the identification of potential impacts on the wetland associated with existing sand mining and other types of developments in the surrounding areas. Buffer zone guidelines for wetlands were used to assess the occurred impacts together with other various kinds of literature.

It was assumed that the area might be affected by a floodplain wetland hence this was not as their area was found to be having a-perennial stream associated with a 50m buffer flood plain. •

Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments

1.3 Definitions and the Legislative Framework and other agreements such as international agreements.

The proposed development must take into consideration the legislative requirements, policies, guidelines, and principles of the relevant regulatory documents such as the National Spatial Development Framework, the Local Municipality Integrated Development Plan (IDP), and National Biodiversity Plan; the provincial biodiversity sector plan and the National Environmental Management Act (NEMA).

The National Environmental Management Act (NEMA) outlines several principles that give guidance to developers, private landowners, members of the public, and authorities, of which principle number three of the act stipulates that development must be socially, environmentally, and economically sustainable. Section number 4(a) of the Act states that consideration should be given to all relevant factors which include ecosystem disturbance and loss of biological diversity must be avoided and prevented, and or where they cannot be completely avoided must be minimized, and mitigation measures applied; and that pollution and environmental degradation be avoided, and or where such cannot be completely avoided remedial action to the environment be instituted.

African Union climate change and resilient development strategy and action plan (2022-2032).

This strategy states the following

Principle 2: Conserving and restoring natural capital.

On 15 July 2021 the African Union launched our continental Green Recovery Action Plan, which focuses in five priority areas of which the following two are relevant to sustaining the natural resources through sustainable development:

Nature-based solutions and focus on biodiversity through work on sustainable land management, forestry, oceans, and ecotourism. Resilient agriculture, by focusing on inclusive economic development and green jobs. Green and resilient cities, including a focus on water (flooding and water resources) and enhancing information, communication and technology.

If natural ecosystems continue to be degraded and habitat loss is left unchecked, human-wildlife conflict is inevitable and the experiences so far suggest that the odds are stacked against wildlife and ecosystems.

Land-based ecosystems and the carbon sinks they comprise are concomitantly Africa's biggest risk

and opportunity in the face of projected impacts of climate change. Terrestrial biodiversity conservation is dependent on the protection and restoration of key ecosystems such as forests, wetlands, grasslands, highlands and coastal systems, which all serve as carbon sinks. Human-induced modification of the structure and function of many ecosystems through land use change and degradation (e.g., agricultural conversion, forest/grassland clearing and burning, urban expansion, mine and road expansion etc.). Africa's extensive tropical forests, mangroves and rangelands are critical land-based ecosystems in combating global climate change and provide valuable

ecosystem services to its people.

2 Description of the Site

2.1 Visual characteristics, topography and Geographic area.

The site is situated within the area of jurisdiction of JB MARKS Local Municipality, north west province. It is located within the following coordinates: Latitude: 26°44'5.8S 27°9'57.22E E. The site located in an area characterized by and surrounded by existing residential areas. Is located along the Mooi Rivier river catchment.



Figure 1: Map of the study area (The site of study is demarcated by the yellow line on the map).

The site of study area is characterized by gentle undulating and flat areas. Main tributary channel to Mooi river is loop spruit which has shallow to deep channels that has alluvial edges and deposits.

Loop spruit joins Mooi river on the south eastern side of the study site.

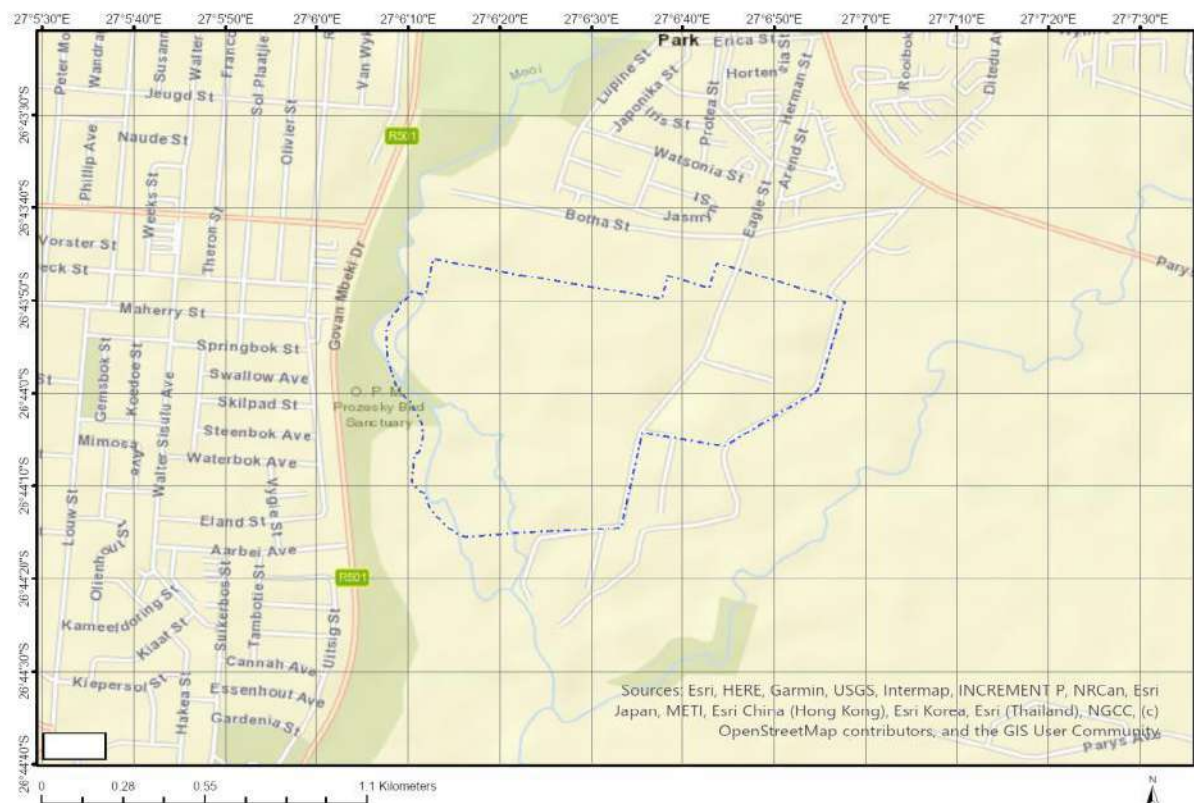


Figure 2: The map above shows orientation to the location of the study site (Sourced from screening report).

2.2 Catchment Assessment.

WATER MANAGEMENT AREA: Middle Vaal (Major Rivers are mooi,vet and vaal)				
QUATENARY CATCHMENT: Tertiary drainage regions C24, C25, C41 to C43, C60 and C70				
WETLAND TYPES IN THE STUDY SITE(HGM): No wetland				
WATER SOURCE TO THE WETLAND: Rainfall recharge and subsurface flow				
DELINEATED BUFFER DESCRIPTION (METRES)			50m flood plain	
WETLAND VEGETATION SPECIES COMPOSITION				
SAMPLING ZONE	FUCULTATIVE SPECIES		OBLIGATES SPECIES	
A01(20CM)	Sporobolus africanus		Typha capensis	
1B 01(40CM)	Sporobolus africanus		Typha capensis	
B02 (60CM)	Sporobolus africanus		Typha capensis	
C01(60CM)	Sporobolus africanus		Typha capensis	
SOIL ASSESSMENT USING AUGER				
ZONE	MOTTLES(Y/N)	COLOR	TYPE	COORDINATES
A01(20CM)	N	Black	Clay loam	-26.733 495/27.106 768
1B 01(40CM)	N	Black	Clay loam	-26.732 999/27.106 723
B02 (60CM)	N	Grey	Clay	-26. 732 263/27. 115 224
C01(60CM)	N	Black	Clay	-26.733 865/27.106 766

Table 1: Catchment, aquatic Wetland assessment for wetland typology and delineation.

2.2.1 Climate, hydrology, geology and geohydrology.

In Potchefstroom, the summers are long, warm, and mostly clear and the winters are short, cold, dry, and clear. Over the course of the year, the temperature typically varies from 36°C.

During the months of April, May, June, July and August you are most likely to experience good weather with pleasant average temperatures that fall between 20°C and 26°C. The area's topography is characterized by flat gentle land. The main geology of the area is characterized by Diabase rock group. Diabase is an intrusive igneous rock with the same mineral composition as basalt. It cools under basaltic volcanoes, like those at mid-ocean ridges. Diabase cools moderately quickly when magma moves up into fractures and weak zones below a volcano. The main soil group falls within the Rhodic Lixisols. Lixisols (notably in argic horizons) are the result of 'rubefaction' by dehydration of ferrihydrite to hematite in long dry seasons. These soils cover a total area of about 435 million hectares, of which more than half in Sub-Saharan and East Africa.

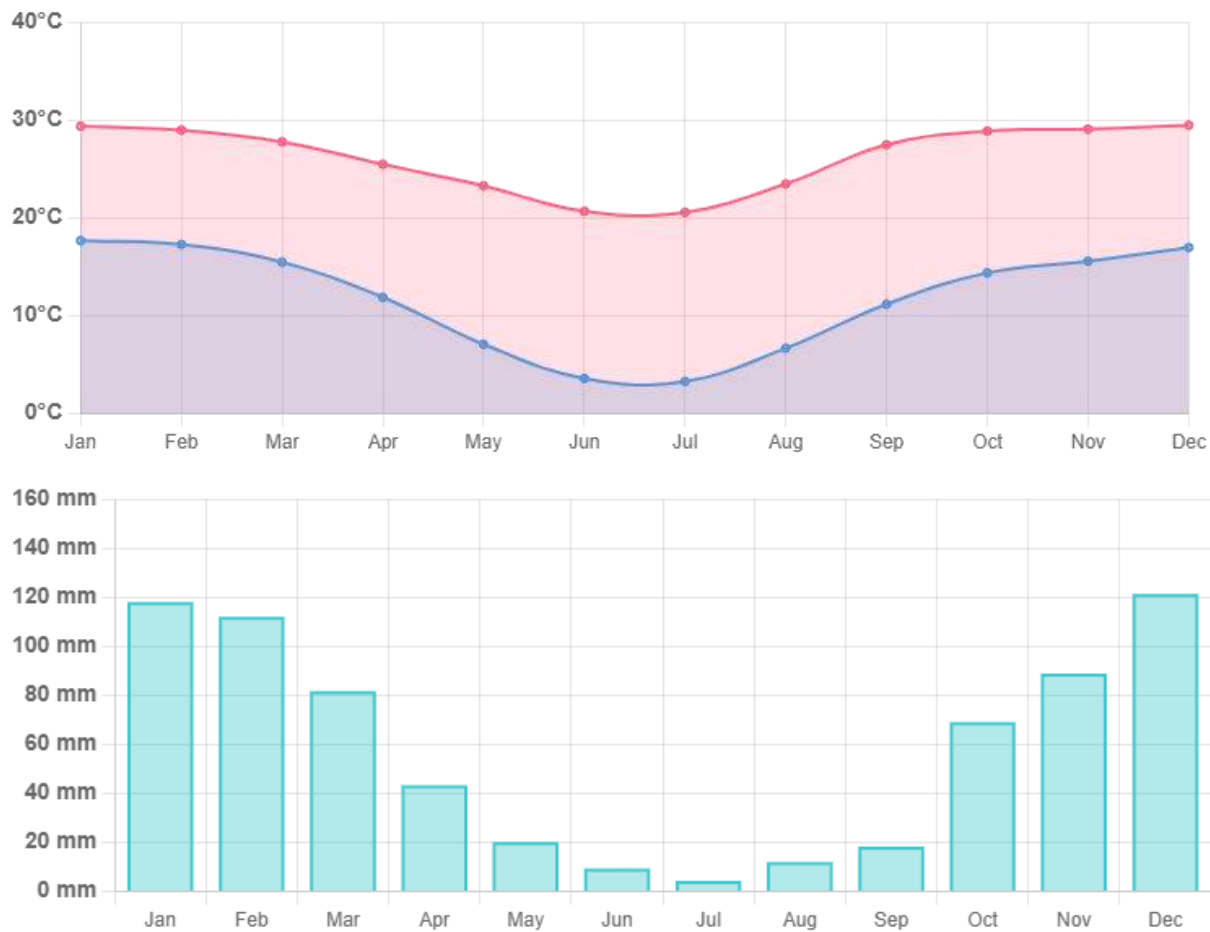


Figure 3: Climatic data of the study area (Climate data.org).

The runoff and the resulting flow within the watercourse on the property is thus higher during summer (December/February to April).

Water Source Area: these quaternary catchments are defined as water source areas, which are crucial for understanding and managing water resources within a region.

Sub-catchments: the Mooi River catchment is further subdivided into three major sub-catchments, which are important for managing water quality and resource allocation.

Dams: the presence of dams like Klerkskraal, Boskop, Klipdrift, and Potchefstroom within the catchment highlights its role in water storage and supply.

Environmental Issues: The Mooi River catchment faces challenges related to mining activities, pollution, and the need for integrated catchment management.

The Mooi River catchment in the North West Province of South Africa is situated within the broader quaternary catchment system, which is a hierarchical unit for water management. Specifically, the Mooi River catchment is defined by its three major sub-catchments: the Wonderfontein Spruit, the Mooi River proper, and the Loop Spruit. The catchment is also home to four major dams: Klerkskraal, Boskop, Klipdrift, and Potchefstroom.

The main geology of the area is characterized by Diabase rock group. Diabase is an intrusive igneous rock with the same mineral composition as basalt. It cools under basaltic volcanoes, like those at mid-ocean ridges. Diabase cools moderately quickly when magma moves up into fractures and weak zones

below a volcano. The main soil group falls within the Rhodic Lixisols. Lixisols (notably in argic horizons) are the result of 'rubefaction' by dehydration of ferrihydrite to hematite in long dry seasons. These soils cover a total area of about 435 million hectares, of which more than half in Sub-Saharan and East Africa.

2.3 Aquatic Vegetation type and Indicator Species.

Detailed aquatic and wetland vegetation assessment was undertaken using vegetation as the main indicator to determine wetland existence; confirm zones and determine the functionality. The results concluded on the area is mainly covered by a flood plain which is linked to Mooi river catchment.

Facultative plants are plants that are equally likely to be found in wetlands and non-wetlands. They are categorized as FAC and are further divided into subcategories FAC+ and FAC-. A plus sign indicates that the plant is more likely to be found in wetlands, while a minus sign indicates that it is less likely to be found in wetlands.

The Mooi River and its tributaries are recharged through several dolomitic eyes by the precipitation that ends up as ground water recharge (Winde & van der Walt, 2004) (Figure 2.4). The Bovenste Oog as well as surface water from the Wonderfontein spruit (WFS) feeds the Mooi River. The Boskop-Turffontein compartment and Gerhard Minnebron eye supplements the Mooi River through underground dolomitic compartments (Annandale and Nealer, 2011).

The main vegetation is characterized by woody invasive species; grass, reeds that were localised on farm boundaries where there are ridges and channelled drains. Weeping willow trees are the most dominate water adapted tree species.

2.4 Aquatic features, Fauna Biodiversity, ecological health, importance and sensitivity.

2.4.1 Aquatic Macroinvertebrates.

The following aquatic identification of the aquatic macroinvertebrates were recorded as presented in a table below. Their population might have been affected by negatively by pollution as Mooi river is known to facing lot of pollution form the industrial activities.

Order	Family	Taxon	Common name
Hemiptera	Corixidae	<i>Hesperocorixa castenea</i>	Water boatmen
Hemiptera	Naucoridae	<i>Ilyocoris cimicoides</i>	Creeping water bugs
Hemiptera	Notonectidae	<i>Notonecta maculata</i>	Backswimmers
Hemiptera	Nepidae	<i>Nepa cinerea</i>	Water scorpion
Diptera	Chironomidae	<i>Chironomus spp</i>	Midges
Mollusca	Lymnaeidae	<i>Lymnaea columella</i>	Reticulate pond snail
Diptera	Tabanidae	<i>Tabanus sulcifrons</i>	Horse flies

Table 2: List of aquatic macroinvertebrates species commonly found in wetlands.

2.4.2 Bird species diversity in the study area.

South Africa is a dry country; its rivers are often stretches of sand rather than of flowing water. Its estuaries, pans, and vleis are of the constant long droughts and human encroachment. Despite these, our wetlands have a considerable bird life of the widest variety and in high numbers. Within the wetland habitat, there are countless niches for individual species to exploit without intruding on others.

Waterbirds use many kinds of wetlands, including swamps, lagoons, mudflats, estuaries, bays and open beaches, freshwater and saltwater lakes, rivers, floodplain wetlands, and dams.

They fall into 3 main categories:

Common threats to wetlands include clearing and draining wetlands for agricultural and urban development; alterations to flooding patterns due to river regulation and climate change disturbance of feeding and roosting habitats by recreational users such as people fishing or walking, especially with dogs, or by feral animals such as foxes.

Bird life in the study area is normal for common birds but very low for aquatic or wetland types of birds because there is no permanent wetland that can provide favorable sites.

2.4.3 Description of aquatic features.

The main aquatic features that are present include flood plain; Mooi river and Loop spruit river. There are no wetlands. The Mooi River is located in the JB Marks Local Municipality in the Highveld eco-region within the North West Province in South Africa. A perennial river, it falls under the upper Vaal River WMA, catchment C23 and drains into the Vaal River (Fosso-Kankeu et al., 2015). The geographic coordinates covering the catchment are 26°52'28"S and 26°57'6"E with elevation between 1 305m (4281 ft.) and 1 550m (5090 ft.)

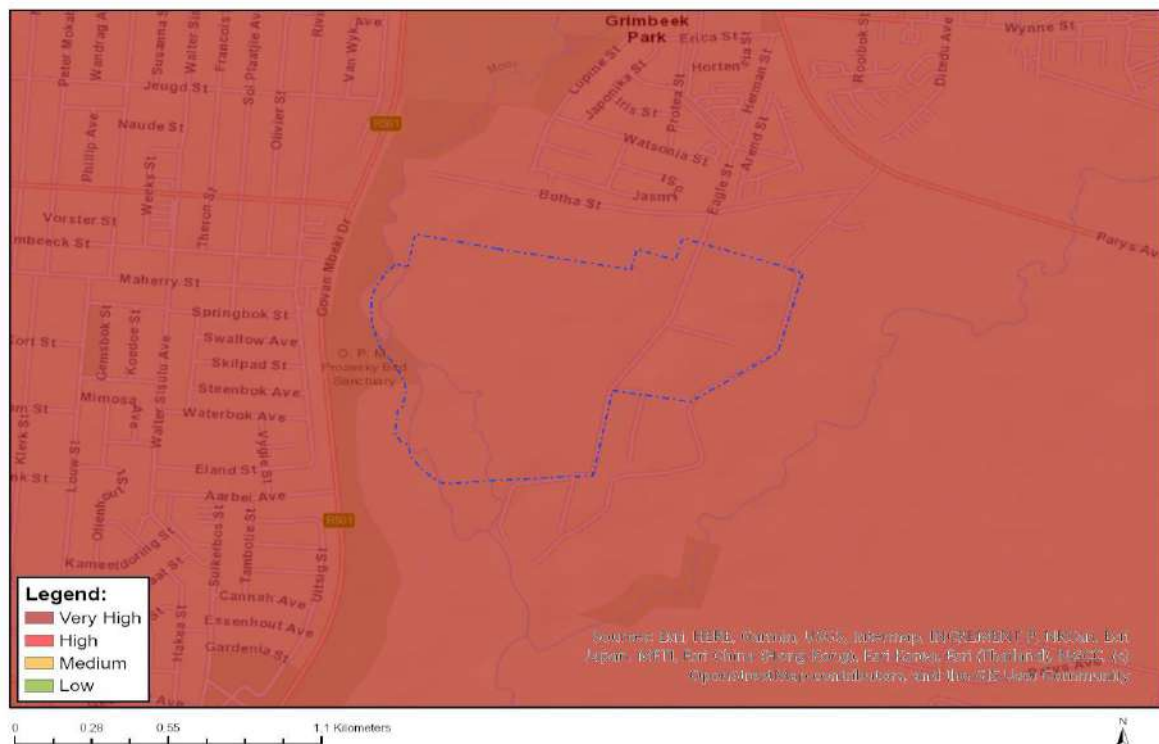
2.4.4 River, characterisation and resource quality objectives (RQOs) for in-stream and riparian zone habitat.

The results showed that there is an abundance of anthropogenic activities which change catchment conditions and the in-channel and bank conditions are modified. The in-stream and riparian zone integrity scores were between 40-59% and 60-79% placing it to category D or C/D. The results for overall fish PES were 52, placing it in category D, therefore, largely modified. The results of the habitat integrity and PES are within the recommended limit of Resource Quality Objectives (RQOs). The results of the PCA and unconstrained ordination indicated temporal variation at Sites 2 and 3 as well as sites 4, 5 and 6 which were grouped together. Site 1 varied spatially and grouped separately due to increased changes in landscape. The PES across all sampling sites is moderately to largely modified, therefore there is a great need to continuously monitor the catchment and alert community and stakeholders on possible activities that may trigger a critical modified environment.

Resource quality objectives for in-stream and riparian habitat were established by the Department of Water and Sanitation to manage the habitat in the ecosystem for catchment C23F (Government Gazette No: 39943, 2016). According to Dickens et al. (2014), the Mooi River in-stream and riparian limit is >D and >42 respectively as shown in Table 4.7. The in-stream results show a limited to largely modified habitat (B/D), while the riparian zone habitat integrity results range between moderately to largely modified (C/D). According to the results, the Mooi River is still within RQOs limit. In 2012, the Mooi River was assessed amongst other catchments, and it was found to be critically modified (E) (Dickens et al., 2014).

Most issues were around the anthropogenic factors such as bank and channel modifications, decreased vegetation and increased exotic species. Other factors were water abstractions, agriculture and water quality deterioration. This shows that the Mooi River requires continuous monitoring as the habitat status is not stable and there seems to be intermittent changes over a short period of time.

Aquatic sensitivity is very high with a flood plain that is a very important ecological feature on the wester side of the site. This has demarcated with a 50m buffer. Maintenance of the buffer must be enforced by all stakeholders in the catchment. The area falls within ecological support area 2.



2.5 Waterbirds review common on aquatic habitats including wetlands:

waterfowls such as ducks, geese, swans, grebes; pelicans.; cormorants; ibises and spoonbills; egrets and herons; crakes, rails, and waterhens; terns and gulls. shorebirds, which are also known as waders.

2.5.1 The three main categories:

Colonial nesting waterbirds: require substantial floods to support large breeding events in floodplain wetlands. They include egrets, ibises, pelicans, cormorants, and herons.

Non-colonial waterbirds: including resident shorebird species, generally don't congregate to breed but are still dependent on wetlands for nesting and feeding habitat in which to raise their young. They include waterfowl, grebes, crakes, rails, and waterhens.

Migratory waterbirds: such as migratory shorebirds, use a range of wetlands to rest, feed, and breed during their annual long journeys between wetlands in Australia and their breeding sites in the northern hemisphere.

Other native bird species also depend on wetlands for all or part of the life cycle. These include reed warblers, grassbirds, and birds of prey such as the swamp harrier.

2.5.2 Birds that live in wetlands:

Floodplain wetlands make up most of the wetland area and provide important habitat for waterbirds. Many species depend on them for breeding. Some sites regularly support more than 20,000 waterbirds. This figure rises to more than 100,000 during large floods.

At those times, the internationally significant Marshes, Wetlands; and Lakes support some of the largest breeding colonies of straw-necked ibis, intermediate egrets, and rufous night herons. Some waterbird species are thought to breed almost entirely within the wetlands. They include glossy ibis, freckled duck, and blue-billed duck.

2.5.3 Birds that stop over in wetlands:

It must be noted that wetlands importance to birds does cover other species from other areas both locally and regionally and internationally as they do move on different seasons across habitats influenced by season changes. Some birds move from one wetland to another. Many coastal and inland wetlands support a variety of migratory waterbird and shorebird species. These birds travel each year between their breeding grounds in the northern hemisphere and non-breeding habitats in Australia. The wetlands in Botany Bay support up to 34 migratory species, including the endangered.

Common name	Species name	Abundance
Village Weaver	<i>Ploceus cucullatus</i>	++++
Cattle egrets	<i>Bubulcus ibis</i>	++++
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>	++++
African Masked Weaver	<i>Ploceus velatus</i>	++++
Laughing dove	<i>Streptopelia senegalensis</i>	++++
Southern Masked Weaver	<i>Ploceus velatus</i>	+
Ring-necked Dove	<i>Streptopelia capicola</i>	+

Table 3: List of birds recorded on site during field survey.

2.6 Anurans or amphibians identified from the wetland sites.

Suitable environmental conditions, especially at breeding sites are critically important to frogs, and most species tend to be in specific habitats such as wetlands and rivers (Du Preez and Carruthers, 2017). No frogs were physically identified or sighted in the study area or even their callings were never heard. The list of frogs likely to be occurring in the local wetlands is shown in Table 4 below.

2.6.1 List of frogs commonly found on wetland sites.

Suitable environmental conditions, especially at breeding sites are critically important to frogs, and most species tend to be in specific habitats such as wetlands and rivers (Du Preez and Carruthers, 2017). No frogs were physically identified or sighted in the study area's wetlands or even their callings were never heard. The list of frogs likely to be occurring in the local wetlands is shown in Table 4 below.

It is important to note that these frogs are plentiful in ponds where water is dammed. They are aquatic and highly adaptable and will lay their eggs whenever conditions allow. During wet rainy seasons, they will travel to other ponds or vernal pools of water to search for food. During drought times these frogs burrow themselves in the mud, becoming dormant for up to a year. This is indeed one of the mechanisms these frogs use to survive the unpredictable and harsh environment.

Family	Species name	Common name
Hemisotidae	<i>Hemius Gunther</i>	Shovel-nosed frog
Racophoridae	<i>Chiromantis xerampelina</i>	Foam nest frogs
Pipidae	<i>Xenopus laevis</i>	African clawed frog
Pyxicephalidae	<i>Amietia Dubois</i>	Common river frog
Pyxicephalidae	<i>Amietia poyntoni</i>	River frog

Table 4: List of frogs commonly found on wetland sites.

3 Methodology for assessment

3.1 Field Assessment and observations

The methodologies used to do the assessment were desktop methodology before the site visit, focusing on the boundaries of the possible wetland area. GPS was used to identify important points (e.g., wetland boundaries). These GPS points were converted into a GIS shapefile to allow these points to be mapped and to facilitate the correction of wetland boundaries and the identification of very sensitive wetlands portions within the study area. Google earth was used to view site of study and made it easy to locate the wetlands; mark them and considered for ground truthing using the KML map linked to the field area measure verification APP.

During the field visit, characterization and integrity assessments of the freshwater features were undertaken. The SANBI Biodiversity GIS, and Freshwater Biodiversity Information System websites were also consulted to identify any constraints in terms of aquatic biodiversity conservation importance. This information/data was used to inform the water resource protection-related recommendations.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following techniques and methodology were utilized to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments.
- The guideline document, “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas” document, as published by DWAF (2005), was followed for the delineation of the wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator; Soil form indicator; Soil wetness indicator; and vegetation indicator.
 - Wetland boundaries reflect the ecological boundary where the interaction between water and plants influences the soils, but more importantly the plant communities. The depth to the water table where this begins to influence plant communities is approximately 50 centimeters. This boundary, based on plant species composition, can vary depending on antecedent rainfall conditions, and can introduce a degree of variability in the wetland boundary between years and/or sampling period. For this reason, several visits and past aerial imagery were utilised for the delineations.
 - The wetlands were subsequently classified according to their hydro-geomorphic determinants based on a classification system devised by Kotze *et al* (2004) and SANBI (2009). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present.
 - A Present Ecological State (PES) assessment was conducted for the identified and delineated within the study area. For this study, the tool WET-Health as defined in the WET Health Series developed for the Water Research Commission was used to assess the present ecological state of each wetland unit.
 - The functional wetland assessment technique, WET-Eco-Services, developed by Kotze *et al* (2009) was used to indicate the ecological benefits and services provided by delineated wetland habitat. This technique consists of assessing a combination of desktop and infield criteria to identify the importance and level of functioning of the wetland within the landscape.

- The ecological importance and sensitivity assessment was conducted according to the guidelines developed by DWAF (1999).
- Recommendations are made with respect to the adoption of buffer zones within the development site, based on the wetland's functioning and site characteristics.

The level of aquatic assessment undertaken was considered to be adequate for this study.

3.2 Wetland Delineation

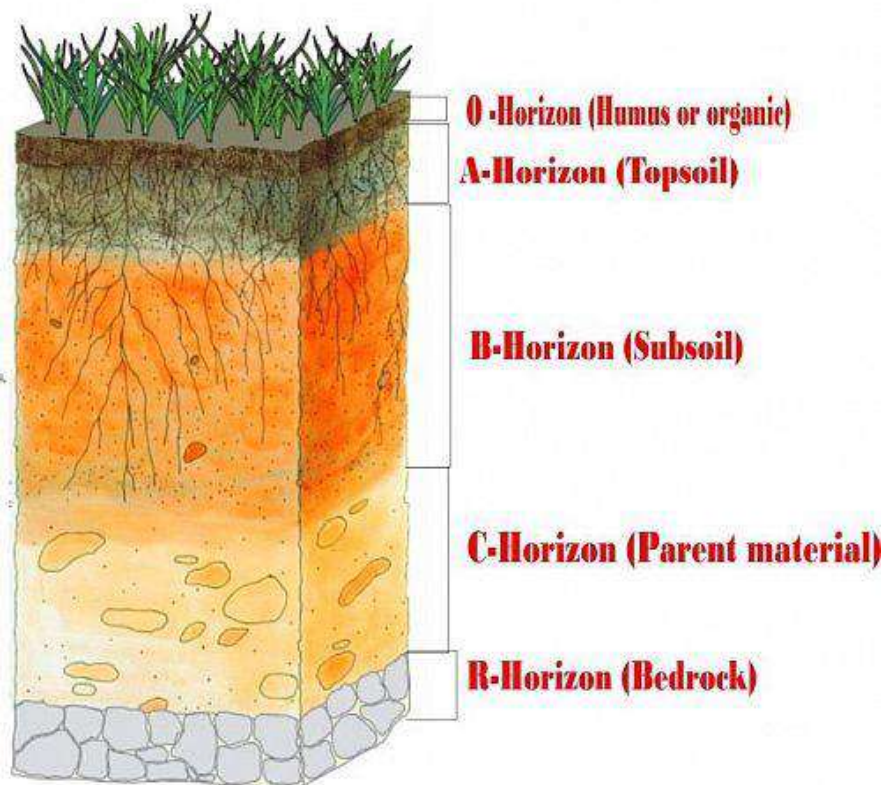
Determining the zone of the wetlands requires the delineator to consider specific indicators. The indicators must always be present in the wetlands, and under normal circumstances, the vegetation indicator is deemed to be the primary indicator. The soil indicator tends to be the most important indicator, and the other two indicators (The Terrain Unit and Soil Form Indicators) are used for confirmatory purposes (DWAF, 2005).

The National Water Act (Act 36 of 1998) defined wetland as a “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and the land in which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

Wetland-based delineation and sampling of wetlands was based upon the DWAF guidelines “A practical field procedure for the identification and delineation of wetlands and riparian areas” (DWAF, 2005), which stipulates that consideration be given to four specific wetland indicators to determine the boundary of the wetland. These indicators are terrain unit indicator, soil form indicator, soil wetness indicator, and vegetation indicator.

This according to the DWAF (2005) guidelines for the delineation and identification of wetlands, soil wetness indicators are the most common indicator of wetland occurrence, because soil wetness indicators remain in wetland soils, even if the wetland site is degraded or drying out. Soil auger, tape measure and spade were used to profile the soil wetness. Existing road cuttings and quarry soil profiles assisted in determining soil layers.

Wetland delineation is important because it accurately identifies the boundaries of wetland areas, allowing for proper protection and management of these valuable ecosystems by enabling informed decisions regarding development projects, conservation efforts, and regulatory compliance, ensuring that wetlands are not inadvertently damaged or destroyed while also maximizing their ecological benefits like flood control, water filtration, and biodiversity support.



Schematic diagram indicating soil profiles as used during field assessment.

3.3 Wetland Functional Assessment

Wetland functionality is defined by Macfarlane et al. (2007), as a measure of the deviation of wetland structure and function from its natural reference condition. The natural reference condition is also based on a theoretical undisturbed state which is derived from an understanding of undisturbed regional vegetation and hydrological conditions knowledge (Macfarlane et al., 2007).

Kotze et al. (2007) emphasized that the wetland systems are critical for groundwater recharges, although flows through them are supplemented by surface water contributions from rain. Kotze et al. (2007) further reported that wetlands serve as unit for ecological services and a functional wetland system could contribute to the following: surface flow attenuation, contribution of water to the stream during dry seasons, provide water quality enhancement benefits, and as such the systems have a high potential to remove nitrogen and nitrates as well as carbon sequestration.

3.4 Determination of the Present Ecological Status (PES) of wetlands

WET-Health is a tool designed to assess the health or integrity of a wetland. Wetland health on the other hand is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. This technique is used to assess hydrological, geomorphological, and vegetation health in the form of ecological status categories and descriptions as shown in the Table below.

Category	Description	Range
A	Unmodified, natural	0-0.9
B	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.5-5.9
E	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable	6-7.9
F	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10

Table 5: The Present Ecological Status (PES) categories and descriptions for WET- Health (Adapted from Macfarlane et al., 2007).

3.5 Determination of the Ecological Importance and Sensitivity (EIS) of Wetlands.

Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (MacFarlane et al., 2007). Water resources can be classified for an appropriate management class based on EIS. The EIS allows the classification of ecological importance in ecosystems and biodiversity for the estimation of species diversity and abundance. The EIS uses the rating scale for the estimation of scores (Table 6). Furthermore, these wetlands provide specialized habitat and dispersal corridors and basic human needs such as subsistence farming and water use.

Ecological Importance and Sensitivity Categories	Rating
Very High These are wetlands that are considered ecologically important and sensitive on a natural or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat alterations. They moderate the water quality and quantity of major rivers.	>3 and ≤4
High These wetlands are ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat alterations. Plays a role in moderating the quantity and quality of water of major rivers.	>2 and ≤3
Moderate These wetlands are considered ecologically important and sensitive at a local or provincial scale. Biodiversity in these wetlands is not usually sensitive to flow and habitat alterations. However, they play a small role in moderating the quantity and quality of water in major rivers.	>1 and ≤2
Low/Marginal Wetlands that are not ecologically important and sensitive at any site. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat alterations. However, they play a role in moderating the quantity and quality of water in major rivers.	>0 and ≤1

Table 6: Ecological Importance and Sensitivity rating scale used for the estimation of scores.

3.6 Determination of Buffer Requirements

The pre-mitigation buffer requirements for the construction and operational phases are 32 m for wetlands sites respectively. These buffer requirements are relevant to all the delineated wetlands sites and should be ideal after the successful application of recommended mitigation measures. It must be noted that the determination of a buffer zone is also dependent on the nature of the wetland system with its associated risks. Therefore, for this study delineated buffer zones were not done because the area does not have wetlands hence it was only done for a perennial stream and flood plain.

3.7 Results and Discussions

3.7.1 Functions and values of the Wetlands in the study site.

Generally, Wetlands perform many ecological functions. Knowledge and understanding of complexities. Hence this was not assessed because there is no wetland. The existing flood plain is providing grazing for livestock.

Wetland ecologists have already documented the following general environmental benefits wetlands provide but this is not happening in the study area because there is no permanent wetland.

- Water purification.
- Flood protection.
- Shoreline stabilization.

The study area only has a non-perennial river and temporary wet zones.

3.8 Status of the study area's wetlands.

The study area does not have a permanent wetland. This has been confirmed by a sensitivity study in which the map is attached. There is a temporary wet zone in an unchanneled flood plain.

3.9 Wetland Delineation Results using various Techniques (soils, vegetation, and soil wetness indicators)

The site does not have wetland that requires delineation but the boundaries for a flood plain had to be established using the same indicators. The delineation was undertaken using vegetation indicators, soil and topography. Soil wetness did play a role because the soil type and texture found that there is a well-drained soil. The delineation for a 50M buffer was done for the flood plain.

3.9.1 Wetland Soils (Wetness and Soil Form Indicators)

The soil is well drained dominated by loamy clay and clay loamy.

3.9.2 Hydric Soil Indicators of Saturation:

No hydric soil due to non-present of permanent wetland. Soil sampling found that there were no indicators for wetland.



3.10 Description of Wetland Type, Hydrology, and catchment characteristics.

The main wetland type in the study area was not analyzed as there is no permanent wetland. Detailed sensitivity analysis confirmed the area to have no permanent wetland. Refer to the attached sensitivity map. Sensitivity Features within confirmed that the site is covered by Ecological support area 2 and a flood plain.

3.11 Present Ecological Status of wetlands in the study area.

The study area is on the Rand Highveld Grassland which is dominated by grass that is non -wetland grass. The habitat is within Ecological support area 2.

3.12 The Ecological Health Assessment

Wetland ecological health is the condition of a wetland, and how it's able to perform its functions and provide services to the environment and people. It's a measure of the wetland's physical, chemical, and biological characteristic. Therefore, this was not done due to the site not having a permanent wetland. The Mooi river is known to be polluted by various factors such as industrial; agriculture; mining and domestic wastes that are being dumped into the riverine areas.

3.13 The EIS Assessment of the Remaining Wetland Areas

The study area does not have a permanent wetland as confirmed with the sensitivity assessment results.

3.14 Buffer Requirements

A 50m buffer was done for flood plain.

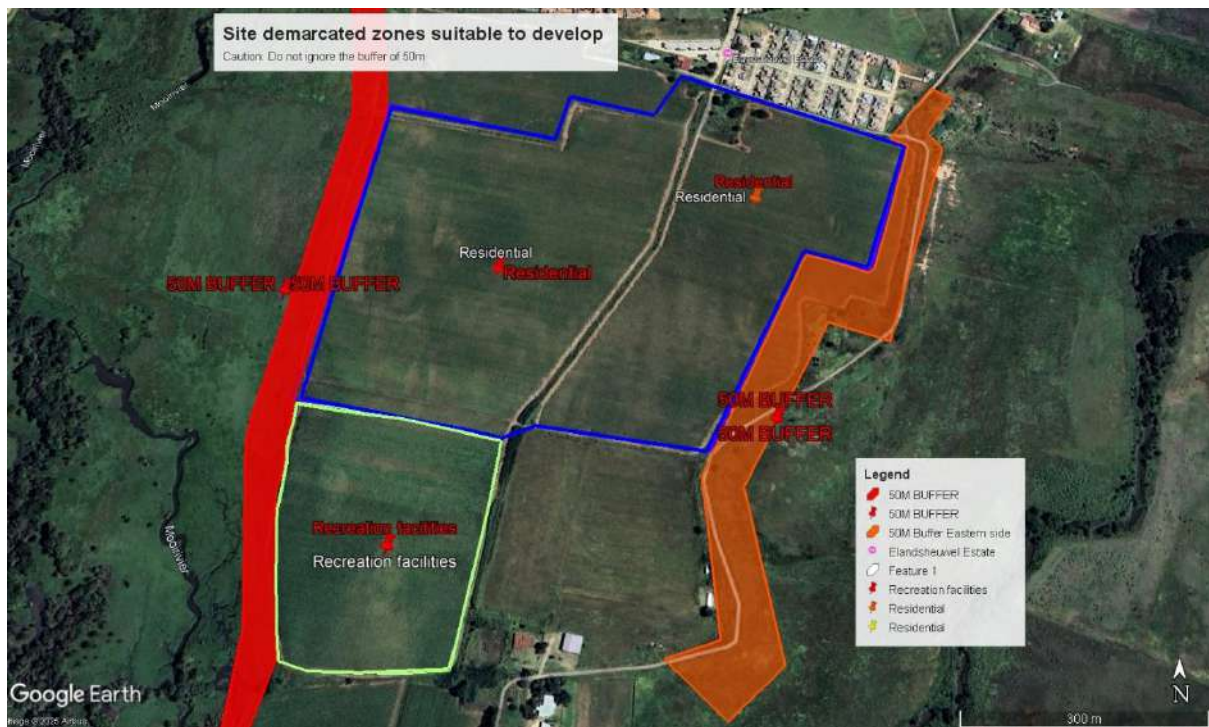


FIGURE 7: Buffer delineations.



4 Impact assessment and significant

4.1 Impact and mitigation measures

Consideration of the mitigation measures was applied on note of the broader catchment area considering that impacts will not be fixed as they can expand outside the footprint.

PROBABILITY	DURATION
1- very improbable	1- very short duration (0-1years)
2- improbable	2- short duration (2-5 years)
3- probable	3- medium term (5-15 years)
4- highly probable	4- long term (>15 years)
5- definite	5- permanent/unknown
EXTENT	MAGNITUDE
1- limited to the site	2- minor
2- limited to the local area	4- low
3- limited to the region	6- moderate
4- national	8- high
5- international	10 – very high

Table 7: the significance scoring technique used for scoring each potential impact.

The impact was estimated to can be moderate and permanent if mitigations not implemented.

SIGNIFICANCE POINTS	SIGNIFICANCE RATING
0 - 30 points	Low environmental significance
31- 59 points	Moderate environmental significance
60-100 points	High environmental significance
Details on scores obtained based on findings are presented in detail on the sections below	

Table 8: shows the impact significance ratings used.

4.2 Nature of the impacts on wetlands associated with the existing land use activities.

4.2.1 Impact Assessment

The impact assessment was generally done in consideration of the non-perennial stream.

Waste dumping is the main problem in the study area.

4.3 Impacts assessed in the wetlands.

Impact	Aspect
Construction phase/Excavation	Will be high
Impeding on flow paths entering Siltation	Expected to be low.
Sedimentation Eutrophication	No impact.
Water quality impairment	
Operational phase	Dumping of waste will continue taking place if not managed.

Table 9: Impacts assessed in the study area.

4.4 Associated Mitigation Measures

Mitigations to prevent destruction of the non-perennial stream must be applied.

4.5 Impact Rating Matrix before and after mitigation measures for wetlands sites.

It was worth it to present this matrix even though there was no permanent wetland on the study site taking into consideration the existence of wetlands in the same catchment area. Impacts can still happen on the wetlands outside and still have direct impacts.

Criteria	Description	Score
Extent	The loss of wetlands is likely to have a local impact, the catchments found within the proposed township establishment could feed directly to the wetland system	20
Duration	The loss of wetland is likely to be permanent, as the portions in the wetland could be destroyed permanently	40
Intensity	Given the largely modified or degraded nature of the Wetlands.	60
Probability of occurrence	The proposed layout could destroy wetland habitat	35

Table 10: The Impact Assessment Matrix of Wetland loss before mitigation. measures.

Criteria	Description	Score
Extent	The loss of wetlands is likely to have a site impact, as the catchments will be rehabilitated	25
Duration	The loss of wetland integrity is likely to be short-term, as the wetlands will have an offset of negative impacts by rehabilitation	40
Intensity	Given the degraded or altered nature of the wetland areas, it is likely that the intensity will be moderate.	55
Probability of occurrence	The proposed development offset will possibly reduce the loss of wetlands site	20

Table 11: The Impact Assessment Matrix of Wetland loss after mitigation measures.

5 Recommendations

RECOMMENDATIONS
Recommendation 1
Wetland monitoring and assessment programs: Consistent, thorough, and timely wetland monitoring and assessment programs are a critical tool for municipality and community to better manage and protect their wetland resources to safe guard their benefits. These programs, if considered, can enhance the following attributes, namely: Establishment of a baseline in wetland extent, condition, and function; Detect change, and Characterize trends within and around the wetlands over time. Wetland monitoring and assessment data can be used to help make decisions in: The National Water Act, 36 of 1998 regulatory programs. Wetland restoration and watershed planning. The development of meaningful water quality standards for wetlands
Recommendation 2
No construction or sand mining may take place within the flood plain, wetlands or 100 m zone of regulation ecosystem buffer zone and such an area demarcated as a no-go area.
Recommendation 3
No dumping of waste may take place on wetlands and water courses (National water act 36 of 1996 prevents pollution of water resources by any land user or individual. Waste dumped in wetlands gets dissolved giving more chances of chemicals and metals to cause ground water pollution. This results to risk of people staying in wetlands and gathering natural resources from the wetlands to get exposed to sicknesses such as cholera.
Recommendation 4
Environmental education to raise awareness on the value and protection of wetlands must be done for local communities and schools for them to understand the importance of wetlands.
Recommendation 5
Protection of specific wetland zones must be done through evaluation of their benefits and ecosystem services at micro level.
Recommendation 6
As stated in chapter 3 part four of the National Water Act invasive alien plants must be controlled using chemical and mechanical methods. Near permanent wetlands only manual removal.
Recommendation 7
The stormwater management plan for the site should ensure that any impacts of stormwater from the site are mitigated as far as possible within the site (measures such as the use of permeable surfaces, re-use of runoff from built areas such as roofs as well as the use of measures such as swales) to minimise the stormwater impacts on the associated aquatic habitats;

Recommendation 8
Integrated stakeholder engagement must urgently take place as it will assist in coming up with joint measures that will assist in the sustainable use and protection of the wetlands.
Recommendation 9
It is recommended that no sand mining trenches and holes digging up to avoid sedimentation.
Recommendation 10
Natural environment must be conserved around the riparian and flood plain.

6 Conclusions

It is the opinion that of the ecologist to conclude that there is no permanent wetland in the study area. The risk of flooding must be prevented by building proper houses that have raised foundations. All areas marked as the no go areas must be conserved. All aquatic features mapped must be protected using the buffer zone.

The following potential impacts to the Bokkemenskloof River and wetland areas that are associated with the proposed development activities could be expected: Short- and longer-term disturbance and loss of aquatic habitat; modified stormwater surface water runoff from the developed site; and potential for localised impairment of water quality during the construction and operational phases of the development.

From a freshwater perspective, the No-Go Alternative would have less potential impact on the aquatic ecosystems within the site. However, if the recommended mitigation measures are implemented, there would be a low significance impact on the aquatic ecosystems and there is no reason why the proposed development could not be approved.

7 Photos and maps

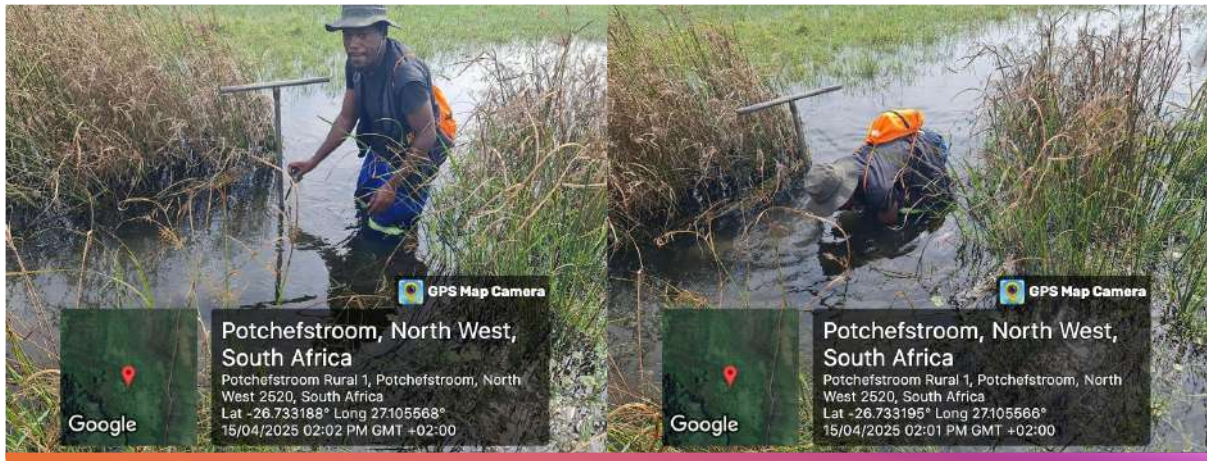


Soil sampling on flooded zone with non -wetland grasses(*Cynodon dactylon*/Bermuda grass)

Soil type is a rich agricultural dark loamy clay soil

Water logged farm road on farm portion 58/436 north eastern corner boundary



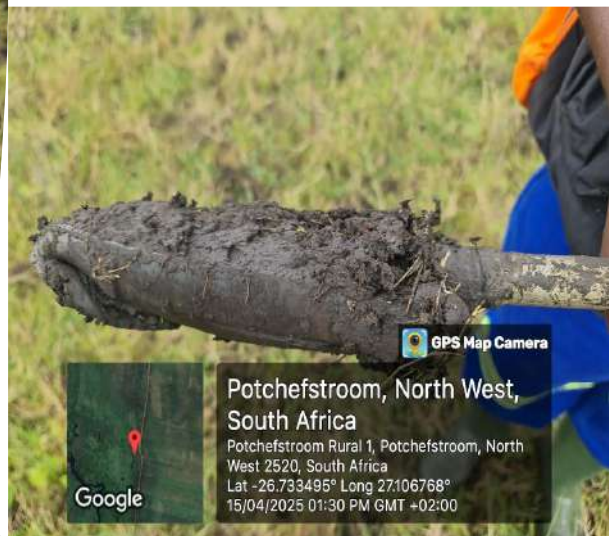
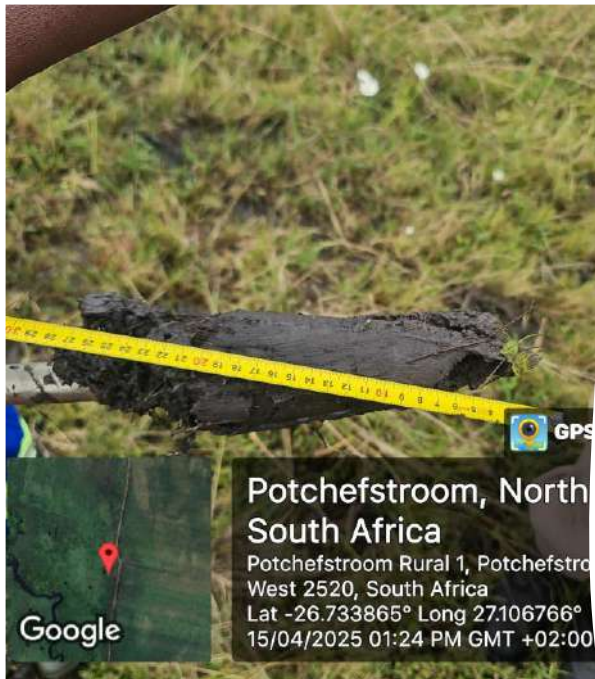


Coordinates points for sampled zones along the flood plain

This is where water flowing channel exist on the flood plain



Soil sampling during wetland investigations



Flood plain on the eastern side of the river not suitable for development



This zone must be excluded and buffered by 200m from the river

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Appendix F

- JB Marks Water and Sewer Master Plan

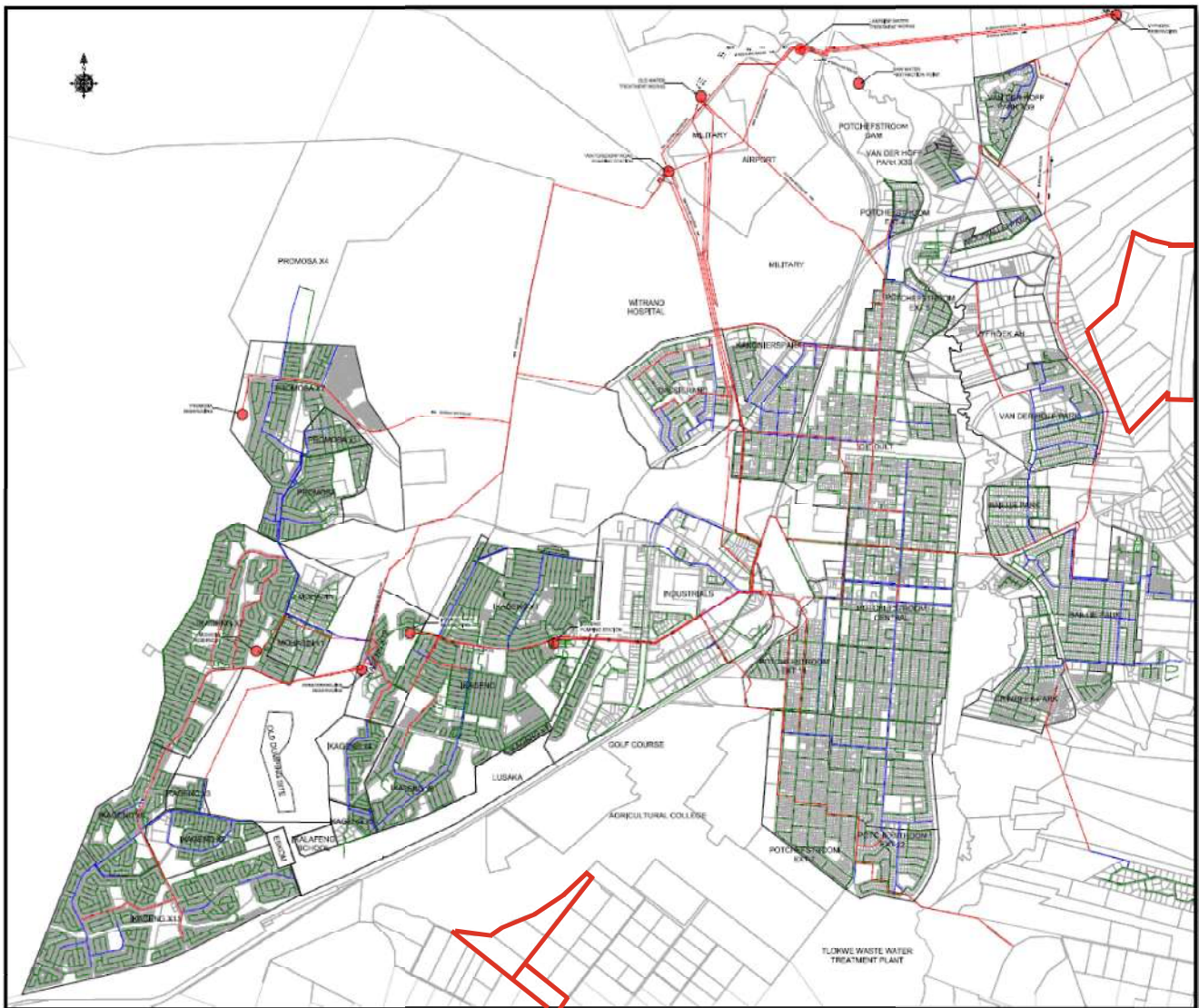


Figure No.5 – Water Master Plan

Drawing Legend

Red : Ø 200 mm - Ø 800 mm

Blue : Ø 110 mm & Ø 160 mm

Green : Ø 25 mm - Ø 90 mm

**Refer to Annexure A for comprehensive Water Master Plan.*



TEKENING Nr. / DRAWING No.
3250/2

WYSIGINGS Nr. / AMENDMENT No.

OUTEURSREG BEHOUL: GEEN GEBRUIK, RE-PRODUSERING OF DUPLISERING DAARVAN
MAG GESKIED SONDER DIE SKRYFTELIKE TOESTEMMING VAN DIE MAATSKAPPY.
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WYSIGINGS

AMENDMENTS

No.	DATUM	DEUR	BESKRYWING
No.	DATE	BY	DESCRIPTION

AANTEKENINGE

NOTES

 **EXISTING PUMPING STATIONS**

**JB MARKS**
Local Municipality
Working Together | For Better Change | Sustained

AFDRUK UITGEREIK OP

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HANDTEKENING \ SIGNATURE

DATUM \ DATE

PROJEK

PROJECT

**POTCHEFSTROOM
MUNICIPAL SEWER
INFRASTRUCTURE**

TEKENINGTITEL

DRAWING TITLE

**EXISTING
PUMPING STATION**

SKAAL

1 : 40 000

SCALE

TEKENING Nr.

9250 / 2

DRAWING No.

J:\3250 Tlokwe Sewer Master Plan\Drigs\3250 - Potch sewer masterplan.dwg

WYSIGINGS Nr.

AMENDMENT No.