HYDROLOGICAL BASELINE FOR THE MPONENG LOWER COMPARTMENT TAILINGS STORAGE FACILITY

VERSION 1

25 JULY 2025

PROJECT NO. EIM-017

HYDROLOGIC CONSULTING

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HYDROLOGICAL BASELINE FOR THE MPONENG LOWER COMPARTMENT TAILINGS STORAGE FACILITY

Prepared For

EIMS (PTY) LTD

Prepared By

HYDROLOGIC CONSULTING (PTY) LTD

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1 INTRODUCTION

Hydrologic Consulting has been appointed by Environmental Impact Management Services (EIMS) to undertake a hydrological baseline assessment for the proposed Harmony Gold Mining Company Limited (the applicant's) Mponeng Lower Compartment Tailings Storage Facility (hereafter referred to as Mponeng TSF), located approximately 7km south-west of the town of Carletonville, in the Gauteng Province of South Africa. The TSF is part of the greater Mponeng Operation.

This report outlines the hydrological baseline relevant to the hydrological assessment of the proposed commencement of deposition on the Mponeng TSF.

1.1 SCOPE OF WORK

The scope of work was achieved by undertaking the following:

- Baseline Assessment – sourcing of baseline climatic and hydrological data. This included the interrogation of rainfall data, site-specific design rainfall (depth/duration/frequency), evaporation, soils, and land use, as well as a regional and local hydrological assessment.
- A report detailing the achieved scope of work (this report).

The above scope of work is based on a desktop assessment of the site.

1.2 PROJECT DESCRIPTION

The following project description[1] outlines the proposed works.

The applicant owns and operates a number of Gold Mines and Plants in the West Wits region in the Gauteng Province. The Savuka Plant currently deposits tailings onto the Savuka 7a & 7b Tailings Storage Facilities (TSFs).

Savuka 7a & 7b TSFs are approaching their final and approved height, and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to recommence deposition on the Mponeng TSF Lower Compartment.

Mponeng Lower TSF is an existing TSF, however, the Mponeng Lower Compartment TSF is no longer in operation and is currently utilised as a Holding Dam, and a portion of it is used as an authorised Landfill Facility. To recommence deposition on the Mponeng TSF, from the Savuka Plant, slurry pipelines will need to be constructed from the Savuka Plant to the TSF. The proposed slurry and return water pipes extend from the south of Savuka Plant at starting point 26°25'24.95"S; 27°23'58.94"E, extending southwards, parallel to each other until reaching the northern extent of Mponeng TSF where they split. Thereafter, the slurry pipeline extends to west before connecting to Mponeng TSF while the return water pipeline extends east then south around the TSF to the return water dam. The proposed alternative slurry and return water pipeline route extends to the east through Western Deep Levels then south along Mponeng Gold Mine before heading to the west where it connects to Mponeng TSF.

[1] *1658_Project Background.pdf*

1.3 REGIONAL SETTING AND LAYOUT

The Mponeng TSF, Return Water Dam, and the Slurry and Return Water Pipelines (hereafter also referred to as the study area) are located at 26° 27' 17" S and 27° 24' 37" E. The regional setting of the site is illustrated in **Figure 1-1** while the layout of the site is presented in **Figure 1-2**.

1.3.1 EXPERTISE OF PRIMARY AUTHOR AND DECLARATION OF INDEPENDENCE

Mr Mark Bollaert has over 17 years of experience working as a consulting hydrologist in both the United Kingdom and South Africa, since completing his Master of Science (MSc) degree in Hydrology at the University of KwaZulu-Natal. Mark has supplemented his tertiary education with professional qualifications which represent his ongoing effort toward maintaining a professional approach and continuing in his professional development. These include qualifications from the UK (Chartered Scientist, Chartered Environmentalist and Chartered Water and Environmental Manager) and South Africa (Professional Natural Scientist in Water Resources).

In terms of the requirement to be independent, Hydrologic Consulting and affiliated consultant Mr Mark Bollaert declare that other than fair remuneration for the work undertaken, he has no business, financial, or personal interest in the proposed activity or application and that there are no circumstances that may compromise his objectivity.

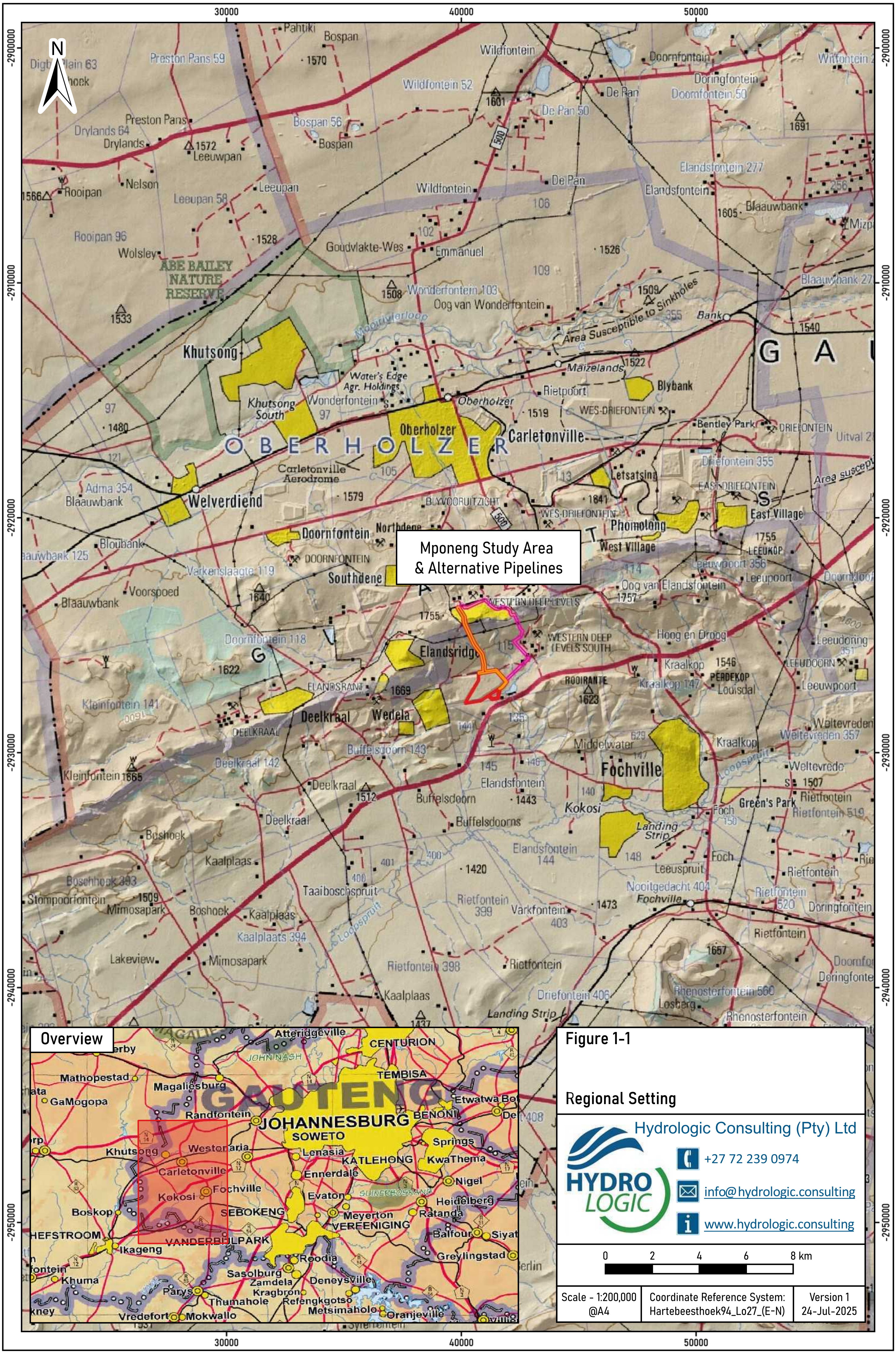
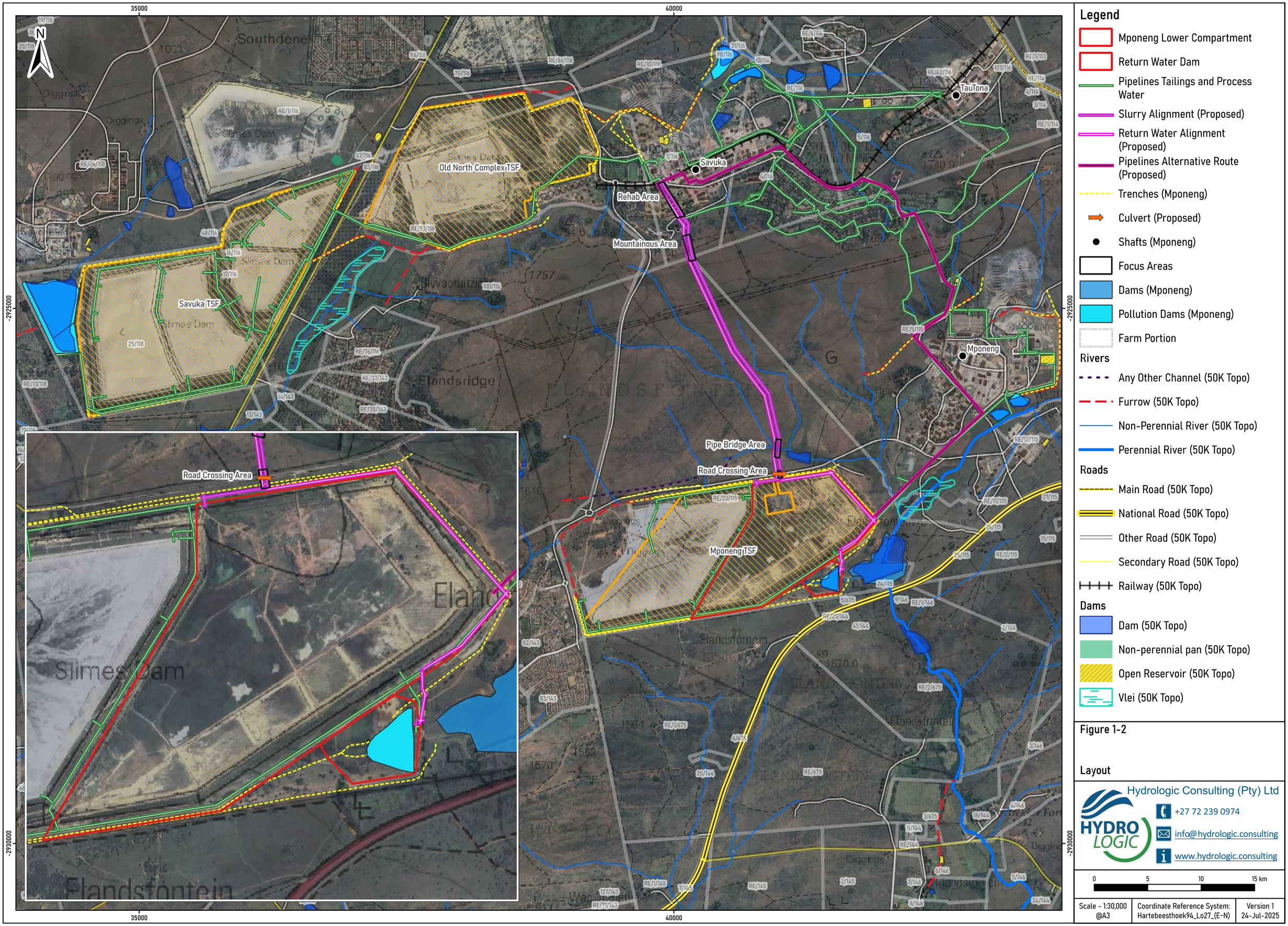


Figure 1-1

Regional Setting



Legend

- Mponeng Lower Compartment
- Return Water Dam
- Pipelines Tailings and Process Water
- Slurry Alignment (Proposed)
- Return Water Alignment (Proposed)
- Pipelines Alternative Route (Proposed)
- Trenches (Mponeng)
- Culvert (Proposed)
- Shafts (Mponeng)
- Focus Areas
- Dams (Mponeng)
- Pollution Dams (Mponeng)
- Farm Portion

Rivers

- Any Other Channel (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)
- Perennial River (50K Topo)

Roads

- Main Road (50K Topo)
- National Road (50K Topo)
- Other Road (50K Topo)
- Secondary Road (50K Topo)
- Railway (50K Topo)

Dams

- Dam (50K Topo)
- Non-perennial pan (50K Topo)
- Open Reservoir (50K Topo)
- Vlei (50K Topo)

Figure 1-2

Layout

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0 5 10 15 km

Scale - 1:30,000 @A3	Coordinate Reference System: Hartebeesthoek94_Lo27_(E-N)	Version 1 24-Jul-2025

2 BASELINE ENVIRONMENT

Baseline information in this section includes discussions on the rainfall, evaporation, design event rainfall, soils, vegetation, and land cover, as well as site topography and regional and local catchment hydrology.

2.1 RAINFALL

Various weather stations managed by both the South African Weather Services (SAWS) and the Department of Water and Sanitation (DWS) were considered in this project. These, together with their proximity to the site can be seen in Figure 2-1.

Numerous SAWS and DWS stations are located near the site. Pegram (2016) provides a collation of SAWS and DWS data into monthly averages. **Table 2-1** presents the summary of the site-specific Pegram (2016) average monthly rainfall distribution while **Figure 2-1** illustrates the rainfall variation in the region of the site.

TABLE 2-1: AVERAGE MONTHLY RAINFALL DISTRIBUTION (PEGRAM, 2016)

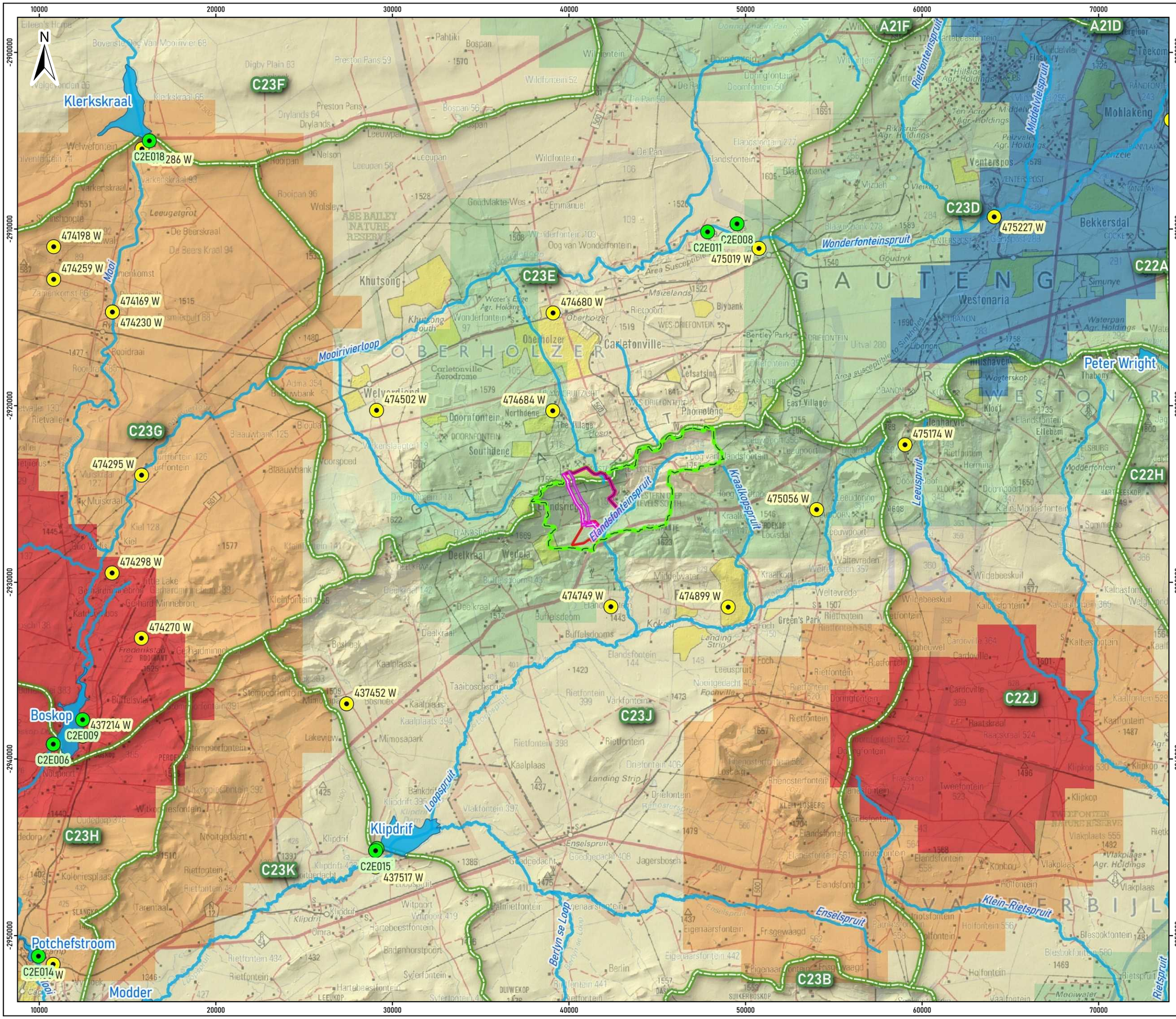
Month	Rainfall (mm)
Jan	111
Feb	90
Mar	83
Apr	44
May	19
Jun	8
Jul	6
Aug	8
Sep	21
Oct	59
Nov	91
Dec	101
Total	**640**

*Estimates were sourced for the centre of the site

2.2 1-DAY DESIGN RAINFALL DEPTHS

For the development of a stormwater management plan and assessment of flooding, design rainfall is the most important rainfall variable to consider, as it is the driver behind peak flows.

Design rainfall estimates for various recurrence intervals (RI) and storm durations were sourced from the Design Rainfall Estimation Software for South Africa (DRESSA), developed by the University of Natal (which has since been incorporated into the University of KwaZulu-Natal) in 2002 as part of a WRC project K5/1060 (Smithers and Schulze, 2002). This method uses a Regional L-Moment Algorithm (RLMA) in conjunction with a Scale Invariance approach to provide site-specific estimates of design rainfall (depth, duration and frequency), based on surrounding station records. WRC Report No. K5/1060 (WRC, 2002) provides more detail on the verification and validation of the method. **Table 2-2** presents the 24-hour storm depths for various recurrence intervals.



Legend

- SA Quaternary Catchment
- Area of Hydrological Relevance
- Mponeng Lower Compartment
- Return Water Dam
- Slurry Alignment (Proposed)
- Return Water Alignment (Proposed)
- Pipelines Alternative Route
- SAWS
- DWS
- River (500K Topo)

Mean Annual Precipitation (mm)

- <= 550
- 550 - 585
- 585 - 620
- 620 - 655
- > 655

Figure 2-1

Mean Annual Precipitation

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0 30 60 90 km

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TABLE 2-2: 24-HOUR STORM DEPTH

Recurrence Interval (Years)	Rainfall Depth (24-hour) (mm)
2	63.7
5	84.9
10	99.2
20	113
50	131.1
100	144.8
200	158.6

* Estimates were sourced for the centre of the catchment of relevance.

2.3 EVAPORATION

Evaporation data was sourced from the South African Atlas of Climatology and Agrohydrology (Schulze and Lynch, 2006) in the form of A-Pan equivalent potential evaporation. The average monthly evaporation distribution is presented in **Table 2-3** and shows the site has an annual potential evaporation of 2,244mm.

TABLE 2-3: AVERAGE MONTHLY A-PAN EQUIVALENT EVAPORATION

Month	Evaporation(mm)
Jan	238
Feb	191
Mar	185
Apr	150
May	129
Jun	103
Jul	117
Aug	162
Sep	218
Oct	254
Nov	246
Dec	251
Total	**2,244**

*Estimates were sourced for the centre of the site

2.4 AVERAGE CLIMATE

The average climate for the site is presented in **Figure 2-2** using the outcome of the investigation into rainfall and evaporation for the site. The combination of rainfall (Pegram, 2016) and evaporation and temperature (Schulze and Lynch, 2006) results in a temperate climate with dry winters and warm summers according to the Köppen-Geiger climate classification[2].

[2] http://stepsatest.csir.co.za/climate_koppen_geiger.html

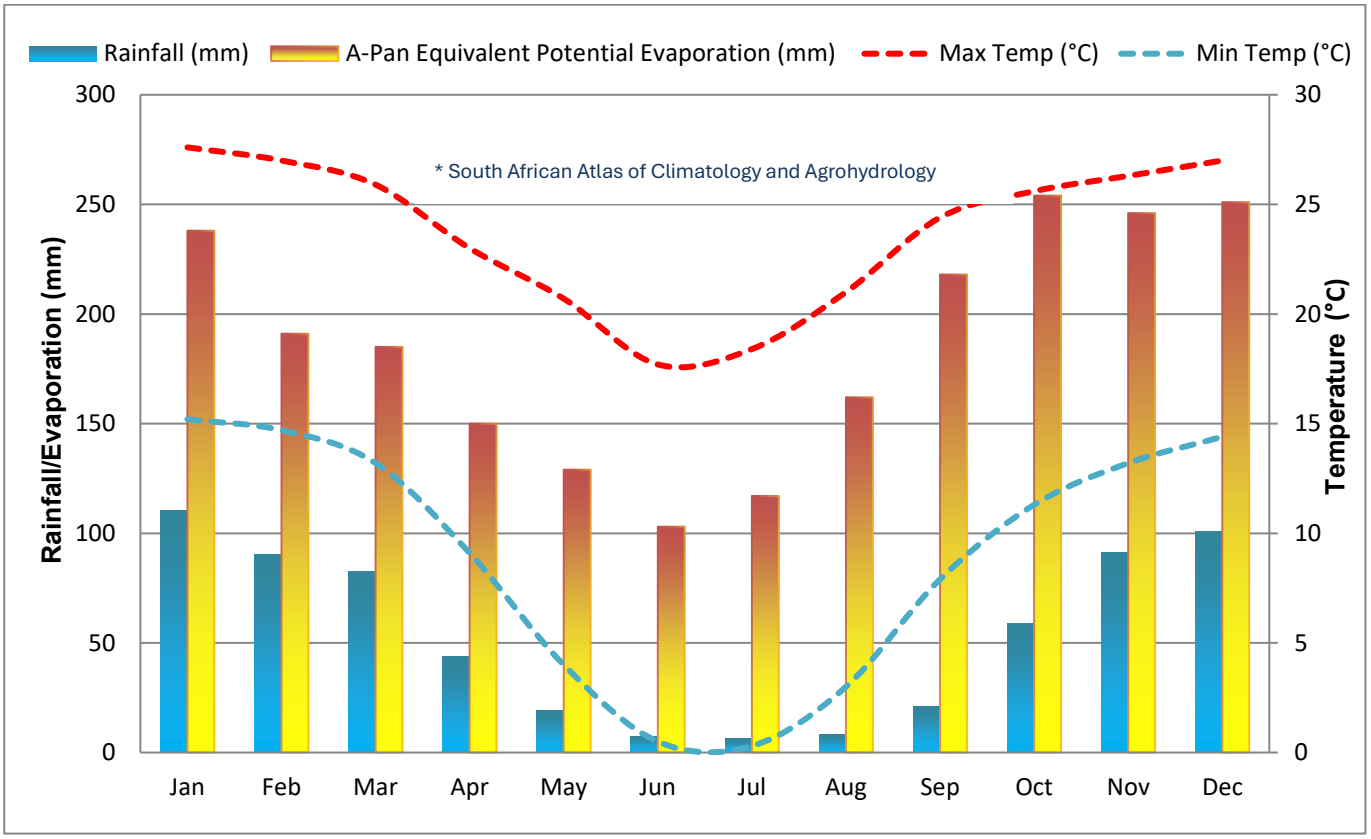


FIGURE 2-2: AVERAGE MONTHLY CLIMATE FOR THE SITE

2.5 TERRAIN

Two datasets were used to assess the elevation of the site and its surrounds, namely:

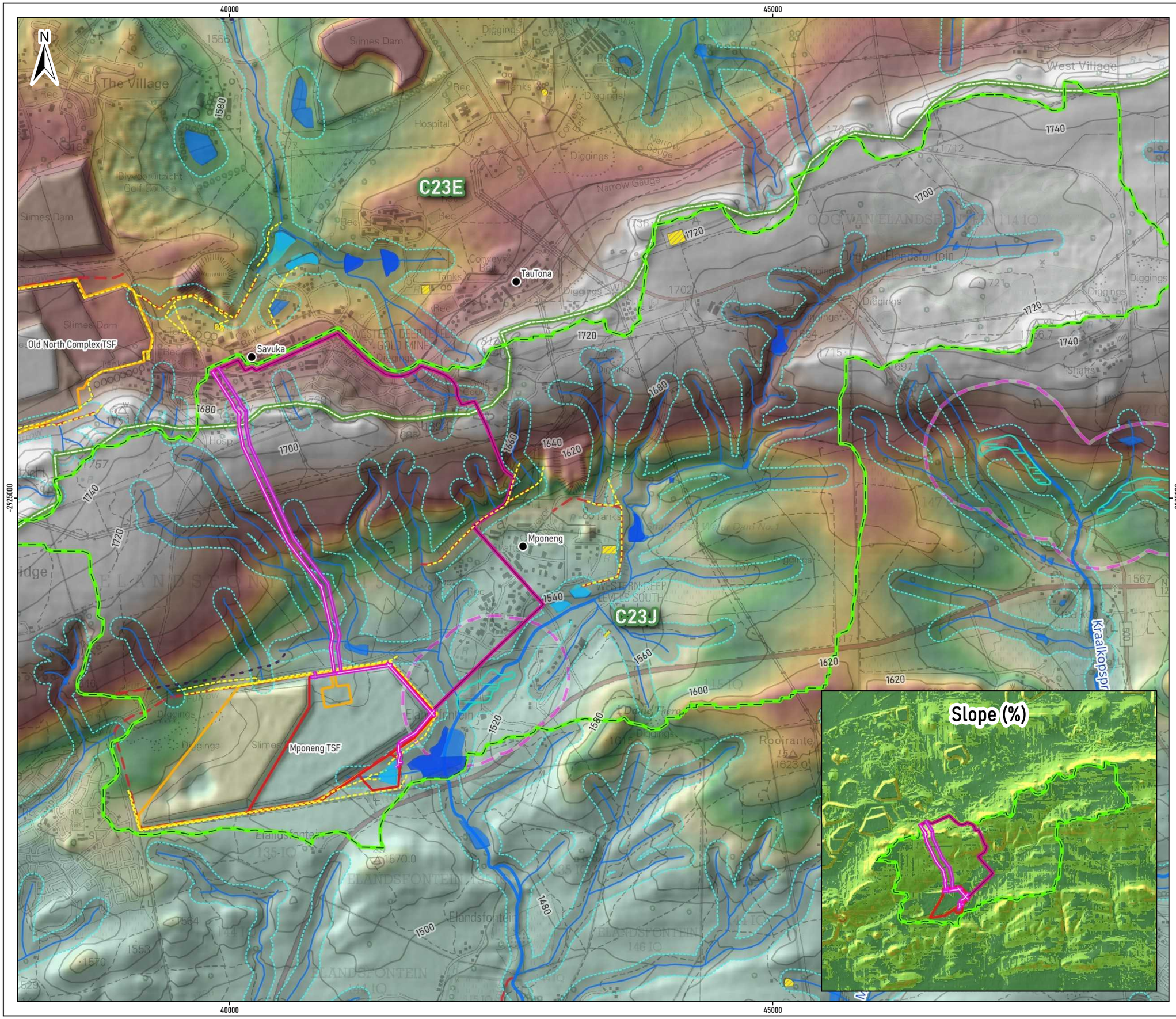
1. A 30m COP30[3] DSM dataset; and
2. The National Geospatial Institutes (NGI's) 1 :50,000 topographical map 20m contours.

The two elevation datasets utilised are illustrated in **Figure 2-3**.

The 30m DSM enabled a high-level understanding of the terrain of the site. Elevation on the site ranges from approximately 1,550m to 1,708m AMSL. The 20m NGI contours were used to illustrate the general 'lie of the land'.

Figure 2-3 also includes a calculation of slope with the site predominantly exhibiting slopes below 10%, however, the areas with existing TSFs are generally more undulating with some slopes here falling between 10-30%.

[2] *Copernicus Digital Elevation Model - Copernicus Contributing Missions Online*



Legend

- SA Quaternary Catchment
- Area of Hydrological Relevance
- Mponeng TSF and RWD
- Dams (Mponeng)
- Pollution Dams (Mponeng)
- Slurry Alignment (Proposed)
- Return Water Alignment (Proposed)
- Pipelines Alternative Route (Proposed)
- Trenches (Mponeng)
- 20m Contour (NGI)
- Any Other Channel (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)
- Perennial River (50K Topo)
- Dam (50K Topo)
- Open Reservoir (50K Topo)
- Vlei (50K Topo)
- 100m Watercourse Buffer (DWS)
- 500m Vlei/Pan Buffer (DWS)

Elevation (m AMSL)

1 708

1 550

Percentage Slope

- <= 3
- 3 - 10
- 10 - 30
- 30 - 50
- > 50

Figure 2-3

Terrain and Hydrology

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0 50 100 150 km

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2.6 HYDROLOGY

Figure 2-3 also illustrates the hydrological setting of the site, while **Figure 2-1** presents the river network of the greater region. The site is positioned within quaternary catchment C23J with the proposed pipelines extending to quaternary catchment C23E.

The nearest River is the Elandsfonteinspruit River to the south-east of the site, however, this river is only labelled in the 1:500,000 river dataset for South Africa. The NGI's 1:50,000 topographical map data illustrates numerous non-perennial river systems to the north and south, both of which converge to the southeast of the site. The northern system feeds the Elandsfonteinspruit, enabling perennial flows (per the NGI's classification).

The northern and southern system are associated with a vlei to the east and dams both north and south to the site. There are upstream furrows directing runoff from part of the greater Mponeng Operation (south of the Old North Complex TSF) and along the Mponeng TSF trenches draining to the non-perennial rivers to the west. The southern system is characterised by two larger dams, one of which is listed as the proposed return water dam for the Mponeng TSF.

All hydrological features have been presented according to the NGI's 1:50,000 topographical map data and this report does not intend to alter their classification.

This report also does not delineate or comment on the significance of any wetlands/vleis – consideration of this would require a wetland specialist. The NGI's 1:50,000 vleis are used for indicative purposes.

2.7 SOILS, VEGETATION AND LAND-COVER

In considering the Soil Conservation Service for South Africa (SCS-SA) dataset of the site, soils are classified as being in hydrological soil group C (moderately high runoff potential). The TSFs have, however, covered over the original soil of the site. TSF soil conditions are expected to also tend to have high runoff potential.

The natural vegetation of the site is classified as Gauteng Shale Mountain Bushveld (according to SANBI, 2018). 'Mines and Quarries' is predominant over the site according to the Department of Forestry, Fisheries and the Environment (DFFE's) 2022 land-cover dataset. 'Grassland' and 'Waterbodies' make up secondary land-covers.

The distributions of the SCS soil types and natural vegetation are illustrated in **Figure 2-4** while **Figure 2-5** presents the land-cover about the site.

40000

-2925000

N

C23E

C23J

SCS Soils

Slimes Dam

Blyvooruitzicht

Elandsridge

Elandsfontein

Western Deep Levels Gold Mine

40000

-2925000

Legend

- SA Quaternary Catchment
- Area of Hydrological Relevance
- Mponeng TSF and RWD
- Slurry Alignment (Proposed)
- Return Water Alignment (Proposed)
- Pipelines Alternative Route (Proposed)
- Any Other Channel (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)
- Perennial River (50K Topo)

SANBI Vegetation Atlas (2018)

- Gauteng Shale Mountain Bushveld

SCS Soils Runoff Potential

- C - Moderately High Runoff Potential

Figure 2-4

Vegetation and Soil Runoff Potential

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0 5 10 15 km

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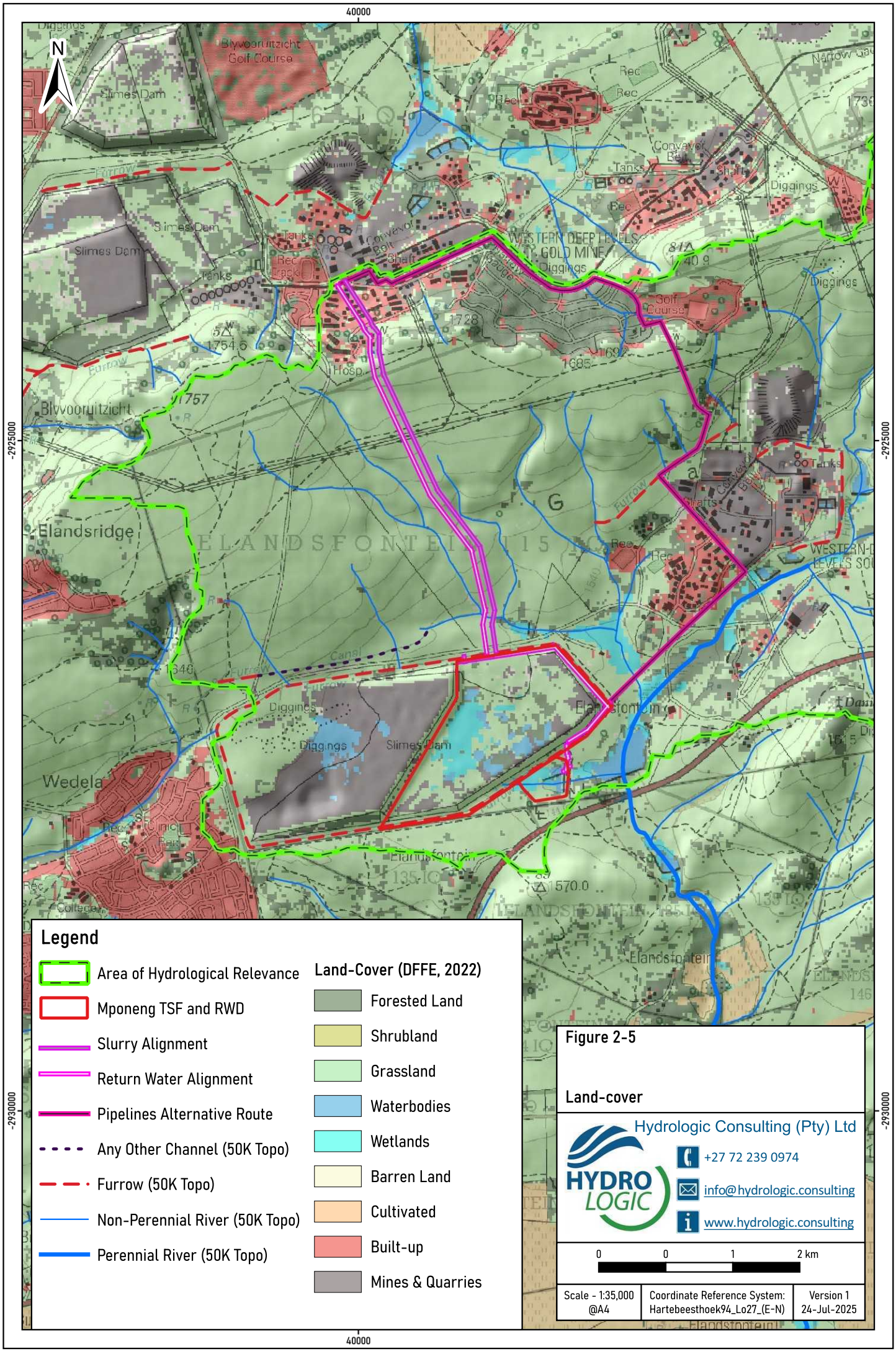
40000
-2925000
-2930000
N
Blyvooruitzicht Golf Course
Slimes Dam
Tanks
Conveyor Belt
Shaft
Diggings
WESTERN DEEP LEVELS GOLD MINE
Golf Course
Hosp.
Blyvooruitzicht
Elandsridge
ELANDSFONTEIN
Wedela
Slimes Dam
Diggings
Elandsfontein
1754.6
1728
1757
1546
1570.0
Legend
Area of Hydrological Relevance
Mponeng TSF and RWD
Slurry Alignment
Return Water Alignment
Pipelines Alternative Route
Any Other Channel (50K Topo)
Furrow (50K Topo)
Non-Perennial River (50K Topo)
Perennial River (50K Topo)
Land-Cover (DFFE, 2022)
Forested Land
Shrubland
Grassland
Waterbodies
Wetlands
Barren Land
Cultivated
Built-up
Mines & Quarries
Figure 2-5
Land-cover
Hydrologic Consulting (Pty) Ltd
HYDRO LOGIC
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0 0 1 2 km
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3 APPLICABLE GUIDANCE

The guidance that informs the hydrological assessment outlined in this report includes the following:

- National Environmental Management Act (Act No. 107 of 1998) as amended, states that "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring…"
- National Water Act (Act No. 36 of 1998) includes Section 21 water uses which require authorisation from the Department of Water and Sanitation (DWS).
- Department of Water and Sanitation Notice 509 of 2016 provides clarity on the regulated area of a watercourse;
- Government Notice 704 (Government Gazette 20118 of June 1999) provides regulations on the use of water for mining and related activities aimed at the protection of water resources;
- Department of Water and Sanitation (DWS) Best Practice Guideline G1 for Stormwater Management;
- Landcom Soils and Construction, Volume 1, 4th edition from 2004 (otherwise known as the Blue Book) has been used widely in the South African context in providing practical recommendations regarding the management of stormwater and associated erosion controls; and
- The South African Roads Agency Limited (SANRAL) 6th edition Drainage Manual (2013) provides some valuable insight specific to the construction and operation of roads.

3.1 NATIONAL WATER ACT

Definitions applicable to the identification of Section 21 water uses as defined by the National Water Act (Act No 36 of 1998) consist of:

- *"Watercourse"* including:
  - a river or spring;
  - a natural channel in which water flows regularly or intermittently; or
  - a wetland, lake or dam into which, or from which, water flows.
- *"Water resource"* – which includes a watercourse, surface water, estuary, or aquifer;
- "*Waste*'' – which includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted;

Section 21 water uses are not reviewed in this report, with EIMS undertaking to identify and authorises these.

3.2 DEPARTMENT OF WATER AND SANITATION NOTICE 4167 OF 2023

DWS Notice 4167 of 2023 "General Authorisation in Terms Of Section 39 of the National Water Act 36 of 1998 for Water Uses as defined in Section 21(c) Or Section 21(i)" includes the following:

- **Regulated area of a watercourse** – for section 21(c) or (i) of the Act water uses in terms of this Notice means:

(a) The outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, dams and lakes;

(b) In the absence of a determined 1 in 100-year flood line or riparian area as contemplated in (a) above the area within 100m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the National Water Act 36 of 1998);

(c) In respect of a wetland: a 500 m radius around the delineated boundary (extent) of any wetland (including pans);

Where the applicable Section 21 water uses per the above are as follows:

- ***Section 21 (c)*** – impeding or diverting the flow of water in a watercourse;
- ***Section 21 (i)*** – altering the bed, banks, course or characteristics of a watercourse.

3.3 GN 704

The Department of Water Affairs and Forestry (now the Department of Water and Sanitation) established GN 704 to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

3.3.1 IMPORTANT DEFINITIONS IN GN 704

- **Activity**: (a) any mining related process on the mine including the operation of washing plants, mineral processing facilities, mineral refineries and extraction plants, and (b) the operation and the use of mineral loading and off-loading zones, transport facilities and mineral storage yards, whether situated at the mine or not,
    - (i) in which any substance is stockpiled, stored, accumulated or transported for use in such process; or
    - (ii) out of which process any residue is derived, stored, stockpiled, accumulated, dumped, disposed of or transported;

- **Clean water system:** This includes any dam, other form of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of unpolluted water.

- **Dirty water system:** This includes any dam, other form of impoundment, canal, works, pipeline, residue deposit and any other structure or facility constructed for the retention or conveyance of water containing waste.

- **Dirty area:** This refers to any area at a mine or activity which causes, has caused or is likely to cause pollution of a water resource (i.e. polluted water).

3.3.2 APPLICABLE CONDITIONS IN GN 704

The principal conditions of GN 704 applicable to the site are:

Condition 4 – Restrictions on locality – No person in control of a mine or activity may:

(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked;

(b) except in relation to a matter contemplated in regulation 10 (i.e. Additional regulations relating to winning sand and alluvial minerals from watercourse or estuary), carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest;

(c) place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or

(d) use any area or locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year flood-line of any watercourse or estuary.

Condition 5 – Restrictions on use of material

No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.

Condition 6 - Capacity requirements of clean and dirty water systems

Every person in control of a mine or activity must:

(a) confine any unpolluted water to a clean water system, away from any dirty area;

(b) design, construct, maintain and operate any clean water system at the mine or activity so that it is not likely to spill into any dirty water system more than once in 50 years;

(c) collect the water arising within any dirty area, including water seeping from mining operations. outcrops or any other activity, into a dirty water system;

(d) design, construct, maintain and operate any dirty water system at the mine or activity so that it is not likely to spill into any clean water system more than once in 50 years; and

(e) design, construct, maintain and operate any dam or tailings dam that forms part of a dirty water system to have a minimum freeboard of 0.8 metres above full supply level, unless otherwise specified in terms of Chapter 12 of the Act.

(f) design, construct and maintain all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

Condition 7 – Protection of water resources

Every person in control of a mine or activity must take reasonable measures to:

(a) prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act;

(b) design, modify, locate, construct and maintain all water systems, including residue deposits, in any area so as to prevent the pollution of any water resource through the operation or use thereof and to restrict the possibility of damage to the riparian or in-stream habitat through erosion or sedimentation, or the disturbance of vegetation, or the alteration of flow characteristics;

(c) cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, adits, entrances or any other openings;

(d) design, modify, construct, maintain and use any dam or any residue deposit or stockpile used for the disposal or storage of mineral tailings, slimes, ash or other hydraulic transported substances, so that the water or waste therein, or falling therein, will not result in the failure thereof or impair the stability thereof;

(e) prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain material or substances so eroded or leached in such area by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources;

(f) ensure that water used in any process at a mine or activity is recycled as far as practicable, and any facility, sump, pumping installation, catchment dam or other impoundment used for recycling water, is of adequate design and capacity to prevent the spillage, seepage or release of water containing waste at any time;

(g) at all times keep any water system free from any matter or obstruction which may affect the efficiency thereof; and

(h) cause all domestic waste, including wash-water, which cannot be disposed of in a municipal sewage system, to be disposed of in terms of an authorisation under the Act.

The Minister of the DWS may in writing, authorise an exemption to instances of GN 704 non-compliance.

Mark Bollaert
MSc, CSci, CEnv, C.WEM, PrSciNat
Author/Project Manager/Reviewer

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4 REFERENCES

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