HYDROLOGICAL ASSESSMENT FOR THE HEIGHT EXTENSION OF THE SAVUKA 7A & 7B TSF

VERSION 2

25 FEBRUARY 2025

PROJECT NO. EIM-016

HYDROLOGIC CONSULTING
Email: info@hydrologic.consulting | Phone: +27 72 239 0974

HYDROLOGICAL ASSESSMENT FOR THE HEIGHT EXTENSION OF THE SAVUKA 7A & 7B TSF

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 assessment of the proposed Golden Core Trade and Invest (Pty) Ltd (the applicant's) Mponeng Operations (Harmony) Savuka 7a and 7b Tailings Storage Facilities (TSFs), located approximately 8km south-west of the town of Carltonville, in the Gauteng Province of South Africa. The TSFs are part of the greater Mponeng Operation.

This report outlines the hydrological baseline relevant to the hydrological assessment and evaluates the hydrological impact of the proposed TSFs height extension.

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.
- Hydrological Impact Assessment – this was undertaken using a recognised risk assessment methodology developed to enable effective communication of the potential consequences or impacts of activities on the hydrological (surface water) environment; and
- 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 own and operate 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 increase the height of the Savuka 7a & 7b TSFs, by between 5m to 10m.

The TSFs are constructed and operated through a drywall paddock system, however, it is proposed to change the deposition method to cycloning. This will lengthen the deposition timeframe up to current approved height, with cyclone deposition continuing into the height extension. No additional infrastructure is proposed as part of the height extension over and above the conversion to cyclone deposition.

[1] *Savuka 7a&7b EA description.docx*

1.3 REGIONAL SETTING AND LAYOUT

The Savuka 7a & 7b TSFs (hereafter also referred to as the site) are located at 26° 26' 6" S and 27° 21' 19" 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.

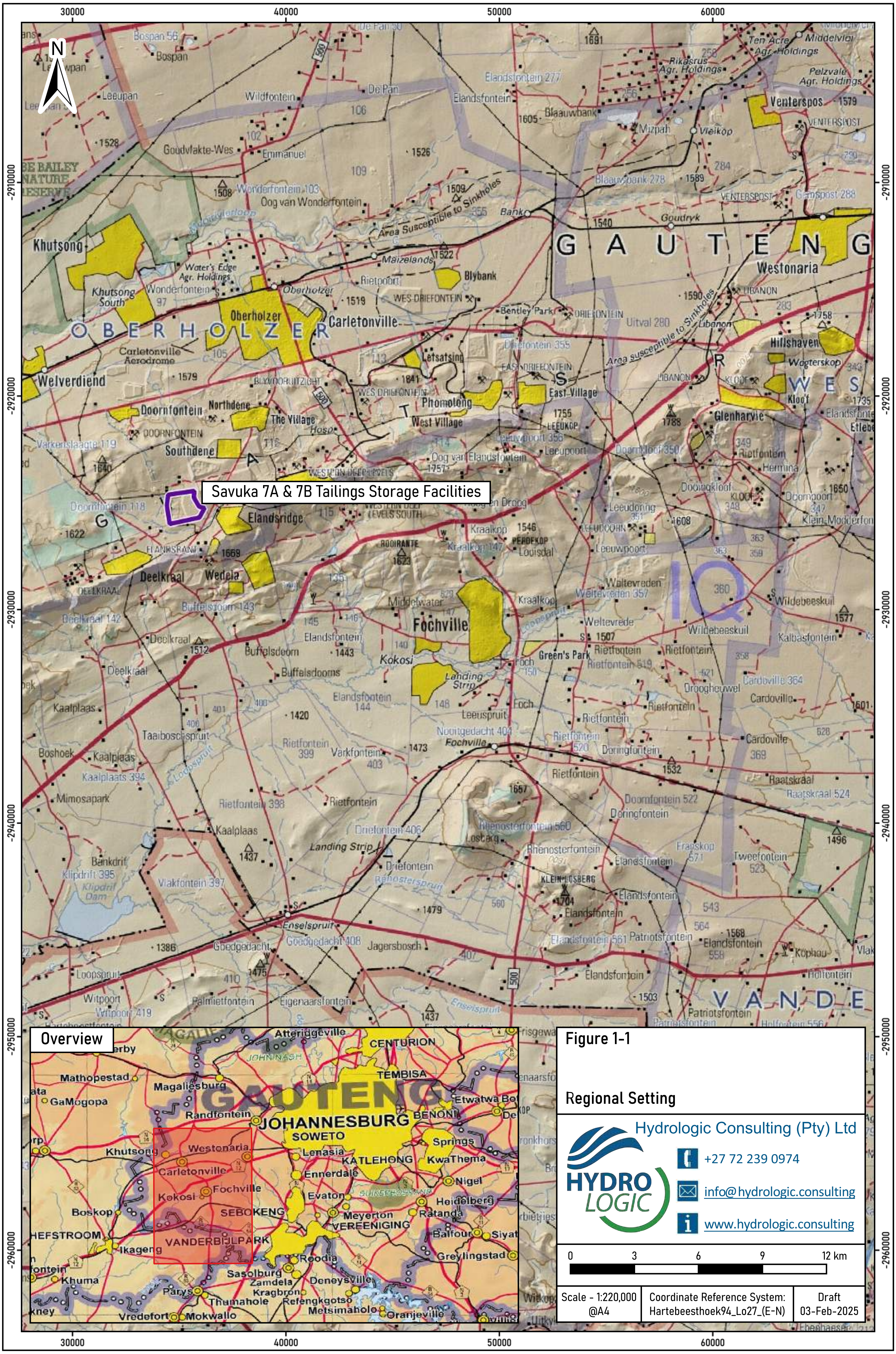


Figure 1-1

Regional Setting

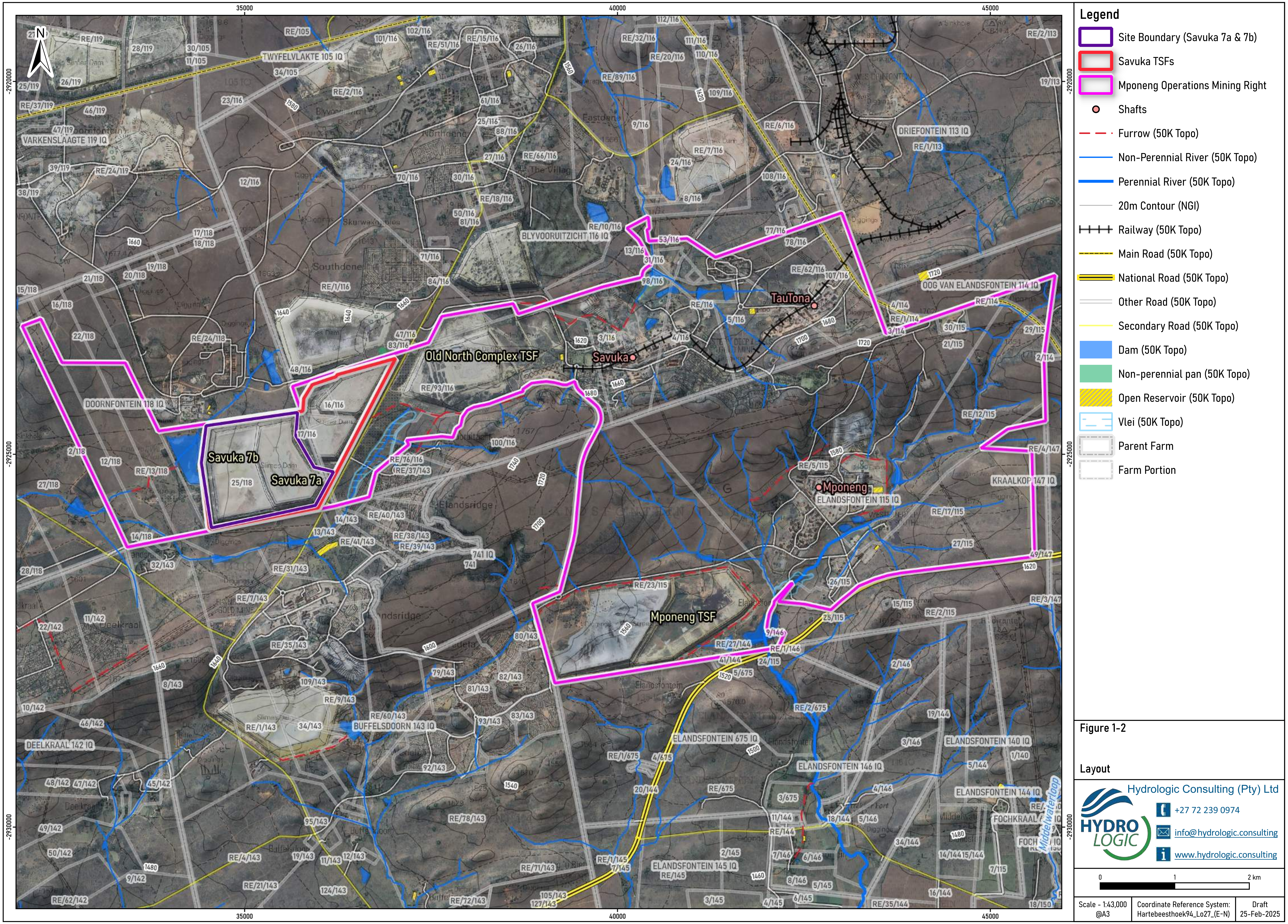


Figure 1-2

Layout

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)

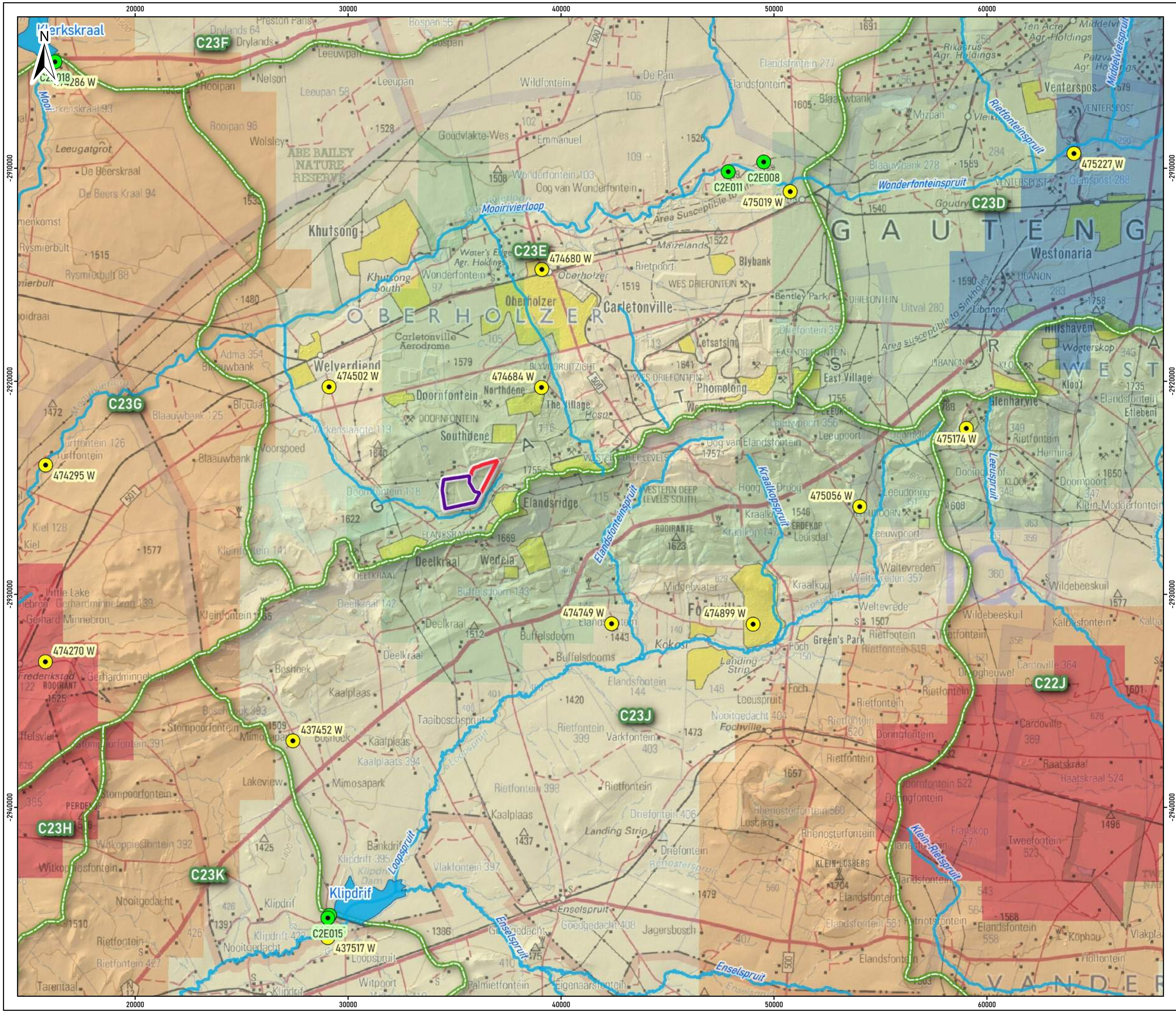
Month	Rainfall (mm)
Jan	113
Feb	92
Mar	84
Apr	45
May	19
Jun	7
Jul	6
Aug	8
Sep	20
Oct	60
Nov	89
Dec	102
Total	**645**

*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 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

- Site Boundary (Savuka 7a & 7b)
- Savuka TSFs
- SA Quaternary Catchment
- River (500K Topo)
- Dam (500K Topo)

Raingauges

- SAWS
- DWS

Mean Annual Precipitation (mm)

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

Figure 2-1

Mean Annual Precipitation

Hydrologic Consulting (Pty) Ltd

HYDRO LOGIC

+27 72 239 0974

info@hydrologic.consulting

www.hydrologic.consulting

0 2 4 6 8 km

Scale - 1:165,000 @A3	Coordinate Reference System: Hartebeesthoek94_Lo27_(E-N)	Draft 25-Feb-2025

TABLE 2-2: 24-HOUR STORM DEPTH

Recurrence Interval (Years)	Rainfall Depth (24-hour) (mm)
2	61.5
5	82
10	95.7
20	109.1
50	126.6
100	139.8
200	153.1

* 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 2,246mm.

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

Month	Evaporation(mm)
Jan	237
Feb	191
Mar	182
Apr	150
May	129
Jun	102
Jul	117
Aug	162
Sep	220
Oct	258
Nov	247
Dec	251
Total	**2,246**

*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

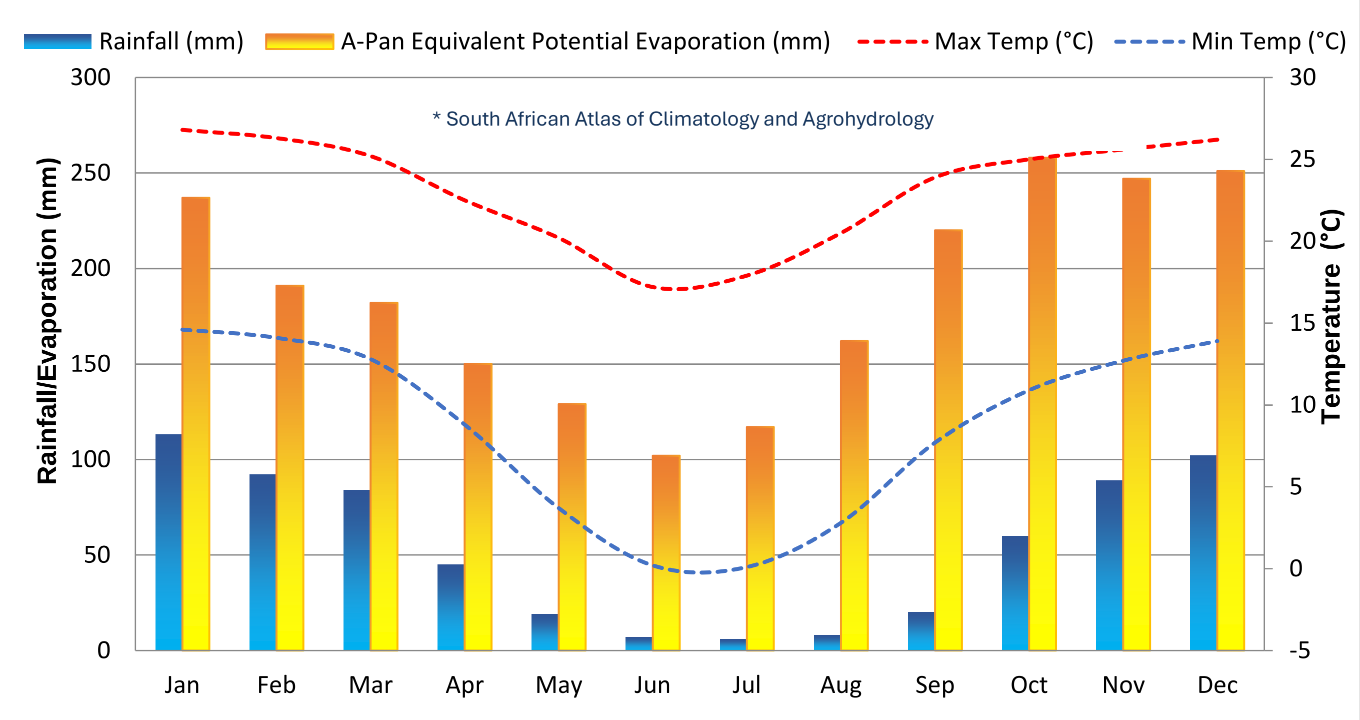


FIGURE 2-2: AVERAGE MONTHLY CLIMATE FOR THE SITE

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 5m 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 1,670 to 1,600m AMSL. The 5m 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 the southeastern portion of the site is generally more undulating with some slopes here falling between 10-30%.

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

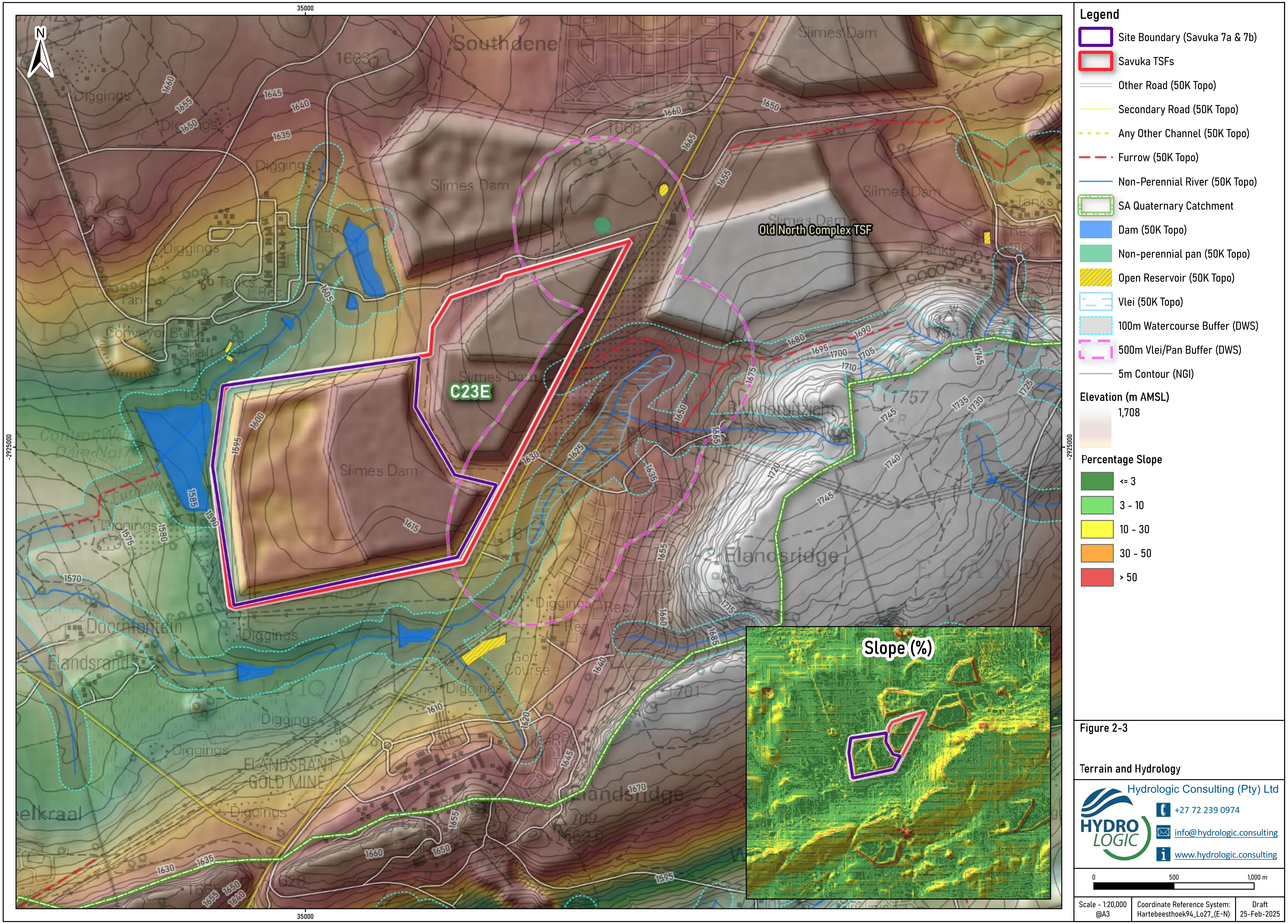


Figure 2-3

Terrain and Hydrology

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 catchments C23E.

Rivers near the site are unnamed, with the NGI's 1:50,000 topographical map data illustrating two non-perennial river systems to the north and south, both of which converge to the west of the site. The southern system is larger than the northern system, however, neither area is sufficiently sized to enable perennial flows (per the NGI's classification).

The southern system is associated with a vlei and has upstream furrows directing runoff from part of the greater Mponeng Operation (south of the Old North Complex TSF). Two small dams are noted. The northern system is characterised by two larger dams, both of which appear to be return water dams when reviewing Google Earth imagery.

A single non-perennial pan is noted to the north-east of the site.

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.

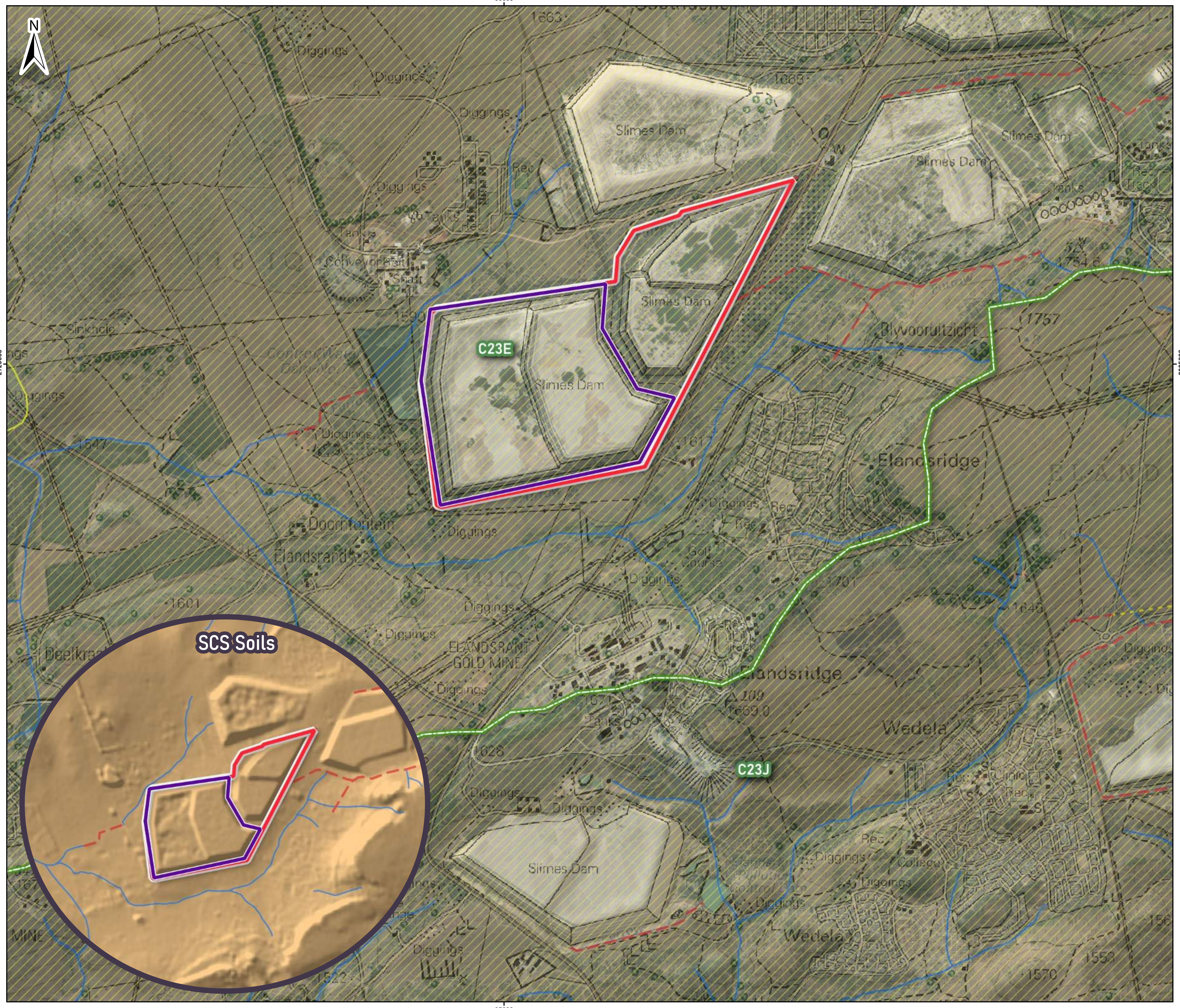
This report also does not delineate or comment on the significance of any wetlands/vleis – consideration of this would require a wetland specialist. The NGI's 1:50,000 vleis are used for indicative purposes.

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.



Legend

- Site Boundary (Savuka 7a & 7b)
- Savuka TSFs
- SA Quaternary Catchment
- Any Other Channel (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)

SANBI Vegetation Atlas (2018)

- Carletonville Dolomite Grassland
- Gauteng Shale Mountain Bushveld

SCS Soils Runoff Potential

- C - Moderately High Runoff Potential

Figure 2-4

Vegetation and Soil Runoff Potential

Hydrologic Consulting (Pty) Ltd

+27 72 239 0974

info@hydrologic.consulting

www.hydrologic.consulting

0 500 1,000 m

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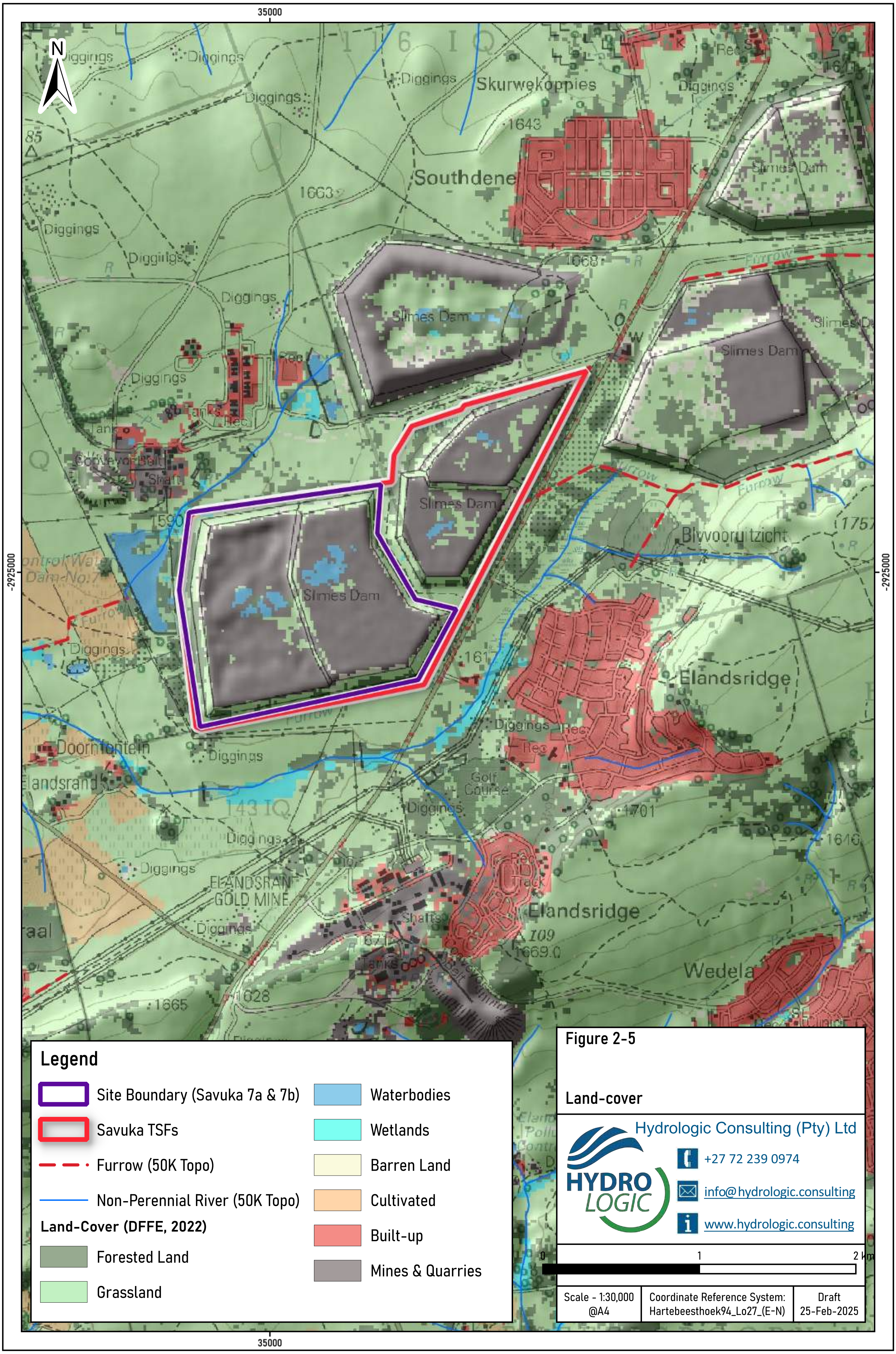


Figure 2-5

Land-cover

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) 6'th 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 principle 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.

4 IDENTIFIED SITE SENSITIVITIES

Sensitivity mapping was undertaken to identify sensitive features relating to the hydrological (surface water) environment within the site. A 1000m buffer from the Savuka 7A & 7B TSFs was used as the area under consideration.

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. This includes the following condition:

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

(e) 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;

The 100m watercourse buffer is consequently one of the main guiding aspects in the assessment of site sensitivities given its relevance to GN 704, and its applicability to both flooding and the potential for contaminants to enter a watercourse (i.e. a wider river buffer is more likely to keep infrastructure/works outside of areas prone to regular or irregular flooding while enabling more time for containments within runoff, to settle out before entering the watercourse). A 100m watercourse buffer distance is, however, limited in its application since the proposed works/infrastructure will either fall within or without this buffer distance, with no grading in site sensitivity possible. An expanded approach to the 100m river buffer was consequently adopted utilising a variation in buffer distances modelled flooding and contour analysis.

The proposed activities lie between two non-perennial river systems as defined per the 1:50,000 topographical map. There is also constructed drainage present (furrows). Where furrows appear to manage larger areas or are otherwise extensions of non-perennial rivers, they are assumed to fall within the conceptual definition of a watercourse insofar as having the potential to cause flooding and route pollutants downstream.

Watercourse buffers have consequently been derived from the 1:50,000 topographical map features inclusive of dams, furrows, the non-perennial river, non-perennial pans and vleis. Open reservoirs have been excluded on the basis that inflows are managed (and that there is no significant upslope catchment area of relevance). Watercourse buffers are technically applicable from the edge (top of the bank) of the watercourse and not from the centreline (as in the case of rivers, drainage canals and furrows). The absence of a river survey means that the river centreline has nevertheless been used to define buffers.

The following sensitivity bands were classified:

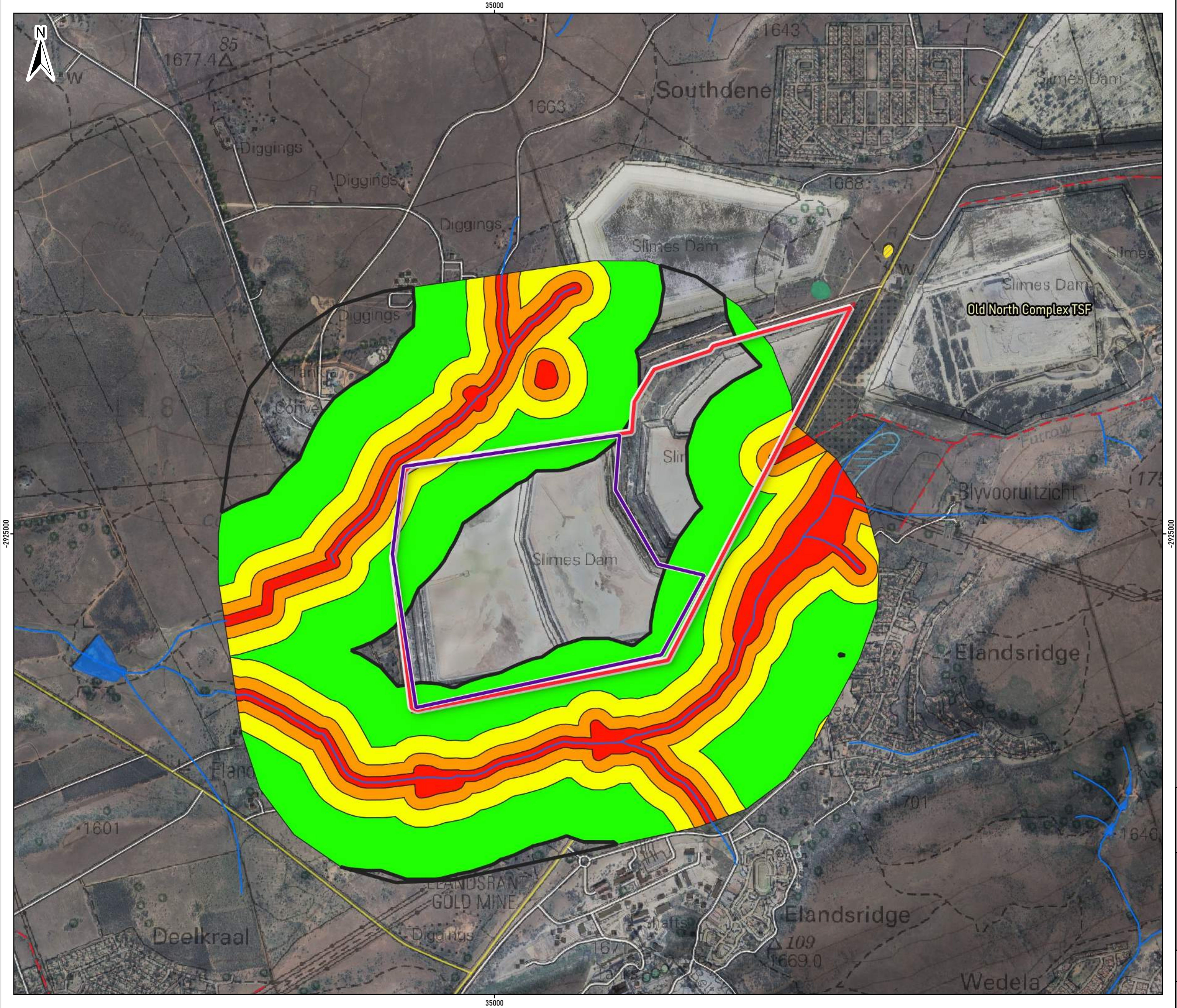
- Prevent Development
  - A 32m watercourse buffer (also applicable to NEMA activities) was used to define the functional area of the watercourse.
  - This 32m buffer factors in the potential error in the 1:50,000 topographical map dataset.

  - All development should be prevented in this area unless water-compatible or otherwise crossing over a watercourse (with flood risk factored in).
- High
  - A 100m buffer distance matches GN 704's and DWS Notice 4167 of 2023 prescribed buffer distance and is the minimum distance to a watercourse requiring motivation if works/infrastructure are going to be permitted, including a written exemption from the Minister of the Department of Water and Sanitation.
  - There is a strong disincentive towards development within this area.
- Medium
  - A 200m buffer distance was included as an intermediate buffer distance to the 100m buffer distance above and the 500m buffer distance below.
  - There is a medium disincentive towards development within this area.
- Low
  - A 500m buffer distance is a reasoned maximum distance from a watercourse which in most instances will reflect the largest distance over which flooding would need to be considered.
  - DWS Notice 4167 of 2023 also outlines how a 500m buffer distance is applicable to wetlands (which includes pans and vleis as present in this study area). This report, however, does not focus on wetlands and only considers the 1:50,000 topographical map rivers.
  - There is a low disincentive towards development within this area.
- Remainder:
  - There is no sensitivity classification for the remainder of the site.

GN 704 restricts development within 100m of a watercourse (e.g. dam or river) and the above outline does not attempt to remove this restriction but is instead a high-level 'scaled' version of this buffer distance.

This classification only partly considers the 500m wetland buffer that applies. This wetland buffer is expected to be more comprehensively assessed as part of a wetland survey of the site and not the higher-level datasets present with the NGI's 1:50,000 topographical map dataset. No assessment of wetlands has been undertaken in this report.

Figure 4-1 presents the results of the identified site sensitives as they relate to the surface water environment. As mentioned in Section 2.6, hydrological features have been defined according to the NGI's 1:50,000 topographical map data and this report does not intend to alter their classification. However, two of the larger dams to the north of the site are known to act as return water dams. They have, consequently been excluded from the sensitivity analysis.



Legend

- Site Boundary (Savuka 7a & 7b)
- Savuka TSFs
- Other Road (50K Topo)
- Secondary Road (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)
- Dam (50K Topo)
- Non-perennial pan (50K Topo)
- Open Reservoir (50K Topo)
- Vlei (50K Topo)

Site Sensitivity - Surface Water

- Prevent Development
- High
- Medium
- Low
- Unclassified

Figure 4-1

Site Sensitivity

Hydrologic Consulting (Pty) Ltd

HYDRO LOGIC

+27 72 239 0974

info@hydrologic.consulting

www.hydrologic.consulting

0 500 1,000 m

Scale - 1:20,000 @A3	Coordinate Reference System: Hartebeesthoek94_Lo27_(E-N)	Draft 25-Feb-2025

5 HYDROLOGICAL IMPACTS AND MITIGATION MEASURES

An impact is any change (positive or negative) to a resource or receptor brought about by the presence of the project component or the execution of a project-related activity.

The project's potential impacts have been evaluated using a recognised risk assessment methodology developed to ensure communication of the potential consequences or impacts of activities on the hydrological (surface water) environment as set out in the National Environmental Management Act (NEMA). A quantitative approach was taken in determining environmental significance since this enables a cross-disciplinary assessment of impact whereby the interpretation of impact significance is the same (i.e. a high impact on the surface water environment has the same interpretation as a high impact on ecology).

5.1 METHOD OF ASSESSING IMPACTS

The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

5.1.1 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology, the consequence of the impact is represented by:

$$C = \frac{E + D + M + R}{4} \times N$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Table 5-1.**

TABLE 5-1: CRITERIA FOR DETERMINING IMPACT CONSEQUENCE

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per **Table 5-2**.

TABLE 5-2: PROBABILITY SCORING

Probability Score	Description
1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
3	Medium probability (the impact may occur; >50% and <75%),
4	High probability (it is most likely that the impact will occur- > 75% probability), or
5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \; x \; P$$

TABLE 5-3: DETERMINATION OF ENVIRONMENTAL RISK

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in **Table 5-4**.

TABLE 5-4: SIGNIFICANCE CLASSES

Environmental Risk Score	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9 & <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post-implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction of the degree to which the impact can be managed/mitigated.

5.1.2 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

TABLE 5-5: CRITERIA FOR DETERMINING PRIORITISATION

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 5-5. The impact priority is therefore determined as follows:

$$Priority = CI + LR$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to **Table 5-6**).

TABLE 5-6: DETERMINATION OF PRIORITISATION FACTOR

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

To determine the final impact significance, the PF is multiplied by the ER of the post-mitigation scoring. The ultimate aim of the PF is an attempt to increase the post-mitigation environmental risk rating by a factor of 0.5 if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

TABLE 5-7: FINAL ENVIRONMENTAL SIGNIFICANCE RATING

Rating	Description
≤ -17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
> -17 ≤ -9	Medium negative (i.e. where the impact could influence the decision to develop in the area).
> -9 < 0	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact

>0 <9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 9 < 17	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

5.2 PROJECT PHASES

Savuka 7a & 7b TSFs are approaching their final and approved height, and the current planned Life of Mine (LOM) for the West Wits region exceeds the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs, by between 5m to 10m.

No additional infrastructure is proposed as part of the height extension over and above the conversion to cyclone deposition.

No alternatives are relevant to this report.

This impact assessment has been developed on the understanding that the project is comprised of the following phases:

- Construction – this phase is not applicable since the TSFs are already in existence;
- Operation – Additional TSF operation beyond the existing approved height will commence;
- Decommissioning – all TSF operations will cease with certain surface infrastructure removed; and
- Rehab/Closure – disturbed surface areas will undergo rehabilitation.

5.3 IDENTIFIED SURFACE WATER IMPACTS

5.3.1 EROSION OF SOILS

The current TSFs are surrounded by toe paddocks reporting to the return water dam (RWD) west of the TSFs. This will limit the potential for eroded soils or sediment to enter the environment. The proposed height increase is expected to make a limited difference in the potential (existing) erosion of soils.

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

TABLE 5-8: EROSION OF SOILS

Impact Name	**Erosion of Soils**				
Phase	Operational, Decommissioning & Rehabilitation/Closure				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	2	2
Extent	1	1	Reversibility	2	2
Duration	2	2	Probability	2	2
Environmental Risk (Pre-mitigation)					-3.5
Mitigation Measures					
The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension. • *Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).* • *Monitor the TSFs to ensure areas of potential erosion are identified and managed appropriately.*					

• *Rehabilitation should include topsoil replacement, re-vegetation and maintenance/aftercare for disturbed areas insofar as it should be developed for disturbed areas.* • *Concurrent rehabilitation of the TSFs should ideally occur during the life of the TSFs. This would likely include cladding of TSFs side slopes and subsequent revegetation with final TSFs rehabilitation resulting in fully vegetated site.* • *Additional guidance on erosion control is available in: Landcom Soils and Construction, Volume 1, 4th edition from 2004 (otherwise known as the Blue Book).*	
Environmental Risk (Post-mitigation)	-3.5
Degree of confidence in impact prediction:	Medium
Impact Prioritisation	
Cumulative Impacts	3
High: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change	
Degree of potential irreplaceable loss of resources	1
Low: Where the impact is unlikely to result in irreplaceable loss of resources.	
Prioritisation Factor	1.25
Final Significance	-4.38

5.3.2 POLLUTANTS ENTERING THE SURFACE WATER ENVIRONMENT

For the most part, potential pollutants are already limited by the design of the project given the containing nature of the existing TSFs.

A stormwater management plan compliant with both TSF-specific regulations and per GN 704 requirements is expected to already be present (in operation).

Uncontrolled release of tailings or contaminated return water is possible and would be considered a residual risk (post-mitigation). A TSF failure while a highly unlikely event has the potential to cause severe pollution of the downstream environment while poor operation/management of the TSFs (and by association the RWD) could see unplanned spill from the RWD.

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

Important. It should also be noted that the potentially severe impact of a TSF failure is not adequately conveyed by the impact table below since the probability is low, resulting in the impact appearing less significant than may be warranted.

TABLE 5-9: POLLUTANTS ENTERING THE SURFACE WATER ENVIRONMENT

Impact Name	**Pollutants Entering the Surface Water Environment**				
Phase	Operational, Decommissioning & Rehabilitation/Closure				
Impact Name					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	5	5
Extent	5	5	Reversibility	5	5
Duration	2	2	Probability	1	1
Environmental Risk (Pre-mitigation)					-4.25
Mitigation Measures					
The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension. • *Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).* • *Develop the TSFs using sound engineering to limit the likelihood of a failure.* • *Maintain and operate the TSFs/RWD to limit the potential for overfilling of the RWD that leads to a spill.* • *Monitor the TSFs to identify any potential failures/slumps.* • *Keep activity within the managed dirty water footprint where possible.* • *Store hydrocarbons off-site where possible, or otherwise implement hydrocarbon storage with adequate bunding.* • *Handle hydrocarbons carefully to limit spillage.*					

• *Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited.* • *Use drip trays for stationary vehicles or otherwise park over areas suited to their storage (e.g. with an oil interceptor)* • *Designate a single location for refuelling and maintenance where possible.* • *Keep a spill kit on site to deal with any hydrocarbon leaks.* • *Remove soil from the site which has been contaminated by hydrocarbon spillage.* • *Undertake surface water monitoring to enable change detection related to contaminants originating from the site.*	
Environmental Risk (Post-mitigation)	-4.25
Degree of confidence in impact prediction:	Medium
Impact Prioritisation	
Cumulative Impacts	3
High: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change	
Degree of potential irreplaceable loss of resources	3
High: May result in the irreplaceable loss of resources of high-value	
Prioritisation Factor	1.5
Final Significance	-6.38

5.3.3 DECREASE IN RUNOFF

The existing TSFs have a containment philosophy in place as enabled by the self-containing TSF basin, toe paddocks and RWD, with overall runoff from the site decreased to near zero (before any treatment and discharge). The proposed height increase is expected to make a negligible difference in the existing decrease in runoff (relative to an undeveloped site).

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

TABLE 5-10: DECREASE IN RUNOFF

Impact Name	**Decrease in Runoff**				
Phase	Operational, Decommissioning & Rehabilitation/Closure				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	1	1
Extent	1	1	Reversibility	1	1
Duration	1	1	Probability	5	5
Environmental Risk (Pre-mitigation)					-5.0
Mitigation Measures					
The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension. • *Limiting the time and area over which machinery operates will limit the compaction of soils on the site.* • *Divert clean water run-on away from the site.*					
Environmental Risk (Post-mitigation)					-5.0
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Cumulative Impacts					1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
Low: Where the impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.25
Final Significance					-5.0

5.3.4 FLOOD RISK

Flood risk is both an impact on the proposed TSFs height extension (flooding originating beyond the TSF) and on the environment (flooding originating from the TSFs) and includes:

- A TSF failure resulting in downstream flooding (flooding originating from the TSF);
- Flooding from the either river system to the north or south of the TSFs (flooding originating beyond the TSFs); and
- Surface water run-on towards the TSFs (flooding originating beyond the TSFs).

This risk is expected to be present during the construction, operational, decommissioning and rehab/closure phases (flooding originating beyond the TSFs) and during the operational, decommissioning and rehab/closure phases (flooding originating from the TSFs). The proposed increase in TSFs height has no influence on existing flood risk to the TSFs, however, flood risk from the TSFs may be increased due to increased TSF volume.

Section 4 presents a site sensitivity grading that can inform potential flood risk, however, this is qualitative only A quantified assessment of flooding would need to consider the actual fluvial flood risk to the TSFs (from the adjacent river systems).

The consequence of flooding is potentially severe, however, flooding originating beyond the TSFs is expected to have been mitigated (to at least a degree) through the toe paddocks and associated bunding that hydraulically separates the TSFs from the adjacent environment.

TSF failure (while highly unlikely to occur), has both flooding and pollutant implications (discussed **in 5.3.2**).

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

Important. It should be noted that the potentially severe impact of flood risk is not adequately conveyed by the impact table below since the probability of extreme flooding is low, resulting in the impact appearing less significant than may be warranted.

TABLE 5-11: RIVER AND SURFACE WATER FLOOD RISK

Impact Name	Flood Risk				
Phase	Operational, Decommissioning, and Rehabilitation/Closure				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature	-1	-1	Magnitude	5	5
Extent	4	4	Reversibility	5	5
Duration	1	1	Probability	1	1
Environmental Risk (Pre-mitigation)					-3.75
Mitigation Measures					
The below mitigation is expected to already be part of the existing TSFs management. • *Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).* • *Ensure that flood protection of the TSFs is sufficient to manage flood risk from both adjacent river systems (north and south) and stormwater run-on.* • *Develop the TSFs using sound engineering to limit the likelihood of a failure.* • *Monitor the TSFs to identify any potential failures/slumps.*					
Environmental Risk (Post-mitigation)					-3.75
Degree of confidence in impact prediction:					Low
Impact Prioritisation					

Cumulative Impacts	1
Low: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	3
High: May result in the irreplaceable loss of resources of high-value	
Prioritisation Factor	1.25
Final Significance	-4.69

5.4 ADDITIONAL CONSIDERATIONS

Flooding and pollutants entering the surface water environment are the two primary impacts indicated by the impact assessment. Both impacts are poorly represented in the impact assessment due to their probability of occurrence (improbable).

6 SURFACE WATER MONITORING

Regular surface water quality monitoring is required to enable change detection resulting from the potential contamination of surface water by the TSFs. Surface water monitoring points are expected to be present given the existing Sakuvka 7A and 7B TSF, plus the surrounding work associated with the greater operation.

For the sake of this study, indicative sampling points are provided for the Savuka 7A and 7B TSFs alone. Sampling points are laid out to either capture flows towards the TSFs or flows away from the TSFs (pre and post-pollutant potential respectively).

6.1 MONITORING PROGRAMME

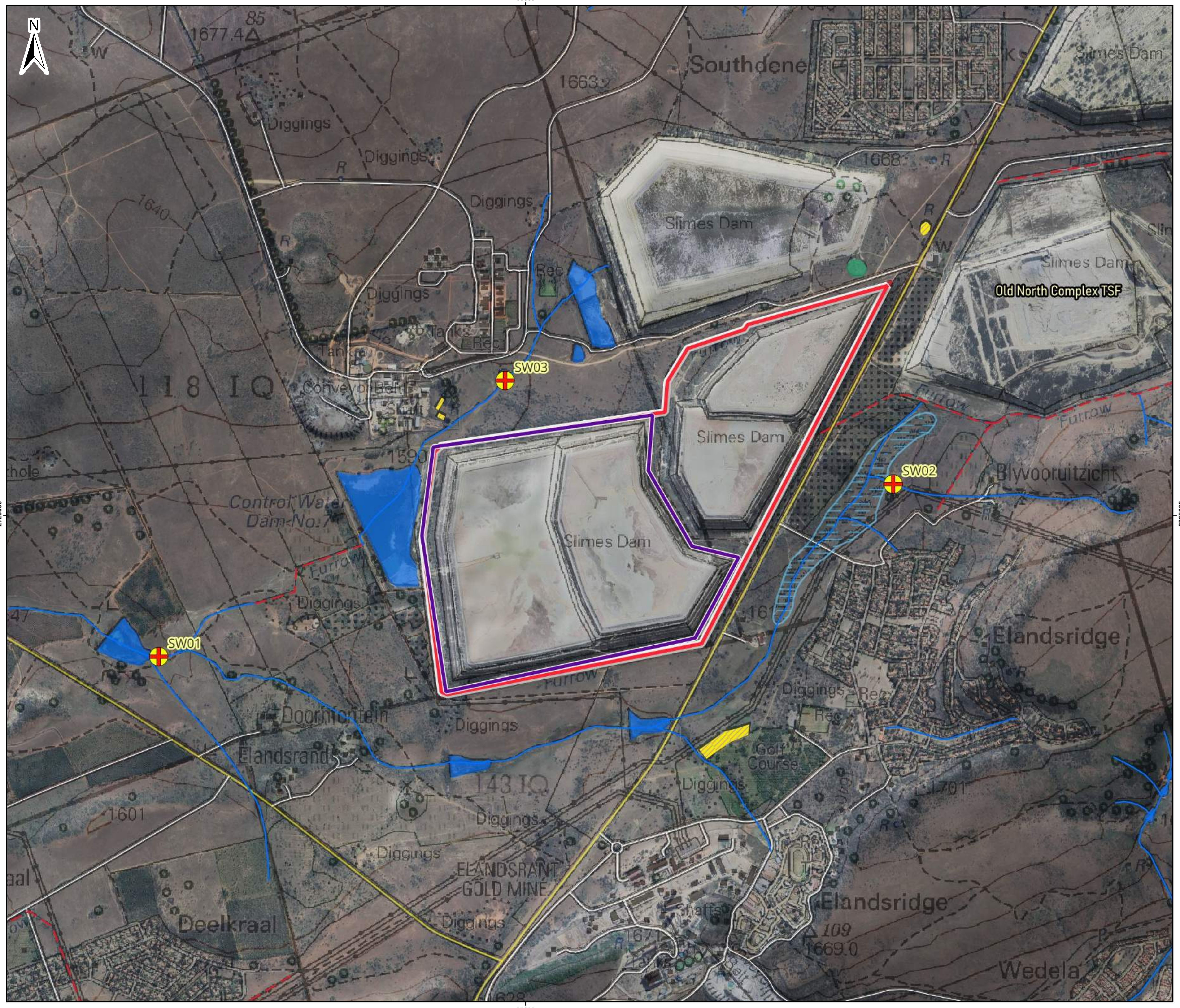
Potential contaminants of concern that need to be monitored are expected to have already been identified based on the historical quarterly surface water quality monitoring that has been undertaken. The understanding of the mine's processes and the associated contaminants that might be released in the event of a failure in an aspect of the TSF's (e.g. toe paddock rupture or RWD overflow) is likewise expected to be clearly understood with monitoring reflecting this.

Quarterly monitoring reports should be produced to differentiate seasonal variations and general trends due to the mining activities, with a comparison of water samples to standards and guidelines set by the Department of Water and Sanitation (DWS) and an analysis of parameters over time so that trends can be established.

The recommended monitoring point is illustrated in **Figure 6-1** and is presented in **Table 6-1**.

TABLE 6-1: ADDITIONAL MONITORING POINT RECOMMENDED

Monitoring Point	Coordinate
SW01	26° 26' 29" S, 27° 19' 49" E
SW02	26° 25' 58" S, 27° 22' 17" E
SW03	26° 25' 39" S, 27° 20' 59" E



Legend

- Site Boundary (Savuka 7a & 7b)
- Savuka TSFs
- Surface Water Sampling Point
- Other Road (50K Topo)
- Secondary Road (50K Topo)
- Furrow (50K Topo)
- Non-Perennial River (50K Topo)
- Dam (50K Topo)
- Non-perennial pan (50K Topo)
- Open Reservoir (50K Topo)
- Vlei (50K Topo)

Figure 6-1

Surface Water Sampling

Hydrologic Consulting (Pty) Ltd

+27 72 239 0974

info@hydrologic.consulting

www.hydrologic.consulting

0 500 1,000 m

Scale - 1:20,000 @A3	Coordinate Reference System: Hartebeesthoek94_Lo27_(E-N)	Draft 25-Feb-2025

7 CONCLUSION AND RECOMMENDATIONS

Savuka 7a & 7b TSFs are approaching their final and approved height, and the current planned Life of Mine (LOM) for the West Wits region exceeds the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs, by between 5m to 10m.

No additional infrastructure is proposed as part of the height extension over and above the conversion to cyclone deposition.

Baseline information including rainfall, evaporation, design event rainfall, soils, vegetation and land-cover, as well as site terrain, flooding and regional and local catchment hydrology have been considered for the proposed pipelines.

Applicable Guidance

The primary guidance applicable to this assessment is as follows:

- 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; and
- 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.

Site Sensitivities

Figure 4-1 presents the results of the identified site sensitives as they relate to the surface water environment. This figure illustrates that there are parts of the TSFs that are within sensitive areas. This primarily includes the influence of the northern and southern river systems adjacent to the TSFs, since the 1:100 RI flood event (medium sensitivity) falls out of the site.

Identified Impacts

Flooding and pollutants entering the surface water environment are the two primary impacts whether or not indicated by the impact assessment. Both impacts are poorly represented in the impact assessment due to their probability of occurrence (improbable). In the case of flooding, there is flooding originating beyond the TSFs (from the northern and southern river systems and surface water run-on) and flooding originating from the TSFs (due to a TSF failure). The latter presents the largest risk to this study (that of flood risk and pollutants entering the surface water environment). A secondary pollutant risk is poor management of the TSFs (and by association the RWD) resulting in a spill.

Surface Water Monitoring

Regular surface water quality monitoring is required to enable change detection, concerning the potential contamination of surface water by any pipeline leaks. Surface water monitoring points presently active over the greater Mponeng Operation have been provided and are presented in **Figure 6-1**. Surface water monitoring points are expected to be present given the existing Sakuvka 7A and 7B TSFs, plus the surrounding work associated with the greater operation. For the sake of this study, indicative sampling points are provided for the Savuka 7A and 7B TSFs alone. Sampling points are laid out to either capture flows towards the TSFs or flows away from the TSFs (pre and post-pollutant potential respectively).

Authorisation

The proposed Savuka 7a & 7b TSFs height extensions can be authorised with regard to the hydrological (surface water) environment inclusive of the recommended mitigation measures presented in **Section 5**. A review of Mponeng's surface water monitoring plan will also be required to ensure that the TSFs are adequately considered (as it relates to monitoring positions).

Jonathan Southwood
BSc, Professional Land Surveyor (GPrLS 1539)
Survey/Modelling/Mapping

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

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8 REFERENCES

Department of Water Affairs and Forestry, 1998. *National Water Act, Act 36 of 1998*

Department of Water Affairs and Forestry, 1999, "*Government Notice 704 (Government Gazette 20118 of June 1999)*

Department of Water Affairs and Forestry, 2006, "*Best Practice Guideline No. G1: Stormwater Management*", DWAF, Pretoria, August 2006

Department of Water and Sanitation, 2016, "*Government Notice 509 General Authorisation In Terms Of Section 39 Of The National Water Act, 1998 (Act No. 36 Of 1998) For Water Uses As Defined In Section 21(c) Or Section 21(i)*"

Pegram, G.G.S. and Sinclair, S., 2016, "*New Methods of Infilling Southern African Raingauge Records Enhanced by Annual, Monthly and Daily Precipitation Estimates Tagged with Uncertainty",* WRC Report No. 2241/1/15

Rossman, L., 2008. Storm Water Management Model user's manual, version 5.0, (March), 271. Retrieved from http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10011XQ.txt

SANBI - South African National Biodiversity Institute, 2018, "*Vegetation Map of South Africa, Lesotho and Swaziland 2018"*

Schulze, R.E. and Lynch, S.E., 2006. "*South African Atlas of Climatology and Agrohydrology",* WRC Report 1489/1/06, Water Research Commission, Pretoria

Water Research Commission 2002. "*Design Rainfall Estimation in South Africa*". WRC Report No. K5/1060