APPENDIX E7 – Hydrology Assessment

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Hydrological Assessment for the EIA of the Proposed 750MW Combined Cycle Gas Turbine Power Plant in Richards Bay

Report

Version - Draft V1

18 March 2026

Nemai Consulting

GCS Project Number: 24-0250

Client Reference: PO 10784/0682

GCS (Pty) Ltd. **Reg No:** 2004/000765/07 Est. 1987
Offices: **Johannesburg (Head Office)** | Durban | Gaborone | Maseru | Windhoek | Ostrava
Directors: AC Johnstone (CEO) | DA Kriel | W Sherriff (Financial) | N Marday (HR) | CR Goodspeed

www.gcs-sa.biz

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	Name	**Signature**	**Date**
Author	Chané Pretorius (MSc, Cert.Sci.Nat.) *Project Hydrologist*		18 March 2026
Water Director	Andrew Johnstone (MSc, Pr.Sci.Nat.) *GCS Group CEO*	Andrew Johnstone	18 March 2026

EXECUTIVE SUMMARY

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Nemai Consulting to undertake a hydrological assessment for the proposed 750 MW Combined Cycle Gas Turbine Power Plant (CCGTPP) located within the Richards Bay Industrial Development Zone (RBIDZ) in KwaZulu-Natal. The assessment was undertaken as part of the Environmental Impact Assessment (EIA) process to characterise baseline hydrological conditions, identify potential hydrological risks associated with the proposed development, and provide recommendations for stormwater management and monitoring.

The project area falls within quaternary catchment W12F of the Pongola–Mtamvuna Water Management Area and is characterised by relatively flat terrain with elevations ranging between 39 and 42 mamsl. Surface drainage across the site generally flows towards the south-west, discharging into a man-made canal located along the western boundary of the site, which has developed wetland-like characteristics over time.

Baseline hydrological conditions were assessed using regional hydrometeorological datasets, catchment analysis, and site observations. The area experiences an average annual rainfall of approximately 1,200 mm, with simulated natural runoff estimated at 22% of mean annual precipitation for the quaternary catchment.

A site walkover assessment confirmed the presence of the canal and associated wetland-like areas along the western boundary of the site. Baseline water quality samples collected upstream, midstream, and downstream of the site indicate that water quality parameters fall within the DWAF Target Water Quality Ranges (TWQR) for domestic use, suggesting that the canal currently exhibits acceptable baseline water quality conditions. In addition, the applicable TWQRs for the lower Mhlathuze River (Resource Unit W1; quaternary catchment W12F) were considered. While the majority of parameters are aligned with these ranges, the measured pH of approximately 7 is slightly below the typical TWQR range of 7.5–8.5 for the Mhlathuze system, although it remains within acceptable limits for freshwater systems..

Peak flood flows were estimated using the Rational Method, Standard Design Flood (SDF) method, and Midgley and Pitman (MIPI) method, and conservative peak flows were applied in hydraulic modelling undertaken using HEC-RAS. Floodline modelling for the 1:10-, 1:50-, and 1:100-year return period events indicates that the canal and adjacent wetland areas may pose a flooding risk to low-lying portions of the site.

The proposed development will introduce additional impervious surfaces associated with plant infrastructure, which will lead to localised increases in stormwater runoff and peak flows. However, the increase in peak flows at the sub-catchment scale is expected to be relatively small. A Conceptual Stormwater Management Plan (CSWMP) was therefore developed to guide the management of stormwater runoff from the site. The plan focuses on the separation of clean and potentially contaminated runoff, stormwater diversion and containment measures, and attenuation infrastructure where required.

Runoff generated from the site is expected to consist primarily of stormwater from impervious surfaces such as roofs, paved areas, and parking areas. While this runoff is generally considered clean stormwater, localised contaminants such as hydrocarbons from vehicles or equipment may occur in certain areas and should therefore be managed through appropriate stormwater infrastructure discussed in Section 7.6.2.

A hydrological risk assessment identified potential risks during both the construction and operational phases, including sediment mobilisation, stormwater contamination, and flood-related risks associated with the nearby canal. With the implementation of appropriate stormwater management measures, erosion control practices, and environmental management procedures, the significance of these risks is expected to be reduced to acceptable levels.

A surface water monitoring programme was also developed to monitor water quality within the canal during both the construction and operational phases of the project.

Key Findings

- **Baseline Hydrology:**
  - The site is located within a relatively small sub-catchment (~2.6 km^2) with flat topography and drainage directed towards a canal along the western boundary of the site.
- **Flood Risk:**
  - Hydraulic modelling indicates that areas associated with the 1:100-year flood line near the canal and wetland areas represent flood-sensitive zones and should preferably be avoided during infrastructure placement.
- **Water Quality:**
  - Baseline surface water quality within the canal is within DWAF Target Water Quality Ranges, indicating acceptable existing conditions.

- **Stormwater Management:**
    - The implementation of a Conceptual Stormwater Management Plan, including the separation of clean and potentially contaminated runoff and appropriate stormwater attenuation infrastructure, will mitigate potential impacts on downstream watercourses. The conceptual stormwater management plan must be included in the engineering design with associated construction plans

Based on the findings of this assessment, the proposed development can be implemented with acceptable hydrological risk, provided that the recommended stormwater management measures, flood risk considerations, and surface water monitoring programme are implemented during the construction and operational phases of the project.

APPENDIX 6 OF THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATION – CHECKLIST AND REFERENCE FOR THIS REPORT

Table 1 - Requirements from Appendix 6 of Environmental Impact Assessment (EIA) Regulations, 2017 (Government Notice Regulation (GN R) 982 of 2014, as amended in June 2021)

Requirements from Appendix 6 of GN 326 EIA Regulation 2017	Chapter
(a) Details of: (i) The specialist who prepares the reports; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Document Issue (Page ii) Appendix E
(b) Declaration that the specialist is independent in a form as may be specialities by the competent authority	Appendix C and D
(c) Indication of the scope of, and purpose for which, the report was prepared	Section 1.1, 1.4 and 1.5
(cA) Indication of the quality and age of base data used for the specialist report	Section 1.3
(cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 8
(d) Duration, Date and seasons of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.3
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process including equipment and modelling used	Section 2
(f) Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associate's structures and infrastructure, inclusive of a site plan identifying alternative	Section 3, 5, 6 and 7
(g) Identification of any areas to be avoided, including buffers	Section 6.4 and 10.1
(h) Map superimposing the activity and associated structures and infrastructure on environmental sensitivities of the site including areas to be avoided, including buffers	Section 1, 3, 5, 6, 7 and 9
(i) Description of any assumptions made and uncertainties or gaps in knowledge	Section 6.5 and 7.4
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity including identified alternatives on the environment or activities	Section 8.3 and 10
(k) Mitigation measures for inclusion in the EMPr	Section 10.2
(l) Conditions for inclusion in the environmental authorisation	Refer to recommendations in Section 10.2
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 9 and 10.2.2
(n) Reasoned opinion – (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities, or portions thereof should be authorised, and avoidance, management, and mitigation measures should be included in the EMPr, and where applicable, the closure plan	Section 10.3
(o) Description of any consultation process that was undertaken during preparing the specialist report	*None required.*
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto	*None required.*
(q) Any other information requested by the competent authority	*None required.*

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Abbreviation	Description
%	Percent
˚C	Degrees Celsius
1D	One dimensional
A	Area
BOP	Balance of Plant
C	Runoff coefficient
CCGTPP	Combined Cycle Gas Turbine Power Plant
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DMEA	Department of Mineral and Environmental Affairs
DMRE	Department of Mineral resources and Energy
DTM	Digital Terrain Model
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
G1	Best Practice Guidelines: Stormwater Management
G3	Best Practice Guidelines: Monitoring
GASIPPP	Gas Independent Power Producers Procurement Programme
GCS	GCS Water and Environment (Pty) Ltd
GE	General Electric
GN	Government Notice
HEC-RAS	Hydrologic Engineering Center's River Analysis System
hr	Hour
HRSG	Heat Recovery Stream Generator
HRY	#N/A
HSG	Hydrological Soil Group
I	Rainfall intensity
IRP	Integrated Resource Plan
km	Kilometre
km/h	Kilometre per hour
km^2	Square kilometres
kV	Kilovolt
KZN	KwaZulu Natal Province
l	Litres
l/s	Litres per second
m	Metres
m^3/a	Cubic metres per annum
MAE	Mean Annual Evaporation
mamsl	Metres above mean sea level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mg/l	Milligrams per litre

MIPI	Midgley and Pitman
mm/a	Millimetres per annum
mm/h	Millimetres per hour
Mm3/a	Million cubic metres per annum
mmol/l	Millimoles per litre
mS/m	Millisiemens/metre
MW	Megawatt
n	Manning's Roughness Coefficients
NEMA	National Environmental Management Agency
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
pH	Potential of Hydrogens
Q	Peak flow
RAS	River Analysis System
RBIDZ	Richards Bay Industrial Development Zone
RM	Rational Method
SANAS	South African National Accreditation System
SANLC	South African National Land Cover
SANRAL	South African National Roads Agency SOC Ltd
SCS	Soil Conservation Services
SDF	Standard Design Flood
SPR	Source-Pathway-Receptor Model/Principle
SW	Surface Water
SWMP	Stormwater Management Plan
TDS	Total Dissolved Solids
TIN	Triangulated Irregular Network
TSS	Total Suspended Solids
TWQR	Target Water Quality Range
uS/cm	Microsemens per centimetre
USDA	United States Department of Agriculture
WARMS	Water Allocation Registration Management System
WGS84	World Geodetic System 1984
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012
WRC	Water Research Commission

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Nemai Consulting (*hereafter referred to as the 'Client'*) to undertake a hydrological assessment as part of the EIA process for the proposed 750 megawatt (MW) Combined Cycle Gas Turbine Power Plant (CCGTPP) (*hereafter referred to as the 'Project' or the 'Plant'*), situated near Richards Bay, KwaZulu-Natal (refer to Figure 1-3). The project is situated in quaternary catchment W12F of the Pongola-Mtamvuna Water Management Area (WMA 3) (DWS, 2023).

This hydrological assessment has been compiled as part of the supporting documents for an Environmental Impact Assessment (EIA) and provides an overview of the hydrological risks associated with the activities on the site.

1.1 Project background

Following the promulgation of the Integrated Resource Plan 2019 (IRP 2019), the Minister of Mineral Resources and Energy determined that the procurement of New Generation Capacity is required to ensure energy security and that approximately 3,000MW would be procured, to be generated from gas. In response, the Department of Mineral Resources and Energy (DMRE) formally invited interested parties in December 2023 to register prospective bids under the first bid window of the Gas Independent Power Producers Procurement Programme (GASIPPPP Bid Window 1).

A total of 2,000MW will be procured in this first round from projects supplying new generation capacity, ancillary services, and energy output from gas-fired power generation technology. This GASIPPPP specifically targets land-based electricity generation facilities utilising natural gas, located anywhere within the borders of the Republic of South Africa.

Mabasa Energy and Fuels (Pty) Ltd (the "Applicant") intends to bid for the GASIPPPP and has proposed the development of a 750MW CCGTPP in Richards Bay, which falls within the City of uMhlathuze Local Municipality in KZN. The earmarked site is located on Erf 16673 in Phase 1F of the Richards Bay Industrial Development Zone (RBIDZ) under a long-term lease agreement (refer to Figure 1-1).

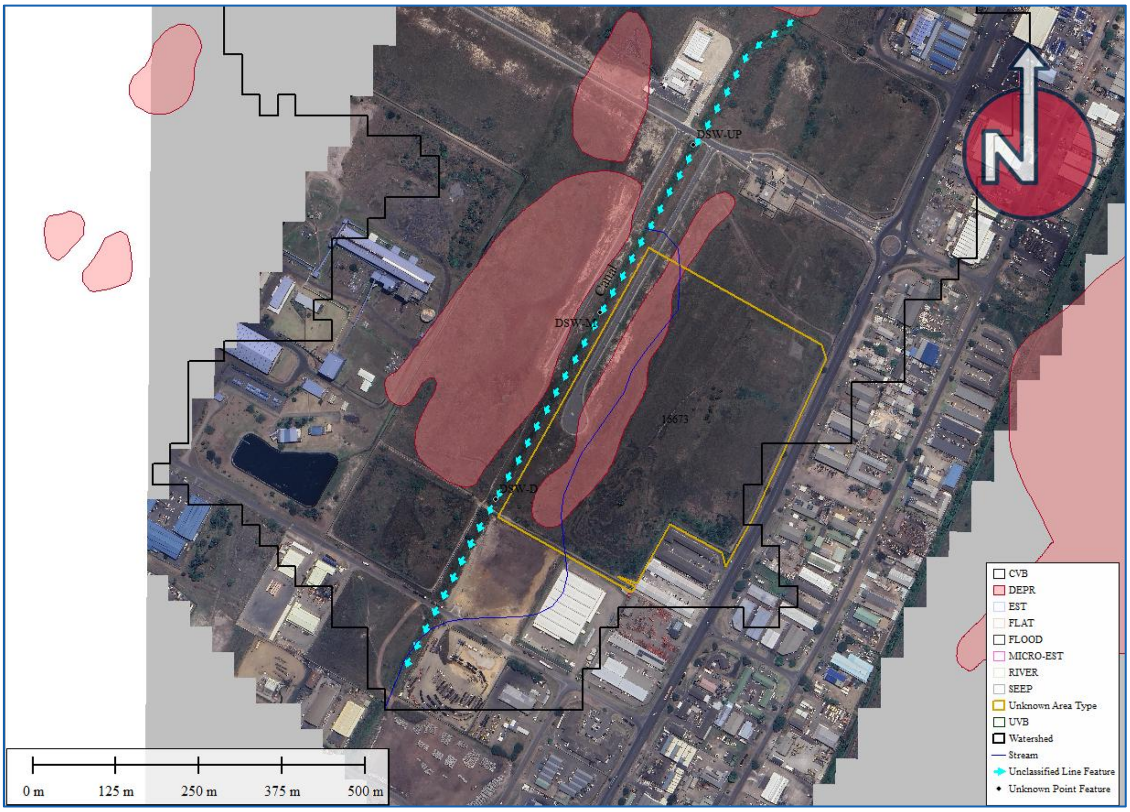


Figure 1-1: Site Layout

1.2 Project overview

The Plant will be designed to provide a reliable, efficient, and low-cost means of generating electricity. Design features of the Plant will be carefully considered to provide the optimum balance between capital cost and operating and maintenance benefits, whilst considering the environmental impacts associated with fuel combustion and using the best available technologies.

The proposed Plant will comprise the following key equipment:

- Two (2) General Electric (GE) Frame 9 (model 9F.03) combustion turbines and generators;
- Two (2) triple-pressure, 3-drum, natural circulation Heat Recovery Steam Generators (HRSGs);
- One (1) condensing steam turbine and generator;
- One (1) de-aerating surface condenser;
- One (1) induced draft cooling tower;
- Balance of plant (BOP) equipment consisting of Pumps, Heat Exchangers, Transformers, Power Electrics, etc.;
- One (1) integrated plant distribution control system; and

- 275 kilovolts (kV) Switchyard comprising three (3) x 15kV to 275kV step-up transformers and one (1) station auxiliary transformer (the rating to be defined during detailed design).

The plant layout is provided in Figure 1-2.

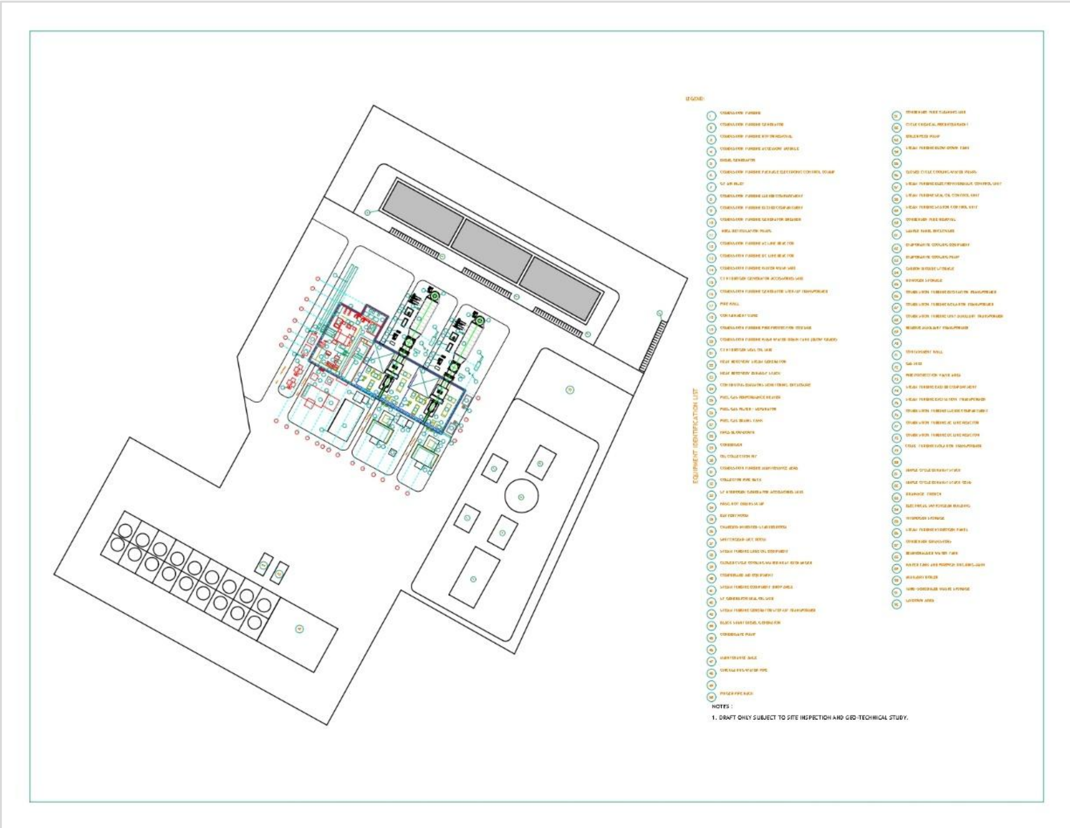


Figure 1-2: Proposed site layout

1.3 Study relevance to the season in which it was undertaken

This study was undertaken as a once-off study and relies on historical hydrological and climate data for the site, as well as recognised hydrological and water resource databases for South Africa. Data generated during this study are not seasonally bound, as average annual data were applied where required and are scientifically acceptable.

1.4 The objective of this report

The objectives of this study were as follows:

- Assess the study area's hydrological functions.
- Undertake a site walkover assessment to confirm drainage lines and rivers.
- Develop a conceptual hydrological model for the sub-catchment associated with the project area, illustrating the sub-catchment hydrological components that may be impacted.

- Investigate 1:10, 1:50 and 1:100-year peak flow return periods to undertake flood line modelling. The aim is to identify possible exclusion zones.
- Investigate 1:2, 1:20, 1:50 and 1:100-year stormwater flood volumes and runoff patterns to develop a conceptual stormwater management plan to manage runoff, and prevent dirty and clean water mixing, erosion, and sedimentation.
- Assess surface water quality and compile a water monitoring plan; and
- Compile a detailed hydrological report with hydrological risks identified.

1.5 Scope of work

The scope of work completed was as follows:

1. **Site walkover assessment:**
    a. A walk-over assessment was undertaken on the 11th of July in 2024, whereby all surface water areas and stream conditions of the site were investigated.
2. **Baseline Hydrology Review:**
    a. Hydro-meteorological data collection and analysis.
    b. Catchment delineation and drainage characteristics.
    c. Determination of catchment hydraulic and geometric parameters.
3. **Hydrological Cycle Conceptual Modelling:**
    a. Conceptual model illustrating sub-catchment hydrological components established in the baseline hydrology review.
4. **Peak Flows & Flood Line Modelling:**
    a. Peak flood volume calculation for the 1:10, 1:50, and 1:100-year recurring events.
    b. Floodline modelling using HEC-RAS hydraulic software – 1:50 and 1:100-year floodlines were presented.
    c. Analysis of the modelling results.
5. **Storm Water Management Plan and Stormwater Monitoring (SWMP):**
    a. Identification of stormwater sub-catchments (i.e., clean and dirty areas).
    b. Determination of stormwater flows and volumes (for 1:2, 1:10, 1:50, and 1:100-year return periods) was undertaken.
    c. Indications and explanations of the placement of stormwater attenuation infrastructure were offered; and
    d. A stormwater monitoring system plan was drafted to ensure that the impact of stormwater discharge on the environment is managed and controlled.

6. **Risk assessment:**
   a. A hydrological risk assessment was undertaken to contextualise the potential hydrological risks associated with this project.
7. **Surface Water Monitoring Plan:**
   a. A surface water monitoring plan was developed.
8. **Reporting:**
   a. This hydrology assessment report, entailing the above-mentioned components, was compiled.

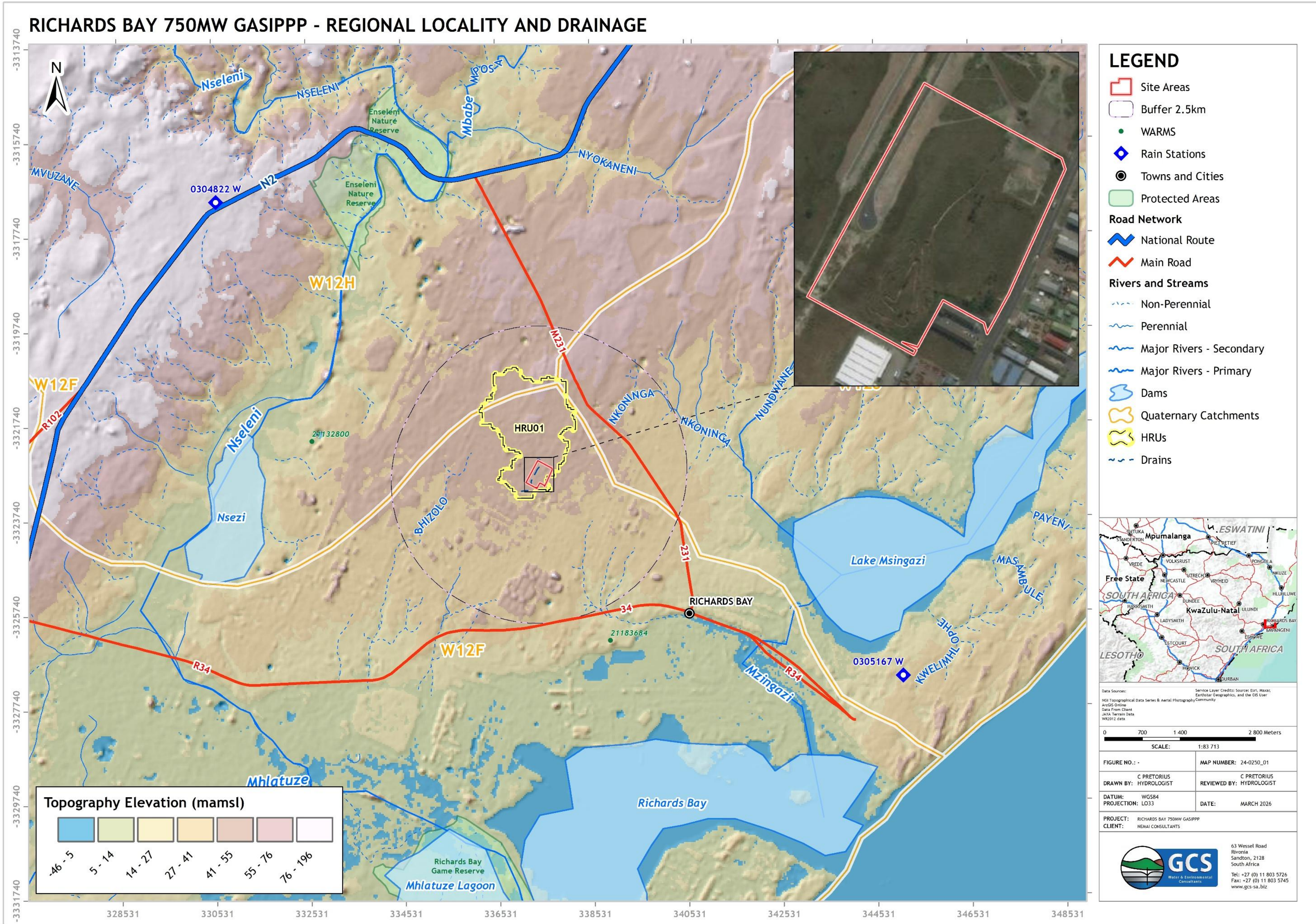


Figure 1-3: Site locality and drainage

2 METHODOLOGY

The methodological approach for the study is described in the sub-sections below.

2.1 Legal considerations

According to Section 144 of the National Water Act of 1998 (Act 36 of 1998), a flood line, representing the highest elevation that would likely be reached during a storm with a return interval of 100 years, must be indicated on all plans for the establishment of townships. The term' establishment of townships' includes the subdivision of stands or farm portions in existing townships or development, if the 100-year flood lines are not already indicated on these plans, or when the land-use category of a particular portion of land is changed.

The National Environmental Management Act (Act 107 of 1998) (NEMA) stipulates that all relevant factors be considered for proposed developments to ensure that water pollution and environmental degradation are avoided. Section 2 of the Act establishes a set of principles that apply to the activities of all state organs that may have a significant environmental impact. These include the following:

- Development must be sustainable.
- Pollution must be avoided, minimised, and remediated.
- Waste must be avoided or minimised, reused, or recycled.
- Negative impacts must be minimised.

The requirements laid down by the National Building Regulations and Building Standards Act (Act 103 of 1977) for development within the 1:50-year flood line area are based solely on safety considerations, without proper consideration of the underlying natural streamflow processes. The Town Planning and Townships Ordinance (Ordinance 15 of 1986) also makes provision in Regulation 44(3) for the extension of flood line areas up to 32 m from the centre of a stream in instances where the 1:50-year flood line is less than 62 m wide in total (CSIR, 2005).

Appendix 6 of the EIA Regulations (GN R 982) further governs hydrological assessments for EIAs. This hydrology report conforms to Appendix 6 of the EIA Regulations (GN R 982), which includes the aspects listed in ***Table 1, located at the front of this report***.

2.2 Hydrological assessment

Hydrometeorological data for the study area were obtained from various sources, including the South African Water Resources Study WR2012 database (Bailey & Pitman, 2015), South African Atlas of Agrohydrology, and Climatology (Schulze, 1997), and the Daily Rainfall Data Extraction Utility (Lynch, 2004). Moreover, sources such as the Köppen Climate Classification (Kottek, et al., 2006), and Meteoblue (Meteoblue, 2026) were used to refine hydrological data.

These sources provided means of determining the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), Mean Annual Evaporation (MAE), and design rainfall data for the study site. Data were applied to runoff peak-flow estimates for stormwater flow used in stormwater system sizing.

2.2.1 Catchment description and delineation

A 5m Digital Terrain Model (DTM) compiled from 5m contour data was used to delineate the area draining to the streams relevant to this study, the sub-catchment flow path, and to derive river geometry characteristics. These characteristics (area, slopes, and hydraulic parameters) are used to parameterise the site hydraulic model for flood-line and stormwater modelling.

South African National Land Cover (SANLC) 2020 data (DFFE, 2021) was used to characterise the sub-catchment vegetation and to derive Manning's surface-roughness (n-value) coefficients.

2.2.2 Design rainfall and peak flow

The Design Rainfall Estimation Software (Smithers & Schulze, 2002) data from the rainfall stations surrounding the study site were used to calculate the 24-hour design rainfall depths for various return periods. Critical storm durations for Rational Methods Alternative 3 were calculated using the Modified Hershfield Equation (Adamson, 1981).

Streams and drainage sections, as well as river segments, were modelled to calculate 1:20-, 1:50-, and 1:100-year storm flow return periods, using three widely used methods. These are the Rational Method (RM), Midgley and Pitman (MIPI), and the Standard Design Flood (SDF) methods. A brief description of each of the peak flow methods can be seen in Table 2-1, below.

Methodologies for using the applied peak flow models are explained broadly in the South African Drainage Manual (SANRAL, 2013). The manual guided calibration of the runoff coefficients for the drainage areas, as well as the understanding of the runoff-generating processes and land cover attributes. The resulting peak flows calculated using the selected methods were evaluated, and conservative values were provided as inputs into the 1D HEC-RAS flood line model.

Table 2-1: Summary of peak flow methods

Rational Method The Rational Method was developed in the mid-19th century and is one of the most widely used methods for calculating peak flows in small catchments (less than 15 km^2). The formula indicates that $\boldsymbol{Q = CIA}$, where $\boldsymbol{I}$ is the rainfall intensity, $\boldsymbol{A}$ is the upstream runoff area, and $\boldsymbol{C}$ is the runoff coefficient. $\boldsymbol{Q}$ is the peak flow. There are 3 alternatives to the Rational Method, which differ in the methodology used to calculate rainfall intensities. The first alternative (RM1) uses the depth-duration frequency relationships approach; the second (RM2) uses the Modified Hershfield Equation; and the third alternative (RM3) uses the Design Rainfall Software for South Africa (SANRAL, 2013).

Midgley and Pitman
The Midgley and Pitman (MIPI) method is an empirical method that relates peak discharge to catchment size, slope, and distance from the drainage point to the centroid of the catchment (Campbell, 1986). The MIPI method uses 10-unit hydrographs for 10 zones in South Africa. The method does not consider overland flow as a component separate from streamflow but considers only the total longest flow path (Campbell, 1986).

Standard Design Flood Method
The SDF method was developed specifically to address the uncertainty in flood prediction under South African conditions (Alexander, 2002). The runoff coefficient (C) is replaced by a calibrated value based on the subdivision of the country into 26 regions or Water Management Areas (WMAs). The design methodology is slightly different and looks at the probability of a peak flood event occurring at any one of a series of similarly sized catchments in a wider region, while other methods focus on point probabilities (SANRAL, 2013).

2.3 Flood line modelling

A 5m DTM was used to derive hydraulic and river-geometry parameters. River/stream cross-sections and flow paths were prepared using RAS Mapper software and provided input into a 1D HEC-RAS (US Army Corps of Engineers, 2016) flood model. Visual assessment of riverbanks from the Google Earth Imagery and land cover types (DEA, 2020) was used to estimate Manning's 'n' coefficients along the river/streamlines. The 1:50 and 1:100-year flood lines were generated and mapped in Global Mapper (Blue Marble Geographics, 2021) and ArcGIS (ESRI, 2018).

2.4 Stormwater management plan

The SWMP was designed in conjunction with the provided proposed infrastructure layout plans and available 5m topographical data. The Rational Method equation was applied to determine stormwater peak flows (sub-catchments < 15 km^2) within each stormwater sub-catchment, and further consider the U.S. Soil Conservation Service (SCS) hydrological soil types and land impervious percentages.

The SWMP was designed to consider relevant South African legislation – the National Water Act (1998) (NWA, 1998) and the Council for Scientific and Industrial Research (CSIR) Human Settlement Planning and Design guidelines (CSIR, 2005).

2.5 Hydrological risk assessment

As per GN 982 of the EIA Regulations (2014), the significance of potential hydrological impacts was assessed. Due to the assessment forming part of a larger risk assessment for the study area, the potential impacts and the determination of impact significance were assessed. The process of assessing the potential impacts of the project includes the following four activities:

1. Identification and assessment of potential impacts.
2. Prediction of the nature, magnitude, extent, and duration of potentially significant impacts.

3. Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
4. Evaluation of the significance of the impact after the mitigation measures have been implemented, i.e., the significance of the residual impact.

Per GN R982 of the EIA Regulations (2014), the significance of potential impacts was assessed in terms of the following criteria:

I. Cumulative impacts.
II. Nature of the impact.
III. The extent of the impact.
IV. Probability of the impact occurring.
V. The degree to which the impact can be reversed.
VI. The degree to which the impact may cause irreplaceable loss of resources; and
VII. The degree to which the impact can be mitigated.

Table 2-2 provides a summary of the criteria used to assess the significance of the potential impacts identified. An explanation of these impact criteria is provided in Table 2-3.

Consequence = (Duration + Extent + Irreplaceability of resource) × Severity

The environmental significance of an impact was determined by multiplying the consequence by probability.

Significance = Consequence × Probability

Table 2-2: Proposed Criteria and Rating Scales to be used in the Assessment of the Potential Impacts

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0 - 6 months.
	Short-term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months - 5 years.
	Long-term (4)	The duration of the activity associated with the impact will last more than 5 years.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50% likely that an impact will occur.
	Probable (1)	It is between 50 and 70% certain that the impact will occur.
	Definite (2)	It is more than 75% certain that the impact will occur or the impact will occur.
Significance	Very high - negative (-49 to -66)	A function of Consequence and Probability.
	High - negative (-37 to -48)	
	Moderate - negative (-25 to -36)	
	Low - negative (-13 to -24)	
	Neutral - Very low (0 to -12)	
	Low-positive (0 to 12)	
	Moderate-positive (13 to 24)	
	High-positive (37 to 48)	
	Very high - positive (49 to 66)	

Table 2-3: Explanation of Assessment Criteria

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact of change on the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), site (limited to the site), and regional (limited to the immediate surroundings and closest towns to the site). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid “double counting,” specialists have been requested to indicate spatial significance under “intensity” or “impact on irreplaceable resources” but not under “extent” as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced should it be impacted. A resource could be replaced by natural processes (e.g., by natural colonisation from surrounding areas), through artificial means (e.g., by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those who are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable, e.g., red data species that are restricted to a particular site or habitat to a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the EIR team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact based on the available information and their level of knowledge and expertise. The degree of confidence is not considered in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

2.6 Water quality screening and surface water monitoring plan

The monitoring network is based on the principles of a monitoring network design as described by the DWAF Best Practice Guidelines: G3 Monitoring (DWAF, 2007). The methodological approach that the monitoring plan follows is represented in Figure 2-1, below.

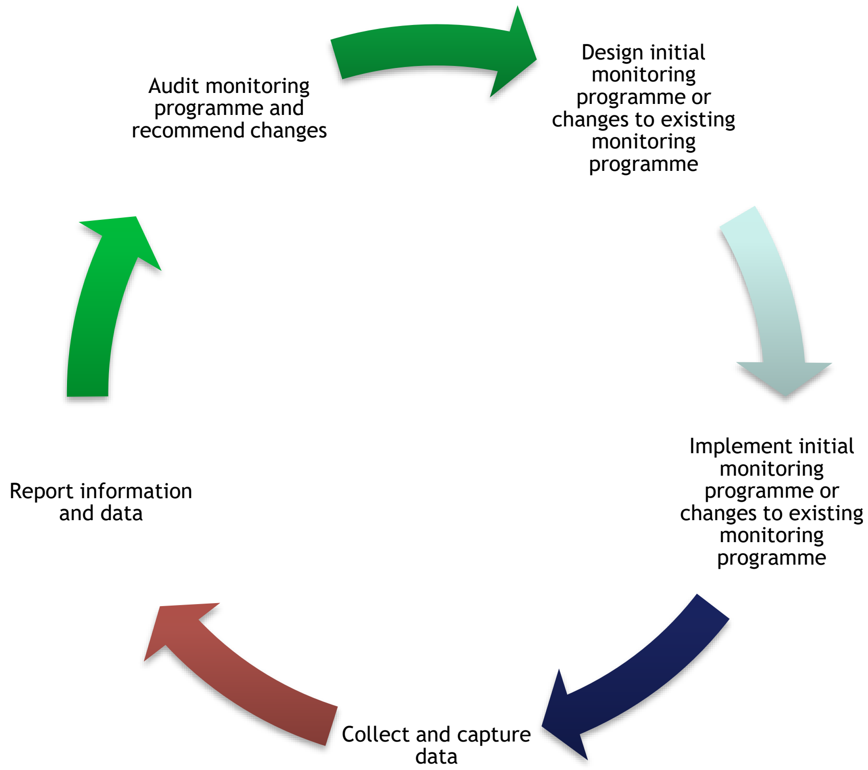


Figure 2-1: Monitoring Process

Baseline water-quality samples were collected during the site walkover. The water quality results were screened per DWAF Guidelines for Domestic Water Use. The results were screened to contextualise the site's water quality.

A surface water monitoring program that specifies water quality constituencies to be analysed, sampling frequency, and the locations of sampling points was drafted. This plan included the construction and operational phase monitoring.

3 SITE OVERVIEW AND HYDROLOGY

As mentioned previously, the project falls within the quaternary catchment W12F of the Pongola-Mtamvuna Water Management Area (WMA 3) (DWS, 2023). Elevations for the site area range from 39 to 42 metres above mean sea level (mamsl) and are therefore relatively flat (refer to Figure 3-1).

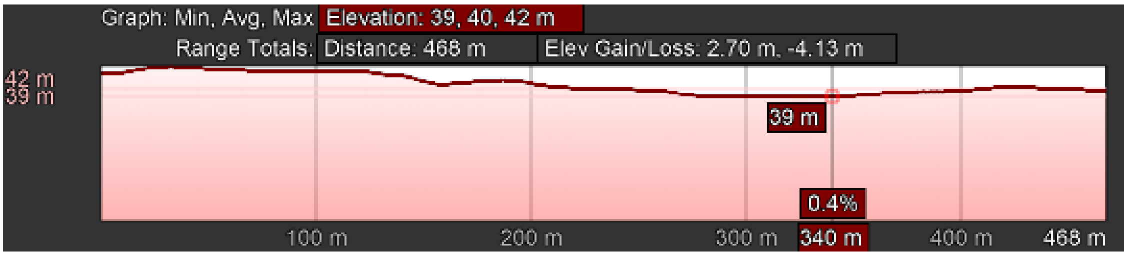


Figure 3-1: Typical cross-section from headwaters to the project area

In terms of the broader hydrological area, the site is surrounded by several perennial and non-perennial streams. The site is situated between the headwaters of non-perennial tributaries of the Mhlatuze and the Mzingazi Rivers.

3.1 Sub-catchments/hydrological response units

One (1) hydrological response unit (HRU) describes the surface water drainage of the greater project area – refer to Figure 1-3 and Figure 3-3. On a more local scale (site specific), drainage is towards the south-west. The proposed site is located within the RBIDZ and is surrounded by built-up areas to the southwest and open veld to the northwest.

3.2 Land cover and slope

Grassland types and urban areas dominate the sub-catchments. Refer to Figure 3-2 for a more detailed overview of the land cover present. The land cover data were used to classify land types into 4 groups, as presented in Figure 3-3. The slope rise (%) for HRU01 was determined using a 5m DTM. The slope rise (%) was used to estimate the channel rise in flood-line modelling. In the modelling process of the flood lines, Manning's coefficient (n-values) values were derived from the vegetation and land cover observed at the site.

Table 3-1: Summary of sub-catchment characteristics

Sub-Catchment		HRU01
Area (km²)		2.644
Longest Drainage Line (km)		0.75
Average Slope (%)		0.31%
Slope (%)	< 3	56.27%
	3 - 10	40.26%
	10 - 30	3.46%
	> 30	0.00%
Land Cover	Thick bush & plantation	14.68%
	Light bush & farmlands	0.00%
	Grasslands	60.72%
	No Vegetation	24.60%

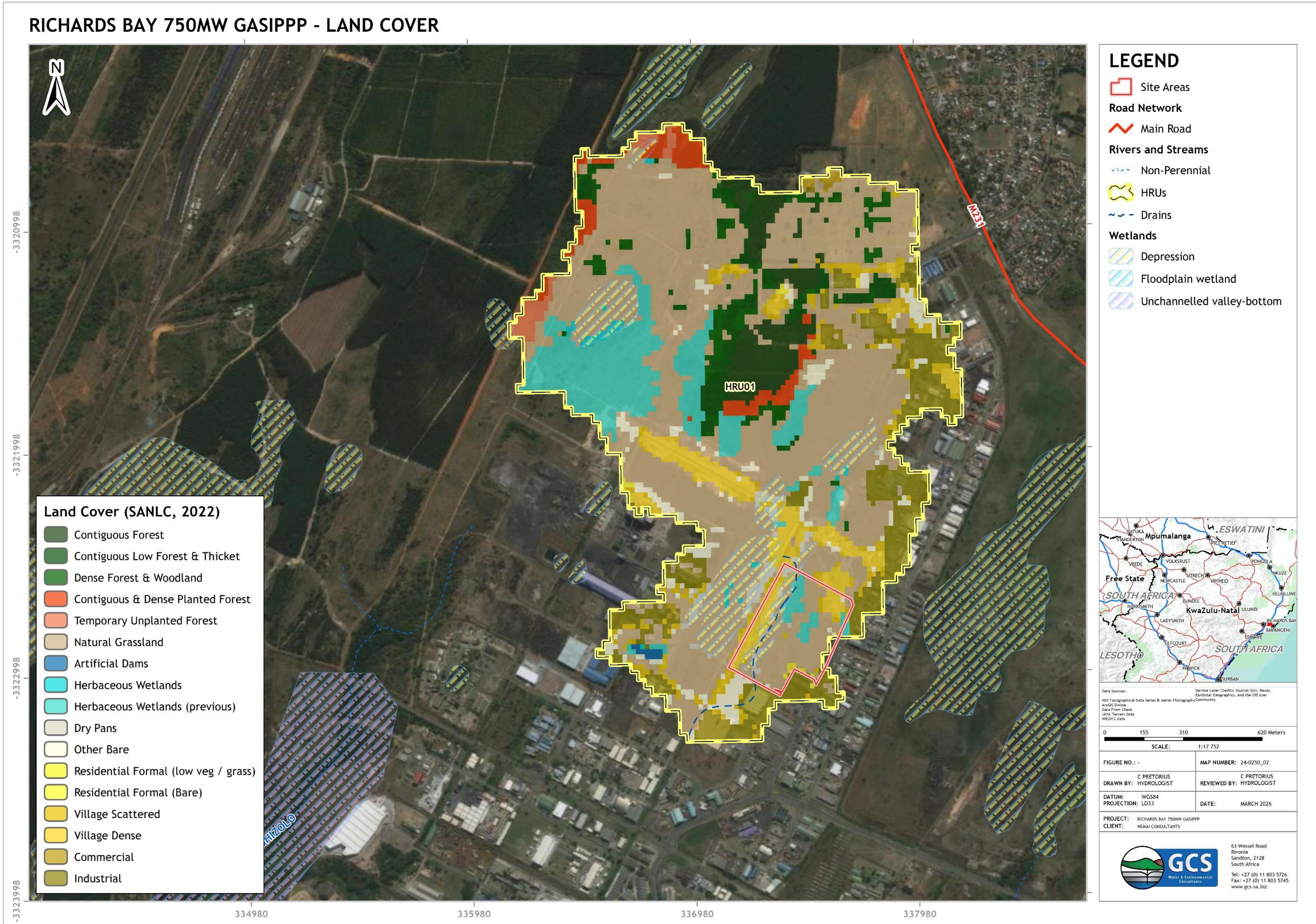


Figure 3-2: Sub-catchment & land cover types

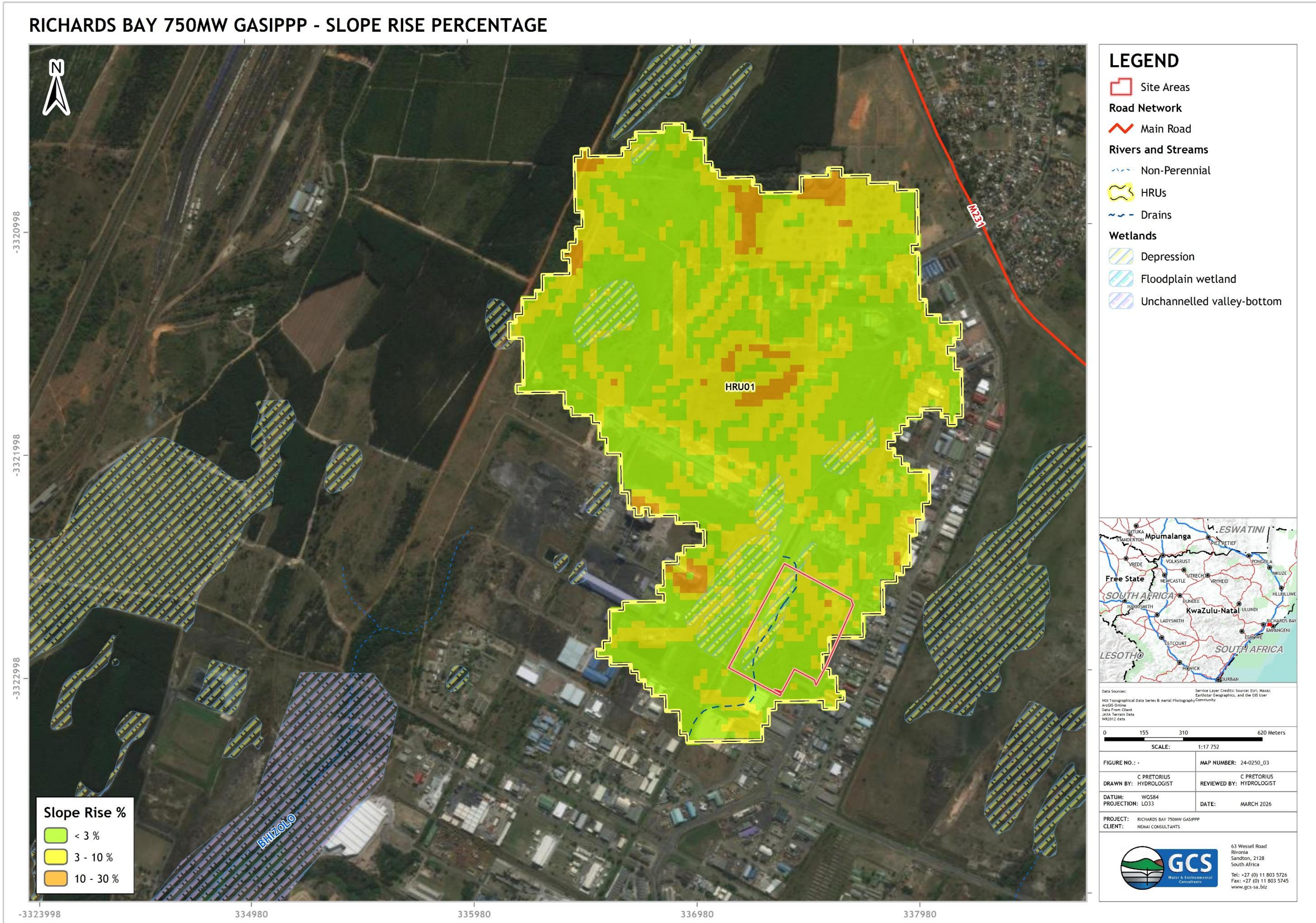


Figure 3-3: Sub-catchments & slope rise %

3.3 Climate

Climate, amongst other factors, influences soil-water processes and stormwater peak flows. The most influential climatic parameter is rainfall. Rainfall intensity, duration, evaporative demand, and runoff were considered in this study to indicate rainfall partitioning within the project area.

3.3.1 Temperature

The average yearly temperature (refer to Figure 3-4) for the project area ranges from 23 to 34°C (high) and 12 to 23°C (low). The study area is situated in a tropical wet savanna climate (Aw) area, as per the Köppen Climate Classification (Kottek, et al., 2006).

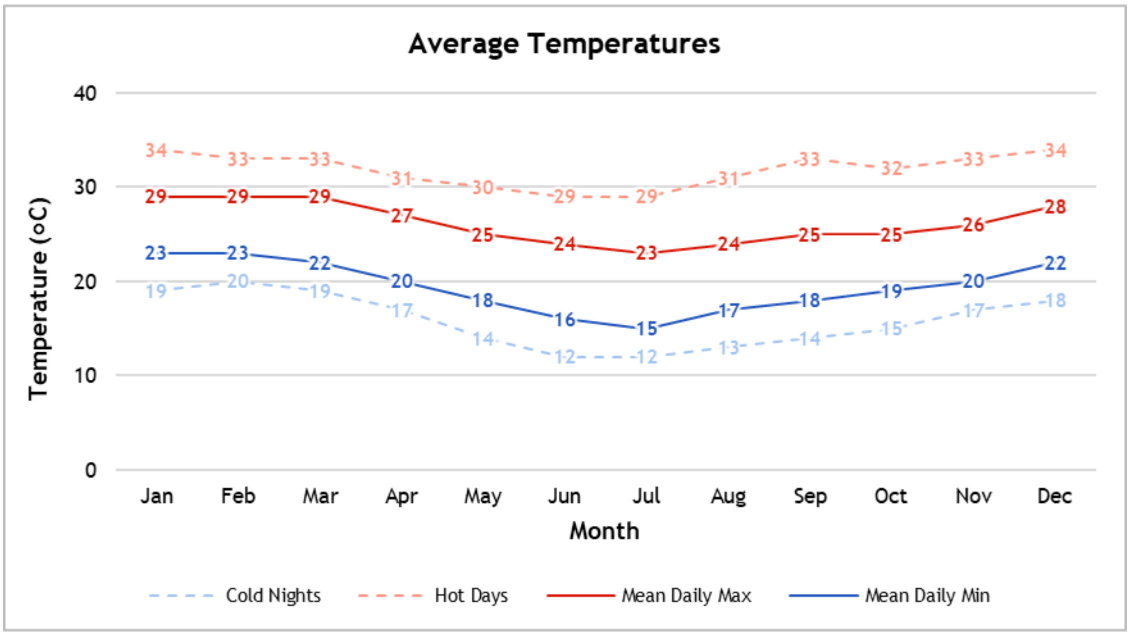


Figure 3-4: Average yearly temperatures (Meteoblue, 2026)

3.3.2 Wind speed and direction

Figure 3-5 shows the wind rose for the project area (Richards Bay used as a reference) and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows more from the NNE and SSW directions, and less often from other directions at velocities from < 12 to > 40 km/h.

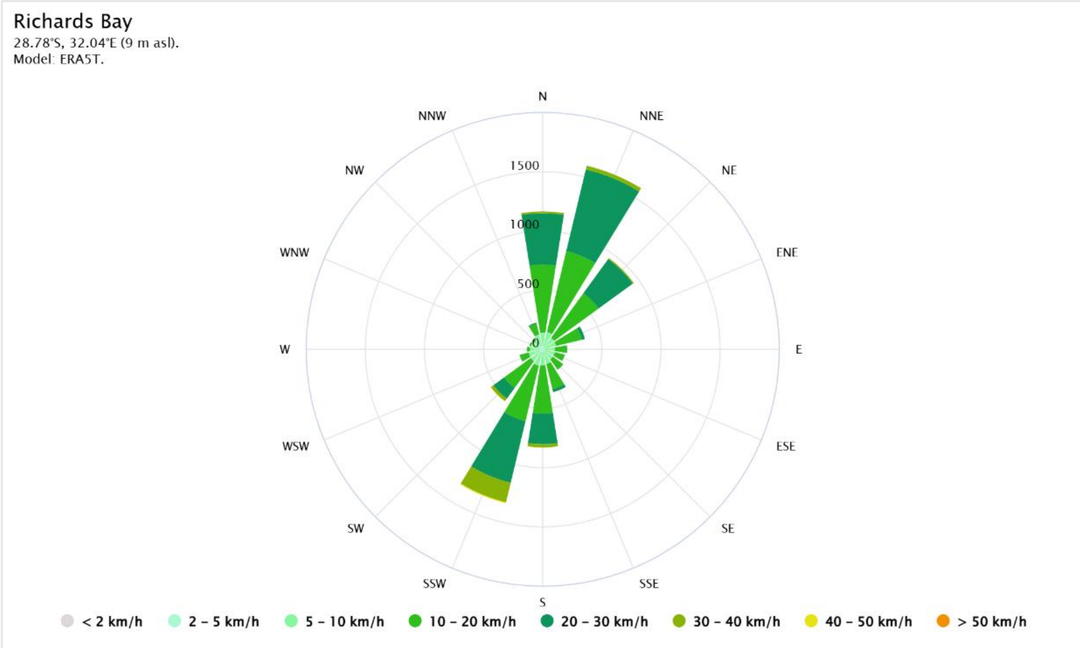


Figure 3-5: Wind rose (Meteoblue, 2026)

3.3.3 Rainfall and evaporation

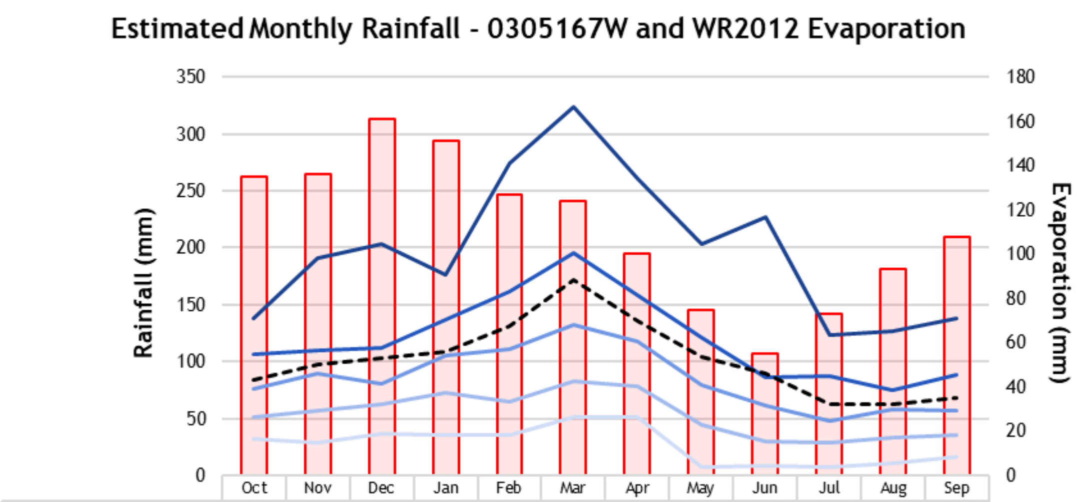
The project area is situated in rainfall zone W1D. The average Mean Annual Precipitation (MAP) for several rainfall stations situated near the site is tabulated in Table 3-2. Rainfall stations have recorded annual rainfall in the same order of magnitude. Richards Bay MUN was chosen to represent the site, as it is the closest.

Table 3-2: Summary of MAP of closest rainfall stations (Smithers & Schulze, 2002)

Name	Station ID	Distance (km)	Record (years)	MAP (mm/a)
RICHARDS BAY (MUN)	***0305167_W***	***0***	***49***	***1,255***
ENSELENI	0305043_W	9	48	1,124
KULU HALT	0304823_S	14.5	69	1,080
KULU HALT	0304822_W	15.5	72	1,109
KWAMBONAMBI(K11)	0305128_S	16.2	71	1,076
MPOSA	0305007_S	19.4	42	1,011
Average				1,109

The monthly rainfall data for the area was obtained from rainfall station 0305167_W (Richards Bay MUN). The rainfall record spans from 1923 to 1973, which is a record length of 49 years. Monthly rainfall for the site is likely to be distributed, as shown in Figure 3-6 below. Available rainfall data suggest a MAP ranging from 640 mm/a (30th percentile) to 2,387 mm/a (90th percentile). The average rainfall is in the order of 1,218.8 mm/a.

The project area falls within evaporation zone 22A, of which Mean Annual Evaporation (MAE) ranges from 1,300 to 1,400 mm/a. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed, as shown in Figure 3-6 below.

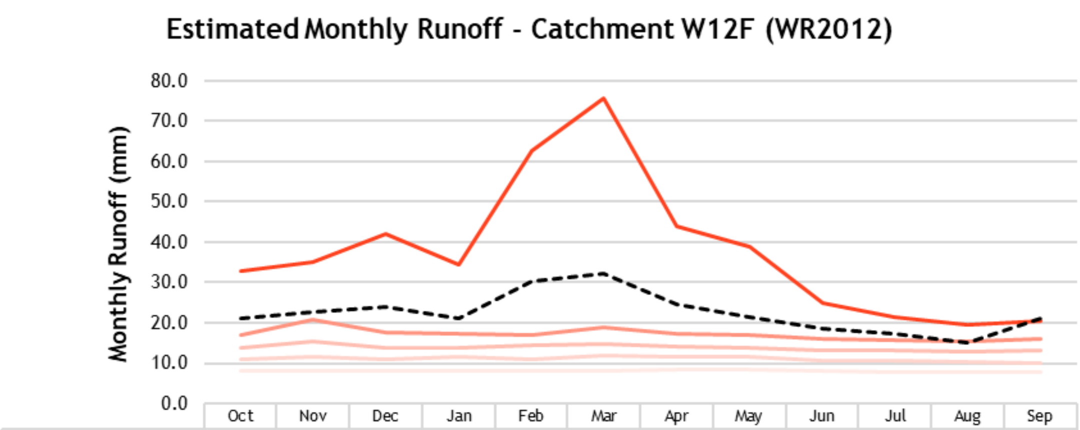


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation (mm)	135	136	161	151	127	124	100	75	55	73	93	108
10th Percentile	32.6	29.1	36.5	35.1	35.4	51.2	51.0	7.3	8.6	7.1	10.4	16.0
30th Percentile	51.6	57.0	62.3	72.2	64.4	83.1	78.3	44.7	29.6	28.2	33.7	34.9
50th Percentile	75.8	89.3	80.8	105.1	111.1	132.9	118.1	79.5	61.5	48.2	57.6	57.0
70th Percentile	106.2	109.7	111.6	136.5	161.4	196.0	158.2	120.8	85.6	87.3	74.4	88.8
90th Percentile	137.6	190.7	203.1	176.6	274.1	324.3	261.2	203.6	227.0	123.7	127.0	137.5
Average	84.2	97.0	103.1	109.0	131.3	171.5	135.6	104.3	89.8	62.9	62.0	68.1

Figure 3-6: Average rainfall for station 0305167_W & WR2012 Evaporation

3.3.4 Runoff

Runoff from natural (unmodified) catchments for quaternary catchment W12F is simulated in WR2012 (WRC, 2015) as being equivalent to 268.8 mm/a (or 22% of the MAP).



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	8.1	8.0	8.2	8.1	8.2	8.2	8.5	8.3	8.2	7.9	7.8	7.8
30th Percentile	10.9	11.7	10.9	11.5	11.1	12.0	11.6	11.5	10.6	10.6	10.2	10.1
50th Percentile	14.0	15.4	13.8	13.7	14.3	14.7	14.2	13.8	13.2	13.1	12.9	13.1
70th Percentile	16.9	20.8	17.7	17.2	17.0	18.9	17.3	16.8	16.1	15.7	15.3	16.0
90th Percentile	32.9	35.1	42.2	34.3	62.6	75.6	43.9	38.9	25.0	21.4	19.6	20.5
Average	21.0	22.7	24.0	21.1	30.2	32.1	24.5	21.3	18.4	17.4	15.1	21.1

Figure 3-7: Simulated natural (unmodified) average runoff for W12F

3.4 Local geology and soils

According to the 2732 St Lucia – 1:250 000 Geological map series (Department of Mineral and Environmental Affairs (DMEA, 1998), the local geology is characterised by yellowish redistributed sand from the Quaternary System.

Soils in the area are generally sandy to sandy clay loams from the soil series Fernwood, Clovelly, and Dundee. Generalised soil patterns indicate that the soils of the project area are sandy with little or no profile development. According to Water Resources 2012 (WR2012) soil data for the area, the erodibility of the soils in the sub-catchment can be considered to be high (WRC, 2015). The hydrological soil group (HSG) classification for the sub-catchments is from group A/B (refer to Table 3-3), and soils in these groups tend to have low to moderately low runoff potential when thoroughly wet. These soils tend to have a clay content of 10% to 20% and a sand content of less than 50% up to 90% (USDA, 2009).

Table 3-3: Characteristics of the four basic SCS hydrological soil groups

Hydrological Soil Group	Characteristics
Soil Group A	*Low stormflow potential*. Infiltration is high and permeability is rapid in this group. Overall drainage is excessive to well-drained (Final infiltration rate ~ 25 mm/h. Permeability rate > 7.6 mm/h).
Soil Group B	*Moderately low stormflow potential*. The soils of this group are characterised by moderate infiltration rates, effective depth and drainage. Permeability is slightly restricted (Final infiltration rate ~ 13 mm/h. Permeability rate 3.8 to 7.6 mm/h).
Soil Group C	*Moderately high stormflow potential*. The rate of infiltration is slow or deteriorates rapidly in this group. Permeability is restricted. Soil depth tends to be shallow (Final infiltration rate ~ 6 mm/h. Permeability rate 1.3 to 3.8 mm/h).
Soil Group D	*High stormflow potential*. Soils in this group are characterised by very low infiltration rates and severely restricted permeability. Very shallow soils and those of high shrink-swell potential are included in this group (Final infiltration rate ~ 3 mm/h. Permeability rate < 1.3 mm/h).
Notes: The typical final infiltration and permeability rates given above both refer to saturated soil; Final infiltration rates refer to soils with a short grass cover; Infiltration rate is controlled by surface conditions whereas permeability rates are controlled by properties of the soil profile.	

3.5 Local hydrogeology & depth to groundwater

The site is situated in an area predominantly underlain by undifferentiated coastal deposits (unconsolidated to semi-consolidated sediment, including sand, calcrete, calcarenite, aeolianite, conglomerate and clay) (King, et al., 1998). The aquifer can be described as primarily intergranular. Yields of approximately 0.5 to 2.0 l/s (King, et al., 1998) may occur.

Recharge to the underlying aquifer is estimated to be in the order of 11% of the MAP (1,218 mm/a), which falls within quaternary catchments W12F (DWAF, 2006c). The aquifer's weathered zones are reported to be approx. 32m thick, with the fractured zone being approximately 100 m thick (DWAF, 2006c). The combined aquifer thickness is estimated at 132 m.

According to (Vegter, 1995) and (DWAF, 2006c), the groundwater levels within the sub-catchments are expected to be 5 mbgl (meters below ground level). The groundwater table is expected to mimic the topography and be shallower closer to perennial streams (i.e., these are prominent groundwater contributions to baseflow areas or areas where groundwater seepage from the resource into the aquifer units may take place).

Figure 3-8 plots available groundwater elevation data for the area, compiled from data exported from the National Groundwater Archive (NGA). The data shows a correlative relationship (R = 88.93%) between groundwater elevation and topography, indicating that the groundwater table mimics topography.

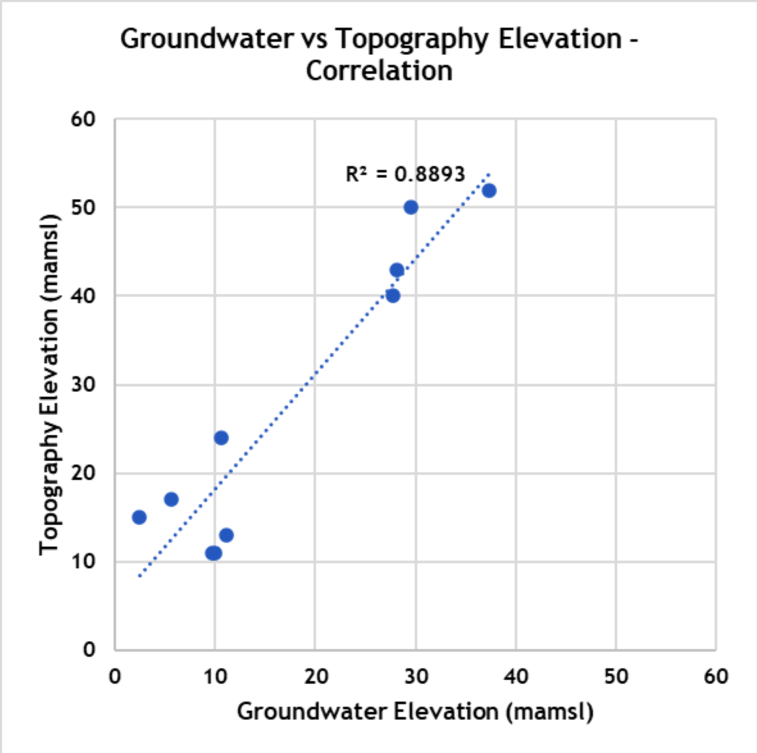


Figure 3-8: Correlation between Topography and Groundwater Elevation

3.6 Wetland areas

Based on the available National Wetland Freshwater Ecosystem Priority Areas (NFEPA) (van Deventer, et al., 2020), a variety of natural depression wetlands exist in the surrounding area. There is a wetland on site and to the west of the site in the form of a canal.

In terms of watercourse (stream/river) geo-hydrology, baseflow is considered the most important contributor to stream and wetland health. Baseflow (refer to Figure 3-9) is a non-process-related term to signify low amplitude high-frequency flow in a river during dry or fair-weather periods. Baseflow is not a measure of the volume of groundwater discharged into a river or wetland, but it is recognised that groundwater contributes to the baseflow component of a river or wetland flow. Baseflow can further be subdivided into soil interflow and may take place above the regional groundwater table.

Available data does suggest that the streams and rivers in the project area are non-perennial, baseflow estimates are still considered even if these systems are potentially losing streams. Available literature (WRC, 2015; DWAF, 2006c) suggests groundwater contribution to baseflow ranges from 51.12mm/a (PITMAN MODEL) to 131.37mm/a (HUGHES MODEL) for the quaternary catchment W12F. This relates to approximately 4% to 11% of rainfall.

Figure 3-9: Groundwater baseflow concept (DWS, 2011)

3.7 Present ecological state and ecological importance and sensitivity

Table 3-4 provides a summary of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) for the quaternary catchment associated with the project area (WRC, 2015).

Table 3-4: Summary of PES and EIS for the Quaternary Catchment

Quat	PES	EIS
W12F	Class C: Moderately Modified	Moderate

3.8 Surface water users within the sub-catchment associated with the site

According to the Water Allocation Registration Management System (WARMS, 2024), there are two (2) WARMS water uses within a 2.5 km radius and within the sub-catchment, of which all are surface water users. The information is summarised in Table 3-5.

Table 3-5: Summary of WARMS users identified in the study area

ID	Latitude (WGS84)	Longitude (WGS84)	User	Resource Type	Resource	Register Status	Lawfulness Finding	Registered Volume (m^3/a)
21132800	-28.74010	31.98790	RJ Barnes	River/ Stream	Nsezi River	Active	Lawfulness still to be determined	80 000
21183684	-28.77381	32.04433	Mondi	River/ Stream	Mhlatuze River	Active	Lawfulness still to be determined	500

3.9 Overview of the site hydrological cycle

Based on the information attained for the study area (as presented in this section), existing groundwater and surface water users, climate, runoff and estimated baseflow to wetland areas, a sub-catchment-specific hydrological cycle was developed (refer to Figure 3-10).

With regards to the hydrological cycle for the sub-catchment, the following is estimated:

- Average rainfall over the surface of the sub-catchments is in the order of 3.22 Mm^3/a (50% of the total water budget);
- Average runoff accounts for a volume in the order of 0.71 Mm^3/a (11% of the total water budget);
- Average evaporation is in the order of 1.95 Mm^3/a (30.3% of the total water budget);
- The average groundwater contribution to baseflow to rivers/wetlands/streams is in the order of 0.14 Mm^3/a (2.1% of the total water budget);
- The average groundwater recharge is in the order of 0.34 Mm^3/a (5.4% of the total water budget); and
- Surface water users account for 0.08 Mm^3/a (1.25% of the total water budget).

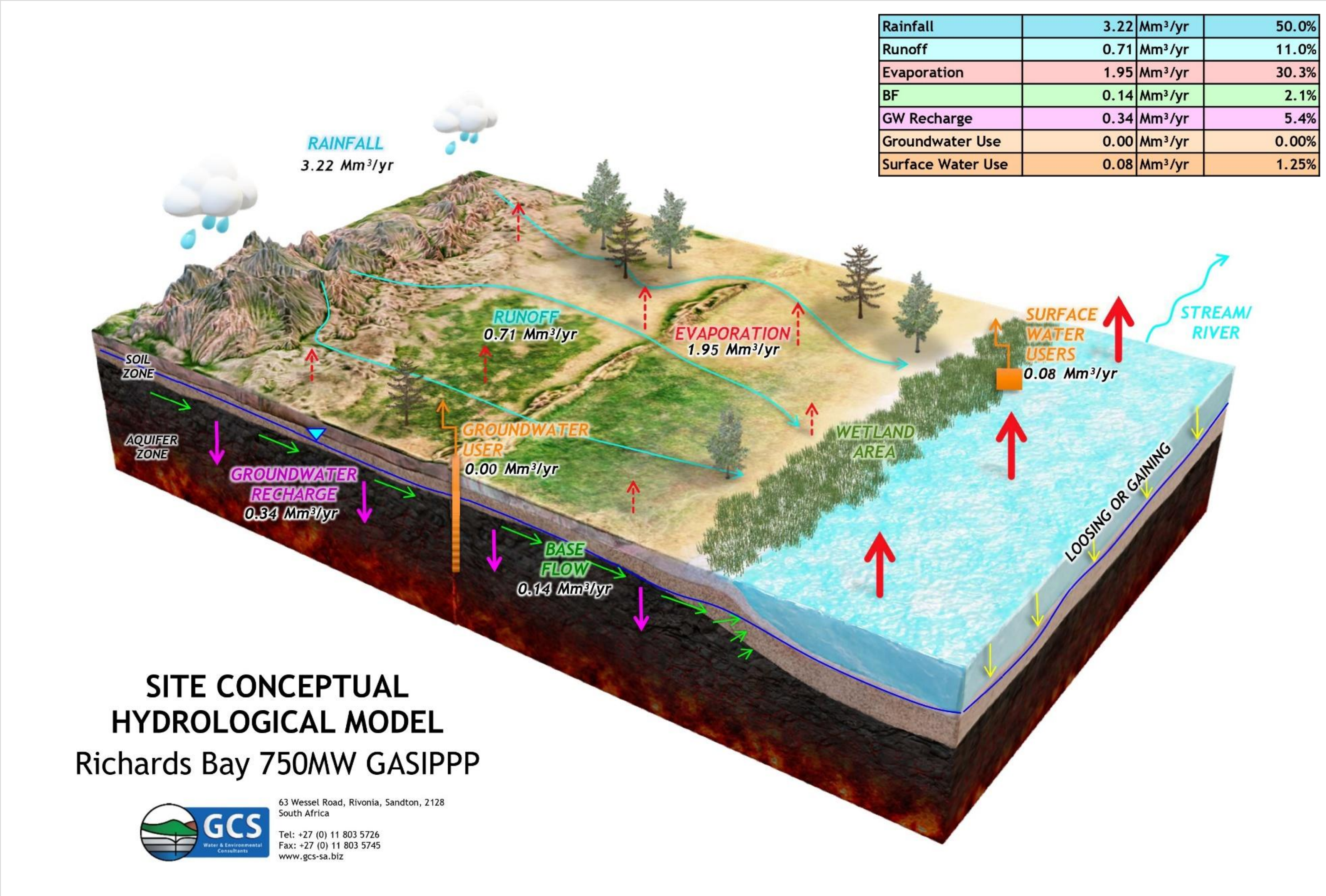


Figure 3-10: Simplified overview of the hydrological cycle at the site

4 SITE INVESTIGATION SUMMARY

GCS undertook a site survey on the 11th of July 2024. The following was observed:

- There appears to be a wetland area on site, based on observations of the vegetation and is confirmed by the NFEPA Wetland spational database.
- The area is characterised by grass and veld shrubs.
- Surface drainage is towards the south-west, with a very small slope rise noted. The area is generally flat.
- There is a water canal that flows along the western end of the site. This is a man-made structure but now has developed wetland-type reeds. During the visit, the water was flowing low. Stream bank height ranges from 1.5 to 2.5 m.
- Two culverts exist in the canal, one upstream and one downstream with regards to the site position.
- 3 Samples (1L) were collected (up-, mid- and downstream) and the results are discussed in the next chapter. Sample names are listed below, and field measurements are available in Table 4-1.
    - DSW-Up
    - DSW-M
    - DSW-D
- No other observations were made.

Table 4-1: Sample sites and field measurements & photographs

Sample ID	Lat	Long	pH	EC (uS/cm)	TDS (mg/l)	Temp	Comment
DSW-UP	-28.742244	32.031466	7.4	580	280	18.7	Located north west, upstream of the site.
							

<table>
<tr><th>Sample ID</th><th>Lat</th><th>Long</th><th>pH</th><th>EC (uS/cm)</th><th>TDS (mg/l)</th><th>Temp</th><th>Comment</th></tr>
<tr><td rowspan="2">DSW-M</td><td>-28.744557</td><td>32.030113</td><td>6.9</td><td>230</td><td>100</td><td>18.3</td><td>Located west, mid-stream of the site.</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td rowspan="2">DSW-D</td><td>-28.747072</td><td>32.028492</td><td>6.9</td><td>230</td><td>100</td><td>15.9</td><td>Located on the south west corner of the site, Down stream of the site.</td></tr>
<tr><td colspan="7"></td></tr>
</table>

5 WATER QUALITY ASSESSMENT

The following sections supply an overview of the surface water (SW) chemistry for the canal associated with the project. The chemistry results are compared against the Drinking Water DWAF (1996) Target Water Quality Ranges (TWQR), as well as the applicable TWQRs for the lower Mhlathuze River (Resource Unit W1; quaternary catchment W12F). These guidelines are used as a means of comparison to give context to the data.

Three water quality samples were obtained, an upstream, midstream and downstream sample for the canal. The sample position is indicated in Figure 5-1.

The sample points serve as the baseline water quality conditions for the receiving surface water stream and should therefore be considered representative of the water quality. The samples were submitted to Talbot Laboratories (SANAS Accredited) for analytical screening, and the laboratory certificates are available in Appendix B.

The hydrochemistry results are summarised in Table 5-1, and all samples indicated acceptable water quality when compared to Drinking Water Standards. When assessed against the TWQRs for the lower Mhlathuze River, the measured pH of approximately 7 is slightly below the typical range of 7.5–8.5, although it remains within acceptable limits for freshwater systems.

Table 5-1: Summary of surface water hydrochemistry

Constituent	Unit	DSW-UP	DSWD	DSW-M	Lower Mhlathuze TWQR/RQO	DWAF 1996 Domestic Use - TWQR
Chemical						
pH in water at 25°C	pH units	7	7	7	7.5 - 8.5	6 - 9
Conductivity in mS/m @ 25°C	mS/m	25	24	25	< 85	0 - 70
Total Dissolved Solids at 180°C	mg/ℓ	130	164	146	ns	0 - 450
Total Alkalinity as CaCO3	mg/ℓ	36	36	35	ns	ns
Calcium	mg/ℓ	11.9	11.8	11.8	ns	0 - 32
Magnesium	mg/ℓ	5.18	5.11	5.1	ns	0 - 30
Potassium	mg/ℓ	2.68	2.66	2.64	ns	0 - 50
Sodium	mg/ℓ	25	25	25	ns	0 - 100
Chloride	mg/ℓ	44	42	43	ns	0 - 100
Fluoride	mg/ℓ	0.44	0.45	0.46	ns	0 - 1
Nitrate	mg/ℓ	<0.25	0.75	<0.25	ns	0 - 6
Sulphate	mg/ℓ	8.12	8.02	8.18	ns	0 - 200
Aluminium	mg/ℓ	0.0107	0.0087	0.0109	ns	0 - 0.15
Iron	mg/ℓ	0.034	0.034	0.033	ns	<0.1
Manganese	mg/ℓ	0.02	0.016	0.021	ns	0 - 0.05
Sodium Absorpion Ration (SAR)	$(mmol/ℓ)^{0.5}$	1.54	1.54	1.53	ns	>8
ns = No Quality Range in Reference Guideline, Red = Above TWQR						

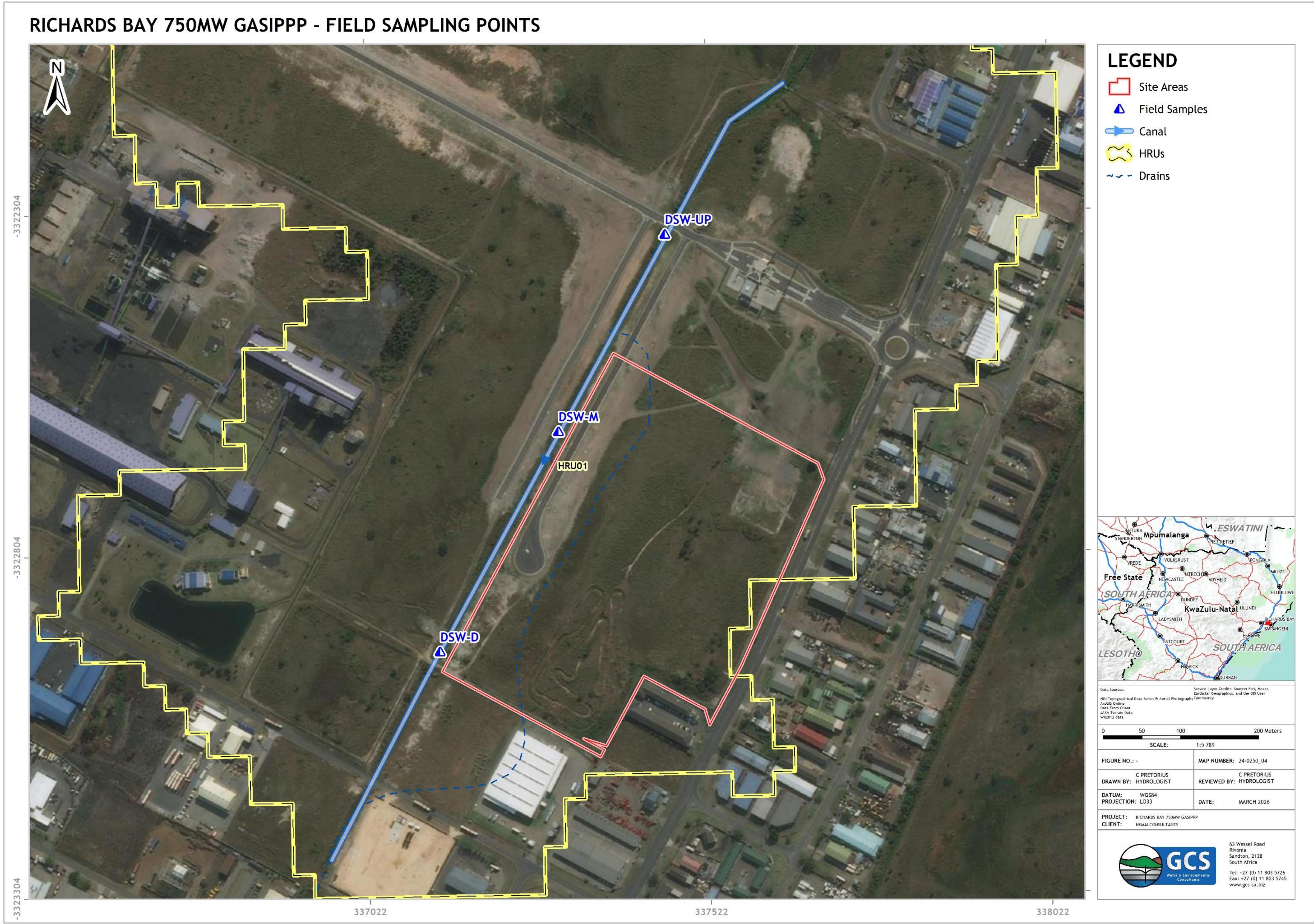


Figure 5-1: **Field sampling locations**

6 SUB-CATCHMENT PEAK FLOW AND FLOOD LINE ASSESSMENT

Flood peak flows for the delineated sub-catchments were calculated using the Rational Method (RM3), Standard Design Flood (SDF) and Midgley & Pitman (MIPI) Method (refer to **Appendix A**). Table 6-1 provides a summary of the design rainfall data used to calculate peak flows, and time concentrations were calculated based on the sub-catchment size and parameters. The upper limit, "U", was used to estimate the worst-case peak flows.

Table 6-1: Summary of design rainfall data used for peak flow estimation

Duration	Return Period (years)						
	2	5	10	20	50	100	200
5 min	16.3	25.4	33.3	42.8	58.6	74.0	93.4
10 min	20.9	32.6	42.7	54.8	75.1	94.9	119.8
15 min	24.2	37.7	49.4	63.4	86.9	109.8	138.5
30 min	31.8	49.6	65.0	83.5	114.3	144.5	182.3
45 min	37.3	58.2	76.3	98.0	134.2	169.7	214.0
1 hr	41.8	65.2	85.6	109.8	150.4	190.1	239.9
1.5 hr	49.1	76.6	100.5	128.9	176.6	223.2	281.7
2 hr	55.0	85.8	112.6	144.5	197.9	250.2	315.6
4 hr	70.2	109.4	143.5	184.2	252.3	318.9	402.4
6 hr	80.9	126.1	165.4	212.3	290.8	367.6	463.8
8 hr	89.4	139.5	183.0	234.8	321.7	406.6	512.9
10 hr	96.7	150.8	197.8	253.9	347.8	439.6	554.6
12 hr	103.1	160.8	210.9	270.7	370.8	468.6	591.2
16 hr	114.0	177.8	233.2	299.4	410.1	518.3	653.9
20 hr	123.3	192.3	252.2	323.7	443.4	560.5	707.1
24 hr	131.4	204.9	268.8	345.1	472.7	597.4	753.7
1 day	114.9	179.3	235.2	301.8	413.5	522.6	659.3
2 days	139.8	218.1	286.1	367.2	503.0	635.7	802.0
3 days	156.8	244.6	320.8	411.8	564.0	712.9	899.4
4 days	165.9	258.8	339.4	435.7	596.8	754.2	951.6
5 days	173.3	270.3	354.6	455.1	623.4	788.0	994.1
6 days	179.6	280.2	367.5	471.7	646.1	816.6	1030.3
7 days	185.1	288.8	378.8	486.2	665.9	841.7	1061.9

6.1 Calculated flood peak flows and post-development peak flows

Calculated peak flows are summarised in Table 6-2. The Rational Method produced higher flood peaks than the SDF and MIPI methods (refer to Figure 6-1). The flood line assessment aims to provide a worst-case inundation scenario to evaluate potential flooding risks. Post-development peak flows will be higher due to changes on the surface of the sub-catchments (e.g., impervious areas could lead to more concentrated runoff, which could increase peak runoff to the nearest watercourse). Table 6-3 summarises the change in peak flow after development. The post-development peak flows will be used to apply to the HEC-RAS model.

Table 6-2: Summary of design peak flows for the delineated sub-catchment (m³/s)

	Method											
	RM (3)			SDF			MIPI			Geometric Mean		
Return Period	1:10 yr	1:50 yr	1:100 yr	1:10 yr	1:20 yr	1:100 yr	1:10 yr	1:50 yr	1:100 yr	1:10 yr	1:50 yr	1:100 yr
Catchment	Peak flow (m³/s)											
HRU01	42	103	156	46	91	113	33	53	67	40	79	106

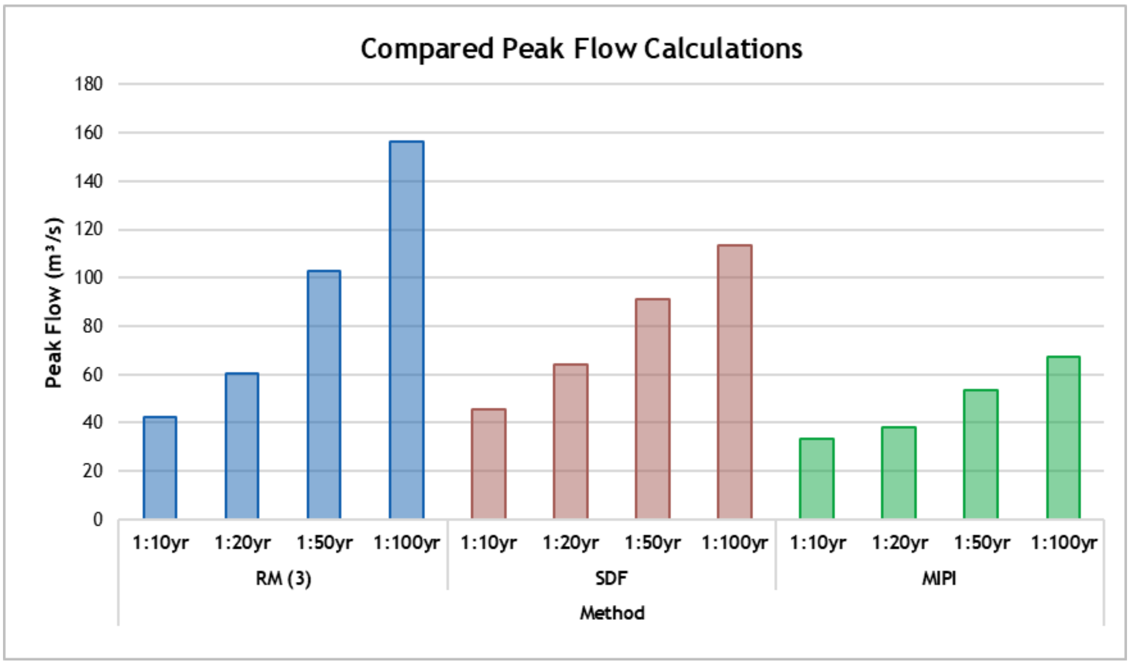


Figure 6-1: Comparison between three design peak flow methods

Table 6-3: Summary of design peak flows for the delineated sub-catchment (m³/s)

Catchment	HRU01
Est. Impermeable/Permeability Area Change (%)	5.3%
1:10Y	
Initial Peak Flow (m³/s)	42.18
Post Development Peak Flow (m³/s)	**44.42**
1:50Y	
Initial Peak Flow (m³/s)	102.53
Post Development Peak Flow (m³/s)	**107.97**
1:100Y	
Initial Peak Flow (m³/s)	156.13
Post Development Peak Flow (m³/s)	**164.42**

6.2 Flood line modelling

6.2.1 Software

HEC-RAS 6.6 was used to flood the elevation profile for the 1:10, 1:50 and 1:100-year flood events. HEC-RAS is a hydraulic programme designed to perform one-dimensional hydraulic calculations for a range of applications, from a single watercourse to a full network of natural or constructed channels. The software is used worldwide and has consequently been thoroughly tested through numerous case studies.

6.2.2 Topography profile data

A triangulated irregular network (TIN) from the 5m contours forms the foundation for the HEC-RAS model and was used to extract elevation data for the river profile and river cross-sections. Furthermore, the TIN was used to determine placement positions for the cross-sections, along with the river profile, so that the watercourse can be modelled at the resolution of the provided topographical data. The positions of the river sections were further refined by evaluating Google Earth Imagery and its correlation with the DTM elevations (i.e., does the actual position of a river/stream correlate with the sub-catchment drainage line generated?).

6.2.3 Manning's roughness coefficients

Manning's roughness factor (n) is used to describe the channel and adjacent floodplains' resistance to flow. Manning's factor ranges from 0.035 to 0.045, best representing the frictional characteristics of the canal (river), and ranges from 0.03 to 0.035 for the floodplain areas.

6.2.4 Inflow and boundary conditions

Based on the HRUs and the confirmed drainage line/canal in the project area, one (1) HEC-RAS river was defined for each HRU (representing the non-perennial stream), consisting of both critical depth (upstream) and normal depth slope boundary conditions. The normal depth slope was determined based on the DTM slope rise for the given sub-catchment drainage line.

6.2.5 Hydraulic structures

Hydraulic structures were not incorporated into the HEC-RAS model. Modelling these hydraulic structures would have been hampered by the lack of good resolution topographical data (better than 5m contour data); as such, including these structures would have been ineffective in the hydraulics of the streams, as well as ineffective areas that were raised (i.e., roads, dam walls, buildings, culverts, etc.).

The terrain was edited in HEC-RAS to capture the canal as best as possible. The canal is modelled as 35m wide, with a depth of 2m.

6.2.6 Model assumptions

In line with the development of the flood lines, the following assumptions were made:

- The topographic data available for the study area is of sufficient accuracy and coverage to enable conceptual hydraulic modelling at a suitable level of detail.
- Steady-state hydraulic modelling was undertaken, which assumes the flow is continuous at the maximum peak rate; and
- A mixed flow regime that is tailored to both subcritical and supercritical flows was selected for running the steady-state model.

6.3 Model results

The flood lines modelled for the site are shown in Figure 6-2. The 1:10, 1:50, and 1:100-year flood lines suggest that the canal will definitely pose a risk of flooding to the plant and associated infrastructure, especially in the wetland areas. It should be noted that the available topography 5m data was modified to characterise the canal. The canal was characterised based on available information.

6.4 Site-specific sensitivity and buffers

A probability of inundation onsite is expected in areas associated with wetlands. *The 1:100-year flood line should be considered an avoidance area (buffer area)*. Care should be taken if the plant or other infrastructure is expanded into the demarcated flooding areas. If development does take place in the exclusion zone, proper flooding protocols and erosion prevention measures should be implemented. These would need to be designed by a certified and registered civil engineer.

6.5 Limitations

Steady-state flood modelling was undertaken, which is a conservative approach as it ignores the effect of storage within the system and therefore produces higher flood levels than would be expected to occur. A steady-state model will result in worst-case (conservative) estimates of flooding, and resultant flood levels and floodplain extents would decrease if unsteady state modelling were undertaken using an inflow hydrograph as opposed to continuous peak flow.

It is noted that some of the flooding zones make flooding “bubbles” or islands. This is due to the moderate-low-resolution DTM, which causes irregular flooding paths. The flood lines produced are based on available data.

Due to the flood risk posed to the project infrastructure, further flood modelling work is considered necessary and would require more detailed topographical data.

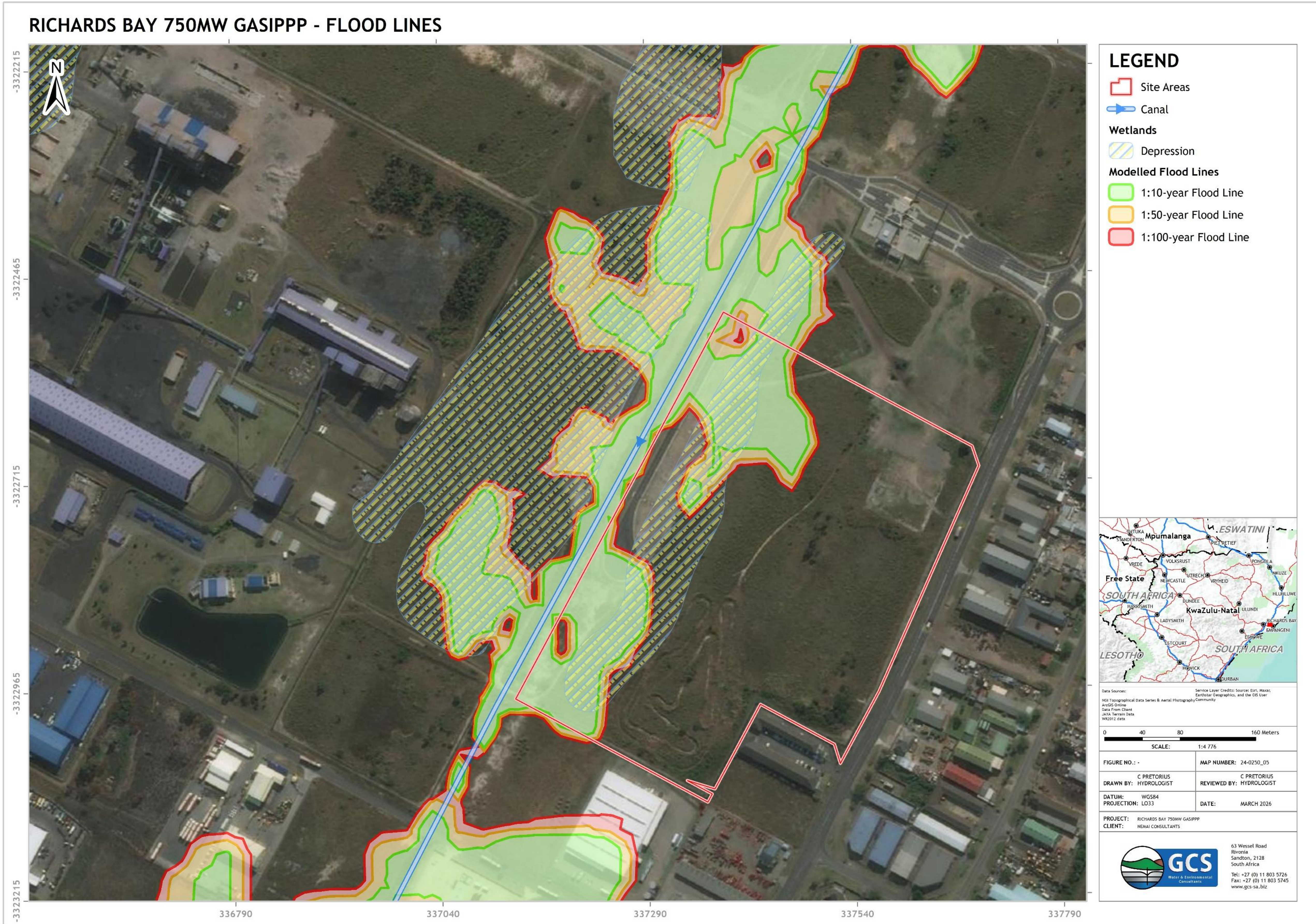


Figure 6-2: Simulated 1:10, 1:50 and 1:100-year flood inundation zones

7 STORMWATER MANAGEMENT PLAN

The following section describes the stormwater management plan (SWMP) developed, which is based on available hydrological data and site layout data. A stormwater plan is necessary due to the nature of the stormwater runoff generated onsite. The stormwater management measures must ensure that dirty water from the site is contained and/or treated, and keep clean run-off water from entering the site.

7.1 Aim of a stormwater management plan

Per *Best Practice Guideline - G1: Stormwater Management (2006),* the SWMP for the site will seek to achieve certain objectives based on a philosophy of protecting the environment from impacts. This is of utmost importance as the sedimentation of drainage streams should be minimised. This can be achieved using the following general guidelines:

- Clean and dirty water should be separated, and it should be ensured that all stormwater structures are designed to keep dirty and clean water separate and can accommodate a defined precipitation event.
- The clean water catchment area should be maximised, and clean water should be routed to a natural watercourse with minimal damage to that watercourse in terms of quantity and frequency of discharge.
- Dirty areas should be minimised, and runoff from these areas should be contained and treated for either reuse or release. Natural watercourses and the environment should be protected from contamination by dirty areas by ensuring that the dirty water cannot enter the clean water system by spillage or seepage.

A CSWMP aims to:

- Illustrate likely stormwater sub-catchments (HRUs) and preferential overland runoff flow paths.
- Determine likely dirty and clean water HRUs.
- Provide water containment and diversion systems to prevent the mixing of clean and dirty water and prevent soil erosion and flooding.
- Attenuate stormwater back to the natural environment; and
- Maintain the downstream water quantity and quality requirements.

Runoff generated across the site is expected to consist primarily of stormwater from impervious surfaces such as roofs, paved areas, and parking areas and would therefore generally be considered clean stormwater rather than dirty water in the conventional industrial or mining sense, although minor contaminants (e.g., hydrocarbons from vehicles or equipment) may be present in localized areas.

7.2 Existing stormwater infrastructure

The site is large undeveloped apart from the existing access tar road and surrounding stormwater infrastructure. The following stormwater infrastructure are currently present around the project area:

- There are roadside channels and intermittent drains on Alumina Allee Street immediately east of the site. This captures and routes stormwater from the road and other areas east of the site.
    - There is a break in the roadside channel close to the proposed 'Yard Waste Storage' area, near the Old Rod Shop on Alumina Allee Street. It is anticipated that some stormwater pooling might occur here.

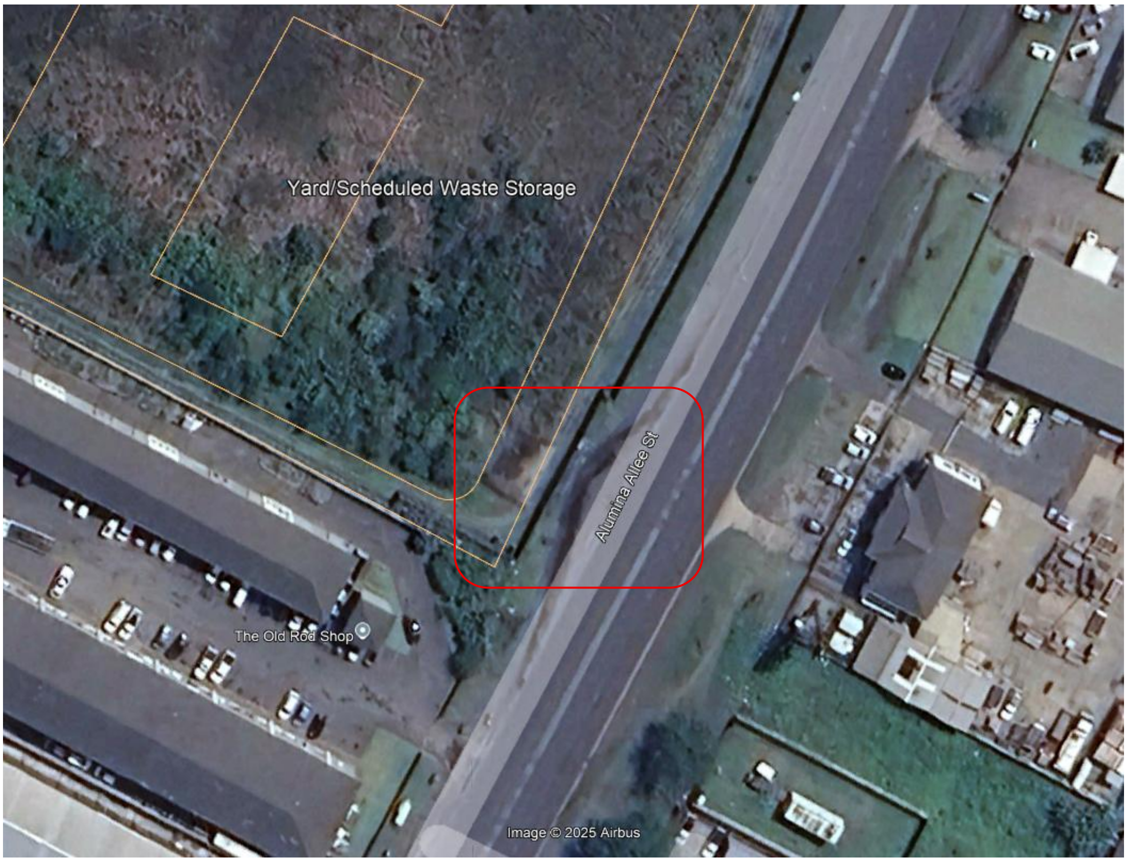


Figure 7-1: Potential stormwater pooling on Alumina Allee Street

- The canal west of the site captures stormwater runoff from the upper reaches of the catchment area and other areas west of the site.
- The roadside channels and the canal effectively eliminate any potential clean water from entering the site from the east or west.

7.3 Stormwater modelling inputs

The following data and resources were used in the preparation of this stormwater management assessment:

- Topographic Data:
    - Given the absence of upstream catchments to the site and the fact that the area is already flat and will likely be levelled further through earthworks and grading, topographic data were not employed in the delineation of catchments.
- Manning's Coefficients:
    - The provided layout indicates that the entire site will undergo transformation from its current land cover and land use. Therefore, the Manning values were selected based on the proposed development, specifically considering impervious surfaces such as tarmac and concrete.
- Rainfall Depths:
    - Design storms for a 24hr period were derived using the Design Rainfall Estimation Software (Smithers & Schulze, 2002).
- Hydrologic and Hydraulic Modelling:
    - The Rational Method was used to calculate runoff volumes for the delineated stormwater sub-catchments.

7.4 Assumptions and limitations

The following assumptions and limitations pertain to the SWMP:

- The proposed layout was used to assume stormwater movement at the site once the site is developed.
- The inputs into the model were based on expected future land use and rainfall data, and the sources were deemed sufficient to represent runoff on the sites.
- No significant changes in upstream or downstream conditions are expected.
- The design storm duration used to model the rainfall-runoff volumes will be fixed at 24 hours. *However, the final stormwater design should be determined by a civil engineering team, who may exercise their professional judgment in selecting the most suitable design storm duration*.
- This stormwater management plan is considered conceptual, and detailed civil engineering designs should be conducted before any construction activities of the proposed measures are commenced.
- This hydrological assessment and conceptual stormwater management plan are intended solely to inform and support civil engineering aspects and subsequent designs.

7.5 Rational method runoff estimation and design rainfall depth

The Rational Method is a widely used hydrological technique for estimating peak runoff rates from small catchments, particularly in urban and semi-urban environments. The method is expressed by the formula:

$$Q = C \times I \times A$$

Where:

Q is the peak runoff (m^3/s),

C is the runoff coefficient (dimensionless), representing the proportion of rainfall that becomes runoff,

I is the rainfall intensity (mm/hr), and

A is the catchment area (km^2).

This method assumes that peak runoff occurs when the entire catchment contributes simultaneously, typically when the rainfall duration equals the time of concentration. While the Rational Method provides a simple and practical tool for estimating design flows, its validity is generally limited to small catchments (typically less than <15 km^2) where stormwater infrastructure is designed for short-duration, high-intensity events. It is less accurate in large or highly complex catchments where flow routing, storage, and spatial rainfall variability become significant.

To derive the rainfall intensity (I), 24-hour rainfall depths from design storm events (e.g., 1:10, 1:50 and 1:100-year recurrence intervals) are often used in conjunction with intensity-duration-frequency curves. These 24-hour depths offer a consistent and conservative basis for estimating potential peak runoff, especially in ungauged or poorly monitored areas, and align with regulatory and engineering design standards.

7.6 Stormwater characterisation

The site is generally flat, with little change in elevation. Based on topographic and aerial imagery, the site is assumed to slope south-to-southwest.

7.6.1.1 Stormwater catchment delineation

Stormwater catchments for the site are indicated in Figure 7-2. Two (2) catchments characterise the runoff generated in the project area. It is assumed that the flow direction will be south-to-southwest, based on the information examined. The site could be graded to encourage this flow direction.

7.6.1.2 Impacts of Infrastructure on Mean Annual Runoff

The proposed activities are unlikely to significantly affect the MAR at the quaternary catchment level, as the project area accounts for only about 0.04% of the total catchment. Due to its limited spatial size relative to the entire catchment, any localised changes in runoff are unlikely to substantially impact the long-term average runoff volumes at the larger catchment scale.

7.6.1.3 Stormwater flows and volumes

Peak flows for each catchment were calculated using the Rational Method and are summarised in Table 7-1.

Table 7-1: Stormwater catchment peak flows

Name	Area (ha)	Rainfall Intensity (mm/24 hr)			Peak Runoff (m^3/s)		
		I_{10}	I_{50}	I_{100}	Q_{10}	Q_{50}	Q_{100}
C_Office	0.025	268.8	472.7	597.4	0.025	0.043	0.055
C_Plant	0.098	268.8	472.7	597.4	0.095	0.167	0.212

7.6.2 Stormwater systems placement and sizing recommendations

The following is recommended in addition to the existing stormwater measures, sized according to a **1:100-yr** rainfall event:

- Two concrete channels are recommended, as indicated in Figure 7-3 and their dimensions are illustrated here.
    - The first is a **triangular concrete channel (V-drain)** that will capture runoff from the office and car park areas and route runoff to the canal.
        - The runoff must first pass through an oil-water separator to remove any potential grease and fuel from the stormwater.
        - A culvert will be required underneath the road currently existing to the west of the site.
        - The stormwater will flow through the culvert and enter the canal. Riprap should be placed at the culvert outlet to prevent erosion.
    - The second is a **trapezoidal concrete channel** flush to the eastern and southern boundary of the site, as indicated in Figure 7-3. This channel will capture runoff from the rest of the site, such as roads, hardstands, and other impervious surfaces.
        - The runoff should be collected in a detention pond to settle any sediments, after which the water can be released into the canal.
        - It is anticipated that this water will be clean, as areas that could give rise to contaminants should be operated and maintained in such a way that the contaminants cannot mobilise into the runoff.
        - Should it become clear that contaminants are not contained, the water in the detention pond should be sampled and analysed to understand the water quality.
- Areas of greater concern of contamination risk should be bunded. These include areas such as:
    - The cooling tower (blowdown or drift deposits)

    - Fuel storage and handling areas
    - Transformer yards (potential oil leaks)
    - Chemical storage areas
    - Maintenance workshops
    - Waste storage areas

- The laydown area should have a berm on the perimeter to prevent sediment from entering the stormwater channels as far as possible. This will aid in maintenance.
- A berm should be placed at the northern boundary of the site to prevent any potential upstream runoff from entering the site.
- It is proposed, if possible, that the roadside channel be connected where it disconnects, as discussed and illustrated in section 7.2. This will aid in routing stormwater away from that particular area.
- The presence of pervious surfaces is recommended where possible. Revegetation of areas not in use will greatly reduce runoff velocities, prevent erosion, and reduce sedimentation. The use of gravelled areas instead of impervious concrete is encouraged where possible.
- It is imperative to conduct regular maintenance and inspections on all stormwater infrastructure to ensure that debris does not cause obstructions or contribute to material being transported by runoff. The plant and its associated paved and unpaved surfaces should be kept free of litter and other unwanted materials that could enter the stormwater system and impact the surrounding environment.

Figure 7-2: Delineated stormwater sub-catchments for the CCGT Power Plant

Figure 7-3: Existing and proposed stormwater management recommendations for the CCGT Power Plant

8 HYDROLOGICAL RISK ASSESSMENT

The anticipated hydrological risk concerning the construction and operational phase of the development was assessed.

The source-pathway-receptor (SPR) model (DWAF, 2008) was used to evaluate potential pollution sources and primary receptors within the study area. Risk assessment entails understanding the generation of a hazard, the probability that it will occur, and the consequences if it does occur. The net consequence is established by the following equation:

$$\boldsymbol{Consequence} = (\boldsymbol{Duration} + \boldsymbol{Extent} + \boldsymbol{Irreplaceability\ of\ resource}) \times \boldsymbol{Severity}$$

The environmental significance of an impact was determined by multiplying the consequence by the probability.

$$\boldsymbol{Significance} = \boldsymbol{Consequence\ x\ Probability}$$

The risk significance rating is summarised in Table 8-1.

Table 8-1: Risk rating scale

Criteria	Rating Scales
Significance	Very high - negative (-49 to -66)
	High - negative (-37 to -48)
	Moderate - negative (-25 to -36)
	Low - negative (-13 to -24)
	Neutral - Very low (0 to -12)
	Low-positive (0 to 12)
	Moderate-positive (13 to 24)
	High-positive (37 to 48)
	Very high - positive (49 to 66)

The potential impacts identified and environmental significance for the construction and operational phases of the project are summarised in Table 8-3 to Table 8-4. Mitigation measures are listed in the table, and the net result of the applied mitigation is evaluated in the last column. No closure-phase risks were evaluated because the end use of the land is unknown. The risk assessment focuses on the proposed activities. Risks are further discussed in the sections below.

8.1 Construction phase

The following activities are anticipated during the construction phase of the project:

- Typical earthworks are required to clear the areas.
- Construction of access roads, foundations and buildings.
- Excavations.

- Establishment of service platforms, material handling areas and other temporary infrastructure.
- Dust suppression of access roads.
- Placing of topsoil in designated areas.

The identified possible hydrological impacts for the construction phase include (refer to Table 8-3):

- The destruction of the vadose zone sediments by clearing activities (levelling) or cut and fill activities. This could lead to sediment runoff and surface water contamination.
- Clearing topsoil from footprint areas will influence the rate of infiltration of water to the shallow groundwater system and/or baseflow component to shallow streams.
- Handling of waste and transport of material can cause various types of spills (i.e. hydrocarbons) which can infiltrate and contaminate the soils and groundwater system.
- Oil and fuel spills and leakages at vehicle park areas, and in the project areas, may cause poor-quality seepage and soil contamination.

Visual monitoring of the site on an ongoing (monthly) basis will serve as a 1st order detection system for any soil and water pollution that may take place. The collected information should be used as part of an active water management system and act as an early warning system for the application of mitigation measures. The identified impacts are not likely to negatively affect the commencement of the proposed projects.

8.2 Operational phase

The identified possible hydrological impacts for the operational phase include (refer to Table 8-4):

- Poor quality runoff from:
  - Sedimentation due to exposed soils or unvegetated surface runoff during storm events.
  - Contaminant leaks that are uncontained.
  - Oil and fuel spills from service vehicles accessing and undertaking maintenance work at the site, as well as leakages from residential vehicles parked at the site.

In general, the operational phase risk associated with the project is predicted low, and it is foreseen that the impacts can be managed.

8.3 Alternative considerations

No alternatives were considered during this assessment. The risk to the hydrology environment for the project is low, and no alternative layouts are proposed.

8.4 Cumulative impacts and impacts on the hydrological cycle

Based on the site's hydrological conditions, identified hydrological linkages, and potential local-scale impacts, no impacts to the greater hydrological cycle are anticipated. Runoff will still be allowed to enter the watercourses (canal) to maintain the current ecology.

The hydrology impact assessment assessed the cumulative impacts of the following projects (refer to Table 8-2) within a 30km radius of the site (retrieved from the SA Renewable Energy EIA Applications Website, hosted by DFFE – date of access 12/03/2026, refer to)

Table 8-2: Summary of other projects within a 30km radius of the site

DEA Reference	Project Title	Application Received	Applicant	EAP	Technology	Megawatt	Project Status
14/12/16/3/3/2/2041	The 320MW emergency risk mitigation power plant (RMPP) and associated infrastructure on sites located in Alton, Richards Bay within the Umhlathuze Local Municipality in Kwa-Zulu Natal Province	30/11/2020	Phinda Power Projects (Pty) Ltd	Savannah Environmental (Pty) Ltd	Solar PV	320	Approved
14/12/16/3/3/2/867	400 MW Richards Bay Power Facility on Erven 17455, 17443 and 17442 within the Richards Bay Industrial Development Zone, uMthlathuze Local Municipality in the Kwazulu Natal Province	15/06/2016	Richards Bay Gas Power 2 (Pty) Ltd	Savannah Environmental (Pty) Ltd	Solar PV	400	Approved
14/12/16/3/3/2/2117	The construction and operation of the Phakwe Richards Bay gas power 3 combined cycle power plant (ccpp), Richards Bay, KwaZulu-Natal Province.	12/11/2021	Richards Bay Gas Power 3 (Pty) Ltd	Savannah Environmental (Pty) Ltd	Biomass Biofuels	2000	Approved
14/12/16/3/3/1/2258	The proposed 132kV underground transmission infrastructure and associated switching station on sites located in Alton, Richards Bay, KwaZulu-Natal Province	13/11/2020	Phinda Power Projects (Pty) Ltd	Savannah Environmental (Pty) Ltd	Biomass Biofuels	450	Approved
14/12/16/3/3/2/2032	Proposed Nseleni Independent Floating Power Plant (NIFPP) and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, Port of Richards Bay, KwaZulu-Natal.	05/11/2020	Nseleni Power Corporation Pty (Ltd)	Sustainable Environmental Solutions (Pty) Ltd	Biomass Biofuels	700	Refused
14/12/16/3/3/2/2033	Proposed Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the Nseleni Independent Floating Power Plant, Port of Richards Bay, KwaZulu-Natal.	05/11/2020	Anchor Energy Pty (Ltd)	Sustainable Environmental Solutions (Pty) Ltd	Biomass Biofuels	700	Refused
14/12/16/3/3/2/2007	The Proposed Gas to Power Powership Project at Port of Richards Bay within UMhlathuze Local Municipality, King Cetshwayo District, KwaZulu-Natal Province.	08/10/2020	Karpowership SA (Pty) Ltd	Triplo4 Sustainable Solutions	Biomass Biofuels	0	Refused

In terms of the construction and operational phases, there are expected cumulative hydrological impacts on the site soils. The impact is expected to improve once development has ceased. No cumulative hydrological impacts are expected from the proposed projects mentioned above. The increase in runoff volumes from the site will be marginal, due to the proposed project scale.

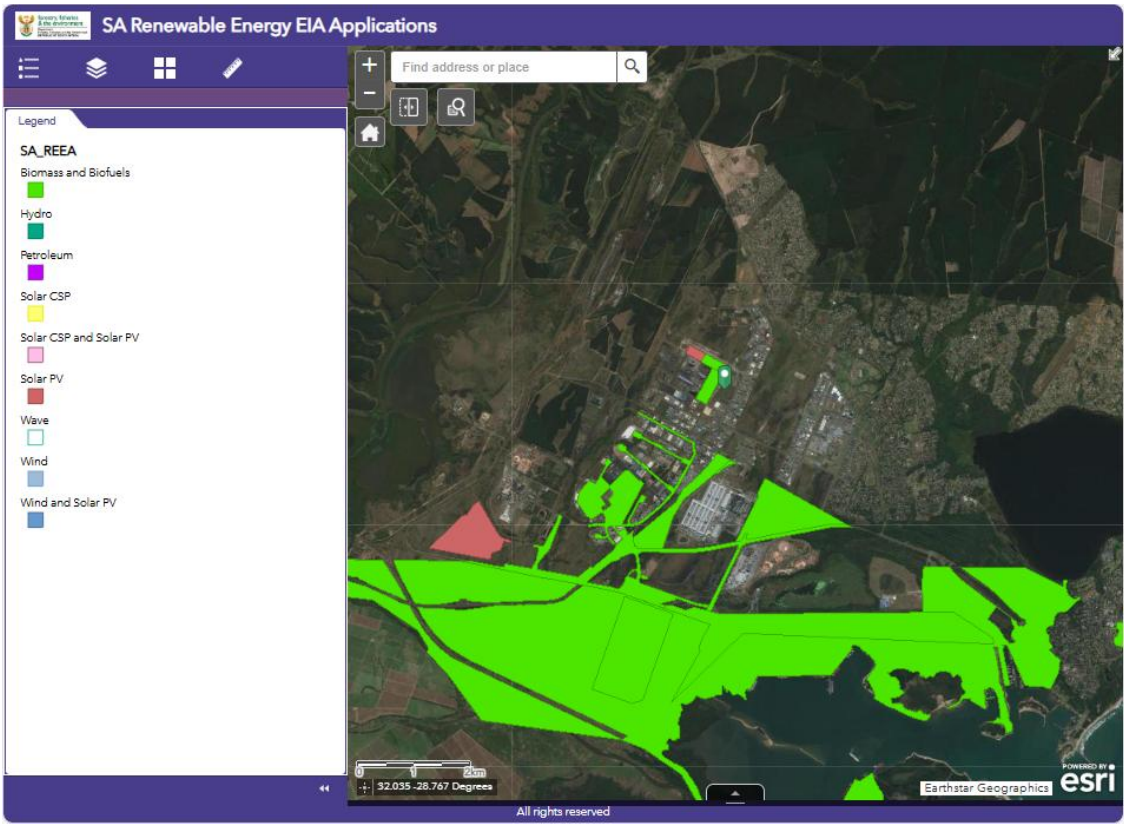


Figure 8-1: Overview of other projects associated with the project area [DFFE (2024)](#)

Table 8-3: Preparation phase hydrological risk

Component Being Impacted On	Activity Which May Cause the Impact	Activity	PRE-MITIGATION Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	RECOMMENDED MITIGATION MEASURES	POST-MITIGATION Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance
Vadose zone soils and subsequent aquifer (groundwater table)	Disturbing vadose zone soils during excavations/construction activities.	Net Result of Earthworks and Development	Medium-term 3	Site 2	Yes 1	Moderate -2	Slightly detrimental (-7 to -12) -12	Definite 2	Low (-13 to -24) -24	• Only excavate areas applicable to the project area. • Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. • Cover excavated soils with a temporary liner to prevent contamination. • Retain as much indigenous vegetation as possible. • Exposed soils are to be protected using a suitable covering or revegetation.	Medium-term 3	Site 2	Yes 1	Low -1	Negligible (-6 to 0) -6	Probable 1	Neutral (0 to -12) -6
	Poor quality seepage from machinery used to excavate soils. Oil, grease and fuel leaks could lead to hydrocarbon contamination of the vadose zone, which could percolate into the shallow aquifer.	Net Result of Earthworks and Development	Medium-term 3	Site 2	Yes 1	Moderate -2	Slightly detrimental (-7 to -12) -12	Definite 2	Low (-13 to -24) -24	• Park heavy machinery in lined and bunded areas and place drip trays under vehicles at the site. • Visual soil assessments for signs of contamination during construction (monthly)	Medium-term 3	Site 2	Yes 1	Low -1	Negligible (-6 to 0) -6	Probable 1	Neutral (0 to -12) -6
Primary Surface Water Receivers • Non-perennial streams • Riparian habitats	***Runoff*** Erosion and sedimentation of nearby canal due to potential dirty water runoff from • Excavations • Construction • Vegetation removal	Net Result of Earthworks and Development	Medium-term 3	Site 2	Yes 1	Moderate -2	Slightly detrimental (-7 to -12) -12	Definite 2	Low (-13 to -24) -24	• Install a temporary cut-off trench to contain poor-quality runoff. • Visual inspections of all vehicles entering and operating at the site. • Visual assessment for signs of erosion or contamination. • Implementation of stormwater recommendations. • Cover any temporary construction material stockpiles.	Medium-term 3	Site 2	Yes 1	Low -1	Negligible (-6 to 0) -6	Probable 1	Neutral (0 to -12) -6

Table 8-4: Operational phase hydrological risk

			PRE-MITIGATION								POST-MITIGATION						
Component Being Impacted On	**Activity Which May Cause the Impact**	**Activity**	**Duration (D)**	**Extent (E)**	**Potential for impact on irreplaceable resources (I)**	**Severity (S)**	**Consequence (C)**	**Probability (P)**	**Significance**	**RECOMMENDED MITIGATION MEASURES**	**Duration (D)**	**Extent (E)**	**Potential for impact on irreplaceable resources (I)**	**Severity (S)**	**Consequence (C)**	**Probability (P)**	**Significance**
Vadose zone soils and subsequent aquifer (groundwater table)	Poor quality seepage from visitors and staff/site vehicles. Oil, grease and fuel leaks could lead to hydrocarbon contamination of the vadose zone which could percolate into the shallow aquifer.	Site activities	Long-term 4	Site 2	Yes 1	Low -1	Slightly detrimental (-7 to -12) -17	Definite 2	Low (-13 to -24) -14	• Park vehicles in lined and bunded areas and place drip trays under site vehicles. • Ensure a stormwater management plan is in place to capture and treat runoff from parking areas and prevent discharge into the environment or spills. • Visual soil assessments for signs of contamination during operations (monthly)	Long-term 4	Site 2	Yes 1	Low -1	Slightly detrimental (-7 to -12) -17	Probable 1	Neutral (0 to -12) -6
Primary Surface Water Receivers • Non-perennial streams • Riparian habitats	***Runoff*** Increased runoff due to compacted surfaces from the proposed site onto the surrounding soils may cause higher velocities and frequency of occurrence and sediment transport to the nearby streams.	Site activities	Long-term 4	Local 3	Yes 1	Low -1	Slightly detrimental (-7 to -12) -8	Probable 1	Neutral (0 to -12) -8	• Release structures for stormwater runoff from the site must dissipate energy and disperse flow to ensure minimal impact on the receiving environment.	Long-term 4	Local 3	No 0	Low -1	Slightly detrimental (-7 to -12) -7	Improbable 0	Neutral (0 to -12) 0
	Sedimentation Potential sedimentation several months after the site has been constructed. It is anticipated that the sediment load will decrease with time to pre-construction levels.	The net result of earthworks	Long-term 4	Local 3	Yes 1	Low -1	Slightly detrimental (-7 to -12) -8	Probable 1	Neutral (0 to -12) -8	• Release structures for stormwater runoff from the site should incorporate silt traps to allow for the settlement of sediments. • Silt traps are to be regularly cleaned.	Long-term 4	Local 3	No 0	Low -1	Slightly detrimental (-7 to -12) -7	Improbable 0	Neutral (0 to -12) 0
	Water quality Water quality impacts due to chemical spills, vehicle pollutants, fuel and oil spillages and leaks.	Site activities	Long-term 4	Site 2	Yes 1	Low -1	Slightly detrimental (-7 to -12) -7	Probable 1	Neutral (0 to -12) -7	• Implementation of the stormwater management plan. • Visual assessment for signs of contamination. • Spills are to be cleaned up immediately. • Vehicles and equipment are to be regularly maintained and cleaned.	Long-term 4	Footprint 1	Yes 1	Low -1	Slightly detrimental (-7 to -12) -6	Probable 1	Neutral (0 to -12) -6

9 STORMWATER AND SURFACE WATER MONITORING PLAN

It is proposed that a stormwater and surface water monitoring programme be implemented to monitor the water quality in and around the sites. Runoff exiting the site must be monitored to ensure the quality of the runoff released into the surrounding area is of adequate quality.

Monitoring would need to be conducted as follows:

- Monitoring during the preparation and construction phases.
- During the operational phase of the project.

9.1 Temporary monitoring

During construction and deconstruction activities, water and soil monitoring should focus on active excavation sites and on equipment/heavy-machinery parking or housing areas. Regular visual inspections of these areas are required. Moreover, the placement and monitoring of drip trays beneath parked construction vehicles will help determine which vehicles need to be repaired/taken off-site to prevent contamination while in service.

If visual observations show areas of concern (i.e., where erosion is increasing or sedimentation is noticed), then it is advised that additional water samples be obtained from the observation point or a water source closest to the area of concern. Mitigation measures should then be formulated based on the observed scale of impact.

9.2 Long-term monitoring

Based on the assessment, it is anticipated that the canal is the main receptor of pollution from the activity (i.e., overland runoff, seepage, stormwater discharge, etc.). Long-term monitoring should focus on these areas and will entail visual inspections every month and sampling each quarter during both the operational phase.

The proposed monitoring positions are indicated in Figure 9-1. Quarterly monitoring is proposed for all sample sites.

9.3 Monitoring duration and responsibility

It is proposed that monitoring be conducted as specified in Table 9-1 for the duration of the activity. The need for further monitoring of the site can be evaluated by the local environmental authorities or DWS representative.

Table 9-1: Proposed monitoring points, frequencies, and sample analyses

Site	Frequency	Purpose
Routine visual inspections	Monthly	Check for oil sheen, sediment, blockages, or erosion in drains and discharge points
Stormwater quality sampling	Quarterly	Confirm runoff quality and detect any contaminants
Event-based monitoring	During or shortly after significant rainfall events (e.g., >10–20 mm)	Assess runoff quality during actual discharge conditions
Operational checks of pollution control measures (oil separators, traps)	Monthly or quarterly	Ensure treatment structures are functioning properly

9.4 Lab testing parameters

Water quality samples from the canal should be tested quarterly for the following:

- pH
- Electrical conductivity (EC)
- Total suspended solids (TSS)
- Oil and grease / hydrocarbons
- Possibly metals if transformers or industrial equipment are present

Figure 9-1: **Proposed monitoring network**

10 CONCLUSIONS

The following conclusions were drawn from the hydrological assessment undertaken for the proposed 750 MW Combined Cycle Gas Turbine Power Plant in Richards Bay:

- The project area is located within quaternary catchment W12F of the Pongola-Mtamvuna Water Management Area and is characterised by relatively flat terrain with elevations ranging between approximately 40 and 43 mamsl.
- The site drains predominantly towards the south-west, ultimately discharging into a man-made canal located along the western boundary of the site, which currently exhibits wetland-like characteristics.
- The broader hydrological response unit associated with the site covers approximately 2.6 km^2 and is dominated by grassland and partially urbanised land cover, with generally low slopes and sandy soils that promote moderate infiltration.
- Climatic conditions in the area are characterised by high rainfall (approximately 1,200 mm/a) and high evaporation, with simulated natural runoff estimated to be approximately 22% of the mean annual precipitation for the quaternary catchment.
- Baseline surface water quality sampling conducted upstream, midstream, and downstream of the site indicated that water quality within the canal falls within the DWAF Target Water Quality Ranges for domestic use, suggesting relatively good baseline water quality conditions.
- Peak flood flows were estimated using the Rational Method, Standard Design Flood method, and Midgley and Pitman method, with conservative values applied to represent worst-case hydrological conditions.
- Hydraulic modelling undertaken using HEC-RAS indicates that the adjacent canal and associated wetland areas may pose a flooding risk to portions of the site during large storm events, particularly within low-lying areas.
- The 1:100-year flood line should be considered a sensitivity or avoidance zone, and infrastructure development within these areas should be avoided where possible or designed with appropriate flood protection measures.
- The proposed development will introduce additional impervious surfaces, which may result in moderate increases in runoff rates and peak flows at the local scale.
- A Conceptual Stormwater Management Plan (CSWMP) was developed to manage runoff from the site. Runoff generated on site is expected to consist primarily of stormwater from impervious surfaces such as roofs, paved areas, and parking areas, and is therefore generally considered clean stormwater, although localised contaminants such as hydrocarbons may occur.

- A hydrological risk assessment identified potential impacts associated with construction and operational activities, including sediment mobilisation, stormwater contamination, and flood-related risks.
- With the implementation of the recommended stormwater management measures, monitoring programme, and environmental management controls, the significance of the identified hydrological impacts is expected to be low to acceptable.
- A surface water monitoring programme was developed to monitor potential changes in water quality in the receiving canal during both the construction and operational phases.

10.1 Identification of any potential avoidance areas

The 1:100-year flood line should be considered an avoidance area (buffer area). Care should be taken if the development or linear infrastructure is expanded into the demarcated flooding areas. If development does take place in the exclusion zone, proper flooding protocols and erosion prevention measures should be implemented.

10.2 Recommendations for EMPr and WUL

10.2.1 Stormwater Management

The following mitigation measures can be implemented as part of the EMPr:

- **Assess the site constraints and any site-specific concerns, including:**
  - Specific vegetation that may need to be identified and/or isolated from the site disturbance.
  - Up-slope drainage catchments that must be diverted around the work site.
  - Workspace limitations may require site-specific sediment control measures and/or the extensive use of skips or bins for material storage and waste management.
  - Construction is recommended to occur during the dry season.
- **Stabilise the site entry/exiting points:**
  - A stabilised site access must be established and, if possible, limited to one point only. The access allows construction vehicles to enter the work area while preventing unnecessary sediment tracking into the nearby environment from multiple locations. A stabilised entry/exit point normally consists of a stabilised rock pad.
- **Prevent erosion & manage stockpiles:**
  - Suitable material storage areas must be located up-slope of the main sediment barrier (e.g., sediment fence).

  - Stockpiles kept on site for more than two weeks will require an impervious cover (e.g., builder's plastic or geofabric) to protect against raindrop impact. Stockpiles of sandy material located behind a sediment fence will only require a protective cover if they are likely to be exposed to strong winds.

- **Manage site waste:**
  - Adequate waste containers must be provided on-site and maintained in a way that potential and actual environmental harm resulting from such material waste is minimised.
  - Building activities must be carried out on a pervious surface, such as grass or open soil, or in such a manner that all sediment-laden runoff is prevented from discharging into a water body.
- Ensure that eroded areas are re-vegetated, to ensure reduced sedimentation risk and reduced runoff volumes to the streams.
- Stormwater runoff should be managed as discussed in Section 7, unless otherwise specified by the contracted civil engineer. And where additional stormwater management is needed, measures should be taken.
- The following disclaimer pertains to the discussed stormwater management plan:
  - The stormwater management plan in this report is conceptual.
  - The hydrological assessment employs a 24-hour design storm rainfall as a worst-case scenario to estimate peak flows.
  - It is crucial to emphasise that the hydrological assessment is a supporting document. Civil engineering, which incorporates professional judgment and detailed site-specific analysis, will take precedence as the authoritative reference for the final stormwater management plan.

10.2.2 Monitoring requirements

- It is proposed that stormwater monitoring be implemented as discussed in Section 9 to monitor the potential impacts of the runoff generated on-site during storm events.

10.2.3 Mitigation measures

10.2.3.1 Construction phase

- Only excavated areas apply to the project area.
- Park heavy machinery in lined areas and place drip trays under vehicles at the site.
- Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils.
- Cover excavated soils with a temporary liner to prevent contamination.

- Retain as much indigenous vegetation as possible.
- Exposed soils are to be protected using a suitable covering or revegetation.
- Park heavy machinery in lined areas and place drip trays under vehicles at the site.
- Visual soil assessments for signs of contamination during construction (monthly).

10.2.3.2 Operational phase

- Visual soil assessments for signs of contamination during construction (monthly)
- Have oil and fuel cleanup kits on site.
- Clear any sandy deposits and debris that collect in the stormwater systems.
- Routine hydraulic monitoring of the stormwater system (monthly)

10.3 Reasoned opinion on whether the activity should be authorised

Based on the existing activities and mitigations to offset impacts, GCS believes that the authorisation of the activities should be considered. The final decision rests with the Government Authorities and should be based on the predicted hydrological impacts as well as the project's socio-economic value. This statement is further founded on the assumption that the proposed mitigation measures and EMPr recommendations will be implemented during the life of the project.

11 REFERENCES

Adamson, P., 1981. *Southern African Storm Rainfall: Technical Report TR102,* Pretoria: Department of Environmental Affairs.

Alexander, J., 2002. The Standard Design Flood. *South African Institution of Engineers,* pp. 26-30.

Bailey, A. & Pitman, W., 2015. *Water Resources of South Africa 2012 Study (WR2012): Executive Summary Version 1. WRC Report No. K5/2143/1,* Gezina, South Africa: Water Research Commission Report.

Blue Marble Geographics, 2021. *Global Mapper 25.0,* Hallowel, ME: Blue Marble Geographics.

Campbell, .. W. A. M. B., 1986. *Evaluation of flood estimation methods- Phase II: An evaluation of hydrological techniques for making flood estimations on small unguaged catchments,* Pretoria: Water Research Commission.

CSIR, 2005. *Guidelines for Human Settlement Planning and Design, Volume 2.* Pretoria: CSIR Building and Construction Technology.

CSIR, 2005. *Guidelines for Human Settlement Planning and Design: Volume 2, Pretoria: CSIR Building and Construction Technology,* s.l.: s.n.

DEA, 2020. *South African National Land Cover,* Pretoria: Department of Environmental Affairs.

DFFE, 2021. *South African National Land Cover (SANLC) 2020,* Pretoria: Department of Forestry, Fisheries and the Environment.

DMEA, 1998. *3028 Kokstad - 1:250 000 Geological map Series,* s.l.: DMEA.

DWAF, 2006c. *Groundwater Resource Assessment II.* s.l.:s.n.

DWAF, 2006c. *Groundwater Resource Assessment II.* s.l.:s.n.

DWAF, 2007. *Best Practice Guidelines G3: Water Monitoring Systems,* Pretoria: Department of Water Affairs and Forestry.

DWAF, 2008. *Best Practice Guidelines G4: Impact Prediction,* Pretoria: Department of Water Affairs and Forestry.

DWS, 2011. *Groundwater Dictionary.* [Online].

DWS, 2023. *New Water Management Areas.* South Africa: Government Gazette No. 40279.

ESRI, 2018. *ArcView10.5,* s.l.: Environmental Systems Research Institute, California.

Eyring, V. et al., 2016. Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization. *Geoscientific Model Development,* 9(5), pp. 1937-1958.

King, G., Maritz, E. & Jonck, F., 1998. *Durban - 1:500 000 Hydrogeological Map Series of the Republic of South Africa.* Pretoria: Department of Water Affairs and Forestry.

Kottek, M. et al., 2006. World Map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift,* 15(3), pp. 259-263.

Lynch, S., 2004. *Development of a Raster Database of Annual, Monthy and Daily Rainfall for Southern Africa, WRC Report No. 1156/1/04,* Pretoria: Water Research Commission.

Meteoblue, 2026. *Climate Data.* [Online].

NWA, 1998. *The South African National Water Act,* s.l.: South Africa.

SANRAL, 2013. *South African Drainage Manual.* 6th ed. Pretoria: South African National Road Agency SOC Limited.

Schulze, R., 1997. *South African Atlas of Agrohydrology and Climatology. WRC Report No. TT85/96,* Pretoria: Water Research Commission.

Smithers, J. & Schulze, R., 2002. *Design Rainfall and Flood Estimation in South Africa, WRC Report No. K5/1060,* Pretoria: Water Research Commision.

US Army Corps of Engineers, 2016. *HEC RAS Hydraulic Modelling Software. Version 5.0.* California: s.n.

USDA, 2009. Hydrologic Soil Groups. In: *Part 630 Hydrology National Engineering Handbook.* s.l.:s.n.

van Deventer, H. et al., 2020. National Wetland Map 5: An improved spatial extent and representation of inland aquatic and estuarine ecosystems in South Africa. *Water SA,* 46(1), pp. 66-79.

Vegter, J., 1995. *An explanation of a set of National Groundwater Maps. Water Research Commission. Report No TT 74/95,* Pretoria: WRC.

WARMS, 2024. *DW760 Kwa-Zulu Natal Office QA Data Report.* Pretoria: DWS.

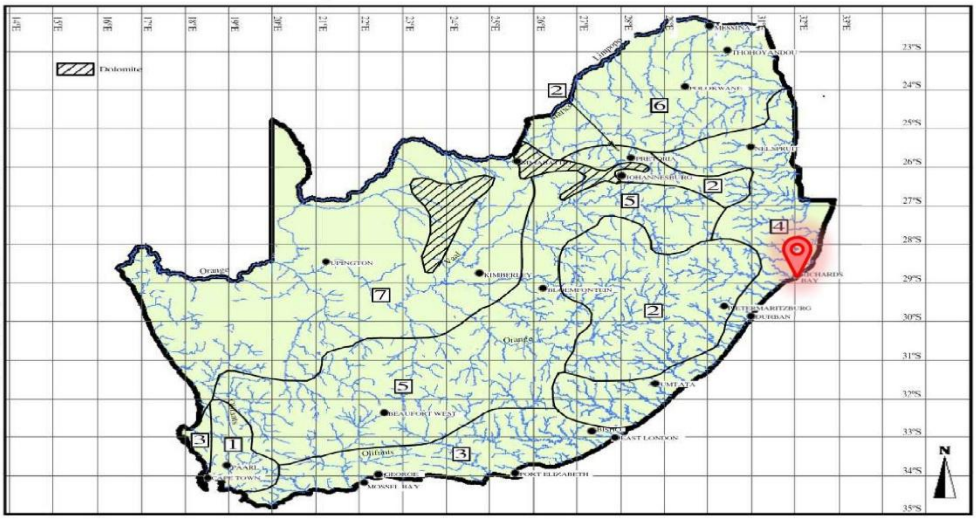
WRC, 2015. *Resouce Centre.* [Online].

APPENDIX A: FLOOD PEAK CALCULATION SHEETS

RATIONAL METHOD 3							
Description of catchment		HRU01					
River detail	Unnamed Drain						
Calculated by	Chané Pretorius			Date	Thursday, 12 March 2026		
Physical characteristics							
Size of catchment (A)	2.644	km^2		Rainfall region		W1D	
Longest watercourse (L)	0.751	km		Area distribution factors			
Average slope (S_{av})	0.0031	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		0.8	0.2	0	
Mean annual rainfall (MAR)	1218.80	mm					
Rural				URBAN			
Surface slope	%	Factor	C_s	Description	%	Factor	C2
Vleis and pans (<3%)	56.27	0.05	2.81	Lawns			
Flat areas (3 - 10%)	40.26	0.11	4.43	Sandy,flat<2%	100	0.08	8
Hilly (10 - 30%)	3.46	0.20	0.69	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.00	0.30	0.00	Heavy s,flat<2%	0	0.15	0
Total	100.00	0.66	7.94	Heavy s,steep>7%	0	0.3	0
Permeability	%	Factor	C_p	Residential Areas			
Very permeable	0	0.05	0.00	Houses	0	0.5	0
Permeable	90	0.10	9.00	Flats	0	0.6	0
Semi-permeable	10	0.20	2.00	Industry			
Impermeable	0	0.30	0.00	Light industry	100	0.6	60
Total	100	0.65	11.00	Heavy industry	0	0.7	0
Vegetation	%	Factor	C_v	Business			
Thick bush & plantation	14.68	0.05	0.73	City centre	0	0.8	0
Light bush & farm-lands	0.00	0.15	0.00	Suburban	0	0.65	0
Grasslands	60.72	0.25	15.18	Streets	0	0.75	0
No vegatation	24.60	0.30	7.38	Max flood	0	1	0
Total	100	0.75	23.29	Total (C2)	200		68
Time of concentration (TC)							
Overland flow	Defined watercourse						
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$	$T_c = \left[\frac{0.87 L^2}{1000 S_{AV}}\right]^{0.385}$			Use Defined watercourse			
1.327 hours	0.492	hours					
Run-off coefficient							
Return Period (years)	2	5	10	20	50	100	PMF
Run-off coefficient, C_1	0.474	0.474	0.474	0.474	0.474	0.474	0.900
Adjusted for dolomitic areas, C_{1D}	0.474	0.474	0.474	0.474	0.474	0.474	0.900
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1.00	1.00
Adjusted run - off coefficient, C_{1T}	0.236918344	0.260610178	0.284302013	0.317	0.393	0.474	0.900
Combined run - off coefficient, C_T	0.236918344	0.260610178	0.284302013	0.317	0.393	0.474	0.900
Rainfall							
Return Period (years)	2	5	10	20	50	100	PMF
Point rainfall (mm), P_T	46.58	72.66	95.35	122.29	167.54	211.75	267.24
Point Intensity (mm/h), P_{it}	94.70	147.74	193.87	248.67	340.67	430.57	543.40
Area reduction factor (%),ARF_T	1.042	1.042	1.042	1.042	1.042	1.042	1.042
Average intensity (mm/hour),I_T	98.679	153.939	202.012	259.106	354.965	448.641	566.210
Return Period (years)	2	5	10	20	50	100	PMF
Peak flow (m^3/s)	17.171	29.465	42.181	60.414	102.530	156.13	374.26

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	Catchment Area	MAP	S	L	Lc	Constant K_T				Catchment Parameter	Peak Flows			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU01	2.644	1219	0.0031	0.75	1.32	0.59	0.68	0.95	1.2	0.1483	33.17	38.23	53.40	67.46

Figure 3.35: Homogeneous flood regions in South Africa



STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment		HRU01					
River detail	Unnamed Drain						
Calculated by	Chané Pretorius				Date	Thursday, 12 March 2026	
Physical characteristics							
Size of catchment (A)	2.644	km^2		Days of thunder per year (R)		17	days
Longest watercourse (L)	0.751	km		Time of concentration, t		29.508	minutes
Average slope (S_{av})	0.0031	m/m		Time of concentration, T_c	$T_c = \left[\frac{0.87 L^2}{1000 S_{AV}}\right]^{0.385}$		0.4918
SDF Basin	27						
2-year return period rainfall (M)	85	mm					
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Point precipitation depth (mm) $P_{t,T}$	23.1	39.1	51.1	63.1	79.0	91.0	103.1
Area reduction factor (%),ARF_T	1.042	1.042	1.042	1.042	1.042	1.042	1.042
Average intensity (mm/hour),I_T	49.0	82.7	108.2	133.7	167.4	192.9	218.4
Run-off coefficient							
Calibration factors C_2 (%)	30		C_{100} (%)		80		
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	2.58
Run-off coefficient, C_T	0.300	0.480	0.575	0.652	0.740	0.800	0.854
Peak flow (m^3/s)	10.81	29.18	45.68	64.03	90.98	113.34	136.92

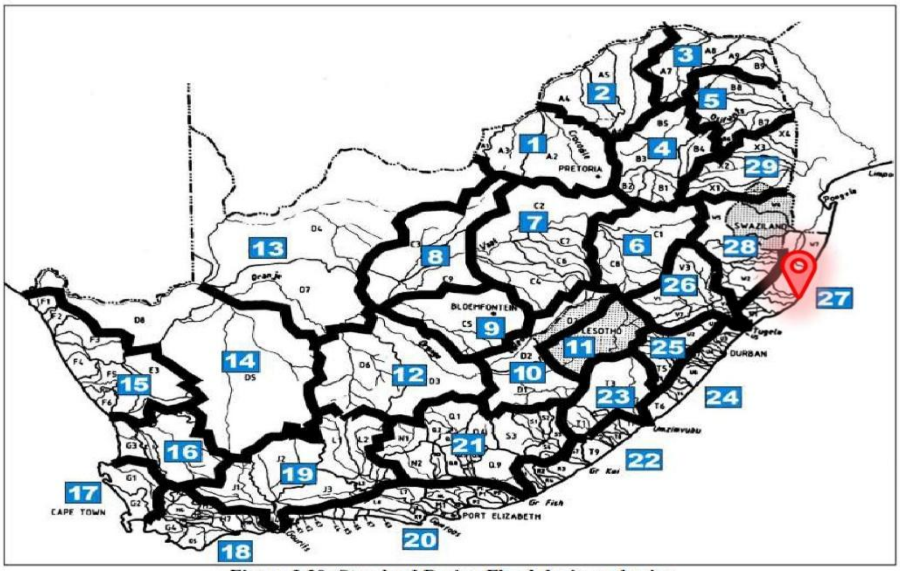


Figure 3.30: Standard Design Flood drainage basins

APPENDIX B: LABORATORY CERTIFICATES

TALBOT
A Level 1 B-BBEE company

sanas
Testing Laboratory
T0122

[005249/24], [2024/06/25]

Certificate of Analysis

Project details

Customer Details

Invoice Category	400.004
Customer reference:	TNPA (24-0250)
Order number:	24-0250
Company name:	GCS (PTY) LTD DURBAN
Contact address:	P O BOX 819, GILLITS, 3603
Contact person:	HENDRIK BOTHA
Additional customer information:	018886/24,018887/24,018885/24 - CLIENT: NEMAI

Sampling Details

Sampled by:	CUSTOMER
Sampled date:	2024/06/11

Sample Details

Sample type(s):	GROUNDWATER SAMPLES
Date received:	2024/06/14
Delivered by:	CUSTOMER - GILLITTS DEPOT
Temperature at sample receipt (°C):	14.3

Report Details

Testing commenced:	2024/06/14
Testing completed:	2024/06/24
Report date:	2024/06/25
Our reference:	005249/24

Talbot Laboratories (Pty) Ltd Reg: 2016/334237/07
P.O Box 22598 Pietermaritzburg 3203 South Africa
+27 (0) 33 346 1444 www.talbot.co.za

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Analytical Results

Methods	Determinands	Units	018885/24	018886/24
			1. DSW-UP 11.06.2024	2. DSWD 11.06.2024
Chemical				
93	Dissolved Calcium	mg Ca/ℓ	11.9	11.8
93	Dissolved Potassium	mg K/ℓ	2.68	2.66
93	Dissolved Magnesium	mg Mg/ℓ	5.18	5.11
93	Sodium	mg Na/ℓ	25	25
83A	Dissolved Aluminium	µg Al/ℓ	10.7	8.7
83A	Dissolved Iron	µg Fe/ℓ	34	34
83A	Dissolved Manganese	µg Mn/ℓ	20	16.0
10G	Total Alkalinity	mg $CaCO_3$/ℓ	36	36
16G	Chloride	mg Cl/ℓ	44	42
2B	Electrical Conductivity at 25°C	mS/m	25	24
18G	Fluoride	mg F/ℓ	0.44	0.45
65Gc	Nitrate	mg N/ℓ	<0.25	0.75
1B	pH at 25°C	pH units	7.0	7.0
67G	Sulphate	mg SO_4/ℓ	8.12	8.02
41	Total Dissolved Solids at 180°C	mg/ℓ	130	164
Calc.	Sodium Adsorption Ratio	$(mmol/ℓ)^{0.5}$	1.54	1.54

Methods	Determinands	Units	018887/24
			3. DSW-M 11.06.2024
Chemical			
93	Dissolved Calcium	mg Ca/ℓ	11.8
93	Dissolved Potassium	mg K/ℓ	2.64
93	Dissolved Magnesium	mg Mg/ℓ	5.10
93	Sodium	mg Na/ℓ	25
83A	Dissolved Aluminium	µg Al/ℓ	10.9
83A	Dissolved Iron	µg Fe/ℓ	33
83A	Dissolved Manganese	µg Mn/ℓ	21
10G	Total Alkalinity	mg $CaCO_3$/ℓ	35
16G	Chloride	mg Cl/ℓ	43
2B	Electrical Conductivity at 25°C	mS/m	25
18G	Fluoride	mg F/ℓ	0.46
65Gc	Nitrate	mg N/ℓ	<0.25
1B	pH at 25°C	pH units	7.0
67G	Sulphate	mg SO_4/ℓ	8.18
41	Total Dissolved Solids at 180°C	mg/ℓ	146
Calc.	Sodium Adsorption Ratio	$(mmol/ℓ)^{0.5}$	1.53

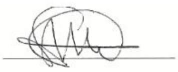
Refer to the “Notes” section at the end of this report for further explanations.

Specific Observations

None

Quality Assurance

Technical signatories



Inorganic Chemistry: Sipho Mgabhi

Notes to this report

Limitations

This report shall not be reproduced except in full without prior written approval of the laboratory.
Results in this report relate only to the samples as taken, and the condition received by the laboratory.
Any opinions and interpretations expressed herein are outside the scope of SANAS accreditation.
The decision rule applicable to this laboratory is available on request.
Sample preparation may require filtration, dilution, digestion or similar. Final results are reported accordingly.
Where the laboratory has undertaken the sampling, the location of sampling and sampling plan are available on request. Talbot is guided by the National Standards SANS 5667-1:2008 Part 1 Guidance on the Design of Sampling Programmes and Sampling Techniques and SANS 5667-3:2008 Part 3 Guidance on the Preservation and Handling of Water Samples.

Customers to contact Talbot Laboratories for further information.

Uncertainty of measurement

Talbot Laboratories' Uncertainty of Measurement (UoM) values are:

- Identified for relevant tests.
- Calculated as a percentage of the respective results.
- Applicable to total, dissolved and acid soluble metals for ICP element analyses.
- Available upon request.

Analysis explanatory notes

Tests may be marked as follows:

^	Tests conducted at our Pretoria satellite laboratory (1 Sydney Brenner St, Lynwood, Pretoria, 0087).
*	Tests not included in our Schedule of Accreditation and therefore that are not SANAS accredited.
#	Tests that have been sub-contracted to a peer laboratory.
NR	Not required -shown, for example, where the schedule of analysis varied between samples.
σ	ISO 9001 Certified testing.
a	Testing has deviated from Method.

End of Report

APPENDIX C: DISCLAIMER AND DECLARATION OF INDEPENDENCE

The opinions expressed in this report have been based on site /project information supplied to GCS (Pty) Ltd (GCS) by [client] (Pty) Ltd and are based on public domain data, field data and data supplied to GCS by the direct client and end client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the site conditions, and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

APPENDIX D: DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Hydrological Assessment for the Proposed 750MW Combined Cycle Gas Turbine Power Plant in Richards Bay

SPECIALIST INFORMATION

Specialist Company Name:	GCS Environmental SA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:	Chané Pretorius			
Specialist Qualifications:	MSc Environmental Sciences (Hydrology & Geohydrology) BSc Hons. Environmental Sciences (Hydrology & Geohydrology) BSc. Geology and Botany			
Professional affiliation/registration:	Cert Sci Nat 136692			
Physical address:	8 Sand Ash Street, Rangeview, Krugersdorp			
Postal address:				
Postal code:	1739	Cell:	074 461 1713	
Telephone:	N/A	Fax:	N/A	
E-mail:	chane@gcs-sa.biz			

Specialist Company Name:	GCS Environmental SA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:				
Specialist Qualifications:				
Professional affiliation/registration:				
Physical address:				
Postal address:				
Postal code:		Cell:		
Telephone:		Fax:		
E-mail:				

DECLARATION BY THE SPECIALIST

I, Chané Pretorius, declare that –

- 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 favourable 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 concerning 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 realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

GCS

Name of Company:

18 March 2026

Date

APPENDIX E: CV'S OF SPECIALIST TEAM

Chané Pretorius

Project Hydrologist

PROFILE

As a Project Hydrologist at GCS Water and Environmental, I specialise in providing comprehensive hydrological assessments and innovative solutions for water-related challenges. My expertise encompasses hydrological modelling, stormwater management, and water balance analysis, ensuring sustainable water resource planning and management. Driven by a passion for environmental stewardship and a commitment to excellence, I work closely with multidisciplinary teams to deliver data-driven insights and actionable strategies tailored to clients' specific needs.

ACADEMIC BACKGROUND

B.Sc. Environmental Sciences with Geology and Botany 2016
North-West University

B.Sc. (Hons) Environmental Sciences with Hydrology and Geohydrology 2018
North-West University

M.Sc. Environmental Sciences with Hydrology and Geohydrology 2023
North-West University

CORE SKILLS

- Project Management
- Hydrological Assessment
- Groundwater impact and risk assessment
- Hydrological and flood line modelling
- Stormwater Management
- Water Balance Studies
- WC/WDM Strategies
- GIS and Mapping
- Data Analyses
- Computer literacy
- Technical report writing

LANGUAGE

- English (Fluent)
- Afrikaans (Home language)

EXPERTISE

- Project Management of hydrological projects for mining, industrial and renewable energy industries.
- Hydrological Assessment including
  - Flood Lines
  - Stormwater Management Plans
  - Water and Salt Balances
  - Water Conservation and Water Demand Management Plans
- Hydrological modelling includes:
  - PCSWMM
  - EPA SWMM
  - HEC-RAS
  - HEC-HMS

PROFESSIONAL MEMBERSHIPS

- SACNASP: Certified Natural Scientist (Cert.Sci.Nat) No. 136692

PROFESSIONAL ASSOCIATIONS

UPSKILLING

- PCSWMM Workshop (2023)

COUNTRIES WORKED IN

- South Africa
- Botswana
- Zimbabwe

WORK EXPERIENCE

REC Services **Mar 2021 – Sep 2021**

Environmental and Water Use License Consultant

Roles and responsibilities:

- Compilations of Water Use License Applications for submission to the Department of Water and Sanitation and online submissions of WULAs on the e-WULAAS system.
- Compilation of Environmental Management Plan reports for projects requiring exemption from Environmental Authorisation.
- Liaison between clients and DWS.
- Conducting site visits with clients and DWS.
- GIS Mapping.

iWULA Water Management Specialists **Sep 2021 – Apr 2022**

Water Use License Consultant

Roles and responsibilities:

- Compiling all gathered information into Water Use License Applications reports on a contractor basis.

GCS Water and Environmental **Mar 2023 – Oct 2024**

Hydrologist

Roles and responsibilities:

- Compilation of Hydrological and Geohydrological assessments for EIA and WULAs.
- Design stormwater management plans, water conservation, and water demand management plans.
- Compilation of water balance studies.

GCS Water and Environmental **Nov 2024 – present**

Project Hydrologist

Roles and responsibilities:

- Project management of hydrological assessments.
- Technical compilation and review of hydrological assessments.
- Design of stormwater management plans and water conservation and water demand management plans.
- Compilation of water balance studies.