Tronox KZN Sands (Pty) Ltd

PORT DURNFORD OPENCAST MINING DEVELOPMENT PROJECT (PHASE 1)

Integrated Water and Waste Management Plan

41106008-REP-00005
APRIL 2025

CONFIDENTIAL

Tronox KZN Sands (Pty) Ltd

PORT DURNFORD OPENCAST MINING DEVELOPMENT PROJECT (PHASE 1)

Integrated Water and Waste Management Plan

REPORT (DRAFT FOR PUBLIC) CONFIDENTIAL

PROJECT NO. 41106008

OUR REF. NO. 41106008-REP-00005

DATE: APRIL 2025

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EXECUTIVE SUMMARY

Tronox KZN Sands (Pty) Ltd (Tronox) currently operates the Fairbreeze mine where heavy mineral sands are mined south-west of Mtunzini in the greater Richards Bay area. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter (collectively known as the Central Processing Complex (CPC) in the Empangeni area. Tronox's previous mining operation, Hillendale is currently in the mine closure phase.

Tronox holds a Prospecting Right (PR) issued by the Department of Mineral Resources and Energy (DMRE) Reference: KZN 30/5/1/1/2/296 PR in respect of ilmenite, rutile and zirkon on the farms measuring 843.72 hectares in extent in the uMlalazi and uMhlathuze Local Municipalities, KwaZulu-Natal province (the Waterloo PR), which was renewed by the DMRE pursuant to section 18 of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA).

Historically, Tronox held the following two PRs in terms of section 17 of the MPRDA:

- DMRE Ref: KZN 30/5/1/1/2/10708 PR (formerly 771 PR) in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 3 945.95 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal province (the Port Durnford PR); and
- DMRE Ref: KZN 30/5/1/1/2/279 PR in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 258.27 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal province (the Penarrow PR).

It is intended that the Heavy Mineral Concentrate (HMC) produced at Port Durnford will be used to replace Fairbreeze's mine commitments to the MSP and to the Empangeni Smelter. Tronox Port Durnford Mining (Pty) Ltd. ("Port Dunford Mining") is a subsidiary of Tronox that will operate the Port Durnford Mine.

The mineral suite in the Port Durnford ore body closely matches that of the Fairbreeze ore bodies, with all previous test work showing that Port Durnford mineral products would effectively be a 'like for like' replacement for Fairbreeze mineral products.

It is proposed that the mining activities will be undertaken in two phases:

- Phase 1: a low-rate mining operation at approximately 70 400 tons per annum (tpa) for approximately 10 years from 2025 to 2035. It is anticipated that the mining operations will increase in throughput after 2035; and
- Phase 2 (Full Scale): an operation with a mining rate of 3 000 tons per hour (tph) which will operate until close of mine in 2069.

This Water Use License Application (WULA) is seeking to apply for authorisation for water uses triggered in Phase 1 (listed above) only.

Mining for Phase 1 will operate at a rate of 100 tph, 70 400 tpa and active mining will take place five (5) days a week per month, for 12 hours a day.

The run-of-mine (ROM) material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. ROM will be transported to Fairbreeze mine by truck on public roads (the R102 and N2) for further processing.

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) defines water use in Section 21 and these water uses relate to the consumption of water, as well as activities which may affect water quality and the condition of the resource itself. The water uses that are applicable to this project include:

- Section 21 (c): Impeding or diverting the flow of a watercourse and Section 21 (i): Altering the bed, banks, course or characteristics of a watercourse:
  - Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland); and
  - Proximity of conservancy tanks within the regulated area of a watercourse (seep wetland).
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource:
  - Two conservancy tanks located at the Port Durnford laydown yard.

None of the Phase 1 activities require exemption in terms of Government Notice 704 (GN R.704).

The primary water uses on site will be dust suppression and site water needs. This water will be supplied by the municipality. It is anticipated that 4 800 m^3 per annum of water will be required during Phase 1.

The following waste streams have been identified for the project:

- Sewage waste which will be contained in the conservancy tanks;
- Hazardous waste such as oil, diesel & grease; and
- General waste which is limited to domestic and commercial waste.

No waste stockpiles or dams containing waste will be generated from this project.

This document serves as the technical report for submission to the Department of Water and Sanitation (DWS) for the authorisation of water uses triggered by the proposed project. As there are waste related uses associated with the proposed development, this report has been structured in line with the approved Integrated Water and Waste Management Plan (IWWMP) Operational Guideline compiled by the DWS.

This IWWMP document includes the operations proposed to be undertaken at Port Durnford Phase 1. The main purpose of this IWWMP is to consolidate all the various site-specific activities such as water balances, storm water management, water reuse, water conservation, waste minimisation and recycling into a simple implementable management plan.

The IWWMP is therefore a living document that will be revised and updated throughout the life of the operation and as per the proposed WUL conditions to accommodate additional information and improved technologies. These will ensure that water and waste management is continually optimised and adapted to the changing needs of the mine and the Water Management Area.

ACRONYMS AND ABBREVIATIONS

Abbreviation	Description
CPC	Central Processing Complex
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ELWU	Existing lawful water use
GN R.704	Government Notice No. 704 of 4 June 1999
ha	hectares
HMC	Heavy Mineral Concentrate
IWWMP	Integrated Water and Waste Management Plan
KZN	KwaZulu-Natal
LOM	Life of Mine
MAE	Mean Annual Evaporation
MAR	Mean Annual Runoff
MAP	Mean Annual Precipitation
mbgl	Meters below ground level
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
MR	Mining Right
MSP	Mineral Separation Plant
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NWA	National Water Act, 1998 (Act 36 of 1998)
OH&S	Occupational Health and Safety
PES	Present Ecological State
Phalane	iNkosi Phalane Community Trust.
RD	Registration Division

Abbreviation	Description
REC	Recommended Ecological Category
ROM	Run of Mine
RQO	Resource Quality Objectives
SHERQ	Safety, Health, Environment, Radiation and Quality
S&EIR	Scoping and Environmental Impact Reporting
Tronox	Tronox KZN Sands (Pty) Ltd
WMA	Water Management Area
WSP	WSP Group Africa (Pty) Ltd
WUL	Water Use Licence
WULA	Water Use License Application

1 INTRODUCTION

1.1 ACTIVITY BACKGROUND

Tronox KZN Sands (Pty) Ltd (Tronox) currently operates the Fairbreeze mine where heavy mineral sands are mined south-west of Mtunzini in the greater Richards Bay area. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter (collectively known as the Central Processing Complex (CPC) in the Empangeni area. Tronox's previous mining operation, Hillendale is currently in the mine closure phase.

Tronox holds a Prospecting Right (PR) issued by the Department of Mineral Resources and Energy (DMRE) Reference: KZN 30/5/1/1/2/296 PR in respect of ilmenite, rutile and zirkon on the farms measuring 843.72 hectares in extent in the uMlalazi and uMhlathuze Local Municipalities, KwaZulu-Natal province (the Waterloo PR), which was renewed by the DMRE pursuant to section 18 of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA).

Historically, Tronox held the following two PRs in terms of section 17 of the MPRDA:

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- DMRE Ref: KZN 30/5/1/1/2/279 PR in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 258.27 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal province (the Penarrow PR).

It is intended that the Heavy Mineral Concentrate (HMC) produced at Port Durnford will be used to replace Fairbreeze's mine commitments to the MSP and to the Empangeni Smelter. Tronox Port Durnford Mining (Pty) Ltd. ("Port Dunford Mining") is a subsidiary of Tronox that will operate the Port Durnford Mine.

The mineral suite in the Port Durnford ore body closely matches that of the Fairbreeze ore bodies, with all previous test work showing that Port Durnford mineral products would effectively be a 'like for like' replacement for Fairbreeze mineral products.

It is proposed that the mining activities will be undertaken in two phases:

- Phase 1: a low-rate mining operation at approximately 70 400 tons per annum (tpa) for approximately 10 years from 2025 to 2035. It is anticipated that the mining operations will increase in throughput after 2035; and
- Phase 2 (Full Scale): an operation with a mining rate of 3 000 tons per hour (tph) which will operate until close of mine in 2069.

This Water Use License Application (WULA) is seeking to apply for authorisation for water uses triggered in Phase 1 only.

1.2 CONTACT DETAILS

The contact details for the responsible personnel at Tronox is indicated in Table 1-1.

Table 1-1 - Contact Details

Area of Responsibility	Contact Details
Company Name	Tronox KZN Sands (Pty) Ltd.
Commodity	Sand Mining
Company Registered Address	R34 Melmoth Road, Empangeni, KwaZulu-Natal
Company Postal Address	Private Bag X20010, Empangeni, 3880
Telephone Number (General)	+27 35 902 7000
Person Responsible for IWWMP Implementation	
Name	Isaac Ndhlazi
Telephone Number	+27 35 902 7364
e-mail address	Isaac.Ndhlazi@tronox.com

1.3 REGIONAL SETTING AND LOCATION OF ACTIVITY

The proposed mine (Phase 1) is situated near Port Durnford, in the uMhlathuze Local Municipality within the King Cetshwayo District Municipality, KwaZulu-Natal Province (Figure 1-1).

1.4 PROPERTY DESCRIPTION

The Phase 1 mining operations will be situated on the farm Richard 16802 GU registration division (RD), Remainder portion. The details of the property on which the water uses occur can be seen in Table 1-2 and shown in Figure 1-2.

This land is currently under commercial forestry, leased by Mondi, owned by the iNkosi Phalane (Phalane) Community Trust.

Table 1-2 - Properties applicable to the Phase 1 project

Farm name & portion	SG Code	Property owner	Size (Ha)	Title deed number
Richard 16802 GU Portion 0	N0GU00000001680200000	Phalane Community Trust-Trustees	1195.2658	T30424/2018

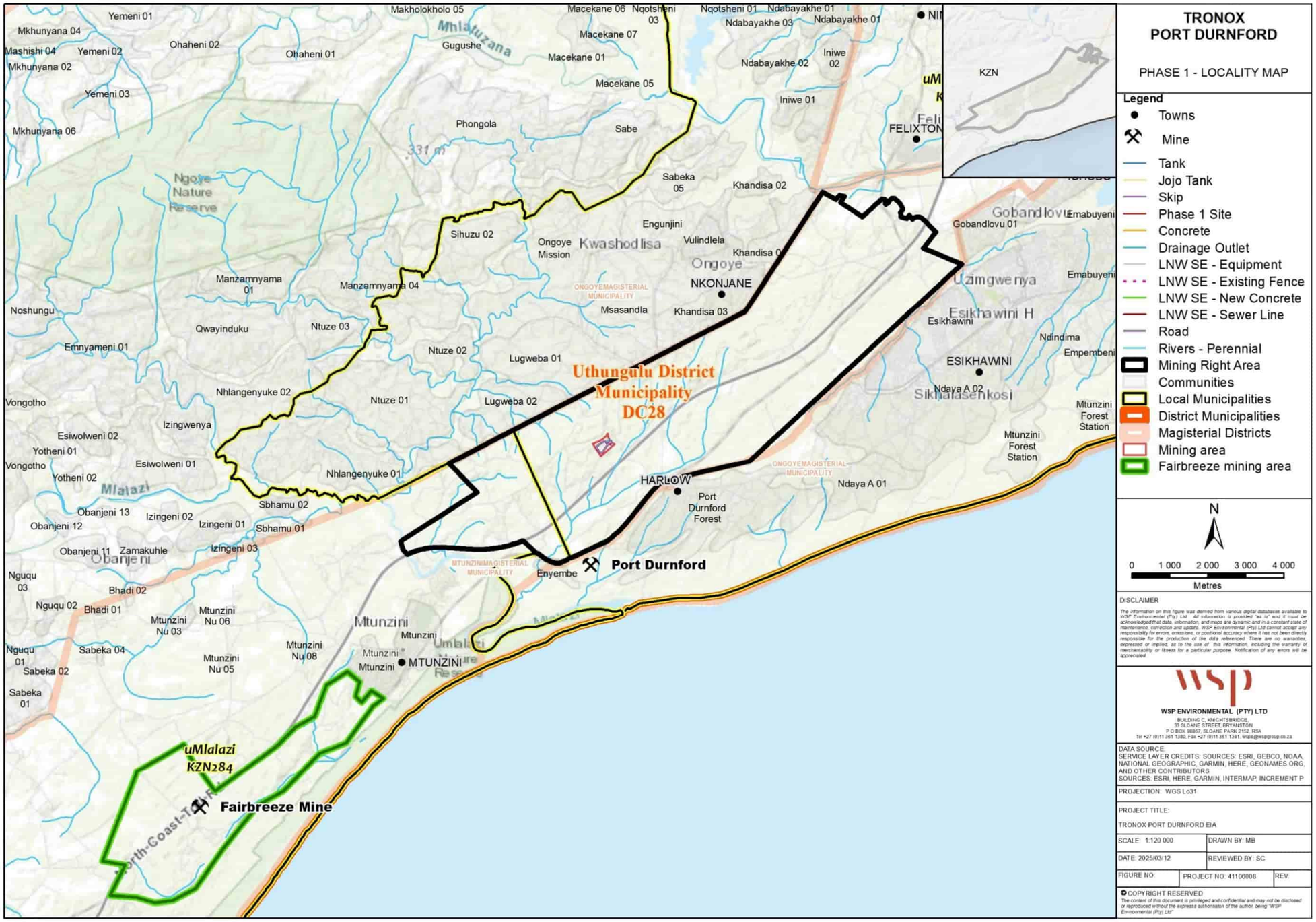


Figure 1-1 - Locality of the Port Durnford Phase 1 project

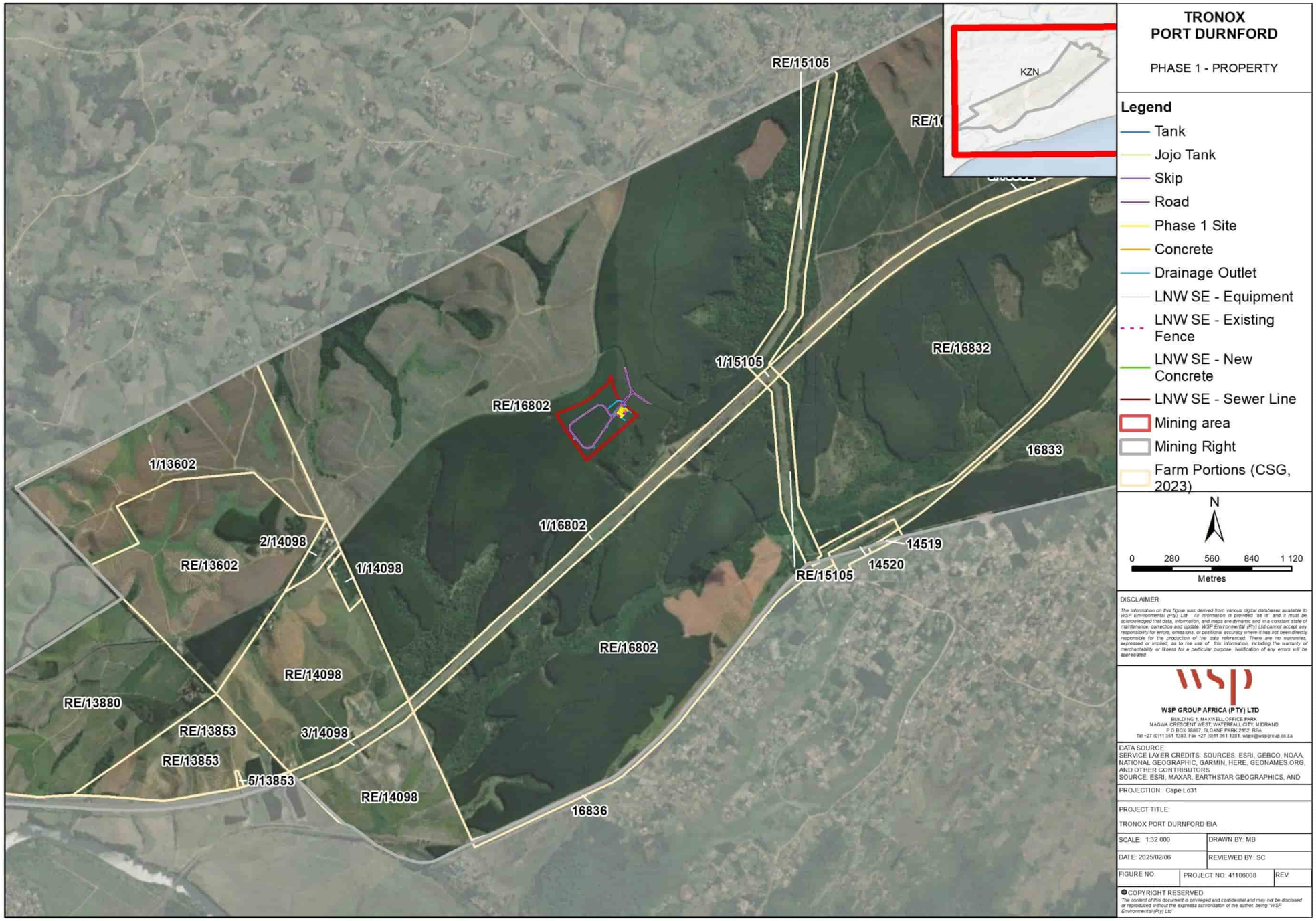


Figure 1-2 - Property Map for the Port Durnford Phase 1 project

1.5 PURPOSE OF IWWMP

This document serves as the technical report to motivate the authorisation of the water uses triggered by the Port Durnford Phase 1 project. As there are waste related uses associated with the proposed development, this report has been structured in line with the approved Integrated Water and Waste Management Plan (IWWMP) Operational Guideline compiled by the Department of Water and Sanitation (DWS).

Although the requirement for the compilation of an IWWMP was originally aimed at collating and rationalising the information submitted for a WULA, it has progressed and provides the following additional functions:

- Provide the regulatory authorities with focused and structured information not only to meet their general information needs, but also to articulate the required management measures and actions to achieve the water and waste related performance on an on-going basis; and
- Provide direction and guidance to the operation on water and waste management of any activity.

The guideline should be used in conjunction with other guidelines as developed by the DWS, such as the published Government Gazette 40713 Regulation no 267, dated 24 March 2017 (GN R.267).

The purpose of this IWWMP is as follows:

- The compilation of a site specific, implementable, management plan addressing all the identified water use and waste management related aspects (e.g. process water balances, storm water management, groundwater management, water reuse and reclamation, water conservation and demand management, waste minimisation and recycling) of a specific activity, in order to meet set goals and objectives, in accordance with Integrated Water Resource Management Principles; and
- The provision of a management plan to guide the operation regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term.

2 CONTEXTUALISATION OF ACTIVITY

2.1 DESCRIPTION OF ACTIVITY

Tronox's existing Fairbreeze operation will conclude its life of mine in 2037. As the mineral suite in the Port Durnford ore body closely matches that of the Fairbreeze ore bodies, with all previous test work showing that Port Durnford mineral products would effectively be a 'like for like' replacement for Fairbreeze mineral products.

The proposed project at Port Durnford is for the mining of heavy minerals (general), Garnet (Abrasive), Kyanite, Leucoxene (heavy mineral), Monazite (heavy mineral), Rutile (heavy mineral), Silica Sand and Zirconium ore which are used to produce:

- Titanium dioxide (TiO_2) pigment which is used in paints, plastics, paper laminates, ink and the food market;
- Titanium metal;
- Welding consumables;

- Titanium feedstocks used in the manufacture of brake pads, roof tiles and in the glass industry; and
- Zircon used for the manufacturing of ceramics, foundry, refractory, zirconia and other zircon chemicals.

It is proposed that the mining activities will be undertaken in two phases:

- Phase 1: a low-rate mining operation at approximately 70 400 tpa for approximately 10 years from 2025 to 2035. It is anticipated that the mining operations will increase in throughput after 2035; and
- Phase 2 (Full Scale): an operation with a mining rate of 3 000 tph which will operate until close of mine in 2069.

This WULA is seeking to apply for authorisation for water uses triggered in Phase 1 only.

2.2 EXTENT OF ACTIVITY

The IWWMP is developed to cover Phase 1 of the project's entire area of operations in order to manage all water and waste issues on site. Refer to Figure 2-1 for a map indicating the extent of the Port Durnford Phase 1 project. Phase 1 will have mining footprint of 14 ha and the pit will be 8-10m deep.

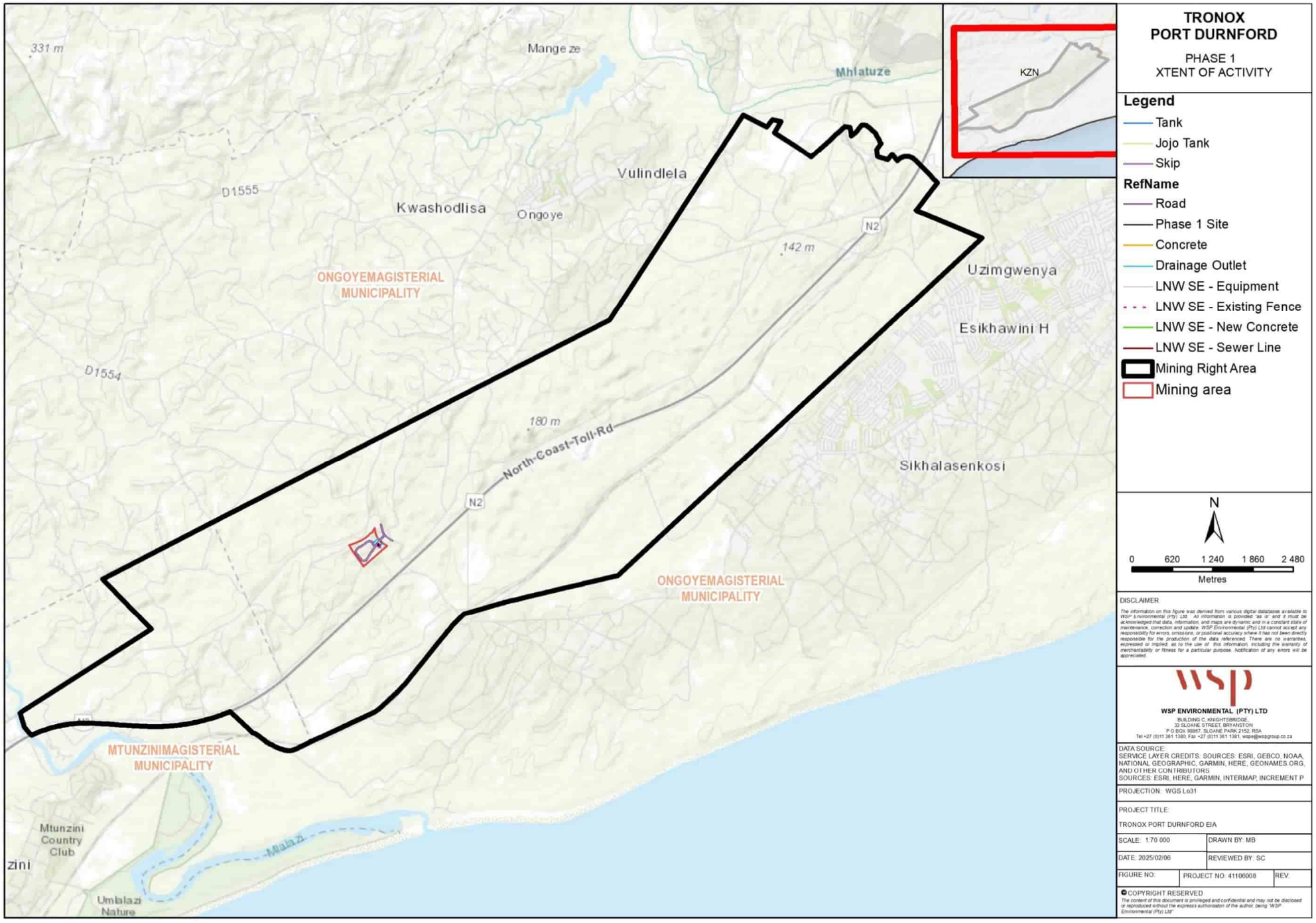


Figure 2-1 - Extent of the Port Durnford Phase 1 project

2.3 KEY ACTIVITY RELATED PROCESSES AND PRODUCTS

Mining for Phase 1 will operate at a rate of 100 tph, 70 400 tpa and active mining will take place five (5) days a week per month, for 12 hours a day.

The run-of-mine (ROM) material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. ROM will be transported to Fairbreeze mine by truck on public roads (the R102 and N2) for further processing. It is expected that 4 x 30-ton (t) trucks will be used to transport the mined material from Port Durnford to Fairbreeze Mine. It is anticipated that 9 truck cycles will be used per day for the 5 days each month that the site is being actively mined.

The mined-out ore bodies at Fairbreeze mine will be used for pit infill from the Port Durnford Phase 1 operation for the first 10 years of mining. The hydraulic mining process at the Fairbreeze mine will continue as per current practice at Fairbreeze, to process the stockpiled material. Hydraulically reclaimed ROM slurry will be pumped to the existing Fairbreeze PWP for processing.

The processed material will then be trucked to the existing MSP located at the CPC in Empangeni as part of the Fairbreeze product. Figure 2-2 illustrates the process flow during Phase 1 operations.

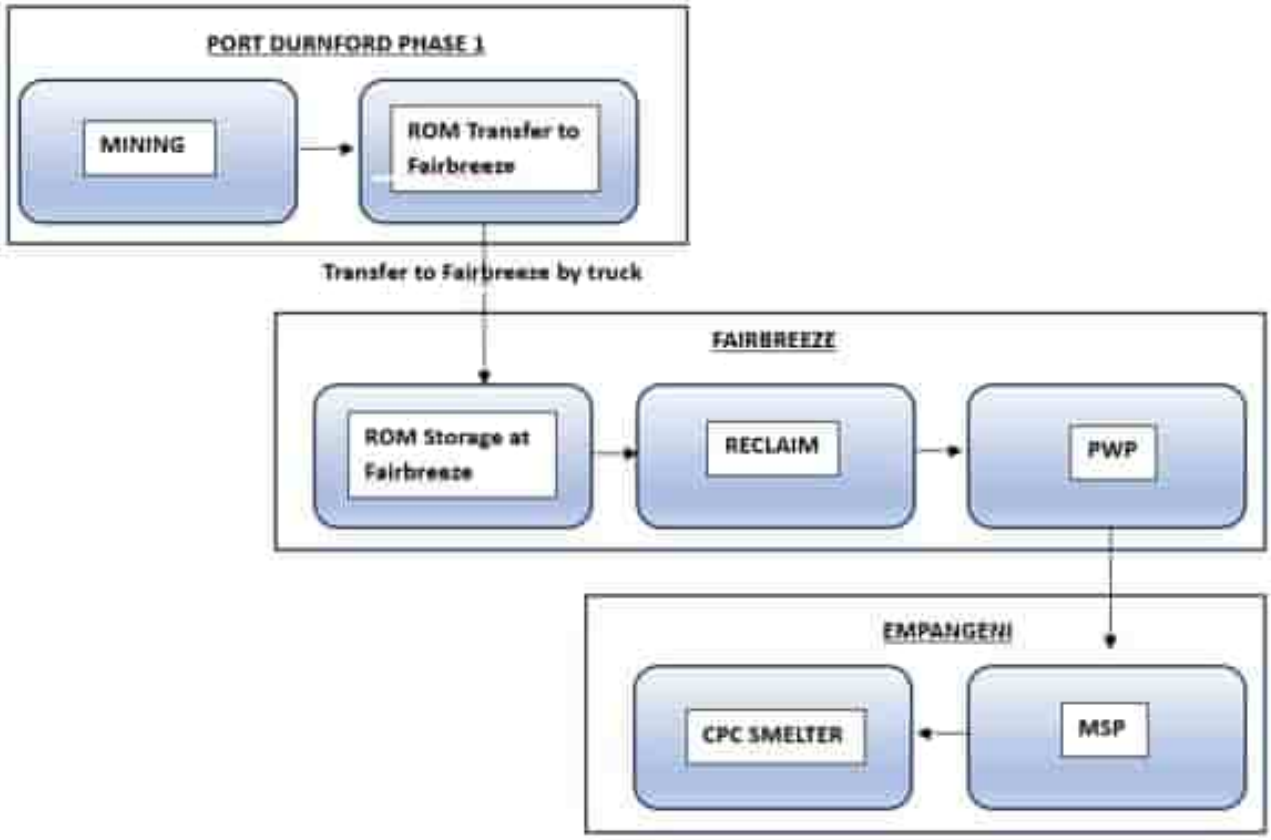


Figure 2-2 - Phase 1 Process flow diagram

2.4 ACTIVITY LIFE DESCRIPTION

Phase 1 will be a low-rate mining operation at approximately 70 400 tpa for approximately 10 years from 2025 to 2035. It is anticipated that the mining operations will increase in throughput after 2035.

2.5 ACTIVITY INFRASTRUCTURE DESCRIPTION

The following infrastructure will be required on the Port Durnford Phase 1 mining site (Figure 2-3):

- Conservancy tank system – 2 x 6000 Litres (L) JoJo tanks placed underground;
- Mining equipment parking area (Gravel with 2 x layers & insitu);
- Workshop laydown area (Concrete stand with 2 x steel containers);
- Water storage tanks (2 x 10kL tanks);
- Internal water reticulation (Reticulation to offices & ablutions);
- Container offices and ablutions and septic tank (2 x 12m units & 1 x 9m unit);
- Internal electrical reticulation [Estimated After Diversity Maximum Demand (ADMD) to be 14.7kW];
- External lighting;
- Light Duty Vehicle (LDV) parking area (1 x G6 layer with RIP & compacted base);
- Guard house (Concrete stand with 1 x steel container);
- Security fence (2.1m high fence & 1.2m parameter fence);
- A gravel access road (200m access road) to connect the laydown yard to the District Road which connects to the R102;
- A general and hazardous waste storage area; and
- Fuel and lubricant storage: Fuel tanks will be supported on a concrete surface bed with edge thickenings. A concrete bund wall will be constructed surrounding the fuel tanks. It is anticipated that a 23 m^3 storage tank will be provided and it is estimated that 153 422L will be utilised per annum.

This laydown yard for Phase 1 will have no hard stand stockpile area. The mined material will be transported straight to Fairbreeze.

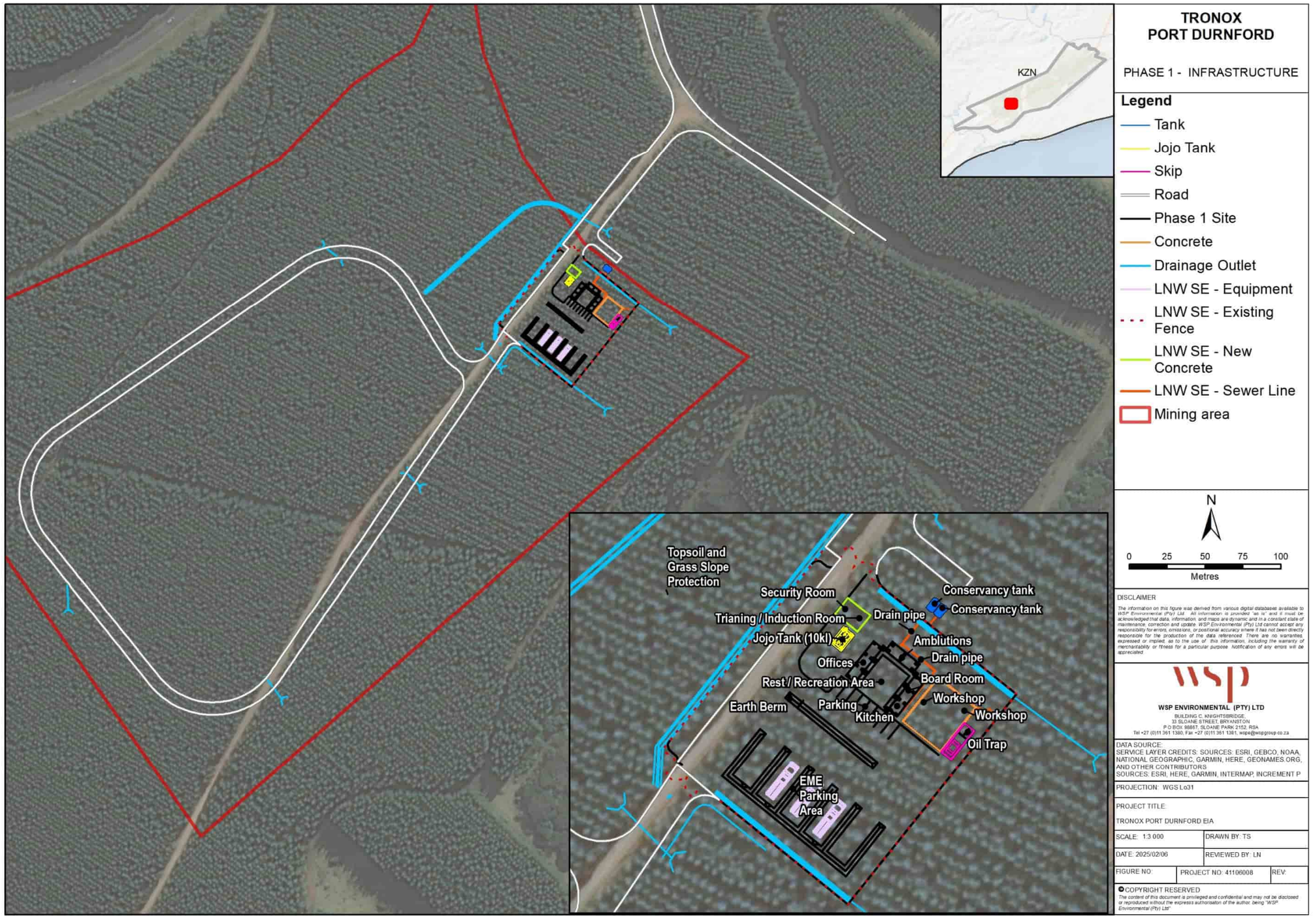


Figure 2-3 – Port Durnford Phase 1 infrastructure layout

2.6 KEY WATER USES AND WASTE STREAMS

2.6.1 WATER USES

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) defines water use in Section 21 and these water uses relate to the consumption of water, as well as activities which may affect water quality and the condition of the resource itself. The water uses that are applicable to this project include:

- Section 21 (c): Impeding or diverting the flow of a watercourse:
  - Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland); and
  - Proximity of conservancy tanks within the regulated area of a watercourse (seep wetland).
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource:
  - Two conservancy tanks located at the Port Durnford laydown yard.
- Section 21 (i): Altering the bed, banks, course or characteristics of a watercourse:
  - Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland); and
  - Proximity of conservancy tanks within the regulated area of a watercourse (seep wetland).

The primary water uses on site will be dust suppression and site water needs. This water will be supplied by the municipality. It is anticipated that 4 800 m^3 per annum of water will be required during Phase 1.

Refer to Section 3.5 for a detailed summary of the proposed water uses being applied for.

2.6.2 WASTE STREAMS

The following waste streams have been identified for the project:

- Sewage waste which will be contained in the conservancy tanks;
- Hazardous waste such as oil, diesel & grease; and
- General waste which is limited to domestic and commercial waste.

No waste stockpiles or dams containing waste will be generated from this project.

Refer to Section 5.2 of this report for more details pertaining to the waste generated on site and the management thereof.

2.7 ORGANISATIONAL STRUCTURE OF ACTIVITY

The organisational structure for Tronox at Port Durnford (Phase 1) can be seen in Figure 2-4.

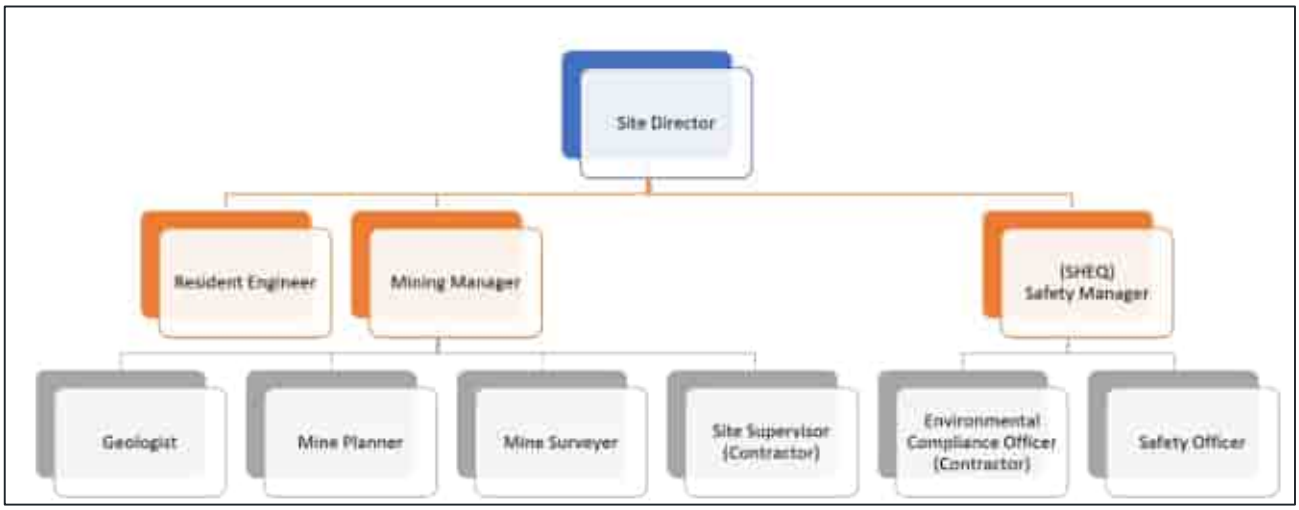


Figure 2-4 - Organisational Structure

2.8 BUSINESS AND CORPORATE POLICIES

Tronox has an existing policy that addresses the safety, health, environmental, radiation and quality (SHERQ) aspects (CPDOC-39-290) (March 2024).

Tronox is committed to:

- The protection and sustainability of the environment;
- The prevention of injury, occupational health incidents, environmental pollution, radioactive contamination; and
- Ensuring of customer and stakeholder satisfaction.

To fulfil this commitment, Tronox shall sustainably:

- Maintain and regularly review the ISO 45001: 2018 Occupational Health and Safety (OH&S) Management System, ISO 14001:2015 Environment Management System, ISO 9001:2015 Quality Management System and ISO 17025:2017 Laboratory Management System.
- Comply with applicable South African & other legislation and other requirements.
- Adhere to RD-005 requirements (NNR Regulatory document).
- Openly communicate the company's SHERQ policy, goals and performance to all employees, long term contractors and the neighbouring communities. This information is available upon request to all interested and affected parties.
- Ensure consultation and participation of workers, and where they exist workers representatives.
- Conduct internal audits and inspections to monitor compliance to the SHERQ management systems and standards.
- Investigate SHERQ incidents to determine the causes and to take corrective action to prevent recurrences.
- Identify SHE hazards/aspects and risks/impacts and implement mitigating measures to eliminate hazards and reduce OH&S risks, as far as reasonably practicable.
- Implement the Tronox Global Process Safety management (PSM) Standard to reduce exposure to process safety risks
- Ensure that adequate resources and infrastructure are provided by management to mitigate risks and impacts.

- Continually review and improve the SHERQ management systems and objectives for suitability, adequacy and overall effectiveness.
- Identify and provide relevant SHERQ training and awareness.
- Apply the Tronox values in our approach to SHERQ.
- Conduct quality assurance checks and produce product according to specifications that describe the criteria for acceptance.
- Continually align the Quality Management system with customer requirements.
- Ensure that public and occupational radiation doses are kept as low as reasonably achievable.
- Implement health commitments in the Tronox integrated health policy.
- Implement energy saving and conservation programmes to minimize our carbon footprint.

3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

3.1 SUMMARY OF ALL WATER USES

To date, no water use licences (WULs) have been issued for this project. The following water uses for this project include:

- Section 21 (c) and (i): Proximity of mining area and related infrastructure as well as conservancy tanks to the regulated area of a watercourse; and
- Section 21 (g): Two conservancy tanks located at the Port Durnford laydown yard.

3.2 EXISTING LAWFUL WATER USES

In terms of Section 32 of the NWA, an existing lawful water use (ELWU) is defined as follows:

"Water use which has taken place at any time during a period of two years immediately before the date of commencement of the Act (1 October 1996 to 30 September 1998) and which was authorised by or under any law which was in force immediately before the date of commencement of this Act, or which has been declared an existing lawful water use in terms of Section 33 of the Act".

No ELWU is applicable to this project.

3.3 RELEVANT EXEMPTIONS

The Government Notice 704 (GN R.704) regulations were developed to enable the DWS to enforce the requirements of the NWA, thereby protecting the nation's water resources. Specific attention is drawn to the following regulations:

Section 26(1) of the NWA makes provision for the Minister of DWS to make regulations to control, monitor, modify or prohibit various practices related to water use. GN R.704 was promulgated by the Minister on 4 June 1999 in Government Gazette vol. 408, No. 20119. The GN R.704 Regulations were published in terms of Section 26(1), (b), (g) and (i) of the NWA and pertain specifically to water uses for mining and related activities; and

Section 3 of GN R.704 makes provision for exemption from the requirements of the GN R.704 schedules. This exemption will only be granted if the mine can prove that they have implemented measures according to the best practice guidelines and regulations that will ensure the protection of the water resources at all times.

Refer to Table 3-1 for an assessment of the relevant listed activities under GN R.704 applicable for the Port Durnford Phase 1 project. No application for GN R.704 is relevant to this project.

Table 3-1 - Government Notice 704 assessment for Port Durnford Phase 1

Schedule	Description of Requirement	Assessment Finding
4	No person in control of a mine or activity may-	
4 a	Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100-year floodline or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of ground water, or on ground likely to become water-logged, undermined, unstable or cracked	Not applicable
4 b	No opencast mining, prospecting or any other operation or activity under or within the 1:50 year floodline or within a horizontal distance of 100 m from any watercourse	Comply with condition
4 c	No placement or disposal of any residue or substance which causes or is likely to cause pollution of a water resource, in the underground workings or opencast excavation.	Comply with condition
4 d	Locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution within the 1:50 year floodline of any watercourse	Comply with condition
5	May not use any residue or substance which causes or is likely to cause pollution of water resource for the construction of any dam or other impoundment or any embankment, road or railway or for any other purpose which is likely to cause pollution of a water resource	Comply with condition
6 a	Any unpolluted water must be confined to a clean water system, away from any dirty area	Comply with condition
6 b	Clean water systems must be designed, constructed, maintained and operated so that it is not likely to spill into any dirty water system more than once in 50 years	Comply with condition
6 c	Water arising within any dirty area must be collected, including water seeping from mining operations, outcrops or any other activity, into a dirty water system	Comply with condition
6 d	Any dirty water systems must be designed, constructed, maintained and operated so that it is not likely to spill into any clean water system more than once in 50 years	Comply with condition

Schedule	Description of Requirement	Assessment Finding
6 e	Dams and tailings storages which form part of the dirty water system must be designed, constructed, maintained and operated with a minimum freeboard of 0.8 m above full supply level, unless otherwise agreed with DWS with respect to the dam safety regulations.	Not applicable
6 f	Water systems shall be designed, constructed and maintained to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.	Comply with condition
7 a	Prevent water containing waste or any substance which causes or is likely to cause pollution of water resource from entering any water resource, either by natural flow or by seepage and retain or collect such water for use, reuse, evaporation or for purification and disposal.	Comply with condition
7 b	Design, modify, locate, construct and maintain all water systems, including residue deposits, in any area so as to prevent the pollution of any water resource through the operation or use thereof.	Comply with condition
7 c	Cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings.	Comply with condition
7 d	Design, modify, construct, maintain and use any dam or any residue deposit or stockpile used for the disposal or storage of mineral slimes, so that the water or waste therein will not result in the failure thereof or impair its stability.	Not applicable
7 e	Prevent the erosion or leaching of materials from any residue deposit or stockpile and contain material or substances so eroded or leached in by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources.	Not applicable
7 f	Ensure that water used in any process at the mine is recycled as far as practicable, and any facility, sump, pumping installation, catchment dam or other impoundment used for recycling water is of adequate design and capacity to prevent the spillage, seepage or release of water containing waste at any time.	Not applicable
7 g	Keep any water system free from any matter or obstruction which may affect the efficiency thereof.	Comply with condition

Schedule	Description of Requirement	Assessment Finding
7 h	Every person in control of a mine or activity must take reasonable measures to cause all domestic waste, including wash-water, which cannot be disposed of in a municipal sewage system, to be disposed of in terms of an authorisation under the Act.	Comply with condition
8 a	Any impoundment or dam containing any poisonous, toxic or injurious substance must be effectively fenced-off to restrict access thereto and must have warning notice boards at prominent locations to warn persons of the hazardous contents thereof.	Not applicable
8 b	Access control in any area used for stockpiling or disposal of any residue or substance which causes, has caused or is likely to cause pollution of water resource is required to protect any measures taken in terms of this regulation.	Not applicable
8 c	The mine shall not allow the area contemplated in 8 a) and b) above to be used for any other purpose, if such use causes or is likely to cause pollution of a water resource.	Not applicable
8 d	The mine must protect any existing pollution control measures or replace any measures deleteriously affected, damaged or destroyed by the removing or reclaiming of materials from any residue deposit or stockpile, and must establish additional measures for the prevention of pollution of a water resource which might occur, is occurring or has occurred as a result of such operations.	Not applicable
9 (1)	Any person in control of a mine or activity must at either temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.	Comply with condition
9 (2)	Any person in control of a mine or activity must ensure that the in-stream and riparian habitat of any water resource, which may have been affected or altered by a mine or activity, is remedied so as to comply with these regulations.	Comply with condition
9 (3)	On either temporary or permanent cessation of a mine or activity the Minister may request a copy of any surface or underground plans as required in terms of the Minerals Act, 1991.	Comply with condition
10	Winning sand and alluvial minerals from a watercourse.	Not applicable

Schedule	Description of Requirement	Assessment Finding
11 a	To ensure all coal residue deposits are compacted to prevent spontaneous combustion and minimise infiltration of water.	Not applicable
11 b	To ensure rehabilitation of coal residue deposits concurrent with mining.	Not applicable

3.4 GENERALLY AUTHORISED WATER USES

In terms of Section 22(1) of the NWA a person may use water without a licence if that water use is permissible in terms of a General Authorisation (GA) issued under Section 39 of the NWA. No GA application is applicable for this project.

At the time of compiling this IWWMP, the following generally authorised notices were in place (Table 3-2).

Table 3-2 - General Authorisations Applicable

Government Notice Reference	Section 21 Water Use Relevant to GA
Government Notice 538 Government Gazette 40243, dated 31 October 2016	Sections 21(a) and 21(b)
Government Notice 4167 Government Gazette 49833, dated 08 December 2023	Sections 21(c) and 21(i)
Government Notice 665 Government Gazette 36820, dated 30 August 2013	Sections 21(e), 21(f), 21(g), 21(h) and 21(j)

3.5 NEW WATER USES TO BE LICENCED

The water uses triggered for Port Durnford Phase 1 project requires authorisation in terms of Section 21 (c), (g), and (i) of the NWA. Refer to Table 3-3 for the water uses being applied for. Refer to Figure 3-1 for the locality of the all the water uses being applied for.

Table 3-3 - New water uses associated with the Port Durnford Phase 1

Section	Water use(s) activities	Purpose	Capacity/ Volume	Property Description	Co-ordinates		
					Polygon point	Latitude	Longitude
Section 21 (c) and (i): Impeding or diverting the flow of water in a watercourse and altering the bed, banks, course or characteristics of a watercourse	Proximity of mining activities within the regulated area	Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland)	Not applicable	Portion 0 of Farm Richard 16802	Point 1	28° 54' 20.880" S	31° 48' 26.640" E
					Point 2	28° 54' 12.240" S	31° 48' 40.896" E
					Point 3	28° 54' 20.952" S	31° 48' 47.916" E
					Point 4	28° 54' 31.284" S	31° 48' 34.668" E
					Centre	28° 54' 22.104" S	31° 48' 37.656" E
	Proximity of conservancy tank 1 within the regulated area	Proximity of conservancy tank 1 to the regulated area of a watercourse (seep wetland)			Start End Centre	28° 54' 18.991" S 28° 54' 19.032" S 28° 54' 19.073" S	31° 48' 44.451" E 31° 48' 44.416" E 31° 48' 44.377" E
	Proximity of conservancy tank 2 within the regulated area	Proximity of conservancy tank 2 to the regulated area of a watercourse (seep wetland)			Start End Centre	28° 54' 19.042" S 28° 54' 19.083" S 28° 54' 19.125" S	31° 48' 44.523" E 31° 48' 44.488" E 31° 48' 44.449" E
Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource	Conservancy tanks	Two conservancy tanks located at the Port Durnford laydown yard	6m^3 each			28° 54' 19.058" S	31° 48' 44.451" E

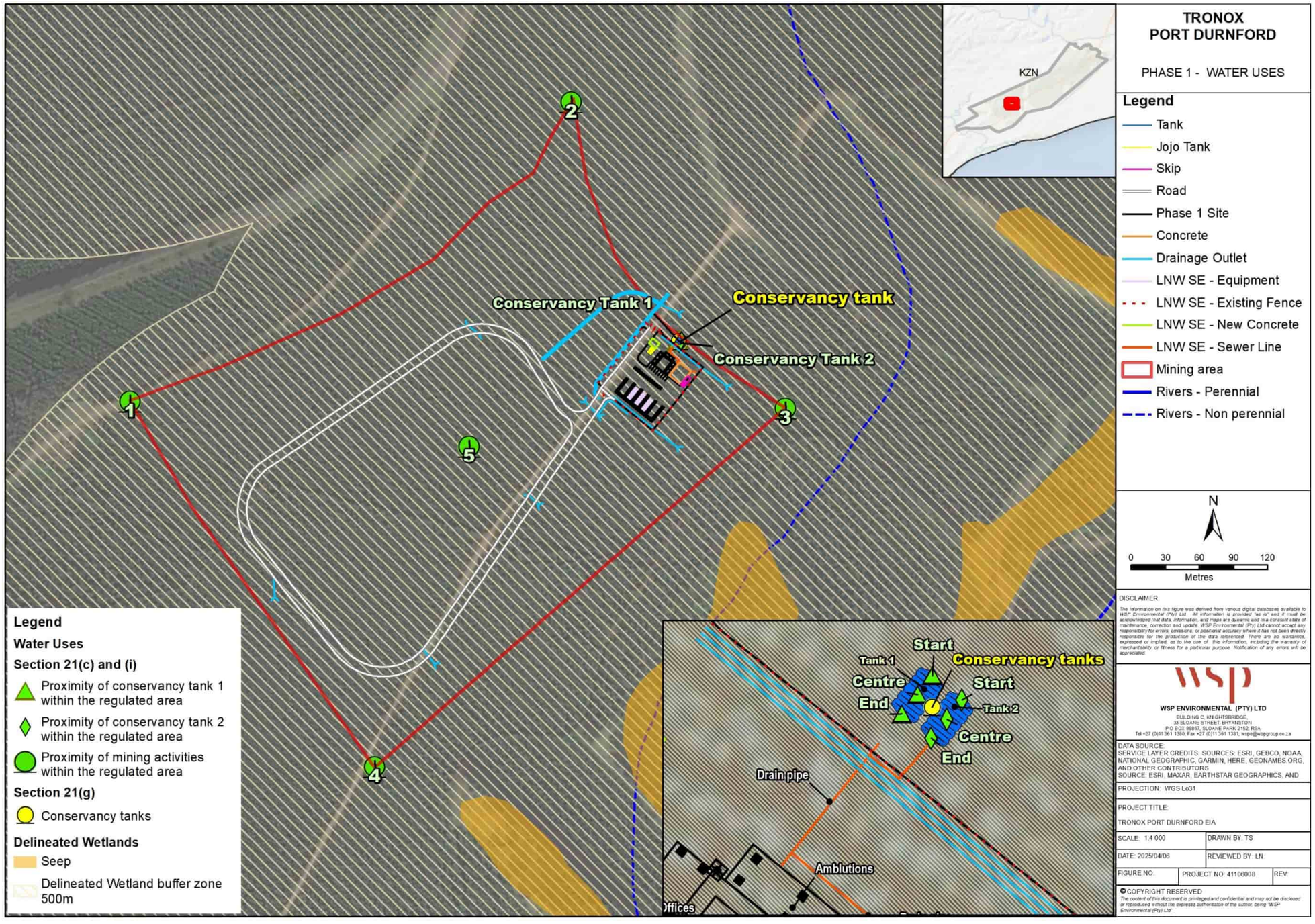


Figure 3-1 - Water use map for new uses

3.6 WASTE MANAGEMENT ACTIVITIES (NEMWA)

No waste management activities as listed in GN R. 718 under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) will be undertaken by Tronox for the Port Durnford Phase 1 project.

3.7 WASTE RELATED AUTHORISATIONS

No waste management activities will be undertaken by the Port Durnford Phase 1 project.

3.8 OTHER AUTHORISATIONS (EIA'S, EMPS, RODS, REGULATIONS)

There are no existing authorisations for this project. Tronox is currently applying for a consolidated mining right area (MRA) for the greater project area and seeking environmental authorisation (EA) to support this.

A full Scoping and Environmental Impact Reporting (S&EIR) Process is required in support of the application for EA for the project. WSP Group Africa (Pty) Ltd (WSP) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the S&EIR process required in terms of the following legislation:

- Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA);
- National Environmental Management Act (No. 107 of 1998) (NEMA) for submission of application for environmental authorisation (EA) in respect of activities identified in terms of GNR 983, 984 and 985 (7 April 2017, as amended); and
- National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) and the list of waste management activities (GN 921:2013, as amended), requiring submission of a waste management license (WML) application.

The competent authority for the EA Application is the Department of Mineral Resources and Energy (DMRE).

4 PRESENT ENVIRONMENTAL SITUATION

4.1 CLIMATE

4.1.1 REGIONAL CLIMATE

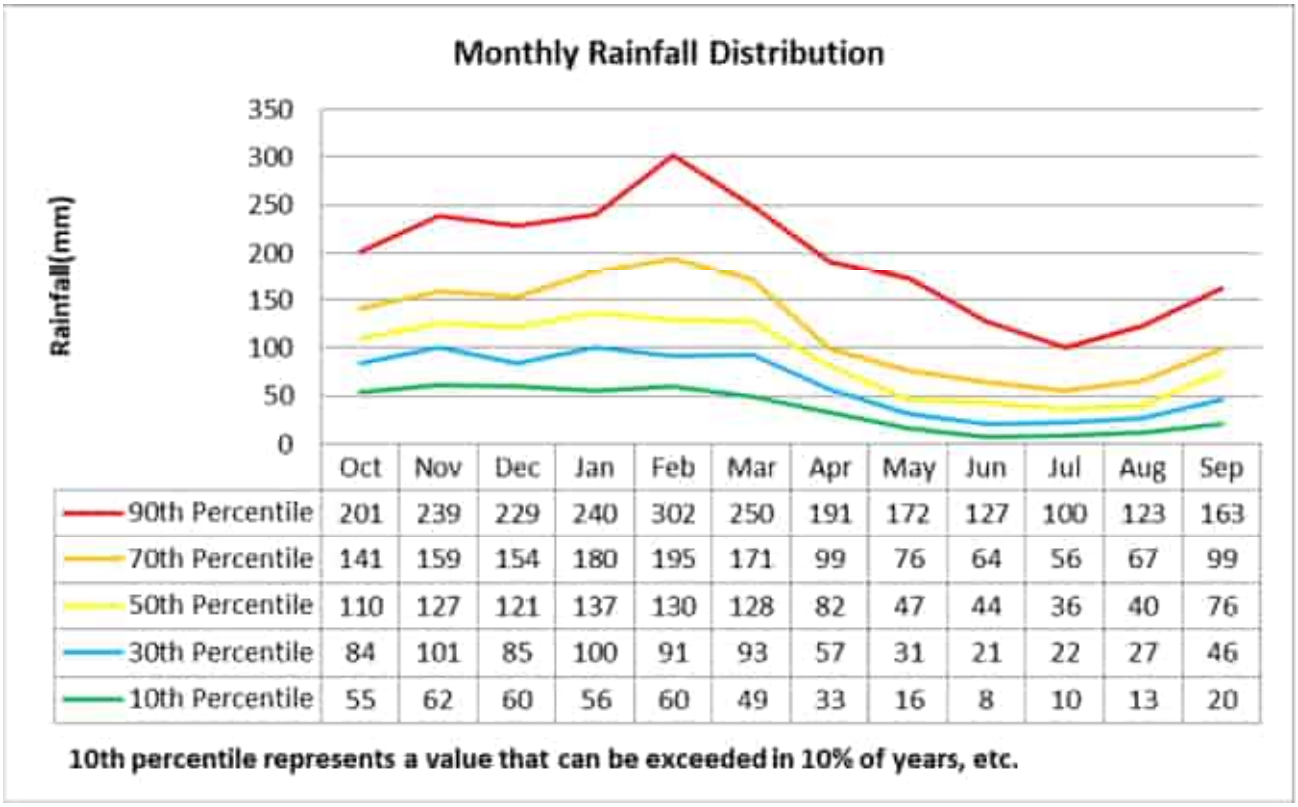
The Port Durnford project area is in a humid subtropical climate, a humid temperate climate sub-type, in Köppen classification (Cfa). This climate is characterised by humid, hot summers and relatively warm winters (Peel, Finlayson, & McMahon, 2007).

Average daily summer temperatures range between 30 ^{o}C and 24 ^{o}C, while daily winter temperatures range between 21 ^{o}C and 12 ^{o}C. The maximum temperatures are consistently experienced in December and January, with an average daily temperature of 30 ^{o}C, while minimum temperatures are experienced in June and July, with an average daily temperature of 12 ^{o}C (Meteoblue, 2024).

4.1.2 RAINFALL

Based on the analysed catchment-wide hydro-meteorological dataset obtained from the WR2012 study (Bailey and Pitman, 2015), the highest rainfall consistently occurs from October to March, while the lowest is experienced between April and September.

The area's Mean Annual Precipitation (MAP) ranges between 1285 and 1293 mm. 90% of monthly rainfall depth events during the wettest month of February are not expected to exceed 302 mm, while 90% of monthly rainfall depth during the driest month of July will not exceed 100 mm (Figure 4-1).



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90th Percentile	201	239	229	240	302	250	191	172	127	100	123	163
70th Percentile	141	159	154	180	195	171	99	76	64	56	67	99
50th Percentile	110	127	121	137	130	128	82	47	44	36	40	76
30th Percentile	84	101	85	100	91	93	57	31	21	22	27	46
10th Percentile	55	62	60	56	60	49	33	16	8	10	13	20

10th percentile represents a value that can be exceeded in 10% of years, etc.

Figure 4-1 - Monthly Rainfall Distribution

4.1.3 EVAPORATION

The region's Mean Annual Evaporation (MAE) is 1300 mm. Figure 4-2 highlights the low summer evaporation potential, resulting in net positive summer rainfall.

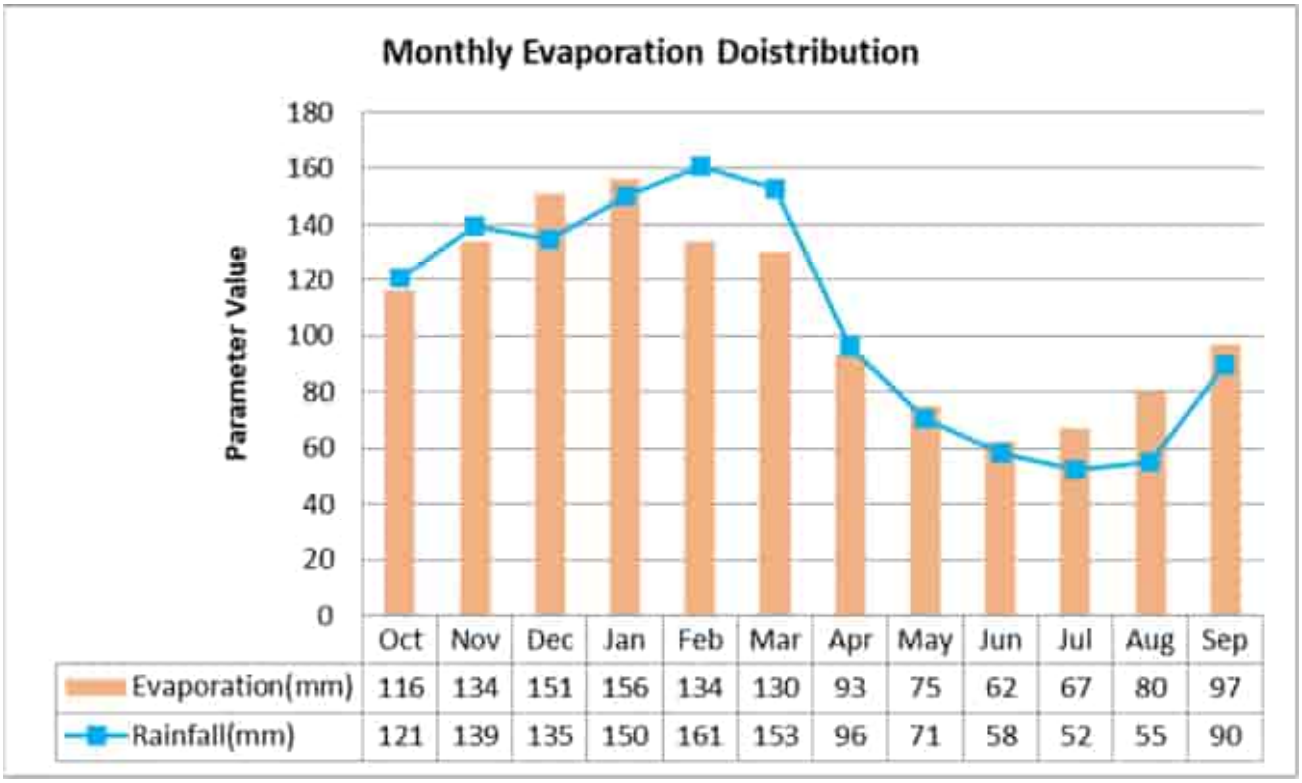


Figure 4-2 - Monthly Evaporation Distribution

4.2 SURFACE WATER

The information provided in this section has been sourced from the '*Surface Water baseline and Impact Assessment*' compiled by WSP (2025). Refer to Appendix A for the full report.

4.2.1 WATER MANAGEMENT AREA

The project falls within the Pongola-Mtamvuna Water Management Area (WMA) and within the W13B quaternary catchment (Figure 4-3).

4.2.2 SURFACE WATER HYDROLOGY

The topography of the study area is characterised by moderately to strongly sloping incised valleys (average slopes of 13%) west of the project area, which grades to gently undulating terrain (average slope of 6%) towards the coastline, with wide valleys that represent the floodplains of prominent drainage channels. The topography of the project area itself is rolling and exhibits gently sloping terrain, but in some areas, significantly steeper slopes are encountered.

Within the W13B quaternary catchment, the perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries flow from northeast to southwest within the site boundary and confluences with the Mlalazi River. Another tributary of the Mlalazi River runs further south of this site boundary. The Mlalazi River runs along the southwestern site boundary and eventually drains into the Indian Ocean. The rivers of importance for the Phase 1 project are the Amanzamnyama River and the Mlalazi River.

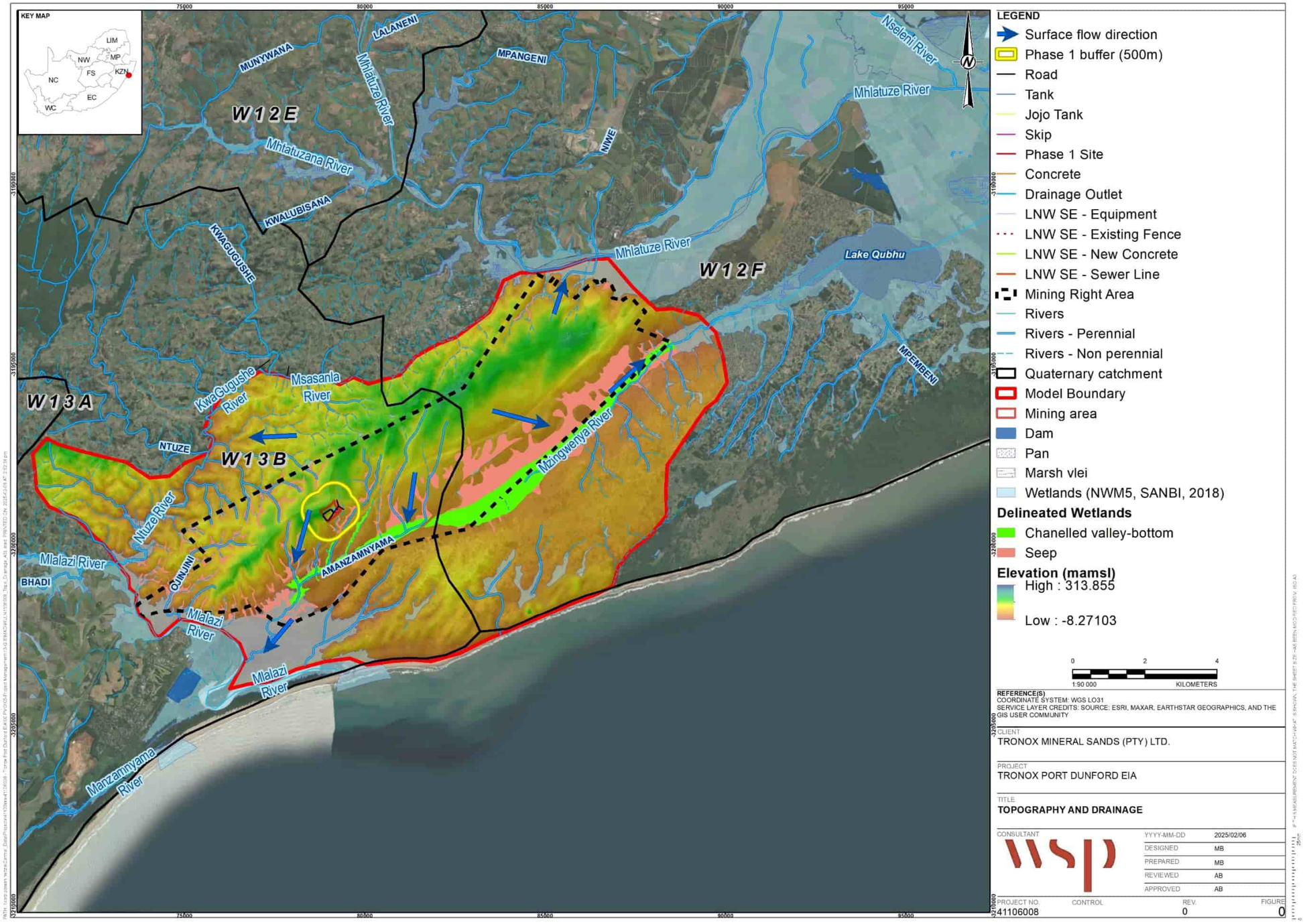


Figure 4-3 - Quaternary Catchment and Surface Water Map

Floodlines

The following describes a summary of calculated floodlines for the tributaries of the Mhlatuze River (i.e. Nkonjane River and the unnamed non-perennial streams) that drain the northwestern areas, the perennial Mzingwenya River and its associated tributaries flowing along the eastern site boundary from southwest to northeast, where they drain into Lake Cubhu, the perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries that flow from northeast to southwest within the site boundary and confluences with the Mlalazi River.

The rivers of importance for the Phase 1 project are the Amanzamnyama River and the Mlalazi River.

Peak Flow

The 1:100-year peak flows for the catchments at the project site were determined using the Rational Method (Alternative 3), Unit Hydrograph and Standard Design Flood (SDF) in UPD.

Design Rainfall

The design rainfall depths were obtained for the site using the Design Rainfall Estimation Software (Smithers & Schulze, 2003). The design rainfall depths calculated for the station Mtunzini (0304475-S) were used for this hydrological assessment.

This station was found to be representative of the site due to it being near the site, having a long historical record of 72 years, and a MAP of 1281 mm that is comparable to the quaternary catchment (W12F and W13B) MAP that ranges between 1285 and 1293 mm. The design rainfall depths for the gauge are presented in Table 4-1.

Table 4-1 - Design Rainfall Depth (m) – Mtunzini (0304475-S)

	2	5	10	20	50	100	200
1-day	85	132	173	221	298	370	457
2- days	108	170	221	279	372	457	557
3 -days	119	187	243	306	405	495	599
7 days	145	223	284	352	454	544	646

Catchments Delineation

Sub-catchments were delineated for Rivers and streams based on a Digital Elevation Model (DEM) generated from 5m contours, as depicted in Figure 4-4**.** The characteristics of the catchments used for peak flow determination are presented in Table 4-2.

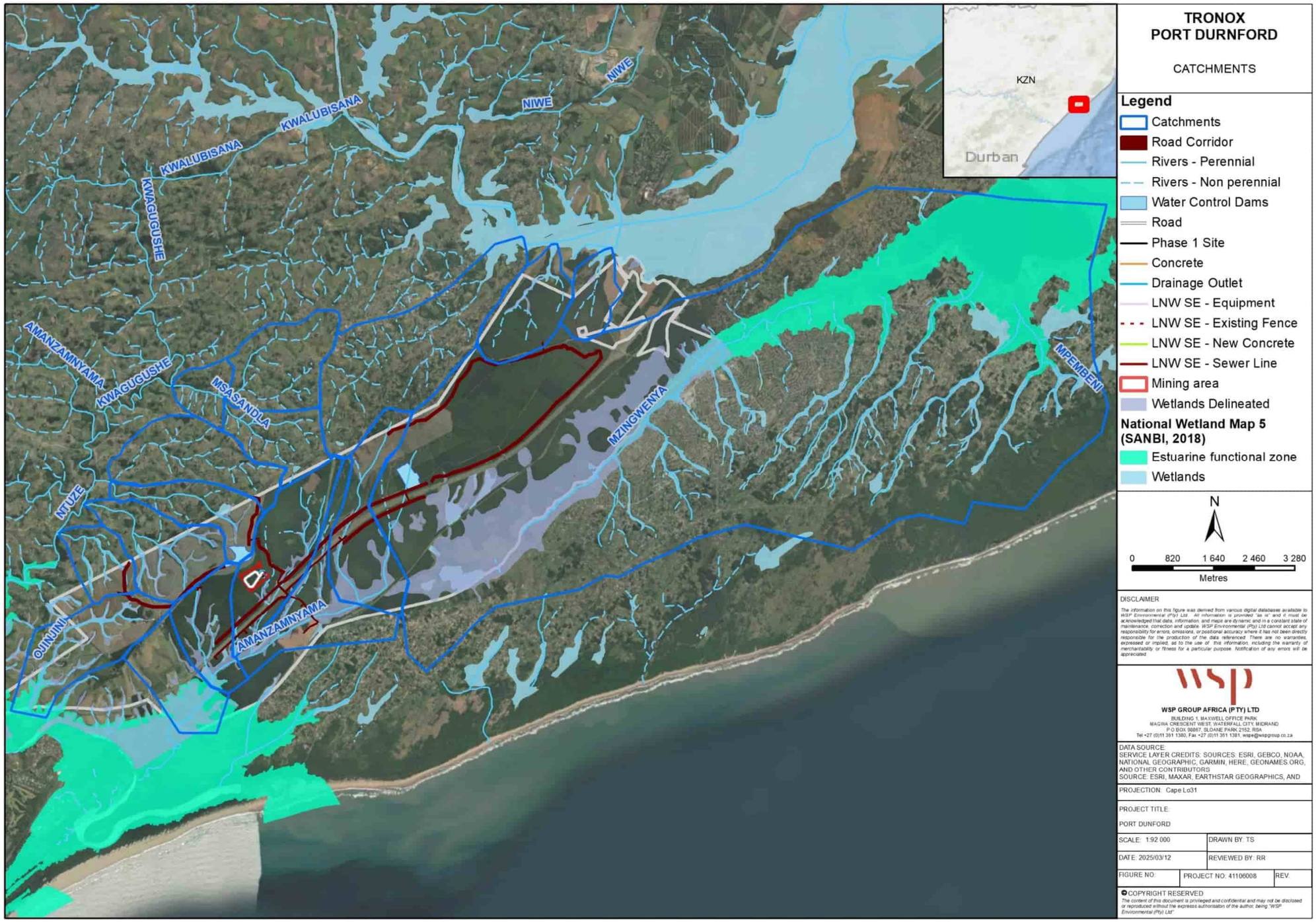


Figure 4-4 - Delineated Sub-catchments

Table 4-2 - Catchment Characteristics

River	Sub-catchment	Area (Km^2)	Longest Watercourse (Km)	Height difference along 1085 Slope (m)	Area distribution %	Surface Slope	Vegetation
Amanzamn-yama River	Tributary 1	4	4.23	52	97% Rura1, 3% Urban	96% Lakes & Pans, 4% flat area	98% thick bush & forests, 2% Grassland.
	Tributary 2	4	4.12	33	94% Rura1, 6% Urban	88% Lakes & Pans, 12% flat area	96% thick bush & forests, 3% Grassland. 1% Light bush & cultivated land
	Tributary 3	4	4.38	58	100% Rura1	12% Lakes & Pans, 88 % flat area	97% thick bush & forests, 2% Grassland. 1% Bare land
	Tributary 4	2	1.96	46	100% Rura1	3 % Lakes & Pans,97 % flat area	99% thick bush & forests, 1% Grassland.
	Tributary 5	2	1.69	58	99% Rura1, 1% Urban	6 % Lakes & Pans,94 % flat area	79% thick bush & forests, 2% Grassland, 18% Light bust & cultivated land.
KwaGugushe River	Tributary 1	3.64	4.05	36	43% Rura1, 57% Urban	92 % Lakes & Pans, 8 % flat area	22% thick bush & forests, 7% Grassland, 71% Light bust & cultivated land.
	Tributary 2	2.34	3.63	28	68% Rura1, 32% Urban	94 % Lakes & Pans, 6 % flat area	60% thick bush & forests, 5% Grassland, 35% Light bust & cultivated land.
	Tributary 3	3.19	3.22	26	84% Rura1, 16% Urban	33 % Lakes & Pans, 67 % flat area	78% thick bush & forests, 3% Grassland, 19% Light bust & cultivated land.
	Tributary 4	1.56	2.014	18	76% Rura1, 24% Urban	55 % Lakes & Pans, 45 % flat area	50% thick bush & forests, 3% Grassland, 47% Light bust & cultivated land.
Mhlatuze Tributary	Unnamed Stream 1	2.64	2.8	28	96% Rura1, 4% Urban	8 % Lakes & Pans, 92 % flat area	83% thick bush & forests, 1% Grassland, 16% Light bust & cultivated land.
	Unnamed Stream 2	1.41	1.93	68	99.5% Rura1, 0.5% Urban	5 % Lakes & Pans, 95 % flat area	78 % thick bush & forests, 2% Grassland, 20% Light bust & cultivated land.

River	Sub-catchment	Area (Km^2)	Longest Watercourse (Km)	Height difference along 1085 Slope (m)	Area distribution %	Surface Slope	Vegetation
Msasandla River	Tributary 1	2.25	2.36	28	32% Rura1, 68% Urban	82 % Lakes & Pans, 18 % flat area	25 % thick bush & forests, 5% Grassland, 70% Light bust & cultivated land.
	Tributary 2	3.28	2.93	36	54% Rura1, 46% Urban	93 % Lakes & Pans, 7 % flat area	12 % thick bush & forests, 5% Grassland, 83 % Light bust & cultivated land.
	Tributary 3	1.09	1.1	3.2	61% Rura1, 39% Urban	20 % Lakes & Pans,80 % flat area	27 % thick bush & forests, 10% Grassland,63 % Light bust & cultivated land.
Mzingwenya River		80	17.36	15	52% Rura1, 43% Urban, 5% Lakes	99% Lakes & Pans,1 % flat area	81 % thick bush & forests, 14% Grassland,4 % Light bust & cultivated land, 1% Bare land.
Nkonjane River		7.47	6.61	60	22% Rura1, 78% Urban	13% Lakes & Pans,87 % flat area	40 % thick bush & forests, 60% Grassland
Ojinjini River		4	3.88	40	99.5% Rura1, 0.5% Urban	63% Lakes & Pans,37 % flat area	47 % thick bush & forests, 7% Grassland, 46% Light bush & cultivated land

Design Peak Flows

Peak flows for the 1:100-year 24-hour storm events were calculated for the delineated sub-catchments. The design peak flows are presented in Table 4-3. The peak flows for SDF were used in the hydraulic modelling for floodline determination. These peak flows were selected because they were conservative and, therefore, presented a worst-case scenario.

Table 4-3 - Design Peak Flows

River	Sub-catchment	Area (Km^2)	Rational Method (Alternative 3)	Unit Hydrograph	Standard Design Flood (SDF)
			m^3/s		
Amanzamnyama River	Tributary 1	4	30.68	33.12	101.76
	Tributary 2	4	28.32	33.59	91.53
	Tributary 3	4	35.8	32.47	101.9
	Tributary 4	2	32.03	25.66	90.94
	Tributary 5	2	40	34.49	107.12
KwaGugushe River	Tributary 1	3.64	26.1	30.89	86.63
	Tributary 2	2.34	17.58	21.51	56.91
	Tributary 3	3.19	31	30.1	84.05
	Tributary 4	1.56	21.05	30.1	54.55
Mhlatuze Tributary	Unnamed Stream 1	2.64	29.29	21.63	79.69
	Unnamed Stream 2	1.41	26.58	18.98	71.34
Msasandla River	Tributary 1	2.25	32.9	15.62	77.98
	Tributary 2	3.28	41.99	28.56	102.16
	Tributary 3	1.09	16.71	22.72	39.01
Mzingwenya River		80	143.87	238.6	415.02
Nkonjane River		7.47	49.33	41.9	134.97
Ojinjini River		4	38	36.17	101.67

Floodline Results

Delineated 1:100-year flood lines for the river depicted in Figure 4-5 shows the proposed mining activity is outside the 1:100-year floodline for most rivers except for the Mhlatuze River non-perennial tributaries and the Amanzamnyama River.

However, in the case of the Amanzamnyama River, the N2 will act as a barrier during the flooding, and the drainage lines of the Mhlatuze River non-perennial tributaries and the Amanzamnyama River have also been modified when establishing the forestry plantation.

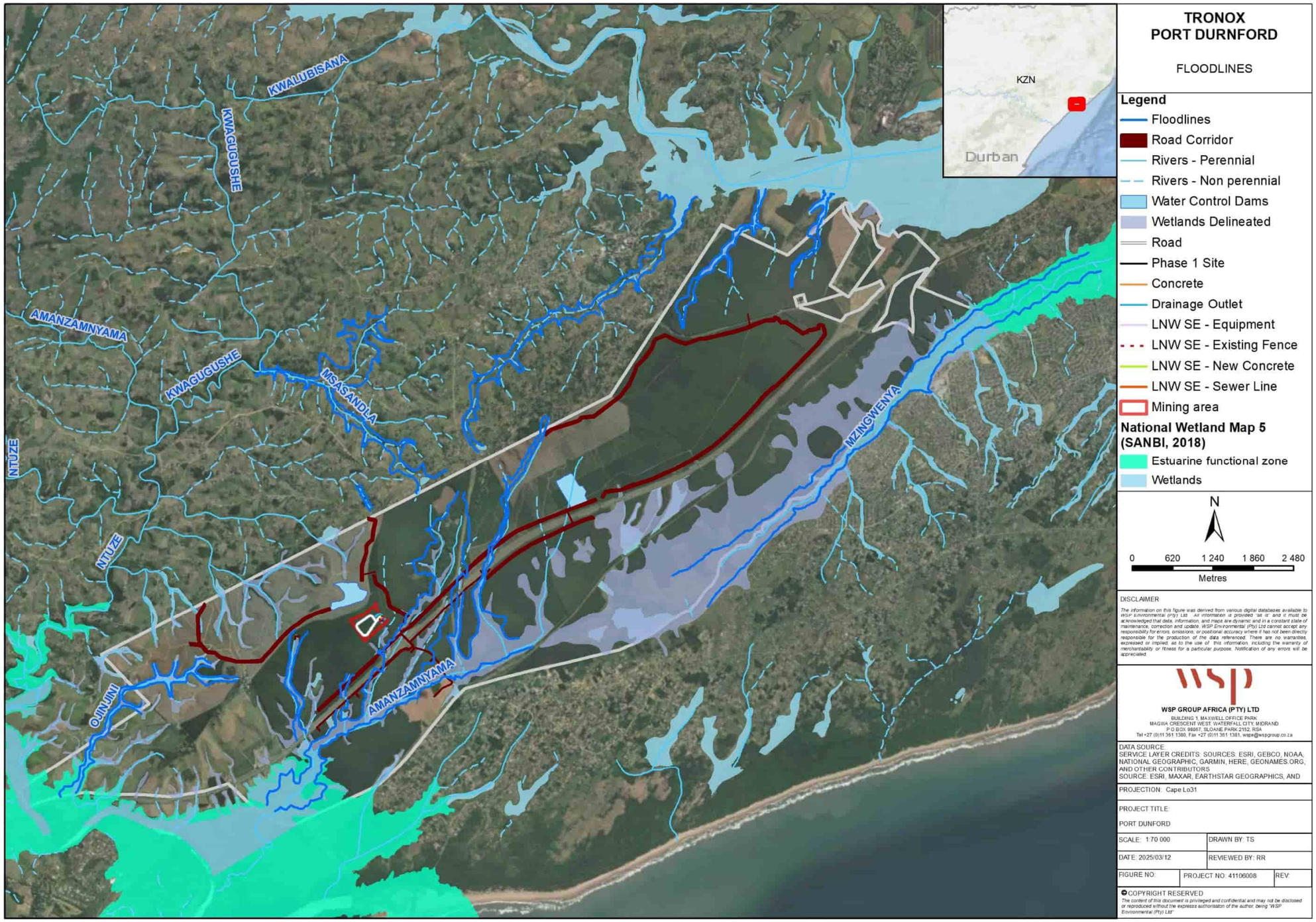


Figure 4-5 - 1:100-year Floodlines

4.2.3 SURFACE WATER QUALITY

Baseline water quality was described based on the water quality data from the sampled locations (i.e. Msasandla River, tributaries of KwaGugushe River, Ntuze River, Ojinjini River, Amanzamnyama River, Mlalazi River, Nkonjane River and Mzingwenya River) in June 2024, and the DWS [Resource Quality Information Services (RQIS)] monitoring points, sampled between 2014 and 2018/19, located upstream and downstream of the proposed Port Durnford Phase 1 and 2 project area on the Mlalazi River and Mhlatuze River. The rivers of importance for the Phase 1 project are the Amanzamnyama River and the Mlalazi River.

The data was benchmarked against the water quality planning limits (WQPLs), derived from assessing the present water quality status based on the fitness for water use for key water users, such as irrigation, industrial, domestic, and aquatic ecosystem.. The water resource classes, and resource quality objectives (RQOs) are not determined for the quaternary catchment in which the Phase 1 mining activity is proposed (W13B).

The baseline water quality of the receiving surface water resources in the vicinity of the project area is shown in Table 4-4 and described below:

- Mlalazi River: The water quality of the Mlalazi River shows general compliance with the WQPLs, with exceedances observed for a few parameters. However, the Mlalazi River monitoring locations at the estuary (i.e. Mlalazi River: W13 193258 and Mlalazi River: W13 193256) are characterised by elevated levels of Electric Conductivity (EC) and thus Total Dissolve Solids (TDS) at a sampled point on the Mlalazi River (1. Umlalazi River WQ), indicating high salinity levels. The latter phenomenon could be attributed to the sea tidal effect and intermixing with riverine flows. Though not apparent due to the lack of supporting data in the table, the impact of effluent discharges from both the Mtunzini Municipal Water Treatment Works and the Mtunzini Aquaculture projects Kob farm as concluded by the DWS Mlalazi estuary reserve determination study (DWS, 2015), has not been ruled out.
- Amanzamnyama River: Shows general compliance with most parameters except for elevated levels of Aluminium (Al), Ammonia (NH_4 as N) and Iron (Fe), which exceed permissible limits and could be attributed to the natural geology as there is no mining/industrial activity upstream of the sampled point.

Table 4-4 - Compliance of water quality against receiving WQPLs

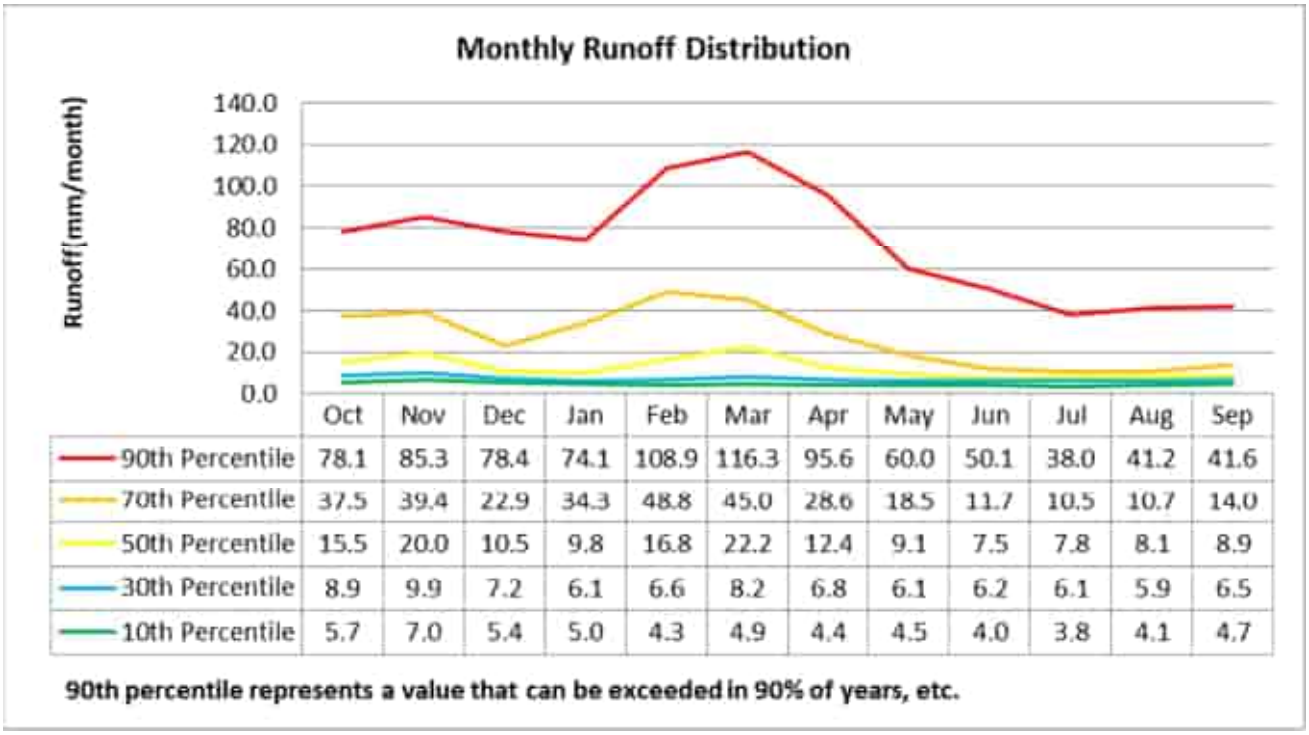
	Sampling Point ID	pH	Electrical Conductivity (EC)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Chloride (Cl)	Sulphate (SO4)	Nitrate (NO3-N)	Flouride (F)	Aluminium (Al)	Iron (Fe)	Manganese (Mn)	Ammonia NH4 as N	Ortho-Phosphate (PO4)	Cadmium (Cd)	Cobalt (Co)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Total alkalinity (CaCO3)
			mS/m	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Ideal		≤ 6.5 ≥ 8.4	30	200		10	70	70	25	40	80	6	0.70	≤0.01		≤0.05	0.015	0.025	≤0.00025		≤0.0008		≤0.0005	≤0.002	
Acceptable			50	350		80	100	92.5	50	120	165	10	1				0.044	0.075				≤0.07			
Tolerable			85	800		80	100	115	100	175	250	20	1.5	≤0.15	≤0.1	≤0.15	0.073	0.125	≤0.005		≤1		≤0.01	≤3	
Uncceptable			>85	>800		>80	>100	>115	>100	>175	>250	>20	>1.5				>0.073	>0.125							
Kwagugushe River tributary	TSW20 (Msasandla River)	7.29	-	126.00	<10	-	7.03	-	-	-	-	-	-	0.11	0.33	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	37.2
	TSW17	7.03	-	134.00	<10	-	6.29	-	-	-	-	-	-	<0.05	0.2	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	30.3
	TSW16	7.39	-	186.00	<10	-	7.96	-	-	-	-	-	-	0.13	0.59	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	45.7
Ntuze River tributaries	TSW18	6.71	-	162.00	<10	-	8.06	-	-	-	-	-	-	<0.05	0.4	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	43.3
	TSW19	6.93	-	164.00	<10	-	6.94	-	-	-	-	-	-	<0.05	0.14	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	45.9
Mlalazi River	W13 193251	7.60	3424.40	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.1	-	-	-	-	-	-	-
	1. Umlalazi River WQ	7.29	-	8256.00	15.00	-	320.94	-	-	-	-	-	-	<0.05	<0.005	-	0.20	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	75.1
	3. Umlalazi Railway Line WQ	7.52	-	220.00	<10	-	12.53	-	-	-	-	-	-	0.1	0.29	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	64
	W13 193258	7.80	3386.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	W13 193256	7.90	3034.50	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Ojinjini River:	2. Ojinjini WQ	7.10	-	234.00	<10	-	12.10	-	-	-	-	-	-	0.05	0.31	-	<0.05	0.01	<0.001	-	<0.001	<0.005	<0.01	<0.005	84.8
Amanzamnyama River	TSW13	4.09	-	232.00	<10	-	9.48	-	-	-	-	-	-	1.06	0.55	-	0.18	<0.005	<0.001	-	<0.001	0.03	<0.01	0.040	<3.5
	TSW21	4.52	-	218.00	<10	-	7.80	-	-	-	-	-	-	0.08	0.11	-	0.112	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	<3.5
	TSW11	6.90	-	156.00	<10	-		-	-	-	-	-	-	<0.05	0.04	-	<0.05	0.006	<0.001	-	<0.001	<0.005	<0.01	0.02	27.1
	TSW12	4.98	-	232.00	<10	-	5.60	-	-	-	-	-	-	0.21	1.51	-	0.341	0.009	<0.001	-	<0.001	<0.005	<0.01	0.02	6.1
Mzingwenya River	5. Mzingwenya River WQ	6.86	-	230.00	<10	-	9.99	-	-	-	-	-	-	<0.05	0.03	-	0.37	0.01	<0.001	-	<0.001	<0.005	<0.01	<0.005	47.8
	W12 187181 (Qubhu Lake)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mhlatuze River	TSW15 (Nkonjane River)	6.33	-	116	<10	-	4.17	-	-	-	-	-	-	<0.05	0.06	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	23.6
	W12 102815	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	W12 188458	8.20	93.80	593.5	36	74.80	31.40	84.30	-	-	-	-	-	-	-	-	-	0.40	-	-	-	-	-	-	-

- No data

4.2.4 MEAN ANNUAL RUNOFF (MAR)

The Mean Annual Runoff (MAR) depth was calculated to be 346 mm per annum, meaning approximately 27% of the MAP is redistributed as surface runoff.

The highest runoff occurs in March, mainly because of antecedent soil moisture from February. The 90th percentile runoff event is 116.3 mm, while the 10th percentile runoff event in the same month is 4.9 mm, as shown in Figure 4-6.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90th Percentile	78.1	85.3	78.4	74.1	108.9	116.3	95.6	60.0	50.1	38.0	41.2	41.6
70th Percentile	37.5	39.4	22.9	34.3	48.8	45.0	28.6	18.5	11.7	10.5	10.7	14.0
50th Percentile	15.5	20.0	10.5	9.8	16.8	22.2	12.4	9.1	7.5	7.8	8.1	8.9
30th Percentile	8.9	9.9	7.2	6.1	6.6	8.2	6.8	6.1	6.2	6.1	5.9	6.5
10th Percentile	5.7	7.0	5.4	5.0	4.3	4.9	4.4	4.5	4.0	3.8	4.1	4.7

90th percentile represents a value that can be exceeded in 90% of years, etc.

Figure 4-6 - Monthly Runoff Distribution

4.2.5 RESOURCE CLASS AND RIVER HEALTH

The water resource classes have not been determined for the quaternary catchment in which the Phase 1 mining activity is proposed (W13B).

Refer to Appendix D for the Aquatic Biodiversity Baseline and Impact Assessment.

4.2.6 RECEIVING WATER QUALITY OBJECTIVES AND RESERVE

The NWA states that the purpose of the RQOs is to establish clear goals relating to the quality of the relevant water resources. It also stipulates that in determining RQOs, a balance must be sought between the need to protect and sustain water resources and the need to use them. RQOs are numerical and/or narrative descriptors of conditions that need to be met to achieve the required management scenario as provided during the water resource classification. Such descriptors relate to the:

- Water quantity, pattern, timing, water level and assurance of instream flow;
- Water quality, including the physical, chemical and biological characteristics of the water;
- Character and condition of the instream and riparian habitat; and

- Characteristics, condition and distribution of aquatic biota.

The RQOs for the sub-quaternary reach (SQR) of focus was not available, therefore the below RQOs (Table 4-5)/Ecological Specifications (EcoSpecs) and Target Ecological Categories (TEC) were extrapolated from those of the Ecological Water Requirements (EWR) site NS1 (Nseleni River; -28.634100° 31.925170°) (Department of Water and Sanitation, 2024b). This was the only EWR site within the same catchment area (i.e. Secondary Catchment code W1) at the time of writing. Therefore, caution must be taken when comparing collected biomonitoring data to these RQOs.

Table 4-5 - Water quality EcoSpecs and TPCs (PES and TEC: B) (Department of Water and Sanitation, 2024)

Metric	Ecological Specifications	Threshold of Potential Concern
Physical variables		
Electrical Conductivity	The 95th percentile of the data must be ≤85 mS/m.	The 95th percentile of the data is 68 - 85 mS/m.
pH	The 5th percentile of the data must range from 6.5 to 8.0, and the 95th percentile from 6.5 to 8.8.	The 5th percentile of the data is <6.7 and >7.8, and the 95th percentile is <6.7 and >8.6.
Temperature	Largely natural temperature range is expected.	Abundance and frequency of occurrence of temperature sensitive species are lower than expected for reference.
Dissolved oxygen	The 5th percentile of the data must be ≥7.5 mg/L.	The 5th percentile of the data is ≤7.7 mg/L.
Turbidity	Moderate impact expected due to land–use and sediment deposits at the site.	Unnaturally high sediment loads and turbidity during runoff events. Impacts are mostly temporary, but some sediment deposits are evident. Check biotic response for habitat-related changes.
Inorganic salts		
$MgSO_4$	The 95th percentile of the data must be ≤37 mg/L.	The 95th percentile of the data is 30 - 37 mg/L.
Na_2SO_4	The 95th percentile of the data must be ≤51 mg/L.	The 95th percentile of the data is 41 - 51 mg/L.
$MgCl_2$	The 95th percentile of the data must be ≤51 mg/L.	The 95th percentile of the data is 41 - 51 mg/L.
$CaCl_2$	The 95th percentile of the data must be ≤105 mg/L.	The 95th percentile of the data is 84 - 105 mg/L.
NaCl	The 95th percentile of the data must be ≤389 mg/L.	The 95th percentile of the data is 311 - 389 mg/L.
$CaSO_4$	The 95th percentile of the data must be ≤1105 mg/L.	The 95th percentile of the data is 884 – 1105 mg/L.
Nutrients		
Total Inorganic Nitrogen (TIN-N)	The 50th percentile of the data must be <0.25 mg/L.	The 50th percentile of the data is 0.2 - 0.25 mg/L.
PO4 -P	The 50th percentile of the data must be ≤0.015 mg/L.	The 50th percentile of the data is 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data must be ≤15 mg/L	The 50th percentile of the data is 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data must be ≤12 mg/m^2}	The 50th percentile of the data is 10 - 12 mg/m^2.

4.2.7 SURFACE WATER USER SURVEY

Land use in the study area includes commercial forestry (*Eucalyptus*), farming (sugar cane and other crops), estuaries and neighbouring residential areas (eSikhawini and KwaDlangezwa). Water uses associated with these land uses are discussed below:

- Domestic: The Mhlathuze Local Municipality is licenced to abstract 6 696 000 m^3 of water per year from Lake Cubhu, primarily to supply water to the local communities of eSikhawini and KwaDlangezwa.
  Additionally, a significant portion of this water is allocated to the University of Zululand, highlighting the lake's crucial role in domestic water supply.
- Agriculture/ irrigation: *Eucalyptus* and sugar cane are not irrigated. However, other crops are irrigated.
- Marine Ecosystems: The Amanzamnyama and Mlalazi Rivers support the marine ecosystem in the uMlalazi estuary, while the Mzingwenya and Mhlatuze Rivers support the uMhlatuze estuary.

4.2.8 SENSITIVE AREAS SURVEY

The information provided in this section has been sourced from the '*Wetland Baseline and Impact Assessment'* compiled by WSP (2025). Refer to Appendix B for the full report.

The wetland assessment includes both Phase 1 and Phase 2, however, only Phase 1 is applicable to this application and address in this document.

Wetland delineation, classification and characteristics

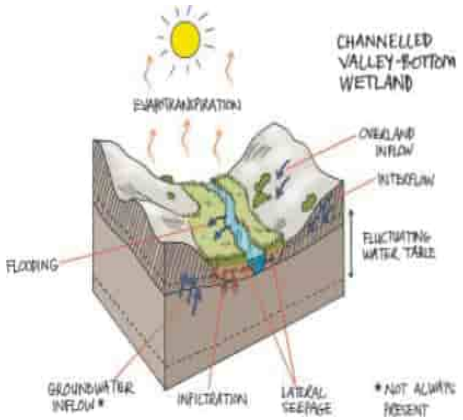
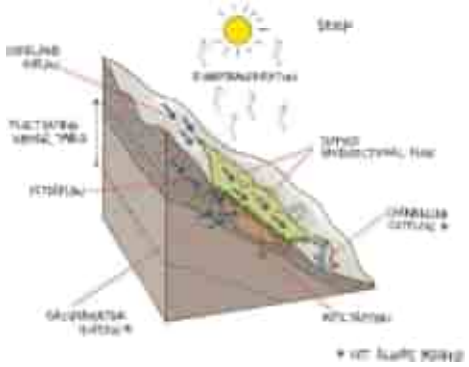
The study area presents a unique setting in which the watershed between two catchments dissects the Port Dunford boundary.

This results in two distinct drainage areas (west and east) which have naturally developed due to the topography – Mlalazi River and tributaries to the west, draining to the Mlalazi Estuary, and the Mhlathuze River and tributaries to the east, draining to the Mhlathuze estuary).

The desktop evaluation, and subsequent field survey revealed the presence of sixty (60) hydrogeomorphic (HGM) units, falling into two wetland HGM types: channelled valley bottom and hillslope seepage wetlands.

In addition, three (3) estuarine regions are also present within the local landscape and are the focus of a separate estuarine assessment study. For further understanding of the freshwater HGM units occurring within the project area, DWAF (2008) and Ollis et al. (2013) have provided broad descriptions which are shown in Table 4-6.

Table 4-6 - HGM unit types present within the study site (DWAF, 2008; Ollis et al., 2013)

Classification	Illustration	Description
Channelled Valley Bottom		Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a 'river'. These valley-bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland.
Hillslope Seepage Wetland		Wetland area situated on a gentle to steep sloping land that facilitates the dominance of colluvial, unidirectional movement of material and water (mainly in the form of interflow) downslope. Water inputs are primarily via subsurface flows from an up-slope direction. Seeps are characterised by their association with geological formations (lithologies) and topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to 'seep' down-slope as subsurface interflow.

A summary of the wetland HGM types identified and delineated within the area of assessment is provided in Table 4-7 and illustrated in Figure 4-7.

Table 4-7 - Summary of Wetland characteristics

Catchment	Wetland Type	Extent (Ha)
W13B	Channelled Valley Bottom	105.77
	Hillslope Seepage	243.73
W13B Estuarine Functional Zone (EFZ)	Mlalazi Estuary	194.59
Grand Total		**1275.27**

According to the surface water report compiled for the Tronox Port Dunford Project (WSPa, 2025), "*the surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater sources. Therefore, groundwater plays a significant role in the hydrological dynamics of the catchments. Based on a report compiled for the Zulti-South Project, located to the immediate east of the Port Durnford Project Area, it was found that due to the high permeability of the upper unconsolidated sediments in the area, groundwater effective recharge is estimated to range from approximately 450 to 750 mm/year. This equates to approximately 50% of the annual rainfall*."

As such, groundwater base flow plays an important role in sustaining the regional wetlands, particularly during drier periods when surface runoff contributions are limited. This characteristic of the wetlands is important in later discussions around the potential mine impacts.

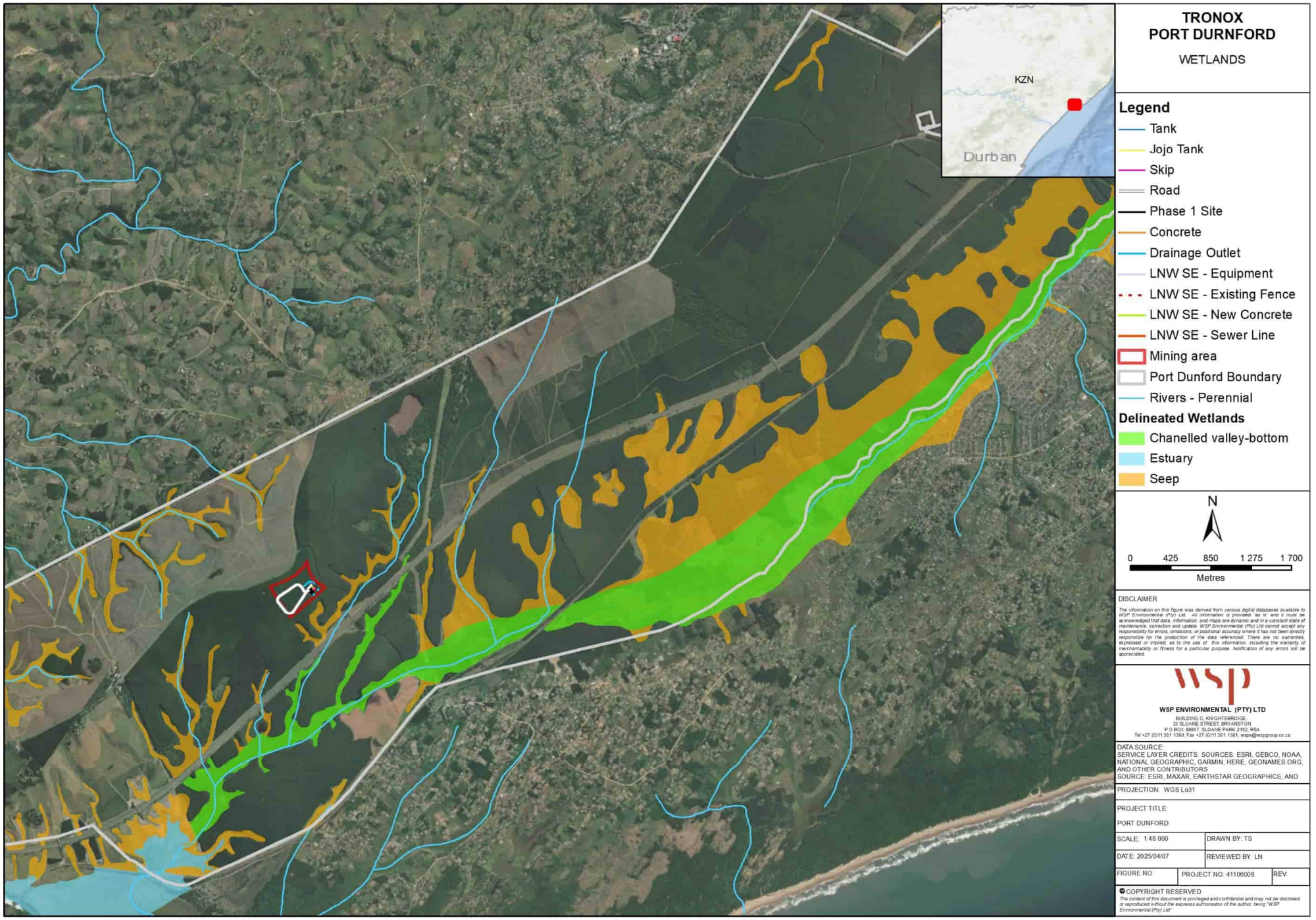


Figure 4-7 - Extent and classification of wetland HGM units identified within the proposed Phase 1 area

Seepage wetlands

The seepage wetlands were identified throughout the study area and are largely situated within sugarcane fields and *Eucalyptus* plantation regions. These seepage wetlands are expected to be saturated due to lateral and subsurface water input from the catchment and linkage to groundwater. Some of the impacts observed in field included gully formation within the seepage wetlands, caused by channelized flows increasing flow velocity and erosion potential (Figure 4-8 A & C).

The wetland vegetation within these seepage systems consists of small sedges (*Cyperus sp.*) and lacked robust obligatory vegetation i.e. *Typha capensis* and *Phragmites australis* especially within agricultural landscapes (Figure 4-8B).

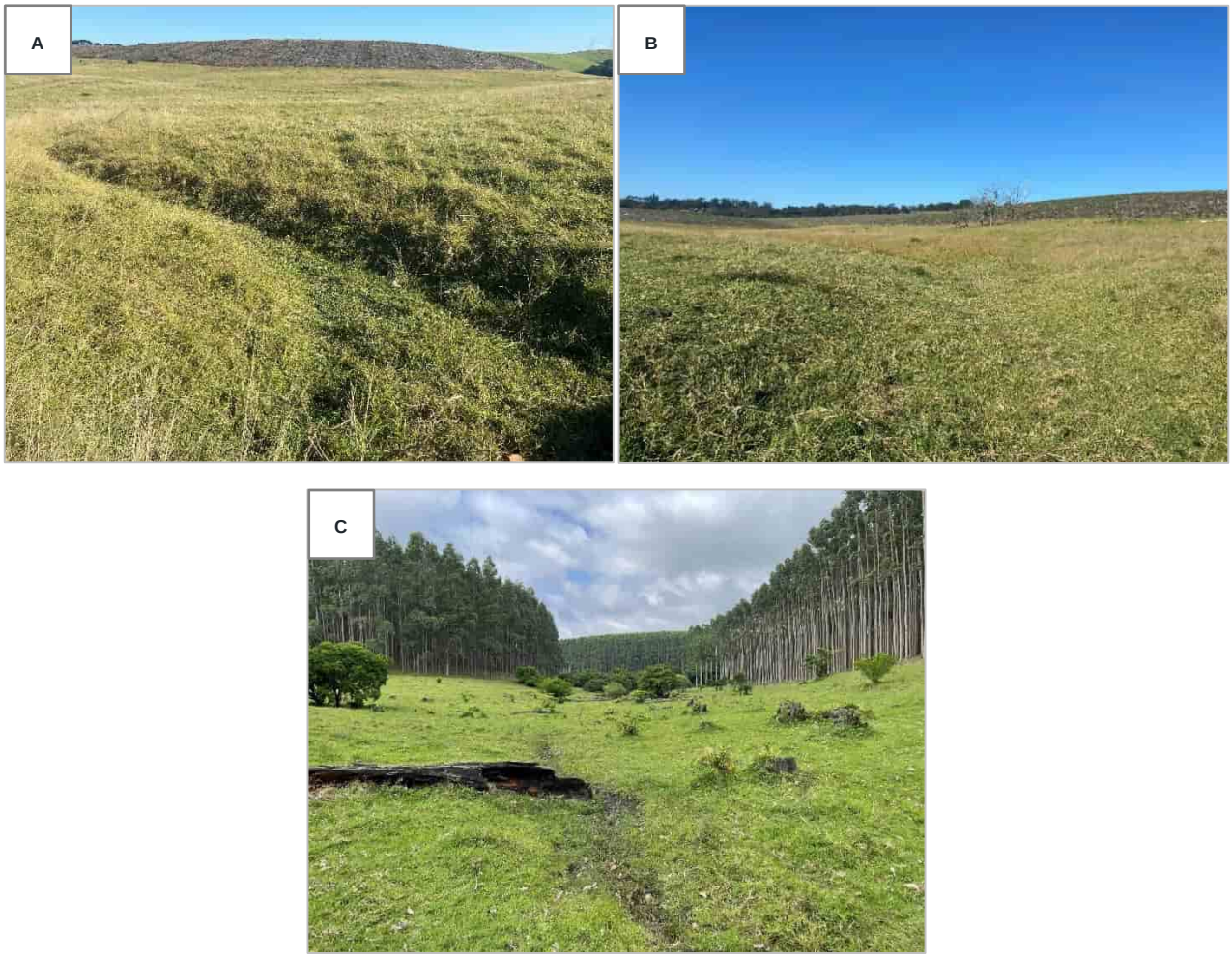


Figure 4-8 - Gully formation occurring within seepage wetland (A), Dominant vegetation consists of smaller sedges (B), Seepage wetland surrounded by *Eucalyptus* plantation.

Channelled Valley Bottom

The channelled valley bottom wetland (CVB) identified within the proposed Port Dunford study area has an extent of approximately 463ha. The system spans across the W12F and W13B catchments. The wetland is situated just south of the railway. The CVB system is fed from northern reaches via a

vast network of seepage wetlands. The CVB wetland has a main channel system that runs through the central regions of the wetland.

The site presents a unique setting as the western portion of the wetland drains towards the Mlalazi Estuary whilst the east drains towards the Qhubu Lake (also referred to as Cubhu Lake) which eventually connects with the Mhlathuze Estuary (Figure 4-9A).

Due to fluctuations in discharge related to rainfall, the course of the channel within the valley bottom may change over short periods, with the extent of open water varying seasonally. The wetland is dominated by dense stands of *Phragmites australis* (Figure 4-9B) and *Typha capensis* (Figure 4-9C).

Figure 4-9 - The main channel that runs through the central regions of the system (A), Dominant vegetation includes *Phragmites australis* (B) and *Typha capensis* (C)

Swamp Forest

A swamp is a wetland permanently saturated with water and dominated by trees. There are two main types of swamps: freshwater swamps and saltwater swamps. Freshwater swamps are common in inland areas. Saltwater swamps protect coasts from the open ocean. The freshwater swamp forest habitats identified during the field survey contain a high species richness but are

dominated by *Barringtonia racemose*. The swamp forest habitat was found to occur across both the seep and valley bottom wetland habitats but was largely confined to wetter areas within these larger wetland systems. Figure 4-11 gives an indicative extent of the larger bodies of swamp forest within the study area wetlands, though swamp forest habitat was also noted in the narrower seep wetlands in the west of the study area. Wetland W12F-04 was considered relatively pristine with the exception of minor encroachment of *Eucalyptus* forestry and infilling (Figure 4-10A).

The soil profile extracted displays bleached horizons around 35cm which is indicative of wetland soils (Figure 4-10B). The swamp forest within W12-07B was significantly degraded and lacks the majority of the common canopy cover as a consequence of anthropogenic influence within the wetland region. The ground cover observed was predominantly sedges (*Cyperus sp.* and *Eleocharis sp*.) with pockets of alien invasives noted i.e., *Solanum mauritianum* and *Arundo donax* (Figure 4-10C). The soil sample displays rich organic matter (darker in colour) and grades into a distinct bleached horizon (Figure 4-10D).

Figure 4-10 - Swamp forest undergrowth (A), Soil profile extracted (B), Alien invasive vegetation infiltrating within swamp forest (C), Distinct organic rich soils (D)

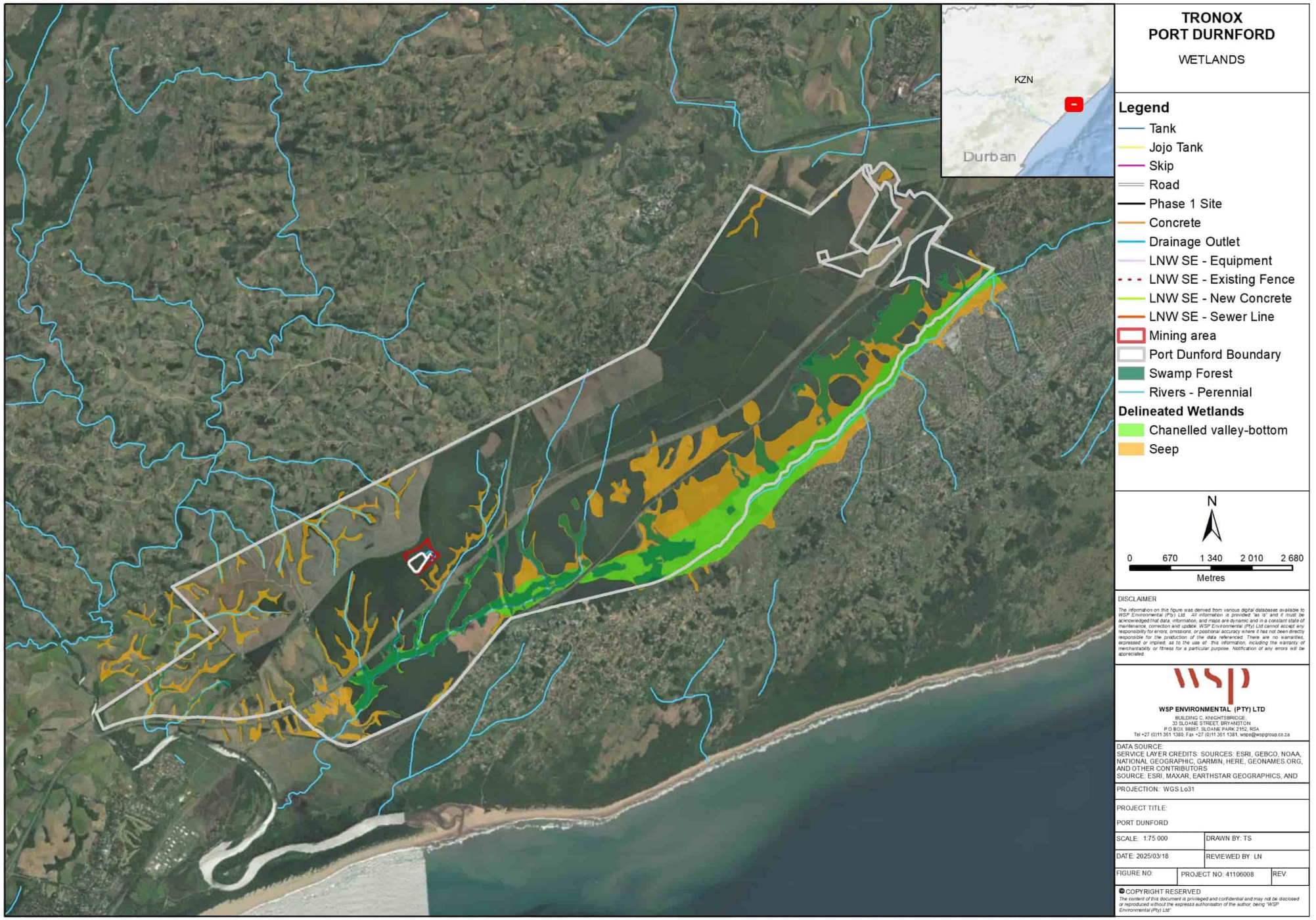


Figure 4-11 - Approximate extent of delineated swamp forest habitat within the broader wetland HGM extent

Historically, the HGM units in this study area would have formed large, uninterrupted networks of wetland habitat linked to the drainage networks. However, with the rapid rate of anthropogenic change within the local landscape, the wetlands have become fragmented in places. To aid in the assessment of the wetlands and for ease of explanation, the wetlands have been subdivided into groupings in this report. Individual wetland HGM units have been placed into groups as per Table 4-8 and Figure 4-12.

The wetland group (7) and associated wetland (W13B-07) applicable to Phase 1 is highlighted in **red** in Table 4-8.

Table 4-8 - The grouping of wetland units based on surrounding landscape

Groups	Wetland Units
1 (spit between catchments) Swamp forest surrounded by *Eucalyptus* plantation	W12F-02 W12F-07 W12F-11 W12F-12 W12F-13 W12F-16
	W13B-18 W13B-41 W13B-42 W13B-43 W13B-44
2 Relatively pristine swamp forest surrounded by *Eucalyptus* plantation	W13B-16 W13B-17
3 Fragmented swamp forest surrounded by *Eucalyptus* plantation	W13B-13 W13B-15
4 (split between catchments) Swamp forest surrounded by *Eucalyptus* plantation	W12F-01
	W13B-01 W13B-10 W13B-12
5 Highly impacted by anthropogenic impacts (housing developments)	W12F-03 W12F-05 W12F-06 W12F-08 W12F-09 W12F-10
6 Reed-dominated wetland adjacent to *Eucalyptus* plantation	W13B-06 W13B-14
7 Relatively pristine swamp forest surrounded by *Eucalyptus* plantation	W13B-05 **W13B-07** W13B-08 W13B-09

Groups	Wetland Units
	W13B-11
8 Wetland within sugarcane agricultural fields	W13B-33 W13B-36 W13B-37 W13B-38 W13B-39 W13B-40
9 Wetlands impacted by sugarcane agriculture and *Eucalyptus* plantations	W12F-14 W12F-15
	W13B-02 W13B-03 W13B-19 W13B-20
10 Wetland within sugarcane agricultural fields	W13B-04 W13B-21 W13B-22 W13B-23 W13B-28 W13B-30 W13B-31 W13B-32
11 Intact pockets of swamp forest within sugarcane agricultural fields	W13B-24 W13B-29 W13B-35
12 Fragmented swamp forest within sugarcane agricultural fields	W13B-25 W13B-26 W13B-27 W13B-34
13 Swamp forest surrounded by *Eucalyptus* plantations	W12F-04

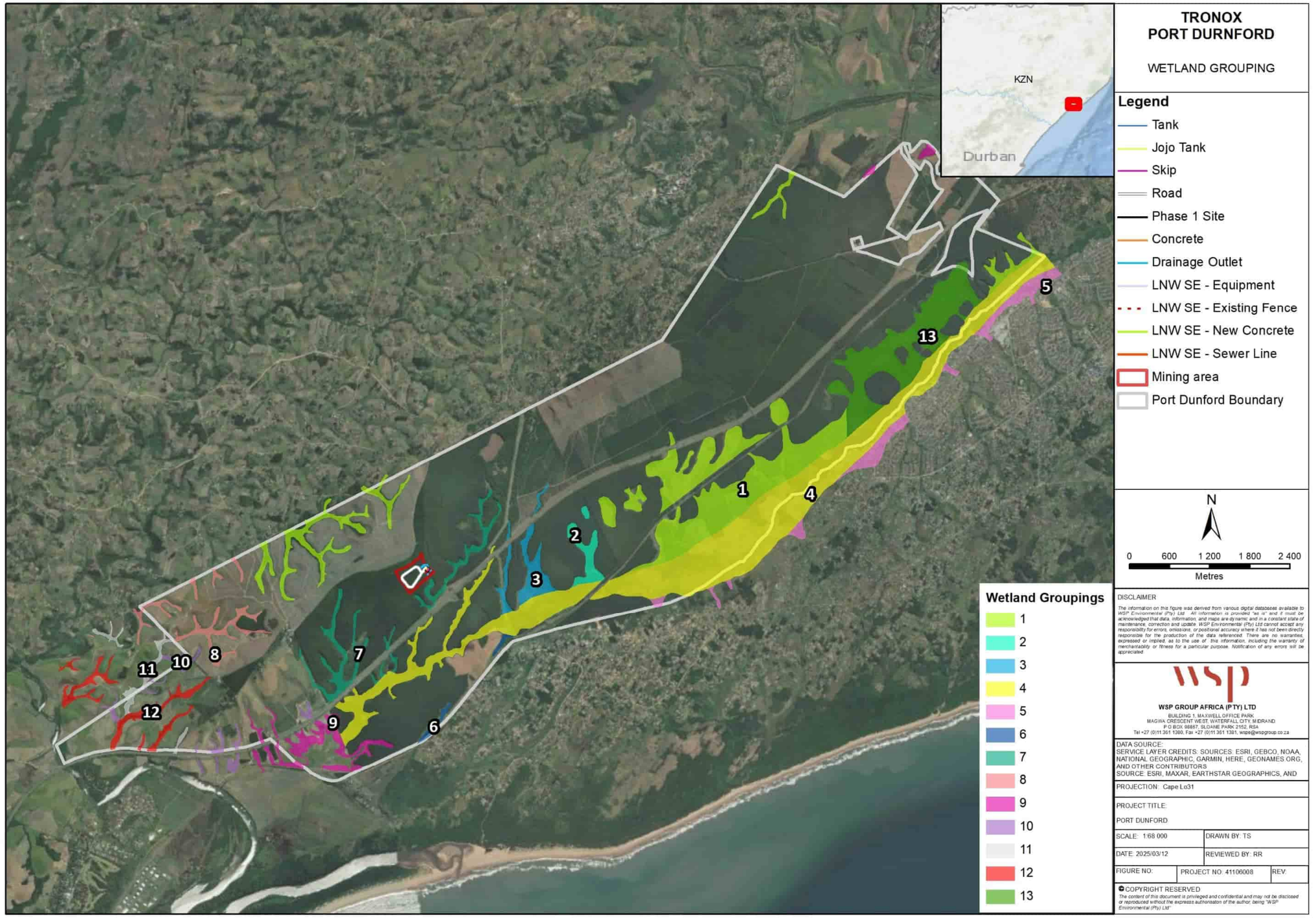


Figure 4-12 - Wetland grouping based on surrounding land use

Wetland Present Ecological State (PES)

The state of the four main functional aspects of the wetland is considered for the WET-Health index includes: (1) hydrology, (2) geomorphology, (3) water quality and (4) vegetation. The assessment of the ecological status of each of these functional aspects follows a broadly similar approach and is used to determine which impacts have affected the health status of the wetland.

The assessment of the PES for these wetlands is presented below.

Hydrological impacts affecting PES

Hydrological impacts experienced by the wetland groups relate to the presence extensive *Eucalyptus* plantations, sugarcane agriculture and road networks within the catchment. Roads that are located in close proximity to or within wetlands create preferential flow paths for surface runoff after rains, resulting in an increase in lateral and longitudinal soil erosion and mobilisation of sediment.

Another impact identified due to roads is the impoundment and pooling of water at road crossings. Agricultural activities surrounding the wetlands also have a negative indirect impact on the hydrology of the system. This often results in reduced flows into the wetlands as a consequence of surface water abstraction from agricultural services as well as increased flow into the wetland as a result of increased hardened surfaces.

Eucalyptus plantation forestry has been a dominant land use within the study area boundary for a prolonged period of time (>50 years), and its presence is expected to have had a long-term impact on the wetlands through higher evapotranspiration of *Eucalyptus* trees over indigenous vegetation resulting in reduced runoff and catchment yield to the wetlands. In spite of this prolonged impact to the wetlands' supporting hydrology, areas of largely natural wetland habitat were still found to occur.

Geomorphological impacts affecting PES

Major geomorphological impacts on the wetland are associated with erosion gullies in the wetlands which have altered the geomorphological template and processes operating within the affected wetlands. Eroded sediments are transported into downstream areas leading to sedimentation and altered geomorphological structure.

Water quality impacts affecting PES

Observations made during the site visit suggest that while the clarity of the water flowing through the open water systems was high (i.e. low turbidity), there was evidence of nutrient loading with large amounts of algae thriving within the primary flow path of some of the wetlands. This suggests that the existing surrounding land uses, which include agricultural activities, are producing runoff that contains nitrates, and possibly phosphates. This has had a negative effect on the overall score for the water quality component of the PES assessments, especially for the wetlands found directly within the sugarcane plantations.

Vegetation impacts affecting PES

Vegetation impacts to the wetland relate to reduced surface roughness/reduced vegetation cover, changes in vegetation species composition in the wetland resulting from overgrazing and the presence of alien invasive species. Additional impacts on wetland vegetation are those associated

with *Eucalyptus* plantations and sugarcane agriculture which have occupied viable wetland habitat and reduced species diversity.

The above-described impacts and noted changes to the wetland habitat drivers (hydrology and geomorphology) and responders (water quality and vegetation) have caused the assessed wetlands to deviate from their assumed natural state.

The outcomes of the PES assessment found the wetlands to currently lie along a spectrum of modification, ranging from largely natural (PES category B) to seriously modified (PES category E). The results of the PES assessment are illustrated in Figure 4-13, and detailed PES results per grouping are provided in Table 4-9.

Table 4-9 - PES for the impacted Group 7 (W13B) wetland units

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.8	0.7	1.8	2.0
Ecological Class	B	A	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	1.6			
Combined Ecological Score	B			

Wetland Functional Assessment

The WET-EcoServices assessment provides guidelines for scoring the importance of an HGM unit in delivering fifteen different ecosystem goods and services (Kotze *et al*., 2009). Ecosystem services include flood attenuation, streamflow regulation, sediment trapping, phosphate trapping, nitrate removal, toxicant removal, erosion control, carbon storage, maintenance of biodiversity, water supply for human use, natural resources, cultivated foods, cultural significance, tourism and recreation and education and research (Kotze *et al*., 2009).

The WET-Ecoservices assessments were undertaken for all of the wetland groups identified within the site boundary (Table 4-10). Given that the various wetlands assessed are located in close proximity to each other in similar landscape settings and surrounded by the same land uses, results of the different wetland units assessed are largely similar.

The swamp forest wetlands, which exist as a mosaic within the larger HGM units, received scores that were moderate for streamflow regulation and sediment trapping, and high scores for biodiversity maintenance due to the variety of microhabitats provided by the swamp forests and noted important species identified in these habitats, such as Pickersgill's reed frog (*Hyperolius pickersgilli)*.

The seep wetlands are mostly situated within highly transformed agricultural lands and therefore reflect low scores, with a distinct pattern of water quality enhancing benefits due to filtering pesticides from adjacent farms.

The channelled valley bottom systems obtained moderate to high scores for streamflow regulation. These systems also displayed higher scores in biodiversity maintenance and direct provisional benefits such as water for human consumption.

Table 4-10 - Ecoservices provided by Group 7 Wetlands

Wetland Unit					Group 7
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0
			Streamflow Regulation		1.5
			Water quality enhancement benefits	Sediment trapping	1.4
				Erosion Control	1.3
				Phosphate assimilation	0.9
				Nitrate assimilation	0.8
				Toxicant assimilation	0.9
			Carbon storage		0.9
	Direct Benefits	**Biodiversity Maintenance**			3.1
		Provisional Benefits	Water for human use		0.9
			Harvestable resources		0.5
			Cultivated foods		1.0
		Cultural benefits	Tourism and recreation		0.0
			Education and Research		0.0
			Cultural heritage		0.0

Wetland Importance and Sensitivity Assessment

The ecological importance of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has been impacted (Kleynhans *et al.*, 1998). The EIS considers biodiversity, rarity, uniqueness and fragility of the resource. The intrinsic ecological value of the resource and its importance to the functioning of neighbouring ecosystems are the main concerns. Further considerations that informed the EIS assessment include:

- The location of the study area within a vegetation type - Maputaland Coastal Belt vegetation and swamp forests that are considered as critically endangered habitats, and which are afforded moderate protection.
- The Critical Biodiversity Area has identified the swamp forests within the site as irreplaceable status.
- The loss of natural vegetation and habitats due to current and past cultivation within the wetlands.
- Species of conservation concern (SCC) were identified within the Port Dunford site boundary (i.e. *Hyperolius pickersgilli* (Pickersgill's reed frog) – Critically Endangered).
- The wetlands towards the western portion of the site form part of the Estuarine Functional Zone of the Mlalazi estuary.

- The wetlands within the southeastern portion have been transformed as a consequence of residential developments.

The EIS assessment for the study area wetlands was conducted for all impacted HGM units with the results illustrated in Figure 4-14.

Table 4-11 - Importance and sensitivity of the wetland group for Phase 1

GROUP 7	Importance
Ecological Importance & Sensitivity	3.1
Hydrological/Functional Importance	1.0
Direct Human Benefits	0.4

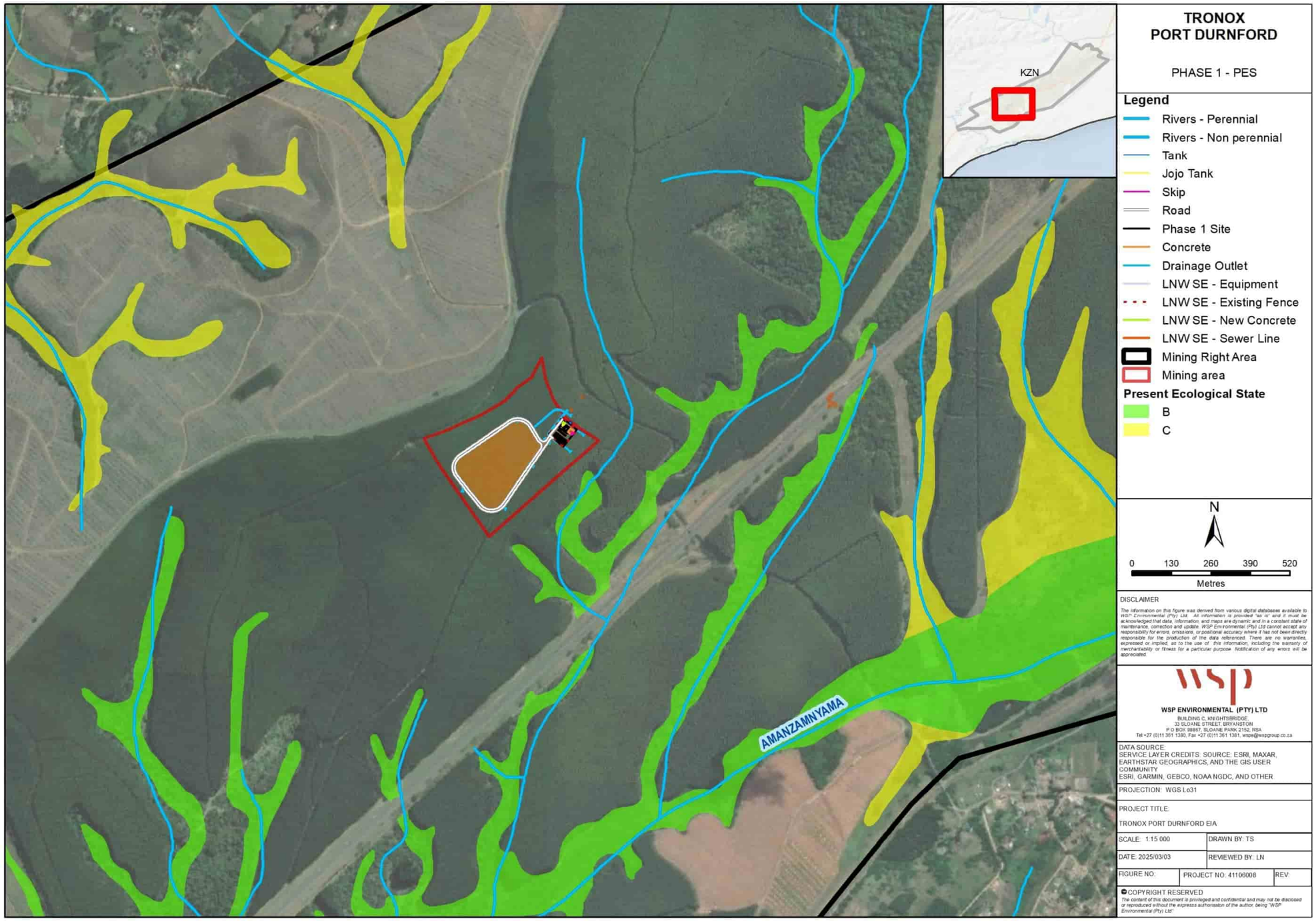


Figure 4-13 - PES of the wetlands located near Phase 1

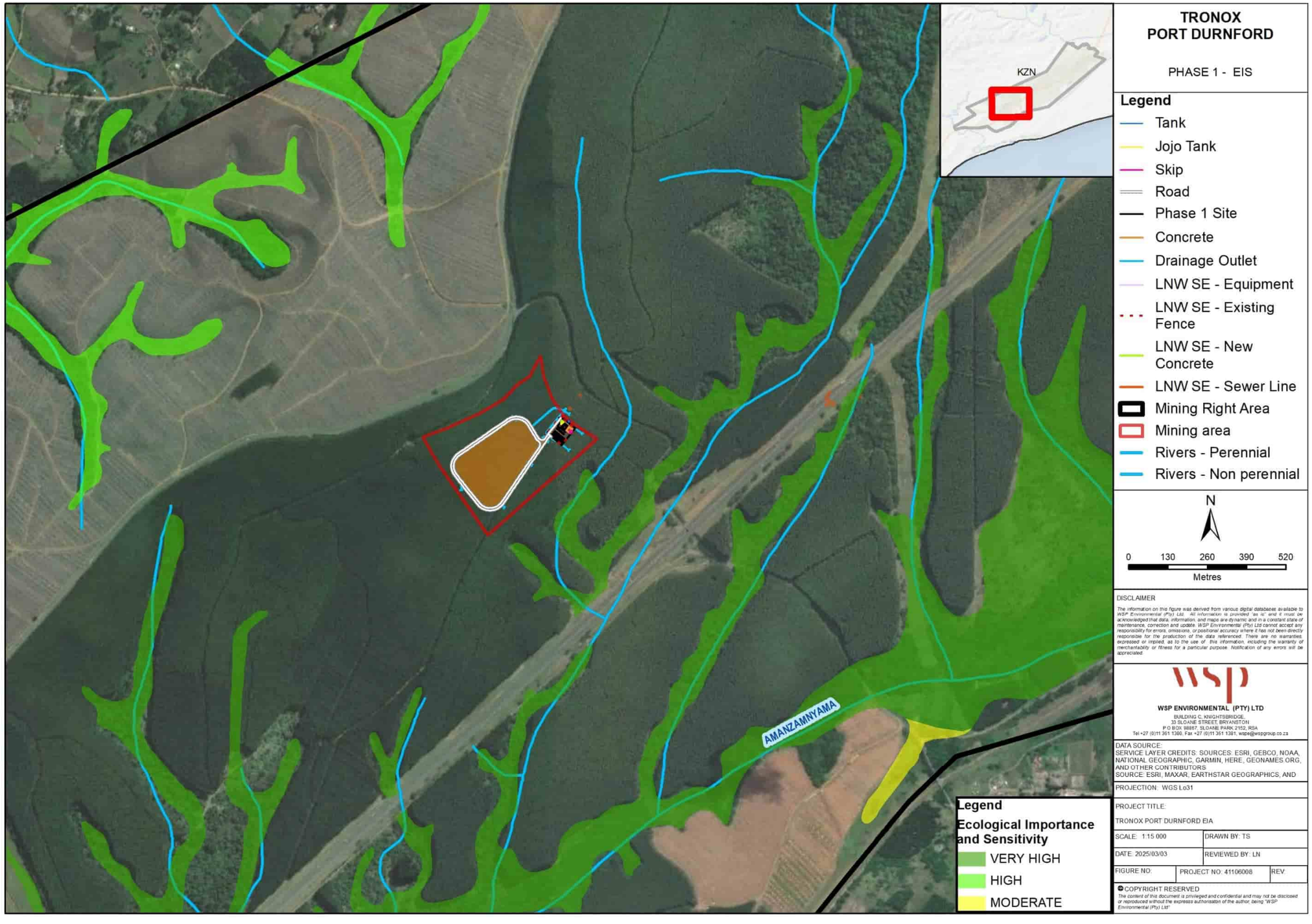


Figure 4-14 – EIS of the wetlands located near Phase 1

Recommended Ecological Category (REC) and water resource management objectives

The future management of the freshwater ecosystems within the project area should be informed by the Recommended Ecological Category (REC) and associated recommended management objectives for the water resources. The REC is the target or desired state of resource units required to meet water resource management objectives and quality targets. It is determined through the consideration of the PES, EIS and realistic opportunities to improve the PES that is driven by the context / setting (These results need to be interpreted in terms of the viability / feasibility of improvement and the desired characteristics of the wetlands based on the context of the catchment in terms of existing impacts/threats and future development pressures.

Table 4-12).

These results need to be interpreted in terms of the viability / feasibility of improvement and the desired characteristics of the wetlands based on the context of the catchment in terms of existing impacts/threats and future development pressures.

Table 4-12 - PES/EIS derived Matrix for the Determination of REC and Management Objectives for Water Resources.

			EIS			
			Very High	High	Moderate	Low
PES	A	Pristine/Natural	A Maintain	A Maintain	A Maintain	A Maintain
	B	Largely Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good - Fair	B Improve	B/C Improve	C Maintain	C Maintain
	D	Poor	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Very Poor	D Improve	E/F Improve	E/F Maintain	E/F Maintain

Based on this matrix and the catchment context, the minimum recommended management objective for the assessed wetlands is listed in Table 4-13 and illustrated in Figure 4-15.

Table 4-13 - REC and Management Objectives for the assessed wetlands for Phase 1

Groups	PES	EIS	REC
7	B	VERY HIGH	A IMPROVE

The above REC's for the wetlands are determined based on a generic matrix that does not taken into consideration the context of the wetlands being considered. Given the ongoing land uses within the landscape that supports these wetlands, it is highly unlikely that a PES category of A can be achieved in any of the wetland systems. A more realistic target would be to maintain the current PES of the wetlands in the long term or allow for limited and managed decline in PES in systems where activities known to affect wetland integrity are authorised.

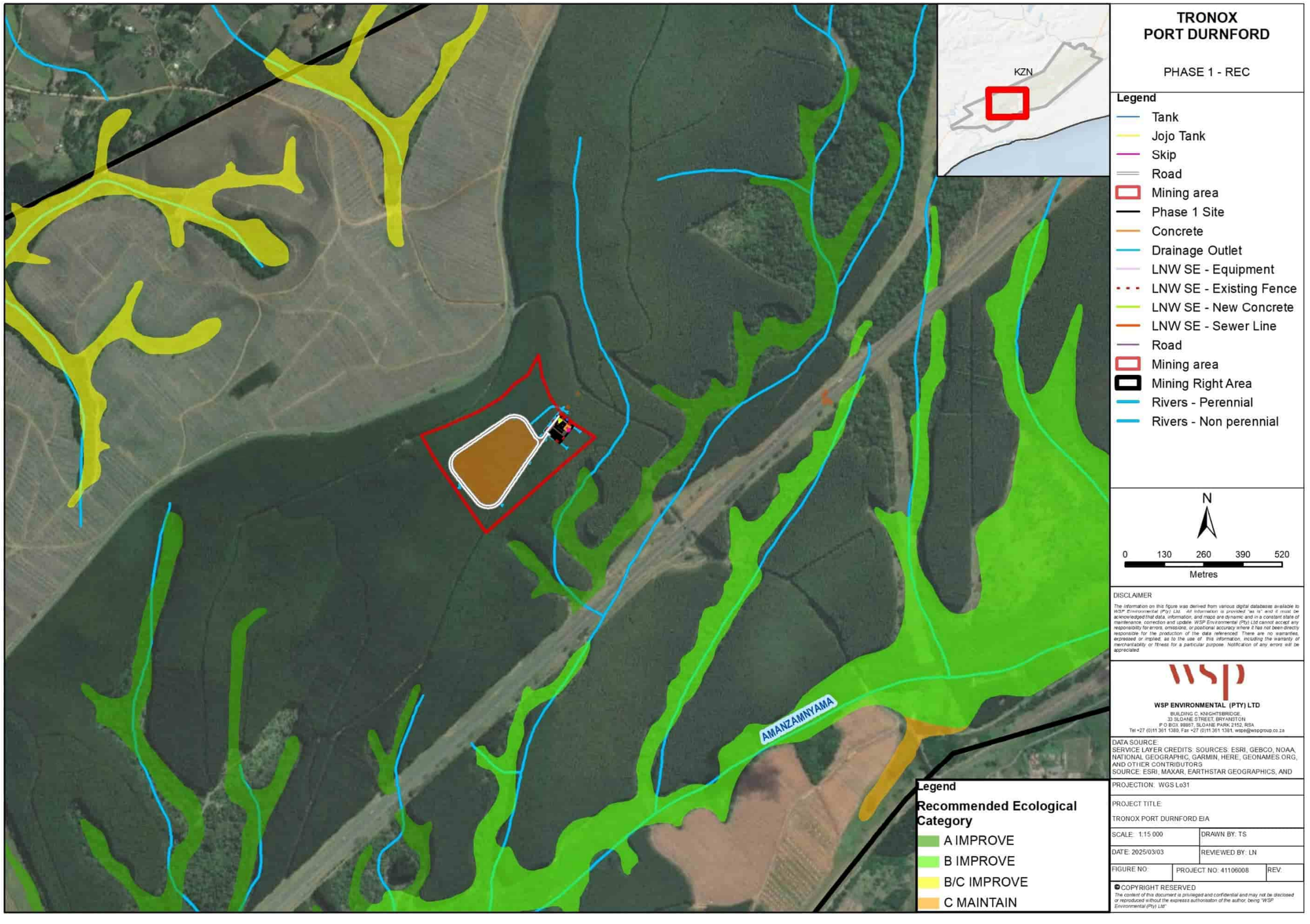


Figure 4-15 - REC for the wetlands within the Phase 1 area

Wetland Impact Assessment

During the field survey (undertaken during November 2022, with an additional site visit undertaken in June 2024), the current impacts that are having a negative impact on the sensitive wetland habitats were identified and are listed below. The effect of these impacts on the wetland ecosystems is discussed in the section detailing the PES of the wetlands.

- Dumping of litter in the wetland area.
- Construction of a road network and bridges that traverse the wetland habitat.
- Rail network that crosses the wetland habitat.
- Housing developments built within/close proximity to wetland habitats.
- Alien Invasive Plants (AIPs).
- Sugarcane agriculture.
- Extensive *Eucalyptus* plantations.

The following impacts at the various phases have been summarised in Figure 4-15.

Table 4-14 – Identified wetland impacts for Phase 1

Phase	Impacts
Pre-construction	No impacts to wetlands are anticipated during the pre-construction phase, however, to limit the risk and significance of certain impacts to wetlands, it is proposed that scientifically determined buffers around wetland habitats be applied where feasible and practical.
Construction	No wetland habitat lies within the Phase 1 mine footprint; therefore no direct loss of wetland habitat is anticipated during construction. Construction activities could result in wetland habitat degradation within adjacent or downstream wetlands through altered geomorphology of the wetlands, water quality deterioration, or changes to the hydrological regime supporting the wetlands.
Operational	Construction activities could result in wetland habitat degradation within adjacent or downstream wetlands through altered geomorphology of the wetlands, water quality deterioration, or changes to the hydrological regime supporting the wetlands.
Decommissioning	Wetland habitat degradation due to erosion, sedimentation, water quality deterioration and spread of Alien Invasive Programme (AIP)

4.3 GROUNDWATER

The information provided in this section has been sourced from the '*Port Durnford Mine Hydrogeological Investigation'* compiled by WSP (2025). Refer to Appendix C for the full report.

The hydrogeological investigation looks at both Phase 1 and Phase 2, however, only Phase 1 is applicable to this application and is addressed below.

4.3.1 AQUIFER CHARACTERISATION

Groundwater vulnerability

Groundwater vulnerability gives an indication of how susceptible an aquifer is to contamination. Figure 4-16 shows the national groundwater vulnerability ratings underlying the project area. This is based on the DRASTIC method which includes the following parameters: Depth to water table; Recharge (net); Aquifer media; Soil media; Topography; Impact of the vadose (unsaturated) zone; conductivity (hydraulic).

The groundwater underlying the project area from west to east has a medium to very high vulnerability rating.

Aquifer classification

WRC (1995) categorizes aquifers into four main classes, Table 4-15. According to Aquifer classification of South Africa Map[1], the site is underlain by minor aquifers (Figure 4-17) which are moderately yielding aquifers with variable water quality.

These aquifers only yield significant groundwater volumes during the raining season when high rainfall and recharge to the aquifer occurs (GCS, 2020).

Table 4-15 - Aquifer classification system (WRC, 1995)

Aquifer Class	Description
Sole Source Aquifer System	An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there are no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
Major Aquifer System	Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m).
Minor Aquifer System	These can be fractured or potentially fractured rocks which do not have high primary permeability, or other formations or variable permeability. Aquifer extent may be limited and water variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers.
Non-Aquifer System	These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer as unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.
Special Aquifer System	An aquifer designated as such by the Minister of Water Affairs after due process.

[1] DWAF (2012). Aquifer Classification of South Africa

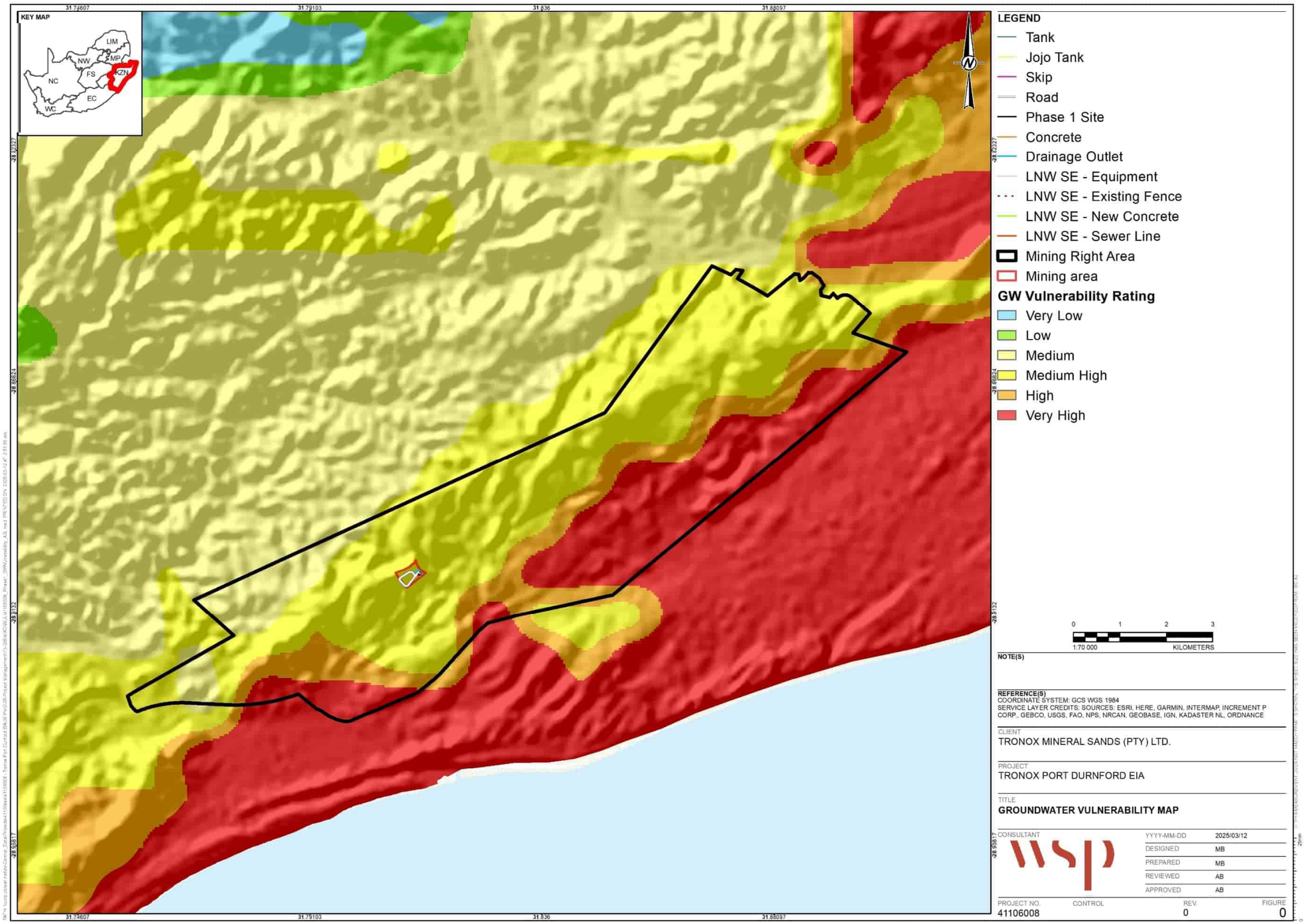


Figure 4-16 - Aquifer vulnerability map

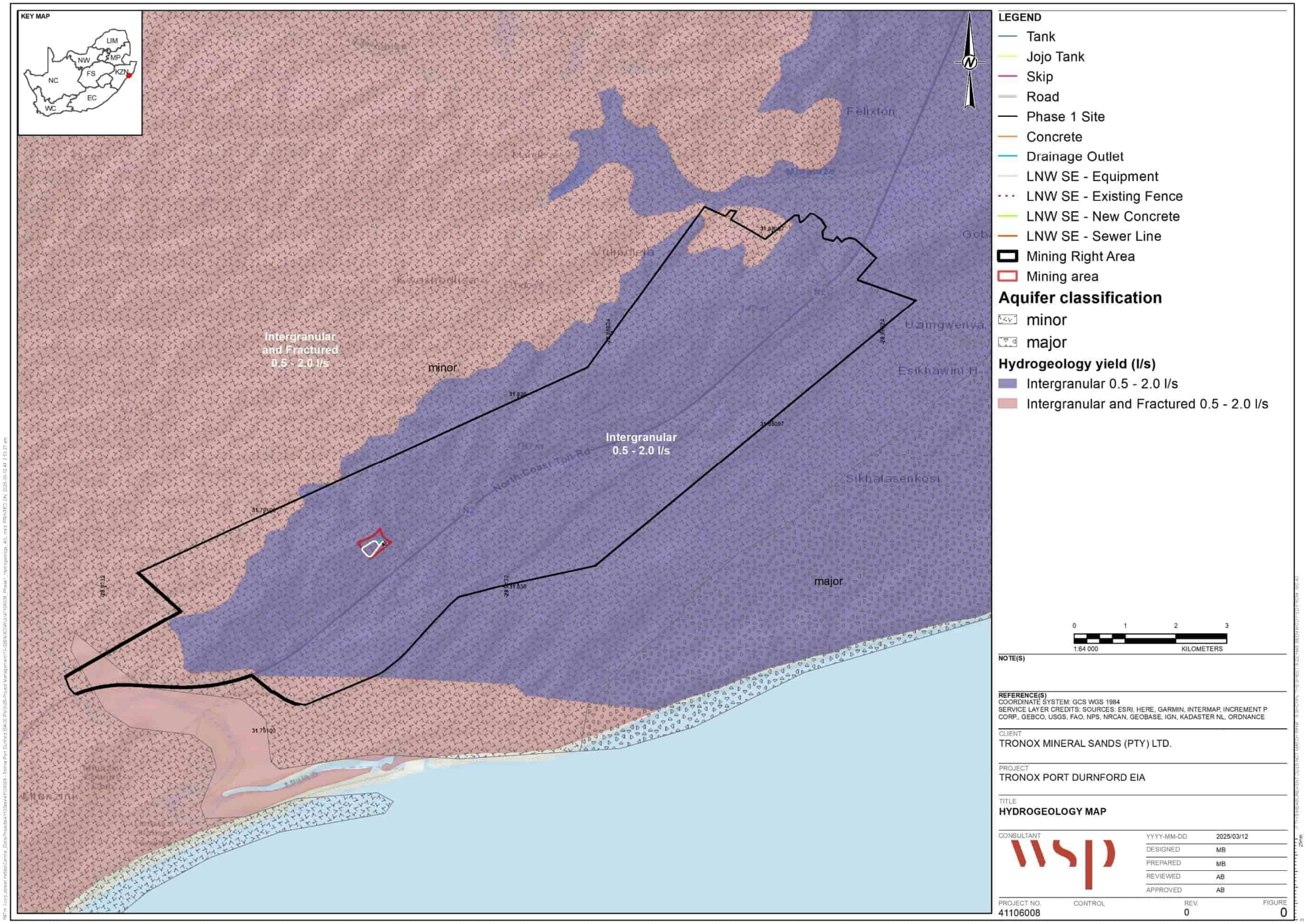


Figure 4-17 - Aquifer classification and yield map

Aquifer protection classification

Aquifer protection classification is based on the aquifer vulnerability classification, threat posed to the aquifer by land use and aquifer system management classification. These attributes are multiplied with the aquifer rating system to obtain the Groundwater Quality Management index (GQM), which is used to determine the level of groundwater protection, as shown in Table 4-16 and Table 4-17.

The project area is underlain by minor aquifer system (2 points) which is highly vulnerable to contamination (3 points). Using aquifer vulnerability and aquifer class, a medium level of groundwater protection is calculated.

Table 4-16 - Ratings for the Groundwater Quality Management Classification System

Aquifer system management classification		Aquifer vulnerability classification	
Class	**Points**	**Class**	**Points**
Sole source aquifer system	6	High	3
Major aquifer system	4	Medium	2
Minor aquifer system	2	Low	1
Non-aquifer system	0		
Special aquifer system	0–6		

Table 4-17 - Appropriate Level of groundwater protection required based on Groundwater Management Classification

GQM Index	Level of protection
<1	Limited protection
1–3	Low level of protection
3–6	**Medium level of protection**
6–10	High level of protection
>10	Strictly non-degradation

4.3.2 GROUNDWATER QUALITY

Groundwater quality was obtained for selected boreholes in November 2022. The results of the groundwater quality testing for the samples obtained during the was compared to the following guidance:

- The ambient groundwater quality as characterised by GCS (2020) represents the water quality range for boreholes sampled in 2020 within the shallow and deeper primary aquifer along the coastline. The water quality as reported by GCS (2020) is included for reference in Appendix B of Appendix C.
- The Department of Water Affairs and Forestry (DWAF) Quality of Domestic Water Supplies Volume 1: Assessment Guide, Second Edition, 1998 (Table 5-1) provides a mechanism to classify the water quality in terms of its suitability for domestic use but it should be noted is not applicable for monitoring boreholes that are not in use. The water quality range for Class 1 and Class 4 is included for comparison in Table 4-18.

- South African National Standard: Drinking water (SANS 241-1), 2015 is included for reference in Table 5-2 where red text is used to indicate where concentrations are elevated above this limit. SANS 241:2015 refers to standards for treatment of water for drinking water.
  - The Operational limit (O) refers to concentrations above which affect the efficient operation of treatment systems and risks to infrastructure.
  - Aesthetic (A) refers to a determinant that taints water with respect to taste, odour or colour and that does not pose an unacceptable health risk if present at concentration values exceeding the numerical limits specified.
  - Acute health (AH) refers to a determinant that poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified.
  - Chronic health (CH) refers to determinant that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified.

Table 4-18 – DWAF Water Quality Classes (1998)

Class	Description	Drinking health effects
Class 0	Ideal water quality	No effects, suitable for many generations.
Class 1	Good water quality	Suitable for lifetime use. Rare instances of sub-clinical effects
Class 2	Marginal water quality, water suitable for short-term use only	May be used without health effects by majority of users but may cause effects in some sensitive groups. Some effects possible after lifetime use.
Class 3	Poor water quality	Poses a risk of chronic health effects, especially in babies, children and the elderly. May be used for short-term emergency supply with no alternative supplies available.
Class 4	Unacceptable water quality	Severe acute health effects, even with short-term use.

Table 4-19 shows the water quality data obtained from the November 2022 analysis.

Table 4-19 - Groundwater quality (Hydrocensus: November 2022)

	Sample ID	SANS 241:2015	Class 1	Class 4	Ambient	W14	W11	TBH14	W5	W1	Ambient	TBH21*	Ambient	W12	W7	TBH2	TBH9*	TBH6*	W4
Aquifer					Shallow aquifer						Coastline aquifer		Deeper aquifer						
Water level meters below ground level (mbgl)						2.2	1.39	0	2.87	2.09		0.58		0	18.53	8.91			38.06
Catchment						W13B	W13B	W13B	W12F	W12F		W12F		W13B	W13B	W13B	W13B	W12F	W12F
pH	pH units	5-9.7	9.5-10	>11	6.8-9.3	8.53	8.72	7.28	8.74	7.81	7.1-7.6	6.77	7.9-8.2	8.38	7.94	7.51	7.66	6.45	8.73
EC	mS/m	170 (A)	70-150	>520	31-51	42.4	28.3	35	29.1	44.2	68-105	48.6	44-60	52.3	51	27.4	40.1	26.1	46.4
TDS	mg/L	1200 (A)	450-1000	>3400	182-296	188	163	199	129	240	370-556	320	242-296	186	278	177	247	155	164
NO_3 as N	mg/L	11 (AH)	"6-10	>40	0.1-0.4	<0.05	<0.05	0.07	<0.05	1.02	<0.14	<0.05	<0.04	0.45	<0.05	0.79	0.20	<0.05	0.43
SO_4	mg/L	250 (A), 500 (AH)	200-400	>1000	0.3-5	3.2	3.2	0.7	3.2	3.2	0.4-33	<0.5	2-5	3.2	25.9	7.2	45.5	3.2	3.4
Cl	mg/L	300 (A)	100-200	>1200	39-99	103.6	36.8	33.3	40.5	44.9	145-173	96.2	73-79	75.8	30.5	33.1	60.6	55.3	45.9
F	mg/L	1.5 (CH)	0.7-1.0	>3.5	0.1-0.5	0.6	0.4	<0.3	0.4	<0.3	<0.3	<0.3	0.1-0.2	<0.3	0.5	0.3	<0.3	<0.3	<0.3
P	mg/L	-	-	-		<0.005	0.027	0.005	<0.005	<0.005		<0.005		<0.005	0.022	0.068	<0.005	<0.005	<0.005
T Alk as $CaCO_3$	mg/L	-	-	-	22-160	44	80	112	84	136	30-231	80	52-166	132	184	76	48	48	156
Ca	mg/L	-	-	-	1-33	2.2	3.8	28.7	2.5	7.1	10-57	18.5	12-13	5.4	16.6	9.9	10.6	5.8	8.7
Mg	mg/L	-	70-100	>400	0.3-7.1	1.6	1.8	6	2.5	2.9	17-30	11.6	13-18	5.4	8.4	5.1	9.4	4	9.8
Na	mg/L	200 (A)	70-100	>400	33-79	74.2	48.3	30.3	48.9	72	75-92	56.6	43-76	56.8	54.7	35.8	46.2	35.5	36.4
K	mg/L	-	25-50	>500	2-10	2.9	3.4	1	3.6	9.5	2-3	1.4	4-5	12.8	23	2.4	3.4	2.3	9.8
Al	mg/L	0.3 (O)	-	-	<0.03	0.047	0.053	<0.02	<0.02	<0.02	<0.02	0.158	<0.02	0.863	1.383	0.155	0.072	0.073	<0.02
As	mg/L	0.01 (CH)	0.01-0.05	>2	<0.04	<0.003	<0.003	<0.003	<0.003	<0.003	<0.04	<0.003	<0.04	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Co	mg/L	-	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	0.002	0.011	<0.002	<0.002	0.012	<0.002
Cr	mg/L	0.05 (CH)	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	<0.002	0.004	0.003	<0.002	<0.002	<0.002
Cu	mg/L	2 (CH)	0.5-1	>15	<0.02	<0.007	<0.007	<0.007	<0.007	<0.007	<0.02	<0.007	<0.02	<0.007	0.013	<0.007	<0.007	<0.007	<0.007
Fe	mg/L	0.3 (A), 2 (CH)	0.5-1	>10	<0.11	9.429	0.951	5.859	2.47	0.403	<0.04	0.468	<0.02 (<0.02-20 in TBH7)	0.286	3.657	0.093	0.022	53.04	<0.02
Mn	mg/L	0.1 (A), 0.4(CH)	0.1-0.4	>10	0.03-0.04	0.26	0.15	0.34	0.092	0.13	0.2-0.5	0.21	<0.13 (<0.02-0.76 in TPH6)	0.568	1.02	0.005	0.006	0.765	0.479
Ni	mg/L	0.07 (CH)	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	0.003	0.025	<0.002	<0.002	0.008	<0.002
Pb	mg/L	0.01 (CH)	-	-	<0.03	<0.005	0.015*	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ba	mg/L	0.7 (CH)	-	-	<0.02	0.013	0.012	0.018	<0.003	<0.003	0.03-0.1	0.063	0.02-0.1	0.072	0.323	0.009	0.045	0.09	0.054
B	mg/L	2.4 (CH)	-	-	<0.03	0.055	0.03	0.043	0.047	0.078	<0.02	0.028	<0.02	0.015	0.017	0.041	0.039	<0.012	0.014
Sr	mg/L	-	-	-	0.04-0.2	0.038	0.037	0.195	0.023	0.061	0.1-0.3	0.151	<0.1	0.088	0.117	0.06	0.083	0.027	0.07
Zn	mg/L	5 (A)	<3	->20	<0.02	0.053	0.037	0.033	0.07	0.014	0.3-3	0.008	<0.03	0.112	0.098	0.008	0.012	9.47	0.005
Class					0	3 (Fe)	1 (Fe, Mn)	3 (Fe)	2 (Fe)	1 (Mn)	0	1 (Mn)		2 (Mn)	2 (Fe & Mn)	0	0	4 (Fe)	2 (Mn)

Notes: Concentrations reported as below detection are indicated in grey text. Cyanide and metals reported at or below detection are excluded from the table.

* Underlined boreholes are assumed to be in use.

SANS 241:2015 refer to standard for treatment of water for drinking water. The Operational limit (O) refers to concentrations above which affect the efficient operation of treatment systems and risks to infrastructure. Aesthetic (A) refers to a determinant that taints water with respect to taste, odour or colour and that does not pose an unacceptable health risk if present at concentration values exceeding the numerical limits specified, Acute health (AH) refers to a determinant that poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified, chronic health (CH) refers to determinant that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified

Table 4-19 is discussed as follows:

- The background water quality in the Port Durnford area is generally of ideal to good water quality (Class 0 – 1: 42% of samples), with marginal water quality noted in 33% of boreholes and poor/unacceptable water quality noted in 25% of boreholes. The marginal and poor quality being due to manganese (0.005 - 1.2 mg/L) and iron (0.09-53.04 mg/L) concentrations that are elevated compared to the guideline values. The water quality is discussed based on the November 2022 as follows:
    - Manganese (0.006 – 1.02 mg/L) is slightly higher in the secondary aquifer (Class 2 in W12, W7, TBH6 and W4) as compared to the shallow aquifer (Class 1) and
    - Iron is locally highest in TBH6 (deeper aquifer) at 53 mg/L and 3.7 mg/L in W7 but otherwise <0.5 mg/L (Class 0) in the secondary aquifer. Concentrations are similarly variable (0.09-0.34 mg/L) in the shallow aquifer but are generally <0.4 mg/L (Class 1).
- The GCS data in 2020 was analysed by Talbot and Talbot laboratory where the metal analyses detection limits were higher than provided in 2022. Metal concentrations were reported at higher concentrations in 2022 as compared to 2020 in both the shallow and deeper aquifers where metals were, except for TBH7 (iron of >20 mg/L), less than the Class 1 guidance values.
- pH varies from 5.6 (TBH7 in GCS, 2020) to 9.3 (W14, GCS 2020 record) but is generally within the ideal range for water quality of 7 – 9.5.
- Electrical conductivity (EC) was generally below 60 mg/L (ideal range) in November 2022 with a locally higher concentration of 105 mS/m reported for TBH21 (coastal aquifer) by GCS in 2020. Similarly, TDS is generally <300 mg/L in boreholes located in and around the MRA and slightly higher (320-556 mg/L) in boreholes in the coastal aquifer (TBH19 and TBH21) to the south of the MRA.
- Concentrations are generally similar in the shallow and deeper aquifers except for sulfate, typically < 8mg/L, but locally higher in W7 (25.9mg/L) and TBH9 (45.5 mg/L) (secondary aquifer).
- Concentrations for aluminium (Al) are locally elevated in W7 and W12 (0.86-1.4 mg/L) compared to the other samples, for lead (Pb) in W11 (0.015 mg/L) and for zinc[2] at (9.47 mg/L). As these concentrations represent only one sample run, it is recommended that the metal concentrations be confirmed.
- Salinity (sodium and chloride) is not reported as elevated in either 2020 or November 2022 since sodium concentrations vary from 24 – 94 mg/L and chloride concentrations vary from 30.5-173 mg/L (< Class 1). Elevated sodium and chloride are however noted for boreholes in the Fairbreeze area (SRK, 2020). This is most likely related to the underlying geology and deeper groundwater. Most of these boreholes appear to be abstracting groundwater from the Karoo sediments, which is generally associated with poorer water qualities.

A piper diagram was constructed using the data retrieved (Figure 4-18). Piper diagrams graphically represent the relative percentages of anions and cations in water samples. The cation percentages

[2] The locally elevated concentration of Zn, if confirmed by routine monitoring, is <10 mg/L. While aesthetic effects are possible, health effects from drinking water are generally only noted at concentrations > 20 mg/L (DWAF, 1998).

are plotted on the left triangle and the anion percentages on the right triangle. A projection of these cation and anion presentations onto the central diamond presents the chemical signature of the major ion composition of the water.

Most of the samples obtained in November 2022 represent a sodium bicarbonate chemical signature which follows the typical dynamic groundwater flow evolution. A few of the samples (W14, TBH6, TBH9 and TBH21) represent sodium chloride type, meaning these boreholes are in areas with chloride enrichment. The above two types of hydrochemical signatures are mainly indicative of possible atmospheric deposition of sodium and chloride within the coastal region and sea water intrusion.

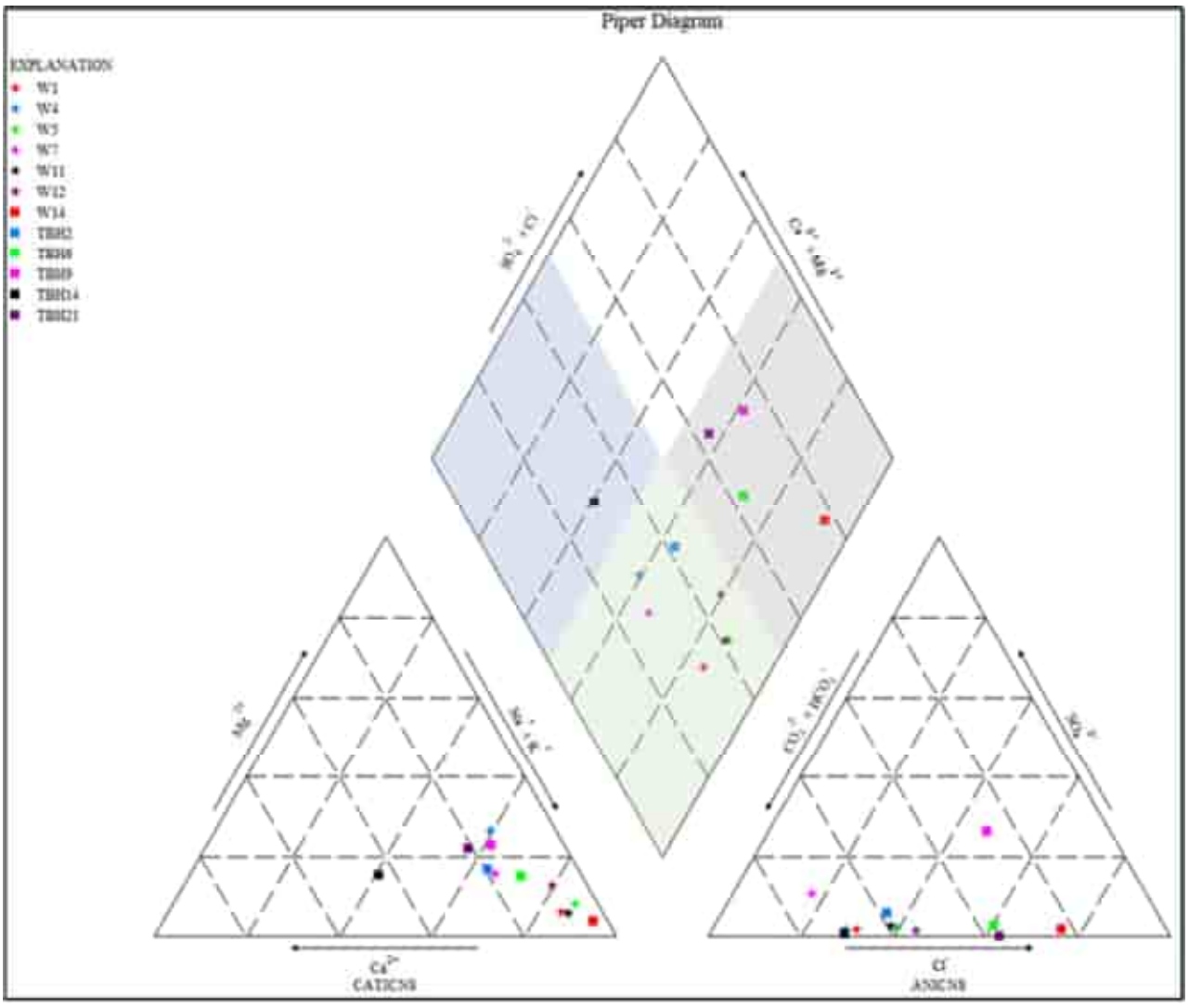


Figure 4-18 - Piper diagram aquifer characterisation

4.3.3 HYDROCENSUS

Previous hydrocensus surveys were performed in 2010 (SRK Consulting, 2010), in 2017 (SRK Consulting, 2017) for the area west of the MRA, and in 2020 in the MRA area (GCS, 2020).

Thirty-six boreholes were identified in and around the MRA by GCS which included 22 privately owned boreholes, of which 6 (TBH2, TBH4, TBH5a, TBH8, TBH19, and TBH21) were in use, and 12

monitoring wells, of which 2 were dry and one damaged. Approximately 71 boreholes are identified in the National Groundwater Archive (NGA) with several indicated in the same location. The locality of the previous hydrocensus' boreholes and NGA borehole is indicated on Figure 4-19. Photos of the hydrocensus boreholes were included in Appendix A of Appendix C (Hydrogeological report of WSP).

A hydrocensus survey was conducted within a 2 km radius of the MRA in November 2022 (Figure 4-20). The survey involved the collection of data from accessible boreholes. GPS co-ordinates, landowners' details, existing equipment, current use, reported yield, measured well depth and static water level were assessed and water levels obtained where accessible.

A total of 31 boreholes were identified and visited during the survey of which 20 fall within the MRA (Figure 4-1).

The field observations are summarised in Figure 4-19 with further detail provided in Appendix A of Appendix C (Hydrogeological report of WSP). The borehole naming convention followed that of the GCS hydrocensus with coordinates within 50 m of the previous census. The previous census information by GCS (2020) is included for reference in Table 4-2. Selected boreholes were sampled and submitted for analyses.

The data was compared to the previous hydrocensus information as follows:

- Of the 71 boreholes identified in the National Groundwater Archive within 2 km of the MRA, only one (2831DD00131) was confirmed during the 2022 hydrocensus (Table 4-20) and was found to be damaged.
- Of the 16 privately owned boreholes identified by GCS, 12 were reassessed with TBH6 and TPH9 confirmed to be in use (not in use in 2020). TBH4 and TBH8 were locked with limited access and are therefore also assumed to still be in use as were TBH5a and TBH19 as these were not included in the 2022 hydrocensus. TBH2 and TBH21 (noted to be in use in 2020) were found to no longer be in use. The locality of boreholes in use are included in Figure 4-19.
- Of the 12 monitoring boreholes identified in 2020, two were still dry/damaged.

Water levels and borehole depths vary from artesian to > 50 mbgl with borehole depths also varying from 1.5-<120 mbgl. Water strike and lithological information is not available for the boreholes.

The hydrocensus data confirms that there are limited groundwater users in the area. Although details of their yields are limited, no large-scale abstraction is taking place.

Other receptors include the sensitive areas namely, the aquatic system as a wetland, the estuaries, and the ocean.

Figure 4-19 – Previous and Current Hydrocensus boreholes

Table 4-20 -Hydrocensus Information

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[3]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
W1	W12F- On Southern boundary and dg of MRA - adjacent to Mzingwenya River	-28.07402	31.89224	2.09	12.14	Mon	Monitoring borehole (Sampled)	Tronox	Mon	16	1.5 (2017) 3.03 (2020)	13	Mon	Monitoring borehole had an Allen key lock and was in good condition
W2	W12F- Inside the Eastern-most portion of the MRA	-28.86715	31.87173	58.55	75.87	Mon	Monitoring borehole.	Tronox	Mon	89	58.9 (2017) 54.85 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W3	W12F-On northern boundary (upgradient)	-28.86645	31.85545		86.88	Mon	Monitoring borehole.	Tronox	No	84	Dry at 45m (2017 & 2020)	45	Mon	Monitoring borehole had an Allen key lock and was in good condition
W4	W12F- Inside the Eastern-most portion of the MRA	-28.87189	31.86835	38.06	61.86	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	89	39.3 (2017) 23.15 (2020)	55	Mon	Monitoring borehole had an Allen key lock and was in good condition
W5	W12F - Within MRA but south of proposed RSF, near topographic watershed but dg of MRA	-28.88717	31.86041	2.87	35.33	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	33	3.78 (2020)	35	Mon	Monitoring borehole had an Allen key lock and was in good condition
W6	W13B - west of topographic watershed within MRA	-28.88597	31.83893	38.11	65.45	Mon	Monitoring borehole.	Tronox	Mon	107	57.05 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W7	W13B - on northern boundary, the KwaGugushe and Msasandla Rivers are to the north.	-28.88943	31.81531	18.53	63.07	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	111	36.46 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W9	W13B - Within MRA on southern boundary near the Amanzamnyama river and near topographic watershed	-28.90648	31.83956			No	Not in use. Destroyed.	Tronox	No		Destroyed (2020)	27	Mon	Monitoring borehole had an Allen key lock and was in good condition
W11	W13B - Within MRA on southern boundary on northern side of Amanzamnyama river and west of W9	-28.91088	31.82568	1.39	25.65	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	25	0.9 (2017) 1.62 (2020)	23	Mon	Monitoring borehole had an Allen key lock and was in good condition
W12	W13B - Within MRA (north-western portion) on northern boundary	-28.90149	31.78862	24.55	56.75	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	59	0.9 (2017) 24.69 (2020)	39	Mon	Monitoring borehole had an Allen key lock and was in good condition
W13	W13B - western portion of the MRA between RSF and sand tail area	-28.90704	31.80481			Mon	Monitoring borehole.	Tronox	Mon	99	73.4- dry at 57 (2017) Dry (2020)	57	Mon	Monitoring borehole had an Allen key lock and was in good condition
W14	W13B - Within MRA on southern boundary on southern side of Amanzamnyama river	-28.93239	31.80258	2.2	20.45	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	11	2.3 (2017) 2.25 (2020)	19.6	Mon	Monitoring borehole had an Allen key lock and was in good condition. Located near plantation
2831 DD001 31	W13B_Inside MRA adjacent to northern boundary near watershed	-25.97568	32.58957	-	5.86	No	Damaged.							Not identified

[3] Coordinate based on GPS readings in November 2022. Coordinates are within 50m of previous GCS, 2020 locality. Boreholes not identified in 2022 include the coordinate provided by GCS and are highlighted in grey text. Elevation is as indicated by GCS, 2020

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[3]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
TBH1	W13B - Inside the mine area just south of W7	-28.89338	31.82102	3.68	32.96	No	Not in use. Pump disconnected.	Siya Qhubeka Forestry	No	57	2.76 (2020)	35	No	Borehole was not locked and did not have a cap or pump installed.
TBH2	W13B - Inside the mine area south of W7 and east of TPH1 and next to TPH3	-28.89146	31.82438	8.91	65.43	No	Not in use. Pump disconnected. (Sampled)	Siya Qhubeka Forestry	**Yes**	65	NA (2020)	Unk	Yes	Submersible pump. Supplied water to the staff houses at Siya Qhubeka Forest. Locked pump house.
TBH3	W13B - Inside the mine area south of W7 and east of TPH1 and next to TPH2	-28.89145	31.82434	8.84	51.8	No	Not in use. Pump disconnected.	Siya Qhubeka Forestry	No	61	NA (2020)	Unk	No	Historically supplied water to the staff houses (Submersible pump). Replaced by TBH2 when borehole collapsed.
TBH4	W13B - Inside the mine area east of TPH1 and next to TPH2	-28.89508	31.82931			**Yes**	Locked.	Siya Qhubeka Forestry	**Yes**	64	NA (2020)	Unk	Yes	Locked and protected by housing. Submersible pump installed.
TBH5a	W13B- West of mine but within the MRA - SW of RSF	-28.92081	31.77874			Assumed Yes	Not included in 2022 hydrocensus	Waterloo farm	Yes	49	NA (2020)	30	Yes	Protected by steel housing. Access to the borehole was granted by the farm owner. Submersible pump installed with yield estimated as 0.83- 1.11 L/s assumed
TBH5b	As above	-28.92082	31.7784				Not included in 2022 hydrocensus	Waterloo farm	No	49	8.19 (2020)	30	No	Located next to TBH5a and protected by a pump house. The farmer mentioned submersible pump equipment from borehole was stolen
TBH6	W12F - Outside MRA to the east	-28.85128	31.90754			**Yes**	In use. Potable water, irrigation and drinking. Hand pump installed. No access. (Sampled)	Community	No	79	NA (2020)		No	Previously used by community as a source of domestic water supply (hand pump). Plots close to borehole 2831DDG4380 on GRIP Database, which reports a depth of 63 mbgl and yield of 0.42 L/s.
TBH7	W12F - Within MRA Eastern boundary	-28.85387	31.88891	10.44		No	Not in use. Pump disconnected.	Jocks Farm	No	36	13.5 (2020)	Unk	No	Pump house was in dense grass inside the forest (approximately 20m into the forest). Equipment had been removed from the borehole.
TBH8	W12F - Within MRA between the sand tails and proposed RSF	-28.86188	31.87807			**Yes**	Locked. Assumed to be use based on previous hydrocensus	Unknown	**Yes**	117	NA (2020)	50	Yes	Locked with a bolt and nut. The borehole was located next to the Vodacom tower opposite Mhlathuze water reservoirs.
TBH9	W13B - just outside northern boundary and west of topographic watershed (north of W6).	-28.882	31.8275			**Yes**	In use. Potable water, irrigation and drinking. (Sampled)	Community	No	87	NA (2020)	Unk	No	The borehole hand pump was broken.
TBH10	W13B-NW of mine - outside the mine area	-28.91631	31.76503			No	Not in use. Damaged.	Savalela	No	28	1 (2020)	30	No	The borehole was in a sugarcane field. The borehole does not have a cap and was not protected. Historically equipped with a submersible pump.
TBH11	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.9226	31.84184			No	Not included in 2022 hydrocensus	Community	No	60	Blocked (2020)	Unk	No	The hand pump was removed (stolen) and the borehole was blocked at1.2 m. Plots close to borehole 2831DD00144 on NGA Database.
TBH12	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.93206	31.83714			No	Not in use. Blocked.	RBM	/	32	NA (2020)	Unk	/	Borehole RBM16 of Zulti South. PVC Casing filled with sand. No access for water level.

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[3]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
TBH13	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.92756	31.83699			No	Not in use. Damaged.	Unknown	No	33	Blocked (2020)	68*	/	Located inside rusted housing and blocked at 3 mbgl. Plots close to borehole 2831DDG2852 on GRIP Database, with a yield of 1.11 L/s, depth of 68 mbgl and water level of 37.4 mbgl in 1995.
TBH14	W13B - Within MRA on southern boundary on northern side of Amanzamnyama river and west of W9	-28.91486	31.8259	-0.29	1.52	No	Not in use. Artesian conditions. (Sampled)	Unknown	No	25	0 (2020)	10	/	Located next to an old power station near railway. Artesian. Plots close to borehole 2831DD00139 on GRIP and NGA database, which was reported to be located at a sawmill and used for domestic water supply.
TBH15	W13B - outside and to the north of the Msasandla River	-28.88267	31.76535			No	Not in use. Pump disconnected.	Unknown	No	73	NA (2020)	157*	No	Located on church premises but mono-pump not working. Plots close to borehole2831DDG4368 on GRIP Database, with a depth of 157 mbgl and yield of 0.67 L/s.
TBH16	W13B - outside and to the north of the Msasandla River	-28.88308	31.75885			No	Not in use. Hand pump broken.	Community	No	71	NA (2020)	120*	No	Located in an open area. Hand pump not working. Plots close to BH 2831DDG4382on GRIP Database, with a depth of 120 mbgl, water level of 25 mbgl in 1995 and yield of 2.83 L/s.
TBH17	W13B - outside and to the north of MRA west of the watershed	-28.85741	31.80899			No	Not in use. Pump disconnected.	Community	No	77	NA (2020)	Unk	No	Borehole not operating and handpump was removed. Plots at BH 2831DD00154 on GRIP and NGA Databases, with a yield of 1.1 L/s.
TBH18	W13B - outside and between the Msasandla River and the northern boundary of the MRA	-28.89353	31.77943				Not included in 2022 hydrocensus	Community	No	79	NA (2020)	*97**	No	Hand pump was broken. Plots close to BH 2831DDV1227 on GRIP Database with a depth of 97 mbgl and water level of 7.8 mbgl in1998
TBH19	W12F - Outside MRA Between the Mzingwenya River (coincident with southern boundary of MRA) and Coastline	-28.89442	31.90556			Assumed Yes	Not included in 2022 hydrocensus	Community	**Yes**	34	NA (2020)	*Unk*	Yes	The borehole had a hand pump. The Borehole was located behind Zulti South Site Office.
TBH20	W12F - Outside MRA South of Mzingwenya River near the coastline	-28.92106	31.88103				Not included in 2022 hydrocensus	RBM (Zulti South)	No	20	NA (2020)	*20**	/	Located at Zulti South Offices but gate locked. Plots at borehole 2831DDV1458 (RBM13) on GRIP Database, with a depth of 20 mbgl. Also plots close to BH2831DDV1457 (RBM12) with a depth of 15 m.
TBH21	W12F - Outside MRA South of Mzingwenya River near the coastline	-28.92814	31.86408	0.58	3.23	No	Unknown. Likely not in use. (Sampled)	RBM (Zulti South)	**Yes**	18	0.41 (2020)	4 (18*)	Yes	Located next to a wetland with datalogger installed and was locked with bolt and nut. Borehole had collapsed as original depth was reported to be18 mbgl on GRIP Database borehole 2831DDV1459 (RBM14).

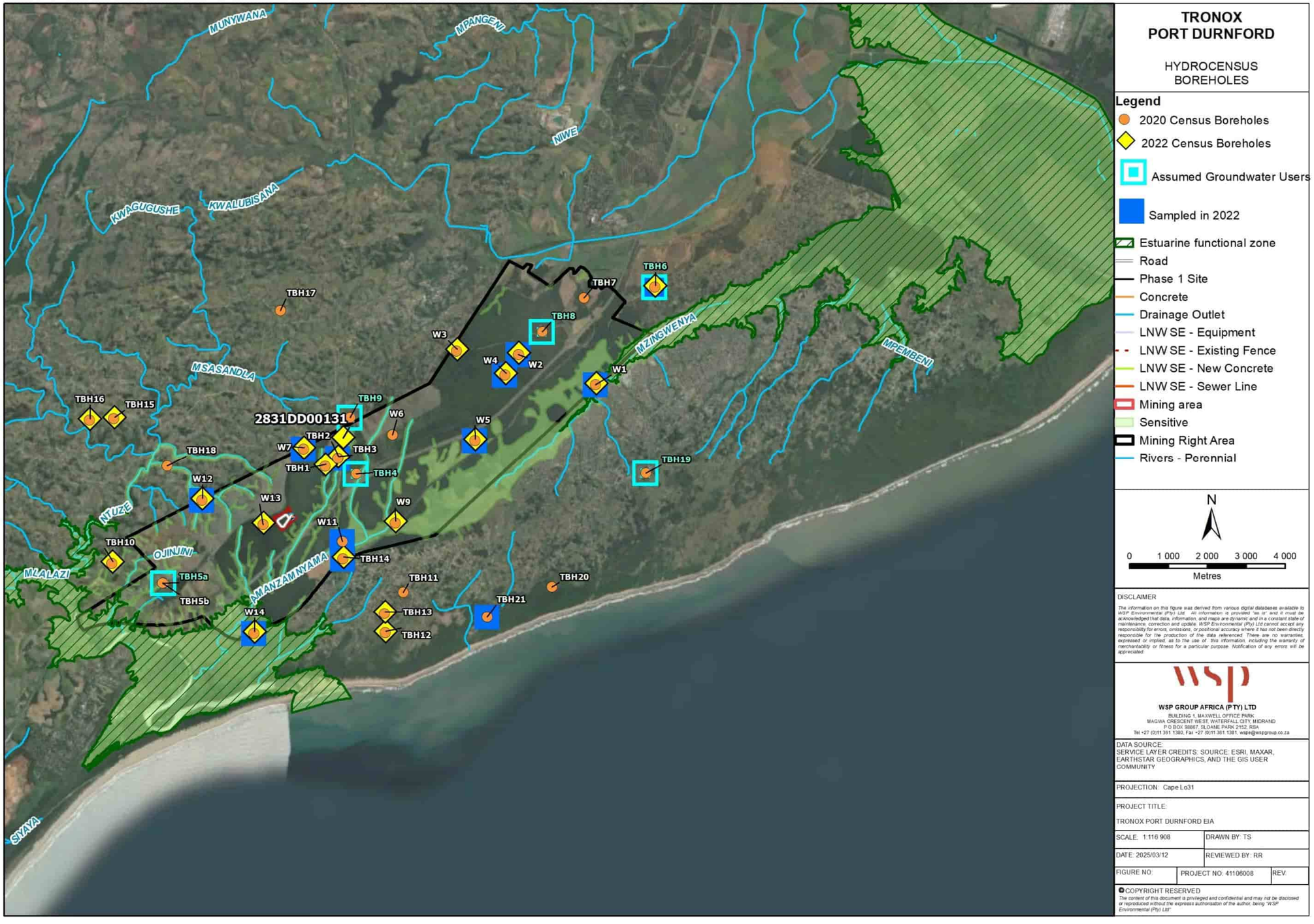


Figure 4-20 – Hydrocensus boreholes (2020 & 2022)

4.3.4 POTENTIAL POLLUTION SOURCE IDENTIFICATION

No pollution sources were identified for Phase 1.

4.3.5 GROUNDWATER MODEL

Conceptual Model

The conceptual site model (CSM) depicted in Figure 4-21 and is described here:

- The shallow and deeper intergranular primary aquifer is unconfined and hosted in undifferentiated coastal deposits of the Maputaland Group and alluvium deposited within Mlalazi and Mhlathuze River systems. It contains:
  - Calcareous sand, dunes and reddish sandy soil of the Sibayi, KwaMbonambi and Berea-type in the upper 20 m. The hydraulic conductivity of the shallow aquifer is between 0.1 and 10 m/d. Yields are generally below 2 L/s.
  - Cross-bedded sand and local calcarenite or fossiliferous mudrock of the Kosi Bay and Port Durnford formations from 20 to >100 m deep.
- The secondary intergranular and fractured aquifer is hosted within mainly argillaceous rocks of the Karoo Supergroup and mainly meta-arenaceous rocks of the Natal Metamorphic Province. The weathered and intergranular portion of the aquifer is 10 to 15 m thick, whilst the fractured portion is roughly 150 to 170 m thick. The hydraulic conductivity of the secondary aquifer is between 0.001 and 0.1 m/d and yields range from 0.1 L/s to 1.5 L/s.
- Based on information gathered during the hydrocensus, groundwater levels range from artesian conditions to 59 mbgl across the area. Shallower water levels are observed near the rivers and in the down gradient areas closer to the coast where primary aquifers are assumed to be locally present. The deeper water levels, located in the topographically higher areas, is assumed to be part of the same the primary aquifer. This is supported by the similar water chemistry in both aquifers and the relative water levels observed in both.
- Groundwater flow from the site is generally towards the east and south-east, in the direction of the Mzingwenya River, the Amanzamnyama and Mlalazi Rivers, and the Indian Ocean. West of the mining area, water drains towards the north-west (Mhlathuze River) and south-west (KwaGugushe River).
- The baseline groundwater quality in the area is generally good with marginal to poor quality noted in some boreholes on the eastern MRA boundary (TBH6 and TBH7) and locally on the south-western boundary in the shallow aquifer (W14 and TPB14) due to elevated iron and manganese concentrations.
- The site is currently occupied by forestry activities and will return these operations upon completion of mining and subsequent rehabilitation.
- GCS (2020) noted that groundwater dependent ecosystems are a common feature along the north-eastern coastline of KwaZulu-Natal. Textural characteristics (including the clay content) can lead to locally perched aquifer conditions resulting in the formation of springs within the shallow aquifer.
- Wetlands east of the project site, mainly along the drainage channels feeding Lake Cubhu and around Kraal Hill, are fed by shallow groundwater from perched aquifers formed by underlying clay rich dune sands.
- The Mlalazi estuary south-west of the site is also fed by shallow groundwater in the area.

- A combination of topography and textural characteristics of the geological formations influence the baseflow component of the project area.

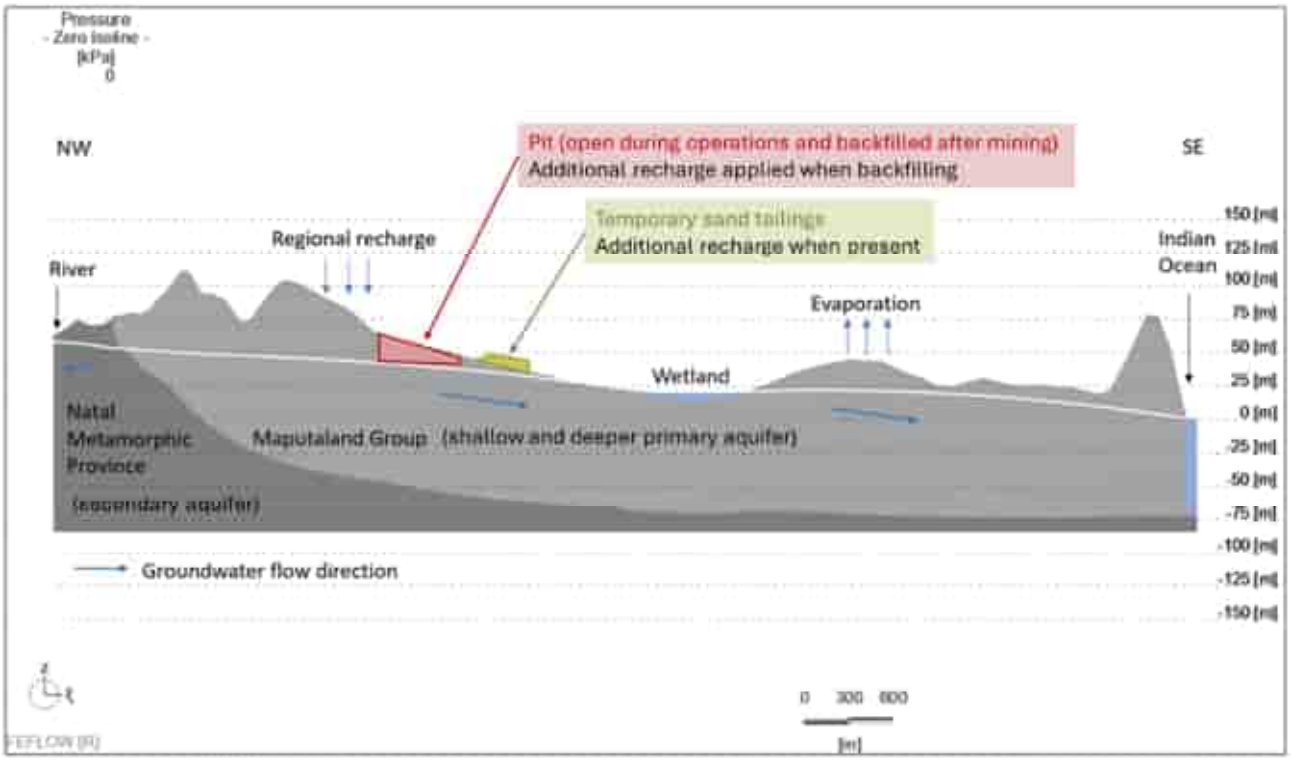


Figure 4-21 - Conceptual site model (white line indicating water level)

Numerical Model

FEFLOW was used for the development of the numerical groundwater model.

The shallow and deeper primary aquifer is a source of water for rivers, lakes and most wetlands in dryer periods and is recharged by these systems in wet periods (GCS, 2020).

Sources

No contaminant sources are applicable to Phase 1.

Sinks

The rivers, wetlands, and mining areas act as sinks as water is removed during mining. In the absence of detailed pumping rates, the model was calibrated against the existing water levels and groundwater abstraction from local boreholes excluded as a sink in the model on the assumption that it minimally affects the regional aquifers.

During mining

The operational mode for Phase 1 runs from January 2025 to January 2035. Figure 4-22 presents the drawdown for the Phase 1 period.

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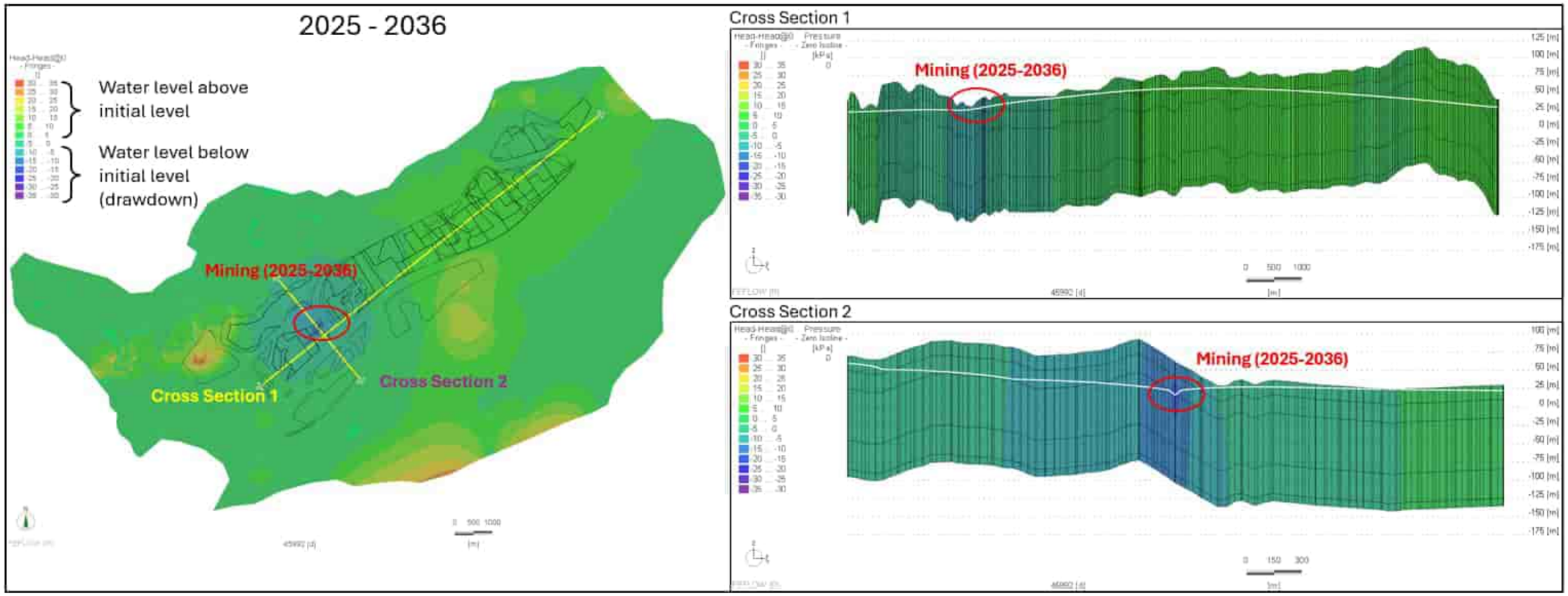


Figure 4-22 - Simulated drawdown 2025 – 2035

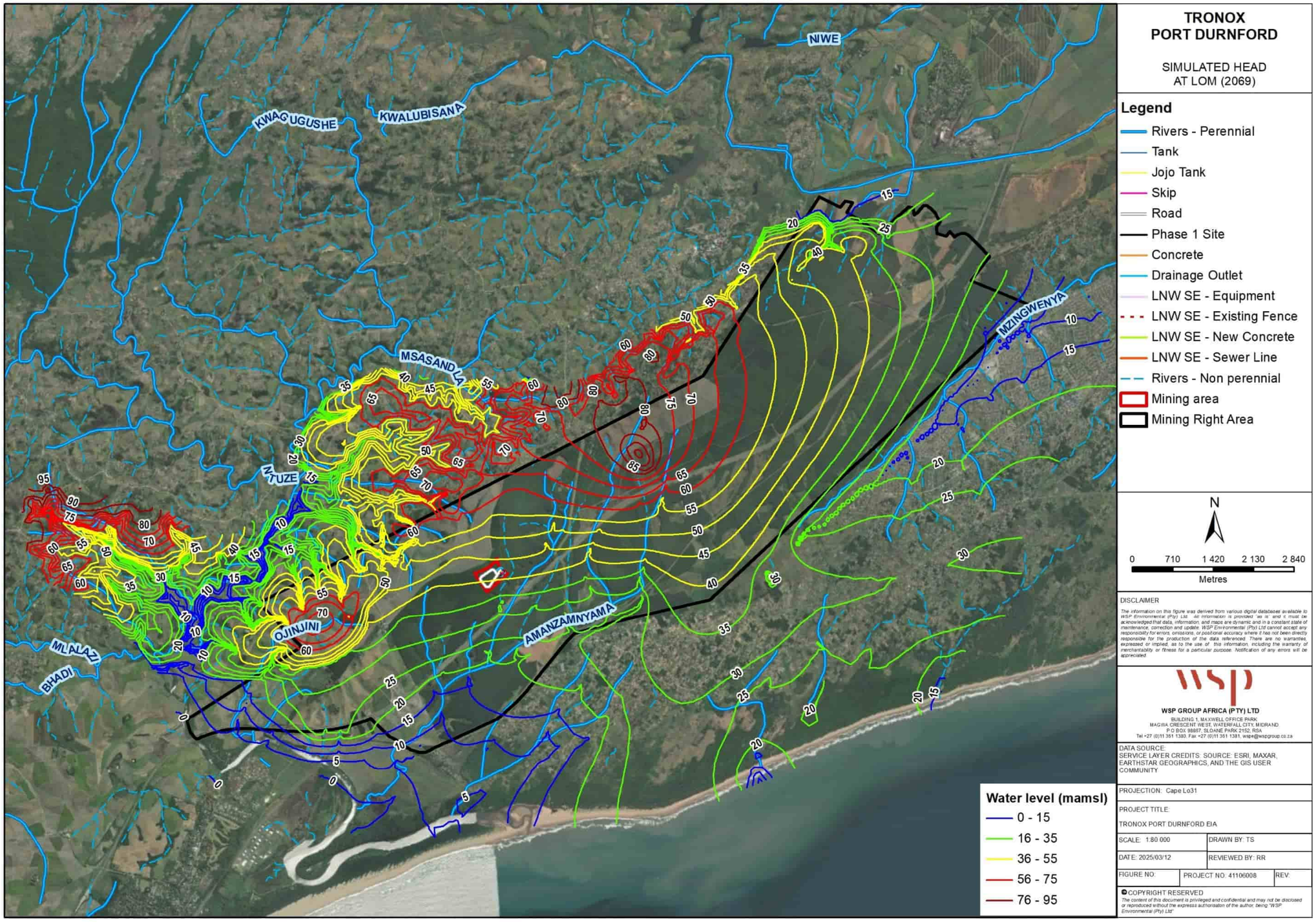


Figure 4-23 - Simulated water level (mamsl) at LOM (2069)

Groundwater ingress

In the first 10 years of low-rate mining (Phase 1), the simulated ingress is approximately 3 500 m^3/d (Table 4-21 and Figure 4-24).

Table 4-21 – Simulated ingress in m^3/d for Phase 1

Year	Mining Only	Mining and Deposition
2025	3 375	3 310
2026	3 554	3 471
2027	3 513	3 474
2028	3 548	3 476
2029	3 532	3 476
2030	3 524	3 475
2031	3 531	3 475
2032	3 520	3 476
2033	3 521	3 474
2034	3 520	3 475
2035	3 521	3 473

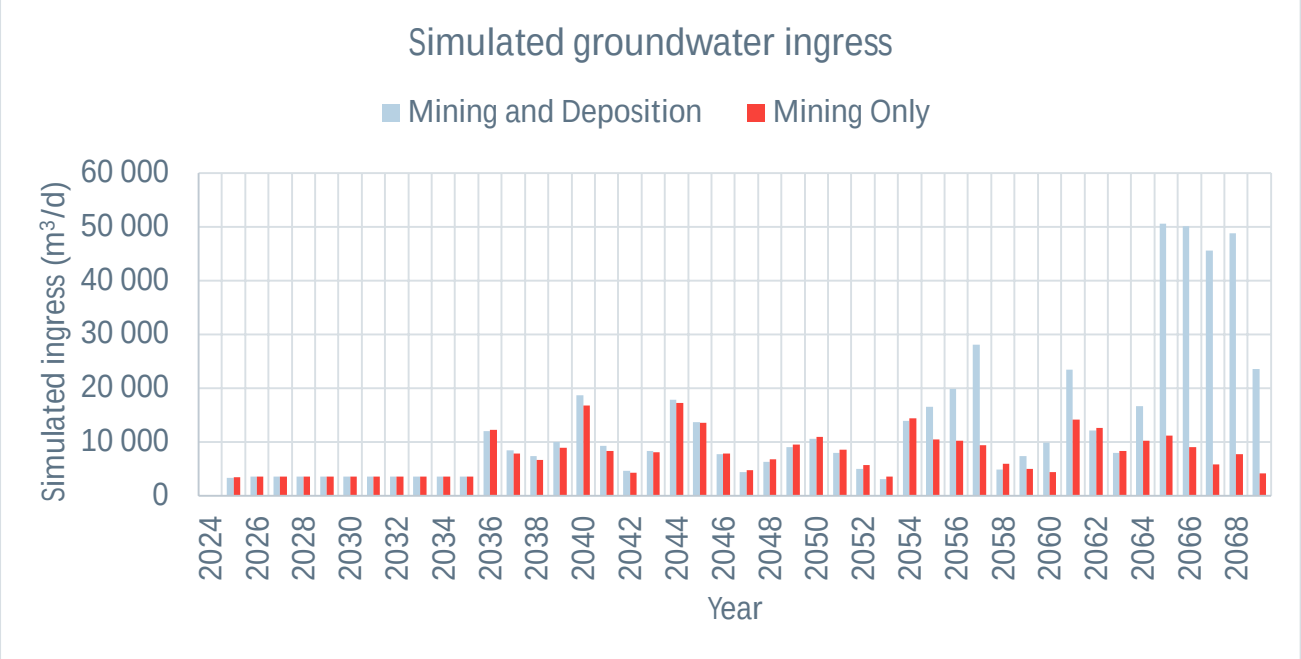


Figure 4-24 - Simulated ingress into the pits

Baseflow into surface water features

The groundwater contribution as baseflow into four major surface water features/areas was analysed over time using the model. Figure 4-25 shows the baseflow contributions over time. The following is noted:

- **Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary** (south of the mining area) shows insignificant reduction in baseflow until 2036.

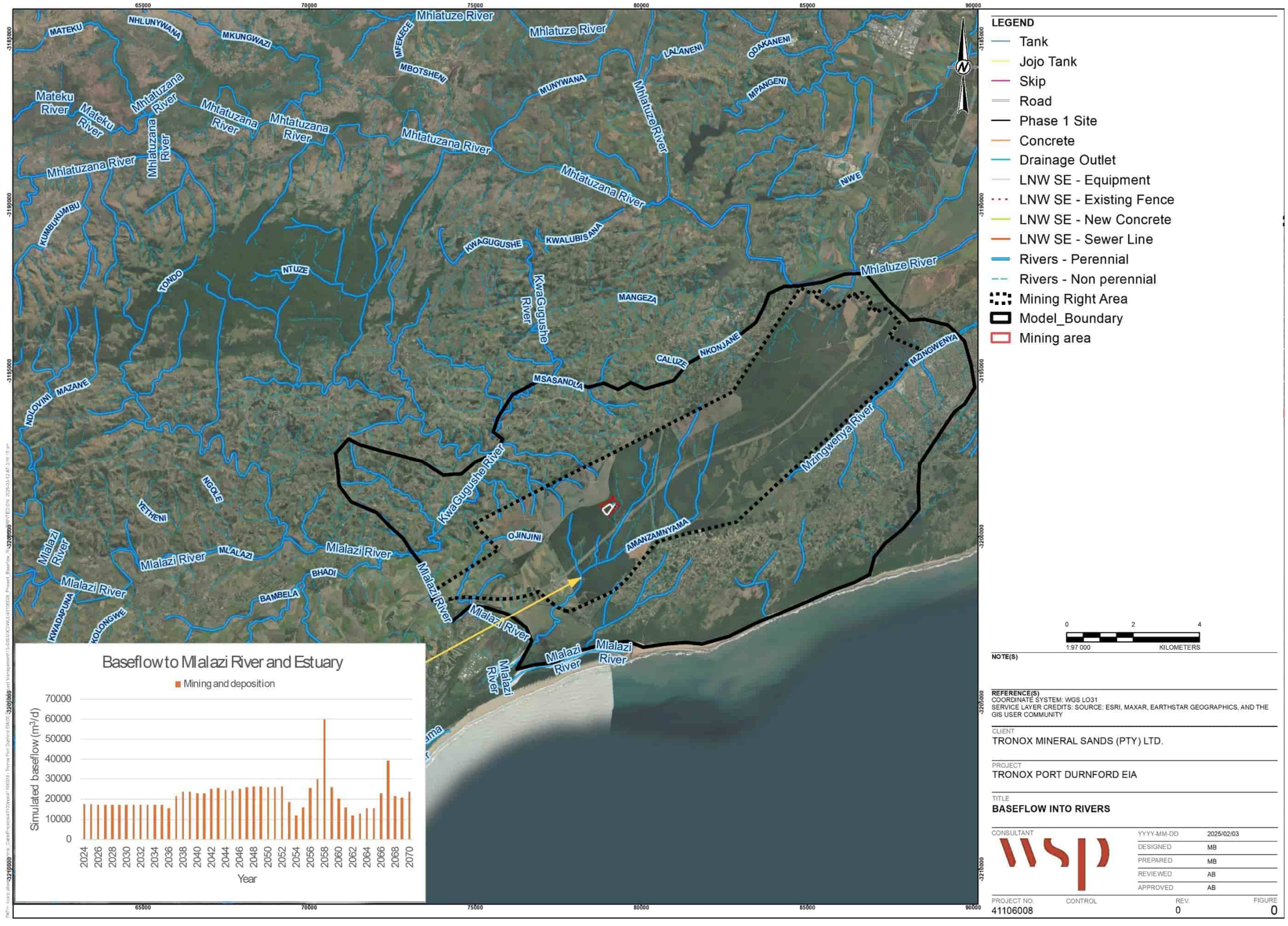


Figure 4-25 - Baseflow into surface water features

4.4 SOCIO-ECONOMIC ENVIRONMENT

Phase 1 is situated in the uMhlathuze Local Municipality within the King Cetshwayo District (KCD) Municipality, KwaZulu-Natal Province.

4.4.1 KING CETSHWAYO DISTRICT MUNICIPALITY

The KCD is located in the KZN province's north-eastern region on the eastern South Africa seaboard. It covers an area of 8 213 square kilometres, from the agricultural town of Gingindlovu in the south to the uMfolozi River in the north and inland to the Nkandla Mountains.

UMkhanyakude District surrounds the KCD to the north, Zululand District to the north-west, uMzinyathi District to the north-east and iLembe District to the south and is approximately 150 km north of the eThekwini metro. The headquarters of the KCD is in Richards Bay, and the district comprises five local municipalities: Mthonjaneni, uMlalazi, Mfolozi, uMhlathuze and Nkandla. The N2 from Durban to Mpumalanga passes through the district (King Cetshwayo District, 2020).

In 2022, the district accounted for a total population of 1 021 344 and ranked the third highest of the total population in KZN, slightly up from 971 135 in 2016. Females constituted 52.7% of the population. The number of households decreased from 225,798 in 2016 to 205,739 in 2022. In 2016, 49.8% of households were headed by women, while 1 552 households were headed by children younger than 18, 80%. Most of the KCD population and households are regarded as rural (King Cetshwayo District, 2020).

The district is among the critical economic players in KZN regarding Gross Domestic Product (GDP) contribution. It contributed 6.5% of the total estimated provincial GDP generated in 2016. KCD is among the largest districts contributing significantly towards the provincial GDP, with eThekwini and uMgungundlovu at 59.5% and 11.3%, respectively. The most significant contributing local municipalities to the GDP of the district is the city of uMhlathuze at 44.0%, followed by uMfolozi at 25.7% and uMlalazi at 21.3%. Although the economy of KCD is predominantly dependent on the tertiary sector at 47.9%, the secondary sector at 29% also plays a significant role in its economy, especially the manufacturing sub-sector (King Cetshwayo District, 2020).

4.4.2 UMHLATHUZE LOCAL MUNICIPALITY

The city of uMhlathuze is situated on the northeast coast of the province of KZN, about 180 kilometres northeast of Durban. The uMhlathuze land area currently covers 123 359 ha. It incorporates Richards Bay, Empangeni, eSikhaleni, Ngwelezane, eNseleni, Felixton, Vulindlela, Bhucanana, Hendersonville, as well as the rural areas under Traditional Councils, namely, Dube, Mkhwanazi, Khoza, Zungu (Madlebe), Somopho, Obizo and a small portion of Obuka.

The municipality borders a coastline that spans approximately 45 kilometres. The N2 highway traverses the uMhlathuze Municipality north-east towards the Swaziland border and south-west towards Durban. The R34 Provincial Main Road passes through Empangeni towards Melmoth (uMhlathuze Local Municipality, 2022/2023 - 2026/2027).

4.4.3 SOCIO-ECONOMIC BASELINE FOR UMHLATHUZE MUNICIPALITY

Population Dynamics

The population increase in KCD, broken down per municipality, is indicated in Table 4-22 for 2011, 2016 and 2022. The population rank shows where a significant increment in population lies within KCD. Umhlathuze is ranked 1st in terms of population size.

Table 4-22 – Population increases of municipalities within KCD Municipality

Year	KCDM	UMFOLOZI	UMHLATHUZE	UMLALAZI	MTHONJANENI	NKANDLA
2011	907 519	122 889	334 459	213 601	47818	114 416
2016	971 135	144 363	410 465	233 140	78 883	114 284
2022	10 21 344	159 668	412 075	241 416	99 289	108 896
Population rank		3	1	2	5	4

Households

The average household size in uMhlathuze was 3.95 in 2011, with about 94,010 households. The average household size increased to 4.1, and there were about 100,441 households in 2022. If an increase of 1.5% is applied (using data from previous years), the IDP estimated households to be 115 330. If the population grows by 5%, 146 219 households will be reached in 2023 and 205 745 in 2030.

Population Gender and Age

In 2016, females numbered 187, 287, and males numbered 177, 175 within the uMhlathuze Local Municipality. Female-headed households increased in 2001 from 36.29 % to 40.70% in 2011.

Table 4-23 shows that the population age cohort <15 has been declining at the district and uMhlathuze Local Municipality level, while the population cohort for the 15-64 age group has shown an increase at both the district and local municipality level between 2001 and 2011 (uMhlathuze Local Municipality, 2022/2023 - 2026/2027).

Table 4-23 - Age Structure (Percentage % of the population)

Municipality	Population		Percentage % of the population					
Age Structure			**≤15**		**15-64**		**65+**	
Year	**2001**	**2011**	**2022**	**2011**	**2022**	**2011**	**2022**	**2011**
KCD	885965	907519	29.9	34.8	57.3	60.7	4.4	4.5
uMhlathuze	289190	334459	25.9	29.9	69.4	66.8	4.7	3.3

Source: (Statistics SA, Census 2022).

Language

IsiZulu is the majority language spoken by 78.73% of its population in the uMhlathuze Municipality. In second place is English, spoken by 13.3% of the total population. In third place is Afrikaans, spoken by 9.3 % of the total population. (uMhlathuze Local Municipality, 2022/2023 - 2026/2027).

Education and Employment

Education

In 2022, matric was the highest qualification for 46.5% of the population in uMhlathuze, whereas only 36.9 % had matric in 2011. KCD had 8.4% of its population having matric and a postgraduate qualification in 2011, 39.5 % of the population passed matric, and only 9.5 % obtained higher qualifications in 2022 (Stats SA, 2022).

Employment

In 2017, 24.6% of the uMhlathuze population was employed. This is slightly lower than the KCD percentage of 26.5%. Figure 4-26 shows the percentage of employment per ward in uMhlathuze in 2011. Ward 23 had the highest employment at 50% and Ward 30 the lowest, below 10%.

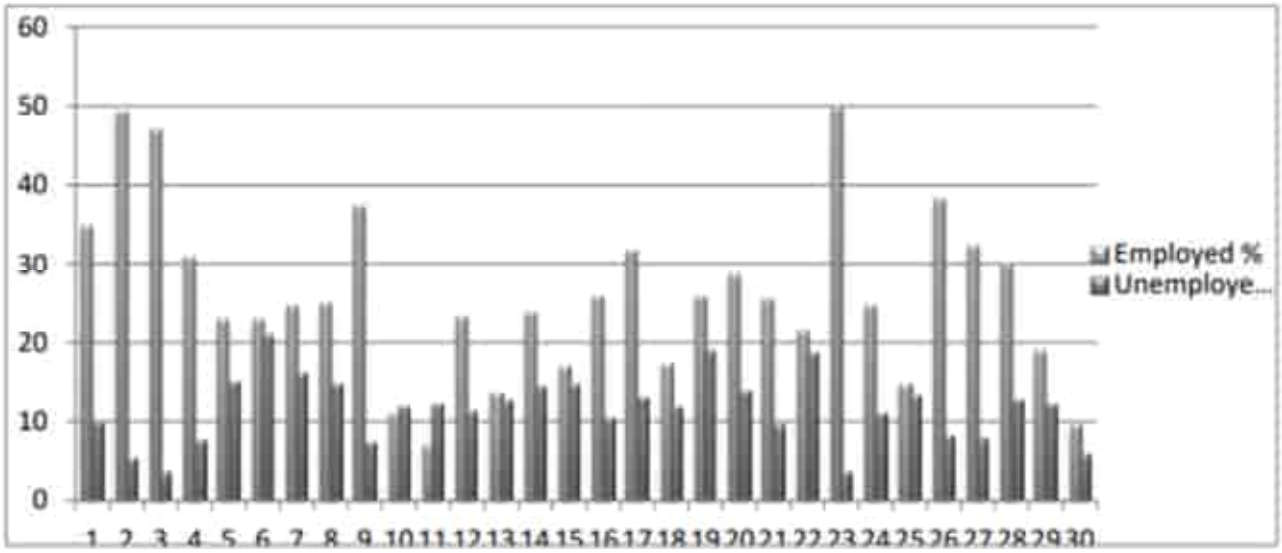


Figure 4-26 - Percentage of Employment per ward in uMhlathuze

5 ANALYSES AND CHARACTERISATION OF ACTIVITY

5.1 SITE DELINEATION FOR CHARACTERISATION

A facility has been selected as the unit activity on which the IWWMP was founded. The facilities were identified and delineated based on the following criteria:

- A facility within the overall complex must display a measure of homogeneity;
- In terms of its spatial extent, a facility should be confined as far as possible to define a direct interaction/relationship with the receiving water environment and/or within the area;
- The sum of the facilities must represent the total activity of the area which could affect the receiving water body; and
- Clear management responsibility must be assignable to a facility.

The performance of the individual facilities is governed by a site-wide management framework that comprises site-wide performance objectives, associated strategies, as well as management measures. Hence, site-wide management requirements are aligned with facility-level management requirements and vice versa.

Two facilities were identified to provide the basis for the characterisation of the Phase 1 operations for this IWWMP:

- Facility 1: Mining area which includes the pit; and
- Facility 2: Infrastructure area.

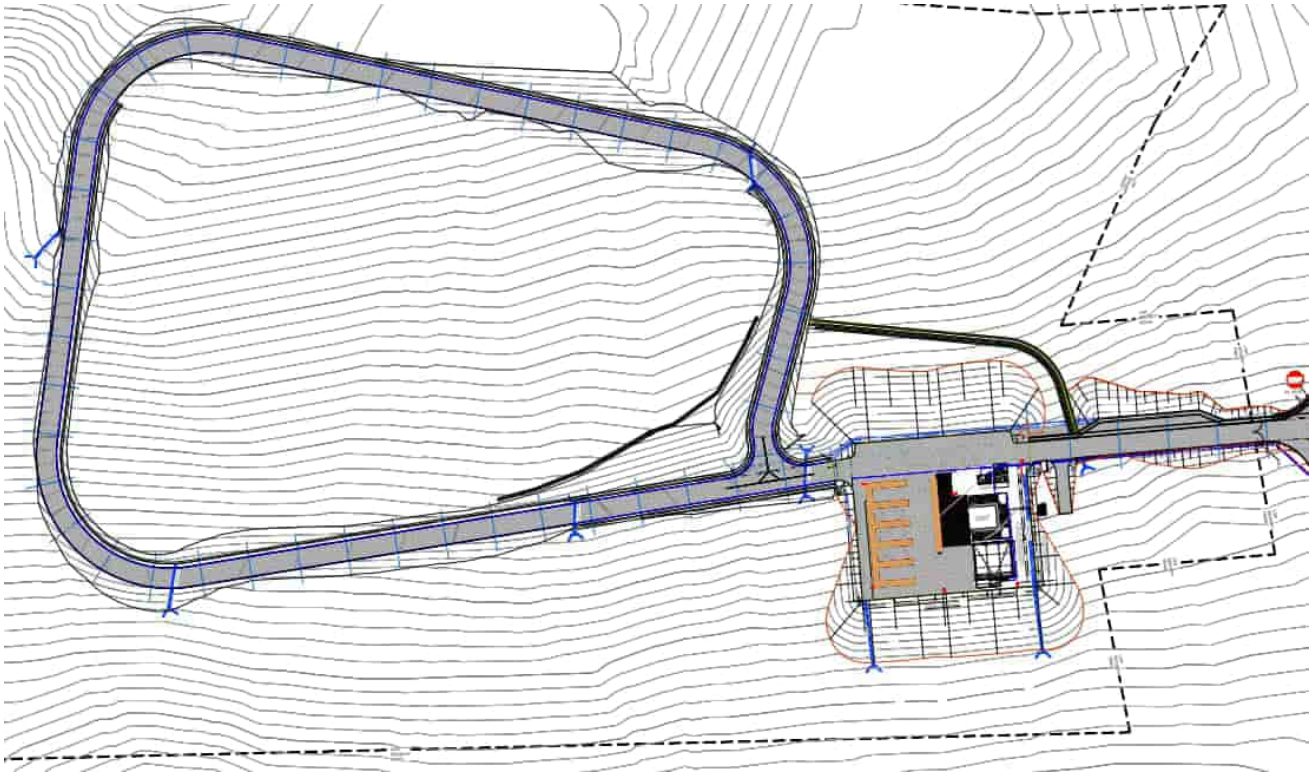
5.2 WATER AND WASTE MANAGEMENT

5.2.1 PROCESS WATER

No process water will be used for Phase 1. ROM material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing.

5.2.2 STORM WATER

A stormwater management system has been designed by LNW Consulting Engineers and Project Managers (Pty) Ltd around the pit and the infrastructure area. Channels and berms have been designed to separate clean and dirty water. The dirty areas consist of the workshop and parking areas. No dirty water is discharged into the environment.



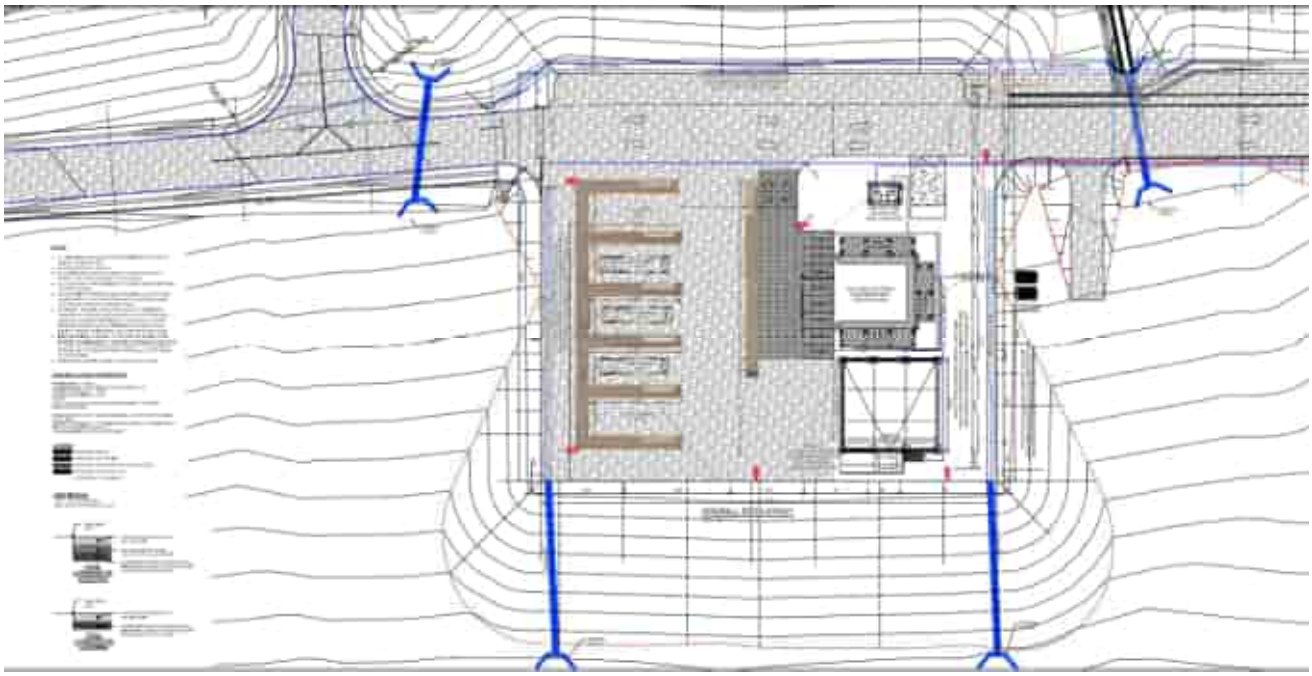


Figure 5-1 - Stormwater management layout

5.2.3 GROUNDWATER

Groundwater management will be carried out as a continuous improvement basis. Routine monitoring is required to check if there are any impacts on the quantity or the water quality in the rivers.

5.2.4 WASTE MANAGEMENT

A waste management procedure (Ref: CPDOC-40-70) dated 12 April 2021 has been established for Tronox.

The following waste types have been identified as per the mine's waste management procedure:

- General waste which includes office papers, cans pellets/woods etc;
- Hazardous waste which includes used oil/grease, oily rags, empty oil drums, empty paint cans, medical waste etc;
- Recyclable waste which includes used oil/diesel, paper, and scrap metal will be recycled by the appointed contractors; and
- Redundant electronic equipment waste which includes computers and screens.

As per the waste management procedure, the following will be done to ensure that the waste is placed into the correct bins or skips:

- The waste storage area is marked or demarcated properly using signs or boards at each of the collection points;
- Skips and bins are marked according to the different types of waste streams contained in them;
- The Environmental section must inspect skips and bins regularly to ensure the right material was placed in the correct bin or skip and provide adequate awareness to the staff;
- Non-conformances are to be logged into the Pivot system and the Leaders of different departments/sections/plants to ensure compliance.; and

- All hazardous waste must be stored in impermeable surfaces with bunding. Bunding must be able to contain 110% volume of the largest tank or container.

Records of the disposal certificates for the waste will be kept on file by the gate keepers of each plant. All sections are responsible for the management and correct disposal of all hazardous waste in their respective areas and records of disposal certificates must be maintained by the relevant sections.

The ad hoc removal of waste by any plant or section is subject to the following conditions:

- All disposal certificates must be retained and filed by the respective sections;
- The certificates must be available at the respective section as an auditable record; and
- All payments will only be done once all required safe disposal certificates have been received.

The Environment/Radiation section is to be contacted for specialist advice when required.

5.3 OPERATIONAL MANAGEMENT

5.3.1 ORGANISATIONAL STRUCTURE

Tronox's organisational structure can be seen in Figure 2-4. The structure indicates the necessary capacity to ensure the implementation of the IWWMP and the likely conditions to be attached to the issued WUL.

5.3.2 RESOURCES AND COMPETENCIES

Management of water and waste will be the responsibility of each person on site. Tronox has a designated and competent Environmental Superintendent who will be accountable for all aspects of water use management associated with the project.

The mine's Environmental Superintendent, Project Manager for the construction phase, as well as the relevant contractors will be responsible for ensuring that all employees (temporary and permanent) are made aware of their responsibilities, i.e. implementation of the Environmental Awareness Plan.

Water related activities which requires independent analysis or where Tronox does not have the necessary resources are outsourced to external parties.

5.3.3 EDUCATION AND TRAINING

Tronox has developed a Skills Development Plan. In line with the Social and Labour Plan (SLP) guidelines, the primary objective of this plan is for the development of requisite skills, knowledge, and attributes, with the aim of enabling employees to perform their jobs, to equip them with knowledge in preparation for future career development. In addition, Tronox's training and leadership development is aligned with and aimed at enhancing Tronox's Value-driven behaviour (Tronox KZN Sands (Pty) Ltd, 2024).

The skills development programmes will mainly focus on the following areas:

- Apprenticeship Programme;
- Learnership Programmes (External and Internal);
- Experiential Development Programmes (Professionals in Training);
- Bursars (External and Internal);
- Internships (External);

- Career Pathing and Mentorship Plan; and
- Portable Skills Development (Where applicable).

Internal human resource development will focus primarily on skills development, with particular emphasis being placed on improving employees' competencies in current positions. It is also aimed at accelerating development programmes in line with internal succession programmes and employment equity strategies.

Where applicable, especially at lower levels, opportunities will be offered to employees to become functionally literate and numerate as per the Mining Charter guidelines. All training and development initiatives will be developed in consultation with the relevant stakeholders (Skills Development Committee) in the spirit of joint participation.

Progress will be measured on a quarterly basis at the Skills Development Committee meetings comprised of Senior Management, Organised Labour representatives and individuals representing the different skill categories and diversity groups.

5.3.4 INTERNAL AND EXTERNAL COMMUNICATION

Tronox has a 'Mass Communication' Policy (Policy No. 90.01) as well as a 'Global External Communications' Policy (Policy Number 90.03) in place. These policies will be implemented for the Phase 1 project.

Internal Communication

The purpose of the Mass Communication Policy is to ensure the ability to communicate and deliver messages to employees uniformly and consistently.

The policy outlines the internal communications framework, the principles and objectives which will underpin it, and the roles of staff, supervisors and managers in establishing effective internal communications.

External Communication

The purpose of this Global External Communications Policy is to outline the rules, requirements and responsibilities related to external communications on behalf of Tronox, including with investors, media and other third parties.

As a public company, Tronox has an obligation to ensure that all of its external communications are factual, accurate, credible and in compliance with legal and regulatory requirements.

5.3.5 AWARENESS RAISING

Environmental awareness shall be provided through the following mechanism:

- Monthly environmental topics:
  Based on analysis of risks, incidents and non-conformities, the environmental team in conjunction with line management shall identify topics requiring awareness. Attendance registers shall be kept as records in their respective work areas;
- Toolbox Talks:
  Ad hoc toolbox talks shall be conducted by the site personnel to promote awareness on specific topics of concern. Information on these topics shall be displayed on notice boards and debriefed by line management. Attendance registers are kept as record; and

- Lessons learned from incidents shall be distributed to line managers to share, and as part of continuous improvement.

5.4 MONITORING AND CONTROL

The objective of a monitoring system is to:

- Develop environmental and water management plans based on impact monitoring;
- Generate monitoring data for the operational phase of the mine to be compared with baseline date before project implementation;
- Assess the impacts on receiving water environment; and
- Assess compliance with legal requirements.

Internal reporting includes monthly reports to the mine management on the performance against management commitments and expectation against authorisations and permits. External reporting requirements is guided by the permit and licenses received to that effect and the mine commit to comply with these statutory requirements at all times.

5.4.1 SURFACE WATER MONITORING

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented. Monitoring frequencies specific to different phases of the project are described in this monitoring plan. Water quality should be benchmarked against the approved WULs for the discharge and Water Quality Planning Limits (WQPL) applicable to the catchment.

It must be noted that the monitoring programme looks at both Phase 1 and Phase 2. This WULA and relevant information focuses on only the Phase 1 information.

The location of the proposed monitoring points can be seen in Table 5-1 and Figure 5-2.

Table 5-1 - Proposed surface water monitoring network

Monitoring Points	Name	Longitude	Latitude	Description
Surface water	P_SW1	31° 53' 38.747" E	28° 52' 28.272" S	Proposed
	P_SW2	31° 48' 3.431" E	28° 55' 41.302" S	Proposed
	P_SW3	31° 47' 17.788" E	28° 53' 57.135" S	Proposed
	P_SW4	31° 52' 15.609" E	28° 50' 55.661" S	Proposed
	P_SW5	31° 46' 3.519" E	28° 55' 21.598" S	Proposed

The surface water monitoring plan for the proposed project is summarised in Table 5-2.

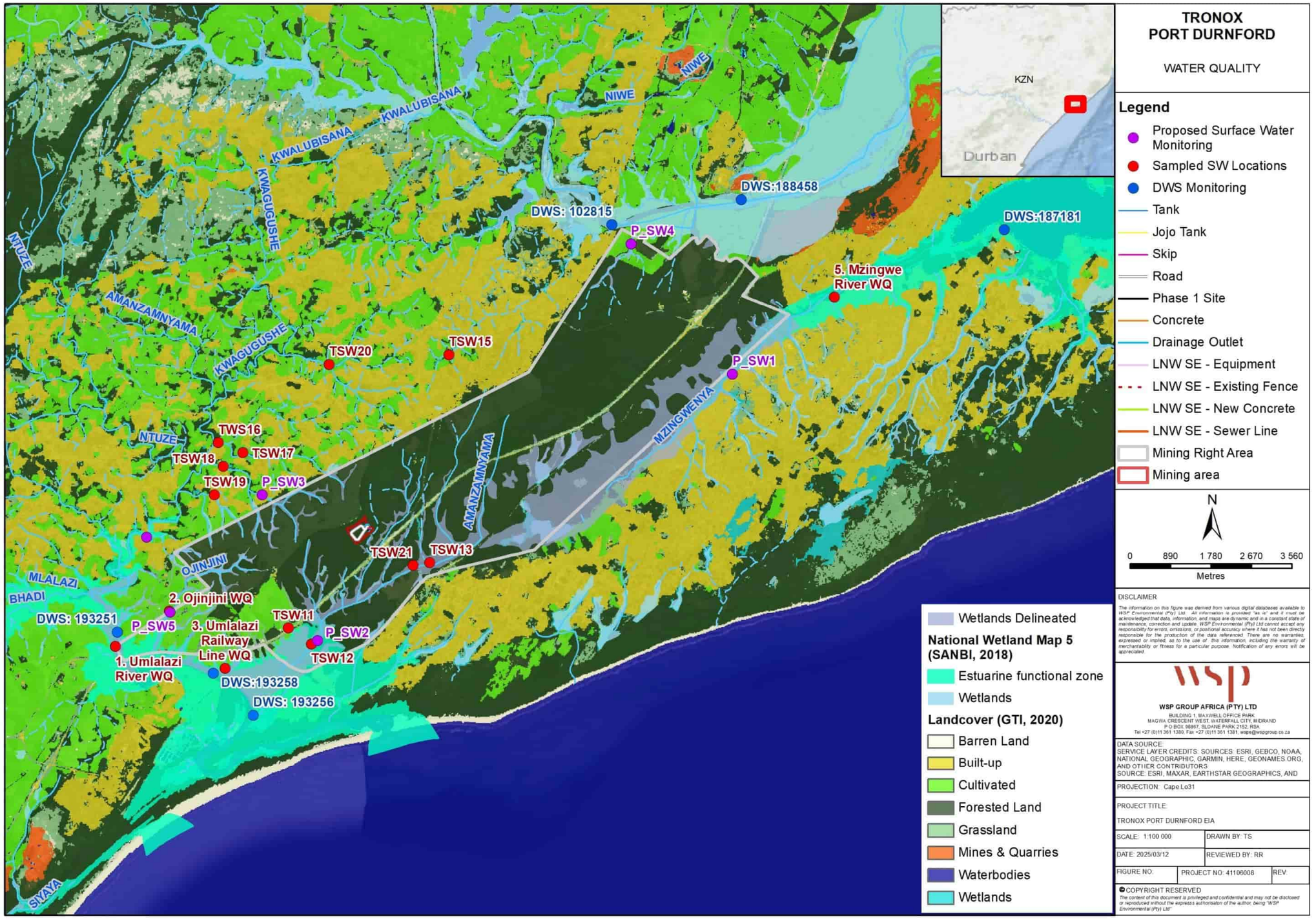


Figure 5-2 - Surface Water Quality Monitoring Points

Table 5-2 – Surface Water Monitoring Programme

Monitoring Aspect / Impacts requiring monitoring	Monitoring and Inspection Methodology	Frequency	Duration	Location of monitoring stations	Reporting schedule	Performance indicator	Responsibility
Water Quality	It is recommended that Port Durnford establishes water quality monitoring Programme, where samples are collected monthly, and ensure the following: Monitoring should be established on all the sampled points used for baseline assessment, and the more points proposed by groundwater study, to assess quality as a result of baseflow. Monitor the parameters that form part of the new WUL. Monitoring the parameters against the catchment WQPLs.	Monthly monitoring is recommended during construction, operation, and decommissioning, and for at least three (3) years after closure or until rehabilitation has reached a sustainable state with no further changes.	Throughout the project life	See Figure 5-2	Monthly	High Total Dissolved Solids (TDS), Aluminium (AL), and Manganese (Mn)	Environmental Officer
Water quantity	Streamflow monitoring should be conducted to detect any changes in the flow regime that might be resulting from project-related activities. Boreholes recommended by the groundwater study to monitor groundwater levels, should monitor fluctuations in baseflow. Real-time streamflow data loggers can be used to capture real-time flows.	Daily flow meter data records should be kept in areas with an automatic monitoring system.	Operational Phase		Daily	Reduced streamflow/ baseflows	Environmental Officer
Rainfall data	Real-time rainfall measurements using a tipping bucket rain gauge, if possible; and Alternatively, a bulk rain gauge can be used to capture the total amount of rainfall for each event.	After a rainfall event	Throughout the project life		Daily	Gaps in the data	Environmental Officer

5.4.2 GROUNDWATER MONITORING

The groundwater monitoring boreholes should be distributed across the site, strategically situated to allow observation of groundwater quality fluctuation upgradient, within and downgradient of the potential contamination sources. The monitoring program must be used to guide environmental management decision making, including taking remedial measures when water quality guidelines are exceeded.

It must be noted that the monitoring programme looks at both Phase 1 and Phase 2. This WULA is only for Phase 1.

During the hydrocensus survey, several boreholes were identified both within the site boundary and outside of this. It is understood that the “W” named boreholes are previously installed monitoring wells. The TBH boreholes could potentially also serve as monitoring boreholes. It is anticipated that some of the boreholes will be destroyed by mining activities.

Figure 5-3 shows the recommended monitoring boreholes and is based on:

- Existing boreholes that will not be destroyed by mining (W1, W5, W7, W11, W12, W14, TBH6, TBH 8 and TBH9).
- Boreholes that should be replaced if destroyed during mining (W3 and W6, these positions have been moved to outside the mining area).
- Additional proposed boreholes (P_BH1 to P_BH4).

The placement of these boreholes was selected to capture any potential plume development and to see what the water quality of the groundwater leaving the Port Durnford MRA is.

Monitoring should be carried out quarterly within the existing network during Phase 1. This is crucial to establish a seasonal baseline. To reduce costs this can be done by analysing a reduced set of parameters such as pH, EC, iron and manganese. It is important to also measure the water levels quarterly to establish the seasonal trend.

The geographic coordinates of the proposed monitoring points are presented in Table 5-3.

Table 5-3 - Proposed groundwater monitoring network

Name	Longitude	Latitude	Description
W1	31° 53' 31.754" E	28° 52' 26.472" S	Existing
W3	31° 51' 21.109" E	28° 51' 48.281" S	Replacement
W5	31° 51' 37.620" E	28° 53' 13.920" S	Existing
W6	31° 50' 39.003" E	28° 53' 24.193" S	Replacement
W11	31° 49' 32.520" E	28° 54' 39.024" S	Existing
W12	31° 47' 19.176" E	28° 54' 5.472" S	Existing
W14	31° 48' 9.360" E	28° 55' 56.712" S	Existing
TBH5a	31° 46' 43.464" E	28° 55' 14.916" S	Existing
TBH6	31° 54' 27.072" E	28° 51' 4.212" S	Existing
TBH8	31° 52' 40.800" E	28° 51' 42.840" S	Existing
TBH9	31° 49' 39.000" E	28° 52' 55.380" S	Existing
P_BH4	31° 47' 56.255" E	28° 55' 26.486" S	Proposed

Name	Longitude	Latitude	Description
P_BH3	31° 48' 54.591" E	28° 54' 18.792" S	Proposed
P_BH2	31° 52' 57.468" E	28° 52' 21.482" S	Proposed
P_BH1	31° 52' 43.129" E	28° 51' 6.155" S	Proposed
W7	31° 48' 55.152" E	28° 53' 21.948" S	Existing

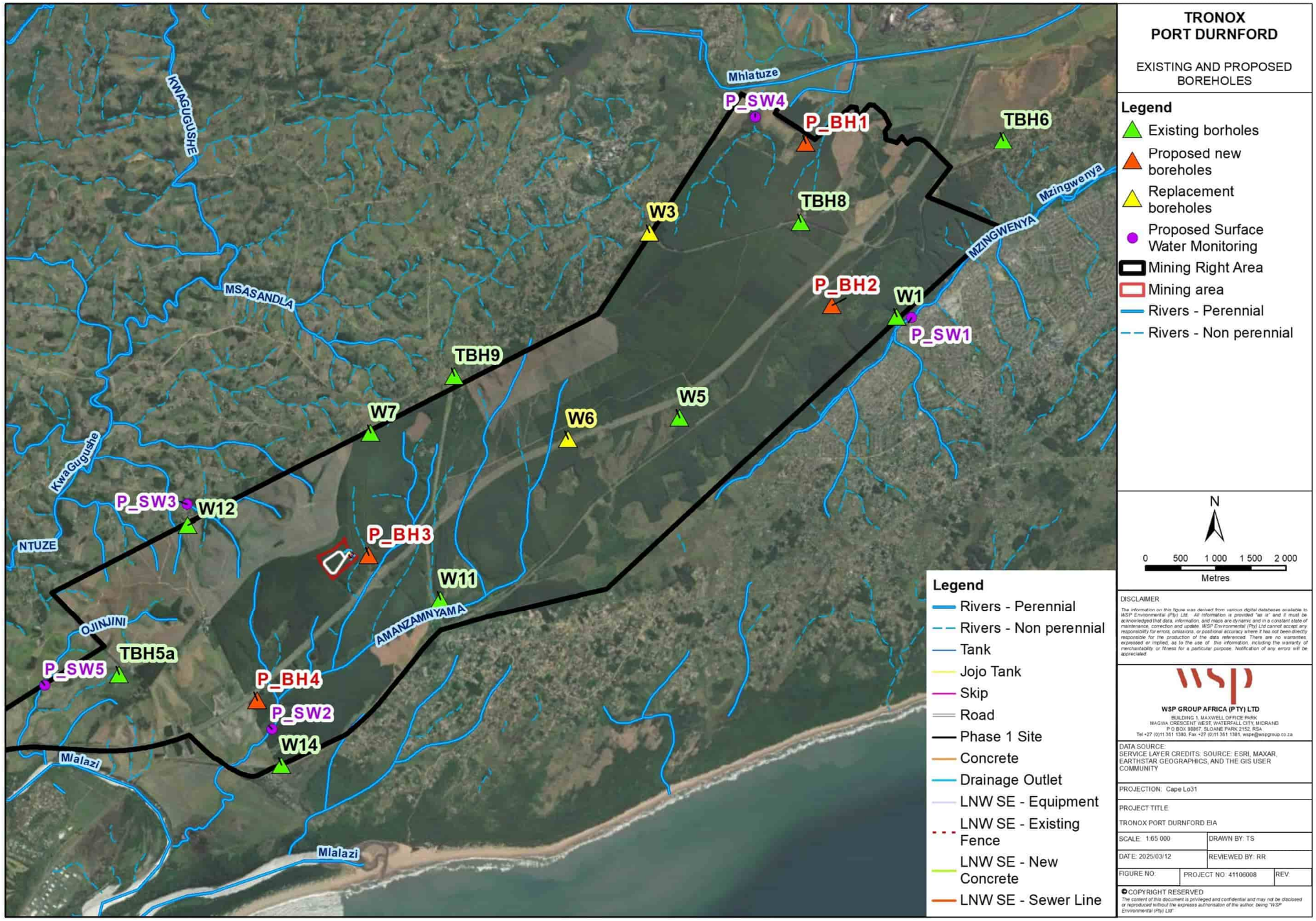


Figure 5-3 - Existing and proposed boreholes

5.4.3 BIOMONITORING

The information provided in this section has been sourced from the '*Aquatic Biodiversity Baseline and Impact Assessment'* compiled by WSP (2025). Refer to Appendix D for the full report.

Selection of the monitoring sites was largely based on the previously undertaken aquatic biodiversity assessment as part of the Port Dunford pre-feasibility study (Marine & Estuarine Research, 2009) for comparative purposes, where possible. Additional sites suspected to support sensitive aquatic biota, such as species of conservation concern, were selected.

A total of 22 sites were visited: four sites associated with the Mhlatuze W12F-03494 SQR; two along the Mzingwenya W12F-03611 SQR; five sites associated with Ntuze W13B-03593 SQR; a single site at the Mlalazi W13A-03609 SQR and ten sites associated with the Mlalazi W13B-03673 SQR.

Site names, GPS coordinates and brief descriptions are provided in Table 5-4 and a map of the study area showing the location of the sampling sites is presented in Figure 5-5. Photographs showing the upstream and downstream views at each monitoring location are provided Appendix B of Appendix D.

It must be noted that the biomonitoring programme looks at both Phase 1 and Phase 2. This WULA is only for Phase 1. The biomonitoring points of relevance have been highlighted in red.

Table 5-4 – Aquatic biomonitoring locations

Catchment	Site	Co-ordinates	Site Description
Mhlatuze W12F-03494	Site 1	28°50'44.56"S 31°52'0.20"E	Located at the R102 bridge near Iniwe township
	Site 5	28°50'44.19"S 31°52'19.18"E	Northern boundary between *Eucalyptus* plantation and small-scale sugarcane production (Fort Argyle)
	Site 3	28°50'34.98"S 31°52'59.70"E	Northern boundary - Stream completely transformed by sugarcane farm
	Site A	28°50'18.65"S 31°54'22.92"E	Located below an overhead walking bridge, approximately 300 m downstream of the N2
Mzingwenya W12F-03611	Site 7	28°53'52.04"S 31°51'56.26"E	Located along the Esikhaweni boundary adjacent plantation
	Site B	28°51'45.92"S 31°54'31.10"E	Located along the Esikhaweni boundary - Approximately 5 km downstream of Site 7
Ntuze W13B-03593	Site 18	28°53'41.86"S 31°48'10.11"E	Ntuze tributary - site located at a low water crossing
	Site 17	28°53'26.96"S 31°47'1.67"E	Approximately 2 km downstream of Site 18 - site located at a low water crossing
	Site 19	28°53'28.24"S 31°46'32.34"E	Located at the bridge near along the Ntuze River
	Site 20	28°54'32.22"S 31°45'29.11"E	Approximately 3 km downstream of Site 19
	Site 39	28°55'3.72"S 31°45'20.62"E	Approximately 3 km downstream of Site 20

Catchment	Site	Co-ordinates	Site Description
Mlalazi W13A-03609	Site D	28°55'6.46"S 31°43'42.20"E	Approximately 1,5 km downstream of Site 20 and 500 m before the confluence with the Mlalazi River
Mlalazi Drainage	Site 11	28°54'34.88"S 31°49'6.46"E	Located at a stream crossing within a commercial forestry area
	Site 12	28°54'47.92"S 31°49'20.33"E	Located at a stream crossing within a commercial forestry area
Mlalazi W13B-03673	Site 33	28°54'51.96"S 31°46'36.56"E	Upper reach of a Mlalazi tributary near the western boundary
	Site 31	28°55'48.74"S 31°45'50.69"E	Approximately 2 km downstream of Site 33
	Site 26	28°55'50.69"S 31°46'59.99"E	Upper reach of a Mlalazi tributary near the southern boundary
	Site 8	28°53'23.91"S 31°50'30.11"E	Upper reach of the aManzamnyama River
	Site 10	28°52'58.83"S 31°50'9.47"E	Tributary of the aMmanzamnyama River
	Site F	28°53'44.01"S 31°49'33.60"E	Tributary of the aMmanzamnyama River
	Site 11	28°54'34.88"S 31°49'6.46"E	Located at a stream crossing adjacent to the aMmanzamnyama River.
	Site 12	28°54'48.59"S 31°49'21.14"E	Middle reach of the aMmanzamnyama River
	Site 15	28°54'29.34"S 31°47'55.75"E	Tributary of the aMmanzamnyama River
	Site C	28°55'44.20"S 31°47'58.43"E	Lower reach of the aMmanzamnyama River

The aquatic biomonitoring programme must be conducted by a suitably qualified Aquatic Scientist [i.e., holds a valid SASS5 certificate issued by the DWS and is registered with the South African Council for Natural Scientific Professions (SACNASP)], and must be adhered to throughout the LOM and must go on until there is no noticeable impact following the end of LOM.

Table 5-5 outlines the aquatic monitoring methods to be undertaken.

Table 5-5: Biomonitoring Programme to be conducted bi-annually

Method and Aquatic Component of Focus	Details
Water Quality: In situ water tests focusing on: - Temperature; - pH; - Conductivity; - Dissolved oxygen. **Ex situ Water Quality:**	In situ water quality should be tested by means of portable meters at each monitoring site. Ex situ water quality analysis should be conducted at a South African National Accreditation System (SANAS) accredited laboratory. Results must be compared to baseline results and RQOs (see Table 4-5) to determine the extent of change

Method and Aquatic Component of Focus	Details
Analysis of selected chemical parameters (see Table 4-5).	
Habitat Quality: Instream and riparian habitat integrity by means of the Index for Habitat Integrity (IHI); and Integrity of macroinvertebrate habitat by means of the Integrated Habitat Assessment System (IHAS).	The IHAS and IHI must be applied at the same sites as in this study to determine the extent of change from baseline results.
Aquatic Macroinvertebrates: Aquatic Macroinvertebrate assemblages must be assessed by means of the SASS5 protocol (or latest version). The Macroinvertebrate Response Assessment Index (MIRAI) must be applied to determine the PES.	The SASS5 and MIRAI results must be compared to the baseline results and RQOs.
Diatoms Assessment: Diatoms samples must be collected, preserved and transported to the laboratory for analysis.	Samples must be collected at the same sites as in this study to determine the extent of change from baseline results.
Fish: Fish assessments must be carried to species level where possible.	Sampling of fish must be undertaken by means of the standard electro-narcosis technique. Other methods such cast nets may be used were necessary. Results must be compared to the baseline results and RQOs.

The assessment concluded that the proposed placement of infrastructure for Phase 1 is located within an area which forms part of the Amanzamnyama catchment.

However direct impacts on riparian habitat are not expected due to 1) the area is heavily transformed, and the drainage lines are no longer apparent (Figure 5-4) and 2) the N2 road occurs between the infrastructure area and the Amanzamnyama River, thus will act a barrier for direct impacts.

Figure 5-4 - - Photos showing some of the altered drainage lines in the area. Site 8 (A) site 10 (B) and site F (C)

Figure 5-5 - Location of aquatic ecology sampling points

5.4.4 WASTE MONITORING

Waste monitoring allows for the control of wastage and enhances the possibilities of waste recovery and reduction. Management of waste will occur as described in Section 5.2.4 above. Monitoring of wastes should include the following:

- Identification and classification of waste into definite categories;
- Ensure awareness and training of employees regarding waste management;
- Measuring the amount of each type of waste that is produced within a specific time period;
- Separation of different waste types to prevent cross-contamination and ensure proper disposal to the correct landfill sites;
- Ensuring that each waste type is correctly managed according to specifications;
- Monitor the removal and disposal of waste – frequency and place of disposal; and
- Regularly ensure that all waste related contractors are licensed and competent.

All waste types are collected in bins on site and a contractor will be employed to remove the waste to a registered disposal facility. All waste removed on site will have a manifest from the waste managers as evidence of cradle to crave principle and with general waste, the waste manifests will be stamped whereas with hazardous waste, disposal certificates are required to be received from the waste disposal sites.

5.5 RISK ASSESSMENT/ BEST PRACTICE ASSESSMENT

5.5.1 METHODOLOGY

The DWS does not stipulate a specific methodology that needs to be used for the risk assessment process. The methodology adopted can be client specific or as chosen by the IWWMP project team. The application for a WUL requires a quantitative environmental risk assessment. During the risk assessment process, the impact of the water use on the water resource is evaluated.

The following risk assessment methodology was chosen for the IWWMP risk assessment. A five by five (5 x 5) consequence vs. probability matrix was utilised to rate the risks. The following summarises the risk assessment methodology process:

- **Probability (P)** of occurrence which describes the likelihood of the impact actually occurring and is indicated as:
  - **Improbable**, where the likelihood of the impact is very low;
  - **Probable**, where there is a distinct possibility of the impact to occur;
  - **Highly probable**, where it very likely that the impact will occur; and
  - **Definite**, where the impact will occur regardless of any management measure.

Table 5-6 - Probability Categories

Description		Probability	Scale Value
H	Probable	>70%	3
M	Could happen	30-70%	2
L	Improbable	<30%	1

- **Consequences** are described as:

- **Nature** of the impact;
- **Extent of the impact (Scale S)**, either local, regional, national or across international borders;
- **Duration (D) of the impact**, either short term (0-5 years), medium term (6 – 15 years) or long term (the impact will cease after the operational life of the activity) or permanent, where mitigation measures by natural processes or human intervention will not occur; and
- **Intensity of the impact (M)**, either being low, medium, or high effect on the natural, cultural and social functions and processes.

Table 5-7 - Impact Categories

Description	Guide Scenario	Scale Value
Critical	Failure that involves significant rework, modification or reassessment	3
Serious	Failure or setback that causes additional work and reassessment but containable	2
Marginal	Impact has some effect causing rework or reassessment but easily handled	1

A significance level is determined by calculating significance points by taking into account occurrence criteria and severity criteria. Occurrence criteria include probability ***(P)*** and duration and severity criteria which includes magnitude ***(M)*** (severity) of impact and scale/extent of impact ***(S)***.

Risks are ranked in terms of all 4 criteria, viz, Probability (***P***) and Duration (***D***) of occurrence and Scale (***S***) and Magnitude (***M***) of impact as follows:

Significance points (***SP***) for each risk are calculated

$$SP = (M + D + S) \times P$$

Significance points will be ranked and classified as follows:

Table 5-8 – Significant scoring range

Significance Points	Risk Classification	Score range	Description
SP > 60	High Risk	64 - 100	An impact which could influence the decision about whether or not to process with the project regardless of any possible mitigation.
30 ≤ SP ≤ 75	Moderate Risk	30 - 60	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP < 30	Low Risk	6 - 28	Impacts with little real effect and which should not have an influence on or require modification of the project design.

Table 5-9 – Occurrence levels

Probability	Duration	Scoring				
5 – Definite/don't know	5 - Permanent	40 (M)	55 (M)	70 (H)	85 (H)	100 (H)
4 – Highly probable	4 – Long term	28 (L)	40 (M)	52 (M)	64 (H)	76 (H)

Probability	Duration	Scoring				
3 - Medium	3 – Medium term	18 (L)	27 (M)	36 (M)	45 (M)	54 (H)
2 – Low	2 – Short term	10 (L)	16 (L)	22 (M)	28 (M)	34 (M)
1 – Improbable	1 - Immediate	4 (L)	7 (L)	10 (M)	13 (M)	15 (M)
SEVERITY LEVEL	Magnitude	2 - Minor	4 - Low	6 - Moderate	8 - High	10 – Very high
	Scale	1 – Site only	2 - Local	3 - Regional	4 - National	5 - International

Table 5-10 – Risk colour code and meaning

	Key/ Critical Risks – can be fatal
	High Risks - closely monitor, manage & develop fallback plans
	Intermediate Risks - monitor and manage to mitigate/ include specific risk allowances in cost estimate/ programme
	Minor Risks - general allowance in base cost estimate & programme

The risk assessment for the Phase 1 project is presented in Table 5-11.

Table 5-11 – Risk Assessment

Risk no	Area	Risk type	Risk description	Potential consequence(s)	Consequence category	Consequence description	Consequence rating	Probability	Probability rating	Risk rating	Risk category	Detailed Mitigation Measures	Time period for implementation	Responsible person
1	Phase 1	Surface water	Site clearance (i.e. excavation, removal of unsuitable material and loading of materials).	Increased sedimentation of surface water resources may result in deteriorated water quality. Dust generation may lead to the increased sedimentation of the nearby rivers. Decrease in infiltration and increased surface runoff – Changes to the hydrological regime.	Environmental	Minor	2	Possible	3	6	Low (6)	• Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of nearby watercourses. • Construction should be undertaken during the dry period to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period. • Install effective sediment and erosion control measures before starting work to minimise sediment entry into the watercourse, such as erosion berms or silt traps. • Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses.	Duration of the construction phase	Site manager and appointed contractor
2	Phase 1	Surface water	• Construction of proposed infrastructure • General construction activities (i.e. use of roads, handling of material).	Contamination of water resources by unplanned spills or leaks during construction or excavation and runoff from contaminated surfaces.	Environmental	Minor	2	Possible	3	6	Low (6)	• Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required). • Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary. • Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills. • All storage areas for fuels and oils used during construction should be appropriately bunded, and spill kits should be in place. • Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease. • Use precast concrete where required for construction to limit extended construction work and • Administer timely clean-ups in the event of spillages occurring. • A comprehensive sediment management plan to be developed describing measures to be applied over the Life of Mine.	Duration of the construction phase	Site manager and appointed contractor
3	Phase 1	Surface water	Haulage of ROM to the Fairbreeze mine by trucks for stockpile and processing	Contamination and increased sediment loads to receiving water resources Increased erosion from areas of exposed soils.	Environmental	Insignificant	1	Possible	3	3	Very Low (3)	• Runoff from dirty areas should be directed to the stormwater management infrastructure and should not be allowed to flow into the natural environment. • Minimise as much as possible, the footprint or catchment of the dirty area and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff. • Overall housekeeping and maintenance of stormwater infrastructure (including berms, de-silting and clean-up of leaks) must be adhered to	Duration of operational phase.	Environmental Manager
4	Phase 1	Surface water	Mechanical mining of ROM and loading ROM onto trucks	Loss of natural vegetation leading to erosion due to open land	Environmental	Minor	2	Possible	3	6	Low (6)			

Risk no	Area	Risk type	Risk description	Potential consequence(s)	Consequence category	Consequence description	Consequence rating	Probability	Probability rating	Risk rating	Risk category	Detailed Mitigation Measures	Time period for implementation	Responsible person
5	Phase 1	Surface water	Mechanical mining of ROM and loading ROM onto trucks	Changes in water quantity or flow regime	Environmental	Moderate	3	Possible	3	9	Medium (9)	throughout the life of the project. • The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to appropriate disposal sites. • The water quality monitoring program provided in this report should be adhered to for monitoring water resources within and near the Project Area to allow detection of any contamination arising from operational activities. • All storage areas for fuels, grease, and oils used during operation activities should be appropriately bunded, and spill kits should be in place. • Administer timely clean-ups in the event of spillages occurring. • Washing and servicing of vehicles and machinery should be undertaken at designated, appropriately designed areas.		
6	Phase 1	Groundwater	Mechanical mining of ROM and loading ROM onto trucks	Lowering of water levels around the mine due to mine dewatering, which may impact on surface or groundwater users	Environmental	Minor	2	Possible	3	6	Low (6)	Monitoring should be conducted according to the recommended groundwater monitoring system.	Prior to project initiation and operational	Environmental Manager
7	Phase 1	Aquatics	Mechanical mining of ROM and loading ROM onto trucks	Water quality modifications due to dust generation, siltation, and spillages of material during hauling	Environmental	Minor	2	Possible	3	6	Low (6)	• Have a spill response and prevention control plan in place. • Consider barriers such as berms between the roads and points with a potential for entry into a water resource. • Cover the hauling trucks (e.g. with tarp) to prevent spilling out during transit.	Duration of operational phase.	Environmental Manager
8	Phase 1	Aquatics	Haulage of ROM to the Fairbreeze Mine on public roads (the R102 and N2).	Potential impacts upon receiving water resources include water quality deteriorations due to spillages of ROM from the hauling trucks	Environmental	Minor	2	Possible	3	6	Low (6)			
9	Phase 1	Wetlands	Vegetation clearance and earthworks	Wetland habitat degradation through altered geomorphological characteristics (sedimentation & erosion) in downstream wetlands	Environmental	Minor	2	Possible	2	4	Low (4)	• Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of receiving wetlands. • Construction should be undertaken during the dry season to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period. • Road upgrades at watercourse crossings should be undertaken during the dry season and design and construction activities should not lead to flow impoundment upstream of the crossing, or flow concentration through the crossing. Measures should be put in place to limit concentrated surface runoff from the road surface and sediment runoff into the watercourses. • A construction stormwater management plan must be developed and implemented prior to the commencement of large-scale vegetation clearing activities or construction activities and be maintained until the end of the construction phase.	Site establishment	Environmental Manager
10	Phase 1	Wetlands	Vegetation clearance and earthworks	Wetland habitat degradation through water quality deterioration	Environmental	Minor	2	Possible	2	4	Low (4)			
11	Phase 1	Wetlands	Construction of proposed infrastructure	Wetland habitat degradation through altered hydrological regime supporting downstream wetlands	Environmental	Minor	2	Possible	2	4	Low (4)			

Risk no	Area	Risk type	Risk description	Potential consequence(s)	Consequence category	Consequence description	Consequence rating	Probability	Probability rating	Risk rating	Risk category	Detailed Mitigation Measures	Time period for implementation	Responsible person
												Such a plan should aim to minimise the transport of sediment off site as well as prevent the discharge of high velocity flows into downslope wetlands. Sediment traps and sediment barriers should be installed where necessary, and clean water discharge points should be protected against erosion and incorporate energy dissipaters. • Sediment transport off the site must be minimised through the establishment of perimeter sediment controls. This can be achieved through the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used. • Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses. • Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required). • All hazardous substances used on site (including all diesel, oil, explosives, cement etc.) should be stored in designated, bunded areas, and spill kits should be in place. Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease. No surface run-off from these areas may be allowed to enter any clean water run-off or the wetlands on site. • Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary. • Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills. • Administer timely clean-ups in the event of spillages occurring.		
12	Phase 1	Wetlands	Opencast mining	Wetland habitat degradation through altered hydrological regime supporting downstream wetlands	Environmental	Minor	2	Possible	2	4	Low (4)	• Lowering of groundwater levels is temporary (generally 2 years). However, the pit for Phase 1 is 8-10m deep. • Reduced surface catchment yield to wetlands is expected to be offset to a degree through a reduction in evapotranspiration associated with removal of forestry from the mine footprint • Implement monitoring of potentially affected wetlands to identify any negative effects that arise and allow for adaptive management.	Operational	Environmental Manager

5.6 ISSUES AND RESPONSES FROM PUBLIC CONSULTATION PROCESS

The issues and responses from the public participation process (PPP) will be included in this section once the PPP period has been concluded. This IWWMP is a draft for public review.

5.7 MATTERS REQUIRING ATTENTION/ PROBLEM STATEMENT

The results of the site characterisation, risk assessment and the issues and responses from the public consultation process were utilised to formulate the water and waste related matters which require attention (Table 5-12).

Table 5-12 - Water and Waste Related Matters Requiring Attention

Theme	Issue/Matter
Storm water	▪ Ensure adequate stormwater measures to capture contaminated water thereof (from workshop and parking areas). ▪ Clean water diversion canals should be regularly inspected and maintained.

5.8 ASSESSMENT OF LEVEL AND CONFIDENCE OF INFORMATION

It can be stated that the level and confidence is adequate to support the compilation of an IWWMP and the submission of a WULA.

6 WATER AND WASTE MANAGEMENT

6.1 WATER AND WASTE MANAGEMENT PHILOSOPHY (PROCESS WATER, STORMWATER, GROUNDWATER, AND WASTE)

6.1.1 PROCESS WATER

No process water will be used for Phase 1. ROM material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing.

6.1.2 STORM WATER

Following the clean and dirty water separation regime, the philosophy for storm water management on site is in keeping with the following principles:

- To prevent contamination of clean water;
- To return clean water to the catchment;
- Contain all contaminated water from the workshop and parking areas for re-use and recycling.

6.1.3 GROUNDWATER

The philosophy for groundwater management at Port Durnford is:

- Conduct all activities in such a manner that it will not pose unnecessary threats to the groundwater resources in terms of quality and quantity;
- Ensure that the conditions and water quality objectives of the future WUL conditions are met;

- Conduct groundwater monitoring regularly (as required by the WUL or any other regulatory tool) to assist in early detection of the risks so that management measures can be implemented timeously;
- Inspect and monitor all aspects that lead to the protection of the groundwater regime on a regular basis; and
- To update the groundwater model if necessary.

6.1.4 WASTE MANAGEMENT

The philosophy for the management of the various waste streams on site include:

- Elimination:
  - Remove the waste source;
  - Substitute for less waste; and
  - Stop unlawful waste practices such as illegal dumping.
- Control at the source:
  - Implementation of waste separation at source;
  - Maximise recycling and reuse of waste materials; and
  - Ensure waste disposal is done at authorised waste disposal facilities.
- Restrict waste:
  - Contain or attenuate the waste source; and
  - Proper maintenance and good housekeeping of equipment and machinery.
- Minimize:
  - Restrict waste (Admin controls); and
  - Competent on-going supervision is needed to ensure compliance.
- Process for Monitoring:
  - Audits;
  - Recording of waste volumes; and
  - Inspections.

6.2 STRATEGIES (PROCESS WATER, STORMWATER, GROUNDWATER, AND WASTE)

6.2.1 PROCESS WATER

No process water will be used for Phase 1. ROM material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing.

6.2.2 STORM WATER

The strategies related to the management of storm water at Port Durnford include the following:

- Clean and dirty separation;
- Channels and/or upstream cut-off trenches to divert clean water away from the surface infrastructure to the natural environment;

- Regular maintenance of all storm water management infrastructures according to a monitoring and maintenance schedule;
- Cutting of grass in and adjacent to storm water infrastructure;
- Slopping and shaping of areas to ensure that storm water is drained via the storm water management channels;
- Install energy dissipators when needed;
- Concrete lining of channels where erosion may occur; and
- Implement monitoring, measurement and reporting of water quantity and quality.

6.2.3 GROUNDWATER

Groundwater management strategies will comprise of:

- Regular monitoring of groundwater levels and quality; and
- Annual compliance audits.

6.2.4 WASTE

The strategies related the waste management at Port Durnford are:

- Implement monitoring, measurement and reporting of waste generated in the operation to facilitate effective waste management;
- Dispose of waste generated at the operation, based on waste stream, in accordance to current waste management guideline; and
- Investigate improved technologies to reduce waste generated by reuse, recycling and/or recovering.

6.3 PERFORMANCE OBJECTIVES/GOALS

Tronox is an ISO certified operation. Therefore, they have implemented an Environmental Management System (EMS) ISO14001 which enables them to set performance objectives and track their performance against it [*Company Objective Specifications for Environmental & Radiation Management* (Ref: CPDOC-39-351)]. The objectives relate to:

- Environmental incidences;
- Radiation incidences;
- Hazardous and non-hazardous waste;
- Carbon emissions;
- Compliance to environmental authorisations;
- Biodiversity offsets; and
- ISO 14001:2015 certification.

The following performance objectives have been identified for the project:

Table 6-1 – Performance objectives relevant to the project

Theme	Performance Objective
Waste	▪ Disposal of all general and hazardous waste in accordance with legislative requirements; and ▪ Waste separation at source and increased recycling and reuse of waste streams generated on site.

Theme	Performance Objective
Storm water	▪ Collection and containment of all contaminated runoff from all dirty areas (workshop and parking) is adequately sized, properly designed and engineered storm water infrastructure; ▪ Zero discharge of contaminated runoff from the mine infrastructure to the receiving environment; and ▪ Diversion and routing of clean runoff to the receiving environment.
Groundwater	▪ Minimise the impact on the quantity and quality of the groundwater resource within the sphere of influence of its operations; ▪ Minimise impact in terms of quality and quantity other water users; and ▪ Ensure the sustainability of the water resource.

6.4 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

The following measures have been identified to achieve the set performance objectives for Tronox (Table 6-2).

Table 6-2 - Measures required to achieve performance objectives relevant to Tronox

Theme	Performance objectives	Measures
Waste	▪ Disposal of all general and hazardous waste in accordance with legislative requirements	▪ Obtain safe disposal certificates for the off-site disposal of waste.
	▪ Contaminated storm water from workshop and parking areas	▪ Containment and removal of any dirty stormwater to existing Fairbreeze operation.
	▪ Zero discharge of contaminated runoff from the mine infrastructure to the receiving environment	▪ Design, construct, and maintain storm water management measures around all facilities and in accordance with GN R. 704.
	▪ Diversion and routing of clean runoff to the receiving environment	▪ Ensure that the designs of the final landform and cover allow for the routing of clean runoff to the receiving environment; and ▪ Implement measures to prevent the ingress of clean water into the mine operations.
Groundwater	▪ Prevent contaminated groundwater from reporting to and impacting on the fitness of use of water utilised by downstream water users	▪ Utilise geochemical characterisation and impact prediction to determine the long-term impact on surface and in-pit on groundwater quality; ▪ Develop and update a site wide groundwater model for the mine to predict the current and the long-term impact from the mine on the groundwater regime; ▪ Identify and update downstream water users and determine the water quality and quantity requirements; and ▪ Update the groundwater monitoring programme for the identification of impacts, as well as the calibration and verification of groundwater and geochemical modelling.

6.5 OPTIONS ANALYSES AND MOTIVATION FOR IMPLEMENTATION OF PREFERRED OPTION

6.5.1 MINE PLAN ALTERNATIVES

The mine alternative locations for the Phase 1 mining operation were assessed in the prefeasibility study. Based on location and access to the R103, the site was deemed to be most suitable site to begin mining at in the Port Durnford mining area.

6.5.2 SITE ALTERNATIVES

Site alternatives were considered for Phase 1 of the project during the pre-feasibility stage. Factors that were considered in the selection of the preferred site were:

- The location of the high grade ore;
- Proximity to existing infrastructure, specifically access roads;
- Topographically uniformity and ease of mining; and
- Avoidance of environmentally sensitive areas.

There were no constraints regarding Phase 1.

6.5.3 MINING METHODS ALTERNATIVES

Preferred alternative mining method

For Phase 1, given the low scale of the mining activities planned, the preferred mining method from an economical perspective makes use of Front End Loader (FEL)/excavators for mining and trucks and front-end loaders to transport material to the existing Fairbreeze operation.

Actively hauling mined material from the Phase 1 mining area at Port Durnford to Fairbreeze is therefore the preferred mining methodology for Phase 1.

Alternative 1 mining method

Mining and stockpiling material within the Phase 1 footprint area was considered as an alternative, however, Tronox concluded that it would be simpler and more cost effective from a process perspective to actively mine and haul material concurrently than to stockpile ROM material in the Phase 1 footprint area. Therefore, this alternative was not considered further.

6.5.4 TRANSPORTATION AND HAULAGE ALTERNATIVES

Phase 1 will be mined at a low rate for up to 10 years (from year 2025). The transportation routes the haulage trucks utilise to and from the Phase 1 yard to Fairbreeze Mine required careful consideration. Three transport routes from Port Durnford to Fairbreeze were considered and assessed for Phase 1.

- Route 1 makes use of existing public roads entirely. From the Port Durnford Phase 1 Yard the trucks would use the R102 Road, westbound for 10 km to the Hely Hutchinson Road intersection with the R102. The Haulage Trucks would turn left at this intersection and take the N2 southbound onramp onto the National N2 Highway southbound. The trucks would go through the Mtunzini Tollgate and travel 6 km on the N2 south bound and take the existing “290 Fairbreeze Mine off-ramp”. The proposed stockpile area is 400 m south of this offramp within within the Fairbreeze mining area. The total distance travelled would be 18.7 km, at an average speed of 53 km/hr, and the average anticipated trip time would be 21 minutes.

- Route 2 makes use of 8.7 km of existing gravel/mine roads. This route entails 10km section of R102 Road use for transporting mined material to Fairbreeze. It, however, bypasses the N2 southbound and toll gate by making use of 6.7km of existing gravel roads, east of the N2 southbound carriageway within the Fairbreeze mining area, south of Mtunzini. The total distance of this route is 20.9 km, with an average of speed of 43 km/hr and have an average trip time of 23 minutes. Approximately 1.8 km of gravel road would need to be upgraded between Hely Hutchinson Road and the Fairbreeze mining operation south of Mtunzini.
- Route 3 involves travel for 12.5 km along the R103 and approximately 5 km of privately owned farm roads. The N2 would be crossed by means of an existing single lane overhead bridge to access the Fairbreeze gravel haulage road, east of the N2 highway. From here the trucks would travel for 2.3 km to the Fairbreeze stockpile area. This route is 20.6 km long, would have an average speed of 43 km/hr, and have an average trip time of 23 minutes.

The proposed haulage route options from the Port Durnford Phase 1 site to Fairbreeze are indicated in Figure 6-1.

Route 1 is the preferred alternative for travel time, road maintenance and public health and safety factors.

Figure 6-1 – Proposed Phase 1 haulage road alternatives, with the preferred route indicated in red (Route 1)

6.6 IWWMP ACTION PLAN

The compilation of an IWWMP is a medium to long-term commitment in terms of resources requirements including technical investigations that are conducted.

These also require disbursing financial resources to implement management measures which can in most cases take months. With this in mind, this IWWMP has been developed for medium term (i.e. first 5 years of the project), with the action plan herein reviewed and updated every year.

It is thus the intention of the mine to have yearly interaction with DWS and update the action plan accordingly. The action plan for the Phase 1 is stipulated in Table 6-3.

Table 6-3 – IWWMP Action Plan

Theme	Action	Implementation date	Person responsible
Regular site inspections	▪ Conduct dust suppression on the roads as and when required. ▪ All maintenance / fitting activities to be conducted on concreted areas and dedicated areas to avoid soil and water contamination. ▪ Conduct regular (daily or weekly) inspection of surface areas. Produce reports for actioning. ▪ Promote general housekeeping. All waste to be deposited in demarcated bins as per mine's waste management procedure. ▪ Regularly undertake workplace inspections in all areas of the operation and document findings accordingly. ▪ Regular inspections of vehicles and machinery. ▪ All water leaks identified must be reported and fixed immediately.	Daily/when required	Mine personnel and contractors
Weekly management inspections	▪ Conduct weekly inspection on the pipelines and water infrastructures to determine new leakage/blockage/theft occurrences. ▪ Designated person to monitor amount of waste in waste receptacles. ▪ All waste off-site must be removed through an approved waste management contractor. ▪ Ensure that waste is separated and stored correctly (as per the mine's waste management procedure). ▪ Obtain safe disposal certificates and ensure correct record keeping. ▪ Maintain the clean water diversion channels which discharges clean water to the environment (As per GN R.704 requirements) ▪ Inspect water management infrastructure to ensure optimal functioning.	Weekly	Environmental Management Department (or responsible personnel)
Groundwater monitoring	▪ Monitor groundwater according to the monitoring plan.	Quarterly	Contractor
Wetland monitoring	▪ Implement a wetland monitoring plan according to monitoring plan recommended in the wetland report. ▪ Establish berms during construction phase after vegetation clearance. This can be removed as construction progresses.		

Theme	Action	Implementation date	Person responsible
Surface water monitoring	▪ Monitor surface water according to monitoring plan. ▪ Implement erosion management at construction sites.	Monthly	Contractor
Biomonitoring	▪ Undertake biomonitoring according to monitoring plan.	Biannually	Contractor
WUL audit (internal)	▪ Annual internal audits of WUL and other environmental authorisations. Facilitate close out of audit findings.	Annually	Environmental personnel
WUL audit (external)	▪ Conduct external audits of WUL and other environmental authorisations as per authorisation issued. Facilitate close-out of the audit findings.	Annually	Environmental personnel
Training and awareness	▪ Ensure training on water and waste matters is conducted regularly.	New employees and after employees return from leave	

6.7 CONTROL AND MONITORING

6.7.1 MONITORING OF CHANGE IN BASELINE (ENVIRONMENT) INFORMATION (SURFACE WATER, GROUNDWATER AND BIO-MONITORING)

Surface Water

Refer to Section 5.4.1 for the monitoring and control of Port Durnford's surface water. The surface water report serves as the baseline.

Groundwater

Refer to Section 5.4.2 for the monitoring and control of Port Durnford's groundwater. The groundwater report serves as the baseline.

Biomonitoring

Refer to Section 5.4.3 for the monitoring and control of biomonitoring at Port Durnford. This report serves as the baseline.

6.7.2 AUDIT AND REPORT ON PERFORMANCE OF MEASURES

Each component within the WUL (when issued) will have an associated audit and performance review component. Regular review and auditing important to ensure systems are up-to-date and still relevant for current situations. Evaluation is required to verify its appropriateness and suitability by comparing performance to objectives set. Changes or adjustments to systems are required where review/auditing highlights shortcomings or gaps.

Performance should be measured against:

- Internal audit (conducted annually); and
- External audit (conducted annually).

6.7.3 AUDIT AND REPORT ON RELEVANCE OF IWWMP ACTION PLAN

All existing and new systems need to be reviewed and modified to ensure continual improvement. It is considered good practice to review or audit all systems at least annually and to update the IWWMP as required in the WUL.

7 CONCLUSION

7.1 REGULATORY STATUS OF ACTIVITY

As a result of the proposed Phase 1 activity for Port Durnford, water uses will be triggered and require authorisation from the DWS in terms of Section 21 of the NWA. This report serves as the technical report to authorise these water uses.

7.2 STATEMENT ON WATER USES REQUIRING AUTHORISATION, DISPENSING WITH THE REQUIREMENT FOR A LICENCE AND POSSIBLE EXEMPTION FROM REGULATIONS

7.2.1 WATER USES

The following water uses are requiring authorisation:

- Section 21 (c): Impeding or diverting the flow of a watercourse:
  - Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland); and
  - Proximity of conservancy tanks within the regulated area of a watercourse (seep wetland).
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource:
  - Two conservancy tanks located at the Port Durnford laydown yard.
- Section 21 (i): Altering the bed, banks, course or characteristics of a watercourse:
  - Proximity of mining area and related infrastructure to the regulated area of a watercourse (seep wetland); and
  - Proximity of conservancy tanks within the regulated area of a watercourse (seep wetland).

7.2.2 EXEMPTION FROM GN R.704

The Regulations on use of water for mining and related activities, GN R.704, places restrictions on locality and use of material and requires protection of the water resource. However, it also allows for the Minister to authorise an exemption from the requirements of regulations 4, 5, 6, 7, 8, 10 or 11 on application, subject to such conditions as the Minister may determine.

None of the activities require exemption in terms of GN R.704.

7.3 MOTIVATION IN TERMS OF SECTION 27(1) OF THE NWA

The motivation in terms of Section 27 of the NWA is listed in Table 7-1.

Table 7-1 - Section 27 Motivation

Section	Content	Description of issues
27(1)(a)	Existing lawful water use	There are no ELWUs associated with this project. All water uses identified in this project are new water uses being applied for in the form of a WULA for Phase 1 of the project.
27(1)(b)	Need to redress the results of past racial and gender discrimination	The following public policies/regulations that address racial and gender equity and Broad-based Black Economic Empowerment (BBBEE) are followed by Tronox: ▪ Bill of Rights, as contained in the Constitution of the Republic of South Africa; ▪ The Constitution of the Republic of South Africa; ▪ The Employment Equity Act as amended and applicable Codes of Good Practice; ▪ The BBBEE Act as amended and applicable Codes of Good Practice; and ▪ The Basic Conditions of Employment Act as amended and applicable Codes of Good Practice. All employees and work applicants including all persons that have dealings with the company are treated fairly, with dignity, free from unfair discrimination; thus, providing equal opportunity to all. Tronox recognises that establishing equity is a business imperative and to remedy these imbalances and create equality in employment, it is necessary to eliminate unfair discrimination in all its employment practices, as well as to embark on positive action to redress the imbalances of the past. Tronox Port Durnford Mining (Pty) Ltd. (“Port Dunford Mining”) is a subsidiary of Tronox and a BEE company. Tronox will hold 70% equity in Port Dunford Mining and 20% equity will be held by a BEE entrepreneur, 5% free-carried shares by Tronox South Africa employees and 5% (also free-carry) by the communities surrounding the prospective mining area. Employment Equity Policy: Port Durnford Mining is committed to employment equity throughout the company. Accordingly, the employment equity policy and plans are developed to ensure there are no discriminatory practices and through affirmative action, to ensure the numbers of employees at senior levels truly reflect the demographics of the South African population. The employment equity policy mentions the following: ▪ Port Durnford Mining will not tolerate unfair discrimination, implicit or explicit, anywhere in the mine; ▪ There will be no sexual and racial harassment. Where it does appear to exist, it will be dealt with decisively following our disciplinary processes and guidelines;

Section	Content	Description of issues
		▪ Barriers that unfairly restrict employment and promotion opportunities of any person will not exist in the workplace; ▪ Port Durnford Mining will create an organizational culture in which diversity is encouraged and valued while focusing on shared values to develop team spirit, promote mutual understanding, optimize potential, and achieve organizational goals in serving the community; and ▪ Each year, Port Durnford Mining employment policies and procedures will be analysed and reviewed to identify employment barriers, and to ensure that affirmative action measures are implemented to address those barriers. Women in mining: Port Durnford Mining will always aim to achieve a high target of women in mining and is committed to diversity in the workplace. Improving women representation in the workplace, specifically women in mining will be continuously worked towards. We will actively recruit women to be a meaningful part of our workforce (Tronox KZN Sands (Pty) Ltd, 2024). Port Durnford Mining will have various programs and work groups in place, focusing on improving women representation in the workplace, as well as creating a favourable environment for female workers. The include: ▪ Four month fully paid maternity leave, with no loss of allowances. ▪ Safety related training to ensure females are protected and safe in our mining operations. ▪ Functional Port Durnford Mining Diversity Network. ▪ Placing pregnant women in alternative positions as opposed to physically demanding operational rolls, for the duration of their pregnancy. The Mining Charter targets for women for 2025 – 2029 can be seen in the table below (Tronox KZN Sands (Pty) Ltd, 2024):

Section	Content	Description of issues

POSITION	2025 %	2026 %	2027 %	2028 %	2029 %
Senior Management (EXCO)	0%	0%	0%	0%	0%
Middle management (Sup, Head)	33%	33%	33%	33%	33%
Junior Management (First Line)	50%	50%	50%	50%	50%
Skilled (CU – APJ4)	N/A	N/A	N/A	N/A	N/A
Semi-skilled (APJ 5 - 7)	47%	47%	47%	47%	47%
Unskilled (APJ 8)	N/A	N/A	N/A	N/A	N/A
Woman's participation in support services	0%	0%	0%	0%	0%
Woman's participation in core mining	25%	25%	25%	25%	25%

HDSA Participation in Management

Historically Disadvantaged South African (HDSA)

Port Durnford Mining will ensure the participation of HDSAs in management through the implementation of a focused succession plan which includes individual development, skills audits, talent identification, fast tracking, training, and mentoring, as well as through affirmative action hiring where necessary.

A strategy to rectify HDSA participation in management positions include:

- Diversity Focus - Preference for management positions to be filled with HDSA candidates;
- External recruitment; and
- Succession planning.

The targets for HDSAs in management can be seen in the table below (Tronox KZN Sands (Pty) Ltd, 2024):

<table>
<tr><th>Section</th><th>Content</th><th>Description of issues</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>POSITION</th><th>2025
%</th><th>2026
%</th><th>2027
%</th><th>2028
%</th><th>2029
%</th></tr>
<tr><td>Senior Management (EXCO)</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Middle management (Sup, Head)</td><td>88%</td><td>88%</td><td>88%</td><td>88%</td><td>100%</td></tr>
<tr><td>Junior Management (First Line)</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Skilled (CU – APJ4)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Semi-skilled (APJ 5 - 7)</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td></tr>
<tr><td>Unskilled (APJ 8)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>
</td></tr>
<tr><td>27(1) (c)</td><td>Efficient and beneficial use of water in public interest</td><td>Tronox recognises that water is a scarce resource which belongs to all people and will strive (through adherence to the conditions and provisions of the WUL) to meet the following principles (as stipulated in Section 2 of the NWA) which form the foundation of the NWA:
■ Redressing the results of past racial and gender discrimination;
■ Promoting the efficient, sustainable, and beneficial use of water in the public interest;
■ Facilitating social and economic development; and
■ Reducing and preventing pollution and degradation of water resources.
In addition to the above mentioned, Tronox will adhere to Section 19 of the NWA which stipulates that a water user must take all reasonable measures to prevent any pollution of a water resource from occurring, continuing or recurring. By adhering to the provision, Tronox will ensure that the surrounding as well as site-specific water resources are protected and utilised in a beneficial manner.
Accordingly, Tronox will contribute to the efficient and beneficial use of water by adhering to the regulatory provisions that will be contained in the WUL and the provisions of the NWA. Water use activities may not commence without an approved water use authorisation. Thus, approval of the water use has indirectly contributed to the beneficial use of water by illustrating that Tronox is committed to adhering to the regulatory regime governing water use in South Africa.
Through the licensing of the water uses, this will allow the Tronox’s stance and objective to create a fair, discrimination free workplace for all will be upheld, thus, ensuring the cultivation of sustainable business and business practice that will benefit the company and the community that exists around it.</td></tr>
</table>

Section	Content	Description of issues
27(1)(d)i	Socio-economic impact of the water uses if authorised	As demonstrated in the sections above, Tronox will have a positive impact on the economy, which will lead to increased local business opportunities, extended training offerings and provides the opportunity to employee numerous skilled workers who are contributing to the economy as individuals. In addition, the Port Durnford Project will thus secure continued feed to the CPC in Empangeni, allow for the continued supply of customers and realise sustained economic benefits for: ■ National gross domestic product (GDP); ■ The CPC in Empangeni (440 direct employees); ■ Tronox's 322 permanent employees; ■ The communities that benefit from the Social and Labour Plan; and ■ The downstream businesses that benefit from the mining operation and its supporting industries within the region within which it operates. Water is becoming a more scarce and costly resource due to climate change impacts and the increasing demands on water resources. As a business they understand the importance of maximising water use efficiency. The authorisation of the water use enables Tronox to start mining operations and implement their initiatives which include, but are not limited to: ■ Skills transfer and training initiatives; ■ Socio-economic development; ■ Improved access to the N2 as a result of the access road improvement; ■ Procurement; and ■ Supplier development.
27(1)(d)ii	Socio-economic impact of failure to authorise water use or uses	Failure to authorise the Section 21 water uses will have the following impacts: ■ The Port Durnford Project will be prevented to secure continued feed to the CPC in Empangeni which will equate to a 440 direct employee loss. ■ The presence of the mine, the employment of local persons and the utilisation of local services will result in an increased income for local communities and business and an increased tax base for traditional authorities and municipalities. These opportunities will be lost should the project not proceed, and will have consequences on local, regional, national and international scale.

Section	Content	Description of issues
27(1)(e)	Catchment Management Strategy applicable to the relevant water resource	The project area is situated in the Pongola-Mtamvuna Water Management Area (WMA) within quaternary catchment W13B. There is a proto-Catchment Management Agency (CMA) established in this catchment area known as the Pongola-Mtamvuna CMA. To date, the established catchment management agency has drafted a strategy to manage the resources in the catchment. However, to date, the strategy has not been finalised. Six strategic themes are composed. Each theme has its own goal defined: ▪ Water Quality: create and preserve healthy water resources; ▪ Water Availability: water resources are sustainable and efficiently managed to meet current and future demand; ▪ Water Allocation: equitable allocation, meeting the needs of inclusive economic growth without threatening the integrity of aquatic ecosystems; ▪ Stakeholder Engagement: well informed and knowledgeable stakeholders partake meaningfully in the decision-making process on Integrated Water Resources Management (IWRM); ▪ Cooperative Governance: as water is a main driver for development, collaborate with other institutions to address inequality and poverty; and ▪ Institutional Arrangements: be an effective and efficient organisation to perform all duties on IWRM for the WMA.
27(1)(f)	Likely effect of the water uses to be authorised on the water resource and other water users (quality and quantity)	The following water use activities being applied for include conservancy tanks and mining infrastructure located within 500m of a wetland. For Phase 1, the nearest wetland is approximately 114m from the operation and the nearest river is a tributary of the Amanzamnyama river which is approximately 410m. The wetland has been categorised as a seep wetland consisting of relatively pristine swamp forest surrounded by *Eucalyptus* plantation. In terms of the potential impacts associated with Phase include: Aquatic ▪ The Aquatic Assessment compiled by WSP (2024) determined that there will be no likely effect on the riverine/riparian habitat from the Phase 1 project. Groundwater ▪ No groundwater users have been identified in the proposed footprint; therefore, the impact is limited to surface water resources.

<table>
<tr><th>Section</th><th>Content</th><th>Description of issues</th></tr>
<tr><td></td><td></td><td>
No decant is expected with Phase 1 and Acid mine drainage conditions are not anticipated to be generated within the mining area.
Wetlands
Changes in wetland health/ functioning (groundwater fed).
Alteration of available groundwater supply.
Soil erosion.
Increased sediment load within water column.
Establishment and spread of alien invasive species.
</td></tr>
<tr><td>27(1)(g)</td><td>Likely effect of the water uses on the class and resource quality objectives</td><td>
The water resource classes, and resource quality objectives (RQOs) have not been determined for the quaternary catchments in which the mining activity is proposed (W13B).

An Ecological Importance and Sensitivity (EIS) Assessment was undertaken in a Wetland Assessment (2024) compiled by WSP. The wetland nearest to Phase 1 has been rated a ‘very high’ EIS score.
<table>
<tr><th>GROUP 7</th><th>Importance</th></tr>
<tr><td>Ecological Importance & Sensitivity</td><td>3.1</td></tr>
<tr><td>Hydrological/Functional Importance</td><td>1.0</td></tr>
<tr><td>Direct Human Benefits</td><td>0.4</td></tr>
</table>
</td></tr>
<tr><td>27(1)(h)</td><td>Investments already made and to be made by the water users in respect of the water use</td><td>Study costs were capitalized to a prefeasibility level to the approximate value of R37 million. This includes a Definitive Feasibility Study concluded in 2024. An estimated capital cost of R64 million for the Phase 1 Feasibility and R7.9 billion for Phase 2 mine development.</td></tr>
<tr><td>27(1)(i)</td><td>Strategic importance of the water uses to be authorised</td><td>
While the water use is not classified as strategic (power generation, etc.), Tronox and the Port Durnford Mining project plays an important role in the economy and community upliftment. Awarding the water use license will enable Tronox to continue to actively participate as an essential element of KwaZulu-Natal’s, as well as South Africa’s economy and remain a vital business for the surrounding community. As previously stated, the Port Durnford mine will allow for the continual contributions to the economy by means of the following:
Job creation;
Improvement of local infrastructure (i.e. the improved access to the N2 as a result of the access road improvement);
Training the youth as well as HDSAs; and
Have a positive impact on the local communities through economic development.
</td></tr>
</table>

Section	Content	Description of issues
		A SLP has been developed for the project (Tronox KZN Sands (Pty) Ltd, 2024).
27(1)(j)	Quality and quantity of the water in the water resource which may be required for the Reserve and for meeting international obligations	In terms of this project, no international obligations will be affected. The nearest river is a tributary of the Amanzamnyama river which discharges into the Mlalazi estuary. No abstraction is taking place for the Phase 1 project. The baseline water quality has been determined based on the water quality data collected at the locations (i.e. Msasandla River, tributaries of KwaGugushe River, Ntuze River, Ojinjini River, Amanzamnyama River, Mlalazi River, Nkonjane River and Mzingwenya River) in June 2024, and the DWS (Resource Quality Information Services (RQIS)) monitoring points, sampled between 2014 and 2018/19, located upstream and downstream of the proposed Port Durnford MRA on the Mlalazi River and Mhlatuze River.
27(1)(k)	The probable duration of any undertaking for which a water use is to be authorised	It is requested that the WUL be authorised until the LOM has been reached for Phase 1 (2035). In terms of future developments, Phase 2 of the Port Durnford Mining development will succeed Phase 1.

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Appendix A

SURFACE WATER BASELINE AND IMPACT ASSESSMENT (WSP, 2025)

Confidential

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Surface Water Baseline and Impact Assessment

41106008-REP-00002
MARCH 2025

CONFIDENTIAL

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Surface Water Baseline and Impact Assessment

REPORT CONFIDENTIAL

PROJECT NO. 41106008

OUR REF. NO. 41106008-REP-00002

DATE: MARCH 2025

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Surface Water Baseline and Impact Assessment

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QUALITY CONTROL

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Signature	
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Signature	
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Report number	41106008-REP-00002

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APPENDICES

APPENDIX A

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EXECUTIVE SUMMARY

Tronox currently operates the Fairbreeze Mine southwest of the Port Durnford tenements. Here, mineralised sand dunes are mined by hydraulic mining using a high-pressure hose that turns the in-situ sand into slurry. The slurry is then pumped to the plant for processing. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter, collectively known as the Central Processing Complex (CPC) in the Empangeni area. Fairbreeze Mine will reach the end of its life span within fifteen years. Tronox's previous mining operation, Hillendale, is currently in the mine closure stage. Tronox intends to develop a low-rate mining-only operation at the Port Durnford Project Area during phase 1, initially producing a run of mine (ROM) to be sent to Fairbreeze for primary beneficiation and then expanding to provide heavy mineral concentrate (HMC) for the KwaZulu-Natal (KZN) Mineral Processing Plant (MSP) once mining at Fairbreeze is complete, during phase 2. It is intended that the HMC produced at Port Durnford will be used to replace Fairbreeze mine commitments to the MSP and the Empangeni Smelter. The mineral suite in the Port Durnford ore body closely matches that of the Fairbreeze ore bodies, with all previous test work showing that Port Durnford mineral products would effectively be a 'like for like' replacement for Fairbreeze mineral products. The Port Durnford Project will thus secure continued feed to the CPC in Empangeni, allow for the continued supply to customers and realise sustained economic benefits.

Tronox is now applying to convert its Prospecting Rights into a consolidated Mining Right and seeks environmental authorisation to mine for Heavy minerals (general), Garnet (Abrasive), Kyanite, Leucoxene (heavy mineral), Monazite (heavy mineral), Rutile (heavy mineral), Silica Sand and Zirconium ore. A full Scoping and Environmental Impact Reporting (S&EIR) Process is required to support the application for EA for the project.

This surface water impact assessment was undertaken to identify the proposed project's potential impacts that may emanate during the construction, operation and decommissioning phases and provide mitigation measures to limit disturbances on surface water resources. This included assessing the baseline water quality, floodline modelling and water balance. The report also incorporates conceptual stormwater and RSF breach undertaken during the PFS. Below are the findings made from this study:

The surface runoff obstructed from contributing to the affected catchments such as (i.e. Mzingwenya, a non-perennial tributary of the Mhlatuze River, Ntuze, Ojinjini, Amanzamnyama and Mlalazi Rivers) is insignificant, mainly because the area where the proposed mining activity is to take place is heavily disturbed, and drainage lines were removed when establishing forestry. Forestry, by nature, reduces runoff through evapotranspiration.

- Baseflow

From the baseflow simulation, it is evident that the mining activity will not impact the water quantities due to the reduction in baseflow in the catchments; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use. The findings are summarised below:

- KwaGugushe, Msasandla and Ojinjini Rivers (west of the Project Area) show an insignificant reduction in baseflow. The increase in baseflow is more significant due to the wet backfill/sand tailings.
- Baseflow to the Mhlatuze River (north of the Project Area) is limited as the area contributing to the Mhlathuze catchment is insignificant. Baseflow reduces from 2036, and the largest effect is seen from 2058 to 2061 during the mining of the north block. However, the wet backfill has a counter effect, and from 2061 to 2064, there is a significant increase in baseflow.
- Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu (northeast of the Project Area) is limited. It reduced slightly from 2036 to the end of mining. However, it increases from 2062 to 2064.
- Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary (south of the Project Area) shows an insignificant reduction in baseflow from 2036. The baseflow reduction is significant from 2054 to 2058 and again from 2062 to 2065. An increase in baseflow due to deposition is evident for the following periods:
  - From 2037 to 2052 - due to deposition of sand tailings A1, A2 and A3.
  - From 2056 to 2058 - due to backfill in area 4.
  - From 2066 to 2067 - due to backfill in area 3.

- Water Quality

Baseline water quality shows general compliance with most parameters except for few elevated levels of some parameters such as Aluminium (Al), Ammonia (NH4 as N) and Iron (Fe), which exceed permissible limits and could be attributed to the natural geology or the current land use. The water quality of the Lower Mlalazi River towards the estuary is characterised by elevated levels of Electric Conductivity (EC) and thus Total Dissolve Solids (TDS) indicating high salinity levels. The latter phenomenon could be attributed to the sea tidal effect and intermixing with riverine flows. Though not apparent due to the lack of supporting data in the table, the impact of effluent discharges from both the Mtunzini Municipal Water Treatment Works and the Mtunzini Aquaculture projects Kob farm as concluded by the DWS Mlalazi estuary reserve determination study ((DWS, 2015), has not been ruled out. The impact of the mining activity on surface water quality will be insignificant, as the dunes have been extensively leached by percolation of rainwater, hence all remaining constituents can be considered to be stable.

- Water Balance

During the wet season, on average 142 000m3/month of raw water is required from Mhlatuze, while during the dry season 170 000m3/month is required. There are imbalances in the water balance, as reflected in the Fairbreeze water balance, which has been carried over to the Port Durnford water balance. The water balance does provide indicative raw water required from Mhlatuze. The water balance must be updated to a dynamic stochastic water balance when more information becomes available on the processing, and the stormwater management becomes available. The model can be applied to size infrastructure to meet regulatory requirements.

- Floodline

Floodlines are modelled for the tributaries of the Mhlatuze River (i.e. Nkonjane River and the unnamed non-perennial streams) that drain the northwestern areas, the perennial Mzingwenya River and its associated tributaries flowing along the eastern site boundary from southwest to northeast, where they drain into Lake Cubhu, the perennial Amanzamnyama and Ojinjini Rivers and their associated

tributaries that flow from northeast to southwest within the site boundary and confluences with the Mlalazi River. The proposed mining activity is outside the 1:100-year floodline for most rivers except for the Mhlatuze River non-perennial tributaries and the Amanzamnyama River. However, in the case of the Amanzamnyama River, the N2 will act as a barrier during the flooding, and the drainage lines of the Mhlatuze River non-perennial tributaries and the Amanzamnyama River have also been modified when establishing the forestry plantation.

- Stormwater Management

Stormwater management has been conceptually designed for access roads and around residue storage facilities (RSF) 9 and C only. In compliance with General Notice 704 and Regulation 77 of the National Water Act, a detailed site-wide stormwater management plan is required during the detailed design phase of the Project.

- RSF Dam Breach

A failure of RSF 9 will inundate the Ntuze River and its tributaries, the Mlalazi and Bhadi Rivers, the Ojinjini River, and ultimately the Mlalazi estuary. Similarly, the failure of RSF C will inundate Amanzamnyama, the nearby wetlands, and ultimately the Qhubu Lake. Although the risk of failure has a very rare likelihood of occurrence, the consequence of RSF failure is catastrophic and could result in adverse impacts that include injuries/fatalities, reputational damage to Tronox, temporary or stopping the mine production and clean-up costs/fees.

- Impacts Assessments

The impacts associated with the construction, operation, decommissioning and post closure phases of the proposed project were rated predominantly moderate prior to implementation of mitigative measures. However, with the implementation of the recommended mitigative measures, the impacts were rated as low.

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1 INTRODUCTION

Tronox KZN Sands (Pty) Ltd ("Tronox") holds a prospecting right under the Department of Mineral Resources and Energy ("DMRE") Reference: KZN 30/5/1/1/2/296 PR in respect of ilmenite, rutile and zircon on the farms [Sub 1 and Remainder of Lot 102 uMlalazi No. 13860, Sub 1,2 and Remainder of Lot 131 uMlalazi No. 14098, Sub 1 and Remainder of Lot 103 uMlalazi No. 13880, Sub 2,3 and Remainder of Lot 104 uMlalazi No. 13853 and Sub 1 and Remainder of Lot Hibbert No. 15714] measuring 843.72 hectares in extent in the uMlalazi Municipality, KwaZulu-Natal Province (the "Waterloo PR"), which prospecting right was renewed by the DMRE pursuant to section 18 of the Mineral and Petroleum Resources Development Act, 2002 ("MPRDA") (WSP Africa (Pty) Ltd, 2024).

Historically, Tronox held the following two prospecting rights in terms of section 17 of the MPRDA:

- KZN 30/5/1/1/2/10708 PR (formerly 771 PR) in respect of ilmenite, rutile, zircon and heavy minerals on the farms measuring 3 945.95 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal province (the "Port Durnford PR").
- KZN 30/5/1/1/2/279 PR in respect of ilmenite, rutile, zircon and heavy minerals on the farms measuring 258.27 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal province (the "Penarrow PR").

Tronox is now applying to convert these Prospecting Rights into a consolidated Mining Right and seeks environmental authorisation (EA) to mine for Heavy minerals (general), Garnet (Abrasive), Kyanite, Leucoxene (heavy mineral), Monazite (heavy mineral), Rutile (heavy mineral), Silica Sand and Zirconium ore. A full Scoping and Environmental Impact Reporting (S & EIR) Process is required to support the application for EA for the project. WSP Group Africa (Pty) Ltd (herein referred to as WSP) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIR (S & EIR) Process required in terms of the following legislation (WSP Africa (Pty) Ltd, 2024):

- Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA).
- National Environmental Management Act (No. 107 of 1998) (NEMA) for submission of application for environmental authorisation (EA) in respect of activities identified in terms of GNR 983, 984 and 985 (7 April 2017, as amended).
- National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM: WA) and the list of waste management activities (GN 921:2013, as amended), requiring submission of a waste management license (WML) application.

Since this is a mining project, the Department of Mineral Resources and Energy (DMRE) is the Competent Authority for the EA Application.

1.1 PURPOSE OF THIS REPORT

This report constitutes the Surface Water Impact Assessment in support of the S & EIR, whose purpose is to support the environmental regulatory process as follows:

- Provide an overview of the surface water baseline settings of the Project Area before the Project development.
- Provide an overview of the site's climatic and hydrological setting.
- Identify potential impacts associated with the Project on the surface water resources.

- Undertake a surface water impact assessment of each identified impact.
- Propose mitigation and management measures to minimise potential impacts.

1.2 LOCATION OF THE PROPOSED PROJECT SITE

The Port Durnford mine is in the uMlalazi and uMhlathuze Local Municipalities under the King Cetshwayo District Municipality. It is located approximately 15km southwest of Richards Bay, adjacent to Mtunzini, Port Durnford, Esikhawini, Gobandlovu, and KwaDlangezwa settlements/towns at different points along the proposed Project Area boundary.

The N2 highway and the R102 traverse the proposed Project Area (Figure 1-1). The R102 is located northwest of the Project Area, and the N2 runs through the centre. A railway line just south of the N2 also traverses the Project Area.

Table 1-1 lists the properties within the proposed Project Area boundary. Mondi currently leases most properties under the prospecting rights for commercial forestry purposes.

Table 1-1 – Description of properties

<table>
<tr><td>Farm Name</td><td>Port Durnford
Portion 0 of Farm Richard 16802
Portion 0 of Farm Birkett 16832
Portion 0 of Farm Ruth 16833
Waterloo
Portion 0 of Farm Umlalazi 14098
Portion 1 of LOT 131 uMlalazi 14098
Portion 2 of Farm Umlalazi 14098
Portion 0 of Farm Umlalazi 13853
Portion 0 of Farm Umlalazi 13880
Penarrow
Portion 0 of Farm Umlalazi 13602
Portion 1 of LOT 132 Umlalazi 13602</td></tr>
<tr><td>Application area (hectares)</td><td>4 454</td></tr>
<tr><td>Magisterial District</td><td>King Cetshwayo District Municipality</td></tr>
<tr><td>Distance and direction from the nearest town</td><td>The Port Durnford study Project Area is adjacent to the following towns at different points along the Mining Right (MR) application boundary:
200 m Northeast from Mtunzini.
60 m North-North-West from Port Durnford.
200 m North-West from Esikhawini; and
200 m Northeast from Gobandlovu</td></tr>
<tr><td>21-digit surveyor general code for each farm portion</td><td><table><tr><th colspan="2">Port Durnford</th></tr><tr><td>Portion 0 of Farm Richard 16802</td><td>N0GU00000001680200000</td></tr><tr><td>Portion 0 of Farm Birkett 16832</td><td>N0GU00000001683200000</td></tr><tr><td>Portion 0 of Farm Ruth 16833</td><td>N0GU00000001683300000</td></tr></table></td></tr>
</table>

Waterloo	
Portion 0 of Farm uMlalazi 14098	N0GU00000001409800000
Portion 1 of Farm uMlalazi 14098	N0GU00000001409800001
Portion 2 of Farm uMlalazi 14098	N0GU00000001409800002
Portion 0 of Farm Umlalazi 13853	N0GU00000001385300000
Portion 0 of Farm uMlalazi 13880	N0GU00000001388000000
Penarrow	
Portion 0 of Farm Umlalazi 13602	N0GU00000001360200000
Portion 1 of Farm Umlalazi 13602	N0GU00000001360200001

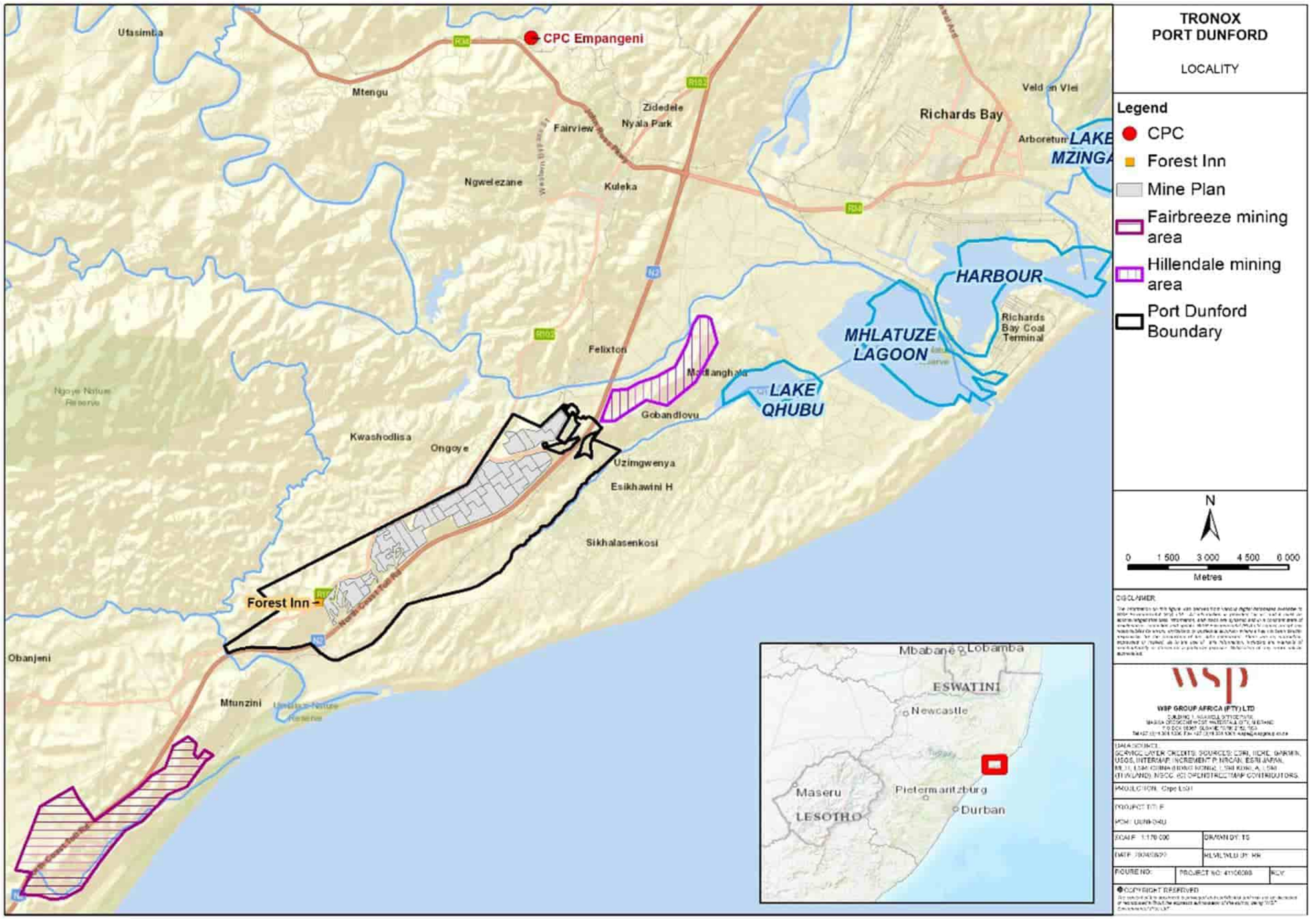


Figure 1-1 – Locality Map

2 PROJECT DESCRIPTION

The description of the proposed Port Durnford mining project, as outlined in the following section, is adapted from the final scoping report compiled by WSP (WSP Africa (Pty) Ltd, 2024).

2.1 PROJECT BACKGROUND

Tronox currently operates the Fairbreeze Mine southwest of the proposed Port Durnford Project Area. Here, mineralised sand dunes are mined by hydraulic mining using a high-pressure hose that turns the in-situ sand into slurry. The slurry is then pumped to the plant for processing. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter, collectively known as the Central Processing Complex (CPC) in the Empangeni area.

Fairbreeze Mine will reach the end of its life span within fifteen years. Tronox's previous mining operation, Hillendale, is currently in the mine closure stage. Tronox intends to develop a low-rate mining operation at Port Durnford, initially producing a run of mine (ROM) to be sent to Fairbreeze for primary beneficiation and then expanding to provide heavy mineral concentrate (HMC) for the KZN (Kwa-Zulu Natal) Mineral Processing Plant (MSP) once mining at Fairbreeze is complete. It is intended that the HMC produced at Port Durnford will be used to replace Fairbreeze mine commitments to the MSP and the Empangeni Smelter. The mineral suite in the Port Durnford ore body closely matches that of the Fairbreeze ore bodies, with all previous test work showing that Port Durnford mineral products would effectively be a 'like for like' replacement for Fairbreeze mineral products. The Port Durnford Project will thus secure continued feed to the CPC in Empangeni, allow for the continued supply to customers and realise sustained economic benefits.

2.2 PROPOSED PORT DURNFORD MINING

The Port Durnford project proposes mining heavy minerals, including ilmenite, rutile and zircon from the mineralised sand dunes with an average mining depth of 45 m. The Project Area is approximately 4,733.64 ha. The mining footprint presented in Figure 2-5 has been reduced to 1 800 ha to exclude approximately 825 ha of "environmentally sensitive areas" (ecosystems such as swamp forests and wetland habitats with high ecological function and value).

This project was conceptually planned for in 2007 and formally planned in 2015 when Tronox appointed Hatch (Pty) Ltd (Hatch) to complete a concept study for developing a mining operation at Port Durnford. Following the concept study, Tronox appointed Hatch to conduct a Pre-Feasibility Study (PFS) on the Port Durnford site, which concluded in November 2020. The concept study assessed multiple mining options and rates. The technical and financial evaluations determined that the Port Durnford mining operation should be stand-alone, mined in two phases (Phase 1 and Phase 2). The mining timeline is from 2025 to 2069 (Hatch (Pty) Ltd, 2020).

- Phase 1 would last 10 years from 2025-2035 at a low production rate of 70,400 tonnes per annum, with operation only occurring on five working days in the month, while
- Phase 2 lasts 33 years from 2036-2069 at a design production rate of 3000 tonnes per hour, 24 hours per day, 365 days a year (26,280,000 tonnes per annum).

2.2.1 PHASE 1

Phase 1 mining operations will be conducted on the remainder of Richards 16802. This land is currently under commercial forestry, leased by Mondi and owned by the iNkosi Phalani Community

Trust. The proposed location for the Phase 1 operation and infrastructure is indicated in Figure 2-1, while a 3D visualisation of the site is provided in Figure 2-2.

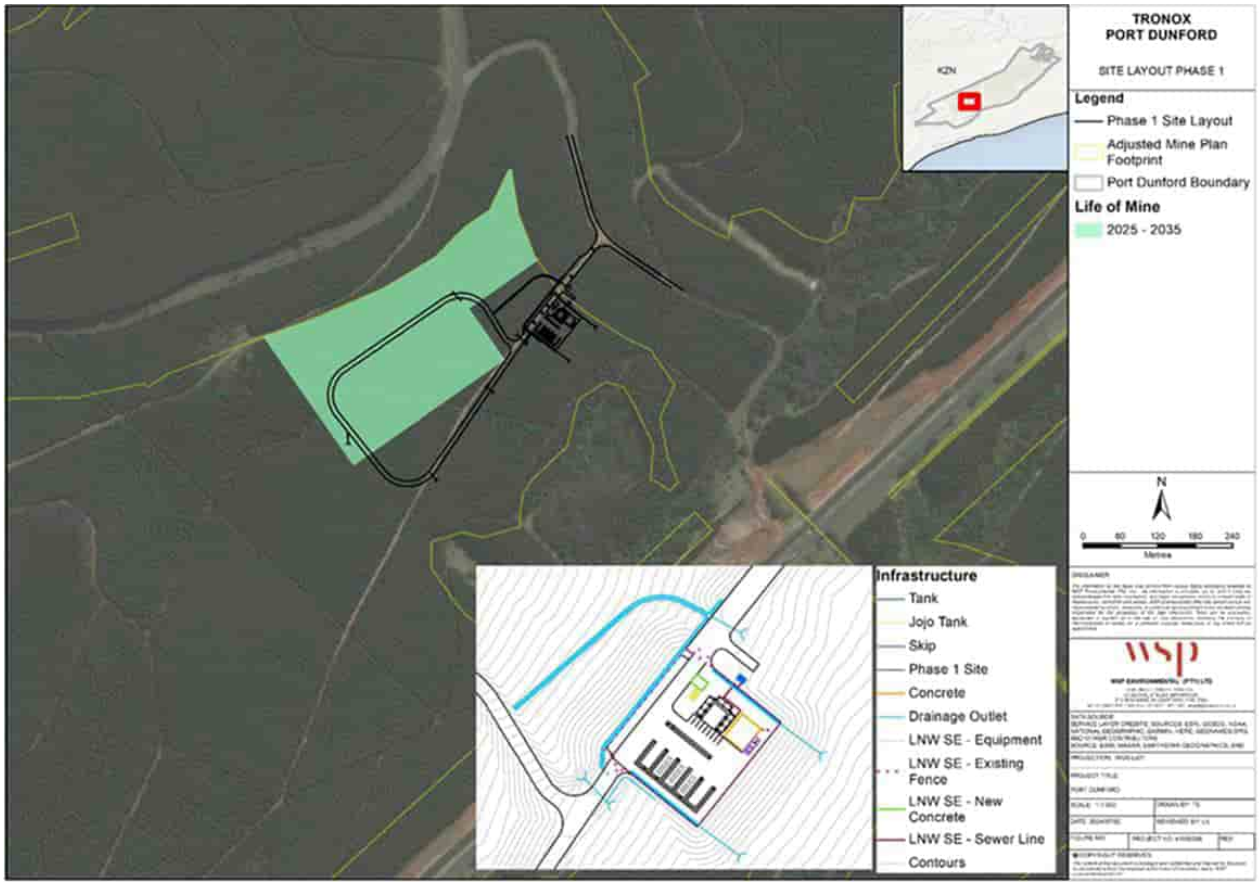


Figure 2-1 - Proposed Phase 1 Layout and Infrastructure

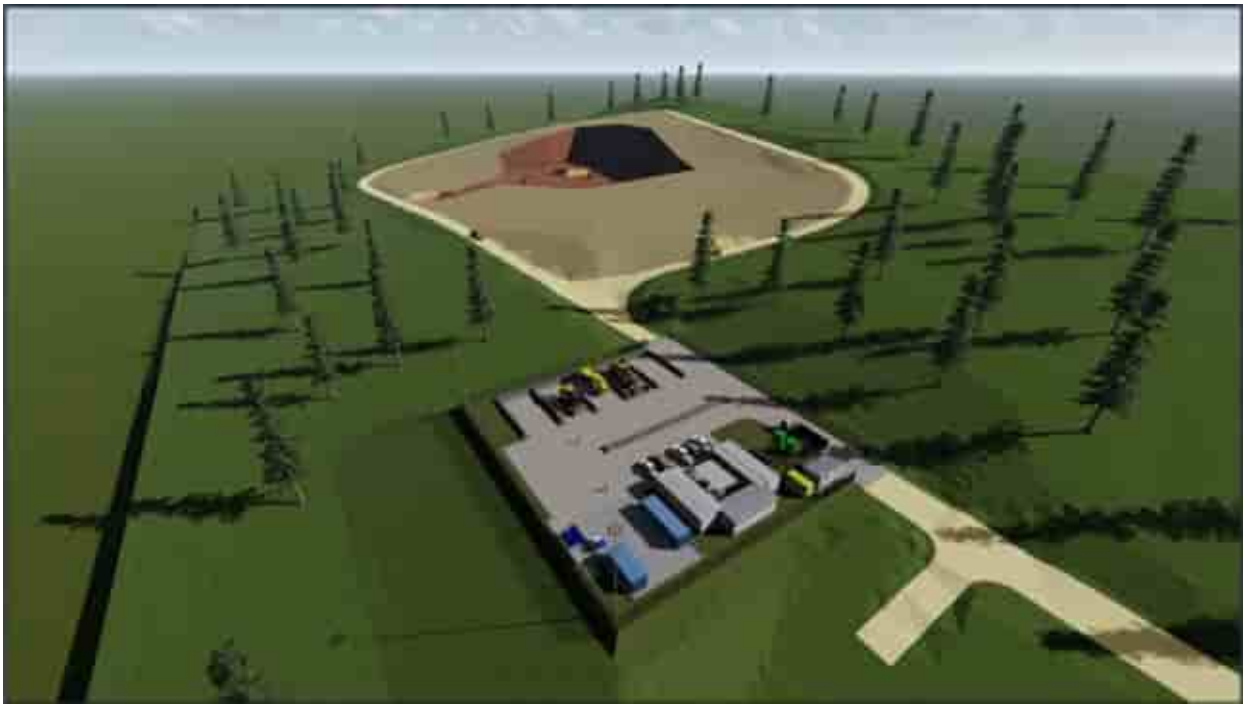


Figure 2-2 - A 3D Visualisation of the Phase 1 Layout

2.2.1.1 Mine Plan and Process

Phase 1 will have a mining footprint of 41 ha and will be located on Portion 1 of Richard 16802, over a ten (10) year period, between 2025-2035. The mining will operate at 100 tonnes per hour (tph) and 70,400 tonnes per annum (tpa). Active mining will occur five (5) days a week per month, 12 hours a day. The run-of-mine (ROM) material will be mined mechanically and hauled to the Fairbreeze mine via trucks for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. ROM will be transported to Fairbreeze Mine by truck on public roads (the R102 and N2) for further processing. It is expected that 4 x 30t trucks will be used to transport the mined material from Port Durnford to Fairbreeze Mine. It is anticipated that 9 truck cycles will be used daily for the 5 days each month the site is being actively mined. The mined-out ore bodies at Fairbreeze Mine will be used for pit infill from the Port Durnford Phase 1 operation for the first 11 years of mining. The hydraulic mining process at the Fairbreeze Mine will continue as per current practice, and the process will continue to process the stockpiled material. Hydraulically reclaimed ROM slurry will be pumped to the existing Fairbreeze Primary Wet Plant (PWP) for processing. The processed material will then be trucked to the existing Mineral Separation Plant (MSP) located at the Central Processing Complex (CPC) in Empangeni as part of the Fairbreeze product. Figure 2-3 illustrates the process flow during Phase 1 operations.

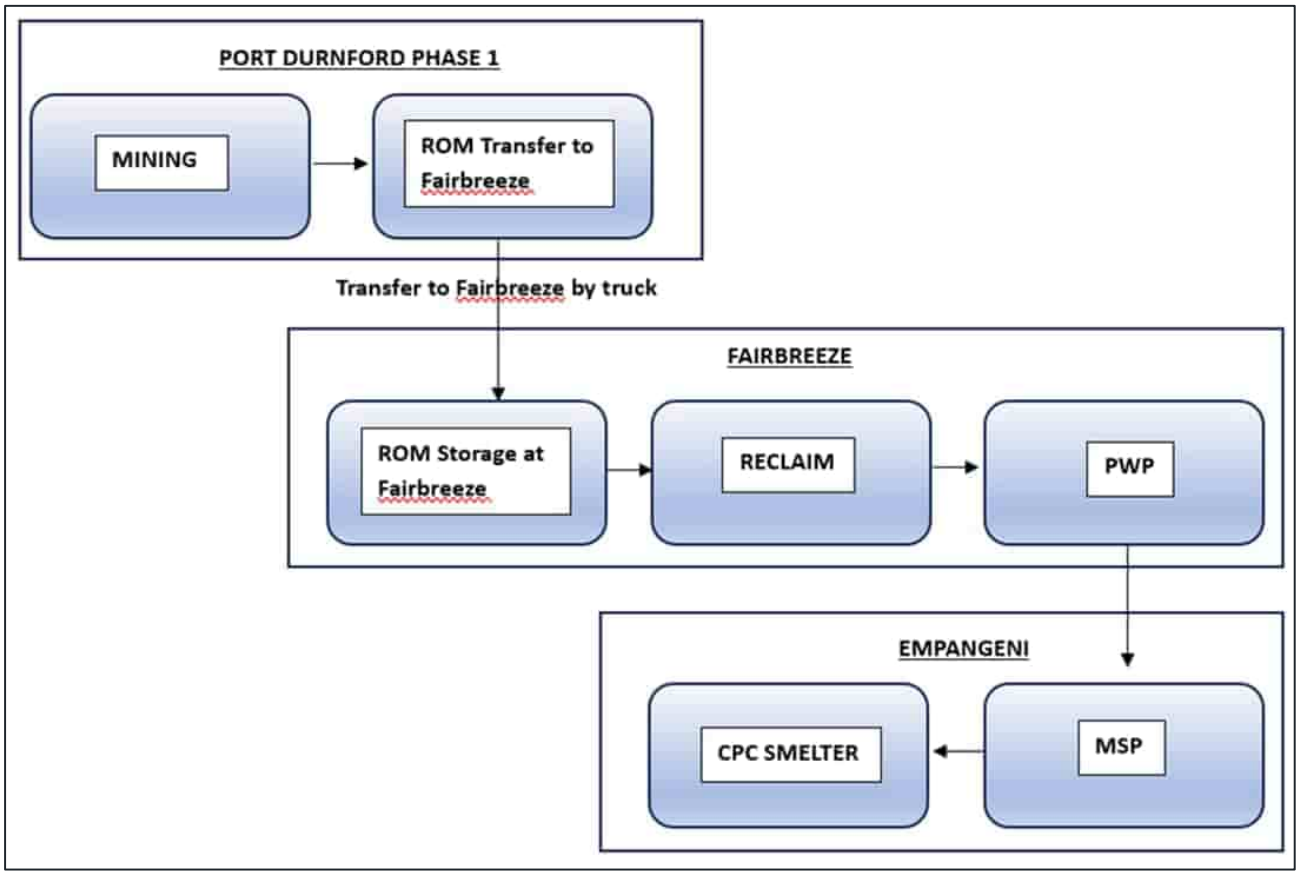


Figure 2-3 - Phase 1 Process Flow Diagram

2.2.1.2 Phase 1 Infrastructure

- Site Camp and Laydown Yard Infrastructure

This laydown yard will have no hardstand stockpile area, as the material will be mined, loaded and transported directly to Fairbreeze. The infrastructure associated with the Phase 1 laydown yard, as depicted in Figure 2-1 will include the following aspects:

- Conservancy Septic tank system - 2 x 6,000l JoJo tanks placed underground.
- Mining equipment parking area (Gravel with 2 x layers & in situ).
- Workshop laydown area (Concrete stand with 2 x steel containers).
- Water storage tanks (2 x 10kL tanks).
- Internal water reticulation (Reticulation to offices & ablutions).
- Offices and ablution and septic tank (2 x 12m units & 1 x 9m unit).
- Internal electrical reticulation (Estimated ADMD to be 14.7kW).
- External lighting.
- LDV parking area (1 x G6 layer with RIP & compacted base).
- Guardhouse (Concrete stand with 1 x steel container).
- Security fence (2.1m high fence & 1.2m parameter fence).
- A gravel access road (200m) connects the laydown yard to the District Road, which connects to the R102.
- A general and hazardous waste storage area.

- Fuel and Lubricant Storage: Fuel tanks will be supported on a concrete surface bed with edge thickenings. A concrete bund wall will be constructed surrounding the fuel tanks. A 23 m^3 storage tank is anticipated to be provided, and it is estimated that 153 422 litres will be utilised per annum.
- Water Supply

  The primary water use on site will be for dust suppression. It is anticipated that 4, 800 m^3 per annum will be required for this project phase. The water supply options include connecting to the nearest municipal supply point, installing a borehole, or utilising water carts to supply the Phase 1 site. Tronox has opted to utilise 10-18 kilolitre (kl) water trucks to cart 6 kl of municipal water to the site, to be stored in 2 x10kl JoJo tanks. The JoJo tanks will be elevated on a steel structure. The municipal water supply points considered are:

  - Potable water sourced from the Port Durnford Clinic: 28°54'57.15"S 31°49'42.06"E – 2.3km from the Phase 1 Laydown Yard.
  - Alton bulk water point: 28°44'45.38"S 32° 1'29.68" E – 34km from Phase 1 Laydown Yard.
  - Empangeni Bulk water Point: 28°44'58.29"S 31°53'6.88"E – 23km from Phase 1 Laydown Yard.

- Electrical Supply

  Power will be required to service the administration offices. The average monthly consumption required for the Laydown yard is expected to be 2,741kWh. Tronox plans to utilise an Eskom Overhead Power line connection with an inverter and batteries for a backup power supply. A miniature substation (MSS) will be required to step down the Eskom 22kV to 400V for the mine office distribution

- Haulage Routes

  Three possible transport routes were considered for the Phase 1 operation to transport mined material between the mining area and Fairbreeze Mine. All three routes follow the same route from the Phase 1 site to the Hely Hutchinson Road intersection. Consequently, this comment section is described for Route 1 below. The alternative for the subsequent two route options is only defined from this interchange onwards.

- Route 1 (illustrated in red in Figure 2-4) is the preferred route. This route makes use of existing public roads. From the Port Durnford mining area and Laydown Yard, the trucks would take the R102 road, westbound for 10km to the Hely Hutchinson Road intersection. Turning left at this intersection and right (passing through the Mtunzini Tollgate) onto the N2 southbound for 6 km until the #290 Bridge #4 Fairbreeze Mine off-ramp. The Phase 1 ROM material will be offloaded at the Fairbreeze site approximately 400 m from the offramp where Fairbreeze mining occurs. The total distance travelled would be 18.7km, at an estimated 53km/hr average speed. The average anticipated trip time would be 21 minutes in one direction. Route 1 is the preferred alternative for travel time, road maintenance, and risk accounting.
- Route 2 (illustrated in yellow in Figure 2-4) follows the common route to the Hely Hutchinson interchange. The route then also turns towards Mtunzini, but rather than accessing the N2, the route would bypass the N2 southbound turnoff and continue towards Mtunzini. At the approach to the town, the route would turn to the right onto existing dirt roads (which would need upgrading) to run along the edge of the town and connect with existing Fairbreeze mine roads. Approximately 1.8km of gravel road would need to be upgraded between Hely Hutchinson Road and the Fairbreeze mining operation. The total distance of this route is 20.9km. An average speed of 43km/hr is estimated, and the average trip time is estimated to be 23 minutes in each direction.

- Route 3 (illustrated in blue in Figure 2-4) follows the common route to the Hely Hutchinson interchange. However, instead of turning towards Mtunzini at that point, the route continues along the R103 for 12.5km before turning to the left onto privately owned-farm roads for approximately 5 km. The N2 would be crossed through a single-lane overhead bridge to connect with existing Fairbreeze haul roads east of the N2 highway. The trucks would travel a further 2.3km from here to the identified or offloading area. This route is 20.6km long, would have an average estimated speed of 43km/hr, and has an average trip time of 23 min in one direction.

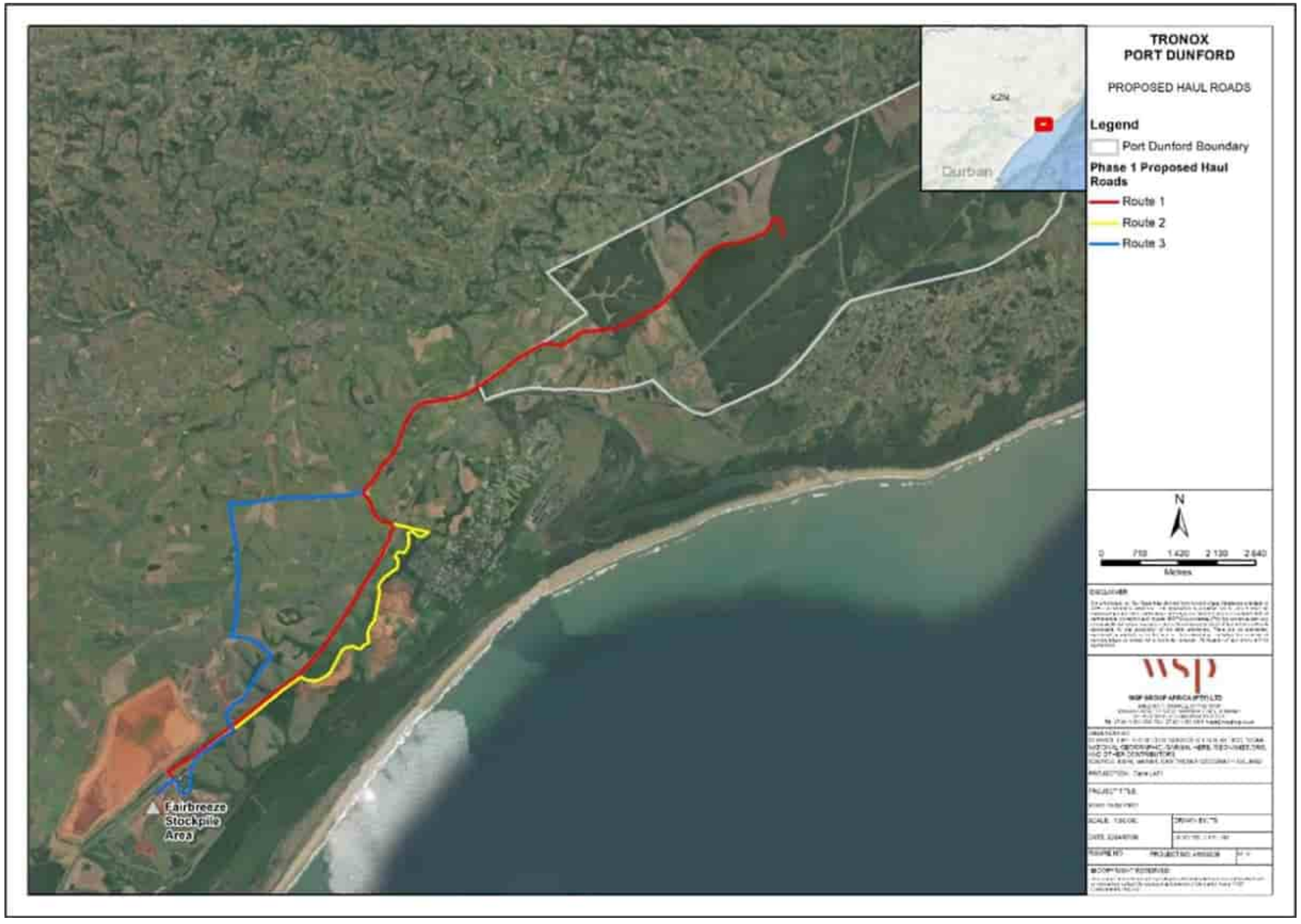


Figure 2-4 – Proposed Haulage Routes from Port Durnford to Fairbreeze

2.2.2 PHASE 2

2.2.2.1 Location and Overview

The infrastructure for Phase 2 will be constructed during the Phase 1 mining period (2025-2036). However, mining and processing for Phase 2 will only commence in 2036.

The proposed Phase 2 operation comprises opencast mining, on-site processing of ROM material in a primary wet plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox mineral separation plant (MSP) located in Empangeni within the Tronox central processing complex (CPC). At the MSP the concentrate is further beneficiated to yield the target minerals. Coarse sand tailings that are not separated at the PWP and thus transported to the MSP as part of the concentrate but do not yield product are returned to the mine and reintroduced into the coarse sand tailings backfill stream. The Port Durnford mining footprint is 1 152 hectares, which will be mined over a 33-year period between 2036 and 2069. The planned mining rate will be 3,000 tph, 24 hours a day, 365 days a year. The Phase 2 layout is presented in Figure 2-5.

2.2.2.2 Mining Operation Plan

The planned mining schedule (mine block plan including time sequencing) is presented in Figure 2-6. The mining schedule is also presented with mining blocks grouped into 5-year units for ease of interpretation of mine progress through time. In this plan, the position of the fine residue storage facilities (RSFs in orange outline) and the sand dumps (in beige outline) are also indicated, along with the position of the PWP (orange rectangle).

Mining commences in Phase 2 in 2035 at the site of the Phase 1 pit to complete mining that block. Thereafter, the active mining window moves to a position immediately east of the PWP and sequentially progresses easterly until the eastern extent of the mine is reached in 2061. Mining is also initiated in the western extent of the proposed mining footprint in 2051 and progresses easterly towards the PWP. The final block, which lies immediately north of the PWP, will be mined in 2069.

From Figure 2-5, it can be seen that RSF 9 in the west of the site will be developed on unmined ground while RSF C in the east of the site will be developed sequentially on the pit floor as each corresponding five-year mining block has been completed and space becomes available. During these periods, the washed sand tailings cannot be backfilled into the pit and, consequently, must sometimes be deposited on the surface. All pit areas will be backfilled with either coarse sand tailings or fine residue (within the RSF). The sand dump positions (beige outline) reflect where a sand dump will be developed above the current ground surface and remain a permanent aboveground feature on the post-mining landscape. Similarly, RSF Site C will also end above the current ground surface.

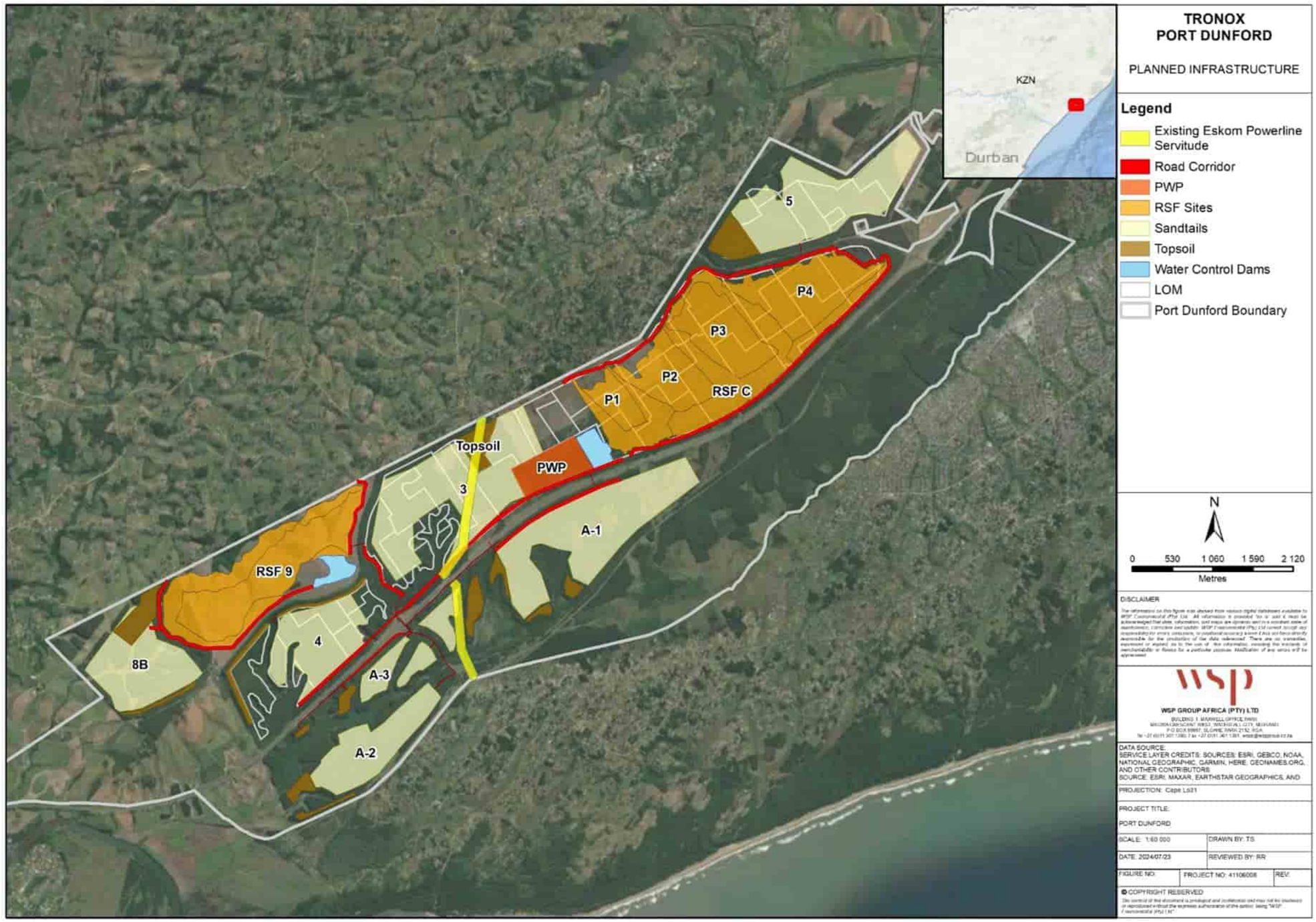


Figure 2-5 -Proposed Phase 2 Infrastructure Layout

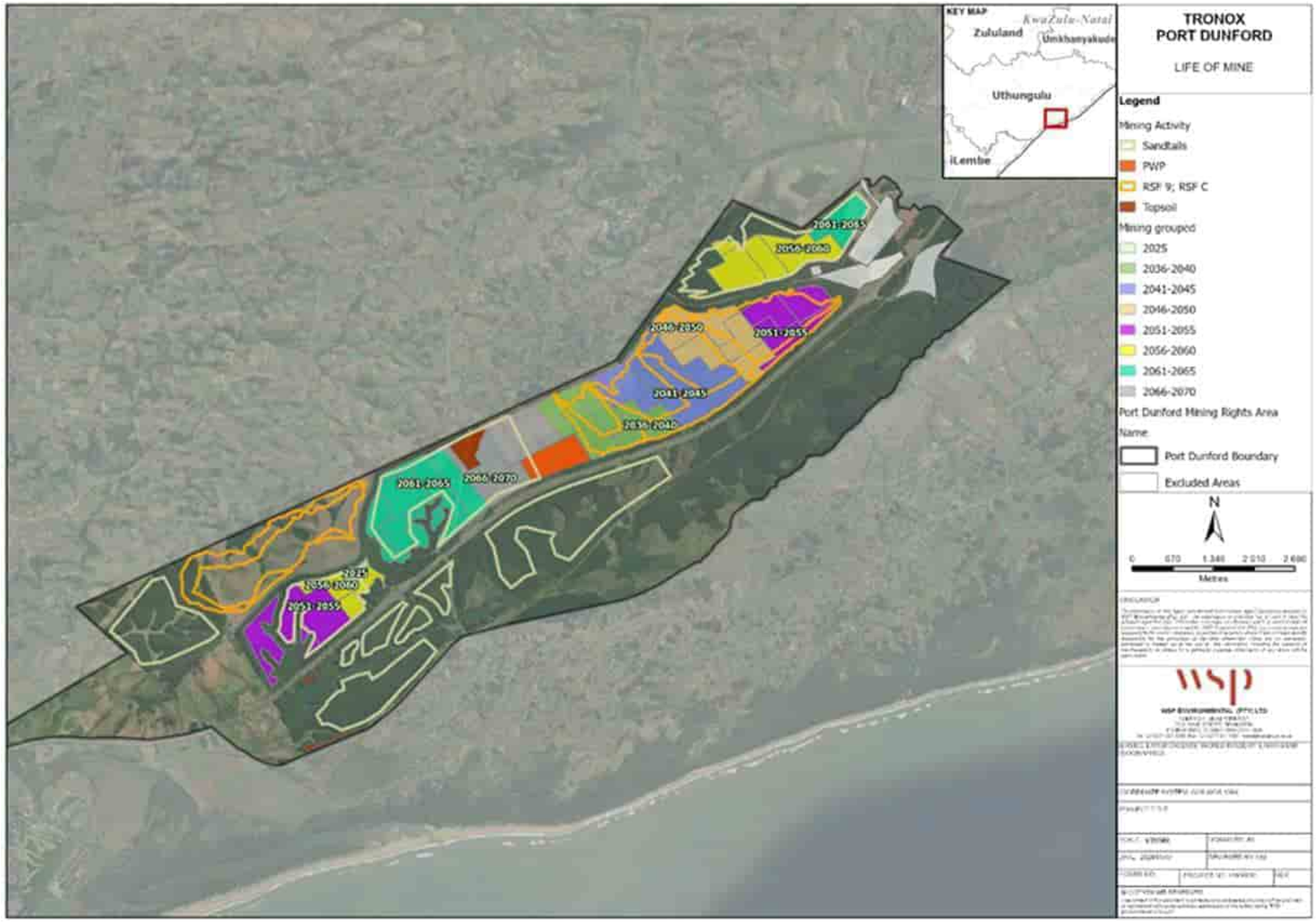


Figure 2-6 -Proposed Phase 2 Mining Block Plan Showing 5-year Mining Windows

2.2.2.3 Sequence of Mining Activities

The basic sequence of mining activities is as follows:

- Before mining starts, a minimum of 0.3 m of topsoil will be stripped. This material will preferably be placed directly in an area available for rehabilitation, or it will be placed in a stockpile for later use if that is not possible.
- Then, the in-situ sands are mined. In the Port Durnford mine, the sands are mineralised from the surface to the base of the economic mining limit within the pit. Consequently, there is mineralisation even in the topsoil that is set aside.
- After a pit has reached the economic limit for mining, it becomes available to be backfilled. Backfill material comprises the washed course tailings.
- Once the pit is backfilled to the design height, it becomes available for rehabilitation, topsoil is replaced, and
- The topsoil areas are revegetated.

2.2.2.4 Mining Method

The proposed Port Durnford heavy mineral sands mine will be an opencast sand mine, similar to the current Tronox Fairbreeze operation. The mining method will, however, differ. At Port Durnford, mobile skid-mounted dozer trap mining units (DTMUs) will be used in active mining areas. The mining process entails dozing the sand material down to the DTMU, which is combined with water and pumped to the PWP. Each DTMU is anticipated to be fed by two D11 dozers and a CAT390 excavator. A DTMU is equipped with a vibrating screen to separate oversized material and is accompanied by a primary pump. Each DTMU is connected to a raw water feed pipeline, a ROM slurry delivery pipeline, and a power connection.

2.2.2.5 Mineral Processing

The ROM material is processed at the PWP to remove fine material from the plant feed and separate the non-mineralised sand fraction to produce a heavy mineral concentrate. The ROM feed at Port Durnford is typically comprised of 76% coarse sand tails and 20% sand tail fines, with the remaining 4% being the heavy mineral concentrate (HMC), which is then transported off-site to the MSP in Empangeni. The primary processing entails:

- Mined material is deslimed and placed through a spiral circuit to separate the coarse sand tailings (+45 µm).
- The coarse sand tailings will be used for backfilling and establishing the walls of the RSF facilities.
- The spiral concentrate is put through a magnetic separation circuit to remove the reject magnetite and fed back into the coarse tailings circuit.
- The non-magnetic material forms the HMC.
- The fine tailings (-45 µm) are collected from the desliming process, a thickener is added, and process water is retrieved before disposal at the residue storage facilities.

The PWP will be designed to process 22,866,000 t/annum ROM at a nominal rate of 3,000 t/h. The PWP layout includes:

- ROM feed preparation and fines removal area.
- Gravity and magnetic separation areas.
- Fine tails dewatering, treatment and pumping area.
- 33kV sub-station and Power Factor Correction (PFC) Yards and Eskom Yard.

- Raw and process water storage and distribution area: Raw water will be stored in a single 10,000 m^3 raw water dam. Process water will be stored in two 7,500 m^3 dams connected by a common overflow sump.
- Compressed air plant: The PWP will be serviced by a single compressed air facility comprising two compressors, air receivers, and air dryers.
- Potable water treatment plant: A standalone packaged potable water plant capable of supplying sufficient water for the total estimated personnel complement.
- Sewage treatment plant: A plant will be developed to accommodate the onsite personnel. Processed effluent from this treatment plant will be pumped to the process water dam.
- Workshop and stores.
- HMC dewatering, stockpiling and reclaiming area.
- MSP tails handling where non-mineralised sand tails returning from the MSP are received to be reincorporated into the course tailings backfill stream.
- Gypsum plant.
- Mine complex includes administration offices with parking, a control room, a change house, a mess, a security office, a laboratory and a sample room.
- The raw water dam will feed directly into a fit-for-purpose and legally compliant fire water pumping station and distribution system at the PWP.

The process flow for Phase 2 activities is summarised in Figure 2-7

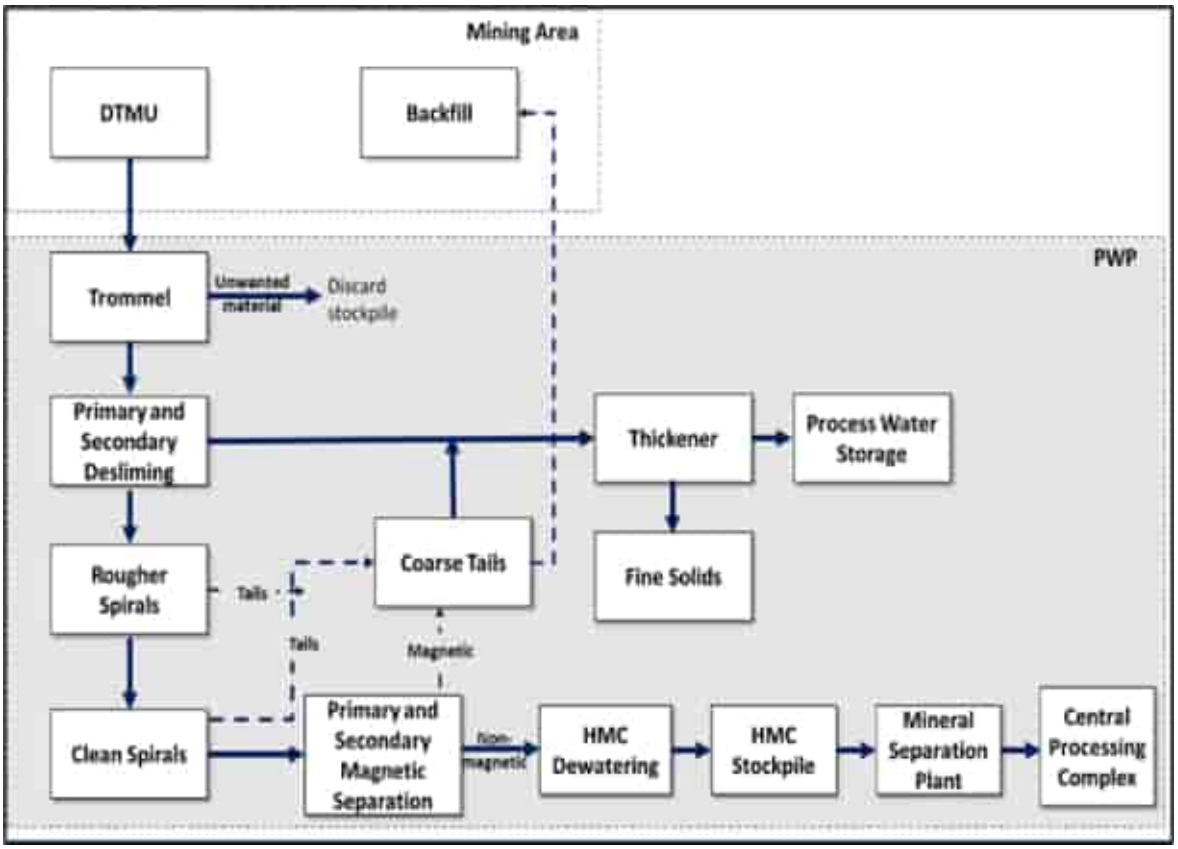


Figure 2-7 – Proposed Phase 2 Process Flow Diagram

2.2.2.6 Supporting Infrastructure

- Water Supply

Raw water will be supplied to Port Durnford from the existing uMhlatuze bulk water supply station directly to the PWP raw water dam via a take-off from the main pipeline currently supplying water to Fairbreeze.

- Power Supply

The site's power supply will come from the adjacent Eskom grid via two 88 KV incoming overhead lines to the Port Durnford 33kV substation, passing through two 88/32kv step-down transformers. Power will be distributed from the substation to points within the site where it is needed via local powerlines.

- Internal Haulage Routes

Twenty-four kilometres (24km) of haulage routes have been conceptually designed within the Mining Boundary. These haulage routes have been given a 40m wide road servitude. They cater for haulage within the mining areas and pipeline service infrastructure. Existing haulage routes will be used and upgraded where possible to accommodate the larger road servitudes. Where the haulage routes cross water courses, crossing structures will be designed and built across the water course.

2.2.2.7 Waste Streams

The proposed mining operation produces three “waste streams”: coarse sand tails, fine residue and gypsum filter cake. The following tails products are received from the CPC (Empangeni) for disposal with the various tails products at the PWP at Port Durnford:

- MSP coarse tails are received by tip truck from the MSP in Empangeni. These are tipped directly into a slurry hopper, which is slurried before being pumped directly into the rougher sand tails tank for disposal with the sand tails at the PWP at Port Durnford. Approximately 678 Mt of sand tails will be deposited during the planned LOM. Large sand tail stockpiles will be utilised for sand tails disposal from 2036 within the Port Durnford mining boundary.
- The PWP receives gypsum filter cake from the MSP in Empangeni via truck. The gypsum cake is fed into a material handling facility for re-slurrying before being fed to the thickener underflow tank for disposal with the fines to the RSF. It is estimated that between 4,800 and 9,600 t/annum of gypsum will be disposed of into the RSF feed stream each year.
- Coarse Sand Tails Disposal

The Port Durnford mining operation is anticipated to have a sand tails material balance of approximately 678 Mt over the full LOM, requiring handling and management between 15.6 and 18.5 million tons of sand per annum. The current mine plan has accounted for all 678 Mt of coarse sand tails over a planned 34-year mining period. Approximately 63 Mt of coarse sand tailings will be used for RSF dam wall construction, and the remaining 615.2 Mt will be used for pit backfill, RSF capping, or permanently deposited onto sand dumps.

- Topsoil Management

For all areas used for mining and mine infrastructure at Port Durnford, 0.3 m of topsoil within the “project footprint” will be removed and kept aside for rehabilitation. This standard practice applies to the RSF Site 9, the mining footprint, sand tails dump areas and the PWP plant site. Wherever possible, within the mining areas, topsoil will be stripped and placed directly in areas available for rehabilitation.

When space has been depleted in the designated 44 ha of topsoil stockpile areas, the topsoil will be stockpiled and used as stormwater runoff berms around the sand tail deposition areas. Prior to mining or stockpiling, the top 300 mm of soil will be stripped and stockpiled in designated topsoil stockpile sites within the Port Durnford mining right boundary. The topsoil stockpiles will be afforded a 30 m buffer from the edge of the nearest wetland or delineated sensitive environmental area. Each area will be cleared of large trees or tree stumps prior to the placement of soil. The height of stockpiles should not exceed 3 m wherever possible, and stockpiles will be protected from stormwater erosion by diversion berms. No road development over the surface of the topsoil stockpiles will be permitted to avoid unintended compassion for the valuable topsoil resource.

- Fine Residue Deposition

Fine residue will need to be managed throughout the life of mine. The RSF capacity for Port Durnford has been designed for a 28-year LOM between 2036 and 2064. It is understood that RSF capping and shaping of the sand tails dump sites with the remaining sand tails will occur between 2064 and 2069. The RSF facilities will be constructed using a phased approach. The RSF dam walls will be constructed with coarse sand tails from the mining operation and be compacted. The dam walls will be erected to the designed heights to create a “holding shell” for the incoming fine residue. Each RSF facility has a determined lifespan of RSF disposal. Each RSF site will have a maximum height and storage capacity. Once the RSF facility has reached its design capacity (design capacity in terms of storage volume and height), the facilities will be capped with coarse sand tailings and vegetated. A geochemical assessment of the waste products was completed and found to have a type 4 waste classification, which does not require a containment barrier.

RSF Site 9 will have a Water Control Dam (WCD) to receive water from the RSF dams and intercept stormwater falling within the managed RSF area. Excess water will be recovered from the surface of the RSF and the under-drainage system and returned for reuse in mining. The RSF dams will use a barge/turret system for excess water removal. The RSF sites will be installed with herringbone, toe, and blanket drainage systems to assist in dewatering the fine tailings to aid stability, manage seepage, and control the phreatic surface within RSF. Stormwater control berms and trenches will be used to manage external water, with toe paddocks to control material eroded from the RSF outer slopes.

- RSF Site 9

RSF Site 9 will be built from the sand tailings material from the Phase 2 mining activity. After 11 years of Phase 1 mining, Phase 2 mining will start adjacent to the then-constructed PWP plant in 2037. The sand tails produced in the first block of Phase 2 mining will be used to construct the dam walls of RSF Site 9. RSF Site 9 will be situated on the southwestern side of the proposed mining footprint, on Portion 1/13602 and the remaining portion of 13602 of Lot 132. This property is leased by Mondi and owned by the Philani Community Trust. This RSF facility will be used for the first 6 years of mining in Phase 2. RSF Site 9 will be 268 ha and have a final height of approximately 55 m above average ground level. The facility will be designed to store up to 26.9Mt of fine residue and 18.2Mt of sand residue. The terminal Rate of Rise for Site 9 is 3.3m/yr, meaning that the RSF facility can safely increase in height by 3.3m per year.

The water control dam for RSF Site 9 was redesigned to avoid environmentally sensitive areas. This dam will be approximately 19 ha in extent and have an 870 000 m3 storage capacity. A barge/ turret system will transport water from the RSF to the Water Control Dam.

It is anticipated that RSF Site 9 will be operational for 6 years and reach full capacity in 2042. Thereafter, capping of the RSF surface with coarse sand tailings site will commence in 2046, assuming that the surface of the RSF has dried out and stabilised sufficiently by that stage. Once backfilled, the site will be topsoiled in 2048. Outer slopes of the RSF will be topsoiled and vegetated as areas become available to stabilise the side slopes against erosion. The RSF will be returned to the landowner once Tronox is satisfied that the facility and the chosen vegetation cover have stabilised.

- RSF Site C

RSF Site C will be utilised during the Phase 2 mining activity. It will be located immediately east of the PWP plant. It will be built in sequential phases (Phase 1-4). RSF Site C will utilise mined-out pits for RSF dam storage capacity. Mining here is expected to last approximately 27.5 years before Phases 1- 4 are completed. The four planned RSF cells for RSF Site C will be converted to RSF storage space as each RSF cell reaches capacity. The phased development of RSF Site C is as follows:

- Phase 1 is expected to operate for 2.9 years and store 12.7 Mt of fines and 18 Mt of sand tails. Phase 1 will be approximately 78 ha in size. This facility will be built at a Rate of Rise (RoR) of 9.8 m/yr.
- Phase 2 is expected to operate for 8.1 years and store 35.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 121ha in size. This facility will be built at a RoR of 5.1 m/yr.
- Phase 3 is expected to operate for 8.1 years and store 40.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 147ha in size. This facility will be built at a RoR of 5 m/yr.
- Phase 4 is expected to operate for 8.3 years and store 39.1 Mt of fines and 4 Mt of sand tails. Phase 2 will be approximately 162ha in size. This facility will be built at a RoR of 3.5 m/yr.

RSF Site C will be designed to store up to 127.3 Mt of fine residue and 64.5 Mt of sand residue. The total footprint area of RSF Site C is expected to be 670 ha and will have a final height of approximately 50 m above the current average ground level.

A 13.75 ha, 540 000 m^3 Return Water Dam has been planned for RSF Site C. The dam will be between RSF Site C's Phase 1 RSF compartment and the PWP plant. The dam will be 500 m long, 275 m wide and will be 9 m high at its highest point.

RSF Site C is anticipated to be operational for 27.5 years and reach full capacity in 2064. The site will be backfilled in 2069, allowing the facility 4 years to dry out and stabilise. Once backfilled, the site will be rehabilitated with topsoil and returned to the landowner (lessee).

2.3 PROJECT ACTIVITIES

Table 2-1 presents the Project's activities, separated into the construction, operation, decommissioning/rehabilitation, closure, and post-closure phases of the Project's life cycle.

Table 2-1 – Project Activities

Phase	Activity
Construction	▪ Prior to site establishment, all authorisations need to be in place. ▪ Forestry activities on the site to cease. ▪ Bush clearing will then commence two years prior to construction. ▪ Bulk earthworks (in case of Phase 2).

Phase	Activity
	▪ Development of required service infrastructure on the site. ▪ Development and upgrade of access roads. ▪ Site establishment. ▪ Topsoil stripping. ▪ Construction of project components
Operation	▪ Mining will commence. One DTMU mines a 200 m by 100 m block at a time. Progressive backfilling and rehabilitation will then take place. It is anticipated that four years after the commencement of mining in a block, the mined area will be subject to rehabilitation. The RSF areas are the exception. These blocks will be rehabilitated post-mining once the RSF has completed its lifespan. ▪ Ongoing processing and supporting activities. ▪ Disposal of wastes from the mining process.
Decommission/rehabilitation	▪ Plant to be demolished and materials to be removed. ▪ Termination of all services to the area. ▪ Rehabilitation of all areas to be completed sufficiently to meet relevant commitments of the closure plan.
Closure and Post Closure	▪ Ongoing monitoring of post-closure impacts and rehabilitation success as required in the closure plan. ▪ Monitoring programs will continue post-closure, where applicable.

3 ASSUMPTIONS, LIMITATIONS AND EXCLUSIONS

Limitations for the report are as follows:

- A reliable long record of historical site-specific rainfall data was unavailable. Therefore, rainfall stations near the Port Durnford Project Area were identified. The Design Rainfall Utility developed by (Smithers & Schulze, 2003), which utilises a regionalised L-moment Algorithm and scale invariance to estimate design rainfall at any 1' × 1' grid interval in South Africa, was adopted to obtain design rainfall for various return periods for floodline modelling.
- No flow data was available against which the runoff calculations might be calibrated. The runoff volumes were, therefore, theoretically calculated.
- Since no flow data was available for estimation of the roughness coefficients, Manning's 'n' coefficients were estimated by comparing the floodplain vegetation and nature of the channel surfaces to published data (Chow, 1959).
- The terrain at ground level was represented by generating a Digital Elevation Model (DEM) with the 1m Contour data provided by Tronox. In more expansive areas where the 1m contour data was unavailable, readily obtainable 5-meter (5m) contours were used to create the DEM.
- A steady-state, one-dimensional hydraulic model was run for floodline modelling, which assumes that flow is continuous at the calculated peak flow rates. This approach is conservative and considered suitable for the impact assessment.
- Floodlines are only indicative, hence can only be used for environmental purposes and not detailed engineering design purposes.

- The stormwater management infrastructure presented in this report is conceptual, a detailed design based on a detailed survey and final infrastructure layout is required.
- The available water quality data is not substantial. Baseline water quality is described based on a once-off round of water quality sampling done in June 2024 and supplemented with DWS data for the Mhlatuze and Mlalazi, sampled between 2014 and 2018/19. It is assumed that the results of the water quality data analysed provide a representative view of baseline conditions in the water courses draining the site. However, a water quality monitoring program is proposed to be conducted before initiating activities at the site to establish a baseline water quality profile for the receiving watercourses.
- The surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater. Therefore, groundwater plays a significant role in the hydrological dynamics of the surrounding catchments, which the proposed mining activity will potentially impact. Therefore, baseflows were simulated to establish baseline flow conditions to assess the impacts of the proposed mining activities on the catchment yield.
- The conceptual stormwater management stipulated in this report was adopted from the Pre-Feasibility Study (PFS) undertaken by Hatch (Pty) Ltd in 2020. A detailed site-wide stormwater management plan is required during the detailed design phase of the Project once the project layout is finalised.
- A water balance was prepared for the Fairbreeze Mine, and the same approach was used to generate a preliminary, average dry and wet seasonal water balance for the Port Durnford Mine.
- This report presents findings from other studies that were not conducted by WSP. Although the reasonableness of the results was assessed, it is assumed that the results are correct and can be accepted.

4 APPLICABLE LEGISLATION

The South African regulatory framework established well-defined requirements and standards for the environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. Table 4-1 provides the legal requirements applicable to surface water management.

Table 4-1 – Applicable Legislation

Legislation	Description of Legislation
Mineral and Petroleum Resources Development Act 2002, (Act No 28 of 2002) (MPRDA)	This Act provides for equitable access to and sustainable development of the nation's mineral and petroleum resources whilst affirming the states obligation to protect the environment for the benefit of present and future generations and ensure ecologically sustainable development of the mineral and petroleum resources to promote economic growth and social development. This Act aligns with the National Environmental Management Act (1998) to provide for one environmental management system.

Legislation	Description of Legislation
National Environmental Management Act 1998 (Act No 107 of 1998) (NEMA)	This Act provides for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment. The Act states that "everyone has the right to an environment that is not harmful to his or her well-being" and imposes a duty of care to "take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring".
NEMA Environmental Impact Assessment Regulation 2014 – (GNR 982 of 04 December 2014, as amended)	Regulations for the procedural requirements for Environmental Authorisations and Environmental Impact Assessments.
National Water Act 1998, (Act No 36 of 1998) (NWA)	The NWA recognises that water is a scarce resource that is unevenly distributed but belongs to all people. The National Government thereby has responsibility for and authority over the nation's water resources and their use, including the equitable allocation of water for beneficial use. The NWA ensures the water resources are protected, used, developed, conserved, managed, and controlled in ways which consider (amongst other factors): ▪ Meet basic human needs (present and future). ▪ Promote efficient, sustainable, and beneficial use of water in the public interest. ▪ Reduce and prevent pollution and degradation of the water resource.
NWA Regulation – GNR 267 of March 2017	Regulations for the procedural requirements for Water Use Licence Applications and Appeals.
NWA Regulation – GN 704 of 4 June 1999	Regulations on the use of water for mining and related activities aimed at the protection of water resources
DWS Best Practice Guidelines: H1: Integrated Mine Water Management. H2: Pollution Prevention and Minimisation of Impacts. H4: Water Treatment. G1: Storm Water Management. G2: Water and Salt Balances G3: Water Monitoring Systems. A5: Water Management for Surface Mines.	Mining has the potential to adversely impact water quality. Failure to manage impacts on water resources throughout the project life will result in an increasing lack of support for mining projects from the local communities and government authorities. Sound management practices to prevent or minimise water pollution are fundamental for mining operations to be sustainable. The best practice guideline series provides principles and approaches for sustainable management of water resources pertaining to water management hierarchy (H series), general water management strategies (G series) and water management pertaining to specific activities (A series). The series aims to:

Legislation	Description of Legislation
	▪ Provide a structure for compiling legal documents and applications (i.e., WULA's, EMPs, EIA's, closure plans etc.) as well as drafting license conditions. ▪ Serve as a uniform basis for negotiations as to what the DWS considers best practice in resource protection and waste management and ▪ Inform interested and affected parties about good practice approaches.

5 DETAILS AND DECLARATION OF THE SPECIALIST

DETAILS OF THE SPECIALIST

Full Name:	Rachel Kganedi
Title/ Position:	Associate Hydrologist
Email:	Rachel.Kganedi@wsp.com
Qualification:	BSc Honours Hydrology
Professional Affiliations:	South African Council for Natural Scientific Professions (SACNASP)
	Pr.Sci.Nat. Reg Number 400202/16 (Water Resources Science)

DECLARATION OF INDEPENDENCE BY SPECIALIST

I, **Rachel Kganedi**, a duly authorised representative of WSP (Pty) Ltd, declare that I –

- Act as the independent specialist in this application.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed.
- Do not have nor will have a vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

6 METHODOLOGY

The methodology applicable to the surface water assessment study is as follows:

6.1 BASELINE HYDROLOGY

A baseline assessment was conducted to establish the prevailing hydrological and climatic characteristics of the Project site before the proposed infrastructure and related activities are established.

The surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater. Therefore, groundwater plays a significant role in the hydrological dynamics of the surrounding catchments, which the proposed mining activity will potentially impact. Based on a report compiled for the Zulti-South Project, located to the immediate east of the Port Durnford Project Area, it was found that due to the high permeability of the upper unconsolidated sediments in the area, groundwater effective recharge is estimated to range from approximately 450 to 750 mm/year. This equates to approximately 50% of the annual rainfall (Golder & Associate (Pty) Ltd, 2014).

A numerical groundwater model (WSP (Pty) Ltd, 2024) was developed for the project site as part of the ESIA. The model was calibrated against measured groundwater levels and applied to simulate the baseflows under the current land use conditions to establish a baseline prior to the proposed mining activities. It also simulated baseflows during the mining activities and post-mining to assess the impacts of the proposed mining activities on the catchment yield.

6.2 BASELINE WATER QUALITY

Baseline water quality was described based on the water quality data collected at the locations (i.e. Msasandla River, tributaries of KwaGugushe River, Ntuze River, Ojinjini River, Amanzamnyama River, Mlalazi River, Nkonjane River and Mzingwenya River) in June 2024, and the DWS (Resource Quality Information Services (RQIS) monitoring points, sampled between 2014 and 2018/19, located upstream and downstream of the proposed Port Durnford Project Area on the Mlalazi River and Mhlatuze River as indicated in Table 6-1, and represented in Figure 6-1.

The data was benchmarked against the Water Quality Planning Limits (WQPLs), derived from assessing the present water quality status based on assessing the fitness for water use for key water users, such as irrigation, industrial, domestic, and aquatic ecosystems. Even though the water resource classes and Resource Quality Objectives (RQOs) are gazetted for the Usuthu to Mhlathuze catchments in the Inkomati-Usuthu and Pongola Mtamvuna WMA, these are not determined for the quaternary catchments in which the mining activity is proposed (W13B and W12F).

Table 6-1 – Surface Water Quality Points

Catchment	Sampling Point ID	Description	Latitude	Longitude
KwaGugushe River Tributary	TSW20 (Msasandla River)	This point is located on Msasandla River, a tributary of KwaGugushe, which drains into Ntuze and ultimately into the Mlalazi River. This point will	S 28.873023	E 31.803126

Catchment	Sampling Point ID	Description	Latitude	Longitude
		monitor the impact of the proposed mining activity on the water quality of the KwaGugushe River		
	TSW17	These points are on the tributaries of KwaGugushe, which drains into Ntuze and ultimately into the Mlalazi River. These points will monitor the impact of the proposed mining activity on the water quality of the KwaGugushe River	S 28.890513	E 31.783955
	TSW16		S 28.888452	E 31.778399
Ntuze River	TSW18	These points are on the tributaries of Ntuze Rier, which drains into the Mlalazi River. These points will monitor the impact of the proposed mining activity on the water quality of the Ntuze River	S 28.893417	E 31.779474
	TSW19		S 28.898939	E 31.777489
Mlalazi River	W13 193251	DWS RQIS monitoring point, located on the Mlalazi River/estuary after its confluence with the Ntuze River. This point will monitor the impact of the proposed mining activity on the water quality of the Mlalazi River via the Ntuze River.	S 28.92673	E 31.75579
	1- Umlalazi River WQ	This point is located on the Mlalazi River after its confluence with the Ntuze River. The point will monitor the impact of mining on the water quality of the Mlalazi estuary via the Ntuze River.	S 28.929406	E 31.755418
	W13 193258	DWS RQIS monitoring point, located on the Mlalazi River, upstream of point 3. This point will monitor the impact of mining on the Mlalazi estuary.	S 28.93479	E 31.7775
	3- Umlalazi Railway line WQ	This point is located on a non-perennial tributary of the Mlalazi River. It will monitor the impact	S 28.933623	E 31.780184

Catchment	Sampling Point ID	Description	Latitude	Longitude
		of mining on the Mlalazi estuary water quality.		
	W13 193256	DWS RQIS monitoring point, located on the confluence of the Amanzamnyama River and the Mlalazi River. It will monitor the impact of the proposed mine on the water quality of the Mlalazi estuary via the Amanzamnyama River.	S 28.943	E 31.78657
Ojinjini River	2- Ojinjini WQ	This point is located on the Ojinjini River before its confluence with the Mlalazi River. It will monitor the impact of mining on the water quality of the Mlalazi estuary.	S 28.915073	E 31.771611
Amanzamnyama River	TSW13	These points are located on the Amanzamnyama River. It will monitor the impact of mining on the water quality of Amanzamnyama before it discharges into the Mlalazi estuary.	S 28.912281	E 31.826250
	TSW21		S 28.912920	E 31.822377
	TSW11		S 28.925523	E 31.794425
	TSW12		S 28.928672	E 31.799599
Mzingwenya River	5- Mzingwenya River WQ	This point is located on the Mzingwenya River. It will monitor the impact of mining on the river's water quality before it discharges into Lake Cubhu.	S 28.854884	E 31.923449
Lake Cubhu	W12 187181	This point is located on the Lake Qhubu. It will monitor the impact of the mining on the water quality of Lake Cubhu via the Mzingwenya River.	S 28.84539	E 31.187181
Mhlatuze River	TSW15 (Nkonjane River)	This point is located on the Nkonjane River, a tributary of the Mhlatuze River. It will monitor the impact of mining on the water quality of Mhlatuze River.	S 28.845	E 31.86667

Catchment	Sampling Point ID	Description	Latitude	Longitude
	W12 102815	DWS RQIS monitoring point. The point is located on the Mhlatuze River, upstream of the mining activity. It will be used as a reference point before mining activity.	S 28.871008	E 31.830169
	W12 188458	DWS RQIS monitoring point. It is located on the Mhlatuze River, downstream of the mining activity. It will be used to monitor the impact of mining on the water quality of the Mhlatuze River	S 28.83981	E 31.89577

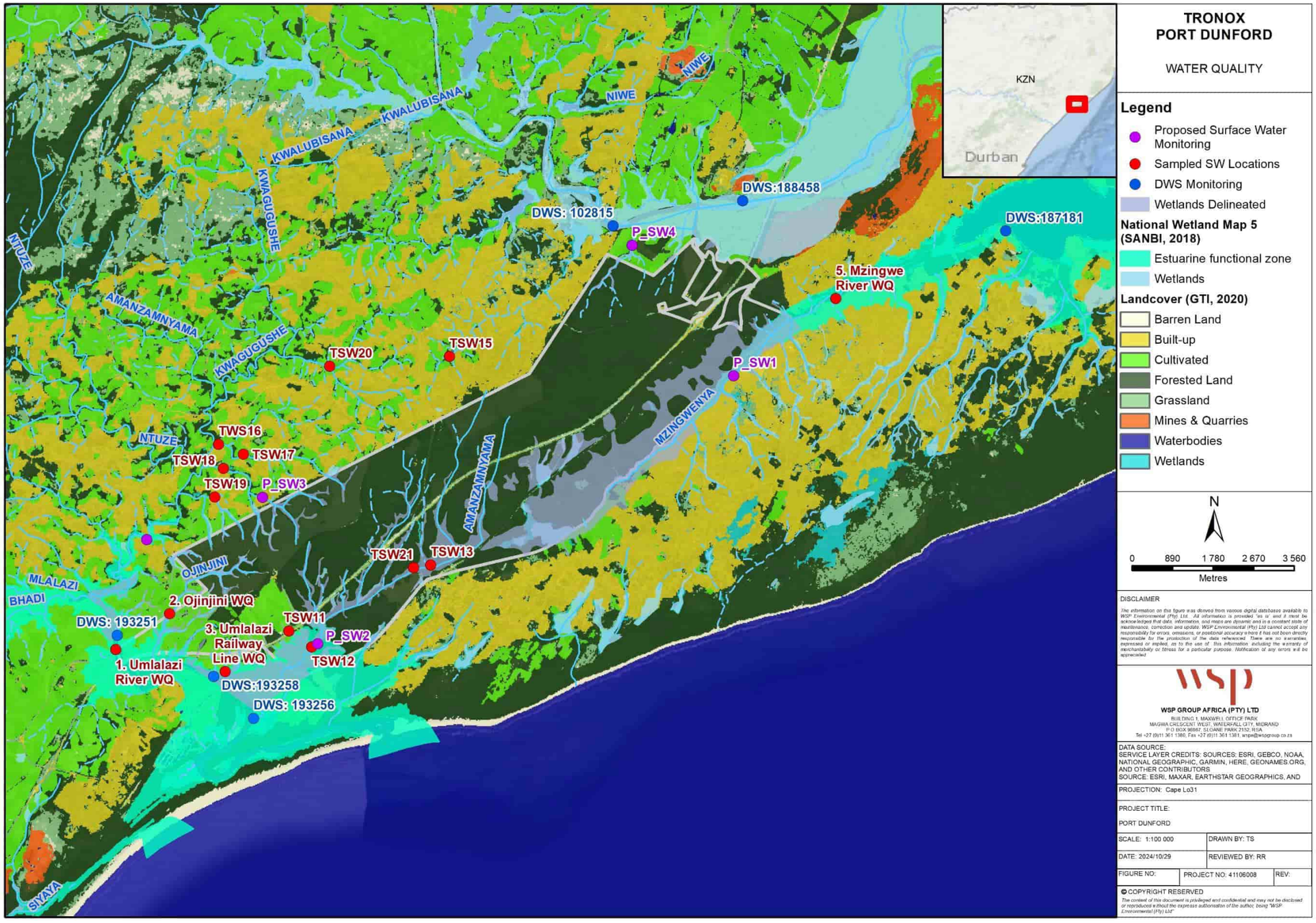


Figure 6-1 – Surface Water Quality Monitoring Points

6.3 FLOODLINE MODELLING

Floodlines on the sections of the Mzingwenya River, Amanzamnyama River, Ojinjini River, and tributaries of the Msasandla River, Nkonjane River, and tributaries of the Mhlatuze River were analysed to evaluate infrastructure flooding risks and protect natural resources. GN704 stipulates that no mining activities may occur within 100m of a riverbank or the 1:100-year flood line, whichever is a greater distance from the river. These limitations describe an exclusion zone where mining activity, including the development of any pollution control measures, is prohibited (DWS, 2007).

The approach to the analysis undertaken is informed by fundamental principles as documented in reviewed and published materials. The approach is outlined in the following sections.

6.3.1 PEAK FLOW ESTIMATION

Determining an appropriate methodology for estimating the design flood peak discharge depends primarily on two factors: the size of the contributing catchment area and the availability of hydrological data (i.e., gauged streamflow data and design rainfall data). Statistical methods are commonly preferred in estimating design flood peaks due to their reliance on historical streamflow data specific to the site. Gauged data for rivers and streams along the study area was unavailable. Except for the statistical method, other methods were calibrated for specific regions and flood events and are limited in terms of the size of the catchment areas to which they could be applied. Table 6-2 lists the methods, input data requirements, the maximum recommended catchment area for which each method can be used, and references related to the methods.

Therefore, the 1:100-year peak flows for the catchments at the project site were estimated using widely used and recommended deterministic methods such as the Rational Method (Alternative 3), Unit Hydrograph and Standard Design Flood (SDF). Applicable methods are briefly described below.

Table 6-2 – Application and Limitation of Flood Estimation Methods

Method	Input data	Recommended maximum area (km^2)	Return period of floods that could be determined (years)	Reference paragraph
Statistical method	Historical flood peak records	No limitation (larger areas)	2 – 200 (depending on the record length)	3.4
Rational methods	Catchment area, watercourse length, average slope, catchment characteristics, design rainfall intensity (3 alternative methods)	Usually < 15, depends on method of calculating rainfall intensity	2 – 200, PMF	3.5.1
Unit Hydrograph method	Design rainfall, catchment area, watercourse length, length to catchment centroid (centre), mean annual rainfall, veld type and synthetic regional unit hydrographs	15 to 5000	2 – 100, PMF	3.5.2
Standard Design Flood method	Catchment area, watercourse length, slope and SDF basin number	No limitation	2 – 200	3.5.3
SCS-SA method	Design rainfall depth, catchment area, Curve Number=f(soils, land cover), catchment lag	< 30	2 - 100	3.5.4
Empirical methods	Catchment area, watercourse length, distance to catchment centroid, mean annual rainfall	No limitation (larger areas)	10 – 100, RMF	3.6

(SANRAL SOC, Ltd, 2013)

6.3.1.1 Rational Method (Alternative 3)

The Rational Method Alternative 3 is described by the formula Q = CIA, where I is the rainfall intensity, A is the runoff contributing area, C is the runoff coefficient, and Q is the peak flow (SANRAL SOC, Ltd, 2013). The method uses the Design Rainfall Utility developed by (Smithers & Schulze, 2003), which utilises a regionalised L-moment Algorithm and scale invariance to estimate design rainfall at any 1' × 1' grid interval in South Africa.

6.3.1.2 Unit Hydrograph

A unit hydrograph is a characteristic runoff response from a specific catchment and is defined in metric terms as the hydrograph resulting from one-millimetre runoff following rainfall of unit duration with uniform spatial and time distribution over the catchment. The duration of the hydrograph is thus proportional to the duration of the rainfall, and the volume of the hydrograph is proportional to the intensity of the rainfall. The Hydrological Research Unit has used historical data to derive unit hydrographs for 96 river measuring stations in South Africa. From these 96 hydrographs, nine synthetic hydrographs have been derived for nine regions in South Africa with similar catchment characteristics such as topography, soil type, vegetation, and rainfall. A typical regional unit hydrograph with confidence bands is shown in Figure 6-2, and the regional division is shown in Figure 6-3.

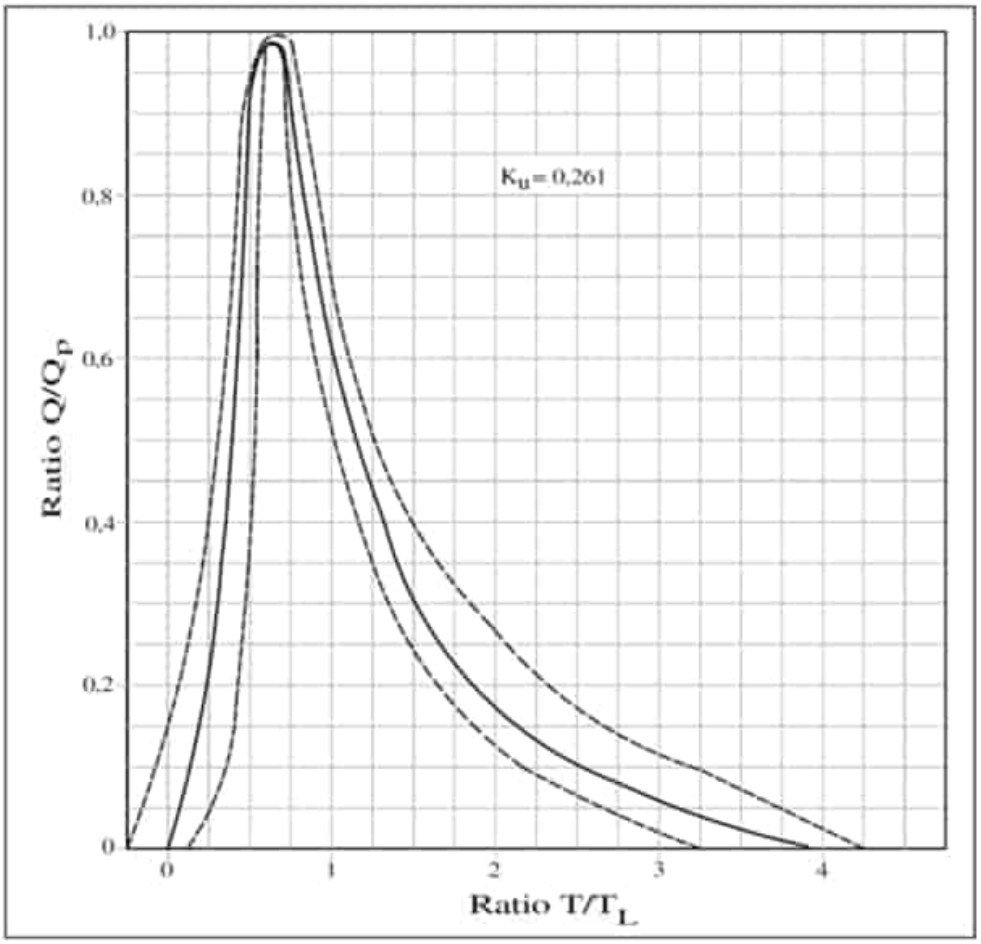


Figure 6-2 – Unit Hydrograph with Confidence Bands (SANRAL SOC, Ltd, 2013)

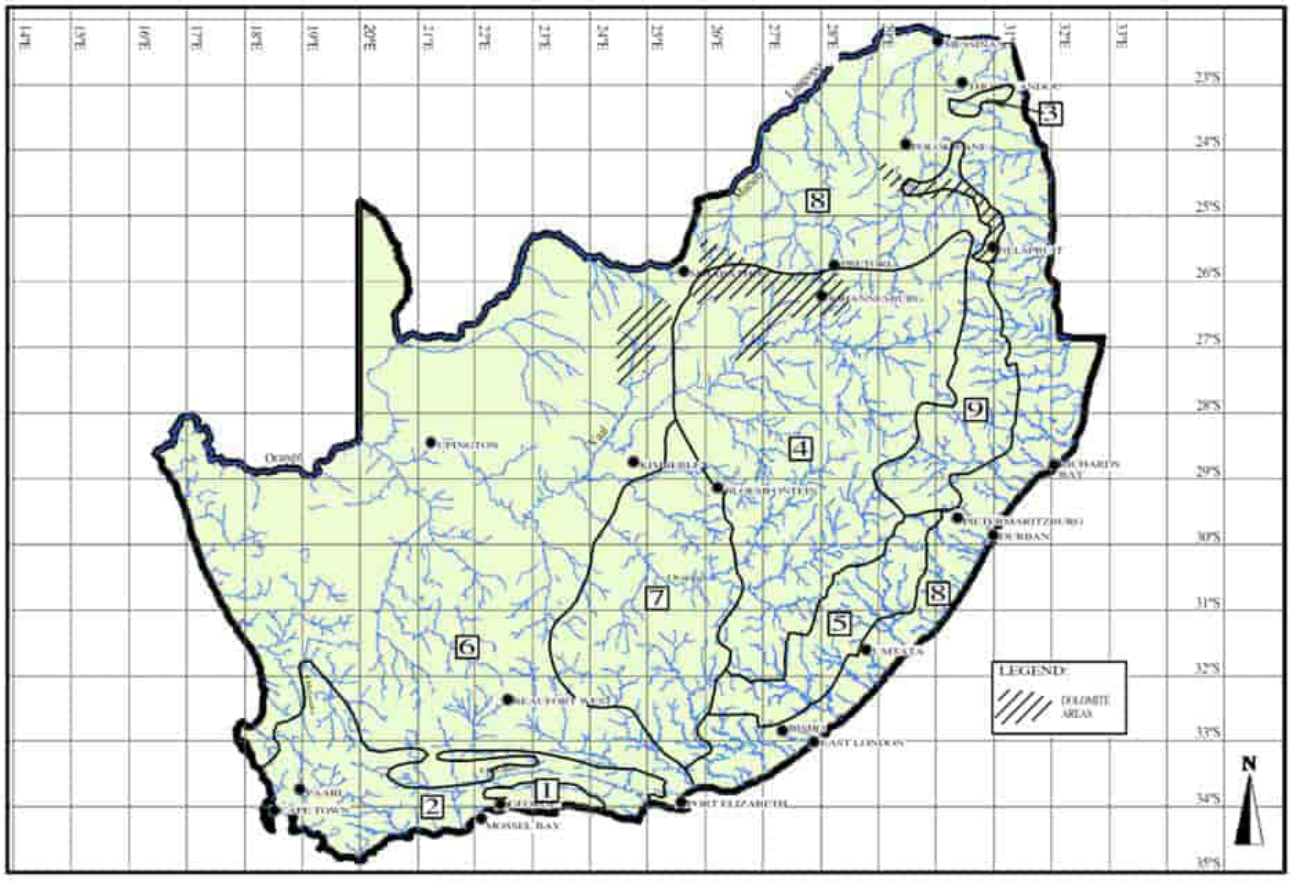


Figure 6-3 – Regions with Generalised Veld Types in South Africa (SANRAL SOC, Ltd, 2013)

6.3.1.3 Standard Design Floods (SDF)

A major component in the development of the SDF was the identification of regions with homogenous flood-producing characteristics The geographical requirement was that the boundaries had to follow catchment watersheds. This ensured that they could be readily identified on topographical maps of any scale and could be related to the DWS drainage region numbering system. The regions were called basins to avoid confusion with the DWS's drainage regions and the South Africa Weather Service's rainfall districts. The second requirement was that, where possible, each basin should contain at least one gauging station from the DWS publication Catalogue of hydrological catchment parameters (SANRAL SOC, Ltd, 2013). The 29 drainage basins are shown in Figure 6-4.

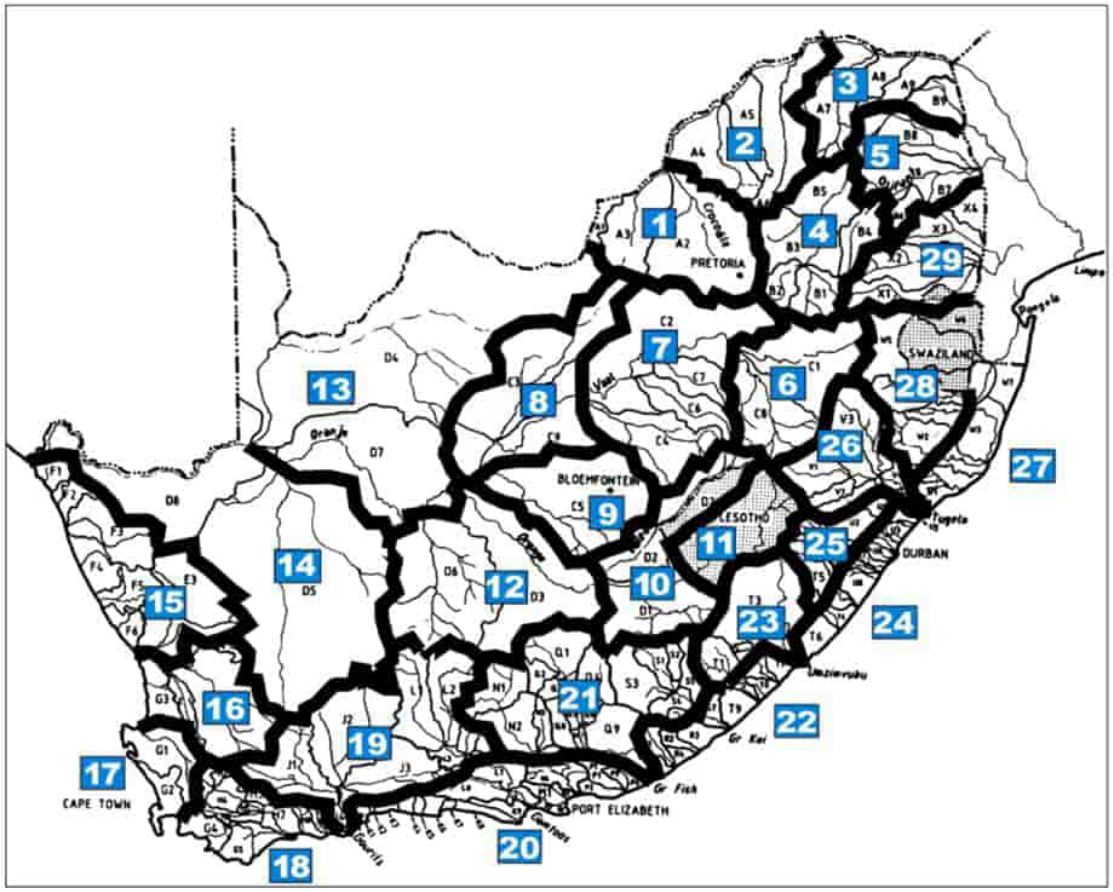


Figure 6-4 – Standard Design Flood Drainage Basins (SANRAL SOC, Ltd, 2013)

The SDF is an empirical, regionally calibrated version of the Rational method. The only information required for its application is the area of the catchment, the length and slope of the longest watercourse, and the drainage basin in which it is located.

6.3.2 FLOODLINE MODELLING

Hydraulic modelling was conducted in HEC-RAS 6.3.1, which allows pre-processing within the in-built RAS Mapper module. The geometry model was built based on the 1m contours derived terrain. The pre-processing involved generating channel geometry, including the river network, banks, flow paths, and cross-sections.

The HEC-RAS model simulates the total energy of water by applying basic principles of mass, continuity, and momentum, as well as roughness factors between all cross-sections (US Army Corps of Engineers, 1995). A height is calculated at each cross-section, representing the level water rises at that section, given the potential peak flows. This was calculated for the 1:100-year flows on all river sections.

Analyses are performed by first modelling flows at the sub-catchment outlet of a particular stream or channel section, moving upstream. Manning's Roughness Coefficients (n) for the channels were set at 0.035, and those for riverbanks were estimated to be 0.075, representing natural channels with reeds and brush on the banks (Chow, 1959).

6.4 RSF BREACH ANALYSIS

An RSF failure, a physical breach resulting in the uncontrolled release of the stored tailings and water, was undertaken for the two facilities (i.e. RSF 9 and C) by Epoch (Pty) Ltd (2020). The two RSF failure modes typically considered for RSFs are (SRK Consulting (Pty) Ltd, 2021):

- Overtopping – an overtopping breach would occur if the facility's freeboard was reduced, and the water level was higher than the crest of the embankment. Overtopping can only occur if the freeboard of the facility is exceeded, i.e. under any of the following scenarios:
  - A flood event larger than the design flood occurs.
  - The pond is allowed to operate higher than the design levels before a flood event, i.e. non-compliant operation.
  - The freeboard of the facility is reduced, i.e. residual settlement or subsidence of the crest that may occur due to consolidation of the waste fill, from embankment deterioration, or seismic settlement.
- Collapse – the breach originates at some point below the crest of the RSF due to either piping, erosion, or some other form of wall instability.

Additionally, dam breach guidelines recommend that two failure scenarios, based on the hydrological conditions, are considered, namely (SRK Consulting (Pty) Ltd, 2021):

- Sunny Day Failure – a sudden failure which occurs during normal conditions caused by internal erosion, piping or earthquakes; and
- Rainy Day Failure (flood induced) – failure resulting from a rain event or natural flood of magnitude greater than what the dam can safely contain and discharge in a controlled manner.

6.5 STORMWATER MANAGEMENT

Stormwater management is a statutory requirement for mining and related activities in South Africa and is defined by General Notice 704 and Regulation 77 of the National Water Act (Act 36 of 1998) (South Africa, 1998). Stormwater management aims to prevent water resource pollution in and around mining areas or areas where mining-related activity occurs. Regulations define a methodological approach to preventing and/or containing pollution on mining sites, set design standards and specify measures that must be taken to monitor and evaluate the efficacy of pollution control measures that are implemented (DWS, 2006).

An effective stormwater management system is essential to ensure that the surrounding natural water resources are protected. Conceptual stormwater management stipulated in this report was adopted from the Pre-Feasibility Study (PFS) undertaken by Hatch (Pty) Ltd in 2020, a detailed site-wide stormwater management plan is required to be developed during the detailed design phase of the Project when the project layout is finalised. This should be done by fulfilling the requirements of the Stormwater Management Plan (SWMP) best practice guidelines with the objective of keeping clean and dirty water separate, as defined by the following principles (DWS, 2006):

- Separation of clean and dirty water—Clean water should, as far as possible, be kept separate from dirty water. Water from clean areas should be diverted from dirty areas and allowed to pass through to downstream users. Dirty water must be contained and captured on site. Spillage of dirty water is not allowed except during extreme flood events that are, on average, exceeded no more than once in 50 years.

- Containment of dirty water - Reasonable measures must be taken to ensure that dirty water is contained. All dirty water must be captured and transported in lined channels (capable of containing 1:50-year design floods) to prevent the seepage of contaminated water into groundwater resources. Dirty water runoff must be stored in a PCD, where reasonable precautions are taken to prevent leaks or seepage. PCDs may not spill more often than (on average) once in 50 years. The design standard is not that a 1 in 50-year flood should be captured but that the dam may not spill.
- Reuse and recycling of dirty water—Regulations stipulate a clear hierarchy of water use. First, reuse any captured dirty water. Recycle as much water as possible. Minimise the import and use of clean water resources. Excess water released from a dirty water area must be treated to a standard agreed to by the regulator (DWS), and any plan to treat and release excess water must be approved and licensed.
- Preventing the pollution of water resources - Exposure to water and potential pollutants should be reduced to a minimum. Special precautions may be required to prevent the transport of pollutants in water. Oil traps should be specified below workshops, fuel depots, and vehicle wash bays to prevent the flow of hydrocarbons into PCDs. Silt traps may be constructed where surface runoff is likely to lead to the transport of suspended sediments and the like.
- Reducing dirty water areas - special attention should be paid to early rehabilitation of mining and other dirty water areas to reduce the dirty water footprint area to an absolute minimum. This will reduce the total volume of dirty water and simplify the final measures to be taken at mine closure. Part of any SWMP will include processes that identify and implement opportunities to reduce the dirty water footprint areas. A benefit of smaller dirty water footprint areas is that polluted runoff is reduced, fewer drains are required, and pollution control dams can often be smaller. (Smaller surface area equates to cheaper and more effective stormwater management).

6.6 WATER BALANCE

A water balance was prepared for the Fairbreeze Mine, and the same approach was used to generate a preliminary water balance for the Port Durnford Mine. This approach was adopted because the phase 2 mine at Port Durnford will replicate the Fairbreeze mine.

6.7 SURFACE WATER IMPACT ASSESSMENT

Potential impacts on surface water resources likely to arise from the proposed Project activities were identified and described. An impact significance rating methodology that considers duration, spatial extent, intensity, and probability of occurrence was used to determine impact significance. Mitigation and management measures were then recommended for each of the identified impacts.

The significance of identified impacts was determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are shown in Table 6-3. The ranking scales in Table 6-4 were utilised to assess these factors for each impact, and the calculation of the significance of impacts is presented in Table 6-5.

Table 6-3 – Impact Assessment Factors

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude (severity) of impact

Table 6-4 – Impact Assessment Scoring Methodology

Magnitude	Duration
10 - Very high / Unknown	5 – Permanent (post-closure)
8 – High	4 - Long-term (impact ceases after site closure has been obtained)
6 – Moderate	3 - Medium-term (impact ceases after the operational life of the activity)
4 – Low	2 - Short-term (impact ceases after the construction phase)
2 – Minor	1 – Immediate
Scale	**Probability**
5 – International	5 – Definite / Unknown
4 – National	4 - Highly Probable
3 – Regional	3 - Medium Probability
2 – Local	2 - Low Probability
1 - Site only	1 - Improbable
0 – None	0 – None

Table 6-5 – Significance of Impact Based on Point Allocation

Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + M) \times P]$ $Significance = (Extent + Duration + Magnitude) \times Probability$

Impact Significance Ratings		
SP >60	Indicates high environmental significance	An impact that could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.

SP 30 – 60	Indicates moderate environmental significance	An impact or benefit that is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

For the methodology outlined above, the following definitions were used:

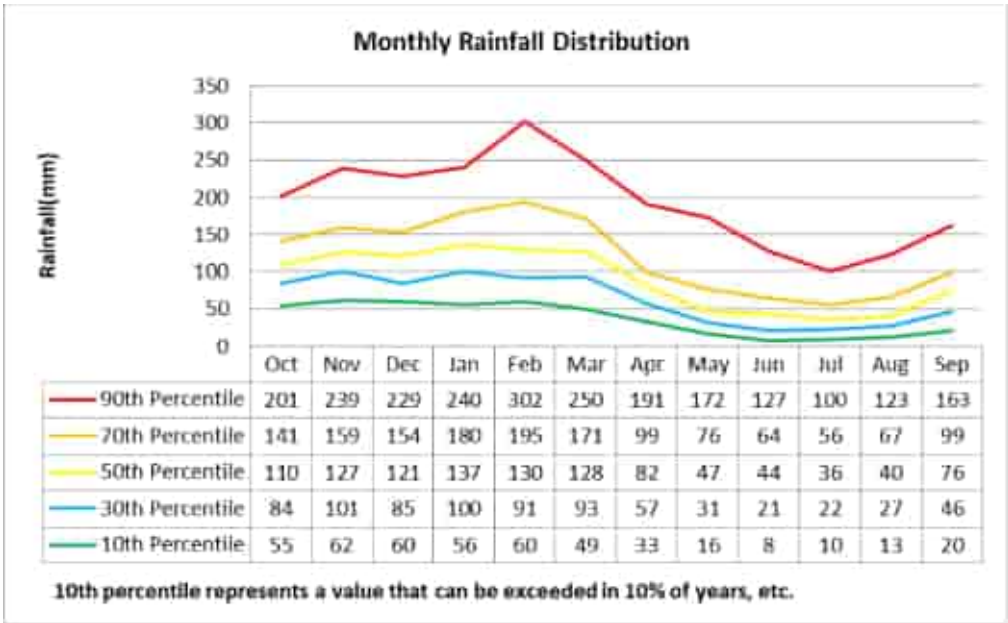
- ***Magnitude*** is a measure of the degree of change in a measurement or analysis (e.g., the severity of an impact on human health, well-being, and the environment). It is classified as none/negligible, low, moderate, high, or very high/unknown.
- ***Scale/Geographic*** extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international.
- ***Duration*** refers to the length of time over which an environmental impact may occur, i.e., immediate/transient, short-term, medium-term, long-term, or permanent.
- ***Probability*** of occurrence is a description of the probability of the impact occurring as improbable (less than 5% chance), low probability (5% to 40% chance), medium probability (40% to 60% chance), highly probable (most likely, 60% to 90% chance) or definite (impact will definitely occur).

7 HYDROLOGY BASELINE DESCRIPTION

7.1 CLIMATE

The Port Durnford Project Area is in a humid subtropical climate, a humid temperate climate sub-type, in Köppen classification (Cfa). This climate is characterised by humid, hot summers and relatively warm winters (peel, et al., 2007). Average daily summer temperatures range between 30 ^{o}C and 24 ^{o}C, while daily winter temperatures range between 21 ^{o}C and 12 ^{o}C. The maximum temperatures are consistently experienced in December and January, with an average daily temperature of 30 ^{o}C, while minimum temperatures are experienced in June and July, with an average daily temperature of 12 ^{o}C (Anon., 2024). The analysis of the daily rainfall data acquired from SASRI weather web for the Mtunzini rainfall station (Lat: -28.94583333; Lon: 31.7083333) for 1991-2022 showed some anomalies in terms of the seasonal trends, whereby for example the dry season received more rainfall than the wet season. Data for the same rainfall station was also acquired from the South African Weather Service (SAWS) for 2020-2022 and was assessed. The data was too short to establish a reliable trend. Therefore, the catchment-wide hydro-meteorological dataset obtained from the WR2012 study (Bailey and Pitman, 2015), was used. The area's Mean Annual Precipitation (MAP) for the W12F and W13B quaternary catchments, the project straddles, is 1285 and 1293 mm, respectively. The rainfall zone for both quaternary catchments is W1D. Based on the analysis of the rainfall data for the W1D zone, the highest rainfall consistently occurs from October to March, while the lowest is experienced between April and September. 90% of the monthly rainfall depth events during the wettest month of

February are not expected to exceed 302 mm, while 90% of monthly rainfall depth during the driest month of July will not exceed 100 mm (Figure 7-1).

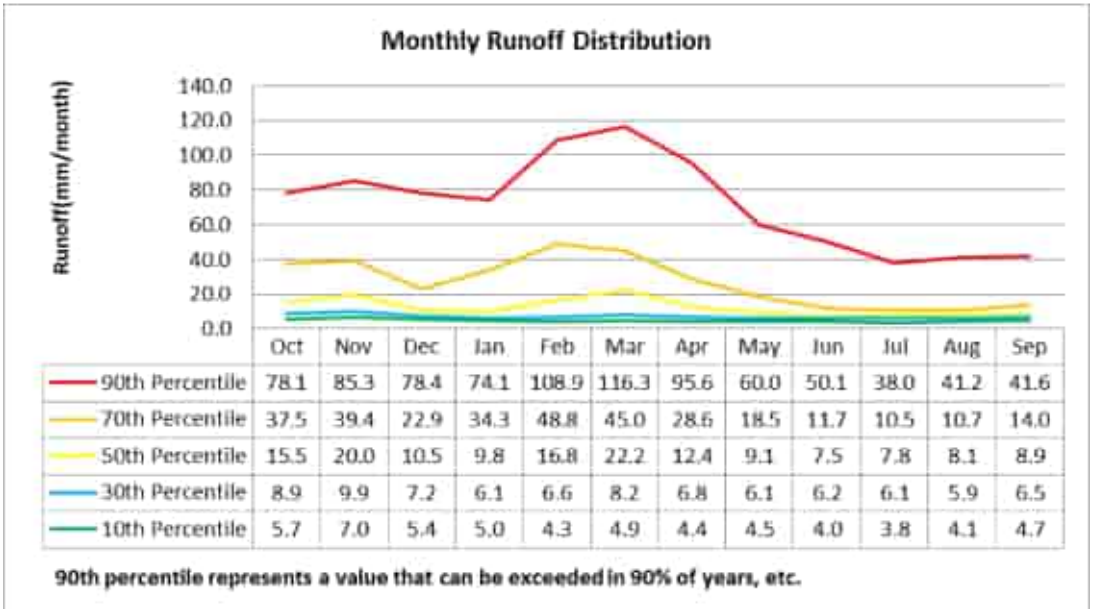


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90th Percentile	201	239	229	240	302	250	191	172	127	100	123	163
70th Percentile	141	159	154	180	195	171	99	76	64	56	67	99
50th Percentile	110	127	121	137	130	128	82	47	44	36	40	76
30th Percentile	84	101	85	100	91	93	57	31	21	22	27	46
10th Percentile	55	62	60	56	60	49	33	16	8	10	13	20

10th percentile represents a value that can be exceeded in 10% of years, etc.

Figure 7-1 – Monthly Rainfall Distribution

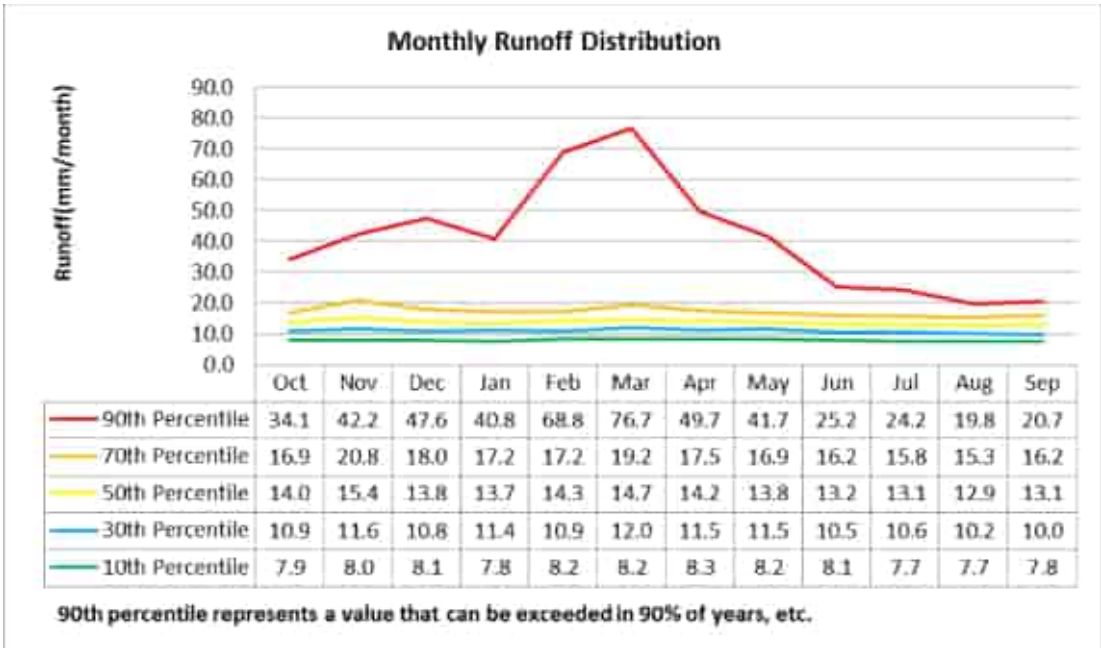
The Mean Annual Runoff (MAR) depth derived from the WR2012 simulated runoff data was calculated to be 268.84 mm per annum for the W12F and 346.39 mm for the W13B quaternary catchment, respectively. Approximately 27% and 21% of the MAP is redistributed as surface runoff for W13B and W12F, respectively. The highest runoff occurs in March, mainly because of antecedent soil moisture from February. The 90th percentile runoff event is 116.3 mm and 76.7 mm for W13B and W12F, respectively, while the 10th percentile runoff event in the same month is 4.9 mm and 8.2 mm for W13B and W12F, as shown in Figure 7-2 and Figure 7-3, respectively.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90th Percentile	78.1	85.3	78.4	74.1	108.9	116.3	95.6	60.0	50.1	38.0	41.2	41.6
70th Percentile	37.5	39.4	22.9	34.3	48.8	45.0	28.6	18.5	11.7	10.5	10.7	14.0
50th Percentile	15.5	20.0	10.5	9.8	16.8	22.2	12.4	9.1	7.5	7.8	8.1	8.9
30th Percentile	8.9	9.9	7.2	6.1	6.6	8.2	6.8	6.1	6.2	6.1	5.9	6.5
10th Percentile	5.7	7.0	5.4	5.0	4.3	4.9	4.4	4.5	4.0	3.8	4.1	4.7

90th percentile represents a value that can be exceeded in 90% of years, etc.

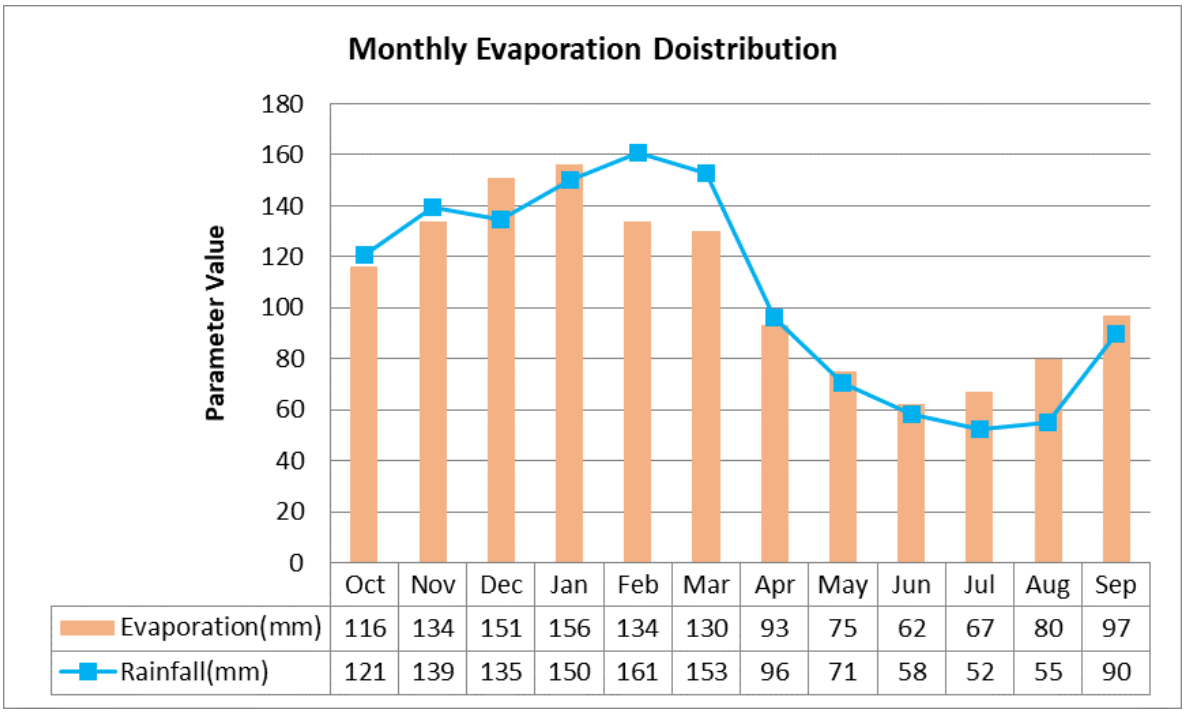
Figure 7-2 – Monthly Runoff Distribution for W13B



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90th Percentile	34.1	42.2	47.6	40.8	68.8	76.7	49.7	41.7	25.2	24.2	19.8	20.7
70th Percentile	16.9	20.8	18.0	17.2	17.2	19.2	17.5	16.9	16.2	15.8	15.3	16.2
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
30th Percentile	10.9	11.6	10.8	11.4	10.9	12.0	11.5	11.5	10.5	10.6	10.2	10.0
10th Percentile	7.9	8.0	8.1	7.8	8.2	8.2	8.3	8.2	8.1	7.7	7.7	7.8

Figure 7-3 -Monthly Runoff Distribution for W12F

The WR2012 Mean evaporation zone for both W13B and W12F is 22A. The S-pan region's Mean Annual Evaporation is 1300 mm. Figure 7-4 highlights the low summer evaporation potential, resulting in net positive summer rainfall.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	116	134	151	156	134	130	93	75	62	67	80	97
Rainfall(mm)	121	139	135	150	161	153	96	71	58	52	55	90

Figure 7-4 – Monthly Evaporation Distribution

7.2 TOPOGRAPHY AND DRAINAGE

The topography of the region is characterised by moderately to strongly sloping incised valleys (average slopes of 13%) west of the Project Area, which grades to gently undulating terrain (average slope of 6%) towards the coastline, with wide valleys that represent the floodplains of prominent drainage channels. The topography of the Project Area itself is rolling and exhibits gently sloping terrain, but in some areas, significantly steeper slopes are encountered. Elevations within the Project Area range between 10 and 130 mamsl, with an average elevation of 55 mamsl. The “whaleback” ridge crest extends from the Forest Inn area towards the northeast in the Project Area, west of the N2, with high points at 112 – 125 mamsl. The low-lying coastal plain is separated from the Indian Ocean by an elevated aeolian dune cordon (GCS Water & Environmental (Pty)Ltd, 2020).

The Port Durnford Project Area is situated within the Usuthu to Mhlatuze water management area (WMA) and is bisected by two quaternary catchments: W12F (northeast) and W13B (southwest), as indicated in Figure 7-5. Within the W12F quaternary catchment, the perennial Mhlatuze River flows past the northern boundary, and its tributaries drain the north-eastern areas. The perennial Mzingwenya River and its associated tributaries flow along the south-eastern site boundary from southwest to northeast, where they drain into Lake Cubhu. Within the W13B quaternary catchment, the perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries flow from northeast to southwest within the site boundary and confluence with the Mlalazi River. A portion of the site will also drain to the KwaGugushe River northwest of the site via its tributaries, which discharge to the Mlalazi River. Another tributary of the Mlalazi River runs further south of this site boundary. The Mlalazi River runs along the southwestern site boundary and eventually drains into the Indian Ocean. Where the groundwater intersects the land surface in topographical depressions between the coastal dunes, wetlands are likely to occur, as shown in the sections through the Siyaya catchment. Significant interflow is likely to contribute to stream flow from sloped land surfaces. Sensitive areas, including the wetlands and estuaries, are presented in Figure 7-6.

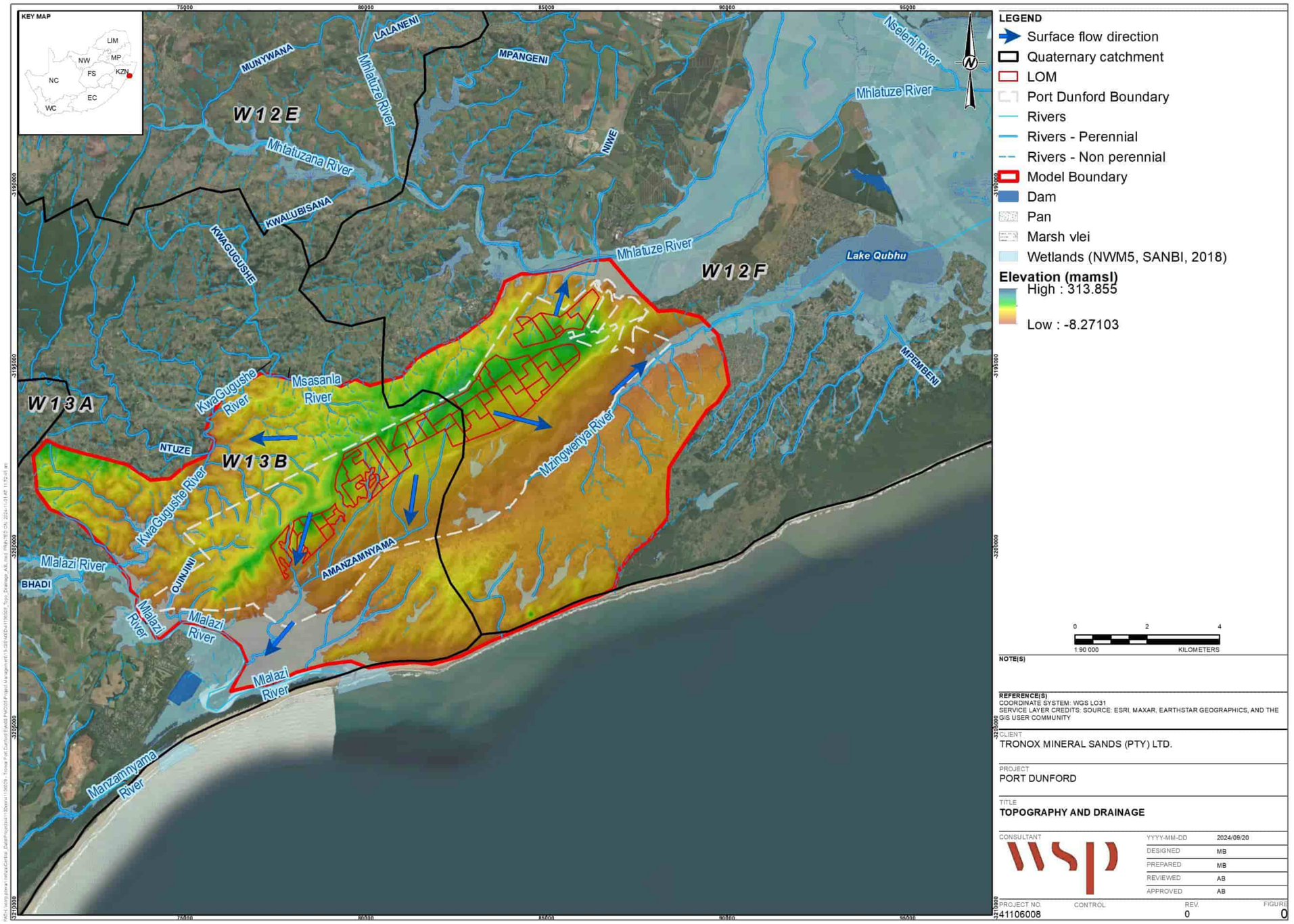


Figure 7-5 -Topography and Drainage

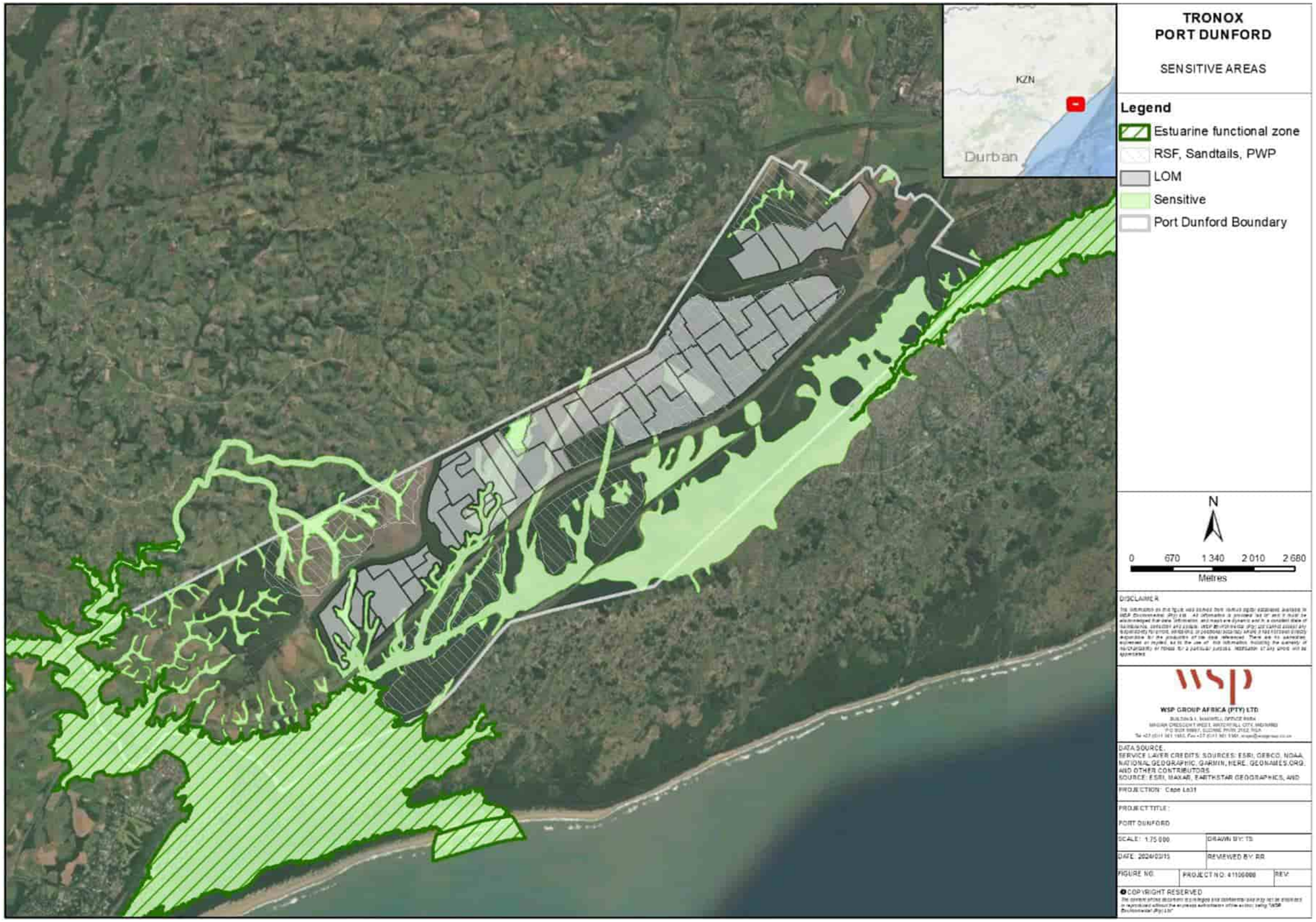


Figure 7-6 – Sensitive Areas

7.3 CATCHMENT HYDROLOGY

7.3.1 SURFACE WATER USERS

Land use in the study area includes commercial forestry (Eucalyptus), farming (sugar cane and other crops), estuaries and neighbouring residential areas (eSikhawini and KwaDlangezwa). Water uses associated with these land uses are discussed below:

- Domestic: The Mhlathuze Local Municipality is licenced to abstract 6 696 000 m^3 of water per year from Lake Cubhu, primarily to supply water to the local communities of eSikhawini and KwaDlangezwa. Additionally, a significant portion of this water is allocated to the University of Zululand, highlighting the lake's crucial role in domestic water supply.
- Agriculture/ irrigation: Eucalyptus and sugar cane are not irrigated. However, other crops are irrigated.
- Marine and aquatic ecosystems in the rivers upstream of the estuaries: The Amanzamnyama and Mlalazi Rivers support the marine ecosystem in the uMlalazi estuary, while the Mzingwenya and Mhlatuze Rivers support the uMhlatuze estuary.

7.3.2 SURFACE RUNOFF

The proposed Port Durnford Project Area occupies a portion of the following rivers as summarised in Table 7-1 and depicted in Figure 7-13:

- Mzingwenya River is a tributary of the Mhlatuze River and drains into Lake Cubhu: The total catchment area of the Mzingwenya River is measured to be 79 km^2 with the mining activity occupying 9 km^2 or 11% of the catchment area. Therefore, assuming that the proposed mining area no longer contributes to the catchment hydrology, conservatively the surface runoff could reduce by approximately 11%.
- Non-perennial tributary of the Mhlatuze River: The catchment area of the tributary was measured to be 3 km^2 of which 2 km^2 falls in the Project Area. Assuming that the catchment area falling in the proposed Project Area no longer contributes to the catchment water balance, the reduction in flow in the tributary is conservatively estimated at approximately 67%. In terms of the Mhlatuze, the tributary area is only 0.08% of the Mhlatuze catchment of 3 836 km^2 so the contribution to the flows in the Mhlatuze are insignificant.
- Ntuze River is a tributary of the Mlalazi River: The catchment area of the Ntuze River was measured to be 89 km^2 of which the mining area occupies approximately 4 km^2. Therefore, assuming the portion of the catchment area falling in the proposed Project Area does not contribute to the Ntuze River catchment water balance, the flow reduction in the Ntuze River is conservatively estimated to be approximately 4.5%.
- Ojinjini River is a tributary of the Mlalazi River: The mining area will potentially reduce the 3.3 km^2 catchment area by 33%, assuming that the mining area does not contribute to the catchment water balance.
- Amanzamnyama River is a tributary of the Mlalazi River that flows into the Mlalazi estuary: The Amanzamnyama River catchment was measured to be 14.4 km^2. The mining activities will occupy about 11.2 km^2 or about 78% of the catchment. Assuming no contribution from the mining area to the river, the flow is conservatively estimated to be reduced by approximately 78%.

Table 7-1 - Summary of Project Area Catchment Reductions

Catchment	Total Catchment Area (km^2)	Area of Mining (km^2)	Reduction (%)
Mzingwenya River	79	9	11%
Non-perennial tributary of Mhlatuze	3	2	67%
Mhlatuze River	3836	3	0.08%
Ntuze River	89	4	4.5%
Ojinjini River	3.3	1.1	33%
Amanzamnyama River	14.4	11.2	78%

However, given that large areas of Port Durnford Project Area (see Figure 7-10) are currently under commercial forestry and leased by Mondi. This area may already contribute less to the overall catchment flows, as most of the flow would be used up and captured by the forestry plantation.

7.3.3 BASEFLOW

A groundwater level map was generated based on water level data recorded from the hydrocensus survey to illustrate the inferred groundwater flow direction distribution of the water level data (see Figure 7-12). Groundwater flow from the site is generally towards the east and southeast, in the direction of the Mzingwenya River, the Amanzamnyama and Mlalazi Rivers, and the Indian Ocean. Water drains west of the mining area towards the northwest (Mhlatuze River) and northwest (KwaGugushe River). Wetlands east of the project site, mainly along the drainage channels feeding Lake Qhubu and around Kraal Hill, are fed by shallow groundwater from perched aquifers formed by underlying clay-rich dunes. The Mlalazi estuary southwest of the site is also fed by shallow groundwater. A combination of topography and textural characteristics of the geological formations influences the baseflow component of the Project Area (WSP (Pty) Ltd, 2024).

The surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater sources. Therefore, groundwater plays a significant role in the hydrological dynamics of the catchments, which the proposed mining activity will potentially impact. Based on a report compiled for the Zulti-South Project, located to the immediate east of the Port Durnford Project Area, it was found that due to the high permeability of the upper unconsolidated sediments in the area, groundwater effective recharge is estimated to range from approximately 450 to 750 mm/year. This equates to approximately 50% of the annual rainfall (Golder & Associate (Pty) Ltd, 2014).

The groundwater contribution as baseflow into the rivers was analysed over time as part of the groundwater numerical modelling to assess the impact of the Port Durnford mining activities over the life of the mine. The results of the analysis are discussed in the following sections. The mining only scenario is assessing baseflows based on mining without deposition, while mining and deposition scenario assesses baseflows based on mining and deposition. The current baseline is the period

before 2026, under the current forestry land use. The post-closure model was run for 100 years after operations. It shows that the groundwater levels recover within two years after mining is completed. This new “steady state” water level is similar to pre-mining conditions (WSP (Pty) Ltd, 2024).

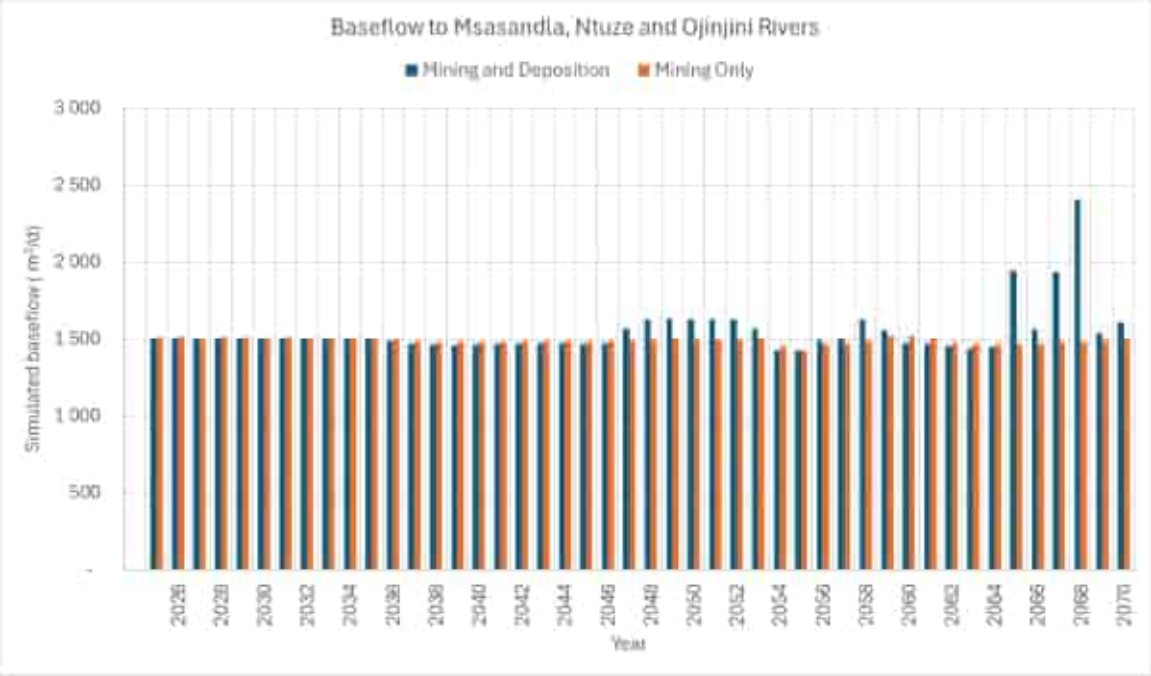


Figure 7-7 – Baseflow to Msasandla, Ntuze and Ojinjini Rivers

Msasandla and Ojinjini Rivers (west of the Project Area) show an insignificant reduction in baseflow. The increase in baseflow is more significant due to the wet backfill/sand tailings. The increase in baseflow from 2047 to 2053 is due to the wet sand tailings in area 8B (see Figure 7-7). The increase in baseflow between 2065 and 2068 is due to the backfilling in the central mining area (backfill area 3). Therefore, the mining activity will not impact the water quantities due to the reduction in baseflow in this catchment; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use.

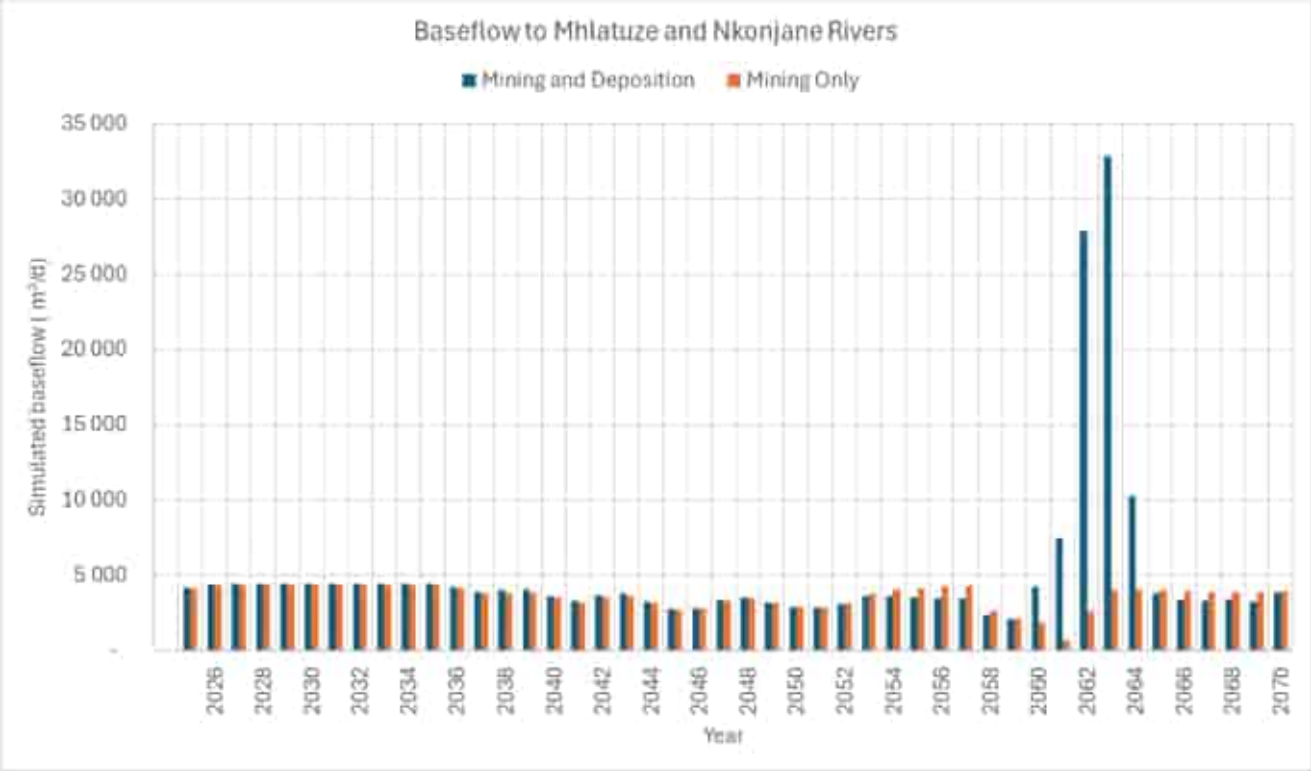


Figure 7-8 – Baseflow to Mhlatuze and Nkonjane Rivers

Baseflow to the Mhlatuze River (north of the Project Area) is limited as the area contributing to the Mhlathuze catchment is insignificant. Baseflow reduces from 2036, and the largest effect is seen from 2058 to 2061 during the mining of the north block (see Figure 7-8). However, the wet backfill has a counter effect, and from 2061 to 2064, there is a significant increase in baseflow. Therefore, the mining activity will not impact the water quantities due to the reduction in baseflow in this catchment; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use.

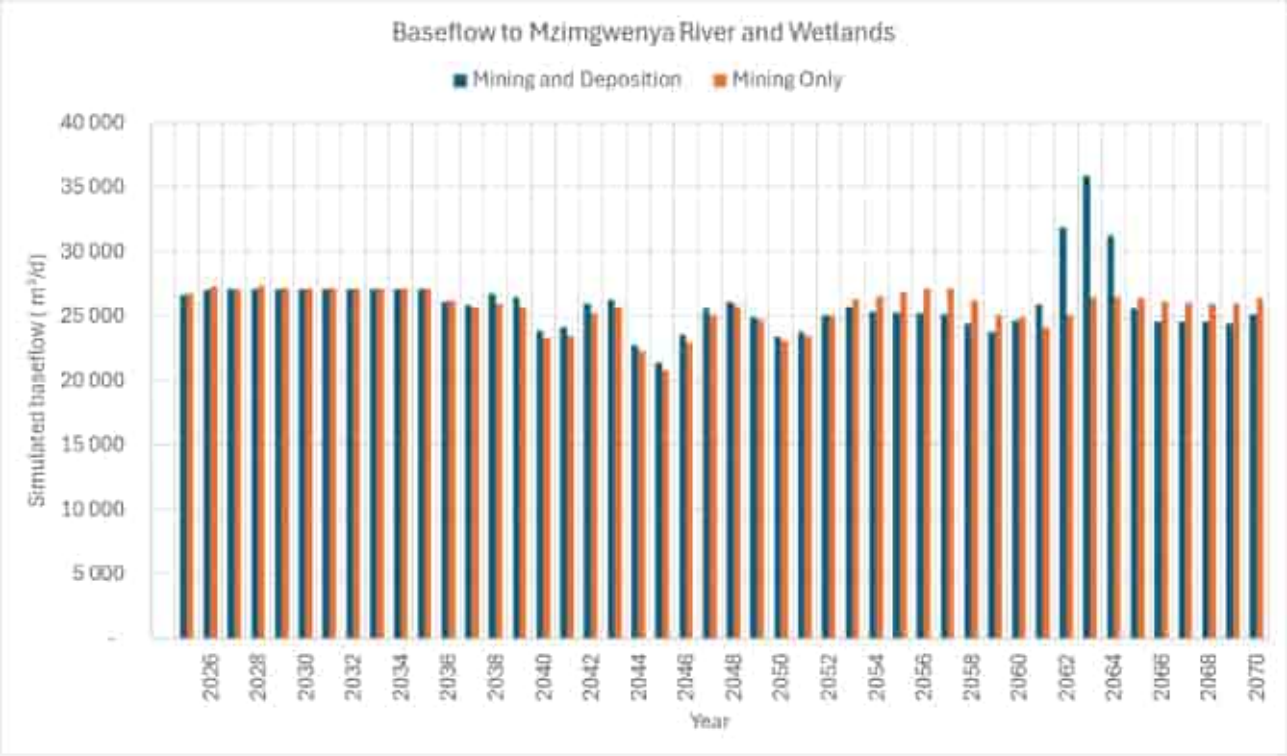


Figure 7-9 – Baseflow to Mzimgwenya River and Wetlands

Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu (northeast of the Project Area, see Figure 7-9) is limited. It reduced slightly from 2036 to the end of mining. However, it increases from 2062 to 2064.

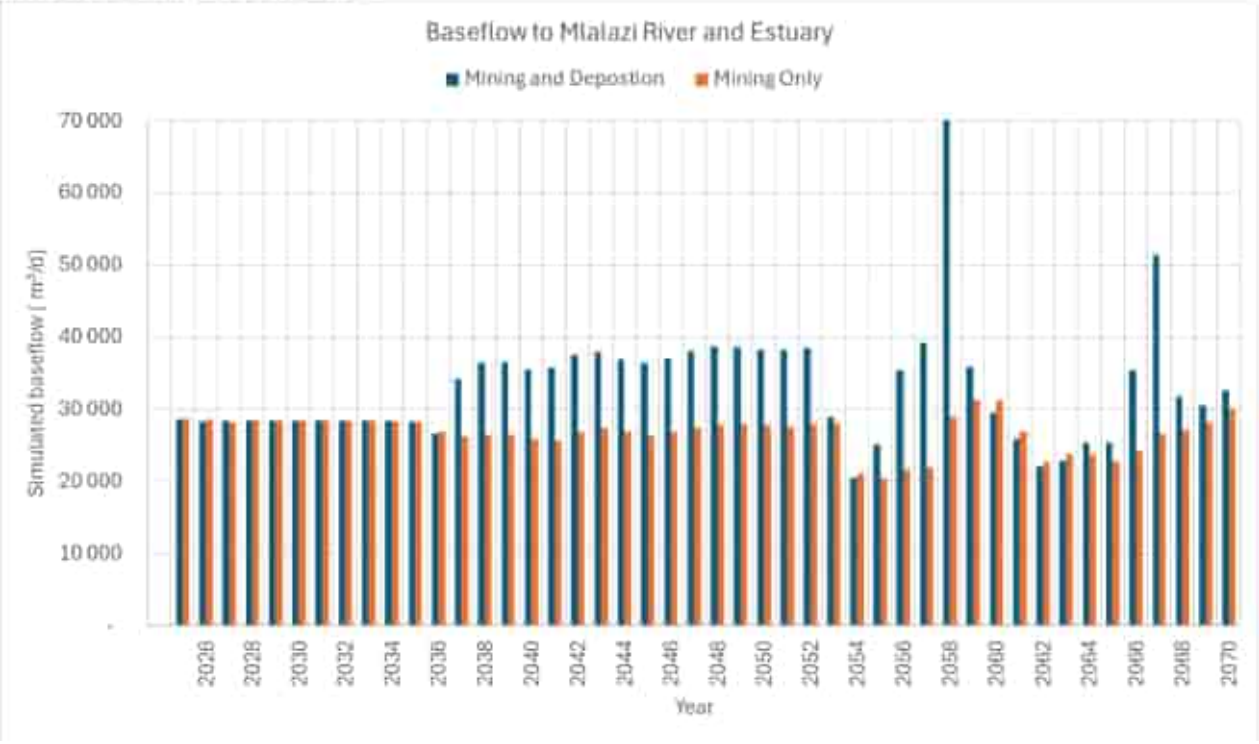


Figure 7-10 -Baseflow to Mlalazi River and Estuary

Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary (south of the Project Area, Figure 7-10**)** shows an insignificant reduction in baseflow from 2036. The baseflow reduction is significant from 2054 to 2058 and again from 2062 to 2065. An increase in baseflow due to deposition is evident for the following periods:

- From 2037 to 2052 - due to deposition of sand tailings A1, A2 and A3.
- From 2056 to 2058 - due to backfill in area 4.
- From 2066 to 2067 - due to backfill in area 3.

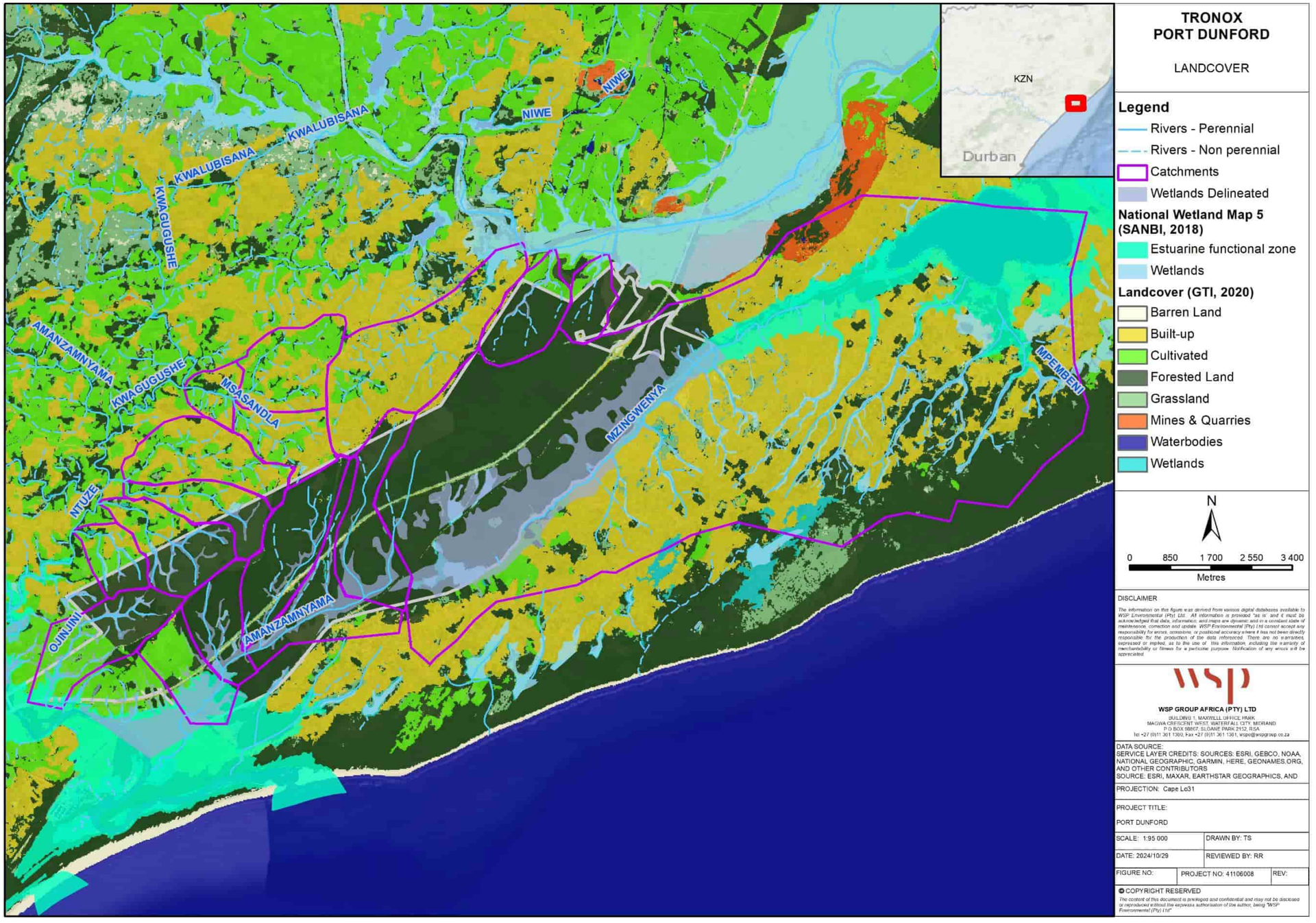


Figure 7-11 – Current Port Durnford Land Cover

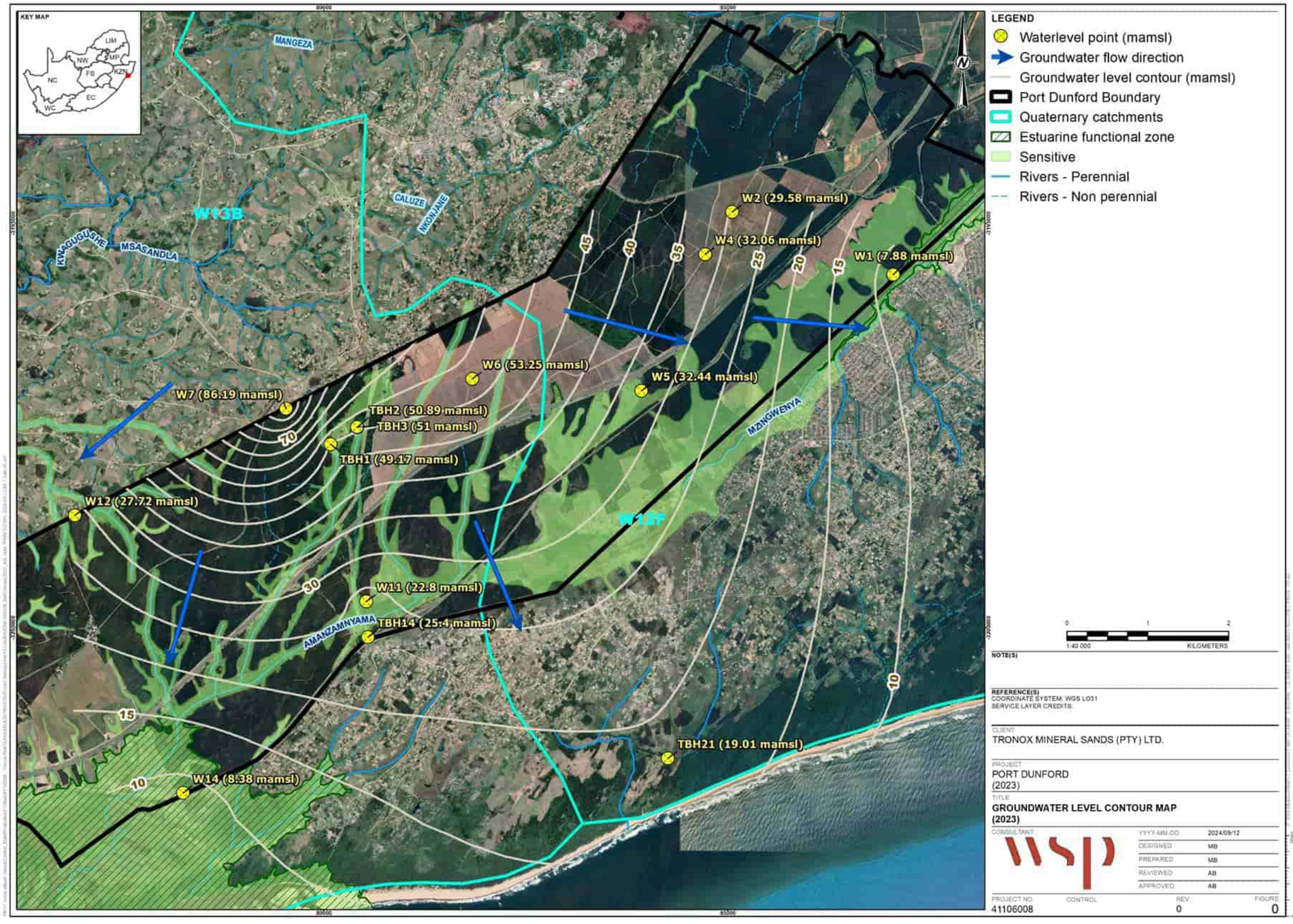


Figure 7-12 – Groundwater Level from November 2022 Hydrocensus

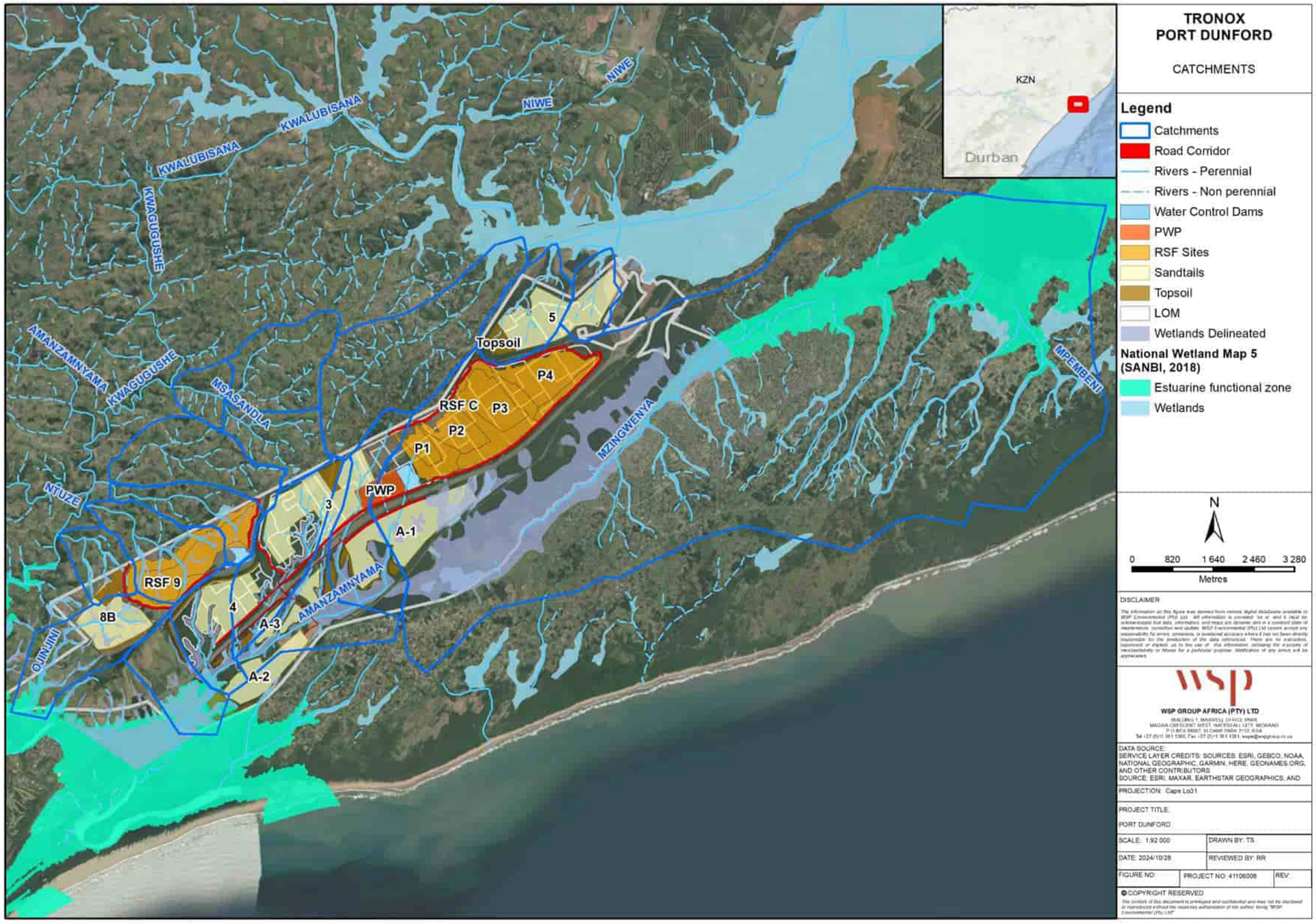


Figure 7-13 – Delineated Sub-catchments

7.4 BASELINE WATER QUALITY

Baseline water quality was described based on the water quality data from the sampled locations (i.e. Msasandla River, tributaries of KwaGugushe River, Ntuze River, Ojinjini River, Amanzamnyama River, Mlalazi River, Nkonjane River and Mzingwenya River) in June 2024, and the DWS (Resource Quality Information Services (RQIS)) monitoring points, sampled between 2014 and 2018/19, located upstream and downstream of the proposed Port Durnford Project Area on the Mlalazi River and Mhlatuze River. The data was benchmarked against the water quality planning limits (WQPLs), derived from assessing the present water quality status based on the fitness for water use for key water users, such as irrigation, industrial, domestic, and aquatic ecosystems. Even though the water resource classes, and resource quality objectives (RQOs) are gazetted for the Usuthu to Mhlathuze catchments in the Inkomati-Usuthu and Pongola Mtamvuna WMA, these are not determined for the quaternary catchments in which the mining activity is proposed (W13B and W12F). The results of the analysis are presented in Table 7-2 and discussed in the following section.

7.4.1 SUMMARY OF WATER QUALITY RESULTS

The main parameters of concern that are good indicators for pollution are listed and described below:

- **Total Dissolved Solids (TDS),** which is a measure of the quantity of all compounds dissolved in water. The total dissolved salt concentration measures the amount of all dissolved compounds in water that carry an electrical charge and is a perfect indicator of pollution. The constituent inorganic salts govern the effects of the TDS. The proportional concentrations of the major ions affect the buffering capacity of the water and, hence, the metabolism of organisms. Secondary effects include those on water chemistry, which affects the fate and impact on the aquatic environment of other chemical constituents or contaminants.
- **Ammonia** may be present in the free, un-ionized form (NH_3) or the ionized form ammoniacal nitrogen as N, also called ammonium ion (NH_4^+). Both are reduced forms of inorganic nitrogen derived mainly from aerobic and anaerobic decomposition of organic material. They exist as ions or can be adsorbed onto suspended organic and inorganic materials. The toxicity of ammonia is directly related to the concentration of the un-ionized form (NH3), the ammonium ion (NH4+) having little or no toxicity to aquatic biota. The ammonium ion, however, indicates poor-quality discharges from wastewater treatment works and will indicate the potential for eutrophication.
- **Orthophosphate** is also an indicator of pollution from various sources, including agricultural run-off and urban pollution. It is crucial in forming algal blooms and the eutrophication of water resources.
- **pH** is affected by factors such as temperature, the concentrations of inorganic and organic ions, and biological activity. The pH may also affect the availability and toxicity of constituents such as trace metals, non-metallic ions such as ammonium, and essential elements such as selenium. A change in pH from that typically encountered in unimpacted streams may have severe effects on the biota. The extent of acidification or alkalinization is important in determining the severity of the impact, which does not vary linearly either with pH or over time. When assessing the potential effect of a change in pH, it is essential to note that some streams are naturally more acidic than others, and their biotas are often adapted to these conditions. Alkalinity is linked in that it indicates buffering capacity, i.e., the ability of the water to neutralise acids and bases and, therefore, maintain a stable pH level.

- **TSS** Total Suspended Solids (TSS) refer to the particles suspended in water that are larger than 2 microns. These particles can include a mix of organic and inorganic materials such as silt, clay, algae, and microorganisms. Typically, high levels of TSS can make water appear cloudy or murky, reducing its clarity. Elevated TSS in water can harm aquatic organisms by clogging fish gills, reducing light penetration, and affecting photosynthesis in aquatic plants. It is noteworthy to note that suspended solids can adsorb pollutants like nutrients, metals, and organic compounds, making it amenable to transport by settlement and later resuspension, impacting water quality.

Furthermore, Table 7-2 Includes measurements of metals such as Aluminium (Al), Cadmium (Cd), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Nickel (Ni) and Zinc (Zn) that may be sources of pollution from industry and mining. The baseline water quality of the receiving surface water resources in the vicinity of the Project Area is shown in Table 7-2 and described below:

- KwaGugushe River Tributary: The baseline water quality of the tributaries that drain into the KwaGugushe River, such as the Msasandla River, shows general compliance with the WQPL, except for elevated Iron (Fe) level.
- Ntuze River Tributaries: The baseline water quality of the tributaries that drain into the Ntuze River shows general compliance with the WQPL.
- Mlalazi River: The water quality of the Mlalazi River shows general compliance with the WQPLs, with exceedances observed for a few parameters. However, the Mlalazi River monitoring locations at the estuary (i.e. Mlalazi River: W13 193258 and Mlalazi River: W13 193256) are characterised by elevated levels of Electric Conductivity (EC) and thus Total Dissolve Solids (TDS) at a sampled point on the Mlalazi River (1. Umlalazi River WQ), indicating high salinity levels. The latter phenomenon could be attributed to the sea tidal effect and intermixing with riverine flows. Though not apparent due to the lack of supporting data in the table, the impact of effluent discharges from both the Mtunzini Municipal Water Treatment Works and the Mtunzini Aquaculture projects Kob farm as concluded by the DWS Mlalazi estuary reserve determination study ((DWS, 2015), has not been ruled out.
- Ojinjini River: The baseline water quality of the Ojinjini River shows general compliance with the WQPL.
- Amanzamnyama River: Shows general compliance with most parameters except for elevated levels of Aluminium (Al), Ammonia (NH4 as N) and Iron (Fe) and lowered pH, which exceed permissible limits and could be attributed to the natural geology as there is no mining/industrial activity upstream of the sampled point.
- Mzingwenya River: Shows general compliance with most parameters except for elevated levels of Ammonia (NH4 as N), which exceed permissible limits and could be attributed to the surrounding urban activity.
- Mhlatuze River: Samples were not collected along the Mhlatuze River, so the existing DWS monitoring points were used to establish the baseline water quality. Unfortunately, the data used was limited, as data for most parameters was unavailable. Therefore, a water quality described in the DWS Reconciliation strategy study was adopted to establish the baseline. The water quality of the lower Mhlathuze River (Sub-catchment W12F) in the vicinity of the proposed mining activity reflects salinity, nutrient and microbiological impacts. Tolerable to non-compliance to electrical conductivity is observed, with high ammonia and E. coli counts present. The water quality is driven by the region's intensive industrial and urban activity, as well as wastewater discharges (DWS, 2022).

Baseline water quality shows general compliance with most parameters except for a few elevated levels of some parameters such as Aluminium (Al), Ammonia (NH4 as N) and Iron (Fe), which exceed permissible limits and could be attributed to the natural geology or the current land use. The water quality of the Lower Mlalazi River towards the estuary is characterised by elevated levels of Electric Conductivity (EC) and thus Total Dissolve Solids (TDS) indicating high salinity levels. The latter phenomenon could be attributed to the sea tidal effect and intermixing with riverine flows. Though not apparent due to the lack of supporting data on the table, the impact of effluent discharges from both the Mtunzini Municipal Water Treatment Works and the Mtunzini Aquaculture projects Kob farm as concluded by the DWS Mlalazi estuary reserve determination study ((DWS, 2015), has not been ruled out. The impact of the mining activity on surface water quality will be insignificant, as the dunes have been extensively leached by percolation of rainwater, hence all remaining constituents can be considered to be stable.

The groundwater contaminant transport model included Total Dissolved Solids (TDS), Aluminium (AL), and Manganese (Mn) as potential contaminants of concern. It was found that the concentration in the aquifer attenuated due to high recharge in the sand aquifer and the additional water added to the system with the backfill and/or residue. This is the opposite of what is generally expected from contamination sources. Therefore, the residue and backfill material are not strictly sources of contamination. However, monitoring will be put in place to check if there are any changes in quality over time. When these diluted plumes reach the rivers and wetlands, it is further reduced, with the effect that minimal impacts are observed (WSP (Pty) Ltd, 2024).

Table 7-2 – Compliance of Water Quality against receiving Water Quality Planning Limits

	Sampling Point ID	pH	Electrical Conductivity (EC)	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Chloride (Cl)	Sulphate (SO4)	Nitrate (NO3-N)	Flouride (F)	Aluminium (Al)	Iron (Fe)	Manganese (Mn)	Ammonia NH4 as N	Ortho-Phosphate (PO4)	Cadmium (Cd)	Cobalt (Co)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Total alkalinity (CaC03)
			mS/m	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Ideal		≤ 6.5 ≥ 8.4	30	200		10	70	70	25	40	80	6	0.70	≤0.01		≤0.05	0.015	0.025	≤0.00025		≤0.0008		≤0.0005	≤0.002	
Acceptable			50	350		80	100	92.5	50	120	165	10	1				0.044	0.075				≤0.07			
Tolerable			85	800		80	100	115	100	175	250	20	1.5	≤0.15	≤0.1	≤0.15	0.073	0.125	≤0.005		≤1		≤0.01	≤3	
Unccceptable			>85	>800		>80	>100	>115	>100	>175	>250	>20	>1.5				>0.073	>0.125							
	TSW20 (Msasandla River)	7.29	-	126.00	<10	-	7.03	-	-	-	-	-	-	0.11	0.33	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	37.2
	TSW17	7.03	-	134.00	<10	-	6.29	-	-	-	-	-	-	<0.05	0.2	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	30.3
Kwagugushe River tributary	TSW16	7.39	-	186.00	<10	-	7.96	-	-	-	-	-	-	0.13	0.59	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	45.7
	TSW18	6.71	-	162.00	<10	-	8.06	-	-	-	-	-	-	<0.05	0.4	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	43.3
Ntuze River tributaries	TSW19	6.93	-	164.00	<10	-	6.94	-	-	-	-	-	-	<0.05	0.14	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	45.9
	W13 193251	7.60	3424.40	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.1	-	-	-	-	-	-	-
	1. Umlalazi River WQ	7.29	-	8256.00	15.00	-	320.94	-	-	-	-	-	-	<0.05	<0.005	-	0.20	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	75.1
	3. Umlalazi Railway Line WQ	7.52	-	220.00	<10	-	12.53	-	-	-	-	-	-	0.1	0.29	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	64
	W13 193258	7.80	3386.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mlalazi River	W13 193256	7.90	3034.50	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Ojinjini River:	2. Ojinjini WQ	7.10	-	234.00	<10	-	12.10	-	-	-	-	-	-	0.05	0.31	-	<0.05	0.01	<0.001	-	<0.001	<0.005	<0.01	<0.005	84.8
	TSW13	4.09	-	232.00	<10	-	9.48	-	-	-	-	-	-	1.06	0.55	-	0.18	<0.005	<0.001	-	<0.001	0.03	<0.01	0.040	<3.5
Amanzamnyama River	TSW21	4.52	-	218.00	<10	-	7.80	-	-	-	-	-	-	0.08	0.11	-	0.112	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	<3.5
	TSW11	6.90	-	156.00	<10	-		-	-	-	-	-	-	<0.05	0.04	-	<0.05	0.006	<0.001	-	<0.001	<0.005	<0.01	0.02	27.1
	TSW12	4.98	-	232.00	<10	-	5.60	-	-	-	-	-	-	0.21	1.51	-	0.341	0.009	<0.001	-	<0.001	<0.005	<0.01	0.02	6.1
	5. Mzingwenya River WQ	6.86	-	230.00	<10	-	9.99	-	-	-	-	-	-	<0.05	0.03	-	0.37	0.01	<0.001	-	<0.001	<0.005	<0.01	<0.005	47.8
Mzingwenya River	W12 187181 (Qubhu Lake)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TSW15 (Nkonjane River)	6.33	-	116	<10	-	4.17	-	-	-	-	-	-	<0.05	0.06	-	<0.05	<0.005	<0.001	-	<0.001	<0.005	<0.01	<0.005	23.6
	W12 102815	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mhlatuze River	W12 188458	8.20	93.80	593.5	36	74.80	31.40	84.30	-	-	-	-	-	-	-	-	-	0.40	-	-	-	-	-	-	-
		-	No Data																						

7.5 FLOODLINE

The following describes a summary of calculated floodlines for the tributaries of the Mhlatuze River (i.e. Nkonjane River and the unnamed non-perennial streams) that drain the northwestern areas, the perennial Mzingwenya River and its associated tributaries flowing along the eastern site boundary from southwest to northeast, where they drain into Lake Cubhu, the perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries that flow from northeast to southwest within the site boundary and confluences with the Mlalazi River.

7.5.1 PEAK FLOW

The 1:100-year peak flows for the catchments at the project site were determined using the Rational Method (Alternative 3), Unit Hydrograph and Standard Design Flood (SDF) in UPD.

7.5.1.1 Design Rainfall

The design rainfall depths were obtained for the site using the Design Rainfall Estimation Software (Smithers & Schulze, 2003). The design rainfall depths calculated for the station Mtunzini (0304475-S) were used for this hydrological assessment. This station was found to be representative of the site due to it being near the site, having a long historical record of 72 years, and a MAP of 1281 mm that is comparable to the quaternary catchment (W12F and W13B) MAP that is 1285 and 1293 mm, respectively. The design rainfall depths for the gauge are presented in Table 7-3.

Table 7-3 – Design Rainfall Depth (m) – Mtunzini (0304475-S)

	2	5	10	20	50	100	200
1-day	85	132	173	221	298	370	457
2- days	108	170	221	279	372	457	557
3 -days	119	187	243	306	405	495	599
7 days	145	223	284	352	454	544	646

7.5.1.2 Catchments Delineation

Sub-catchments were delineated for Rivers and streams based on a DEM generated from 5m contours, as depicted in Figure 7-13. The characteristics of the catchments used for peak flow determination are presented in Table 7-4.

Table 7-4 – Catchment Characteristics

River	Sub-catchment	Area (Km^2)	Longest Watercourse (Km)	Height difference along 1085 Slope (m)	Area distribution %	Surface Slope	Vegetation
Amanzamnyama River	Tributary 1	4	4.23	52	97% Rura1, 3% Urban	96% Lakes & Pans, 4% flat area	98% thick bush & forests, 2% Grassland.
	Tributary 2	4	4.12	33	94% Rura1, 6% Urban	88% Lakes & Pans, 12% flat area	96% thick bush & forests, 3% Grassland. 1% Light bush & cultivated land
	Tributary 3	4	4.38	58	100% Rura1	12% Lakes & Pans, 88 % flat area	97% thick bush & forests, 2% Grassland. 1% Bare land
	Tributary 4	2	1.96	46	100% Rura1	3 % Lakes & Pans,97 % flat area	99% thick bush & forests, 1% Grassland.
	Tributary 5	2	1.69	58	99% Rura1, 1% Urban	6 % Lakes & Pans,94 % flat area	79% thick bush & forests, 2% Grassland, 18% Light bust & cultivated land.
KwaGugushe River	Tributary 1	3.64	4.05	36	43% Rura1, 57% Urban	92 % Lakes & Pans, 8 % flat area	22% thick bush & forests, 7% Grassland, 71% Light bust & cultivated land.
	Tributary 2	2.34	3.63	28	68% Rura1, 32% Urban	94 % Lakes & Pans, 6 % flat area	60% thick bush & forests, 5% Grassland, 35% Light bust & cultivated land.
	Tributary 3	3.19	3.22	26	84% Rura1, 16% Urban	33 % Lakes & Pans, 67 % flat area	78% thick bush & forests, 3% Grassland, 19% Light bust & cultivated land.

River	Sub-catchment	Area (Km^2)	Longest Watercourse (Km)	Height difference along 1085 Slope (m)	Area distribution %	Surface Slope	Vegetation
	Tributary 4	1.56	2.014	18	76% Rura1, 24% Urban	55 % Lakes & Pans, 45 % flat area	50% thick bush & forests, 3% Grassland, 47% Light bust & cultivated land.
Mhlatuze Tributary	Unnamed Stream 1	2.64	2.8	28	96% Rura1, 4% Urban	8 % Lakes & Pans, 92 % flat area	83% thick bush & forests, 1% Grassland, 16% Light bust & cultivated land.
	Unnamed Stream 2	1.41	1.93	68	99.5% Rura1, 0.5% Urban	5 % Lakes & Pans, 95 % flat area	78 % thick bush & forests, 2% Grassland, 20% Light bust & cultivated land.
Msasandla River	Tributary 1	2.25	2.36	28	32% Rura1, 68% Urban	82 % Lakes & Pans, 18 % flat area	25 % thick bush & forests, 5% Grassland, 70% Light bust & cultivated land.
	Tributary 2	3.28	2.93	36	54% Rura1, 46% Urban	93 % Lakes & Pans, 7 % flat area	12 % thick bush & forests, 5% Grassland, 83 % Light bust & cultivated land.
	Tributary 3	1.09	1.1	3.2	61% Rura1, 39% Urban	20 % Lakes & Pans,80 % flat area	27 % thick bush & forests, 10% Grassland,63 % Light bust & cultivated land.
Mzingwenya River		80	17.36	15	52% Rura1, 43% Urban, 5% Lakes	99% Lakes & Pans,1 % flat area	81 % thick bush & forests, 14% Grassland,4 % Light bust & cultivated land, 1% Bare land.

River	Sub-catchment	Area (Km^2)	Longest Watercourse (Km)	Height difference along 1085 Slope (m)	Area distribution %	Surface Slope	Vegetation
Nkonjane River		7.47	6.61	60	22% Rura1, 78% Urban	13% Lakes & Pans,87 % flat area	40 % thick bush & forests, 60% Grassland
Ojinjini River		4	3.88	40	99.5% Rura1, 0.5% Urban	63% Lakes & Pans,37 % flat area	47 % thick bush & forests, 7% Grassland, 46% Light bush & cultivated land

7.5.1.3 Design Peak Flows

Peak flows for the 1:100-year 24-hour storm events were calculated for the delineated sub-catchments. The design peak flows are presented in Table 7-5. The peak flows for SDF were used in the hydraulic modelling for floodline determination. These peak flows were selected because they were conservative and, therefore, presented a worst-case scenario.

Table 7-5 – Design Peak Flows

River	Sub-catchment	Area (Km^2)	Rational Method (Alternative 3)	Unit Hydrograph	Standard Design Flood (SDF)
			m^3/s		
Amanzamnyama River	Tributary 1	4	30.68	33.12	101.76
	Tributary 2	4	28.32	33.59	91.53
	Tributary 3	4	35.8	32.47	101.9
	Tributary 4	2	32.03	25.66	90.94
	Tributary 5	2	40	34.49	107.12
KwaGugushe River	Tributary 1	3.64	26.1	30.89	86.63
	Tributary 2	2.34	17.58	21.51	56.91
	Tributary 3	3.19	31	30.1	84.05
	Tributary 4	1.56	21.05	30.1	54.55
Mhlatuze Tributary	Unnamed Stream 1	2.64	29.29	21.63	79.69
	Unnamed Stream 2	1.41	26.58	18.98	71.34
Msasandla River	Tributary 1	2.25	32.9	15.62	77.98
	Tributary 2	3.28	41.99	28.56	102.16
	Tributary 3	1.09	16.71	22.72	39.01

River	Sub-catchment	Area (Km^2)	Rational Method (Alternative 3)	Unit Hydrograph	Standard Design Flood (SDF)
			m^3/s		
Mzingwenya River		80	143.87	238.6	415.02
Nkonjane River		7.47	49.33	41.9	134.97
Ojinjini River		4	38	36.17	101.67

7.5.2 FLOODLINE RESULTS

Delineated 1:100-year flood lines for the river depicted in Figure 7-14 shows the proposed mining activity is outside the 1:100-year floodline for most rivers except for the Mhlatuze River non-perennial tributaries and the Amanzamnyama River. However, in the case of the Amanzamnyama River, the N2 will act as a barrier during the flooding, and the drainage lines of the Mhlatuze River non-perennial tributaries and the Amanzamnyama River have also been modified when establishing the forestry plantation. The runoff from the catchment feeding these tributaries will also be largely contained or cutoff when the mining occurs as the headwaters are located within the mining footprint. However, the current forestry landuse is also reducing the runoff contribution from the footprint under the proposed mining activity.

7.6 RSF DAM BREACH ANALYSES RESULTS

The extent of the RSF breach inundation is shown in Figure 7-15 , as assessed by (Epoch Resources (Pty) Ltd, 2020). A failure of RSF 9 will inundate the Ntuze River and its tributaries, the Mlalazi and Bhadi Rivers, the Ojinjini River, and ultimately the Mlalazi estuary. Similarly, the failure of RSF C will inundate Amanzamnyama, the nearby wetlands, and ultimately the Qhubu Lake.

Although the risk of failure has a very rare likelihood of occurrence, the consequence of RSF failure is catastrophic and could result in adverse impacts that can include (Hatch (Pty) Ltd, 2020):

- Injuries/fatalities.
- Reputational damage to Tronox.
- Temporarily or stopping the mine production and
- Clean-up costs/fees.

The treatment plan would entail design and operational controls to be initiated as follows (Hatch (Pty) Ltd, 2020):

- Design of a downstream impoundment construction, spillways, etc. - safe/robust design
- Conducting a stability assessment - geotechnical data
- Quarterly inspections and monitoring data with an experienced tailings operator and
- Ensuring adequate construction supervision.

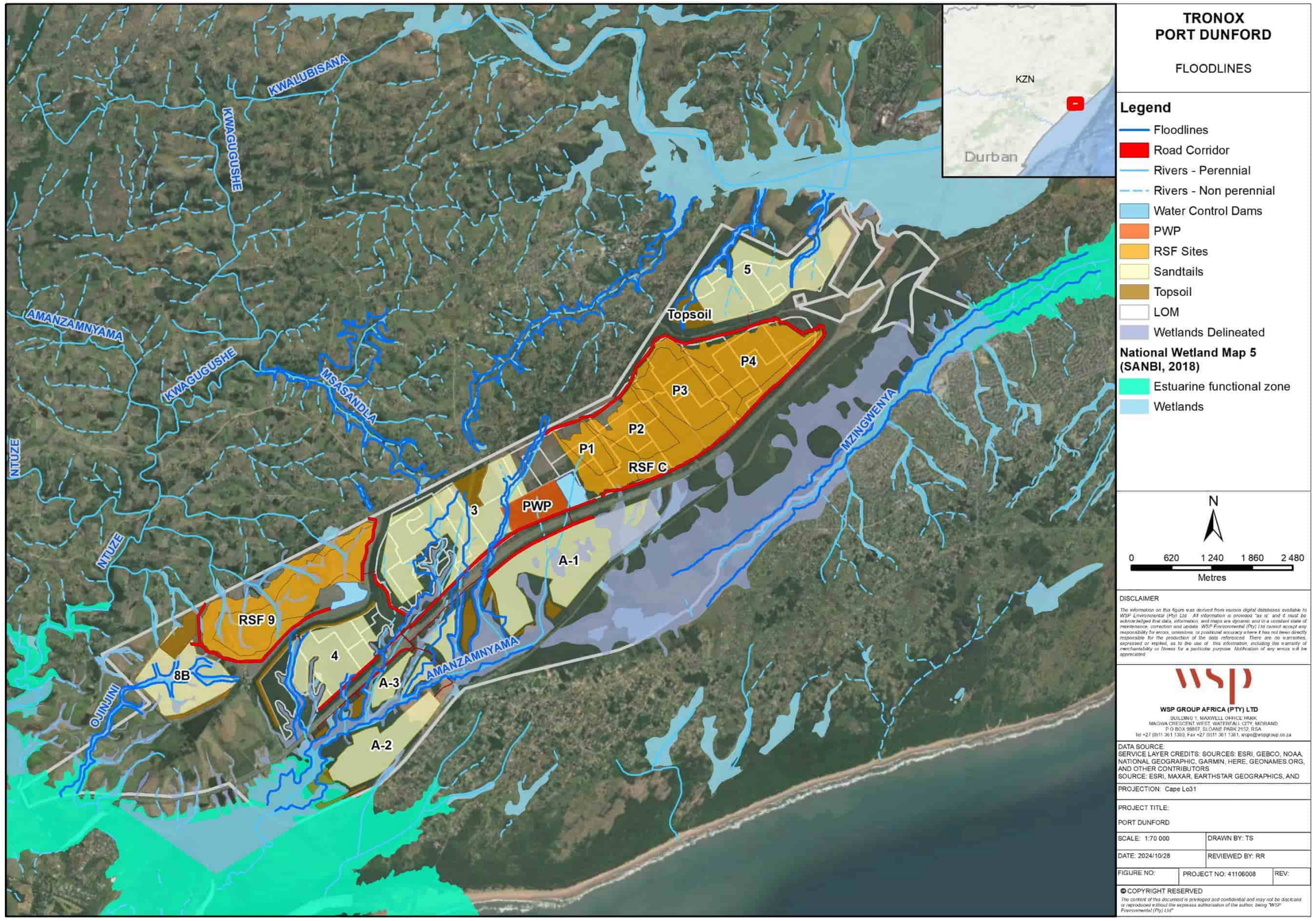


Figure 7-14 – 1:100-year Floodlines

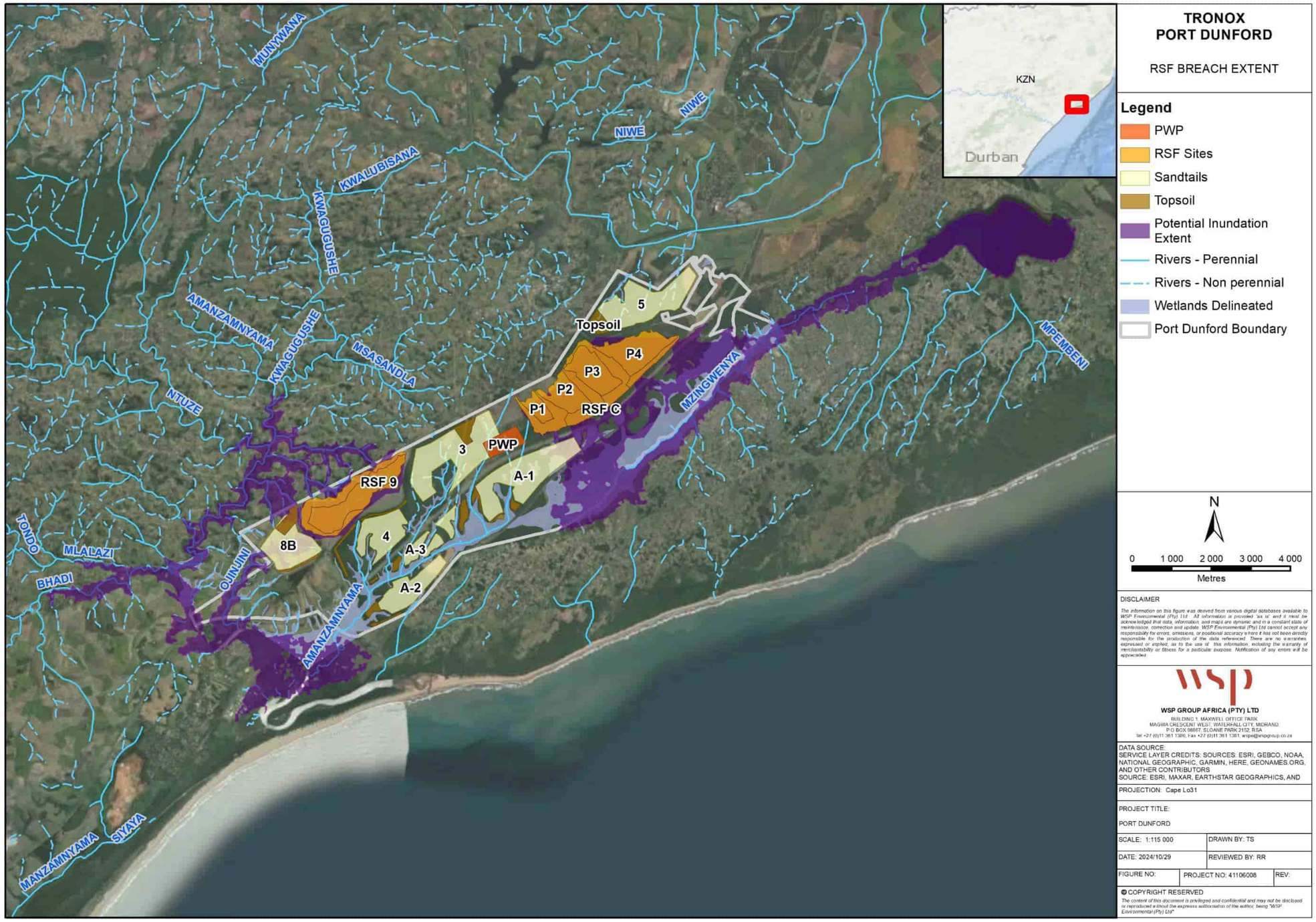


Figure 7-15 – RSF Breach Inundation Extent

7.7 STORMWATER MANAGEMENT

Stormwater management has been conceptually designed as follows:

7.7.1 ACCESS ROAD

Catchment areas contributing runoff to the proposed main access road included the catchment areas contributing to the existing SANRAL (N2) road. To direct clean stormwater into the natural water courses, suitable berms have been provided along the length of the access road. Pipe and box culverts have also been provided for in the design (Epoch Resources (Pty) Ltd, 2020).

7.7.2 RSF 9

RSF Site 9, as depicted in Figure 7-16 will have a Water Control Dam (WCD) to receive water from the RSF dams and intercept stormwater falling within the managed RSF area. This dam will be approximately 19 ha in extent and have an 870 000 m^3 storage capacity. A barge/ turret system will transport water from the RSF to the Water Control Dam. Excess water will be recovered from the surface of the RSF and the under-drainage system and returned for reuse in mining. The RSF dams will use a barge/turret system for excess water removal. The RSF sites will be installed with herringbone, toe, and blanket drainage systems to assist in dewatering the fine tailings to aid stability, manage seepage, and control the phreatic surface within the RSF. Stormwater control berms and trenches will be used to manage external water, with toe paddocks to control material eroded from the RSF outer slopes. It is anticipated that RSF Site 9 will be operational for 6 years and reach full capacity in 2042. Thereafter, capping of the RSF surface with coarse sand tailings site will commence in 2046, assuming that the surface of the RSF has dried out and stabilised sufficiently by that stage. Once backfilled, the site will be topsoiled in 2048. Outer slopes of the RSF will be topsoiled and vegetated as areas become available to stabilise the side slopes against erosion. The RSF will be returned to the landowner once Tronox is satisfied that the facility and the chosen vegetation cover have stabilised (Epoch Resources (Pty) Ltd, 2020).

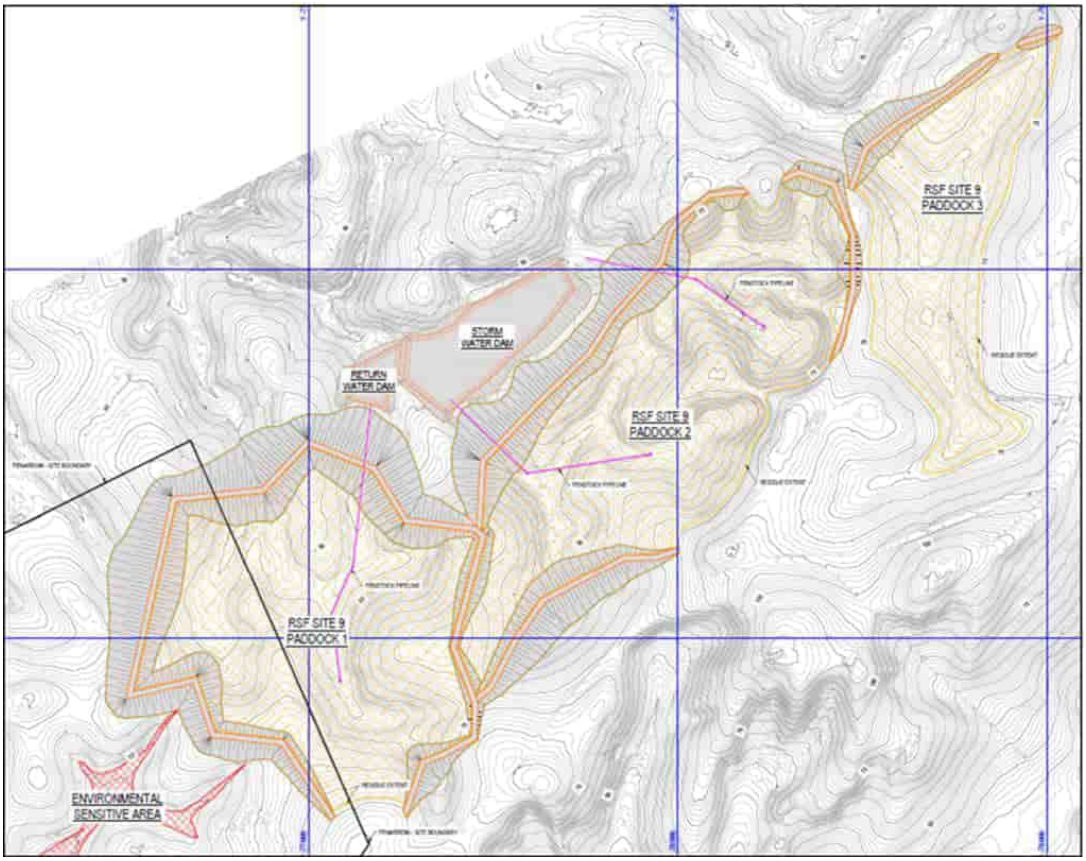


Figure 7-16 – RSF Site 9 Layout (Epoch Resources (Pty) Ltd, 2020)

7.7.3 RSF SITE C

The RSF situated on Site C will consist of 4 phases. The first three phases will be developed consecutively next to each other, allowing the site to be utilised as an RSF while mining operations continue on the site. The fourth and final phase on Site C will involve raising the developed phases to provide the required capacity for the remainder of the 24 years. Site C will be a full containment facility, with the walls being built using cyclone (dewatered) sand tailings deposited behind a nominal starter wall. Stormwater will be decanted from the top of the facility to be utilised by the mining operations or discharged into the mined-out void next to each phase as necessary. Following the development of Phase 3, and if deemed necessary, a stormwater dam may be built to the east of Phase 3 after the final section of the Site C mined-out void has been backfilled with sand tailings. This strategy has been planned to reduce unnecessary capital expenditure. However, the philosophy that stormwater can be stored on top of the Phase 3 facility above NGL will be confirmed by seepage and slope stability analyses and through the relevant authorities during the project's next phase. Development of a stormwater dam within the unutilised portion of the mined-out void should also be considered for stages whereafter the residue is above NGL. RSF Site C is anticipated to be operational for 27.5 years and reach full capacity in 2064. The site will be backfilled in 2069, allowing the facility 4 years to dry out and stabilise. Once backfilled, the site will be rehabilitated with topsoil and returned to the landowner (lessee). (Epoch Resources (Pty) Ltd, 2020).

7.8 WATER BALANCE

The complete phase 2 mining operation is expected to operate for thirty-three years, and the water balance would vary depending on which residue dam is being used and for what purpose (slimes or sand). For simplicity, the water balance has been divided into a typical dry (i.e. July) and wet (i.e. December) season. A monthly water balance was set up for the mining activities to determine the average raw water make-up requirement during the wet (see Table 7-6) and dry (Table 7-7) season.

Additionally, the water balance has not separated the in-pit and sand dumps deposition as it is dealing with water recovery from the backfill.

During the wet season, on average 142 000m3/month of raw water is required from Mhlatuze, while during the dry season 170 000m3/month is required. There are imbalances in the water balance as was reflected in the Fairbreeze water balance that have been carried over to the Port Durnford water balance. The water balance does provide indicative raw water required from Mhlatuze. The water balance must be updated to a dynamic stochastic water balance when more information becomes available on the processing, and the stormwater management becomes available. The model can be applied to size infrastructure to meet regulatory requirements.

Table 7-6 – An Average Wet Season Water Balance

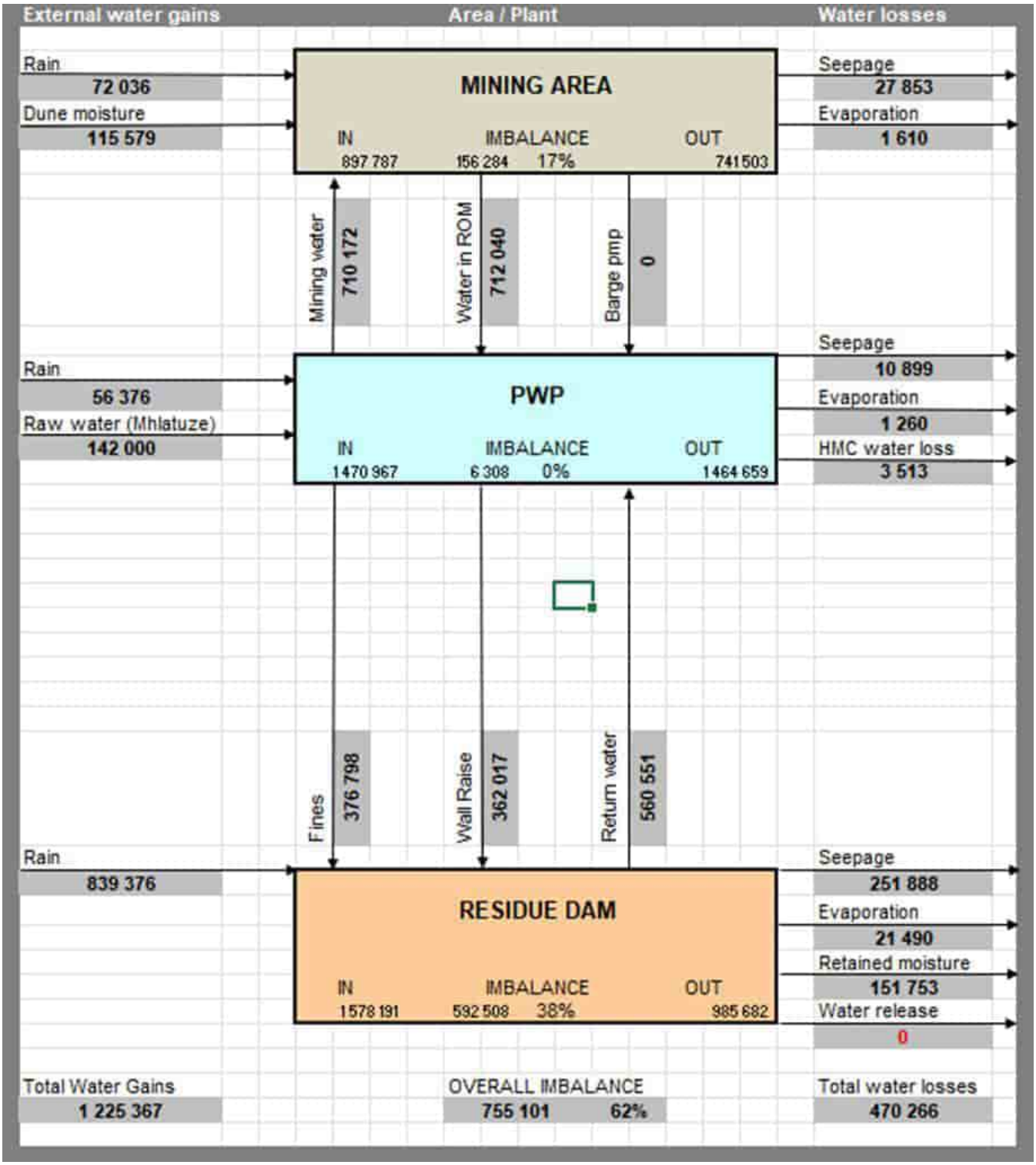
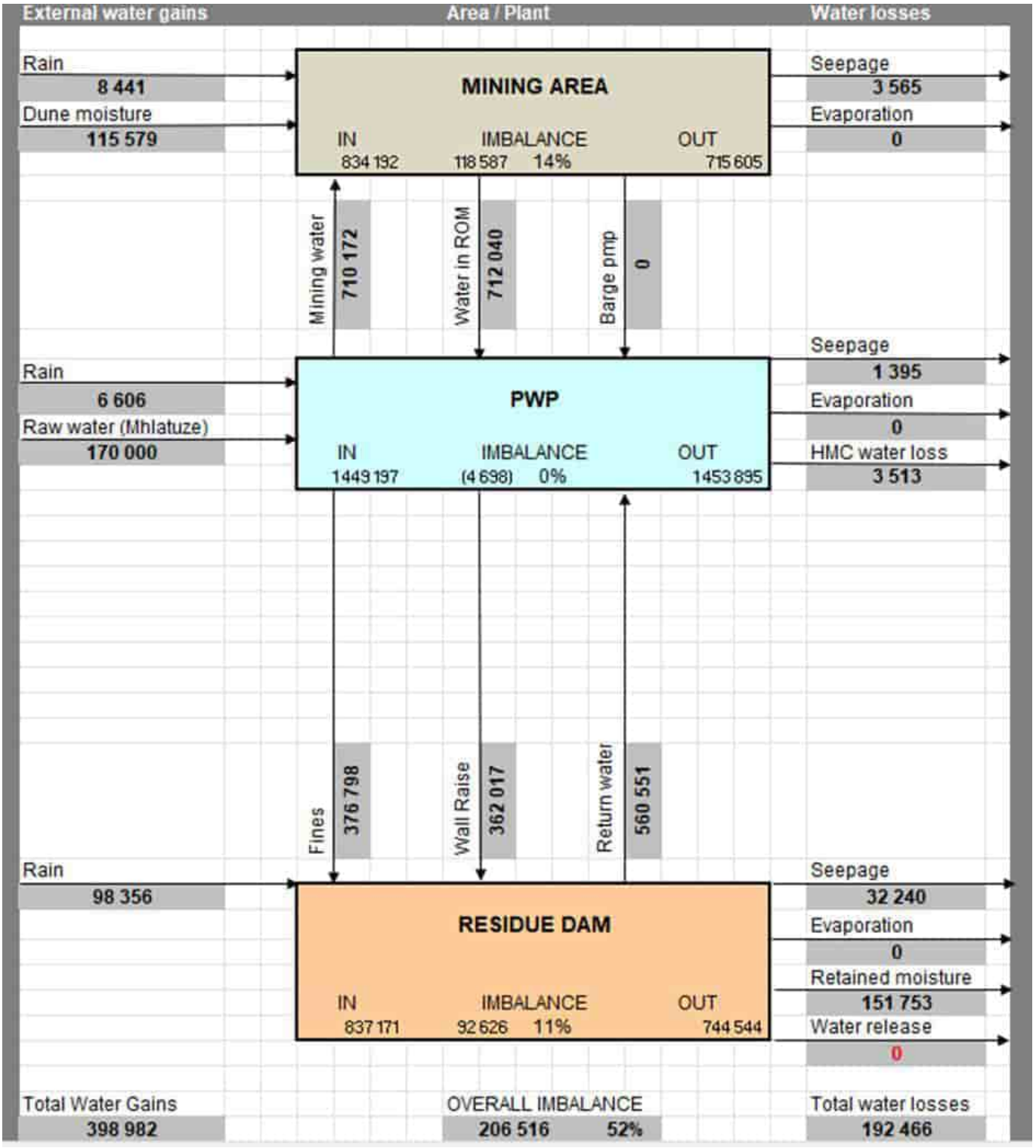


Table 7-7 - An Average Dry Season Water Balance



8 SURFACE WATER IMPACT ASSESSMENT

This section identifies and assesses the significance of the impacts likely to arise during the construction, operation, closure and decommissioning phases of the proposed mining activities, and

those cited by the interested and affected parties (IAPs). It provides a short description of the mitigation required to limit the magnitude of the potential impact on the receiving surface water resources described below:

- The perennial Mhlatuze River flows past the northern boundary, and its tributaries drain the northwestern areas.
- The perennial Mzingwenya River and its associated tributaries flow along the eastern site boundary from southwest to northeast, where they drain into Lake Cubhu.
- The perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries flow northeast to southwest within the site boundary and confluence with the Mlalazi River.
- Another tributary of the Mlalazi River runs further south of the site boundary. The Mlalazi River runs along the southwestern site boundary and eventually drains into the Indian Ocean.

The proposed mining activities to be considered as part of the impact assessment are detailed in section 2.2 and summarised below as follows:

- Phase 1 would last 10 years, from 2025 to 2035. The mining will operate at a low production rate of 100 tons per hour (tph) and 70 400 tons per annum (tpa). Active mining will occur five (5) days a week per month, 12 hours a day. The run-of-mine (ROM) material will be mined mechanically and hauled to the Fairbreeze mine via trucks for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. The infrastructure for Phase 2 will be constructed during the Phase 1 mining period.
- Phase 2 would last 33 years, from 2036 to 2069. The planned mining rate will be 3,000 tph, 24 hours a day, 365 days a year, at a design production rate of 3000 tonnes per hour. Phase 2 operation comprises opencast mining, on-site processing of ROM material in a primary wet plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox MSP located in Empangeni within the Tronox CPC.

8.1 CONSTRUCTION PHASE

Activities during the construction phase that may potentially impact the receiving surface water resources are described in Table 8-1.

Table 8-1 – Construction Phase Impacts

Activity	Impact
Vegetation clearance; topsoil and overburden removal; excavation and loading of materials for infrastructure establishment	Sedimentation of surface water resources may result in deteriorated water quality. Dust generation may lead to sedimentation of the receiving rivers.
General construction activities (i.e., use of haul roads, handling of material and waste products)	Unplanned spills or leaks during construction or excavation and runoff from contaminated surfaces.

8.1.1 IMPACT DESCRIPTION

- Construction of infrastructure will require site clearance or removal of vegetation. Clearing the natural vegetation and topsoil to establish infrastructure results in denuded catchment areas with higher erosion and runoff potential delivering sediment to the river systems.

- Dust generated during construction activities caused by increased vehicular movements can be deposited into the rivers, thereby contributing to suspended solids accumulating and increasing sedimentation.
- Accidental spills or leakages of hydrocarbons may occur directly from vehicles and machinery during construction. However, the potential impact of each spill or leak will depend on the volume and duration of release. Spills during the dry season are unlikely significant as the spillage can be contained and cleaned up without significant impact. However, during the rainy seasons, such spillages could be washed off downstream with more widespread potential effects on aquatic life and the downstream water users

8.1.2 CONSTRUCTION PHASE MANAGEMENT ACTIONS

The following management actions are recommended:

- Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of receiving watercourses.
- Construction should be undertaken during the dry period to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period.
- Install effective sediment and erosion control measures before starting work to minimise sediment entry into the watercourse, such as sediment ponds, erosion berms, weep berms, vegetative filters or silt fences.
- Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses.
- Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required).
- Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary.
- Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills.
- All storage areas for fuels and oils used during construction should be appropriately bunded, and spill kits should be in place. Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease.
- Use precast concrete where required for construction to limit extended construction work.
- Administer timely clean-ups in the event of spillages occurring

8.1.3 IMPACT ASSESSMENT

Impact assessment ratings for activities associated with the construction phase for Phases 1 and 2 of the proposed mining are presented in Table 8-4. The proposed infrastructure for both phases will be placed in an already disturbed environment where drainage lines are no longer visible, as the areas were previously drained by non-perennial streams prior to the establishment of the forest plantation. The Amanzamnyama River is the primary receptor of the anticipated impacts. Even though the 1:100-year floodline encroaches some of the proposed mining activity, the N2 road will be between the proposed construction site and the Amanzamnyama River and will act as a barrier. Impacts associated with the construction activities were determined to be of predominantly moderate environmental

significance pre-mitigation and low post-mitigation. This finding was mainly due to the distance between the receptor (Amanzamnyama River) and the construction sites, plus the N2 road, which is expected to act as a barrier. Potential impacts will likely reach the receptor during periods of heavy rain.

8.2 OPERATIONAL PHASE

Activities during the operational phase (1 and 2) that may potentially impact the receiving surface water resources are described in Table 8-2.

Table 8-2 – Operational Phase Impacts

Activity	Impact
Mechanical mining of the run-of-mine (ROM) material. Progressive backfilling and rehabilitation Haulage of ROM to the Fairbreeze mine via trucks for stockpile and processing On-site processing of ROM material in the PWP. The on-site backfill and disposal of both coarse and fine sand tailings into the pit and on sand dumps from the PWP and the transport of heavy mineral concentrate to the existing Tronox MSP. Handling and disposal of general hazardous waste	Contamination and sedimentation of receiving water resources Changes in water quantity or flow regime. Impact of mining on Ntuze River flows and Mtunzini Municipality abstraction. Increased erosion from areas of exposed soils. Additional water abstraction from the Mtunzini water supply system for Phase 1. Flooding and the impact of RSF breach on the receiving surface resources. Overtopping of impacted water storages Spills and leaks of hazardous materials

8.2.1 IMPACT DESCRIPTION

Contamination and sedimentation of receiving water resources

Water quality, required by downstream users and in particular the aquatic ecology can be impacted through point sources discharges and diffuse pollution. No point source discharges are planned from the proposed operations. Therefore, potential impacts will arise from accidental point sources and diffuse sources. Accidental point source pollution can arise from the following activities, which are more difficult to detect and control than planned point source discharges, but that can be managed with appropriate systems in place:

- Spills from pipelines (slurry) and vehicles (fuel, oil, grease, ore).
- Flooding causing mixing of clean and dirty waters, including RSF breach.
- Discharges or spillage of surplus stormwater or process water during wet periods.

Diffuse pollution, which is often more difficult to manage, can arise from:

- Seepage from the open pits and sand dumps (directly to surface waters and indirectly via groundwater) affected by geochemical changes and process reagents.
- Unmanaged stormwater runoff from contaminated surfaces.
- Runoff from exposed areas, including sand dumps, carrying increased sediment load.
- Sediment loads from coarse and fine sand tailings storage facilities and sand dumps.

Changes in Water Quantity or flow regimes

The proposed Project Area will be established on top of the upstream ends of some rivers. Mining activity will affect sections of the Amanzamnyama River, Ojinjini River, and tributaries of the Msasandla River, Nkonjane River, and tributaries of the Mhlatuze River. Therefore, assuming that the proposed Project Area no longer contributes to the catchment hydrology, surface runoff could be reduced, thereby changing flow regimes and reducing catchment yield.

Impact of mining on Mtunzini Municipality abstraction.

The primary water use on-site during phase 1 will be dust suppression, and it is anticipated that 4 800 m3 per annum will be required for this project phase. Tronox opted to utilise 10-18 kilolitre (kl) water trucks to cart 6 kl of municipal water to the site, to be stored in 2 x10kl JoJo tanks, as a source of water supply.

Increased erosion from areas of exposed soils

There will be increased sediment loads from mining areas and coarse and fine sand tailings disposal facilities, including sand dumps. Mining will potentially expose sediment and runoff from exposed areas during the operational phase, depositing these sediments into the receiving surface water resources, especially during heavy rainfall events.

Flooding and the impact of RSF breach on the receiving surface resources

An overtopping breach could occur if the facility's freeboard was reduced and the water level was higher than the crest of the embankment. Overtopping can only occur if the freeboard of the facility is exceeded, i.e. under any of the following scenarios:

- A flood event larger than the design flood occurs.
- The pond is allowed to operate higher than the design levels before a flood event, i.e. non-compliant operation.
- The freeboard of the facility is reduced, i.e. residual settlement or subsidence of the crest that may occur due to consolidation of the waste fill, from embankment deterioration, or seismic settlement.

Collapse – the breach originates at some point below the crest of the RSF due to either piping, erosion, or some other form of wall instability.

8.2.2 OPERATION PHASE MANAGEMENT ACTIONS

The following management actions are recommended:

- Runoff from dirty areas should be directed to the stormwater management infrastructure and not be allowed to flow directly into the natural environment. The main pollutant of concern is sediment (WSP (Pty)Ltd, 2025). Sediment control structures such as sediment traps/ponds, containment berms, silt fences, and vegetation filters should be used to manage the sediment in the stormwater runoff. The reuse of stormwater should be considered in the water balance to reduce the intake from Mhlatuze. Excess stormwater can be discharged to the environment after passing through sediment management measures.
- Minimise the footprint or catchment of the dirty area as much as possible and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff. Berms should be erected around the sand dumbs footprint to contain sediments and runoff to prevent it from reaching the receiving surface water resources

- Overall housekeeping and maintenance of stormwater infrastructure (including berms, de-silting of dams and conveyance channels and clean-up of leaks) must be adhered to throughout the life of the project.
- The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that approved contractors can collect for disposal to appropriate disposal sites.
- The groundwater monitoring boreholes should be distributed across the site, strategically situated to allow observation of groundwater quality fluctuation upgradient, within and downgradient of the potential contamination sources. The monitoring program must be used to guide environmental management decision making, including taking remedial measures when water quality guidelines are exceeded.
- The water quality monitoring program provided in this report should be adhered to for monitoring water resources within and near the Project Area to allow detection of any contamination arising from operational activities.
- Bare surfaces downstream from the mine where sediment traps are not an option should be vegetated to limit erosion and runoff that might be carrying contaminants.
- The design of the coarse and fine sand tailings disposal facilities must include concurrent rehabilitation and perimeter runoff and sediment management infrastructure.
- A comprehensive sediment management plan must be developed for the life of the project.
- Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly.
- Emergency preparedness and response plan (EPRP) for the RSF should be prepared based on a credible RSF breach analysis taking the impacts of climate change into consideration.
- Conducting a stability assessment on the RSFs - geotechnical data
- Quarterly inspections and monitoring data with an experienced tailings operator

8.2.3 IMPACT ASSESSMENT

Impact assessment ratings for activities associated with the operational phase for Phases 1 and 2 of the proposed mining are presented in Table 8-4 and discussed in the following section:

- Water Quality of runoff from site:
    - Increased sediment loads from mining areas, coarse and fine sand tailings disposal facilities: The mining will expose sediment in any runoff potentially coming from exposed areas during the operational phase but is not expected from the inter basin transfer as the water will be contained in the plant and mine water circuits and will not directly enter the environment. Higher sediment loads may naturally be introduced into the receiving surface water resources due to increased frequency and intensity of flooding, large-scale erosion and sediment movement.
    - The mining of heavy metals does not impact adversely on surface water quality, as the dunes have been extensively leached by percolation of rainwater, hence all remaining constituents can be considered to be stable. The beneficiation process could probably increase the levels of certain constituents in the tailings largely due to elevated levels of sulphate and calcium resulting from evaporation in the residue dam.
- The proposed mining activity is outside the 1:100-year floodline for most rivers except for the Mhlatuze River non-perennial tributaries and the Amanzamnyama River. However, in the case of the Amanzamnyama River, the N2 will act as a barrier during the flooding, and the drainage lines

of the Mhlatuze River non-perennial tributaries and the Amanzamnyama River have also been modified when establishing the forestry plantation.

- Although vegetation will be removed during the operational phase, the runoff from the ore body areas will be contained, resulting in a decrease in surface run-off. This, however, will be for the short term as the mined ore body will be rehabilitated and the ground sloped to drain back to the original catchments. There is, however, currently forestry in the areas that are going to be mined. Forestry reduces runoff potential as it intercepts and uptake rainfall and groundwater within areas that contributes to flow. Therefore, the areas to be occupied by mining and its associated infrastructure were already not contributing to the surface runoff due to unnatural flow regimes that already exist. From the baseflow simulation it is evident that the mining activity will not impact the water quantities due to the reduction in baseflow in the catchments; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use. The findings are summarised below:
  - KwaGugushe, Msasandla and Ojinjini Rivers (west of the Project Area) show an insignificant reduction in baseflow. The increase in baseflow is more significant due to the wet backfill/sand tailings.
  - Baseflow to the Mhlatuze River (north of the Project Area) is limited as the area contributing to the Mhlathuze catchment is insignificant. Baseflow reduces from 2036, and the largest effect is seen from 2058 to 2061 during the mining of the north block. However, the wet backfill has a counter effect, and from 2061 to 2064, there is a significant increase in baseflow.
  - Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu (northeast of the Project Area) is limited. It reduced slightly from 2036 to the end of mining. However, it increases from 2062 to 2064.
  - Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary (south of the Project Area) shows an insignificant reduction in baseflow from 2036. The baseflow reduction is significant from 2054 to 2058 and again from 2062 to 2065. An increase in baseflow due to deposition is evident for the following periods:
    - From 2037 to 2052 - due to deposition of sand tailings A1, A2 and A3.
    - From 2056 to 2058 - due to backfill in area 4.
    - From 2066 to 2067 - due to backfill in area 3.

8.3 DECOMMISSIONING PHASE AND POST CLOSURE

Backfilling will be concurrent with mining and a rehabilitation plan to ensure the land can be returned for use by forestry should be developed. However, impacts associated with the decommissioning of the surface infrastructure such as the plant and dams are presented in Table 8-3.

Table 8-3 – Decommissioning Phase Impacts

Activity	Impact
Decommissioning and removal of infrastructure	Sedimentation and siltation of nearby watercourses
Rehabilitation activities including spreading of topsoil and revegetation of disturbed footprints.	Contamination of surface water due to accidental spillages of hydrocarbon during rehabilitation activities.

Activity	Impact
Post-closure monitoring	This will allow for the detection of any residual water quality impacts and enable immediate measures where required.

8.3.1 IMPACT DESCRIPTION

Sedimentation and siltation of receiving watercourses is likely to happen during the decommissioning and rehabilitation phase. This will potentially deteriorate the water quality of the surrounding rivers. Disturbance of soils through demolition and removal of infrastructure may increase the rate of soil erosion leading to sedimentation and siltation of the nearby watercourses. Restoration of the topography and re-vegetation of other disturbed areas will intend to return the site to a desired post mining land use, which should improve the drainage of the area.

Accidental spills or leakages of hydrocarbons may occur directly from vehicles and machinery during decommissioning phase. However, the potential impact associated with each spill or leak will depend on the volume and duration of release. Spills during the dry season are unlikely to be significant as the spillage can be contained and cleaned up without major impact. However, during the rainy seasons, such spillages could be washed off downstream with more widespread potential effects on aquatic life and the downstream water users.

8.3.2 DECOMMISSIONING PHASE MANAGEMENT ACTIONS

The following management actions are recommended:

- Re-profile the rehabilitated landscapes to suit desired post mining land use as much as is practically possible.
- Demolition should be undertaken during the dry winter period to reduce sedimentation in the proximal watercourses since there will be minimal to no occurrence of rainfall during this period and ensure the immediate revegetation of cleared areas.
- Ensure that waste stockpiles are frequently collected and away from riverbanks.
- Minimise the footprint of disturbance, as far as practicable. Demarcate the proposed areas for rehabilitation and closure works to minimise the unnecessary expansion of the footprint of disturbance, movement of vehicles and machinery should be confined to designated haul and access roads, as far as practicable.
- Maintain the sediment and erosion control measures in place until the completion of demolition and rehabilitation activities to minimise entry of sediment into watercourses.
- Ensure that the existing SWMP infrastructure is still functional and can contain runoff from dirty areas.
- Strategic removal of surface infrastructure should be implemented so that potentially contaminated runoff is diverted away from designated clean water areas. This may be achieved by temporarily retaining stormwater infrastructure to divert dirty water from clean areas while the potentially contaminating sources are decommissioned.
- Use of accredited contractors for removal or demolition of infrastructure during decommissioning is recommended; this will reduce the risk of waste generation and accidental spillages.

- All mining personnel should be taught and trained to handle hazardous chemical waste to minimise spillages. The use of spill kits is highly recommended. All storage facilities should be bunded.
- Washing and servicing of vehicles and machinery should only be undertaken at designated, appropriately designed areas.
- Administer effective and timely clean-ups in the event of spillages occurring.
- Ensure maintenance and management of remaining infrastructure and stormwater infrastructure around the area to prevent water quality contamination from runoff from the remaining areas.
- Ensure that the infrastructure (e.g., PCD,) are first emptied of all residual material before decommissioning.
- Ensure chemicals, reagents or hydrocarbons are stored on impermeable surfaces with appropriate containment structures.
- Surface water quality monitoring should continue to detect any potential sources of pollution and thereby enable remediation measure.

Table 8-4 – Surface Water Impact Assessment

Item	Activity	Potential Impact	Aspects Affected	Magnitude (M)	Duration (D)	Scale/ extent (E)	Reversibility (R)	Probability (P)	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Reversibility (R)	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures	Mitigation Type	Time period for implementation	Standards to be Achieved	Compliance with Standards	Responsible person
1	• Site clearance (i.e. excavation, removal of unsuitable material and loading of materials).	Increased sedimentation of surface water resources may result in deteriorated water quality. Dust generation may lead to the increased sedimentation of the nearby rivers.	Surface Water quality & quantity	6	2	2	3	4	52	Moderate	4	2	1	3	2	20	Low	• Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of nearby watercourses. • Construction should be undertaken during the dry period to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period. • Install effective sediment and erosion control measures before starting work to minimise sediment entry into the watercourse, such as erosion berms or silt traps. • Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses.	Minimise and control through stormwater management and erosion control measures.	Duration of the construction phase	N/A	N/A	Site manager and appointed contractor
		Decrease in infiltration and increased surface runoff – Changes to the hydrological regime.		2	3	1	3	4	36	Moderate	2	3	1	3	2	18	Low						

Item	Activity	Potential Impact	Aspects Affected	Magnitude (M)	Duration (D)	Scale/ extent (E)	Reversibility (R)	Probability (P)	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Reversibility (R)	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures	Mitigation Type	Time period for implementation	Standards to be Achieved	Compliance with Standards	Responsible person
2	• Construction of proposed infrastructure • General construction activities (i.e. use of roads, handling of material and waste products).	Contamination of water resources by unplanned spills or leaks during construction or excavation and runoff from contaminated surfaces.	Surface Water quality.	6	2	2	3	4	52	Moderate	4	2	1	3	2	20	Low	• Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required). • Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary. • Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills. • All storage areas for fuels and oils used during construction should be appropriately bunded, and spill kits should be in place. • Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease. • Use precast concrete where required for construction to limit extended construction work and • Administer timely clean-ups in the event of spillages occurring. • A comprehensive sediment management plan to be developed describing measures to be applied over the Life of Mine.	Control through Water quality monitoring.	Duration of the construction phase	N/A	N/A	Site manager and appointed contractor
		Operational phase																					
1	• Haulage of ROM to the Fairbreeze mine by trucks for stockpile and processing • on-site processing of ROM material in a primary wet plant (PWP). • The on-site backfill and disposal of both coarse and fine sand tailings from the	Contamination and increased sediment loads to receiving water resources Increased erosion from areas of exposed soils and sand dumps. Overtopping/spillages from impacted water containment facilities. Leaks and pills of other contaminants	Surface Water quality and quantity	8	3	2	3	4	64	High	4	3	1	3	2	22	Low	• Runoff from dirty areas should be directed to the stormwater management infrastructure and should not be allowed to flow into the natural environment. • Minimise as much as possible, the footprint or catchment of the dirty area and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff. • Overall housekeeping and maintenance of stormwater infrastructure (including berms, de-silting of dams and conveyance channels and clean-up of leaks) must be	Control through implementation.	Duration of operational phase.	N/A		Environmental Manager

Item	Activity	Potential Impact	Aspects Affected	Magnitude (M)	Duration (D)	Scale/ extent (E)	Reversibility (R)	Probability (P)	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Reversibility (R)	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures	Mitigation Type	Time period for implementation	Standards to be Achieved	Compliance with Standards	Responsible person
	PWP and the transport of heavy mineral concentrate to the existing Tronox mineral separation plant (MSP). • Handling and disposal of general hazardous waste																	adhered to throughout the life of the project. • The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to appropriate disposal sites. • The groundwater monitoring boreholes should be distributed across the site, strategically situated to allow observation of groundwater quality fluctuation upgradient, within and downgradient of the potential contamination sources. The monitoring program must be used to guide environmental management decision making, including taking remedial measures when water quality guidelines are exceeded. • The water quality monitoring program provided in this report should be adhered to for monitoring water resources within and near the Project Area to allow detection of any contamination arising from operational activities. • Bare surfaces downstream from the developments where sediment traps are not an option should be vegetated to attempt to limit erosion and runoff that might be carrying contaminants. • All storage areas for fuels, grease, and oils used during operation activities should be appropriately bunded, and spill kits should be in place. • Administer timely clean-ups in the event of spillages occurring. • Washing and servicing of vehicles and machinery should be undertaken at designated, appropriately designed areas. • Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. • The emergency preparedness and response plan (EPRP) for the RSF should be prepared based on a credible RSF					
2	• Mechanical mining of the run-of-mine (ROM) material. • Progressive backfilling and rehabilitation	Changes in water quantity or flow regime	Surface water quantity.	4	3	2	3	3	36	Moderate	6	4	2	3	4	+60	Moderate						
3	• Mechanical mining of the run-of-mine (ROM) material. • Progressive backfilling and rehabilitation	Loss of natural vegetation leading to erosion due to open land	Water resources	8	3	1	3	4	60	Moderate	4	3	1	3	2	22	Low		Control through implementation.	Duration of operational phase.	N/A		Environmental Manager
		Flooding and the impact of RSF breach on the receiving surface resources	Water resources	10	4	2	3	1	19	Low	10	4	2	3	1	17	Low						

Item	Activity	Potential Impact	Aspects Affected	Magnitude (M)	Duration (D)	Scale/ extent (E)	Reversibility (R)	Probability (P)	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Reversibility (R)	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures	Mitigation Type	Time period for implementation	Standards to be Achieved	Compliance with Standards	Responsible person
																		breach analysis that considers the impacts of climate change. • Conducting a stability assessment on the RSFs - geotechnical data • Perform quarterly inspections and monitor data with an experienced tailings operator.					
		Decommissioning and Rehabilitation phase																					
1	• Decommissioning and removal of infrastructure • Rehabilitation activities including spreading of topsoil and revegetation of disturbed footprints. • Post-closure monitoring	Sedimentation and siltation of nearby watercourses Contamination of surface water due to accidental spillages of hydrocarbon during rehabilitation activities. This will allow for the detection of any residual water quality impacts and enable immediate measures where required.	Surface Water quality & quantity	6	2	2	3	4	52	Moderate	4	2	1	3	2	20	Low	• Re-profile the rehabilitated landscapes to suit desired post mining land use as much as is practically possible. • Demolition should be undertaken during the dry winter period to reduce sedimentation in the proximal watercourses since there will be minimal to no occurrence of rainfall during this period and ensure the immediate revegetation of cleared areas.	Minimise and control through stormwater management and erosion control measures.	Duration of the decommission and rehabilitation phase	N/A	N/A	Site manager and appointed contractor

2	• General decommissioning and rehabilitation activities (i.e., use of haul roads, handling of material and waste products) • Post-closure monitoring	Contamination of surface water due to spillages of hydrocarbons during rehabilitation activities This will allow for the detection of any residual water quality impacts and enable immediate measures where required.	Surface Water quality.	4	2	2	3	4	44	Moderate	2	2	2	3	2	18	Low	• Ensure that waste stockpiles are frequently collected and away from riverbanks. • Minimise the footprint of disturbance, as far as practicable. Demarcate the proposed areas for rehabilitation and closure works to minimise the unnecessary expansion of the footprint of disturbance, movement of vehicles and machinery should be confined to designated haul and access roads, as far as practicable. • Maintain the sediment and erosion control measures in place until the completion of demolition and rehabilitation activities to minimise entry of sediment into watercourses. • Ensure that the existing SWMP infrastructure is still functional and can contain runoff from dirty areas. • Strategic removal of surface infrastructure should be implemented so that potentially contaminated runoff is diverted away from designated clean water areas. This may be achieved by temporarily retaining stormwater infrastructure to divert dirty water from clean areas while the potentially contaminating sources are decommissioned. • Use of accredited contractors for removal or demolition of infrastructure during decommissioning is recommended; this will reduce the risk of waste generation/ accidental spillages. • All mining personnel should be taught and trained to handle hazardous chemical waste to minimise spillages. The use of spill kits is highly recommended. All storage facilities should be bunded. • Washing/ servicing of vehicles/ machinery should only be undertaken at designated, appropriately designed areas. • Administer effective and timely clean-ups in the event of spillages occurring. • Ensure maintenance and management of remaining infrastructure and stormwater infrastructure around the area to prevent water quality contamination from runoff from the remaining areas. • Ensure that the infrastructure (e.g., PCD) are first emptied	Control through Water quality monitoring.	Duration of the decommission and rehabilitation phase	N/A	N/A	Site manager and appointed contractor

Item	Activity	Potential Impact	Aspects Affected	Magnitude (M)	Duration (D)	Scale/ extent (E)	Reversibility (R)	Probability (P)	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Reversibility (R)	Probability	Significance	Significance with Mitigation	Detailed Mitigation Measures	Mitigation Type	Time period for implementation	Standards to be Achieved	Compliance with Standards	Responsible person
																		of all residual material before decommissioning. • Ensure chemicals, reagents or hydrocarbons are stored on impermeable surfaces with appropriate containment structures. • Surface water quality monitoring should continue to detect any potential sources of pollution and thereby enable remediation measure.					

9 CUMULATIVE IMPACTS

Currently, the primary land-use activities within the proposed Project Area are Eucalyptus Plantations and sugar cane farms which have in some parts heavily transformed the landscape i.e. reduced streamflow or even defined channels along mapped drainage lines. Major impacts within riverine habitat were increased sediment load, acid pH water driven by pine/eucalyptus plantations. Furthermore, the major impacts associated with the residential areas, which are scattered around the Project Area boundary, include water quality modifications from the small-scale sugarcane fields and cattle farming activities. The impacts associated with the proposed mining activity include slight reduction in baseflow in the early stages of mining, increased sedimentation, which might result in deteriorated water quality and siltation of nearby watercourses.

Given these factors, the cumulative water impacts may be greater, however, these could be minimised with the implementation of the proposed mitigation measures.

9.1 MONITORING PROGRAMME

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented. Monitoring frequencies specific to different phases of the project are described in this monitoring plan. Water quality should be benchmarked against the approved IWULs for the discharge and Water Quality Planning Limits (WQPL) applicable to the catchment. The surface water monitoring plan for the proposed Project is summarised in Table 9-1.

Table 9-1 – Monitoring Programme

Monitoring Aspect / Impacts requiring monitoring	Monitoring and Inspection Methodology	Frequency	Duration	Location of monitoring stations	Reporting schedule	Performance indicator	Responsibility
Water Quality	It is recommended that Port Durnford establishes water quality monitoring Programme, where samples are collected monthly, and ensure the following: ▪ Monitoring should be established on all the sampled points used for baseline assessment, and the more points proposed by groundwater study, to assess quality as a result of baseflow. ▪ Monitor the parameters that form part of the new WUL. ▪ Monitoring the parameters against the catchment WQPLs.	Monthly monitoring is recommended during construction, operation, and decommissioning, and for at least three (3) years after closure or until rehabilitation has reached a sustainable state with no further changes.	Throughout the project life	See Figure 6-1	Monthly	High Total Dissolved Solids (TDS), Aluminium (AL), and Manganese (Mn)	Environmental Officer
Water quantity	▪ Streamflow monitoring should be conducted to detect any changes in the flow regime that might be resulting from project-related activities. ▪ Boreholes recommended by the groundwater study to monitor groundwater levels, should monitor fluctuations in baseflow ▪ Real-time streamflow data loggers can be used to capture real-time flows.	Daily flow meter data records should be kept in areas with an automatic monitoring system.	Operational Phase		Daily	Reduced streamflow/ baseflows	Environmental Officer
RSF	▪ Regular infrastructure inspections should be conducted to determine their condition and identify any anomalies and system malfunctions. ▪ Conduct a stability assessment on RSFs - geotechnical data ▪ Inspect the RSFs and monitoring data with an experienced tailings operator ▪ Ensuring adequate construction supervision.	Quarterly	Operational Phase		Quarterly	Infrastructure malfunction	Experienced Tailings Operator
Rainfall data	▪ Real-time rainfall measurements using a tipping bucket rain gauge, if possible; and ▪ Alternatively, a bulk rain gauge can be used to capture the total amount of rainfall for each event.	After a rainfall event	Throughout the project life		Daily	Gaps in the data	Environmental Officer

10 CONCLUSION

The following key findings are highlighted as part of the surface water assessment study:

- Surface Runoff
  - Mzingwenya River is a tributary of the Mhlatuze River and drains into Lake Cubhu (i.e. of the total catchment area of approximately 79 km^2, mining activity will only occupy 9 km^2). Therefore, assuming that the occupied portion of the catchment area is effective, the surface runoff obstructed from contributing to the Mzingwenya River flow will be approximately 11%.
  - Non-perennial tributary of the Mhlatuze River: The mining activity occupies approximately 2 km^2 of the 3 km^2 of the sub-catchment that discharges into the Mhlatuze River, which has a catchment area of approximately 3 836 km^2. Assuming that the occupied portion of the catchment area is effective, the surface runoff obstructed from contributing to the river is approximately 67%. However, given that the tributary is non-perennial and small compared to the overall Mhlatuze catchment (i.e. 0.08%), the impact to the flow regime in the Mhlatuze is expected to be negligible.
  - Ntuze River is a tributary of the Mlalazi River (of the total catchment area of approximately 89 km^2, mining activity will only occupy approximately 4 km^2). Therefore, assuming the occupied portion of the catchment area is effective, the surface runoff obstructed from contributing to the Ntuze River flow will be approximately 4.5%.
  - Ojinjini River is a tributary of the Mlalazi River (of the total catchment area of approximately 3.3 km^2, mining activity will only occupy approximately 1.1 km^2). Therefore, assuming the occupied portion of the catchment area is effective, the surface runoff obstructed from contributing to the Ojinjini River flow will be approximately 33%.
  - Amanzamnyama River is a tributary of the Mlalazi River that flows into the Mlalazi estuary (of the total catchment area of approximately 14.4 km^2, mining activity will occupy approximately 11.2 km^2). Therefore, assuming the occupied portion of the catchment area is effective, the surface runoff obstructed from contributing to the Amanzamnyama River flow will be approximately 78%.

The mining activity will not impact the water quantities, given that large areas of Port Durnford Project Area are currently under commercial forestry and leased by Mondi. This area may already contribute less to the overall catchment runoff, as most of the flow would be used up and captured by the forestry plantation.

- Baseflow

From the baseflow simulation it is evident that the mining activity will not impact the water quantities due to the reduction in baseflow in the catchments; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use. The findings are summarised below:

- KwaGugushe, Msasandla and Ojinjini Rivers (west of the Project Area) show an insignificant reduction in baseflow. The increase in baseflow is more significant due to the wet backfill/sand tailings.
- Baseflow to the Mhlatuze River (north of the Project Area) is limited as the area contributing to the Mhlathuze catchment is insignificant. Baseflow reduces from 2036, and the largest effect is

seen from 2058 to 2061 during the mining of the north block. However, the wet backfill has a counter effect, and from 2061 to 2064, there is a significant increase in baseflow.

- Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu (northeast of the Project Area) is limited. It reduced slightly from 2036 to the end of mining. However, it increases from 2062 to 2064.
- Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary (south of the Project Area) shows an insignificant reduction in baseflow from 2036. The baseflow reduction is significant from 2054 to 2058 and again from 2062 to 2065. An increase in baseflow due to deposition is evident for the following periods:
  - From 2037 to 2052 - due to deposition of sand tailings A1, A2 and A3.
  - From 2056 to 2058 - due to backfill in area 4.
  - From 2066 to 2067 - due to backfill in area 3.
- Water Quality

Baseline water quality shows general compliance with most parameters except for a few elevated levels of some parameters such as Aluminium (Al), Ammonia (NH4 as N) and Iron (Fe), which exceed permissible limits and could be attributed to the natural geology or the current land use. The water quality of the Lower Mlalazi River towards the estuary is characterised by elevated levels of Electric Conductivity (EC) and thus Total Dissolve Solids (TDS) indicating high salinity levels. The latter phenomenon could be attributed to the sea tidal effect and intermixing with riverine flows. Though not apparent due to the lack of supporting data on the table, the impact of effluent discharges from both the Mtunzini Municipal Water Treatment Works and the Mtunzini Aquaculture projects Kob farm as concluded by the DWS Mlalazi estuary reserve determination study ((DWS, 2015), has not been ruled out. The impact of the mining activity on surface water quality will be insignificant, as the dunes have been extensively leached by percolation of rainwater, hence all remaining constituents can be considered to be stable.

- Water Balance

During the wet season, on average 142 000m3/month of raw water is required from Mhlatuze, while during the dry season 170 000m3/month is required. There are imbalances in the water balance, as reflected in the Fairbreeze water balance, which has been carried over to the Port Durnford water balance. The water balance does provide indicative raw water required from Mhlatuze. The water balance must be updated to a dynamic stochastic water balance when more information becomes available on the processing, and the stormwater management becomes available. The model can be applied to size infrastructure to meet regulatory requirements.

- Floodline

The proposed mining activity is outside the 1:100-year floodline for most rivers except for the Mhlatuze River non-perennial tributaries and the Amanzamnyama River. However, in the case of the Amanzamnyama River, the N2 will act as a barrier during the flooding, and the drainage lines of the Mhlatuze River non-perennial tributaries and the Amanzamnyama River have also been modified when establishing the forestry plantation.

- Stormwater Management

Stormwater management has been conceptually designed for the access roads and around the RSF 9 and C, only. A detailed site-wide stormwater management plan is required during the detailed design

phase of the Project in compliance with the General Notice 704 and Regulation 77 of the National Water Act.

- RSF Dam Breach

A failure of RSF 9 will inundate the Ntuze River and its tributaries, the Mlalazi and Bhadi Rivers, the Ojinjini River, and ultimately the Mlalazi estuary. Similarly, the failure of RSF C will inundate Amanzamnyama, the nearby wetlands, and ultimately the Qhubu Lake. Although the risk of failure has a very rare likelihood of occurrence, the consequence of RSF failure is catastrophic and could result in adverse impacts.

10.1 REASONED OPINION WHETHER THE PROJECT SHOULD PROCEED

It is the professional opinion of the Surface Water Specialist that the proposed project should go ahead provided that the recommendations, mitigation, and monitoring measures as set out in this report are adhered to and included in the Environmental Monitoring Plan.

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Appendix A

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Appendix B

WETLAND ASSESSMENT (WSP, 2025)

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Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Wetland Baseline and Impact Assessment

OUR REF. 41106008-REP-00008
MARCH 2025

PUBLIC

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Wetland Baseline and Impact Assessment

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RESULTS OF THE WETLAND OFFSET CALCULATIONS

EXECUTIVE SUMMARY

WSP Group Africa (Pty) Ltd. was commissioned by Tronox KZN Sands (Pty) Ltd. to conduct a wetland baseline and impact assessment as part of the Environmental Authorisation (EA) process to obtain the mining rights to mine heavy mineral sands within the proposed Port Dunford study area. The proposed Port Dunford project site covers an extent of approximately 4682 Ha (taking into account excluded areas) and is situated in the KwaZulu-Natal province, approximately 16km southwest of Richards Bay.

The proposed infrastructure development includes construction of a Primary Wet Plant (PWP), water control dams, Residue Fine Tailings (RSF) facilities, demarcated Sand Tails mounds and topsoil stockpiles. Therefore, a specialist wetland assessment was required to identify the location and extent of wetlands within the study site; determine the functionality and health status of the wetlands and identify the impacts of the proposed activity on the surrounding wetlands.

The wetland delineation and baseline assessment were informed by both desktop and infield investigations. Extensive wetland habitat was found to occur within the Port Dunford project site, including both channelled valley bottom and hillslope seepage wetlands. Within areas of extended saturation within both wetland types, critically endangered swamp forest was identified. Wetland habitat was found to vary widely in terms of its current condition, ranging from largely natural to seriously modified. Land uses that have significantly influenced current wetland condition include sugarcane cultivation, *Eucalyptus* plantation forestry and urban developments. The wetlands provide a range of important ecosystem services including streamflow regulation, flood attenuation and biodiversity support. Given the presence of the swamp forest habitat and species of conservation concern (SCC) that it is likely to support, such as the Pickersgill's reed frog, the wetland habitats' role in biodiversity maintenance is elevated. The ecological importance and sensitivity of wetlands in the project area ranges from moderate to very high.

The proposed Port Dunford Mine facilities will have a series of potential impacts that need to be managed, particularly during the life of the mine. These mostly relate to the physical disturbance of the footprint of the mining operations and associated activities, such as *inter* alia vegetation removal, vehicle movements, excavations for pits, creation of facilities on site and earth moving activities. These activities are likely to have a negative impact on wetland habitat both directly within the footprint of the proposed development and downstream within affected catchments. Although impacts will be most severe and quantifiable within the Port Dunford boundary, certain impacts may translate to wetland habitat beyond the site boundary. Anticipated direct and indirect impacts include loss of wetland habitat (approximately 124 hectares) and wetland habitat degradation as a consequence of hydrological and geomorphological changes, water quality deterioration, and vegetation compositional changes. The impacts associated with the construction, operation, decommissioning and closure phases of the proposed project were rated predominantly moderate prior to implementation of mitigative measures. However, with the implementation of the recommended mitigative measures, the impacts were mostly reduced to moderate to low significance. The exception is the anticipated loss of wetland habitat within the mine infrastructure footprints. The loss of wetland habitat will occur even with implementation of the mitigation measures recommended in this report and represents a residual, negative wetland impact. Therefore,

application of the mitigation hierarchy indicates that significant residual, negative impact, such as the unavoidable loss of wetland habitat, requires an offset. It is therefore recommended that some form of wetland offset, or compensatory mitigation strategy be developed to address the residual wetland impact - the permanent loss of wetland habitat. The wetland offset developed must be aligned with the National Biodiversity Offset Guideline (GN3569, 2023, Issued under Stion 24J of the National Environmental Management Act), and the SANBI wetland offset guidelines (SANBI & DWS, 2016).

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1. INTRODUCTION

WSP Group Africa (Pty) Ltd. was commissioned by Tronox KZN Sands (Pty) Ltd. (herein referred to as Tronox) to conduct a wetland impact assessment as part of the Environmental Authorisation (EA) process to obtain the mining rights to mine heavy mineral sands within the proposed Port Dunford study area. The proposed Port Dunford project site is situated in the KwaZulu-Natal province, approximately 16km southwest of Richards Bay.

Tronox currently operates the Fairbreeze mine where heavy mineral sands are mined south-west of Mtunzini in the greater Richards Bay area. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter (collectively known as the Central Processing Complex (CPC)) in the Empangeni area (see Figure 1-1). Tronox's previous mining operation, Hillendale is currently in the mine closure phase.

Tronox KZN Sands (Pty) Ltd (Tronox) is applying for a mining right for the following tenements:

- A renewed prospecting right (KZN 30/5/1/1/2/10708 PR) covering the following farms: Remainder of the farm Richards 16802, Remainder of the farm Birkett 16832 and Ruth 16833 (known as the Port Durnford lease area),
- Waterloo prospecting right (DMRE Ref: KZN30/5/1/1/2/296 PR) located on the following farms: Portion 1,2 and Rem of Lot 131 uMlalazi 14098; Rem of Lot 103 uMlalazi 13880 and Rem of Lot 104 uMlalazi 13853, and
- Penarrow located on the following farms: Remainder of Lot 132 uMlalazi 13602 and Portion 1 of Lot 132 uMlalazi 13602.

1.1. PROJECT LOCATION AND EXTENT

The study area is situated in the uMhlathuze Local Municipality that falls under the King Cetshwayo District Municipality. It is located approximately 16km south-west of Richards Bay and is adjacent to the following settlements/towns at different points along the boundary:

- Mtunzini- 200m South-West
- Port Dunford – 60m South-South-East
- Esikhawini – 200m South-East
- Gobandlovu – 200m North-East

The N2 highway as well as the R102 traverse the length of the orebody (Figure 1-1). The R102 being located to the northwest and the N2 running through the centre. There is also a railway line just south of the N2 that also traverses the mining right area. The proposed mining right area is approximately 4682 ha (taking into account excluded areas), however only 996 ha are earmarked for development for the initial phase of mining.

The project area includes the southern areas of Waterloo (KZN30/5/1/1/2/296 PR), as well as the Penarrow area (KZN30/5/1/1/2/279 PR) that has a lapsed prospecting right.

Mondi plc is currently leasing the majority of properties under the prospecting rights for commercial forestry purposes.

Figure 1-1 - Location of the Port Durnford Mining Rights Application area

1.2. PURPOSE OF THIS REPORT

All forms of development impact on the natural environment to some extent. In general, the rapid rate of urbanisation, for instance, has allowed for the progressive degradation and elimination of wetland ecosystems due to direct and indirect human induced activities. Therefore, in order to protect these pristine natural resources, responsibility falls to the relevant government authorities which enforce national legislation (e.g. NWA and NEMA). Such legislation generally calls for landowners to ensure the protection, utilisation, development, conservation and if necessary, the rehabilitation of such valuable ecosystems.

Tronox is currently planning on applying for a consolidated Mining Right for all of the above listed areas and seeking environmental authorisation (EA) to support this. A full Scoping and Environmental Impact Reporting (S&EIR) Process is required in support of the application for EA for the project. WSP has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIR (S&EIR) Process.

WSP was requested to provide a specialist wetland assessment to identify the location of extent of potential wetlands within the consolidated Phase 1 & 2 Tronox Mining Right in Port Durnford. The wetland assessment will also determine the functionality of the systems, calculate the health status of "at risk" wetlands and identify the impacts of the proposed activity on the surrounding wetlands. This report, after taking into consideration the findings and recommendation provided by the specialist

herein, should inform and guide the EAP and regulatory authorities, enabling informed decision making with regards to the proposed activity.

1.3. SCOPE OF WORKS

The aim of this wetland impact assessment was to identify, delineate and assess the wetland environments within the proposed study site and a 500m buffer thereof (to give effect to the regulated area of a wetland as per GN4167). The details pertaining to the scope of work include the following:

Wetland Delineation, incorporating the following:

- To identify and delineate potential wetland environments within the study site and 500m buffer based on aerial photography and available wetland coverages via a desktop survey.
- To conduct a comprehensive field survey to identify and delineate wetlands using the Department of Water Affairs & Forestry guideline manual (DWAF, 2005).
- To classify and describe the wetland areas affected by the proposed development using the National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al., 2013).
- To undertake a rapid desktop aquatic screening and risk assessment to determine which of the desktop delineated wetlands are likely to be affected by the proposed development.
- For wetlands assessed to be 'at risk' of the proposed development:
    - To establish the present Ecological State (PES) of the affected wetlands using a Level 1 WET-Health assessment tool (Macfarlane et al., 2020).
    - To assess the importance of the affected wetland areas in providing ecosystem goods and services using a Level 2 WET-EcoServices assessment tool (Kotze et al., 2020).
    - To assess the Ecological Importance and Sensitivity (EIS) of the affected wetland areas (Kleynhans, 1999).
- To identify and describe the potential aquatic ecological impacts associated with the proposed development, using the risk assessment tool (DWS, 2015 updated 2024).
- To provide wetland buffer zone recommendations based on best-practice guidelines and available buffer zone guidelines (Macfarlane & Bredin, 2017).
- To determine the significance of impacts identified for the proposed project (DEAT, 2014) and.
- To provide suitable recommendation and mitigation measures for the wetland environments to maintain and ideally improve the wetland ecological health status and provision of eco-services.

2. PROJECT DESCRIPTION

2.1. PROJECT BACKGROUND

This project was conceptually planned from 2007 and formally scheduled in 2015 when Tronox commissioned Hatch (Pty) Ltd (Hatch) to complete a concept study for the development of a mining operation at Port Durnford. Following the concept study, Tronox commissioned Hatch to conduct a Pre-Feasibility Study1 (PFS) on the Port Durnford site which was concluded in November 2020. The concept study assessed multiple mining options and rates. The technical and financial evaluations determined that the Port Durnford mining operation should be a stand-alone operation, mined in two phases (Phase 1 and Phase 2).

- Phase 1 would last 10 years from 2025-2035 at a low production rate of 70,400 tons per annum with operation only occurring on five working days in the month, whilst,
- Phase 2 lasts 33 years from 2036-2069 at a design production rate of 3000 tonnes per hour, 24 hours per day, 365 days a year.

The PFS study project description sought to maximise the mining area. The PFS informed the original Environmental and Social Impact Assessment (ESIA) project description, detailed in the original Draft Scoping Report, circulated in the public domain in November 2022.

Baseline specialist studies conducted on the site after the previous scoping period, identified additional sensitive areas overlapping with aspects of the project, as originally proposed.

Tronox has revised both the mine plan and mining schedule to avoid these identified highly sensitive areas, where possible. Since changing the mine plan, it was necessary to rerun the materials balance which informs the volumes of coarse and fine sand tailings (the new amounts that require to be handled and disposed of). Consequently, changes were needed to the Residue Storage Facility (RSF) and sand tails concept designs and location studies. The timeframes for this reconfiguration and specialist assessment thereof, could not be accommodated in the original stipulated ESIA timeframes.

For this reason, the scoping phase and ESIA Process are being re-run. This is a new ESIR Process in support of a revised mining rights application by Tronox lodged in May 2024 and subsequently formally accepted by the DMRE on the 19th of July 2024 under DMRE Ref: KZN 30/5/1/2/2/10133MR. The project description presented in this report is the culmination of previous assessment, planning and specialist baseline findings.

The scope of the proposed Port Durnford mining project is described in this section. No changes are anticipated to be needed at Fairbreeze (which receives Phase 1 run-of-mine (ROM)) or at the Tronox Mineral Separation Plant (MSP) located at the Central Processing Complex (CPC) in Empangeni (which receives the Phase 2 concentrate).

2.2. PROPOSED MINING INFRASTRUCTURE

The proposed Tronox KZN sands, Port Dunford Mining development area covers and extent of approximately 4787Ha.

The mine plan consists of the following proposed infrastructure:

- **PWP: Primary Wet Plant**
  - This facility will be constructed on site to separate the fine and coarse sediment from the mined slurry mixture.
- **RSF Facilities: Residue Fine Tailings**
  - These facilities will contain the “residual” fine sediment after extraction of heavy minerals have taken place at the Empangeni Smelter Complex (mineral separation plant off-site).
  - The RSF facilities will not be lined.
  - It should be noted that RSF C will first be used as an open mining pit (compartmentalised). Once mining has concluded the area will be converted into a RSF and will eventually be backfilled with Sand Tailings from the PWP and the excess “residual fine sediment”

- **Water Control Dams**
  - These dams will be used to store/manage water required for the hydraulic mining process.
  - These facilities will also be used as a storing point for excess water collected after separation process at the PWP.
- **Sand Tails: Sand Tailing**
  - These areas are designated to store the coarse sediment that was processed at the PWP.
  - Given, the approximately 40% bulking factor when compared with previously stripped/processed material, these sites will accumulate the additional sand tailings after the walls of the RSF have been constructed using cyclone technology.
- **Topsoil/ Overburden**
  - These selected areas will contain the topsoil that has been extracted during the creation of the open pit mines.
  - The soil will be stored separately as it will be used later for rehabilitation processes.
- **LOM: Life of Mine**
  - This is the current planned/proposed mining areas and infrastructure that will be adapted/refined in the future.

2.3. PHASE 1 OF THE PROPOSED MINE

The mine plan for Phase 1 has not changed between the release of the initial Scoping Report in 2022/2023 and the second Scoping Report in 2024.

2.3.1. PHASE 1 LOCATION

The Phase 1 mining operations will be situated on the Remainder of Richards 16802. This land is currently under commercial forestry, leased by Mondi, owned by the Phalani Community Trust. The proposed location for the Phase 1 operation and infrastructure is indicated in Figure 2-1, while a 3D visualisation of the site is provided in Figure 2-2

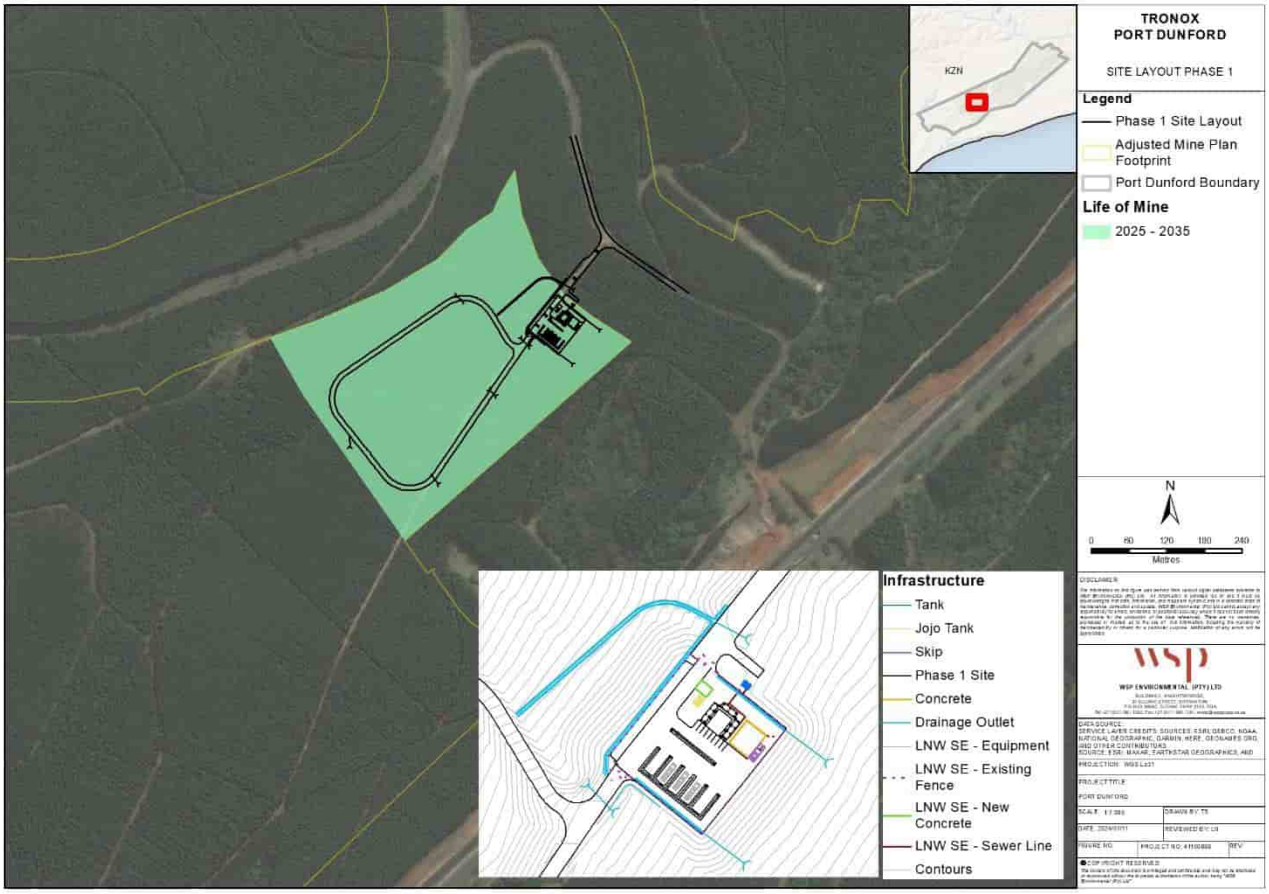


Figure 2-1 - Proposed Phase 1 infrastructure development for the Port Dunford study area

Figure 2-2 - 3D visualisation of the Phase 1 Layout

2.3.2. PHASE 1 MINE PLAN AND PROCESS

Phase 1 will have a mine pit footprint of 4.8 ha and a surface infrastructure footprint of 1.9 ha, will be located on Portion 1 of Richard 16802, and will span over a ten (10) year period, between 2025-2035. The mining will operate at a rate of 100 tph, 70 400t pa. Active mining will take place five (5) days a week per month, for 12 hours a day.

The run-of-mine (ROM) material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. ROM will be transported to Fairbreeze mine by truck on public roads (the R102 and N2) for further processing. It is expected that 4 x 30t Trucks will be used to transport the mined material from Port Durnford to Fairbreeze Mine. It is anticipated that 9 truck cycles will be used per day for the 5 days each month that the site is being actively mined. See Section 1.3.3.5 for further description of the transport routes and alternatives considered for Phase 1.

The mined-out ore bodies at Fairbreeze mine will be used for pit infill from the Port Durnford Phase 1 operation for the first 11 years of mining. The hydraulic mining process at the Fairbreeze mine will continue as per current practice at Fairbreeze, to process the stockpiled material. Hydraulically reclaimed ROM slurry will be pumped to the existing Fairbreeze Primary Wet Plant (PWP) for processing.

The processed material will then be trucked to the existing Mineral Separation Plant (MSP) located at the Central Processing Complex (CPC) in Empangeni as part of the Fairbreeze product. Figure 2-3 illustrates the process flow during Phase 1 operations.

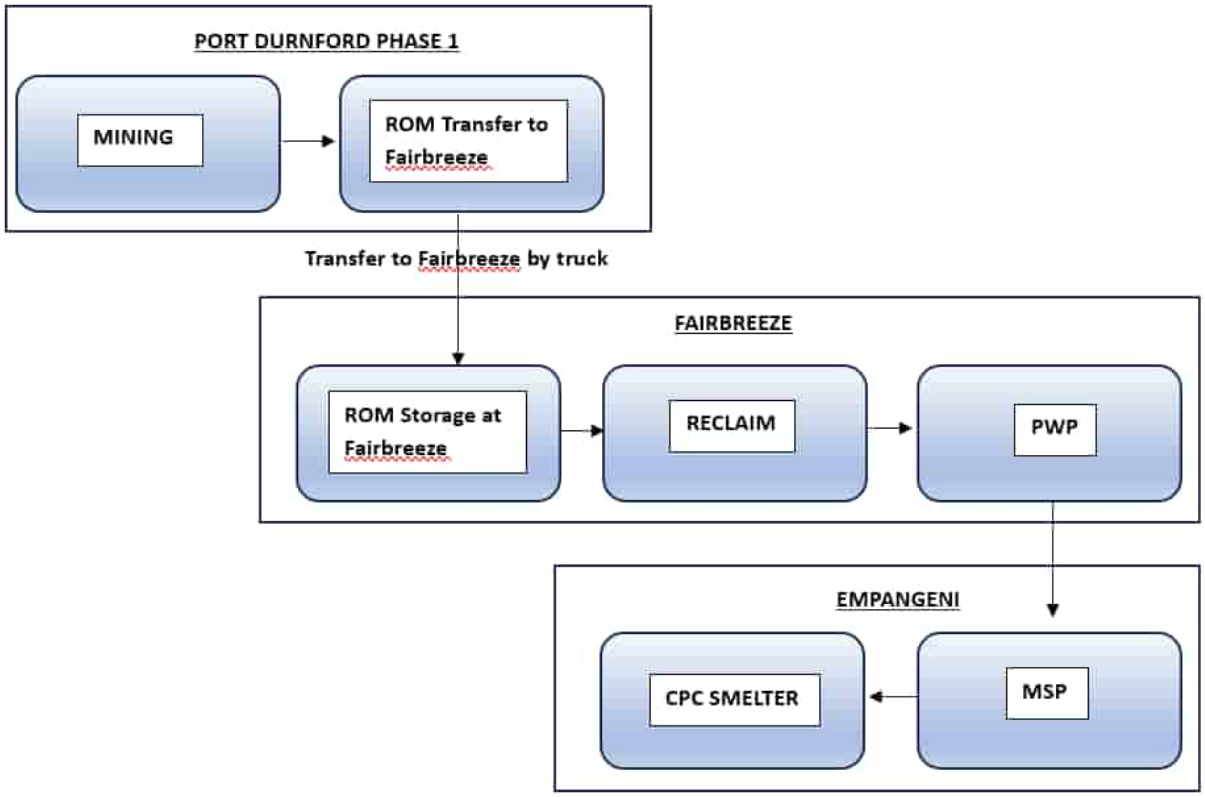


Figure 2-3: Phase 1 Process flow diagram

2.3.3. PHASE 1 INFRASTRUCTURE

2.3.3.1. Site Camp and Laydown Yard Infrastructure

With reference to Figure 2-1, the infrastructure associated with the Phase 1 laydown yard will include the following aspects:

- Conservancy Septic tank system – 2 x 6000l JoJo tanks placed under ground.
- Mining equipment parking area (Gravel with 2 x layers & in situ).
- Workshop laydown area (Concrete stand with 2 x steel containers).
- Water storage tanks (2 x 10 kL tanks).
- Internal water reticulation (Reticulation to offices & ablutions).
- Offices and ablution and septic tank (2 x 12 m units & 1 x 9 m unit).
- Internal electrical reticulation (Estimated ADMD to be 14.7 kW).
- External lighting.
- LDV parking area (1 x G6 layer with RIP & compacted base).
- Guard house (Concrete stand with 1 x steel container).
- Security fence (2.1 m high fence & 1.2m parameter fence).
- A gravel access road (200 m access road) to connect the laydown yard to the District Road which connects to the R102.
- A general and hazardous waste storage area; and
- Fuel and lubricant storage: Fuel tanks will be supported on a concrete surface bed with edge thickenings. A concrete bund wall will be constructed surrounding the fuel tanks. It is anticipated

that a 23 m^3 storage tank will be provided and it is estimated that 153 422 litres will be utilised per annum.

This laydown yard will have no hard stand stockpile area. The mined material will be mined, loaded and transported directly to Fairbreeze.

2.3.3.2. Water Supply

The primary water use on site will be dust suppression. It is anticipated that 4 800 m^3 per annum will be required for this phase of the project.

With the options to connect to the nearest Municipal Supply point, install a borehole or utilise water carts to supply the Phase 1 site. Tronox have opted to utilise 10-18 kl water trucks to cart 6 kl of municipal water to the site, to be stored in 2 x10kl JoJo tanks. The JoJo tanks will be elevated on a steel structure. The municipal water supply points considered are:

- Potable water sourced from the PD Clinic: 28°54'57.15"S 31°49'42.06"E – 2.3km from the Phase 1 laydown yard.
- Alton bulk water point: 28°44'45.38"S 32° 1'29.68"E – 34km from Phase 1 laydown yard; and
- Empangeni Bulk water Point: 28°44'58.29"S 31°53'6.88"E – 23km from Phase 1 laydown yard.

2.3.3.3. Electrical Supply

Power will be required to service the administration offices. The average monthly consumption required for the laydown yard is expected to be 2 741kWh. Tronox plan to utilise and Eskom Overhead Power line connection with an inverter and batteries for backup power supply.

A miniature substation (MSS) will be required for stepping down the Eskom 22kV to 400V for the mine offices distribution.

2.3.3.4. Employment

It is currently estimated that there will be 25 employment opportunities created through the Phase 1 mining operation.

2.3.3.5. Haulage Routes

Three possible transport routes were considered for the Phase 1 operation for transporting mined material between the mining area and Fairbreeze Mine. All three routes follow the same route from the Phase 1 site to the Hely Hutchinson Road intersection. Consequently, this comment section is described for Route 1 below. For the subsequent two route options the alternative is only described from this interchange onwards.

Route 1 (illustrated in red in Figure 2-4 below), is the preferred route. This route makes use of existing public roads. From the Port Durnford mining area and laydown yard the trucks would take the R102 road, westbound for 10km to the Hely Hutchinson Road intersection. Turning left at this intersection and then right (passing through the Mtunzini Tollgate) onto the N2 south bound for 6 km until the #290 Bridge #4 Fairbreeze Mine off-ramp. The Phase 1 ROM material will be offloaded at Fairbreeze at a site approximately 400 m from the offramp where Fairbreeze mining is taking place. The total distance travelled would be 18.7km, at an average estimated speed of 53km/hr. The average anticipated trip time would be 21 minutes in one direction. Route 1 is the preferred alternative for travel time, road maintenance and accounting for risk.

Route 2 (illustrated in yellow in Figure 2-4) follows the common route to the Hely Hutchinson interchange. The route to then also turns towards Mtunzini but rather than accessing the N2, the route would by-pass the N2 south bound turnoff and continue towards Mtunzini. At the approach to the town the route would turn to the right onto existing dirt roads (which would need upgrading) to run along the edge of the town to connect with existing Fairbreeze mine roads. Approximately 1.8km of gravel road would need to be upgraded between Hely Hutchinson Road and the Fairbreeze mining operation. The total distance of this route is 20.9km. An average of speed of 43km/hr is estimated and the average trip time is estimated to be 23 minutes, in each direction.

Route 3 (illustrated in blue in Figure 2-4) follows the common route to the Hely Hutchinson interchange. However, instead of turning towards Mtunzini at that point the route continues along the R103 for 12.5km before turning to the left onto privately owned farm roads for approximately 5 km. The N2 would be crossed by means of an existing single lane overhead bridge to connect with existing Fairbreeze haul roads east of the N2 highway. From here the trucks would travel a further 2.3km to the identified or offloading area. This route is 20.6km long, would have an average estimated speed of 43km/hr, and have an average trip time of 23 minutes in one direction.

Note: This transport route will be used for the first 10 years of mining during Phase 1. Once Phase 2 commences, all ROM will be processed at the Port Durnford PWP which will have been constructed by that time.

Figure 2-4 - Proposed Haulage Routes from Port Durnford to Fairbreeze.

2.4. PHASE 2 OF THE PROPOSED MINE

2.4.1. LOCATION AND OVERVIEW

The infrastructure for Phase 2 will be constructed during the Phase 1 mining period (2025-2036), however, mining and processing for Phase 2 will only commence in 2036.

The proposed Phase 2 operation comprises opencast mining, on-site processing of ROM material in a Primary Wet Plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox mineral separation plant (MSP) located in Empangeni within the Tronox central processing complex (CPC).

At the MSP the concentrate is further beneficiated to yield the target minerals. Coarse sand tailings that are not separated out at the PWP and are thus transported to the MSP as part of the concentrate, but which do not yield product, are returned to the mine and are reintroduced into the coarse sand tailings backfill stream.

The Port Durnford mining footprint is 1 152 hectares which will be mined over a 33-year period, between 2036-2069. The planned rate of mining will be 3,000 tph, 24 hours a day, 365 days a year.

The revised Phase 2 layout is presented in Figure 2-5. Key changes in the layout of flag below and discussed in more detail as part of the project description in the sections which follow. In summary:

- The mine plan has been revised to avoid sensitive habitats to the extent possible. No mining takes place south of the railway line or N2 in the revised mine plan. This has shortened the life of mine by approximately five years,
- Similarly, the sand tailings deposition areas have been moved from areas south of the railway line that are largely comprised of wetlands. Additional sand tailings areas have been identified and are indicated. Some of these (A1, A2, A3 complex and 8B) are located on unmined land. Sand dumps 3, 4 and 5 will largely be developed over the backfilled pit areas although some extension beyond the pit limit does occur for sand dump 5,
- The return water dam for RSF 9 has been moved to the southern side of the dam to minimise impact to a natural forest area north of RSF 9,
- The PWP position has moved slightly to the west to accommodate siting of a return water dam for RSF C,
- RSF C has been expanded through inclusion of a fourth compartment on its eastern side, labelled P4 below, and
- The locations of enabling and support infrastructure are better defined including on-site roads and the positions of topsoil stockpiles

Figure 2-5 - Proposed Phase 2 infrastructure development for the Port Dunford study area

2.4.2. THE PHASE 2 MINING OPERATION

2.4.2.1. Mine plan

The planned mining schedule (mine block plan including time sequencing) is presented below Figure 2-6. The mining schedule is also presented (Figure 2-7) with mining blocks grouped into 5-year units for ease of interpretation of mine progress through time. On this plan, the position of the fine Residue Storage Facilities (RSF's in orange outline) and the sand dumps (in beige outline) are also indicated together with the position of the PWP (orange rectangle).

Mining commences in Phase 2 in 2036 at the site of the Phase 1 pit to complete mining that block. Thereafter, the active mining window moves to a position immediately east to the PWP and sequentially progresses in an easterly direction until the eastern extent of the mine is reached in 2061.

In 2051, mining is also initiated in the western extent of the proposed mining footprint and progresses in an easterly direction back towards the PWP, with the final block which lies immediately north of the PWP, being mined in 2069.

Figure 2-6 - Proposed Phase 2 Life of Mine (LOM) Plan

Figure 2-7 - Proposed Phase 2 mining block plan showing 5-year mining windows

From Figure 2-7, it can be seen that RSF 9 in the west of the site will be developed on unmined ground while RSF C, in the east of the site, will be developed sequentially on the pit floor as each corresponding five-year mining block has been completed space becomes available. During these periods the washed sand tailings cannot be backfilled into the pit and consequently must at times be deposited on surface. All pit areas will be backfilled with either coarse sand tailings or fine residue (within the RSF). The sand dump positions (beige outline) reflect where a sand dump will be developed above the current ground surface and will remain as a permanent aboveground feature on the post mining landscape. Similarly, RSF Site C will also end at a height above the current ground surface (see section on post mining topography).

2.4.2.2. Sequence of mining activities

The basic sequence of mining activities is as follows:

- Before mining starts a minimum of 0.3 m of topsoil will be stripped. This material will preferably be placed directly onto an area available for rehabilitation. If that is not possible, it will be placed on a stockpile for later use (see Section 2.4.8 on topsoil management),
- Then, the *in situ* sands are mined. In the Port Durnford mine, the sands are mineralised from surface to the base of the economic mining limit within the pit. Consequently, there is mineralisation even in the topsoil that is set aside (see Section 2.4.2.3 which describes the mining method).
- After a pit has reached the economic limit for mining it becomes available to be backfilled. Backfill material comprises the washed course tailings.
- Once the pit is backfilled to the design height, it becomes available for rehabilitation and topsoil is replaced, and
- The topsoiled areas are revegetated following this approach described in Section 2.4.8.

2.4.2.3. Mining method

The proposed Port Durnford heavy mineral sands mine is in opencast sand mine, not dissimilar to the current Tronox Fairbreeze operation. The mining method will however differ. At Port Durnford mobile skid mounted dozer trap mining units (DTMUs) will be used within the active mining areas. The mining process entails dozing the sand material down to the DTMU's where it is combined with water and pumped to the PWP. Each DTMU is anticipated to be fed by two D11 dozers and a CAT390 excavator. A DTMU is equipped with a vibrating screen to separate oversize material and accompanied by a primary pump. Each DTMU is connected to a raw water feed pipeline, a ROM slurry delivery pipeline, and a power connection.

A typical DTMU is shown in Figure 2-8 for visual reference.

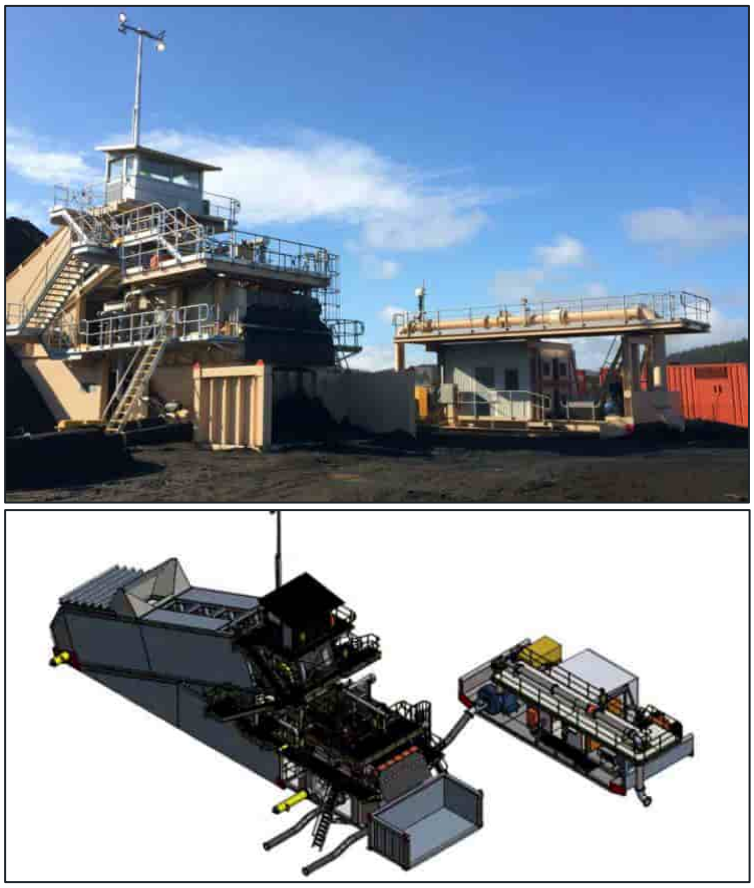


Figure 2-8: A typical dozer trap mining unit (DTMU) showing the trap on the LHS into which material is dozed and an associated pump unit on the RHS

2.4.3. PHASE 2 MINERAL PROCESSING

The ROM material is processed at the primary wet plant (PWP) to remove fine material from the plant feed and separate the non-mineralised sand fraction to produce a heavy mineral concentrate. The ROM feed at Port Durnford is typically comprised of 76% coarse sand tails, and 20% sand tail fines with the remaining 4% being the heavy mineral concentrate (HMC) which is then transported off site to the Tronox mineral separation plant (MSP) in Empangeni.

The primary processing entails:

- Mined material is deslimed and placed through a spiral circuit to separate out the coarse sand tailings (+45 µm),
- The coarse sand tailings will be used for backfilling and for the establishment of the walls of the RSF facilities,
- The spiral concentrate is put through a magnetic separation circuit to remove the reject magnetite, which is fed back into the coarse tailings circuit,
- The non-magnetic material forms the Heavy Metal Concentrate (HMC), and
- The fine tailings (-45 µm) are collected from the desliming process, a thickener is added and process water retrieved before disposal on the residue storage facilities.

The PWP will be designed to process 22,866,000 t/annum ROM at a nominal rate of 3,000 t/h. The process will produce the following output streams:

The PWP layout is indicated in Figure 2-9 (Hatch 2020) and the process flow for Phase 2 activities is presented in Figure 2-10 (Tronox 2022). The PWP layout includes:

- ROM feed preparation and fines removal area.
- Gravity and magnetic separation areas.
- Fine tails dewatering, treatment and pumping area.
- 33kV sub-station and power factor correction (PFC) Yards and Eskom Yard.
- Raw and process water storage and distribution area: Raw water will be stored in a single 10,000 m^3 raw water dam. Process water will be stored in two 7,500 m^3 dams connected by a common overflow sump.
- Compressed air plant: The PWP will be serviced by a single compressed air facility comprising of two compressors, two air receivers and two air dryers.
- Potable water treatment plant: A standalone packaged potable water plant capable of supplying sufficient water for the total estimated personnel compliment.
- Sewage treatment plant: a plant will be developed to accommodate the onsite personnel. Processed effluent from this treatment plant will be pumped to the process water dam.
- Workshop and stores.
- HMC dewatering, stockpiling and reclaim area.
- MSP tails handling where non-mineralised sand tails returning from the MSP are received to be reincorporated into the course tailings backfill stream.
- Gypsum plant.
- Mine Complex including administration offices with parking, control room, change house, mess, security office, laboratory and sample room; and
- A fit for purpose and legally compliant fire water pumping station and distribution system at the PWP to be fed directly from the raw water dam.

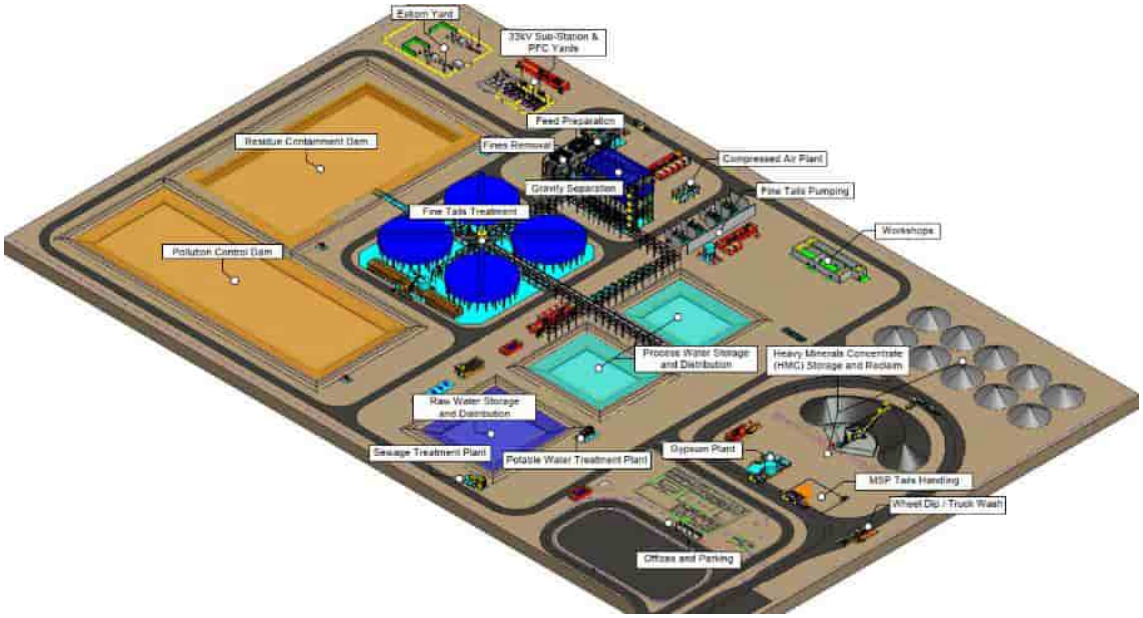


Figure 2-9: Proposed Phase 2 PWP Layout

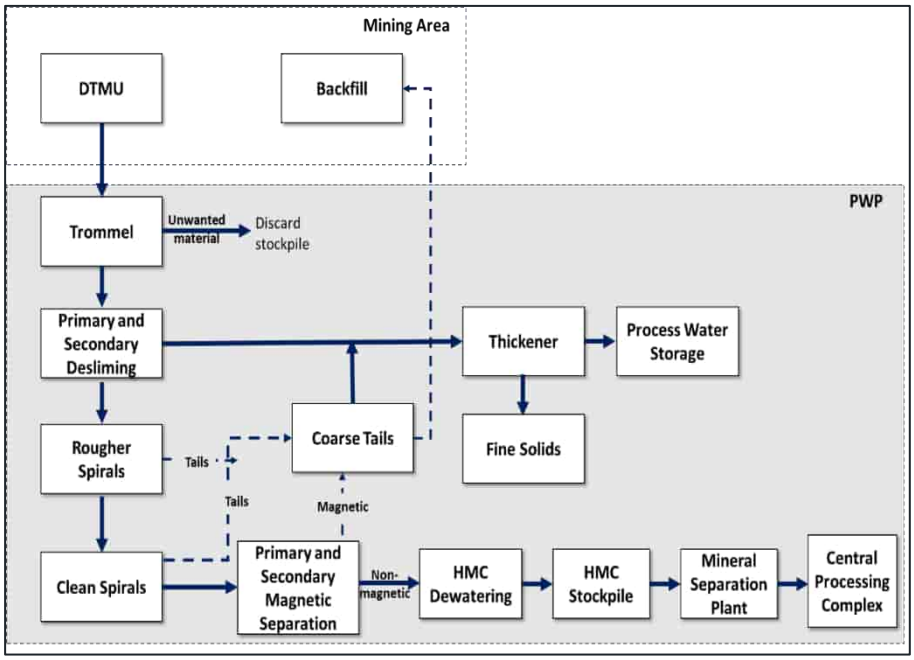


Figure 2-10: Proposed Phase 2 Summary Process Block Diagram

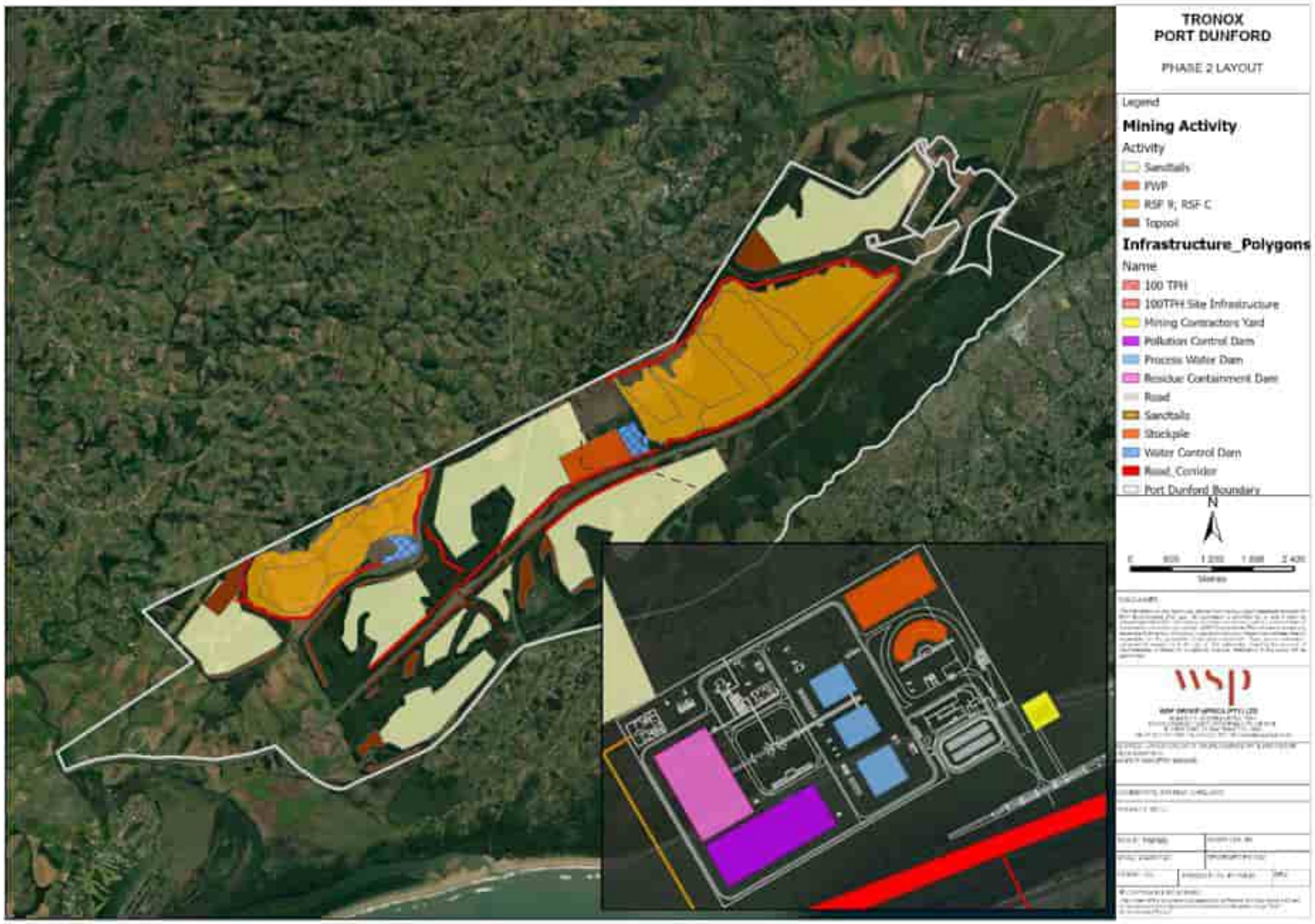


Figure 2-11 - PWP location and inset detail of the PWP site

2.4.4. SUPPORTING INFRASTRUCTURE

2.4.4.1. Water Supply

Raw water will be supplied to Port Durnford from the existing uMhlathuze bulk water supply station directly to the PWP raw water dam via a take-off from the main pipeline currently supplying water to Fairbreeze.

2.4.4.2. Power Supply

The power supply to the site will be from the adjacent Eskom grid via two 88 KV incoming overhead lines to the Port Durnford 33kV substation passing through two 88/32kv stepdown transformers. From the substation power will be distributed to points within the site where it is needed via pre-existing local powerlines.

2.4.5. EMPLOYMENT

The Phase 2 mining operation at Port Durnford will be of similar scale to the current Fairbreeze operation (with 322 employees) and largely act as a replacement reserve as production tails off at Fairbreeze. Consequently, there will be few new job opportunities created however the Port Durnford operation provides opportunity for transition of the Fairbreeze workforce to the new operation.

2.4.5.1. Internal Haulage routes

Twenty-four kilometres (24km) of haulage routes have been conceptually designed within the Mining Boundary. These haulage routes have been given a 40m wide road servitude. They cater for haulage within the mining areas and pipeline service infrastructure. Where possible, existing haulage routes will be used and upgraded to accommodate the larger road servitudes. Where the haulage routes cross water courses, crossing structures will be designed and built across the water course.

2.4.6. WASTE STREAMS

Three “waste streams” are produced from the proposed mining operation, coarse sand tails, fine residue and gypsum filter cake. The following tails products are received from the CPC (Empangeni) for disposal with the various tails products at the PWP at Port Durnford:

- MSP coarse tails are received by tip truck from the MSP in Empangeni. These are tipped directly into a slurry hopper where it is slurried before pumping directly into the rougher sand tails tank for disposal with the sand tails at the PWP at Port Durnford. It is expected that total MSP tails received for disposal will be between 260 and 330 kt/annum (15.6 -18.5 million tonnes per annum. Approximately 678 Mt of sand tails will be deposited during the planned LOM. Large sand tail stockpiles will be utilised for sand tails disposal from 2036 within the Port Durnford mining boundary.
- Gypsum filter cake from the MSP in Empangeni is received via truck from the CPC. The gypsum cake is fed into a materials handling facility for re-slurrying before being fed to the thickener underflow tank for disposal together with the fines to the RSF. It is estimated that between 4,800 and 9,600 t/annum of gypsum will be disposed of into the RSF feed stream each year.

2.4.7. COARSE SAND TAILS DISPOSAL

2.4.7.1. Material Balance

It is anticipated that the Port Durnford mining operation will have a sand tails material balance of approximately 678 Mt over the full LOM; thus between 15.6-18.5 million tons of sand per annum requiring handling and management. All 678 Mt of coarse sand tails over a planned 34-year mining period has been accounted for in the current mine plan.

Approximately 63Mt of coarse sand tailings will be used for RSF dam wall construction and the remaining 615.2 Mt will be used for pit backfill, for RSF capping or will be permanently deposited onto sand dumps.

Motivated by the presence of sensitive wetland and vegetation, the original sand tails location south of the N2 were largely removed from the mining plan. Tronox assessed different sand tails disposal alternatives and propose the following sand tails disposal for the Port Durnford mining operation:

- For the first 7 years of mining in Phase 2 (2036-2047), while opening and mining the pit area for the first compartment of RSF Site C, coarse sand tails (57Mt) will be used in containment wall construction at RSF 9 or deposited outside of the mining pit footprint (sand dump sites A1, A2, and A3 south of the N2) or later used in RSF C compartment 1 wall construction.
- For 5 years (1948-1953) Backfill Area 8 will be used for the deposition of 89Mt of sand tails.
- In years 2049-2051, approximately 21Mt of sand tails will be used in further wall construction for RSF Site C Phase 3.
- In years 2053 to 2059, 117Mt of sand tails will be deposited in backfill Area 4; and
- In years 2064, 2.7Mt of sand tails will be stockpiled in backfill area 3.

Table 2-1 presents the proposed sand tails deposition schedule over the LOM. In this schedule the identified sand deposition areas have been called sand “backfill” areas. These are not necessarily pit backfill areas but rather sites for permanent sand placement which will remain in the post mining landscape.

Table 2-1 - Sand Tails Deposition Schedule (Tronox, 2024)

Sand tails	Capacity (Mt)	2036-2038	2039-2047	2045-2046	2047-2055	2054-2064	Post 2064
Backfill A1, A2, A3	150			-	-	-	
RSF Site 9	18			-	-	-	
RSF Site C (Phase 1)	18						
RSF Site C (Phase 2)	21						
Backfill 8	89						
RSF Site C (Phase 3)	21						
Backfill 4	117						
RF Site C (Phase 4)	4						
Backfill 5	96						
Backfill 3 (post 2064)	133	-		-	-	-	

The sand tails material will be transported to the sand tails stockpiles through feed pipelines which will run alongside roads on site. Cyclones will help deposit the sand tails on the top of each stockpile area, and a return water pipeline will recycle the water back to the PWP. The existing road infrastructure will be utilized for the pipeline routing as far as possible. A topsoil berm will surround each sand tail dump to contain the sand tails and storm water runoff.

The following information will apply to the sand tails deposition strategy:

- The sand tails stockpiles have been designed with a 1:3 vertical height. Each stockpile will have a 100 m buffer from the stockpile to the nearest public infrastructure (roads, railways and residential areas) and a 30 m buffer to the nearest environmental sensitive area. A key recommendation of the EIA has been that slopes do not exceed 1:5 vertical height adjacent to wetlands, which has been accepted by the client and will carry to the detailed design during final feasibility.
- Sand tailings stockpiles will vary in height from approximately 25 to 28 above mean natural ground surface.
- Capping the RSF facilities with coarse sand will be subject to RSF stability and surface bearing capacity, which will be determined during detailed design and subsequent operational monitoring.
- The mined-out pits volumes are included in the available airspace calculation for backfill areas 3,4, and 5. In these areas, sand deposition will also occur above the original ground surface within the identified areas indicated below; and
- Utilising co-disposal of fines and coarse sand mix will be explored with this operation. There are reports of positive results with in-pit mixing with the aid of re-flocculation in deposition piping. This could result in better consolidation and water recovery resulting in higher densities of the deposited residue and overall space saving.

A total of 396 ha have been identified for coarse sand tails disposal within the Port Durnford Boundary, 136 ha within pit disposal, and 259 ha outside the mined-out areas as indicated on the Phase 2 layout (Figure 2-5).

2.4.8. TOPSOIL MANAGEMENT

For all areas that will be used for mining and mine infrastructure at Port Durnford, 0.3 m of topsoil within the “project footprint” will be removed and kept aside for rehabilitation. This standard practice is applicable to the RSF Site 9, the mining footprint, sand tails dump areas and the PWP plant site. Wherever possible within the mining areas topsoil will be stripped and placed directly on areas available for rehabilitation. When space has been depleted in the designated 44 ha of topsoil stockpile areas, topsoil will be stockpiled and used as stormwater runoff berms around the sand tail deposition areas.

Prior to mining or stockpiling, the top 0.3 m of soil will be stripped and stockpiled in designated topsoil stockpile sites within the Port Durnford mining right boundary (see Figure 2-5 where topsoil stockpiles are indicated in brown).

The topsoil stockpiles will be afforded a 30 m buffer from the edge of the nearest wetland or delineated sensitive environmental area. Each topsoil stockpile area will be cleared of large trees or tree stumps prior to placement of soil. The height of stockpiles should not exceed 3 m wherever possible and stockpiles will be protected from stormwater erosion by use of diversion berms. No road development over the surface of the topsoil stockpiles will be permitted in order to avoid unintended compassion of the valuable topsoil resource.

The topsoil stockpiles will be grassed with a mix of indigenous grass seed, containing the following grass types:

- *Eragrostis tef* (Teff).
- *Eragrostis curvula* (Weeping lovegrass).
- *Cynodon dactylon* (Bermuda grass).
- *Cenchrus ciliaris* (Bloubuffels grass).
- *Panicum maximum* (Guinea grass).
- *Chloris gayana* (Rhodes grass).
- *Digitaria eriantha* (Smuts finger grass); and
- *Paspalum notatum* (Bahia grass).

A vegetation canopy cover of 30-50% will be achieved on the topsoil stockpiles.

2.4.9. FINE RESIDUE DEPOSITION

Fine residue will need to be managed throughout the life of mine. The RSF capacity for Port Durnford has been designed for a 28-year LOM between 2036 and 2064. It is understood that RSF capping and shaping of the sand tails dump sites with the remaining sand tails will take place between 2064 and 2069.

The RSF facilities will be constructed in a phased approach. The RSF dam walls will be constructed with coarse sand tails from the mining operation and be compacted. The dam walls will be erected to the designed heights to create a “holding shell” for the incoming fine residue. Each RSF facility has a determined lifespan of RSF disposal. Each RSF site will have a maximum height and storage capacity. Once the RSF facility has reached its design capacity (design capacity in terms of storage volume and height) the facilities will be capped with coarse sand tailings and vegetated.

The RSF infill is considered a “Class 3 waste” for purpose of design. Class 3 waste facilities require lining. The design assumes that a double layer containment barrier, made up of a 1500-micron geomembrane and a geosynthetic clay liner will be installed in the RSF dams to prevent environmental contamination. The materials will be classified to confirm their waste class, which will inform subsequent detailed designs.

RSF Site 9 will have a Water Control Dam (WCD) to receive water from the RSF dams and intercepted stormwater falling within the managed RSF area. Excess water will be recovered from the surface of the RSF and under drainage system and returned for reuse in mining. The RSF dams will use a barge/turret system for excess water removal. The RSF sites will be installed with herringbone, toe, and blanket drainage systems to assist in dewatering the fine tailings in order to aid stability and manage seepage and control the phreatic surface within RSF.

Stormwater control berms and trenches will be used to manage external water, with toe paddocks to control material which has been eroded from the RSF outer slopes. The fine residues disposal concept study and supporting concept designs has been updated (Epoch, 2023). The typical drainage and design detail has been provided in Figure 3-12, below and RSF specific general arrangements provided in the sub sections which follow.

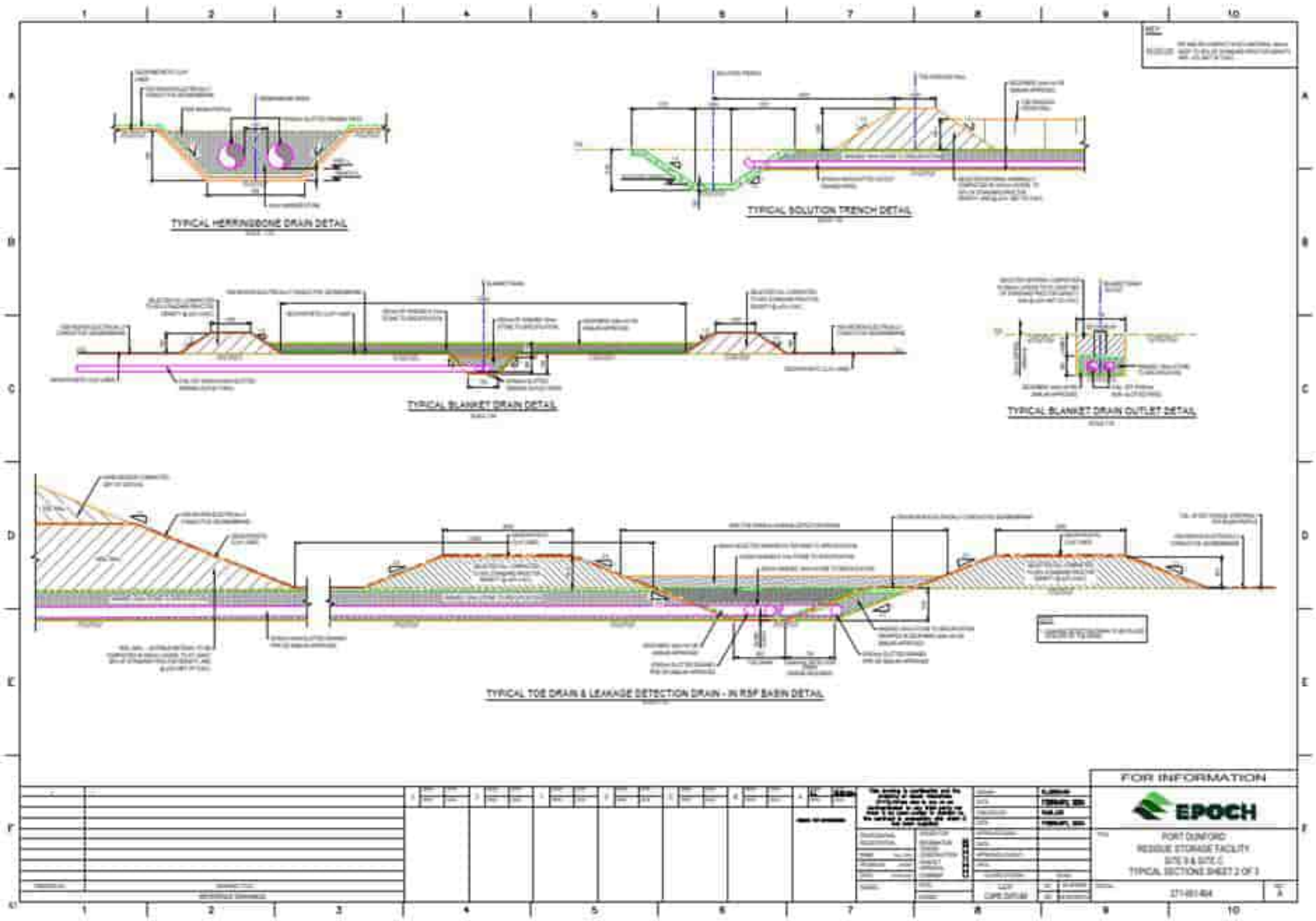


Figure 2-12: Typical RSF Drainage Design Sections

2.4.9.1. RSF Site 9

RSF Site 9 will be built from the sand tailings material from the Phase 2 mining activity. After the 11 years of Phase 1 mining, Phase 2 mining will start adjacent to the then constructed PWP plant in 2037. The sand tails that are produced in the first block of Phase 2 mining will be used to construct the dam walls of RSF Site 9. RSF Site 9 will be situated in the southwestern side of the proposed mining footprint, on Portion 1/13602 and remaining portion of 13602 of Lot 132. This property is leased by Mondi and owned by the Philani Community Trust. This RSF facility will be used for the first 6 years of mining in Phase 2. RSF Site 9 will be 268 ha in size and have a final height of approximately 55 m above average ground level. The facility will be designed to store up to 26.9Mt of Fines residue and 18.2Mt of Sands residue.

The terminal Rate of Rise for Site 9 is 3.3m/yr, meaning that the RSF facility can safely increase in height by 3.3m per year.

2.4.9.2. Supporting Infrastructure

The water control dam for RSF Site 9 was redesigned to avoid environmental sensitive areas. This dam will be approximately 19 ha in extent and have an 870 000 m^3 storage capacity. A barge / turret system will be used to transport water from the RSF to the Water Control Dam.

2.4.9.3. RSF Closure

It is anticipated that RSF Site 9 will be operational for 6 years and reach full capacity in 2042. Thereafter, capping of the RSF surface with coarse sand tailings will commence in 2046 assuming that the surface of the RSF has dried out and stabilised sufficiently by that stage. Once backfilled the site will be topsoiled in 2048. Outer slopes of the RSF will be topsoiled and vegetated as areas become available in order to stabilise the side slopes against erosion. The RSF will be returned to the landowner once Tronox is satisfied that the facility, and the chosen vegetation cover, has stabilised.

A conceptual design has been provided in Figure 2-13 below.

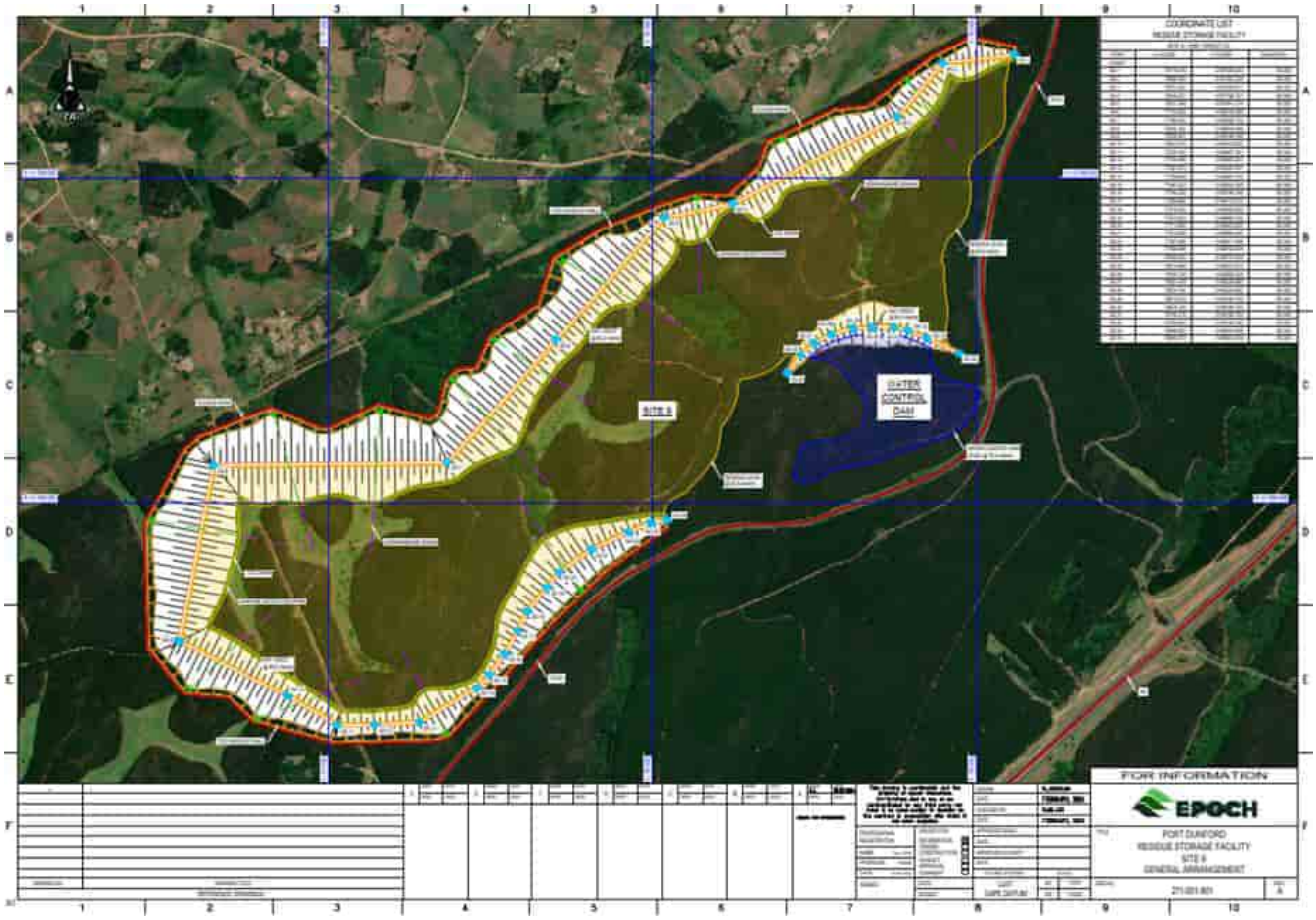


Figure 2-13: RSF Site 9 General Arrangement Design indicating Impoundment walls and inundation Area

2.4.9.4. RSF Site C

RSF Site C will be utilised during the Phase 2 mining activity. It will be located immediately east of the PWP plant. It will be built in sequential phases (Phase 1-4). RSF Site C will utilise mined-out pits for RSF dam storage capacity. Mining here is expected to last approximately 27.5 years before Phases 1- 4 are completed. The four planned RSF cells for RSF Site C will be converted to RSF storage space as each RSF cell reaches capacity. The phased development of RSF Site C is as follows:

- Phase 1 is expected to operate for 2.9 years and store 12.7 Mt of fines and 18 Mt of sand tails. Phase 1 will be approximately 78 ha in size. This facility will be built at a Rate of Rise (RoR) of 9.8 m/yr.
- Phase 2 is expected to operate for 8.1 years and store 35.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 121ha in size. This facility will be built at a RoR of 5.1 m/yr.
- Phase 3 is expected to operate for 8.1 years and store 40.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 147ha in size. This facility will be built at a RoR of 5 m/yr; and
- Phase 4 is expected to operate for 8.3 years and store 39.1 Mt of fines and 4 Mt of sand tails. Phase 2 will be approximately 162ha in size. This facility will be built at a RoR of 3.5 m/yr.

RSF Site C will be designed to store up to 127.3Mt of Fines residue and 64.5Mt of Sands residue. The total footprint area of RSF Site C is expected to be 670 ha and will have a final height of approximately 50 m above the current average ground level.

2.4.9.5. Supporting Infrastructure

A 13.75 ha, 540 000 m^3 Return Water Dam has been planned for RSF Site C. The dam will be located between RSF Site C's Phase 1 RSF Dam and the PWP plant. The dam will be 500 m long, 275 m wide and will be 9 m high at its highest point (Figure 2-14).

2.4.9.6. RSF Closure

It is anticipated that RSF Site C will be operational for 27.5 years and reach full capacity in 2064. Thereafter, the site will be backfilled in 2069, affording the facility 4 years to dry out and stabilise. Once backfilled the site will be rehabilitated with topsoil and returned to the Landowner (lessee) thereafter.

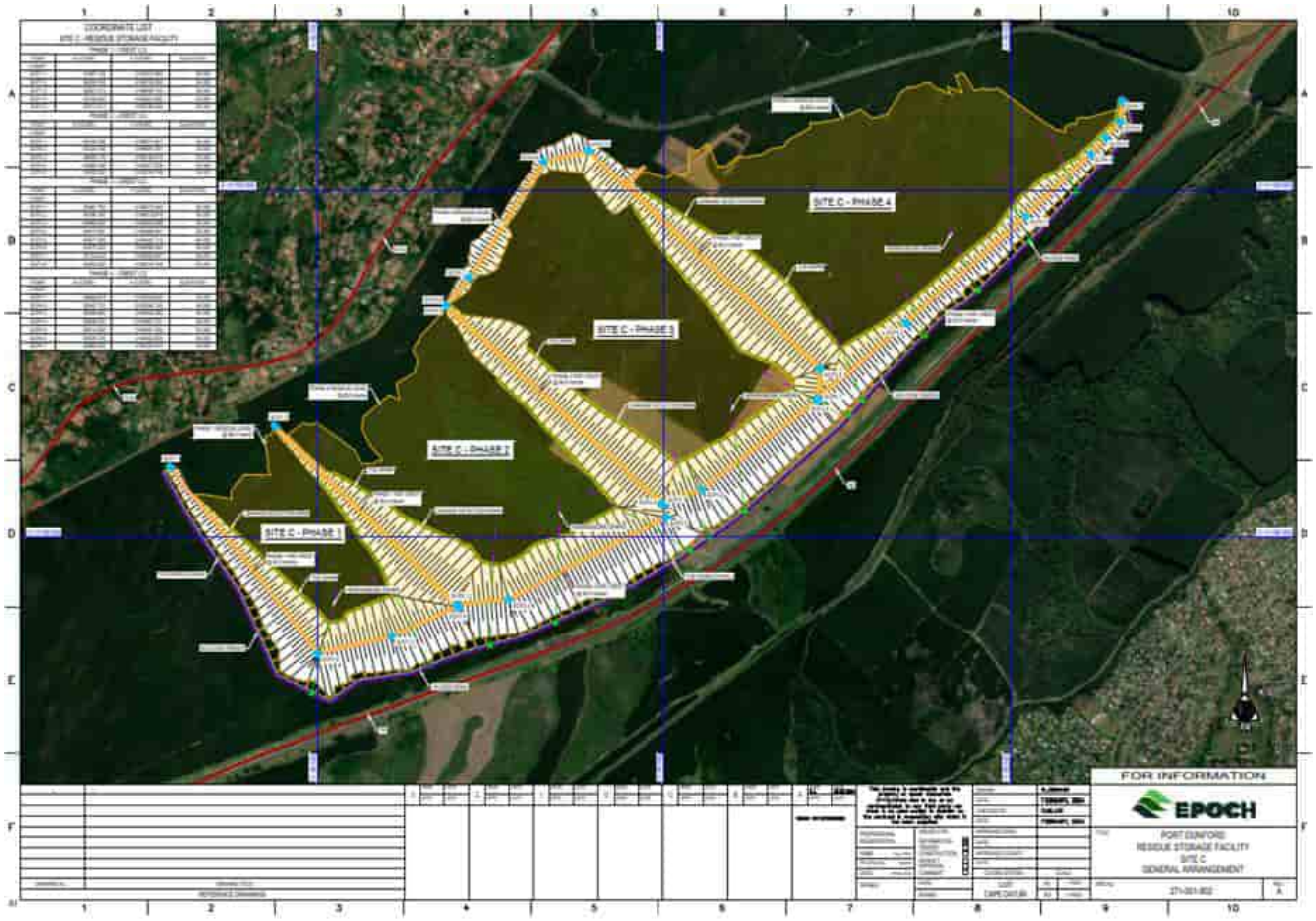


Figure 2-14: RSF Site C General Arrangement Design indicating impoundment walls and inundation area

2.5. PROJECT ACTIVITIES FOR EACH PHASE OF THE PROJECT

The following activities are anticipated for each phase of the project:

- **Construction Phase:**
  - Obtaining the rights to mine the lease.
  - Prior to site establishment all authorisations need to be in place.
  - Forestry activities on the site to cease.
  - Bush clearing will then commence two years prior to production.
  - Bulk earthworks (in case of Phase 2).
  - Development of required service infrastructure on the site.
  - Development and improvement of access roads.
  - Site establishment.
  - Topsoil stripping; and
  - Construction of project components
- **Operational Phase:**
  - Mining to commence. One DTMU mines a 200 m by 100 m block at a time. Progressive backfilling and rehabilitation will then take place. It is anticipated that 4 years post the commencement of mining in a block, the mined area will be subject to rehabilitation. The RSF areas, the exception. These blocks will be rehabilitated post mining, once the RSF has completed its lifespan.
  - Ongoing processing and supporting activities; and
  - Disposal of wastes from the mining process.
- **Decommissioning Phase:**
  - Plant to be demolished and materials to be removed.
  - Termination of all services to the area; and
  - Rehabilitation of all areas to be completed sufficiently to meet relevant commitments of the closure plan.
- **Closure and post closure**
  - Ongoing monitoring of post-closure impacts and success of rehabilitation as required in terms of the closure plan; and
  - Monitoring programs to continue post-closure, where applicable.

2.6. END LAND USE AND TOPOGRAPHY

Once mining is complete and the mined-out areas rehabilitated, the land will be returned to the landowner. It is anticipated that some land will be used for forestation, and others for crops and informal grazing land. The topography of the mined-out areas within the broader mining rights area is expected to change substantially. The RSF sites and sand tails deposition areas will leave permanent elevated features on the landscape.

The pre-mining and post mining topographic surface is presented in Figure 2-15. The natural valleys and peaks are depicted by green and red respectively.

Figure 2-15: Pre mining (LHS) and Post Mining (RHS) Topography

The elevated RSF dam walls and sand tails deposition areas become prominent features in the post mining landscape.

3. BACKGROUND TO THE WETLAND ASSESSMENT

3.1. WETLAND CHARACTERISTICS

Wetlands can be described as areas of inundated land or saturated for extended periods of time. They are intermediate zones between terrestrial lands and aquatic ecosystems, usually occurring when the water table is located just below the surface. Certain plants have adapted to wetland conditions such as growing in anaerobic soil (Ramachandra and Kumar, 2008). The space that exists between soils particles usually become filled with water due to the soil becoming increasingly wet. A typical characteristic of wetlands is their ability to store water and allow drainage to occur at an extremely slow rate, hence they are often waterlogged. Anaerobic conditions usually occur in waterlogged wetland soils due to the rapid usage of oxygen by organisms and plant roots. Wetlands are therefore characterized by soil saturation together with redoxymorphic features; high clay and organic matter content in soils; a suite of characteristic wetland vegetation types and particular topographic settings in which they occur.

Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation and other factors, including human disturbance. In the identification of wetland areas more than one distinguishing characteristic must be present before positive identification of wetlands is accomplished.

3.2. IMPORTANCE OF WETLANDS

Wetlands are considered to be one of the most valued and important ecosystems as they provide a plethora of benefits, not only to the natural environment, but to humans as well (Ramsar Convention on Wetlands, 2018). In particular, wetlands have been studied to improve water quality, often referred to as the 'kidneys of the Earth' and serve as reservoirs which allow for the gradual stable release of water throughout the year. This also proves as an added benefit during flood occurrences as wetlands

play a vital role in mitigating flooding by decreasing their initial velocity by absorbing excess flood waters, as well as trapping suspended solids.

3.3. APPLICABLE SOUTH AFRICAN LEGISLATION, POLICY AND STANDARDS

This wetland assessment report took cognisance of the requirements of specific applicable national and provincial legislation and associated regulations that are pertinent to wetland biodiversity. These were used to guide this assessment, and include:

- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) – Section 24 (1)(a) and (b) states that "the potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment must be considered, investigated and assessed before their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) – The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act regulates the protection of species and ecosystems that require national protection and considers the management of alien and invasive species.
- National Water Amendment Act (Act No. 27 of 2014) (NWA) – The NWA aims to protect, use, develop, conserve, manage and control water resources including rivers, dams, wetlands, the surrounding land, groundwater, as well as human activities that influence them. The NWA intends to protect these water resources against over exploitation and to ensure that there is water for social and economic development and water for the future.
- National Water Act (Act 36 of 1998) – Part 5 of chapter 3 deals with pollution of water resources following an emergency incident, such as an accident involving the spilling of a harmful substance that finds or may find its way into a water resource. The responsibility for remedying the situation rests with the person responsible for the incident or the substance involved. If there is a failure to act, the relevant catchment management agency may take the necessary steps and recover the costs from every responsible person.

4. ASSUMPTIONS AND LIMITATIONS

- This study is considered as a once off assessment, which can only take into consideration the current condition with some speculation of historical events based on evidence observed in field and with the aid of satellite imagery. As vegetation and habitats often vary temporally and spatially, there must be recognition of the fact that certain aspects or features may not have been present during the periods of the site surveys.
- Field verification of wetland boundaries was limited to the area indicated in figures as the Port Dunford boundary and therein focus was placed on verifying wetlands in close proximity to project infrastructures and activities.
- The wetland Present Ecological State (PES), ecosystem service provision (Ecoservices) and Importance and Sensitivity (IS) assessments were based on a combination of desktop information and datasets, and the findings of the site survey.

- Hydrogeomorphic units on site and in the buffer were assessed in their entirety, even if it included sections of wetland that were inaccessible; the latter would be assessed from aerial imagery with limited infield verification.
- All delineation verification is done using a GPS system. The precision of such systems is generally limited to 5m and therefore this error must be taken into account when utilising the GPS coordinates.
- Whilst the assessment techniques applied in this report are used in order to standardise and 'objectify' the assessment of the systems' function, potential impacts and services, it must be noted that much of the information is subjectively collected based on the assessor's experience and training. The assessor will, if additional information or counter arguments are provided and verified, hold the right to amend the report if need be.
- Monitoring and management of any wetland impacts/ remediation/ rehabilitation are advised in accordance with best practice.

5. DETAILS AND DECLARATIONS OF THE SPECIALISTS

DETAILS OF THE SPECIALISTS

Task	Wetland delineation and infield verification
Full Name	Brad Graves
Title/Position	Senior Wetland Ecologist
Qualification	BSc Honours, Geography
Professional Affiliations	South African Council for Natural Scientific Professions (SACNASP)
	Pr.Sci.Nat. Reg Number 400041/17 (Ecological Science)

Task	Wetland assessments and report compilation
Full Name	Bhavna Ramdhani
Title/Position	Wetland Ecologist
Email	bhavna.ramdhani@wsp.com
Qualification	MSc Environmental Science

Task	Report review and revision
Full Name	Shavaughn Davis
Title/Position	Senior Wetland Ecologist
Email	shavaughn.davis@wsp.com
Qualification	MSc Zoology
Professional Affiliations	South African Council for Natural Scientific Professions (SACNASP)
	Pr.Sci.Nat. Reg Number 115025 (Ecological Science, Zoological Science)

DECLARATION OF INDEPENDENCE BY SPECIALIST

I, Shavaughn Davis, a duly authorised representative of WSP (Pty) Ltd, declare that I –

- Act as the independent specialist in this application.
- Do not have and will not have any financial interest in the undertaking of the activity, other than
- remuneration for work performed.
- Do not have nor will have a vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the
- potential to influence the decision of the competent authority or the objectivity of any report, plan
- or document.

DECLARATION OF INDEPENDENCE BY SPECIALIST

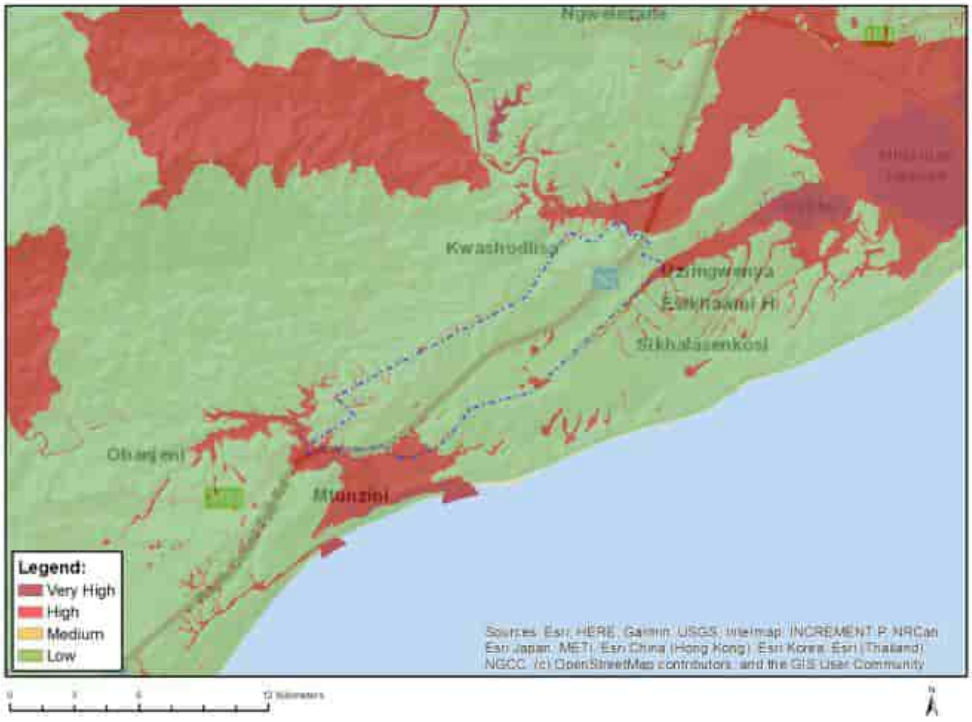
I, Bhavna Ramdhani, a duly authorised representative of WSP (Pty) Ltd, declare that I –

- Act as the independent specialist in this application.
- Do not have and will not have any financial interest in the undertaking of the activity, other than
- remuneration for work performed.
- Do not have nor will have a vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the
- potential to influence the decision of the competent authority or the objectivity of any report, plan
- or document.

6. ENVIRONMENTAL SCREENING TOOL

The study area was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Aquatic Biodiversity Theme for the study area is rated 'Very High Sensitivity' due to the presence of sensitive features such as wetland and estuaries as well as being located within an area mapped as a Strategic Water Source Areas (Figure 8-1).

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	Estuary_uMhlathuze
Very High	Estuary_uMlalazi
Very High	Rivers_C
Very High	Wetlands_(Estuary)
Very High	Wetlands_Indian Ocean Coastal Belt Bioregion (Depression)
Very High	Wetlands_Indian Ocean Coastal Belt Bioregion (Floodplain)
Very High	Wetlands_Indian Ocean Coastal Belt Bioregion (Seep)
Very High	Wetlands_Indian Ocean Coastal Belt Bioregion (Valley-bottom)

Figure 6-1 - Screening report highlighting very high sensitivity for the aquatic biodiversity theme

7. METHODOLOGY

The current wetland biodiversity study takes cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning 'Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation'.

7.1. DESKTOP STUDY

A desktop study was initially undertaken to garner as much prior understanding of the general physiographic characteristics of the study area as possible. This was achieved by sourcing and utilizing all relevant GIS data available, such as data on the topographical layout, vegetation characteristics, fluvial hydrology, ecoregion classification, Critical Biodiversity Areas (CBA), National Wetland Map Version 5 (NWM5) and land uses occurring in the region. The details of these various desktop datasets are presented in Section 7. Further desktop assessment was thereafter conducted of the study area to identify potential wetland areas of interest within the site. This was accomplished via satellite imagery from Google Earth Pro ® and shapefiles obtained from the South African National Biodiversity Institute (SANBI). The delineation of the wetland boundaries was therefore first conducted at desktop level and later verified via a comprehensive field survey.

7.2. FIELD VERIFICATION

Wetland habitat surrounding the development footprint, and initially delineated at a desktop level, was then verified in the field as part of a comprehensive wetland field survey undertaken during November 2022, with an additional site visit undertaken in June 2024 to address project changes. As such, the initial survey aligned with the wet, spring-summer season, and the later survey in 2024 aligned with the drier, winter season.

The field survey, conducted by the WSP team, comprised of augering and logging of sediment cores to 50cm or slightly greater depths, assessing targeted areas identified from aerial photographs and on-site visual identification. The field survey thus included identifying wetland habitat, delineating the outer boundaries, and collecting data relevant to the classification of the wetlands and determination of their current condition and importance and sensitivity.

It should be noted that areas not accessible were delineated at a desktop level using the best available spatial data.

7.3. WETLAND DELINEATION

Four specific wetland indicators were used to identify/verify wetland areas:

- Terrain unit,
- Vegetation (further detail provided in Table 7-1),
- Soil: texture (sand & clay), colour (hue, chroma & value), and organic matter.
- Degree of saturation.

The wetland delineation procedure identifies the outer edge of the temporary wetland zone, marking the boundary between the aquatic and adjacent terrestrial areas. The wetland delineation field

verification began at the lower lying areas of a given wetland and proceeded outwards from the permanent, through the seasonal and ultimately to the outermost temporary zone. To identify the outer edge of the temporary wetland zone, wetland vegetation indicators were noted, and a soil auger was used to extract and observe sediment cores. The sediment samples were evaluated on-site for typical redoxymorphic soil features such as mottling, and gleying, as illustrated along a wetness gradient in Figure 7-1. The wetland boundaries were determined utilising the initially developed desktop delineation, and refined according to the findings of the site survey and observations made.

Wetland systems may comprise of one or more hydrogeomorphic (HGM) units. The wetland habitat identified and delineated was then classified according to the National Wetland Classification System developed by the South African National Biodiversity Institute (SANBI) (Ollis et al., 2013) and DWAF (2008). The HGM classification system uses the geomorphological and hydrological features of the delineated wetland unit to determine its classification. The features that are assessed relate to the way in which water behaves in the wetland system.

Table 7-1 - Classification of plants according to occurrence in wetlands (DWAF, 2008)

TYPE	DESCRIPTION
Obligate Wetland Species	Almost always grow in wetlands (> 99% of occurrences)
Facultative Wetland Species	Usually grow in wetlands (67%-99% of occurrences) but occasionally are found in non-wetland areas
Facultative Species	Are equally likely to grow in wetlands and non-wetland areas (34%-66% of occurrences)
Facultative Dry-land Species	Usually grow in non-wetland areas but sometimes grow in wetlands (1%- 34% of occurrences)

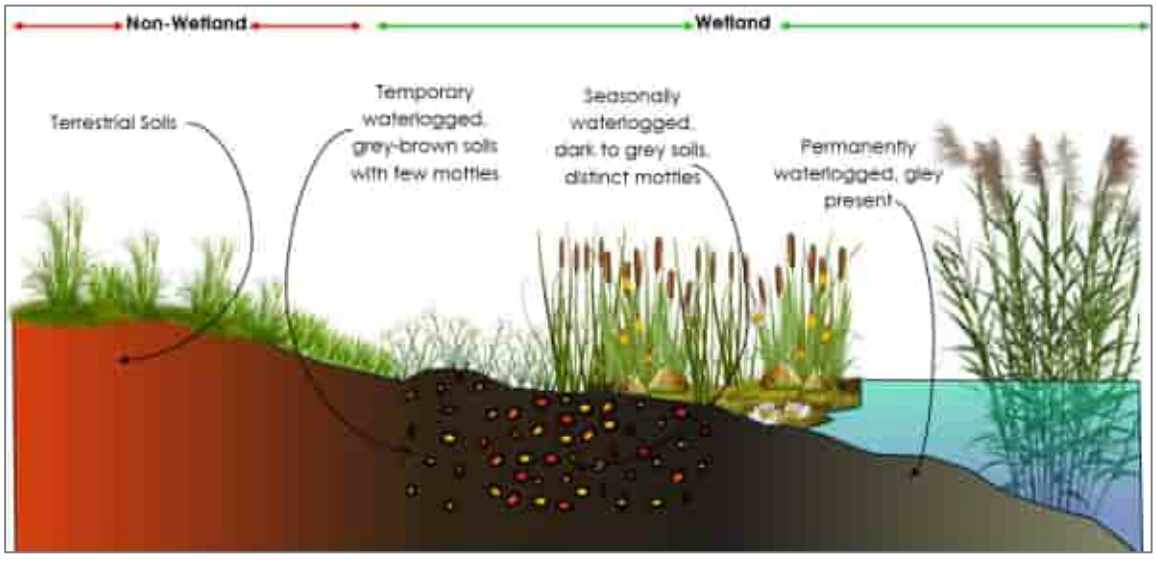


Figure 7-1 - Cross sectional diagram of a wetland, indicating how the soil moisture and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland (Author, 2024).

7.4. WETLAND CONDITION AND VALUE

The current condition and value of wetlands at risk of being compromised as a consequence of the proposed development activity were assessed through a suite of tools specific to wetland habitat assessments.

7.4.1. WETLAND PRESENT ECOLOGICAL STATE (PES)

The WET-Health Level 1 assessment was undertaken to ascertain the Present Ecological State (PES) of the wetland environments affected by the proposed development (Macfarlane *et al*. 2009). The state of the four main functional aspects of the wetland is considered for the WET-Health index. These include: (1) hydrology, (2) geomorphology (3) water quality and (4) vegetation. Each of these functional aspects follows a broadly similar approach and is used to determine which anthropogenic impacts have affected the health status of the wetland. The overall score is integrated and expressed as a PES category. In addition, the trajectory of change of the wetland health is also assessed and is expressed as a change symbol.

Table 7-2 - Present Ecological Status (PES) score categories for describing the integrity of wetlands

Impact Category	Health Category	Description	Range
None	A	Unmodified/natural	0 – 0.9
Small	B	Mostly Natural with a few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9
Moderate	C	Moderately modified. A moderate change in the ecosystem processes and the loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9
Large	D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 – 5.9
Serious	E	A very large change in ecosystem processes and loss of natural habitat and biota but some of the remaining natural habitat features are still recognizable.	6 – 7.9
Critical	F	The modification has reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota	8 – 10

7.4.2. ECOSYSTEM SERVICE PROVISION (ECOLOGICAL GOODS AND SERVICES)

A WET-EcoServices Level 2 assessment evaluates the "ecological goods and services" provided by HGM units potentially affected by the proposed development. The tool provides information on the importance of wetlands in delivering different ecosystem services under several different categories (Kotze *et al.*, 2009). These categories are illustrated in Figure 7-2.

Figure 7-2 - Wetland ecological goods and services assessed by the WET-EcoServices tool

This highlights the importance rating calculated and the description in terms of the wetland ecoservices (Table 7-3).

Table 7-3 - Ecosystem services classes and descriptions (Kotze *et al*., 2020).

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.

Importance Category		Description
Moderately High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

7.4.3. WETLAND IMPORTANCE AND SENSITIVITY (IS)

The IS scores were calculated using the **Resource Directed Measures** *for Protection of Water Resources* (Kleynhans, 1999) methods. This approach provides information on the ecological importance of the HGM unit in terms of unique biodiversity and sensitivity, which refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience).

Table 7-4 - Ecological importance and sensitivity categories.

EIS Category	Ecological Management Class[1]	Description	Range of Median
Very High	**A**	Ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4
High	**B**	Ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate	**C**	Ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2

EIS Category	Ecological Management Class[1]	Description	Range of Median
Low/marginal	**D**	Ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>0 and <=1

7.5. WETLAND RISK ASSESSMENT

The risk assessment developed as part of the amendment GA for section 21 (c) and (i) water uses, which was published in the Government Gazette (No 49833 Pg 208 Notice 4167) on 8 December 2023 is frequently applied to assess the risk to water resources in terms of Section 21 (c) and (i) water uses, and the applicable authorisation process, either a general authorisation (GA) or a Water Use Licence (WUL). **However, according to GN4167 Section 3 (Exclusions to the notice), Paragraph (h), the notice does not apply to any section 21 (c) or (i) water use associated with mining activities and associated infrastructure unless it falls within appendix D1 or D2 of the notice. The proposed Port Dunford mine does not, in its entirety, fall within appendix D1 or D2. As such, a full WUL would be the applicable authorisation process, and a GN4167 risk assessment matrix was not included in this report.**

7.6. IMPACT ASSESSMENT

The significance (quantification) of potential environmental impacts identified during the assessment have been assessed as per the "Guideline Documentation on EIA Regulation" (Department of Environmental Affairs and Tourism, 2014). To determine the significance of impacts identified for a project, there are several parameters that need to be assessed. These include four factors, which, when inserted into a formula, will give a significance score. The five parameters are described as follows:

- **Duration**, which is the relationship of the impact to temporal scale. This parameter determines the timespan of the impact and can range from very short term (less than a year) to permanent.
- **Extent**, which is the relationship of the impact to spatial scales. Each impact can be defined as occurring in minor extent (limited to the footprint of very small projects) to International, where an impact has global repercussions (an example could be the destruction of habitat for an IUCN Critically Endangered listed species).
- **Magnitude**, which is used to rate the severity of impacts. This is done with and without mitigation, so that the residual impact (with mitigation) can be rated. The Magnitude, although usually rated as negative, can also be positive.
- **Probability**, which is the likelihood of impacts taking place. These include unlikely impacts (such as the rate of roadkill of frogs, for example) or definite (such as the loss of vegetation within the direct construction footprint of a development).

- **Impact Reversibility**, which is the ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change

Each of the abovementioned aspects are rated according to Table 7-5 below.

Table 7-5 – The impact assessment aspects and scoring system applied.

Based on impact significance criteria determined by DEAT, 1998					
CRITERIA	**SCORE 1**	**SCORE 2**	**SCORE 3**	**SCORE 4**	**SCORE 5**
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	**Very low**	**Low**	**Medium**	**High**	**Very high**
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	**Site:** Site only	**Local:** Inside activity area	**Regional:** Outside activity area	**National:** National scope or level	**International:** Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	**Reversible:** Recovery without rehabilitation		**Recoverable:** Recovery with rehabilitation		**Irreversible:** Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	**Immediate:** On impact	**Short term:** 0-5 years	**Medium term:** 5-15 years	**Long term:** Project life	**Permanent:** Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	**Improbable**	**Low Probability**	**Probable**	**Highly Probably**	**Definite**
ENVIRONMENTAL SIGNIFICANCE = (MAGNITUDE + EXTENT + REVERSIBILITY + DURATION) x PROBABILITY					
TOTAL SCORE	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
ENVIRONMENTAL SIGNIFICANCE RATING	**Very low**	**Low**	**Moderate**	**High**	**Very High**

The results of the assessment are then interpreted using the below rating system which categorises the scores into 5 categories ranging from low to very high impact significance. A description of each category is provided in Table 7-6.

Table 7-6 - Description of Impact Assessment Scores

Label	Motivation
Negligible	The impact is very small to absent
Low	where this impact would not have a direct influence on the decision to develop in the area
Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
High	where the impact must have an influence on the decision process to develop in the area
Very high	Where the impact may constitute a fatal flaw for the project

Each impact was assessed based on the methodology above, and a table produced, indicating the scores and the overall significance rating both without and with mitigation. Where relevant, mitigation measures are recommended.

8. REGIONAL SETTING

8.1. CLIMATE

Climate generally describes inter alia, the temperature and moisture conditions of a particular area over a period of time. Climate plays a significant role in the formation of soil properties. For instance, soils that are found in warmer or moist climates are more developed as compared to soils found in cooler or drier climates.

The proposed activity site lies within the summer rainfall region of South Africa. The study area is located in close proximately to the Indian Ocean, which acts as a climate regulating factor along the KZN coast. This region is influenced by the Agulhas Current resulting in the high humidity experienced in the area. The study site is situated in the sub-tropical rainfall region of South Africa, which experiences a strongly seasonal rainfall occurring in the summer months from November to mid-April. The lowest rainfall is experienced during the winter months from May to August (Hunter, 2007). Mean annual precipitation is approximately 973 mm and mean annual potential evaporation is 1650 mm. The mean annual minimum and maximum temperatures are 15°C and 29°C, respectively.

8.2. CATCHMENTS

The study area is located within the W12F and W13B quaternary catchments of the Usuthu-Mhlathuze Water Management Area. The W12F covers the northeast section of the study area while the W13B covers the southwest section of the study area. The area is characterised by two prominent perennial rivers, the Mlalazi and the Mhlathuze, that drain into the Indian Ocean. Floodplain wetlands and estuaries are situated along the lower reaches of the Mlalazi and Mhlathuze rivers. The Mhlathuze River flows past the northern boundary of the project area and its tributaries drain the northwestern areas, whilst the Mzingwenya River flows along a section of the eastern boundary of the project area and drains the area northeast towards Qhubu Lake. The tributaries of the Mlalazi River drain the Penarrow and Waterloo areas, and a portion of the Port Durnford area. The Amanzamnyama River, situated in the central to southern section of the project development area and the southern boundary of the Waterloo area, drain south and southeast towards the Mlalazi River. The Mlalazi River flows past the southwestern and southern boundaries of the Waterloo area.

8.3. STRATEGIC WATER SOURCE AREAS

Holland, Smith-Adao, Nel, Maherry, and Witthüser, (2018) as part of a Water Research Commission Project (Report No. TT 743/1/18) and are defined by the authors “as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b).”

Figure 8-1 below shows project study area in relation to the delineated Strategic Water Source Areas (Le Maitre *et a*l., 2018). The project study area falls within the Zululand Coast & Richards Bay Groundwater Fed Estuary Strategic Water Source Area. This highlights the area as being nationally important due to a high groundwater availability and due to the fact that the available groundwater forms an important resource for water supply. This water resource is a key resource in the supply of water to downstream economies and urban centres (WWF, 2013) (Figure 8-1).

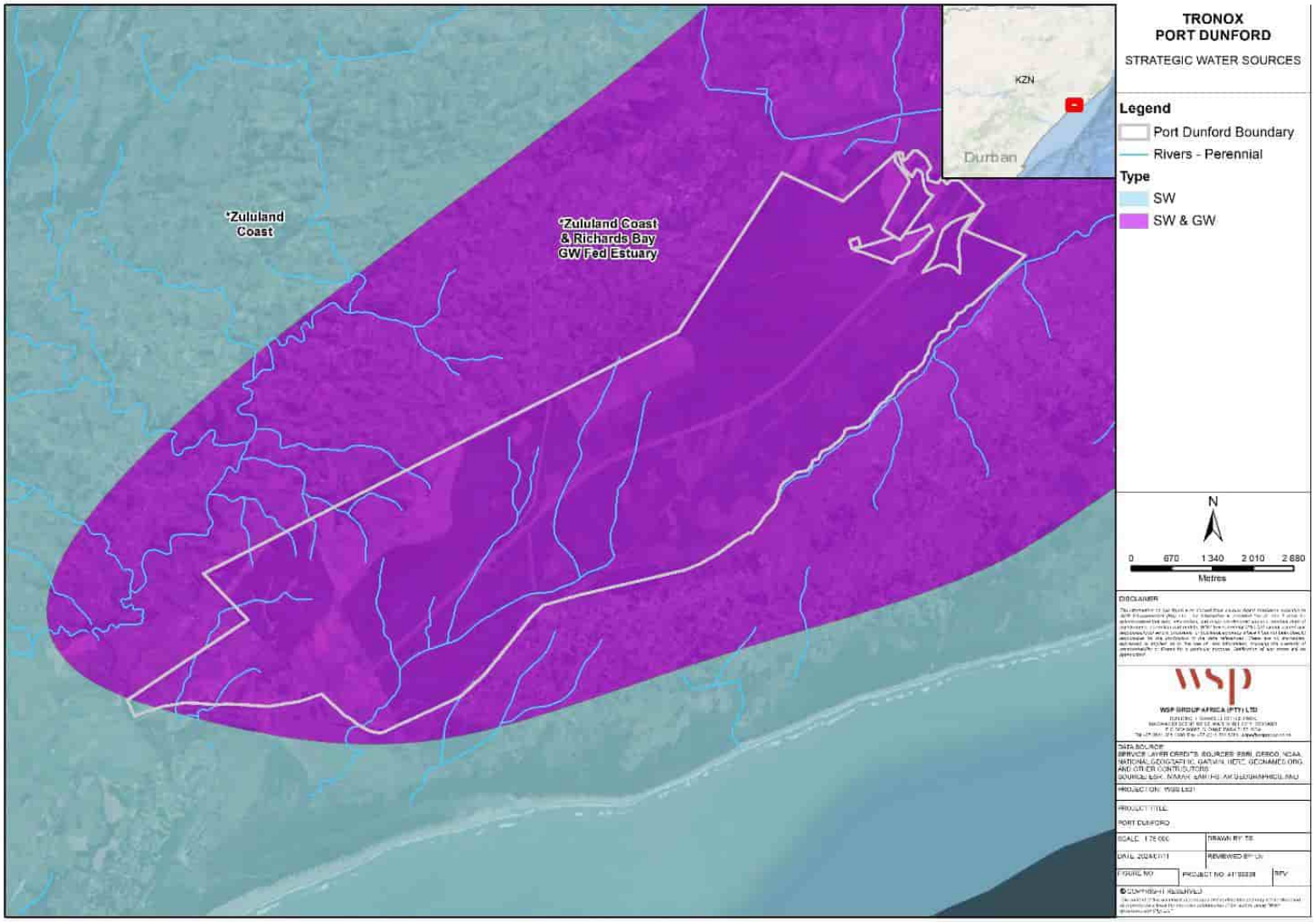


Figure 8-1 - Strategic Water Source Area in relation to the Port Dunford study area and surrounds.

8.4. SOILS

8.4.1. TERRESTRIAL SOILS

A number of different lithologies occur within the study area. Lithologies of the of the Natal Metamorphic Province outcrop west and north of the Port Durnford mining area and consist mainly of ultramafic rocks and gneiss. This is overlain by sedimentary rocks of the Natal Group which outcrop in the north-west and south-west. This is in turn overlain by shales and sandstones of the Ecca Group, Karoo Supergroup which are found south-west of the site. Rocks of the Ecca Group are finally overlain by Quaternary deposits of the Maputaland Group which form the coastal dune deposits in the area (GCS, 2020). These lithologies weather to produce soils with differing physical and chemical properties. These include sandy and clayey soils derived from weathered sand of the Berea Red Sand dune complex, as well as varied-textured soils derived from weathering of Sandstone, Quartzite and Gneiss (Red Earth, 2025). According to Snyman (2008) as referenced in Red Earth (2025), the soils within a large proportion of the Port Dunford study area (Port Dunford Plantation in particular) can be characterised as follows:

- Alluvium associated within and adjacent to channels gives rise to alluvial soils. These deposits occupy narrow strips parallel to channels.
- Quaternary grey-brown sands occur in the east. Derived soils are typically sandy in texture with hydromorphic properties common.
- Brownish red weathered material (.... Berea Formation) occupies the central and western area. Derived soils have red hues and sandy-loam to sandy-clay-loam textures. Other Quaternary sand Aeolian material often blankets the weathering material providing sandy topsoils on top of the clay-loam textured underlying horizons.
- Gneiss of the Intuzi Formation, Matigulu Group occurs at the south-western corner of the study area. Typical derived soils are lithosols (gravelly shallow soils) with clayey textures.

8.4.2. WETLAND SOILS

The main difference of wetland soils from terrestrial soils, is that they are typically anaerobic. This absence of oxygen produces distinct characteristic differences in soil colour and texture. When soils are flooded, oxidized Fe^{3+} (ferric) is reduced to Fe^{2+} (ferrous) chemically and by microbes to support respiration, and result in soil changes from the basic yellow, orange, or red to a recognizable grey colour (Refer to Figure 8-2 below) (Vepraskas, 1994). Mineral soils that are continuously inundated or saturated may display uniform grey colour, also known as gley. Sometimes, soil takes on hues of green or blue that indicates complete reduction of Fe^{3+} in the soil matrix. In wetlands that dry down periodically, reduced Fe can re-oxidize and the soil may take on a mottled colour, with areas of red (oxidized Fe) and grey (reduced Fe) (Craft, 2015).

Figure 8-2 - The typical formation of a redoximorphic feature within the soil profile (adapted from Jackson et al, 2014)

8.5. VEGETATION

The National Vegetation Map Project (VEGMAP) delineates, classifies, maps and samples the vegetation of South Africa, Lesotho and Swaziland which was produced and revised throughout the years by Mucina and Rutherford (2006/2012). The purpose of creating this project was to map the extent of various vegetation types across the country, which would aid in establishing their individual conservation status. Therefore, these refined datasets were subsequently used to determine the natural state of the proposed study area. Thus, a comparison could thereafter be conducted between the present state and recorded natural state of the vegetation units, which would provide insight on the range of impacts induced on the vegetation cover. Note that these classifications are done on a broad scale and at a desktop level.

The VEGMAP indicates that the study area is predominately consistent of the Maputaland Coastal Belt vegetation. The eastern extends contain swamp forest whilst the central regions indicate pockets of Northern Coastal Forest type vegetation. The western extremities are dominated by the KwaZulu-Natal Coastal Belt Grassland with regions of Subtropical Alluvial Vegetation type.

The Maputaland Coastal Belt is a range of flat coastal plain originally probably densely forested in places with a wide range of interspersed non-forest plant communities including dry grasslands, hygrophilous grasslands and thicket groups. Today the vegetation landscape is composed of pockets of various forest types (separated into different vegetation units), thickets, primary and secondary grasslands, with the intrusion of extensive *Eucalyptus* plantations and cane fields. The vegetation unit is given an Endangered status with moderate protection (Jewitt, 2018).

The Swamp Forest vegetation is typically described as 12-15 m tall forests with 2 main strata (canopy and shrub layers). The dominating trees include *Ficus trichopoda, Barringtonia racemosa, Casearia gladiiformis, Cassipourea gummiflua, Syzygium cordatum, Phoenix reclinata* and *Raphia australis*. Understorey is poorly developed. Some ferns such as *Microsorum punctatum* and *Nephrolepsis bisserata* are of importance and orchids (*Eulophia horsfallii*) occur frequently. It should be noted that this vegetation is regarded as Critically Engaged and receives moderate protection status (Jewitt, 2018). The vegetation was identified on site and aligns with the dataset.

The Subtropical Alluvial Vegetation can be described as flat alluvial riverine terraces supporting an intricate complex of macrophytic vegetation (channel of flowing rivers and river-fed pans), marginal reed belts (in sheltered oxbows and along very slow-flowing water courses) as well as extensive flooded grasslands, ephemeral herblands and riverine thickets. The entire study area is located in close proximity to the Mlalazi Estuary and therefore the western portions exhibit this type of vegetation distribution. The Subtropical Alluvial Vegetation type is regarded as vulnerable however is afforded full protection (Jewitt, 2018).

The KwaZulu-Natal Coastal Belt vegetation unit occurs as a long strip along the coast from Mtunzini in the north to just short of Port Edward in the south, with an altitudinal range of about 20-450 m. The overall landscape is carved by rivers which drain eastwards across KwaZulu-Natal resulting in undulating coastal plains which extensively included various types of subtropical coastal forest. Some primary grassland dominated by *Themeda triandra* still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevail. This vegetation unit is affected by array of anthropogenic pressures i.e., extensive sugarcane fields, *Eucalyptus* plantations and coastal holiday resorts, with interspersed secondary *Aristida* grasslands (*A. junciformis subsp. galpinii*), thickets and patches of coastal thornveld. The national land cover and supplementary provincial and metropolitan land cover data show that KwaZulu-Natal Coastal Belt Grassland has experienced extensive spatial declines of approximately 89% since 1750. KwaZulu-Natal Coastal Belt Grassland is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse (DFFE, 2022). It should be noted that this vegetation is regarded as Critically Engaged and receives nominal protection status (Jewitt, 2018).

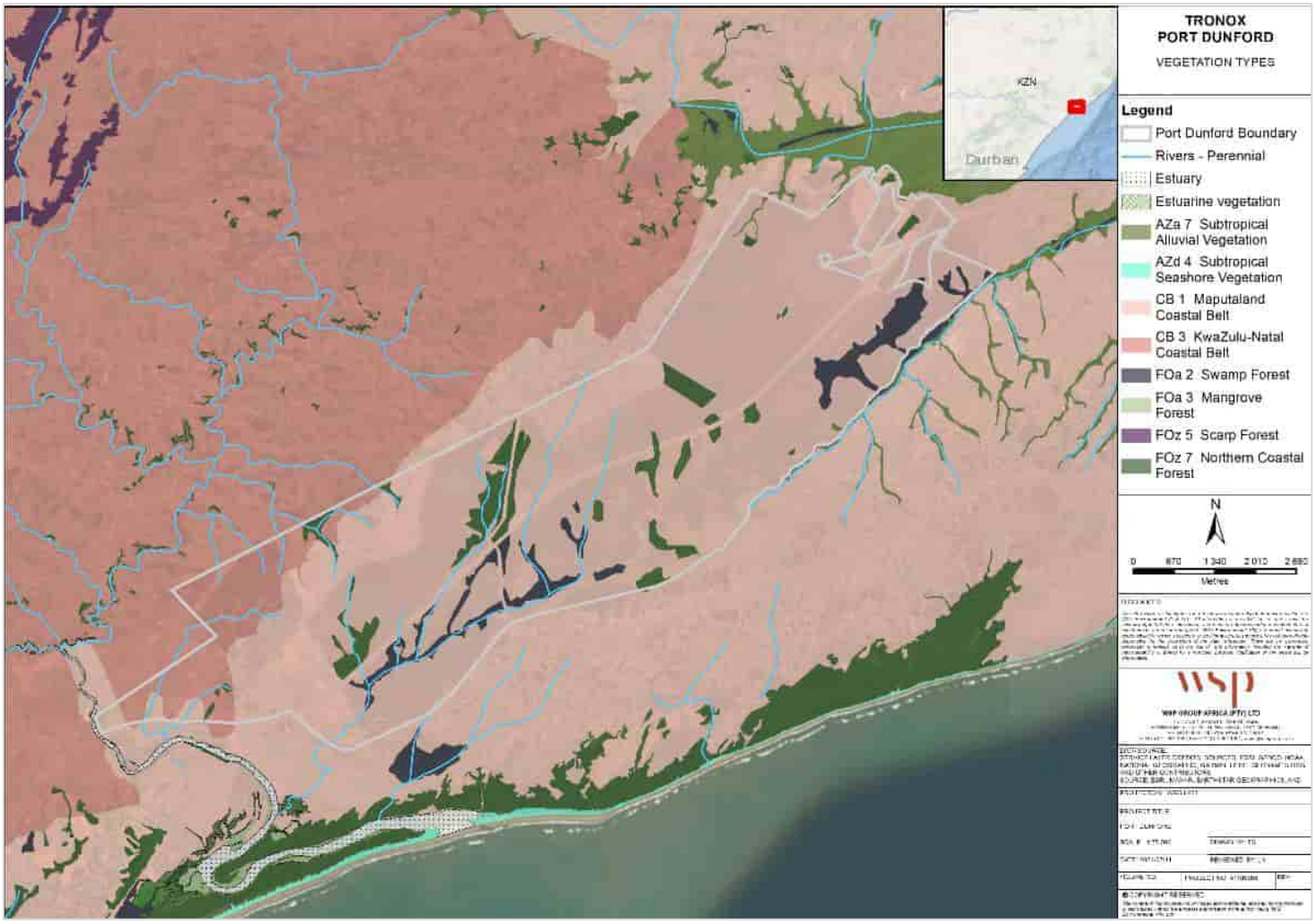


Figure 8-3 - Vegetation types of the proposed Port Dunford study area and surrounds.

8.6. CRITICAL BIODIVERSITY AREAS (CBA)

Ezemvelo KwaZulu-Natal Wildlife developed and implemented the KwaZulu-Natal Biodiversity Plan to assist with development, protected areas expansion and conservation with the province (Ezemvelo Wildlife, 2016). The plan identified areas as Critical Biodiversity Areas (CBAs) which cannot be lost if conservation goals are to be met. Furthermore, Ecological Support Areas (ESAs) were also established as these areas are required to support the functioning of CBAs and ecosystems. The guidelines of the KwaZulu-Natal Biodiversity Plan for each CBA and ESA category are outlined in Table 8-1.

Table 8-1 - CBA Descriptions adapted from Escott et al., 2012

CBA	DESCRIPTION
Critical Biodiversity Area: Irreplaceable	These regions are identified as having an Irreplaceability value of 1, these areas represent the only localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved, i.e. there are no alternative sites available. Hence are considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Area: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high-cost areas as much as possible (Category driven primarily by process but is informed by expert input).
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of Ecosystem Services.
Modified Areas	Areas with no significant natural vegetation remaining and therefore regarded as having a low biodiversity value (e.g. sugarcane plantation areas or highly developed areas with no connectivity to natural environment).
Protected Area	A specifically delineated area that is both designated and managed to achieve the conservation of the indigenous state and the maintenance of associated ecosystem services and cultural values, through legal or other effective means.

The CBA associated with the proposed activity is CBA irreplaceable and pockets of Optimal at a desktop level (Figure 8-4). This means that the proposed operation occurs in areas considered critical for meeting biodiversity targets and thresholds, which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.

It must be noted that the aforementioned CBA type was identified at a desktop level. However, the CBA type is justifiable, as it highlights the multiple swamp forest regions towards the east and central portions (these areas were verified in field) and identified the Mlalazi EFZ that is considered to have extremely high importance (high biodiversity and providing human benefits). This report provides insight towards the sensitive wetland environments identified within the study area that should be preserved to maintain biodiversity integrity.

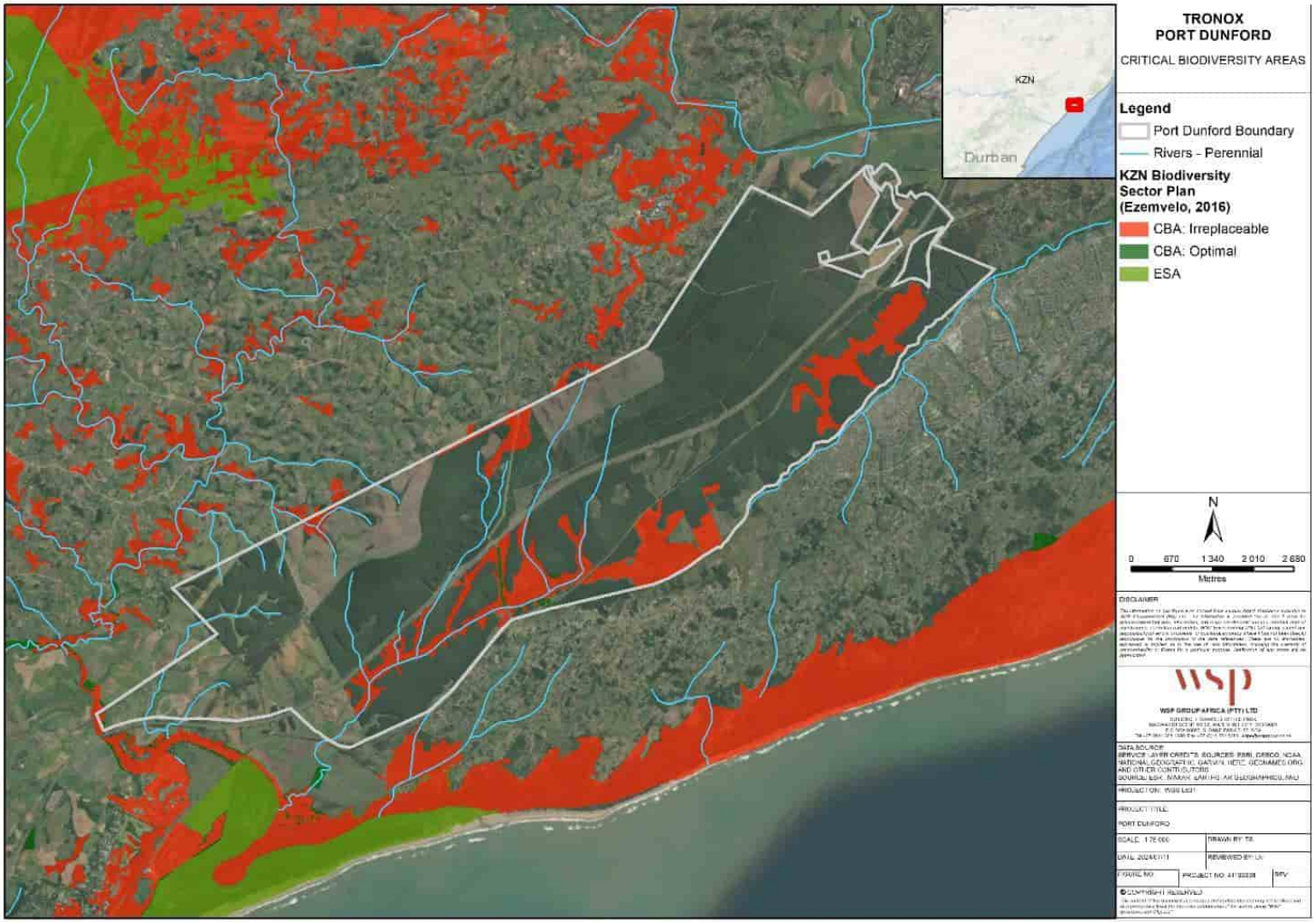


Figure 8-4 - Critical Biodiversity Areas (CBA) for the Port Dunford study area and surrounds.

8.7. NATIONAL WETLAND MAP VERSION 5

The South African National Wetland Map version 5 (NWM5) portrays the spatial extent and ecosystem types of two of the three broad aquatic ecosystems, namely, estuarine and inland aquatic (freshwater) ecosystems. The NWM5 is aimed at improving the representation of spatial extent and type of inland wetland and estuarine ecosystem types of South Africa (Van Deventer et al., 2019).

The National Wetland Map version 5 (NWM5) (Van Deventer *et al.*, 2019), was consulted to provide an indication on the occurrence of wetland habitat on site and within the immediate area. The NWM5 indicates the presence of unchanneled Valley Bottom (UVB) wetland, seep wetland, floodplain and depression wetlands as well as an estuarine functional zone within the proposed development footprint (Figure 8-5). The NWM5 categorises the UVB wetland as a *Largely/Critically modified* wetland in terms of its Present Ecological Status (PES) (Figure 8-5), which infers that the wetland has suffered a large loss of natural habitat and its basic ecosystem function. The NWM5 is the most up-to-date and accurate representation of spatial extent and type of inland wetland ecosystem types at desktop level in South Africa. However, it is noted that the National Wetland Map 5 dataset is based predominantly on desktop and/or remote sensing data and as such must be considered Low Confidence data, especially at the scale of an individual project site. Field verification (refer to Section 9 below) is thus always required to provide a more accurate representation of wetland extent and types on site.

An earlier version of the National Wetland Map was included in the National Freshwater Ecosystem Priority Areas Project (NFEPA), which culminated in the Atlas of Freshwater Ecosystem Priority Areas (Nel *et al,* 2011). That report provided a series of maps detailing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. Freshwater Ecosystem Priority Areas (FEPAs) were identified through a systematic biodiversity planning approach that incorporated a range of biodiversity aspects such as ecoregion, current condition of habitat, presence of threatened vegetation, fish, frogs and birds, and importance in terms of maintaining downstream habitat. According to the FEPA wetlands dataset, of the wetlands indicated as extending into the Port Dunford study area, only the Mlalazi Estuary is considered to be a FEPA wetland.

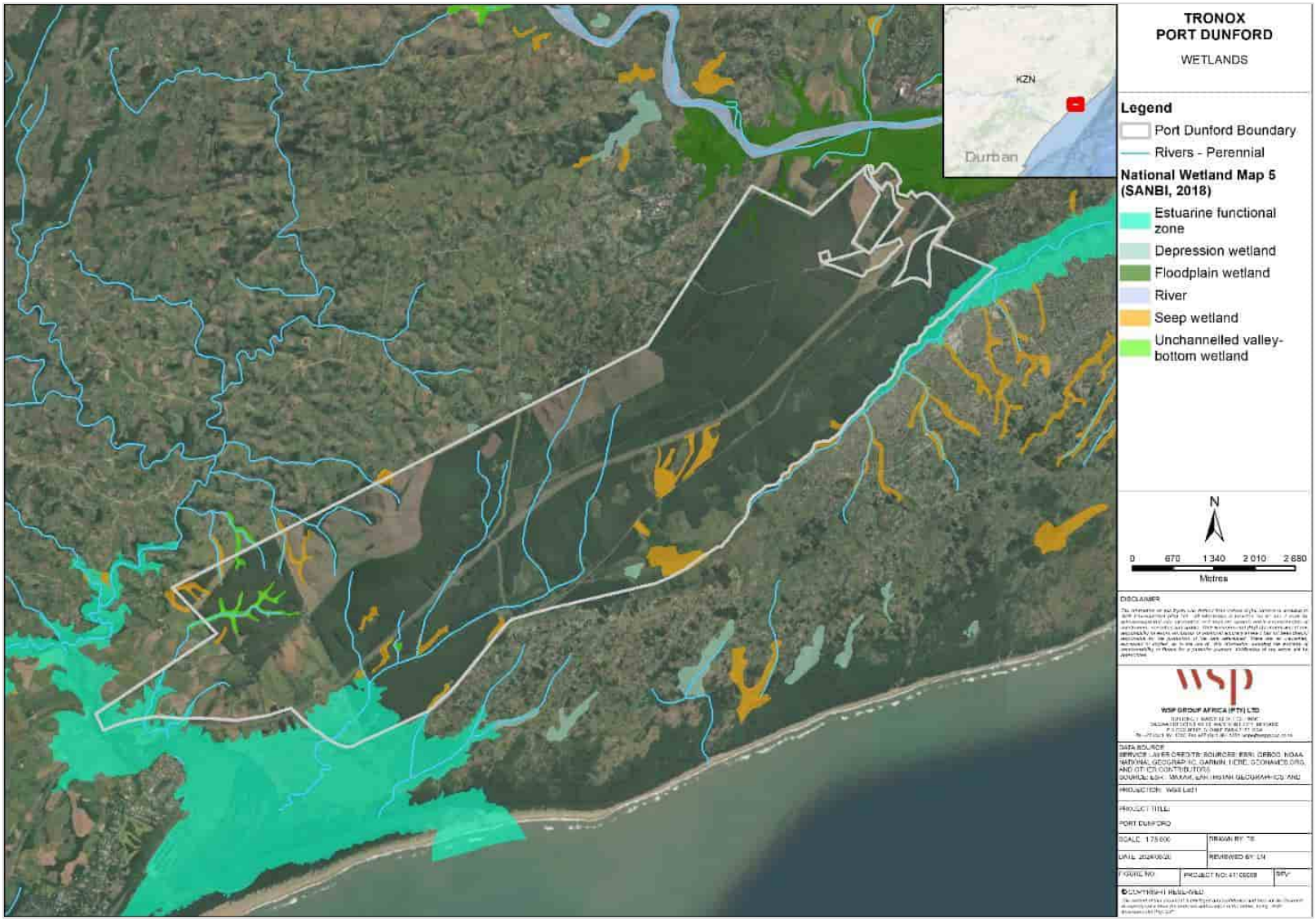


Figure 8-5 - National Wetland Map 5 in relation to the Port Dunford study area and surrounds.

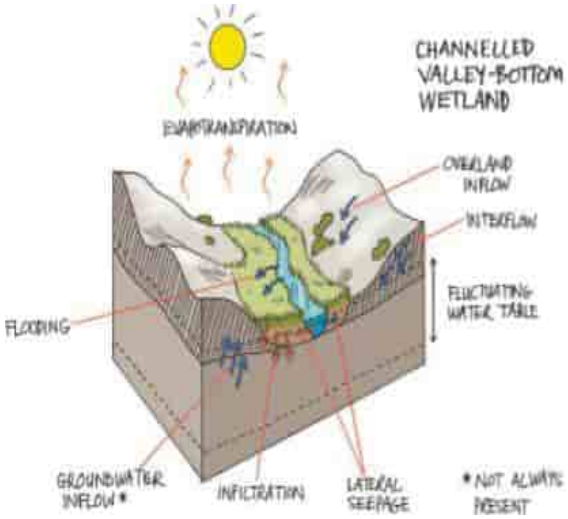
9. SITE-BASED FINDINGS

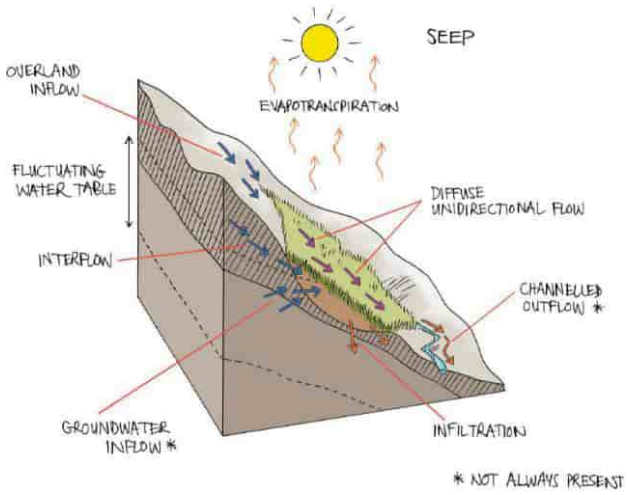
9.1. WETLAND DELINEATION, CLASSIFICATION AND CHARACTERISTICS

The study area presents a unique setting in which the watershed between two catchments dissects the Port Dunford boundary. This results in two distinct drainage areas (west and east) which have naturally developed due to the topography – Mlalazi River and tributaries to the west, draining to the Mlalazi Estuary, and the Mhlathuze River and tributaries to the east, draining to the Mhlathuze estuary).

The desktop evaluation, and subsequent field survey revealed the presence of sixty (60) HGM units, falling into two wetland HGM types: channelled valley bottom and hillslope seepage wetlands. In addition, three (3) estuarine regions are also present within the local landscape and are the focus of a separate estuarine assessment study. For further understanding of the freshwater HGM units occurring within the project area, DWAF (2008) and Ollis et al. (2013) have provided broad descriptions which are shown in Table 9-1.

Table 9-1 - HGM unit types present within the study site (DWAF, 2008; Ollis et al., 2013)

Classification	Illustration	Description
Channelled Valley Bottom		Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a 'river'. These valley-bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland.

Classification	Illustration	Description
Hillslope Seepage Wetland		Wetland area situated on a gentle to steep sloping land that facilitates the dominance of colluvial, unidirectional movement of material and water (mainly in the form of interflow) downslope. Water inputs are primarily via subsurface flows from an up-slope direction. Seeps are characterised by their association with geological formations (lithologies) and topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to 'seep' down-slope as subsurface interflow.

A summary of the wetland HGM types identified and delineated within the area of assessment is provided in Table 9-2 and illustrated in Figure 9-1.

Table 9-2 - Summary of Wetland characteristics for systems within the Mineral Rights Area (MRA) boundary.

CATCHMENT	WETLAND TYPE	EXTENT (Ha)
W12F	Channelled Valley Bottom	346.5
	Hillslope Seepage	384.68
W13B	Channelled Valley Bottom	105.77
	Hillslope Seepage	243.73
	Estuary (Mlalazi Estuary Estuarine Functional Zone (EFZ))	194.59
Grand Total		1275.27

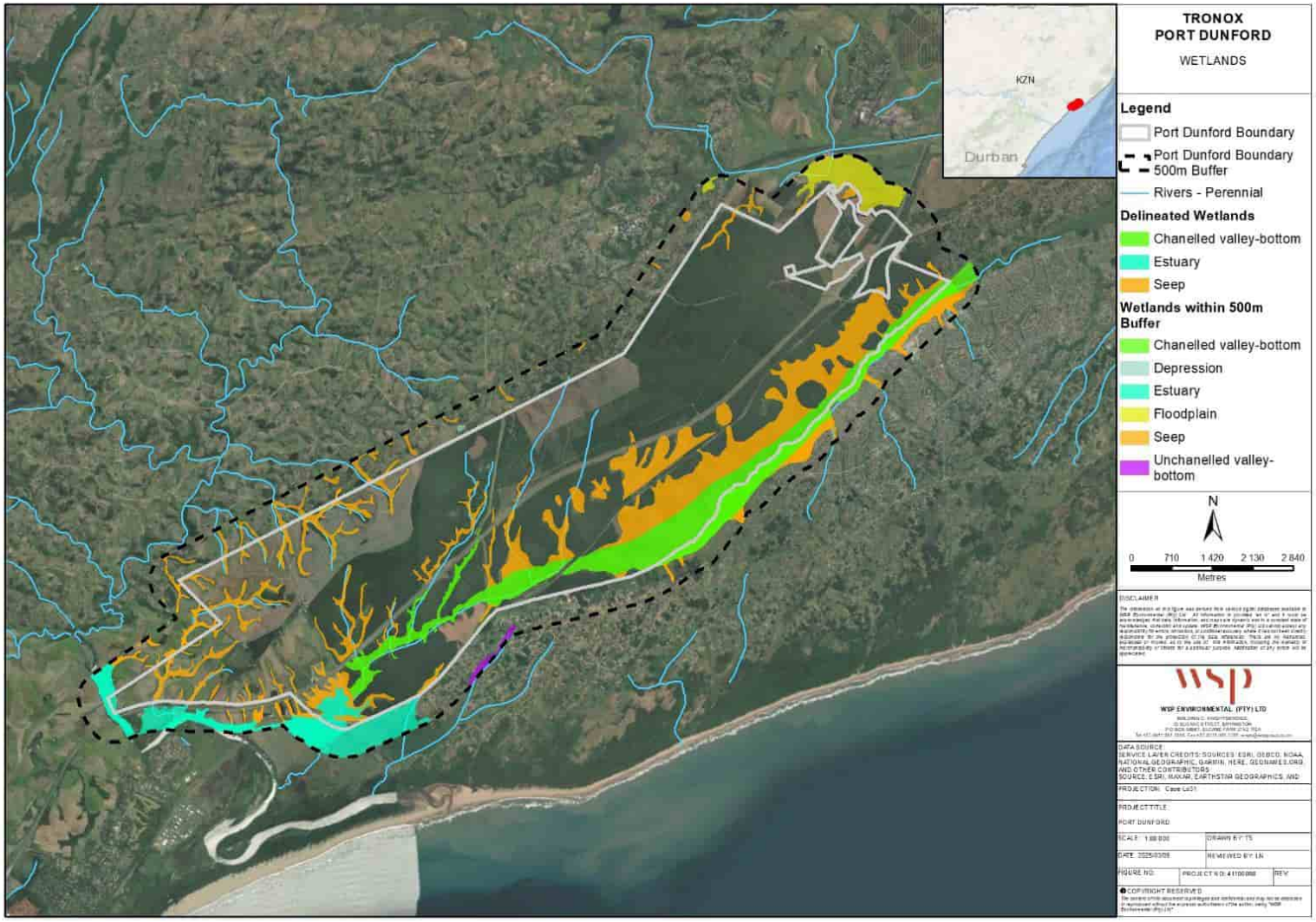


Figure 9-1 – Extent and classification of wetland HGM units identified within the proposed Port Dunford study area boundary and a 500m buffer thereof.

According to the surface water report compiled for the Tronox Port Dunford Project (WSPa, 2025), "*the surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater sources. Therefore, groundwater plays a significant role in the hydrological dynamics of the catchments. Based on a report compiled for the Zulti-South Project, located to the immediate east of the Port Durnford Project Area, it was found that due to the high permeability of the upper unconsolidated sediments in the area, groundwater effective recharge is estimated to range from approximately 450 to 750 mm/year. This equates to approximately 50% of the annual rainfall*." As such, groundwater base flow plays an important role in sustaining the regional wetlands, particularly during drier periods when surface runoff contributions are limited. This characteristic of the wetlands is important in later discussions around the potential mine impacts.

Seepage wetlands

The seepage wetlands were identified throughout the study area and are largely situated within sugarcane fields and *Eucalyptus* plantation regions. These seepage wetlands are expected to be saturated due to lateral and subsurface water input from the catchment and linkage to groundwater. Some of the impacts observed in field included gully formation within the seepage wetlands, caused by channelized flows increasing flow velocity and erosion potential (Figure 9-2A & C). The wetland vegetation within these seepage systems consists of small sedges (*Cyperus sp*.) and lacked robust obligatory vegetation i.e. *Typha capensis* and *Phragmites australis* especially within agricultural landscapes (Figure 9-2B).

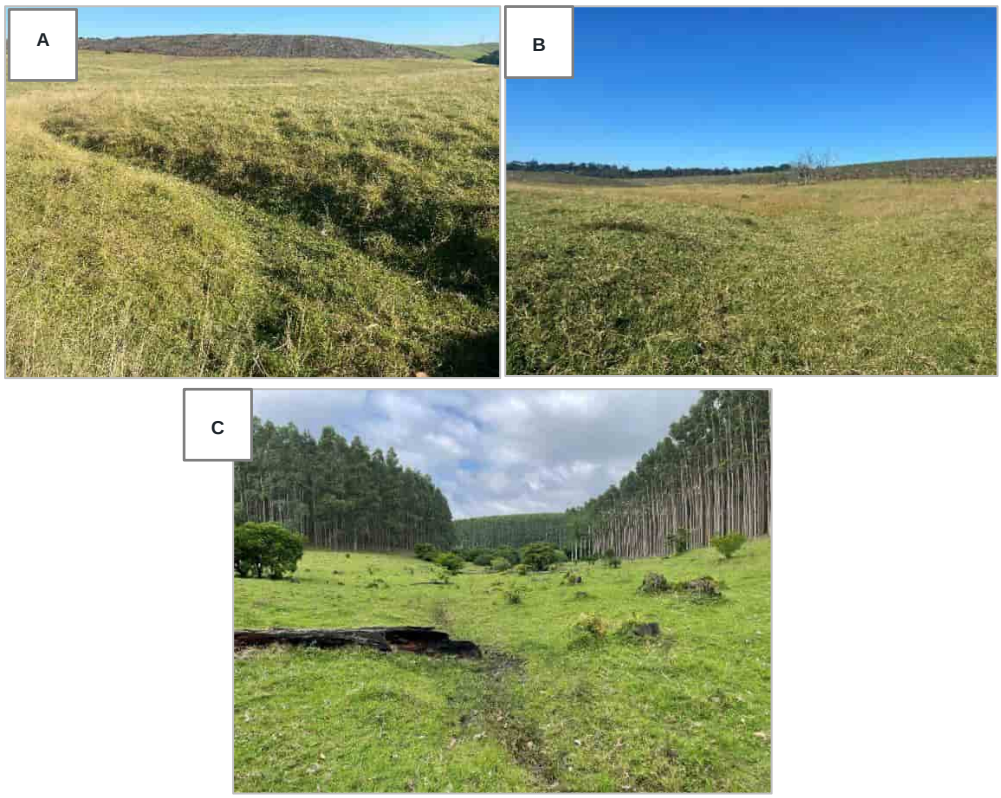


Figure 9-2 - Gully formation occurring within seepage wetland (A), Dominant vegetation consists of smaller sedges (B), Seepage wetland surrounded by *Eucalyptus* plantation.

Channelled Valley Bottom

The channelled valley bottom wetland (CVB) identified within the proposed Port Dunford study area has an extent of approximately 463ha. The system spans across the W12F and W13B catchments. The wetland is situated just south of the railway (Figure 9-1). The CVB system is fed from northern reaches via a vast network of seepage wetlands. The CVB wetland has a main channel system that runs through the central regions of the wetland. The site presents a unique setting as the western portion of the wetland drains towards the Mlalazi Estuary whilst the east drains towards the Qhubu Lake (also referred to as Cubhu Lake) which eventually connects with the Mhlathuze Estuary (Figure 9-3A). Due to fluctuations in discharge related to rainfall, the course of the channel within the valley bottom may change over short periods, with the extent of open water varying seasonally. The wetland is dominated by dense stands of *Phragmites australis* (Figure 9-3B) and *Typha capensis* (Figure 9-3C).

Figure 9-3 - The main channel that runs through the central regions of the system (A), Dominant vegetation includes *Phragmites australis* (B) and *Typha capensis* (C)

Swamp Forest

A swamp is a wetland permanently saturated with water and dominated by trees. There are two main types of swamps: freshwater swamps and saltwater swamps. Freshwater swamps are common in inland areas. Saltwater swamps protect coasts from the open ocean. The freshwater swamp forest

habitats identified during the field survey contain a high species richness but are dominated by *Barringtonia racemose*. The swamp forest habitat was found to occur across both the seep and valley bottom wetland habitats but was largely confined to wetter areas within these larger wetland systems. Figure 9-5 gives an indicative extent of the larger bodies of swamp forest within the study area wetlands, though swamp forest habitat was also noted in the narrower seep wetlands in the west of the study area. Wetland W12F-04 was considered relatively pristine with the exception of minor encroachment of *Eucalyptus* forestry and infilling (Figure 9-4A). The soil profile extracted displays bleached horizons around 35cm which is indicative of wetland soils (Figure 9-4B). The swamp forest within W12-07B was significantly degraded and lacks the majority of the common canopy cover as a consequence of anthropogenic influence within the wetland region. The ground cover observed was predominantly sedges (*Cyperus sp.* and *Eleocharis sp*.) with pockets of alien invasives noted i.e., *Solanum mauritianum* and *Arundo donax* (Figure 9-4C). The soil sample displays rich organic matter (darker in colour) and grades into a distinct bleached horizon (Figure 9-4D).

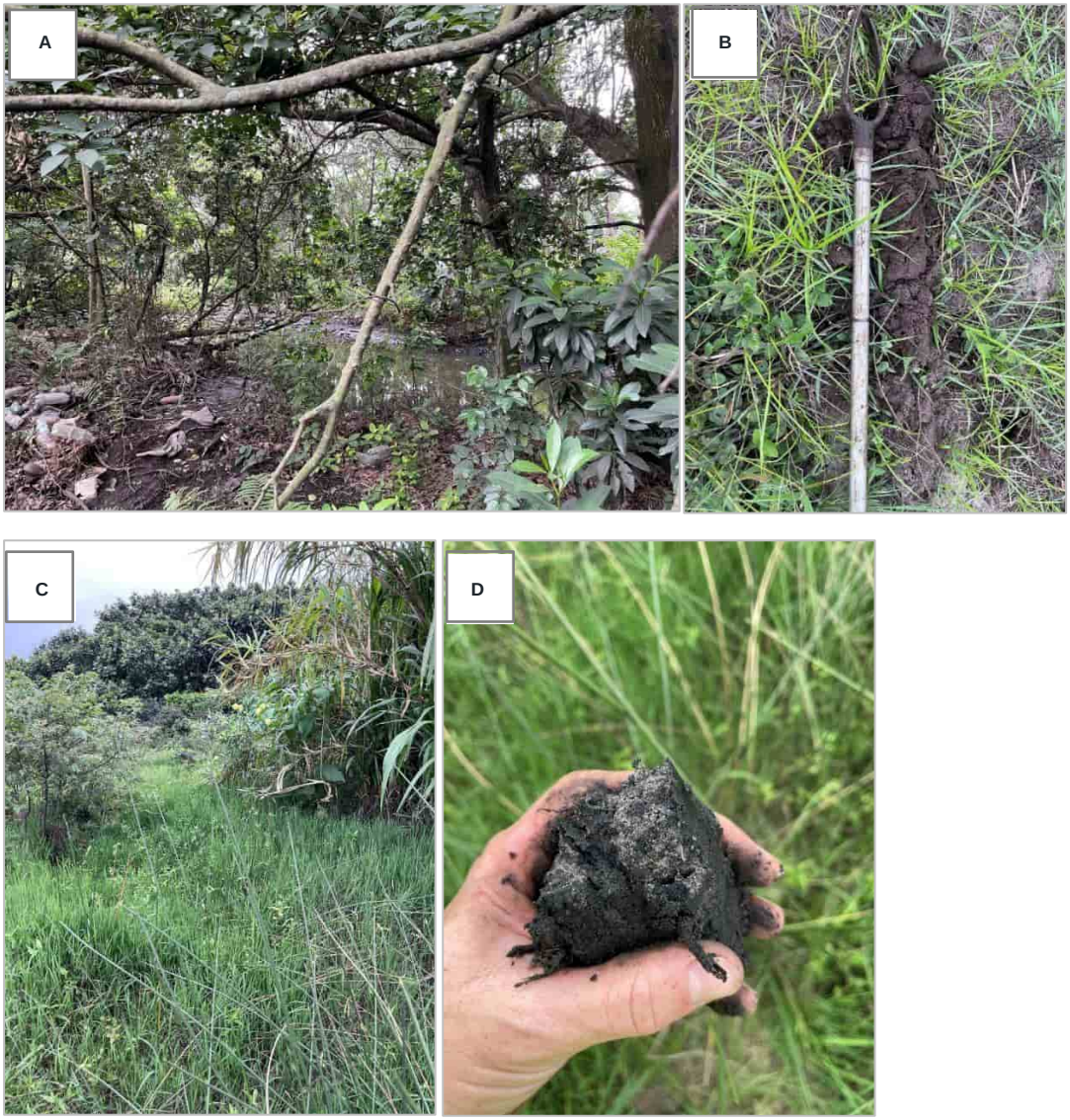


Figure 9-4 - Swamp forest undergrowth (A), Soil profile extracted (B), Alien invasive vegetation infiltrating within swamp forest (C), Distinct organic rich soils (D)

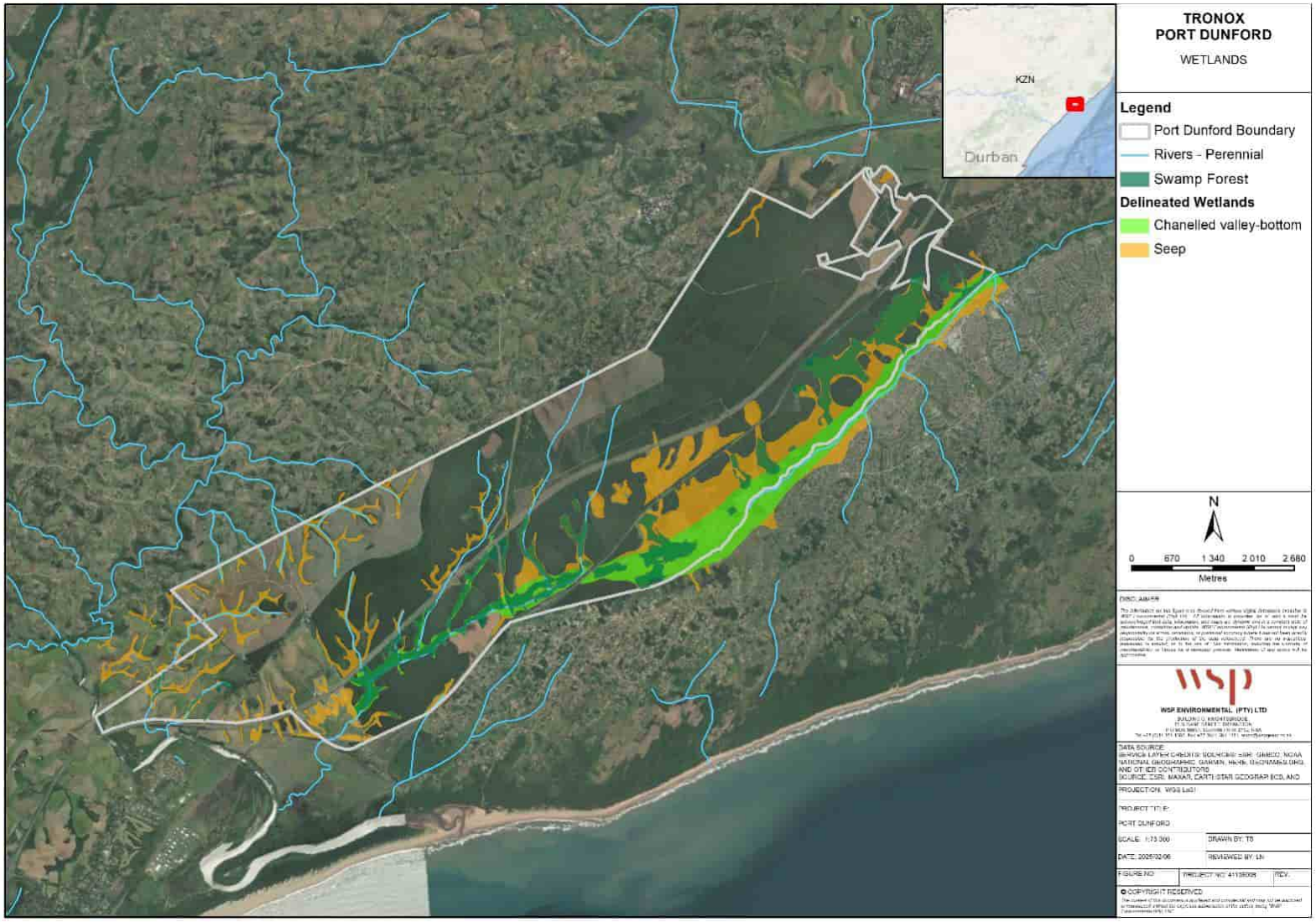


Figure 9-5 - Approximate extent of delineated swamp forest habitat within the broader wetland HGM extent.

Historically, the HGM units in this study area would have formed large, uninterrupted networks of wetland habitat linked to the drainage networks. However, with the rapid rate of anthropogenic change within the local landscape, the wetlands have become fragmented in places. To aid in the assessment of the wetlands and for ease of explanation, the wetlands have been subdivided into groupings in this report. Individual wetland HGM units have been placed into groups as per Table 9-3 and Figure 9-6 Figure 9-7 shows the wetland extent and grouping in relation to the proposed Port Dunford Mine infrastructure.

Table 9-3 - The grouping of wetland units based on surrounding landscape

Groups	Wetland Units
1 **(spit between catchments)** **Swamp forest surrounded by *Eucalyptus* plantation**	W12F-02 W12F-07 W12F-11 W12F-12 W12F-13 W12F-16
	W13B-18 W13B-41 W13B-42 W13B-43 W13B-44
2 **Relatively pristine swamp forest surrounded by *Eucalyptus* plantation**	W13B-16 W13B-17
3 **Fragmented swamp forest surrounded by *Eucalyptus* plantation**	W13B-13 W13B-15
4 **(split between catchments)** **Swamp forest surrounded by *Eucalyptus* plantation**	W12F-01
	W13B-01 W13B-10 W13B-12
5 **Highly impacted by anthropogenic impacts (housing developments)**	W12F-03 W12F-05 W12F-06 W12F-08 W12F-09 W12F-10
6 **Reed-dominated wetland adjacent to *Eucalyptus* plantation**	W13B-06 W13B-14

Groups	Wetland Units
7 **Relatively pristine swamp forest surrounded by *Eucalyptus* plantation**	W13B-05 W13B-07 W13B-08 W13B-09 W13B-11
8 **Wetland within sugarcane agricultural fields**	W13B-33 W13B-36 W13B-37 W13B-38 W13B-39 W13B-40
9 **Wetlands impacted by sugarcane agriculture and *Eucalyptus* plantations**	W12F-14 W12F-15
	W13B-02 W13B-03 W13B-19 W13B-20
10 **Wetland within sugarcane agricultural fields**	W13B-04 W13B-21 W13B-22 W13B-23 W13B-28 W13B-30 W13B-31 W13B-32
11 **Intact pockets of swamp forest within sugarcane agricultural fields**	W13B-24 W13B-29 W13B-35
12 **Fragmented swamp forest within sugarcane agricultural fields**	W13B-25 W13B-26 W13B-27 W13B-34
13 **Swamp forest surrounded by *Eucalyptus* plantations**	W12F-04

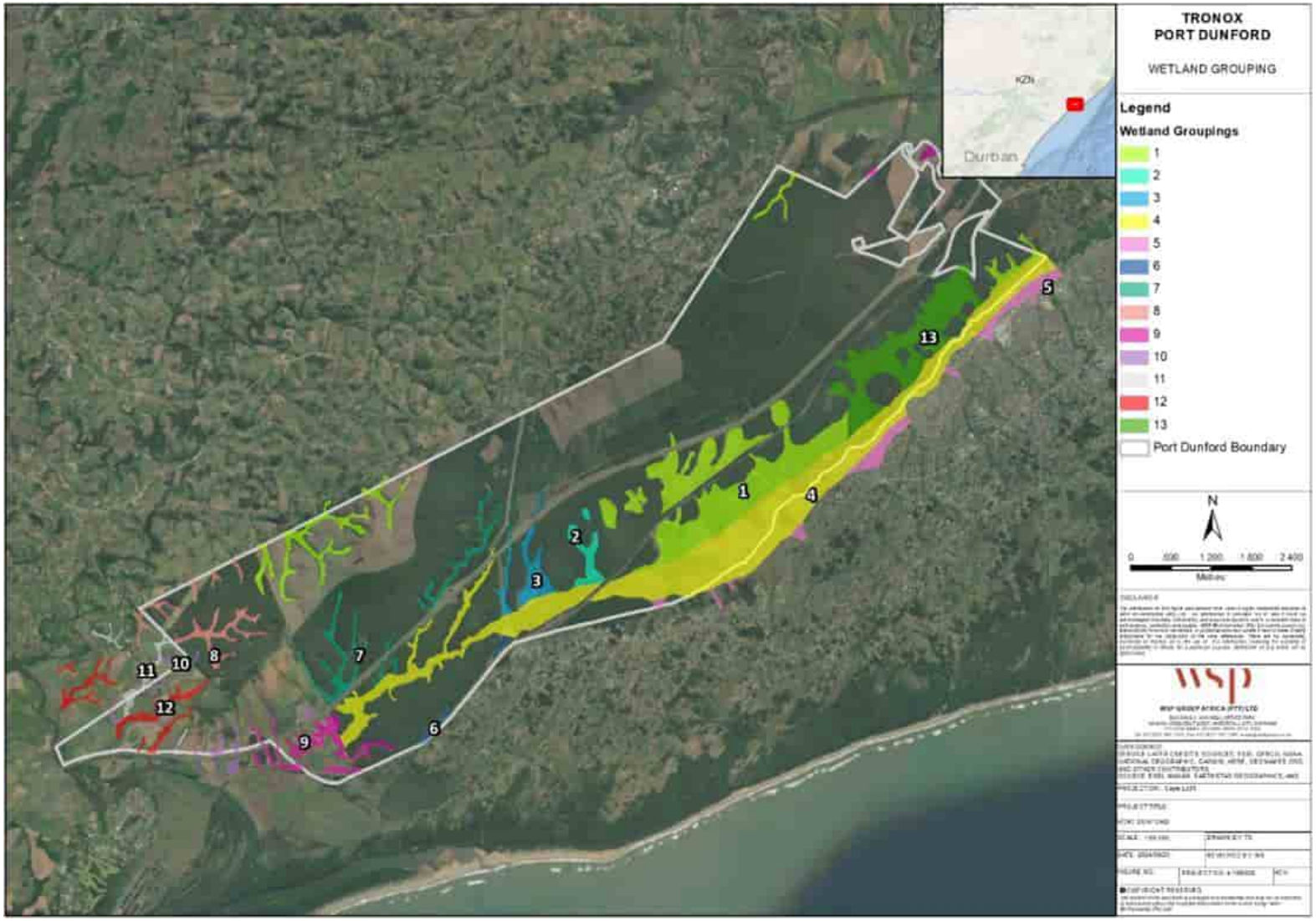


Figure 9-6- Wetland grouping based on surrounding landuse

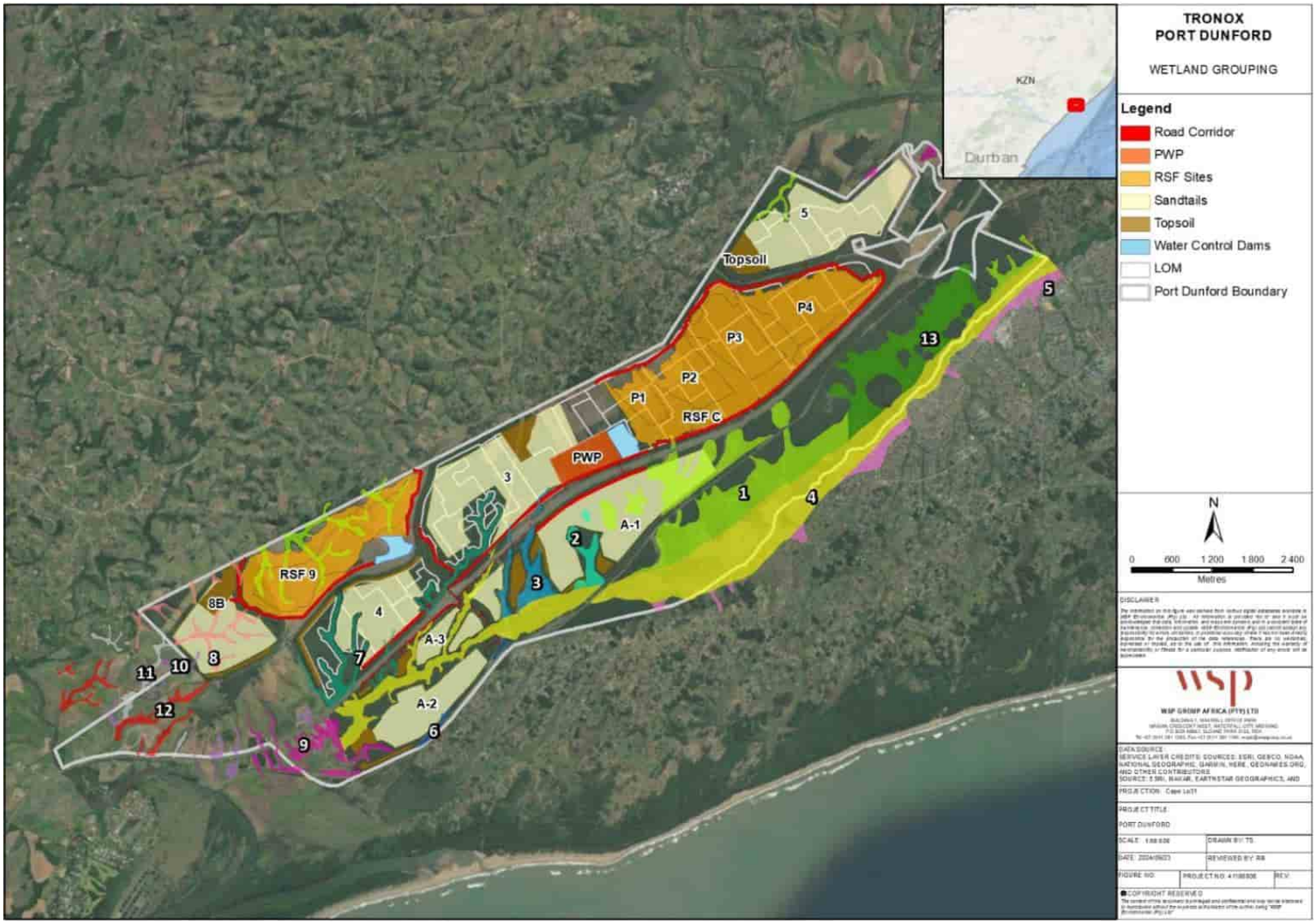


Figure 9-7 - The proposed infrastructure at Port Dunford in relation to the wetland groups on site.

9.2. WETLAND PRESENT ECOLOGICAL STATE (PES)

The state of the four main functional aspects of the wetland is considered for the WET-Health index. These are: (1) hydrology, (2) geomorphology, (3) water quality and (4) vegetation. The assessment of the ecological status of each of these functional aspects follows a broadly similar approach and is used to determine which impacts have affected the health status of the wetland. The assessment of the PES for these wetlands is presented below.

9.2.1. HYDROLOGICAL IMPACTS AFFECTING PES

Hydrological impacts experienced by the wetland groups relate to the presence of extensive *Eucalyptus* plantations, sugarcane agriculture, and road networks within the catchments. Roads that are located in close proximity to, or within, wetlands create preferential flow paths for surface runoff after rains, resulting in an increase in lateral and longitudinal soil erosion and mobilisation of sediment. Another impact identified due to roads is the impoundment and pooling of water at road crossings. Agricultural activities surrounding the wetlands also have a negative indirect impact on the hydrology of the systems. Sugarcane plantations can result in reduced flows into the wetlands as a consequence of surface water abstraction for irrigation purposes, as well as altered flow patterns due to trenching and flow diversion through cultivated footprints. *Eucalyptus* plantation forestry has been a dominant landuse within the study area boundary for a prolonged period of time (>50 years), and its presence is expected to have had a long-term impact on the wetlands through higher evapotranspiration of *Eucalyptus* trees over indigenous vegetation resulting in reduced runoff and catchment yield to the wetlands. In spite of this prolonged impact to the wetlands' supporting hydrology, areas of largely natural wetland habitat were still found to occur.

9.2.2. GEOMORPHOLOGICAL IMPACTS AFFECTING PES

Major geomorphological impacts on the wetland are associated with erosion gullies in the wetlands which have altered the geomorphological template and processes operating within the affected wetlands. Eroded sediments are transported into downstream areas leading to sedimentation and altered geomorphological structure.

9.2.3. WATER QUALITY IMPACTS AFFECTING PES

Observations made during the site visit suggest that while the clarity of the water flowing through the open water systems was high (i.e. low turbidity), there was evidence of nutrient loading with large amounts of algae thriving within the primary flow path of some of the wetlands. This suggests that the existing surrounding land uses, which include agricultural activities, are producing runoff that contains nitrates, and possibly phosphates. This has had a negative effect on the overall score for the water quality component of the PES assessments, especially for the wetlands found directly within the sugarcane plantations.

9.2.4. VEGETATION IMPACTS AFFECTING PES

Vegetation impacts to the wetland relate to reduced surface roughness/reduced vegetation cover, changes in vegetation species composition in the wetland resulting from overgrazing and the presence of alien invasive species. Additional impacts on wetland vegetation are those associated with *Eucalyptus* plantations and sugarcane agriculture which have occupied viable wetland habitat and reduced species diversity.

The above-described impacts and noted changes to the wetland habitat drivers (hydrology and geomorphology) and responders (water quality and vegetation) have caused the assessed wetlands to deviate from their assumed natural state. The outcomes of the PES assessment found the wetlands to currently lie along a spectrum of modification, ranging from largely natural (PES category B) to seriously modified (PES category E). The results of the PES assessment are illustrated in Figure 9-8, and detailed PES results per grouping are provided in Appendix 1 .

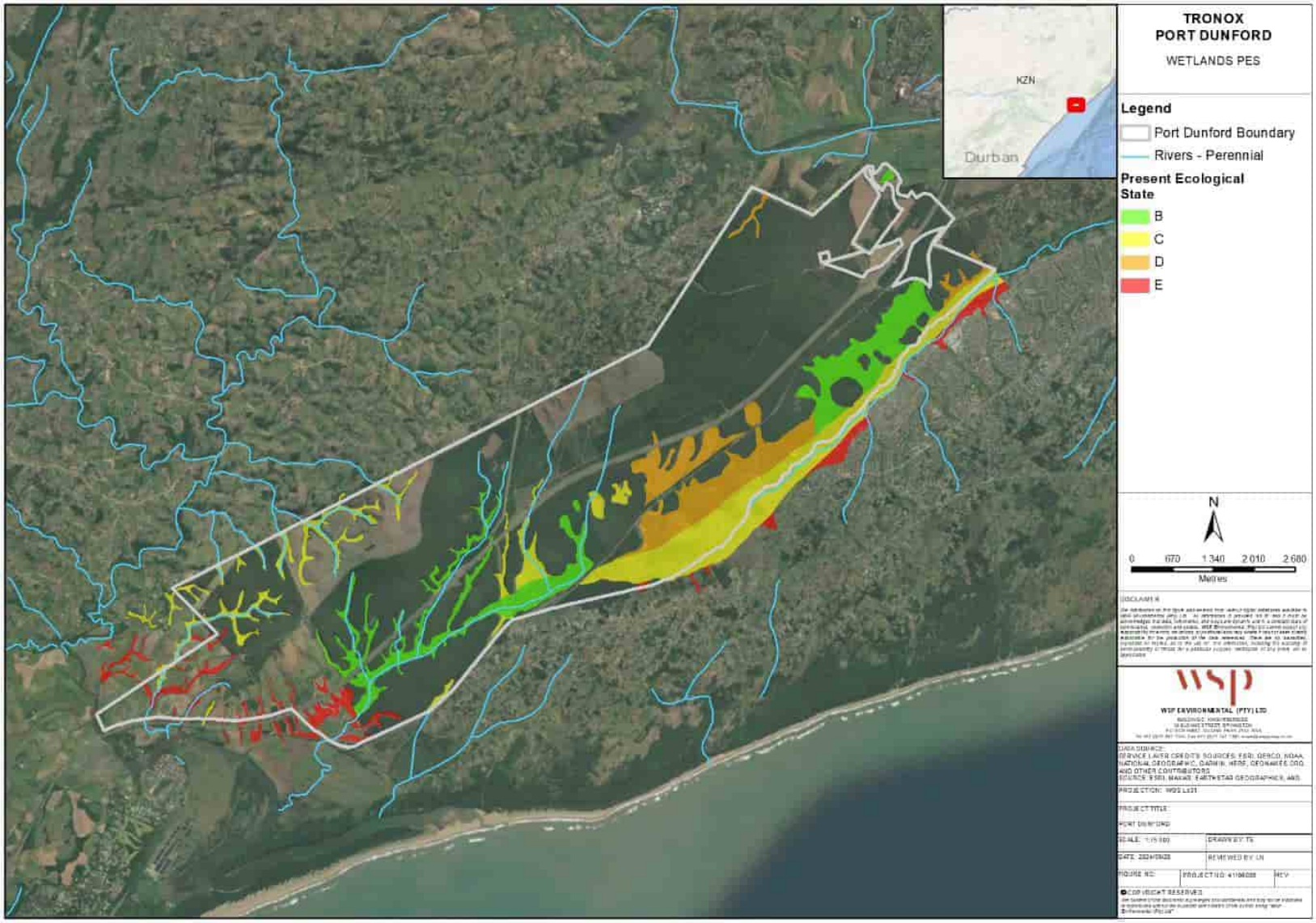


Figure 9-8 - PES of the wetlands within the proposed Port Dunford site.

9.3. WETLAND FUNCTIONAL ASSESSMENT

The WET-EcoServices assessment provides guidelines for scoring the importance of an HGM unit in delivering fifteen different ecosystem goods and services (Kotze *et al*., 2009). Ecosystem services include flood attenuation, streamflow regulation, sediment trapping, phosphate trapping, nitrate removal, toxicant removal, erosion control, carbon storage, maintenance of biodiversity, water supply for human use, natural resources, cultivated foods, cultural significance, tourism and recreation and education and research (Kotze *et al*., 2009).

The WET-Ecoservices assessments were undertaken for all of the wetland groups identified within the site boundary (refer to Appendix 3 for the detailed results of the ecosystem services assessments). Given that the various wetlands assessed are located in close proximity to each other in similar landscape settings and surrounded by the same land uses, results of the different wetland units assessed are largely similar.

The swamp forest wetlands, which exist as a mosaic within the larger HGM units, received scores that were moderate for streamflow regulation and sediment trapping, and high scores for biodiversity maintenance due to the variety of microhabitats provided by the swamp forests and noted important species identified in these habitats, such as Pickersgill's reed frog (*Hyperolius pickersgilli)*.

The seep wetlands are mostly situated within highly transformed agricultural lands and therefore reflect low scores, with a distinct pattern of water quality enhancing benefits due to filtering pesticides from adjacent farms.

The channelled valley bottom systems obtained moderate to high scores for streamflow regulation. These systems also displayed higher scores in biodiversity maintenance and direct provisional benefits such as water for human consumption.

9.4. WETLAND IMPORTANCE AND SENSITIVITY ASSESSMENT

The ecological importance of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has been impacted (Kleynhans *et al.*, 1998). The EIS considers biodiversity, rarity, uniqueness and fragility of the resource. The intrinsic ecological value of the resource and its importance to the functioning of neighbouring ecosystems are the main concerns. Further considerations that informed the EIS assessment include:

- The location of the study area within a vegetation type - Maputaland Coastal Belt vegetation and swamp forests that are considered as critically endangered habitats, and which are afforded moderate protection.
- The Critical Biodiversity Area has identified the swamp forests within the site as irreplaceable status.
- The loss of natural vegetation and habitats due to current and past cultivation within the wetlands.
- Species of conservation concern (SCC) were identified within the Port Dunford site boundary (i.e. *Hyperolius pickersgilli* (Pickersgill's reed frog) – Critically Endangered).
- The wetlands towards the western portion of the site form part of the Estuarine Functional Zone of the Mlalazi estuary.

- The wetlands within the southeastern portion have been transformed as a consequence of residential developments.

The EIS assessment for the study area wetlands was conducted for all impacted HGM units with the results illustrated in Figure 9-9 and Appendix 4.

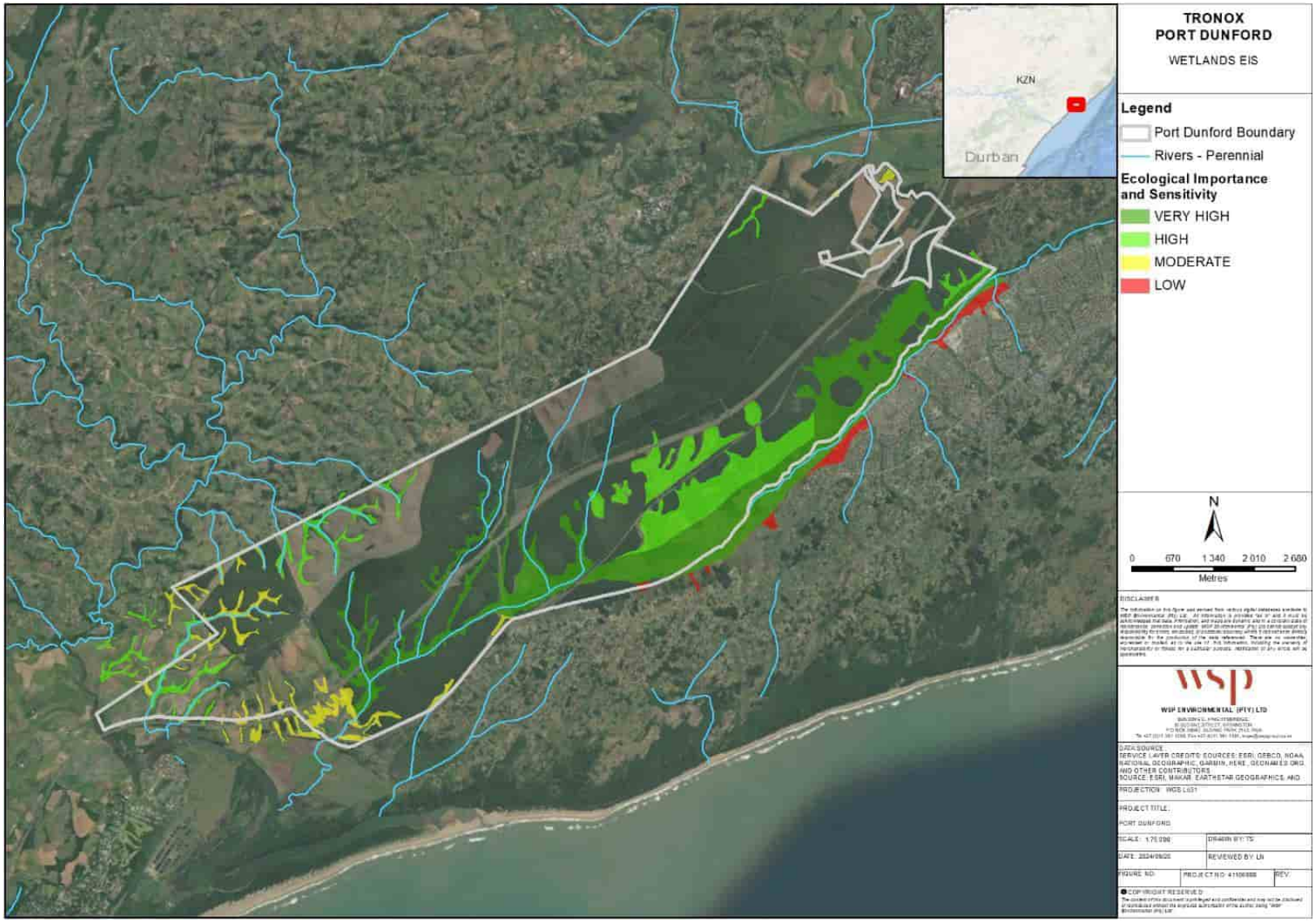


Figure 9-9 – Importance and Sensitivity of the wetlands within the proposed Port Dunford study area

9.5. RECOMMENDED ECOLOGICAL CATEGORY (REC) AND WATER RESOURCE MANAGEMENT OBJECTIVES

The future management of the freshwater ecosystems within the project area should be informed by the Recommended Ecological Category (REC) and associated recommended management objectives for the water resources. The REC is the target or desired state of resource units required to meet water resource management objectives and quality targets. It is determined through the consideration of the PES, EIS and realistic opportunities to improve the PES that is driven by the context / setting (Table 9-4). These results need to be interpreted in terms of the viability / feasibility of improvement and the desired characteristics of the wetlands based on the context of the catchment in terms of existing impacts/threats and future development pressures.

Table 9-4 - PES/EIS derived Matrix for the Determination of REC and Management Objectives for Water Resources.

			EIS			
			Very High	High	Moderate	Low
PES	A	Pristine/Natural	A Maintain	A Maintain	A Maintain	A Maintain
	B	Largely Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good - Fair	B Improve	B/C Improve	C Maintain	C Maintain
	D	Poor	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Very Poor	D Improve	E/F Improve	E/F Maintain	E/F Maintain

Based on this matrix and the catchment context, the minimum recommended management objective for the assessed wetlands is listed in Table 9-5 Below:

Table 9-5 - REC and Management Objectives for the assessed wetlands

Groups	PES	EIS	REC
1: W12F	D	HIGH	C/D IMPROVE
1: W13B	C	HIGH	B/C IMPROVE
2	B	VERY HIGH	A IMPROVE
3	C	VERY HIGH	B IMPROVE
4: W12F	C	VERY HIGH	B IMPROVE
4: W13B	B	VERY HIGH	A IMPROVE
5	E	LOW	E/F MAINTAIN
6	C	MODERATE	C MAINTAIN
7	B	VERY HIGH	A IMPROVE
8	C	MODERATE	C MAINTAIN
9: W12F	B	MODERATE	B MAINTAIN

Groups	PES	EIS	REC
9: W13B	E	MODERATE	E/F MAINTAIN
10	E	MODERATE	E/F MAINTAIN
11	C	HIGH	B/C IMPROVE
12	E	HIGH	E/F IMPROVE
13	B	VERY HIGH	A IMPROVE

The above REC's for the wetlands are determined based on a generic matrix that does not taken into consideration the context of the wetlands being considered. Given the ongoing land uses within the landscape that supports these wetlands, it is highly unlikely that a PES category of A can be achieved in any of the wetland systems. A more realistic target would be to maintain the current PES of the wetlands in the long term or allow for limited and managed decline in PES in systems where activities known to affect wetland integrity are authorised.

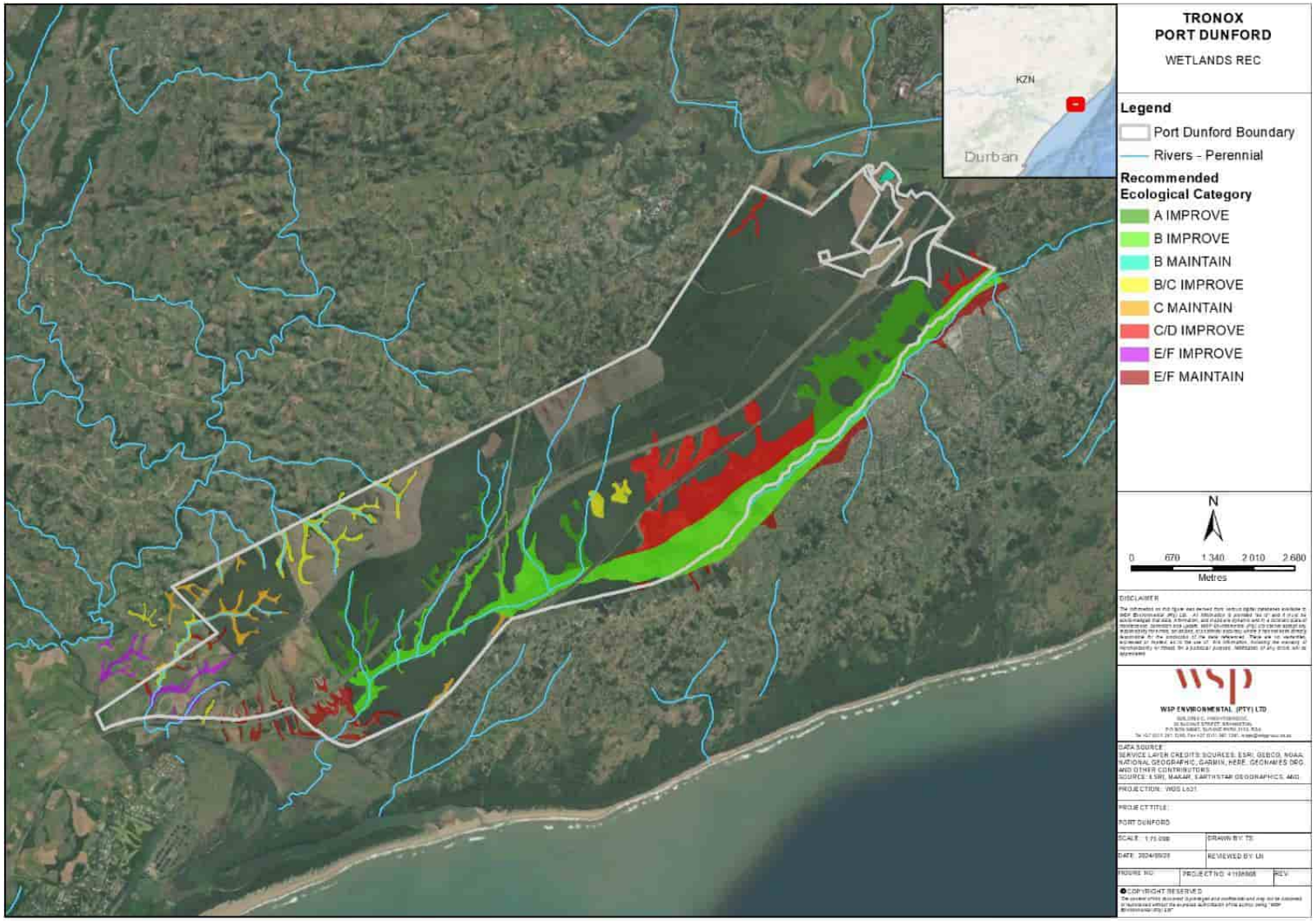


Figure 9-10 - The REC for the wetlands within the Port Dunford study area

10. WETLAND IMPACT ASSESSMENT

10.1. CURRENT IMPACTS

During the field survey, the current impacts that are having a negative impact on the sensitive wetland habitats were identified and are listed below. The effect of these impacts on the wetland ecosystems is discussed in the section detailing the PES of the wetlands.

- Dumping of litter in the wetland area
- Construction of a road network and bridges that traverse the wetland habitat.
- Rail network that crosses the wetland habitat
- Housing developments built within/close proximity to wetland habitats
- Alien Invasive Plants (AIPs)
- Sugarcane agriculture
- Extensive *Eucalyptus* plantations

10.2. PROJECT ACTIVITIES AND ASSOCIATED POTENTIAL IMPACTS

The proposed Port Dunford Heavy Mineral Mining operation will include the construction of the following infrastructure and designated regions:

- PWP,
- Open pit mining areas,
- RSF facilities,
- Water control dams,
- Sand Tails mounds
- Topsoil mounds and,
- Watercourse crossing infrastructure (pipelines, haulage road bridges, etc)

The proposed mining activities to be considered as part of the impact assessment are detailed in Section 2.2 and summarised below as follows:

- Phase 1 would last 10 years, from 2025 to 2035. The mining will operate at a low production rate of 100 tons per hour (tph) and 70 400 tons per annum (tpa). Active mining will occur five (5) days a week per month, 12 hours a day. The run-of-mine (ROM) material will be mined mechanically and hauled to the Fairbreeze mine via trucks for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. The infrastructure for Phase 2 will be constructed during the Phase 1 mining period.
- Phase 2 would last 33 years, from 2036 to 2069. The planned mining rate will be 3,000 tph, 24 hours a day, 365 days a year, at a design production rate of 3000 tonnes per hour. Phase 2 operation comprises opencast mining, on-site processing of ROM material in a primary wet plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox MSP located in Empangeni within the Tronox CPC.

Like any development, the proposed Port Dunford Mine facilities will have a series of potential impacts that need to be managed, particularly during the life of the mine. These mostly relate to the physical disturbance of the footprint of the mining operations and associated activities, such as *inter* alia vegetation removal, vehicle movements, excavations for pits, creation of facilities on site and earth moving activities. These activities are likely to have a negative impact on wetland habitat both directly within the footprint of the proposed development and downstream within affected catchments. Although impacts will be most severe and quantifiable within the Port Dunford boundary, certain impacts may translate to wetland habitat beyond the site boundary.

The project description and findings of the baseline wetland assessment were used to identify and quantify the potential impacts using the impact assessment approach detailed in Section 7.6. Additionally, the findings of the following studies were consulted to assist in the assessment of potential impacts to wetland habitats:

- Integrated Environmental Authorisation for the Port Durnford Mine, Kwazulu-Natal: Surface Water Baseline and Impact Assessment (WSP, 2025)
- Port Durnford Mine Hydrogeological Investigation (WSP, 2025)
- Soils, Land Capability, Land Use, and Hydropedology of the Port Durnford Mining Development (Red Earth, 2025).

To understand some of the potential hydrological impacts to wetlands posed by the proposed mine, there needs to be an understanding of certain key infrastructures and how they interact hydrologically with the environment, and therefore, the wetlands. The following can be stated based on a review of the surface water, and hydrogeological studies:

- The RSF material will be deposited as a slurry with 28% solids and 72% water and are expected to be a source of recharge to groundwater.
- The coarse sand tailings will be deposited as a slurry with 50% solids and 50% water and are expected to be a source of recharge to groundwater
- During operations, the groundwater levels are decreased due to mining activity (showing a drawdown) and increased due to deposition of wet sand tailings (showing a water level recovery).
- Although vegetation will be removed during the operational phase, the ore body areas will be contained resulting in a decrease in surface run-off and a potentially reduced catchment yield. This, however, will be for the short term as the mined ore body will be rehabilitated and the ground sloped to drain back to the original catchments. There is, however, currently forestry in the areas that are going to be mined. Forestry reduces runoff potential as it intercepts and uptakes rainfall and groundwater within areas that contribute to flow. Therefore, the areas to be occupied by mining and its associated infrastructure were already not contributing to the surface runoff. The baseflow simulation indicated that the mining activity will not impact the water quantities due to the reduction in baseflow in the catchments; instead, over time, the catchments will experience a slight increase in water quantities as the rivers are recharged as opposed to water being lost to evapotranspiration under the current land use.
- The findings of the surface water study regarding changes in base flow as a consequence of mining are relevant to the discussion of wetland hydrological impacts, as baseflow is considered to be an important driver of many of the wetlands, particularly during drier periods. Key findings are summarised below:

- KwaGugushe, Msasandla and Ojinjini Rivers (west of the Project Area) show an insignificant reduction in baseflow. The increase in baseflow is more significant due to the wet backfill/sand tailings.
- Baseflow to the Mhlatuze River (north of the Project Area) is limited as the area contributing to the Mhlathuze catchment is insignificant. Baseflow reduces from 2036, and the largest effect is seen from 2058 to 2061 during the mining of the north block. However, the wet backfill has a counter effect, and from 2061 to 2064, there is a significant increase in baseflow.
- Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu (northeast of the Project Area) is limited. It reduced slightly from 2036 to the end of mining. However, it increases from 2062 to 2064.
- Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary (south of the Project Area) shows an insignificant reduction in baseflow from 2036. The baseflow reduction is significant from 2054 to 2058 and again from 2062 to 2065. An increase in baseflow due to deposition is evident for the following periods:
  - From 2037 to 2052 - due to deposition of sand tailings A1, A2 and A3.
  - From 2056 to 2058 - due to backfill in area 4.
  - From 2066 to 2067 - due to backfill in area 3.

10.3. IMPACT MITIGATION AND MANAGEMENT HIERARCHY

According to the NEMA, sensitive, vulnerable, highly dynamic or stressed ecosystems (such as wetlands and rivers) require specific attention in management and planning procedures, especially where they are subject to significant resource and development pressure. A risk-averse and cautious approach which considers the limits of current knowledge about the consequences of decisions and actions is therefore required, and the precautionary principle of ‘no-net-loss’ therefore applies. Cost-effective measures must be implemented to pro-actively prevent degradation of the region’s water resources. The protection of ecosystems and associated biodiversity predictably begins with the mitigation of risks and avoidance of negative impacts, and where avoidance is not feasible; to apply appropriate and practical actions that minimize or reduce impacts. Mitigation therefore requires proactive planning that is enabled by following the mitigation hierarchy (Figure 10-1).

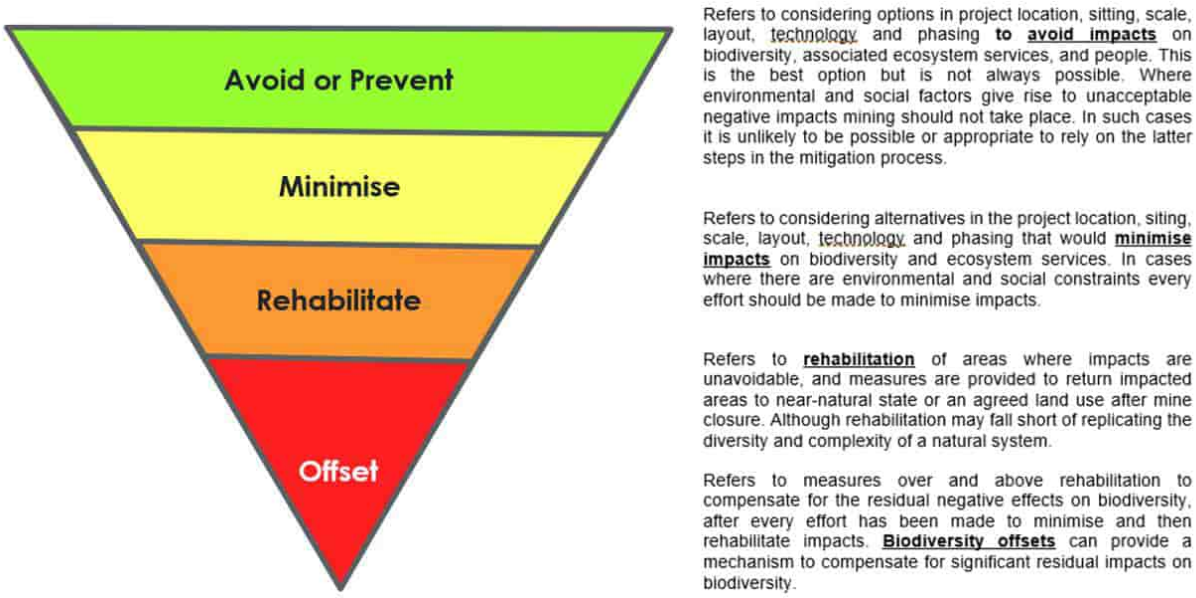


Figure 10-1 - Diagram illustrating the 'mitigation hierarchy' (DEA et al., 2013)

10.4. PRE-CONSTRUCTION PHASE

No impacts to wetlands are anticipated during the pre-construction phase, however, to limit the risk and significance of certain impacts to wetlands, it is proposed that scientifically determined buffers around wetland habitats be applied where feasible and practical. The proposed buffers should be integrated into the environmental planning and design of the project, and as far as possible, project activities and infrastructures should remain outside of these buffers.

10.4.1. BUFFER ZONES

Water resource buffer zones have been shown to perform a wide range of functions and have therefore been adopted as a standard measure to protect water resources and associated biodiversity (Macfarlane & Bredin, 2017a). Some of these key functions include:

- Maintaining basic aquatic processes.
- Reducing impacts on water resources from upstream activities and adjoining land uses.
- Providing habitat for aquatic and semi-aquatic species.
- Providing habitat for terrestrial species.
- A range of ancillary societal benefits.

However, though buffer zones can potentially provide some, or all, of the above-mentioned functions, not all water resource related problems can be addressed simply by applying a buffer zone, and they should ideally be implemented with a range of complementary mitigation and management measures (Macfarlane & Bredin, 2017a). Notable impacts or threats to water resources that cannot necessarily be addressed through the application of a buffer zone alone include:

- Point-source discharges (such as sewage outflows),
- Hydrological changes caused by stream flow reduction, and

- Groundwater contamination or use

The wetland buffer tool identified buffer distances for wetlands based on the type of mineral sand deposits that will be in close proximity of the wetlands, as per Table 10-1 below. However, it must be noted that in many instances, according to the current mine plan, infrastructure will overlap with the wetlands, leaving no opportunity for buffers to be effectively applied. Where infrastructures that could act as a sediment source intersect wetland habitat, as will be the case with RSF9, and several of the larger sand tails mounds, other mitigation measures, as proposed in Section 10.6.2.3, would be more appropriate and effective in minimising impacts to wetland habitat. The LOM has already been amended in places to avoid large (though not all) areas of wetland habitat and a 30m buffer. Where possible within the project constraints, it is suggested that the footprints of the topsoil and sand tails mounds be revised slightly to avoid intersecting with wetland habitats and remaining outside of a 30m buffer thereof. Other anticipated impacts, such as hydrological changes, are specifically not addressed through the application of buffers, and therefore application of these buffers would do little to minimise any hydrological changes. Buffer areas recommended by other specialists to address impacts to specific wetland SCC's may be more applicable in this instance.

It is important to note that application of the buffer zones, and exclusion of project activities from within the buffer zone where feasible, should be seen as part of a suite of mitigation and management tools required to minimise impact to the aquatic environment as a result of proposed development. Therefore, application of the buffer zones does not exempt the user from effectively and fully applying other recommended mitigation and management measures considered necessary to protect the wetland habitats from impact.

Table 10-1 - Recommended wetland buffer distances to be adopted for the proposed development

Buffer Tool	
Wetlands adjacent to Residue Fine Tailings (RSF)	45m
Wetlands adjacent to Sand Tails & Topsoil/Overburden material	30m

10.5. CONSTRUCTION PHASE

10.5.1. ANTICIPATED IMPACT DESCRIPTION

The construction phase will encompass construction of the Phase 1 infrastructure area, and preconstruction of the phase 2 PWP during the period 2025 to 2035. The construction phase will include vegetation clearance, topsoil and overburden removal of the Phase 1 mine area, construction of proposed infrastructure and general construction activities, including use of the road network, handling of potentially polluting materials and waste.

No wetland habitat lies within the Phase 1 mine footprint or the PWP footprint, therefore no direct loss of wetland habitat is anticipated during construction. Construction activities could result in wetland habitat degradation within adjacent or downstream wetlands through altered geomorphology of the wetlands, water quality deterioration, or changes to the hydrological regime supporting the wetlands.

The wetland systems potentially affected by these impacts are the seepage wetlands draining southwards across the N2, which drain towards the Amanzamnyama River, and to a lesser extent, the seepage wetlands draining to the southeast below the N2 towards the Mzingwenya River. Potential impacts include the following:

10.5.1.1. Altered wetland geomorphology

During site clearance undertaken as part of construction, areas of bare soils will be exposed to erosion during rainfall events. Earthworks and the stockpiling of topsoil represent further erosion risks and sediment sources. Where existing roads are expanded or upgraded, there is also a risk of flow concentration, erosion and sedimentation. Run-off from these areas is likely to be sediment-rich and could enter the adjacent wetlands, leading to increased sedimentation in the wetlands, increased turbidity and suspended sediment loads, as well as changes to the wetlands substrate where the sediment is deposited. If sediment originating from these activities and infrastructures does reach the wetlands, these changes will impact on the biodiversity of the wetland, potentially with short-term, negative effects.

10.5.1.2. Water quality deterioration

Water quality deterioration with the receiving wetlands could take place during the construction phase predominantly due to increased turbidity and suspended solids derived from soil erosion on the bare soil surfaces exposed during construction. In addition, use of hazardous substances such as oil, diesel, cement, etc. during the construction process could lead to pollution of water resources through spillages and leakages.

10.5.1.3. Altered hydrological regime

Vegetation clearing, soil compaction and an increased extent of hardened surfaces could lead to reduced flow infiltration to the soil profile in favour of surface runoff. In addition to increasing the risk of erosion, as discussed above, increased surface runoff may alter the hydrological regime of the downstream wetlands, which are largely supported by groundwater. However, given the small areas being affected by construction activities, it is unlikely that the reduction in groundwater recharge experienced will significantly affect the wetlands.

10.5.2. MITIGATION AND MANAGEMENT RECOMMENDATIONS

The following mitigation and management measures are recommended to limit wetland habitat degradation outside the footprints of the construction activities:

- Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of receiving wetlands.
- Construction should be undertaken during the dry season to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period.
- Road upgrades at watercourse crossings should be undertaken during the dry season and design and construction activities should not lead to flow impoundment upstream of the crossing, or flow concentration through the crossing. Measures should be put in place to limit concentrated surface runoff from the road surface and sediment runoff into the watercourses.
- A construction stormwater management plan must be developed and implemented prior to the commencement of large-scale vegetation clearing activities or construction activities and be

maintained until the end of the construction phase. Such a plan should aim to minimise the transport of sediment off site as well as prevent the discharge of high velocity flows into downslope wetlands. Sediment traps and sediment barriers should be installed where necessary, and clean water discharge points should be protected against erosion and incorporate energy dissipaters.

- Sediment transport off the site must be minimised through the establishment of perimeter sediment controls. This can be achieved through the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used.
- Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses.
- Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required).
- All hazardous substances used on site (including all diesel, oil, explosives, cement etc.) should be stored in designated, bunded areas, and spill kits should be in place. Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease. No surface run-off from these areas may be allowed to enter any clean water run-off or the wetlands on site.
- Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary.
- Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills.
- Administer timely clean-ups in the event of spillages occurring.

Table 10-2 – Wetland Impact Assessment: Construction Phase (Phase 1 and Phase 2)

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation							Mitigation Measures	Post-Mitigation						
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating
1	Wetlands	Vegetation clearance and earthworks (Phase 1 area, Phase 2 PWP)	Phase 1 and start of Phase 2	Site Establishment	Wetland habitat degradation through altered geomorphological characteristics (sedimentation & erosion) in downstream wetlands	Negative	3	2	3	3	3	**33**	**N3**	Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of receiving wetlands. Construction should be undertaken during the dry season to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses since there will be minimal to no rainfall during this period. Road upgrades at watercourse crossings should be undertaken during the dry season and design and construction activities should not lead to flow impoundment upstream of the crossing, or flow concentration through the crossing. Measures should be put in place to limit concentrated surface runoff from the road surface and sediment runoff into the watercourses. A construction stormwater management plan must be developed and implemented prior to the commencement of large-scale vegetation clearing activities or construction activities and be maintained until the end of the construction phase. Such a plan should aim to minimise the transport of sediment off site as well as prevent the discharge of high velocity flows into downslope wetlands. Sediment traps and sediment barriers should be installed where necessary, and clean water discharge points should be protected against erosion and incorporate energy dissipaters. Sediment transport off the site must be minimised through the establishment of perimeter sediment controls. This can be achieved through the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used. Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses. Disturbed areas remaining after construction activities should be rehabilitated timeously, i.e., rip soils and revegetate (if required). All hazardous substances used on site (including all diesel, oil, explosives, cement etc.) should be stored in designated, bunded areas, and spill kits should be in place. Onsite personnel should be trained to use spill kits to contain and clean up any leakages or spills of fuels, oils, and grease. No surface run-off from these areas may be allowed to enter any clean water run-off or the wetlands on site. Regularly monitor TSS, TDS, turbidity, oils, and grease in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary. Vehicle and machinery should be inspected, washed, and serviced regularly in designated areas to avoid accidental leaks and spills. Administer timely clean-ups in the event of spillages occurring.	2	1	1	3	2	**14**	**N1**
						Significance	**N3 - Moderate**								**N1 - Very Low**						
2	Wetlands	Vegetation clearance and earthworks (Phase 1 area, Phase 2 PWP)	Phase 1 and start of Phase 2	Site Establishment	Wetland habitat degradation through water quality deterioration	Negative	3	3	3	3	3	**36**	**N3**		2	1	1	3	2	**14**	**N1**
						Significance	**N3 - Moderate**								**N1 - Very Low**						
3	Wetlands	Construction of proposed infrastructure	Phase 1 and start of Phase 2	Site Establishment	Wetland habitat degradation through altered hydrological regime supporting downstream wetlands	Negative	2	2	1	4	2	**18**	**N2**		2	2	1	4	1	**9**	**N1**
						Significance	**N2 - Low**								**N1 - Very Low**						

10.6. OPERATIONAL PHASE

10.6.1. ANTICIPATED IMPACT DESCRIPTION

The operational phase will be split between Phase 1 (Year 2025-2035) and Phase 2 (2036-2069. Potential impacts include the following:

10.6.1.1. Direct wetland habitat loss

Complete loss of wetland habitat will occur wherever project footprints (opencast pits, RSF facilities, topsoil and sand tails stockpiles, dams, and other supporting infrastructures) overlap directly with wetland habitat. This loss of wetland habitat is conservatively assumed to be permanent.

The originally proposed Port Dunford mine plan intersected considerably with sensitive habitats, such as wetlands, and to reduce the environmental impact, the mine plan has been revised prior to this point to avoid sensitive environmental habitats to a greater extent. The original mining footprint presented in the scoping phase has been reduced significantly to exclude environmentally sensitive areas, including delineated wetlands, CBA and areas comprised of indigenous vegetation. Although not all wetlands are now excluded from the mine plan, where the Life of Mine (LOM) has been amended to avoid wetland habitat, a 30m buffer has also been applied around excluded wetlands. This effort to avoid impact to wetlands to a greater extent illustrates an effort to apply the mitigation hierarchy through impact avoidance.

The currently proposed mine plan does still infringe on wetland habitat, though to a lesser degree. The total extent of direct wetland habitat loss under the current mine plan is approximately 124 hectares (see Table 10-3 and the areas of wetland loss illustrated in Figure 10-2). The RSF9 facility in the west of the mine boundary, and sand tails stockpiles in the west (Stockpile 8B) and in the centre (Stockpile 1A) of the mine boundary will result in the largest loss of wetland habitat, which is largely classified as hillslope seepage wetland containing areas of swamp forest habitat.

Table 10-3 - Anticipated wetland loss (hectares) associated with the Port Dunford Mine.

Infrastructure	Wetland Loss Area (Ha)
LOM/RSF C	3.45
Road Corridor	2.15
RSF 9	35.86
Sandtails/Topsoil	82.14
Grand Total	123.6

Figure 10-2 - Wetland habitat loss within the Port Dunford Mine footprint

10.6.1.2. Wetland habitat degradation through alteration of the hydrological regime

As discussed in Section 10.2, the proposed mining activities will influence the hydrology driving the wetlands (both base flow and surface runoff) in the following ways:

- Mine areas will remove areas of the catchments of wetlands downslope within the same catchments, potentially reducing surface water catchment yield to the wetlands.
- However, the planned mining will replace current *Eucalyptus* forestry, thereby potentially increasing surface water (and base flow) availability to the wetlands through reduced evapotranspiration.
- During mining, groundwater level will be temporarily depressed below and surrounding active mining pits, and base flow to rivers will be reduced temporarily. This depression in groundwater and base flow reduction will be of short duration (generally periods of <5 years) for any given area. The wetland systems affected will depend on the area actively being mined at that time.
- Backfill of the mine pits with sand tails, deposition of RSF fill, and placement of additional sand tails mounds below the N2 and west of RSF 9 will increase recharge to groundwater and base flow sustaining the wetlands, as well as expected toe seepage contributing to surface water runoff along the lower margins of sand tails in some instances.

The above indicates that the proposed mining is likely to affect the hydrological regime of the wetlands remaining within the Port Dunford area and may translate some distance downstream to wetlands beyond the mine boundary. However, quantification of this impact, given the opposing forces contributing to potential increase versus decrease in surface runoff and groundwater recharge, is challenging. Base flow is thought to be important in sustaining the wetlands during drier periods, while surface runoff will play an important role in driving seasonality during high rainfall periods. It is expected that the spatially shifting drawdown cone (depressing groundwater level) will drive localised and temporarily (<2 years) drier conditions within the wetlands which could result in shifts in the wetland vegetation community in response. Swamp forest vegetation communities are largely limited to permanently saturated (waterlogged) conditions, therefore catchment hydrological changes that may result in reduced baseflow to the wetlands could result in alteration of one of the key drivers maintaining this vegetation type and potentially resulting in change. However, as already described, these potentially drier periods will be offset by periods of increased recharge, elevated baseflow, and likely wetter conditions in downstream wetlands. These potentially drier and wetter conditions may drive localised vegetation community shifts within the wetlands that could be advantageous to species that thrive in unstable conditions, such as pioneer and alien invasive species. However, the overall impact is temporary and the wetlands, at an HGM unit scale are unlikely to be significantly impacted.

10.6.1.3. Wetland habitat degradation through alteration of geomorphological processes

Sediment transport into wetland habitat and erosion of wetland soils can have significant effects on wetland integrity, having knock-on effects to flow patterns, vegetation composition and structure, and water quality.

There is anticipated to be increased sediment loads from mining areas and coarse and fine sand tailings disposal facilities, including sand dumps. Mining will potentially expose sediment and runoff from exposed areas during the operational phase, depositing these sediments into the wetlands, especially during heavy rainfall events. This can lead to vegetation smothering, increased turbidity of open water, and altered geomorphological structure of the wetlands. Wetlands can act as valuable

sediment traps limiting sediment transport to downstream rivers. However, there is the risk that this capacity could be exceeded and that the wetland habitat could become degraded as a consequence.

Wetland erosion could occur at any point source flow discharge locations, or at flow concentration points, such as road or linear infrastructure crossings through wetlands, where concentrated, higher velocity flow has a greater erosive energy.

10.6.1.4. Wetland habitat degradation through water quality degradation

Water quality within the wetlands can be impacted through point sources discharges and diffuse pollution. No point source discharges are planned from the proposed operations. Therefore, potential impacts will arise from accidental point sources and diffuse sources. Accidental point source pollution can arise from the following activities,

- Spills from pipelines (slurry) and vehicles (fuel, oil, grease, ore).
- Flooding causing mixing of clean and dirty waters, including RSF breach.
- Discharges or spillage of surplus stormwater.

Diffuse pollution, which is often more difficult to manage, can arise from:

- Seepage from the open pits and sand dumps (directly to surface waters and indirectly via groundwater) affected by geochemical changes and process reagents.
- Unmanaged stormwater runoff from contaminated surfaces.
- Runoff from exposed areas, including sand dumps, carrying increased sediment load which can increase turbidity in receiving watercourses.

10.6.1.5. Wetland habitat degradation through vegetation disturbances

Wetland vegetation, including areas of swamp forest present in both the seep and valley bottom wetlands, may be disturbed through changes in hydrology that create drier or wetter conditions that cause a shift in species composition, sediment deposition that leads to physical burial of vegetation, or encroachment of alien invasive and pioneer species that establish in areas of disturbance. A key driver of invasion by alien plants is high disturbance. Exotic species are often more prevalent near infrastructural disturbances than further away. Typical consequences of this include the loss of indigenous vegetation, change in vegetation structure and habitat, increased water consumption and impaired wetland functioning. Swamp forest vegetation communities are largely limited to permanently saturated (waterlogged) conditions, therefore catchment hydrological changes that may result in reduced baseflow to the wetlands could result in alteration of one of the key drivers maintaining this vegetation type and potentially resulting in change.

10.6.1.6. RSF Dam Breach

Residue Storage Facilities (RSF) provide a cost-effective means of storing large volumes of waste slurry over the productive phases of mine life allowing for the discontinuation of other detrimental waste-management practices, such as riverine tailings disposal, where tailings are piped directly into river system. However, owing to their size, tailings dams are considered a major hazard that can pose risks to local people and the environment. Breaches near watercourses have been shown to be detrimental to aquatic ecosystems functioning, and the tailings can intermix with natural soil/sediment and result in long term impacts to stream chemistry (Byrne et al., 2018; Marais et al., 2024).

Based on the Dam Breach and Flow Slide (DBFS) analysis report (Epoch Resources, 2025), which was aimed at estimating potential outflow volumes associated with potential breaches in the RSFs, It was determined that should the RSF facilities breach, though considered to be of low probability, a significant volume of residue is expected to be released from the RSFs in the event of a failure (approximately 20.5% and 20% of stored material could potentially breach from Sites 9 and C, respectively)(Epoch, Resources, 2025) and will affect a considerable portion of the downstream wetland regions, including but not limited to hillslope seep and channelled valley bottom wetlands associated with the Mzingwenya River, and wetlands associated with the KwaGugushe and Mlalazi Rivers (Groups 1, 4, 5, 8, 9, 10, 11, 12 and 13) (Figure 10-3).

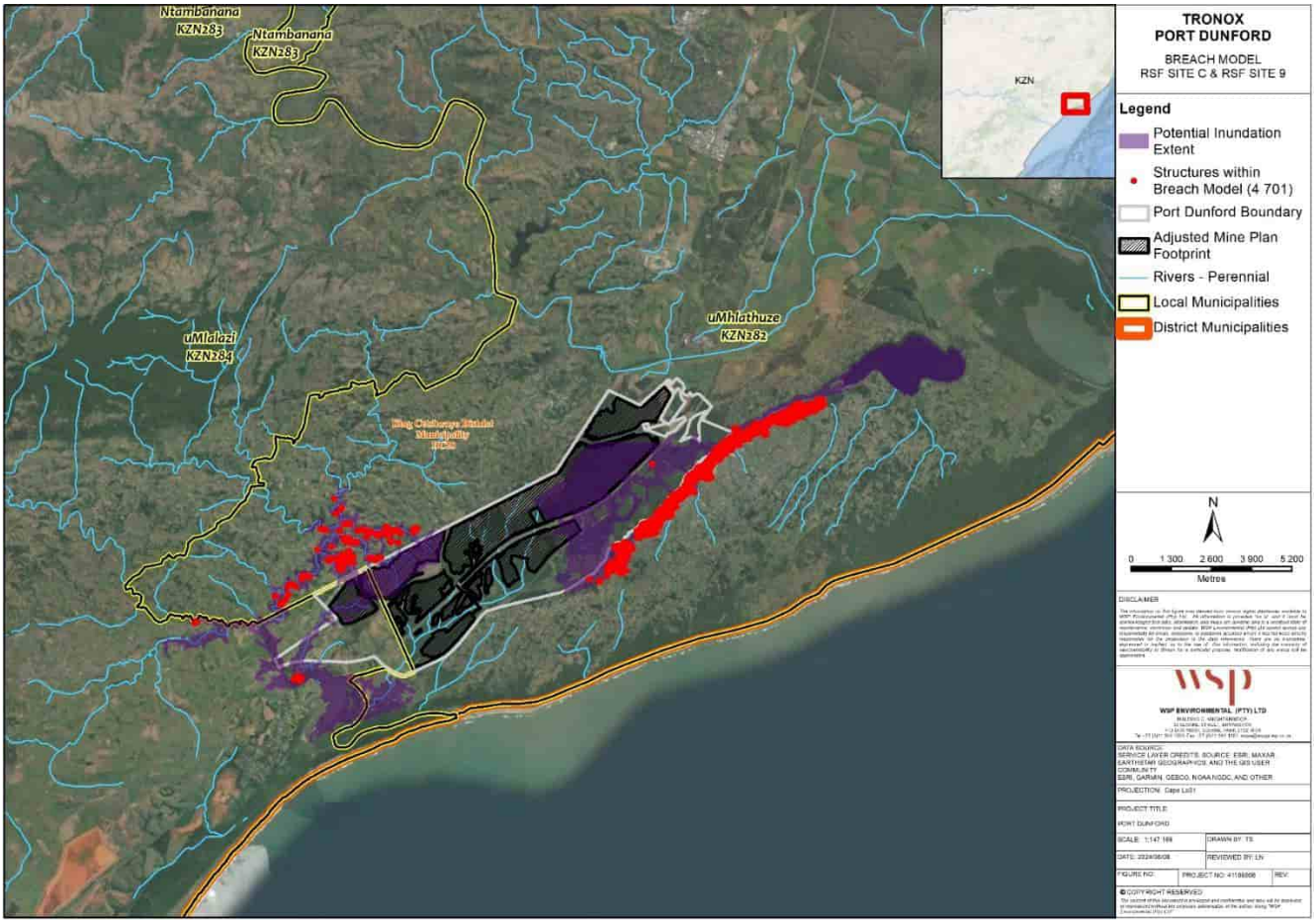


Figure 10-3 - RSF facility dam breach model, highlighting possible inundated regions

10.6.2. MITIGATION AND MANAGEMENT RECOMMENDATIONS

10.6.2.1. Wetland Habitat Loss

Wetland loss is unavoidable within the footprint of approved activities. The following avoidance and minimisation measures are recommended:

- It is suggested that the sand tails and topsoil stockpiles below the N2 be reshaped slightly to avoid intersecting marginally with wetland habitats, and wherever possible, a 30m buffer. This will realise a small reduction in wetland loss.

- All construction activities must be limited to the smallest area possible by remaining fully within authorised and clearly demarcated areas.
- No stockpiles should be placed in wetland habitat, except where expressly authorised.

However, the loss of wetland habitat will occur even with implementation of the mitigation measures recommended in this report and represents a residual, negative wetland impact.

The LOM will be rehabilitated concurrently with mining, and the various stockpiles and storage facilities will be shaped and revegetated prior to closure. However, the topography of the landscape will be permanently altered, and it is assumed that wetland habitat lost within these footprints cannot be reinstated in the post mining landscape, at least not with any degree of certainty. Therefore, application of the mitigation hierarchy indicates that significant residual, negative impact, such as the unavoidable loss of wetland habitat, requires an offset. It is therefore recommended that some form of wetland offset, or compensatory mitigation strategy be developed to address the residual wetland impact - the permanent loss of wetland habitat. The wetland offset developed must be aligned with the National Biodiversity Offset Guideline (GN3569, 2023, Issued under Stion 24J of the National Environmental Management Act), and the SANBI wetland offset guidelines (SANBI & DWS, 2016). Further discussion around the wetland offset requirements, and preliminary quantification of the wetland offset requirement is provided in Section 10.9.

10.6.2.2. Wetland habitat degradation through alteration of the hydrological regime

Lowering of groundwater levels is temporary (generally 2 years), and backfilling into the pits will add water to the aquifer, reducing the duration of the impact to wetlands. Reduced surface catchment yield to wetlands is expected to be offset to a degree through a reduction in evapotranspiration associated with removal of forestry from the mine footprint. The following additional measures are proposed:

- The post mining landscape will be returned to plantation forestry; however, it is recommended that re-establishment of plantation forestry be limited to the areas falling outside of all delineated wetland habitats and a 50m buffer thereof to limit edge effects and provide a natural buffer zone for diffuse impacts between the wetlands and future landuse.
- Implement monitoring of potentially affected wetlands, as detailed in Section 10.10, to identify any negative effects that arise and allow for adaptive management.

10.6.2.3. Wetland habitat degradation through alteration of geomorphological processes

Mitigation will be aimed at limiting the opportunity for sediment mobilisation, or wetland erosion, and placing barriers to entry for sediments into potentially receiving wetlands. The following is proposed:

- It is recommended that the topsoil and sand tails mounts have a maximum side slope of 1:5 to limit the risk of erosion of the side slopes and sediment transport to the wetlands.
- The design of the coarse and fine sand tailings disposal facilities must include concurrent rehabilitation and perimeter runoff and sediment management infrastructure.
- A comprehensive sediment management plan and stormwater management plan must be developed for the life of the project. Generation of runoff and transport of sediment off site must be controlled and minimised through appropriate stormwater management and the use of sediment controls or barriers, such as sediment fences or similar and as appropriate to the nature of the potential sediment source. The project engineers should advise on the best sediment control option based on the nature and magnitude of the potential sediment source and loads. Unvegetated earth

berms should not be considered sufficient to act as barriers between active mine areas and the remaining, adjacent natural environment, as they are prone to erosion and can act as an additional sediment source to the wetlands if breached.

- Bare surfaces downstream from the mine where sediment traps are not an option should be vegetated to limit erosion and runoff that might be carrying contaminants.
- Sediment mobilization off the RSF dam wall should be minimized through re-vegetation of the dam wall with suitable grass cover as soon as possible, as well as establishment of sediment fences/barriers along the downslope edge of the dam wall. Such sediment barriers must be regularly inspected by an appropriately qualified engineer and repaired if damaged or showing signs of erosion.
- It is proposed that the mining infrastructures (RSF, sand tails mounds, LOM boundary) and downslope habitat should be monitored during operation for any signs of erosion. Any erosion issues arising should be addressed immediately. Appropriate means of addressing any erosion will depend on the specific situation and should be referred to an environmental engineer or wetland ecologist to address.
- Topsoil stockpiles to be maintained and managed as per the mine rehabilitation plan guidelines. To protect stockpiles from erosion, particularly those exceeding 2m in height, the stockpiles should be vegetated.
- Limit the storage time of topsoil to as short a time period as possible. If stockpiling is longer than 1 year, the topsoil stockpiles should ideally be re-vegetated with locally occurring indigenous vegetation.
- Do not burn, cut or remove natural vegetation outside of authorised and designated areas of the development as this may expose soils to erosion.
- Do not allow activities which result in soil compaction to occur outside of authorized and designated areas, e.g., storing of heavy machinery, driving or dumping of materials.
- Areas inadvertently compacted must be ripped with a small machine (agricultural) to alleviate compaction.
- Any road crossings established through wetland habitat must be designed such that they do not cause any flow impoundment or concentration that could lead to erosion of the downstream areas.
- Any areas where concentrated flow is anticipated to discharge must be protected against erosion through the application of appropriate erosion protection mechanisms appropriate to the situation.

10.6.2.4. Wetland habitat degradation through water quality degradation

The aim of mitigation will be to limit the sources of potential pollutants to the environment, and address polluting events efficiently and effectively if they do occur.

- Runoff from dirty areas should be directed to the stormwater management infrastructure and not be allowed to flow into the natural environment. Stormwater should be contained and pumped to the plant over time.
- Minimise the footprint or catchment of the dirty area as much as possible and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff.
- Any infrastructure used in the storage or transport (e.g., pipelines) of potentially hazardous materials or slimes, must be regularly inspected to ensure proper functioning and identify any maintenance or repair issues that should be addressed.
- It is recommended that a Hazardous Material Management Plan and Waste Management Plan (aligned to the requirements of international best practice) be developed and implemented at the

site prior to initiation of the construction and operational activities. Handling of hazardous substances should be kept to a minimum within the development activity site. Additionally, thorough training should be administered to site personnel regarding handling of the aforementioned substances.

- All measures to limit erosion and increased sedimentation within wetland habitat to be applied to limit increased turbidity of the water column in receiving wetlands.
- Measures must be implemented to prevent runoff or dust from dirty water areas, such as the PWP and other surface infrastructure areas, from entering the aquatic system. This can be achieved by ensuring that such infrastructure remains outside of all wetland and aquatic systems, ensuring effective clean and dirty water separation, managing and disposing of any contaminated runoff or potential pollutants in an appropriate manner and ensuring these do not enter the aquatic system, and by implementing (if necessary) a dust control system.
- No dumping of any materials or storage of any equipment should be allowed within the sensitive areas, particularly the wetlands.
- During all phases of the development activity, all waste should be removed to an appropriate waste facility and under no circumstance should waste materials or contaminants be discharged into the environment or buried.
- Washing and cleaning of equipment should be done within berms or bunds, in order to trap any pollutants/sediment and prevent excessive soil erosion. These sites must be re-vegetated after development activity has been completed.
- Proactive measures should be enforced to ensure that work vehicles are up to standard regarding maintenance and function. These measures should include routine leak checks prior to development activity and decommissioning of vehicles and machinery not up to par. Dripping during the aforementioned leak checks and maintenance must be accommodated for by the provision of drip trays.
- Regarding sanitation – portable chemical toilets should be made available to site personal as needed and should be located more than 30m away from sensitive environments. Waste from the toilets should be collected and disposed of appropriately by a waste contractor.
- Fuels, chemicals and other hazardous substances should be stored in the appropriate, marked containers with closed lids.
- Where leaks and spillages from storage facilities or pipelines occur, these need to be contained and repaired as soon as possible. All spillages or contaminations are to be immediately reported to the Site Manager and Environmental Control Officer so that appropriate clean up measures may be enacted. An emergency “clean up kit” containing spillage clean up materials should be readily available on site to be used in event of a spill.

10.6.2.5. Wetland habitat degradation through vegetation disturbances

- Disturbance of indigenous vegetation must be kept to a minimum.
- Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
- Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled to avoid the development of a soil seed bank of alien plants within the stockpiled soil.
- An Alien Invasive Management Plan must be compiled and implemented for the Port Dunford Mine. This should divide the area of control into logical management units, have clear objectives for detection and control, and include regular monitoring throughout the life of the project. Non-compliance should result in real and enforceable significant consequences. The AIP management

plan must extend to cover all wetland habitats within the Port Dunford boundary, and not only infrastructure areas.

- Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove.
- An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.
- Apply all measures aimed at minimising sediment transport into wetland habitats.
- The removal of alien vegetation should be undertaken manually by hand near sensitive areas such as wetlands. The use of heavy machinery or potentially harmful chemicals should be kept to a minimum near sensitive environments.
- An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.
- Implement the wetland monitoring plan proposed, inclusive of vegetation monitoring.

10.6.2.6. Burial of wetland habitat and loss of wetland biota downstream of the RSFs due to RSF failure

No mitigation measures are available to further reduce the risk or significance of this impact. However, the following measures are proposed to ensure that the risk of this impact occurring remain minimal:

- Throughout operation and continuing post-closure, the stability of the RSFs must be regularly monitored to ensure that the potential for dam wall failure or exceedance is avoided.
- Emergency preparedness and response plan (EPRP) for the RSF should be prepared based on a credible RSF breach analysis taking the impacts of climate change into consideration.
- Conducting a stability assessment on the RSFs - geotechnical data
- Quarterly inspections and monitoring data with an experienced tailings operator

Table 10-4 – Wetland Impact Assessment – Operational Stage (Phase 1).

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 1:	Wetlands	LOM Opencast pit	Phase 2	Operational	Wetland habitat degradation through altered hydrological regime supporting downstream wetlands	Negative	3	2	3	4	4	**48**	**N3**	Lowering of groundwater levels is temporary (generally 2 years). Backfilling into the pits will add water to the aquifer, reducing the duration of the impact to wetlands. Reduced surface catchment yield to wetlands is expected to be offset to a degree through a reduction in evapotranspiration associated with removal of forestry from the mine footprint Implement monitoring of potentially affected wetlands to identify any negative effects that arise and allow for adaptive management.	2	2	3	3	3	**30**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							
Impact 2:	Wetlands	Opencast Mining and associated infrastructure	Phase 1	Operational	Wetland habitat degradation through altered geomorphological characteristics (sedimentation & erosion) in downstream wetlands	Negative	2	2	3	3	3	**30**	**N2**	A comprehensive sediment management plan and stormwater management plan must be developed for the life of the project. Generation of runoff and transport of sediment off site must be controlled and minimised through appropriate stormwater management and the use of sediment controls or barriers, such as sediment fences or similar and as appropriate to the nature of the potential sediment source. The project engineers should advise on the best sediment control option based on the nature and magnitude of the potential sediment source and loads. Unvegetated earth berms should not be considered sufficient to act as barriers between active mine areas and the remaining, adjacent natural environment, as they are prone to erosion and can act as an additional sediment source to the wetlands if breached. It is proposed that the mining infrastructures (LOM boundary, surface infrastructure) and downslope habitat should be monitored during operation for any signs of erosion. Any erosion issues arising should be addressed immediately. Appropriate means of addressing any erosion will depend on the specific situation and should be referred to an environmental engineer or wetland ecologist to address. Do not burn, cut or remove natural vegetation outside of authorised and designated areas of the development as this may expose soils to erosion. Do not allow activities which result in soil compaction to occur outside of authorized and designated areas, e.g., storing of heavy machinery, driving or dumping of materials. Areas inadvertently compacted must be ripped with a small machine (agricultural) to alleviate compaction. Any road crossings established through wetland habitat must be designed such that they do not cause any flow impoundment or concentration that could lead to erosion of the downstream areas. Any areas where concentrated flow is anticipated to discharge must be protected against erosion through the application of appropriate erosion protection mechanisms appropriate to the situation.	2	2	3	3	2	**20**	**N2**
						Significance	**N2 - Low**								**N2 - Low**							

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 3:	Wetlands	Opencast Mining	Phase 1	Operational	Wetland habitat degradation through changes in vegetation composition and increase in AIP's	Negative	3	2	3	3	4	**44**	**N3**	Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled to avoid the development of a soil seed bank of alien plants within the stockpiled soil. An Alien Invasive Management Plan must be compiled and implemented for the Port Dunford Mine. This should divide the area of control into logical management units, have clear objectives for detection and control, and include regular monitoring throughout the life of the project. Non-compliance should result in real and enforceable significant consequences. The AIP management plan must extend to cover all wetland habitats within the Port Dunford boundary, and not only infrastructure areas. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens. Apply all measures aimed at minimising sediment transport into wetland habitats. The removal of alien vegetation should be undertaken manually by hand near sensitive areas such as wetlands. The use of heavy machinery or potentially harmful chemicals should be kept to a minimum near sensitive environments. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens. Implement the wetland monitoring plan proposed, inclusive of vegetation monitoring.	2	2	3	3	2	**20**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 4:	Wetlands	Opencast Mining	Phase 1	Operational	Wetland habitat degradation through water quality deterioration	Negative	3	2	3	3	3	**33**	**N3**	Runoff from dirty areas should be directed to stormwater management infrastructure designed to ensure effective management of stormwater, and maintenance of effective clean and dirty water separation. Dirty water should not be allowed to flow into the natural environment. Design of stormwater infrastructure for Phase 1 is in progress. Design for Phase 2 will be developed during the Phase 1 period. All design of such infrastructure should aim to achieve the above-mentioned goal of ensuring effective clean and dirty water separation and limiting dirty water discharge to the environment. Minimise the footprint or catchment of the dirty area as much as possible and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff. Any infrastructure used in the storage or transport (e.g., pipelines) of potentially hazardous materials or slimes, must be regularly inspected to ensure proper functioning and identify any maintenance or repair issues that should be addressed. It is recommended that a Hazardous Material Management Plan and Waste Management Plan (aligned to the requirements of international best practice) be developed and implemented at the site prior to initiation of the construction and operational activities. All measures to limit erosion and increased sedimentation within wetland habitat to be applied to limit increased turbidity of the water column in receiving wetlands. Ensure effective clean and dirty water separation, manage and dispose of any contaminated runoff or potential pollutants in an appropriate manner and ensuring these do not enter the aquatic system, and implement (if necessary) a dust control system. No dumping of any materials or storage of any equipment should be allowed within the wetlands. During all phases of the development activity, all waste should be removed to an appropriate waste facility. Washing and cleaning of equipment should be done within berms or bunds, in order to trap any pollutants/sediment and prevent excessive soil erosion. Proactive measures should be enforced to ensure that work vehicles are up to standard regarding maintenance and function. Portable chemical toilets should be made available to site personal as needed and should be located more than 30m away from sensitive environments. Fuels, chemicals and other hazardous substances should be stored in the appropriate, marked containers with closed lids. Where leaks and spillages from storage facilities or pipelines occur, these need to be contained and repaired as soon as possible. An emergency “clean up kit” containing spillage clean up materials should be readily available on site to be used in event of a spill.	2	2	3	3	3	**30**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							

Table 10-5 – Wetland Impact Assessment – Operational Stage (Phase 2).

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 1:	Wetlands	LOM Opencast pit, RSF, Topsoil and Course Tails Stockpiles, Road Corridors	Phase 2	Operational	Wetland habitat loss within the footprint of surface infrastructure, LOM, RSFs, stockpiles. Total of 124 ha to be lost.	Negative	5	2	5	5	5	**85**	**N5**	It is suggested that the sand tails and topsoil stockpiles below the N2 be reshaped slightly to avoid intersecting marginally with wetland habitats, and wherever possible, a 30m buffer. This will realise a small reduction in wetland loss of approximately 4 hectares. All construction activities must be limited to the smallest area possible by remaining fully within authorised and clearly demarcated areas. No stockpiles should be placed in wetland habitat, except where expressly authorised. A wetland offset strategy must be developed and implemented to address remaining residual negative impact	5	2	5	5	5	**85**	**N5**
						Significance	**N5 - Very High**								**N5 - Very High**							
Impact 2:	Wetlands	LOM Opencast pit, RSF, Topsoil and Course Tails Stockpiles	Phase 2	Operational	Wetland habitat degradation through altered hydrological regime supporting downstream wetlands	Negative	3	2	3	4	4	**48**	**N3**	Lowering of groundwater levels is temporary (generally 2 years). Backfilling into the pits will add water to the aquifer, reducing the duration of the impact to wetlands. Reduced surface catchment yield to wetlands is expected to be offset to a degree through a reduction in evapotranspiration associated with removal of forestry from the mine footprint Implement monitoring of potentially affected wetlands to identify any negative effects that arise and allow for adaptive management.	2	2	3	3	3	**30**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation						
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating
Impact 3:	Wetlands	Topsoil and Course Tails Stockpiles, Road Corridors	Phase 2	Operational	Wetland habitat degradation through altered geomorphological characteristics (sedimentation & erosion) in downstream wetlands	Negative	3	2	3	3	4	**44**	**N3**	It is recommended that the topsoil and sand tails mounts have a maximum side slope of 1:5 to limit the risk of erosion of the side slopes and sediment transport to the wetlands. The design of the coarse and fine sand tailings disposal facilities must include concurrent rehabilitation and perimeter runoff and sediment management infrastructure. A comprehensive sediment management plan and stormwater management plan must be developed for the life of the project. Generation of runoff and transport of sediment off site must be controlled and minimised through appropriate stormwater management and the use of sediment controls or barriers, such as sediment fences or similar and as appropriate to the nature of the potential sediment source. The project engineers should advise on the best sediment control option based on the nature and magnitude of the potential sediment source and loads. Unvegetated earth berms should not be considered sufficient to act as barriers between active mine areas and the remaining, adjacent natural environment, as they are prone to erosion and can act as an additional sediment source to the wetlands if breached. Sediment mobilization off the RSF dam wall should be minimized through re-vegetation of the dam wall with suitable grass cover as soon as possible, as well as establishment of sediment fences/barriers along the downslope edge of the dam wall. Such sediment barriers must be regularly inspected by an appropriately qualified engineer and repaired if damaged or showing signs of erosion. It is proposed that the mining infrastructures (RSF, sand tails mounds, LOM boundary) and downslope habitat should be monitored during operation for any signs of erosion. Any erosion issues arising should be addressed immediately. Appropriate means of addressing any erosion will depend on the specific situation and should be referred to an environmental engineer or wetland ecologist to address. Topsoil stockpiles to be maintained and managed as per the mine rehabilitation plan guidelines. To protect stockpiles from erosion, particularly those exceeding 2m in height, the stockpiles should be vegetated. Limit the storage time of topsoil to as short a time period as possible. If stockpiling is longer than 1 year, the topsoil stockpiles should ideally be re-vegetated with locally occurring indigenous vegetation. Do not burn, cut or remove natural vegetation outside of authorised and designated areas of the development as this may expose soils to erosion. Do not allow activities which result in soil compaction to occur outside of authorized and designated areas, e.g., storing of heavy machinery, driving or dumping of materials. Areas inadvertently compacted must be ripped with a small machine (agricultural) to alleviate compaction. Any road crossings established through wetland habitat must be designed such that they do not cause any flow impoundment or concentration that could lead to erosion of the downstream areas. Any areas where concentrated flow is anticipated to discharge must be protected against erosion through the application of appropriate erosion protection mechanisms appropriate to the situation.	3	2	3	3	3	**33**	**N3**
						Significance	**N3 - Moderate**								**N3 - Moderate**						

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation						
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating
Impact 4:	Wetlands	Mining and associated infrastructures	Phase 2	Operational	Wetland habitat degradation through changes in vegetation composition and increase in AIP's	Negative	3	3	3	3	4	**48**	**N3**	Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled to avoid the development of a soil seed bank of alien plants within the stockpiled soil. An Alien Invasive Management Plan must be compiled and implemented for the Port Dunford Mine. This should divide the area of control into logical management units, have clear objectives for detection and control, and include regular monitoring throughout the life of the project. Non-compliance should result in real and enforceable significant consequences. The AIP management plan must extend to cover all wetland habitats within the Port Dunford boundary, and not only infrastructure areas. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens. Apply all measures aimed at minimising sediment transport into wetland habitats. The removal of alien vegetation should be undertaken manually by hand near sensitive areas such as wetlands. The use of heavy machinery or potentially harmful chemicals should be kept to a minimum near sensitive environments. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens. Implement the wetland monitoring plan proposed, inclusive of vegetation monitoring.	2	2	3	2	3	**27**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**						

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 5:	Wetlands	Mining and associated infrastructures	Phase 2	Operational	Wetland habitat degradation through water quality deterioration	Negative	3	2	3	2	4	**40**	**N3**	Runoff from dirty areas should be directed to the stormwater management infrastructure and not be allowed to flow into the natural environment. Minimise the footprint or catchment of the dirty area as much as possible and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff. Any infrastructure used in the storage or transport (e.g., pipelines) of potentially hazardous materials or slimes, must be regularly inspected to ensure proper functioning and identify any maintenance or repair issues that should be addressed. It is recommended that a Hazardous Material Management Plan and Waste Management Plan (aligned to the requirements of international best practice) be developed and implemented at the site prior to initiation of the construction and operational activities. All measures to limit erosion and increased sedimentation within wetland habitat to be applied to limit increased turbidity of the water column in receiving wetlands. Ensure effective clean and dirty water separation, manage and dispose of any contaminated runoff or potential pollutants in an appropriate manner and ensuring these do not enter the aquatic system, and implement (if necessary) a dust control system. No dumping of any materials or storage of any equipment should be allowed within the wetlands. During all phases of the development activity, all waste should be removed to an appropriate waste facility. Washing and cleaning of equipment should be done within berms or bunds, in order to trap any pollutants/sediment and prevent excessive soil erosion. Proactive measures should be enforced to ensure that work vehicles are up to standard regarding maintenance and function. Portable chemical toilets should be made available to site personal as needed and should be located more than 30m away from sensitive environments. Fuels, chemicals and other hazardous substances should be stored in the appropriate, marked containers with closed lids. Where leaks and spillages from storage facilities or pipelines occur, these need to be contained and repaired as soon as possible. An emergency “clean up kit” containing spillage clean up materials should be readily available on site to be used in event of a spill.	2	2	3	2	3	**27**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							
Impact 6:	Wetlands	RSF9	Phase 2	Operational	Wetland habitat degradation or burial due to RSF breach or exceedance	Negative	5	2	3	4	2	**28**	**N2**	No mitigation measures are available to further reduce the risk or significance of this impact. However, the following measures are proposed to ensure that the risk of this impact occurring remain minimal: Global Industry Standard on Tailings Management requirements should be met in terms of the design of RSF facilities. Throughout operation and continuing post-closure, the stability of the RSFs must be regularly monitored to ensure that the potential for dam wall failure or exceedance is avoided. Emergency preparedness and response plan (EPRP) for the RSF should be prepared based on a credible RSF breach analysis taking the impacts of climate change into consideration. Conducting a stability assessment on the RSFs - geotechnical data Quarterly inspections and monitoring data with an experienced tailings operator	5	2	3	4	2	**28**	**N2**

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation						
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating
						Significance	N2 - Low								N2 - Low						

10.7. DECOMMISSIONING AND CLOSURE PHASE

10.7.1. ANTICIPATED IMPACT DESCRIPTION

The decommissioning and closure phase will involve the decommissioning and removal of infrastructure, and rehabilitation activities, including spreading of topsoil and revegetation of disturbed footprints. Anticipated impacts are expected to be of a similar nature to those experienced during the construction phase. Decommissioning and closure should not lead to the loss of any additional wetland habitat, though it may cause degradation of wetland habitat near related activities. Potential impacts include the following:

10.7.1.1. Altered wetland geomorphology

During demolition undertaken as part of closure, areas of bare soils will be exposed to erosion during rainfall events. Earthworks represent a further erosion risk and sediment sources. Run-off from these areas is likely to be sediment-rich and could enter the adjacent wetlands, leading to increased sedimentation in the wetlands, increased turbidity and suspended sediment loads, as well as changes to the wetlands substrate where the sediment is deposited. If sediment originating from these activities and infrastructures does reach the wetlands, these changes will impact on the biodiversity of the wetland, potentially with short-term, negative effects.

10.7.1.2. Water quality deterioration

Water quality deterioration with the receiving wetlands could take place during the decommissioning and closure phase predominantly due to increased turbidity and suspended solids derived from soil erosion on the bare soil surfaces exposed during demolition and rehabilitation of disturbance footprints. In addition, use of hazardous substances such as oil, diesel, etc. during the demolition and rehabilitation process could lead to pollution of water resources through spillages and leakages.

10.7.1.3. Vegetation disturbance through spread of AIP's

Wetland vegetation may be disturbed through encroachment of alien invasive and pioneer species that establish in areas of disturbance. A key driver of invasion by alien plants is high disturbance. Exotic species are often more prevalent near infrastructural disturbances than further away. Typical consequences of this include the loss of indigenous vegetation, change in vegetation structure and habitat, increased water consumption and impaired wetland functioning.

10.7.2. MITIGATION AND MANAGEMENT RECOMMENDATIONS

The following mitigation and management measures are recommended to limit wetland habitat degradation outside the footprints of the decommissioning and demolition activities:

- Re-profile the rehabilitated landscapes to suit the desired post mining land use as much as is practically possible.
- Demolition should be undertaken during the dry winter period to reduce risk of sediment transport into adjacent wetland
- Ensure all cleared areas are revegetated successfully immediately.
- Minimise future plantation forestry to outside of wetlands and a 50m buffer.
- Implement mitigation measures proposed for the construction phase to minimise pollution sources, and vegetation disturbance.

Maintain the AIP management plan throughout decommissioning and closure

Table 10-6 – Wetland Impact Assessment – Decommissioning and Closure Phase.

Impact number	Aspect	Feature	Phase	Project Stage	Impact Description	Character	Pre-Mitigation								Post-Mitigation							
							Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating		Magnitude	Extent	Reversibility	Duration	Probability	Significance	S Rating	
Impact 1:	Wetlands	Decommissioning and removal of infrastructure Rehabilitation activities including spreading of topsoil and revegetation of disturbed footprints.	Phase 1 & 2	Decommissioning & Closure	Wetland habitat degradation due to erosion, sedimentation, water quality deterioration and spread of AIP	Negative	3	2	3	3	3	**33**	**N3**	Re-profile the rehabilitated landscapes to suit the desired post mining land use as much as is practically possible. Demolition should be undertaken during the dry winter period to reduce risk of sediment transport into adjacent wetland Ensure all cleared areas are revegetated successfully immediately. Implement mitigation measures proposed for the construction phase to minimise pollution sources, and vegetation disturbance. Maintain the AIP management plan throughout decommissioning and closure	2	1	3	2	3	**24**	**N2**
						Significance	**N3 - Moderate**								**N2 - Low**							

10.8. CUMULATIVE IMPACTS

The predominant land-use within the Port Dunford study area is currently dominated by *Eucalyptus* plantations and sugar cane agriculture. The peripheral regions along the southeast are also highly transformed by residential development. The current major impacts to the surrounding wetland environment are reduction in flows as a consequence of forestry and farming practices. Furthermore, a complete lack of wetland vegetation within residential areas and in cultivated farm portions. Although the wetland has experienced impacts from surrounding land-uses, there are pockets of largely natural swamp forest within the wetlands of the central regions of the site and south of the N2 freeway.

Current landuse in the region includes mining, cultivation and plantation forestry and urban development. These landuses contribute towards ongoing wetland habitat loss and fragmentation, and deterioration of wetland habitat due to changes in water quantity and quality, and encroachment of alien invasive species. The Port Dunford Mine, if approved, will add to these negative, cumulative impacts, contributing towards ongoing wetland habitat loss, and loss of potential SCC's that they support.

10.9. OFFSET OF SIGNIFICANT RESIDUAL IMPACTS TO WETLANDS

10.9.1. WHAT ARE BIODIVERSITY AND WETLAND OFFSETS?

A useful and widely accepted definition of biodiversity offsets is provided by the Business and Biodiversity Offsets Programme (BBOP):

> "Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity." (BBOP, 2018).

Wetland offsets fall under the broader umbrella of biodiversity offsets, and from the definition above, the goal of wetland offsets can be said to achieve a measurable "**No Net Loss**" or "**Net Gain**" in conservation outcomes as a means of compensating for residual adverse impacts to wetlands. The requirement for biodiversity offsets and the approach to achieving them is detailed in the gazetted National Biodiversity Offset Guideline (GN3569, 2023, Issued under Stion 24J of the National Environmental Management Act).

Within the broader context of the approach detailed in the National Biodiversity Offset Guideline, the SANBI wetland offset guidelines (SANBI & DWS, 2016), which have undergone several iterations since their first release in 2012, are a specific guideline proposing an approach and methodology to wetland offsets in South Africa. This document has been published by the Water Research Commission and is endorsed by the DWS as "*an official guideline to aid the development of appropriate wetland offsets in situations where an offset is required*".

The "**No Net Loss**" principle requires that the gains provided by an offset program equal or exceed the losses that have occurred as a result of the project impacts. There is thus a need for an accounting system to accurately quantify and calculate the losses and gains – in the SANBI Guidelines and this is achieved through the use of hectare equivalents. The gains provided by the offset should be

equivalent to the losses in terms of type (e.g. wetland type or condition), time and space. What this means for wetland offsets is that generally, the following concepts apply:

- Offsets should be like for like (e.g. the loss of a pan would require a pan as offset, while offsetting a highly degraded wetland system to compensate for the loss of a pristine system would not generally be acceptable).
- Ideally, offset gains should materialise before, or at the same time, as wetland losses.
- All values of the lost wetland system should be targeted (e.g. if a wetland supports African Grass Owls and plays an important role in flow regulation, both these functions should be provided for in the offset target. This might require increasing the offset target area to cater for both functions).
- To ensure that "No Net Loss" is realised, an offset strategy needs to be accompanied by rehabilitation and enhancement of the target functions and values, as protection alone does not provide the gains that count towards "No Net Loss". Where offsets are done on a 1:1 basis (i.e. 1ha of a wetland is offset to compensate for the loss of 1ha of wetland), a net loss of 50 % would result, unless interventions are put in place to enhance the functions and values of the offset target.
- Offset multipliers are generally applied to take into account risks and uncertainties about the success or performance of planned offset measures.

The SANBI guidelines recognise five types of offsets:

- Protection-based offset: Refers to the implementation of legal mechanisms (e.g. declaration of a Protected Environment or Nature Reserve under the National Environmental Management: Protected Areas Act, a legally binding conservation servitude, or a long-term Biodiversity Agreement under NEMA) and putting in place appropriate management structures and actions to ensure that conservation outcomes are secured and maintained in the long-term.
- Averted loss offset: Refers to physical activities which prevent the loss or degradation of an existing wetland system and its biodiversity, where there is a clearly demonstrated threat of decline in the system's condition.
- Rehabilitation/restoration offset: Refers to activities which result in an improvement in wetland condition, functions, and associated biodiversity. Rehabilitation/restoration involves the manipulation of the physical, chemical, and/or biological characteristics of a degraded wetland system in order to repair or improve wetland integrity and associated ecosystem services. By increasing the condition of a wetland system and its biodiversity, a positive contribution is made towards the goal of no net loss.
- Wetland establishment: This involves the development (i.e. creation) of a new wetland system where none existed before by manipulating the physical, chemical, and/or biological characteristics of a specific site.
- Direct compensation: Direct compensation involves directly compensating affected parties for the ecosystem services lost as a result of development activities. This is ideally done by providing an equivalent substitute form of asset or in some cases may take the form of monetary compensation. This form of offset action is generally most relevant to direct services.

10.9.2. PROJECT-RELATED DETERMINATION OF WETLAND OFFSET TARGETS

The proposed project will lead to the direct and permanent loss of approximately 124 hectares of wetland habitat, which cannot be avoided under the current mine plan, fully minimised or reversed through rehabilitation. In order to ensure full application of the mitigation hierarchy, a wetland offset will be required to address this significant residual impact to important and sensitive wetland habitat.

The specifications of the required offset will need to be determined as part of a detailed wetland offset plan that accurately quantifies the required offset, identifies appropriate wetland offsets and details a strategy to realise the offset targets set. However, a preliminary determination of the wetland offset target is provided here to guide further revision of the mine plan, if feasible, and act as a starting point for development of the wetland offset plan.

The SANBI & DWS (2016) wetland offset calculator was applied for the determination of the functional offset targets, using the wetland assessment data and the current mine plan as input data. For the purpose of determining the required offset targets, direct wetland loss will occur in areas where wetlands will be completely lost within the footprints of mining and surface infrastructures. Importantly, the wetlands affected fall within a strategic water source area (SWSA) as detailed in Section 8.3. In light of this, the wetland offset calculator attracts a Functional Importance Ratio multiplier of 1.5 that increases the wetland functional target. Table 10-7 provides a summary of the wetland offset targets, in terms of the functional offset target component only. The wetland losses/target are split according to the infrastructure type that will cause the wetland loss, and the wetland types that will be affected. The target is represented as both the actual hectares to be lost and the “hectare equivalents” that will need to be achieved through the offset exercise. A total of approximately 124 hectare-equivalents (ha.eq.) will need to be met through rehabilitation and protection of targeted offset wetland systems. Table 10-8 provides the summarised functional and ecosystem conservation offset targets associated with the anticipated wetland losses. The ecosystem conservation target determination is informed by the condition of the wetland vegetation in wetlands to be lost, as well as factors such as the wetland vegetation group protection and threat status, priority of the wetlands as defined in regional and national conservation plans, biodiversity value, level of connectivity in the landscape. It is important to note that these two offset targets can be achieved in the same wetland systems if the target wetlands meet the various offset criteria for each component. The detailed results of the wetland offset calculations are provided in Appendix 5.

The most significant wetland losses will be associated with Sandtails stockpiles A-1 (56 ha lost, Seep wetlands, Largely natural to Largely modified, High to Very High EIS), and 8B (23 ha lost, Seep wetlands, Moderately modified, Moderate EIS), and the RSF9 (36 ha lost, Seep wetlands, Moderately modified, High EIS). Most of the wetlands affected will be seep wetlands (122 hectares, 98.5%). 94% of wetlands lost are currently in a moderately to largely modified condition (PES categories C and D), and 93% are of moderate to high importance and sensitivity.

Table 10-7 - Summary of the wetland offset requirements – Wetland Functional Target.

Infrastructure Type	Channelled Valley Bottom Wetland		Seep Wetland		Total	
	Hectares	Hectare Equivalents	Hectares	Hectare Equivalents	Hectares	**Hectare Equivalents**
LOM - Phase 2			2.13	2.11	2.13	2.11
LOM - Phase 2/RSF C			0.29	0.26	0.29	0.26
LOM - Phase 2/Sand tails			1.03	1.25	1.03	1.25

Infrastructure Type	Channelled Valley Bottom Wetland		Seep Wetland		Total	
	Hectares	Hectare Equivalents	Hectares	Hectare Equivalents	Hectares	**Hectare Equivalents**
Road Corridor	0.42	0.54	1.73	2.00	2.15	2.54
RSF 9			35.86	39.78	35.86	39.78
Sand tails	1.34	1.71	77.90	72.10	79.24	73.81
Sand tails/Topsoil			0.42	0.39	0.42	0.39
Topsoil	0.16	0.20	2.32	2.63	2.48	2.83
Total	1.92	0.20	121.68	120.52	123.59	**122.97**

Table 10-8 - Summary of the wetland offset requirements – Wetland Functional and Ecosystem Conservation Targets.

Infrastructure Type	Wetland Area Lost	Functional Offset Target	Ecosystem Conservation Offset Target
	Hectares	**Hectare Equivalents**	**Hectare Equivalents**
LOM - Phase 2	2.13	2.11	11.23
LOM - Phase 2/RSF C	0.29	0.26	1.01
LOM - Phase 2/Sand tails	1.03	1.25	15.60
Road Corridor	2.15	2.54	19.86
RSF 9	35.86	39.78	253.98
Sand tails	79.24	73.81	346.58
Sand tails/Topsoil	0.42	0.39	1.97
Topsoil	2.48	2.83	19.08
Total	**123.59**	**122.97**	**669.30**

According to the offset concepts (both for biodiversity and wetland offsets), the wetland offset should aim to achieve No Net Loss, meaning that the calculated loss (123 ha.eq functional/669 ha.eq ecosystem conservation)) must be met in full, and should be achieved through a Like-for-Like approach wherein the wetlands targeted should be of a similar type to those lost. In this instance, this would mean targeting mostly seep wetlands as part of the offset. Both biodiversity offsets and wetland offsets will be required for the Port Dunford Mine project, and according to the National Biodiversity Offset Guideline, "*where offsets are required for terrestrial ecosystems as well as wetland ecosystems and/ or forest ecosystems, the specialist or specialists and the EAP should strive to integrate these different requirements in the Biodiversity Offset Report, and select candidate offset areas which would meet all offset requirements, where at all possible.*" In line with this, it is recommended that the wetland offset plan and targets be integrated into the larger biodiversity offset to ensure opportunities for target

sites to contribute to both targets are not missed. The functional wetland target requires that target offset wetlands are not only protected but also rehabilitated to improve their functional capacity to offset the wetland functionality lost as a result of the project. The National Biodiversity Offset Guideline further states with regards to wetland offsets that "*selecting areas with good potential for rehabilitation and restoration within recognised freshwater priority areas (FEPAs) or SWSAs may be advantageous. Those areas should be located in the same local or quaternary catchment, unless there are good reasons why they are not*."

The Mlalazi Estuary lies to the southwest of the mine boundary and is a potential receiving environment for indirect impacts from the project, such as changes in flow inputs, and inputs of fine sediment. These impacts will largely be temporary (hydrological changes) or minimised through effective implementation of mitigation and management measures (erosion and sedimentation). However, the estuary has been put forward as a potentially valuable addition to the biodiversity/wetland offset strategy. The EFZ, where the Amanzamnyama River enters the estuary, is currently under intensive sugar cane cultivation, which is associated with a complete conversion of natural habitat and the maintenance of a trenched drainage system to diverts flow through the sugar cane fields. Rehabilitation of this modified area of the estuary back to natural vegetation, and closure of the drainage system would be valuable, not only in increasing the extent of available natural habitat within the EFZ, but also in terms of increasing this part of the estuaries capacity to trap any ultrafine sediment originating from the Port Dunford Mine, and preventing such sediment from reaching the estuary mouth and potentially affecting the geomorphology and hydrology of the estuary. Including estuarine rehabilitation in the wetland offset would not fulfil the like-for-like offset requirement but could perhaps be motivated as a like-for-better offset. The next step would be to further develop the biodiversity and wetland offset strategy to determine how such estuarine rehabilitation and protection could contribute to the offset targets, and whether further areas would need to be targeted to satisfy the offset requirements.

10.10. MONITORING RECOMMENDATIONS

It is recommended that a wetland monitoring plan be developed to facilitate long term monitoring of a selection of potentially affected wetlands. The monitoring plan should span the construction, operation, and decommissioning phases of the project, with the intention of identifying any changes in wetland condition that may result from secondary, indirect impacts, such as altered hydrological regime, sediment transport or water quality deterioration. Ongoing monitoring allows for both expected and unexpected impacts to be identified, and adaptive management applied where appropriate, through the project lifespan. The wetland units suggested for inclusion in the monitoring plant are illustrated in Figure 10-4. Given the large extent of wetlands across the mine area, a subset of wetland units is proposed for monitoring. These systems represent wetlands expected to be affected by the various activities. Additional wetlands may be added to the monitoring plan based on infield observations during routine monitoring or audit of the mine's authorisations.

For the purpose of monitoring of the Port Dunford Mine wetlands, it is recommended that the wetland rehabilitation monitoring tool – WETRehabEvaluate (Walters et al., 2019) be used to guide the selection of appropriate monitoring tools and monitoring intervals. Based on the WETRehabEvaluate guideline document, the wetland monitoring approach is detailed in Table 10-9.

Table 10-9 - Summary of proposed nature, timing and frequency of wetland monitoring for the Port Dunford Mine.

MONITORING ACTIVITES	TOOL	TIMING	FREQUENCY	RESPONSIBLE PERSON
Wetland Condition (PES) monitoring	WetHealth V2 Level 1B or 2	Not Applicable	At a minimum 3-year interval	Wetland Ecologist
Erosion and sedimentation monitoring	Visual inspection and fixed-point photographic record maintained at locations of potential sediment erosion and transport	Late spring/Summer	Annually	Wetland Ecologist
Wetland vegetation monitoring	As per WETRehabEvaluate approach	Late spring/Summer	At a minimum 3-year interval	Wetland Ecologist

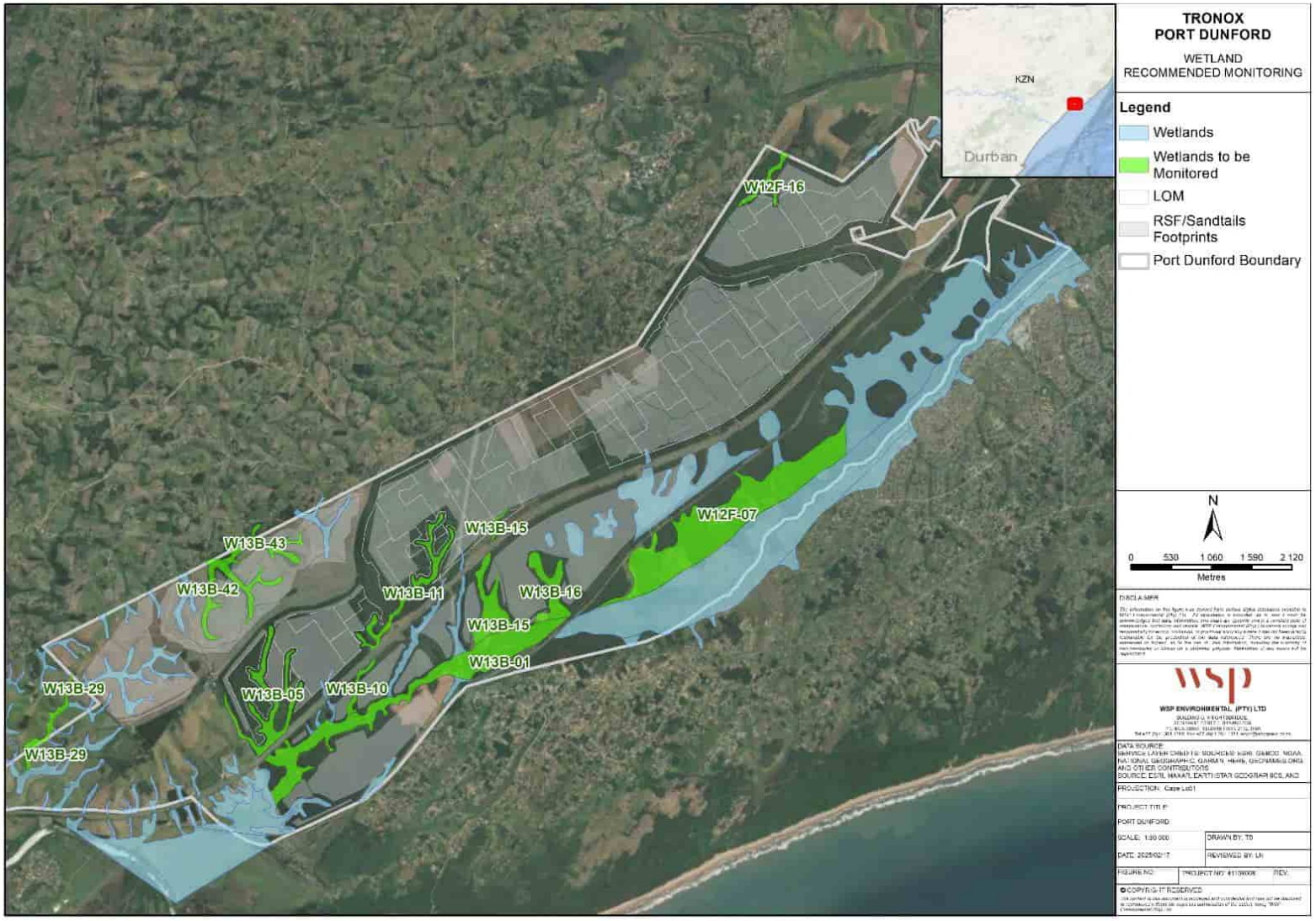


Figure 10-4 - Wetland HGM units proposed for inclusion in the wetland monitoring programme for Port Dunford Mine.

11. CONCLUSION

WSP was commissioned by Tronox KZN Sands (Pty) Ltd. to conduct a wetland baseline and impact assessment as part of the EA process to obtain the mining rights to mine heavy mineral sands within the proposed Port Dunford study area. The proposed Port Dunford project site covers an extent of approximately 4787Ha and is situated in the KwaZulu-Natal province, approximately 16km southwest of Richards Bay.

The proposed infrastructure development includes construction of aPWP, water control dams, RSF , demarcated Sand Tails mounds and topsoil stockpiles. Therefore, a specialist wetland assessment was required to identify the location and extent of wetlands within the study site; determine the functionality and health status of the' wetlands and identify the impacts of the proposed activity on the surrounding wetlands.

The wetland delineation and baseline assessment were informed by both desktop and infield investigations. Extensive wetland habitat was found to occur within the Port Dunford project site, including both channelled valley bottom and hillslope seepage wetlands. Within areas of extended saturation within both wetland types, critically endangered swamp forest was identified. Wetland habitat was found to vary widely in terms of its current condition, ranging from largely natural to seriously modified. Landuses that have significantly influenced current wetland condition include sugarcane cultivation, *Eucalyptus* plantation forestry and urban developments. The wetlands provide a range of important ecosystem services including streamflow regulation, flood attenuation and biodiversity support. Given the presence of the swamp forest habitat and SCC that it is likely to support, such as the Pickersgill's reed frog, the wetland habitats' role in biodiversity maintenance is elevated. The ecological importance and sensitivity of wetlands in the project area ranges from moderate to very high.

The proposed Port Dunford Mine facilities will have a series of potential impacts that need to be managed, particularly during the life of the mine. These mostly relate to the physical disturbance of the footprint of the mining operations and associated activities, such as *inter* alia vegetation removal, vehicle movements, excavations for pits, creation of facilities on site and earth moving activities. These activities are likely to have a negative impact on wetland habitat both directly within the footprint of the proposed development and downstream within affected catchments. Although impacts will be most severe and quantifiable within the Port Dunford boundary, certain impacts may translate to wetland habitat beyond the site boundary. Anticipated impacts include loss of wetland habitat (approximately 124 hectares) and wetland habitat degradation as a consequence of hydrological and geomorphological changes, water quality deterioration, and vegetation changes. The impacts associated with the construction, operation, decommissioning and closure phases of the proposed project were rated predominantly moderate prior to implementation of mitigative measures. However, with the implementation of the recommended mitigative measures, the impacts were mostly reduced to moderate to low significance. The exception is the anticipated loss of wetland habitat within selected mine infrastructure footprints. The loss of wetland habitat will occur even with implementation of the mitigation measures recommended in this report and represents a residual, negative wetland impact. Therefore, application of the mitigation hierarchy indicates that significant residual, negative impact, such as the unavoidable loss of wetland habitat, requires an offset. It is therefore recommended that some form of wetland offset, or compensatory mitigation strategy be developed to address the residual

wetland impact - the permanent loss of wetland habitat. The wetland offset developed must be aligned with the National Biodiversity Offset Guideline (GN3569, 2023, Issued under Stion 24J of the National Environmental Management Act), and the SANBI wetland offset guidelines (SANBI & DWS, 2016).

11.1. REASONED OPINION WHETHER THE PROJECT SHOULD PROCEED

Although the mine plan has been revised to avoid sensitive wetland habitats where feasible, some wetlands will be permanently lost as a consequence of the development, including areas of important swamp forest, and possible habitat for species of conservation concern. However, the revised mine plan does place much of the major infrastructure and mine operations predominately within highly transformed lands. Significant negative impacts to wetland habitat could occur, however, if the proposed mitigation, management and monitoring measures are fully applied, most impacts can be reduced to “Low” negative significance.

It is the professional opinion of the Wetland Specialists that the proposed project could go ahead under the condition that the recommendations, mitigation, and monitoring measures as set out in this report are adhered to in full and included in the Environmental Management and Monitoring Plan for the mine, and significant residual impacts (unavoidable wetland loss) is fully addressed through the compilation of a detailed offset strategy that aligns with both SANBI & DWS (2014) and General Notice 3569 of 2023 (National Biodiversity Offset Guideline) to mitigate loss of wetland habitat and functionality. This offset plan must be submitted to the competent authority for review and approval prior to authorisation and implementation of the mine project.

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Appendix A

WETLAND HYDROGEOMORPHIC UNITS

Public

A summary table of the area of each wetland HGM unit per catchment is provided below

Summary of Wetland characteristics

HGM UNIT	WETLAND TYPE	EXTENT (Ha)
CATCHMENT W12F		
W12F – 01	CVB	346.50
W12F – 02	HS	12.91
W12F – 03	HS	24.58
W12F – 04	HS	148.20
W12F – 05	HS	2.5
W12F – 06	HS	19.46
W12F – 07	HS	150.80
W12F – 08	HS	4.16
W12F – 09	HS	0.9 & 1.85
W12F – 10	HS	2.39
W12F – 11	HS	8.46 & 3.25
W12F – 12	HS	1.1 & 68.82
W12F – 13	HS	7.61
W12F – 14	HS	3.17
W12F – 15	HS	1.71
W12F – 16	HS	7.19
CATCHMENT W13B		
W13B – 01	CVB	100.50
W13B – 02	HS	36.28
W13B – 03	HS	1.74 & 1.35
W13B – 04	HS	2.43
W13B – 05	HS	27.57
W13B – 06	HS	5.28
W13B – 07	HS	0.56
W13B – 08	HS	0.88
W13B – 09	HS	1.6 & 1.5
W13B – 10	CVB	5.27
W13B – 11	HS	20.06
W13B – 12	CVB	0.36 & 11.14
W13B – 13	HS	0.87 & 7.08
W13B – 14	HS	2.46
W13B – 15	HS	1.80 & 24.94
W13B – 16	HS	18.88
W13B – 17	HS	1.61

HGM UNIT	WETLAND TYPE	EXTENT (Ha)
W13B – 18	HS	8.42
W13B – 19	HS	2.41 & 1.82
W13B – 20	HS	1.93
W13B – 21	HS	2.14 & 3.61
W13B – 22	HS	3.37 & 0.75
W13B – 23	HS	0.48 & 0.74
W13B – 24	HS	2.13
W13B – 25	HS	5.98
W13B – 26	HS	0.95
W13B – 27	HS	15.29
W13B – 28	HS	1.03 & 1.61
W13B – 29	HS	9.05 & 2.51
W13B – 30	HS	0.61
W13B – 31	HS	0.82
W13B – 32	HS	4.62
W13B – 33	HS	22.06
W13B – 34	HS	1.82 & 13.10
W13B – 35	HS	3.55
W13B – 36	HS	0.20
W13B – 37	HS	7.03
W13B – 38	HS	1.78
W13B – 39	HS	1.73
W13B – 40	HS	1.87
W13B – 41	HS	7.79
W13B – 42	HS	19.40
W13B – 43	HS	12.54
W13B – 44	HS	9.02
Estuarine Functional Zone (EFZ)	**DESCRIPTION**	**EXTENT (Ha)**
CATCHMENT W13B		
EFZ1	Mlalazi Estuary	45.47
EFZ2	Mlalazi Estuary	124.80
EFZ3	Mlalazi Estuary	24.32

HGM – Hydrogeomorphic, CVB – Channelled Valley Bottom, HS – Hillslope Seepage

Appendix B

DETAILED WETLAND PES RESULTS

Public

PES for the impacted Group 1 (W12F) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	5.1	1.8	1.8	7.0
Ecological Class	D	B	B	E
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**4.1**			
Combined Ecological Score	**D**			

PES for the impacted Group 1 (W13B) wetland units of the proposed activity

GROUP 2	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	2.6	1.9	1.8	3.9
Ecological Class	C	B	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**2.6**			
Combined Ecological Score	**C**			

PES for the impacted Group 2 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	2.0	0.9	1.8	2.6
Ecological Class	B	A	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**1.8**			
Combined Ecological Score	**B**			

PES for the impacted Group 3 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	2.6	2.0	1.8	3.6
Ecological Class	C	C	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**2.5**			

Combined Ecological Score	**C**

PES for the impacted Group 4 (W12F) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.9	2.3	1.8	5.6
Ecological Class	D	C	B	D
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**3.8**			
Combined Ecological Score	**C**			

PES for the impacted Group 4 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.6	0.5	1.8	2.1
Ecological Class	B	A	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**1.5**			
Combined Ecological Score	**B**			

PES for the impacted Group 5 (W12F) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	6.9	5.8	3.5	8.0
Ecological Class	E	D	C	F
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**6.3**			
Combined Ecological Score	**E**			

Table 12-9 - PES for the impacted Group 6 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.7	2.8	1.8	5.8
Ecological Class	C	C	B	D
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**3.6**			

Combined Ecological Score	**C**

PES for the impacted Group 7 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.8	0.7	1.8	2.0
Ecological Class	B	A	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**1.6**			
Combined Ecological Score	**B**			

PES for the impacted Group 8 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.9	3.4	1.8	6.0
Ecological Class	C	C	B	D
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**3.8**			
Combined Ecological Score	**C**			

PES for the impacted Group 9 (W12F) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.7	1.2	1.8	2.3
Ecological Class	B	B	B	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**1.7**			
Combined Ecological Score	**B**			

Table 12-13 - PES for the impacted Group 9 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	7.4	3.9	5.6	9.1
Ecological Class	E	C	D	F
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**6.8**			
Combined Ecological Score	**E**			

PES for the impacted Group 10 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	7.9	4.0	6.1	9.5
Ecological Class	E	D	E	F
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**7.2**			
Combined Ecological Score	**E**			

PES for the impacted Group 11 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.5	1.7	2.2	3.8
Ecological Class	C	B	C	C
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**2.9**			
Combined Ecological Score	**C**			

PES for the impacted Group 12 (W13B) wetland units of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	7.1	3.6	5.4	8.5
Ecological Class	E	C	D	F
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**6.5**			
Combined Ecological Score	**E**			

PES for the impacted Group 13 (W12F-04) wetland unit of the proposed activity

GROUP 1	PES			
	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1.9	1.3	1.8	1.5
Ecological Class	B	B	B	B
Trajectory of Change	↓	↓	↓	↓
Combined PES Score	**1.7**			
Combined Ecological Score	**B**			

Appendix C

WET-ECOSERVICES RESULTS

Public

Ecoservices provided by Group 1 and 2 wetlands

Wetland Unit					Group 1 W12F	Group 1 W13B	Group 2
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0	0.0	0.0
			Streamflow Regulation		2.0	2.0	1.5
			Water quality enhancement benefits	Sediment trapping	2.0	2.0	1.2
				Erosion Control	0.5	0.2	1.2
				Phosphate assimilation	1.0	1.0	0.7
				Nitrate assimilation	1.0	1.0	0.6
				Toxicant assimilation	1.1	1.1	0.7
			Carbon storage		0.0	0.0	0.9
	Direct Benefits	**Biodiversity Maintenance**			3.1	2.2	3.1
		Provisional Benefits	Water for human use		1.5	1.5	0.9
			Harvestable resources		0.0	0.0	0.5
			Cultivated foods		1.0	1.0	1.0
		Cultural benefits	Tourism and recreation		0.0	0.0	0.0
			Education and Research		0.0	0.0	0.0
			Cultural heritage		0.0	0.0	0.0

Ecoservices provided by Group 3 and 4 wetlands

Wetland Unit					Group 3	Group 4 W12F	Group 4 W13B
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0	0.0	0.0
			Streamflow Regulation		1.5	2.0	1.7
			Water quality enhancement benefits	Sediment trapping	1.0	1.5	2.0
				Erosion Control	0.8	0.0	1.1
				Phosphate assimilation	0.5	0.7	0.6
				Nitrate assimilation	0.5	0.6	0.0
				Toxicant assimilation	0.6	0.5	0.4
			Carbon storage		0.9	0.0	0.4
	Direct Benefits	**Biodiversity Maintenance**			2.2	2.4	3.3
		Provisional Benefits	Water for human use		0.0	1.7	1.7
			Harvestable resources		0.0	1.5	1.5
			Cultivated foods		1.0	1.0	1.0
		Cultural benefits	Tourism and recreation		0.0	0.0	0.0
			Education and Research		0.0	0.0	0.0
			Cultural heritage		0.0	0.0	0.0

Ecoservices provided by Group 5, 6 and 7 Wetlands

Wetland Unit					Group 5	Group 6	Group 7
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0	0.0	0.0
			Streamflow Regulation		1.2	1.5	1.5
			Water quality enhancement benefits	Sediment trapping	0.0	0.0	1.4
				Erosion Control	0.0	0.6	1.3
				Phosphate assimilation	0.0	0.0	0.9
				Nitrate assimilation	0.0	0.0	0.8
				Toxicant assimilation	0.0	0.1	0.9
			Carbon storage		0.0	0.5	0.9
	Direct Benefits	**Biodiversity Maintenance**			0.0	0.7	3.1
		Provisional Benefits	Water for human use		0.0	0.0	0.9
			Harvestable resources		0.0	1.0	0.5
			Cultivated foods		1.5	1.0	1.0
		Cultural benefits	Tourism and recreation		0.0	0.0	0.0
			Education and Research		0.0	0.0	0.0
			Cultural heritage		0.0	0.0	0.0

Ecoservices provided by Group 8 and 9 wetlands

Wetland Unit					Group 8	Group 9 W12F	Group 9 W13B
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0	0.0	0.0
			Streamflow Regulation		1.5	1.5	1.5
			Water quality enhancement benefits	Sediment trapping	0.8	0.5	0.8
				Erosion Control	0.0	0.8	0.0
				Phosphate assimilation	0.3	0.0	1.3
				Nitrate assimilation	0.4	0.0	1.4
				Toxicant assimilation	0.4	0.0	0.4
			Carbon storage		0.0	0.8	0.0
	Direct Benefits	**Biodiversity Maintenance**			0.2	2.1	0.0
		Provisional Benefits	Water for human use		0.0	0.0	0.0
			Harvestable resources		0.0	1.0	0.0
			Cultivated foods		1.0	1.0	1.0
		Cultural benefits	Tourism and recreation		0.0	0.0	0.0
			Education and Research		0.0	0.0	0.0
			Cultural heritage		0.0	0.0	0.0

Ecoservices provided by Group 10, 11 and 12 wetlands

Wetland Unit					Group 10	Group 11	Group 12
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0	0.0	0.0
			Streamflow Regulation		1.5	1.5	1.5
			Water quality enhancement benefits	Sediment trapping	0.8	1.2	1.0
				Erosion Control	0.0	0.5	0.3
				Phosphate assimilation	1.3	1.7	1.5
				Nitrate assimilation	1.4	1.6	1.5
				Toxicant assimilation	0.4	0.7	0.6
			Carbon storage		0.0	0.9	0.9
	Direct Benefits	**Biodiversity Maintenance**			0.0	1.7	1.7
		Provisional Benefits	Water for human use		0.0	0.1	0.1
			Harvestable resources		0.0	0.5	0.5
			Cultivated foods		1.0	1.0	1.0
		Cultural benefits	Tourism and recreation		0.0	0.0	0.0
			Education and Research		0.0	0.0	0.0
			Cultural heritage		0.0	0.0	0.0

Ecoservices provided by Group 13 (W12F-04) wetland

Wetland Unit					Group 13
Ecosystem services supplied by wetland	Indirect Benefits	Regulating & Supporting Benefits	**Flood attenuation**		0.0
			Streamflow Regulation		1.7
			Water quality enhancement benefits	Sediment trapping	1.9
				Erosion Control	1.2
				Phosphate assimilation	1.2
				Nitrate assimilation	1.0
				Toxicant assimilation	0.9
			Carbon storage		0.7
	Direct Benefits	**Biodiversity Maintenance**			3.3
		Provisional Benefits	Water for human use		4.0
			Harvestable resources		0.5
			Cultivated foods		1.2
		Cultural benefits	Tourism and recreation		0.0
			Education and Research		0.0
			Cultural heritage		0.0

Appendix D

WETLAND IMPORTANCE AND SENSITIVITY RESULTS

Public

Importance and sensitivity of the wetland groups

GROUP 1: W12F	Importance
Ecological Importance & Sensitivity	2.9
Hydrological/Functional Importance	1.0
Direct Human Benefits	0.4
GROUP 1: W13B	**Importance**
Ecological Importance & Sensitivity	2.9
Hydrological/Functional Importance	1.0
Direct Human Benefits	0.4
GROUP 2	**Importance**
Ecological Importance & Sensitivity	3.4
Hydrological/Functional Importance	0.8
Direct Human Benefits	0.4
GROUP 3	**Importance**
Ecological Importance & Sensitivity	3.1
Hydrological/Functional Importance	0.7
Direct Human Benefits	0.2
GROUP 4: W12F	**Importance**
Ecological Importance & Sensitivity	3.2
Hydrological/Functional Importance	0.7
Direct Human Benefits	0.7
GROUP 4: W13B	**Importance**
Ecological Importance & Sensitivity	3.4
Hydrological/Functional Importance	0.7
Direct Human Benefits	0.7
GROUP 5	**Importance**
Ecological Importance & Sensitivity	1
Hydrological/Functional Importance	0.2
Direct Human Benefits	0.2
GROUP 6	**Importance**
Ecological Importance & Sensitivity	1.5
Hydrological/Functional Importance	0.3
Direct Human Benefits	0.3
GROUP 7	**Importance**

Ecological Importance & Sensitivity	3.1
Hydrological/Functional Importance	1.0
Direct Human Benefits	0.4
GROUP 8	**Importance**
Ecological Importance & Sensitivity	1.3
Hydrological/Functional Importance	0.4
Direct Human Benefits	0.4
GROUP 9: W12F	**Importance**
Ecological Importance & Sensitivity	2.3
Hydrological/Functional Importance	0.5
Direct Human Benefits	0.3
GROUP 9: W13B	**Importance**
Ecological Importance & Sensitivity	1.3
Hydrological/Functional Importance	0.7
Direct Human Benefits	0.2
GROUP 10	**Importance**
Ecological Importance & Sensitivity	1.3
Hydrological/Functional Importance	0.7
Direct Human Benefits	0.2
GROUP 11	**Importance**
Ecological Importance & Sensitivity	2.8
Hydrological/Functional Importance	1.0
Direct Human Benefits	0.3
GROUP 12	**Importance**
Ecological Importance & Sensitivity	2.6
Hydrological/Functional Importance	0.9
Direct Human Benefits	0.3
GROUP 13 (W12F-04)	**Importance**
Ecological Importance & Sensitivity	3.4
Hydrological/Functional Importance	1.0
Direct Human Benefits	1.0

Appendix E

RESULTS OF THE WETLAND OFFSET CALCULATIONS

Public

					PRIOR TO DEVELOPMENT			POST DEVELOPMENT			WETLAND FUNCTIONAL TARGETS				
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	Change in Functional Value (%)	Preliminary Development Impact (Functional ha.eq)	Triggers for Potential Adjustment in Exceptional Circumstances	Functional Importance Ratio	Final Functional Offset Target (ha.eq)
LOM	W12F-12	Seep	0.0556817	HIGH	D	59	30	F	0	0	59	0.032852181	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.05**
LOM	W12F-16	Seep	1.1477524	HIGH	D	59	30	F	0	0	59	0.677173944	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**1.02**
LOM	W13B-13	Seep	0.1138146	VERY HIGH	C	75	64	F	0	0	75	0.085360915	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.13**
LOM	W13B-15	Seep	0.7965301	VERY HIGH	C	75	64	F	0	0	75	0.597397544	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.90**
LOM	W13B-09	Seep	0.0141771	VERY HIGH	B	84	80	F	0	0	84	0.011908767	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.02**
LOM/RSF C	W12F-12	Seep	0.289988	HIGH	D	59	30	F	0	0	59	0.171092931	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.26**
LOM/Sandtails	W13B-13	Seep	0.1057677	VERY HIGH	C	75	64	F	0	0	75	0.079325784	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.12**
LOM/Sandtails	W13B-15	Seep	0.2107014	VERY HIGH	C	75	64	F	0	0	75	0.158026014	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.24**
LOM/Sandtails	W13B-09	Seep	0.7118844	VERY HIGH	B	84	80	F	0	0	84	0.597982927	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.90**
Road Corridor	W12F-12	Seep	0.1774104	HIGH	D	59	30	F	0	0	59	0.104672151	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.16**
Road Corridor	W13B-13	Seep	0.0120386	VERY HIGH	C	75	64	F	0	0	75	0.009028984	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.01**
Road Corridor	W13B-15	Seep	0.0228668	VERY HIGH	C	75	64	F	0	0	75	0.017150089	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.03**
Road Corridor	W13B-13	Seep	0.0014681	VERY HIGH	C	75	64	F	0	0	75	0.001101101	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.00**
Road Corridor	W13B-15	Seep	0.0151824	VERY HIGH	C	75	64	F	0	0	75	0.011386787	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.02**
Road Corridor	W13B-01	CVB	0.0807315	VERY HIGH	B	85	79	F	0	0	85	0.068621776	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.10**
Road Corridor	W13B-10	CVB	0.264373	VERY HIGH	B	85	79	F	0	0	85	0.224717092	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.34**
Road Corridor	W13B-12	CVB	0.0784107	VERY HIGH	B	85	79	F	0	0	85	0.066649067	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.10**
Road Corridor	W13B-11	Seep	0.9338735	VERY HIGH	B	84	80	F	0	0	84	0.784453704	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**1.18**
Road Corridor	W13B-09	Seep	0.2355284	VERY HIGH	B	84	80	F	0	0	84	0.197843817	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.30**
Road Corridor	W13B-05	Seep	0.0004229	VERY HIGH	B	84	80	F	0	0	84	0.00035521	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.00**
Road Corridor	W13B-09	Seep	0.0167778	VERY HIGH	B	84	80	F	0	0	84	0.014093311	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.02**
Road Corridor	W13B-40	Seep	0.3061623	MODERATE	C	62	40	F	0	0	62	0.189820619	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.28**

					PRIOR TO DEVELOPMENT			POST DEVELOPMENT			WETLAND FUNCTIONAL TARGETS				
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	Change in Functional Value (%)	Preliminary Development Impact (Functional ha.eq)	Triggers for Potential Adjustment in Exceptional Circumstances	Functional Importance Ratio	Final Functional Offset Target (ha.eq)
Road Corridor	W13B-33	Seep	0.0082385	MODERATE	C	62	40	F	0	0	62	0.005107846	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.01**
RSF 9	W13B-44	Seep	7.0326143	HIGH	C	74	61	F	0	0	74	5.204134604	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**7.81**
RSF 9	W13B-42	Seep	14.376336	HIGH	C	74	61	F	0	0	74	10.63848889	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**15.96**
RSF 9	W13B-41	Seep	6.8511825	HIGH	C	74	61	F	0	0	74	5.069875024	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**7.60**
RSF 9	W13B-43	Seep	7.4739704	HIGH	C	74	61	F	0	0	74	5.530738121	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**8.30**
RSF 9	W13B-40	Seep	0.1244478	MODERATE	C	62	40	F	0	0	62	0.077157619	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.12**
Sandtails	W12F-13	Seep	7.615554	HIGH	C	59	30	F	0	0	59	4.493176873	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**6.74**
Sandtails	W13B-18	Seep	8.4242666	HIGH	C	74	61	F	0	0	74	6.233957267	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**9.35**
Sandtails	W12F-12	Seep	37.910821	HIGH	D	59	30	F	0	0	59	22.36738419	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**33.55**
Sandtails	W13B-32	Seep	0.6010022	MODERATE	E	28	5	F	0	0	28	0.168280604	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.25**
Sandtails	W13B-17	Seep	1.6192499	VERY HIGH	B	82	74	F	0	0	82	1.327784939	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**1.99**
Sandtails	W13B-01	CVB	0.0184873	VERY HIGH	B	85	79	F	0	0	85	0.015714244	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.02**
Sandtails	W13B-10	CVB	0.0047131	VERY HIGH	B	85	79	F	0	0	85	0.004006095	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.01**
Sandtails	W13B-12	CVB	1.3147415	VERY HIGH	B	85	79	F	0	0	85	1.117530284	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**1.68**
Sandtails	W13B-06	Seep	0.3054415	MODERATE	C	64	42	F	0	0	64	0.195482583	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.29**
Sandtails	W13B-39	Seep	0.3037261	MODERATE	C	62	40	F	0	0	62	0.188310163	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.28**
Sandtails	W13B-33	Seep	21.117733	MODERATE	C	62	40	F	0	0	62	13.09299446	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**19.64**
Sandtails/Topsoil	W13B-39	Seep	0.3669211	MODERATE	C	62	40	F	0	0	62	0.227491085	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.34**
Sandtails/Topsoil	W13B-33	Seep	0.0557879	MODERATE	C	62	40	F	0	0	62	0.034588472	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.05**
Topsoil	W13B-16	Seep	1.5584672	VERY HIGH	B	82	74	F	0	0	82	1.277943131	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**1.92**
Topsoil	W13B-15	Seep	0.2470278	VERY HIGH	C	75	64	F	0	0	75	0.185270833	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.28**
Topsoil	W13B-01	CVB	0.1414158	VERY HIGH	B	85	79	F	0	0	85	0.12020342	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.18**
Topsoil	W13B-10	CVB	0.0165072	VERY HIGH	B	85	79	F	0	0	85	0.01403109	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.02**

					PRIOR TO DEVELOPMENT			POST DEVELOPMENT			WETLAND FUNCTIONAL TARGETS				
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	PES Category	Wetland Integrity (%)	Habitat Intactness (%)	Change in Functional Value (%)	Preliminary Development Impact (Functional ha.eq)	Triggers for Potential Adjustment in Exceptional Circumstances	Functional Importance Ratio	Final Functional Offset Target (ha.eq)
Topsoil	W13B-09	Seep	0.0265237	VERY HIGH	B	84	80	F	0	0	84	0.022279873	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.03**
Topsoil	W13B-40	Seep	0.3668411	MODERATE	C	62	40	F	0	0	62	0.227441512	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.34**
Topsoil	W13B-39	Seep	0.0029564	MODERATE	C	62	40	F	0	0	62	0.001832995	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.00**
Topsoil	W13B-02	Seep	0.118463	MODERATE	E	32	9	F	0	0	32	0.037908171	Wetland loss in a strategic water resource area which could compromise water regulation / supply	1.5	**0.06**
			123.59498												**122.97**

					PRIOR TO DEVELOPMENT		POST DEVELOPMENT		ECOSYSTEM CONSERVATION TARGETS											
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Habitat Intactness (%)	PES Category	Habitat Intactness (%)	Wetland Ecosystem Group	Threat Status	Protection Level	Ecosystem Status Muliplier	Priority of Wetland as Defined in Regional and National Conservation Plans	Regional & National Context Multiplier	Uniqueness and Importance of Biota Present in the Wetland	Biodiversity Value Score	Local Connectivity	Local Context Multiplier	Ecosystem Conservation Ratio	Ecosystem Conservation Target (ha.eq)
LOM	W12F-12	Seep	0.0556817	HIGH	D	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.19**
LOM	W12F-16	Seep	1.1477524	HIGH	D	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**4.00**
LOM	W13B-13	Seep	0.1138146	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.85**
LOM	W13B-15	Seep	0.7965301	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**5.93**
LOM	W13B-09	Seep	0.0141771	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	High Importance	1.00	High biodiversity value	1.00	Moderate connectivity	0.78	23.25	**0.26**
LOM/RSF C	W12F-12	Seep	0.289988	HIGH	D	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.01**
LOM/Sandtails	W13B-13	Seep	0.1057677	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.79**
LOM/Sandtails	W13B-15	Seep	0.2107014	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.57**
LOM/Sandtails	W13B-09	Seep	0.7118844	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	High Importance	1.00	High biodiversity value	1.00	Moderate connectivity	0.78	23.25	**13.24**
Road Corridor	W12F-12	Seep	0.1774104	HIGH	D	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.62**
Road Corridor	W13B-13	Seep	0.0120386	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.09**
Road Corridor	W13B-15	Seep	0.0228668	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.17**

					PRIOR TO DEVELOPMENT		POST DEVELOPMENT		ECOSYSTEM CONSERVATION TARGETS											
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Habitat Intactness (%)	PES Category	Habitat Intactness (%)	Wetland Ecosystem Group	Threat Status	Protection Level	Ecosystem Status Muliplier	Priority of Wetland as Defined in Regional and National Conservation Plans	Regional & National Context Multiplier	Uniqueness and Importance of Biota Present in the Wetland	Biodiversity Value Score	Local Connectivity	Local Context Multiplier	Ecosystem Conservation Ratio	Ecosystem Conservation Target (ha.eq)
Road Corridor	W13B-13	Seep	0.0014681	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.01**
Road Corridor	W13B-15	Seep	0.0151824	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.11**
Road Corridor	W13B-01	CVB	0.0807315	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**0.77**
Road Corridor	W13B-10	CVB	0.264373	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**2.51**
Road Corridor	W13B-12	CVB	0.0784107	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**0.74**
Road Corridor	W13B-11	Seep	0.9338735	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**8.69**
Road Corridor	W13B-09	Seep	0.2355284	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	High Importance	1.00	High biodiversity value	1.00	Moderate connectivity	0.78	23.25	**4.38**
Road Corridor	W13B-05	Seep	0.0004229	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.00**
Road Corridor	W13B-09	Seep	0.0167778	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	High Importance	1.00	High biodiversity value	1.00	Moderate connectivity	0.78	23.25	**0.31**
Road Corridor	W13B-40	Seep	0.3061623	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.42**
Road Corridor	W13B-33	Seep	0.0082385	MODERATE	C	40	F	0	Indian Ocean Coastal Belt	CR	Not protected	30.00	Not specifically	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.04**

					PRIOR TO DEVELOPMENT		POST DEVELOPMENT		ECOSYSTEM CONSERVATION TARGETS											
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Habitat Intactness (%)	PES Category	Habitat Intactness (%)	Wetland Ecosystem Group	Threat Status	Protection Level	Ecosystem Status Muliplier	Priority of Wetland as Defined in Regional and National Conservation Plans	Regional & National Context Multiplier	Uniqueness and Importance of Biota Present in the Wetland	Biodiversity Value Score	Local Connectivity	Local Context Multiplier	Ecosystem Conservation Ratio	Ecosystem Conservation Target (ha.eq)
									Group 2_Seep				identiifed as important							
RSF 9	W13B-44	Sep	7.0326143	HIGH	C	61	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**49.87**
RSF 9	W13B-42	Sep	14.376336	HIGH	C	61	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**101.95**
RSF 9	W13B-41	Sep	6.8511825	HIGH	C	61	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**48.58**
RSF 9	W13B-43	Sep	7.4739704	HIGH	C	61	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**53.00**
RSF 9	W13B-40	Sep	0.1244478	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.58**
Sandtails	W12F-13	Sep	7.615554	HIGH	C	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**26.56**
Sandtails	W13B-18	Sep	8.4242666	HIGH	C	61	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**59.74**
Sandtails	W12F-12	Sep	37.910821	HIGH	D	30	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**132.21**
Sandtails	W13B-32	Sep	0.6010022	MODERATE	E	5	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.35**
Sandtails	W13B-17	Sep	1.6192499	VERY HIGH	B	74	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**13.93**
Sandtails	W13B-01	CVB	0.0184873	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**0.18**
Sandtails	W13B-10	CVB	0.0047131	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**0.04**

					PRIOR TO DEVELOPMENT		POST DEVELOPMENT		ECOSYSTEM CONSERVATION TARGETS											
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Habitat Intactness (%)	PES Category	Habitat Intactness (%)	Wetland Ecosystem Group	Threat Status	Protection Level	Ecosystem Status Muliplier	Priority of Wetland as Defined in Regional and National Conservation Plans	Regional & National Context Multiplier	Uniqueness and Importance of Biota Present in the Wetland	Biodiversity Value Score	Local Connectivity	Local Context Multiplier	Ecosystem Conservation Ratio	Ecosystem Conservation Target (ha.eq)
									2_Channelled valley-bottom wetland											
Sandtails	W13B-12	CVB	1.3147415	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**12.46**
Sandtails	W13B-06	Seep	0.3054415	MODERATE	C	42	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.49**
Sandtails	W13B-39	Seep	0.3037261	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.41**
Sandtails	W13B-33	Seep	21.117733	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**98.20**
Sandtails/Topsoil	W13B-39	Seep	0.3669211	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.71**
Sandtails/Topsoil	W13B-33	Seep	0.0557879	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.26**
Topsoil	W13B-16	Seep	1.5584672	VERY HIGH	B	74	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**13.41**
Topsoil	W13B-15	Seep	0.2470278	VERY HIGH	C	64	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.84**
Topsoil	W13B-01	CVB	0.1414158	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-bottom wetland	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**1.34**
Topsoil	W13B-10	CVB	0.0165072	VERY HIGH	B	79	F	0	Indian Ocean Coastal Belt Group 2_Channelled valley-	CR	Poorly protected	15.00	High Importance	1.00	High biodiversity value	1.00	Good connectivity	0.80	12.00	**0.16**

					PRIOR TO DEVELOPMENT		POST DEVELOPMENT		ECOSYSTEM CONSERVATION TARGETS											
Infrastructure Type	Wetland ID	HGM	Area (HA)	EIS	PES Category	Habitat Intactness (%)	PES Category	Habitat Intactness (%)	Wetland Ecosystem Group	Threat Status	Protection Level	Ecosystem Status Muliplier	Priority of Wetland as Defined in Regional and National Conservation Plans	Regional & National Context Multiplier	Uniquenes s and Importance of Biota Present in the Wetland	Biodiversity Value Score	Local Connectivity	Local Context Multiplier	Ecosystem Conservation Ratio	Ecosystem Conservation Target (ha.eq)
									bottom wetland											
Topsoil	W13B-09	Seep	0.0265237	VERY HIGH	B	80	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	High Importance	1.00	High biodiversity value	1.00	Moderate connectivity	0.78	23.25	**0.49**
Topsoil	W13B-40	Seep	0.3668411	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**1.71**
Topsoil	W13B-39	Seep	0.0029564	MODERATE	C	40	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.01**
Topsoil	W13B-02	Seep	0.118463	MODERATE	E	9	F	0	Indian Ocean Coastal Belt Group 2_Seep	CR	Not protected	30.00	Not specifically identiifed as important	0.50	High biodiversity value	1.00	Moderate connectivity	0.78	11.63	**0.12**
			123.59498																	**669.30**

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Appendix C

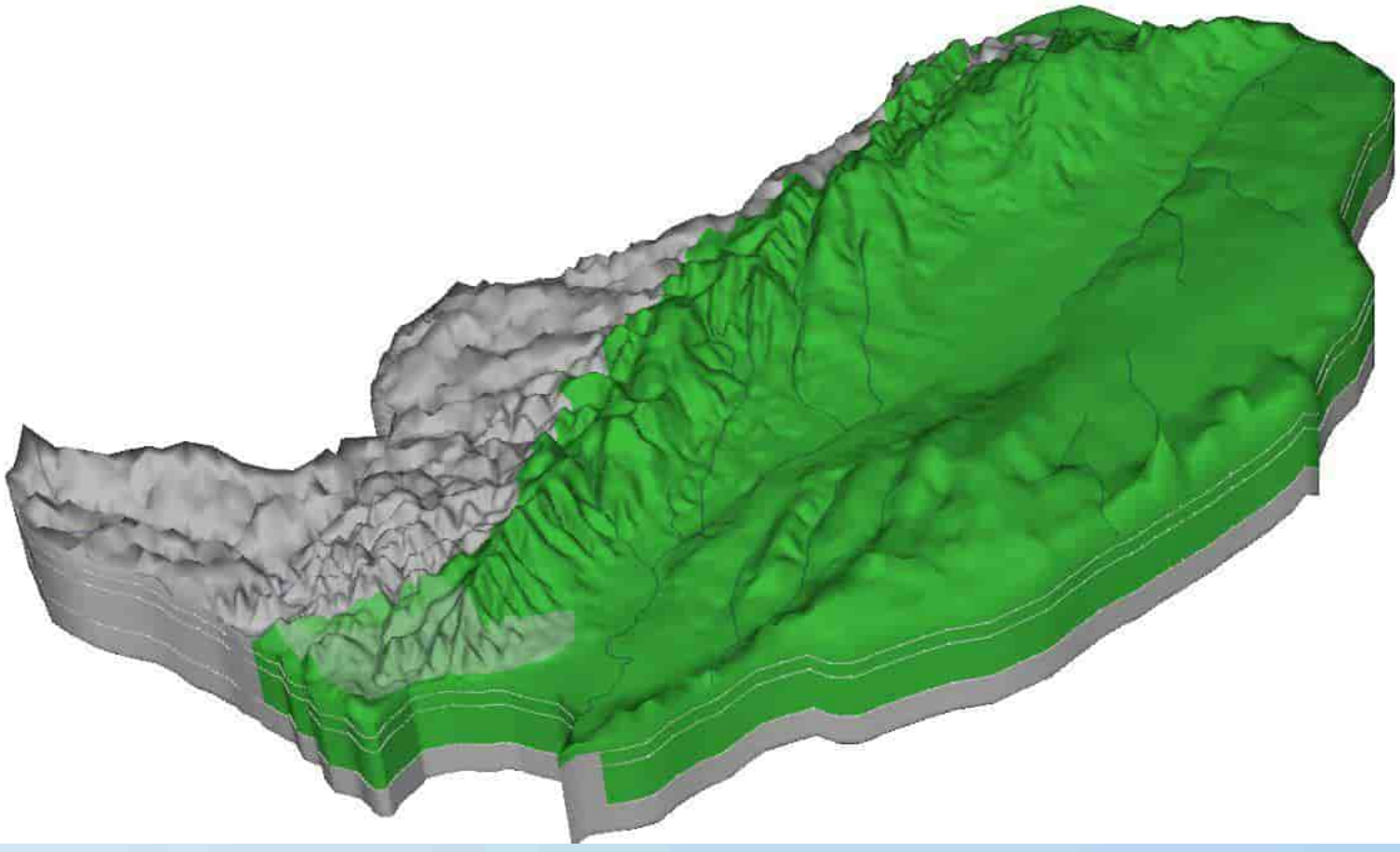
HYDROGEOLOGICAL INVESTIGATION (WSP, 2025)

Confidential

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Hydrogeological Investigation



41106008-REP-00001
MARCH 2025

CONFIDENTIAL

Tronox KZN Sands (Pty) Ltd

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORT DURNFORD MINE, KWAZULU-NATAL

Hydrogeological Investigation

FINAL REPORT CONFIDENTIAL

PROJECT NO. 41106008

OUR REF. NO. 41106008-REP-00001

DATE: MARCH 2025

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QUALITY CONTROL

Issue/revision	Draft	Revision 1	Revision 2	Revision 3	Final
Remarks	Draft	Revision 1	Revision 2	Revision 3	Final
Date	December 2024	21 January 2025	04 February 2025	12 February 2025	03 March 2025
Prepared by	Talita Van Zyl	Talita Van Zyl	Aashna Bissoon	Aashna Bissoon	Talita Van Zyl
Signature					
Checked by	Sarah Skinner	Sarah Skinner	Sarah Skinner	Sarah Skinner	Sarah Skinner
Signature					
Authorised by	Sarah Skinner	Sarah Skinner	Sarah Skinner	Sarah Skinner	Sarah Skinner
Signature					
Project number	41106008				
Report number	41106008-REP-00001				
File reference	41106008-REP-00001 Port Durnford Hydrogeological Report				

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EXECUTIVE SUMMARY

This report provides the groundwater specialist report for the Port Durnford mining operations.

Background:

Tronox KZN Sands (Pty) Ltd (herein referred to as Tronox) currently operates the Fairbreeze mine where the heavy mineralised sand dunes mined south-west of Mtunzini in the Greater Richards Bay area. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter (collectively known as the Central Processing Complex (CPC)) in the Empangeni area. Tronox's previous mining operation, Hillendale, is currently in the mine closure phase.

The proposed project is for the mining of heavy minerals including ilmenite, rutile, zircon and heavy minerals within the Port Durnford Mining Rights area. It is proposed that the mining activities will be undertaken in two phases.

The objective of the groundwater study was to establish the baseline geohydrological conditions on site and understand the potential impact of the proposed Port Durnford mining activities on the groundwater and surface water resources. The scope of work included a hydrocensus (November 2022), description of baseline, numerical groundwater modelling and impact assessment.

The site is currently occupied by forestry activities and will return to these operations upon completion of mining and subsequent rehabilitation. The main receptor from groundwater are surface water (rivers) resources and wetland areas that contribute to baseflow, where groundwater dependent ecosystems are a common feature along the northeastern coastline of KwaZulu-Natal. Wetlands east of the project site, mainly along the drainage channels feeding Lake Cubhu and around Kraal Hill, are fed by shallow groundwater from perched aquifers formed by underlying clay rich dune sands. The Mlalazi estuary is also fed by shallow groundwater in the area.

The project area is underlain by Quaternary sands of the Maputaland Group towards the east, with rocks of the Vryheid Formation and Natal Group outcropping south-west of the site and the Natal Metamorphic Province situated west and north, forming the basement lithologies. Groundwater levels range from artesian conditions to 59 mbgl across the area. Shallower water levels are observed near the rivers and in the down gradient areas closer to the coast. A combination of topography and textural characteristics of the geological formations influence the baseflow component of the project area, which appears to be more prominent east of the N2 national route.

Groundwater flow from the site is generally towards the east and south-east, in the direction of the Indian Ocean and Mlalazi River respectively. Based on information from previous studies in the region, the primary aquifer is unconfined and has variable hydraulic conductivity generally between 0.1 – 10 m/day with variable yields, generally below 2 L/s. For the secondary aquifer, hydraulic conductivity ranges between 0.1 – 0.001 m/day with higher values anticipated for the dolerite contact and fault zones and low yields ranging from 0.1 L/s to 1.5 L/s.

The baseline groundwater quality in the area is generally good with marginal to poor quality noted in some boreholes along the site boundary. The background water quality in the Port Durnford area is generally good with electrical conductivity ranging between 0–150 mS/m. Iron, manganese, aluminium and lead were locally present in some boreholes.

Potential sources of contamination were identified but due to the low salinity; the mining is anticipated to have a low impact to the groundwater resource and surface resources receiving baseflow.

The model results show that in the first 10 years of low-rate mining, the simulated ingress is approximately 3 500 m^3/d. Thereafter the average simulated ingress for the “mining only” scenario is 8 911 m^3/d. By including the additional water from backfilling and residue deposition the total ingress rises to 51 311 m^3/d in 2065. Model results further show that the reduction in baseflow is mostly insignificant and that the backfilling allows for quick recovery of the drawdown during mining.

Due to high recharge in the sand aquifer and the additional water added to the system with the backfill, the coarse sand tailings deposits and the fine residue, as well as the benign nature of the waste streams, the contaminant concentration in the aquifer is attenuated. This is the opposite of what is generally expected from contamination sources. Therefore, the residue and backfill material are not strictly sources of contamination and will have a positive impact on the groundwater and river qualities in most areas.

The impact assessment indicates that dewatering and groundwater quality are the main impacts on the system. Impacts were found to be moderate without mitigation and low after mitigation.

The existing monitoring network consists of fourteen (14) known boreholes although not all of them are monitored and some of them are outside the mining boundary. Approximately six (6) of the boreholes are within the mining area and will most probably be destroyed during mining. The proposed future monitoring is guided by a risk-based source-pathway-receptor principle. The boreholes in the network should cover the following:

- Source monitoring – monitoring close to possible contaminant sources (this can be achieved by replacing boreholes W2 and W7 after mining).
- Plume (pathway) monitoring – monitoring along identified contamination plumes (W5, W11 and TBH1).
- Impact (receptor) monitoring – monitoring at expected sensitive receptors. Surface water monitoring is proposed for
    - The Mzingwenya River (P_SW1).
    - The Amanzamnyama River (P_SW2).
    - Tributary of the KwaGugushe River (P_SW3).
    - Tributary of the Mhlatuze river (P_SW4)

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1 INTRODUCTION

WSP Group Africa (Pty) Ltd (WSP) was appointed by Tronox KZN Sands (Pty) Ltd (Tronox) to undertake an independent environmental impact assessment (EIA), associated authorisation and licencing processes and specialist studies to support the mining right application for the proposed Port Durnford Mining Rights Area (MRA).

This report provides the groundwater specialist report as informed by the requirements set out by Annexure D.5. of Regulation 267 (R267) of March 2017[1] for geohydrology specialist, (Government Gazette No. 40713).

1.1 OBJECTIVES

The objective of the groundwater study is to establish the baseline geohydrological conditions on site and potential impacts of the proposed Port Durnford mining activities on the groundwater and surface water receptors in support of the environmental authorization.

1.2 LOCALITY

Port Durnford mine is situated in the uMhlatuze Local Municipality that falls under the King Cetshwayo District Municipality. It is located approximately 15 km south-west of Richards Bay and between 4 and 15 km north-east of Mtunzini in the Greater Richards Bay area.

The N2 highway as well as the R102 traverse the length of the proposed MRA (Figure 1-1). The R102 is located to the north-west of the MRA and the N2 runs through the centre. There is also a railway line just south of the N2 that also traverses the mining right area.

Mondi is currently leasing most properties under the prospecting rights for commercial forestry purposes. The plan is to rehabilitate the site and restore it to forestry after mining.

1.3 DESCRIPTION OF ACTIVITIES

1.3.1 EXISTING MINING

Tronox currently operates the Fairbreeze mine, to the south-west of the Port Durnford[2] MRA, where mineralised sand dunes are mined by hydraulic mining using a high-pressure hose that turns the in-situ sand into slurry. The slurry is then pumped to the plant for processing. This is supported by a Tronox Mineral Separation Plant (MSP) and Smelter, collectively known as the Central Processing Complex (CPC) in the Empangeni area (Figure 1-2). Tronox's previous mining operation, Hillendale, is currently in the mine closure phase and located to the north-east of the MRA.

[1] A revision to these regulations (GN 48630 dated 19 May 2023) was published for comment on the 10 March 2023.
[2] Note that Durnford and Dunford is used interchangeably

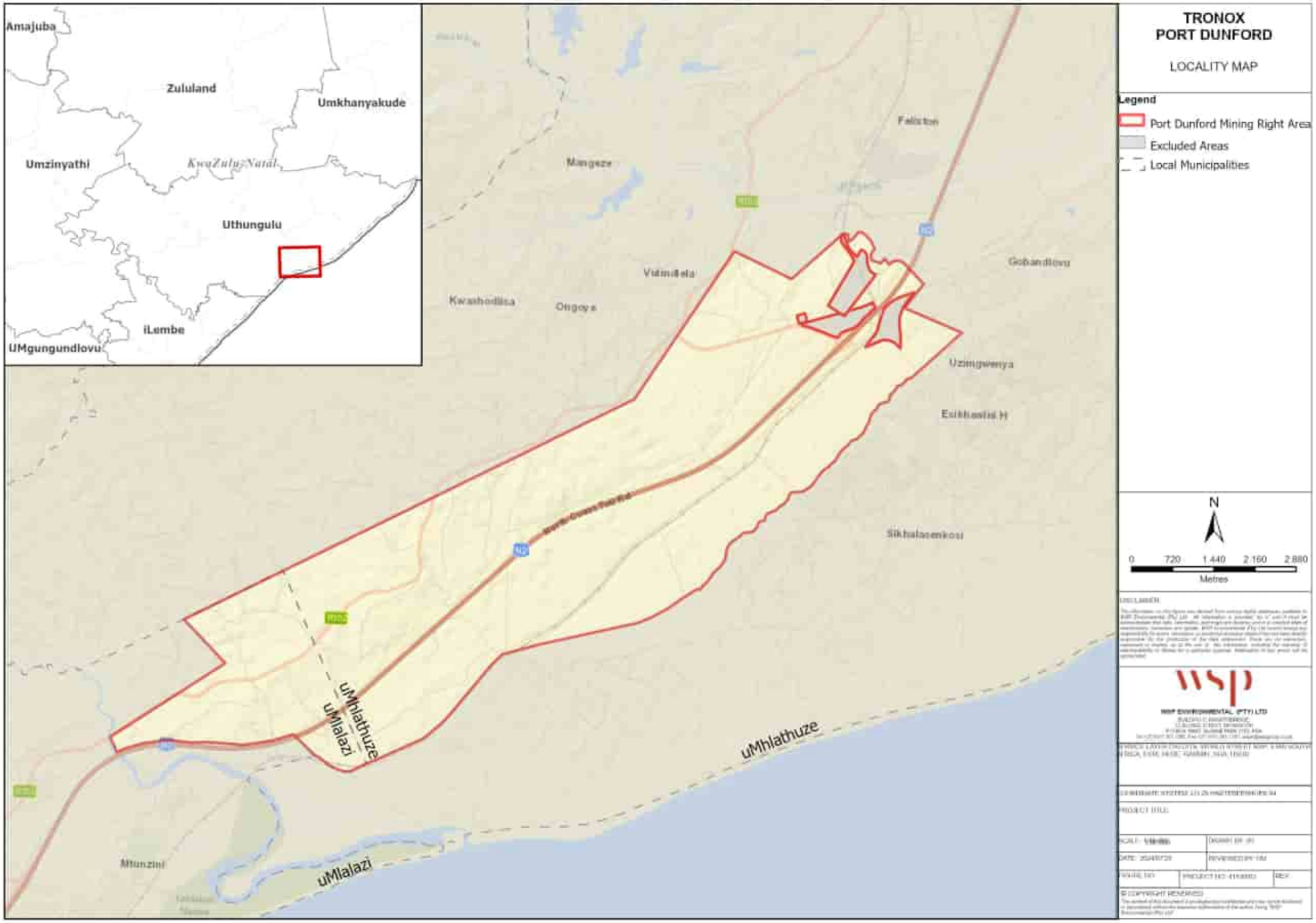

Figure 1-1 - Locality map

1.3.2 WATER AND MINE WASTE MANAGEMENT

Process water is distributed to the Primary Wet Plant (PWP) as make-up water from two process water storage dams via a header and pump distribution system. Process water supply to the new Dozer Trap Mining Unit (DTMU) is supplied from the process water manifold using dedicated water supply pumps. The process water is supplemented with raw water from the raw water dam which in turn is supplied from the Mhlatuze River bulk water supply station (Hatch, 2020).

The following tails products are received from the Central Processing Complex (CPC) for disposal with the various tails' products at the PWP:

- Mineral Separation Plant (MSP) tails are received by tip truck from the MSP. It is tipped directly into a slurry hopper where it is slurried before pumping directly into the rougher sand tails tank for disposal with the coarse sand (PWP) tails.
- Gypsum filter cake from the MSP is received via truck from the CPC and deposited on a dedicated stockpile. The cake is reclaimed and fed into a materials handling facility for re-slurrying before being fed to the thickener underflow tank for disposal together with the fine tails to the RSF.

1.3.3 PROPOSED MINING

The Port Durnford project proposes mining of heavy minerals including ilmenite, rutile, zircon and heavy minerals from the mineralised sand dunes with an average mining depth of 45 m. The MRA is approximately 4733.64 ha. The mining footprint area has been reduced to 1800 ha to exclude approximately 825 ha of "environmentally sensitive areas" (ecosystems such as swamp forests and wetland habitat with high ecological function and value) and is presented in Figure 1-2. The mining timeline is from 2025 to 2069 and is discussed in further detail in Section 7. It is proposed that the mining activities will be undertaken in two phases:

- Phase 1 (approximately 41 ha) will be a small-scale mining phase for the first 10 years where an estimated 70 400 tons per annum (tpa) run-of-mine (ROM) sands will be mined and transported to the existing Fairbreeze Mine for processing. The rate of mining will be 100 tons per hour (tph) and mining will only take place for 5 days in a month.
- The proposed Phase 2 mining operation will commence from 2036 onwards and will involve developing a 3 000 ton per hour (tph) hydraulic sand mine within in the Port Durnford MRA which will be of similar scale to the Fairbreeze mining operation. From 2036 it was assumed that mining will be active for one year per mining block. A primary wet plant (PWP) will be constructed on site to separate the run of mine (ROM) feed into a heavy mineral concentrate (HMC). Fines will go to two proposed Residual Storage Facilities (RSF 9 and RSF C) and the coarse sand tailings will be temporarily stored to the south (A1, A2, & A3) and west (8B) of the mine area before being returned as backfill to the pit. Both fine residue and coarse sand tails will be disposed of above ground or in mined out pit areas, depending on disposal area availability. The HMC will be transported to the existing Tronox Mineral Separation Plant (MSP). Figure 1-3 indicates the location of RSF Site C on the mining area and RSF Site 9 to the west of the mining area as well as the areas where sand tailings will be deposited.

The backfill timeline follows the fine residue deposition schedule as provided by Tronox in March 2024 (Table 1-1). It should be noted that this schedule reflects information that was used in the setup of the groundwater model, however this has subsequently been updated.

- RSF C will be built on mining blocks 2036 to 2055. RSF C will become operational in 2069.

- RSF 9 will be active from 2036 to 2046 according to the spatial data received in March 2024.
- The RSF slurry contains 28% solids and 72% water (although the latest data (January 2025) indicates a ratio of 35% solids to 65% water).

The coarse sand tailings will be deposited as a slurry with 50% solids and 50% water and will become active from 2036 to 2068 as follows:

- Sand tailings A1 to A3 from 2036 to 2047.
- Sand tailings North from 2054 – 2055, two years after mining of the northern mining blocks.
- Sand tailings 4 from 2056 to 2059, two years after mining of the south-western mining blocks.
- Sand tailings 5 from 2060 to 2063, two years after mining.
- Sand tailings 3 from 2063 to 2068, two years after mining.
- Sand tailings 8B from 2047 to 2053.

The slurry ratio of 50% solids to 50% water for the coarse sand tailings is based on measured data from Fairbreeze for the period January 2021 to August 2022. The latest information received in January 2025 indicates that the ratio is 45% solids to 55% water, however, no data was available on the percentage water recovery or losses due to evaporation. It is recommended that this be confirmed during the feasibility study.

Figure 1-2 - Planned infrastructure for Port Durnford operation

Table 1-1 – Sand tailings deposition schedule (received March 2024)

Area	Capacity (Mt)	Sequence	Unit	Jan 36	Jan-37	Jan-38	Jan-39	Jan-40	Jan-41	Jan-42	Jan-43	Jan-44	Jan-45	Jan-46	Jan-47	Jan-48	Jan-49	Jan-50	Jan-51	Jan-52	Jan-53	Jan-54	Jan-55	Jan-56	Jan-57	Jan-58	Jan-59	Jan-60	Jan-61	Jan-62	Jan-63	Jan-64	Jan-65	Jan-66	Jan-67
Backfill A1, A2, A3	150	1	Mt	9.4	11.2	14.2	18.2	18.1	11.2	11.2	7.6	10.9	12.0	18.3	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Backfill 4	117	8	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.8	12.9	17.2	17.4	18.2	12.0		-	-	-	-	-	-	-
Backfill 3	133	10	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7	17.4	17.3	17.7
Backfill 5	96	9	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.3	19.0	18.7	18.7	19.1	15.0			
RSF Site 9	18	2	Mt	6.2	7.5	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RSF Site C P1	18	3	Mt	-	-	-	-	-	7.5	7.5	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RSF Site C P2	21	4	Mt	-	-	-	-	-	-	-	7.3	7.3	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RSF Site C P3	21	5	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	7.5	7.5	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RSF Site C P4	4	6	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	-	-	-	-	-	-	-	-	-	-	-	-
Backfill 8	89	7	Mt	-	-	-	-	-	-	-	-	-	-	-	11.1	19.0	10.9	11.0	13.3	18.7	18.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Backfill (Site 9 Sand capping)	11	-	Mt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**678.20**	**-**	**Mt**	16	19	19	18	18	19	19	18	18	19	18	18	19	18	18	19	19	18	17	17	17	17	18	18	19	19	19	19	18	17	17	18

Figure 1-3 - Mining schedule

2 GEOGRAPHICAL SETTING

2.1 TOPOGRAPHY AND DRAINAGE

The topography of the area is characterised by moderately sloping incised valleys in the north-west, which grades to undulating terrain towards the coastline, with wide valleys representative of floodplains of prominent drainage channels. Surface elevations range between 10 – 130 mamsl. A whaleback ridge crest extends from the Forest Inn area towards the north-eastern boundary, west of the N2, with highpoints at 112 – 125 mamsl (Hatch, 2020). The low-lying coastal plain is separated from the Indian Ocean by an elevated aeolian dune cordon (GCS, 2020).

Port Durnford mine is situated within the Usuthu to Mhlathuze[3] water management area (WMA) and is bisected by two quaternary catchments: W12F (north-east) and W13B (south-west) as indicated in Figure 2-1. Within the W12F quaternary catchment, the perennial Mhlathuze River flows past the northern boundary and its tributaries drain the north-western areas. The perennial Mzingwenya River and its associated tributaries flow along the eastern site boundary from southwest to north-east where it drains into Lake Cubhu.

Within the W13B quaternary catchment, the perennial Amanzamnyama and Ojinjini Rivers and their associated tributaries flow from north-east to south-west within the site boundary and confluences with the Mlalazi River. Another tributary of the Mlalazi River runs further south of this site boundary. The Mlalazi River runs along the southwestern site boundary and eventually drains into the Indian Ocean.

Where the groundwater intersects the land surface in topographical depressions between the coastal dunes, wetlands are likely to occur as shown in the sections through the Siyaya catchment. Significant interflow is likely to contribute to stream flow from sloped land surfaces. Sensitive wetland areas are presented in Figure 2-2.

[3] Refer to Section 3 for river naming convention

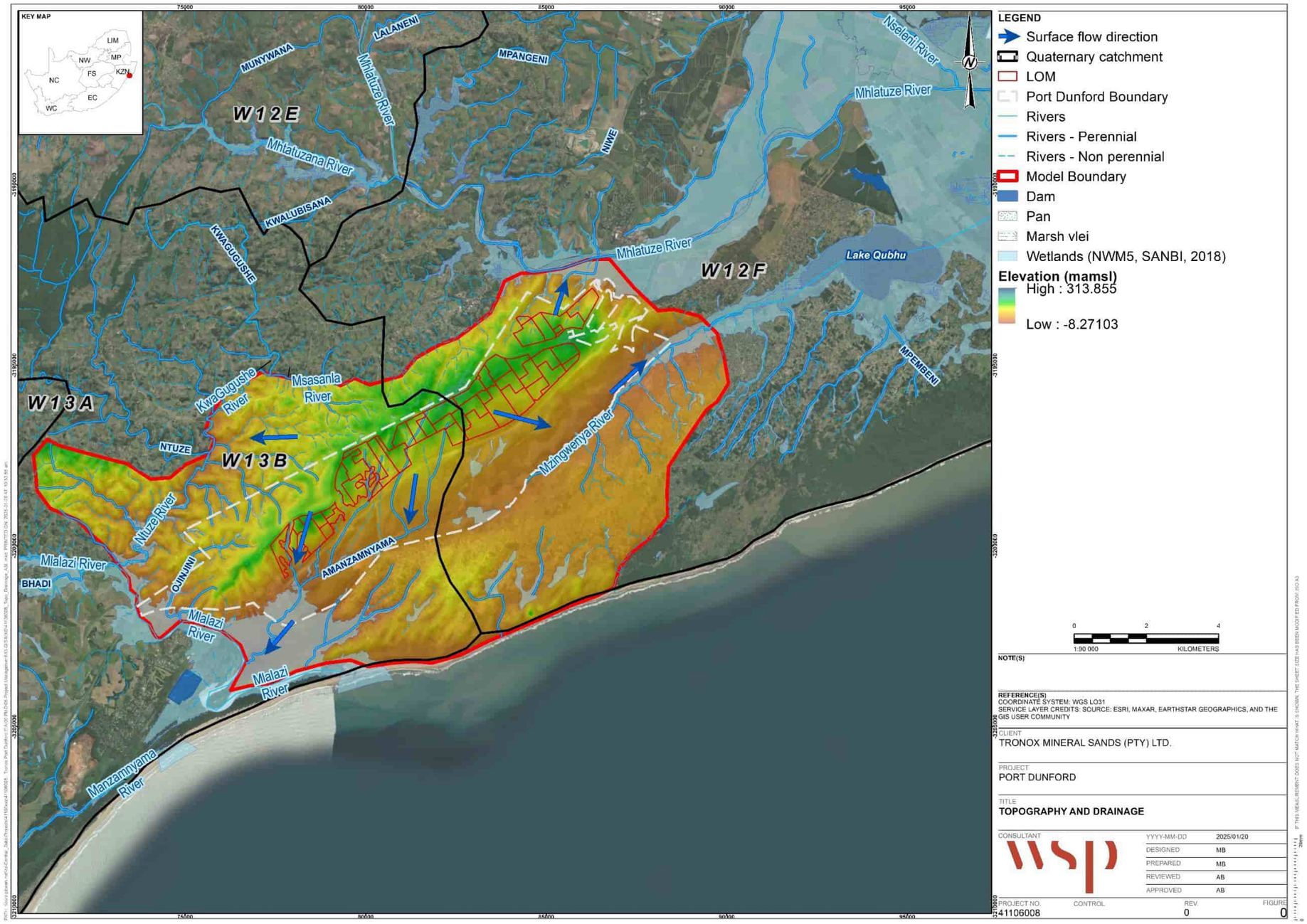

Figure 2-1 - Topography and drainage

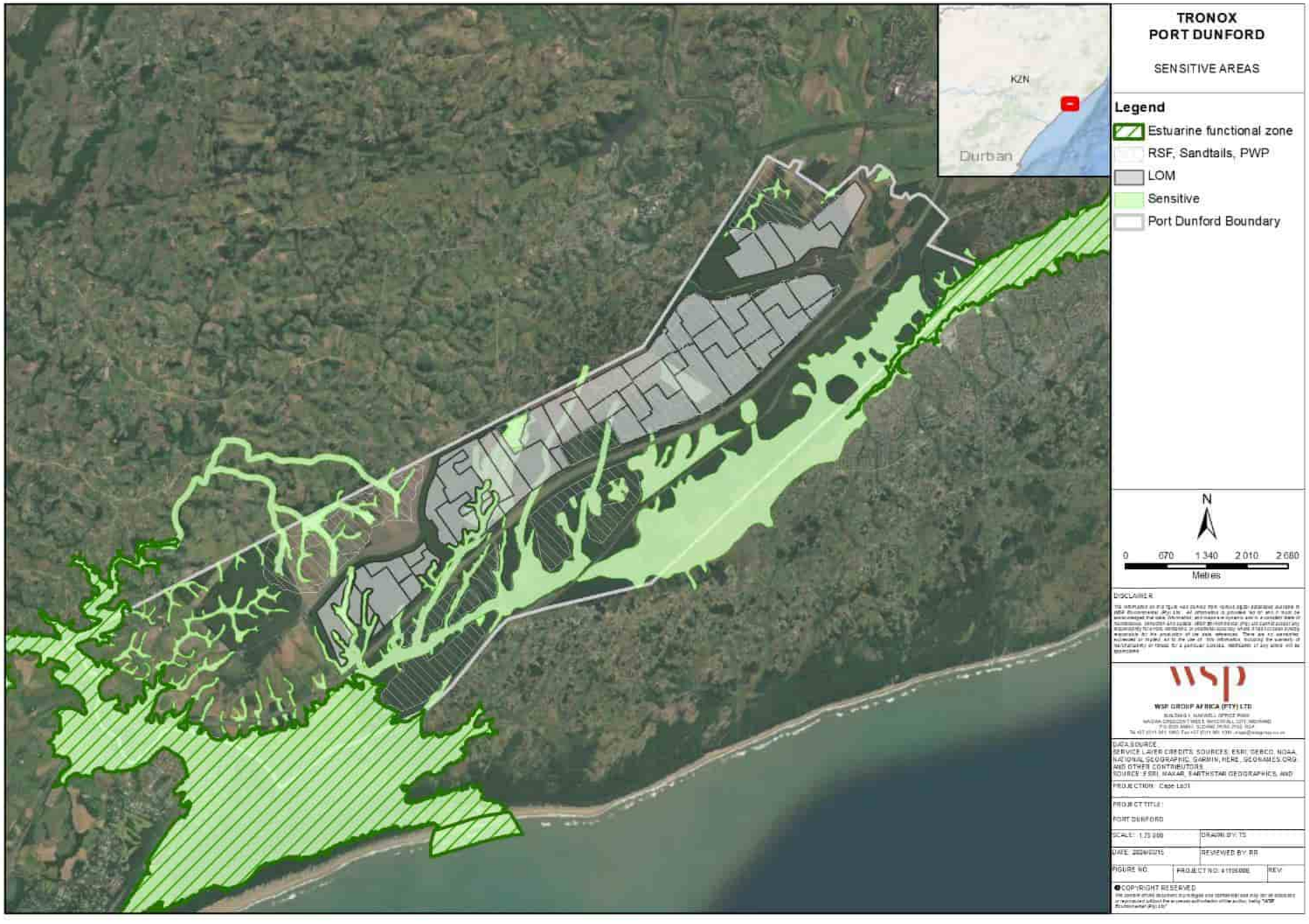

Figure 2-2 – Sensitive wetland areas

2.2 CLIMATE

According to GCS (2020), the area experiences a warm temperate, fully humid climate with hot summers. Temperatures during summer months range between 21 – 28° C and in winter months between 11 – 22 °C. High humidity is experienced in the area within the range of 61 – 88 %. Prevailing winds are mainly northeast and southwest running parallel to the coast (Hatch, 2020).

GCS (2020) noted that the area receives rainfall of between 1 200 – 1 400 mm/a. Historical rainfall data was supplied by Tronox for the SASRI Weather Web station located in Mtunzini, ~5 km south-west of Tronox for the period January 1966 – May 2022. Based on the data received, the area experiences a mean annual precipitation (MAP) of 1 224 mm/a. Figure 2-3 shows the average monthly rainfall for the area between 1966 – 2021. Evaporation ranges between 1 300 – 1 400 mm/a within the project area (Hatch, 2020).

According to Hatch (2020), rainfall occurs through the year, predominantly during the summer months. Extreme rainfall conditions have occurred on several occasions in the region due to tropical cyclones which occasionally move close enough to the coast to produce extensive flooding, causing loss of life and damage to property. The increasing frequency of such events are considered important for future planning and development in the area.

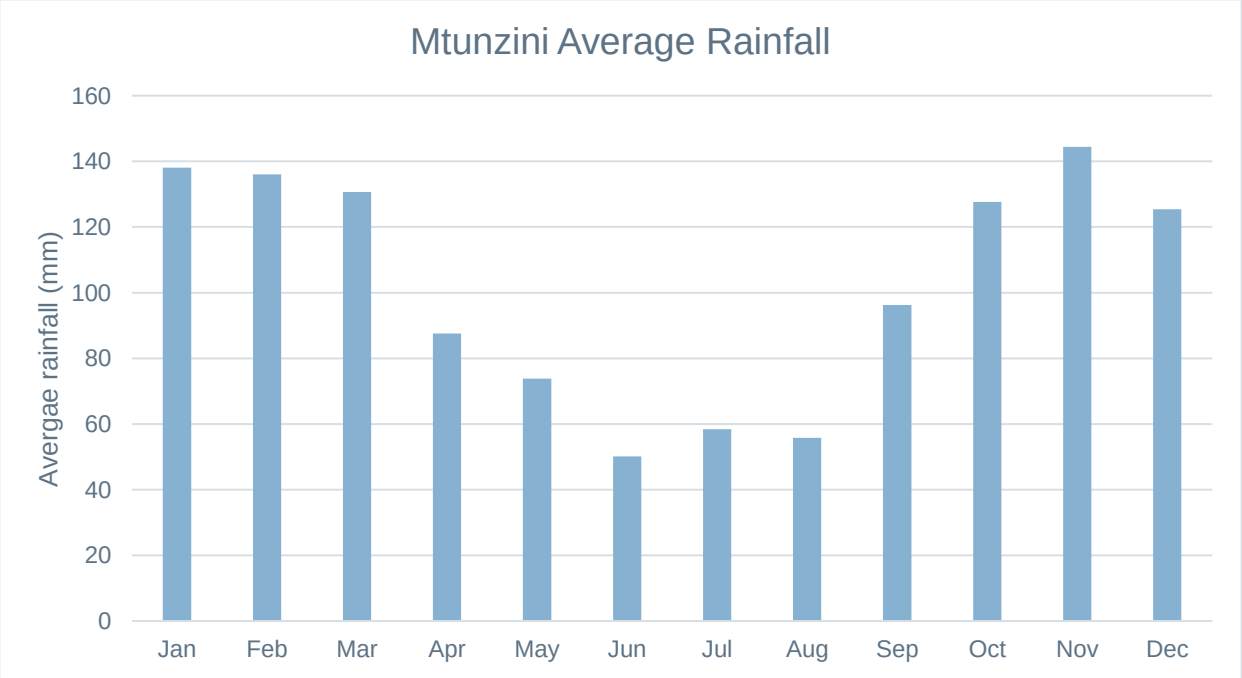

Figure 2-3 - Average monthly rainfall for Mtunzini (1966 - 2021)

3 SCOPE OF WORK

The scope of work includes the following:

- A review of the available information (baseline assessment).
- Hydrocensus conducted in November 2022 including groundwater sampling and analyses.
- Identify data gaps and/or limitations required to inform the R267 report and/or updated groundwater model and impact assessment.

- Numerical modelling and impact assessment (IA) with updates following changes in the mine plan including
  - Development and revision of the groundwater conceptual model/ understanding.
  - Initial groundwater monitoring programme.
  - Qualitative impact assessment.
- Compilation of the groundwater specialist report as informed by the requirements set out by Annexure D.5. of Regulation 267 (R267) of March 2017 for geohydrology specialist, (Government Gazette No. 40713).

Data gaps and limitations

It should be noted that the naming convention followed for the rivers follows the 1:50 000 topographical maps. Lake Cubhu and Qubhu are used interchangeably, as well as uMlalazi and Mlalazi and uMhlathuze and Mhlathuze.

The following limitations were noted as part of the study:

- The study is based on available data and is informed by the hydrogeological reports (refer section 4). Site specific installation of boreholes, borehole logs and aquifer test data were not available other than from the available reports.
- Monitoring borehole information was obtained from the hydrocensus data carried out in previous studies (2017 and 2020) and by WSP in November 2022.
- Water strike and lithological information is not available for the boreholes.
- The study focused on water quality considerations for metals and inorganic species and did not consider additions from anthropogenic sources such as forestry or sewage.
- During the hydrocensus, the detection limits for Cu and Cr were higher than the guidelines for Aquatic and Marine ecosystems. methodology

3.1 DESK STUDY

An information review of existing hydrogeological reports was undertaken to gain an understanding of the hydrogeology and geology of the investigation area. Existing geological, groundwater, and hydrological reports, geological information and maps were studied as part of the information review and formed part of the basis of understanding. The following documents were consulted to provide an understanding of the site hydrogeology, assess impacts and formulate mitigation measures as presented in Table 3-1.

Table 3-1 - Summary of available information and communications

Date	Report reference
August 2024	WSP, August 2024, Port Durnford (EA) Study, geochemistry specialist report.
September 2020	GCS Water and Environmental Consultants, 2020, Baseline Hydrogeological Assessment for the Proposed Tronox Port Durnford Mining Right Area (Final Report). GCS Reference Number: 20-0472.
2020	Hatch, 2020, Tronox KZN Sands (Pty) Ltd – Port Durnford PFS Project Study Report. Report H362603-00000-100-146-0001, Rev. 0.

Date	Report reference
June 2020	SRK Consulting (2020). Tronox Everglades current and proposed RSF and RWD: Surface and groundwater specialist report. Report number 468000/10/Rev1

3.2 HYDROCENSUS

Previous hydrocensus surveys were performed in 2010 (SRK Consulting, 2010), in 2017 (SRK Consulting, 2017) for the area west of the MRA, and in 2020 in the MRA area (GCS, 2020). Thirty-six boreholes were identified in and around the MRA by GCS which included 22 privately owned boreholes, of which 6 (TBH2, TBH4, TBH5a, TBH8, TBH19, and TBH21) were in use, and 12 monitoring wells, of which 2 were dry and one damaged. Approximately 71 boreholes are identified in the National Groundwater Archive (NGA) with several indicated in the same location. The locality of the previous hydrocensus' boreholes and NGA borehole is indicated on Figure 3-1. Photos of the hydrocensus boreholes were included in Appendix A.

A hydrocensus survey was conducted within a 2 km radius of the MRA in November 2022 (Figure 3-2). The survey involved the collection of data from accessible boreholes. GPS co-ordinates, landowners' details, existing equipment, current use, reported yield, measured well depth and static water level were assessed and water levels obtained where accessible. A total of 31 boreholes were identified and visited during the survey of which 20 fall within the MRA (Figure 4-1). The field observations are summarised in Figure 3-1 with further detail provided in Appendix A. The borehole naming convention followed that of the GCS hydrocensus with coordinates within 50 m of the previous census. The previous census information by GCS (2020) is included for reference in Table 4-2. Selected boreholes were sampled and submitted for analyses (refer Section 5.6).

The data was compared to the previous hydrocensus information as follows:

- Of the 71 boreholes identified in the National Groundwater Archive within 2 km of the MRA, only one (2831DD00131) was confirmed during the 2022 hydrocensus (Refer Table 3-2) and was found to be damaged.
- Of the 16 privately owned boreholes identified by GCS, 12 were reassessed with TBH6 and TPH9 confirmed to be in use (not in use in 2020). TBH4 and TBH8 were locked with limited access and are therefore also assumed to still be in use as were TBH5a and TBH19 as these were not included in the 2022 hydrocensus. TBH2 and TBH21 (noted to be in use in 2020) were found to no longer be in use. The locality of boreholes in use are included in Figure 3-1.
- Of the 12 monitoring boreholes identified in 2020, two were still dry/damaged.

Water levels and borehole depths vary from artesian to > 50 mbgl with borehole depths also varying from 1.5-<120 mbgl. Water strike and lithological information is not available for the boreholes.

The hydrocensus data confirms that there are limited groundwater users in the area. Although details of their yields are limited, no large-scale abstraction is taking place.

Other receptors include the sensitive areas namely, the aquatic system as a wetland, the estuaries, and the ocean.

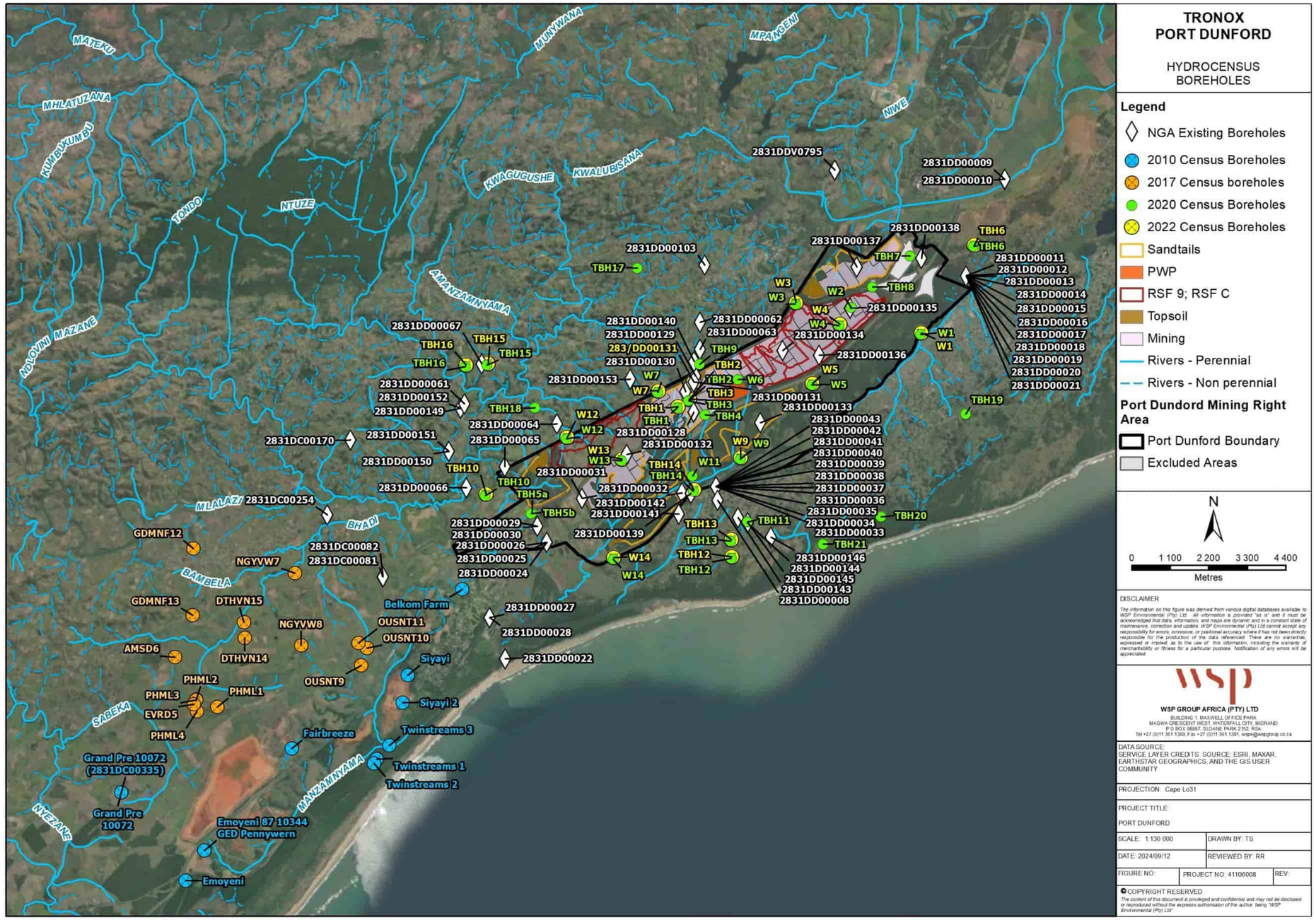

Figure 3-1 – Previous and Current Hydrocensus boreholes

Table 3-2 -Hydrocensus Information

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[4]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
W1	W12F- On Southern boundary and dg of MRA - adjacent to Mzingwenya River	-28.07402	31.89224	2.09	12.14	Mon	Monitoring borehole (Sampled)	Tronox	Mon	16	1.5 (2017) 3.03 (2020)	13	Mon	Monitoring borehole had an Allen key lock and was in good condition
W2	W12F- Inside the Eastern-most portion of the MRA	-28.86715	31.87173	58.55	75.87	Mon	Monitoring borehole.	Tronox	Mon	89	58.9 (2017) 54.85 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W3	W12F-On northern boundary (upgradient)	-28.86645	31.85545		86.88	Mon	Monitoring borehole.	Tronox	No	84	Dry at 45m (2017 & 2020)	45	Mon	Monitoring borehole had an Allen key lock and was in good condition
W4	W12F- Inside the Eastern-most portion of the MRA	-28.87189	31.86835	38.06	61.86	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	89	39.3 (2017) 23.15 (2020)	55	Mon	Monitoring borehole had an Allen key lock and was in good condition
W5	W12F - Within MRA but south of proposed RSF, near topographic watershed but dg of MRA	-28.88717	31.86041	2.87	35.33	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	33	3.78 (2020)	35	Mon	Monitoring borehole had an Allen key lock and was in good condition
W6	W13B - west of topographic watershed within MRA	-28.88597	31.83893	38.11	65.45	Mon	Monitoring borehole.	Tronox	Mon	107	57.05 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W7	W13B - on northern boundary, the KwaGugushe and Msasandla Rivers are to the north.	-28.88943	31.81531	18.53	63.07	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	111	36.46 (2020)	65	Mon	Monitoring borehole had an Allen key lock and was in good condition
W9	W13B - Within MRA on southern boundary near the Amanzamnyama river and near topographic watershed	-28.90648	31.83956			No	Not in use. Destroyed.	Tronox	No		Destroyed (2020)	27	Mon	Monitoring borehole had an Allen key lock and was in good condition
W11	W13B - Within MRA on southern boundary on northern side of Amanzamnyama river and west of W9	-28.91088	31.82568	1.39	25.65	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	25	0.9 (2017) 1.62 (2020)	23	Mon	Monitoring borehole had an Allen key lock and was in good condition
W12	W13B - Within MRA (north-western portion) on northern boundary	-28.90149	31.78862	24.55	56.75	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	59	0.9 (2017) 24.69 (2020)	39	Mon	Monitoring borehole had an Allen key lock and was in good condition
W13	W13B - western portion of the MRA between RSF and sand tail area	-28.90704	31.80481			Mon	Monitoring borehole.	Tronox	Mon	99	73.4- dry at 57 (2017) Dry (2020)	57	Mon	Monitoring borehole had an Allen key lock and was in good condition
W14	W13B - Within MRA on southern boundary on southern side of Amanzamnyama river	-28.93239	31.80258	2.2	20.45	Mon	Monitoring borehole. (Sampled)	Tronox	Mon	11	2.3 (2017) 2.25 (2020)	19.6	Mon	Monitoring borehole had an Allen key lock and was in good condition. Located near plantation
2831 DD001 31	W13B_Inside MRA adjacent to northern boundary near watershed	-25.97568	32.58957	-	5.86	No	Damaged.							Not identified
TBH1	W13B - Inside the mine area just south of W7	-28.89338	31.82102	3.68	32.96	No	Not in use. Pump disconnected.	Siya Qhubeka Forestry	No	57	2.76 (2020)	35	No	Borehole was not locked and did not have a cap or pump installed.

[4] Coordinate based on GPS readings in November 2022. Coordinates are within 50m of previous GCS, 2020 locality. Boreholes not identified in 2022 include the coordinate provided by GCS and are highlighted in grey text. Elevation is as indicated by GCS, 2020

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[4]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
TBH2	W13B - Inside the mine area south of W7 and east of TPH1 and next to TPH3	-28.89146	31.82438	8.91	65.43	No	Not in use. Pump disconnected. (Sampled)	Siya Qhubeka Forestry	Yes	65	NA (2020)	Unk	Yes	Submersible pump. Supplied water to the staff houses at Siya Qhubeka Forest. Locked pump house.
TBH3	W13B - Inside the mine area south of W7 and east of TPH1 and next to TPH2	-28.89145	31.82434	8.84	51.8	No	Not in use. Pump disconnected.	Siya Qhubeka Forestry	No	61	NA (2020)	Unk	No	Historically supplied water to the staff houses (Submersible pump). Replaced by TBH2 when borehole collapsed.
TBH4	W13B - Inside the mine area east of TPH1 and next to TPH2	-28.89508	31.82931			Yes	Locked.	Siya Qhubeka Forestry	Yes	64	NA (2020)	Unk	Yes	Locked and protected by housing. Submersible pump installed.
TBH5a	W13B- West of mine but within the MRA - SW of RSF	-28.92081	31.77874			Assumed Yes	Not included in 2022 hydrocensus	Waterloo farm	Yes	49	NA (2020)	30	Yes	Protected by steel housing. Access to the borehole was granted by the farm owner. Submersible pump installed with yield estimated as 0.83- 1.11 L/s assumed
TBH5b	As above	-28.92082	31.7784				Not included in 2022 hydrocensus	Waterloo farm	No	49	8.19 (2020)	30	No	Located next to TBH5a and protected by a pump house. The farmer mentioned submersible pump equipment from borehole was stolen
TBH6	W12F - Outside MRA to the east	-28.85128	31.90754			Yes	In use. Potable water, irrigation and drinking. Hand pump installed. No access. (Sampled)	Community	No	79	NA (2020)		No	Previously used by community as a source of domestic water supply (hand pump). Plots close to borehole 2831DDG4380 on GRIP Database, which reports a depth of 63 mbgl and yield of 0.42 L/s.
TBH7	W12F - Within MRA Eastern boundary	-28.85387	31.88891	10.44		No	Not in use. Pump disconnected.	Jocks Farm	No	36	13.5 (2020)	Unk	No	Pump house was in dense grass inside the forest (approximately 20m into the forest). Equipment had been removed from the borehole.
TBH8	W12F - Within MRA between the sand tails and proposed RSF	-28.86188	31.87807			Yes	Locked. Assumed to be use based on previous hydrocensus	Unknown	Yes	117	NA (2020)	50	Yes	Locked with a bolt and nut. The borehole was located next to the Vodacom tower opposite Mhlathuze water reservoirs.
TBH9	W13B - just outside northern boundary and west of topographic watershed (north of W6).	-28.882	31.8275			Yes	In use. Potable water, irrigation and drinking. (Sampled)	Community	No	87	NA (2020)	Unk	No	The borehole hand pump was broken.
TBH10	W13B-NW of mine - outside the mine area	-28.91631	31.76503			No	Not in use. Damaged.	Savalela	No	28	1 (2020)	30	No	The borehole was in a sugarcane field. The borehole does not have a cap and was not protected. Historically equipped with a submersible pump.
TBH11	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.9226	31.84184			No	Not included in 2022 hydrocensus	Community	No	60	Blocked (2020)	Unk	No	The hand pump was removed (stolen) and the borehole was blocked at1.2 m. Plots close to borehole 2831DD00144 on NGA Database.
TBH12	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.93206	31.83714			No	Not in use. Blocked.	RBM	/	32	NA (2020)	Unk	/	Borehole RBM16 of Zulti South. PVC Casing filled with sand. No access for water level.
TBH13	W13B-Outside and to the south of the mine area between the mine area and the coastline (TPBH11, 12 and 13 near each other)	-28.92756	31.83699			No	Not in use. Damaged.	Unknown	No	33	Blocked (2020)	68*	/	Located inside rusted housing and blocked at 3 mbgl. Plots close to borehole 2831DDG2852 on GRIP Database, with a yield of 1.11 L/s, depth of 68 mbgl and water level of 37.4 mbgl in 1995.

BH ID	Relative location	2022 Hydrocensus: 09-11 November 2022						2020 Hydrocensus; 6 – 10 July 2020 (GCS, 2020)						
		GPS -coordinate[4]		Water Level	BH Depth	Opera-tional	Current Status	Owner Information (GCS, 2020)	Opera-tional	Eleva-tion	Water level information	Borehole Depth	Opera-tional	Comment
		Latitude	Longitude	(mbgl)	(mbgl)	[Yes/No]			[Yes/ No]	(Mamsl)	[mbgl]	[mbgl]	[Yes/No]	
TBH14	W13B - Within MRA on southern boundary on northern side of Amanzamnyama river and west of W9	-28.91486	31.8259	-0.29	1.52	No	Not in use. Artesian conditions. (Sampled)	Unknown	No	25	0 (2020)	10	/	Located next to an old power station near railway. Artesian. Plots close to borehole 2831DD00139 on GRIP and NGA database, which was reported to be located at a sawmill and used for domestic water supply.
TBH15	W13B - outside and to the north of the Msasandla River	-28.88267	31.76535			No	Not in use. Pump disconnected.	Unknown	No	73	NA (2020)	157*	No	Located on church premises but mono-pump not working. Plots close to borehole2831DDG4368 on GRIP Database, with a depth of 157 mbgl and yield of 0.67 L/s.
TBH16	W13B - outside and to the north of the Msasandla River	-28.88308	31.75885			No	Not in use. Hand pump broken.	Community	No	71	NA (2020)	120*	No	Located in an open area. Hand pump not working. Plots close to BH 2831DDG4382on GRIP Database, with a depth of 120 mbgl, water level of 25 mbgl in 1995 and yield of 2.83 L/s.
TBH17	W13B - outside and to the north of MRA west of the watershed	-28.85741	31.80899			No	Not in use. Pump disconnected.	Community	No	77	NA (2020)	Unk	No	Borehole not operating and handpump was removed. Plots at BH 2831DD00154 on GRIP and NGA Databases, with a yield of 1.1 L/s.
TBH18	W13B - outside and between the Msasandla River and the northern boundary of the MRA	-28.89353	31.77943				Not included in 2022 hydrocensus	Community	No	79	NA (2020)	*97**	No	Hand pump was broken. Plots close to BH 2831DDV1227 on GRIP Database with a depth of 97 mbgl and water level of 7.8 mbgl in1998
TBH19	W12F - Outside MRA Between the Mzingwenya River (coincident with southern boundary of MRA) and Coastline	-28.89442	31.90556			Assumed Yes	Not included in 2022 hydrocensus	Community	**Yes**	34	NA (2020)	*Unk*	Yes	The borehole had a hand pump. The Borehole was located behind Zulti South Site Office.
TBH20	W12F - Outside MRA South of Mzingwenya River near the coastline	-28.92106	31.88103				Not included in 2022 hydrocensus	RBM (Zulti South)	No	20	NA (2020)	*20**	/	Located at Zulti South Offices but gate locked. Plots at borehole 2831DDV1458 (RBM13) on GRIP Database, with a depth of 20 mbgl. Also plots close to BH2831DDV1457 (RBM12) with a depth of 15 m.
TBH21	W12F - Outside MRA South of Mzingwenya River near the coastline	-28.92814	31.86408	0.58	3.23	No	Unknown. Likely not in use. (Sampled)	RBM (Zulti South)	**Yes**	18	0.41 (2020)	4 (18*)	Yes	Located next to a wetland with datalogger installed and was locked with bolt and nut. Borehole had collapsed as original depth was reported to be18 mbgl on GRIP Database borehole 2831DDV1459 (RBM14).

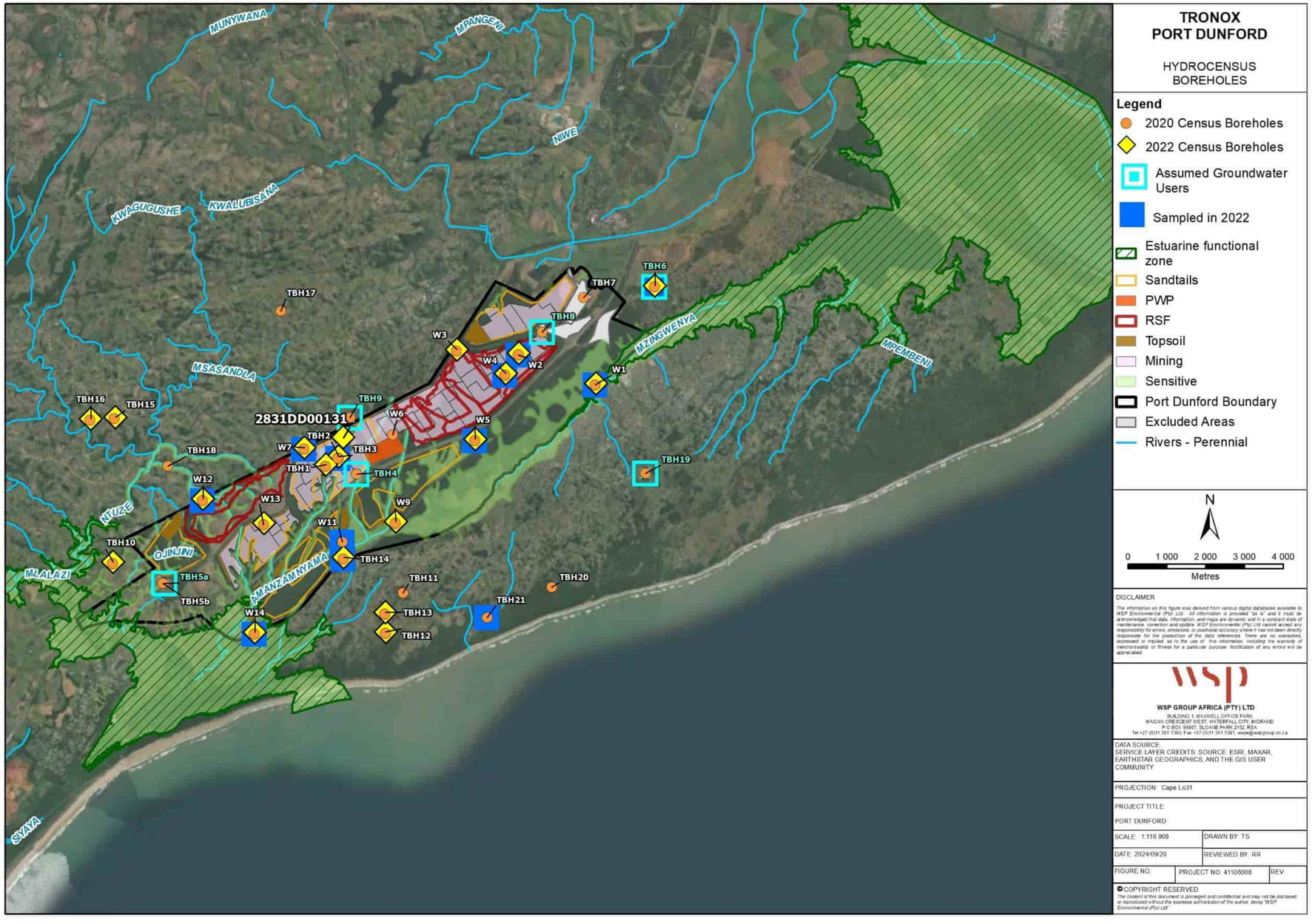

Figure 3-2 – Hydrocensus boreholes (2020 & 2022)

3.3 GEOPHYSICAL SURVEY AND RESULTS

Geophysical surveys were not available but there are existing monitoring boreholes available to inform the baseline.

3.4 DRILLING AND SITING OF BOREHOLES

Borehole information is limited to hydrocensus boreholes and historic reports. The existing monitoring network consists of twelve (12) monitoring boreholes of varying depths with two dry (W3 and W13) and one damaged (W9), Refer Table 3-1and Figure 3-1.

3.5 AQUIFER TESTING

No field tests were conducted during this investigation; therefore, the hydraulic conductivity data reported by GCS (2007b) is evaluated. GCS (2007b) evaluated permeability data for the greater study area based on existing data contained in the public domain, other studies performed by GCS in the area and grain size distribution data for run of mine and tailing samples at the Fairbreeze and Hillendale Mines.

Table 3-3 presents a wide range of hydraulic conductivities obtained for the aquifers during previous studies, which can be attributed to the large variation of deposit grain size and distribution. The hydraulic conductivity of the unconsolidated deposits can vary substantially and depends on the clay content of the material (SRK Consulting, 2011). The expected range of hydraulic conductivity of the shallow aquifer is in the order of 0.1 to 10 m/day. According to WR2012 (2012), transmissivity values up to 100 m^2/day is recorded for the project area.

The saturated hydraulic conductivity of secondary aquifers within the study area varies between 0.001 to 0.1 m/day. Larger hydraulic conductivity values are associated with dolerite contacts and fault zones (GCS, 2019). According to SRK Consulting (2011), hydraulic conductivities in the order of 3.7 m/day have been recorded for the secondary aquifer.

Table 3-3 - Hydraulic Conductivity of aquifers within the Maputaland Group sediments

Source	Hydraulic Conductivity (m/d)				Comment
	Pump tests		Laboratory Test	Other/not known	
	Drawdown Test	Recovery Test			
Pumping test – GCS4S Zulti South EMPR – Groundwater study (GCS, 2020)	0.9	0.9			Fine-grained sands of the KwaMbonambi Formation. Aquifer 20 metres thick.
Pumping test – GCS6S Zulti South EMPR – Groundwater study (GCS, 2020)	0.3 (GCS6A – 3 metres away)	0.2 – Theis recovery			Fine to coarse grained ands of the KwaMbonambi/Kosi Bay Formations. Aquifer 14 metres thick.
Report to Richards Bay Minerals on the geology and geohydrology of the Zulti South lease area for the purposes of complying with the minimum requirements for the rehabilitation programme (Davies Lynn & Partners, 1993)				26	Cover sand – Sibayi Formation
Landform geomorphology and geology (Davies, Lynn & Partners, 1992)			13-26		Cover sand – Sibayi Formation
			0.83-0.88		Older cover sands – KwaMbonambi Formation
			7.5		Low clay fraction Port Durnford sands – (Upper Port Durnford Member) Kosi Bay Formation
			0.11-0.59		Yellow to Grey Port Durnford sand
KwaZulu Natal geohydrological mapping project mapping unit 7 (Meyer et al., 1994)			15.6		Cover sand – Sibayi Formation
			0.87		Older cover sands – KwaMbonambi Formation
			4.3		Port Durnford and Kosi Bay Formations
Specialist study on hydrology and water quality (Iscor Heavy Minerals Project KwaZulu Natal) (Kelbe & Rawlins, 1996)			4 (2 – 8)		Unconsolidated sands (Sibayi and KwaMbonambi Formations)

Source	Hydraulic Conductivity (m/d)				Comment
	Pump tests		Laboratory Test	Other/not known	
	Drawdown Test	Recovery Test			
Geohydrological studies of the primary coastal aquifer in Zululand (Kelbe et al., 2016)				25	Upper Arenaceous layer (probably Sibayi, KwaMbonambi and Kosi Bay Formations)
				0.3-2.5	Argillaceous layer (probably Port Durnford)
Block P Pre-Feasibility Study – Hydrogeological Study. Hydraulic conductivities calculated using grain size distribution data				0.1 – 0.2	Fairbreeze (run of mine)
				0.3 – 0.7	Fairbreeze (sand tail)
				12.1 – 26.4	Hillendale (sand tail)
Fairbreeze Mine Integrated Water Use License Application Hydrogeological Assessment (SRK Consulting, 2011)				0.11 - 26	Based on studies by Kelbe et al (2001), Rison (2004) and SRK (2005)
Fairbreeze Mine Numerical Model (SRK Consulting, 2020)				10	Hydraulic conductivity attributed to dunes in numerical model.

3.6 SAMPLING AND CHEMICAL ANALYSIS

Groundwater samples were collected during the hydrocensus survey of existing boreholes to determine the current groundwater conditions. The sampling was undertaken as per WSP's standard sampling procedure and samples were submitted to a SANAS accredited laboratory (Element Materials Technology Laboratory)[5] for chemical analysis.

The analytical suite for water samples included major cations (sodium, potassium, magnesium and calcium), major anions (chloride, fluoride, sulfate, nitrate, total alkalinity and cyanide), physico-chemical parameters (pH, electrical conductivity, Total Dissolved Solids (TDS)), and metals such as iron, aluminium, copper, lead and zinc as determined by ICP-OES).

This information is assessed and reported in Section 5-6.

3.7 GROUNDWATER RECHARGE CALCULATIONS

Groundwater recharge was assumed from the available information as 10 – 17% of the mean annual precipitation, GC, 2020. An overall reduction in recharge is expected from the coast towards the inland areas.

3.8 GROUNDWATER MODELLING

Groundwater modelling has been carried out as part of this study, the results of which are included in Section 7.

3.9 GROUNDWATER AVAILABILITY ASSESSMENT

Large areas of Port Durnford are currently under commercial forestry, leased by Mondi and owned by the Phalani Community Trust. Therefore, forestry is the main groundwater use in the area. During mining, Mondi will move out of the area and the plan is that they will re-establish forestry plantations after mining. Based on the hydrocensus, groundwater use is generally for local domestic, irrigation, stock watering and firefighting.

According to the Aquifer Classification of South Africa (DWAF, 2012) the groundwater yield is between 0.5 L/s and 2 L/s which is consistent with the information obtained by GCS from the GRIP and NGA data.

4 PREVAILING GROUNDWATER CONDITIONS

4.1 GEOLOGY

4.1.1 REGIONAL GEOLOGY

A geological map of the area is provided in Figure 4-1. According to the 1:250 000 Geological Map Series 2830 Dundee and GCS (2020), lithologies of the of the Natal Metamorphic Province outcrop

[5] Element's South Africa-based environmental laboratory extends SANAS ISO/IEC 17025 accreditation (February 2018)

west and north of the Port Durnford mining area and consist mainly of ultramafic rocks and gneiss. This is overlain by sedimentary rocks of the Natal Group which outcrop in the north-west and south-west. This is in turn overlain by shales and sandstones of the Ecca Group, Karoo Supergroup which are found south-west of the site. Rocks of the Ecca Group are finally overlain by Quaternary deposits of the Maputaland Group which form the coastal dune deposits in the area.

Geological Structures

Thrust faults trending predominantly west to east are observed to the west of the MRA (Figure 5-1) the most notable include:

- The Mhlatuze fault which trends in a W – E direction to the northwest whilst the Mlalazi Fault extends in a westerly direction along the valleys of the Mlalazi and Ntuze Rivers and marks the down faulted southern boundary of the Ngoye Horst. The displacement along the fault decreases from east to west (Golder, 2014).
- The Matigulu Group and Buhleni Gneiss are juxtaposed and repeat as a series of nappes along northeast – south-west aligned thrust faults towards the west and south, known as the Ngoye Horst. These rocks dip steeply (~70°) towards the south (GCS, 2020).
- The Mlalazi and Mhlatuze faults underlie the mineralized sands of the Zulti South lease area. As a result of the geological structures, groundwater is localized along fault and weathered zones towards the west. At Tronox and the area along the coast, the more recent thick sedimentary rocks post-date and cover these geological structures (Golder, 2014).

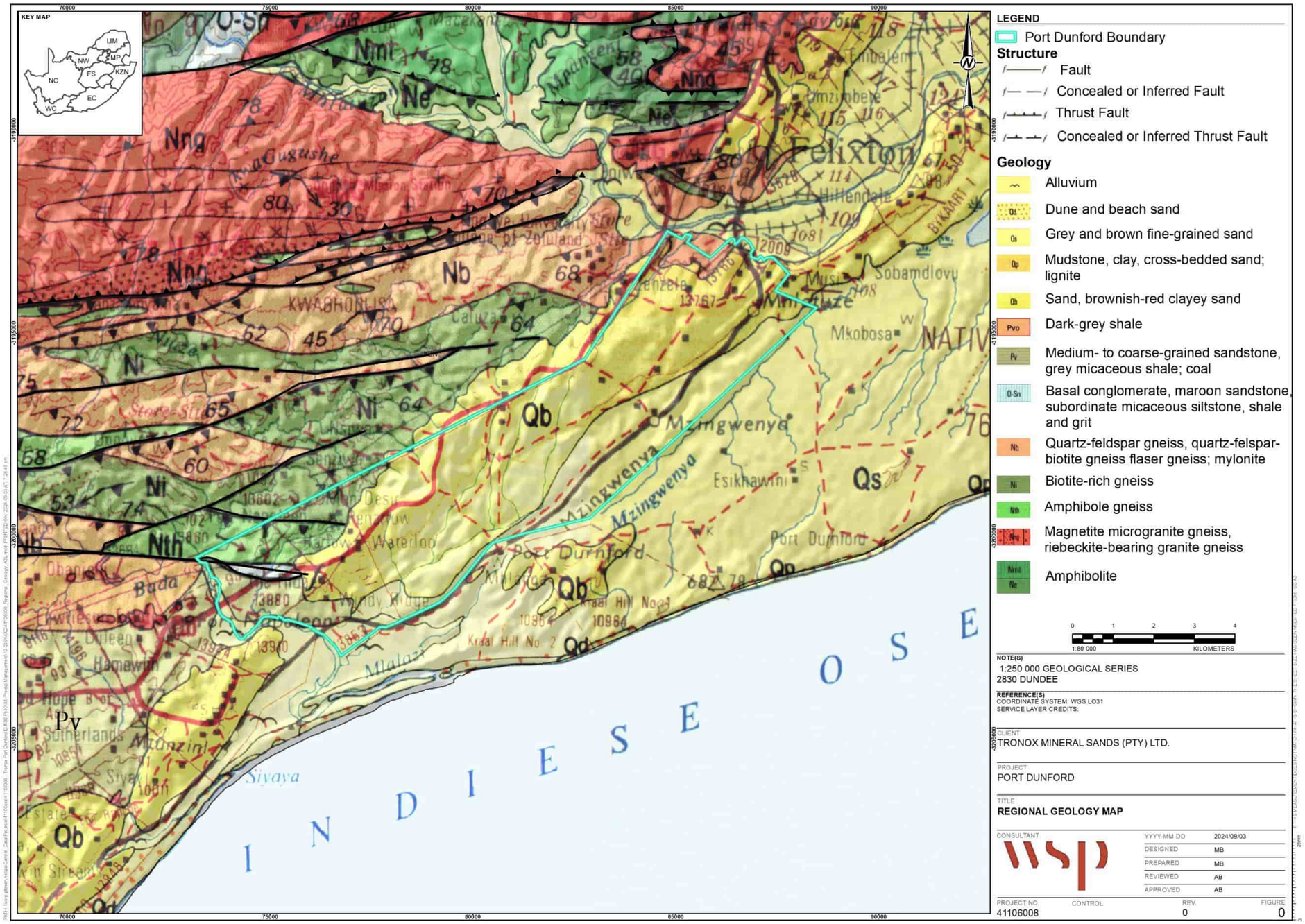

Figure 4-1 – Geological map

4.1.2 LOCAL GEOLOGY

Lithologies of the Matigulu Group and Buhleni Gneiss of the Natal Metamorphic Province mainly consisting of ultramafic rocks, amphibolite gneiss, biotite gneiss and quartz-feldspathic gneiss outcrop in the west and north of Port Durnford and form the base of the succession.

A small outcrop of the Natal Group consisting of basal conglomerate, sandstone, siltstone, and shale occurs in the southwest. The Ecca Group outcrops south of this and comprises medium to coarse grained sandstones, micaceous shale, and coal. Dolerite dykes and sills are found as intrusions in the rocks from the Ecca Group.

The bedrock layers are overlain by deposits of the Maputaland Group (summarized in Figure 4-2). The basal contact with granitoid rocks has a mean elevation of 76 mamsl, whilst the contact in the eastern portion occurs at ~15 mamsl. The thickness of the Maputaland Group may be more than 50 m thick (GCS, 2020).

The tertiary Uloa and Umkwelane Formations form the base of the Maputaland Group. The Umkwelane Formation is overlain by Berea-type red sands. This is in turn overlain by the quaternary Port Durnford Formation which comprises calcarenite at the base, fossiliferous mudrock as well as beachrock, coral-bearing coquina and lignite. Throughout the thickness of the Port Durnford deposit, heavy minerals are deposited. Mineralization gradually decreases with depth (GCS, 2020).

The Kosi Bay Formation overlies the Port Durnford Formation and is in turn overlain by Berea-type red sands. According to Hatch (2020), the Port Durnford deposit is covered by the Berea Type Red Sands. The KwaMbonambi Formation lies east of the Port Durnford prospecting area, which is characterized by a low-lying coastal plain. The dunes in this Formation are approximately 10m thick and are non-calcareous. Further towards the coast, dunes of the Sibayi Formation occur with an average thickness of ~10m (GCS, 2020).

Mining

It is understood that mining will occur within the sands that form the ore body present on site. The Port Durnford deposit (~20–25 m thick) is covered by Berea-type red sands has been de-calcified by leaching and the feldspars have been kaolinized. The red color of the sands is a result of pigmentation due to decomposition of the ferromagnesian minerals. Mineralization in the dune is erratic (vertically and laterally) but is more concentrated in the upper horizons of red sands (Hatch, 2020). The ore body is reasonably large by mineral sands standards (1 billion tons of mineral resources) (GCS, 2020).

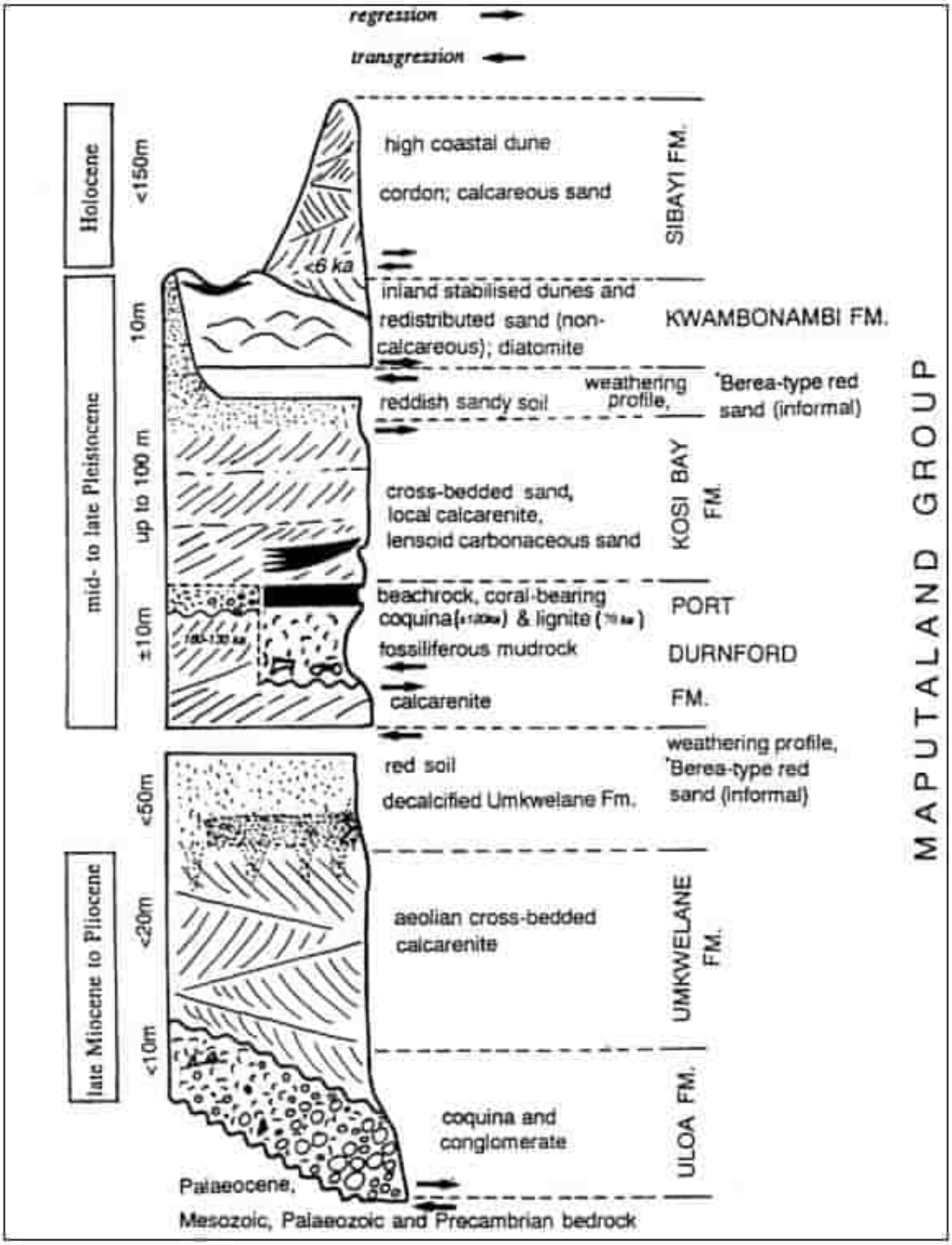

Figure 4-2 - Simplified stratigraphy of the Zululand coastal region (Botha 1997))

4.2 ACID GENERATION CAPACITY

Acid mine drainage conditions are not anticipated to be generated within the mining areas (WSP, 2024b).

4.3 HYDROGEOLOGY

The hydrogeological units can be characterized by a primary intergranular aquifer which is hosted within the coastal dune deposits as well as a secondary intergranular and fractured aquifer within the sedimentary and metamorphic rocks. Both aquifers are low to moderate yielding with yields between 0.5 – 2 L/s (GCS, 2020).

4.3.1 UNSATURATED ZONE

The unsaturated zone varies across the site, encompassing the zone above the water table. The unsaturated zone is thin closer along the drainage lines where the depth to groundwater table is shallow (1.39 m thick in W11), compared to 58.55 m thick in W2. There is limited hydraulic information available for the unsaturated zone.

4.3.2 SATURATED ZONE

The saturated zone encompasses the section below the water table. The saturation within the intergranular aquifer is high relating to porosity of the overburden compared to the fractured aquifer. Within the fractured secondary aquifer, water saturation is limited to the fractures.

The hydraulic characterisation of the saturated zones (shallow and deep aquifers) is detailed in the subsequent section.

4.3.3 HYDRAULIC CONDUCTIVITY

Primary aquifer

The primary intergranular aquifer is unconfined and hosted in undifferentiated coastal deposits of the Maputaland Group and alluvium deposited within Mlalazi and Mhlathuze River systems. This aquifer is a source of water for rivers, lake and most wetlands during dry periods and is recharged by these systems in wet periods. Groundwater discharge zones in areas below 50 mamsl support permanent wetlands and swamps (GCS, 2020). Hydraulic conductivities of this aquifer can range between 0.1 – 10 m/d whilst transmissivity value up to 100 m2/d have been recorded (GCS, 2020). The shallow and deep aquifers noted within the study area are characterised (GCS, 2020) as the primary intergranular aquifer. GCS (2020) also mentions the primary coastal aquifer located along the coastline.

Secondary aquifer

The secondary intergranular and fractured aquifer is hosted within mainly argillaceous rocks of the Karoo Supergroup and mainly meta-arenaceous rocks of the Natal Metamorphic Province. The weathered and intergranular portion of the aquifer is ~10 – 15 m thick, whilst the fractured portion is ~ 150 – 170 m thick. The thrust faults in the western and southern portions of the site play an important role in terms of storage and flow of groundwater given their potential to act as preferential flow pathways or barriers. This is also anticipated from dolerite intrusions with the Karoo Supergroup. The saturated hydraulic conductivity for this aquifer within the study area varies between 0.001 – 0.1 m/d, with higher values anticipated for the dolerite contact and fault zones. SRK (2011) noted hydraulic conductivities in the order of 3.7 m/d (GCS, 2020).

4.4 GROUNDWATER LEVELS

The results from the hydrocensus are summarised in Figure 3-2and Table 3-2.

The data was evaluated to provide an understanding of depth to groundwater level across the study area. The groundwater level ranges, and borehole depths vary from artesian conditions to 58.55 meter below ground level (mbgl), with a median of 8.2 mbgl. The water level (0-4 mbgl) and borehole depth (1.5 - 35 mbgl) is generally shallower (< 4 mbgl) in the boreholes in or near the sensitive estuarine zones (W1, W5, W11, W14, TBH10, TBH14) and on the coastline (TBH21 and TBH20) with water levels otherwise generally <25 mbgl (8 – 24.5 mbgl) such as in W7, W12, TBH2, TBH3, TBH7 and previously TBH5 and TBH18. Three boreholes (W2, W4, W6) have water levels at depths greater than 38 mbgl (38 – 58.55 mbgl). W3 and W13 are dry.

Water levels are generally similar (within 3 m) in the shallower boreholes (water levels <25 mbgl) as compared to 2017 and 2020 except for W7 which reported 36.5 mbgl in 2020 and 18.5 mbgl in 2022. The deeper boreholes (water level >38 m) were also variable particularly W3 (23.1 – 38.1 in 2020 and 2022 respectively) and W6 (57.05-38.1 mbgl in 2020 and 2022 respectively).

A groundwater level map was generated based on water level data recorded from the hydrocensus survey to illustrate the inferred groundwater flow direction distribution of the water level data (Refer Figure 4-4). It is evident that the groundwater flow direction is towards the rivers and ocean, mimicking the surface topography.

There is a strong correlation between the water levels and topography at the lower elevations (shallow boreholes), but the boreholes at higher elevations (W2, W4, W6. W7 and W12 which represent the deeper aquifer) do not show a strong correlation (Table 4-3).

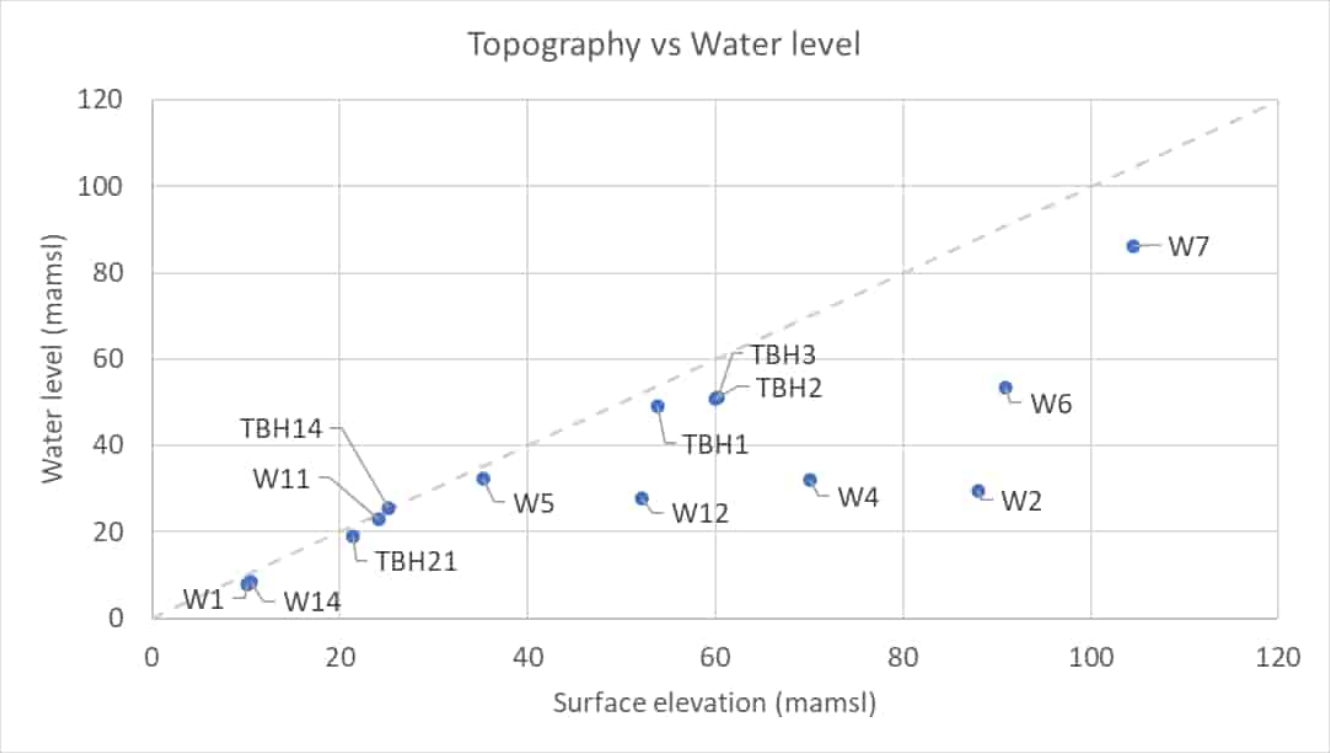

Figure 4-3 - Topography vs water level

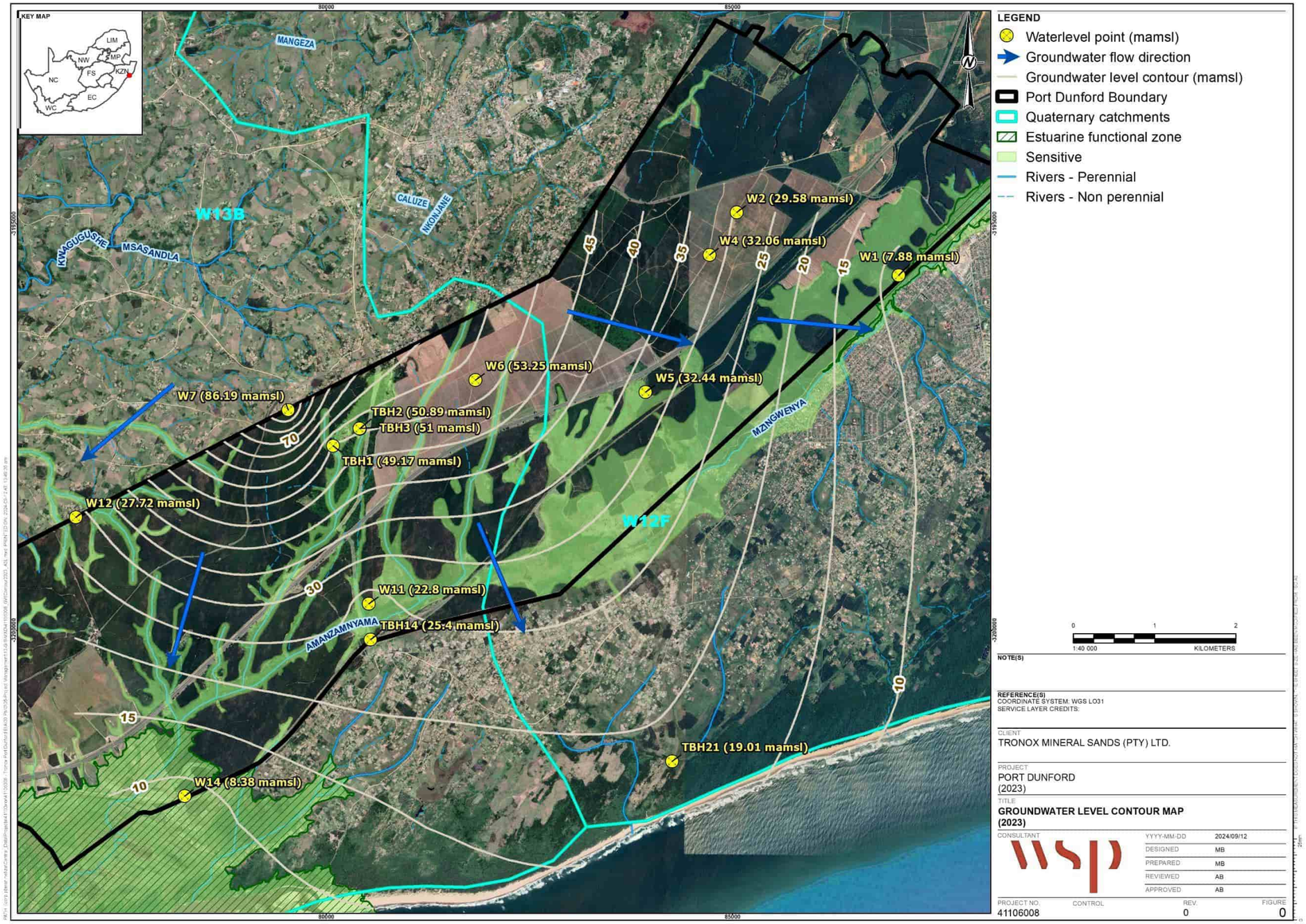

Figure 4-4 - Groundwater level from November 2022 hydrocensus

4.5 GROUNDWATER QUALITY

Groundwater quality was obtained for selected boreholes in November 2022. The results of the groundwater quality testing for the samples obtained during the was compared to the following guidance:

- The ambient groundwater quality as characterised by GCS (2020) represents the water quality range for boreholes sampled in 2020 within the shallow and deeper primary aquifer along the coastline. The water quality as reported by GCS (2020) is included for reference in Appendix B.
- The Department of Water Affairs and Forestry (DWAF) Quality of Domestic Water Supplies Volume 1: Assessment Guide, Second Edition, 1998 (Refer Table 5-1) provides a mechanism to classify the water quality in terms of its suitability for domestic use but it should be noted is not applicable for monitoring boreholes that are not in use. The water quality range for Class 1 and Class 4 is included for comparison in Table 4-1.
- South African National Standard: Drinking water (SANS 241-1), 2015 is included for reference in Table 5-2 where red text is used to indicate where concentrations are elevated above this limit. SANS 241:2015 refers to standards for treatment of water for drinking water.
    - The Operational limit (O) refers to concentrations above which affect the efficient operation of treatment systems and risks to infrastructure.
    - Aesthetic (A) refers to a determinant that taints water with respect to taste, odour or colour and that does not pose an unacceptable health risk if present at concentration values exceeding the numerical limits specified.
    - Acute health (AH) refers to a determinant that poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified.
    - Chronic health (CH) refers to determinant that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified.

Table 4-1 – DWAF Water Quality Classes (1998)

Class	Description	Drinking health effects
Class 0	Ideal water quality	No effects, suitable for many generations.
Class 1	Good water quality	Suitable for lifetime use. Rare instances of sub-clinical effects
Class 2	Marginal water quality, water suitable for short-term use only	May be used without health effects by majority of users but may cause effects in some sensitive groups. Some effects possible after lifetime use.
Class 3	Poor water quality	Poses a risk of chronic health effects, especially in babies, children and the elderly. May be used for short-term emergency supply with no alternative supplies available.
Class 4	Unacceptable water quality	Severe acute health effects, even with short-term use.

Table 4-2 shows the water quality data obtained from the November 2022 analysis.

Table 4-2 - Groundwater quality (Hydrocensus: November 2022)

	Sample ID	SANS 241:2015	Class 1	Class 4	Ambient	W14	W11	TBH14	W5	W1	Ambient	TBH21*	Ambient	W12	W7	TBH2	TBH9*	TBH6*	W4
Aquifer					Shallow aquifer						Coastline aquifer		Deeper aquifer						
Water level (mbgl)						2.2	1.39	0	2.87	2.09		0.58		0	18.53	8.91			38.06
Catchment						W13B	W13B	W13B	W12F	W12F		W12F		W13B	W13B	W13B	W13B	W12F	W12F
pH	pH units	5-9.7	9.5-10	>11	6.8-9.3	8.53	8.72	7.28	8.74	7.81	7.1-7.6	6.77	7.9-8.2	8.38	7.94	7.51	7.66	6.45	8.73
EC	mS/m	170 (A)	70-150	>520	31-51	42.4	28.3	35	29.1	44.2	68-105	48.6	44-60	52.3	51	27.4	40.1	26.1	46.4
TDS	mg/L	1200 (A)	450-1000	>3400	182-296	188	163	199	129	240	370-556	320	242-296	186	278	177	247	155	164
NO_3 as N	mg/L	11 (AH)	"6-10	>40	0.1-0.4	<0.05	<0.05	0.07	<0.05	1.02	<0.14	<0.05	<0.04	0.45	<0.05	0.79	0.20	<0.05	0.43
SO_4	mg/L	250 (A), 500 (AH)	200-400	>1000	0.3-5	3.2	3.2	0.7	3.2	3.2	0.4-33	<0.5	2-5	3.2	25.9	7.2	45.5	3.2	3.4
Cl	mg/L	300 (A)	100-200	>1200	39-99	103.6	36.8	33.3	40.5	44.9	145-173	96.2	73-79	75.8	30.5	33.1	60.6	55.3	45.9
F	mg/L	1.5 (CH)	0.7-1.0	>3.5	0.1-0.5	0.6	0.4	<0.3	0.4	<0.3	<0.3	<0.3	0.1-0.2	<0.3	0.5	0.3	<0.3	<0.3	<0.3
P	mg/L	-	-	-		<0.005	0.027	0.005	<0.005	<0.005		<0.005		<0.005	0.022	0.068	<0.005	<0.005	<0.005
T Alk as $CaCO_3$	mg/L	-	-	-	22-160	44	80	112	84	136	30-231	80	52-166	132	184	76	48	48	156
Ca	mg/L	-	-	-	1-33	2.2	3.8	28.7	2.5	7.1	10-57	18.5	12-13	5.4	16.6	9.9	10.6	5.8	8.7
Mg	mg/L	-	70-100	>400	0.3-7.1	1.6	1.8	6	2.5	2.9	17-30	11.6	13-18	5.4	8.4	5.1	9.4	4	9.8
Na	mg/L	200 (A)	70-100	>400	33-79	74.2	48.3	30.3	48.9	72	75-92	56.6	43-76	56.8	54.7	35.8	46.2	35.5	36.4
K	mg/L	-	25-50	>500	2-10	2.9	3.4	1	3.6	9.5	2-3	1.4	4-5	12.8	23	2.4	3.4	2.3	9.8
Al	mg/L	0.3 (O)	-	-	<0.03	0.047	0.053	<0.02	<0.02	<0.02	<0.02	0.158	<0.02	0.863	1.383	0.155	0.072	0.073	<0.02
As	mg/L	0.01 (CH)	0.01-0.05	>2	<0.04	<0.003	<0.003	<0.003	<0.003	<0.003	<0.04	<0.003	<0.04	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Co	mg/L	-	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	0.002	0.011	<0.002	<0.002	0.012	<0.002
Cr	mg/L	0.05 (CH)	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	<0.002	0.004	0.003	<0.002	<0.002	<0.002
Cu	mg/L	2 (CH)	0.5-1	>15	<0.02	<0.007	<0.007	<0.007	<0.007	<0.007	<0.02	<0.007	<0.02	<0.007	0.013	<0.007	<0.007	<0.007	<0.007
Fe	mg/L	0.3 (A), 2 (CH)	0.5-1	>10	<0.11	9.429	0.951	5.859	2.47	0.403	<0.04	0.468	<0.02 (<0.02-20 in TBH7)	0.286	3.657	0.093	0.022	53.04	<0.02
Mn	mg/L	0.1 (A), 0.4(CH)	0.1-0.4	>10	0.03-0.04	0.26	0.15	0.34	0.092	0.13	0.2-0.5	0.21	<0.13 (<0.02-0.76 in TPH6)	0.568	1.02	0.005	0.006	0.765	0.479
Ni	mg/L	0.07 (CH)	-	-	<0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.02	<0.002	<0.02	0.003	0.025	<0.002	<0.002	0.008	<0.002
Pb	mg/L	0.01 (CH)	-	-	<0.03	<0.005	0.015*	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ba	mg/L	0.7 (CH)	-	-	<0.02	0.013	0.012	0.018	<0.003	<0.003	0.03-0.1	0.063	0.02-0.1	0.072	0.323	0.009	0.045	0.09	0.054
B	mg/L	2.4 (CH)	-	-	<0.03	0.055	0.03	0.043	0.047	0.078	<0.02	0.028	<0.02	0.015	0.017	0.041	0.039	<0.012	0.014
Sr	mg/L	-	-	-	0.04-0.2	0.038	0.037	0.195	0.023	0.061	0.1-0.3	0.151	<0.1	0.088	0.117	0.06	0.083	0.027	0.07
Zn	mg/L	5 (A)	<3	->20	<0.02	0.053	0.037	0.033	0.07	0.014	0.3-3	0.008	<0.03	0.112	0.098	0.008	0.012	9.47	0.005
Class					0	3 (Fe)	1 (Fe, Mn)	3 (Fe)	2 (Fe)	1 (Mn)	0	1 (Mn)		2 (Mn)	2 (Fe & Mn)	0	0	4 (Fe)	2 (Mn)

Notes: Concentrations reported as below detection are indicated in grey text. Cyanide and metals reported at or below detection are excluded from the table.

* Underlined boreholes are assumed to be in use.
SANS 241:2015 refer to standard for treatment of water for drinking water. The Operational limit (O) refers to concentrations above which affect the efficient operation of treatment systems and risks to infrastructure. Aesthetic (A) refers to a determinant that taints water with respect to taste, odour or colour and that does not pose an unacceptable health risk if present at concentration values exceeding the numerical limits specified, Acute health (AH) refers to a determinant that poses an immediate unacceptable health risk if present at concentration values exceeding the numerical limits specified, chronic health (CH) refers to determinant that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the numerical limits specified

Table 4-2 is discussed as follows:

- The background water quality in the Port Durnford area is generally of ideal to good water quality (Class 0 – 1: 42% of samples), with marginal water quality noted in 33% of boreholes and poor/unacceptable water quality noted in 25% of boreholes. The marginal and poor quality being due to manganese (0.005 - 1.2 mg/L) and iron (0.09-53.04 mg/L) concentrations that are elevated compared to the guideline values. The water quality is discussed based on the November 2022 as follows:
    - Manganese (0.006 – 1.02 mg/L) is slightly higher in the secondary aquifer (Class 2 in W12, W7, TBH6 and W4) as compared to the shallow aquifer (Class 1) and
    - Iron is locally highest in TBH6 (deeper aquifer) at 53 mg/L and 3.7 mg/L in W7 but otherwise <0.5 mg/L (Class 0) in the secondary aquifer. Concentrations are similarly variable (0.09-0.34 mg/L) in the shallow aquifer but are generally <0.4 mg/L (Class 1).
- The GCS data in 2020 was analysed by Talbot and Talbot laboratory where the metal analyses detection limits were higher than provided in 2022. Metal concentrations were reported at higher concentrations in 2022 as compared to 2020 in both the shallow and deeper aquifers where metals were, except for TBH7 (iron of >20 mg/L), less than the Class 1 guidance values.
- pH varies from 5.6 (TBH7 in GCS, 2020) to 9.3 (W14, GCS 2020 record) but is generally within the ideal range for water quality of 7 – 9.5.
- Electrical conductivity (EC) was generally below 60 mg/L (ideal range) in November 2022 with a locally higher concentration of 105 mS/m reported for TBH21 (coastal aquifer) by GCS in 2020. Similarly, TDS is generally <300 mg/L in boreholes located in and around the MRA and slightly higher (320-556 mg/L) in boreholes in the coastal aquifer (TBH19 and TBH21) to the south of the MRA.
- Concentrations are generally similar in the shallow and deeper aquifers except for sulfate, typically < 8mg/L, but locally higher in W7 (25.9mg/L) and TBH9 (45.5 mg/L) (secondary aquifer).
- Concentrations for aluminium (Al) are locally elevated in W7 and W12 (0.86-1.4 mg/L) compared to the other samples, for lead (Pb) in W11 (0.015 mg/L) and for zinc[6] at (9.47 mg/L). As these concentrations represent only one sample run, it is recommended that the metal concentrations be confirmed.
- The boreholes TBH14 (GCS data), TBH7 (GCS data), and TBH6 are not recommended for domestic use due to the elevated iron concentrations. Of these, only TBH6 was noted to be in use at the time of the hydrocensus. Based on the information provided in the GCS report, the community are aware of the poor quality of this borehole. TBH14 is artesian. Discharge of elevated concentrations of manganese (>0.37[7] mg/L) could potentially affect the aquatic environment depending on the flow volume (load) to the sensitive wetland receptor.

[6] The locally elevated concentration of Zn, if confirmed by routine monitoring, is <10 mg/L. While aesthetic effects are possible, health effects from drinking water are generally only noted at concentrations > 20 mg/L (DWAF, 1998).
[7] DWAF, 1996, South African Water Quality Guidelines – Aquatic Ecosystems, Volume 7 where Chronic effect value is 0.37 mg/L and acute effect value is 1.3 mg/L for dissolved manganese

- Salinity (sodium and chloride) is not reported as elevated in either 2020 or November 2022 since sodium concentrations vary from 24 – 94 mg/L and chloride concentrations vary from 30.5-173 mg/L (< Class 1). Elevated sodium and chloride are however noted for boreholes in the Fairbreeze area (SRK, 2020). This is most likely related to the underlying geology and deeper groundwater. Most of these boreholes appear to be abstracting groundwater from the Karoo sediments, which is generally associated with poorer water qualities.

A piper diagram was constructed using the data retrieved (Figure 4-5). Piper diagrams graphically represent the relative percentages of anions and cations in water samples. The cation percentages are plotted on the left triangle and the anion percentages on the right triangle. A projection of these cation and anion presentations onto the central diamond presents the chemical signature of the major ion composition of the water

Most of the samples obtained in November 2022 represent a sodium bicarbonate chemical signature which follows the typical dynamic groundwater flow evolution. A few of the samples (W14, TBH6, TBH9 and TBH21) represent sodium chloride type, meaning these boreholes are in areas with chloride enrichment. The above two types of hydrochemical signatures are mainly indicative of possible atmospheric deposition of sodium and chloride within the coastal region and sea water intrusion.

One sample represents a calcium magnesium bicarbonate type water (TBH14) implying recently recharged water.

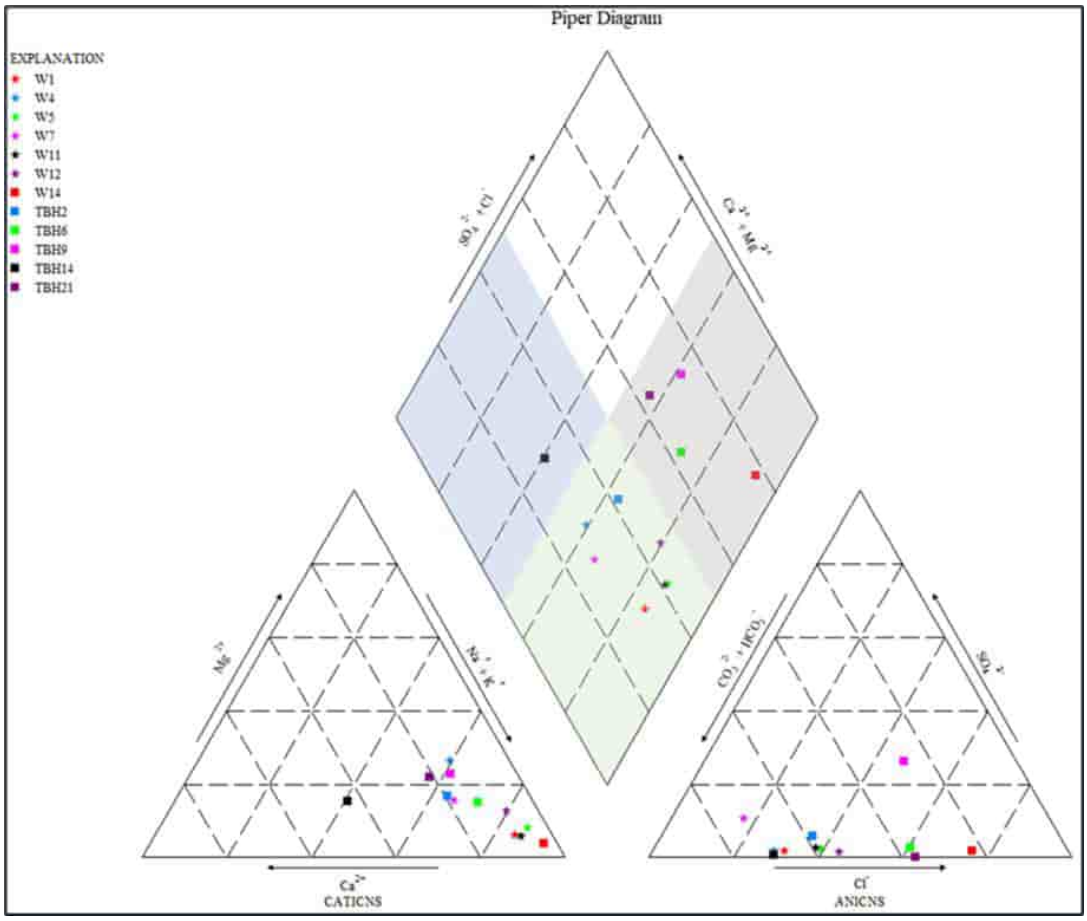

Figure 4-5 - Piper diagram aquifer characterisation

4.6 GROUNDWATER POTENTIAL CONTAMINANTS

A geochemical study (WSP, 2024b) was conducted a s part of the Environmental Authorisation Application Process for the Mining of the Tronox Port Durnford Resource. The investigation comprised of a risk assessment, waste classification and waste assessment. The report on this investigation is provided separately.

WSP (2024b) developed the source terms for modelling. They concluded that the mineral phases present in the MSP and RSF tailings were all inert and very slow weathering. None of the samples were acid generating. Model source terms for the RSF tailings indicates that aluminium (Al) and manganese (Mn) are constituent of environmental risk concern during the mine operational phase, Zn and Pb at post-closure phase. In the backfill material, the constituents of concern are Cu and Cd, and to a lesser extent, aluminium and zinc.

Samples of the MSP tailings, gypsum waste and Residue Storage Facility (RSF) tailings were obtained from Fairbreeze Mine and submitted for analysis. Based on the analysis, the Constituents of Potential Concern (CoPC's) in the RSF sand tailings sample were generally measured at low concentrations.

The geochemistry study (WSP, 2024b) compared the source terms based on ASLP leach test results to aquatic guidelines (DWAF, 1996) and coastal marine guidelines (DEA, 2018). They concluded that:

- RSF operational phase:
  - Source terms generally comply with the aquatic and marine guidelines, but the averaged concentrations of Mn (1.32 mg/L) and Al (0.03 mg/L) exceed the aquatic guideline.
- RSF closure phase:
  - Cd exceeds both the aquatic and marine guidelines.
  - Cu exceeds the aquatic guidelines.
  - Pb and Zn both exceed the marine guidelines.
- Sand tailings (backfill) operational and closure phases:
  - Cu exceeds both the aquatic and marine guidelines.
  - Zn exceeds the aquatic guidelines.
  - Al and Cr exceed the marine guidelines.

The CoPC were also compared with the background values of the shallow and deeper primary aquifers and is shown in Figure 4-3. The background values were taken from the ambient values from the hydrocensus data (Figure 4-2).

The three elements selected for contaminant transport modelling included total dissolved solids (TDS), Al, and Mn. TDS needs to be modelled as the estuary is highly sensitive to changes in salinity. TDS cannot change by >15% from the normal cycles of the water body. Al and Mn were selected due to the environmental risk concern during the operational phase.

Table 4-3 – Constituents of potential concern

COPC	Aquatic target water quality guideline	Marine target water quality guideline	Ambient (shallow aquifer)	Ambient (deeper aquifer)	RSF operational	RSF post closure	Backfill operational and post closure
Al	0.01	n/a	<0.03	<0.02	0.36	0.0003	0.033
Cd	0.00015	0.00012	<0.02	<0.02	-	**0.0002**	0.0002
Cu	0.0003	0.003	<0.02	<0.02	-	0.0014	**0.00035**
Fe	n/a	n/a	<0.11	<0.02	0.7	0.02	0.0424
Pb	0.0002	0.002	<0.03	<0.03	-	0.0025	0.0025
Mn	0.18	n/a	0.03-0.04	<0.13	1.32	0.012	0.0061
TDS	<15% change	n/a	182-296	242-296	210.58	67.15	7.293
Zn	0.002	0.02	<0.02	<0.03	-	0.034	0.0119

5 AQUIFER CHARACTERISATION

5.1 GROUNDWATER VULNERABILITY

Groundwater vulnerability gives an indication of how susceptible an aquifer is to contamination. Figure 5-1 shows the national groundwater vulnerability ratings underlying the project area. This is based on the DRASTIC method which includes the following parameters: Depth to water table; Recharge (net); Aquifer media; Soil media; Topography; Impact of the vadose (unsaturated) zone; conductivity (hydraulic). The groundwater underlying the project area from west to east has a medium to very high vulnerability rating.

5.2 AQUIFER CLASSIFICATION

WRC (1995) categorizes aquifers into four main classes, Table 5-1. According to Aquifer classification of South Africa Map[8], the site is underlain by minor aquifers (Figure 5-2) which are moderately yielding aquifers with variable water quality. These aquifers only yield significant groundwater volumes during the raining season when high rainfall and recharge to the aquifer occurs (GCS, 2020).

[8] DWAF (2012). Aquifer Classification of South Africa

Table 5-1 - Aquifer classification system (WRC, 1995)

Aquifer Class	Description
Sole Source Aquifer System	An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there are no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
Major Aquifer System	Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m).
Minor Aquifer System	These can be fractured or potentially fractured rocks which do not have high primary permeability, or other formations or variable permeability. Aquifer extent may be limited and water variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers.
Non-Aquifer System	These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer as unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.
Special Aquifer System	An aquifer designated as such by the Minister of Water Affairs after due process.

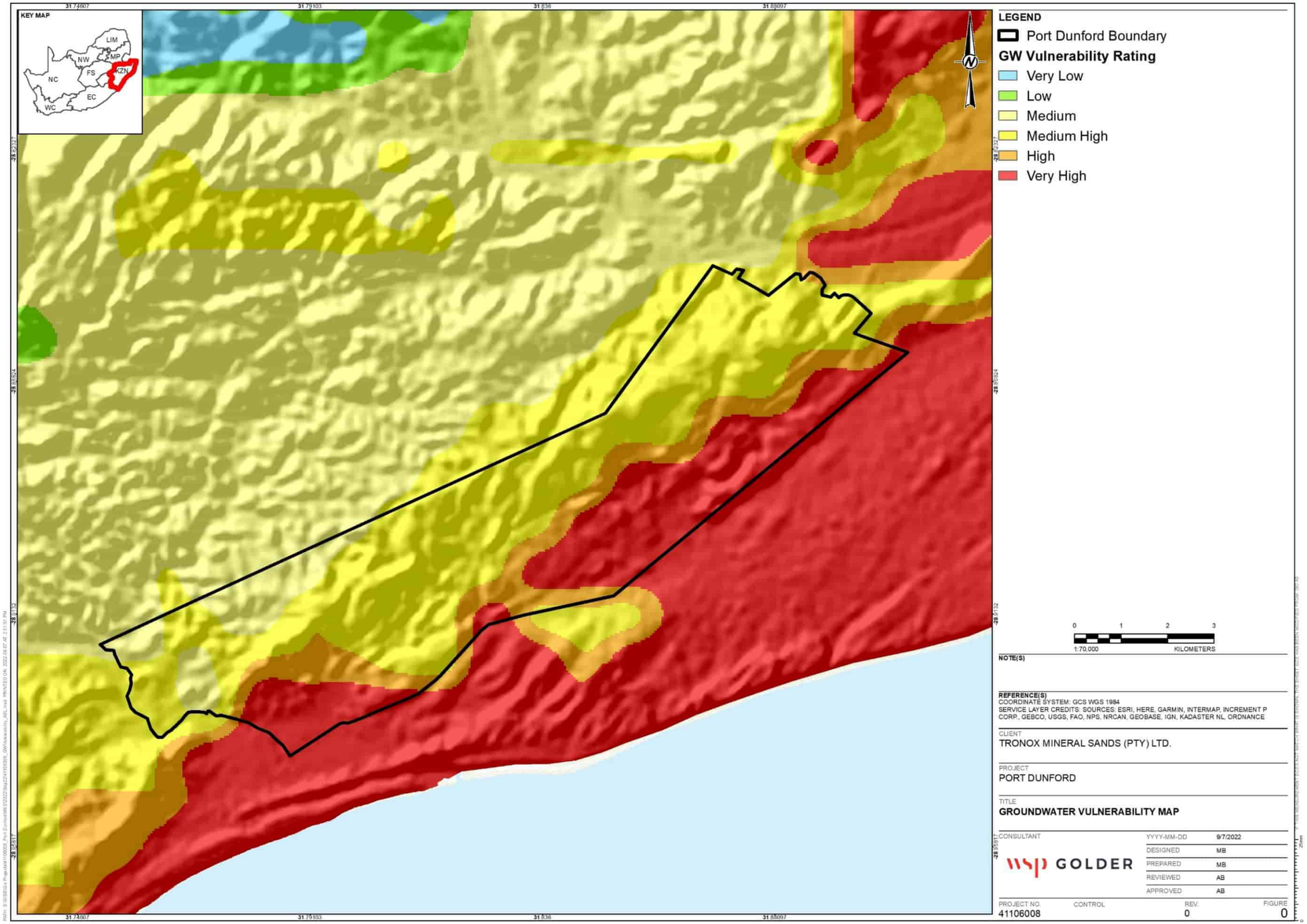

Figure 5-1 - Aquifer vulnerability map

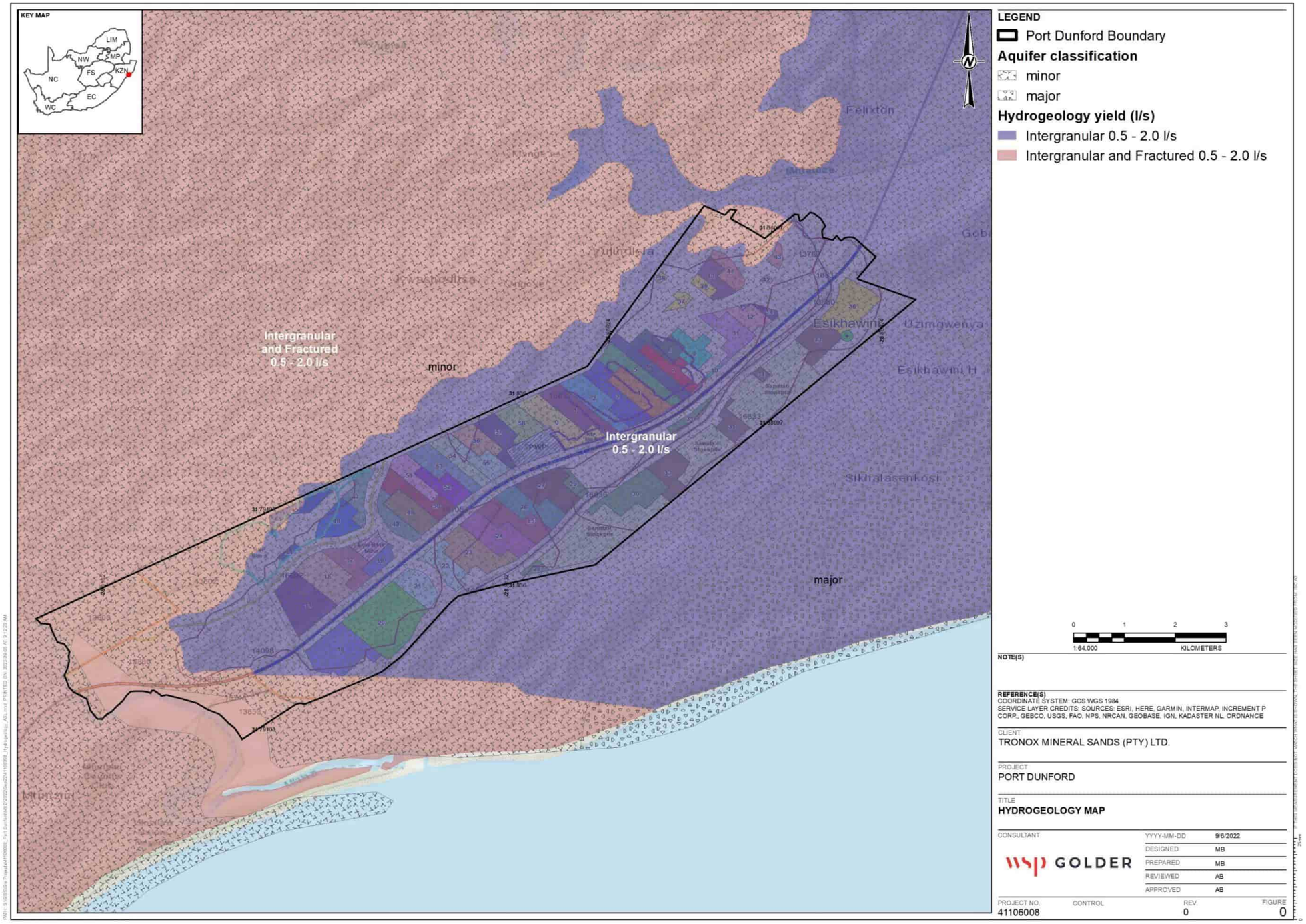

Figure 5-2 - Aquifer classification and yield map

5.3 AQUIFER PROTECTION CLASSIFICATION

Aquifer protection classification is based on the aquifer vulnerability classification, threat posed to the aquifer by land use and aquifer system management classification. These attributes are multiplied with the aquifer rating system to obtain the Groundwater Quality Management index (GQM), which is used to determine the level of groundwater protection, as shown in Table 5-2 and Table 5-3. The project area is underlain by minor aquifer system (2 points) which is highly vulnerable to contamination (3 points). Using aquifer vulnerability and aquifer class, a medium level of groundwater protection is calculated.

Table 5-2 - Ratings for the Groundwater Quality Management Classification System

Aquifer system management classification		Aquifer vulnerability classification	
Class	**Points**	**Class**	**Points**
Sole source aquifer system	6	High	3
Major aquifer system	4	Medium	2
Minor aquifer system	2	Low	1
Non-aquifer system	0		
Special aquifer system	0–6		

Table 5-3 - Appropriate Level of groundwater protection required based on Groundwater Management Classification

GQM Index	Level of protection
<1	Limited protection
1–3	Low level of protection
3–6	Medium level of protection
6–10	High level of protection
>10	Strictly non-degradation

6 GROUNDWATER MODELLING

The section below describes the translation of the conceptual model into a numerical groundwater flow and mass transport model.

6.1 CONCEPTUAL MODEL

The conceptual site model (CSM) depicted in Figure 6-1 and is described here:

- The shallow and deeper intergranular primary aquifer is unconfined and hosted in undifferentiated coastal deposits of the Maputaland Group and alluvium deposited within Mlalazi and Mhlathuze River systems. It contains:
  - Calcareous sand, dunes and reddish sandy soil of the Sibayi, KwaMbonambi and Berea-type in the upper 20 m. The hydraulic conductivity of the shallow aquifer is between 0.1 and 10 m/d. Yields are generally below 2 L/s.
  - Cross-bedded sand and local calcarenite or fossiliferous mudrock of the Kosi Bay and Port Durnford formations from 20 to >100 m deep.
- The secondary intergranular and fractured aquifer is hosted within mainly argillaceous rocks of the Karoo Supergroup and mainly meta-arenaceous rocks of the Natal Metamorphic Province. The weathered and intergranular portion of the aquifer is 10 to 15 m thick, whilst the fractured portion is roughly 150 to 170 m thick. The hydraulic conductivity of the secondary aquifer is between 0.001 and 0.1 m/d and yields range from 0.1 L/s to 1.5 L/s.
- Based on information gathered during the hydrocensus, groundwater levels range from artesian conditions to 59 mbgl across the area. Shallower water levels are observed near the rivers and in the down gradient areas closer to the coast where primary aquifers are assumed to be locally present. The deeper water levels, located in the topographically higher areas, is assumed to be part of the same the primary aquifer. This is supported by the similar water chemistry in both aquifers and the relative water levels observed in both.
- Groundwater flow from the site is generally towards the east and south-east, in the direction of the Mzingwenya River, the Amanzamnyama and Mlalazi Rivers, and the Indian Ocean. West of the mining area, water drains towards the north-west (Mhaltuze River) and south-west (KwaGugushe River).
- The baseline groundwater quality in the area is generally good with marginal to poor quality noted in some boreholes on the eastern MRA boundary (TBH6 and TBH7) and locally on the south-western boundary in the shallow aquifer (W14 and TPB14) due to elevated iron and manganese concentrations.
- The site is currently occupied by forestry activities and will return these operations upon completion of mining and subsequent rehabilitation.
- GCS (2020) noted that groundwater dependent ecosystems are a common feature along the north-eastern coastline of KwaZulu-Natal. Textural characteristics (including the clay content) can lead to locally perched aquifer conditions resulting in the formation of springs within the shallow aquifer.
- Wetlands east of the project site, mainly along the drainage channels feeding Lake Cubhu and around Kraal Hill, are fed by shallow groundwater from perched aquifers formed by underlying clay rich dune sands.
- The Mlalazi estuary south-west of the site is also fed by shallow groundwater in the area.

- A combination of topography and textural characteristics of the geological formations influence the baseflow component of the project area.

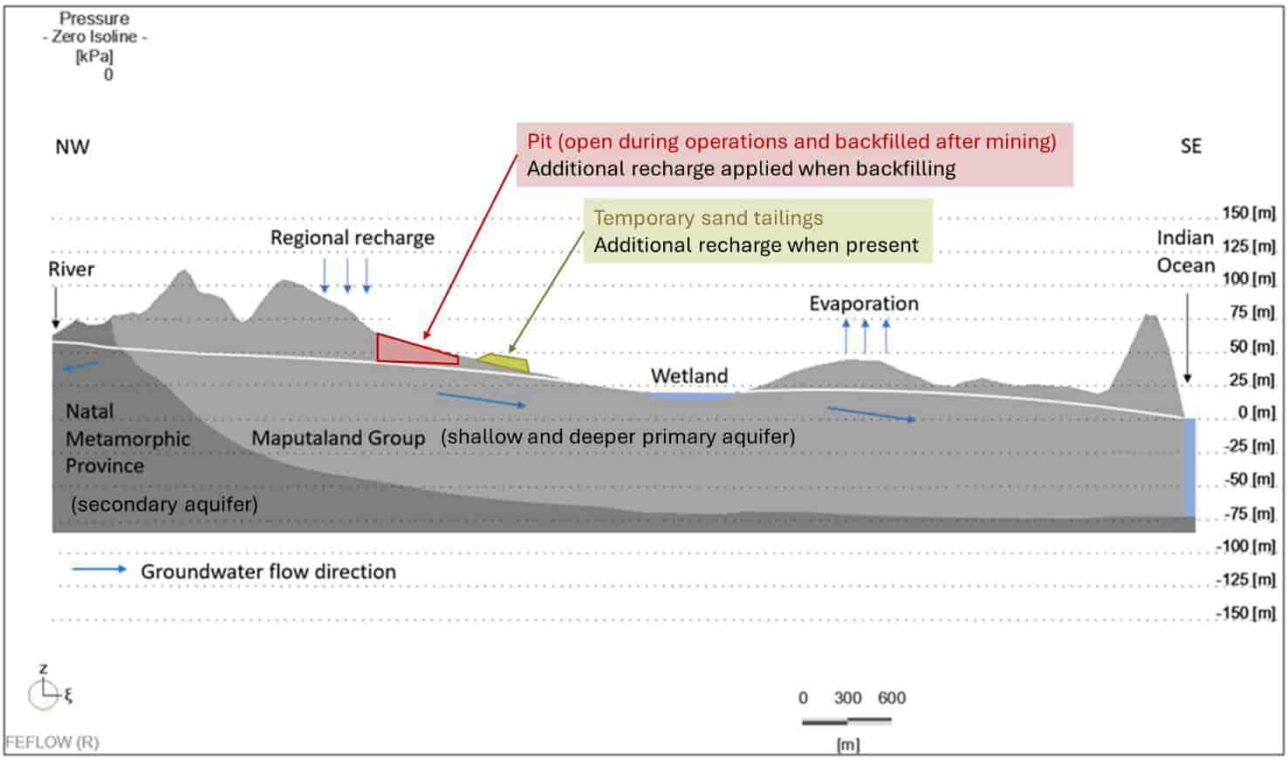

Figure 6-1 - Conceptual site model (white line indicating water level)

6.2 GROUNDWATER ELEVATION AND GRADIENT

Groundwater levels were discussed under Section 4.4. The groundwater elevations within the project area vary from 8 to 86 mamsl and the average groundwater gradient is approximately 0.01 m.

6.3 NUMERICAL MODEL

As discussed above, FEFLOW was used for the development of the numerical groundwater model. The model construction is as discussed in Section 7.4, 7.5 and 7.6.

6.3.1 SOFTWARE MODEL CHOICE

The code selected for conducting the modelling of the study area is FEFLOW® (Diersch, 2014) developed by the WASY Institute for Water Resources Planning and Systems Research, Ltd. Berlin, Germany. FEFLOW® is an interactive groundwater modelling system for three and two-dimensional, aerial, and cross-sectional, fluid density-coupled, thermohaline or uncoupled, variably saturated, transient, or steady state flow, mass, and heat transport in subsurface water resources with or without one or multiple free surfaces.

FEFLOW® can be efficiently used to describe the spatial and temporal distribution of groundwater contaminants, to estimate the duration and travel times of pollutants in aquifers, to plan and design remediation strategies and interception techniques, and to assist in designing alternatives and effective monitoring schemes.

6.3.2 MODEL SET-UP AND BOUNDARIES

The model area was conceptualized large enough to cover the location of the key stresses on the groundwater system. The model boundaries should also be far enough to not affect the modelling simulations. The current groundwater model boundary is large enough to account for all the influences. The model boundaries consider the topography, rivers and Indian Ocean. The Mhlatuze River, KwaGugushe River, Msasandla River and Mlalazi River were included in the model boundary. The model area is depicted in Figure 6-2 and spans area of approximately 126 km^2.

The rivers and wetlands were set as seepage faces which allow the model to remove water when the water level is higher than the river elevation, but it cannot add water when the water level is below the river.

6.3.3 GEOMETRIC STRUCTURE OF THE MODEL

6.3.3.1 Model Structure

The numerical model encompasses the project area covering a total area of approximately 126 km^2 (approximately 7 km × 17 km). A finite element network (grid) was designed to provide a high resolution of the numerical solution, while at the same time accommodating the large model area. The finite element grid is based on a super element mesh constructed across the area. The super element mesh contains the main important features of the conceptual model, e.g., the surface expression of the main hydro lithological aquifer units, rivers/drainage and mining infrastructure.

The mesh contains 85 031 elements per layer (425 155 elements in total for 5 layers) and 42 722 nodes per slice (256 332 nodes in total for 6 slices). The mesh quality was considered good with:

- Interior holes: 0.
- Obtuse-angled triangles: 0.1% > 120º and 6.3% > 90º.
- Delaunay-violating triangles: 1.0%.

The mesh (Figure 6-3) was refined in the mining area so that the nodes are approximately 50 m apart.

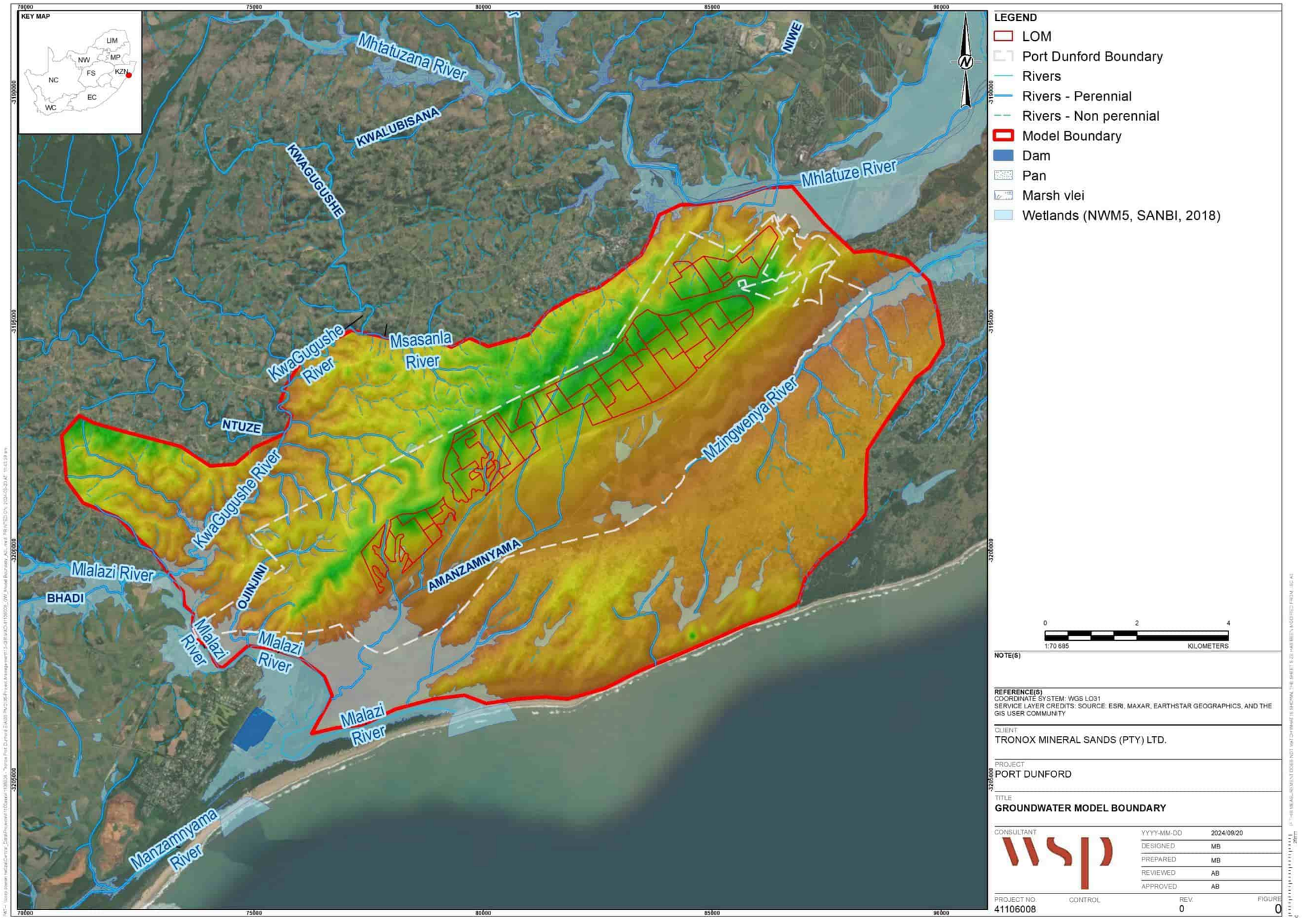

Figure 6-2 - Model Boundary

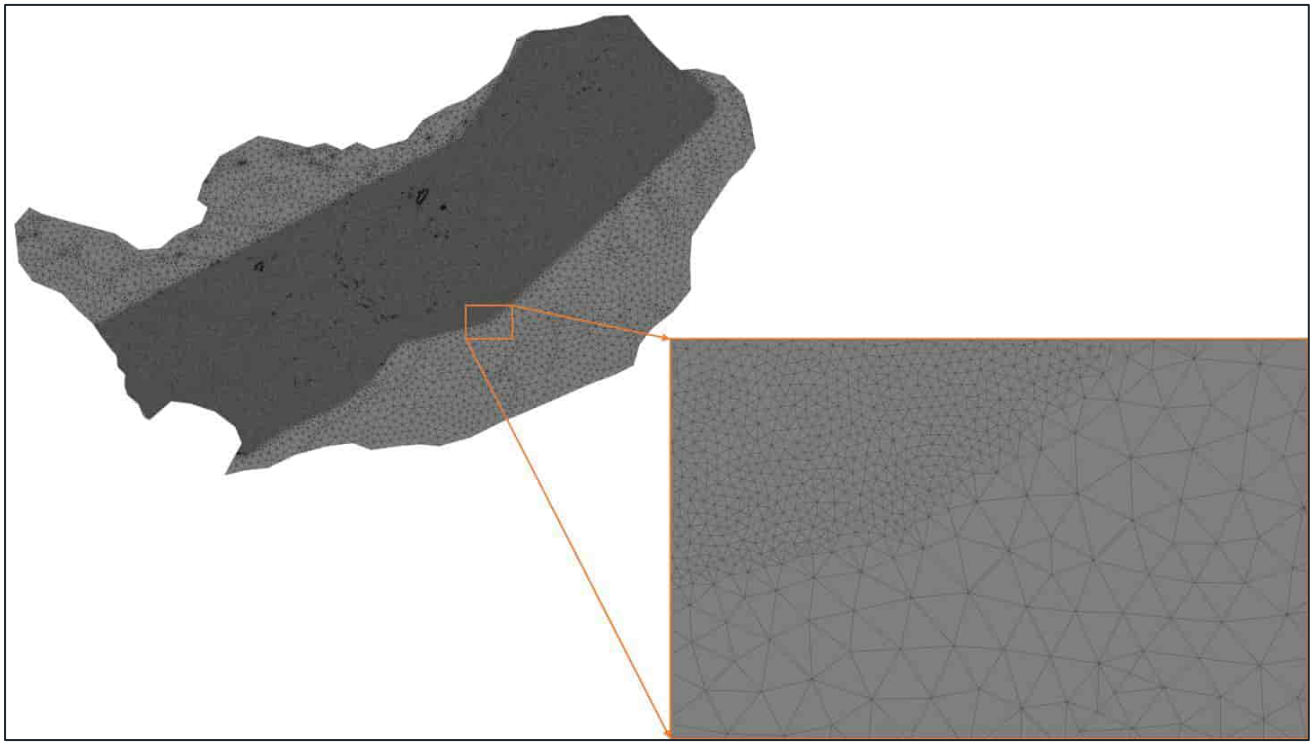

Figure 6-3 - Model mesh indicating refinement in the site boundary

6.3.3.2 Model Layers

The study area is represented by a five-layered model based on existing data. The model domain was assumed to extend vertically to encompass the proposed mine pits and their depths. The model was setup such that the base of the pits is represented by the base of Layer 2 (Slice 3).

Table 6-1 presents the model layers and average thickness.

Table 6-1 – Model layers

Model layer	Layer number	Layer thickness (m)
Maputaland Group	Layers 1 to 3 where present	20
Base of mining	Base of layer 2	25
Ecca Group	Layers 1 to 3 where present	70
Natal Group	Layers 1 to 3 where present	40
Natal Metamorphic Province	Layers 1 to 3 where present and entire layers 4 and 5	10

6.3.4 MODEL ASSUMPTIONS & LIMITATIONS

Groundwater models are simplified mathematical representations of complex natural systems. Because of this, there are limits to the accuracy with which groundwater systems can be simulated.

6.3.4.1 Mining assumptions

Certain assumptions need to be made to simulate the mining sequence, the backfilling after mining, and then adding RSF C on top of the mining area.

The model timeline is based on the mine schedule received in March 2024 (Refer Section 1 and Figure 7-2) as follows:

- The steady state model represents pre-mining conditions (Refer Section 7.8)
- The operational model runs from January 2024 to January 2069, a forty five-year period.
- The post closure model starts January 2070 and runs for 100 years until January 2170.

The following assumptions were made to apply the mining and backfilling to the groundwater model:

- Dewatering is limited to the mining block; therefore, dewatering will be activated in the model at the start of mining, and it will be de-activated one year later. There is one exception where dewatering for mining block 2025 will be active from 2025 to 2035 since this area is earmarked for low-rate mining over 10 years.
- Backfilling:
  - For all mining blocks, except 2025, backfilling will commence 2 years after the start of mining.
  - Backfilling in mining block 2025 will commence in 2059.
- Deposition:
  The deposition schedule used in the model (based on data received in March 2024), however, the schedule was adjusted slightly to make sure that deposition starts one year after mining. The modelling schedule for deposition is presented in Figure 6-4
  The RSF material will be deposited as a slurry with 28% solids and 72% water which will be entered into the model as additional recharge as follows:
  - RSF 9 will be filled from 2036 to 2046 according to the spatial data received.
  - RSF C area will be filled from 2069 to 2070 at the end of mining.
  - The coarse sand tailings will be deposited as a slurry with 50% solids and 50% water which will be entered into the model as additional recharge. The sand tailings deposition areas will be active from 2036 to 2068 with the following assumptions based on the spatial location:
    - Sand tailings A1 to A3: 2036 to 2055. Assumed all areas will be active for this entire period.
    - Sand tailings North: 2054 – 2055, two years after mining of the northern mining blocks.
    - Sand tailings 4:2056 to 2058, two years after mining of the south-western mining blocks. Mining block 2025 will be filled in 2059.
    - Sand tailings 5:2060 to 2063, two years after mining.
    - Sand tailings 3:2063 to 2068, two years after mining.

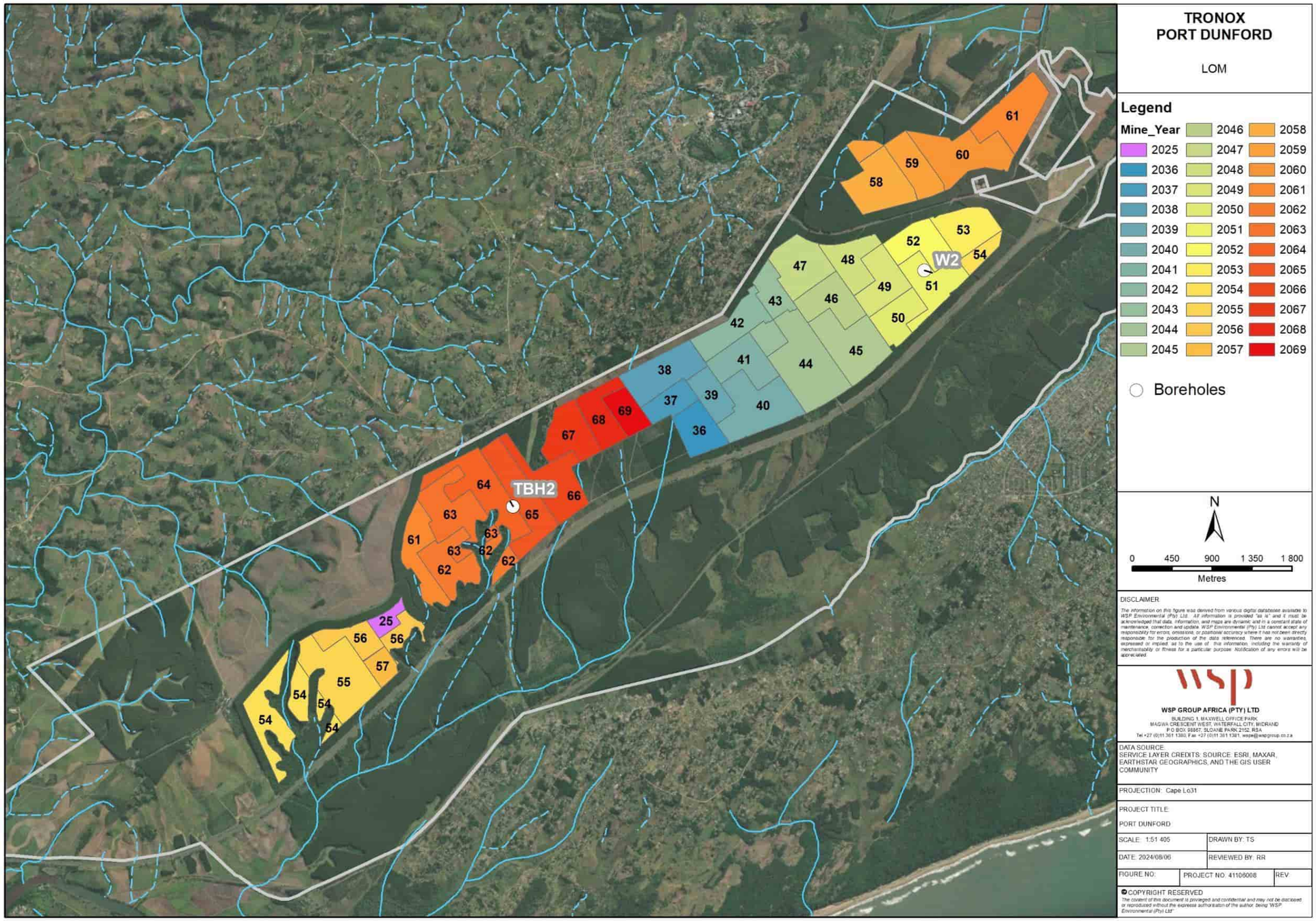

Figure 6-4 - Mine plan used for modelling

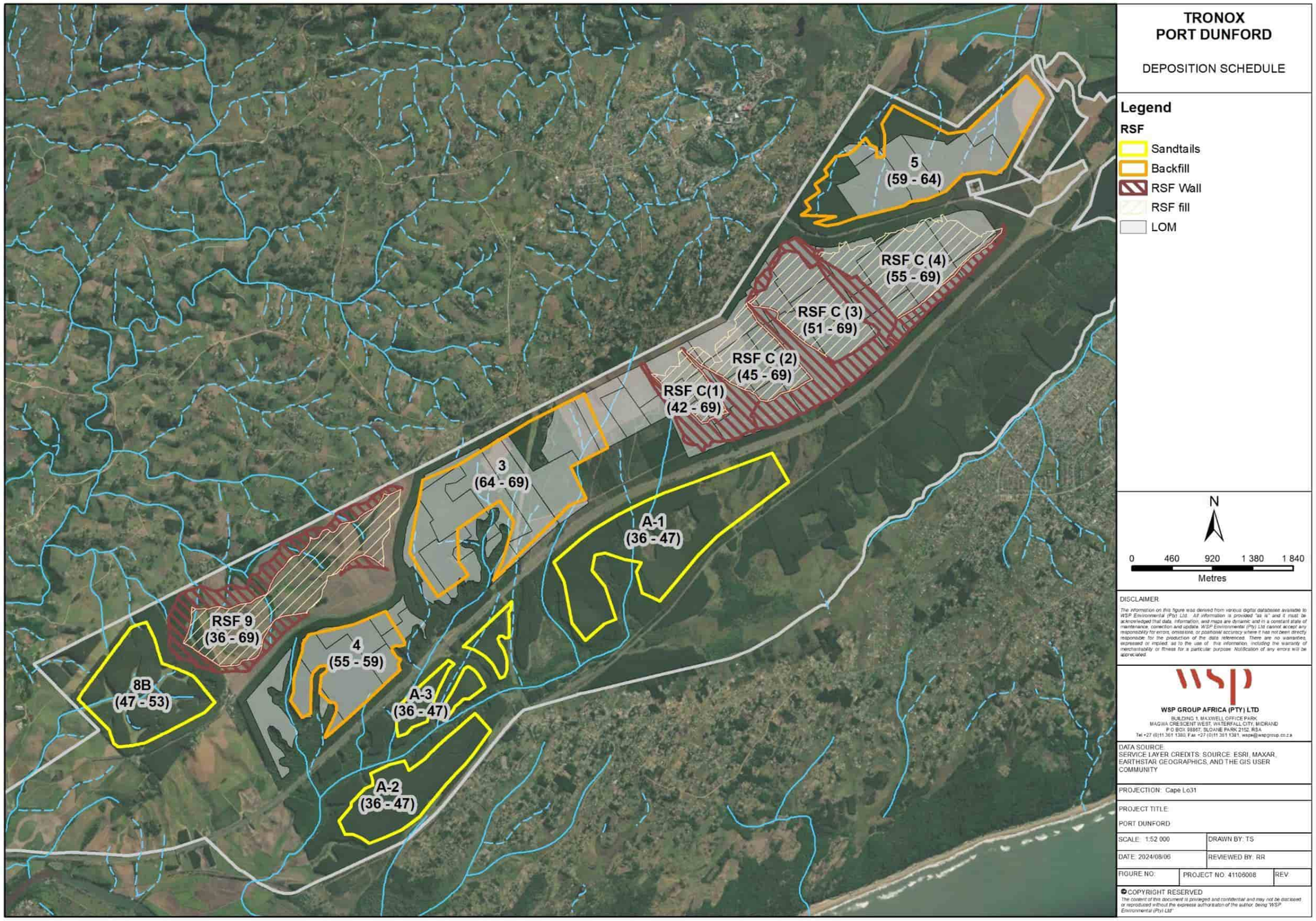

Figure 6-5 - Deposition plan used for modelling

6.3.4.2 General Assumptions

Calibration depends on the interaction between water levels, abstraction, hydraulic conductivity, and recharge. There is a level of uncertainty in each of these. The uncertainties are described below:

- Uncertainty will always be present due to aquifer heterogeneity.
- Some uncertainty arises from measurement errors.
- The model is a simplification / approximation of reality.
- The following assumptions were made in the numerical model:
  - No aquifer tests were conducted by GCS (2020) or WSP during the current project, therefore the aquifer parameters used in the model were estimated based on literature and previous experience.
  - Geological structures were not included in the model as the locations and properties of these were unknown.
  - The regional recharge was kept constant at before and after mining as the area is currently occupied by forestry and it is understood that it will return to forestry after mining.
  - The model does not account for pumping activity in the surrounding boreholes, and it is assumed that the contaminant plume is not influenced by any pumping activity. Although wells fitted with pump were identified during the hydrocensus survey, no information on their usage and pumping rates is available.
  - Facilities such as dams and stockpiles were excluded from the model as these are assumed to be controlled storage units, located in concrete bunded/ lined areas, where leaks and subsequent impacts to the groundwater are not anticipated to occur.
  - The source terms used in the groundwater model, were based on results from the geochemical study for the RSF and the backfill material.

6.4 GROUNDWATER SOURCES AND SINKS

The shallow and deeper primary aquifer is a source of water for rivers, lakes and most wetlands in dryer periods and is recharged by these systems in wet periods (GCS, 2020).

6.4.1 SOURCES

The data gathered from this investigation was processed and interpreted in the subsequent tasks.

- Sources include the RSF feed and backfill material. The RSF 9 is located on the SW of the site boundary, close to borehole TBH8, while RSF C is located on the NE of the site boundary. Backfill 3 is located on the SW of the mine site, near RSF 9, Backfill 4 is located in the centre of the site, NE of RSF 9 and Backfill 5 is located NE of the of RSF C. Monitoring close to possible contaminant sources (this can be achieved by replacing boreholes W2 and W7 after mining).
- Pathways include monitoring along identified contamination plumes (W5, W11 and TBH1). It also includes the surface water (streams), groundwater and RSF of which can transport the waste material from the sources to the receptors.
  - The Mzingwenya River (P_SW1).
  - The Amanzamnyama River (P_SW2).
  - Tributary of the KwaGugushe River (P_SW3).
  - Tributary of the Mhlatuze river (P_SW4)

In accordance with the conceptual model, the coastal sand deposits have higher recharge that the inland lithologies. The model recharge was calibrated at:

- 306 mm/a (25% of MAP) for the coastal sands
- 12.24 mm/a (1% of MAP) for the remaining lithologies

Other sources include the deposition of sand tailings containing 55% water and the RSF's containing 72% water during deposition. The location of these sources is shown in Figure 6-6.

Please note that contaminant sources are discussed in section 6.6.4.

6.4.2 SINKS

The rivers, wetlands, and mining areas act as sinks as water is removed during mining. In the absence of detailed pumping rates, the model was calibrated against the existing water levels and groundwater abstraction from local boreholes excluded as a sink in the model on the assumption that it minimally affects the regional aquifers.

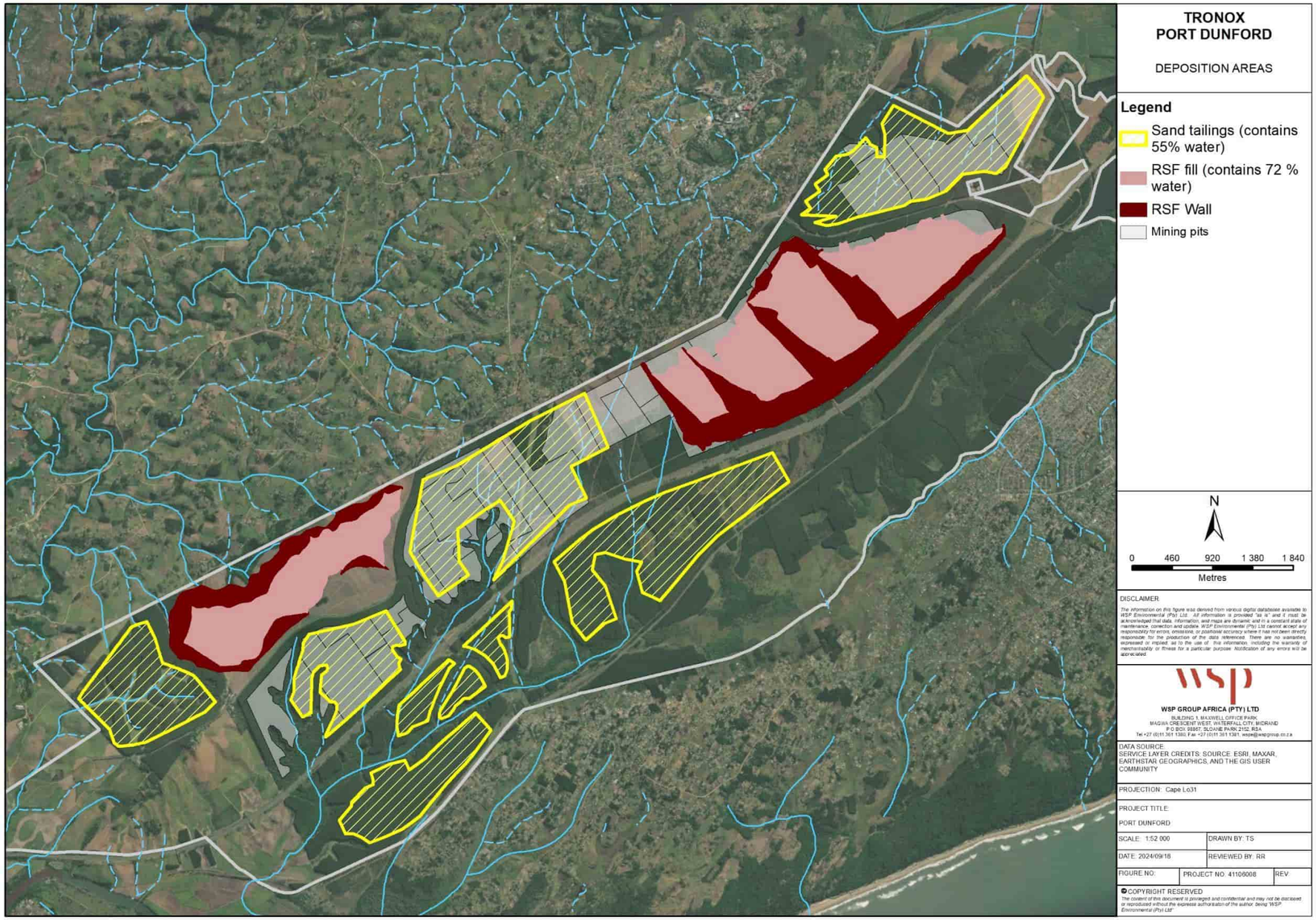

Figure 6-6 - Additional sources of water

6.5 MODEL CALIBRATION

The groundwater flow direction generally follows the topography with the flow direction either to the north-west or south-east towards the Indian Ocean and/or the rivers. The groundwater levels measured during the November 2022 hydrocensus conducted by WSP were used to calibrate the steady state model.

Two boreholes did not calibrate well:

- W12 which is situated to the west of the mining area in the Natal Metamorphic Group and therefore not important for water levels in and around the mine and was removed for calibration. The measured water levels for 2020 (~25 mbgl) are very different from the 2017 data when 0.9 mbgl were reported.
- W7, which borders the mining area in the north-west, at a topographical high elevation of 102 mamsl and close to the contact between the lithologies of the Natal Metamorphic Province and the Maputaland Group. The measured water levels from two hydrocensus surveys differ greatly with a water level of 18.5 mbgl measured in 2017 and 36.5 mbgl in 2020.

The root mean square error (RMSE) was 4.9 m and the normalised root mean square error (NRMSE) was 10.8%. The simulated steady state calibration is indicated in Figure 6-7 and Figure 6-8, while Figure 6-9 shows the simulated head at steady state (prior to mining).

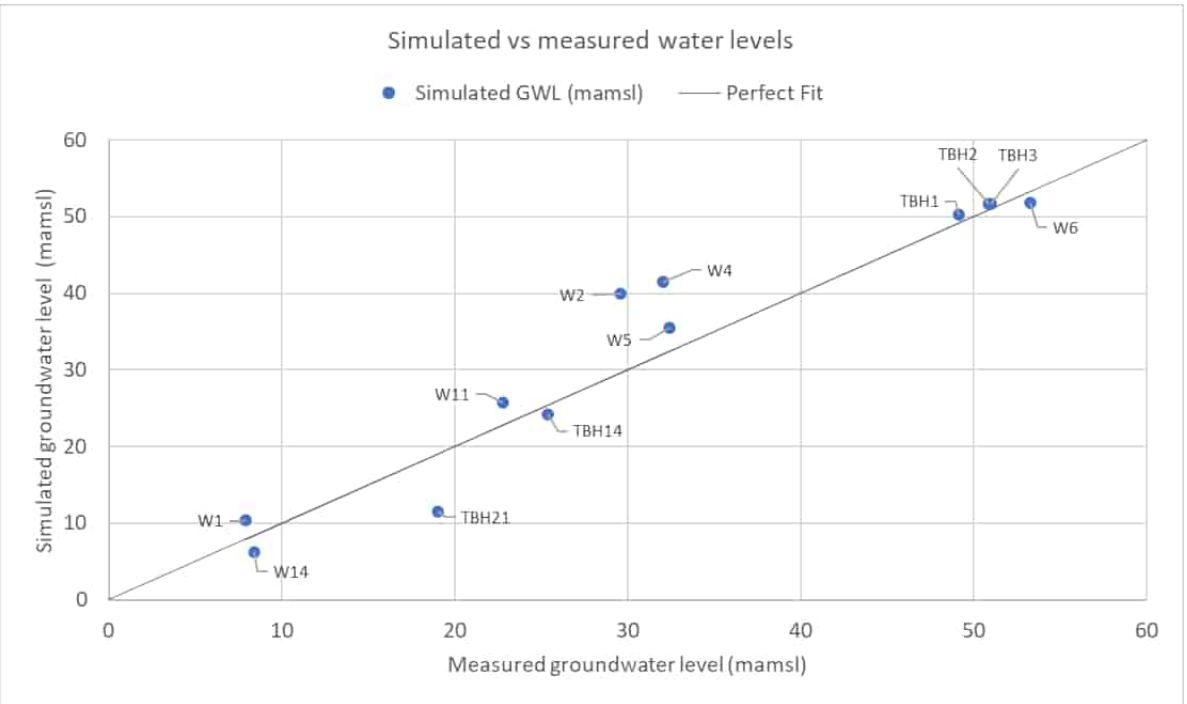

Figure 6-7 - Simulated versus measured water levels scatter plot

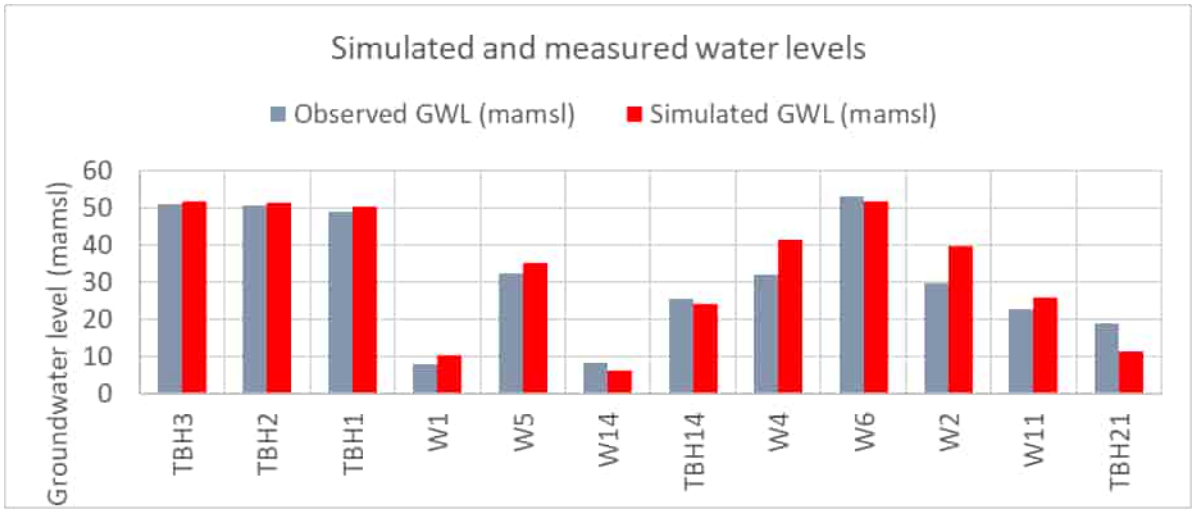

Figure 6-8 - Simulated versus measured water levels bar graph

6.5.1 CALIBRATED MODEL PARAMETERS

In accordance with the conceptual model, the coastal sand deposits have higher recharge than the other areas. The model recharge was calibrated at:

- 306 mm/a (25% of MAP) for the coastal sands
- 12.24 mm/a (1% of MAP) for the remaining lithologies

The calibrated aquifer parameters are presented in Table 6-2. These compare to the range provide for the baseline for the primary aquifer (Maputaland Group) of 0.1 – 10m/d and secondary aquifer (Natal/Ecca) of 0.1-0.001m/d.

Table 6-2 – Calibrated aquifer parameters

Maputaland Group			Natal Metamorphic Province			Ecca Group, Karoo Supergroup			Natal Group		
K (m/d)	SS (m^{-1})	n_e	K (m/d)	SS (m^{-1})	n_e	K (m/d)	SS (m^{-1})	n_e	K (m/d)	SS (m^{-1})	n_e
1	9.93E-05	0.03	0.001	1.04E-06	0.03	0.02	1.03E-05	0.03	0.1	1.03E-05	0.03

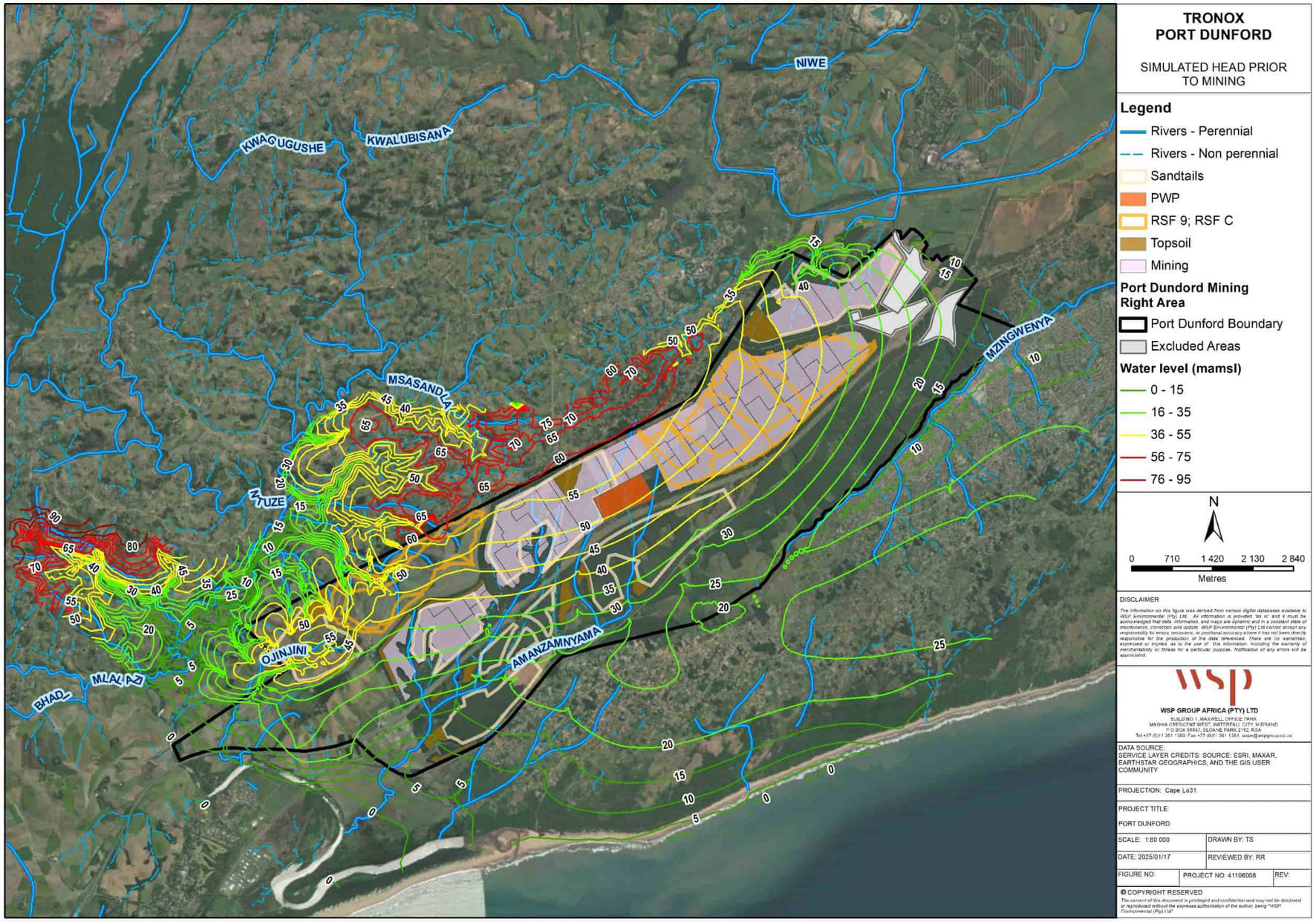

Figure 6-9 – Simulated water level prior to mining

6.6 RESULTS OF THE MODEL

6.6.1 PRE-MINING

The mining conditions were simulated for the pre-mining scenario with the groundwater flow directions described above. The steady state model represents pre-mining conditions (Figure 6-9).

6.6.2 DURING MINING

The operational model runs from January 2024 to January 2069, a forty five-year period.

Figure 6-10 to Figure 6-17presents the drawdown at various intervals during the mine operations. During operations, the water levels are decreased due to mining activity (showing a drawdown) and increased due to deposition of wet sand tailings (showing a water level recovery).

It should be noted that the water level mound that forms on the sand tailings area 8B in 2050 (Figure 6-10) is likely due to the backfill area being situated on Natal Metamorphic Province geology which has lower hydraulic conductivity, slowing down the backfill slurry from seeping into the ground below. It is therefore important to add cut-off trenches to remove excess water from area 8B or find another way to manage the excess water.

Figure 6-18 and Figure 6-19 presents the drawdown at various intervals during the mine operations and the effect on Wetlands 2, 1 and 5. Water levels remain consistently above surface in Wetland 2, indicating that this is likely unimpacted by the RSF operations. An initial drawdown and subsequent recovery are observed in Wetlands 1 and 5 indicating that the impact of the mining is transient (2063 – 2068).

Figure 6-20 shows the final water level at the end of mining and Figure 6-21 shows the post closure water level which stays constant from two years after mining onward.

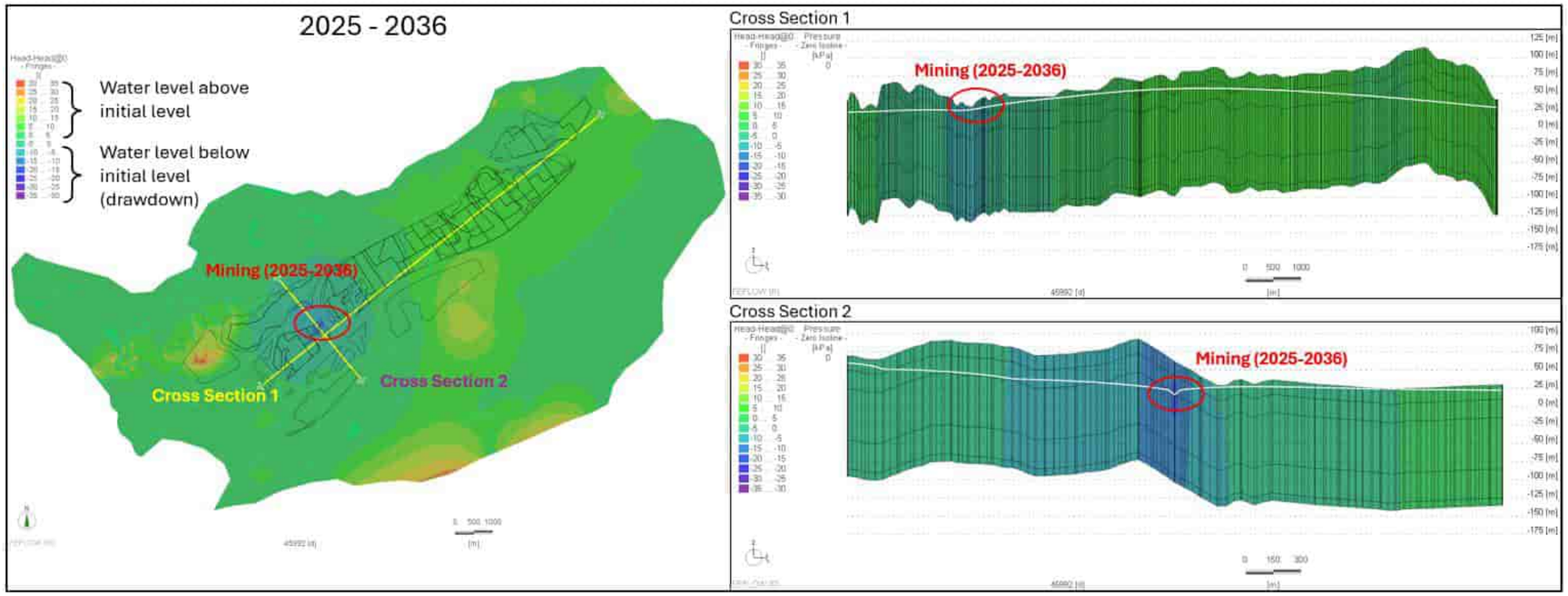

Figure 6-10 - Simulated drawdown 2025 – 2035

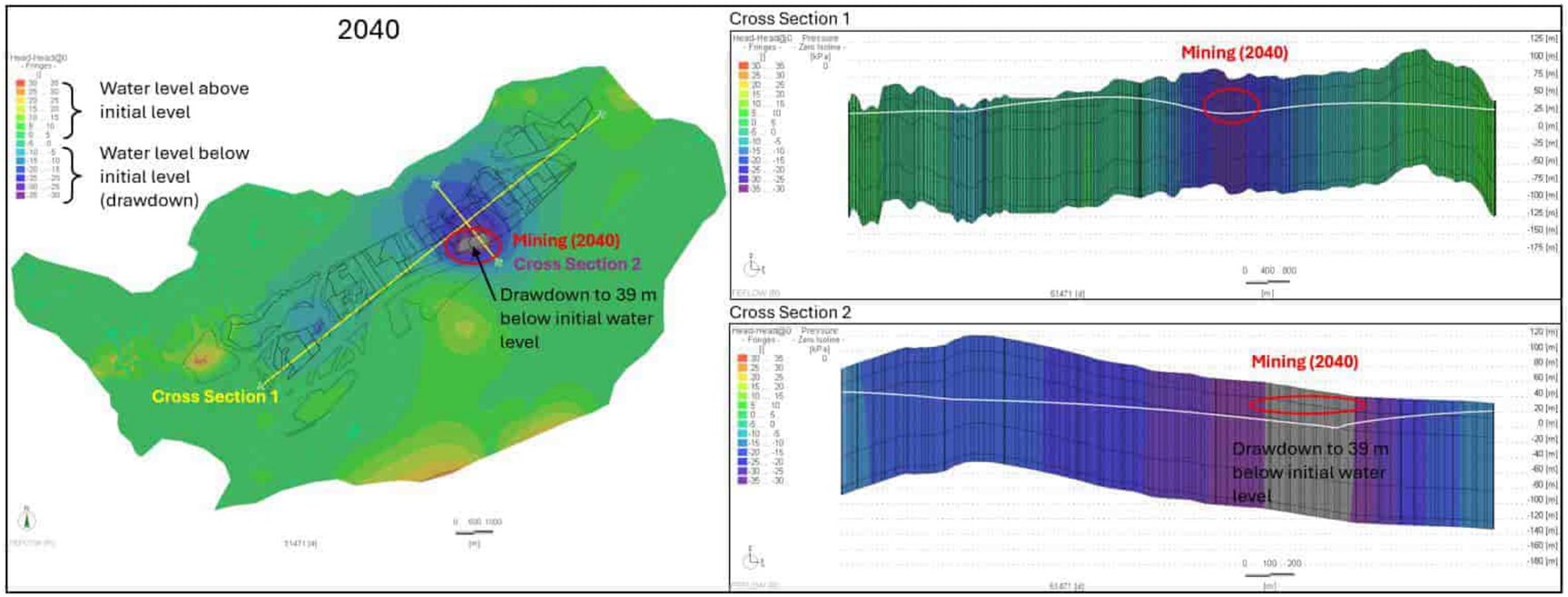

Figure 6-11 - Simulated drawdown 2040

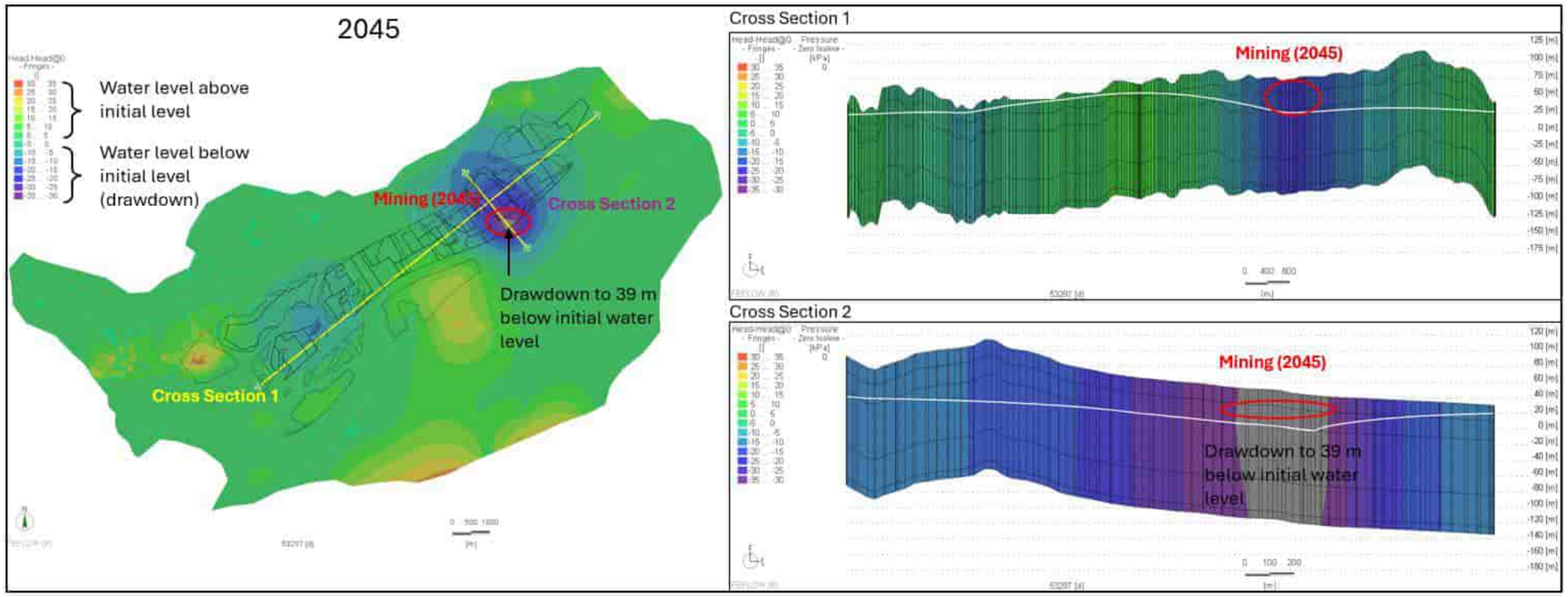

Figure 6-12 - Simulated drawdown 2045

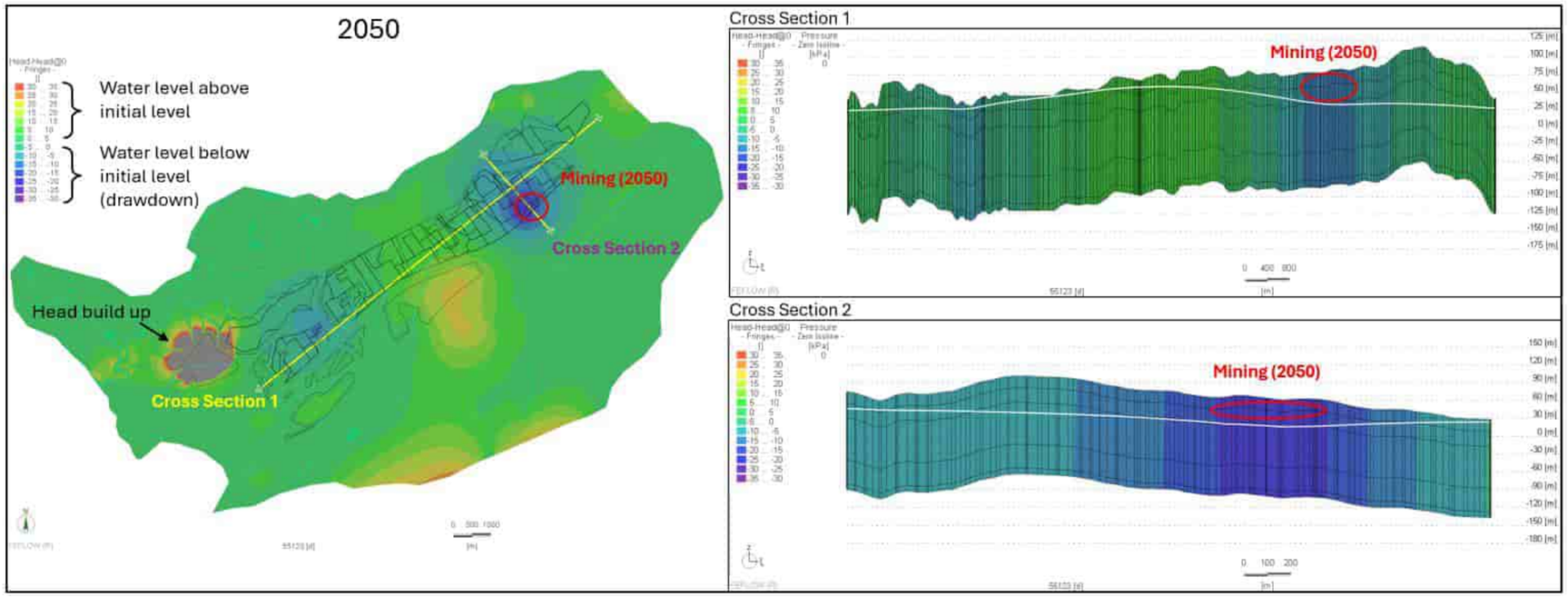

Figure 6-13 - Simulated drawdown 2050

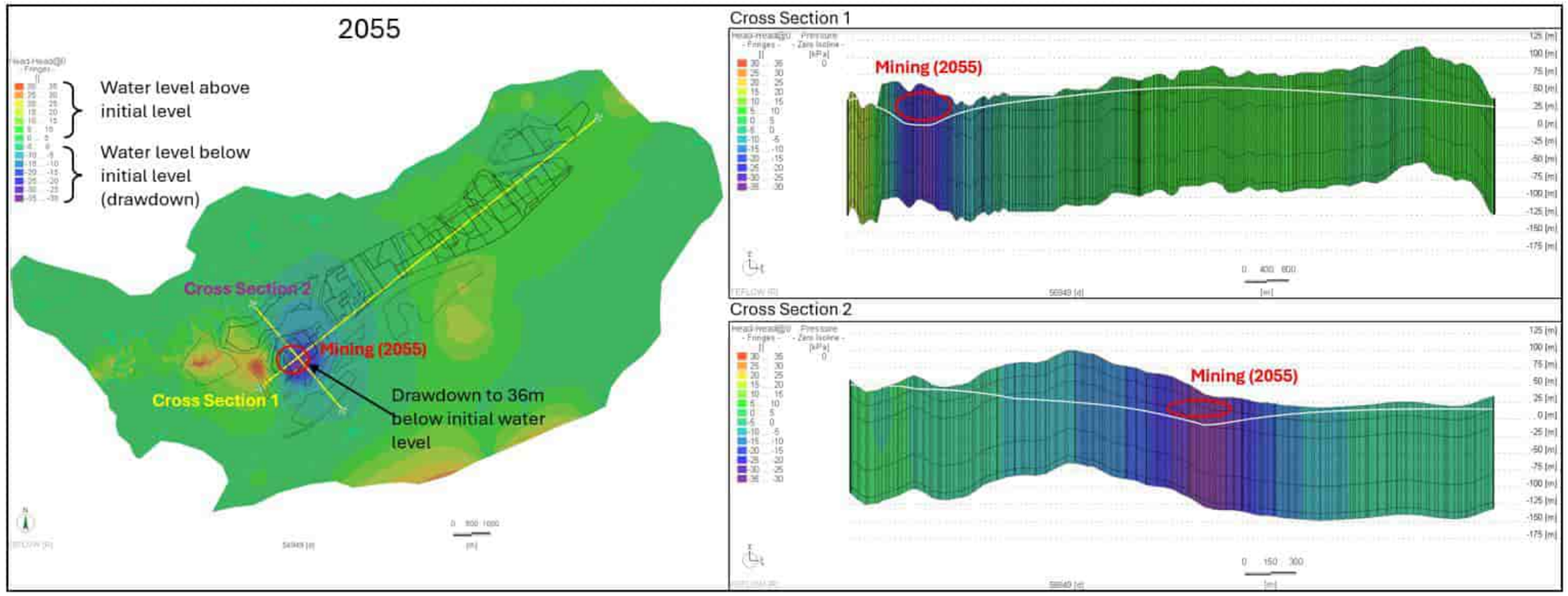

Figure 6-14 - Simulated drawdown 2055

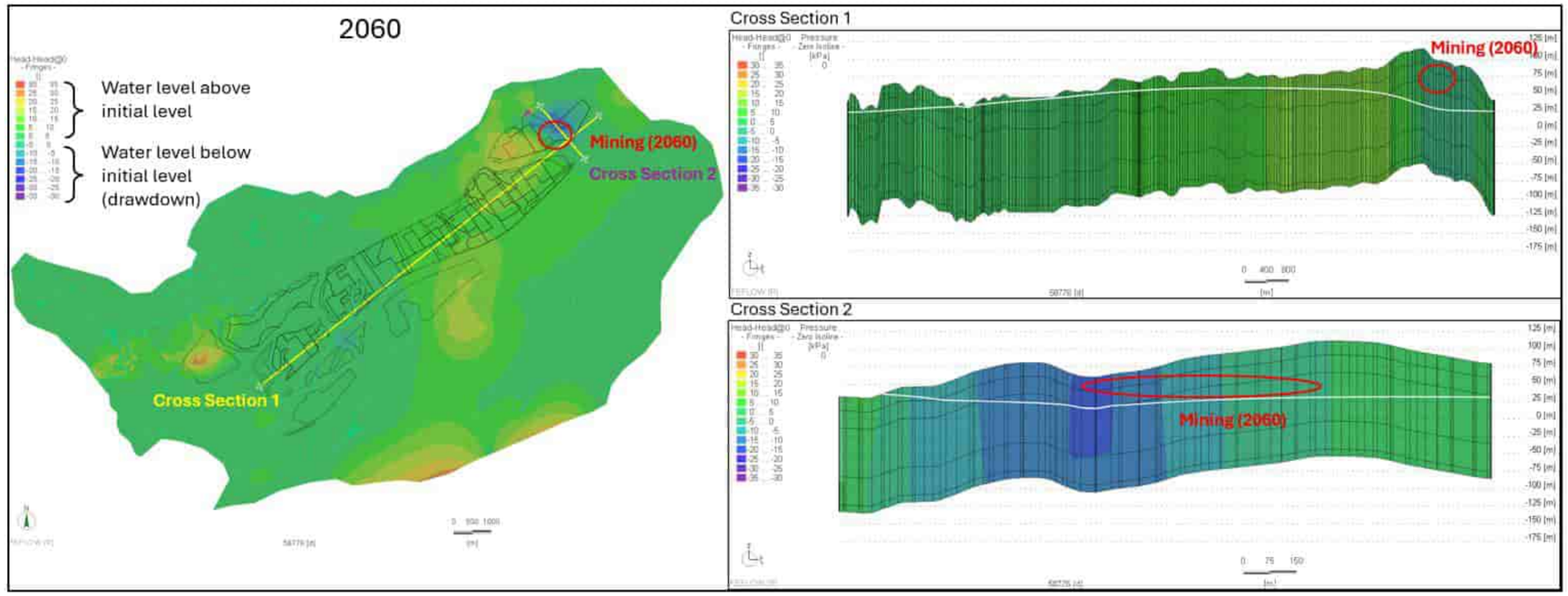

Figure 6-15 - Simulated drawdown 2060

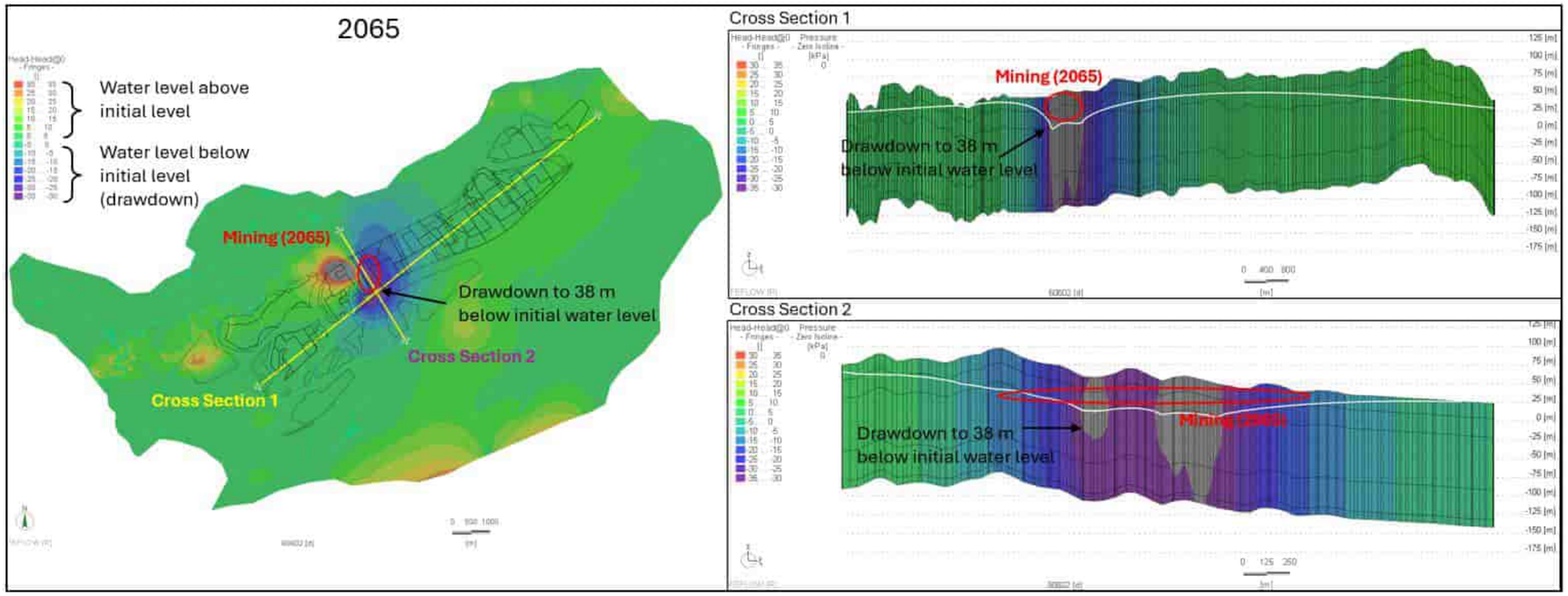

Figure 6-16 - Simulated drawdown 2065

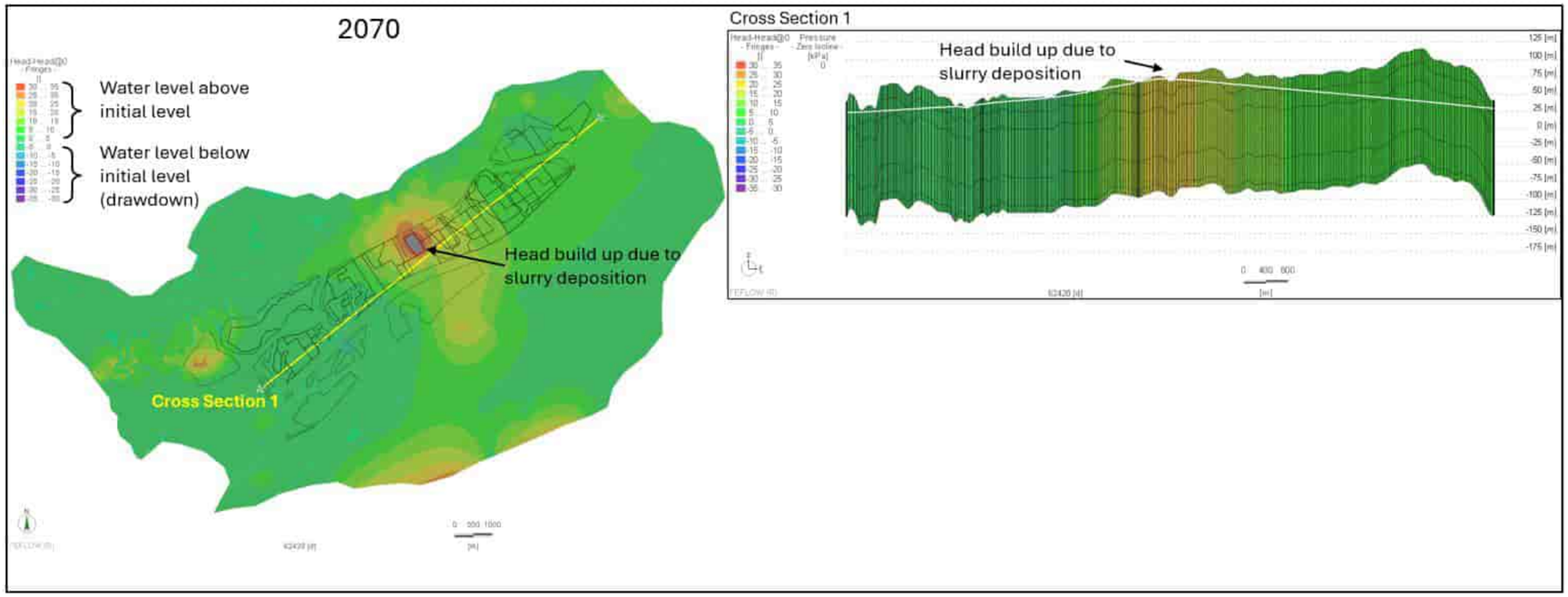

Figure 6-17 - Simulated drawdown 2070

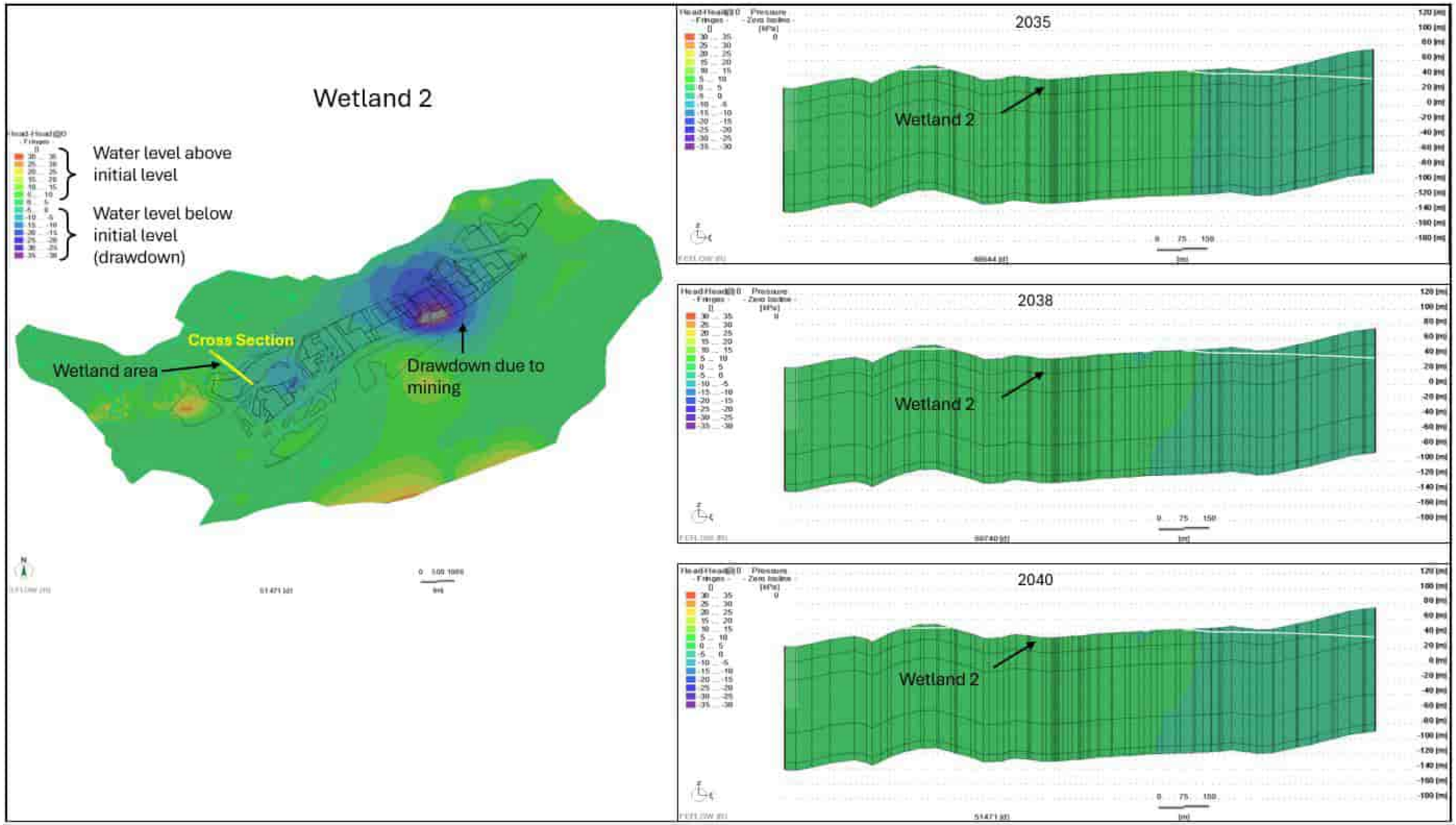

Figure 6-18 – Simulated drawdown in Wetland 2

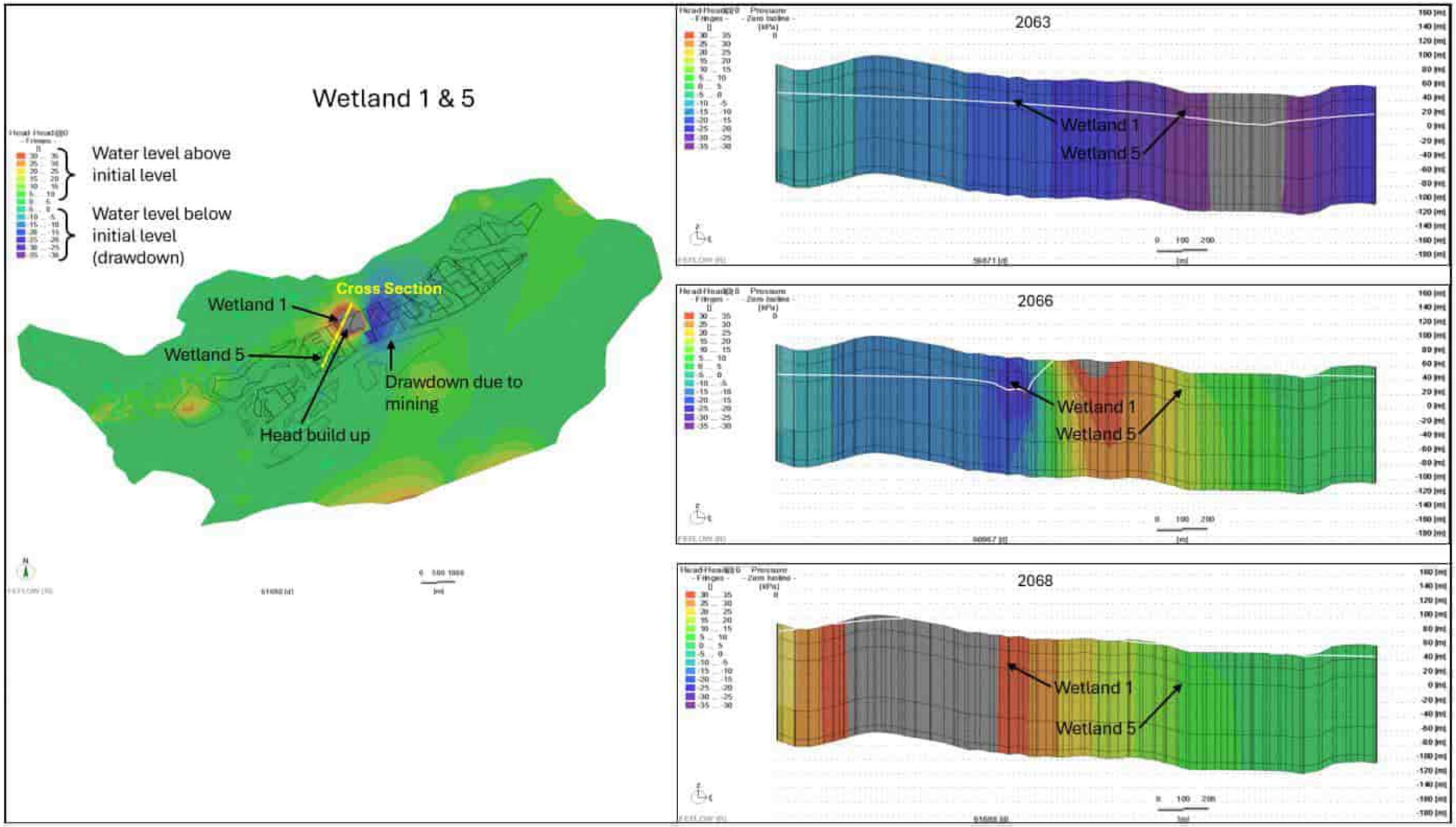

Figure 6-19 – Simulated drawdown in Wetland 1 and 5

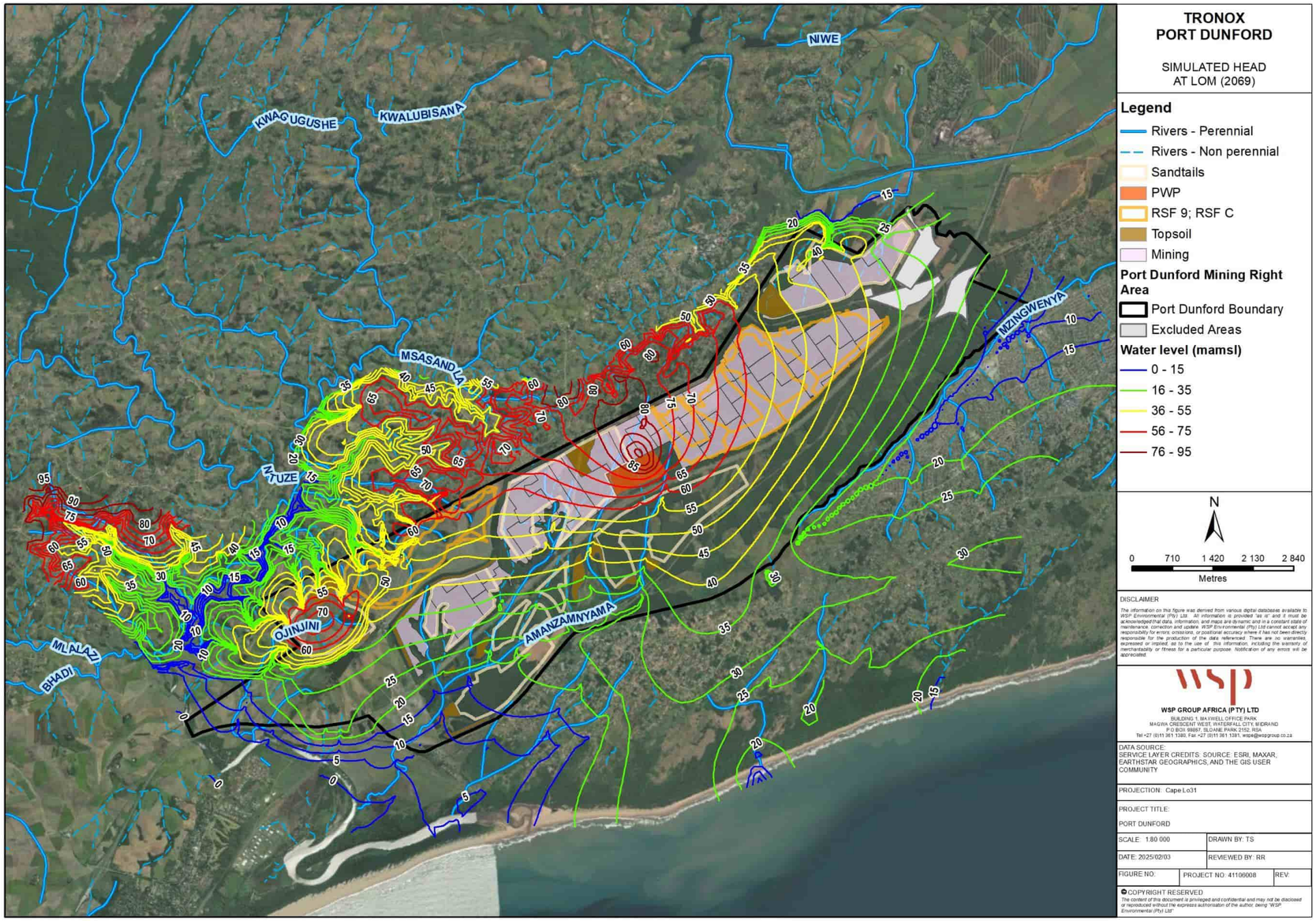

Figure 6-20 – Simulated water level (mamsl) at LOM (2069)

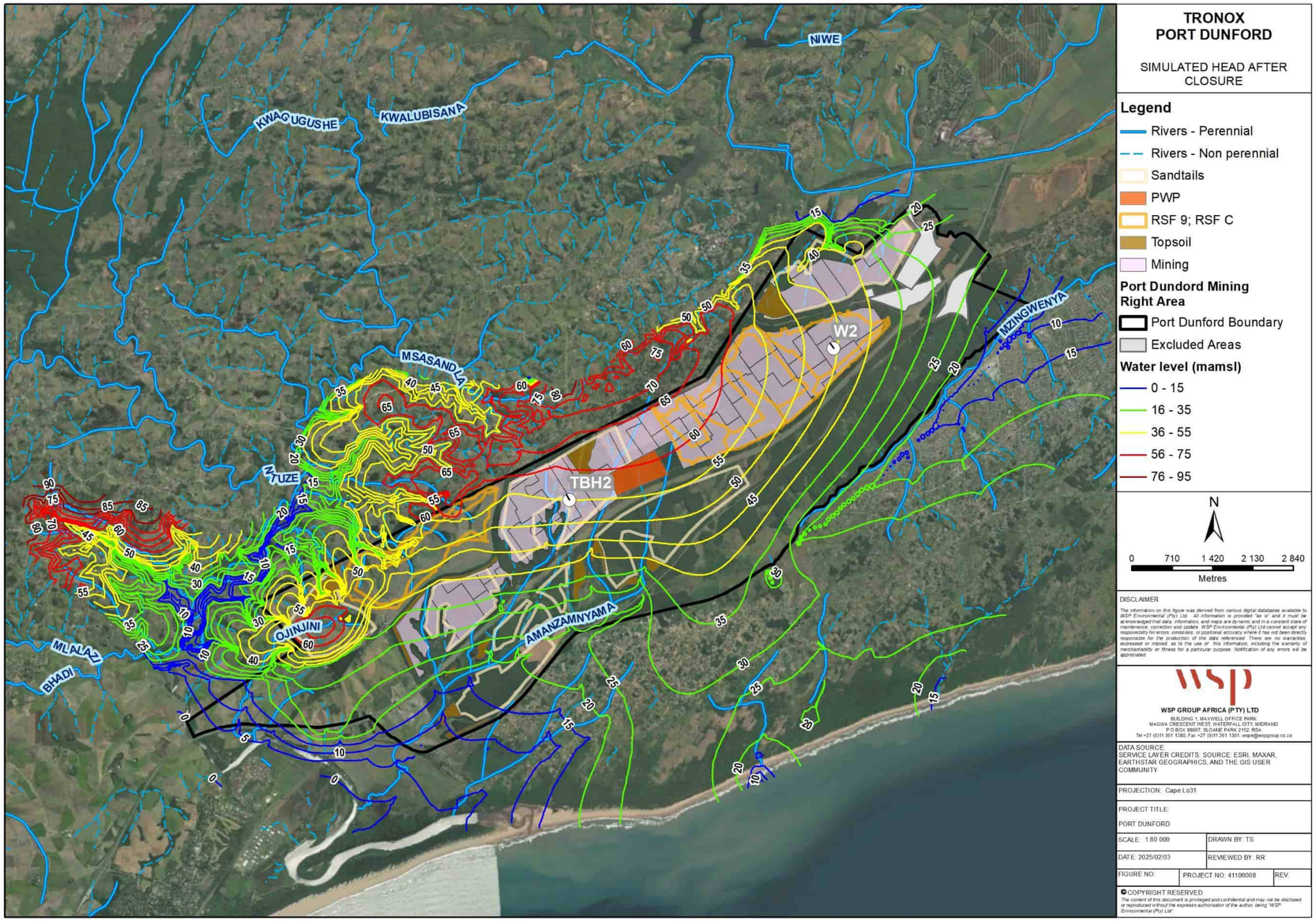

Figure 6-21 – Simulated water level (mamsl) 10 years after closure

To be able to show mine inflows with and without deposition, two scenarios were run:

- Mining only.
- Mining and deposition.

Two boreholes indicated in Figure 6-22 were selected to show water levels over time for the two scenarios. The water levels are shown in Figure 6-22 for TBH2 and in Figure 6-23 for W2.

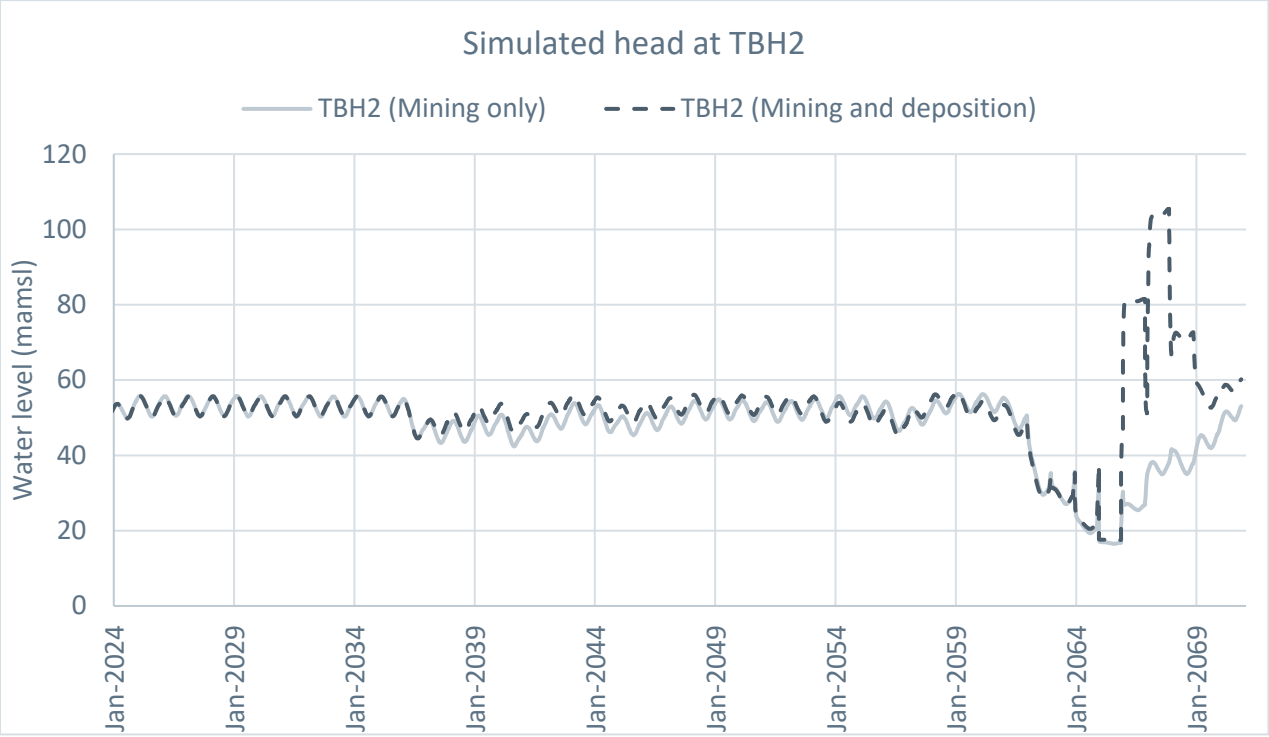

Figure 6-22 - Simulated head at TBH2

TBH2 is located in an area that will be mined in 2064. Figure 6-22 shows how the water levels stay relatively constant (with some seasonal fluctuation) until 2062. The nearby mining of 2062 and 2063 starts to affect the water levels at TBH2 and the water levels reach a minimum during 2064 as expected. From 2065 the water levels gradually increase for the “mining only” scenario, while it increases drastically with the “mining and deposition” scenario due to the additional water that is added with the sand tailings as backfill. The excess water from backfill is expected to accumulate on surface and may need to be managed.

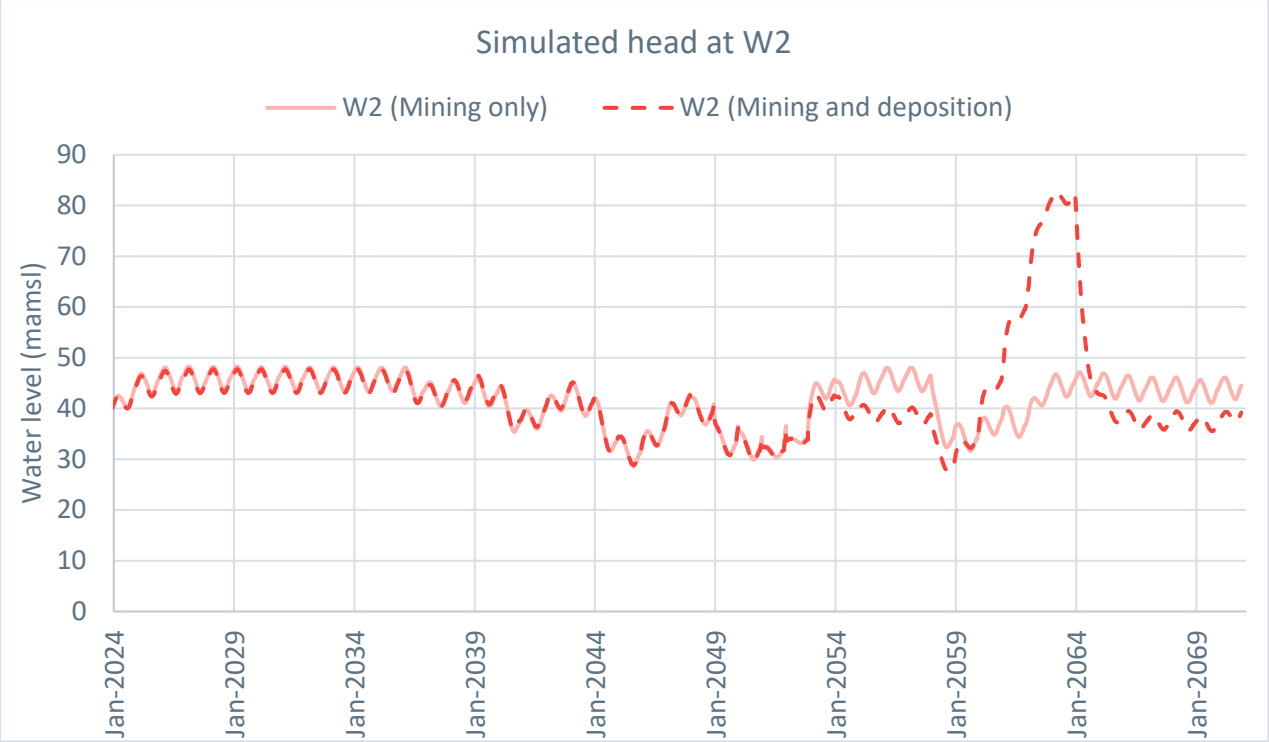

Figure 6-23 - Simulated head at W2

W2 is located in an area that will be mined in 2051. Figure 6-23 shows how the water levels are affected by nearby mining from all sides. There are several cycles with drawdown and recovery. The main feature of this graph is the difference between the two scenarios when RSF C Phase 4 becomes active in 2059. The effect of the RSF is reduced in 2059 and 2060 due to mining (dewatering) in the North block but reaches a maximum in January 2064. The excess water from backfill is expected to accumulate on surface and may need to be managed.

6.6.2.1 Groundwater ingress

The mining cycle supplied by Tronox was used to guide the setup of the operational model. Dewatering in each of the pits was simulated by applying time-constrained seepage faces to the planned pit floors. According to the mining cycle supplied by Tronox, the seepage faces in the pits were generally active for two years and then removed, to simulate backfilling after mining. The seepage faces in the Site C RSF pits were activated for four years to simulate the gradual transition of the pit into the RSF according to the operation schedule provided by Tronox.

Fluid flux boundary conditions were calculated and applied to all deposition areas according to the operation schedule. The deposition areas include the sand tailings areas (A1, A2, A3, and 8B), the backfill areas (3, 4, and 5) and the two RSF areas. The simulated ingress reported for the mining areas is presented in Table 6-3 and Figure 6-24.

In the first 10 years of low-rate mining, the simulated ingress is approximately 3 500 m^3/d. Thereafter the average simulated ingress for the “mining only” scenario is 8 911 m^3/d. By including the additional water from backfilling and residue deposition the total ingress rises to 51 311 m^3/d in 2065.

Table 6-3 – Simulated ingress in m^3/d

Year	Mining Only	Mining and Deposition		Year	Mining Only	Mining and Deposition
2025	3 375	3 310		2048	6 705	7 185
2026	3 554	3 471		2049	9 490	10 001
2027	3 513	3 474		2050	10 862	11 629
2028	3 548	3 476		2051	8 485	9 060
2029	3 532	3 476		2052	5 688	6 108
2030	3 524	3 475		2053	3 503	3 546
2031	3 531	3 475		2054	14 335	14 790
2032	3 520	3 476		2055	10 408	17 178
2033	3 521	3 474		2056	10 175	20 597
2034	3 520	3 475		2057	9 406	28 391
2035	3 521	3 473		2058	5 935	5 913
2036	12 181	12 100		2059	4 959	8 145
2037	7 777	8 870		2060	4 310	10 469
2038	6 594	7 877		2061	14 139	24 458
2039	8 847	10 489		2062	12 604	12 793
2040	16 740	19 183		2063	8 313	8 594
2041	8 288	9 737		2064	10 161	17 357
2042	4 201	5 195		2065	11 083	51 311
2043	8 066	9 047		2066	8 935	51 045
2044	17 220	18 651		2067	5 772	46 231
2045	13 517	14 707		2068	7 696	49 779
2046	7 858	8 854		2069	4 054	24 579
2047	4 671	5 330				

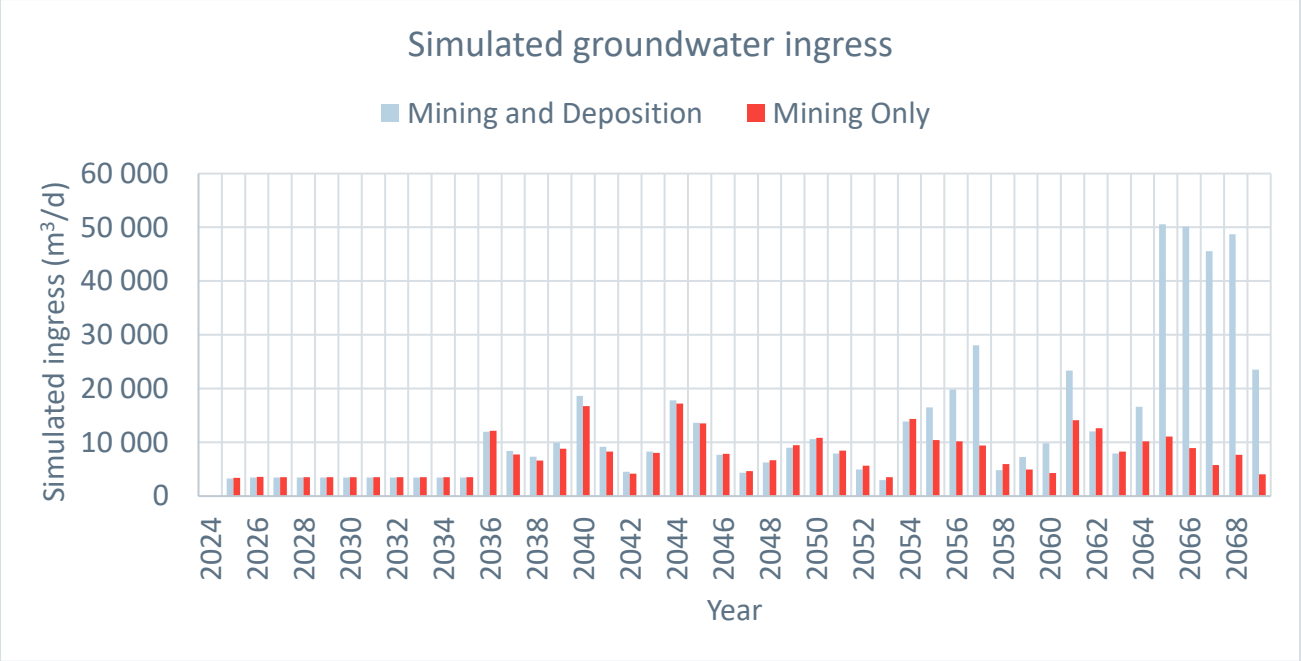

Figure 6-24 – Simulated ingress into the pits

6.6.2.2 Sensitivity analysis

A sensitivity analysis was performed on the operational model by changing the hydraulic conductivity (K), recharge (by 20%) and specific storage (SS) values (inputs) in the model and observing the changes in simulated pit ingress over time (output).

The result of the analysis is plotted in Figure 6-25 below. The results show that model is generally more sensitive to changes in recharge and less sensitive to changes in specific storage. Generally, however, changes observed in the pit ingress were not substantial.

Please note that the sensitivity analysis was conducted on a previous version of the mine plan, and therefore the results are slightly different from the inflows simulated using the latest mine plan.

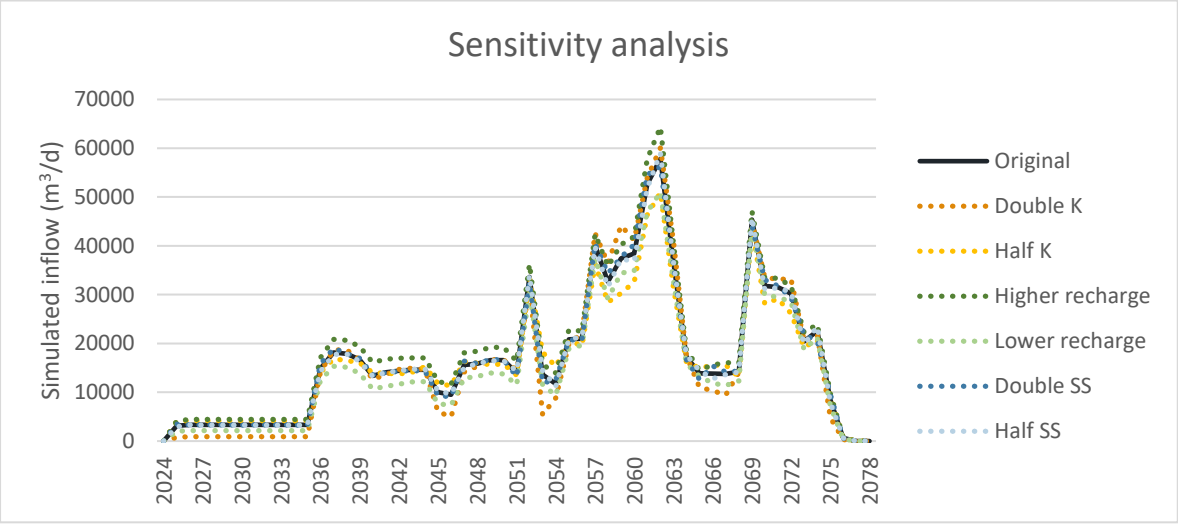

Figure 6-25 – Sensitivity analysis results

6.6.2.3 Baseflow into surface water features

The groundwater contribution as baseflow into four major surface water features/areas was analysed over time using the model. Figure 6-26 shows the baseflow contributions over time. Based on the results of the operational model, it is evident that the baseflow contribution is reduced as the mining activity progresses across the site. However, increases in baseflow is observed as a result of the wet backfill or deposition of sand tailings. The following is noted:

- **The KwaGugushe, Msasandla, and Ojinjini Rivers** (west of the mining area) shows insignificant reduction in baseflow. More significant is the increase in in baseflow due to the wet backfill / sand tailings. The increase in baseflow from 2047 to 2053 is due to the wet sand tailings in area 8B. The increase in baseflow between 2065 and 2068 is due to the backfilling in the central mining area (backfill area 3).
- **Baseflow to the Mhlathuze River** (north of the mining area) is limited as the model area contributing to the Mhlathuze catchment is insignificant. The baseflow reduces from 2036 and the largest effect is seen in 2058 to 2061 during mining of the north block. However, the wet backfill has a counter effect and from 2061 to 2064 there is a large increase in baseflow.
- **Baseflow to the Mzingwenya River and the wetlands south of Lake Cubhu** (north-east of the mining area) is limited. The baseflow reduces from 2036 to the end of mining. However, from 2062 to 2064 there is an increase in baseflow. This can be monitored in future at boreholes W1 and W5.
- **Baseflow to the Amanzamnyama and Mlalazi Rivers and estuary** (south of the mining area) shows insignificant reduction in baseflow from 2036. From 2054 to 2058 and again from 2062 to 2065 the baseflow reduction is significant. Increase in baseflow due to deposition is evident for the following periods:
    - From 2037 to 2052 – due to deposition of sand tailings A1, A2 and A3.
    - From 2056 to 2058 – due to backfill in area 4.
    - From 2066 to 2067 – due to backfill in area 3.

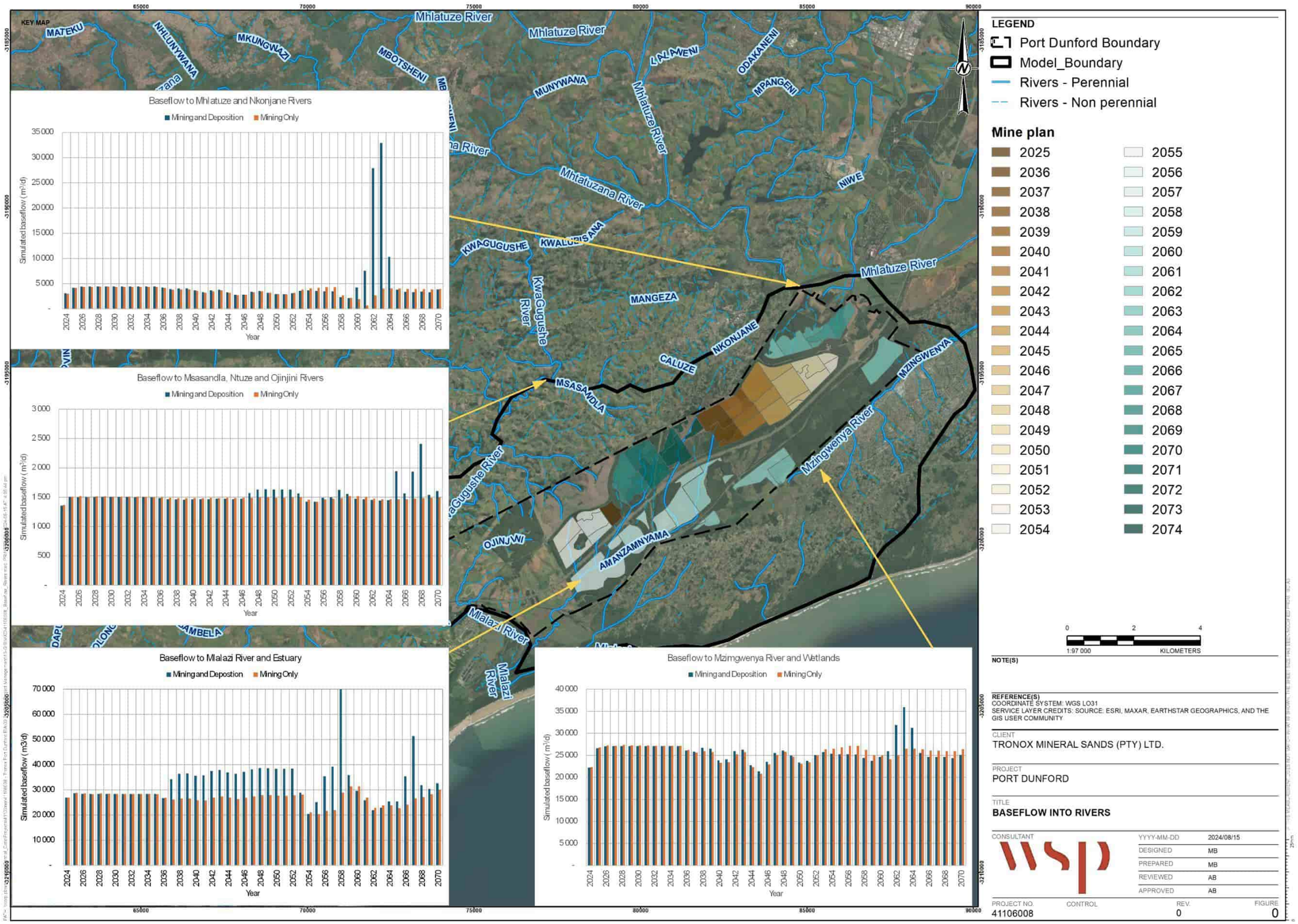

Figure 6-26 - Baseflow into surface water features

6.6.3 POST CLOSURE

The post closure model starts January 2070 and runs for 100 years until January 2170.

6.6.3.1 Groundwater levels

The post closure model was run for a period of 100 years after operations. The model shows that the groundwater levels recover within two years after completion of mining. This new “steady state” water level is similar to pre-mining conditions as shown in Table 6-4.

6.6.4 CONTAMINANT TRANSPORT

The contaminants of potential concern were discussed in section 5.6. The three elements selected for contaminant transport modelling included total dissolved solids (TDS), Al, and Mn. TDS needs to be modelled as the estuary is highly sensitive to changes in salinity. Al and Mn were selected due to the environmental risk concern during the operational phase. The operational values were applied in the model. For post-closure, no additional or adjusted source terms were applied as the model continues with the operational plume and diluting it as recharge enters the model.

Table 6-4 – Source terms applied to the model (mg/L)

	TDS	Al	Mn
RSF (operational)	210	0.36	1.32
Backfill	7.3	0.033	0.06

The concentrations were applied as mass flux boundary conditions to the RSFs and mining pits from the time of deposition/backfill, according to the operational schedules discussed in section 8.8. A mass flux is in essence the recharge multiplied by the concentration and is entered into the model with a unit of g/m^2/d. The aquifer background concentrations were based on the average of the measured concentrations during the hydrocensus which was 203.8 mg/L TDS, 0.35 mg/L Al, and 0.34 mg/L Mn.

Due to high recharge in the sand aquifer and the additional water added to the system with the backfill and/or residue, the concentration in the aquifer attenuated. This is the opposite of what is generally expected from contamination sources. Therefore, the residue and backfill material are not strictly sources of contamination. However, monitoring should be put in place to check if there are any change in quality over time. When these diluted plumes reach the rivers and wetlands it is further reduced with the effect that minimal impacts are observed.

Figure 6-27 shows a cross section through RSF C and the Mzingwenya River as illustration to indicate how the concentrations build up in the base rock (NMP). There seems to be a build-up of contaminants in the rivers, however, this is a numerical artefact which is not real. Figure 6-28 shows the simulated TDS concentration over time in the three main rivers. Figure 6-29 and Figure 6-30 show the simulated Al and Mn concentrations over time in the three main rivers.

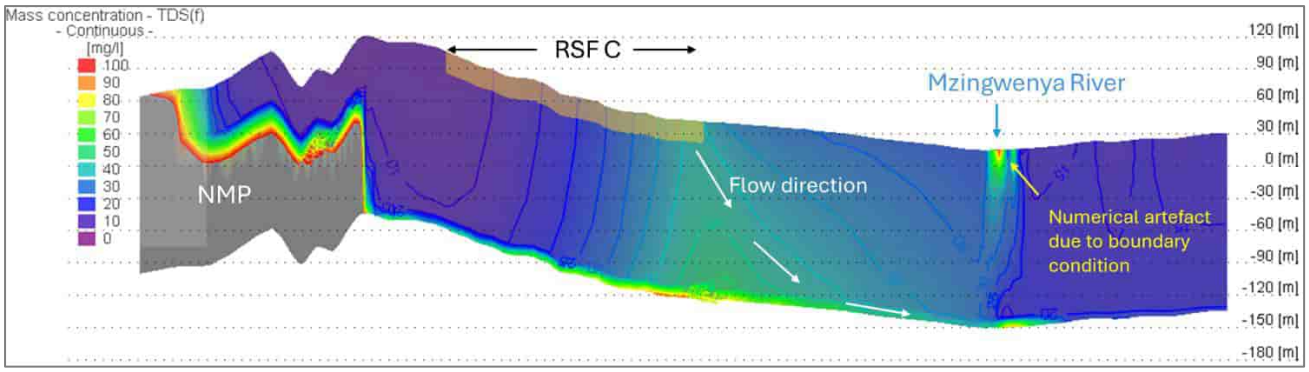

Figure 6-27 – Illustration of concentration

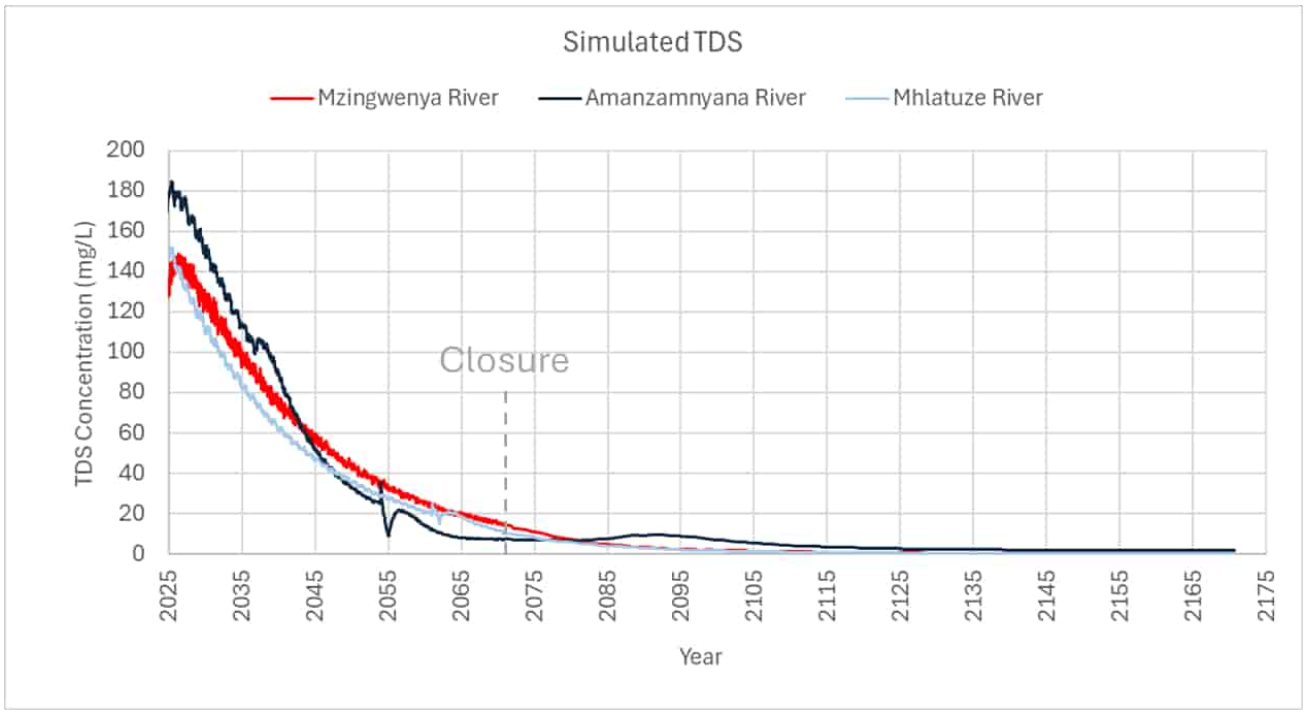

Figure 6-28 - Simulated TDS in Rivers

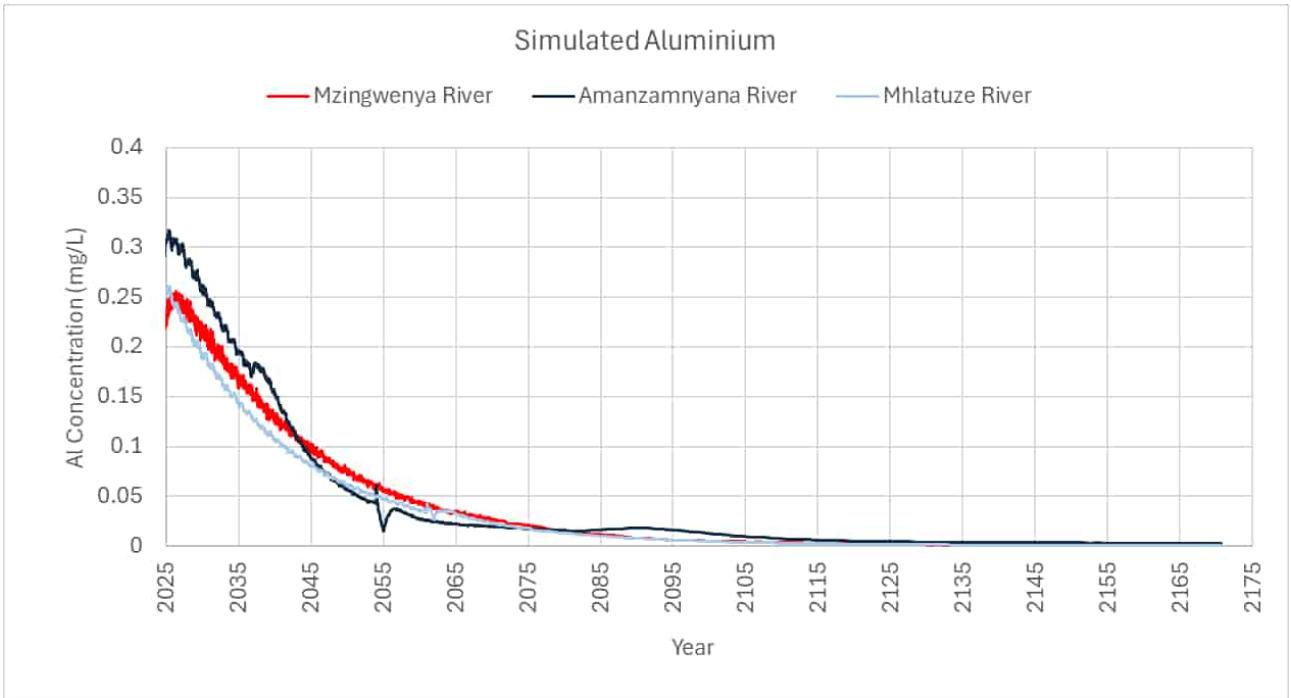

Figure 6-29 - Simulated Aluminium in Rivers

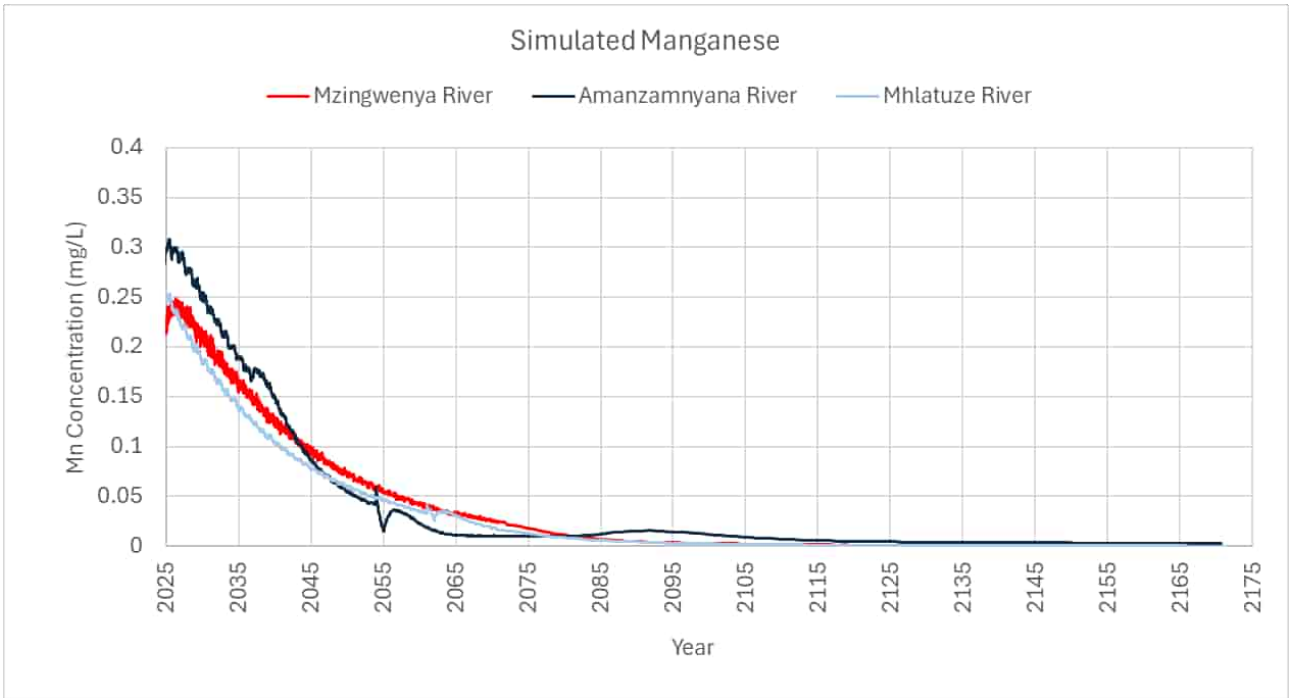

Figure 6-30 - Simulated Manganese in Rivers

From the figures above it is clear that the concentration in the rivers will gradually reduce over time. This dilution effect is a result of the addition of water during backfilling (50% water) and the RSF material which is deposited as a slurry with 72% water.

7 GEOHYDROLOGICAL IMPACTS

Based on the site hydrogeological understanding, project infrastructure requirements and site conditions at each stage of the project development, a groundwater impact assessment was carried out for the project.

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts.

As required by the EIA Regulations (2014) as amended, the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact
- Significance of the Impact
- Consequence of the Impact
- Extent of the impact
- Duration of the Impact
- Probability of the impact
- Reversibility:
  - can be reversed
  - may cause irreplaceable loss of resources and
  - can be avoided, managed or mitigated

7.1 METHODOLOGY FOR ASSESSING IMPACT SIGNIFICANCE

The Impact Assessment methodology is described in Appendix C. The significance rating table is presented in Table 7-1.

7.2 CONSTRUCTION PHASE

Not relevant to this application. No new infrastructure developments foreseen, except general maintenance to existing infrastructures.

7.3 OPERATIONAL PHASE

The following impact on the local aquifer system is foreseen due to the abstraction:

- Water level fluctuations driven by climate variation(s), viz. deeper levels during drier seasons, however, under normal wet/dry climate conditions water levels will oscillate above and below an average water level depth. Lowering of water levels is temporary with quick recovery during backfilling, therefore the impact is limited.

7.3.1 IMPACTS ON GROUNDWATER QUANTITY

The groundwater quantity will be reduced in localised mining areas for short periods after which backfilling with coarse slurry containing 50% water will quickly recover any drawdown. Therefore, the impact on groundwater quantity is considered to be minimal.

The coarse sand tailings dumps will remain for a period of time during which the recharge to the aquifer may increase. The coarse sand tailings deposition area 8B will leach most of the water as toe seepage which will have to be managed by digging trenches around it and collecting the water. Toe seepages may also occur to a lesser extent in the other coarse sand tailings deposition areas.

The potential impact and their detailed mitigation measures before and after operation due to dewatering activities are as follows:

- Lowering of water levels around the mine due to mine dewatering, which may impact on surface or groundwater users and wetlands during operation.
- Backfilling into the pits following operation adds water to the aquifer. This reduces the dewatering impact as it minimises the cone of depression and potential impacts on users and the surface resources.

7.3.2 IMPACTS ON GROUNDWATER QUALITY

Quality impacts are observed from the existing facilities as listed in the impact assessment in Table 7-1.

- Deterioration of groundwater quality during operation

  - Impact without mitigation at **RSF9:** Contamination of groundwater because of deposition of material into RSF 9 as mining progresses. This is however mitigated salinity of the residue was shown by the geochemistry study to be lower than the ambient groundwater quality.
  - Impact without mitigation at **RSFC:** Contamination of groundwater because of deposition of material into RSF C as mining progresses. RSF C is located on an already disturbed area (mining pits). The possible contamination impact is mitigated by the low salinity of the residue which is shown by the geochemistry study to be lower than the ambient groundwater quality.
  - Impact without mitigation in the **Backfill areas 3, 4, & 5:** Contamination of groundwater because of deposition of material into pits as mining progresses. This is mitigated by the low salinity of the residue which is shown by the geochemistry study to be lower than the ambient groundwater quality. Furthermore, backfilling is active for a short period.

Boreholes lost during operation in the backfill areas should be replaced to confirm that the anticipated impact is low and to monitor the change in quality over time.

7.3.3 IMPACTS ON SURFACE WATER

The main receptors are the receiving surface water streams and wetlands.

7.3.4 GROUNDWATER MANAGEMENT

Groundwater management is carried out as a continuous improvement basis. The site area is within the Mhlathuze water management area (WMA). Routine monitoring is required to check if there are any impacts on the water quality in the rivers.

7.4 DECOMMISSION PHASE AND POST CLOSURE PHASE

Backfilling is concurrent with mining. A rehabilitation plan to ensure the land can be returned for use by forestry will be developed.

- Dewatering after closure
  - Recovery of water levels (positive). Area will return to forestry after closure.
- Deterioration of groundwater quality after closure
  - The potential impacts at **RSF 9** (without mitigation are potentially negative) due to the backfill material potentially contaminating groundwater. This is mitigated by the low salinity of the residue which is shown by the geochemistry study to be lower than the ambient groundwater quality. The facility will be covered with topsoil and returned to forestry.
  - The potential impact at **RSFC** (without mitigation) are potentially negative due to the possibility of contamination of groundwater from the deposition of material into RSF C as mining progresses. This is mitigated by the low salinity of the residue which is shown by the geochemistry study to be lower than the ambient groundwater quality. Facility will be covered with topsoil and returned to forestry.
  - The potential impact from the **Backfill areas 3, 4, & 5** is potentially negative without mitigation due to the possibility of contamination of groundwater because of deposition of material into pits as mining progresses. This is mitigated by the low salinity of the backfill and since the affected areas will be covered with topsoil and returned to forestry.

7.5 CUMULATIVE IMPACTS

All the impacts have been evaluated as the total (cumulative) impact in the section above. Impacts on the Wildlife Trust Rehabilitation area south of the coarse sand tailings dump area A2, will be low.

Table 7-1 - Significance rating table

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Groundwater	Lowering of water levels around the mine due to mine dewatering, which may impact on surface or groundwater users	Operation (mining)	Negative	Easy	3	2	1	2	4	**32**	**N3**	2	2	3	3	3	**30**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Groundwater	Recovery of water levels (positive). Area will return to forestry after closure.	Decommissioning and Closure	Positive	Easy	0	2	3	2	5	**35**	**P3**	0	2	3	2	5	**35**	**P3**
					Significance	**P3 - Moderate**							**P3 - Moderate**						
Impact 3:	Groundwater	Contamination of groundwater because of deposition of material into RSF 9 as mining progresses.	Operation (RSF 9)	Negative	Easy	2	2	3	5	5	**60**	**N3**	1	1	3	5	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 4:	Groundwater	Contamination of groundwater because of deposition of material into RSF 9 as mining progresses.	Decommissioning and Closure (RSF 9)	Negative	Easy	2	2	3	2	5	**45**	**N3**	1	1	3	2	3	**21**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 5:	Groundwater	Contamination of groundwater because of deposition of material into RSF C as mining progresses.	Operation (RSF C)	Negative	Easy	2	2	3	5	5	**60**	**N3**	1	1	3	5	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 6:	Groundwater	Contamination of groundwater because of deposition of material into RSF C as mining progresses.	Decommissioning and Closure (RSF C)	Negative	Easy	2	2	3	2	5	**45**	**N3**	1	1	3	2	3	**21**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 7:	Groundwater	Contamination of groundwater because of deposition of material into pits as mining progresses.	Operation Backfill areas 3,4, & 5	Negative	Easy	2	2	3	5	5	**60**	**N3**	1	1	3	5	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 8:	Groundwater	Contamination of groundwater because of deposition of material into pits as mining progresses.	Decommissioning and Closure (Backfill areas 3,4, & 5)	Negative	Easy	2	2	3	2	5	**45**	**N3**	1	1	3	2	3	**21**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

8 GROUNDWATER MONITORING SYSTEM

8.1 GROUNDWATER MONITORING NETWORK

8.1.1 SYSTEM RESPONSE MONITORING NETWORK

The groundwater monitoring boreholes should be distributed across the site, strategically situated to allow observation of groundwater quality fluctuation upgradient, within and downgradient of the potential contamination sources. The monitoring program must be used to guide environmental management decision making, including taking remedial measures when water quality guidelines are exceeded.

During the hydrocensus survey, several boreholes were identified both within the site boundary and outside of this. It is understood that the “W” named boreholes are previously installed monitoring wells. The TBH boreholes could potentially also serve as monitoring boreholes. It is anticipated that some of the boreholes will be destroyed by mining activities. Figure 8-1 shows the recommended monitoring boreholes and is based on:

- Existing boreholes that will not be destroyed by mining (W1, W5, W7, W11, W12, W14, TBH6, TBH 8 and TBH9).
- Boreholes that should be replaced if destroyed during mining (W3 and W6, these positions have been moved to outside the mining area).
- Additional proposed boreholes (P_BH1 to P_BH4).

The placement of these boreholes was selected to capture any potential plume development and to see what the water quality of the groundwater leaving the Por Durnford MRA is.

Five surface water monitoring points are also recommended:

- The Mzingwenya River (P_SW1).
- The Amanzamnyama River (P_SW2).
- Tributary of the KwaGugushe River (P_SW3).
- Tributary of the Mhlatuze river (P_SW4).
- Ojinjini River (P_SW5).

The geographic coordinates of the proposed monitoring points are presented in Table 8-1.

Figure 8-1 - Existing and proposed boreholes

Table 8-1 – Proposed system response monitoring network

Monitoring Points	Name	Longitude	Latitude	Description
Groundwater	W1	31° 53' 31.754" E	28° 52' 26.472" S	Existing
	W3	31° 51' 21.109" E	28° 51' 48.281" S	Replacement
	W5	31° 51' 37.620" E	28° 53' 13.920" S	Existing
	W6	31° 50' 39.003" E	28° 53' 24.193" S	Replacement
	W11	31° 49' 32.520" E	28° 54' 39.024" S	Existing
	W12	31° 47' 19.176" E	28° 54' 5.472" S	Existing
	W14	31° 48' 9.360" E	28° 55' 56.712" S	Existing
	TBH5a	31° 46' 43.464" E	28° 55' 14.916" S	Existing
	TBH6	31° 54' 27.072" E	28° 51' 4.212" S	Existing
	TBH8	31° 52' 40.800" E	28° 51' 42.840" S	Existing
	TBH9	31° 49' 39.000" E	28° 52' 55.380" S	Existing
	P_BH4	31° 47' 56.255" E	28° 55' 26.486" S	Proposed
	P_BH3	31° 48' 54.591" E	28° 54' 18.792" S	Proposed
	P_BH2	31° 52' 57.468" E	28° 52' 21.482" S	Proposed
	P_BH1	31° 52' 43.129" E	28° 51' 6.155" S	Proposed
	W7	31° 48' 55.152" E	28° 53' 21.948" S	Existing
Surface water	P_SW1	31° 53' 38.747" E	28° 52' 28.272" S	Proposed
	P_SW2	31° 48' 3.431" E	28° 55' 41.302" S	Proposed
	P_SW3	31° 47' 17.788" E	28° 53' 57.135" S	Proposed
	P_SW4	31° 52' 15.609" E	28° 50' 55.661" S	Proposed
	P_SW5	31° 46' 3.519" E	28° 55' 21.598" S	Proposed

8.1.2 MONITORING FREQUENCY

Monitoring should be carried out quarterly within the existing network during Phase 1. This is crucial to establish a seasonal baseline. To reduce costs this can be done by analysing a reduced set of parameters such as pH, EC, iron and manganese. It is important to also measure the water levels quarterly to establish the seasonal trend.

During Phase 2 mining, quarterly should continue with all monitoring parameters listed in section 8.2. If trends remain stable or are decreasing, monitoring can be reduced to bi-annual. The monitoring must be incorporated into the groundwater monitoring programme.

A database must be established, water quality fluctuation trends interpreted, exceedances be highlighted, and this data must be used to inform management decisions on the groundwater status quo thereafter. Based on this analysis, the monitoring frequency may be amended as considered necessary.

8.2 MONITORING PARAMETERS

The analytical suite for water samples should include pH and EC (and /or Total Dissolved Solids) with annual analyses of pH, EC, TDS, nitrate, sulfate, total alkalinity, and metals.

8.3 MONITORING BOREHOLES

A map showing the existing monitoring network is summarized in in Figure 8-1.

9 GROUNDWATER ENVIRONMENTAL MANAGEMENT PROGRAMME

9.1 CURRENT GROUNDWATER CONDITIONS

The current groundwater quality is shown in section 5.6, and these can be seen as baseline conditions before mining commences. The quality of is generally good.

9.2 PREDICTED IMPACTS OF FACILITY (MINING)

The water quality of the backfill and residue material is generally better than the background water quality. Together with the additional water, the model predicts a plume of dilution causing the groundwater quality to improve. This remains to be proven by future monitoring.

9.3 MITIGATION MEASURES

9.3.1 LOWERING OF GROUNDWATER LEVELS DURING FACILITY OPERATION (MINING)

No groundwater users have been identified in the area; therefore, the impact is limited to surface water resources. Backfilling into the pits will add water to the aquifer which reduces the duration of the impact. This minimises the cone of depression and impact on surface resources.

9.3.2 RISE OF GROUNDWATER LEVELS POST FACILITY OPERATION (MINING)

The model shows that the groundwater levels recover within two years after completion of mining. This new “steady state” water level is similar to pre-mining conditions. This is a positive impact.

9.3.3 SPREAD OF GROUNDWATER POLLUTION POST FACILITY OPERATION (MINING)

Salinity of the residue was shown by the geochemistry study (WSP, 2024b) to be lower than the ambient groundwater quality. Backfilling is active for a short period.

Due to the generally good water quality of the backfill and residue material the contamination plume causes dilution and results better water quality than before mining.

Lost boreholes in the backfill areas should be replaced as a mitigatory measure to check if there is any change in quality over time.

10 POST CLOSURE MANAGEMENT PLAN

Mondi is currently leasing most properties under the prospecting rights for commercial forestry purposes. Mondi will move out of the area and the plan is that they will re-establish forestry plantations after mining.

10.1 REMEDIATION OF STORAGE FACILITIES

In the draft scoping report for Port Durnford Mine, WSP (2024a) mentions the following actions for the decommissioning phase:

- Plant to be demolished and materials to be removed.
- Termination of all services to the area.
- Rehabilitation of all areas to be completed sufficiently to meet relevant commitments of the closure plan.

10.2 REMEDIATION OF ENVIRONMENTAL IMPACTS

Environmental impacts were shown to be minimal. After closure all the mining and backfilling areas will be topsoiled and returned to forestry.

10.3 REMEDIATION OF WATER RESOURCES IMPACTS

The impacts on water resources were shown to be minimal. The backfilled areas and RSF's will be covered with topsoil and returned to forestry after closure.

11 CONCLUSIONS AND RECOMMENDATIONS

The objective of the groundwater study was to establish the baseline geohydrological conditions on site and understand the potential impact of the proposed Port Durnford mining activities on the groundwater and surface water resources.

Model results show that the reduction in baseflow is mostly insignificant and that the backfilling with wet slurry allows for quick recovery of the drawdown during mining. Due to high recharge in the sand aquifer and the additional water added to the system with the backfill and/or residue, the concentration in the aquifer is attenuated. This is the opposite of what is generally expected from contamination sources. Therefore, the residue and backfill material are not strictly sources of contamination. However, monitoring should be put in place to check if there are any change in quality over time. When these diluted plumes reach the rivers and wetlands it is further reduced with the effect that minimal impacts are observed.

Water level and water quality impacts on the aquifer and receptors were found to be moderate before mitigation and low with mitigation. Water level drawdown is of short duration and backfilling (mitigation) with wet slurry allows the water levels to recover quickly. Contamination of the aquifer is limited due to the benign quality of the residue and backfill material. The model shows that the groundwater levels recover within two years after completion of mining. This new "steady state" water level is similar to pre-mining conditions. This is a positive impact. Salinity of the residue was shown by the geochemistry study (WSP, 2024b) to be lower than the ambient groundwater quality. The better water quality together with additional water added in the backfill and residue has a dilution effect on the water quality in the aquifer.

Impacts on the Wildlife Trust Rehabilitation area south of the coarse sand tailings dump area A2, will be low. A monitoring plan was recommended (Section 9) and should be put in place to check if there are any change in water level or quality over time.

Specific mention needs to be made to the following:

- There are two wetland areas that were excluded from the original mine plan. In these areas, the drawdown due to mining will be for the operational period, after which the water level will recover. It is however uncertain how the coarser backfill sand will affect the wetlands in the long-term.
- Sand tailings dump 8B is situated directly above the Natal Metamorphic Province geology which has a lower hydraulic conductivity. Therefore, water cannot infiltrate easily into the aquifer. Modelling showed that there will be accumulation of water during its operational time from 2047 to 2053. This additional water will need to be managed by digging trenches around it and collecting the water. Monitoring of water levels in the Ojinjini River is recommended.
- Toe seepages may also occur to a lesser extent in the other coarse sand tailings deposition areas. This needs to be monitored and managed as above if necessary.
- It is recommended that the ratio of solids to water for the coarse sand deposition as well as the fines (RSF) be confirmed during the feasibility study. It is important to also understand the water recovery after deposition and the losses due to evaporation.

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DETAILS AND DECLARATION OF THE SPECIALIST

DETAILS OF THE SPECIALISTS

Task	Hydrogeology model
Full Name	Talita van Zyl
Title/Position	Groundwater modeller
Qualification	MSc
Professional Affiliations	SACNASP 400045/06

DECLARATION OF INDEPENDENCE BY SPECIALIST

I, Talita van Zyl., a duly authorised representative of WSP (Pty) Ltd, declare that I –

- Act as the independent specialist in this application.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed.
- Do not have nor will have a vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

Appendix A

2022 HYDROCENSUS FIELD NOTES AND BOREHOLE PHOTOS

Confidential

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	2831DD00131				
Village/Farm:	Mondi Farm		Date:		/10/2022
GPS Co-ordinates:	Latitude 25.97568				
(WGS 1984)	Longitude 032.58957				
1:50 000 Map No.					
Elevation:			(mamsl)		
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	6.18		Diameter:	150	
WL: (m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	0.32	(m)	SWL: (m below ground level)		
Water sample collected:	~~Yes~~ / (No)	Time: 9:38	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH3				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.89145°				
(WGS 1984)	Longitude 031.82434°				
1:50 000 Map No.					
Elevation: 57			(mamsl)		
Topography: Flat Lying					
Geology:					
General location and accessibility: Accessible					
Photo:	(Yes) / No	Test pumping of existing strong yielding borehole		Yes / (No)	

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	51.80	Diameter:	150
WL: (m below measuring point)	—	Yield: (Reported/measured)	/
Height: (measuring point above ground level)	0 (m)	SWL: (m below ground level)	8.84
Water sample collected:	Yes / (No)	Time: 10:06	Field pH and EC taken: pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH2				
Village/Farm:	Mandi		Date:	8 /10/2022	
GPS Co-ordinates:	Latitude 28.89146°				
(WGS 1984)	Longitude 031.82438°				
1:50 000 Map No.					
Elevation:	57 (mamsl)				
Topography:	Flat lying				
Geology:					
General location and accessibility:	Accessible				
Photo:	(Yes) / No	Test pumping of existing strong yielding borehole		Yes (No)	

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	65.70		Diameter:	150	
WL:(m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	027 (m)		SWL: (m below ground level)	9.18	
Water sample collected:	Yes / (No)	Time: 10:07	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH1				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.89338				
(WGS 1984)	Longitude 031.82102				
1:50 000 Map No.					
Elevation: 44			(mamsl)		
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	33.10	Diameter:	150
WL: (m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) 0.14 (m)		SWL: (m below ground level)	3.82
Water sample collected:	Yes (No) Time: 10:36	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W1				
Village/Farm:			Date: 9 /10/2022		
GPS Co-ordinates:	Latitude 28.07402				
(WGS 1984)	Longitude 031.89224				
1:50 000 Map No.					
Elevation: #	44 (mamsl)				
Topography: Flat lying					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	12.74	Diameter:	150
WL: (m below measuring point)	2.69	Yield: (Reported/measured)	
Height: (measuring point above ground level) 0.60 (m)		SWL: (m below ground level)	
Water sample collected:	Yes / No	Time: 9:51	Field pH and EC taken
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W5				
Village/Farm:			Date: 9 /11/2022		
GPS Co-ordinates: (WGS 1984)	Latitude 28.88717				
	Longitude 031.86041				
1:50 000 Map No.					
Elevation:	36 (mamsl)				
Topography: Flat lying					
Geology: Adjacent to swamp wetland area.					
General location and accessibility:					
Photo: (Yes) / No	Test pumping of existing strong yielding borehole				Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:	200	
WL: (m below measuring point)	3.54 m		Yield: (Reported/measured)		
Height: (measuring point above ground level)	(m)		SWL: (m below ground level)		
Water sample collected:	(Yes) / No	Time: 10:15	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W13				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 2890704				
(WGS 1984)	Longitude 031.80481				
1:50 000 Map No.					
Elevation: 111			(mamsl)		
Topography: On hill within forrest.					
Geology:					
General location and accessibility: Adjacent to road in Mondi Forest					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	>100m		Diameter:	200mm	
WL: (m below measuring point)	—		Yield: (Reported/measured)		
Height: (measuring point above ground level)	0.35	(m)	SWL: (m below ground level)		
Water sample collected:	Yes (No)	Time: 11:29	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:	Dry				

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W14				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.93239				
(WGS 1984)	Longitude 31.80258				
1:50 000 Map No.					
Elevation:	4 (mamsl)				
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	20.95		Diameter:	200	
WL: (m below measuring point)	2.70		Yield: (Reported/measured)		
Height: (measuring point above ground level)	0.50 (m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time: 11:44	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH11				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude				
(WGS 1984)	Longitude				
1:50 000 Map No.					
Elevation:			(mamsl)		
Topography:					
Geology:					
General location and accessibility:	Likely ~~dead~~ destroyed. couldn't locate				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:		
WL: (m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	(m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time:	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH 12				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.93206°				
(WGS 1984)	Longitude 031.83714°				
1:50 000 Map No.					
Elevation:	26 (mamsl)				
Topography:					
Geology:					
General location and accessibility:	Blocked.				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:		
WL: (m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	(m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time: 12:32	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH13				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.92756				
(WGS 1984)	Longitude 031.83699				
1:50 000 Map No.					
Elevation:	29	(mamsl)			
Topography: On Coastal dunes					
Geology:					
General location and accessibility: Difficult to access destroyed.					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:		
WL: (m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	(m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time: 12:50	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa

Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH4				
Village/Farm:	Mandi		Date:		/10/2022
GPS Co-ordinates:	Latitude 28.91486				
(WGS 1984)	Longitude 031.82590				
1:50 000 Map No.					
Elevation: 21			(mamsl)		
Topography: flat lying saturated area					
Geology:					
General location and accessibility: adjacent to tramline in swamp area					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	1.97		Diameter:	170	
WL: (m below measuring point)	0.16		Yield: (Reported/measured)		
Height: (measuring point above ground level)		(m)	SWL: (m below ground level)		
Water sample collected:	Yes / No	Time: 13:07	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W9				
Village/Farm:	Mondi		Date:		/10/2022
GPS Co-ordinates:	Latitude 28.90648				
(WGS 1984)	Longitude 031.83956				
1:50 000 Map No.					
Elevation: 21			(mamsl)		
Topography: Flat lying area					
Geology:					
General location and accessibility: adjacent to road, completely destroyed					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	
WL: (m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes (No) Time: 13:26	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa

Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH6				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.85128				
(WGS 1984)	Longitude 031.90754				
1:50 000 Map No.					
Elevation:	48	(mamsl)			
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	/	Diameter:	
WL: (m below measuring point)	/	Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	(Yes) / No Time: 14:13	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type: Hand Pump		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	2831DD00129		Inaccessible (cannot locate)		
Village/Farm:	Not Located		Date: 8 /10/2022		
GPS Co-ordinates:	Latitude				
(WGS 1984)	Longitude				
1:50 000 Map No.					
Elevation:			(mamsl)		
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:		
WL: (m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)	(m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time:	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBHK				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28,9163				
(WGS 1984)	Longitude 031,7503				
1:50 000 Map No.					
Elevation:	23 (mamsl)				
Topography:					
Geology:					
General location and accessibility:	Destroyed				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	
WL:(m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes / No Time: 10:50	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
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Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH 5 + 5a				
Village/Farm:			Date: **/10/2022**		
GPS Co-ordinates: (WGS 1984)	Latitude				
	Longitude				
1:50 000 Map No.					
Elevation:			(mamsl)		
Topography:					
Geology:					
General location and accessibility:	Behind locked farm gates. No access				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:			Diameter:		
WL:(m below measuring point)			Yield: (Reported/measured)		
Height: (measuring point above ground level)		(m)	SWL: (m below ground level)		
Water sample collected:	Yes / No	Time:	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

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Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	WI2				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates: (WGS 1984)	Latitude 28.90149				
	Longitude 031.78862				
1:50 000 Map No.					
Elevation: 57			(mamsl)		
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	~~60~~ 57.20	Diameter:	200
WL: (m below measuring point)	25.00	Yield: (Reported/measured)	
Height: (measuring point above ground level) 0.45 (m)		SWL: (m below ground level)	
Water sample collected:	(Yes) / No Time: 11:19	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH15				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.88267				
(WGS 1984)	Longitude 031 76535.				
1:50 000 Map No.					
Elevation:	79. (mamsl)				
Topography:					
Geology:					
General location and accessibility:	Removed				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	
WL:(m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes (No) Time: 11:59	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH16				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.88308				
(WGS 1984)	Longitude 031.75885				
1:50 000 Map No.					
Elevation: 73			(mamsl)		
Topography:					
Geology:					
General location and accessibility: Broken Pump.					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	
WL: (m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes (No) Time: 12:04	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W7				
Village/Farm:	Monali		Date:		/10/2022
GPS Co-ordinates:	Latitude 28.88943				
(WGS 1984)	Longitude 31.81531				
1:50 000 Map No.					
Elevation: 108			(mamsl)		
Topography: On the hillside adjacent to to forrest					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	63.73		Diameter:	200	
WL:(m below measuring point)	19.19.		Yield: (Reported/measured)		
Height: (measuring point above ground level)		(m)	SWL: (m below ground level)		
Water sample collected:	(Yes) / No	Time: 12:24	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
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Telephone: + (27) (0)11 254-4800
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Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W4				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.87189				
(WGS 1984)	Longitude 031.86835				
1:50 000 Map No.					
Elevation:	73 (mamsl)				
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	62.46	Diameter:	200
WL: (m below measuring point)	38.66	Yield: (Reported/measured)	
Height: (measuring point above ground level)	0.60 (m)	SWL: (m below ground level)	
Water sample collected:	(Yes) / No Time: 15:07	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	W3.				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates: (WGS 1984)	Latitude 28.86645				
	Longitude 031.85545				
1:50 000 Map No.					
Elevation:	78 (mamsl)				
Topography:	Side of hill adjacent to Mondi forrest				
Geology:					
General location and accessibility:	Adjacent to Mondi Forrest				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	~~210m~~ 87.44	Diameter:	200
WL: (m below measuring point)	Dry.	Yield: (Reported/measured)	
Height: (measuring point above ground level)	0.5m (m)	SWL: (m below ground level)	
Water sample collected:	Yes / No Time: 15:19.	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	NG				
Village/Farm:			Date: // /10/2022		
GPS Co-ordinates:	Latitude 28.88597				
(WGS 1984)	Longitude 031.83893				
1:50 000 Map No.					
Elevation: 65m			(mamsl)		
Topography: Undulating surface					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	200
WL: (m below measuring point)	38.66	Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected: Yes / No	Time: 10:09	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH4				
Village/Farm:			Date:	11/10/2022	
GPS Co-ordinates:	Latitude 28.89508				
(WGS 1984)	Longitude 031.82931				
1:50 000 Map No.					
Elevation: 45 (mamsl)					
Topography: Undulating surface in ravine ~~btw~~ between forest mound					
Geology:					
General location and accessibility: Locked.					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	
WL: (m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes / (No) Time: 10:18	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	WZ				
Village/Farm:			Date: 11 /11/2022		
GPS Co-ordinates:	Latitude 28.86715				
(WGS 1984)	Longitude 031.87173				
1:50 000 Map No.					
Elevation: 90 (mamsl)					
Topography: Slightly sloping area within the mendi forest.					
Geology:					
General location and accessibility:					
Photo: Yes / No	Test pumping of existing strong yielding borehole			Yes / No	

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	76.42.	Diameter:	200
WL: (m below measuring point)	59.10	Yield: (Reported/measured)	
Height: (measuring point above ground level) 0.55 (m)		SWL: (m below ground level)	
Water sample collected:	Yes / No Time: 10:34	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:			(l/s)
Pumping Period:			(hrs/day)
Diameter of Discharge Pipe:			(mm) (Estimated)
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH8				
Village/Farm:			Date:	11 /10/2022	
GPS Co-ordinates:	Latitude 28.86188				
(WGS 1984)	Longitude 031.87807				
1:50 000 Map No.					
Elevation:	120 (mamsl)				
Topography:	Top of hill adjacent to water pump station.				
Geology:					
General location and accessibility:	The well was locked with a rusted bolt next I battled to open.				
Photo:	(Yes) / No	Test pumping of existing strong yielding borehole		Yes / No	

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:		Diameter:	200
WL: (m below measuring point)		Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	(Yes) / No Time: 10:53	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
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Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH7				
Village/Farm:	Mondi + Transnet		Date: 11 /10/2022		
GPS Co-ordinates: (WGS 1984)	Latitude 28.85387				
	Longitude 031.88891				
1:50 000 Map No.					
Elevation:	37 (mamsl)				
Topography:	Slightly undulating surface adjacent to the rail line Mondi forest				
Geology:					
General location and accessibility:	Dry				
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	10.44	Diameter:	200
WL: (m below measuring point)	~~0.00~~ —	Yield: (Reported/measured)	
Height: (measuring point above ground level)	0 (m)	SWL: (m below ground level)	
Water sample collected:	Yes / No Time: 11:24	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

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Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	WII				
Village/Farm:	Mondi		Date:	11 /10/2022	
GPS Co-ordinates:	Latitude 28.91088				
(WGS 1984)	Longitude 031. 82568				
1:50 000 Map No.					
Elevation: 34			(mamsl)		
Topography:					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole		Tel no:		
BH Depth:	26.18		Diameter:	200	
WL:(m below measuring point)	1.92		Yield: (Reported/measured)		
Height: (measuring point above ground level)	0.53 (m)		SWL: (m below ground level)		
Water sample collected:	Yes / No	Time: 11:51	Field pH and EC taken	pH:	
Volume collected				EC:	mS/m
Water use:					

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:			(l/s)
Pumping Period:			(hrs/day)
Diameter of Discharge Pipe:			(mm) (Estimated)
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
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Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH 21				
Village/Farm:			Date:		**/10/2022**
GPS Co-ordinates:	Latitude 28.92814				
(WGS 1984)	Longitude 031.86408				
1:50 000 Map No.					
Elevation:	24	(mamsl)			
Topography: On dunes ~~bord~~ bordering the local community adjacent to open water system					
Geology:					
General location and accessibility:					
Photo:	Yes / No	Test pumping of existing strong yielding borehole			Yes / No

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	3.97	Diameter:	110
WL: (m below measuring point)	1.32	Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	(Yes) / No Time: 12:32.	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:		Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:		(l/s)	
Pumping Period:		(hrs/day)	
Diameter of Discharge Pipe:		(mm) (Estimated)	
Condition of facility			
Use:			
Estimated yield:			

Hydrocensus Form

WSP Group Africa (Pty) Ltd
P O Box 6001, Halfway House, 1685, South Africa
Telephone: + (27) (0)11 254-4800
Facsimile: + (27) (0)11 315-0317

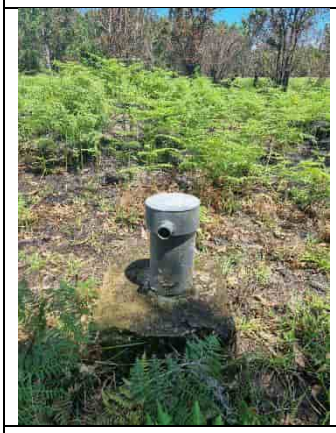
Project Description:	**Tronox Port Dunford**	Project No.:	**41106008**	Phase	**008**
Hydrocensus No:			Recorded by:		
Existing BH No. (if visible)	TBH17				
Village/Farm:	Kwashodlisa		Date:	11/10/2022	
GPS Co-ordinates:	Latitude 28.85741				
(WGS 1984)	Longitude 031.80899.				
1:50 000 Map No.					
Elevation:	84	(mamsl)			
Topography:	low lying area between adjacent hills				
Geology:					
General location and accessibility:	Broken Pump in the bushes.				
Photo:	(Yes) / No	Test pumping of existing strong yielding borehole		Yes / No	

BOREHOLE INFORMATION

Owner:	Community borehole	Tel no:	
BH Depth:	—	Diameter:	—
WL: (m below measuring point)	—	Yield: (Reported/measured)	
Height: (measuring point above ground level) (m)		SWL: (m below ground level)	
Water sample collected:	Yes / (No) Time: 15:30	Field pH and EC taken	pH:
Volume collected			EC: mS/m
Water use:			

PUMPING EQUIPMENT

Pump Type:	Pump.	Driven By:	
Pump Depth:	(m)	Horse Power:	
Discharge:	(l/s)		
Pumping Period:	(hrs/day)		
Diameter of Discharge Pipe:	(mm) (Estimated)		
Condition of facility			
Use:			
Estimated yield:			

View of W1	View of W2
View of W3	View of W4
	
View of W5	View of W6
View of W7	View of W9

View of W11	View of W12
View of W13	View of TBH1
View of TBH2	View of TBH3
View of TBH4	View of TBH 5a and 5b surroundings

View of TBH6	View of TBH7
View of TBH8	View of TBH9
View of TBH10	View of TBH12
View of TBH13	View of TBH14

View of TBH15	View of TBH16
View of TBH17	View of TBH18 surroundings
View of TBH19	View of TBH20 surroundings
View of TBH21	

Appendix B

PREVIOUS HYDROCENSUS RESULTS (GCS 2020)

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	Sample ID	ANS 241:2011	Class 0	Class 1	Class 2	Class 3	Class 4	Ambient	TBH10	W14	W5	W1	Ambient	TBH21	TBH19	Ambient	TBH5A	TBH2	TBH7	TBH6	W4
												SE boundary in sensitve wetland			outside and to the south						
Aquifer								Shallow					Coastal			Deeper					
Water level (mbg)									1	2.2	3.78	3.03		0.41					13.5		23.15
									Jul-20	Jul-20	Jul-20	Jul-20		Jul-20	Jul-20		Jul-20	Jul-20	Jul-20	Jul-20	Jul-20
									W13B	W13B	W12F	W12F		W12F	W12F		W13B	W13B	W12F	W12F	W12F
pH	pH units	5-9.7	7-9.5	9.5-10	10-10.5	10.5-11	>11	6.8-9.3	7.9	9.3	9.1	8.3	7.1-7.6	7.1	7.6	7.9-8.2	8.2	6.8	5.6	8.4	8.5
Electrical Conductivity @25C	mS/m	170 (A)	<70	70-150	150-370	370-520	>520	31-51	59.6	43.7	31.1	51.2	68-105	105	68	44-60	43.7	36.4	48.3	31.2	37
TDS	mg/l	1200 (A)	<450	450-1000	1000-2400	2400-3400	>3400	182-296	296	230	182	296	370-556	"556	"370	242-296	242	182	254	174	186
Nitrate as N	mg/l	11 (AH)	<6	"6-10	"10-20	20-40	>40	0.1-0.4	-0.04	-0.04	-0.04	-0.04	<0.14	-0.04	0.14	<0.04	-0.04	0.36	-0.04	-0.04	-0.04
Sulphate	mg/l	250 (A), 500 (AH)	<200	200-400	400-600	600-1000	>1000	0.3-5	2.14	0.28	0.44	0.42	0.4-33	32.8	0.39	2-5	5.21	4.82	0.43	0.26	0.74
Chloride	mg/l	300 (A)	<100	100-200	200-600	600-1200	>1200	39-99	79	99	41	53	145-173	145	173	73-79	73	39	121	71	52
Fluoride	mg/l	1.5 (CH)	<0.7	0.7-1.0	1.0-1.5	1.5-3.5	>3.5	0.1-0.5	0.21	0.45	0.31	0.17	<0.3	-0.03	0.33	0.1-0.2	0.12	0.16	-0.03	-0.03	0.21
Phosphorus	mg/l	-	-	-	-	-	-														
Total Cyanide	mg/l	0.2 (AH)	-	-	-	-	-														
Total Alkalinity as CaCO3	mg/l	-	-	-	-	-	-	22-160	166	22	80	160	30-231	231	30	52-166	52	110	4	22	96
Calcium	mg/l	-	-	-	-	-	-	1-33	12.8	1.4	1.6	7.81	10-57	57	10.4	12-13	13.4	17.7	9.24	2.64	5.29
Magnesium	mg/l	-	<70	70-100	100-200	200-400	>400	0.3-7.1	17.7	0.29	2.23	2.68	17-30	30	17.5	13-18	13	5.38	8.31	4.78	3.36
Sodium	mg/l	200 (A)	<70	70-100	100-200	200-400	>400	33-79	76	79	53	79	75-92	92	75	43-76	43	42	24	33	33
Potassium	mg/l	-	<25	25-50	50-100	100-500	>500	2-10	4.58	2.82	3.94	9.68	2-3	2.4	2.84	4-5	3.95	3.99	3.12	2.33	7.34
Aluminium	mg/l	0.3 (O)	-	-	-	-	-	<0.03	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	0.03	-0.02	-0.02	-0.02
Arsenic	mg/l	0.01 (CH)	<0.01	0.01-0.05	0.05-0.2	0.2-2	>2	<0.04	-0.04	-0.04	-0.04	-0.04	<0.04	-0.04	-0.04	<0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Cobalt	mg/l	-	-	-	-	-	-	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Chromium	mg/l	0.05 (CH)	-	-	-	-	-	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Copper	mg/l	2 (CH)	0-0.5	0.5-1	"1-2	"2-15	>15	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Iron	mg/l	0.3 (A), 2 (CH)	<0.5	0.5-1	"1-5	"5-10	>10	<0.11	0.02	-0.02	-0.02	-0.02	<0.04	-0.02	0.04	(<0.02-20 in	-0.02	0.11	20	0.53	-0.02
Manganese	mg/l	0.1 (A), 0.4(CH	<0.1	0.1-0.4	0.4-4	"4-10	>10	0.03-0.04	0.13	-0.02	-0.02	0.04	0.2-0.5	0.24	0.50	(<0.02-0.76 in	-0.02	-0.02	0.90	0.51	-0.02
Nickel	mg/l	0.07 (CH)	-	-	-	-	-	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Lead	mg/l	0.01 (CH)	-	-	-	-	-	<0.03	-0.03	-0.03	-0.03	-0.03	<0.03	-0.03	-0.03	<0.03	-0.03	-0.03	0.04	-0.03	-0.03
Barium	mg/l	0.7 (CH)	-	-	-	-	-	<0.02	0.02	-0.02	-0.02	-0.02	0.03-0.1	0.03	0.1	0.02-0.1	0.06	-0.02	0.50	0.08	-0.02
Boron	mg/l	2.4 (CH)	-	-	-	-	-	<0.03	-0.02	-0.02	-0.02	0.04	<0.02	-0.02	-0.02	<0.02	-0.02	0.03	0.10	-0.02	-0.02
Strontium	mg/l	-	-	-	-	-	-	0.04-0.2	0.06	-0.02	-0.02	0.07	0.1-0.3	0.29	0.12	<0.1	0.12	0.09	0.11	0.03	0.04
Tin	mg/l	-	-	-	-	-	-	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Vanadium	mg/l	-	-	-	-	-	-	<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc	mg/l	5 (A)	<3	>5	10	20	>20	<0.02	0.03	-0.02	-0.02	-0.02	0.3-3	0.3	3.25	<0.03	-0.02	-0.02	0.05	0.93	-0.02
Zirconium	mg/l							<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Antimony	mg/l	0.02 (CH)						<0.009	-0.009	-0.009	-0.009	-0.009	<0.009	-0.009	-0.009	<0.009	-0.009	-0.009	-0.009	-0.009	-0.009
Beryllium	mg/l							<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Bismuth	mg/l																				
Cadmium	mg/l	0.003 (CH)						<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Lithium	mg/l							<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/l	0.006 (CH)						<0.002	-0.002	-0.002	-0.002	-0.002	<0.002	-0.002	-0.002	<0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Molybdenum	mg/l							<0.11	-0.11	-0.11	-0.11	-0.11	<0.11	-0.11	-0.11	<0.11	-0.11	-0.11	-0.11	-0.11	-0.11
Selenium	mg/l	0.04 (CH)						<0.07	-0.07	-0.07	-0.07	-0.07	<0.07	-0.07	-0.07	<0.07	-0.07	-0.07	-0.07	-0.07	-0.07
Silver	mg/l							<0.01	-0.01	-0.01	-0.01	-0.01	<0.01	-0.01	-0.01	<0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Tellurium	mg/l																				
Thallium	mg/l							<0.02	-0.02	-0.02	-0.02	-0.02	<0.02	-0.02	-0.02	<0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Titanium	mg/l							<0.03					<0.03			<0.03					
Class								0	1 (Mn)	1 (Mn)	0	0	0	1 (Mn)	2 (Mn)	0	0	0	4 (Fe)	1 (Mn, Fe)	0

Appendix C

METHODOLOGY FOR ASSESSING IMPACT SIGNIFICANCE

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METHODOLOGY FOR ASSESSING IMPACT SIGNIFICANCE

Impacts will be assessed in terms of the following criteria:

Nature

This is a description of what causes the effect, what will be affected and how it will be affected as described in **Table 9-1**.

Table 9-1 – Nature or type of impact

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

Physical extent

Table 9-2 – Physical extent rating of impact

Score	Description
1	the impact will be limited to the site;
2	the impact will be limited to the local area (local study area);
3	the impact will be limited to the region;

Score	Description
4	the impact will be national; or
5	the impact will be international;

Duration

The duration, wherein it is indicated whether the lifetime of the impact will be as described in **Table 9-3**.

Table 9-3 – Duration rating of impact

Score	Description
1	Of a very short duration (0 to 1 years)
2	Of a short duration (2 to 5 years)
3	Medium term (5–15 years)
4	Long term (> 15 years)
5	Permanent (this is considered permanent if the impact will be experienced post mine closure)

Reversibility

An impact is either reversible or irreversible. This considers how long it takes before impacts on receptors cease to be evident and is described in **Table 9-4**.

Table 9-4 – Reversibility of Impact

Score	Description
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

Magnitude

The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned (Table 9-5).

Table 9-5 – Magnitude rating of impact

Score	Description
0	Small and will have no effect on the environment.
1	Minor and will not result in an impact on processes (to be defined by individual specialist fields).
2	Low and will cause a slight impact on processes.
3	Moderate and will result in processes continuing but in a modified way.
4	High (processes are altered to the extent that they temporarily cease).
5	Very high and results in complete destruction of patterns and permanent cessation of processes.

Probability

The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale of 1 – 5 (**Table 9-6**).

Table 9-6 – Probability Rating of Impact

Score	Description
1	Very improbable (probably will not happen).
2	Improbable (some possibility, but low likelihood).
3	Probable (distinct possibility).
4	Highly probable (most likely).
5	Definite (impact will occur regardless of any prevention measures).

The significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;

- The status, which is described as either positive, negative or neutral;

- The degree to which the impact can be reversed;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

The significance is determined by combining the above criteria in the following formula:

Significance = (Extent + Duration + Reversibility + Magnitude) x Probability

[S= (E+D+R+M) ×P]

Where the symbols are as follows:

Symbol	Criteria	Description
S	Significance Weighting	-
E	Extent	**Table 9-2**
D	Duration	**Table 9-3**
M	Magnitude	**Table 9-5**
P	Probability	**Table 9-6**

The significance weightings for each potential impact are as follows:

Overall Score	Significance Rating (Negative)	Significance Rating (Positive)	Description
< 30 points	Low	Low	Where this impact would not have a direct influence on the decision to develop in the area
31 - 60 points	Medium	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	High	High	Where the impact must have an influence on the decision process to develop in the area

Appendix D

DOCUMENT LIMITATIONS

DOCUMENT LIMITATIONS

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Appendix D

AQUATIC BIODIVERSITY ASSESSMENT (WSP, 2025)

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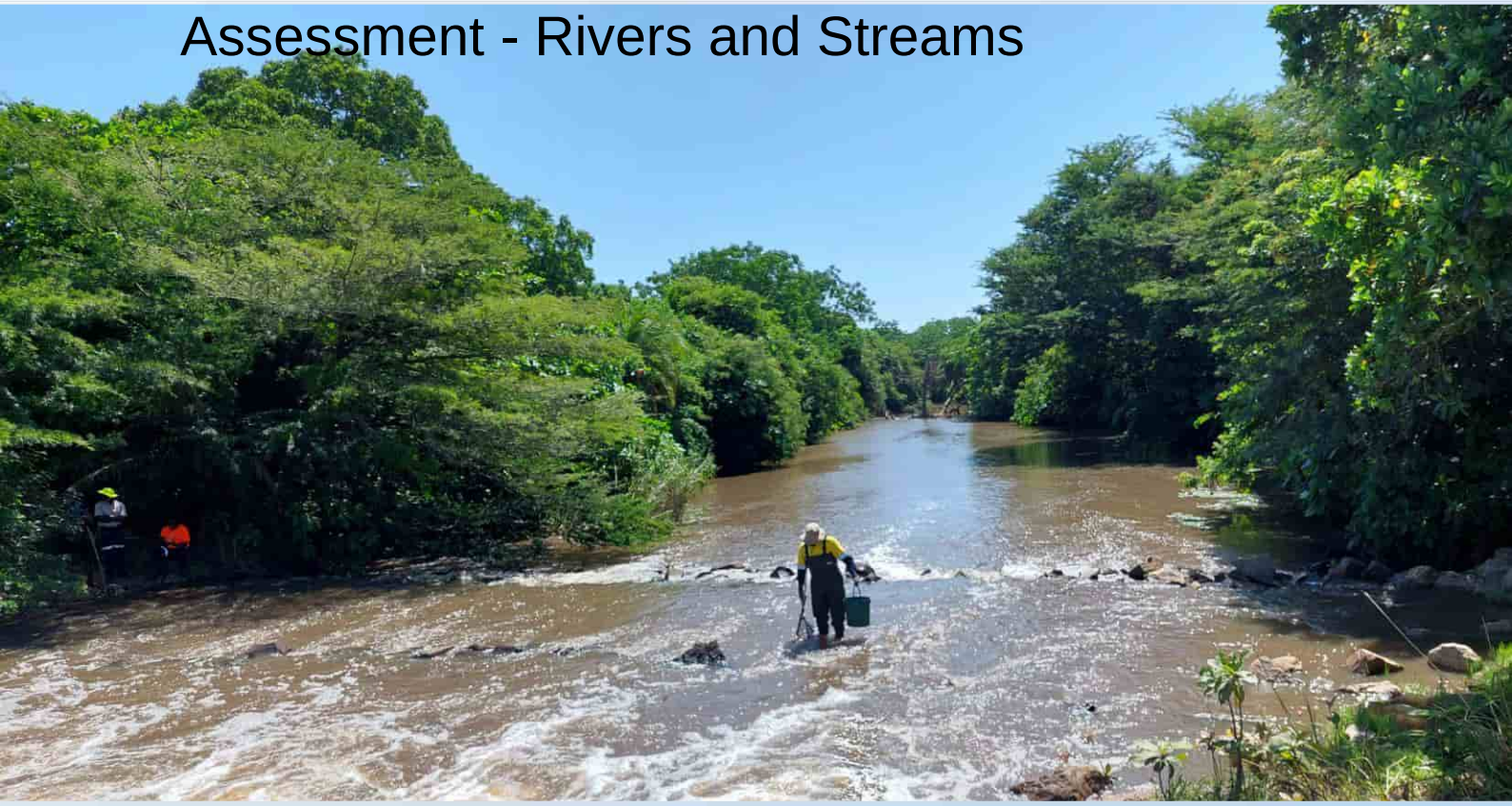
Tronox KZN Sands (Pty) Ltd.

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORTDUNFORT MINE, KWAZULU-NATAL

Aquatic Biodiversity Baseline and Impact Assessment - Rivers and Streams



41106008
FEBRUARY 2025

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Tronox KZN Sands (Pty) Ltd.

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORTDUNFORT MINE, KWAZULU-NATAL

Aquatic Biodiversity Baseline and Impact Assessment - Rivers and Streams

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 41106008

OUR REF. NO. 41106008

DATE: FEBRUARY 2025

Tronox KZN Sands (Pty) Ltd.

INTEGRATED ENVIRONMENTAL AUTHORISATION FOR THE PORTDUNFORT MINE, KWAZULU-NATAL

Aquatic Biodiversity Baseline and Impact Assessment - Rivers and Streams

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2
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Date	August 2024	November 2024	February 2025
Prepared by	Tebogo Khoza	Tebogo Khoza	Tebogo Khoza
Signature			
Checked by	Brent Baxter	Client	Brent Baxter
Signature			
Authorised by	Tebogo Khoza	Tebogo Khoza	Tebogo Khoza
Signature			
Project number	41106008		
Report number	41106008-REP001		
File reference			

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EXECUTIVE SUMMARY

WSP Group Africa (Pty) was appointed by Tronox KZN Sands (Pty) Ltd (Tronox) to undertake the independent environmental impact assessment (EIA), associated authorisation or licensing processes and supporting specialist studies for the proposed Port Dunford Project. The current document details findings from the Baseline Aquatic Biodiversity survey and Impact Assessment. Surveys were undertaken in November 2022 and May 2023.

The Port Dunford Project Area is situated within the KwaZulu-Natal Province under the jurisdiction of the uMhlathuze and uMlalazi Local Municipalities, both of which fall within the uThungulu District Municipality. The Project area is surrounded by a number of villages and townships with Mtunzini being the nearest town – approximately 3 km southwest from the nearest proposed Project boundary. The Hillendale mine, which is in the process of application for closure, is located adjacent the northeast boundary of the Project area and the active Fairbreeze mine is located approximately 5 km southwest.

The project area falls within primary drainage region W within the Pongola Mtamvuna Water Management Area (WMA) and the W12F and W13B quaternary catchments which drain the eastern and western portions of the proposed project site respectively. Major rivers which drain the Mining Right Area (MRA) include the Mhlatuze, Mzingwenya, Ntuze and Mlalazi. The affected portions of these rivers and associated tributaries were the focus of the current study.

The MRA predominantly lies within a heavily transformed area dominated by commercial Eucalyptus plantations, areas previously under commercial sugarcane which are in process of being planted to macadamia nut orchards, and community-based agriculture including small-scale sugar production and livestock raising. Major existing impacts within riverine habitats include increased sediment load and acid pH water possibly driven by Eucalyptus plantations. Furthermore, the major impacts associated with the community-based residential areas, which surround much of the MRA, include water quality modifications from the small-scale sugarcane fields and cattle farming activities.

The following key findings are highlighted as part of the current aquatic biodiversity and impact assessment study:

In situ water quality in the upper reach of the Mlalazi River was *Good*. Conversely, water quality at most other sites sampled in situ was *Moderate* to *Poor* (with notable exceedances in pH and dissolved oxygen levels) at a few sites. All sites where *Poor* water quality was recorded lie downstream or within Eucalyptus plantations and or areas of sugarcane cultivation. In addition to *in situ* water quality sampling, samples were collected for diatom analysis. Diatoms are indicators of good water quality. The trend in ecological water quality, as indicated by diatom presence and diversity, was similar to the *in situ* water quality results; across the breadth of the site, variable conditions from *Good* through to *Poor* were encountered and largely consistent in relation to quality when compared to *in situ* water quality.

The sampled macroinvertebrate community was of low diversity, comprising of only 30 taxa, and the assemblages were dominated by pollution-tolerant taxa. The Macroinvertebrate Response Assessment Index based (MIRAI) ecological condition ranged from *Seriously Modified* to *Critically Modified*. The modified state is an indication that the condition deviates from the reference condition.

A total of 701 fish specimens comprising of 19 species – seven more compared to the previous aquatic biodiversity assessment (Marine & Estuarine Research, 2009) – were recorded in the current study. Only two of the collected species are of conservation concern – *Aplocheilichthys myaposae* reported as 'Near Threatened' (NT) and *Enteromius gurneyi* as Vulnerable (VU). The Ecological Categories ranged from *Moderately Modified* to *Critically Modified* conditions.

The integrated ecological state (EcoStatus) of the assessed reaches were determined to be *Largely Modified* at most of the sites during both surveys, *Moderately Modified* at the mainstem Ntuze River during both surveys and *Seriously Modified* at the Ntuze Tributary and Mlalazi River during the high flow survey. The low macroinvertebrate and fish diversity were attributed to the historic and on-going land use activities, mainly small-scale to large-scale sugarcane farming and Eucalyptus plantations within the study area which have significantly impacted the receiving environment.

Based on the impact assessment, potential impacts are predicted to range between *High* to *Moderate* and may be reduced upon implementation of mitigation measures. Furthermore, the planned placement of infrastructure and mine operations predominantly occurs within heavily transformed areas where drainage lines are no longer apparent, thus the potential to impact upon riparian habitat ecosystems has been significantly reduced

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ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Acronym/Abbreviation	Definition
ASPT	Average Score Per Taxa
CBA	Critical Biodiversity Area
CPC	Central Processing Complex
CSIR	Council for Scientific and Industrial Research
DMRE	Department of Mineral Resources and Energy
DO	Dissolved Oxygen
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Category
EMPr	Environmental Management Programme
ESIA	Environmental and Social Impact Assessment
FRAI	Fish Response Assessment Index
IHAS	Invertebrate Habitat Assessment System
IHI	Index for Habitat Integrity
MIRAI	Macro-Invertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act
MRA	Mining Rights Area
MSP	Mineral Separation Plant
NBA	National Biodiversity Assessment
NEM:WA	National Environmental Management: Waste Act
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REMP	River EcoStatus Monitoring Programme
RHP	River Health Programme
RSF	Residue Storage Facility
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SASS5	South African Scoring System version 5
SQR	Sub-Quaternary Reach
TWQR	Target Water Quality Range
WMA	Water Management Area
WML	Waste Management License

Acronym/Abbreviation	Definition
WRC	Water Research Commission
WUL	Water Use Licenses

Report Requirements

Legal Requirement		Section in Report
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	See below current table Appendix F
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	See below current table
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
c (i)	And indication of the quality and age of the base data used for the specialist report;	Section 5
c (ii)	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7.5
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	Section 4 and Appendix A
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 7.1.1
(g)	an identification of any areas to be avoided, including buffers;	Section 7.1.2
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7.1.2
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7

Legal Requirement		Section in Report
(k)	any mitigation measures for inclusion in the EMPr;	Section 7
(l)	any conditions/aspects for inclusion in the environmental authorisation;	Section 8
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7.6
(n)	a reasoned opinion (Environmental Impact Statement) -	Section 7.5.1
	whether the proposed activity, activities or portions thereof should be authorised; and	
	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q)	any other information requested by the competent authority.	N/A

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DECLARATION OF INDEPENDENCE BY SPECIALIST

I, Tebogo Khoza, declare that I –

- Act as the independent specialist in this application;

- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and

Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document

1 INTRODUCTION

Tronox KZN Sands (Pty) Ltd ("Tronox") holds a prospecting right under the Department of Mineral Resources and Energy ("DMRE") Reference: KZN 30/5/1/1/2/296 PR in respect of ilmenite, rutile and zirkon on the farms [Sub 1 and Remainder of Lot 102 uMlalazi No. 13860, Sub 1,2 and Remainder of Lot 131 uMlalazi No. 14098, Sub 1 and Remainder of Lot 103 uMlalazi No. 13880, Sub 2,3 and Remainder of Lot 104 uMlalazi No. 13853 and Sub 1 and Remainder of Lot Hibbert No. 15714] measuring 843.72 hectares in extent in the uMlalazi Municipality, KwaZulu-Natal Province (the "**Waterloo PR**"), which prospecting right was renewed by the DMRE pursuant to section 18 of the Mineral and Petroleum Resources Development Act, 2002 ("MPRDA").

Historically, Tronox held the following two prospecting rights in terms of section 17 of the MPRDA:

- DMRE Ref: KZN 30/5/1/1/2/10708 PR (formerly 771 PR) in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 3 945.95 hectares in extent in the uMhlathuze Municipality, KwaZulu-Natal Province (the "**Port Durnford PR**"); and
- DMRE Ref: KZN 30/5/1/1/2/279 PR in respect of ilmenite, rutile, zirkon and heavy minerals on the farms measuring 258.27 hectares in extent in the uMlalazi Municipality, KwaZulu-Natal Province (the "**Penarrow PR**")

The Prospecting Rights area is situated in the uMlalazi and uMhlathuze Local Municipalities, under the King Cetshwayo District Municipality. It is located approximately 15 km south-west of Richards Bay and is adjacent to the following settlements/towns at different points along the boundaries; **Mtunzini, Port Dunford, Esikhawini, Gobandlovu; and KwaDlangezwa** (Figure 1-1).

Tronox is now planning on applying for a consolidated Mining Right for all of these areas and seeking environmental authorisation (EA) to support this. A full Scoping and Environmental Impact Reporting (S&EIR) Process is required in support of the application for EA for the project. WSP Group Africa (Pty) Ltd (WSP) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIR (S&EIR) Process required in terms of the following legislation:

- Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA);
- National Environmental Management Act (No. 107 of 1998) (NEMA) for submission of application for environmental authorisation (EA) in respect of activities identified in terms of GNR 983, 984 and 985 (7 April 2017, as amended); and
- National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) and the list of waste management activities (GN 921:2013, as amended), requiring submission of a waste management license (WML) application.

Given that this project is a mining project, the Department of Mineral Resources and Energy (DMRE) is the Competent Authority for the EA Application.

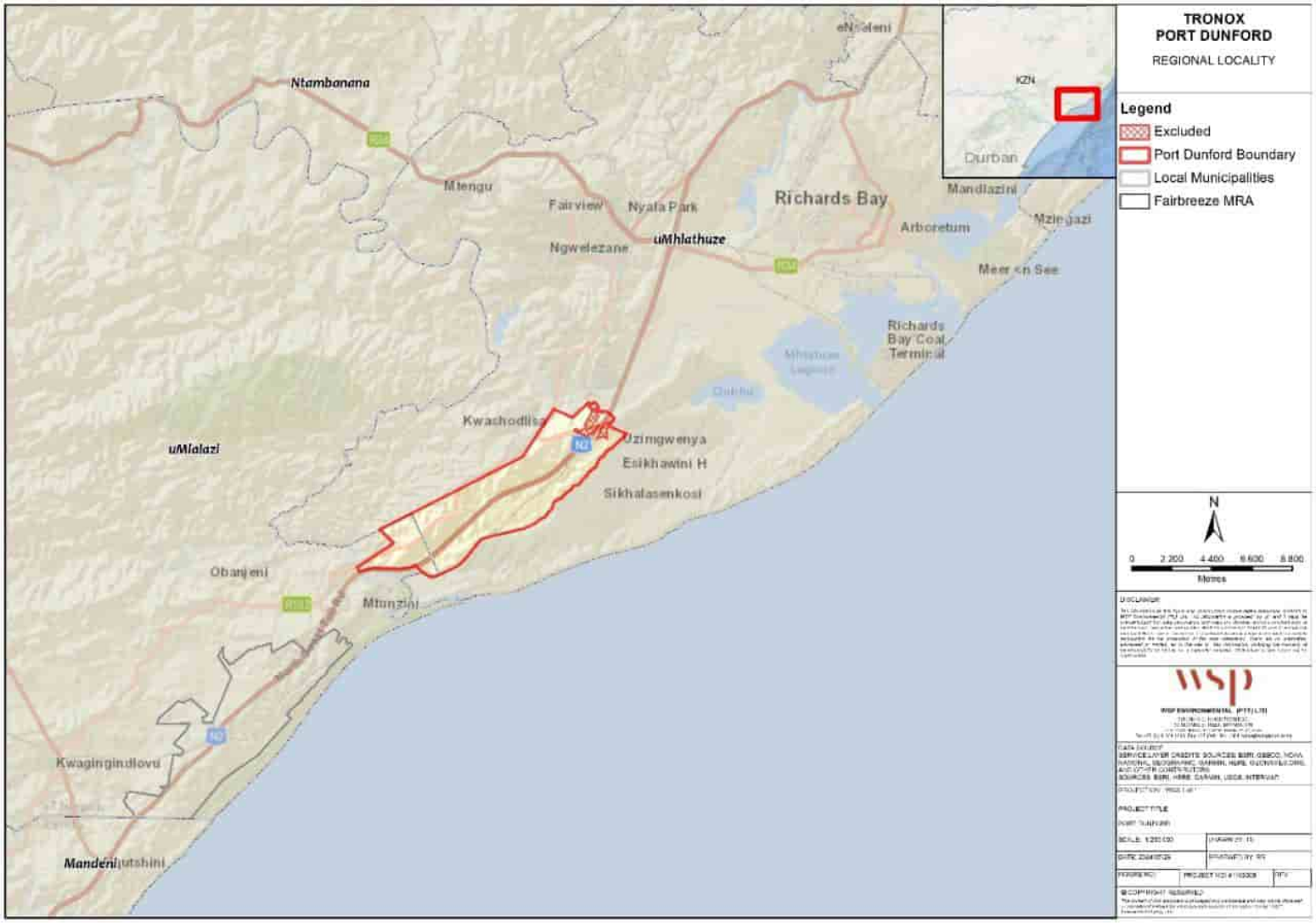

Figure 1-1: Location of the Port Durnford Mining Rights Application area

1.1 PURPOSE OF THE REPORT

WSP was appointed to undertake the supporting specialist studies for the proposed project. This report describes the baseline aquatic biodiversity – focusing on the rivers and streams – within the potential zone of influence of the mine. Potential impacts, positive or negative, were assessed and practical mitigation/management measures developed for inclusion in the Environmental Management Programme (EMPr).

Surveys were undertaken from the 14th to the 18th of November 2022 prior to the onset of any significant rain (low flow) and the 9th to 12th May 2023 (high flow).

This Section is structured to align to Part A, Section 3 (i)(ii) of the DMRE Environmental Impact Assessment Report and Environmental Management Programme Report Template.

2 PROJECT DESCRIPTION CONTEXT

This project was conceptually planned for in 2007 and formally planned in 2015 when Tronox commissioned Hatch (Pty) Ltd (Hatch) to complete a concept study for the development of a mining operation at Port Durnford. Following the concept study, Tronox commissioned Hatch to conduct a Pre-Feasibility Study1 (PFS) on the Port Durnford site which was concluded in November 2020. The concept study assessed multiple mining options and rates. The technical and financial evaluations determined that the Port Durnford mining operation should be a stand-alone operation, mined in two phases (Phase 1 and Phase 2).

- Phase 1 would last 10 years from 2025-2035 at a low production rate of 70,400 tons per annum with operation only occurring on five working days in the month, while
- Phase 2 lasts 33 years from 2036-2069 at a design production rate of 3000 tonnes per hour, 24 hours per day, 365 days a year.

The PFS study project description sought to maximise the mining area. The PFS informed the original Environmental and Social Impact Assessment (ESIA) project description, detailed in the original Draft Scoping Report, circulated in the public domain in November 2022.

Baseline specialist studies conducted on the site after the previous scoping period, identified additional sensitive areas overlapping with aspects of the project, as originally proposed.

Tronox revised both the mine plan and mining schedule to avoid these highly sensitive areas, as far as possible. With the change in mine plan, it was necessary to rerun the materials balance which informs the volumes of coarse and fine sand tailings that needed to be handled and disposed of. Consequently, changes were needed to the Residue Storage Facility (RSF) and sand tails concept designs and location studies. The timeframes for this reconfiguration and specialist assessment thereof, could not be accommodated in the original stipulated ESIA timeframes.

For this reason, the scoping phase and ESIA Process are being re-run. This is a new ESIR Process in support of a revised mining rights application by Tronox lodged in May 2024 and subsequently formally accepted by the DMRE on the 19th of July 2024 under DMRE Ref: KZN 30/5/1/2/2/10133MR. The project description presented in this report is the culmination of previous assessment, planning and specialist baseline findings.

The scope of the proposed Port Durnford mining project is described in this section. No changes are anticipated to be needed at Fairbreeze (which receives Phase 1 ROM) or at the Tronox MSP (which receives the Phase 2 concentrate).

2.1 PHASE 1 OF THE PROPOSED MINE

The mine plan for Phase 1 has not changed between the release of the initial Scoping Report in 2022/2023 and the second Scoping Report in 2024.

2.1.1 PHASE 1 LOCATION

The Phase 1 mining operations will be situated on the Remainder of Richards 16802. This land is currently under commercial forestry, leased by Mondi, owned by the Phalani Community Trust. The proposed location for the Phase 1 operation and infrastructure is indicated in Figure 2-1, while a 3D visualisation of the site is provided in Figure 2-2.

Figure 2-1: Proposed Phase 1 layout and infrastructure

Figure 2-2: A 3D visualisation of the Phase 1 Layout

2.1.2 PHASE 1 MINE PLAN AND PROCESS

Phase 1 will have mining footprint of 41 ha and will be located on Portion 1 of Richard 16802, over a ten (10) year period, between 2025-2035 during Phase 1. The mining will operate at a rate of 100 tph, 70 400t pa. Active mining will take place five (5) days a week per month, for 12 hours a day.

The run-of-mine (ROM) material will be mined mechanically and hauled via trucks to the Fairbreeze mine for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation. ROM will be transported to Fairbreeze mine by truck on public roads (the R102 and N2) for further processing. It is expected that 4 x 30t Trucks will be used to transport the mined material from Port Durnford to Fairbreeze Mine. It is anticipated that 9 truck cycles will be used per day for the 5 days each month that the site is being actively mined. See 2.1.3.5 for further description of the transport routes and alternatives considered for Phase 1.

The mined-out ore bodies at Fairbreeze mine will be used for pit infill from the Port Durnford Phase 1 operation for the first 11 years of mining. The hydraulic mining process at the Fairbreeze mine will continue as per current practice at Fairbreeze, to process the stockpiled material. Hydraulically reclaimed ROM slurry will be pumped to the existing Fairbreeze Primary Wet Plant (PWP) for processing.

The processed material will then be trucked to the existing Mineral Separation Plant (MSP) located at the Central Processing Complex (CPC) in Empangeni as part of the Fairbreeze product. Figure 2-3 illustrates the process flow during Phase 1 operations.

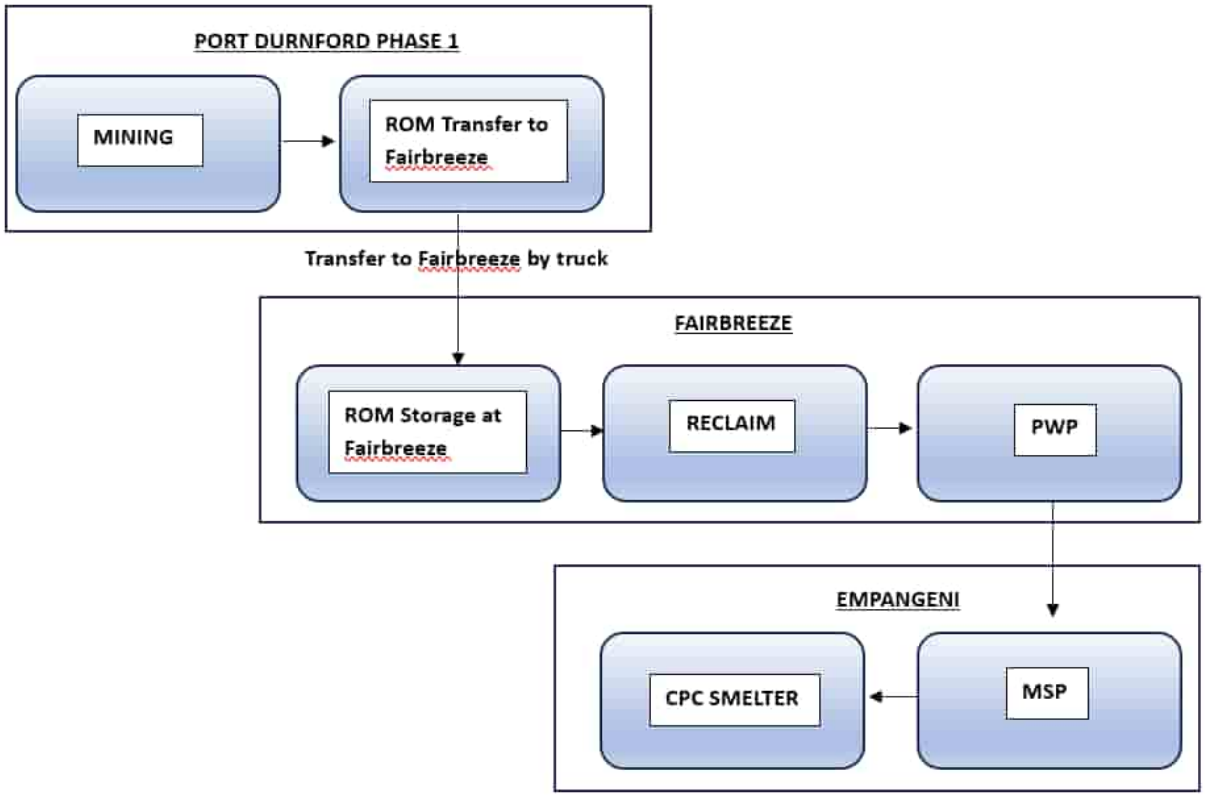

Figure 2-3: Phase 1 Process flow diagram

2.1.3 PHASE 1 INFRASTRUCTURE

2.1.3.1 Site Camp and Laydown Yard Infrastructure

With reference to Figure 2-1, the infrastructure associated with the Phase 1 laydown yard will include the following aspects:

- Conservancy Septic tank system – 2 x 6000l JoJo tanks placed under ground;
- Mining equipment parking area (Gravel with 2 x layers & in situ);
- Workshop laydown area (Concrete stand with 2 x steel containers);
- Water storage tanks (2 x 10 kL tanks);
- Internal water reticulation (Reticulation to offices & ablutions);
- Offices and ablution and septic tank (2 x 12 m units & 1 x 9 m unit);
- Internal electrical reticulation (Estimated ADMD to be 14.7 kW);
- External lighting;
- LDV parking area (1 x G6 layer with RIP & compacted base);
- Guard house (Concrete stand with 1 x steel container);
- Security fence (2.1 m high fence & 1.2m parameter fence);
- A gravel access road (200 m access road) to connect the laydown yard to the District Road which connects to the R102;
- A general and hazardous waste storage area; and
- Fuel and lubricant storage: Fuel tanks will be supported on a concrete surface bed with edge thickenings. A concrete bund wall will be constructed surrounding the fuel tanks. It is anticipated

that a 23 m^3 storage tank will be provided and it is estimated that 153 422 litres will be utilised per annum.

This laydown yard will have no hard stand stockpile area. The mined material will be mined, loaded and transported directly to Fairbreeze.

2.1.3.2 Water Supply

The primary water use on site will be dust suppression. It is anticipated that 4 800 m^3 per annum will be required for this phase of the project.

With the options to connect to the nearest Municipal Supply point, install a borehole or utilise water carts to supply the Phase 1 site. Tronox have opted to utilise 10-18 kl water trucks to cart 6 kl of municipal water to the site, to be stored in 2 x10kl JoJo tanks. The JoJo tanks will be elevated on a steel structure. The municipal water supply points considered are:

- Potable water sourced from the PD Clinic: 28°54'57.15"S 31°49'42.06"E – 2.3km from the Phase 1 laydown yard;
- Alton bulk water point: 28°44'45.38"S 32° 1'29.68"E – 34km from Phase 1 laydown yard; and
- Empangeni Bulk water Point: 28°44'58.29"S 31°53'6.88"E – 23km from Phase 1 laydown yard.

2.1.3.3 Electrical Supply

Power will be required to service the administration offices. The average monthly consumption required for the laydown yard is expected to be 2 741kWh. Tronox plan to utilise and Eskom Overhead Power line connection with an inverter and batteries for backup power supply.

A miniature substation (MSS) will be required for stepping down the Eskom 22kV to 400V for the mine offices distribution.

2.1.3.4 Employment

It is currently estimated that there will be 25 employment opportunities created through the Phase 1 mining operation.

2.1.3.5 Haulage Routes

Three possible transport routes were considered for the Phase 1 operation for transporting mined material between the mining area and Fairbreeze Mine. All three routes follow the same route from the Phase 1 site to the Hely Hutchinson Road intersection. Consequently, this comment section is described for Route 1 below. For the subsequent two route options the alternative is only described from this interchange onwards.

Route 1 (illustrated in red in Figure 2-4 below), is the preferred route. This route makes use of existing public roads. From the Port Durnford mining area and laydown yard the trucks would take the R102 road, westbound for 10km to the Hely Hutchinson Road intersection. Turning left at this intersection and then right (passing through the Mtunzini Tollgate) onto the N2 south bound for 6 km until the #290 Bridge #4 Fairbreeze Mine off-ramp. The Phase 1 ROM material will be offloaded at Fairbreeze at a site approximately 400 m from the offramp where Fairbreeze mining is taking place. The total distance travelled would be 18.7km, at an average estimated speed of 53km/hr. The average anticipated trip time would be 21 minutes in one direction. Route 1 is the preferred alternative for travel time, road maintenance and accounting for risk.

Route 2 (illustrated in yellow in Figure 2-4) follows the common route to the Hely Hutchinson interchange. The route to then also turns towards Mtunzini but rather than accessing the N2, the route

would by-pass the N2 south bound turnoff and continue towards Mtunzini. At the approach to the town the route would turn to the right onto existing dirt roads (which would need upgrading) to run along the edge of the town to connect with existing Fairbreeze mine roads. Approximately 1.8km of gravel road would need to be upgraded between Hely Hutchinson Road and the Fairbreeze mining operation. The total distance of this route is 20.9km. An average of speed of 43km/hr is estimated and the average trip time is estimated to be 23 minutes, in each direction.

Route 3 (illustrated in blue in Figure 2-4) follows the common route to the Hely Hutchinson interchange. However, instead of turning towards Mtunzini at that point the route continues along the R103 for 12.5km before turning to the left onto privately owned farm roads for approximately 5 km. The N2 would be crossed by means of an existing single lane overhead bridge to connect with existing Fairbreeze haul roads east of the N2 highway. From here the trucks would travel a further 2.3km to the identified or offloading area. This route is 20.6km long, would have an average estimated speed of 43km/hr, and have an average trip time of 23 minutes in one direction.

Note: This transport route will be used for the first 10 years of mining during Phase 1. Once Phase 2 commences, all ROM will be processed at the Port Durnford PWP which will have been constructed by that time.

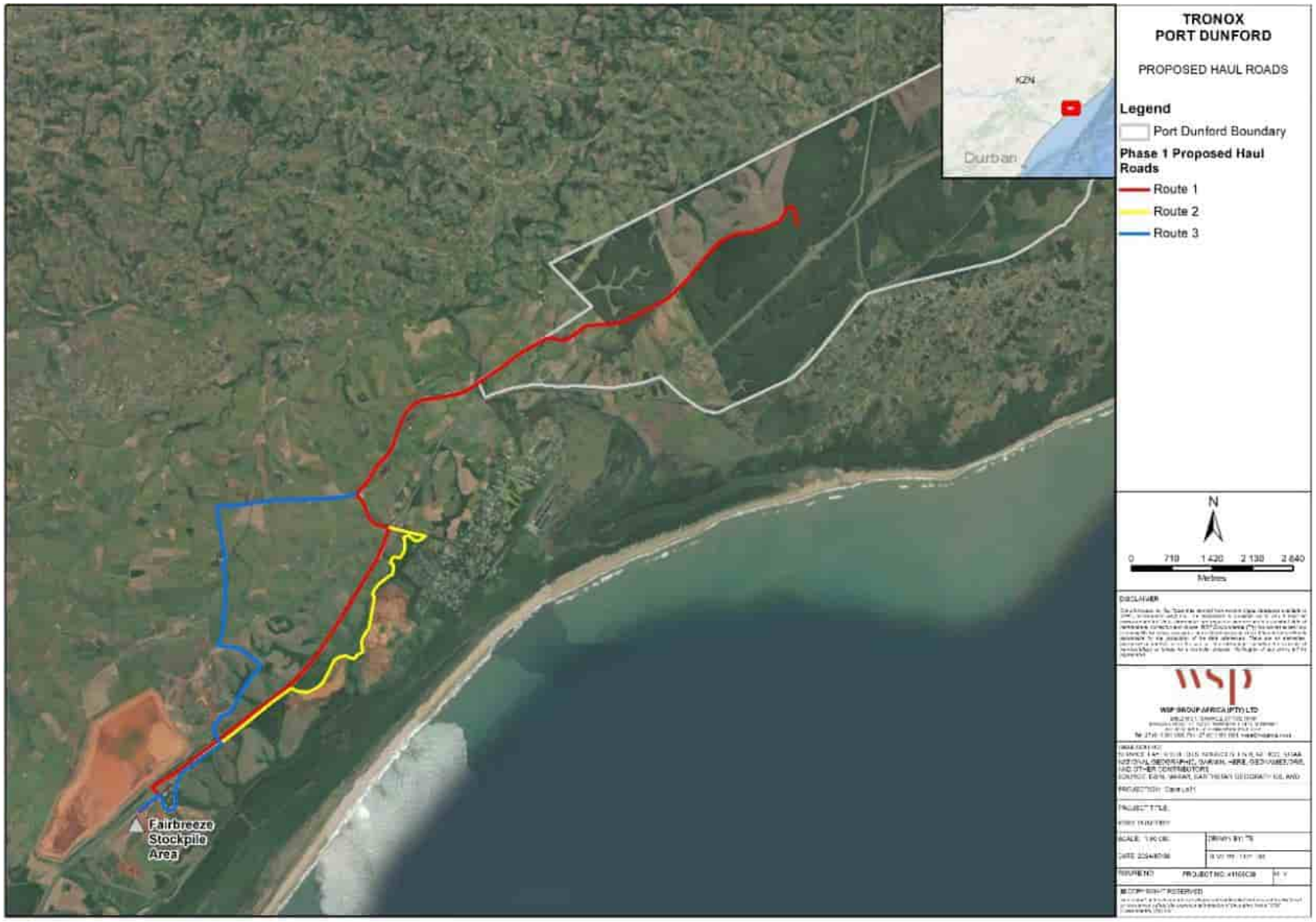

Figure 2-4: Proposed Haulage Routes from Port Durnford to Fairbreeze

2.2 PHASE 2 OF THE PROPOSED MINE

2.2.1 LOCATION AND OVERVIEW

The infrastructure for Phase 2 will be constructed during the Phase 1 mining period (2025-2036), however, mining and processing for Phase 2 will only commence in 2036.

The proposed Phase 2 operation comprises opencast mining, on-site processing of ROM material in a Primary Wet Plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox mineral separation plant (MSP) located in Empangeni within the Tronox central processing complex (CPC). At the MSP the concentrate is further beneficiated to yield the target minerals. Coarse sand tailings that are not separated out at the PWP and are thus transported to the MSP as part of the concentrate, but which do not yield product, are returned to the mine and are reintroduced into the coarse sand tailings backfill stream.

The Port Durnford mining footprint is 1 152 hectares which will be mined over a 33 year period, between 2036-2069. The planned rate of mining will be 3,000 tph, 24 hours a day, 365 days a year.

The revised Phase 2 layout is presented in Figure 2-5. Key changes in the layout of flag below and discussed in more detail as part of the project description the sections which follow. In summary;

- The mine plan has been revised to avoid sensitive habitats to the extent possible. No mining takes place south of the railway line or N2 in the revised mine plan. This has shortened the life of mine by approximately five years,
- Similarly, the sand tailings deposition areas have been moved from areas south of the railway line that are largely comprised of wetlands. Additional sand tailings areas have been identified and are indicated. Some of these (A1, A2, A3 complex and 8B) are located on unmined land. Sand dumps 3, 4 and 5 will largely be developed over the backfilled pit areas although some extension beyond the pit limit does occur for sand dump 5,
- The return water dam for RSF 9 has been moved to the southern side of the dam to minimise impact to a natural forest area north of RSF 9,
- The PWP position has moved slightly to the west to accommodate siting of a return water dam for RSF C,
- RSF C has been expanded through inclusion of a fourth compartment on its eastern side, labelled P4 below, and
- The locations of enabling and support infrastructure are better defined including on-site roads and the positions of topsoil stockpiles

Figure 2-5: Proposed Phase 2 infrastructure layout

2.2.2 THE PHASE 2 MINING OPERATION

2.2.2.1 Mine plan

The planned mining schedule (mine block plan including time sequencing) is presented below Figure 2-6. The mining schedule is also presented (Figure 2-7) with mining blocks grouped into 5-year units for ease of interpretation of mine progress through time. On this plan, the position of the fine Residue Storage Facilities (RSF's in orange outline) and the sand dumps (in beige outline) are also indicated together with the position of the PWP (orange rectangle).

Mining commences in Phase 2 in 2035 at the site of the Phase 1 pit to complete mining that block. Thereafter, the active mining window moves to a position immediately east to the PWP and sequentially progresses in an easterly direction until the eastern extent of the mine is reached in 2061.

In 2051, mining is also initiated in the western extent of the proposed mining footprint and progresses in an easterly direction back towards the PWP, with the final block which lies immediately north of the PWP, being mined in 2069.

Figure 2-6: Proposed Phase 2 Life of Mine (LOM) Plan

Figure 2-7: Proposed Phase 2 mining block plan showing 5-year mining windows

From Figure 2-7, it can be seen that RSF 9 in the west of the site will be developed on unmined ground while RSF C, in the east of the site, will be developed sequentially on the pit floor as each corresponding five-year mining block has been completed space becomes available. During these periods the washed sand tailings cannot be backfilled into the pit and consequently must at times be deposited on surface. All pit areas will be backfilled with either coarse sand tailings or fine residue (within the RSF). The sand dump positions (beige outline) reflect where a sand dump will be developed above the current ground surface and will remain as a permanent aboveground feature on the post mining landscape. Similarly, RSF Site C will also end at a height above the current ground surface (see section on post mining topography).

2.2.2.2 Sequence of mining activities

The basic sequence of mining activities is as follows:

- Before mining starts a minimum of 0.3 m of topsoil will be stripped. This material will preferably be placed directly onto an area available for rehabilitation. If that is not possible, it will be placed on a stockpile for later use (see Section 2.2.8 on topsoil management),
- Then, the *in situ* sands are mined. In the Port Durnford mine, the sands are mineralised from surface to the base of the economic mining limit within the pit. Consequently, there is mineralisation even in the topsoil that is set aside (see Section 2.2.2.3 which describes the mining method);
- After a pit has reached the economic limit for mining it becomes available to be backfilled. Backfill material comprises the washed course tailings;
- Once the pit is backfilled to the design height, it becomes available for rehabilitation and topsoil is replaced, and
- The topsoiled areas are revegetated following this approach described in Section 2.2.8.

2.2.2.3 Mining method

The proposed Port Durnford heavy mineral sands mine is in opencast sand mine, not dissimilar to the current Tronox Fairbreeze operation. The mining method will however differ. At Port Durnford mobile skid mounted dozer trap mining units (DTMUs) will be used within the active mining areas. The mining process entails dozing the sand material down to the DTMU's where it is combined with water and pumped to the PWP. Each DTMU is anticipated to be fed by two D11 dozers and a CAT390 excavator. A DTMU is equipped with a vibrating screen to separate oversize material and accompanied by a primary pump. Each DTMU is connected to a raw water feed pipeline, a ROM slurry delivery pipeline, and a power connection.

A typical DTMU is shown in Figure 2-8 for visual reference.

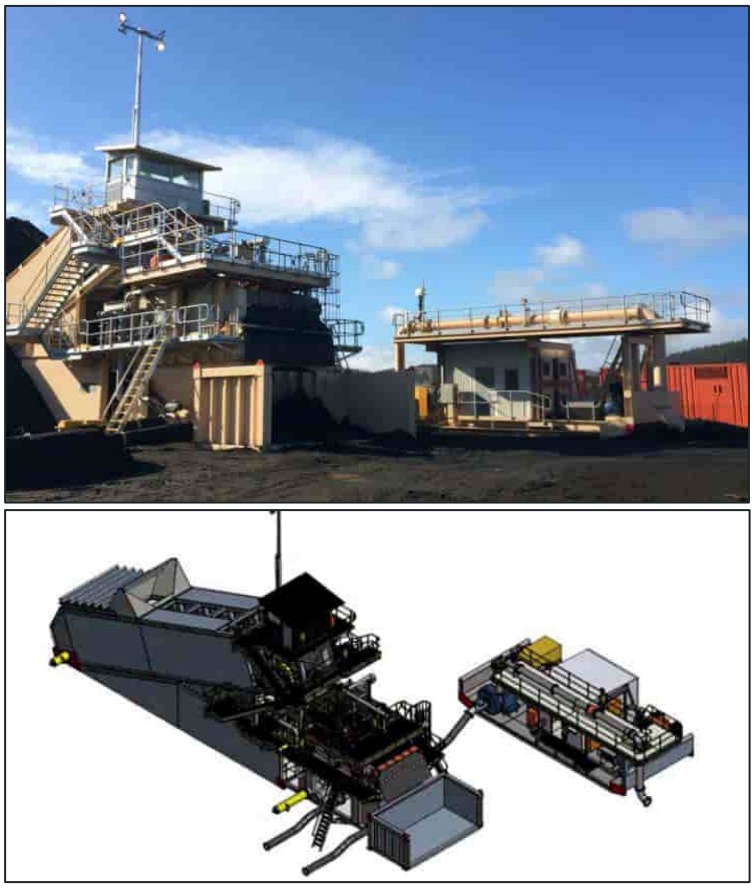

Figure 2-8: A typical dozer trap mining unit (DTMU) showing the trap on the LHS into which material is dozed and an associated pump unit on the RHS

2.2.3 PHASE 2 MINERAL PROCESSING

The ROM material is processed at the primary wet plant (PWP) to remove fine material from the plant feed and separate the non-mineralised sand fraction to produce a heavy mineral concentrate. The ROM feed at Port Durnford is typically comprised of 76% coarse sand tails, and 20% sand tail fines with the remaining 4% being the heavy mineral concentrate (HMC) which is then transported off site to the Tronox mineral separation plant (MSP) in Empangeni.

The primary processing entails:

- Mined material is deslimed and placed through a spiral circuit to separate out the coarse sand tailings (+45 µm),
- The coarse sand tailings will be used for backfilling and for the establishment of the walls of the RSF facilities,
- The spiral concentrate is put through a magnetic separation circuit to remove the reject magnetite which is fed back into the coarse tailings circuit,
- The non-magnetic material forms the Heavy Metal Concentrate (HMC) ,and
- The fine tailings (-45 µm) are collected from the desliming process, a thickener is added and process water retrieved before disposal on the residue storage facilities.

The PWP will be designed to process 22,866,000 t/annum ROM at a nominal rate of 3,000 t/h. The process will produce the following output streams:

The PWP layout is indicated in Figure 2-9 (Hatch 2020) and the process flow for Phase 2 activities is presented in Figure 2-10 (Tronox 2022). The PWP layout includes;

- ROM feed preparation and fines removal area;
- Gravity and magnetic separation areas;
- Fine tails dewatering, treatment and pumping area;
- 33kV sub-station and power factor correction (PFC) Yards and Eskom Yard;
- Raw and process water storage and distribution area: Raw water will be stored in a single 10,000 m^3 raw water dam. Process water will be stored in two 7,500 m^3 dams connected by a common overflow sump;
- Compressed air plant: The PWP will be serviced by a single compressed air facility comprising of two compressors, two air receivers and two air dryers;
- Potable water treatment plant: A standalone packaged potable water plant capable of supplying sufficient water for the total estimated personnel compliment;
- Sewage treatment plant: a plant will be developed to accommodate the onsite personnel. Processed effluent from this treatment plant will be pumped to the process water dam;
- Workshop and stores;
- HMC dewatering, stockpiling and reclaim area;
- MSP tails handling where non-mineralised sand tails returning from the MSP are received to be reincorporated into the course tailings backfill stream;
- Gypsum plant;
- Mine Complex including administration offices with parking, control room, change house, mess, security office, laboratory and sample room; and
- A fit for purpose and legally compliant fire water pumping station and distribution system at the PWP to be fed directly from the raw water dam.

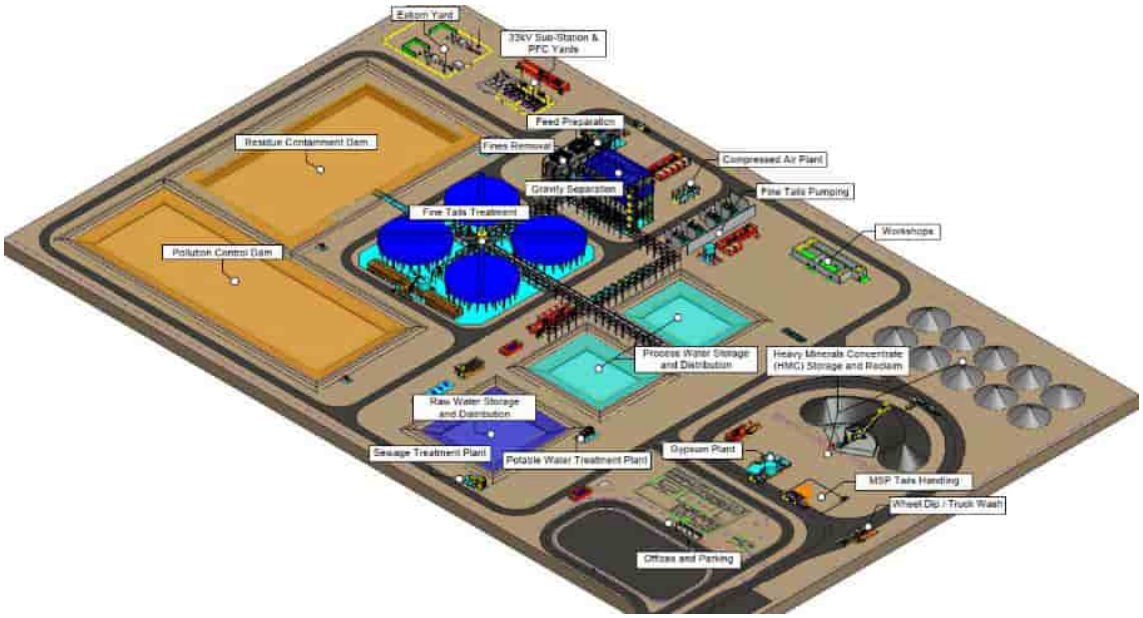

Figure 2-9: Proposed Phase 2 PWP Layout

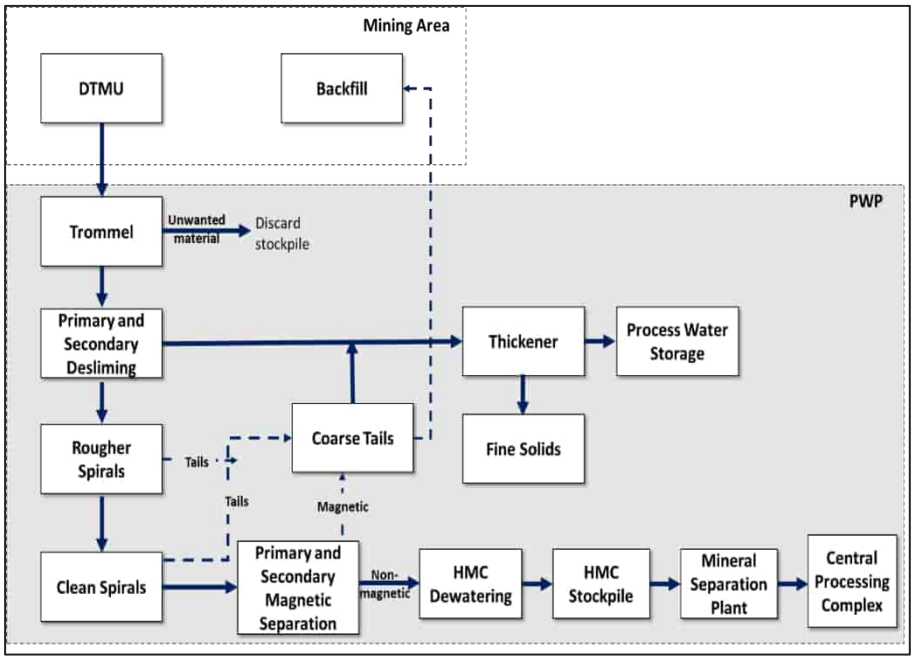

Figure 2-10: Proposed Phase 2 Summary Process Block Diagram

The location of the PWP plant in relation to the mine plan is illustrated in Figure 2-11.

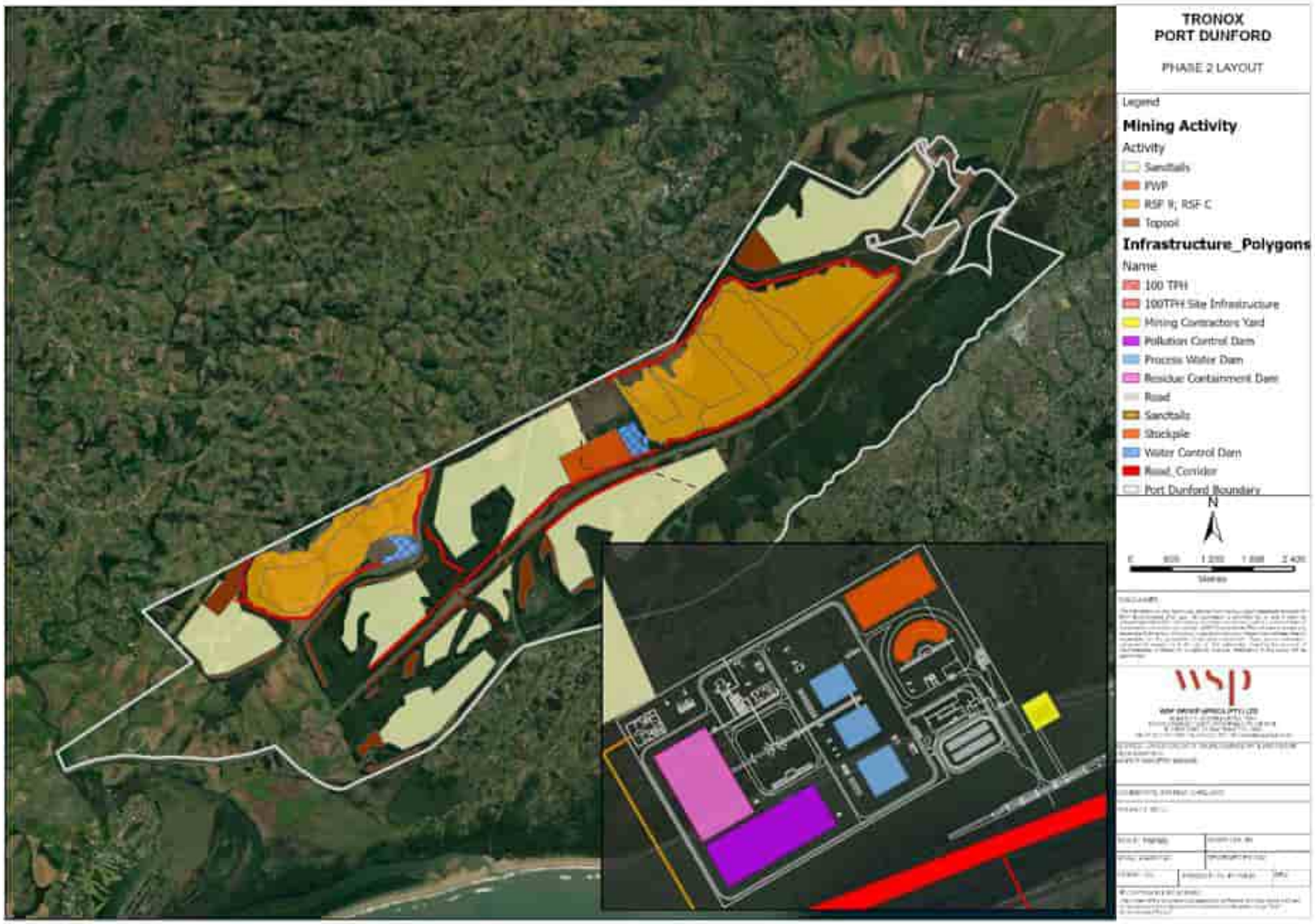

Figure 2-11: PWP location and inset detail of the PWP site

2.2.4 SUPPORTING INFRASTRUCTURE

2.2.4.1 Water Supply

Raw water will be supplied to Port Durnford from the existing uMhlatuze bulk water supply station directly to the PWP raw water dam via a take-off from the main pipeline currently supplying water to Fairbreeze.

2.2.4.2 Power Supply

The power supply to the site will be from the adjacent Eskom grid via two 88 KV incoming overhead lines to the Port Durnford 33kV substation passing through two 88/32kv stepdown transformers. From the substation power will be distributed to points within the site where it is needed via local powerlines.

2.2.5 EMPLOYMENT

The Phase 2 mining operation at Port Durnford will be of similar scale to the current Fairbreeze operation (with 322 employees) and largely act as a replacement reserve as production tails off at Fairbreeze. Consequently, there will be few new job opportunities created however the Port Durnford operation provides opportunity for transition of the Fairbreeze workforce to the new operation.

2.2.5.1 Internal Haulage routes

Twenty-four kilometres (24km) of haulage routes have been conceptually designed within the Mining Boundary. These haulage routes have been given a 40m wide road servitude. They cater for haulage within the mining areas and pipeline service infrastructure. Where possible, existing haulage routes will be used and upgraded to accommodate the larger road servitudes. Where the haulage routes cross water courses, crossing structures will be designed and built across the water course. The planned haulage routes are illustrated in Figure 2-5.

2.2.6 WASTE STREAMS

Three “waste streams” are produced from the proposed mining operation, coarse sand tails, fine residue and gypsum filter cake. The following tails products are received from the CPC (Empangeni) for disposal with the various tails products at the PWP at Port Durnford:

- MSP coarse tails are received by tip truck from the MSP in Empangeni. These are tipped directly into a slurry hopper where it is slurried before pumping directly into the rougher sand tails tank for disposal with the sand tails at the PWP at Port Durnford. It is expected that total MSP tails received for disposal will be between 260 and 330 kt/annum (15.6 -18.5 million tonnes per annum. Approximately 678 Mt of sand tails will be deposited during the planned LOM. Large sand tail stockpiles will be utilised for sand tails disposal from 2036 within the Port Durnford mining boundary.
- Gypsum filter cake from the MSP in Empangeni is received via truck from the CPC. The gypsum cake is fed into a materials handling facility for re-slurrying before being fed to the thickener underflow tank for disposal together with the fines to the RSF. It is estimated that between 4,800 and 9,600 t/annum of gypsum will be disposed of into the RSF feed stream each year.

2.2.7 COARSE SAND TAILS DISPOSAL

2.2.7.1 Material Balance

It is anticipated that the Port Durnford mining operation will have a sand tails material balance of approximately 678 Mt over the full LOM; thus between 15.6-18.5 million tons of sand per annum requiring handling and management. All 678 Mt of coarse sand tails over a planned 34 year mining period has been accounted for in the current mine plan.

Approximately 63Mt of coarse sand tailings will be used for RSF dam wall construction and the remaining 615.2 Mt will be used for pit backfill, for RSF capping or will be permanently deposited onto sand dumps.

Motivated by the presence of sensitive wetland and vegetation, the original sand tails location south of the N2 were largely removed from the mining plan. Tronox assessed different sand tails disposal alternatives and propose the following sand tails disposal for the Port Durnford mining operation:

- For the first 7 years of mining in Phase 2 (2036-2047), while opening and mining the pit area for the first compartment of RSF Site C, coarse sand tails (57Mt) will be used in containment wall construction at RSF 9 or deposited outside of the mining pit footprint (sand dump sites A1, A2, and A3 south of the N2) or later used in RSF C compartment 1 wall construction,
- For 5 years (1948-1953) Backfill Area 8 will be used for the deposition of 89Mt of sand tails;
- In years 2049-2051, approximately 21Mt of sand tails will be used in further wall construction for RSF Site C Phase 3;
- In years 2053 to 2059, 117Mt of sand tails will be deposited in backfill Area 4; and
- In years 2064, 2.7Mt of sand tails will be stockpiled in backfill area 3.

Table 2-1 presents the proposed sand tails deposition schedule over the LOM. In this schedule the identified sand deposition areas have been called sand “backfill” areas. These are not necessarily pit backfill areas but rather sites for permanent sand placement which will remain in the post mining landscape.

Table 2-1: Sand Tails Deposition Schedule (Tronox, 2024)

Sand tails	Capacity (Mt)	2036-2038	2039-2047	2045-2046	2047-2055	2054-2064	Post 2064
Backfill A1,A2,A3	150			-	-	-	
RSF Site 9	18			-	-	-	
RSF Site C (Phase 1)	18						
RSF Site C (Phase 2)	21						
Backfill 8	89						
RSF Site C (Phase 3)	21						
Backfill 4	117						
RF Site C (Phase 4)	4						
Backfill 5	96						
Backfill 3 (post 2064)	133	-		-	-	-	

The sand tails material will be transported to the sand tails stockpiles through feed pipelines which will run alongside roads on site. Cyclones will help deposit the sand tails on the top of each stockpile area, and a return water pipeline will recycle the water back to the PWP. The existing road infrastructure will be utilized for the pipeline routing as far as possible. A topsoil berm will surround each sand tail dump to contain the sand tails and storm water runoff.

The following information will apply to the sand tails deposition strategy:

- The sand tails stockpiles have been designed with a 1:3 vertical height. Each stockpile will have a 100 m buffer from the stockpile to the nearest public infrastructure (roads, railways and residential areas) and a 30 m buffer to the nearest environmental sensitive area;
- Sand tailings stockpiles will vary in height from approximately 65 m (stockpile A1) to over 100 m (stockpile 8) above average natural ground surface;
- Capping the RSF facilities with coarse sand will be subject to RSF stability and surface bearing capacity, which will be determined during detailed design and subsequent operational monitoring;
- The mined-out pits volumes are included in the available airspace calculation for backfill areas 3,4, and 5. In these areas, sand deposition will also occur above the original ground surface within the identified areas indicated below; and
- Utilising co-disposal of fines and coarse sand mix will be explored with this operation. There are reports of positive results with in-pit mixing with the aid of re-flocculation in deposition piping. This could result in better consolidation and water recovery resulting in higher densities of the deposited residue and overall space saving.

A total of 396 ha have been identified for coarse sand tails disposal within the Port Durnford Boundary, 136 ha within pit disposal, and 259 ha outside the mined out areas as indicated on the Phase 2 layout (Figure 2-5).

2.2.8 TOPSOIL MANAGEMENT

For all areas that will be used for mining and mine infrastructure at Port Durnford, 0.3 m of topsoil within the “project footprint” will be removed and kept aside for rehabilitation. This standard practice is applicable to the RSF Site 9, the mining footprint, sand tails dump areas and the PWP plant site. Wherever possible within the mining areas topsoil will be stripped and placed directly on areas available for rehabilitation. When space has been depleted in the designated 44 ha of topsoil stockpile areas, topsoil will be stockpiled and used as stormwater runoff berms around the sand tail deposition areas.

Prior to mining or stockpiling, the top 0.3 m of soil will be stripped and stockpiled in designated topsoil stockpile sites within the Port Durnford mining right boundary (see Figure 2-6 where topsoil stockpiles are indicated in brown).

The topsoil stockpiles will be afforded a 30 m buffer from the edge of the nearest wetland or delineated sensitive environmental area. Each topsoil stockpile area will be cleared of large trees or tree stumps prior to placement of soil. The height of stockpiles should not exceed 3 m wherever possible and stockpiles will be protected from stormwater erosion by use of diversion berms. No road development over the surface of the topsoil stockpiles will be permitted in order to avoid unintended compassion of the valuable topsoil resource.

The topsoil stockpiles will be grassed with a mix of indigenous grass seed, containing the following grass types:

- *Eragrostis tef* (Teff);
- *Eragrostis curvula* (Weeping lovegrass);
- *Cynodon dactylon* (Bermuda grass);
- *Cenchrus ciliaris* (Bloubuffels grass);
- *Panicum maximum* (Guinea grass);
- *Chloris gayana* (Rhodes grass);
- *Digitaria eriantha* (Smuts finger grass); and
- *Paspalum notatum* (Bahia grass);

A vegetation canopy cover of 30-50% will be achieved on the topsoil stockpiles.

2.2.9 FINE RESIDUE DEPOSITION

Fine residue will need to be managed throughout the life of mine. The RSF capacity for Port Durnford has been designed for a 28 year LOM between 2036 and 2064. It is understood that RSF capping and shaping of the sand tails dump sites with the remaining sand tails will take place between 2064 and 2069.

The RSF facilities will be constructed in a phased approach. The RSF dam walls will be constructed with coarse sand tails from the mining operation and be compacted. The dam walls will be erected to the designed heights to create a “holding shell” for the incoming fine residue. Each RSF facility has a determined lifespan of RSF disposal. Each RSF site will have a maximum height and storage capacity. Once the RSF facility has reached its design capacity (design capacity in terms of storage volume and height) the facilities will be capped with coarse sand tailings and vegetated.

The RSF infill is considered a “Class 3 waste” for purpose of design. Class 3 waste facilities require lining. The design assumes that a double layer containment barrier, made up of a 1500-micron geomembrane and a geosynthetic clay liner will be installed in the RSF dams to prevent environmental contamination. The materials will be classified to confirm their waste class, which will inform subsequent detailed designs.

RSF Site 9 will have a Water Control Dam (WCD) to receive water from the RSF dams and intercepted stormwater falling within the managed RSF area. Excess water will be recovered from the surface of the RSF and under drainage system and returned for reuse in mining. The RSF dams will use a barge/turret system for excess water removal. The RSF sites will be installed with herringbone, toe, and blanket drainage systems to assist in dewatering the fine tailings in order to aid stability and manage seepage and control the phreatic surface within RSF.

Stormwater control berms and trenches will be used to manage external water, with toe paddocks to control material which has been eroded from the RSF outer slopes. The fine residues disposal concept study and supporting concept designs has been updated (Epoch, 2023). The typical drainage and design detail has been provided in Figure 3-12, below and RSF specific general arrangements provided in the sub sections which follow.

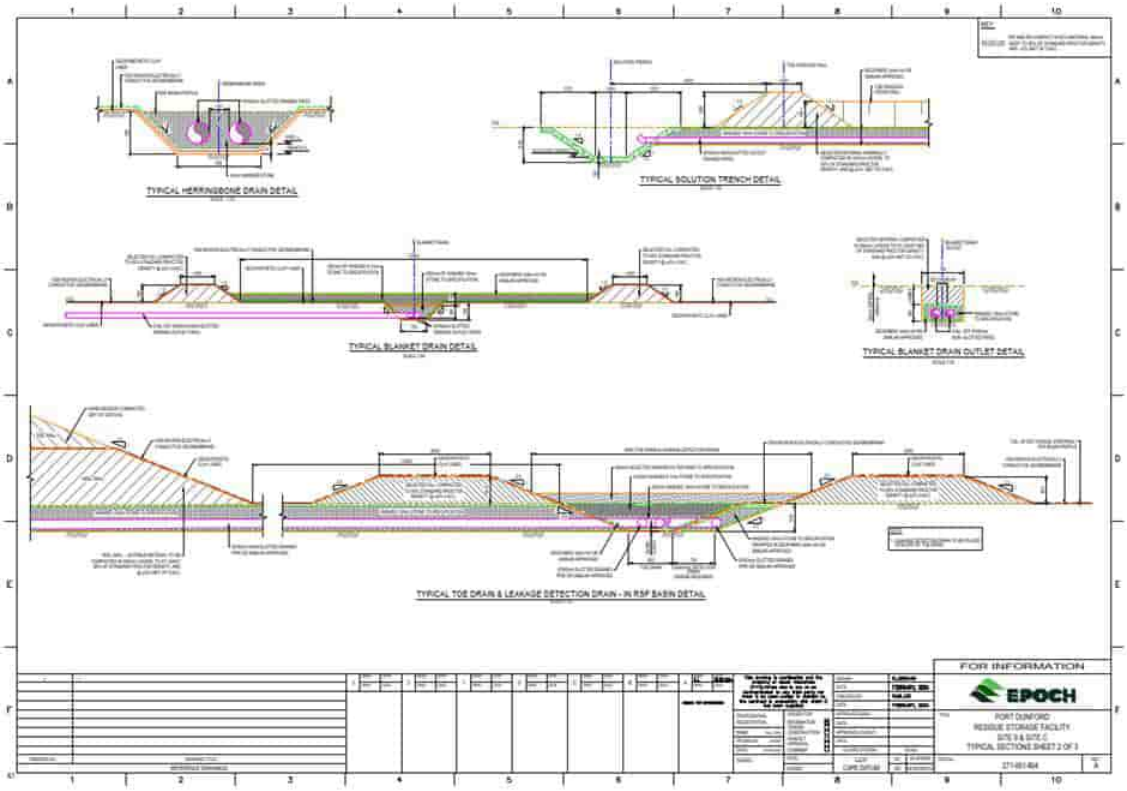

Figure 2-12: Typical RSF Drainage Design Sections

2.2.9.1 RSF Site 9

RSF Site 9 will be built from the sand tailings material from the Phase 2 mining activity. After the 11 years of Phase 1 mining, Phase 2 mining will start adjacent to the then constructed PWP plant in 2037. The sand tails that are produced in the first block of Phase 2 mining will be used to construct the dam walls of RSF Site 9. RSF Site 9 will be situated in the south western side of the proposed mining footprint, on Portion 1/13602 and remaining portion of 13602 of Lot 132. This property is leased by Mondi and owned by the Philani Community Trust. This RSF facility will be used for the first 6 years of mining in Phase 2. RSF Site 9 will be 268 ha in size and have a final height of approximately 55 m above average ground level. The facility will be designed to store up to 26.9Mt of Fines residue and 18.2Mt of Sands residue.

The terminal Rate of Rise for Site 9 is 3.3m/yr, meaning that the RSF facility can safely increase in height by 3.3m per year.

Supporting Infrastructure

The water control dam for RSF Site 9 was redesigned to avoid environmental sensitive areas. This dam will be approximately 19 ha in extent and have an 870 000 m^3 storage capacity. A barge / turret system will be used to transport water from the RSF to the Water Control Dam.

RSF Closure

It is anticipated that RSF Site 9 will be operational for 6 years and reach full capacity in 2042. Thereafter, capping of the RSF surface with coarse sand tailings site will commence in 2046 assuming that the surface of the RSF has dried out and stabilised sufficiently by that stage. Once backfilled the

site will be topsoiled in 2048. Outer slopes of the RSF will be topsoiled and vegetated as areas become available in order to stabilise the side slopes against erosion. The RSF will be returned to the landowner once Tronox is satisfied that the facility, and the chosen vegetation cover, has stabilised.

A conceptual design has been provided in Figure 2-13 below.

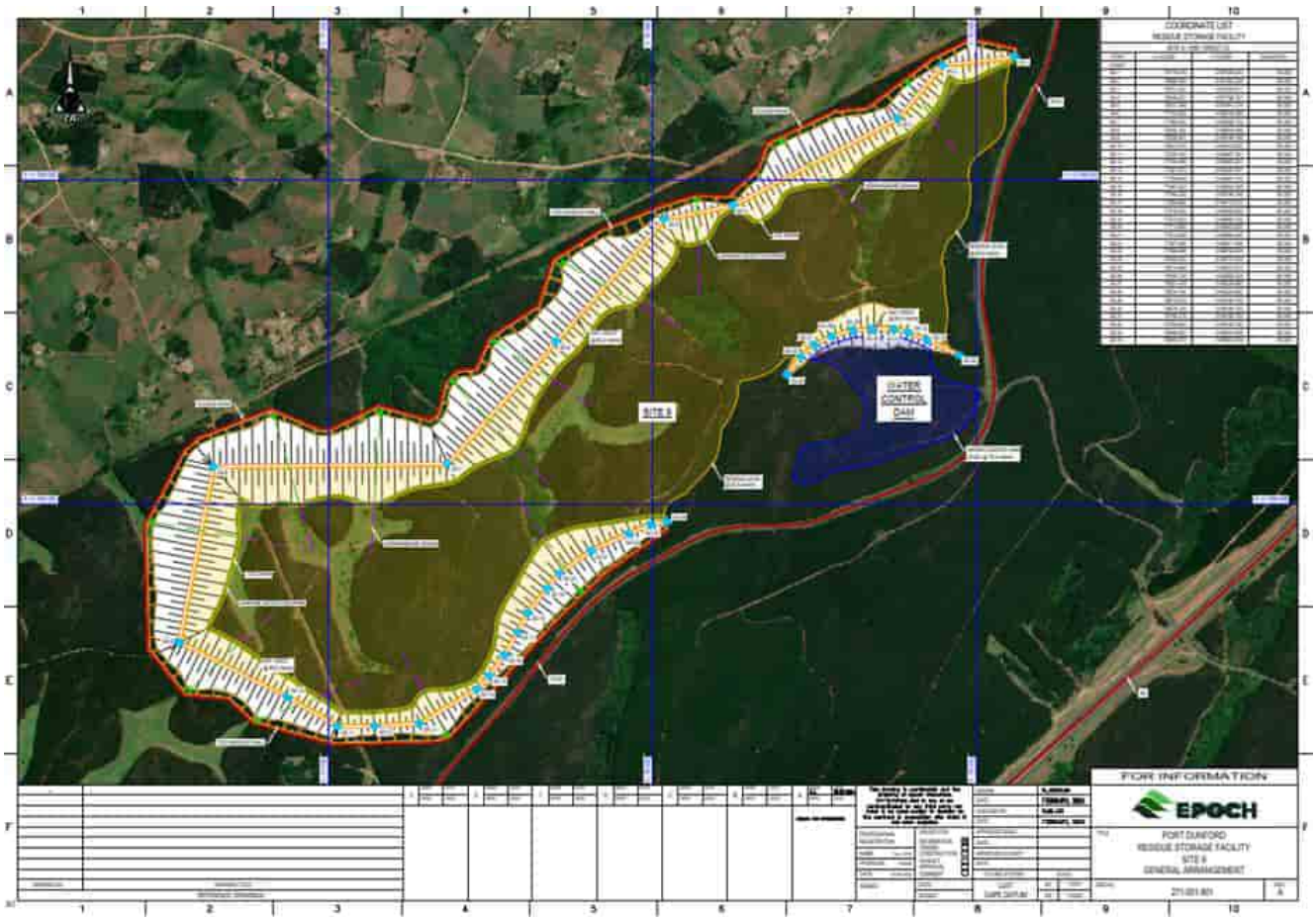

Figure 2-13: RSF Site 9 General Arrangement Design indicating Impoundment walls and inundation Area

2.2.9.2 RSF Site C

RSF Site C will be utilised during the Phase 2 mining activity. It will be located immediately east of the PWP plant. It will be built in sequential phases (Phase 1-4). RSF Site C will utilise mined-out pits for RSF dam storage capacity. Mining here is expected to last approximately 27.5 years before Phases 1- 4 are completed. The four planned RSF cells for RSF Site C will be converted to RSF storage space as each RSF cell reaches capacity. The phased development of RSF Site C is as follows:

- Phase 1 is expected to operate for 2.9 years and store 12.7 Mt of fines and 18 Mt of sand tails. Phase 1 will be approximately 78 ha in size. This facility will be built at a Rate of Rise (RoR) of 9.8 m/yr;
- Phase 2 is expected to operate for 8.1 years and store 35.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 121ha in size. This facility will be built at a RoR of 5.1 m/yr;
- Phase 3 is expected to operate for 8.1 years and store 40.2 Mt of fines and 21 Mt of sand tails. Phase 2 will be approximately 147ha in size. This facility will be built at a RoR of 5 m/yr;, and

- Phase 4 is expected to operate for 8.3 years and store 39.1 Mt of fines and 4 Mt of sand tails. Phase 2 will be approximately 162ha in size. This facility will be built at a RoR of 3.5 m/yr.

RSF Site C will be designed to store up to 127.3Mt of Fines residue and 64.5Mt of Sands residue. The total footprint area of RSF Site C is expected to be 670 ha and will have a final height of approximately 50 m above the current average ground level.

Supporting Infrastructure

A 13.75 ha, 540 000 m^3 Return Water Dam has been planned for RSF Site C. The dam will be located between RSF Site C's Phase 1 RSF Dam and the PWP plant. The dam will be 500 m long, 275 m wide and will be 9 m high at its highest point (Figure 2-14).

RSF Closure

It is anticipated that RSF Site C will be operational for 27.5 years and reach full capacity in 2064. Thereafter, the site will be backfilled in 2069, affording the facility 4 years to dry out and stabilise. Once backfilled the site will be rehabilitated with topsoil and returned to the Landowner (lessee) thereafter.

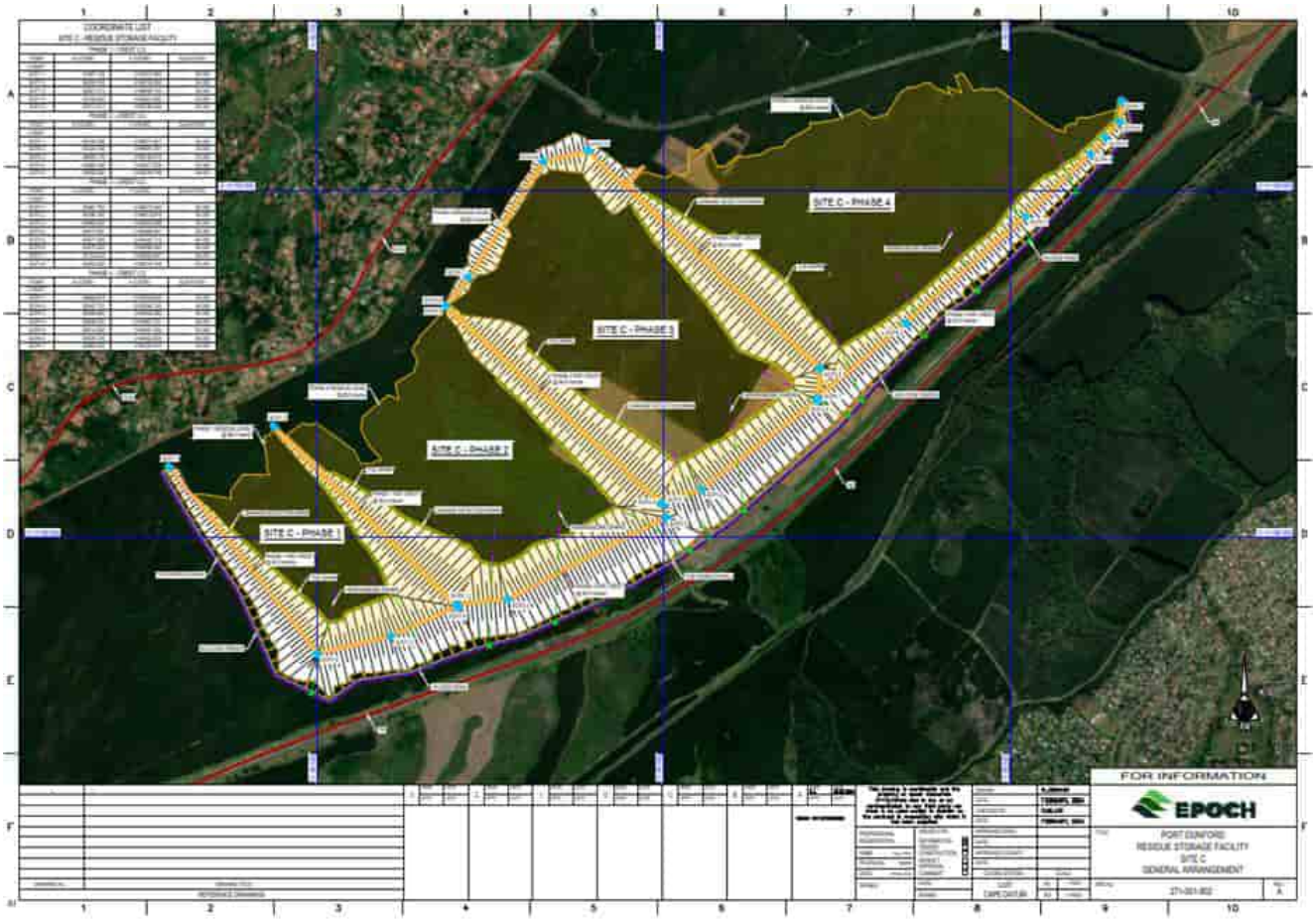

Figure 2-14: RSF Site C General Arrangement Design indicating impoundment walls and inundation area

2.3 PROJECT ACTIVITIES FOR EACH PHASE OF THE PROJECT

The following activities are anticipated for each phase of the project:

- **Construction Phase:**
  - Obtaining the rights to mine the lease;
  - Prior to site establishment all authorisations need to be in place;
  - Forestry activities on the site to cease;
  - Bush clearing will then commence two years prior to production;
  - Bulk earthworks (in case of Phase 2);
  - Development of required service infrastructure on the site;
  - Development and improvement of access roads;
  - Site establishment;
  - Topsoil stripping; and
  - Construction of project components
- **Operational Phase:**
  - Mining to commence. One DTMU mines a 200 m by 100 m block at a time. Progressive backfilling and rehabilitation will then take place. It is anticipated that 4 years post the commencement of mining in a block, the mined area will be subject to rehabilitation. The RSF areas, the exception. These blocks will be rehabilitated post mining, once the RSF has completed its lifespan;
  - Ongoing processing and supporting activities; and
  - Disposal of wastes from the mining process.
- **Decommissioning Phase:**
  - Plant to be demolished and materials to be removed;
  - Termination of all services to the area; and
  - Rehabilitation of all areas to be completed sufficiently to meet relevant commitments of the closure plan.
- **Closure and post closure**
  - Ongoing monitoring of post-closure impacts and success of rehabilitation as required in terms of the closure plan; and
  - Monitoring programs to continue post-closure, where applicable.

2.4 END LAND USE AND TOPOGRAPHY

Once mining is complete and the mined-out areas rehabilitated, the land will be returned to the landowner. It is anticipated that some land will be used for forestation, and others for crops and informal grazing land. The topography of the mined-out areas within the broader mining rights area is expected to change substantially. The RSF sites and sand tails deposition areas will leave permanent elevated features on the landscape.

The pre-mining and post mining topographic surface is presented in Figure 2-15. The natural valleys and peaks are depicted by green and red respectively.

Figure 2-15: Pre mining (LHS) and Post Mining (RHS) Topography

The elevated RSF dam walls and sand tails deposition areas become prominent features in the post mining landscape.

3 LEGAL REQUIREMENTS, STANDARDS AND GUIDELINES

The legislative context for aquatic ecology studies which applies to the proposed project are listed and discussed below.

- **National Environmental Management Act (Act No. 107 of 1998) (NEMA)** – Section 24 (1)(a) and (b) states that "the potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment must be considered, investigated and assessed before their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.
- **National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA)** – The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act regulates the protection of species and ecosystems that require national protection and considers the management of alien and invasive species.
- **National Water Act (Act No. 36 of 1998) (NWA)** – The NWA aims to protect, use, develop, conserve, manage and control water resources including rivers, dams, wetlands, the surrounding land, groundwater, as well as human activities that influence them. The NWA intends to protect these water resources against over exploitation and to ensure that there is water for social and economic development and water for the future.
- **KwaZulu-Natal nature conservation management Act (Act no. 9 of 1997)** – aims to provide institutional structures for nature conservation in Kwazulu-Natal; to establish control and monitoring bodies and mechanisms.
- **uThungulu District Municipality Biodiversity Sector Plan** – the purpose of this bioregional plan is to provide a map of biodiversity priorities (identified as Critical Biodiversity Areas and Ecological Support Areas) with accompanying land use planning and decision making guidelines, to inform land use planning, environmental assessment and authorisations as well as natural resource management by a range of sectors whose policies and decision impact on biodiversity.

4 METHODOLOGY

This aquatic biodiversity and impact assessment took cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning the 'Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity' and the 'Procedures for the assessment and minimum criteria for reporting on identified environmental theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation'.

In line with the assessment and reporting requirements set out in the protocol, this report includes two main study components; a desktop literature review, supplemented by a field survey within the proposed development footprint and extended areas of influence. The objectives and tasks associated with these components are described below.

4.1 LITERATURE REVIEW AND GAP ANALYSIS

The aim of the desktop literature review component was to collate and review the extensive available ecological information related to important biodiversity and conservation features in the project area, key ecological processes and function, and the likely composition and structure of local aquatic fauna communities (specifically macroinvertebrates and fish).

The following sources were consulted for the desktop literature review:

- The Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments Report (Department of Water and Sanitation, 2024a);
- Port Dunford Pre-feasibility study report – water quality and biological monitoring (Marine & Estuarine Research, 2009); and
- National spatial planning datasets, namely the uThungulu Biodiversity Sector Plan (BSP), the National Freshwater Ecosystem Priority Areas (NFEPA) and National Protected Area Expansion Strategy (NPAES).

4.2 FIELD SURVEY

This section provides a brief description of the aquatic biodiversity study approach and methodologies utilised during the field surveys and the locations wherein the assessments were undertaken.

4.2.1 STUDY APROACH

To enable an adequate description of the aquatic environment and the determination of the present ecological state, the following stressor, habitat and response indicators were evaluated:

Water Quality

- *In situ* water quality assessment including temperature, pH, electrical conductivity, dissolved oxygen and comparison to applicable guideline values and identification of variables of potential concern.

Habitat Indicators

- General habitat assessment including site location (GPS coordinates), site photographs and surrounding features such as land uses, potential sources of pollution, erosion etc.
- Aquatic macroinvertebrate biotope evaluation through the Invertebrate Habitat Assessment System (IHAS, Version 2.2).

Response Indicators

- Aquatic macroinvertebrate assessment, including the determination of ecological condition through the South African Scoring System (SASS Version 5) and the Macro-Invertebrate Response Assessment Index (MIRAI);
- Ichthyological assessment, including the evaluation of reference conditions and determination of ecological condition through the Fish Response Assessment Index (FRAI);
- Diatom community assessment to determine the ecological water quality of the aquatic ecosystems based on the diatom assemblages, thus improve the understanding of the potential impacts on the associated aquatic ecosystems; and
- Determination of the integrated EcoStatus (EcoStatus 4, Version 1.02).

A detailed description of the aquatic biomonitoring methodologies used for the survey is provided in Appendix A.

4.2.2 MONITORING SITES

Selection of the monitoring sites was largely based on the previously undertaken aquatic biodiversity assessment as part of the Port Dunford pre-feasibility study (Marine & Estuarine Research, 2009) for comparative purposes, where possible. Additional sites suspected to support sensitive aquatic biota, such as species of conservation concern, were selected.

A total of 22 sites were visited: four sites associated with the Mhlatuze W12F-03494 SQR; two along the Mzingwenya W12F-03611 SQR; five sites associated with Ntuze W13B-03593 SQR; a single site at the Mlalazi W13A-03609 SQR and ten sites associated with the Mlalazi W13B-03673 SQR.

Site names, GPS coordinates and brief descriptions are provided in Table 4-1 and a map of the study area showing the location of the sampling sites is presented in Figure 4-1. Photographs showing the upstream and downstream views at each monitoring location are provided in Appendix B.

Table 4-1 - Location of the sampling points and brief descriptions

Catchment	Site	Co-ordinates	Site Description
Mhlatuze W12F-03494	Site 1	28°50'44.56"S 31°52'0.20"E	Located at the R102 bridge near Iniwe township
	Site 5	28°50'44.19"S 31°52'19.18"E	Northern boundary between Eucalyptus plantation and small-scale sugarcane production (Fort Argyle)
	Site 3	28°50'34.98"S 31°52'59.70"E	Northern boundary - Stream completely transformed by sugarcane farm
	Site A	28°50'18.65"S 31°54'22.92"E	Located below an overhead walking bridge, approximately 300 m downstream of the N2
Mzingwenya W12F-03611	Site 7	28°53'52.04"S 31°51'56.26"E	Located along the Esikhaweni boundary adjacent plantation
	Site B	28°51'45.92"S 31°54'31.10"E	Located along the Esikhaweni boundary - Approximately 5 km downstream of Site 7
Ntuze W13B-03593	Site 18	28°53'41.86"S 31°48'10.11"E	Ntuze tributary - site located at a low water crossing
	Site 17	28°53'26.96"S 31°47'1.67"E	Approximately 2 km downstream of Site 18 - site located at a low water crossing
	Site 19	28°53'28.24"S 31°46'32.34"E	Located at the bridge near along the Ntuze River
	Site 20	28°54'32.22"S 31°45'29.11"E	Approximately 3 km downstream of Site 19
	Site 39	28°55'3.72"S 31°45'20.62"E	Approximately 3 km downstream of Site 20
Mlalazi W13A-03609	Site D	28°55'6.46"S 31°43'42.20"E	Approximately 1,5 km downstream of Site 20 and 500 m before the confluence with the Mlalazi River
Mlalazi Drainage	Site 11	28°54'34.88"S 31°49'6.46"E	Located at a stream crossing within a commercial forestry area
	Site 12	28°54'47.92"S 31°49'20.33"E	Located at a stream crossing within a commercial forestry area
Mlalazi W13B-03673	SIte 33	28°54'51.96"S 31°46'36.56"E	Upper reach of a Mlalazi tributary near the western boundary
	SIte 31	28°55'48.74"S 31°45'50.69"E	Approximately 2 km downstream of Site 33
	Site 26	28°55'50.69"S 31°46'59.99"E	Upper reach of a Mlalazi tributary near the southern boundary
	Site 8	28°53'23.91"S 31°50'30.11"E	Upper reach of the aManzamnyama River
	Site 10	28°52'58.83"S 31°50'9.47"E	Tributary of the aMmanzamnyama River
	Site F	28°53'44.01"S 31°49'33.60"E	Tributary of the aMmanzamnyama River
	Site 11	28°54'34.88"S 31°49'6.46"E	Located at a stream crossing adjacent to the aMmanzamnyama River.
	Site 12	28°54'48.59"S 31°49'21.14"E	Middle reach of the aMmanzamnyama River
	Site 15	28°54'29.34"S 31°47'55.75"E	Tributary of the aMmanzamnyama River
	Site C	28°56'26.14"S 31°47'19.24"E	Lower reach of the aMmanzamnyama River

Figure 4-1 - Locations of the Aquatic Ecology sampling points

4.3 STUDY LIMITATIONS

The following limitations were expressed as part of the current assessment:

- Sites 1 and A along the Mhlatuze River and sites 19 and 20 along the Ntuze River are located within significantly wide and deep river systems, thus restricting sampling to the margins where it is shallow. Therefore, some of the instream biota may have been missed during sampling.
- The biotic indices South African Scoring System version 5 (SASS5) and Integrated Habitat Assessment System (IHAS) were designed for the evaluation of perennial streams and rivers with low/moderate flow hydrology (Dickens & Graham, 2002), therefore results obtained from sites resembling impoundments/wetlands (i.e. sites 5, 11, 12, 15, and 17) should be interpreted with caution.
- A total of 13 sites were assessed during the low flow survey and reduced to nine during the high flow survey due to the change in layout plans. The nine sites were strategically selected based on habitat suitability, ease of access and their locations relative to the proposed Projects' potential areas of influence.

5 AQUATIC BIODIVERSITY DESKTOP ASSESSMENT

The following sections describe the physical and biological characteristics for the region within which the proposed Project is located.

5.1 FRESHWATER ECOREGIONS

Ecoregions are regions characterised by a relative similarity in the type of ecosystems and ecosystem components, i.e. biotic and abiotic. The proposed Project area is located within the Zambezian Lowveld freshwater ecoregion. This ecoregion is defined by low-lying portions of the coastal rivers south of the Zambezi Delta to Lake St Lucia (Abell et al., 2008; Darwall et al., 2009).

5.2 ASSOCIATED WATER RESOURCES

The proposed Project area falls within the primary drainage region W of the Pongola Mtamvuna Management Area (WMA) and the W12F and W13B quaternary catchments draining the eastern and western portions of the proposed Project site respectively.

The W12F quaternary catchment consists of Sub-Quaternary Reaches (SQRs): Mhlatuze W12F-03494 and Mzingwenya W12F-03611. The W13B quaternary catchment consists of SQRs: Ntuze W13B-03593 and Mlalazi W13B-03673 (Table 5-1).

Table 5-1 – Summary of watercourses associated with the proposed Project (Department of Water and Sanitation, 2014)

WMA	Quaternary Catchment	SQR	River Name	Stream Order	River Length
Pongola Mtamvuna	W12F	W12F-03494	Mhlatuze	3	17.9 km
		W12F-03611	Mzingwenya	1	7.4 km
	W13B	W13B-03593	Ntuze	1	19.3 km
		W13B-03673	Mlalazi	3	no data
WMA = Water Management Area; SQR = Sub-Quaternary Reach					

5.3 REGIONAL BIODIVERSITY CONTEXT

5.3.1 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a collaboration of multiple organisations including the South African National Biodiversity Institute (SANBI), Council for Scientific and Industrial Research (CSIR), Water Research Commission (WRC), Department of Environmental Affairs (DEA), Department of Water Affairs (DWA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks) (Water Research Commission, 2011).

The project is aimed to "*provide guidance on how many rivers, wetlands and estuaries, and which ones should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998), the National Environmental Management: Biodiversity Act (Act 10 of 2004) and the National Environmental Management: Protected Areas Act (Act 57 of 2003)*" (Water Research Commission, 2011)

Based on the current outputs of the NFEPA project (Water Research Commision, 2011), the Sub-Quaternary Reaches (SQRs): Mhlatuze, Mzingwenya, Ntuze and Mlalazi are classified as Freshwater Ecosystem Priority Area (FEPA) Rivers; a wetland cluster occurs south west of the MRA and several FEPA wetlands are scattered within and outside the Mining Right Boundary (MRB) (Figure 5-1). Descriptions of these FEPA features are provided in Table 5-2.

The quaternary catchments associated with the proposed Project (W12F and W13B) are not considered FEPA Water Management Areas, however within the larger screening area (upper reaches of the Mhlatuze and Mlalazi Rivers to the west of the proposed Project area), lies an Upstream Management Area – sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas (Water Research Commision, 2011).

Table 5-2 - FEPA categories associated with the proposed Project

FEPA Category	Description
River FEPA	River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
Wetland FEPA	Wetland FEPAs were identified using ranks that were based on a combination of special features and modelled wetland condition. Wetland condition was modelled using the presence of artificial water bodies as well as by quantifying the amount of natural vegetation in and around the wetland (within 50 m, 100 m and 500 m of the wetland). Based on these factors, wetlands were ranked in terms of their biodiversity importance. Biodiversity targets for wetland ecosystems were met first in high-ranked wetlands, proceeding to lower ranked wetlands only if necessary.
Wetland Cluster	Wetland clusters are groups of wetlands embedded in a relatively natural landscape. This allows for important ecological processes such as migration of frogs and insects between wetlands. In many areas of the country, wetland clusters no longer exist because the surrounding land has become too fragmented by human impacts.

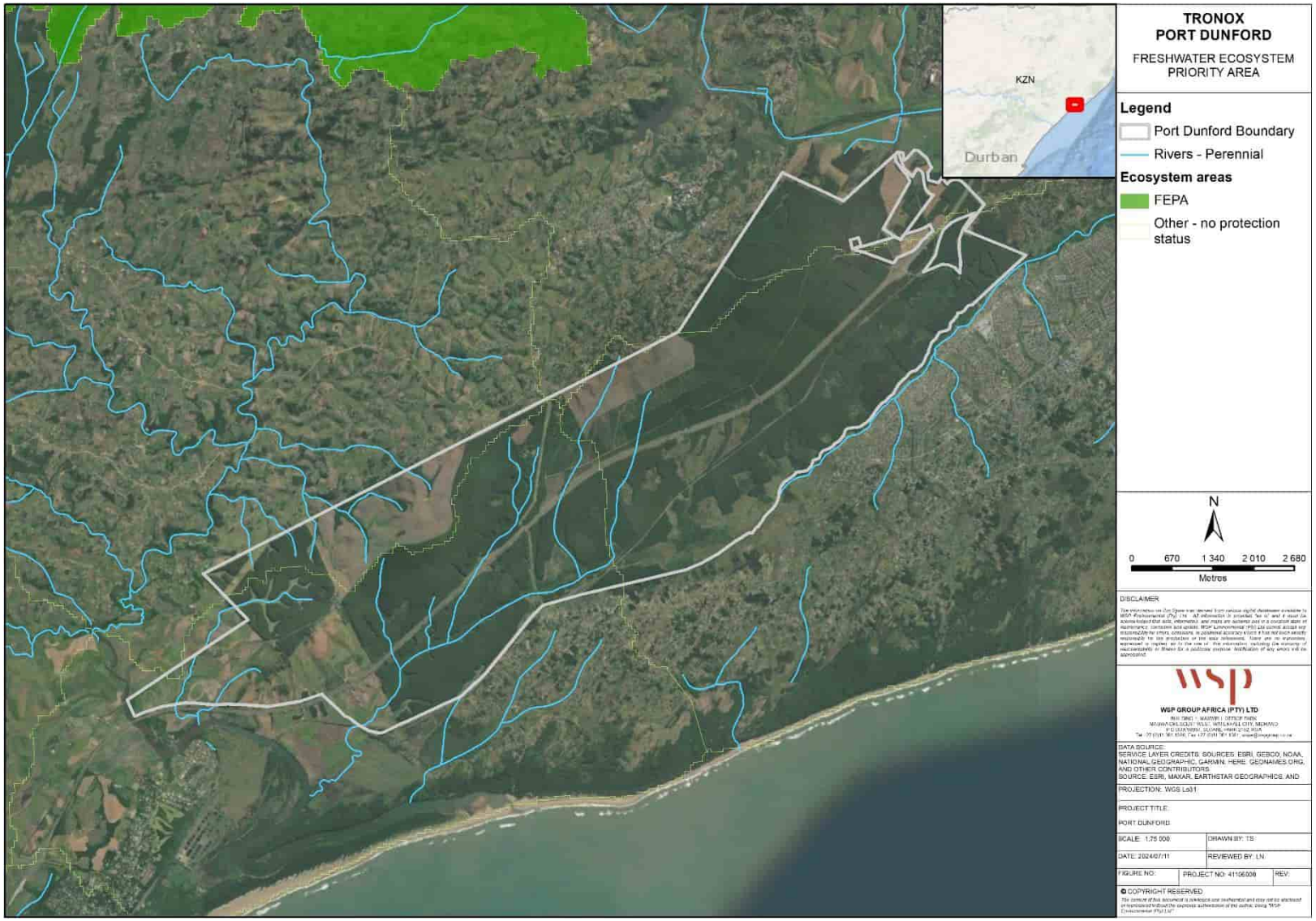

Figure 5-1 - FEPA features related to the proposed Project Area

5.3.2 BIODIVERSITY SECTOR PLAN – UTHUNGULU DISTRICT MUNICIPALITY

The Biodiversity Sector Plan (BSP) has been developed to provide a map of biodiversity priorities identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with accompanying land use planning and decision making guidelines, to inform land use planning, environmental assessment and authorisations as well as natural resource management by a range of sectors whose policies and decision impact on biodiversity (Ezemvelo KZN Wildlife, 2014b).

The proposed Project MRB lie within isolated patches of CBA-irreplaceable mostly associated with the non-perennial streams draining the MRA. An ESA occurs along the Mlalazi estuary outside the MRA boundary to the south (Figure 5-2). CBA-irreplaceable are areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems. ESAs are functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the critical biodiversity areas. The area also contributes significantly to the maintenance of ecological infrastructure.

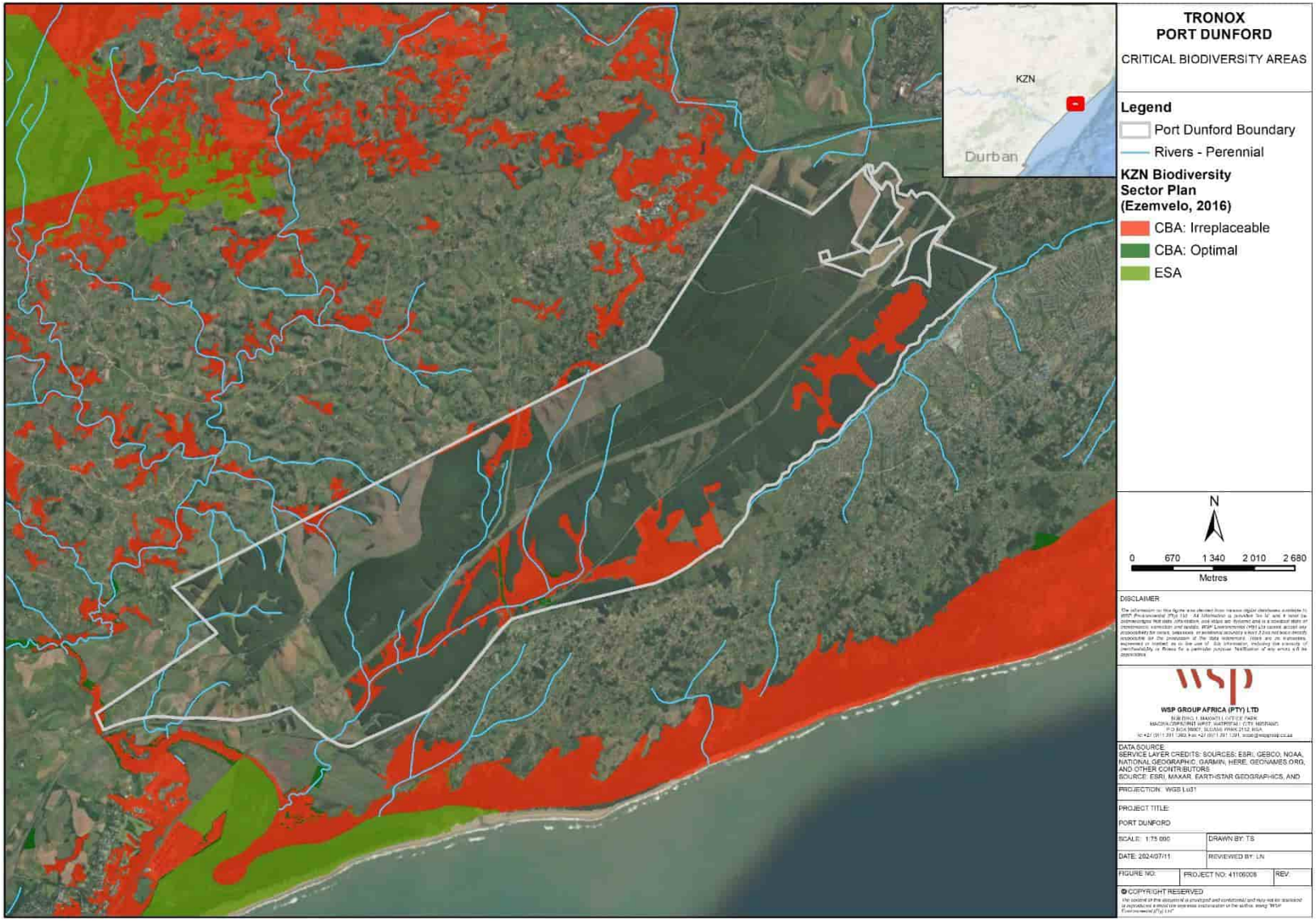

Figure 5-2 - Biodiversity Priorities associated with the proposed Project. Biodiversity Sector Plan Map

5.3.3 DESKTOP PRESENT ECOLOGICAL STATUS

The Present Ecological Status (PES) for the Mhlathuze and Mzingwenya River is provided within the W12-6 Resource Unit (RU), and the Mlalazi and Ntuze River within the W13-1 RU in the recently published Resource Quality Objectives for water resources in the Usutu to Mhlathuze catchments (Department of Water and Sanitation, 2024a).

The PES and Recommended Ecological Category (REC) for the Mhlathuze and Mzingwenya Rivers is classified as Moderately Modified condition. The status quo within this catchment is influenced by activities associated with industrial and settlements which include the Richards Bay Port, paper mill, forestry, sand mining, fruit and vegetable production, and extensive irrigated sugar cane. These result in water quality impacts, with major impacts being high sedimentation and turbidity. Within the Mlalazi and Ntuze catchment, the PES and REC are classified as Moderately Modified and Largely Natural respectively. The status quo is influenced by farm dams, formal agriculture, emerging and subsistence agriculture (Department of Water and Sanitation, 2024).

Table 5-3 – Present Ecological Status of the watercourses associated with the proposed Project (Department of Water and Sanitation, 2024a)

IUA	RU	River	PES	REC
W12-c Lower Mhlathuze	W12-6	Mhlathuze (Incl. Mzingwenya)	C	C
W13	W13-1	Mlalazi (Incl. Ntuze)	C	B
IUA = Integrated Unit of Analysis; RU = Resource Unit; PES = Present Ecological Status; REC = Recommended Ecological Category				

5.3.3.1 Present Ecological State, Ecological Importance and Ecological Sensitivity

According to the DWS (2016) Present Ecological State database, Ecological Importance and Ecological Sensitivity (PESEIS) data, the Ecological Importance (EI) and Ecological Sensitivity (ES) of each of the SQRs of focus is *High* and *Very High* respectively, except for the Mhlathuze SQR which has a EI of *Moderate*. The expected number of fish species and aquatic macroinvertebrate taxa per SQR is provided in Table 5-4.

Table 5-4 – Present Ecological State, Ecological Importance and Ecological Sensitivity data

River Name	SQR Code	EI	ES	Fish Species	Invertebrate Taxa
Mhlatuze	W12F-03494	Moderate	Very High	29	65
Mzingwenya	W12F-03611	High	Very High	28	65
Ntuze	W13B-03593	High	Very High	28	47
Mlalazi	W13A-03609	High	Very High	23	54
	W13B-03673	No data			
SQR = Sub-Quaternary Reach; EI = Ecological Importance; ES = Ecological Sensitivity					

5.3.3.2 Expected Fish Species and Aquatic Macroinvertebrate Taxa

The expected fish species for the SQRs associated with the Project area are presented in Table 5-5. It should be noted that no data was available for the Mlalazi SQR W13B-03673 from the DWS

database, therefore previous assessments were referred to for the list of expected fish and macroinvertebrates. A total of 32 indigenous fish species are expected within the study area, most of which are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species. A total of 65 aquatic macroinvertebrate taxa are expected within the study area. The macroinvertebrate community assemblages are comprised of taxa with a wide variety of tolerance/sensitivity to flow and water quality conditions.

Fish species of conservation concern

Six of the expected species are of conservation concern. A summary of these species and major impacts associated with them have been outlined below:

The Indian Mottled Eel (*Anguilla bengalensis*), Shortfin Eel (*Anguilla bicolor*) and African Longfin Eel (*Anguilla mossambica*) are listed as Near Threatened by the IUCN. These anguillid eels are susceptible to a number of, primarily anthropogenic, threats including, but not limited to; barriers to migration, climate change, habitat degradation, invasive species, parasitism, pollution, predation and unsustainable exploitation. In South Africa, poor water quality is suggested to have caused eel species to become rare in some localities. The predatory bass (*Micropterus sp.)* and catfish (*Clarias sp*.), may also have contributed to the decline. Conservation actions should focus on a holistic approach and not on a single threat in isolation because all anguillids migrate to the ocean to breed, therefore barriers – such as dam walls – between continental waters and the ocean together with threats associated with both freshwater and marine environments increase the impact of threats (Pike, 2019).

The Natal Topminnow (*Aplocheilichthys myaposae*) is listed as Near Threatened, the population trend of *A. myaposae* (Natal Topminnow) is reported to be decreasing with impacts including widespread agricultural activities affecting habitat condition, water quality and flows within the entire region of this species range. Ongoing habitat degradation due to agricultural activities interacting synergistically with the effects of the severe drought experienced between 2015 and 2016 has affected many of the subpopulations of this species. Coastal dune mining, harbour developments, alien fishes and other tourist related coastal developments are potential threats (IUCN, 2023).

The Redtail Bard (*Enteromius gurneyi*) has been listed as Vulnerable by the IUCN. The species is threatened by the synergistic effects of land use practices, alien fishes and increases in drought associated with climate change. Specific threats include agriculture, urban and peri-urban communities and associated stressors such as waste water treatment works and industries affecting water quality, quantity and habitat of the rivers and alien species. The synergistic effects of drought experienced in the region between 2015 and 2016 resulted in many rivers drying up, which along with land use practices has contributed to the decline in the distribution of the species.

The Mozambique tilapia (*Oreochromis mossambicus*) has been listed as Vulnerable by the IUCN. According to (Bills, 2019), the Nile Tilapia (*Oreochromis niloticus*), is invading this species' natural range in the Zambezi and Limpopo rivers systems. Hybridisation is occurring in the Limpopo River System and pure Mozambique Tilapia are likely to become extirpated in those systems through competition and hybridisation. Conservation actions that should be taken to protect the genetic integrity of Mozambique Tilapia include prevention of deliberate and accidental introductions of the Nile Tilapia and other non-native *Oreochromis* species in river systems of the Pongola Mtamvuna Management Area.

Table 5-5 - Expected fish species and IUCN conservation status

Fish Species	Common Name	IUCN Status	Mhlatuze W12F-03494	Mzingwenya W12F-03611	Ntuze W13B-03593	Mlalazi W13A-03609
Acanthopagrus berda	River Bream	LC	●	●	●	
Anguilla bengalensis	African Mottled Eel	NT	●	●		
Anguilla bicolor	Shortfin Eel	NT	●	●	●	●
Anguilla marmorata	Giant Mottled Eel	LC	●	●	●	●
Anguilla mossambica	Longfin Eel	NT	●	●	●	●
Aplocheilichthys johnstoni	Johnston's Topminnow	LC	●			●
Aplocheilichthys katangae	Striped Topminnow	LC	●	●	●	
Aplocheilichthys myaposae	Natal Topminnow	NT	●	●	●	●
Awaous aeneofuscus	Freshwater Goby	LC	●	●	●	●
Clarias gariepinus	Sharptooth Catfish	LC	●	●	●	●
Clarias theodorae	Snake Catfish	LC	●	●	●	
Ctenopoma multispine	Manyspined Climbing Perch	LC	●	●	●	
Enteromius gurneyi	Redtail Barb	VU			●	●
Enteromius paludinosus	Straightfin barb	LC	●	●	●	●
Enteromius trimaculatus	Threespot barb	LC	●	●	●	●
Enteromius viviparus	Bowstripe barb	LC	●	●	●	●
Gilchristella aestuaria	Estuarine Round-Herring	LC	●	●		
Glossogobius callidus	River Goby	LC	●	●	●	●
Glossogobius giuris	Bareye Goby	LC	●	●	●	●
Labeo cylindricus	Redeye Labeo	LC	●	●	●	
Labeo molybdinus	Leaden Labeo	LC	●	●	●	●
Labeobarbus natalensis	Natal Yellowfish	LC	●	●	●	●
Liza macrolepis	Largescale Mullet	LC			●	●
Marcusenius pongolensis	-	LC	●	●	●	●
Megalops cyprinoides	Indo-Pacific Tarpon	DD	●	●		
Mugil cephalus	Flathead Mullet	LC			●	●
Myxus capensis	Freshwater Mullet	LC	●	●	●	●
Oreochromis mossambicus	Mozambique Tilapia	VU	●	●	●	●
Pseudocrenilabrus philander	Southern Mouthbrooder	LC	●	●	●	●
Redigobius dewaali	Checked Goby	LC	●	●	●	
Tilapia rendalli	Redbreast Tilapia	LC	●	●	●	●
Tilapia sparrmanii	Banded Tilapia	LC	●	●	●	●
LC = Least Concern; NT = Near Threatened; VU = Vulnerable; DD = Data Deficient						

6 RESULTS AND DISCUSSION

Results for the aquatic biodiversity assessment undertaken on the 14th to 18th November 2022 (low flow) and on the 9th to 12th May 2023 (high flow) are discussed in the below sections. The results have been separated per SQR and presented from upstream site to downstream site for ease of interpretation. Where possible, the collected data is compared against findings from the previously undertaken aquatic biodiversity assessment (Marine & Estuarine Research, 2009).

It should be noted that nine of the 22 sites were assessed during the high flow survey due to time constraints. The nine sites were strategically selected based on data collected during the low flow survey (such as availability of suitable habitat and representativeness per catchment group).

6.1 FLOW CONDITIONS AND GENERAL HABITAT OBSERVATIONS

Flow conditions influence the processes that determine the size, shape, structure and dynamics of the aquatic ecosystems, and subsequently linked to habitats and biotic communities (Thoms & Thoms, 2006). Thus, flow conditions and water levels aid in the interpretation of biological results.

The typical flow conditions observed within each of the assessed streams is presented in Figure 6-1 and brief descriptions are as follows:

- Mhlatuze - A wide and deep river with moderate flow velocity at the time of the low flow survey and fast flows during the high flow survey.
- Mzingwenya - A narrow stream with variable depth profiles. Average stream velocity was moderate during the low flow survey and fast during the high flow survey.
- Ntuze - Associated tributaries are characterised of narrow and shallow streams with fast flows. The main stem river is wide and deep with some shallow sections.
- Mlalazi - Associated tributaries are characterised of narrow and shallow-to-deep streams with slow flows. Main stem river is wide and deep with still-to-slow flows.

It is worth noting that the water levels and stream velocity were significantly higher during the May 2023 survey compared to the November 2023 survey. This was owing to the rainfall received in the area between December 2022 and May 2023.

Furthermore, the Mhlatuze, Mzingwenya and Ntuze Rivers lie within lower foothills predominantly characterised by a sandy bed forming islands within the channel. The assessed Ntuze tributary was composed of a mixed bed alluvial channel with cascading water at a low water crossing. A section of rapids was sampled below a weir along the Ntuzemiddle reach. The assessed Mlalazi upper reach lies within a lowland river characterised by a low gradient alluvial fine bed channel. A section of cascading water was sampled below a low water bridge. The Mlalazi tributary was characterised by increased silt content within a meandering pattern (Figure 6-2).

Several sites of interest mapped during the desktop analysis were found to be heavily transformed with modifications ranging from being canalised for irrigation purposes to no apparent channel present. These occur within sugarcane farms and Eucalyptus plantations.

Figure 6-1 - Representative flow conditions of the assessed streams during the current study

Figure 6-2 - Cascading water: at the Ntuze River – Tributary (A), main stem middle reach (B) and at the Mlalazi upper reach (C). High silt content at the Mlalazi tributary (D)

6.2 *IN SITU* WATER QUALITY

The variables temperature, pH, electrical conductivity and dissolved oxygen were measured onsite by means of portable water meters. Results from the low flow and high flow surveys are presented in Table 6-2 and Table 6-3, respectively.

These data are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms, and provide an indication of the physico-chemical status of the water at a sampling site at the time of the survey.

Results were referenced against various water quality guidelines shown in Table 6-1. The following terms have been used to denote the state of the water quality based on deviations from the water quality guidelines:

- **'Good'** – denotes no exceedances from the recommended guidelines.
- **'Moderate'** – denotes minor exceedances, from the recommended guidelines, in one or more of the water quality variables.

- **'Poor'** – denotes notable exceedances, from the recommended guidelines, in one or more of the water quality variables.

Table 6-1 - Sources for the recommended water quality guidelines for aquatic ecosystems

Variable	Source	Guideline limit
Temperature	South African Water Quality Guidelines: *Aquatic Ecosystems (Volume 7)* (Department Of Water Affairs And Forestry, 1996)	5 – 30 ˚C
pH		6 – 8
Dissolved Oxygen % Saturation		80 – 120 %
Dissolved Oxygen concentration	Minimum Dissolved Oxygen concentration for aquatic macroinvertebrates (Nebeker et al., 1996)	> 5 mg/ℓ
Electrical Conductivity	Conductivity guideline value of 500 µS/cm stipulated in U.S. Environmental Protection Agency (2010)	< 500 µS/cm

Table 6-2 – *In situ* water quality data collected during the low flow survey

Sites	Time	Temp. (ºC)	pH	EC (µS/m)	DO (mg/ℓ)	DO (%)
TWQR	**-**	**5 - 30º**	**6 – 8**	**<500**	**>5.0**	**80 - 120**
Mhlatuze W12F-03494 SQR						
Site 1	13h36	25,1	7,66	430	**4,30**	**74,3**
Site 5	12h36	24,1	6,80	368	**1,22**	**23,1**
Site 3	N/A					
Site A	8h35	25,4	7,85	450	**4,82**	**77,1**
Mzingwenya W12F-03611 SQR						
Site 7	12h57	23,2	**4,00**	**618**	**4,47**	**75,5**
Site B	14h41	23	6,33	**506**	No data	
Ntuze W13B-03593 SQR						
Site 18	N/A					
Site 17	13h40	23,1	7,01	237	**4,41**	**51,6**
Site 19	11h06	22,3	7,25	295	**4,88**	**76,2**
Site 20	11h13	25,3	6,77	289	**4,78**	**75,7**
Site 39	12h47	23,3	6,96	273	6,11	88,3
Mlalazi W13A-03609 SQR						
Site D	8h39	24,2	7,45	416	No data	
Mlalazi and aManzamnyama W13B-03673 SQR						
SIte 33	N/A					
SIte 31	8h27	23,1	6,81	**680**	**3,11**	**31,0**
Site 26	15h06	27,2	7,41	351	**2,85**	**27,7**
Site 8	N/A					
Site 10						
Site F						

Sites	Time	Temp. (ºC)	pH	EC (µS/m)	DO (mg/ℓ)	DO (%)
Site 11	10h10	16,1	6,59	336	3,31	33,0
Site 12	12H01	23,4	**4,08**	490	No data	
Site 15	N/A					
SIte C	8H33	22,3	6,13	**627**	No data	
EC = Electrical Conductivity; DO = Dissolved Oxygen. N/A = Not Assessed						

Table 6-3 - *In situ* water quality data collected during the high flow survey

Sites	Time	Temp. (ºC)	pH	EC (µS/m)	DO (mg/ℓ)	DO (%)
TWQR	**-**	**5 - 30º**	**6 – 8**	**<500**	**>5.0**	**80 - 120**
Mhlatuze W12F-03494 SQR						
Site 1	9h21	20,5	7,61	382	**4,71**	**77,9**
Site A	11h14	20,6	7,41	390	**4,91**	**76,5**
Mzingwenya W12F-03611 SQR						
Site 7	12h50	20,3	**5,67**	445	**4,97**	**78,2**
NtuzeW13B-03593 SQR						
Site 17	14h07	20,4	**5,96**	170	**4,89**	**73,7**
Site 19	14h58	20,3	6,17	223	**4,94**	**77,4**
Site 39	10h16	21,1	6,25	225	5,88	81,5
Mlalazi W13A-03609 SQR						
Site D	12h46	20,7	6,57	290	**4,66**	**73,0**
Mlalazi and aManzamnyama W13B-03673 SQR						
Site 31	11h36	22,2	6,30	342	**3,16**	**27,9**
Site C	9h14	20,6	7,41	390	**3,22**	**28,3**
EC = Electrical Conductivity; DO = Dissolved Oxygen						

6.2.1 TEMPERATURE

Temperature plays an important role in water by affecting the rates of chemical reactions and consequently the metabolic rates of organisms. Temperature is therefore one of the major factors controlling the distribution of aquatic organisms (DWAF, 1996b).

In the current study, temperature values ranged between 20,3 ºC (at Site 7 in May 2023) and 27,2 ºC (at site 27 in November 2022), thus all the values fell within the range for inland water temperatures in South Africa. The temperatures at all sites were not expected to limit the occurrence of aquatic biota.

6.2.2 PH

The pH value is a measure of hydrogen (H^+), hydroxyl (OH^-), bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) ions in water (Dallas & Day, 2004). In natural water, pH is determined by geological influences

and biotic activities and may also vary both diurnally and seasonally. Diurnal fluctuations occur in productive systems, where the relative rates of photosynthesis and respiration vary over a 24-hour period. Most fresh waters in South Africa are relatively well buffered and more or less neutral, with pH ranges between 6 and 8 (DWAF, 1996b).

The pH values recorded during the low flow and high flow surveys were predominantly circumneutral (close to neutral pH 7) and most of the sites recorded within the recommended pH range of 6-8. Only three sites recorded acidic pH (pH 4 at site 7 and pH 5,08 at site 12 during the low flow survey; pH 5,67 at site 7 and pH 5,96 at site 17 during the high flow survey. Thus, only these sites were expected to deter aquatic biota. These sites lie within swamp forest habitat (Figure 6-3) surrounded by a Eucalyptus plantation (sites 7 and 12) which are known to cause the acidification of soils i.e. through the decay of organic matter and use of fertilizers (Singwane & Malinga, 2012).

Slight improvements in pH values were recorded throughout the assessed sites during the high flow survey. This was likely due to the increased flows which facilitated the dilution of contaminants.

Figure 6-3 - Swamp Forest habitat at sites 7 (A), 12 (B) and 17 (C)

6.2.3 ELECTRICAL CONDUCTIVITY

Electrical Conductivity (EC) is a measure of the ability of water to conduct an electrical current. This ability is a result of the presence in water of dissolved ions, which carry an electrical charge. The EC in natural waters varies in part on the characteristics of geological formations which the water has been in contact with and the dissolution of minerals in soils and plant matter. Anthropogenic sources of increased dissolved salts include domestic and industrial effluent discharges and surface runoff from urban, industrial and cultivated areas (DWAF, 1996b).

The EC values recorded during the present study were predominantly low and recorded within the recommended guideline of 500 µS/cm (USEPA, 1998) at most sites during the low flow survey and at all the assessed sites during the high flow survey. Only sites 7, 31, B and C recorded exceedances (618 µS/m, 680 µS/m, 506 µS/m and 627 µS/m respectively) during the low flow survey. Therefore, only these sites were expected to deter aquatic biota at the time of the survey. Activities associated with the sugarcane (site 31 and C) and Eucalyptus Plantations (sites 7 and B) surrounding these sites were suspected to be linked to the elevated EC levels. Similar to pH levels, improvements in EC levels were recorded throughout the sites during the high flow survey.

6.2.4 DISSOLVED OXYGEN

The maintenance of adequate Dissolved Oxygen (DO) is critical for the survival of aquatic biota as it is required for the respiration of all aerobic organisms (DWAF, 1996b) Therefore, DO concentration

provides a useful measure of the health of an ecosystem (DWAF, 1996b) The median guideline for DO for the protection of freshwater fish, determined by a variety of fish faunas is > 4 - 5 mg/ℓ (Doudoroff & Shumway, 1970; DWAF, 1996b) and that of aquatic macroinvertebrates is ≥ 5 mg/ℓ. The amount of oxygen that can be dissolved in water is influenced by the temperature, as the temperature of the water increases, the concentration of dissolved oxygen decreases (Davies & Day, 1998), thus seasonal fluctuations in oxygen levels are expected.

The recorded dissolved oxygen levels were low and predominantly recorded below the recommended guidelines. Most of the assessed systems lacked the aquatic vegetation (one of the primary drivers of dissolved oxygen) and a variety of habitat and flow required to aid in the mixing and oxygenating of the water column, therefore the oxygen content was expected to be low, and to fluctuate diurnally and seasonally. Only site 39 recorded within the recommended guidelines of 5 mg/ℓ and 80 % saturation during both surveys. The cobbles below a weir cause bubbling rapids which facilitate the entrapment of dissolved oxygen within this system (Figure 6-4).

The low DO saturation levels indicate that the oxygen levels had been depleted from the theoretical equilibrium possibly due to the presence of contaminants. Therefore, aquatic biota was expected to be deterred due to low DO levels at most of the sites.

Figure 6-4 - Bubbling water within rapids at site 39

6.2.5 OVERALL WATER QUALITY

Based on the recorded *in situ* water quality variables, the water quality at site 39 was considered to be '*Good'* whilst that of most sites was '*Moderate'* or '*Poor'* at few sites including sites 5, 12, 26 31 and C due to notable exceedances in pH and DO levels. Most of the sites recorded as *'Poor'* (12, 26, 31 and C) drain Eucalyptus plantations which cover most of the MRB's southern portion. Therefore, the poor state of water quality was likely linked to activities associated with the Eucalyptus plantations.

6.3 DIATOM ANALYSIS

Diatoms are unicellular organisms most widely used as indicators of river health. They are cosmopolitan, have a rapid life cycle and can provide a relatively rapid response to specific physico-chemical conditions in water. The presence or absence of indicator taxa can be used to detect specific changes in environmental conditions such as eutrophication, organic enrichment, salinization and changes in pH.

In the current study, diatom samples were collected from seven sites during the low flow survey and submitted to Ecotone Freshwater Consultants CC (independent specialist) for analysis. Sites were selected based on the availability of substrates. The index scores and ecological water quality are presented in Table 6-8 and a summary of the results is provided below. Refer to Appendix C which contains the comprehensive Diatom Report for more detail.

A total of 115 diatom species were recorded at the seven sites and the diatom assemblages were generally comprised of species characteristic of brackish to fresh brackish, acidic to circumneutral and oligotrophic to eutrophic conditions. Similar to the *in situ* water quality findings, the diatom-based ecological water quality indicated variable conditions ranging from Poor to Good. Whilst most of the results were consistent with those of the *in situ* water quality assessment – sites 7, 17, 39, and 31 for example – Site 5 unexpectedly indicated Good conditions based on the collected diatom sample. This was suspected to be a delay in response of the diatom community to environmental changes.

Table 6-4 - Diatom index scores and ecological water quality

River	Site	%PTV	SPI	Ecological Category	Class
Mhlatuze	Site 5	23,8	14,6	B	Good
Mzingwenya	Site 7	74,0	7,2	D	Poor
	Site B	20,0	11,1	C	Moderate
KwaGugushe	Site 17	11,8	14,7	B	Good
	Site 39	16,0	13,4	B	Good
Mlalazi	Site 31	25,0	8,0	D	Poor
aManzamnyama	Site C	18,3	12,5	C	Moderate

6.4 HABITAT ASSESSMENT

Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations in order to facilitate the interpretation of results (Ollis et al., 2006). The quality of the instream and riparian habitat influences the structure and function of the aquatic community in a stream; therefore, assessment of the habitat is critical to any assessment of ecological integrity.

The Index for Habitat Integrity (IHI) was applied to determine the instream and riparian habitat integrity, and the Integrated Habitat Assessment System (IHAS) was applied to determine the availability and integrity of aquatic macroinvertebrate habitat.

INDEX FOR HABITAT INTEGRITY

The Index for Habitat Integrity (IHI) is a rapid, visual assessment of modifications to a number of pre-selected biophysical drivers and used to determine the PES or Ecological Category of associated instream and riparian habitats (Kleynhans et al., 2008).

The IHI assessment was completed on a desktop-level for each aquatic ecosystem considered in the present study and populated with observations recorded during the field survey. Results are presented in Table 6-5.

Table 6-5 - IHI findings for the watercourses associated with the proposed Project

River	System	Habitat	IHI Score	EC	Major Impacts
Mhlatuze	Main stem	Instream	69,4	C	Inundation and bed modification
		Riparian	64,8	C	Bank erosion
	Tributaries	Instream	38,5	E	Channel modification and Inundation
		Riparian	39,0	E	Indigenous vegetation removal and exotic vegetation encroachment
Mzingwenya	Main stem	Instream	68,8	C	Water quality and channel modification
		Riparian	65,3	C	Indigenous vegetation removal and exotic vegetation encroachment
Ntuze	Main stem	Instream	73,2	C	Water abstraction and channel modification
		Riparian	86,4	B	Water quality and inundation
	Tributary	Instream	58,5	D	Flow and channel modification and Inundation
		Riparian	47,1	D	Indigenous vegetation removal and exotic vegetation encroachment
Mlalazi	Site D	Instream	70,7	C	Water quality, flow and channel modifications
		Riparian	82,3	B	Indigenous vegetation removal and exotic vegetation encroachment
	aManzamnyama	Instream	38,7	E	Flow, bed and channel modification
		Riparian	36,5	E	Indigenous vegetation removal and exotic vegetation encroachment

The IHI was conducted for each sub-quaternary reach (SQR) and separated between the mainstem river and associated tributaries within the river's drainage basin. The findings are summarised and discussed below:

The findings from the IHI assessments conducted during the current survey indicate that the habitat integrity ranged between *Moderately Modified* and *Seriously Modified* for the instream habitat component and between *Largely Natural* and *Seriously Modified* for the riparian habitat component. The observed major impacts are summarised per river system below:

Mhlatuze River

Both instream and riparian habitat components were determined to be *Moderately Modified* (Ecological Category C). Major impacts along the assessed mainstem Mhlatuze River reach were inundation, bed modification and erosion. The high sediment load results from the upstream

sugarcane farming and illegal sand mining activities observed along the banks at site 1. Two tributaries were assessed (sites 5 and 3), both of which have been heavily transformed with no apparent channel visible within the thick bush, including the alien-invasive Lantana (at site 5) and the sugarcane farm (at site 3) (Figure 6-5).

Figure 6-5 - Impacts associated with the Mhlatuze River: sand mining at site 1 (A), alien vegetation resulting in channel modifications at sites 5 (B) and 3 (C)

Mzingwenya River

Both instream and riparian habitat components were determined to be *Seriously Modified* (Ecological Category E). Major impacts along the assessed reach were water quality and channel modifications, indigenous vegetation removal and exotic vegetation encroachment. The river reach is flanked by Eucalyptus plantations to the left and the Esikhawini Township to the right.

Ntuze River

The instream and riparian habitat components along the mainstem Ntuze River were determined to be *Moderately Modified* (Ecological Category C) or *Largely Natural* (Ecological Category B) respectively. A weir and pump station at the downstream site 39 (Figure 6-6) result in water abstraction, instream channel and flow modifications. The assessed Ntuze River tributary was observed to be heavily transformed within the upper reach (site 18) by Eucalyptus plantation and sugarcane farms, the lower reach site was mainly impacted by sugarcane farms (Figure 6-6). Consequently, the overall instream and riparian components were determined to be *Largely Modified* (Ecological Category D).

Figure 6-6 - Impacts associated with the Ntuze River: Pump station and weir at the site 39 (A); Sugarcane farms indicated by red arrows at sites 18 (B) and 17 (C)

Mlalazi River

The assessed Mlalazi River upper reach (SQR W13A-03609) lies adjacent the Sbhamu Township, residents of which use the river water for washing clothes (Figure 6-7), thus water quality modification is one of the major impacts. Furthermore, the low water bridge at site D causes inundation, channel and flow modifications whilst parts of the riparian zone have been transformed into sugarcane fields. The resultant instream and riparian habitat components were determined to be *Moderately Modified* (Ecological Category C) or *Largely Natural* (Ecological Category B) respectively.

The tributaries draining the lower Mlalazi River reach (SQR W13B-03673) have predominantly been transformed by Eucalyptus plantations (sites 8, 10, F, 12 and 15) and to a lesser extent by sugar cane fields (sites 26 and C). The instream and riparian habitat components were determined to be *Seriously Modified* (Ecological Category E) with some of the drainage lines serving as roads within the Eucalyptus Plantations (site 10 for example; Figure 6-7).

Figure 6-7 - Major impacts associated with the Mlalazi River: washing of clothes at the upper reach (left); transformed non-perennial system within the drainage basin of the aManzamnyama River

6.5 AQUATIC MACROINVERTEBRATE ASSESSMENT

The following sections provide insight on the data collected as part of the aquatic macroinvertebrate assessment. The South African Scoring System (SASS, Version 5) and available habitat (Invertebrate Habitat Assessment System) that was sampled at each of the suitable sites, as well as the subsequent determination of the ecological condition of the observed assemblages in relation to reference conditions (Macroinvertebrate Response Assessment Index) are discussed.

6.5.1 INTEGRATED HABITAT ASSESSMENT SYSTEM

The Integrated Habitat Assessment System (IHAS) was developed by (McMillan, 1998) for use in conjunction with the South African Scoring System (SASS5) bioassessment. Results from the current study are provided in Table 6-6.

The assessed ecosystems lie within the upper foothills and lower foothills geomorphological zone (class D and E respectively). Characteristic channel features within these geomorphological zones include lower gradient, mixed-bed alluvial channels with sand and gravel dominating the bed and

pools of significantly greater extent than rapids or riffles, and flood plain are often present (Rowntree et al., 2000).

As such, the assessed sites generally lacked the stones-in-current biotope. This biotope was only found at site 39, site D and site 31.

Based on the obtained IHAS scores, most of the assessed sites presented *Poor* macroinvertebrate habitat availability, whilst a few sites exhibited *Adequate* habitat availability and a single site *Good* habitat availability (site 31). Therefore, most of the sites were not expected to host macroinvertebrate assemblages comprising of high diversity of taxa.

Table 6-6 - Integrated Habitat Assessment System scores

Site	Sampling Habitat				IHAS	
	Stones-in-Current	Vegetation	Other Habitat / General	Physical Stream Condition	Score	Description
Mhlatuze W12F-03494 SQR						
Site 1	0	10	17	27	54	Poor
Site 5	0	12	12	24	48	Poor
Site A	0	11	16	27	54	Poor
Mzingwenya W12F-03611 SQR						
Site B	0	15	12	29	56	Adequate
KwaGugushe W13B-03593 SQR						
Site 17	0	5	20	31	56	Adequate
Site 19	0	12	20	33	65	Adequate
Site 20	0	14	10	23	47	Poor
Site 39	18	5	14	27	64	Adequate
Mlalazi W13A-03609 SQR						
Site D	13	6	8	25	52	Poor
Mlalazi and aManzamnyama W13B-03673 SQR						
Site 31	11	13	16	29	69	Good
Site 11	0	13	10	27	50	Poor
Site 12	0	15	10	28	53	Poor
SIte C	0	10	16	22	48	Poor
Maximum possible scores for Stones-in-Current = 20; Vegetation = 15; Other Habitat/General = 20; Physical Stream Condition = 45						

ECOLOGICAL CONDITION OF THE AQUATIC MACROINVERTEBRATES

The SASS5 protocol was conducted to sample macroinvertebrates at sites with suitable habitat. This protocol provides a general indication of the current state of the macroinvertebrate community and subsequently the 'health' of the river (Dickens & Graham, 2002). The collected SASS5 data is provided in Table 6-7 for the low flow survey and Table 6-8 for the high flow survey.

A total of 30 invertebrate taxa were collected at the 13 sampled sites during the low flow season. The macroinvertebrate community assemblage was similar in composition throughout the sites ranging from 2 taxa (at site D) to 15 taxa (at site 17). The low diversity assemblage was dominated by pollution-tolerant taxa i.e., with a SASS quality value or sensitivity value of less than 6. The most sensitive taxon

collected (at site 19 only) belongs to the Heptageniidae family (Flathead mayflies) with a SASS sensitivity value of 13.

Contrary to expectation, fewer taxa were collected from the nine sampled sites (23 taxa) during the high flow survey, compared to the low flow survey. The macroinvertebrate community assemblage was of low diversity and dominated by pollution-tolerant taxa. The most sensitive taxon collected (at site 19 only) belongs to the Perlidae family (Stoneflies; Figure 6-8) with a SASS sensitivity value of 12. The lower macroinvertebrate diversity during the high flow survey was attributed to the fact that fewer sites were sampled and the heavy rainfall prior to undertaking the survey, which likely had flushed the invertebrates to downstream reaches.

Figure 6-8 – Sensitive aquatic invertebrate, Perlidae (stonefly) sampled at site 19 during the high flow survey

Table 6-7 – SASS5 data for the low flow survey

Site	SASS5	Number of Taxa	ASPT
Mhlatuze W12F-03494 SQR			
Site 1	43	9	4,8
Site 5	19	5	3,8
Site A	41	8	5,1
Mzingwenya W12F-03611 SQR			
Site 7	34	8	4,3
Site B	42	10	4,2
NtuzeW13B-03593 SQR			
Site 17	66	15	4,4
Site 19	62	10	6,2
Site 20	38	7	5,4
Site 39	32	6	5,3
Mlalazi W13A-03609 SQR			
Site D	11	2	5,5
Mlalazi and aManzamnyama W13B-03673 SQR			
Site 31	61	13	4,7

Site	SASS5	Number of Taxa	ASPT
Site 11			
Site 12	37	9	4,1
Site C	36	5	7,2
ASPT = Average Score Per Taxon			

Table 6-8 - SASS5 data for the high flow survey

Site	SASS5	Number of Taxa	ASPT
Mhlatuze W12F-03494 SQR			
Site 1	36	7	5,1
Site A	12	2	6,0
Mzingwenya W12F-03611 SQR			
Site 7	13	4	3,3
NtuzeW13B-03593 SQR			
Site 17	48	10	4,8
Site 19	64	11	5,8
Site 39	29	5	5,8
Mlalazi W13A-03609 SQR			
Site D	18	4	4,5
Mlalazi and aManzamnyama W13B-03673 SQR			
Site 31	51	12	4,3
Site C	22	5	4,4
ASPT = Average Score Per Taxon			

The SASS5 data obtained was used in the MIRAI (Thirion, 2008) to determine the Present Ecological State (PES, or Ecological Category) of the associated macroinvertebrate assemblage. The MIRAI provides a habitat-based cause-and-effect basis to interpret the deviation of the aquatic macroinvertebrate community from the reference condition. Results for the reach-based MIRAI are shown in Table 6-9 and Table 6-10 for the low flow and high flow surveys respectively.

Based on the MIRAI, the ecological condition of the aquatic macroinvertebrate communities ranged from *Seriously Modified* to *Critically Modified*. The modified states recorded were as a result of the change from reference conditions, especially within the flow and habitat metrics during the low flow survey and within the flow and water quality metric during the high flow survey, and the overall low diversity present within the assessed systems. Furthermore, the historic and on-going land use activities (mainly small-scale to large-scale sugarcane farming and Eucalyptus plantations within the study area have significantly impacted the receiving environment and subsequently the indigenous fauna and flora, including aquatic biota.

Table 6-9 – MIRAI data for the low flow survey

River	System	Metric Group % change from Reference		MIRAI Value	EC	Description
Mhlatuze	Mainstem	Flow Modification	98	14,3	F	Critically Modified
		Habitat	81			
		Water Quality	75			
	Tributary	Flow Modification	88	8,2	F	Critically Modified
		Habitat	96			
		Water Quality	88			
Mzingwenya	Mainstem	Flow Modification	88	17,0	F	Critically Modified
		Habitat	82			
		Water Quality	77			
Ntuze	Mainstem	Flow Modification	74	27,1	E	Seriously Modified
		Habitat	74			
		Water Quality	69			
	Tributary	Flow Modification	85	27,6	E	Seriously Modified
		Habitat	68			
		Water Quality	81			
Mlalazi and aManzamnyama W13B-03673 SQR	Mainstem	Flow Modification	98	3,4	F	Critically Modified
		Habitat	95			
		Water Quality	97			
	Tributary	Flow Modification	50	37,5	E	Seriously Modified
		Habitat	64			
		Water Quality	70			
EC = Ecological Category						

Table 6-10 – MIRAI data for the high flow survey

River	System	Metric Group % change from Reference		MIRAI Value	EC	Description
Mhlatuze	Mainstem	Flow Modification	93	8,2	F	Critically Modified
		Habitat	93			
		Water Quality	89			
	Tributary	N/A				
Mzingwenya	Mainstem	Flow Modification	98	7,0	F	Critically Modified
		Habitat	88			
		Water Quality	92			
Ntuze	Mainstem	Flow Modification	86	22,2	E	Seriously Modified
		Habitat	73			
		Water Quality	72			
	Tributary	Flow Modification	91	16,3	F	Critically Modified
		Habitat	84			
		Water Quality	74			
Mialazi and aManzamnyama W13B-03673 SQR	Mainstem	Flow Modification	91	13,1	F	Critically Modified
		Habitat	77			
		Water Quality	92			
	Tributary	Flow Modification	49	33,7	E	Seriously Modified
		Habitat	63			
		Water Quality	83			
EC = Ecological Category; N/A = Not Assessed						

6.6 ICTHYOFAUNA

The composition of fish communities is often altered by anthropogenic activities in the catchment. Changes in water quality, flows and habitat can result in the absence or addition of species, ultimately altering the biotic integrity of the system. Thus, fish can effectively give an indication of the degree of modification of the aquatic environment.

Fish sampling was undertaken by means of the electroshocking technique at sites with suitable fish habitat. The collected fish specimens were identified in the field and released back into the river. A list of collected fish species within the study area is provided in Table 6-11 and photographs taken onsite are provided in Appendix E.

A total of 701 specimens comprising of 19 species were recorded in the current study, seven more compared to the previous aquatic biodiversity assessment undertaken by Marine & Estuarine Research (2009). Seventeen species were collected during the low flow survey and fourteen during

the high flow survey. Only two of the collected species are of conservation concern according to the IUCN Red List of Threatened Species (IUCN, 2023) – *Aplocheilichthys myaposae* reported as 'Near Threatened' (NT) and *Enteromius gurneyi* as Vulnerable (VU). A description of the factors influencing the decreasing populations of *A. myaposae* and *E. gurneyi* are provided in section 5.3.

The species *Myxus capensis*, *Pseudocrenilabrus philander* and *Tilapia sparrmanii* comprised the highest abundances of the total specimens collected i.e. 22%, 18% and 15% respectively.

Table 6-11 - Fish species collected during the low flow and high flow surveys

Scientific Name	Mhlatuze	Mzingwenya	Ntuze		Mlalazi	
	Mainstem	Mainstem	Mainstem	Tributary	Mainstem	Tributary
Acanthopagrus berda	-	-	-	-	9	5
Anguilla marmorata	-	-	2	1	2 (1)	-
Aplocheilichthys myaposae	-	7	(9)	18 (13)	(1)	-
Clarias gariepinus	-	1 (1)	(1)	-	1	3 (1)
Ctenopoma multispine	-	(1)	-	-	-	-
Eleotris melanosoma	1 (1)	-	2 (3)	-	(3)	(1)
Enteromius gurneyi	1	-	-	-	-	-
Enteromius paludinosus	33 (7)	-	3	-	-	-
Enteromius trimaculatus	12 (23)	-	-	-	-	-
Enteromius viviparus	2 (5)	-	5 (8)	-		
Glossogobius callidus	9	-	15 (3)	-	6	17 (1)
Glossogobius giuris	1	-	5	-	1	-
Kuhlia rupestris	-	-	(1)	-	(1)	-
Labeo cylindricus	2 (8)	-	-	-	-	-
Myxus capensis	19	-	32 (5)	-	63 (3)	25 (5)
Monodactylus falciformis	-	-	7	-	43	7
Oligolepis acutipennis	-	-	-	-	-	1
Pseudocrenilabrus philander	31 (17)	-	11 (26)	24 (21)	-	-
Tilapia sparrmanii	34 (22)	-	6 (7)	-	9 (4)	18 (5)
Abundance	**145 (83)**	**8 (2)**	**88 (63)**	**43 (34)**	**134 (13)**	**78 (13)**
Diversity	**12 (8)**	**2 (2)**	**10 (9)**	**3 (2)**	**8 (6)**	**8 (5)**
Data collected during the high flow survey indicated in brackets						

BIOTIC INTEGRITY BASED ON FISH COMMUNITIES

The Fish Response Assessment Index (FRAI) was applied to determine the ecological integrity of the fish community assemblages within the monitoring sites for the current study. The FRAI forms part of the River EcoStatus Monitoring Programme (REMP) which replaced the River Health Programme (RHP) in 2016 and is a component of the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) (Kleynhans, 2008).

The FRAI is based on a combination of fish species habitat preferences, as well as intolerance to habitat changes, and the present frequency of occurrence (FROC) of species compared to the

reference FROC, thus provides a cause-and-effect basis to interpret the deviation of the fish assemblage from the reference condition.

6.6.1 FISH HABITAT POTENTIAL ASSESSMENT

Fish habitat potential refers to the presence and abundance of suitable conditions for fish to inhabit, depending on the expected species' preferences for the particular river reach. The considered habitat metric groups are velocity-depth and cover – with five types of cover within each of the four velocity-depth classes (Table 6-12).

Table 6-12 - Fish habitat potential assessment metric groups

Slow-Deep	Slow-Shallow	Fast-Deep	Fast-Shallow
Overhanging veg.	Overhanging veg.	Overhanging veg.	Overhanging veg.
Undercut banks	Undercut banks	Undercut banks	Undercut banks
Substrate	Substrate	Substrate	Substrate
Aquatic veg.	Aquatic veg.	Aquatic veg.	Aquatic veg.
Water column	Water column	Water column	Water column

The sampled fish habitat potential was rated between 0 to 5 (1 = rare; 2 = sparse; 3 = common; 4 = abundant; 5 = very abundant) at each of the assessed sites (Figure 6-9) and these were considered in the determination of the expected frequency of occurrence (FROC) for each fish species.

The dominant fish habitat cover types were as follows:

- Overhanging vegetation and water column within the slow deep and fast deep velocity-depth classes at the Mhlatuze River, Ntuze River (mainstem), Mlalazi River (mainstem);
- Overhanging vegetation and undercut banks within the slow deep and fast deep velocity-depth classes at the Mzingwenya River;
- Overhanging vegetation across all the velocity-depth classes at the Ntuze River tributary; and
- Overhanging vegetation and substrate within the slow deep velocity-depth class at the Mlalazi River tributary.

Thus, the expected fish species were largely those with a preference for the available habitat types within each of the river reaches.

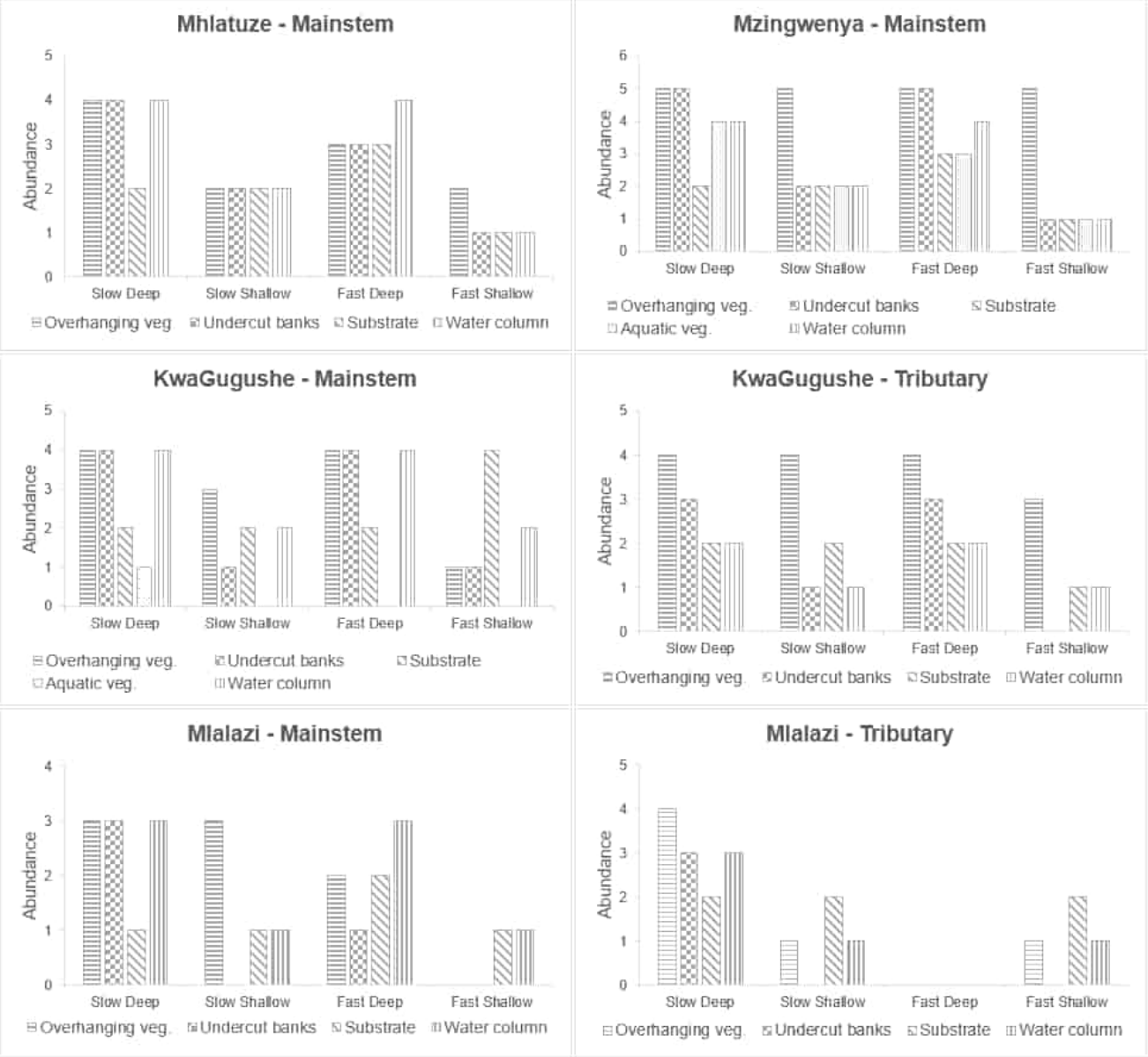

Figure 6-9 - Fish habitat metric group abundances per river reach

6.6.2 FISH RESPONSE ASSESSMENT INDEX (FRAI)

The FRAI Index is based on a combination of fish species habitat preferences as well as intolerance to habitat changes, and the present/observed frequency of occurrence (FROC) of species compared to the reference FROC (Kleynhans, 2008).

The FRAI-based Present Ecological State (PES) for the assessed river reaches is provided in (Table 6-13). Ratings for the FROC were based on the species habitat preferences and previous capture data.

A low diversity of species was recorded in relation to the number of expected species. Twenty nine (29) species were expected within the study area based on the previously undertaken Port Durnford pre-feasibility study (Marine & Estuarine Research, 2009) and the DWS (2014) database. Only 14

species were recorded within the W12F catchment (Mhlatuze and Mzingwenya rivers) and 15 were recorded within the W13B catchment Ntuze and Mlalazi rivers). Of the recorded species, two were not listed as expected: *E.melanosoma* and *K.rupestris.* The former species is commonly found in muddy reaches or estuaries and freshwater streams leading into coastal lagoons (Skelton, 2001). Thus, these species were collected from reaches consisting of the preferred habitat types in the current study. The overall recorded fish community was dominated by species with a high preference for slow-shallow velocity-depth class; over-hanging vegetation cover and are tolerant to modified water quality. Furthermore, the recorded fish community was comprised of a single species (*Anguilla marmorata*) with a requirement for catchment scale migrations whilst most species require migrations between reaches.

The absence of other species can be attributed to several factors including the lack of preferred habitat types such as aquatic macrophytes and intolerance to modified water quality (*Redigobius dewaali* for example), and/or the prolonged inputs of contaminants from surrounding farming and mining activities.

The subsequent Ecological Categories ranged from *Moderately Modified* to *Critically Modified* conditions.

Table 6-13 – FRAI results for the assessed river reaches

River	System	FRAI Score	Ecological Category	Description
Low Flow Survey				
Mhlatuze	**Mainstem**	60,6	**C**	Moderately Modified
Mzingwenya	**Mainstem**	29,9	**E**	Seriously Modified
Ntuze	**Mainstem**	43,5	**D**	Largely Modified
	Tributary	30,1	**E**	Seriously Modified
Mlalazi	**Mainstem**	39,7	**E**	Seriously Modified
	Tributary	75,7	**C**	Moderately Modified
High Flow Survey				
Mhlatuze	**Mainstem**	44,8	**D**	Largely Modified
Mzingwenya	**Mainstem**	26,4	**E**	Seriously Modified
Ntuze	**Mainstem**	42,7	**D**	Largely Modified
	Tributary	27,2	**E**	Seriously Modified
Mlalazi	**Mainstem**	24,6	**E**	Seriously Modified
	Tributary	44,2	**D**	Largely Modified

6.7 INTEGRATED ECOSTATUS DETERMINATION

The EcoStatus is defined as: "*The totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services*" (Iversen et al., 2000). Thus, the EcoStatus represents an integrated ecological state representing the drivers (hydro-morphology and physico-chemical) and responses (riparian vegetation, aquatic invertebrates and fish; (Kleynhans & Louw, 2008).

The integrated EcoStatus for the sampled river reaches associated with the Project Area are

presented in Table 6-14.

Following integration of the defined ecological conditions obtained for the riparian component (i.e. IHI from riparian vegetation assessment) and the instream biological integrity (i.e. MIRAI from aquatic invertebrates and FRAI from fish), it was determined that the sampled reaches predominantly represented an integrated EcoStatus of *Largely Modified* conditions. All the assessed systems presented *Largely Modified* conditions, except the Ntuze River which presented *Moderately Modified* conditions during the low flow survey. The riparian zone along the assessed Ntuze River reach was largely natural – sugarcane fields mostly occur 50 m (and more) away from the riverbanks. Thus, the vegetation component attained the highest score of the assessed systems.

Table 6-14 – Integrated EcoStatus categories for the current study – EcoStatus version 1.02 (Kleynhans and Louw, 2007)

River	System	Response Indices				EcoStatus	
		Riparian Vegetation EC (IHI)	MIRAI EC	FRAI EC	Instream EC	Score	Category
Low Flow Survey							
Mhlatuze	Mainstem	64,8	14,3	60,6	37,7	52,1	D
Mzingwenya	Mainstem	65,3	17,0	29,9	23,5	45,8	D
Ntuze	Mainstem	86,4	27,1	43,5	34,8	64,3	C
	Tributary	58,5	27,6	30,1	28,8	43,6	D
Mlalazi	Mainstem	82,3	3,4	39,7	21,6	53,9	D
	Tributary	36,5	37,5	75,7	55,3	45,9	D
High Flow Survey							
Mhlatuze	Mainstem	64,8	8,2	44,8	25,3	47,9	D
Mzingwenya	Mainstem	65,3	7,0	26,4	25,3	45,3	D
Ntuze	Mainstem	86,4	22,2	42,7	31,8	63,0	C
	Tributary	58,5	16,3	27,2	21,3	39,9	E
Mlalazi	Mainstem	82,3	13,1	24,6	18,9	52,7	D
	Tributary	36,5	33,7	44,2	38,2	37,3	E

7 SCREENING OF POTENTIAL IMPACTS

Like any development, the proposed facilities have a series of potential impacts that need to be managed, particularly during the life of the mine. These mostly relate to the physical disturbance within the footprint of the mining operations and associated activities, such as *inter* alia vegetation removal, vehicle movements, excavations for pits, creation of facilities on site and earth moving activities. These activities are likely to have a negative impact on riparian habitat as well as the instream functioning of the aquatic ecosystems. Upon completion of the development, these impacts are either to be addressed by rehabilitative measures or should no longer occur with the cessation of construction.

The proposed development is however likely to have residual risks associated with alterations to water quality and quantity, as well as the establishment and spread of alien invasive species. Where developments are built within or in close proximity to riparian habitat, storm water management, and mitigation measures or contingency plans are critically important in reducing the potential negative impacts on the systems.

7.1 PRE-CONSTRUCTION ENVIRONMENTAL PLANNING

7.1.1 SENSITIVE AREAS

Freshwater and estuarine ecosystems should be avoided irrespective of their sensitivity and ecosystem threat status. As such, all freshwater ecosystem boundaries should be considered high sensitivity and avoided. Watercourses such as rivers, wetlands and drainage lines collect, retain, and convey surface water in the landscape to estuaries and subsequently to the Indian Ocean and are sensitive to impacts such as erosion and water quality deteriorations. A sensitivity map showing watercourses that are likely to be impacted by the proposed Project activities is presented in Figure 7-1. It should be noted that the mine plan has been revised to avoid sensitive habitats to the extent possible.

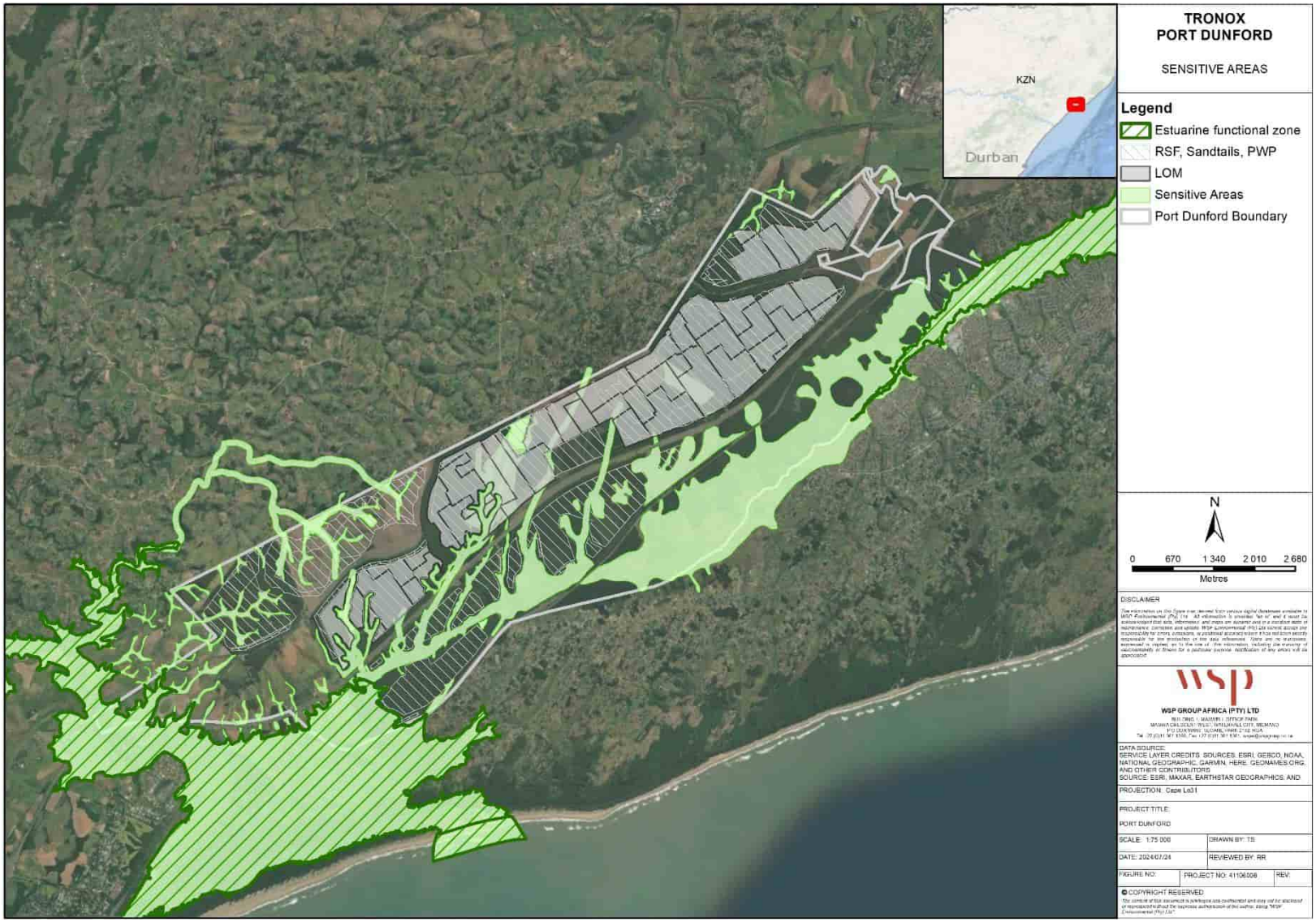

Figure 7-1 - Sensitivity map of watercourses associated with the Project

7.1.2 BUFFER ZONES

Buffer zones are natural areas around the watercourse boundaries, which are requested to protect the watercourse from developmental or land use changes. Protection may also extend to peak runoff/flood flows and the buffer zone may also provide feeding / breeding areas for river or wetland fauna and accordingly enhance the corridor function of drainage lines. In terms of the guidelines presented by DWAF, an appropriate buffer strip surrounding the riparian / wetland habitat is required to protect the habitat and the water resource. The buffer strip is dependent on the following (Kotze, et al., 2009):

- The type of adjacent land use;
- The sensitivity of the wetland/river; and
- The scarcity and quality of the water resource.

To protect the aquatic ecosystems from impacts linked to activities during the construction phase and the operational phase of this development, appropriate buffer zones are calculated using '*The Estuary, River and Wetland Buffer Guidelines*' model (Macfarlane *et al*. 2015). This tool measures the relative risk of construction and operational phases, taking into consideration the specific conditions on the site, and potential mitigation measures that could be implemented in line with best practise.

The mainstem rivers, Mhlathuze, Mzingwenya, Ntuze and Mlalazi, were delineated at a desktop level by analysing available digital elevation contours and colour aerial photography. The delineation encompassed polygon features representing riparian habitat.

The recommended aquatic buffer width is 25m for each of the above-mentioned freshwater ecosystems (Figure 7-2). Therefore, the planned construction and mining activities (excluding roads) should not be permitted to take place within 25m of the edge of the riparian zone.

Rationale: Each of the mainstem freshwater systems are located more than 500m from the proposed infrastructure footprint, except for the Ntuze Tributary (wherein lies site 18) which is located adjacent to RSF 9, thus a buffer of 45m is recommended to protect this river reach as recommended in the Wetlands Report (WSP, 2024).

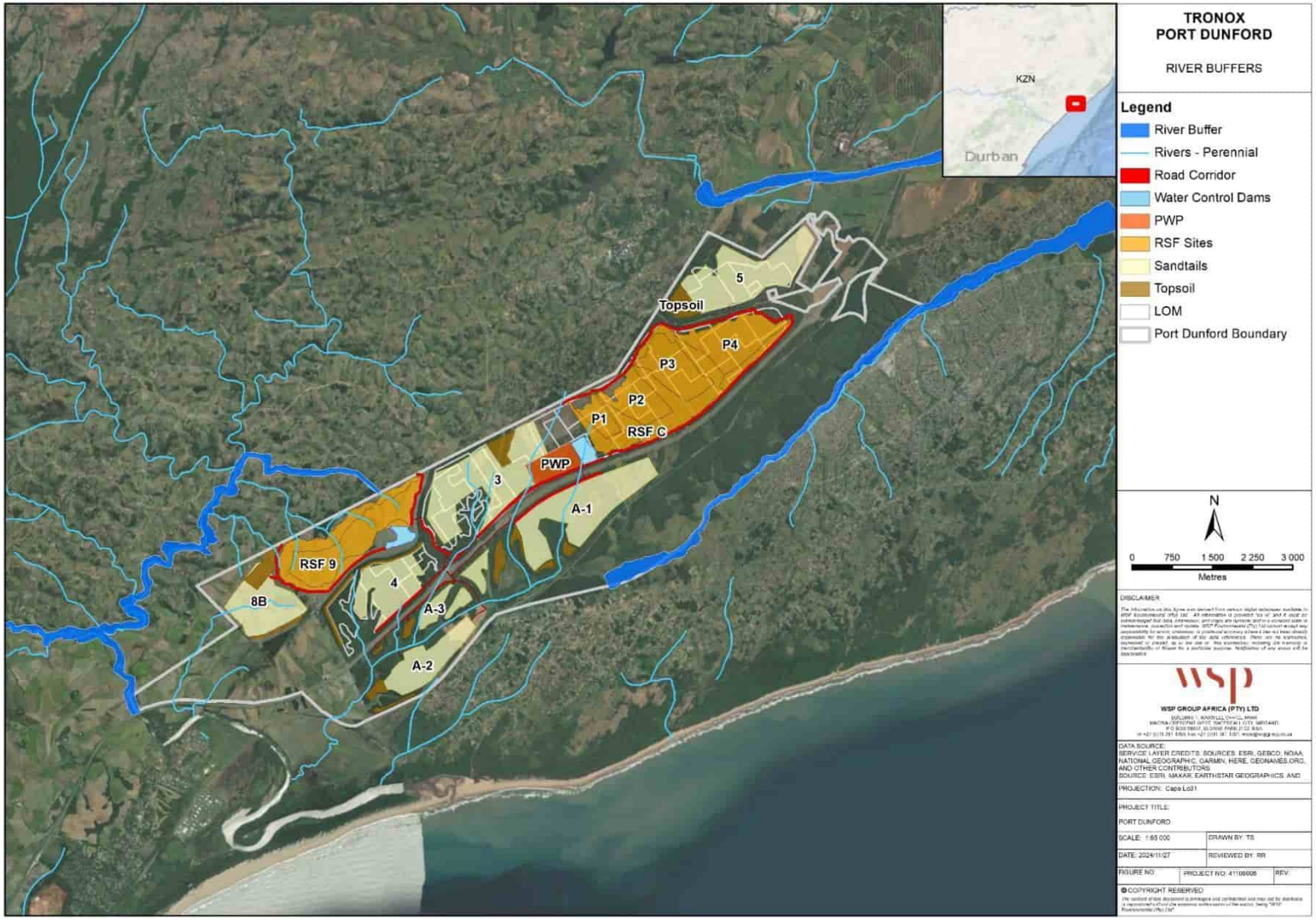

Figure 7-2 – Map showing recommended buffer width for riparian habitat

7.2 SIGNIFICANCE OF POTENTIAL IMPACTS

This section identifies and assesses the significance of the impacts likely to arise during the proposed activities and provides a short description of the mitigation required to limit the magnitude of the potential impact on the aquatic biodiversity receptors.

Potential impacts associated with Phase 1 and Phase 2 are discussed separately in the below sections.

The proposed Phase 1 and Phase 2 activities to be considered as part of the impact assessment are:

- Phase 1 would last 10 years from 2025-2035 at a low production rate of 70,400 tons per annum with operation only occurring on five working days in the month (12 hours a day). The run-of-mine (ROM) material will be mined mechanically and hauled to the Fairbreeze mine via trucks for stockpile and processing. No processing on site is proposed for the Phase 1 mining operation.
- Phase 2 would last 33 years from 2036-2069 at a design production rate of 3000 tonnes per hour, 24 hours per day, 365 days a year. The operation comprises opencast mining, on-site processing of ROM material in a primary wet plant (PWP), the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox MSP located in Empangeni within the Tronox CPC.
- The infrastructure for Phase 2 will be constructed during the Phase 1 mining period (2025-2036), however, mining and processing for Phase 2 will only commence in 2036.

7.2.1 CONSTRUCTION PHASE

This phase will entail the establishment of infrastructure required for Phase 1 and Phase 2 of the Project. The proposed location for the Phase 1 infrastructure is indicated in Figure 2-1, while a 3D visualisation of the site is provided in Figure 2-2. The list of infrastructure and descriptions are provided in section 2.1.3. The infrastructure for Phase 2 will be constructed during the Phase 1 mining period (2025-2036). Figure 2-5 shows the proposed infrastructure layout.

7.2.1.1 Impact Description

The proposed placement of infrastructure (Phase 1 and Phase 2) are located within an area which forms part of the Amanzamnyama catchment. However direct impacts on riparian habitat are not expected due to 1) the area is heavily transformed, and the drainage lines are no longer apparent (Figure 7-3); and 2) the N2 road occurs between the infrastructure area and the Amanzamnyama River, thus will act a barrier for direct impacts.

According to the Surface Water Baseline and Impact Assessment report (WSP, 2025), the surface water resources, including rivers, wetlands and lakes, are largely fed by groundwater sources. Therefore, groundwater plays a significant role in the hydrological dynamics of the catchments, thus indirect impacts in water quantity and quality may occur through baseflows to the Amanzamnyama River.

The upgrading of haulage roads at the stream crossings (-28.909690° 31.818462° and -28.913311° 31.822313°; shown as sites 11 and 12 in Figure 4-1) will entail vegetation clearing, soil disturbance and the establishment of culverts. These activities result in dust generation (leading to siltation in the watercourse), bare land (leading to an increase in surface runoff), erosion and subsequently an increase in the amount of suspended and dissolved solids and potential pollutants from the construction site entering areas down gradient of the construction site (hydrocarbons, cement and domestic litter for example).

The above-mentioned activities pose risks to the aquatic ecosystem functioning in various ways. Siltation/sedimentation in watercourses can directly alter aquatic habitats after deposition (Wood, 1997) which in turn will negatively impact biotic community structure by displacing biota that favour the affected habitat. Suspended solids can also directly impact aquatic biota through the accumulation of silt on respiratory organs (i.e. gills) and by decreasing visibility (i.e. increasing turbidity) which will affect feeding habits of specific taxa. Vegetation clearing near watercourses can result in the introduction of alien invasive species (both fauna and flora) which often negatively impact indigenous species. This can lead to the loss of invertebrates such as dragonflies, which in turn, has the potential to alter biological community structure.

Impact assessment ratings for activities associated with the construction phase for Phases 1 and 2 of the proposed mining are presented in Table 7-1.

Figure 7-3 - Photos showing some of the altered drainage lines in the area. Site 8 (A) site 10 (B) and site F (C)

Table 7-1 – Impact assessment ratings for the construction phase (Phase 1 and Phase 2)

Main Activity	Associated Activities	Impact Description	Riverine / Riparian Habitat Receptor	Pre-Mitigation							Post-Mitigation							Mitigation description
				Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	
Phase 1 Infrastructure	The establishment of infrastructure (listed in section 2.1.3.1)	Vegetation clearing and soil disturbances will result in modifications in water quantity (due to bare surfaces) and water quality (due to sedimentation).	Amanzamnyama River	2	2	3	2	2	**18**	**Low**	2	1	3	2	1	**8**	**Very low**	• Site preparation for the proposed infrastructure should be confined to demarcated footprint areas to minimise soil disturbance and the probability of sedimentation of nearby watercourses. • Construction should be undertaken during the dry period to minimise soil erosion by overland flow and subsequent sedimentation in nearby watercourses. • Install effective sediment and erosion control measures before starting work to minimise sediment entry into the watercourse, such as erosion berms or silt traps. • Implement erosion management at construction sites to reduce the velocity of water flowing downslope. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses.
	Primary wet plant (PWP).																	
Phase 2 Infrastructure	Upgrading of haulage - Existing roads will be used and upgraded where possible to accommodate the larger (40m) road servitude.	Dust generation; Siltation of the receiving water resources; Water quality and habitat modifications.	Two of the nine water resource crossings will impact a riverine/riparian systems (-28.909690° 31.818462° and -28.913311° 31.822313°).	5	2	3	2	5	**60**	**Moderate**	4	2	3	2	2	**22**	**Low**	• Install environmentally friendly barrier systems, such as silt nets to limit erosion and trap contaminated runoff from construction. • Construction chemicals, such as hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions. • All vehicles must be frequently inspected for leaks; No material may be dumped or stockpiled within the river or riparian zone. • All waste must be removed and transported to appropriate waste facilities. • Construction should be undertaken during the dry period to avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and/or dissolved solids) into associated aquatic systems

7.3 OPERATIONAL PHASE

This phase entails the mining operations. The proposed Phase 1 operation will comprise opencast mining and the run-of-mine (ROM) material will be hauled via trucks to the Fairbreeze mine for stockpile and processing. Phase 2 operation comprises opencast mining, on-site processing of ROM material in a PWP, the on-site backfill and disposal of both coarse and fine sand tailings from the PWP and the transport of heavy mineral concentrate to the existing Tronox mineral separation plant (MSP) located in Empangeni within the Tronox central processing complex (CPC).

7.3.1 RSF DAM BREACH

Based on the Dam Breach and Flow Slide (DBFS) analysis report (Epoch Resources, 2024), which was aimed at estimating potential outflow volumes associated with potential breaches in the RSFs, It was determined that a significant volume of residue is expected to be released from the RSFs in the event of a failure and will affect a considerable portion of the downstream areas, including the Mzingwenya, Ntuze and Mlalazi Rivers (Figure 7-4).

7.3.2 IMPACT DESCRIPTION

The revised mine plan avoids sensitive environmental habitats, as such, the potential to impact the main-stem rivers: Mhlatuze, Mzingwenya, Ntuze and Mlalazi has been significantly reduced (with the exception of an RSF dam breach occurring). The mining activities likely to impact riparian habitat during the operational phase include the following:

Activity	Riparian Habitat Receptor
Haulage of ROM to the Fairbreeze Mine in Phase 1	Mlalazi River at the R102 and N2 crossings.
Haulage within the mine boundary in Phase 2	Sites 11 and 12. Located within the upper reaches of a drainage system which report to the Amanzamnyama River.
Placement of the sand tail stockpiles	
Placement of the RSF 9	Upper reaches of the Ntuze River drainage.
RSF Dam Breach	Mzingwenya, Ntuze and Mlalazi Rivers and associated drainages.

In Phase 1, ROM will be hauled on existing public roads R102 and N2, both of which traverse the Mlalazi River, thus posing a risk of spilling the ROM and hydrocarbons (gasoline) into the river and generating dust which may settle within the riparian zone and within the instream channel. In Phase 2, mine material will be hauled to various facilities within the mine boundary. This will pose a risk of spillages into or nearby water resources especially at stream crossings.

The placement of sand tails and the RSF 9 occur within drainage systems associated with the Amanzamnyama and Ntuze Rivers, respectively. These areas were observed to be heavily transformed with no apparent riparian habitat, thus impacts upon aquatic ecosystems are likely to occur through sub-surface flows (WSP, 2025).

Associated impacts to the above include an ongoing risk of water quality deteriorations (as a result of adverse chemical processes involving the ROM, gypsum and other mine material) and habitat modifications (as a result of siltation/sedimentation). Furthermore, increased anthropogenic activities near water resources increase the risk of introducing alien invasive species which disrupt ecosystem functioning.

In the event of a dam breach at the RSF C and RSF 9, the release of residue is expected to inundate the Mzingwenya, Ntuze and Mlalazi drainage systems. This would result in catchment level impacts reaching the estuarine zone and subsequently the Indian Ocean.

Residue Storage Facilities provide a cost-effective means of storing large volumes of waste slurry over the productive phases of mine life allowing for the discontinuation of other detrimental waste-management practices, such as riverine tailings disposal, where tailings are piped directly into river system. However, owing to their size, tailings dams are considered a major hazard that can pose risks to local people and the environment. Breaches near watercourses have been shown to be detrimental to aquatic ecosystems functioning, the tailings intermix with natural soil/sediment and result in long term impacts to stream chemistry (Byrne et al., 2018; Marais et al., 2024).

Impact assessment ratings for the above-described activities are presented in Table 7-2.

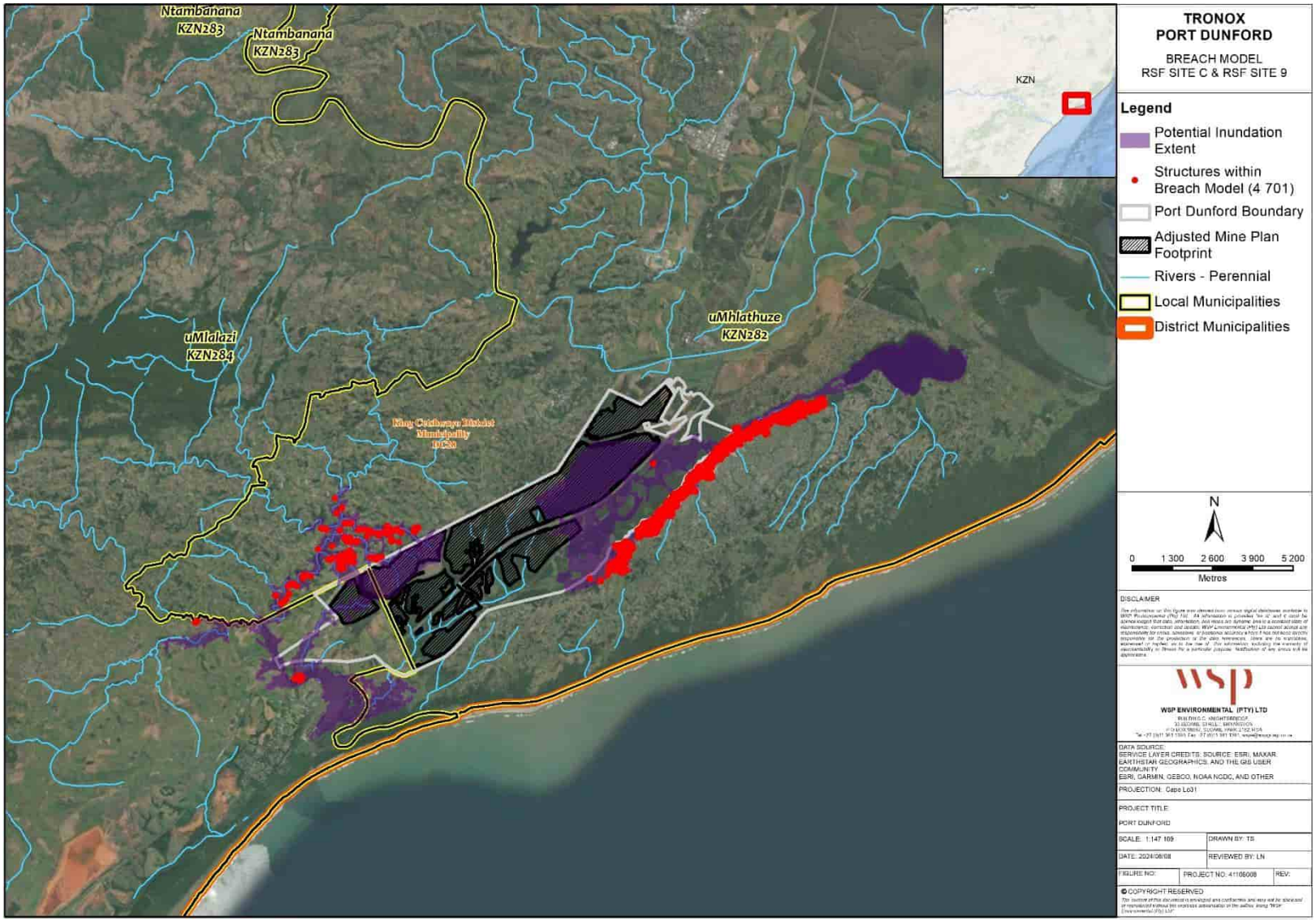

Figure 7-4 - RSF dam breach model

Table 7-2 – Impact assessment ratings for the operational phase

Main Activity	Associated Activities	Impact Description	Receptor	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	Mitigation description
Phase 1 mining	Mechanical mining of ROM; Loading ROM onto trucks. Mining will occur over a ten year period (2025 to 2035)	Water quality modifications due to dust generation, siltation, and spillages of material during hauling	Amanzamnyama River	2	2	3	2	2	**18**	**Low**	2	1	3	2	1	**8**	**Very Low**	Concurrent rehabilitation - The mined-out ore bodies at Fairbreeze Mine will be used for pit infill from the Port Durnford Phase 1 operation for the first 11 years of mining.
	Haulage of ROM to the Fairbreeze Mine on public roads (the R102 and N2).	Potential impacts upon receiving water resources include water quality deteriorations due to spillages of ROM from the hauling trucks.	Mlalazi River crossings at both the R102 and N2.	3	2	3	4	3	**36**	**Moderate**	1	1	1	4	1	**7**	**Very Low**	• Have a spill response and prevention control plan in place. • Consider barriers such as berms between the roads and points with a potential for entry into a water resource. • Cover the hauling trucks (e.g. with tarp) to prevent spilling out during transit.
Phase 2 mining	Topsoil Stripping associated with the sequential mining. A minimum of 0.3 m of topsoil will be stripped. And topsoil stockpile.	Water quality modifications due to dust generation, siltation, and spillages of material during hauling	Amanzamnyama, Mzingwenya, Ntuze, Mlalazi Rivers and Mhlathuze Rivers.	2	3	3	2	2	**20**	**Low**	2	2	3	2	1	**9**	**Very Low**	• Runoff from dirty areas should be directed to the stormwater management infrastructure and should not be allowed to flow into the natural environment. • Bare surfaces downstream from the developments where sediment traps are not an option should be vegetated to attempt to limit erosion and runoff that might be carrying contaminants. • Minimise as much as possible, the footprint or catchment of the dirty area and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff.
	Sequential opencast mining. Bulk earthworks to remove mine material and haulage of ROM		Amanzamnyama, Mzingwenya, Ntuze, Mlalazi Rivers and Mhlathuze Rivers.	2	2	3	4	3	**33**	**Moderate**	2	2	1	2	2	**14**	**Very Low**	• Have a spill response and prevention control plan in place. • Consider barriers such as berms between the roads and points with a potential for entry into a water resource. • Cover the hauling trucks (e.g. with tarp) to prevent spilling out during transit.

Main Activity	Associated Activities	Impact Description	Receptor	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Rating	Mitigation description
																		• All vehicles must be frequently inspected for leaks. • All waste must be removed and transported to appropriate waste facilities.
	Wet backfill/sand tailings	Water quantity modifications i.e. reduction in baseflows during mining and increase in baseflows due to wet backfill	Amanzamnyama, Mzingwenya, Ntuze, Mlalazi Rivers and Mhlathuze Rivers.	2	2	3	4	3	**33**	Moderate	2	2	1	2	2	**14**	Very Low	• Install environmentally friendly barrier systems, e.g. stormwater control berms and trenches may be used to prevent contaminated water from entering the watercourses.
	Disposal of gypsum into RSF C and 9.	Dust generation; Siltation of the receiving water resources; Water quality and habitat modifications.	Ntuze River	1	2	3	3	4	**36**	Moderate	1	1	3	3	1	**8**	Very Low	
	RSF Dam Breach	Modifications to the geomorphology, water and overall habitat of watercourses. High likelihood of decimating aquatic biota within directly affected river systems	Mzingwenya, Ntuze and Mlalazi Rivers and associated drainages	5	5	3	4	4	**68**	High	5	2	3	2	2	**24**	Low	• Prevent the breach from occurring by ensuring conformance with the design and the quality of the works being constructed; monitor the RSF throughout the operational phase; Have an emergency response plan in place to allow for effective actions in the event of a breach despite mitigation efforts, e.g. act swiftly to remove as much of the spilled tailings in watercourses as possible to reduce the short-to long-term impacts on the aquatic ecosystems.

7.4 DECOMISSIONING PHASE

Not applicable as backfilling is concurrent with mining. A rehabilitation plan to ensure the land can be returned for use by forestry will be developed.

7.5 CUMULATIVE IMPACTS

Presently, the main land-use activities within the study area are Eucalyptus plantations and sugar cane farms which have in some parts heavily transformed the landscape i.e. lack of water or even defined channels along mapped drainage lines. Major impacts within riverine habitat were increased sediment load, acidic pH water driven by Eucalyptus plantations. Furthermore, the major impacts associated with the residential areas, which are scattered around the MRA boundary, include water quality modifications from the small-scale sugarcane fields and cattle farming activities. The proposed Project will potentially contribute to habitat quality, water quality and quantity modifications within aquatic ecosystems.

7.5.1 REASONED OPINION WHETHER PROJECT SHOULD PROCEED

The mine plan has been revised to avoid sensitive environmental habitats, as such, the planned placement of infrastructure and mine operations predominantly occurs within heavily transformed areas where drainage lines are no longer apparent, thus the potential to impact upon riparian habitat ecosystems has been significantly reduced. However, the surface water resources within the project area are largely fed by groundwater sources, therefore the proposed mine areas are linked to the down-gradient river systems. Impacts are predicted to range between **High** to **Moderate** and may be reduced upon implementation of mitigation measures.

Two fish species of conservation concern (SCC) were collected in the current study, the Natal Topminnow (*Aplocheilichthys myaposae*) and the Redtail Bard (*Enteromius gurneyi*). These species are respectively listed as Near Threatened and Vulnerable by the IUCN. The populations of both species are largely threatened by impacts associated with agricultural activities including water quality and habitat modifications interacting synergistically with decreasing water levels. The water quantities within the catchments understudy are anticipated to increase overtime as the rivers will be recharged as opposed to water being lost to evapotranspiration under the current land use. This will likely benefit these fish SCC. However, the mine should implement management procedures to minimize potential negative impacts on the riparian habitat and water quality.

7.6 MONITORING PROGRAMME

An aquatic biomonitoring programme has been developed for the monitoring the preservation of the aquatic ecosystems associated with the proposed mine. This programme is aimed at better determining the ecological health of the ecosystems, as well as to act as an early detection tool for impacts that might severely affect the expected aquatic biota in the associated riverine systems. The annual programme comprises of a single survey during the dry season (or low flow season) and a single survey during the wet season (or high flow) at the monitoring points indicated in section 4.2.2.

The aquatic biomonitoring programme must be conducted by a suitably qualified Aquatic Scientist (i.e., holds a valid SASS5 certificate issued by the department of Water and Sanitation and is registered with SACNASP), and must be adhered to throughout the LoM and must go on until there is no noticeable impact following the end of LoM.

Table 7-3 outlines the aquatic monitoring methods to be undertaken. The determined ecological integrity should be compared to the collected baseline data and the Resource Quality Objectives (RQOs), Ecological Specifications (EcoSpecs) and Target Ecological Categories (TEC) detailed in the below tables to determine whether the mining activities are impacting the associated aquatic ecology and to what extent.

Resource Quality Objectives (RQOs) for water quality are presented in Table 7-4, those for macroinvertebrates in Table 7-5 and Table 7-6, and those for fish in Table 7-7

It should be noted that Resource Quality Objectives (RQOs) for the SQRs of focus were not available, therefore the below RQOs / Ecological Specifications (EcoSpecs) and Target Ecological Categories (TEC) were extrapolated from those of the Ecological Water Requirements (EWR) site NS1 (Nseleni River; -28.634100° 31.925170°) (Department of Water and Sanitation, 2024b). This was the only EWR site within the same catchment area (i.e. Secondary Catchment code W1) at the time of writing. Therefore, caution must be taken when comparing collected biomonitoring data to these RQOs.

Table 7-3: Biomonitoring Programme to be conducted bi-annually

Method and Aquatic Component of Focus	Details
Water Quality: *In situ* water tests focusing on: ▪ Temperature; ▪ pH; ▪ Conductivity; ▪ Dissolved oxygen. *Ex situ* Water Quality: ▪ Analysis of selected chemical parameters (see Table 7-4).	*In situ* water quality should be tested by means of portable meters at each monitoring site. *Ex situ* water quality analysis should be conducted at a *South African National Accreditation System* (SANAS) accredited laboratory. Results must be compared to baseline results and RQOs (see section 6.2 and able 7-4) to determine the extent of change
Habitat Quality: Instream and riparian habitat integrity by means of the Index for Habitat Integrity (IHI); and Integrity of macroinvertebrate habitat by means of the Integrated Habitat Assessment System (IHAS).	The IHAS and IHI must be applied at the same sites as in this study to determine the extent of change from baseline results.
Aquatic Macroinvertebrates: Aquatic Macroinvertebrate assemblages must be assessed by means of the SASS5 protocol (or latest version). The Macroinvertebrate Response Assessment Index (MIRAI) must be applied to determine the PES.	The SASS5 and MIRAI results must be compared to the baseline results and RQOs (see section 6.5 and Table 7-6).
Diatoms Assessment: Diatoms samples must be collected, preserved and transported to the laboratory for analysis.	Samples must be collected at the same sites as in this study to determine the extent of change from baseline results.
Fish: Fish assessments must be carried to species level where possible	Sampling of fish must be undertaken by means of the standard electro-narcosis technique. Other methods such cast nets may be used were necessary. Results must be compared to the baseline results and RQOs (see Table 7-7).

Table 7-4 - Water quality EcoSpecs and TPCs (PES and TEC: B) (Department of Water and Sanitation, 2024)

Metric	Ecological Specifications	Threshold of Potential Concern
Physical variables		
Electrical Conductivity	The 95th percentile of the data must be ≤85 mS/m.	The 95th percentile of the data is 68 - 85 mS/m.
pH	The 5th percentile of the data must range from 6.5 to 8.0, and the 95th percentile from 6.5 to 8.8.	The 5th percentile of the data is <6.7 and >7.8, and the 95th percentile is <6.7 and >8.6.
Temperature	Largely natural temperature range is expected.	Abundance and frequency of occurrence of temperature sensitive species are lower than expected for reference.
Dissolved oxygen	The 5th percentile of the data must be ≥7.5 mg/L.	The 5th percentile of the data is ≤7.7 mg/L.
Turbidity	Moderate impact expected due to land–use and sediment deposits at the site.	Unnaturally high sediment loads and turbidity during runoff events. Impacts are mostly temporary, but some sediment deposits are evident. Check biotic response for habitat-related changes.
Inorganic salts		
$MgSO_4$	The 95th percentile of the data must be ≤37 mg/L.	The 95th percentile of the data is 30 - 37 mg/L.
Na_2SO_4	The 95th percentile of the data must be ≤51 mg/L.	The 95th percentile of the data is 41 - 51 mg/L.
$MgCl_2$	The 95th percentile of the data must be ≤51 mg/L.	The 95th percentile of the data is 41 - 51 mg/L.
$CaCl_2$	The 95th percentile of the data must be ≤105 mg/L.	The 95th percentile of the data is 84 - 105 mg/L.
NaCl	The 95th percentile of the data must be ≤389 mg/L.	The 95th percentile of the data is 311 - 389 mg/L.
$CaSO_4$	The 95th percentile of the data must be ≤1105 mg/L.	The 95th percentile of the data is 884 – 1105 mg/L.
Nutrients		
Total Inorganic Nitrogen (TIN-N)	The 50th percentile of the data must be <0.25 mg/L.	The 50th percentile of the data is 0.2 - 0.25 mg/L.
PO_4 -P	The 50th percentile of the data must be ≤0.015 mg/L.	The 50th percentile of the data is 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data must be ≤15 mg/L	The 50th percentile of the data is 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data must be ≤12 mg/m^2}	The 50th percentile of the data is 10 - 12 mg/m^2 .

Table 7-5 - Macro-invertebrate indicator taxa (Department of Water and Sanitation, 2024b)

Indicator group	Families	Velocity (m/s)	Substratum	Water Quality
1	Hydropsychidae >2spp	>0.6	Cobbles	High
2	Elmidae	>0.6	Cobbles	Moderate
3	Leptophlebiidae	0.3 - 0.6	Cobbles	Moderate
4	Atyidae	<0.1	Vegetation	Moderate
5	Coenagrionidae	<0.1	Vegetation	Low

Table 7-6 - Macro-invertebrate EcoSpecs and TPCs (PES and TEC: B/C) (Department of Water and Sanitation, 2024b)

EcoSpecs	TPCs
Ensure that the SASS5 scores and ASPT values occur in the following range SASS5 score range 120 to 180; ASPT value: >5.0.	ASPT below 5.5 - grading from a biological band C towards a C/D.
Ensure that the MIRAI score is within the range of a B/C Category (>77.99 and <82.0 using the same reference data used in DWS (2022c).	A MIRAI score of 78% or less.
Maintain suitable flow velocity (maximum >0.6 m/s) and clean, unembedded surface area (cobbles) to support the Hydropsychidae (>2 species) assemblages in the VFCS biotope.	Hydropsychidae (>2 species): This taxon missing in two consecutive surveys.
Maintain suitable conditions for the following flow-dependent species in the SIC biotope: ▪ Elmidae: Abundance A. ▪ Leptophlebiidae: Abundance B.	Any one of Elmidae and Leptophlebiidae missing in two consecutive surveys.
To maintain sufficient quantity and quality of inundated vegetation to support the Coenagrionidae and Atyidae.	Any one of Coenagrionidae and Atyidae missing in two consecutive surveys.
To ensure that no group consistently dominates the fauna, defined as D abundance (>1000) over more than two consecutive surveys.	Any taxon occurring in an abundance of >500 for two consecutive surveys.
EcoSpecs = Ecological Specifications; TPC = Threshold of Potential Concern; VFCS = Very fast over coarse substrate; SIC = Stone-in-current	

Table 7-7 - Fish species FROC, EcoSpecs and TPCs (PES and TEC: C) (Department of Water and Sanitation, 2024b)

Species (Abbr.)	Scientific names: Reference species (Introduced species excl.)	Reference FROC	PES: C EC	
			EC: Observed and habitat derived FROC	FROC TPC
PPHI	*Pseudocrenilabrus philander*	5	4	FROC <4 (present at <50% of suitable sites sampled in reach).
GCAL	*Glossogobius callidus*	4	3	FROC <3 (present at <25% of suitable sites sampled in reach).
CGAR	*Clarias gariepinus*	3	2.5	FROC <2.5 (present at <10% of suitable sites sampled in reach).
OMOS	*Oreochromis mossambicus*	3	2	FROC <2 (present at <10% of suitable sites sampled in reach).
BPAU	*Enteromius paludinosus*	3	2	FROC <2 (present at <10% of suitable sites sampled in reach).
BTRI	*Enteromius trimaculatus*	3	2	FROC <2 (present at <10% of suitable sites sampled in reach).
BVIV	*Enteromius viviparus*	3	2	FROC <2 (present at <10% of suitable sites sampled in reach).
LMOL	*Labeo molybdinus*	3	2	FROC <2 (present at <10% of suitable sites sampled in reach).
LNAT	*Labeobarbus natalensis*	3	1.5	FROC <1.5 (absent from all suitable sites sampled in reach).
AMOS	*Anguilla mossambica*	2	1	FROC <1 (absent from all suitable sites sampled in reach).
MMAC	*Marcusenius macrolepidotus (Caudisquamatus Sp.Nov)*	2	1	FROC <1 (absent from all suitable sites sampled in reach).
TSPA	*Tilapia sparrmanii*	2	1	FROC <1 (absent from all suitable sites sampled in reach).
GGIU	*Glossogobius giuris*	1	0.5	FROC < 0.5 (absent from all suitable sites sampled in reach).
AAEN	*Awaous aeneofuscus*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
MKAT	*Macropanxhax katangae*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
ALAB	*Anguilla bengalensis labiata*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).

Species (Abbr.)	Scientific names: Reference species (Introduced species excl.)	Reference FROC	PES: C EC	
			EC: Observed and habitat derived FROC	FROC TPC
AMAR	*Anguilla marmorata*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
MMYA	*Macropanxhax myaposae*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
BGUR	*Enteromius gurneyi*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
CTHE	*Clarias theodorae*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
MBRE	*Mesobola brevianalis*	1	0.5	FROC <0.5 (absent from all suitable sites sampled in reach).
Metric	**Indicator**	**EcoSpecs/RQOs**	**TPC (Biotic)**	**TPC (Habitat)**
Ecological status	PES	PES of fish is in a C (FRAI = 67.9%).	Decrease of PES towards a lower EC than PES (FRAI <63%)	Any deterioration in a habitat feature that results in decrease in FROC of species that lead to deterioration of PES.
FROC = Frequency of Occurrence; PES = Present Ecological State; TPC = Threshold of Potential Concern				

8 CONCLUSION AND RECOMMENDATIONS

The following key findings are highlighted as part of the current aquatic biodiversity and impact assessment study:

The aquatic ecosystems associated with the study area were determined to be modified to varying extents. These modifications were largely attributed to the main land-use activities which include Eucalyptus plantations and sugar cane farms. These have, in some parts, heavily transformed the landscape. Furthermore, impacts associated with the residential areas, which are scattered around the MRA boundary, include water quality modifications from the small-scale sugarcane fields and cattle farming activities. Consequently, the integrated ecological state (EcoStatus) of the assessed reaches were determined to range from *Largely Modified* to *Seriously Modified*.

The planned placement of infrastructure and mine operations predominantly occurs within heavily transformed areas where drainage lines are no longer apparent, thus the potential to impact upon riparian habitat ecosystems has been significantly reduced. However, the surface water resources within the project area are largely fed by groundwater sources, therefore the proposed mine areas are linked to the down-gradient river systems. Impacts are predicted to range between High to Moderate and may be reduced upon implementation of mitigation measures.

It is recommended that the aquatic biomonitoring programme must be adhered to throughout the LoM to ensure protection of the aquatic ecosystems. The proposed Project should adopt a water and habitat quality preservation mindset throughout the LoM to prevent.

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Appendix A

METHODOLOGY

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Methodology	Measurement description	Guidelines/Description		
		***In situ* water variable**	**Guideline**	**Guideline referenced**
***In Situ* Water Quality**	Determined using portable field instruments: pH: Eutech pHTester2; Electrical Conductivity: Eutech ECTester11 Dual Range; Dissolved oxygen: Eutech CyberScan DO300; and Temperature: Eutech CyberScan DO300.	Temperature (ºC)	5 - 30	South African Water Quality Guidelines: *Aquatic Ecosystems (Volume 7)* (Department Of Water Affairs And Forestry, 1996)
		pH	6 - 8	
		Dissolved Oxygen Saturation (%)	80 – 120	
		Dissolved Oxygen concentration (mg/ℓ)	>5	Minimum Dissolved Oxygen concentration for aquatic macroinvertebrates (Nebeker et al., 1996)
		Electrical Conductivity (µS/m)	< 500	Conductivity guideline value of 500 µS/cm stipulated in U.S. U.S. Environmental Protection Agency (2010)
Habitat Assessment	Habitat assessment can be defined as the evaluation of the structure, of the surrounding physical habitat, that influences the quality of the water resource, and the condition of the resident aquatic community (Barbour et al., 1999). Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations in order to facilitate the interpretation of results.			

Methodology	Measurement description	Guidelines/Description			
Integrated Habitat Assessment System (IHAS)	The quality of the instream and riparian habitat influences the structure and function of the aquatic community in a stream; therefore, assessment of the habitat is critical to any assessment of ecological integrity. The IHAS, *Version 2* was developed specifically for use with the SASS5 index and rapid biological assessment protocols in South Africa (McMillan, 1998).	**IHAS**	**Description**		
		>65%	Good		
		55% – 65%	Adequate/Fair		
		<55%	Poor		
Intermediate Habitat Integrity Assessment	Habitat integrity refers to the maintenance of a balanced, integrated composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).	**Descriptive classes for the assessment of modifications to habitat integrity (Kleynhans, 1996).**			
		Score	**Impact Category**	**Description**	
		0	None	No discernible impact, or the factor is located in such a way that it has no impact on habitat quality diversity, size and variability.	
		1 – 5	Small	The modification is limited to a very few localities and the impact on habitat quality, diversity, size and variability is also very small.	
		6 – 10	Moderate	The modification is present at a small number of localities and the impact on habitat quality, diversity, size and variability is also limited.	
		11 – 15	Large	The modification is generally present with a clearly detrimental impact on quality habitat quality, diversity, size and variability. Large areas are, however, not influenced.	
		16 – 20	Serious	The modification is frequently present and the habitat quality, diversity, size and variability almost the whole of the defined section are affected. Only small areas are not influenced.	
		21 – 25	Critical	The modification is present overall with a high intensity; the habitat quality, diversity, size and variability in almost the whole of the defined section are detrimentally influenced.	
	Intermediate habitat integrity assessment classes/categories (Kleynhans, 1996)				
	Score	**Class (% of total)**	**Description**		
	90 - 100	A	Unmodified, natural.		
	80 - 90	B	Largely natural with few modifications.		

Methodology	Measurement description		Guidelines/Description
	60 - 79	C	Moderately modified.
	40 - 59	D	Largely modified.
	20 - 39	E	The loss of natural habitat, biota and basic ecosystem functions is extensive.
	0 - 19	F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates were sampled using the qualitative kick sampling method called South African Scoring System (SASS, *version 5*) (Dickens & Graham, 2002)and identified using the hand guide from Gerber & Gabriel (2002).

The SASS5 data obtained was used in the Macroinvertebrate Response Assessment Index (MIRAI) (Thirion, 2008) to determine the Present Ecological State (PES, or Ecological Category) of the associated macroinvertebrate assemblages.

Biotic Integrity (Highveld (11) Upper Ecoregion)

MIRAI Score	Class	Description
90-100	A	Unmodified and natural. Community structures and functions comparable to the best situation to be expected. Optimum community structure for stream size and habitat quality.
80-89	B	Largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged.
60-79	C	Moderately modified. Community structure and function less than the reference condition. Community composition lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.
40-59	D	Largely modified. Fewer species present then expected due to loss of most intolerant forms. An extensive loss of basic ecosystem function has occurred.
20-39	E	Seriously modified. Few species present due to loss of most intolerant forms. An extensive loss of basic ecosystem function has occurred.
0-19	F	Critically modified. Few species present. Only tolerant species present, if any.

Diatoms

Diatoms are a unicellular algal group widely used as indicators of river health as they provide a rapid response to specific physico-

Interpretation of the Specific pollution index (SPI) scores (CEMAGREF, 1982)

Index score	Class
>17	A (high quality)

Methodology	Measurement description	Guidelines/Description	
	chemical conditions in the water and are often the first indication of environmental change. The presence or absence of indicator taxa can be used to detect specific changes in environmental conditions namely, eutrophication, organic enrichment, salinization and pH variation (Kelly *et al*. 1998). Diatom laboratory procedures were carried out according to the methodology described by (Taylor et al., 2005). Two indices, namely the Specific Pollution Sensitivity Index (SPI; CEMAGREF, 1982) and the Biological Diatom Index (BDI; (Lenoir, A. & Coste, 1996) were used in the diatom assessment.	13 - 17	B (good quality)
		9 - 13	C (moderate quality)
		5 - 9	D (poor quality)
		<5	E (bad quality)
		Percentage of Pollution Tolerant Value (%PTV) (Kelly & Whitton, 1995)	
		<20	Site free from organic pollution.
		21 - 40	There is some evidence of organic pollution.
		41 - 60	Organic pollution likely to contribute significantly to eutrophication.
		>61	Site is heavily contaminated with organic pollution.

Methodology	Measurement description	Guidelines/Description		
		FRAI Score (%)	Class	Description of generally expected conditions for integrity classes
Ichthyofauna	Fish samples were collected using an electro-fishing device (Smith-Root LR24). Based on a survey of available literature and previous assessments, an expected species list was compiled, utilising the following sources: Skelton (2001), (Kleynhans et al., 2007) and IUCN. The PES or Ecological Category of the fish assemblage of the watercourses associated with the Project Area was conducted by means of the Fish Response Assessment Index (FRAI) (Kleynhans, 2008)	90 – 100	A	Unmodified, or approximate natural conditions closely.
		80 – 89	B	Largely natural with few modifications.
		60 – 79	C	Moderately modified. A lower than expected species richness and presence of most intolerant species.
		40 – 59	D	Largely modified. A clearly lower than expected species richness and presence of most intolerant species.
		21 – 39	E	Seriously modified. A strikingly lower than expected species richness and general absence of intolerant and moderately intolerant species.
		0 – 20	F	Critically modified. Extremely lowered species richness and an absence of intolerant and moderately intolerant species.

Appendix B

SITE PHOTOGRAPHS

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Mhlatuze River system	
Site 1 downstream view	**SIte 5 upstream view**
Site 5 downstream view	**Site A downstream view**
Mzingwenya River	
Site 7 downstream view	**Site B downstream view**

Ntuze River system	
Site 18 upstream view	**Site 18 downstream view**
Site 17 upstream view	**Site 19 downstream view**
Site 20 downstream view	**Site 39 downstream view**
Mlalazi River system	

Site D downstream view	**Site 33 upstream view**
Site 31 upstream view	**Site 17 upstream view**
Site 11	**Site 12**
Amanzamnyama River system	

Site 8	**Site 10**
Site 12 upstream view	**Site F upstream view**
Site 15 upstream view	**Site C upstream view**

Appendix C

LABORATORY ANALYSIS REPORT

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Appendix D

AQUATIC MACROINVETEBRATES DATA

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	Low Flow												High Flow										
Taxon	**Site 1**	**Site 5**	**Site 7**	**Site 11**	**Site 12**	**Site 17**	**Site 19**	**Site 20**	**Site 31**	**Site 39**	**Site A**	**Site B**	**Site C**	**Site D**	**Site 1**	**Site 7**	**Site 17**	**Site 19**	**Site 31**	**Site 39**	**Site A**	**Site C**	**Site D**
Oligochaeta				1	1	A			A	1		A	1			1	1		A				A
Hirudinea						1																	
Potamonautidae	1		1			A	1	A	A	1		A		A			1	A	B	A		A	A
Atyidae	A					A	A	A	B	A	A	A	B	B	A		B	B	B	B	A	B	A
Paleomonidae										A	A									1			
Hydracarina												A											
Perlidae																		1					
Baetidae 1sp	1			A	1		A				1										A		
Baetidae 2spp						A						A			B		A	A	B				
Baetidae >2spp																							
Caenidae						A			A									A					
Heptageniidae							1																
Coenagrionidae	A	A	1			A	B	1	A		A	A					A		A				
Protoneuridae							A																
Aeshnidae			A	1	A			1	A				1										
Gomphidae									A										A				1
Libellulidae			A		A					1		1			1								
Belostomatidae	A																			1		A	
Corixidae						A			A			1											
Gerridae	A		A		A	A	1	A	A				A			A	B	A	A				
Nepidae																		1				1	

	Low Flow												High Flow										
Taxon	**Site 1**	**Site 5**	**Site 7**	**Site 11**	**Site 12**	**Site 17**	**Site 19**	**Site 20**	**Site 31**	**Site 39**	**Site A**	**Site B**	**Site C**	**Site D**	**Site 1**	**Site 7**	**Site 17**	**Site 19**	**Site 31**	**Site 39**	**Site A**	**Site C**	**Site D**
Notonectidae		1	A		A				A		A	1							1				
Pleidae								1															
Veliidae		A	A	A	A	1					A		A			1		B	1	1			
Hydroptilidae							1																
Leptoceridae	A						B	A	A	1					1		A	A					
Dytiscidae					A	A									1							1	
Gyrinidae	A	A		A		A	A		A		B				A		A	B					
Psephenidae													A										
Chironomidae		A	1		A	A					1	A			A	A			A				
Simuliidae	1					A											1	A	B				
Tabanidae						A											1						
Thiaridae									B										A				
SASS5 Score	43	19	34	23	37	66	62	38	61	32	41	42	36	11	36	13	48	64	51	29	12	22	18
No. of Taxa	9	5	8	5	9	15	10	7	13	6	8	10	5	2	7	4	10	11	12	5	2	5	4
ASPT Score	4.8	3.8	4.3	4.6	4.1	4.4	6.2	5.4	4.7	5.3	5.1	4.2	7.2	5.5	5.1	3.2	4.8	5.8	4.3	5.8	6.0	4.4	4.5

Appendix E

PHOTOGRAPHED FISH SPECIMEN

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Family: Cyprinidae	
Enteromius viviparus (Bowstripe barb)	
Enteromius trimaculatus (Threespot barb)	
Enteromius paludinosus (Straightfin barb)	
Labeo cylindricus (Redeye labeo)	
Family: Anabantidae	

Ctenopoma multispine (Manyspined Climbing Perch)	
Family: Cichlidae	
Tilapia sparrmanii (Banded Tilapia)	
Pseudocrenilabrus philander (Southern Mouthbrooder)	
Family: Monodactylidae	

Monodactylus falciformis (Oval Moony)	
Family: Sparidae	
Acanthopagrus berda (Goldsilk seabream	
Family: Kuhlia rupestris	
Kuhlia rupestris (Jungle perch)	
Family: Gobiidae	

Glossogobius giuris (Tank Goby)	
Glossogobius callidus (River Goby)	
Oligolepis acutipennis (Paintedfin Goby)	
Family: Eleotridae	
Eleotris fusca (Dusky sleeper)	
Eleotris melanosome (Broadhead Sleeper)	
Family: Mugilidae	

Myxus capensis (Freshwater mullet)	
Family: Poeciliidae	
Aplocheilichthys (Micropanchax) myaposae (Natal topminnow)	
Family: Anguillidae	
Anguilla marmorata (Giant mottled eel)	
Family: Clariidae	
Clarias gariepinus (Sharptooth catfish)	

Appendix F

SPECIALIST **CURRICULUM VITAE**

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Tebogo Khoza Curriculum Vitae
Aquatic Scientist
SASS5
***Pr.Sci.Nat* (Aquatic Science - 119651)**

CAREER SUMMARY

Tebogo is currently the lead aquatic scientist at WSP Group Africa. He is a SASS5-accredited and holds an M.Sc. in Biodiversity and Conservation. He has over 6 years' worth of experience in the environmental management field. He has spent 5 years within the consulting industry with focus on various aquatic-related studies thereby establishing himself as an aquatic scientist. Tebogo has been involved in numerous Aquatic Ecology projects across various sectors including mining (e.g., coal, gold, platinum, diamond, titanium etc.), industrial (e.g, smelters, special economic zones, etc.), transport infrastructure upgrades (e.g, roads, airports, rapid transport systems, etc.), public utility services infrastructure (e.g., powerline installations, bulk water pipelines, etc.), as well as mixed-use, residential and commercial developments.

He has undertaken aquatic ecology surveys across Gauteng, Mpumalanga, Free-State, KwaZulu Natal and Limpopo provinces of South Africa and other African countries including Swaziland, Lesotho, Zimbabwe, Tanzania, Mali as well as along the Zambezi and Chobe rivers in Botswana, Zambia and Namibia. He has acted as lead Aquatic Ecologist for numerous projects, responsible for completion of the aquatic biodiversity and impact assessment surveys, report compilation and amendment to the report queries.

He has been involved at various levels of Specialist Input required for the nationally legislated environmental processes throughout South Africa, especially in the form of Environmental Impact Assessments (EIA's) or Environmental and Social Impact Assessments (ESIA's), Mining Right Applications (MRA's), Water Use License Applications (WULA's), as well as in fulfilment of Biodiversity Management Plans (BMP's).

Area of expertise

Aquatic Biomonitoring (Invertebrate and fish surveys)
Data analysis (Ecoclassification Models)
GIS and Mapping (QGIS)
Microsoft Office

Language

English – Fluent
isiZulu – Fluent
Sesotho – Fluent
Setswana – Fluent
Xitsonga – Intermediate
Sepedi – Intermediate

EDUCATION

Master of Science (MSc.) Biodiversity & Conservation, University of Johannesburg, South Africa	2018
Bachelor of Science (Hons) Zoology, University of Johannesburg, South Africa	2015
Bachelor of Science (BSc) Biochemistry & Zoology, University of Johannesburg, South Africa	2014

ADDITIONAL TRAINING

Basic First Aid	2021
Defensive Driving Course	2020
Environmental Impact Assessment for Reviewers	2018
Advanced Driving Skills (Specialising in off-road 4x4 conditions)	2015

PROFESSIONAL MEMBERSHIPS

SACNSP

- *Professional Natural Scientist* – Aquatic Science (Reg. 119651)
- *Candidate Natural Scientist* – Environmental Science (Reg. 119651)

SASS5 - South African Scoring System version 5 practitioner, DWA (Expires in 2025)

PROFESSIONAL HISTORY

WSP Group Africa (Pty) Ltd	June 2022 – present
Digby Wells Environmental, Johannesburg, Aquatic Ecologist	November 2019 – May 2022
GCS Water & Environmental (Pty) Ltd. Junior Aquatic Ecologist	March 2019 – November 2019
The Biodiversity Company (Pty) Ltd. Junior Natural Scientist	September 2018 – March 2019
Gauteng Department of Agriculture & Rural Development	March 2018 – August 2018

RELEVANT PROFESSIONAL EXPERIENCE

(Below is a list of some of the relevant projects involved in. A complete list can be provided upon request)

ESIA

Karo Platinum, ESIA, Chegutu, Zimbabwe
2022
Aquatic Biodiversity Assessment Lead
Environmental and Social Impact Assessment (ESIA) for the proposed powerline. Responsible for the aquatic biodiversity and impact assessment including field surveys, report compilation and client liaison.

Barrick Gold, ESIA, Nyamongo, Tanzania
2022
Field Surveyor & Data Collation
Environmental and Social Impact Assessment for the proposed Gena-Gokona. Expansion Project.

Aquatic Biomonitoring

KBP-JV, Kasane, Botswana
2021 – 2022
Field Surveyor & Data Collation
Environmental Monitoring for the Kazungula Bridge Project. Responsible for undertaking quarterly aquatic biomonitoring surveys and data collation.

Barrick Gold, Loulo, Mali
2021
Field Surveyor & Data Collation
Aquatic Biomonitoring at the Loulo & Gounkoto Gold Mining Complex. Responsible for assisting with field surveys and data collation.

Rio Tinto, Richards Bay Minerals: Aquatic Biomonitoring, KZN, South Africa
2022 - 2023
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring at the SP&L site. Responsible for undertaking quarterly aquatic biomonitoring surveys, data collation and report writeup.

Exxaro Resources, Malta Colliery Mpumalanga, South Africa
2019 - 2022
Aquatic Biodiversity Assessment Lead

Aquatic Biomonitoring at the Matla Colliery. Responsible for undertaking quarterly aquatic biomonitoring surveys, data collation and report writeup.

Mafube Coal, Mafube Colliery, Mpumalanga, South Africa
2020 – 2022
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring at the Mafube Colliery. Responsible for undertaking biannual aquatic biomonitoring surveys, data collation and report writeup.

Sasol, Defunct Sigma Colliery, Free State, South Africa
2020 – 2022
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring for the proposed Ash Backfilling Project at Defunct Sigma Colliery. Responsible for undertaking biannual aquatic biomonitoring surveys, data collation and report writeup.

Sasol, Mooikraal Colliery, Free State, South Africa
2020 – 2022
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring for the Mooikraal Colliery. Responsible for undertaking biannual aquatic biomonitoring surveys, data collation and report writeup.

Ivanplats, Ivanplats complex, Limpopo, South Africa
2021
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring for the Ivanplats complex. Responsible for undertaking biannual aquatic biomonitoring surveys, data collation and report writeup.

Harmony Gold, Kusasalethu Operations, Gauteng, South Africa
2021 – 2022
Aquatic Biodiversity Assessment Lead
Aquatic Biomonitoring for the Kusasalethu Operations. Responsible for undertaking biannual aquatic biomonitoring surveys, data collation and report writeup.

Aquatic Biodiversity & Impact Assessment

Tronox KZN Sands, Kwazulu-Natal, South Africa
2023-2024
Aquatic Biodiversity Assessment Lead
Aquatic Biodiversity Baseline and Impact Assessment as part of an Integrated Environmental Authorisation for the Port Dunford Mine. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Eskom Matla, Mpumalanga, South Africa
2023
Aquatic Biodiversity Assessment Lead
Environmental Impact Assessment for various Areas Associated with the Matla Power Station. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Sasol, Northern Cape, South Africa
2022
Aquatic Biodiversity Assessment Lead
Aquatic Biodiversity and Impact Assessment, desktop screening for the proposed Sasol Boegoebaai Green Hydrogen and Renewable Energy Project
Responsible for the aquatic biodiversity and impact assessment report compilation

Universal Coal, new Clydesdale Colliery Mining Right, Limpopo, South Africa
2021
Aquatic Biodiversity Assessment Lead

Aquatic Biodiversity and Impact Assessment Update for the Proposed Environmental Regulatory Process for the New Clydesdale Colliery Mining Right Area. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Pan African Resources, Pan African Resources, Gauteng, South Africa
2021
Aquatic Biodiversity Assessment Lead
Aquatic Biodiversity & Impact Assessment for the Pan African Resources PLC Environmental Application Process. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Far West Gold Recoveries, Far West Gold Recoveries, Gauteng, South Africa
2021
Aquatic Biodiversity Assessment Lead
Aquatic Ecology and Impact Assessment for the Far West Gold Recoveries Kloof Application. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation

Copper Sunset Sand, Mine Expansion, Gauteng, South Africa
2021
Aquatic Biodiversity Assessment Lead
Aquatic Ecology and Impact Assessment for the Proposed Sand Mine Expansion. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Universal Coal, Dalyshope Coal Mine, Limpopo, South Africa
2020
Aquatic Biodiversity Assessment Lead
Aquatic Ecology and Impact Assessment for the Proposed Dalyshope Coal Mining Project. Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

Fetakgomo-Tubatse Municipality, Fetakgomo – Tubatse, Limpopo, South Africa
2020
Aquatic Biodiversity Assessment Lead
Aquatic Ecology and Impact Assessment for the Proposed Fetakgomo-Tubatse Special Economic Zone (FTSEZ). Responsible for the aquatic biodiversity and impact assessment including field surveys and report compilation.

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Appendix E

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DOCUMENT LIMITATIONS

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