



FRESHWATER ECOSYSTEM AND AQUATIC ECOLOGICAL ASSESSMENT

AS PART OF THE ENVIRONMENTAL
AUTHORISATION (EA) AND WATER USE
AUTHORISATION (WUA) PROCESS FOR THE
PROPOSED BERTH 605 AND ASSOCIATED
INFRASTRUCTURE AT THE PORT OF RICHARDS
BAY, KWAZULU-NATAL.

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecosystem and aquatic ecological assessment as part the Environmental Authorisation (EA) process for the proposed Berth 605 and associated infrastructure at the Port of Richards Bay (PoRB).

During the assessment, no wetlands were identified within the study area associated with the proposed Berth 605 project and various depression wetlands were identified within the investigation area (defined as 500m of the study area). The ecological integrity was ascertained to be largely modified and of low to moderate ecological importance and sensitivity (EIS).

According to the layout of the proposed Berth 605 project, there are no direct impacts on the wetlands delineated as a result of the proposed activities, this is for both the construction as well as the operation phase of the project. Considering the location of the wetlands, which are upgradient of the proposed activities (although within 500m of the wetlands) and the existing infrastructure within the study area which limits the potential migration of impacts, the overall risk significance to the delineated wetlands is considered negligible. Based on the outcome of the Risk Assessment Matrix for those wetlands within the regulated zone, the impact is low therefore a General Authorisation (GA) is applicable.

To minimise potential cumulative impacts in the study area given the extensive development that is present, it is recommended that the contractor make use of existing roads into the development sites are used during construction. Where temporary roads have been constructed, the pre-construction ecological state of these areas must be re-instated following construction phase, excavated topsoil and subsoil from the terrestrial areas must be stockpiled separately and reinstated in the order of subsoil and topsoil once construction activities are completed and the proliferation of alien and invasive species within the site must be managed accordingly in terms of the site-specific Alien and Invasive Species management plan. Furthermore, it must be ensured that the pattern, timing and flow of water in the landscape is re-instated following the construction activities and artificial ponding are avoided.

It is the opinion of the specialist that given the limited impacts on the delineated wetlands, in consultation with the relevant authorities the project can be considered for environmental authorisation.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a Freshwater Ecosystem and Aquatic Ecological Assessment as part the Environmental Authorisation (EA) process for the proposed Berth 605 and associated infrastructure at the Port of Richards Bay (PoRB). The PoRB is situated on the north-eastern coast of KwaZulu Natal (KZN) and falls within the uMhlathuze Local Municipality (ULM) and King Cetshwayo District Municipality (KCDM) in the KwaZulu – Natal province.

To identify all freshwater ecosystems that may potentially be impacted by the activities associated with the proposed Berth 605 and associated infrastructure project, a 500 m “zone of investigation” around the development area (study area), in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (as amended) (NWA) was used as a guide in which to assess possible sensitivities of the receiving environment. This 500 m “zone of investigation” will henceforth be referred to as the ‘investigation area’. The assessment took the following approach:

- A desktop study was conducted in which possible freshwater ecosystems were identified for on-site investigation and relevant national and provincial databases were consulted;



- In addition, the freshwater ecosystems within the study area were delineated and ground-truthed during a single site assessment conducted in September 2024 where an assessment of the delineated freshwater ecosystems was undertaken;
- The wetlands were then classified according to the Ollis *et al.* (2013) classification system; and
- The characteristics of the freshwater ecosystems were defined including the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), Recommended Ecological Class (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS).

All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed Berth 605 and associated infrastructure project were identified, delineated and assessed. During the assessment, no wetlands were identified within the study area associated with the proposed Berth 605 project and various depression wetlands were identified within the investigation area (defined as 500m of the study area).

The activities associated with the PoRB date back as early as the 1970s, when the Port was first planned in the early 1970s, the area where the port is located was primarily a small, ecologically sensitive environment with extensive mangrove forests, coastal wetlands, and estuarine ecosystems.

The development of the Port and its subsequent expansion has resulted in a change in the landscape which has changed drivers of freshwater ecosystems in the landscape. Changes in the pattern, timing and timing of water flow and quality due to dredging and industrial activities have overtime resulted in impacts to freshwater ecosystems as well as estuarine habitat and mangroves impacting on the biota established within these diverse ecosystems. This has resulted in loss of functionality for these systems although reduced provision of ecological services.

The process of the delineation of freshwater ecosystems within the study area is complex as a result of the dynamic and unique influence of the adjacent estuary. As a result of fluctuating water levels which results in overlapping zones of wetland and estuarine influence, sediment deposition which deposits sediment across various areas of the wetlands, causing morphological changes in the landscape and variable salinity which are an influence of the estuarine system, over-time the transitional zones between the boundary of the freshwater ecosystems and estuary overlap or lack clear boundaries. Linked to these natural dynamics, surrounding industrial activities, developed artificial drainage systems, including artificial channels/canals, historical excavations and depositions of sediments further add to the complexity of these activities have the potential to create new, unnatural boundaries.

The result of the ecological assessment is summarised in Table A below.

Table A: Summary of the freshwater ecological assessment results.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Depression Wetlands	Category D: (Largely modified)	Very Low to Moderate	Moderate	REC Category: D BAS Category: RMO: Maintain

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed Berth 605 project. A summary (Table B) of the risk assessment is shown below:



Table B: Summary of the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023).

No.	Phases	Activity	Risk Assessment Output
1	Pre-construction (design)	Site clearing and vegetation removal prior to commencement of construction for the proposed Berth 605 project and associated infrastructure.	Low
2	Construction	Clearing of vegetation within the proposed footprint of the container handling facility.	Low
3		Construction activities associated with the development the quay wall.	Low
4		Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (access roads, railway lines and electrical supply infrastructure).	Low
5		Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure).	Low
6	Operation Phase	Operation of proposed dredging and stockpiling activities.	Low
7		Operation of the proposed service infrastructure.	Low

According to the layout of the proposed Berth 605 project, there are no direct impacts on the wetlands delineated as a result of the proposed activities, both the construction as well as the operation phase of the project. Considering the location of the wetlands, which are upgradient of the proposed activities (although within 500 m of the wetlands) and the existing infrastructure within the study area which limits the potential migration of impacts, the overall risk significance to the delineated wetlands is considered negligible. Since a degree of risk to the identified wetlands still exist, and it cannot be rated as no impact, the Risk Assessment Matrix output was Low Risk for all identified impacts. This means that a GA will be required under the NWA.

To minimize cumulative impacts in the study area, given the extensive existing development, the following measures must be implemented during construction:

- Existing roads should be used to access development sites where practical. Where temporary roads are necessary, the affected areas must be restored to their pre-construction ecological state after construction.
- Excavated topsoil and subsoil from terrestrial areas must be stockpiled separately and reinstated in the correct order—subsoil first, followed by topsoil—once construction is complete.
- The spread of alien and invasive species must be managed in accordance with the site-specific Alien and Invasive Species Management Plan.
- The natural pattern, timing, and flow of water across the landscape must be restored following construction disturbances, and artificial ponding should be avoided.

Therefore, through the implementation of these measures, the ecological integrity of the study area can be preserved, minimizing long-term and cumulative environmental impacts while ensuring sustainable development.



DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Table C: Specialist Report Requirements

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Front Page and Appendix E
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 4
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3 and 4
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 5
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 6
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 6
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities.	Section 6
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system);	Section 6



	<p>b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river);</p> <p>c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland);</p> <p>d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); and</p> <p>e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).</p>	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 6
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 6
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	Section 6
3.	The report must contain as a minimum the following information:	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix G
3.2	A signed statement of independence by the specialist;	Appendix G
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 1.2, 2 and Appendix C
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 5
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	N/A
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 5
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 6
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being not considered; and	Section 6
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Section 6
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 5
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a "low" aquatic biodiversity and sensitivity and that were not considered appropriate.	
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 7
3.16	Any conditions to which this statement is subjected.	Section 7



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GLOSSARY OF TERMS

% DO sat	In aquatic environments, oxygen saturation is a ratio of the concentration of dissolved oxygen in the water to the maximum amount of oxygen that will dissolve in the water at that temperature and pressure under stable equilibrium.
Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
ASPT	The average sensitivity of the aquatic community obtained by determining the sum of the sensitivity scores for each aquatic macro-invertebrate family observed and then dividing by the number of families present.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Chroma:	The relative purity of the spectral colour which decreases with increasing greyness.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
DO	Dissolved Oxygen is the amount of oxygen that is present in the water. It is measured in milligrams per litre (mg/L).
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
EIS	Ecological importance refers to the diversity, rarity or uniqueness of the habitats and biota. Ecological sensitivity refers to the ability of the ecosystem to tolerate disturbances and to recover from certain impacts.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
IHI	The habitat integrity of a river refers to the maintenance of a balanced 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.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Intermittent flow:	Flows only for short periods.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
PES	The current state or condition of a water resource in terms of its biophysical components (drivers) such as hydrology, geomorphology and water quality and biological responses viz. fish, invertebrates, riparian vegetation). The degree to which ecological conditions of an area have been modified from natural (reference) conditions.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
RQIS	RQIS provides national water resource managers with aquatic resource data, technical



	information, guidelines and procedures that support the strategic and operational requirements for assessment and protection of water resource quality.
SQR	A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments).
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
VEGRAI	VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results presented as Ecstatus Categories.
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: <ul style="list-style-type: none"> • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.
WULA	The National Water Act (Act 36 of 1998) gives the Department of Water and Sanitation the tools to gather the information that we need for the optimal management of our water resources. The registration of water use is one of these tools.



ACRONYMS

°C	Degrees Celsius.
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DO	Dissolved Oxygen
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
m	Meter
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application



1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a Freshwater Ecosystem and Aquatic Ecological Assessment as part the S&EIR and WUA process for the proposed Berth 605 infrastructure at the Port of Richards Bay (PoRB). The PoRB is situated on the north-eastern coast of KZN and falls within the ULM and KCDM in the KZN province (Figure 1 and Figure 2).

To identify all freshwater ecosystems that may potentially be impacted by the activities associated with the Berth 605 and associated infrastructure, a 500 m “zone of investigation” around the proposed development area (referred to as the study area) was delineated. This zone is defined and explained in the National Water Act, 1998 (Act No. 36 of 1998) (as amended) (NWA). Under the NWA a “regulated area” of a watercourse is the area influenced by flooding, including a 500m radius from wetlands or pans, or a 100m buffer if floodlines are unavailable, and potentially triggering Section 21 (c) and (i) water uses. The zone of investigation for purposes of this report is the regulated area as defined by the NWA.

This 500 m “zone of investigation” will henceforth be referred to as the ‘investigation area’. The purpose of this report is to define the ecology of the area in terms of freshwater ecosystems characteristics, which includes mapping of the freshwater ecosystems, discuss key ecological drivers and to define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS). Additionally, it assesses the socio-cultural and ecological service provision of the freshwater ecosystems. Current industry “best practice” assessment methods are used to determine any potential impacts of the proposed Berth 605 and associated infrastructure project on these ecosystems.

The Department of Water and Sanitation (DWS) prescribed Risk Assessment Matrix (as prescribed by GN 4167 of December 2023) as it relates to the NWA was applied to determine the significance of the perceived impacts associated with the proposed project on the receiving environment. In addition, mitigatory measures were developed, which aim to minimise the perceived impacts associated with the existing activities, followed by an assessment of the significance of the impacts post-mitigation. Additionally, this report aims to define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the freshwater ecosystems. The objective of the study is to provide detailed information when considering the existing activities in the vicinity of the freshwater ecosystems, to ensure the ongoing functioning of the ecosystem such that local and regional



conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

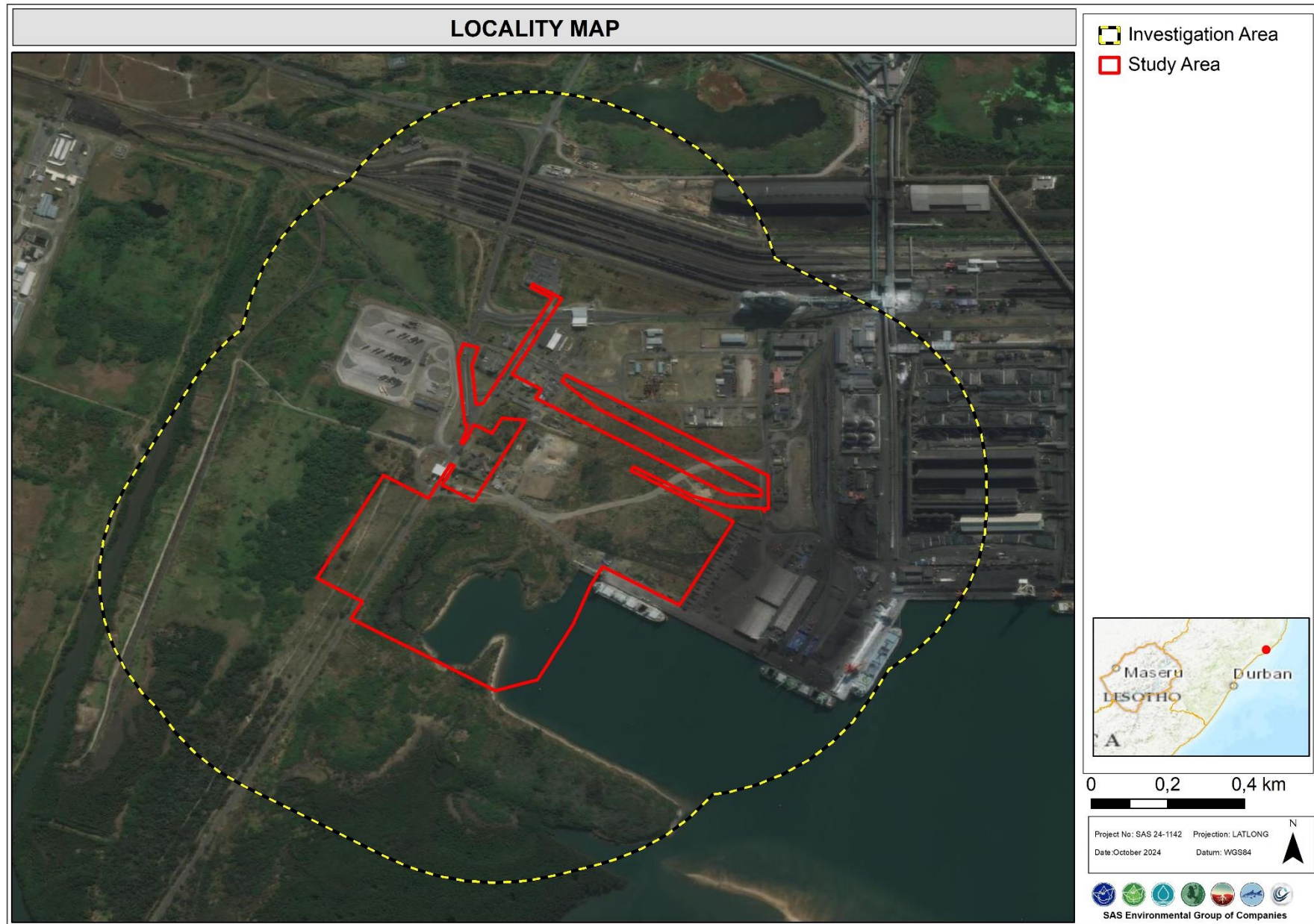


Figure 1: Digital satellite image depicting the location of the study and investigation areas in relation to the surrounding environment.



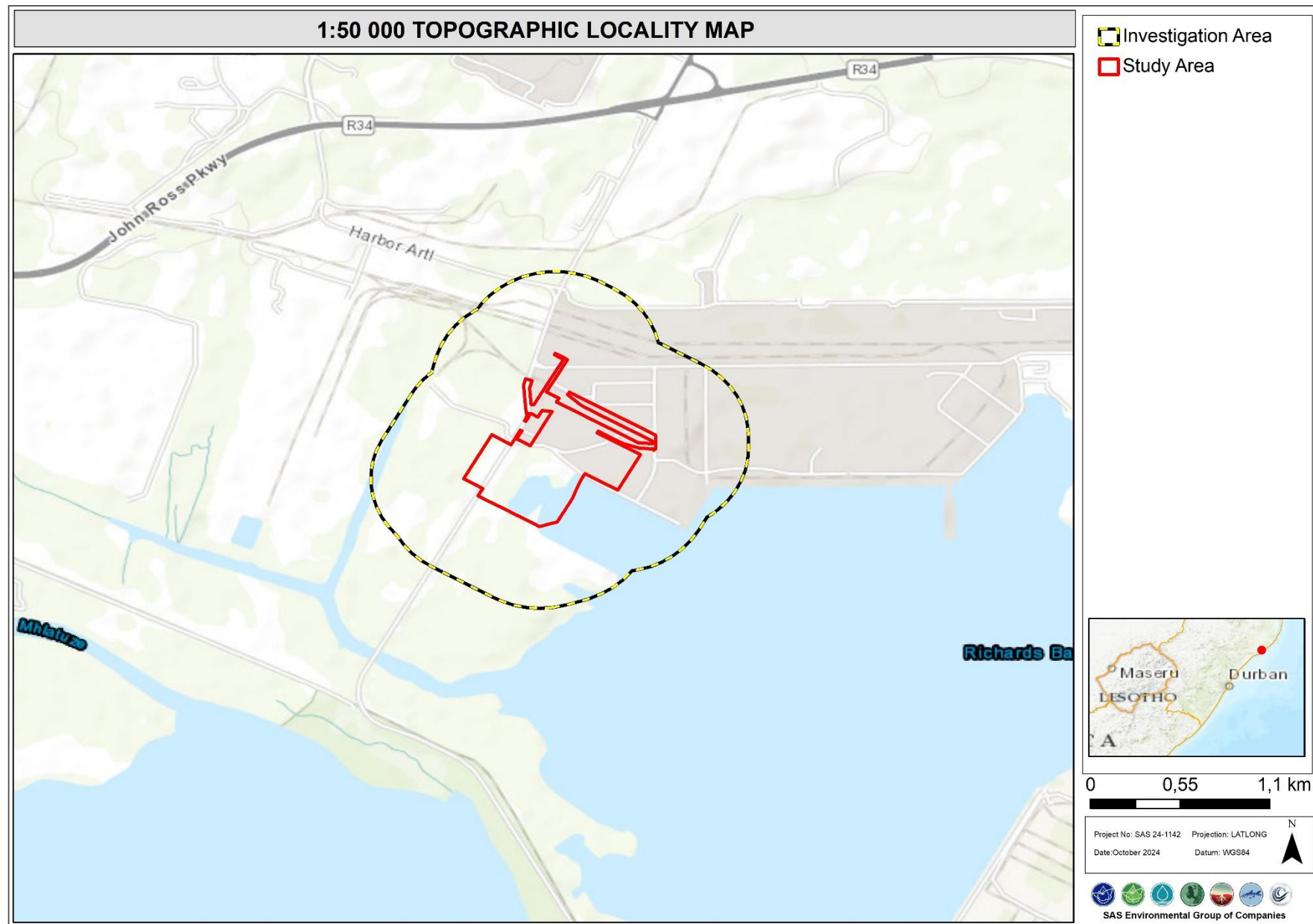


Figure 2: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding environment.



1.2 Summary of Project Components

The following structures and infrastructure are deemed necessary to achieve the overall objective of the project and are included in the project description (the proposed layout of the Berth 605 project is indicated in Figure 3 that follows):

- **New Berth Pocket and Quay Wall** – A new berth pocket and quay wall is proposed. The new proposed Berth 605 quay wall will extend from the existing Berth 606 quay wall maintaining the same cope line alignment (cope level is the top of the quay wall). On the other end of Berth 605, the quay wall will stop short of Urania Road. The quay is a mass gravity structure with a concrete foundation and walls with soil backfill internally which provides a wider footprint, but a lower density will result in a stable foundation, this is aligned to the existing Berth 606 quay wall and is considered as an economical design that has been used at the PoRB and Port of Coega. The quay wall is expected to be 366 m in length. The new quay wall is designed for a future depth of -19 m Port Chart Datum (PCD). This will ensure that the berth can be lengthened and deepened without the need for additional quay wall deepening costs.
- **End of Berth Basin Slopes** – The Berth 605 must fit within the space between the end of the existing Berth 606 and the South Dunes Road. The location of the end of Berth 606 berth pocket is defined as the end of the existing berth which is the lower retained earth wall. With a slope of 1V:3H from -14.5 m PCD to the existing ground level is 60 m long, this provides a total berth length of 338.5 m from the toe of the embankment to the start of Berth 606. This will support a vessel of 315 m Length Overall (LOA). A basin width of 305 m is applied to the bottom of the basin where a proclaimed depth of at least -14.5 m PCD is to be maintained.
- **Dredging** – The new Berth 605 quay wall will be constructed to -19m PCD to allow for further Port expansion at a point in the future. For this project, the berth will be dredged such that a proclaimed depth of -14.5 m PCD is achieved, however the design dredging depth also considers sedimentation and sounding accuracy i.e. 0.6 m below -14.5 m PCD providing a design depth of -15.1 m PCD. This dredge depth is consistent with the PoRB depths and the requirements of the design vessel. This approach limits the volume of dredge material requiring disposal.
- **Dredge Disposal** – An estimated 2.8 million cubic metres of dredged material will be disposed of at an existing authorised offshore disposal site. However, it is estimated that a bulked volume of approximately 3.6 million cubic metres will be disposed of at the offshore dump site.
- **Scour Protection** - The concept design evaluated the necessary scour protection to prevent excessive erosion, which will compromise the structural integrity of nearby infrastructure, such as Urania Road, or cause excessive sediment movement within the



berth pocket. The movement of material within the berth is also of significant concern. The depth of the berth pocket is impacted when material erodes from one area and is deposited elsewhere in the berth pocket. Consequently, maintenance dredging will be required to maintain the required berth pocket minimum navigation depth. A revetment (sloped embankment) will be constructed on the seaward side of the Urania Road. This slope must be protected against wave and propeller action to maintain the structural integrity of the Urania Road. A riprap scour protection system has been considered.

- **New Rail Siding** – Based on the design throughput and the current requirement of a 50-wagon container train and 2 locomotives, it is proposed that the rail siding will consist of two rail lines that are 370m each in length, each servicing 25 rakes. The existing Mhlatuze Yard will be used for shunting and staging purposes to service the new proposed rail siding.
- **New Access Road** – a new shared access road and vehicle access control point to the PoRB, the CHF) and the adjacent vacant land surrounding the CHF is proposed. The new road will be an estimated 735 m length with a lane with of 3.7 m and a reserve width of 30 m. It will consist of two (2) lanes each direction and three (3) intersections; at Urania Road, at Ventura Road and one to the CHF. The shared access road will also have a security control facility as the road is accessible from outside of the Port's security perimeter. Street lighting will be provided for as part of the new road network extension. It must be noted that the road itself and the berth will not be traffic generating, the traffic that will be generated is associated with the operation of the CHF.
- **Footprint of the CHF and Apron Area** – The CHF will be built and operated by the operator therefore this S&EIR process only considers the disturbance footprint of the CHF and not the associated permits that it will require when operational. The total area considered is 6.75 Ha for the CHF with estimated dimensions of 270 m x 250 m. The apron area is an operational area located behind the quay wall and is used for the movement of trucks. The apron area is an estimated 33 m wide and 400 m in length.
- **Provision of Electrical Supply to Feed the Facility Operations and Equipment** – The preferred alternative is applicable where the required electrical demand is within the available capacity of the current existing 11 kV network. A new feed will be taken from the existing 11 kV network to provide electrical power to the new CHF and quay wall. However, while there is existing capacity on the current 11 kV network, this is limited and may not be able to provide for the full electrical demands in the future. To protect against restricting future electrical supply constraints, a new 11 kV Switching Station fed from the existing Primary Substation is proposed.
- **Water** – The concept design allows for water to be sourced from the municipal supply. There are three municipal feeds into the port, supplied by two separate municipal reservoirs. This provides adequate supply contingency, and therefore, no additional



storage has been included in the system. The existing 225mm diameter water main will be extended along with the new quay wall to supply ship water along the new quay. At the end of the new quay wall extension the water main will follow Urania Road to tie into the existing 150mm diameter pipe in the vicinity of the existing gate house. Connections to new buildings will be off takes from either the existing network directly, or via extensions to the existing network brought to the boundary of the proposed CHF. A tie in point will be provided. Connections to new buildings will be off takes from either the existing network directly, or via extensions to the existing network brought to the boundary of the proposed CHF. A tie in point will be provided which will consist of approximately 500 m of pipework with a diameter of 150 mm. Inside the quay wall, water will be provided to landing valves for ships and firefighting.

- **Building water** - A new 75mm diameter pipe will branch off from the 150mm diameter water pipe to supply a metered connection for the handling facility. Any connections to new buildings will be made from the metered supply point, located on the western side of the site, just south of the Seafarers club. The Container Handling Facility operator will be responsible for the water network within the facility.
- **Ship water** - The proposed new water main line will tie into the existing 225mm diameter asbestos cement water pipe, that is in the existing quay of berth 606, located on the eastern side of the new berth 605. The new pipe will be 200 mm diameter, within the new quay wall, with 75 mm off takes to the landing valves. The 200mm diameter pipe reduce in size to a 160 mm diameter, where the pipe exits the new quay wall and is parallel to Urania Road and will tie into the existing 150mm diameter asbestos cement pipe north of the existing security access to complete the ring.
- **Fire water** - The fire water in the PoRB is off the water reticulation network. Allowance for fire-
- hydrants will be made where there isn't a dedicated firefighting system. This allowance is for normal hydrants outside the container handling facility boundary along the lengths of pipelines that will be installed to service the new quay wall extension.
- **Sewerage** – The existing sewer network has been evaluated to identify areas that require upgrades to accommodate the extension of the sewer network for the new proposed CHF. The sewerage system will allow for wastewater from new toilets, basins, baths and showers. The proposed sewer will be designed to tie into the closest existing pipe network or an existing pump station closest to the proposed CHF. Sewerage inside the CHF will be designed to accommodate for approximately 160 people. The new sewerage pipeline will have a connection point at the northwestern boundary of the CHF. It will be approximately 100 m in length and 160 mm pipe diameter. The preferred alternative involves designing a sump to accommodate the facility's sewer through gravity flow, with



pumping from the sump to the existing pumpstation PS20, located north of the facility. The final sewer pipe route will be determined during the design phase.

- **Stormwater** – With the hydrological analysis complete and design flows computed, the stormwater pipes were sized. The minimum size of stormwater pipelines is 600mm diameter, which considers effective maintenance of the stormwater network. With the hydrological analysis complete and design flows computed, the stormwater pipe system has been designed to accommodate a 1 in 5-year storm. The propose handling facility, as well as any future development adjacent to berth 605 will require major floods to flow overland into the bay. The area will therefore have to be designed and shaped to accommodate overland flow during a major storm, to prevent water ponding and to control flood damage to any infrastructure. The minimum size of stormwater pipelines is 450mm diameter, which considers effective maintenance of the stormwater network. Conventional catchpits, at 50m to 80m spacing, have been shown along the proposed access road. The access road stormwater is then routed in a pipe system to the bay at a slope of 0.5%. The pipeline will be approximately 360 m along the quay line and 400 m on the other side with a 900mm pipe diameter. It will have a velocity of 0.6 m/s for self-cleaning, to prevent sand settling inside the pipe and blocking. There will also be cross drainage at the new rail siding which will be 400 m in length and 600 mm diameter. The existing network discharges into the bay through the existing quay wall.
- **Provision for Temporary Laydown and Stockpile Areas** – Areas for temporary stockpiles and laydown areas have been designated and will be further assessed as part of the project. An approximate area of 4.2 Ha, 220 m in length and 170 m wide to be used as a potential lay down area for the project. In addition, two temporary stockpile areas are proposed. The first image is an area of approximately 2.4 Ha, 250 m in length and 100 m wide. The area is located SE of the CHF. The second area is split into two areas across the Harbour Arterial Road. These areas cover an area of approximately 6 Ha. The infilling of approximately 6 Ha of the basin is also being considered for stockpiling (this infilled area also forms part of the basin to be dredged).



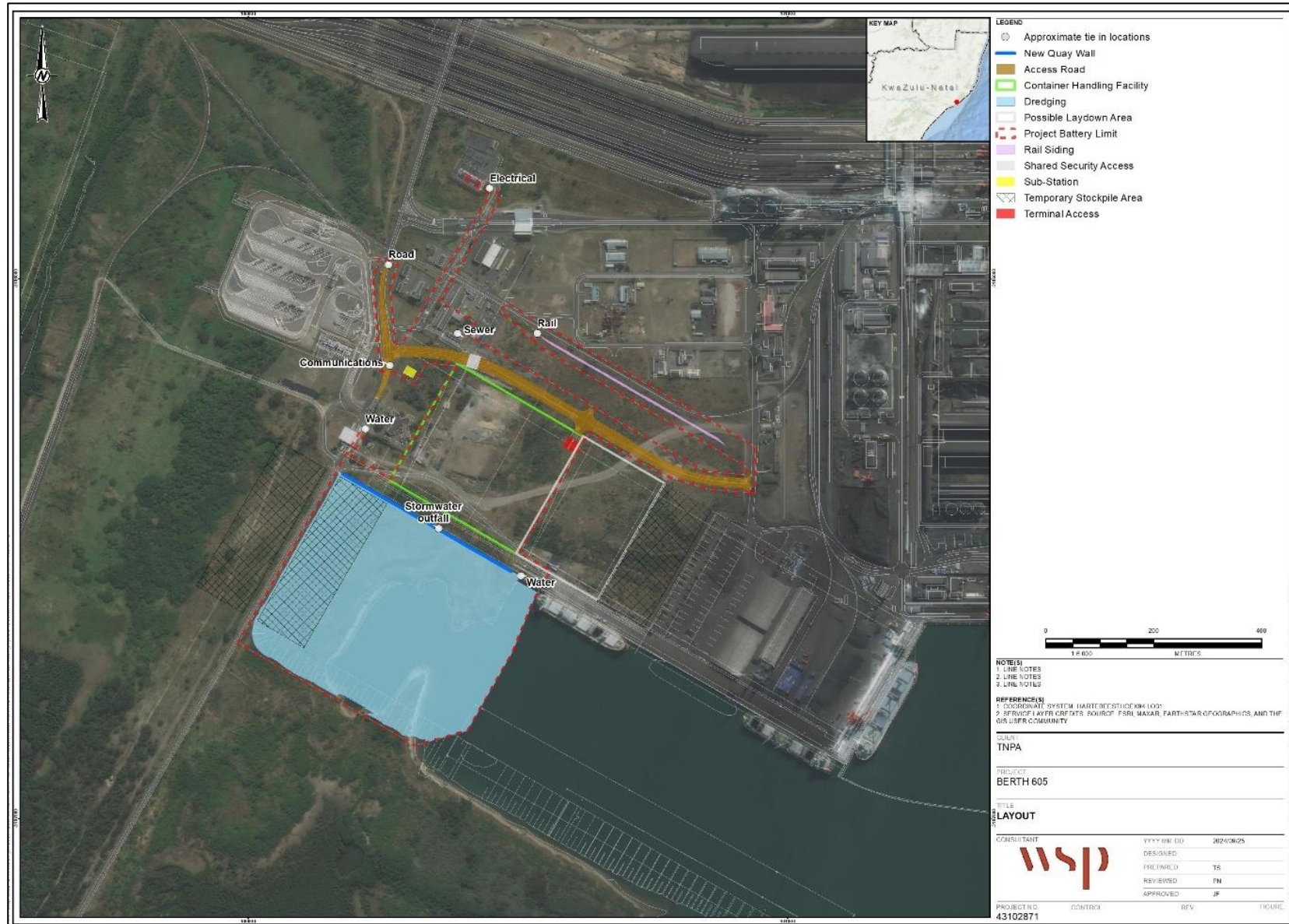


Figure 3: The proposed layout of the Berth 605 project.

1.3 Scope of Work

Specific outcomes in terms of this report are outlined below:

Freshwater Ecological Assessment

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], (2014) database, National Biodiversity Assessment (NBA) (2018), and the Guideline: Biodiversity Impact Assessment in KwaZulu-Natal (EKZN, 2013), were undertaken to aid in defining the PES and EIS of the freshwater ecosystems;
- All freshwater ecosystems within the investigation area were delineated using desktop methods in accordance with GN509 of 2016 as it relates to activities as stipulated in the NWA and verified where possible according to the “Department of Water Affairs and Forestry (DWAFF)¹ (2005)²: A practical field procedure for identification of wetlands and riparian areas”. Aspects such as soil morphological characteristics, vegetation types and wetness were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al.*, 2013);
- The EIS of the freshwater ecosystem was determined according to the method described by Rountree and Kotze (2013);
- The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.*, (2008);
- The freshwater ecosystems were mapped according to the hydrogeomorphic units in relation to the proposed infrastructure. In addition to the freshwater ecosystem boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable RMO, REC and Best Attainable State (BAS) to the freshwater ecosystems based on the results obtained from the PES and EIS assessments; and
- The Department of Water and Sanitation (DWS) risk Assessment Matrix as defined in Appendix A of GN 4167 of December 2023 as it applies to the National Water Act, 1998 (Act No. 36 of 1998) was applied to ascertain the significance of perceived impacts associated with the proposed Berth 605 and associated infrastructure project;

¹ The Department of Water Affairs and Forestry (DWAFF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

² Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this The risk Assessment Matrix as defined in Appendix A of GN 4167 of December 2023 as it applies to the National Water Act, 1998 (Act No. 36 of 1998) was applied to ascertain the significance of perceived impacts is still considered a draft document currently under review.



- The WSP impact assessment (provided by the EAP) was also applied to identify potential impacts that may affect the identified freshwater ecosystems as a result of the proposed development and aim to quantify the significance thereof; and
- To present management and mitigation measures which should be implemented going forward to assist in minimising the impact on the receiving environment.

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- During the field assessment, an aquatic ecological assessment was not conducted, this was due to the absence of riverine systems within the study area and only a canal associated with the Mhlathuze Estuary was identified. Canals particularly those associated with estuarine systems do not provide the necessary freshwater conditions for an aquatic ecological assessment as these canals have altered hydrological regimes that area influenced by tides, salinity and are an anthropogenic feature in the landscape, which essentially makes them representative of transitional or estuarine systems;
- All freshwater ecosystems associated with the proposed Berth 605 and associated infrastructure project, where access was possible (where access was granted and where there were no railway crossings and fence lines), were ground-truthed, and where access was not possible due to fences and restrictions around access (areas around the railway line), desktop methods including use of topographic maps, historical and current digital satellite imagery and aerial photographs was used to improve accuracy of the delineations. Desktop delineations were ground-truthed where feasible;
- The process of the delineation of freshwater ecosystems within the study area is a complex as a result of the dynamic and unique influence of the adjacent estuary. As a result of fluctuating water levels which leads to overlapping zones of wetland and estuarine influence, sediment deposition which deposits sediment across various areas of the wetlands, causing morphological changes in the landscape and variable salinity which are an influence of the estuarine system, over-time the transitional zones between the boundary of the freshwater ecosystems and estuary overlap or lack clear boundaries;
- Linked to the above, due to presence of various activities and disturbances in the area, such as vegetation clearing, and surface infrastructure vegetation was not always a reliable indicator of the presence of freshwater ecosystems throughout the areas assessed. As such, in highly disturbed areas, the vegetation indicator may have affected the accuracy of the delineation;
- All freshwater ecosystems associated with the proposed Berth 605 and associated infrastructure project were ground-truthed, however freshwater ecosystems within 500 m of the study area were delineated in fulfilment of the NWA using various desktop methods



including use of topographic maps, historical and current digital satellite imagery and aerial photographs. Desktop delineations were ground-truthed where feasible;

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the study area's actual site characteristics at the scale required to inform the EA and WUA processes;
- Wetland, riparian and terrestrial ecosystem zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;
- Due to proximity of the study area and the uMhlathuze Estuary, consideration was given to some areas observed to have a vegetation response indicative of saturated conditions. These areas are transitional zones which are still considered to be largely driven by estuarine influence. Estuaries as “the meeting places of rivers and the salt waters of the sea, and their character is determined by this interplay” – meaning that estuaries are characterized by the influence of a variety of factors such as river inflow, tidal flows, wave energy, temperature and rainfall, amongst others; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. A more reliable assessment of the biota would require seasonal sampling, with sampling being undertaken under both low flow and high flow conditions. However, the specialist is confident that the existing activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of aquatic, riparian and wetland ecology.

1.5 Legislative Requirements and Provincial Guidelines

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:



- Constitution of the Republic of South Africa, 1996³;
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The National Environmental Management: Biodiversity Act (NEMBA), (Act No. 10 of 2004)
- The National Environmental Management: Integrated Coastal Management Act (ICMA), (Act No. 24 of 2008);
- The National Environmental Management: Biodiversity Act: Alien and Invasive Species Regulations, 2014;
- Guideline: Biodiversity Impact Assessment in KwaZulu-Natal (EKZN, 2013); and
- Department of Forestry, Fisheries and the Environment (DFFE), (2020) National Web-based Environmental Screening Tool (hereafter the “screening tool”).

2 ASSESSMENT APPROACH

2.1 Freshwater Ecosystem Definition

For the purposes of this investigation, the definition of a watercourse riparian and wetland habitats were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A **watercourse** means:

- (a) a river or spring;
 - (b) a natural channel in which water flows regularly or intermittently;
 - (c) a wetland, lake or dam into which, or from which, water flows; and
 - (d) any collection of water which the Minister may, by notice in the *Gazette*, declare to be a watercourse,
- and a reference to a watercourse includes where relevant, its bed and banks.

Wetland habitat is “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

³ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the ‘Constitution of the Republic of South Africa, 1996’. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

For the purposes of the location of the project, in proximity to an estuary, the definition of an estuary in terms of the National Water Act, 1998 (Act No. 36 of 1998) is given as follows: A partially or fully enclosed body of water -

- a) Which is open to the sea permanently or periodically, and
- b) Within which the sea water can be diluted, to an extent that is measurable, with fresh water drained from land.

Thus, for the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) and the terms may be used interchangeably in this report.

2.2 Freshwater Ecosystem Field Verification

As mentioned in Section 1.3 use was made of historical aerial photographs, historical and current digital satellite imagery, topographic maps, and available provincial and national wetland databases to aid in the delineation of those portions of the freshwater ecosystems associated with the proposed Berth 605 and associated infrastructure project following the field assessment. The following was taken into consideration when utilising the above during delineation:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.



The freshwater ecosystem delineation was verified in the field at pre-selected points, and this delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

A field assessment was undertaken between 14 and 16 October 2024 during the Spring season, during which the presence of any riparian or wetland characteristics as defined by DWAF (2008) and by the NWA were noted (please refer to Section 4 of this report). In addition to the delineation process, detailed assessments of the delineated freshwater ecosystems were undertaken, at which time, factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.3 Sensitivity Mapping

All freshwater ecosystems associated with the proposed project were delineated on a desktop basis, with these delineations being ground-truthed in the field at certain pre-selected points where possible with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto digital satellite imagery and topographic maps. The sensitivity map presented in Section 5 should guide the design and layout of the proposed Berth 605 and associated infrastructure project.

2.4 Risk Assessment and Recommendations

Following the completion of the assessment, a risk assessment was conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed Berth 605 and associated infrastructure project. These recommendations also include general ‘best practice’ management measures, which apply to the project as a whole, and which are presented in Appendix F.

Mitigation measures have been developed to address issues in all phases throughout the life of the proposed Berth 605 and associated infrastructure project including site preparation,



construction and operation. The detailed site-specific mitigation measures are outlined in Section 6 of this report.



3 RESULTS OF THE DESKTOP ANALYSIS

3.1 *Analyses of Relevant Databases*

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard style” report (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader to take place. Where required, further discussion and interpretation is provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the assessed areas actual site characteristics at the scale required to inform the environmental authorisation and/or water use licensing application processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must however, be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process. Actual site conditions at the time of the assessment may differ to the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation.

Findings from the various desktop sources are indicated in the figures that follow below (Figures 4 – 9).



Table 1: Desktop data (from available databases only) relating to the character of the freshwater ecosystems within the investigation area.

Aquatic ecoregion and sub-regions in which the study and investigation areas are located		Detail of the study and investigation areas in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Natal Coastal Plain	FEPACODE	The study and the investigation areas are located within a SubWMA currently not considered important in terms of fish importance or conservation (FEPACODE = 0).
Catchment	Mfolozi/Pongola		
Quaternary Catchment	W12F	NFEPA Wetlands (Figure 3 and 4)	According to the NFEPA database, an unchanneled valley bottom (UCVB) wetland is indicated within the study area along the edges of the estuary in the south eastern and south western portions, with additional areas of UCVB wetland also mapped along the estuarine boundaries of the investigation area. The UCVB wetland is indicated to be in an unmodified to largely natural (Class A/B) ecological condition. Furthermore, an estuarine is indicated within the southeastern and south western portions of the study area and the majority of the investigation area. The Estuarine is indicated to be in a heavily to critically modified (ecological state (Class Z). Field findings indicate that the areas indicated to be UCVB wetlands form part of the uMhlathuze estuary and are not deemed to be freshwater ecosystems in terms of their ecology.
WMA	Usutu to Mhlathuze		
subWMA	Mhlathuze		
Dominant characteristics of the Natal Coastal Plain Ecoregion (Level II 13.03) (Kleynhans <i>et al.</i> , 2007)			
Dominant primary terrain morphology	Plains, low relief		
Dominant primary vegetation types	Sand Forest and Valley Thicket	Wetland Vegetation Type	The study and investigation areas fall within the Indian Ocean Coastal Belt Group 1 wetland vegetation group, which is classified as Least Threatened (Mbona <i>et al</i> 2014).
Altitude (m a.m.s.l)	0-300		
MAP (mm)	600 to 1000	NFEPA Rivers	According to the NFEPA Database, no NFEPA river systems are located within the study area. The Mhlathuze River is located approximately 1.5 km south west of the investigation area. The Mhlathuze River is assessed to be in a moderately modified (Class C) river condition.
Coefficient of Variation (% of MAP)	<20 - 30		
Rainfall concentration index	30 to 50		
Rainfall seasonality	Late summer		
Mean annual temp. (°C)	20- >22		
Winter temperature (July)	> 10 – >24 °C	National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) – Includes National Wetland Map 5 (Figure 5 and 6).	
Summer temperature (Feb)	>20 – 30 °C	According to the NBA 2018: SAIIAE, there are no natural or artificial wetlands or rivers indicated within the study area. However, there is an estuarine indicated in the entire study and investigation areas. The estuarine is indicated to be in endangered according to the Ecosystem Threat Status (ETS) and) is currently poorly protected as per Ecosystem Protection Level (EPL). Furthermore, the NBA Rivers database indicates the Mhlathuze River located approximately 1.5 Km south west of the investigation area. The Mhlathuze River is assessed to be in moderately modified (Class C) river condition. The ETS of the rivers is Critically Endangered (ETS), and EPL is Poorly Protected.	
Median annual simulated runoff (mm)	52 - 420		
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)		National Web Based Environmental Screening Tool (Accessed 2024) (Figure 7).	
Sub-quaternary reach	W12F – 03511 (Mhlathuze River)	The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their development footprint to avoid sensitive areas.	
Proximity to study area	located approximately 1.5 Km south west of the investigation area.		
Assessed by expert?	N/A	The screening tool indicates that the majority of the study and investigation areas have high sensitivity for the aquatic biodiversity theme. A small area in the southeastern portion of the study and investigation areas are identified as having very high sensitivity for the aquatic biodiversity theme. The very high sensitivity classification is triggered by the study area's proximity to wetlands and the presence of the estuary.	
PES Category Median	N/A		
Mean Ecological Importance (EI) Class	N/A	Detail of the Assessment area in terms of the Land Type Data (Job <i>et al.</i> , 2019) (Figure 9)	
Mean Ecological Sensitivity (ES) Class	N/A		
Stream Order	N/A	The entire study area and majority of the investigation area fall within the la74 land type. Only a very small portion of the eastern portion of the investigation area falls within la 67. The la land types accommodate land characterised by undifferentiated deep soil deposits. The soils within this landtype are typically deep pedologically youthful soils.	
Default Ecological Class (based on median PES and highest EI or ES mean)	N/A		
Strategic Water Source Areas (2017).			
Surface water SWSAs are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide complete coverage.			
According to the Strategic Water Source Area Database (2017), the entire study area and its associated investigation area are indicated to be within a Zululand Coast & Richards Bay GW Fed Estuary Surface Strategic Water Source Area(swqw).			



Detail of the study area in terms of the Draft KwaZulu-Natal Biodiversity Spatial Planning Terms and Processes (2016) (Figure 8)	
Critical Biodiversity Area (CBA) Irreplaceable	<p>The entire study area and majority of the investigation area are considered to be Critical Biodiversity Area (CBA) Irreplaceable. CBA: Irreplaceable areas are areas considered critical to meet biodiversity targets and thresholds, which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.</p> <p>which occur mostly along river courses, valley bottoms and in lower lying areas. Soils are usually weakly structured, with a great variety of colour (often mottled) and often, several layers have been deposited (usually by water) with different soil textures</p>

DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; m.a.m.s.l = Metres above Mean Sea Level; MAP = Mean Annual Precipitation; mm = millimetres; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area



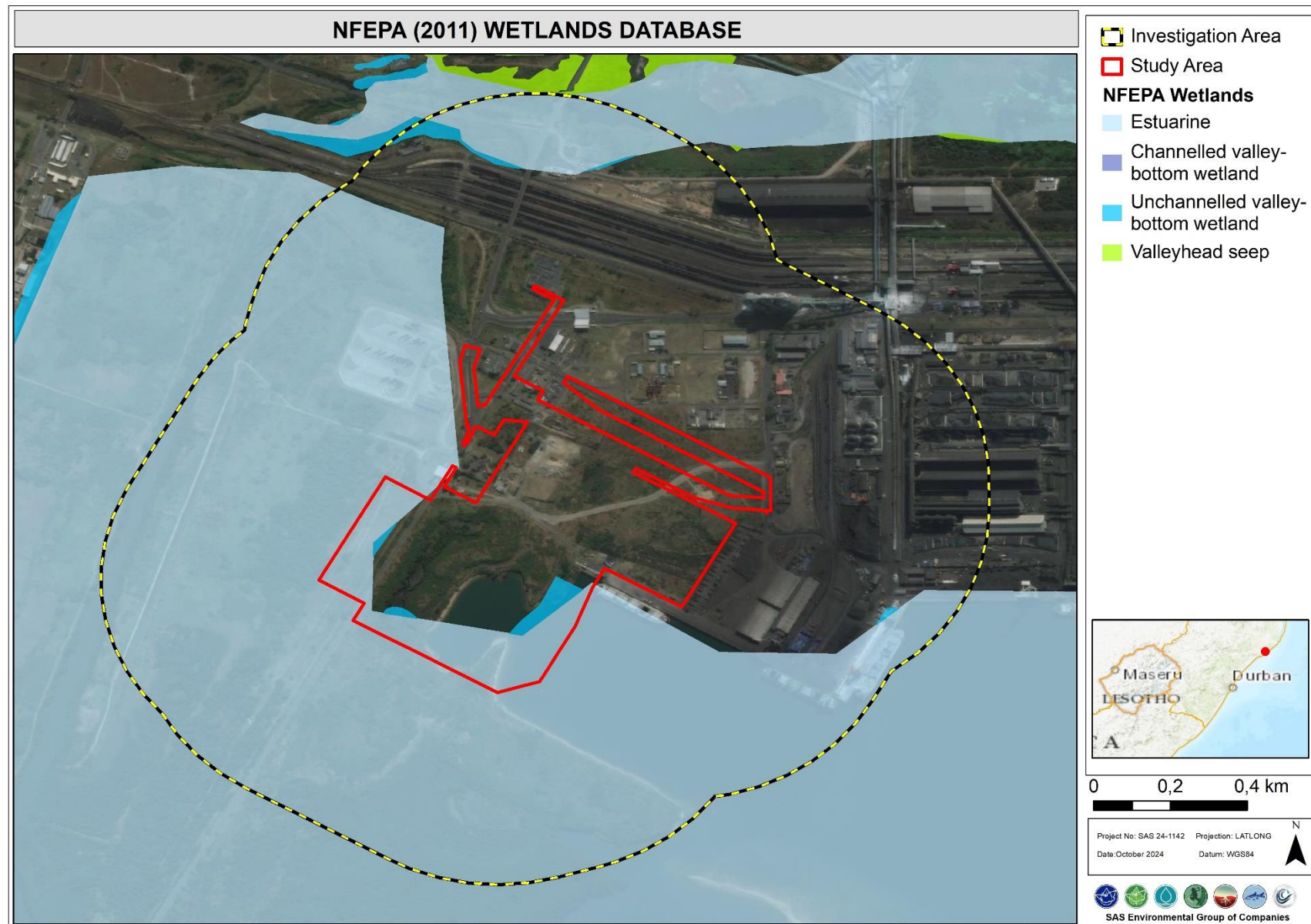


Figure 4: NFEPA wetlands associated with the study and investigation areas according to the National Freshwater Ecosystems Priority Areas (NFEPA, 2011).



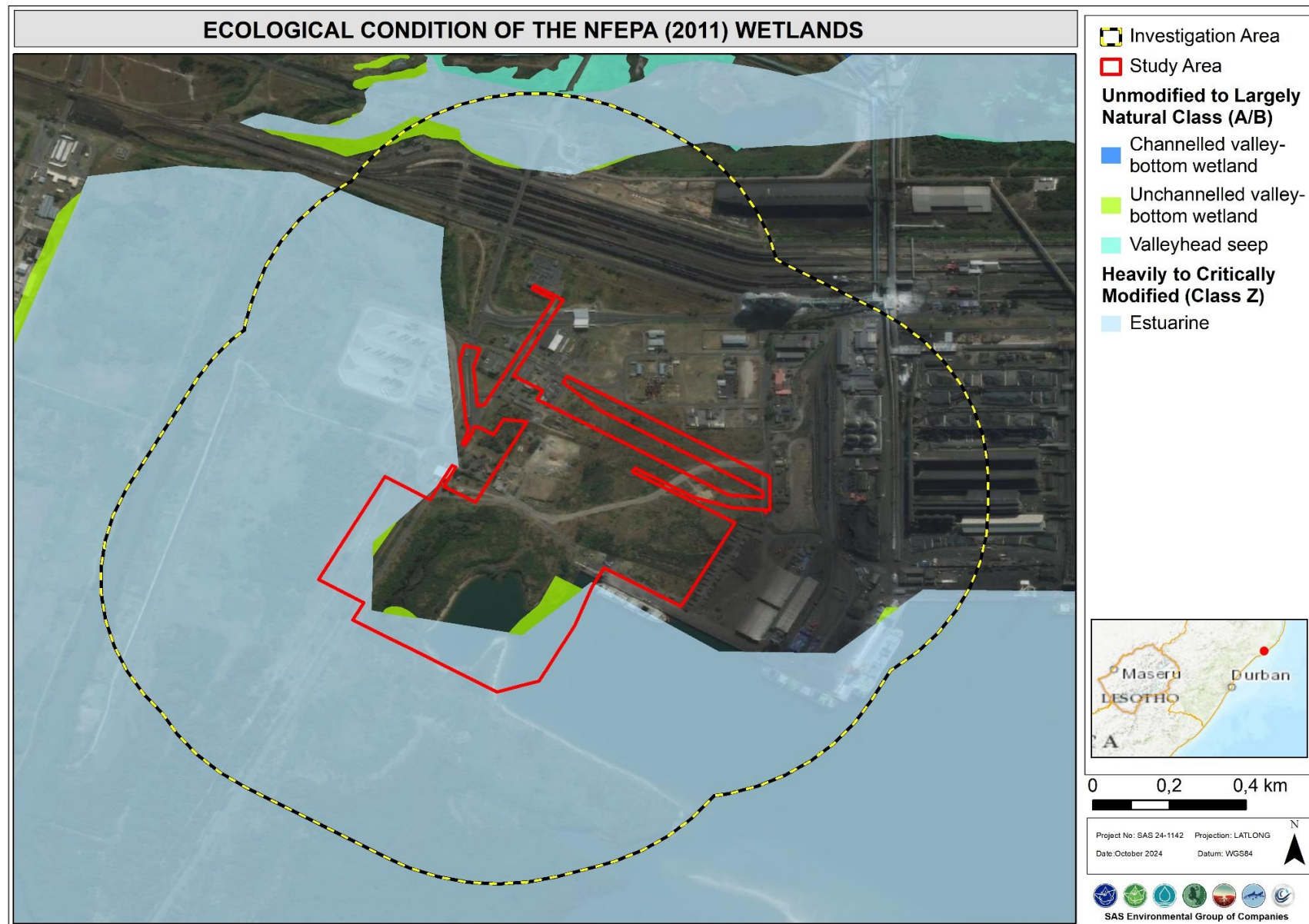


Figure 5: NFEPA wetlands condition (Unmodified to Largely Natural and heavy to Critically Modified) according to the National Freshwater Ecosystems Priority Areas (NFEPA, 2011).



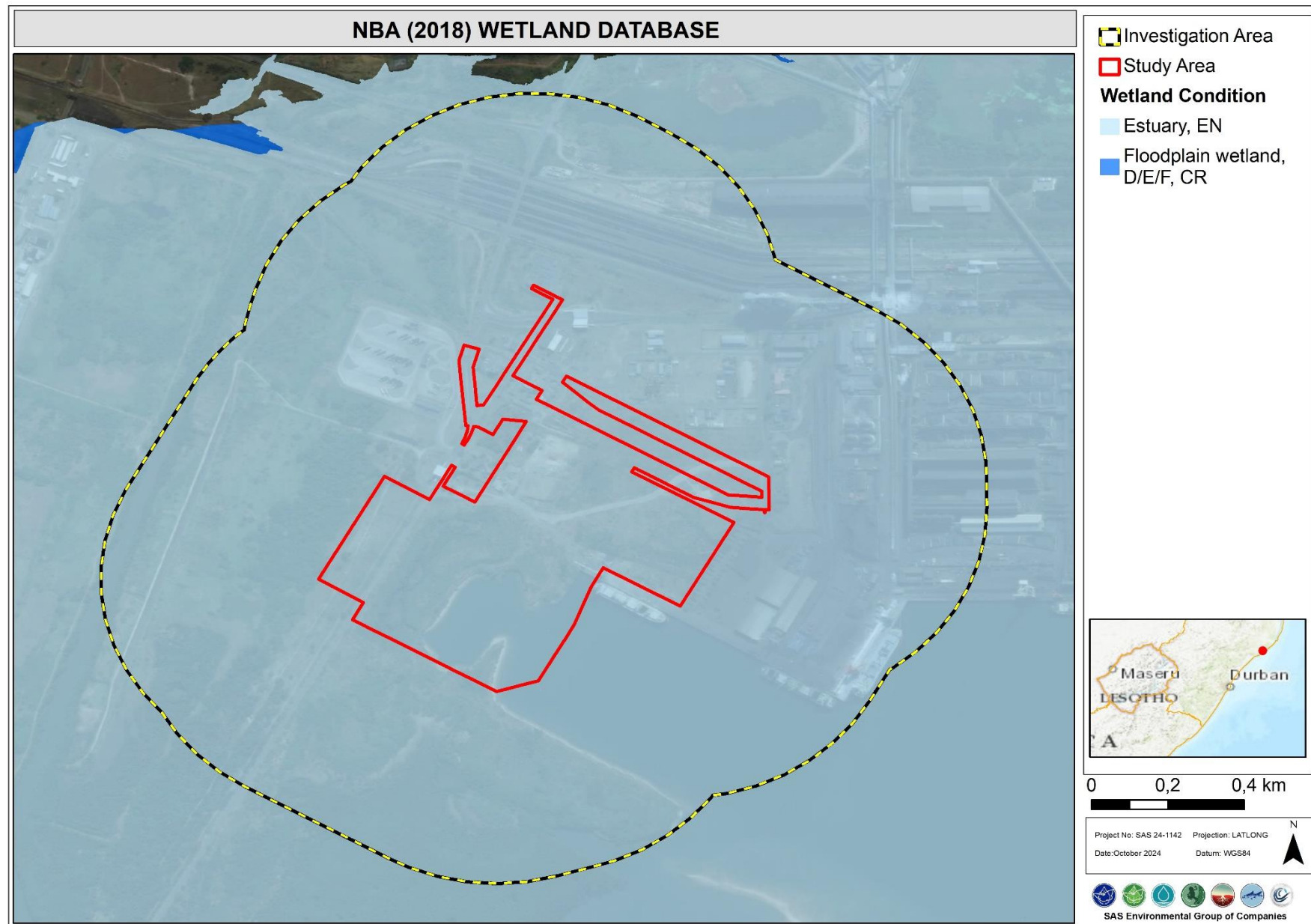


Figure 6: Wetlands and rivers associated with the study and investigation areas according to the National Biodiversity Assessment (2018).



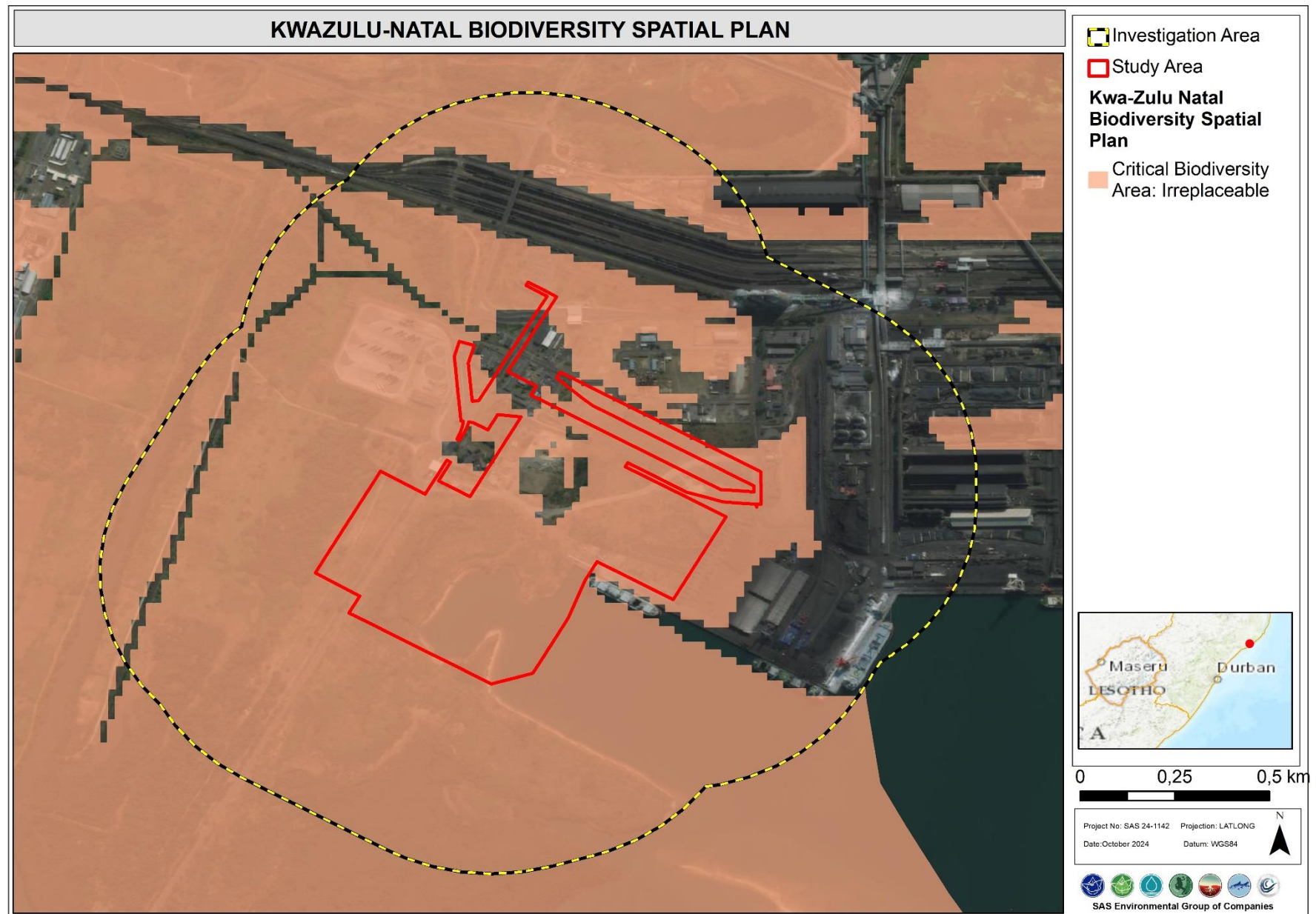


Figure 7: Critical Biodiversity Areas (CBAs): Irreplaceable areas in terms of the KwaZulu – Natal Biodiversity Spatial Plan.



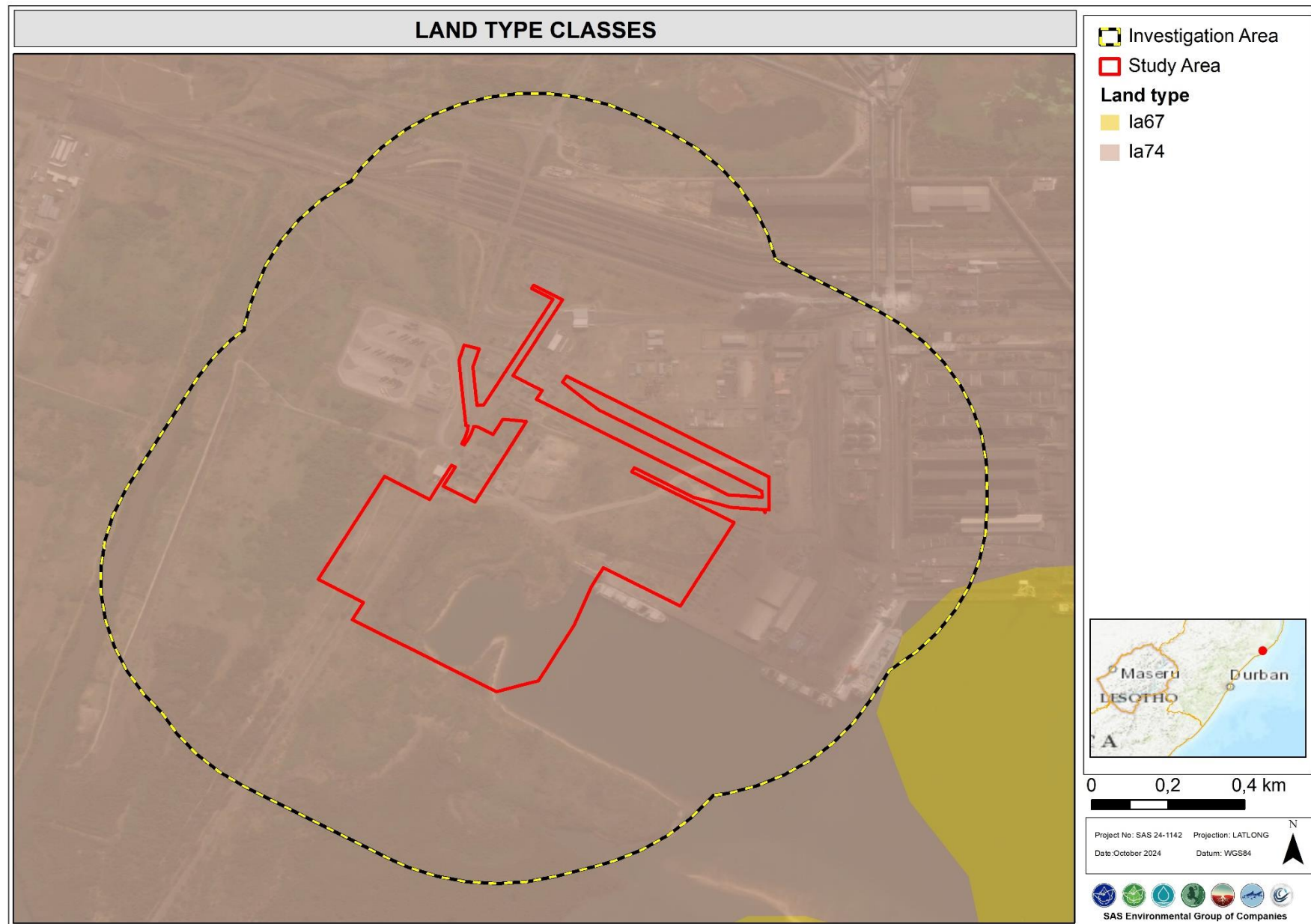


Figure 8: Land type data associated with the study and investigation areas in terms of the Soils/Land Type Database (Job *et al.*, 2019).



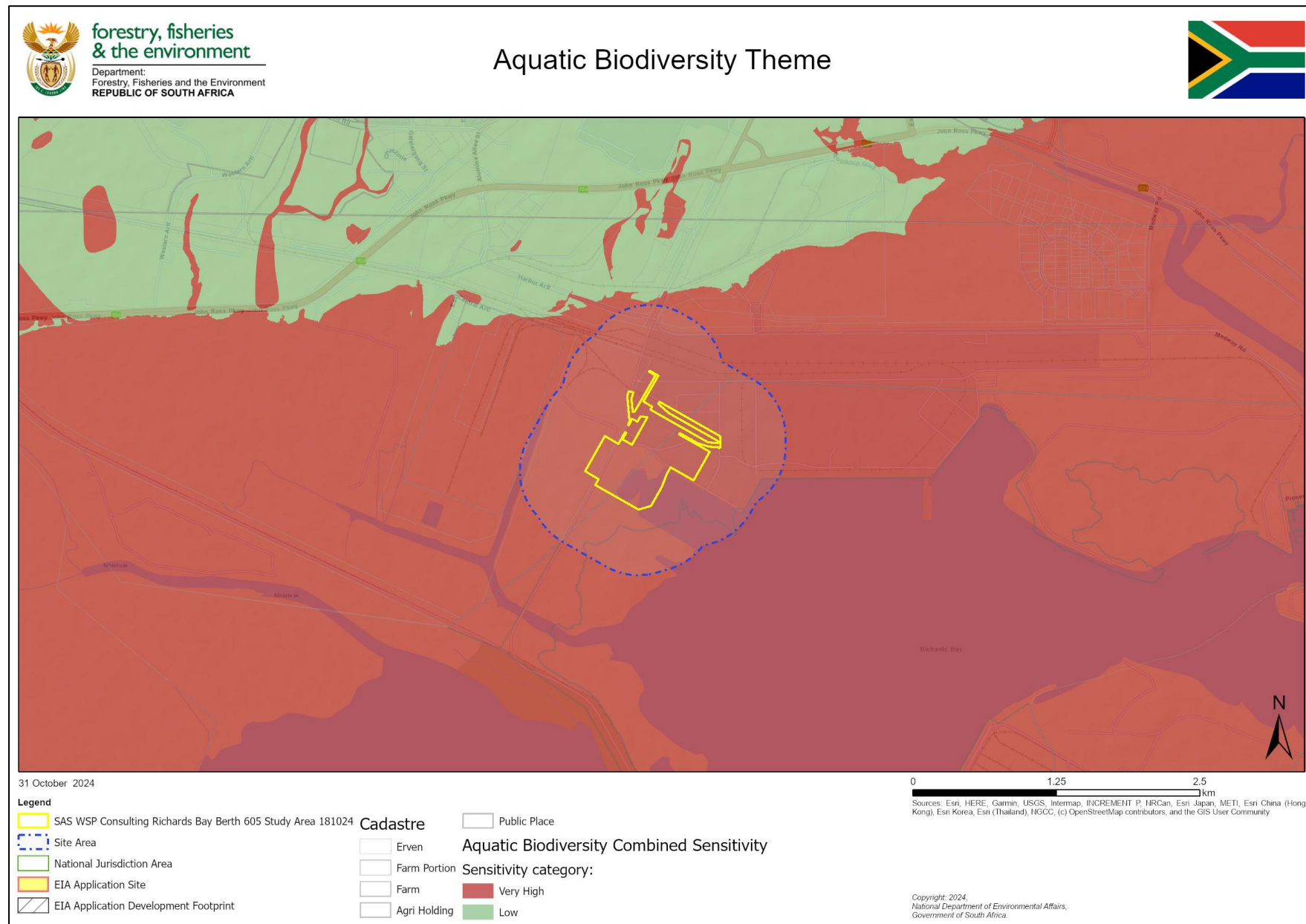


Figure 9: The DFFE National Web-based Environmental Screening Tool.



4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 *Historical Context of the Receiving Environment*

The activities associated with the PoRB date back as early as the 1970s, when the Port was first planned in the early 1970s. The area where the Port is currently located was initially a small, ecologically sensitive environment with extensive mangrove forests, coastal wetlands, and estuarine ecosystems.

The development of the Port and its subsequent expansion has resulted in a change in the landscape which has changed drivers of freshwater ecosystems in the landscape. Changes in the pattern, timing and timing of water flow and quality due to dredging and industrial activities have overtime resulted in impacts to freshwater ecosystems as well as estuarine habitat and mangroves impacting on the biota established within these diverse ecosystems.

The process of the delineation of freshwater ecosystems within the study area is complex as a result of the dynamic and unique influence of the adjacent estuary. As a result of fluctuating water levels which contributes to the creation of overlapping zones of wetland and estuarine influence, sediment deposition which deposits sediment across various areas of the wetlands, causing morphological changes in the landscape and variable salinity which are an influence of the estuarine system, over-time the transitional zones between the boundary of the freshwater ecosystems and estuary overlap or lack clear boundaries. Linked to these natural dynamics, surrounding industrial activities, developed artificial drainage systems, including artificial channels/canals, historical excavations and depositions of sediments further add to the complexity of as these activities have the potential create new, unnatural boundaries.

The time-series satellite images below demonstrate how anthropogenic activities at the site have progressively altered the natural movement of water across the landscape, leading to observable changes over time in water flow patterns. These shifts have, in turn, influenced the composition and distribution of vegetation, as evidenced by changes in the overall vegetation response visible in digital satellite images and an on-site photograph (Figure 10).



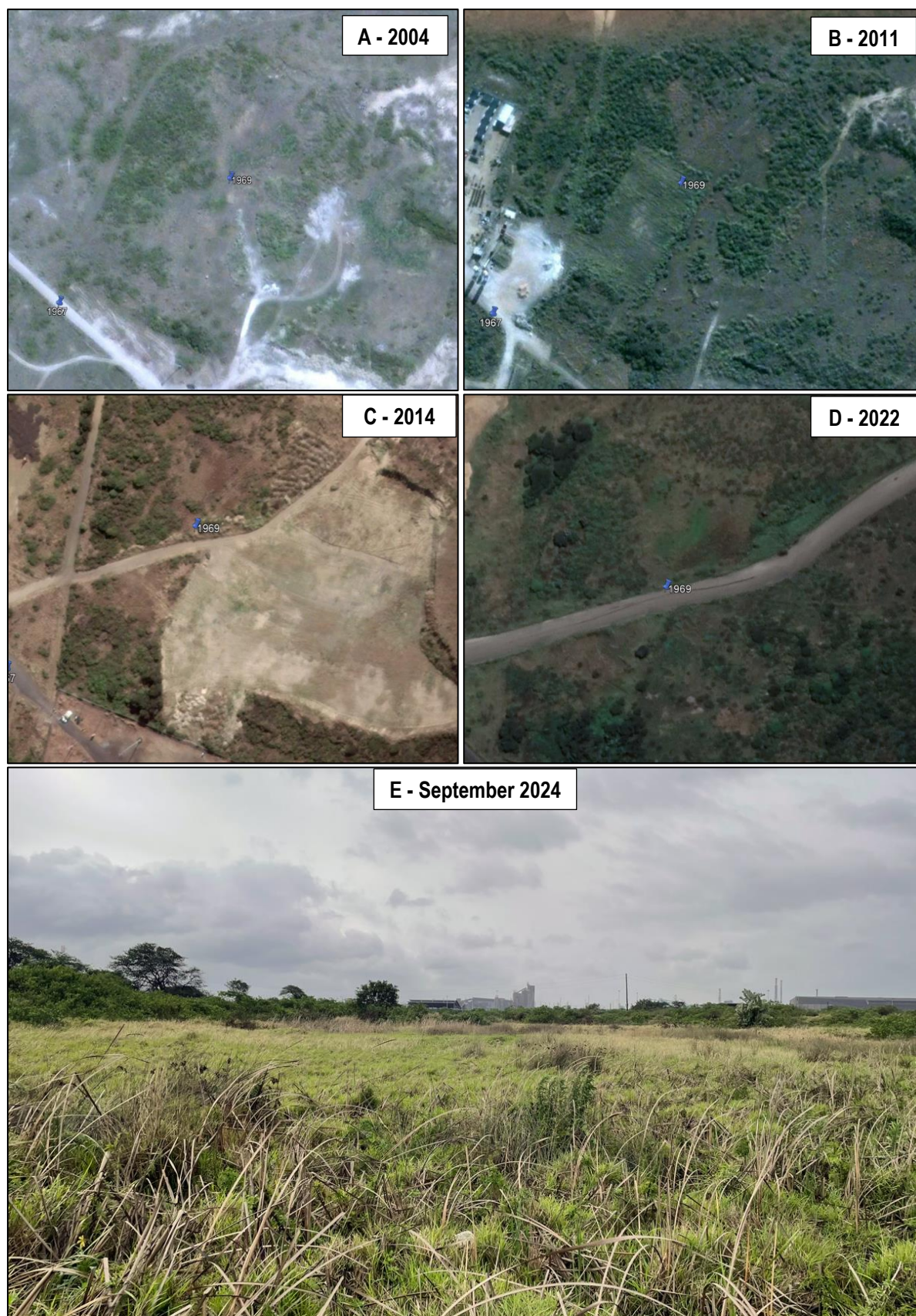


Figure 10: The time-series satellite images (A – D) and an on-site photograph (E) illustrating anthropogenic activities influence on movement of water across the landscape and vegetation response over time.

4.2 Freshwater Ecosystem Characterisation

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national wetland databases (as outlined in Section 2 of this report) were used to identify areas of interest at a desktop level. All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed Berth 605 and associated infrastructure project were identified, delineated and assessed. During the assessment various depressional wetlands were identified within the study area associated with the proposed Berth 605 and associated infrastructure project.

The freshwater ecosystems were classified according to the Classification System (Ollis *et al.*, 2013) as Inland Systems, falling within the Natal Coastal Plain Ecoregion. The study and investigation areas fall within the Indian Ocean Coastal Belt Group 1 wetland vegetation group, which is classified as Least Threatened (LT) (Mbona *et al.*, 2015). At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the freshwater ecosystems were classified as per the summary in Table 2 below.

Table 2: Characterisation of the freshwater ecosystems associated with the proposed Berth 605 and associated infrastructure project according to the Classification System (Ollis *et al.*, 2013).

Freshwater Ecosystem	Level 3: Landscape unit	Level 4: HGM Type
Depression Wetland	Plain: an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.	Depression: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.

4.3 Freshwater Ecosystem Delineation

As noted in Section 2.1, the freshwater ecosystems associated with the proposed Berth 605 and associated infrastructure project were initially delineated using desktop methods (use of aerial photographs, digital satellite imagery and topographical maps) and refined in the field by ground-truthing the desktop delineation at certain pre-selected points. The delineations as presented in this report are thus regarded as a best estimate of the freshwater habitat boundaries based on the site conditions present at the time of assessment. The following indicators were used to delineate the boundaries of the temporary zones associated with the identified freshwater ecosystems:

- **Terrain Units:** Terrain units were used as the primary indicator. Despite transformation of the landscape associated with the investigation area, the terrain provided an indication of low-lying areas where water is likely to collect and/or move through the landscape and areas in the landscape where seep and depressional type wetlands could potentially be expected to occur;



- **Vegetation Indicator:** The vegetation associated with riparian areas: the identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:

- In species composition relative to the adjacent terrestrial area; and
- In the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the vigour, density, size, structure and/or numbers of individual plants.

Due to the extensive transformation due to current and historical activities such as dredging as part of the extension of the port, construction of surface infrastructure such as buildings, access roads, and extensive deposition of sediment within the study area the vegetation indicator was not always reliable. Where such challenges were experienced, historical digital satellite imagery including historical delineation information was utilised to improve the accuracy of the delineations.

- **The presence of alluvial soils:** The presence of alluvial soil was used as an indicator of riparian zones, as defined by the National Water Act, 1998 (Act No. 36 of 1998). The occurrence of alluvial deposited material adjacent to the active channel is a good indicator of the riparian zone of a riparian freshwater ecosystem.
- **The soil wetness indicator:** The duration and frequency of saturation in the soil profile provides a diagnostic indicator since it influences the colour change in the soil. Low chroma (grey and muted colours) as well as mottles are more prominent in soil which is associated with fluctuating water table. Within the CVB wetland areas, this indicator was not always present given the significant impacts that historical sugarcane cultivation has had on the saturation patterns within the wetlands.

The figures (Figure 11 – Figure 12) below indicate the location of the delineated freshwater ecosystems associated with the study and investigation area.

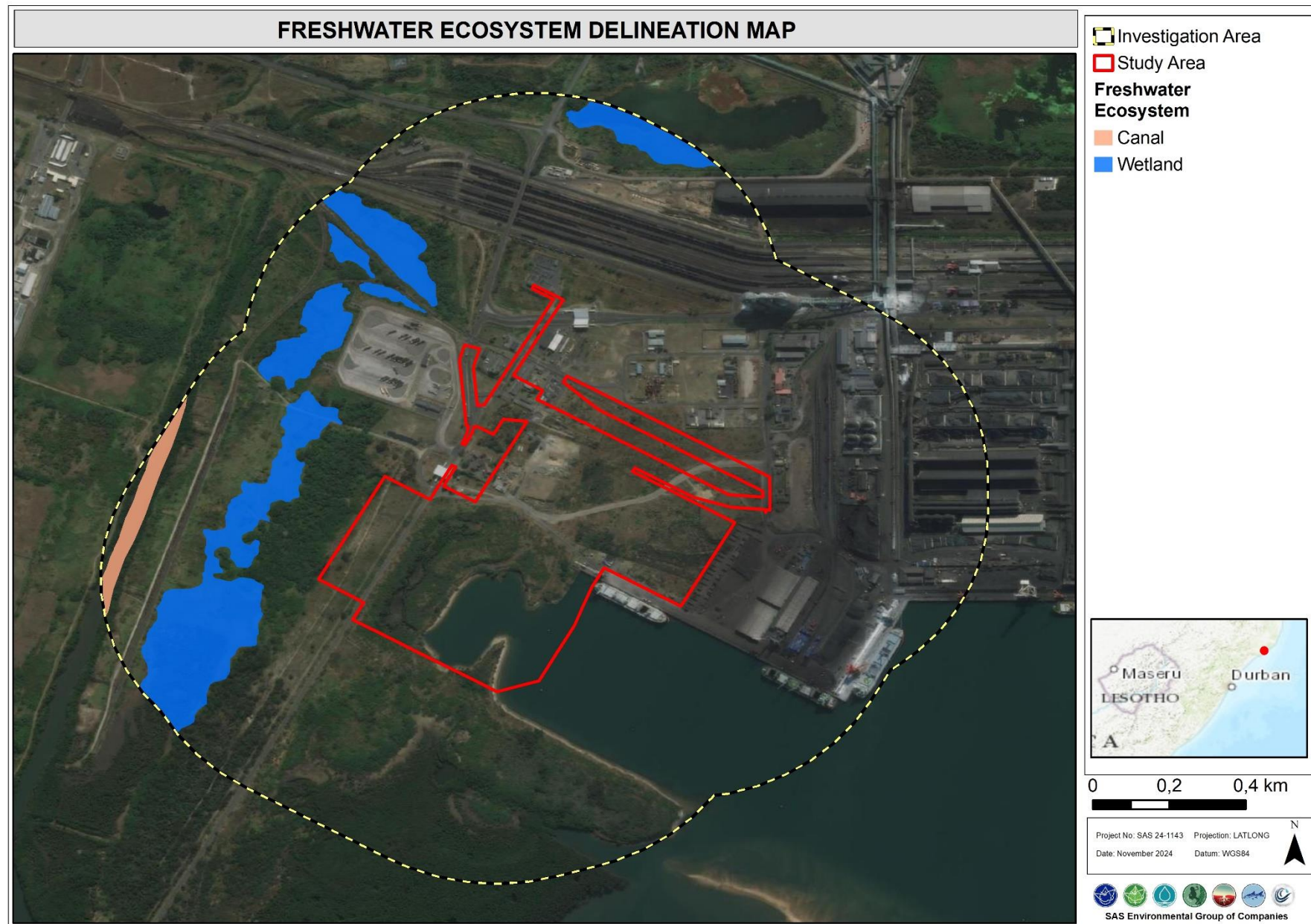


Figure 11: The location of the delineated freshwater ecosystems associated with the study and investigation area.



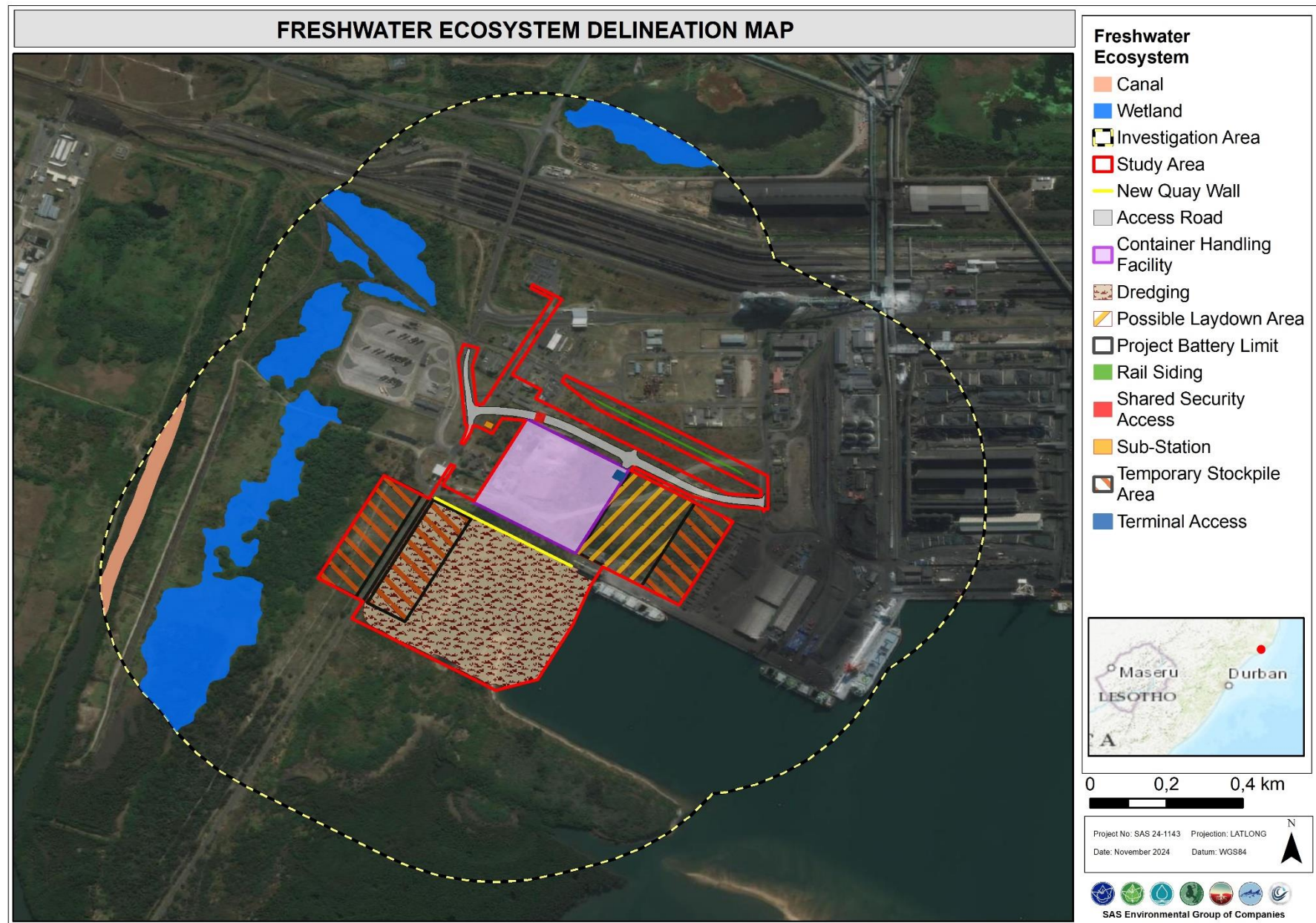


Figure 12: The location of the delineated freshwater ecosystems (including layout) associated with the study and investigation area.



4.4 Field Verification Results

Following the site visit, various assessments were undertaken to determine the following:

- The PES, incorporating aspects such as hydrology, vegetation and geomorphology of the wetlands;
- Service provision of the delineated freshwater ecosystems which incorporates biodiversity maintenance, flood attenuation, streamflow regulation and toxicant assimilation, to name a few;
- The EIS is guided by the results obtained from the assessment of the PES and service provision of the wetlands; and
- Allocation of appropriate REC, RMO and BAS based on the PES, service provision and EIS results to guide the management of the wetlands with the intent of enhancing the ecological integrity of the systems, where feasible.

The depression wetlands having been subjected to similar anthropogenic impacts (historical deposition/infilling, encroachment alien and invasive species and some fragmentation from infrastructure such as railways and roads), the ecoservice provision, hydrological regime, geomorphological characteristics, water quality and habitat of these systems were assessed in a combined fashion.

The results of the assessments are presented in the “dashboard style” reports below (Table 3).

Table 3: Summary of the assessment of the wetland associated with the proposed Berth 605 and associated infrastructure project.

<div>Ecological & socio-cultural service provision graph:</div> <div><div><div>Present State Assessment</div><table border="1"><caption>Estimated data from Present State Assessment radar chart</caption><thead><tr><th>Service</th><th>Demand (0-4.0)</th><th>Supply (0-4.0)</th></tr></thead><tbody><tr><td>Flood attenuation</td><td>3.5</td><td>1.5</td></tr><tr><td>Stream flow regulation</td><td>3.0</td><td>1.0</td></tr><tr><td>Sediment trapping</td><td>2.5</td><td>1.0</td></tr><tr><td>Erosion control</td><td>2.0</td><td>1.0</td></tr><tr><td>Phosphate assimilation</td><td>1.5</td><td>1.0</td></tr><tr><td>Nitrate assimilation</td><td>1.0</td><td>1.0</td></tr><tr><td>Toxicant assimilation</td><td>1.5</td><td>1.0</td></tr><tr><td>Carbon storage</td><td>2.0</td><td>1.0</td></tr><tr><td>Biodiversity maintenance</td><td>1.0</td><td>1.0</td></tr><tr><td>Water for human use</td><td>1.0</td><td>1.0</td></tr><tr><td>Harvestable resources</td><td>1.0</td><td>1.0</td></tr><tr><td>Food for livestock</td><td>1.0</td><td>1.0</td></tr><tr><td>Cultivated foods</td><td>1.0</td><td>1.0</td></tr><tr><td>Tourism and Recreation</td><td>1.0</td><td>1.0</td></tr><tr><td>Education and Research</td><td>1.0</td><td>1.0</td></tr><tr><td>Cultural and Spiritual</td><td>1.0</td><td>1.0</td></tr></tbody></table></div></div> <div><div></div><div>Figure A: Representative photographs of the wetlands associated with the proposed Berth 605 and associated infrastructure project.</div></div>		Service	Demand (0-4.0)	Supply (0-4.0)	Flood attenuation	3.5	1.5	Stream flow regulation	3.0	1.0	Sediment trapping	2.5	1.0	Erosion control	2.0	1.0	Phosphate assimilation	1.5	1.0	Nitrate assimilation	1.0	1.0	Toxicant assimilation	1.5	1.0	Carbon storage	2.0	1.0	Biodiversity maintenance	1.0	1.0	Water for human use	1.0	1.0	Harvestable resources	1.0	1.0	Food for livestock	1.0	1.0	Cultivated foods	1.0	1.0	Tourism and Recreation	1.0	1.0	Education and Research	1.0	1.0	Cultural and Spiritual	1.0	1.0
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<div>PES discussion</div>	<div><div>PES Category: D (Largely modified)</div><div>The ecological integrity of the wetlands was assessed to be largely modified as a result of historical and ongoing activities which include historical infilling which contributes to encroachment by terrestrial vegetation, catchment hardening, dredging of sediments associated with Port operations and construction of infrastructure such as access roads. The hydrological regime of the wetlands was assessed to be the impacted attribute as a result of water inputs from hardened surfaces within the catchment. The input of water from hardened surfaces has in addition altered the hydroperiod of the wetland and has augmented wetland response observed in some parts of the system. The vegetation community was largely uniform, dominated by <i>Phragmites australis</i> (Common reed).</div></div> <div><div>Ecoservice provision</div><div><div>Very Low to Moderate</div><div>The ecoservice provision by the wetlands was assessed to be very low to moderate. Important ecological services provided by the system include services such as toxicant assimilation, flood attenuation, sediment trapping and nitrate assimilation due to presence of broad vegetation which increases roughness. The demand for such services was, ascertained to be moderately high due to the prevalence of sediment, excess nutrients and toxicants is higher due to surrounding activities such as stockpiling and movement of heavy-duty vehicles which increases prevalence of dust.</div><div>Furthermore, given the robust vegetation within the wetland, it is considered likely that it is also an important feature in the landscape for biodiversity maintenance, particularly for amphibians such as reed frogs.</div></div></div>																																																			
<div>EIS discussion</div>	<div><div><div>REC, RMO & BAS Category</div><div><div>REC: D</div><div>BAS: D</div><div>RMO: Maintain</div></div><div>The Recommended Management Objective (RMO) based on the PES and the EIS scores is to maintain the ecological integrity of the system. No further degradation should be permitted. Given the existing impacts that the wetlands are subjected to, no further degradation should occur, and any future developments must ensure that they do not result in further impacts to the system.</div></div></div> <div><div>EIS Category: Moderate</div><div>The system is considered of moderate ecological importance and sensitivity (EIS) as a result of its important for the provision of ecoservices such as toxicant assimilation, flood attenuation, sediment trapping and nitrate assimilation. The wetland vegetation group within which the investigation occur is the Indian Ocean Coastal Belt Group 1 wetland vegetation group which is classified as Least Threatened (Mbona <i>et al.</i>, 2015) and this limits the ecological sensitivity of the system to a degree.</div></div>																																																			



Freshwater ecosystem drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):

The wetlands within the investigation area are primarily driven by sub-surface inputs (potentially influenced by the presence of the estuary) and these areas where the wetlands are found are areas where the water table is exposed in topographical depressions. The hydrological regime of the wetlands is likely impacted to a degree by stormwater runoff from increased catchment hardening from the roads and surface infrastructure which is likely to increase water inputs into the system. The presence of infrastructure such as roads and railway lines has also resulted in the disruption of freshwater ecosystem connectivity and altered the natural flow, pattern and timing of water in the landscape.

The disturbances associated with the development of roads and access routes within the study area has in addition impacted on the natural geomorphological processes within the wetland. Historical deposition of sediments potentially from dredging activities has also impacted on the geomorphological balance within the wetland. Presence of hardened areas such as TNPA permit offices and the trucking area contributes to changes in sediment balances within the wetlands.

At the time of the assessment, no surface water was present within the assessed wetlands and no water quality was taken. No sampling was taken within the estuary areas due to safety and access restrictions into the areas.

The wetland was observed to consist of robust vegetation (predominantly the common reed and *Imperata cylindrica*) which is likely to provide habitat for faunal and avifaunal species. In addition, the reeds potentially provide breeding and feeding habitat for faunal species such as the reed frog. The vegetation cover has been impacted to a degree by activities associated with the construction of access roads, historical infilling and general disturbances within the site which has led to invasion by alien and invasive species which include *Psidium guajava*, *Lantana camara* and *Chromolaena odorata*. Furthermore, shrub species such *Chrysanthemoides monilifera* and *Helichrysum kraussii* were observed to have significantly invaded portions of the wetland areas.



5 LEGISLATIVE REQUIREMENTS, NATIONAL AND PROVINCIAL GUIDELINES PERTAINING TO THE APPLICATION OF BUFFER ZONES

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone. However, in summary, it is considered to be “a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another”. Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species and a range of ancillary societal benefits (Macfarlane *et al.*, 2015). It should be noted, however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et al.*, 2015).

The definition and motivation for a regulated zone of activity for the protection of the freshwater ecosystems can be summarised in Table 4 below.

Table 4: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	<p>Government Notice 4167 as published in the Government Gazette 49833 of 08 January 2024 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended.</p> <p>In accordance with GN 4167, a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as:</p> <ul style="list-style-type: none"> • a 500 m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended must be taken into consideration if any activities (for example, access roads) are to take place within the applicable zone of regulation. This must	<p>Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states that:</p> <p><i>The development of:</i></p> <p>(xii) <u>Infrastructure or structures with a physical footprint of 100 square meters or more;</u></p> <p><i>Where such development occurs—</i></p> <p>a) <i>Within a watercourse;</i></p>



Regulatory authorisation required	Zone of applicability
be determined by the EAP in consultation with the relevant authorities.	<i>b) In front of a development setback; or</i> <i>c) If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.</i>
Biodiversity Impact Assessment Handbook for KwaZulu-Natal (Draft) (Ezemvelo KZN Wildlife, 2010)	The biodiversity assessment must comply with the minimum requirements as stipulated by Ezemvelo Biodiversity Guidelines (2010) and must contain the following information: <ul style="list-style-type: none"> ➤ Rules for buffer zone widths are as follows: <ul style="list-style-type: none"> • 30 m from the outer edge of the temporary zone of the wetland.

In terms of GN 4167 (December 2023) of the National Water Act, 1998 (Act No. 36 of 1998), a 500 m radius from the delineated boundary (extent) of any wetland or pan is applicable in terms of this regulation. A 32 m zone of regulation in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) is also applicable to the wetland.

In addition, according to the Biodiversity Impact Assessment Handbook (Ezemvelo KZN Wildlife, 2010), a 30 m buffer from the outer edge of the temporary zone of the wetland is applicable to wetlands. The applicable zones of regulation and applicable buffers are indicated below in Figure 13 and Figure 14.

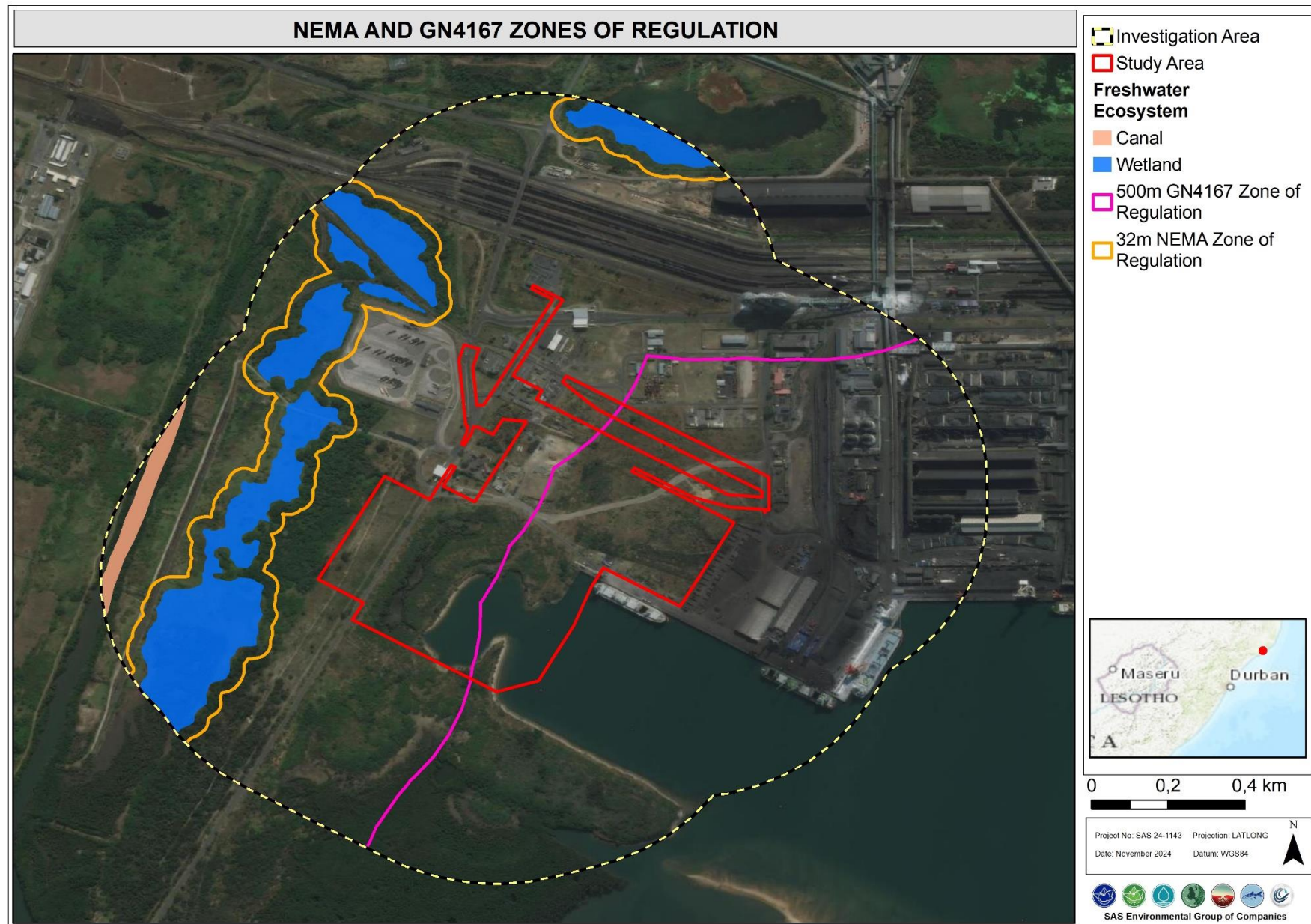


Figure 13: Conceptual presentation of the zones of regulation in terms of NEMA and GN4167 of the National Water Act, 1998 (Act No. 36 of 1998).



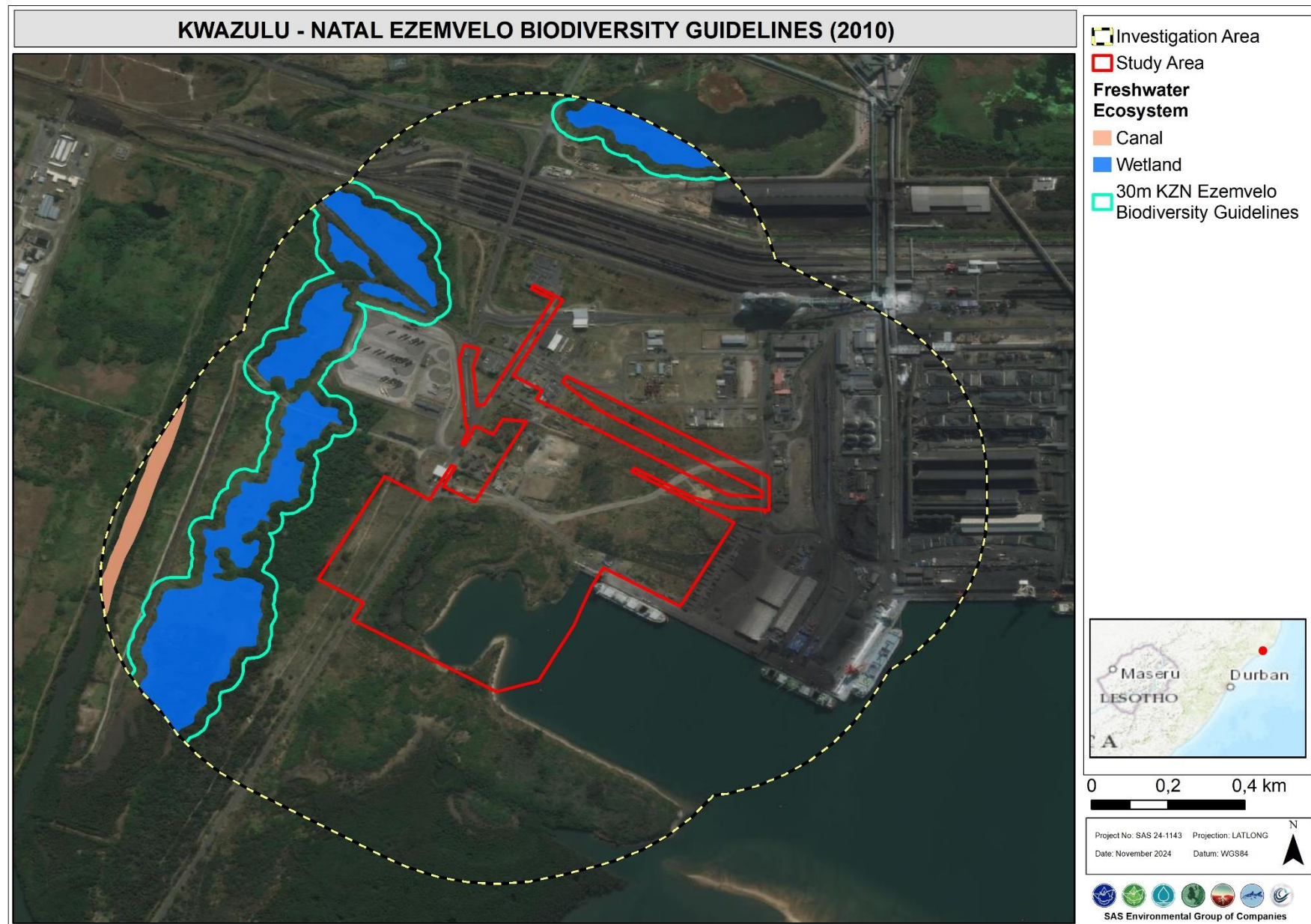


Figure 14: Conceptual presentation of the KwaZulu – Natal Ezemvelo Biodiversity Guidelines (2010).



6 DEPARTMENT OF WATER AND SANITATION (DWS) RISK ASSESSMENT AND IMPACT ASSESSMENT

This section presents the significance of potential impacts as a result of the proposed Berth 605 activities. When evaluating the perceived impacts of the activities, the risk significance was ascertained based on the assumption that the recommended mitigation measures will be implemented to reduce the risk significance. Thus, the risk assessment provided in this report presents the perceived impact significance post-mitigation.

6.1 Risk Assessment Analysis

6.1.1 Consideration of impacts and application of mitigation measures

The Risk Assessment Matrix as defined in Appendix A of GN 4167 of December 2023 as it applies to the NWA was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) on the wetlands within the investigation area (Table 5).

- The DWS risk assessment (2023) was applied assuming that a high level of mitigation will be implemented, thus the results of the DWS risk assessment provided in this report presents the perceived impact significance post-mitigation;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al*, (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required; and
- While the operation and maintenance of the activities associated with the proposed Berth 605 project will be permanent, the construction thereof is envisioned to take six months to a year. However, the frequency of the construction impacts may be expected to be daily during the construction of specific infrastructure.

6.2 Impact Discussion and Essential Mitigation Measures

There are four key potential ecological impacts on surrounding freshwater ecosystems that are anticipated:

- Loss of freshwater habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance; and
- Impacts on water quality.



Table 5: Summary of the risk assessment matrix for the proposed Berth 605 and associated infrastructure development.

No.	Phases	Activity	Impacts	Potentially affected	PES	Significance Rating	Reversibility	Confidence Level
1	Pre-Construction	<ul style="list-style-type: none"> Site clearing and vegetation removal prior to commencement of construction for the proposed Berth 605 project and associated infrastructure. 	<ul style="list-style-type: none"> Changes in runoff and potential increase in erosion within the site due to removal of vegetation; Potential smothering of freshwater biota due to increased dust generation within the development site; and Decreased ecoservice provision. 	Depression Wetlands	Largely Modified	Low	Partially Reversible	Medium
2	Construction	<ul style="list-style-type: none"> Clearing of vegetation within the proposed footprint of the container handling facility. 	<ul style="list-style-type: none"> Removal of vegetation and associated disturbance to soil within the construction footprint; Altered timing, pattern and flow within the landscape due to disturbance; and Increased generation of dust due to increase bare areas within the development footprint. 	Depression Wetlands	Largely Modified	Low	Fully Reversible	Medium
3		<ul style="list-style-type: none"> Construction activities associated with the development the quay wall. 	<ul style="list-style-type: none"> Removal of vegetation and associated disturbance to soil within the construction footprint; Potential changes in the freshwater-saltwater interaction due to dredging; Increased likelihood of dust generation; Changes to the timing of flow in the landscape and flood peaks of water moving through the landscape; and Potential contamination of estuarine water which interacts with freshwater systems due to potential leak of fuels and other oils. 			Low	Fully Reversible	Medium
4		<ul style="list-style-type: none"> Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (access roads, railway lines and electrical supply infrastructure). 	<ul style="list-style-type: none"> Formation of ponding areas or of areas of preferred flows; Increased likelihood of dust generation; Mixing and casting of concrete for construction purposes; and Miscellaneous activities by construction personnel. 			Low	Fully Reversible	Medium
5		<ul style="list-style-type: none"> Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure). 	<ul style="list-style-type: none"> Increased likelihood of dust generation; Removal of vegetation and topsoil and associated stockpiling; Loss of catchment yield resulting from stormwater containment, leading to reduced volume of water entering freshwater environment; and Altered vegetation community structure and diversity due to moisture stress in some localized areas. 			Low	Fully Reversible	Medium
6	Operation Phase	<ul style="list-style-type: none"> Operation of proposed dredging and stockpiling activities. 	<ul style="list-style-type: none"> Potential alteration of flows within the area resulting in draining or flooding of the freshwater ecosystems; Smothering of freshwater habitat due to increased dust generation; Changes in vegetation composition and loss ecological service provision; Potential contamination of wetlands due to dredging activities through migration of pollutants via wind or during rainfall events; and Potential impacts on wetland recharge patterns due to dredging activities. 	Depression Wetlands	Largely Modified	Low	Partially Reversible	Medium
7		<ul style="list-style-type: none"> Operation of the proposed service infrastructure 	<ul style="list-style-type: none"> Potential for erosion of upland areas as a result of the formation of preferential flow paths, leading to sedimentation of the freshwater ecosystems; Changes in the timing, pattern and flows of water reporting to the wetlands due to increased activities and altered landscape; Changes in vegetation composition and potential increased proliferation of alien and invasive species; and Exposure of soil, leading to increased runoff from cleared areas using for maintenance of the associated infrastructure. 			Low	Partially Reversible	Medium



According to the above risk assessment for the proposed Berth 605 project, there are no direct impacts on the wetlands delineated as a result of the proposed activities associated with both the construction as well as the operation phase of the project and therefore with the application of the recommended mitigatory measures, the overall impact significance is Low. Based on the Low impact significance, a GA is required in accordance with the NWA.

6.3 Mitigation Measures

Construction Phase:

- It must be ensured that the approved development areas are clearly demarcated prior to any construction activities;
- It is essential to ensure appropriate monitoring by an appointed Environmental Compliance Officer (ECO) throughout the construction phase of the project. For infrastructure that is expected to be completed within a short-duration, daily monitoring should be conducted during construction. For longer-term infrastructure which may take several months to complete, monitoring should occur weekly throughout the construction phase;
- If areas within the construction footprint need to be cleared of vegetation, clearing must take place in an incremental / phased fashion in accordance with a construction method statement. The entire construction footprint must not be cleared of vegetation at the commencement of the construction phase to limit large-scale dust generation;
- Areas which are to be cleared of vegetation for contractor laydown areas must remain as small as possible and it must be ensured as far as possible that vegetation clearing is limited to the proposed development footprint;
- A stormwater control system must be implemented during the construction phase as part of a comprehensive stormwater management plan, ensuring effective controls are in place throughout all stages of development. Temporary measures must be used to control construction phase stormwater - e.g. the use of berms, silt traps / silt curtains, along with the retention of natural vegetation where possible;
- During excavation activities, it must be ensured that topsoil stockpiles are not higher than 2 m in height and all exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) to prevent erosion. Furthermore, measures must be undertaken to limit the time in which topsoil is exposed to ensure preservation of the topsoil integrity for later reuse in site rehabilitation or landscaping;
- Dust suppression measures must be implemented (such as spray watering on gravel roads) throughout the proposed development activities to prevent excessive dust;
- A permeable pioneering layer must be used during the construction of the roads. This is crucial in road construction because it helps manage water drainage and stabilize the soil.



A permeable layer allows water to seep through rather than accumulate on the road surface or below it, it helps prevent water from pooling and eroding the subgrade and therefore maintaining the structural integrity of the road; and

- Cement powder, wet cement, and uncured cementitious mortars are highly alkaline and can be toxic to aquatic life and other biota. It is therefore imperative to ensure proper handling and disposal of these materials during construction to prevent any discharge into freshwater areas. The following recommendations must be adhered to:
 - Fresh concrete and cement mortar must not be mixed near, or within the wetland;
 - Mixing of cement should only be undertaken within the construction camp and may not be mixed on bare soils;
 - Mixing of cement is also to be strictly undertaken within a lined, bound or banded portable mixer. Consideration must be taken to use ready mix concrete;
 - A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing;
 - Cement bags must be disposed of in the demarcated hazardous waste receptacles;
 - Concrete spillage outside of the demarcated area must be promptly removed and taken to a suitably licenced waste disposal site.

Operation Phase:

- During periodic maintenance activities of the surface infrastructure, monitoring for erosion should be undertaken with specific mention of investigating the support structures and areas accessed to facilitate maintenance activities;
- Should erosion be noted alongside infrastructure areas, the areas must be rehabilitated by infilling and erosion gullies, resurfacing disturbed areas and revegetating these areas with suitable indigenous vegetation;
- Monitoring for the establishment for AIP's must be undertaken by the Applicant along disturbed areas and access roads/railway lines used to facilitate maintenance activities. Should AIP's be identified, they must be removed and disposed of as per an AIP control plan and the area must be revegetated with suitable indigenous vegetation;
- During dredging and disposal, it must be ensured that controlled disposal practices for dredged materials are implemented continually in order to minimize impacts on the receiving freshwater environment. This includes managing the timing and location of disposal to reduce sediment intrusion into sensitive habitats;
- It must be ensured that sediment management techniques, such as sediment traps or barriers are implemented in order to help reduce the amount of fine sediment that has potential to migrate to freshwater habitats; and



- During the operation phase, it must be ensured that the pattern, timing and flow of water in the landscape is re-instated following the construction activities and artificial ponding are avoided.

6.4 Impact Assessment

Identified impacts are described in terms of the nature of the impact, receptor sensitivity and the significance of the predicted environmental change (with and without mitigation). The assessment of the identified impacts is based on determining the following aspects: impact probability, duration, extent, consequence, and loss of the resource. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation. The impacts were also qualitatively assessed (Table 6) using the impact assessment method provided by the EAP and the results are presented below.

Table 6: Summary of the impact assessment for the proposed Berth 605 and associated infrastructure development.

No.	Phases	Activity	Potential Impact	Aspects Affected	Significance	Significance without mitigation	Significance with mitigation	
1	Construction	<ul style="list-style-type: none">Clearing of vegetation within the proposed footprint of the container handling facility.	<ul style="list-style-type: none">Increased bare areas due to removal of vegetation;Altered timing, pattern and flow within the landscape due to disturbance; andSmothering of freshwater habitat due to increased generation of dust.	<ul style="list-style-type: none">Loss of vegetation and associated disturbance to soil within the construction footprint;Excavation and infilling;Increased generation of dust due to increase bare areas within the development footprint; andSoil compaction from construction activities, reducing infiltration and aeration.	48	Moderate	14	Low
2		<ul style="list-style-type: none">Construction activities associated with the development of the quay wall.	<ul style="list-style-type: none">Removal of vegetation and associated disturbance to soil within the construction footprint;Potential changes in the freshwater-saltwater interaction due to dredging;-Increased likelihood of dust generation;Potential contamination of estuarine water which interacts with freshwater systems due to potential leak of fuels and other oils.	<ul style="list-style-type: none">Smothering of freshwater habitat due to dust generated from cleared areas;Increase in bare areas including changes in runoff patterns in the landscape;Proliferation of alien and invasive species and potential spread to freshwater habitat; andIncreased erosion and sedimentation of the freshwater systems.	36	Moderate	14	Low
3		<ul style="list-style-type: none">-Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (access roads, railway lines and electrical supply infrastructure).	<ul style="list-style-type: none">Formation of ponding areas or of areas of preferred flows;Mixing and casting of concrete for construction purposes; and Miscellaneous activities by construction personnel.	<ul style="list-style-type: none">Increased likelihood of dust generation;Proliferation of alien and invasive species within the freshwater habitat.	27	Low	10	Low



No.	Phases	Activity	Potential Impact	Aspects Affected	Significance	Significance without mitigation	Significance	Significance with mitigation
4		<ul style="list-style-type: none"> Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure). 	<ul style="list-style-type: none"> Increased likelihood of dust generation; Removal of vegetation and topsoil and associated stockpiling; Loss of catchment yield resulting from stormwater containment, leading to reduced volume of water entering freshwater environment; and Altered vegetation community structure and diversity due to moisture stress in some localized areas. 	<ul style="list-style-type: none"> Proliferation of alien and invasive species within the freshwater habitat; Increased erosion and sedimentation of the freshwater systems; and Alteration of surface water quality from concrete casting. 	27	Low	10	Low
5	Operation Phase	<ul style="list-style-type: none"> Operation of proposed dredging and stockpiling activities. 	<ul style="list-style-type: none"> Potential alteration of flows within the area resulting in draining or flooding of the freshwater ecosystems; Smothering of freshwater habitat due to increased dust generation; Potential contamination of wetlands due to dredging activities through migration of pollutants via wind or during rainfall events; and Potential impacts on wetland recharge patterns due to dredging activities. 	<ul style="list-style-type: none"> Potential increased dust deposition freshwater habitats; Soil compaction and erosion due to operational activities; Loss of vegetation providing habitat or ecological services; and Introduction of pollutants from dredging or runoff particularly during rainfall. 	36	Moderate	10	Low
6		<ul style="list-style-type: none"> Operation of the proposed service infrastructure 	<ul style="list-style-type: none"> Increased impermeable surfaces due to the presence of surface infrastructure; and Changes in the timing, pattern and flows of water reporting to the wetlands due to increased activities and altered landscape. 	<ul style="list-style-type: none"> Increased likelihood of dust generation; and Potential indiscriminate movement of vehicles within the operation area. 	27	Low	10	Low

6.5 Cumulative Impacts

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 6.1 above. Freshwater ecosystems within the region are under continued pressure from activities such as development of and expansion of industrial zones, residential developments and mining activities for different resources as well as increased activity associated with the transportation of various goods and services. These activities cumulatively contribute to the loss of ecological integrity and reduction of ecological functionality. This happens through direct loss of freshwater habitat, fragmentation of freshwater habitat, smothering of freshwater vegetation due to increased windblow dust leading to changes in the composition of vegetation as well as loss of water quality due to migration of contaminants to freshwater ecosystems.

This proposed Berth 605 project will not result in any direct loss of freshwater habitat or direct fragmentation of freshwater habitat. Increased activities within the study area will potentially result in changes in the pattern, timing and flow of water in the landscape and increased dust



particularly during the construction phase, however these impacts have the potential to be minimised. Potential impacts on the estuary as a result of dredging and associated activities must be managed accordingly in terms of legislative frameworks for managing and protecting coastal and estuarine environments such as the National Environmental Management: Integrated Coastal Management Act (ICMA) (2008). The quantitative assessment of the cumulative impacts using the method provided by the EAP is presented below in Table 7.

Table 7: Cumulative impact assessment for the proposed operation of Berth 605 and associated infrastructure development.

Phases	Activity	Potential Impact	Aspects Affected	Significance	Significance without mitigation	Significance	Significance without mitigation
Cumulative Impact	· Operation of the Berth 605 and associated infrastructure development.	· Alteration of water quality; and · Changes in habitat integrity and vegetation structure.	· Potential indiscriminate disposal of waste (litter); · Potential spills from construction vehicles; and · Potential risk of contaminated runoff from the service roads associated with the proposed development.	33	Moderate	10	Low

Cumulative impacts are considered limited given no direct impacts on the system are likely. However, given the nature of the proposed activities within the proposed development site, suitable measures must be implemented to manage any indirect impacts and edge effects.

7 CONCLUSION

SAS was appointed to conduct a freshwater ecosystem and aquatic ecological assessment as part of the S&EIR and WUA processes for the proposed Berth 605 infrastructure at the PoRB.

All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed Berth 605 and associated infrastructure project were identified, delineated and assessed. During the assessment various depression wetlands were identified within the study area associated with the proposed Berth 605 and associated infrastructure project. The result of the ecological assessment is summarised in Table 8 below.

Table 8: Summary of results of the field assessment as discussed in Section 4.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Depression Wetlands	Category D: (Largely modified)	Very Low to Moderate	Moderate	REC Category: D BAS Category: RMO: Maintain

According to the layout of the proposed Berth 605 project, there are no direct impacts on the wetlands delineated as a result of the proposed activities, both the construction as well as the operation phase of the project. Considering the location of the wetlands, which are upgradient of the proposed activities (although within 500 m of the wetlands) and the existing infrastructure within the study area which limits the potential migration of impacts, the overall risk significance to the delineated wetlands is considered negligible.

- To minimize cumulative impacts in the study area, given the extensive existing development, the following measures must be implemented during construction:
- Existing roads should be used to access development sites. Where temporary roads are necessary, the affected areas must be restored to their pre-construction ecological state after construction.
- Excavated topsoil and subsoil from terrestrial areas must be stockpiled separately and reinstated in the correct order—subsoil first, followed by topsoil—once construction is complete.
- The spread of alien and invasive species must be managed in accordance with the site-specific Alien and Invasive Species Management Plan.
- The natural pattern, timing, and flow of water across the landscape must be restored following construction disturbances, and artificial ponding should be avoided.

Therefore, through the implementation of these measures, the ecological integrity of the study area can be preserved, minimizing long-term and cumulative environmental impacts while ensuring sustainable development.

Based on the information presented within this report, the specialist is of the opinion that the EA be considered positively for the proposed Berth 605 and associated infrastructure. The specialist is also of the opinion that based on the Low impact significance outcome of the Risk Assessment Matrix, a WUA process must be undertaken in the form of a GA.



REFERENCES

- Branch, G. and Branch, M. 1981. *The Living Shores of Southern Africa*. Random Struik, Cape Town. 1st Ed
- Department of Water Affairs and Forestry (DWAF). 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.
- Department of Water Affairs and Forestry (DWAF). 2005. *Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas*.
- Department of Water and Sanitation (DWS). 2014. *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: C2 Compiled by RQIS-RDM*. Online available: <https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx>
- Kleynhans C.J., Thirion C. and Moolman J. 2005. *A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria
- Kleynhans C.J., Thirion C., Moolman J, Gaulana L. 2007. *A Level II River Ecoregion Classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria
- Kotze D.C., Marneweck G.C., Batchelor, A.L., Lindley D.S. and Collins N.B. 2009. *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No TT 339/08, Water Research Commission, Pretoria.
- National Environmental Management Act (NEMA) 107 of 1998
- National Water Act (NWA) 36 of 1998.
- Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2008. *WET-Health: A technique for rapidly assessing wetland health*. WRC Report No. TT 340/08. Water Research Commission, Pretoria.
- Nel, J.L., Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J., Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011. *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources*. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria.
- NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murrui, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. *Implementation Manual for Freshwater Ecosystem Priority Areas*. Water Research Commission. Report No. 1801/1/11. Online available: <http://bgis.sanbi.org/nfepa/project.asp>
- Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.
- Rossouw, L., Avenant, M. F., Seaman, M. T., King, J. m., Barker, C. H., du Preez, P. J., Pelser, A. J., Roos, J. C., van Staden, J. J., van Tonder, G. J., and Watson, M. 2005. *Environmental Water Requirements in Non-Perennial Systems*. WRC Report 1414/1/05. Water Research Commission. Pretoria.
- Rountree, M.W. and Kotze, D.C. 2013. Appendix A3: Ecological Importance and Sensitivity Assessment. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. *Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0)*. WRC Report No. 1788/1/12. Pretoria. STS 210042.
- Thirion, C, Mocke, A. M, and Woest, R. 1995. *Biological Monitoring of Streams and Rivers using SASS4: A User Manual*. Internal Report No. 0000/00/REQ/1195 Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria, South Africa.
- Van Deventer, H.; Smith-Adao, L.; Mbona, N.; Petersen, C.; Skowno, A.; Collins, N.B.; Grenfell, M.; Job, N.; Lötter, M.; Ollis, D.; Scherman, P.; Sieben, E.; Snaddon, K. 2018. *South African Inventory of Inland Aquatic Ecosystems*. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number <http://hdl.handle.net/20.500.12143/5847>.
- Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. & Van der Colff, D. 2019. *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm*. CSIR report number



CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria.
<http://hdl.handle.net/20.500.12143/6230>.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. 2018. *South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 November 2019.* Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number
<http://hdl.handle.net/20.500.12143/5847>.



APPENDIX A – Terms of Use and Indemnity

INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as the available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	<p>Ecosystems that are threatened or in need of protection</p> <p>(1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection.</p> <p>(b) An MEC for environmental affairs in a province may, by notice in <i>the Gazette</i>, publish a provincial list of ecosystems in the province that are threatened and in need of protection.</p> <p>(2) The following categories of ecosystems may be listed in terms of subsection (1):</p> <p>(a) critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;</p> <p>(b) endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;</p> <p>(c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and</p> <p>(d) protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs (a), (b) or (c).</p>
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette	<p>NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to:</p> <ul style="list-style-type: none"> ➤ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➤ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and



<p>40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)</p>	<p>➤ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.</p> <p>Alien species are defined, in terms of the NEMBA as:</p> <ul style="list-style-type: none"> (a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. <p>Categories according to NEMBA (Alien and Invasive Species Regulations, 2017):</p> <ul style="list-style-type: none"> ➤ Category 1a: Invasive species that require compulsory control; ➤ Category 1b: Invasive species that require control by means of an invasive species management programme; ➤ Category 2: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➤ Category 3: Ornamentally used plants that may no longer be planted.
<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)</p>	<p>In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. <p>This notice replaces GN1199 and may be exercised as follows:</p> <ul style="list-style-type: none"> i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. <p>A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA.</p> <p>Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.</p>
<p>National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)</p>	<p>NEMWA, which reforms the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government, and provides for the licensing and control of waste management activities.</p>
<p>National Environmental Management: Integrated</p>	<p>The National Environmental Management: Integrated Coastal Management Act, 2008 (ICM Act, Act No. 24 of 2008) is South Africa's comprehensive law for managing, protecting, and promoting sustainable development in coastal areas. The ICM Act provides a legal</p>



**Coastal Management Act,
2008 (Act No. 24 of 2008)**

framework for balancing development and conservation in South Africa's coastal areas, with a focus on sustainable use, protection of natural resources, and resilience to environmental challenges.



APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses present or in close proximity of the study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the study area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The watercourses encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al.*, 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)



Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
		(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean⁴ (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

⁴ Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.



Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.*, 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al.*, 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.*, 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al.*, 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa.



Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al.*, 2008), WET-IHI (DWAf, 2007) and WET-EcoServices (Kotze *et al.*, 2009).

3. Watercourse Function Assessment

“The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class”.⁵ The assessment of the ecosystem services supplied by the identified watercourses was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow 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.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the watercourses. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the watercourses.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

⁵ Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999



In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et al*, 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
<u>Very high</u> Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and ≤4	A
<u>High</u> Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and ≤3	B
<u>Moderate</u> Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and ≤2	C
<u>Low/marginal</u> Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and ≤1	D

5. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure” (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.



Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

*PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

6. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C8 below.

Table C9: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 - 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 - 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19



7. The Riparian Vegetation Response Assessment Index (VEGRAI)

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007a). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (NWA; Act 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Table C10: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

8. Freshwater ecosystem delineation

The freshwater ecosystem delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).





APPENDIX D – Risk Assessment Methodology

DWS Risk Assessment Matrix (2023)

In order for the proponent to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- **Environmental impacts** are the consequences of these impacts on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Intensity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial scale** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The intensity, spatial scale and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 75. The likelihood of the impact occurring is determined by assigning a likelihood score of between 20% and 100%. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary⁶.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

"RISK ASSESSMENT KEY" (Based on DWS 2023 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Intensity (What is the intensity of the impact on the resource quality - hydrology, water quality, geomorphology, biota?)

⁶ Some risks/impacts that have low significance will however still require mitigation



Negative impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

*PES of affected watercourses must be considered when scoring Impact Intensity

Table D2: Spatial Scale (How big is the area that the activity is impacting on, relative to the size of the impacted watercourses).

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

Table D3: Duration (How long does the aspect impact on the resource quality).

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

Table D4: Likelihood of impact (What is the probability that the activity will impact on the resource quality).

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

Table D5: Rating Classes.

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 - 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 - 100	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.



A low risk class must be obtained for all activities to be considered for a GA

Table D6: Calculations.

Intensity = Maximum Intensity Score (negative value for positive impact)	MAX = 5
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 15 (MIN = -15 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 75
Significance\Risk = (Consequence X Likelihood) X (100/75)	MAX = 100

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
 - Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts⁷ are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
 - Avoidance or prevention of impact;
 - Minimisation of impact;
 - Rehabilitation; and
 - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

⁷ Mitigation measures should address both positive and negative impacts



APPENDIX E – Freshwater and Aquatic Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES) AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the Ecoservices assessment applied to drainage lines.

ECOSYSTEM SERVICE		Present State			
		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,2	0,1	0,0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	0,4	1,5	0,0	Very Low
	Erosion control	1,0	2,3	0,6	Very Low
	Phosphate assimilation	0,4	2,3	0,0	Very Low
	Nitrate assimilation	0,5	1,5	0,0	Very Low
	Toxicant assimilation	0,4	0,8	0,0	Very Low
	Carbon storage	0,7	2,7	0,5	Very Low
	Biodiversity maintenance	2,0	1,0	1,0	Low
PROVISIONING SERVICES	Water for human use	0,4	2,3	0,1	Very Low
	Harvestable resources	3,0	0,3	1,7	Moderately Low
	Food for livestock	2,0	1,3	1,2	Low
	Cultivated foods	3,0	1,3	2,2	Moderate
CULTURAL SERVICES	Tourism and Recreation	0,3	0,7	0,0	Very Low
	Education and Research	0,5	0,3	0,0	Very Low
	Cultural and Spiritual	1,0	0,3	0,0	Very Low



Table E2: Presentation of the results of the EIS results of the drainage lines.

		Unnamed tributary		Confidence		
Ecological Importance and Sensitivity		Score (0-4)		Confidence (1-5)		
Biodiversity support		A (average)		(average)		
		0.67		4		
Presence of Red Data species		0		4		
Populations of unique species		1		4		
Migration/breeding/feeding sites		1		4		
Landscape scale		B (average)		(average)		
		1.40		4		
Protection status of the wetland		1		4		
Protection status of the vegetation type		2		4		
Regional context of the ecological integrity		2		4		
Size and rarity of the wetland type/s present		1		4		
Diversity of habitat types		1		4		
Sensitivity of the wetland		C (average)		(average)		
		1.00		4		
Sensitivity to changes in floods		1		4		
Sensitivity to changes in low flows/dry season		1		4		
Sensitivity to changes in water quality		1		4		
ECOLOGICAL IMPORTANCE & SENSITIVITY		(max of A,B or C)		(average of A, B or C)		
Fill in highest score:		B		1.40		
Moderate: Wetlands that are considered to be 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 and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.						
Hydro-Functional Importance			Score (0-4)	Score (0-4)		
Regulating & supporting benefits	Flood attenuation		2	4		
	Streamflow regulation		1	4		
	Water Quality Enhancement	Sediment trapping		1	4	
		Phosphate assimilation		2	4	
		Nitrate assimilation		1	4	
		Toxicant assimilation		2	4	
		Erosion control		1	4	
	Carbon storage		1	4		
HYDRO-FUNCTIONAL IMPORTANCE			1.38	2		
Direct Human Benefits			Score (0-4)	Score (0-4)		
Subsistence benefits	Water for human use		1	4		
	Harvestable resources		2	4		
	Cultivated foods		1	4		
Cultural benefits	Cultural heritage		0	4		
	Tourism and recreation		0	4		
	Education and research		0	4		
DIRECT HUMAN BENEFITS			0.67	4.00		

Table E3: Presentation of the results of the IHI for the drainage lines.

Hydrology		Geomorphology		Vegetation		Overall Category	PES
PES category	Trajectory of change	PES category	Trajectory of change	PES category	Trajectory of change		
F	→	D	→	F	→	E/F (7.9)	



APPENDIX F – Risk Analysis and General Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecosystem ecology and biodiversity, will include any activities which take place in close proximity to the project activities may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater ecosystem identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should only encroach into the freshwater ecosystem where authorisation has been granted;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Appropriate sanitary facilities must be provided for the life of the repair and maintenance phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. Alien invasive species are opportunistic, and where disturbances do occur, they will promulgate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the freshwater ecosystem must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Species specific and area specific eradication recommendations:
 - Footprint areas should be kept as small as possible when removing alien plant species; and
 - No vehicles should be allowed to drive through designated sensitive freshwater ecosystems areas during the eradication of alien and weed species.

Soils

- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils and minimise runoff into the riparian freshwater systems; and
- Regular monitoring should be undertaken to assess the footprint area and to measure the degree of sedimentation and soil disturbance in order to allow for adaptive management.



Table F1: Risk assessment matrix for the proposed Berth 605 and associated infrastructure development.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating (without mitigation)	Confidence level
			Name/s	PES	Ecological Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorphology	Vegetation	Fauna										
PRE-CONSTRUCTION	Site clearing and vegetation removal prior to commencement of construction for the proposed Berth 605 project and associated infrastructure.	Changes in runoff and potential increase in erosion within the site due to removal of vegetation; Potential smothering of freshwater biota due to increased dust generation within the development site; and Decreased ecosystem service provision.	Depression Wetland	D	Moderate	1	1	1	2	2	4	1	1	6	3	18	80%	14,4	L	Medium
	Activities associated with preparation of the site for the container handling facilities																			
CONSTRUCTION	Clearing of vegetation within the proposed footprint of the container handling facility.	Removal of vegetation and associated disturbance to soil within the construction footprint. Altered timing, pattern and flow within the landscape due to disturbance; and Increased generation of dust due to increase bare areas within the development footprint.	Depression Wetland	D	Moderate	1	2	1	2	2	4	1	2	7	3	21	80%	16,8	L	Medium
	Ground-breaking, excavations and other earthworks related to construction of pocket and quay wall.																			
	Construction activities associated with the development of the quay wall.	-Removal of vegetation and associated disturbance to soil within the construction footprint; -Potential changes in the freshwater-saltwater interaction due to dredging; -Increased likelihood of dust generation; -Changes to the timing of flow in the landscape and flood peaks of water moving through the landscape; and -Potential contamination of estuarine water which interacts with freshwater systems due to potential leak of fuels and other oils.	Depression Wetland	D	Moderate	1	2	2	1	2	4	1	2	7	3	21	80%	16,8	L	Medium
	Construction activities associated with development of linear infrastructure (roads, railways and electrical supply infrastructure).																			
	Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (access roads, railway lines and electrical supply infrastructure).	-Formation of ponding areas or of areas of preferred flows; -Increased likelihood of dust generation; -Mixing and casting of concrete for construction purposes; and -Miscellaneous activities by construction personnel.	Depression Wetland	D	Moderate	1	1	2	2	2	4	1	1	6	3	18	60%	10,8	L	Medium
	Construction activities associated with development of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure).																			
	Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure).	Increased likelihood of dust generation; Removal of vegetation and topsoil and associated stockpiling; and Loss of catchment yield resulting from stormwater containment, leading to reduced volume of water entering freshwater environment. Altered vegetation community structure and diversity due to moisture stress in some localized areas.	Depression Wetland	D	High	1	1	2	2	2	4	1	1	6	4	24	60%	14,4	L	Medium



Operation of proposed dredging and stockpiling activities																				
OPERATIONAL	-Operation of proposed dredging and stockpiling activities	Potential alteration of flows within the area resulting in draining or flooding of the freshwater ecosystems; 'Smothering of freshwater habitat due to increased dust generation; 'Changes in vegetation composition and loss ecological service provision; 'Potential contamination of wetlands due to dredging activities through migration of pollutants via wind or during rainfall events; and 'Potential impacts on wetland recharge patterns due to dredging activities.	Depression Wetland	D	Moderate	2	2	2	1	2	4	2	5	11	3	33	80%	26,4	L	Medium
	Operation of the proposed service infrastructure (container yards, access roads, railway lines and electrical supply infrastructure)																			
	-Operation of the proposed service infrastructure	Potential for erosion of upland areas as a result of the formation of preferential flow paths, leading to sedimentation of the freshwater ecosystems; 'Changes in the timing, pattern and flows of water reporting to the wetlands due to increased activities and altered landscape; 'Changes in vegetation composition and potential increased proliferation of alien and invasive species; and 'Exposure of soil, leading to increased runoff from cleared areas using for maintenance of the associated infrastructure.	Depression Wetland	D	Moderate	1	1	2	3	1	6	1	1	8	3	24	40%	9,6	L	Medium
Operation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure).																				



Table F2: Impact assessment for the proposed Berth 605 and associated infrastructure development.

ACTIVITY <i>whether listed or not listed.</i> (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc....etc...)	ASPECTS AFFECTED	PHASE In which impact is anticipated (e.g. Construction, commissioning, operational	Size and Scale of Disturbance (volumes, tonnages, and hectares, or m ²)	Magnitude	Duration	Scale	Probability	Significance	Significance without Mitigation	Magnitude	Duration	Scale	Probability	Significance	Significance with Mitigation
Construction Phase																
-Clearing of vegetation within the proposed footprint of the container handling facility.	-Increased bare areas due to removal of vegetation; *-Altered timing, pattern and flow within the landscape due to disturbance; and *-Smothering of freshwater habitat due to increased generation of dust.	-Loss of vegetation and associated disturbance to soil within the construction footprint; *-Excavation and infilling; *-Increased generation of dust due to increase bare areas within the development footprint; and *-Soil compaction from construction activities, reducing infiltration and aeration.	Construction	0 (No Direct Disturbance)	8	3	1	4	48	Moderate	4	2	1	2	14	Low
-Construction activities associated with the development the quay wall.	-Removal of vegetation and associated disturbance to soil within the construction footprint; *-Potential changes in the freshwater-saltwater interaction due to dredging; *-Increased likelihood of dust generation; *-Changes to the timing of flow in the landscape and flood peaks of water moving through the landscape; and *-Potential contamination of estuarine water which interacts with freshwater systems due to potential leak of fuels and other oils.	-Smothering of freshwater habitat due to dust generated from cleared areas; *-Increase in bare areas including changes in runoff patterns in the landscape; *-Proliferation of alien and invasive species and potential spread to freshwater habitat; and *-Increased erosion and sedimentation of the freshwater systems.	Construction	0 (No Direct Disturbance)	8	3	1	3	36	Moderate	4	2	1	2	14	Low
-Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (access roads, railway lines and electrical supply infrastructure).	-Formation of ponding areas or of areas of preferred flows; *-Mixing and casting of concrete for construction purposes; and *-Miscellaneous activities by construction personnel.	-Increased likelihood of dust generation; *-Proliferation of alien and invasive species within the freshwater habitat.	Construction	0 (No Direct Disturbance)	6	2	1	3	27	Low	2	2	1	2	10	Low
-Ground-breaking, excavations and other earthworks related to construction and installation of linear infrastructure (stormwater, water supply pipelines and sewer infrastructure).	-Increased likelihood of dust generation; *-Removal of vegetation and topsoil and associated stockpiling; *-Loss of catchment yield resulting from stormwater containment, leading to reduced volume of water entering freshwater environment; and *-Altered vegetation community structure and diversity due to moisture stress in some localized areas.	-Proliferation of alien and invasive species within the freshwater habitat; *-Increased erosion and sedimentation of the freshwater systems; and *-Alteration of surface water quality from concrete casting.	Construction	0 (No Direct Disturbance)	6	2	1	3	27	Low	2	2	1	2	10	Low
Operational Phase																
-Operation of proposed dredging and stockpiling activities.	-Potential alteration of flows within the area resulting in draining or flooding of the freshwater ecosystems; *-Smothering of freshwater habitat due to increased dust generation; *-Changes in vegetation composition and loss ecological service provision; *-Potential contamination of wetlands due to dredging activities through migration of pollutants via wind or during rainfall events; and *-Potential impacts on wetland recharge patterns due to dredging activities.	-Potential increased dust deposition freshwater habitats; *-Soil compaction and erosion due to operational activities; *-Loss of vegetation providing habitat or ecological services; and *-Introduction of pollutants from dredging or runoff particularly during rainfall.	Operation	0 (No Direct Disturbance)	8	3	1	3	36	Moderate	2	2	1	2	10	Low
-Operation of the proposed service infrastructure	-Increased impermeable surfaces due to the presence of surface infrastructure; and *-Changes in the timing, pattern and flows of water reporting to the wetlands due to increased activities and altered landscape.	-Increased likelihood of dust generation; *-Potential indiscriminate movement of vehicles within the operation area;	Operation	0 (No Direct Disturbance)	6	2	1	3	27	Low	2	2	1	2	10	Low



F3: Impact monitoring and Reporting Frequency including roles and responsibilities.

Source Activity	Impacts Requiring Monitoring Programmes	Functional Requirements for Monitoring	Roles and Responsibilities (For the execution of the monitoring programmes)	Monitoring and Reporting Frequency and Time Periods for Implementing Impact Management Actions
Construction	Loss of vegetation and potential proliferation of alien and invasive species	1. Provide a list of species occurring within the study area; 2. Discuss the density of species; and 3. Fixed point photography showing alien control priority areas.	ECO must be appointed for the construction phase	Frequency of the reportig must be the end of the first growing season following the completion of construction, and on an on-going monthly basis during operations.
Construction	Geomorphological impacts on the wetlands due to erosion	1. Photographs and GPS location to be taken at existing erosion target areas; and 2. Target areas must be mapped and control measures be discussed in an erosion method statement.	ECO must be appointed for the construction phase	Frequency of monitoring and reporting should be after each major storm and monthly report must be compiled by the ECO during the construction phase of the project.
Construction	Impacts on water quality	When surface flows are present within the freshwater systems, monitoring of water quality must be done at pre-determined points. GPS points at these sites must be taken to ensure that monitoring takes place consistently at the same point. Monitoring must include measurement of pH, electrical conductivity (EC), total suspended solids (TSS), and turbidity.	ECO must be appointed for the construction phase	Water must be tested before construction commences (when surface flows are present).
Operation	Freshwater ecological functionality monitoring	1. Monitoring must be done using best practice methods for determination of the present ecological state (PES), the ecological importance and sensitivity (PES) and ecoservices. Important aspects include hydrological changes, water quality, soil erosion, and changes in the vegetation composition.	Suitably qualified freshwater ecologist must be appointed to conduct assessment following the construction activities.	Results of the must be compared to the baseline results and any changes in ecological integrity/ecostatus or ecoservice provision must be documented. This can be done by assessing ecological drivers and receptors of the freshwater system.



APPENDIX G – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Nqobile Lushozi MSc (Geoinformatics) (Stellenbosch University)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Physical address:	29 Arterial Road West, Oriel		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

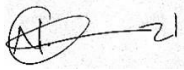
- I act as the independent specialist (**report reviewer**) in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Nqobile Lushozi, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist



SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **STEPHEN VAN STADEN**

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation



4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **NQOBILE LUSHOZI**

PERSONAL DETAILS

Position in Company	Freshwater Ecologist Wetland and Aquatic Ecology
Joined SAS Environmental Group of Companies	April 2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa
 Member of the South African Wetland Society (SAWS)
 Member of the South African Council for Natural Scientific Professions (SACNASP Reg No - 124679)

EDUCATION

Qualifications

MSc Geoinformatics (Cum laude) (Stellenbosch University)	2019
BSc (Hons) Environmental Sciences (University of KwaZulu-Natal)	2015
BSc Environmental Sciences (University of KwaZulu-Natal)	2014

Short courses

Tools for Wetland Assessment (Rhodes University)	2020
Grass Identification Course (Africa Land-Use Training)	2021

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans

Aquatic Ecological Assessment and Water Quality Studies

- Toxicological Analysis
- Surface and groundwater quality Monitoring
- Screening Test
- Mass and salt balance determination

