Environmental Management Programme

Proposed Dredging of the Milnerton Lagoon, Cape Town

PREPARED IN COMPLIANCE WITH THE REQUIREMENTS OF THE EIA REGULATIONS, GN 326 OF 2017 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT NO. 107 OF 1998

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DATE: 28 January 2026

APPLICANT

City of Cape Town

CITY OF CAPE TOWN
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STAD KAAPSTAD

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REPORT DETAILS

PROPOSED DREDGING OF THE MILNERTON LAGOON, CAPE TOWN: ENVIRONMENTAL MANAGEMENT PROGRAMME

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Report purpose

This Environmental Management Programme is prepared as part of a Basic Assessment in terms of the Environmental Impact Assessment Regulations of 2014, as amended. It prescribes control methods to mitigate and manage negative environmental impacts and enhance positive impacts associated with the implementation of the development and provides a programme for monitoring the performance of personnel in applying such methods.

DOCUMENT CONTROL

Date	Version
05 November 2025	Draft 1
28 January 2026	Final

DECLARATION OF EAP'S INDEPENDENCE

I, Jeremy Rose, appointed by the City of Cape Town as Environmental Assessment Practitioner for the Environmental Management Programme, hereby declare that the information provided in this report and supporting documentation is complete and correct to the best of my knowledge; that other than fair remuneration for work performed in terms of this application I have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; that I have disclosed, to the Applicant, the specialist(s), the Competent Authority and registered interested and affected parties all material information that have or may have the potential to influence the decision of the Competent Authority; that I have ensured that information in respect of the application was distributed or was made available to registered interested and affected parties and that participation will be facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments; and that I am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations.

Jeremy Themba Rose BSc (Hons), Reg. E.A.P. 2019/1116, Pr.Sci.Nat. 120148, IAIAsa member 5781
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RECORD OF REVISIONS

Rev. No.	Reason for Revision	Section Revised	Revised By	Effective Date
00	DRAFT	ALL	T HOBSON	03 November 2025
01	FINAL	ALL (changes underlined)	J ROSE	28 January 2026

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ANNEXURES

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TERMS AND ACRONYMS

BAR	Basic Assessment Report
DO	Dissolved Oxygen
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry Fisheries and the Environment
MMP	Maintenance Management Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended
NEM: ICMA	National Environmental Management: Integrated Coastal Management Act, 2008 (Act 24 of 2008), as amended

1 INTRODUCTION

The Milnerton Lagoon ('lagoon' or 'estuary') is the well-known lower section of the Diep River Estuary where the Diep River enters the sea at Lagoon Beach in Cape Town (refer to **Figure 1** below). Water quality in the lagoon has declined significantly in recent years due to high levels of pollution and other anthropogenic impacts. The effects of poor water quality in the estuary include a sulphurous odour and discoloured water, due to high levels of suspended solids and extremely low oxygen levels.

Sewage-derived pollution is a major contributor to water quality impacts in the estuary, and includes excessive loading of organic solids from the Potsdam wastewater treatment works (WWTW). During 2024 and 2025, the lagoon has also been affected by the discharge of large volumes of untreated sewage because of the episodic failure of the Koeberg Road sewage pump station and its resulting discharges into the Theo Marais stormwater canal upstream of Otto du Plessis Drive.

In addition to the ongoing effects of inflowing pollutants, water quality in the lower estuary is affected by the extent to which clean seawater can enter the lagoon during high tides, replacing polluted river flows with cooler, saline water with higher dissolved oxygen concentrations. This daily tidal exchange is dependent on the dynamics of the estuary mouth, coastal processes, and flows from the river. In general, greater tidal exchange has been associated with improved water quality in the lower lagoon (between the Loxton Road bridge and the mouth). Tidal exchange is reduced when the mouth is partially closed, which is influenced by many different factors including deposition of sediments at the mouth. Organic sediments derived from wastewater and urban runoff accumulate on the bed of the estuary over time and are periodically flushed out to sea in large flood events. Accumulated organic-rich sediments increase the demand for oxygen from the water column as microbes decompose the material. This process reduces the levels of dissolved oxygen concentrations in the estuary. If there is insufficient oxygen available in the water (as is often the case in the lagoon), conditions turn anoxic, allowing certain bacteria to produce hydrogen sulphide, resulting in characteristic foul odours.

The proposed activity is the dredging (with or without off-site disposal) of the lower section of the Milnerton Lagoon from just upstream of the Loxton Road bridge to the estuary mouth with the placement of dredged sediment along channel margin(s) (refer to **Figure 2 and 3** below).

Up to 30 000 m^3 of material will be moved within the lagoon to achieve this during the dredging phase of the project, and up to 120 000 m^3 during the post-dredging phase to maintain the scoured depth of the dredged channel and an open estuary mouth in accordance with the MMP (see Appendix H2 of the Basic Assessment Report [BAR]), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained. Furthermore, should partial off-site disposal be the implemented design and layout alternative (refer to Design and Layout Alternative 5 below) then the dredged material would be separated by cyclone, with clean sand returned to the lagoon (i.e., with placement of sediment particularly on the eastern bank of the channel) and approximately 6 000 m^3 of nutrient-enriched fine sediments dewatered and removed off-site (see **Figure 3** below).

Figure 1: Locality map indicating the site located on Erf 20315, within the Milnerton Lagoon.

1.1 CURRENT & PLANNED POLLUTION REMEDIATION WITHIN THE GREATER DIEP RIVER ESTUARY

In response to the impacts on waterbodies caused by failing sewage infrastructure, the Applicant, the City of Cape Town ('the City'), has initiated a series of ongoing and planned projects to reduce pollution in the canal and estuary and to upgrade infrastructure across the catchment. Current pollution response actions include routine unblocking and repair of sewers, investigations and enforcement of pollution incidents, increased maintenance frequency at the Koeberg Pump Station, and water pressure reduction in parts of the catchment.

In addition, major infrastructure upgrades are underway or scheduled, including:

» the upgrading and expansion of the Potsdam Wastewater Treatment Works (scheduled for completion by December 2027);
» A capacity upgrade and construction of an overflow pond at Koeberg Road Pump Station (2027);
» Construction of the new Montague Gardens Bulk Sewer (2026);
» Rehabilitation of the Montague Drive Bulk Sewer (2027);
» Upgrades to the Phoenix Park Pump Station (2028); and
» Upgrades to the Sanddrif East Pump Station (June 2027).

1.2 PROJECT BACKGROUND AND MOTIVATION

The Diep River Estuarine Management Plan (adopted in 2022) includes a set of objectives and actions, of which Objective H1 and Action 12 involve the following, '*Assess the possible cost and*

benefit of dredging the lower lagoon to facilitate the release of sediments and nutrient loads and emulate natural scour and enable ingress of increased volumes of seawater into the system… Implement dredging if a significant benefit is anticipated.' (refer to pg 9. of EMP (2022)).

A Water Quality Remediation Plan for the Milnerton Lagoon was prepared for the City of Cape Town in 2023 (Rose et al., 2023), 'the 2023 Remediation Plan', which assessed various short-, medium- and long-term remediation measures proposed for the lagoon and recommended that the primary focus of remediation of the pollution within the lagoon should be on reducing the sources of pollution into the estuary. Of the short-term remediation measures assessed in the 2023 Remediation Plan, one that was recommended for implementation was dredging of the lagoon to remove built-up organic sediments and increase tidal exchange in the estuary.

Hydrodynamic modelling of the proposed dredging has been conducted, and found that the proposed dredging would facilitate greater saline intrusion during incoming and outgoing tides in the lower part of the lagoon. The dredging is expected to increase the exchange of saline and fresh water in the lower lagoon. The increased seawater intrusion is also expected to introduce dissolved oxygen into the lagoon, reducing chemical oxygen demand and disrupting anoxic conditions. During the dry season, average salinities near the mouth of the lagoon are modelled to increase by 11.6 %. During the wet season, average salinities near the mouth are modelled to increase by 54.0 % in the lower water column.

Since 2023, multiple flood events have naturally scoured the system, flushing significant quantities of sediment from the lagoon out to sea. The removal of organic sediments has become less of a priority, and dredging is instead proposed for its potential to improve the hydrodynamics and tidal exchange as a viable remediation measure.

Dredging alone is not expected to achieve the desired permanent ecological, human health and/or aesthetic outcomes within the Milnerton Lagoon unless there is a significant reduction in polluted inflows into the Diep River. It is therefore proposed that the implementation of dredging be delayed until water quality inflows into the lagoon reach acceptable levels, defined here in terms of dissolved oxygen as the 90th percentile of oxygen concentrations in bottom waters being above the 1.0 mg/L threshold over a three-month period with weekly monitoring, and the 90th percentile in mid- and surface water concentrations being above 2.0 mg/L.

The **proposed dredging of the lower reaches of the Milnerton Lagoon is the subject of this Environmental Management Programme (EMPr)**.

1.3 ALTERNATIVES

The various sensitivities and contextual constraints presented by the site resulted in two potential design and layout alternatives, which together with the no-go alternative were considered for this application:

- **Alternative 1 *(Preferred Alternative)* - Dredging with placement of material within the lagoon:** This option involves dredging approximately 30,000 m³ of sediment from the channel and placing it on the sides of the dredged area to build up sandbanks within the intertidal zone – refer to **Figure 2** below. During the post-dredging phase of the project, up to 120 000 m³ of sediment will be dredged from the channel and/or estuary mouth, and placed on the sides of the channel within the intertidal zone and an open estuary mouth maintained in accordance with the MMP (see **Appendix H2**), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

These sandbanks would be naturally exposed to cycles of oxygen and ultraviolet light (UV) through wetting and drying, assisting in the breakdown of organics. Importantly, this option does not require off-site disposal or dewatering, thereby will not take up scarce landfill space nor involve the excessive transport and loading to move sediment off-site to an appropriate and capacitated landfill site, making it the least costly and least disruptive alternative. Dredging could be completed in approximately five months, with impacts limited to the dredged footprint and without significant loss of public space.

This proposed intervention includes the creation of a berm upstream of the small island at the Wooden Bridge, using 600 m^3 of dredged material, as a means to potentially concentrate flows west of the island and increase flow velocities.

- **Alternative 5 *(Least Preferred)* – Dredging of the channel with partial off-site disposal:** This option involves dredging of up to 30,000 m^3 of material, which would be separated by cyclone, with clean sand returned to the lagoon (i.e., with placement of sediment particularly on the eastern bank of the channel) and only around 6 000 m^3 of nutrient-enriched fine sediments dewatered and removed off-site (refer to **Figure 3** below). During the post-dredging phase of the project, up to 120 000 m^3 of sediment will be dredged to maintain the scoured depth of the dredged channel and an open estuary mouth and placed on the eastern side of the channel within the intertidal zone in accordance with the MMP (see **Appendix H2**), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

  The intervention involves forming a berm upstream of the small island at the Wooden Bridge, using approximately 600 m^3 of dredged material, to help direct flows to the west of the island and enhance flow velocities.

- **The No-Go Alternative**: Entails maintenance of the *status quo* and therefore not implementing dredging in the Milnerton Lagoon. Under this option, the hydrodynamic functioning of the lagoon would remain dependent on natural processes, potentially with limited tidal flushing and increased retention of freshwater during summer. While winter flooding may cause natural and temporarily improved intertidal exchange, this has proven insufficient to support lasting ecological recovery.

Given the continued environmental degradation and potential to lose out on socio-economic opportunities under the No-Go Alternative, it is considered neither reasonable nor feasible. The implementation of the proposed dredging (with or without off-site disposal) and sediment placement activity is therefore strongly preferred, as it offers clear, tangible short- to medium-term benefits for the hydrodynamic function of the lower lagoon, with the subsequent potential to pose a positive indirect impact both on estuary ecosystem health and upon local community well-being.

Figure 2: Schematic of the updated preferred alternative, illustrating the proposed dredging area (blue) in the Milnerton Lagoon, with the excavated material (yellow polygons) placed on either side of the channel. The proposed sand berm is highlighted in orange, while the dotted outline depicts the precise footprint of the dredged area. The design has been amended slightly since the draft BAR based on comments received, to maintain deeper water along the western bank immediately downstream of the Loxton Road bridge.

The main purpose of the dredging is to maximise tidal flushing and improve the hydrodynamics of the lower section of the lagoon. The creation of a dredge channel is intended to increase flow velocities and help keep fine material suspended so that it can be flushed out to sea during tidal cycles. The dredged material is proposed to be placed on the sides of the dredge channel to form sandbanks. Additional bioremediation benefits associated with this sediment placement on the sides of the channel include exposure of the deposited sediment to ultraviolet (UV) light and oxygen during low tide, which can reduce foul odours, pathogens, and labile organics such as dissolved organic carbon.

Figure 3: This schematic presents the design and layout Alternative 5 – the proposed dredging with off-site disposal.

1.4 Objective

The overarching objective, from which the detail contained in this EMPr flows, is to implement and operate the project in a manner that –

- Reduces the risk of pollution or damage to ground and surface water, ecosystems, soils and air;
- Minimises nuisance and disruption to people residing in, working in or commuting through the area;
- Adheres to all relevant environmental legislation.
- The objectives of this EMPr are therefore:
- To prescribe the best practicable control methods to mitigate and manage negative environmental impacts and enhance positive impacts associated with the Implementation Phase (dredging) and Post-dredging Phase; and
- To provide a programme for monitoring the performance of personnel in applying such methods.

Limitations of dredging as a remediation measure

It must be clearly stated that dredging of the Milnerton Lagoon is not in itself expected to contribute significantly to improving water quality or amenity value of this waterbody other than by improving tidal exchange in the lower part of the lagoon. The causes of water quality impacts are well understood and include the discharge of wastewater at the Potsdam WWTW, the periodic discharge of substantial volumes of untreated sewage from failing pump stations and the ongoing low-level runoff of untreated wastewater from un-serviced areas of the catchment. As assessed in the Basic Assessment Report, the positive impacts of dredging as a remediation measure are likely to be limited in extent (since improvements to tidal exchange will occur mainly in the lower lagoon) and duration

(as winter flooding may cause the channel to revert to its current channel). Therefore, the dredging of the lower lagoon is preferably recommended after some improvement in water quality occurs, ensuring that the intervention coincides with improvements in upstream water quality. Dredging is therefore recommended as a short- to medium-term intervention that can feasibly be implemented to help address pollution within the Milnerton Lagoon considering the complimentary maintenance activities ensuring the dredged channel depth is maintained and the estuary mouth kept open.

1.5 Environmental Sensitivities

The proposed site is the lower reaches of the Milnerton Lagoon: a part of the Diep River Estuary with significant tidal influence. Rietvlei wetland, fed by the Diep River habitat, is located north of the Milnerton Lagoon and is 5 km north-east of the Cape Town harbour. The Diep River originates from the Riebeek Kasteel Mountains north-east of the town of Malmesbury, flowing south-west for approximately 65 km towards the estuary in Cape Town. The lower catchment of the Diep River in Cape Town is highly urbanised, and the estuary is confined to a channel stabilised by road embankments and bridges with a maximum width of 150 m. The estuary mouth naturally migrates between a gabion structure and concrete wall to the south and the Woodbridge Island, a naturally raised area approximately 250 m north of the mouth.

The City of Cape Town's Biodiversity Spatial Plan (BSP), specifically the 2018 BioNet and draft 2025 BSP, classifies the proposed site as a Protected Area, as it forms part of the Table Bay Nature Reserve (promulgated in Provincial Notice No. 175, published in Gazette No. 9345, 3 August 1984). The BSP objectives are to maintain the area as a Protected Area. The proposed dredging is a remediation measured intended to address certain impacts of pollution within the lagoon, which would contribute to the maintenance of the Protected Area.

The Estuarine Impact Assessment and the Avifaunal Compliance Statement describe in detail the fauna and their habitats in the lower Diep River Estuary:

The Estuarine Impact Assessment described the modification and domination of the Diep River Estuary by freshwater, and its degradation in water quality, reduced biodiversity, and a near-collapse of native fish populations because of agricultural runoff, effluent from the Potsdam WWTW, and stormwater inputs.

The specialist notes that the estuarine area below the Woodbridge Island bridge is highly disturbed, with the only remaining 'natural vegetation' of environmental significance is the vegetation downstream of the Woodbridge Island comprising a thin strip of dunes between the Woodbridge Island development and the beach itself (Anchor, 2025). This section of dune habitat is to be avoided during dredging, and any dredging-related activities should not impact this area of dune vegetation.

With regard to invertebrate fauna, it notes that there have been significant changes to the benthic macrofauna communities in the Diep River Estuary over time, specifically, a dramatic decline in species richness, and an increase in freshwater species. Species that have increased in abundance include insects (primarily freshwater species). Two alien invertebrates not previously reported from the system have also been introduced. These changes reflect the changing water quality profile of the system.

The Diep River Estuary system (including Rietvlei) is considered an important area for water birds in the region and is recognised as an Important Bird and Biodiversity Area (IBA) by Birdlife International.

While most of the information of bird abundance and species richness for the area is focused on Rietvlei, rather than the lower estuary, various sources have reported kelp gull *Larus dominicanus*, Hartlaub's gull *Chroicocephalus hartlaubii*, common tern *Sterna hirundo* and Cape shoveler *Spatula smithii*, as well as predominantly freshwater species such as red-knobbed coot *Fulica cristata* and

African darter *Anhinga rufa*. Site visits undertaken by Anchor in December 2020 and February 2022 confirmed that the estuary is an important feeding and roosting area for many bird species, including greater flamingo *Phoenicopterus roseus*, white-breasted cormorants *Phalacrocorax lucidus* and pied avocets *Recurvirostra avosetta*. The avifaunal compliance statement confirms that, despite at least 14 different bird species potentially being affected by the proposed dredging, the post-mitigation impacts of this project on the local birdlife are likely to be of Low significance if all the mitigation measures recommended in the Estuarine Impact Assessment (Anchor 2025) are implemented.

Estuaries are considered critically important nursey habitat for fish, and the Diep Estuary historically represented some 10% of the nursery area for fish on the West Coast, including species such as the white steenbras *Lithognathus lithognathus*. However, there are clear declines in fish species richness over time. These changes are likely linked to changes in water quality, specifically increased ammonia levels linked to malfunctions in the Potsdam WWTW, as well as substantially reduced dissolved oxygen concentrations, which regularly drop below the 2 mg/l threshold for the survival of aquatic species. While many estuarine-associated species are adapted to hypoxia, an increased frequency of low oxygen events (anoxia) has almost certainly negatively impacted benthic fish communities.

Dredging is expected to result in short-term disturbance and related impacts to birds and any fish remaining in the lower lagoon. Invertebrates will be impacted more directly, if present in the dredged areas, but are expected to recover from adjacent areas.

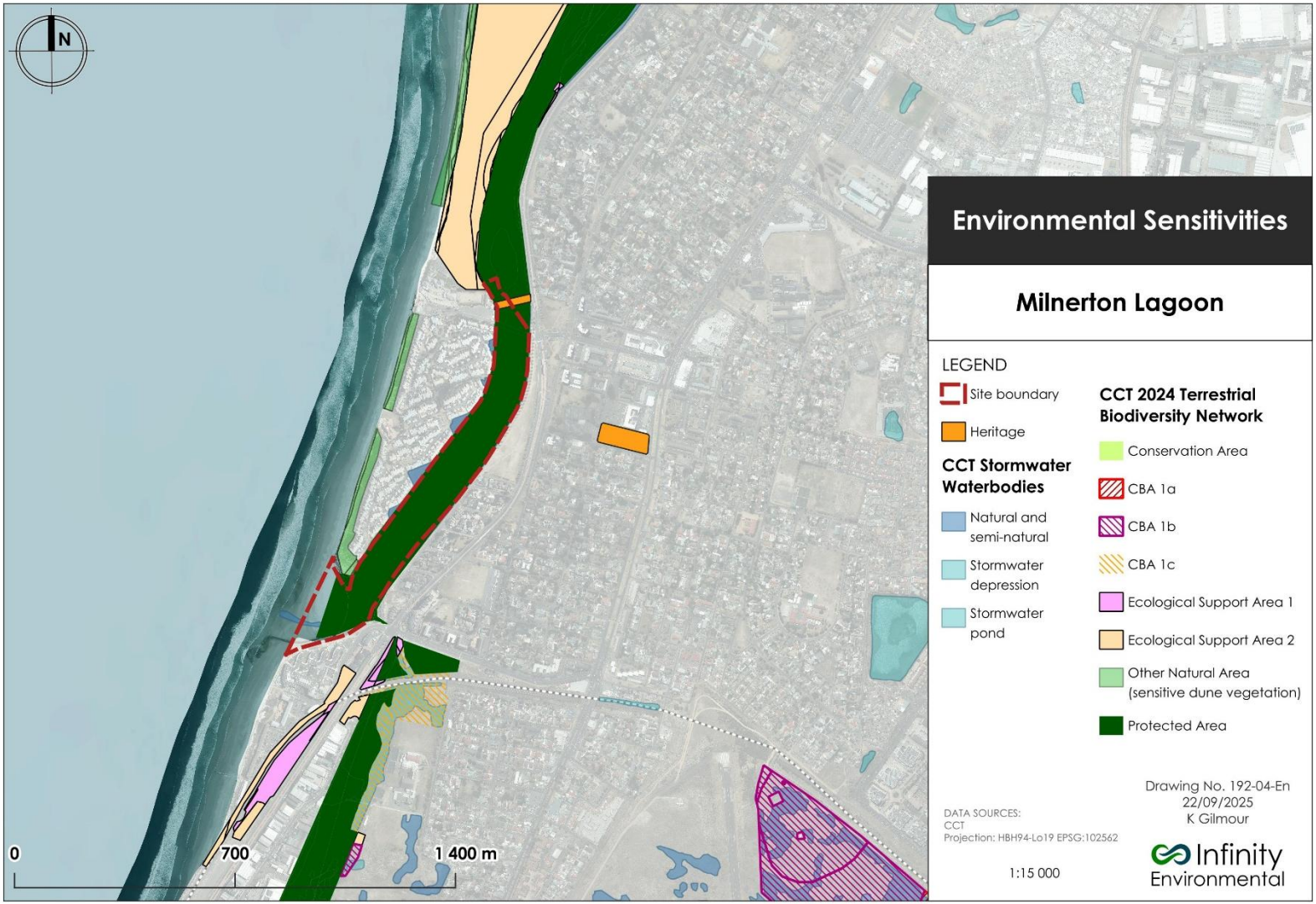

Figure 4: Site boundary of the proposed dredging of the Milnerton Lagoon superimposed on terrestrial and aquatic sensitivities.

1.6 Impacts identified during the EIA

The impacts and management measures identified by the specialists (see **Table 1.1.** below) have been incorporated into this EMPr to manage impacts and monitor compliance during implementation of the proposed activity. The relevant specialist reports are included under Appendix G of the BAR.

Note that the EMPr also includes impacts not covered by specialist studies but which still require mitigation or management (refer to **Sections 4–7** below).

Table 1.1. Key Impacts identified during the EIA process

Specialist study	Impacts identified and assessed (Implementation Phase)
Estuarine Impact Assessment	**Disturbance to and mortality of estuarine communities in the dredge footprint** Direct removal of some 30 000 m³ of estuarine channel sediments during the dredging phase and up to 120 000 m³ during the post-dredging phase, as part of dredge activities will lead to direct mortality of fauna associated with those sediments, namely macrofauna and epifaunal species present within the dredge area. The Milnerton Lagoon benthic macrofauna is very depauperate (i.e., lacking in variety, numbers and/or vitality), with a dramatic decline in species richness over time, and an increase in freshwater species. Of particular concern has been the declines and shifts in behaviour of the burrowing sand prawn, *K. kraussi*, which is an ecosystem engineer. The communities that are present are typical, albeit depauperate, communities that characterise estuaries of the west coast of South Africa. The estuarine specialist confirmed that there are no species of particular conservation concern within the lagoon. While fish are generally considered to be mobile, and will move away from the disturbance, benthic fish species as well as species that are dependent on the estuary for the completion of their life cycle were assessed to be potentially disproportionally affected by the proposed dredging activities. However, it is noted that, in tandem with the declines in macrofauna species, there has been a complete loss of species that depend on these invertebrate communities within the system (benthic goby species in particular), as well as drastic declines in the number of juveniles of linefish species that depend on estuarine habitat (white steenbras and white stumpnose). Therefore, it seems likely that there are very few fish species of sensitivity, conservation concern or commercial importance left in the system that require management. Although the majority of the benthic organisms are likely to die or be removed from the dredged areas, this should not have any repercussions at the population levels as the estuarine specialist affirmed that communities are likely to recover from other sites in the system relatively rapidly after the impact.
	Disturbance to estuarine habitat due to dewatering activities The proposed dewatering methodology (should the Design and Layout Alternative 5 be pursued) involves the use of large geotextile "geo-tubes" that will be placed in the grassy recreational space on the eastern side of

	the estuary body alongside Marine Drive, covering an area of about 0.025 km^2 (see **Figure 3** above). There is no functional estuarine vegetation on site, and the entire eastern bank of the estuary in that area is canalised. This means that the area has ceased to have any connectivity with the estuarine water body (for example, it is no longer inundated with tides and hosts no natural estuarine vegetation). Impacts on estuarine habitat resulting from the proposed dewatering activity is therefore considered to be Insignificant, and no mitigation is required.
	Noise impacts on surrounding estuarine ecology due to dredging activities Noise associated with dredging operations may have an impact on estuarine organisms in the vicinity. Noise generated by dredging activities may include noise associated with service vehicles, vessels, cranes, heavy machinery, generators, etc. Estuarine and marine invertebrates have been shown to be relatively insensitive to low frequency sound, whilst fish appear to be able to tolerate moderate sound levels (Keevin and Hempen, 1997). Waterbirds that use the intertidal flats in the lower estuary for foraging are expected to avoid the sound source should it reach levels sufficient to cause discomfort. The dredge area and area of sand enrichment will overlap with intertidal areas of known importance to avifauna like greater flamingos, white-breasted cormorants and pied avocets. The extent of the impact may extend beyond the local area (i.e., by affecting how migratory species use the system).
	Smothering of estuarine fauna Impacts of smothering related to dredging activities will affect most of the lower reaches of the system. For the Design and Layout Alternative 5, the enrichment of sediment back into the system will result in direct smothering of approximately 51 000 m^2 of lower estuarine habitat. The preferred Design and Layout Alternative 1 is likely to disturb the same area, and potentially even a greater area overall. Smothering occurs when sediments are disturbed and settle on the seabed, covering and potentially suffocating organisms (Wilber et al., 2005). Sediments stirred up by dredging activities can settle over large areas, smothering benthic organisms (Wilber et al., 2005, Pineda et al., 2017). This can lead to decreased oxygen levels in the sediment, suffocating organisms unable to escape or tolerate the changes. The impacts of smothering also have cascading effects on entire ecosystems. For example, changes in the abundance or distribution of key species can alter predator-prey dynamics, trophic interactions, and overall ecosystem function (Wilber et al., 2005). Again however, there is evidence that the benthic habitats of the estuary are depauperate, with significant changes in community composition and structure. In addition, the estuary is relatively turbid for periods with high flow rates (the wet season, for example), and any communities still present are likely adapted to occasional periods of high sediment load. The permanently open mouth of the system is likely to reduce the intensity of this impact, as is the generally low receptor sensitivity. While the dredging itself will take place over the short-term, and modelling results also indicate almost complete tidal flushing even before dredging during the dry season. Strong freshwater flow (i.e., complete flushing during the wet season), means that resuspended

	materials are likely to quickly leave the system during this time. Note that no mitigation is possible for smothering linked to the areas of enrichment, and the impact rating remains the same post-mitigation
	Impacts on estuarine water quality This sedimentation can cloud the water (increased turbidity), reducing water clarity and light penetration and can disrupt the feeding and reproductive behaviours of various species that rely on clear water for survival. This may have negative implications for the primary productivity of microalgae (phytoplankton and microphytobenthos), and for invertebrates and fish. The response of larval fish to turbidity of the water column is generally species-specific (Harris et al., 1999) and estuarine fauna are generally well adapted to high levels of turbidity. However, fine particulate matter may result in the clogging of the feeding and breathing apparatus of certain organisms (e.g., filter feeding invertebrates and the gills of sensitive fish species) (Wenger et al., 2017). Released sediment can also introduce excess nutrients into estuarine waters (Kahn & Mohammad, 2014). Nutrient enrichment can lead to eutrophication, promoting algal blooms and reducing oxygen levels in the water. This can result in fish kills, habitat degradation, and the loss of biodiversity. Elevated nutrient levels associated with finer particle sizes have been reported by Gihwala et al., (2021) in the proposed dredging area. These nutrients will likely therefore be remobilised into the water column during dredging activities. Dredging can also release contaminants trapped in sediments, such as heavy metals, hydrocarbons, and other pollutants, into the water column (Eggleton & Thomas, 2004). These contaminants can have toxic effects on marine fauna, causing physiological stress, reproductive problems, and even death. There are elevated levels of trace metals in the sediments of the system, some of which (As, Cd, Ni, Zn) exceeded the South African and international sediment quality guidelines (Gihwala et al., 2021). Indeed, the average trace metal concentrations for Cd, Ni and Zn within the Diep Estuary were relatively high in comparison to other local and international estuaries (Gihwala et al., 2021). These trace metals will also therefore be remobilised into the water column during dredging activities. It is important to note that just because a trace metal is present within sediment at a specific concentration does not mean that the metal is in a bioavailable (i.e., harmful) form, nor that the concentration in the sediment translates to a 100 % resuspension to a dissolved form. Indeed, it has been suggested by previous sediment transport studies that a small fraction (0.5 %) of trace metals bound to benthic sediment enters the water column as dissolved trace metals during large scale disturbance of the sediment such as dredging (Van Ballegooyen et al., 2023). Therefore, while resuspension of trace metals into the water column due to dredging is noted, the magnitude of the impact is likely tempered by lower bioavailability. The preferred Design and Layout Alternative 1 will likely have the high intensity, immediate impacts on estuarine water quality through sediment disturbance and remobilisation. For this option, the sediment will essentially be redistributed to create 'intertidal' areas along the eastern edge of the lower system. Any organic matter or other containments present in the sediment will therefore be remobilised within the system, and not physically

	removed — this will likely result in higher intensity short term impacts on water quality, especially in terms of oxygen levels, given that the dredging cannot be planned for times of optimal flushing (i.e., the wet season). This option does not result in any long-term removal of organic material from the lower estuary. The material that remains on the created intertidal flats will be inundated at high tide, likely resulting on continued 'leeching' of organic material to the water column. The impact is therefore assessed as of a medium-term duration. The Design and Layout Alternative 5 involves a dewatering process, which involves the use of large geotextile "geo-tubes" that contain the material and filter the water as it permeates through the bag. This water will ultimately flow from the geo-tubes and will re-enter the estuary. The volumes of water re-entering the system will be relatively small and will be released over the course of around eight months. It is anticipated that most of the sediments and organic matter present in this dewatering process will be contained within the geo-textile bags. It is also anticipated then that the water re-entering the estuary will be of sufficient quality to not pose a risk to the health of the system in terms of suspended solids and organic material. The impact is therefore assessed as of a short-term duration. There is some risk that sediment disturbance and remobilisation of organic material will have implications for oxygen level in the system. While low oxygen levels do occur within the system (due to organic enrichment), it is important to ensure that additional low oxygen events are suitably managed (and preferably prevented). It is proposed that oxygen monitoring take place in the lower reaches of the system for the duration of the dredging process to monitor these impacts, with control sites upstream of Woodbridge Island. Should the 95th percentile Dissolved Oxygen levels in the lower system fall below 10 % of the control sites, additional management actions may be required (such as oxygenation). The project engineers have stated that dredging cannot be scheduled for the wet season, which is characterised by almost complete tidal flushing, and strong freshwater flow, with complete flushing, during which resuspended materials are likely to quickly leave the system. While the dredging itself will take place over the short-term, modelling results indicate that there is limited tidal exchange with water in the lower estuary (even before dredging) in the dry season. Indeed, there are potential risks that dredging may result in increased deposition of organic material in the dredge channel in the dry season; however, these are likely to be mitigated by the increased tidal flushing, provided that the mouth stays open.
	Waste generation and disposal The problem of litter entering the environment has escalated dramatically in recent decades, with an ever-increasing proportion of litter consisting of non-biodegradable plastic materials. South Africa has laws against littering, both on land and in the coastal zone, but they are seldom rigorously enforced. Objects that are particularly detrimental to aquatic fauna include plastic bags and bottles, pieces of rope and small plastic particles. Large numbers of aquatic organisms are killed or injured daily by becoming entangled in debris or as a result of the ingestion of small plastic particles (Gregory, 2009; Wright et al., 2013). These materials, being largely plastics, may be transported by currents for long distances out to sea or around the

	coast. The impact on certain forms of marine life by floating or submerged solid materials cannot be overstressed. Most at risk are seabirds and fish, including possibly rare or even endangered species. Poor management of the dredging and dewatering operations site can also have impacts on water quality. For example, uncontrolled runoff of sewage and other organic wastes is harmful to biota due to high concentrations of nutrients which stimulate primary production that in turn leads to changes in species composition and changes to biodiversity, toxicity effects and impacts on water quality parameters like oxygen (Cloern, 2001). Dredging will also involve the presence of vehicles on the intertidal areas of the estuary. Spills or improper disposal of waste associated with the full project operation on site can lead to water contamination, posing risks to aquatic life and human health. Pollutants can bioaccumulate in the food chain and have long-lasting impacts on ecosystems. To reduce this, all domestic and general waste generated during construction must be disposed of responsibly. All reasonable measures must be implemented to ensure there is no littering and that construction waste is adequately managed. Staff must be regularly reminded about the detrimental impacts of pollution on aquatic species, and suitable handling and disposal protocols must be clearly explained, and sign boarded. The 'reduce, reuse, recycle' policy must be implemented. This impact is rated as Medium without mitigation and is reduced to Very Low with appropriate mitigation actions (for all dredge options).
Avifaunal Compliance Statement	The impacts on birds of the dredging project are likely to include disturbance and degradation of habitat during the construction phase (negative), and ultimately the improvement of habitat in the long-term during operation (positive), as identified in the original estuarine impact assessment. The affected avifauna could include at least 14 regionally and/or globally red-listed species, the most likely and significant of which are Hartlaub's Gull *Chroicephalus hartlaubii*, Cape Cormorant *Phalacrocorax capensis*, Caspian Tern *Hydroporogne caspia*, Great Crested Grebe *Podiceps cristatus*, Grey Plover *Pluvialis squaterola*, Sanderling *Calidris alba*, and Yellow-billed Duck *Anas undulata*. Three species – African Marsh Harrier *Circus ranivorus*, Great White Pelican *Pelecanus onocrotalus*, and Caspian Tern - are identified as species of conservation concern (SCC) by the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool. This impact is expected to be of low significance post mitigation according to the avifaunal compliance statement.
Specialist study	**Impacts identified and assessed (Post-dredging Phase)**
Estuarine Impact Assessment	**Impacts of proposed dredging on magnitude of the estuarine tidal prism** Model results for both the low flow and high flow scenarios indicate that the dredging increases tidal exchange between the study area and the ocean. This increased salinity is indicative of tidal flushing — there is more ocean water pushed into the lower system by the tides (in particular, at spring high tide) after dredging. This improvement in tidal flux (as demonstrated by saline

	inflow) does not appear to increase modelled upstream saline intrusion and any positive impacts appear to be limited to the lower reaches of the system. In the case of this fresher dominated system, increased salinity would ideally result in a more brackish system, which would better support estuarine communities (such as sand prawns). This would also potentially result in potential improvements in water quality, improved habitat for benthic organism and fish, with positive cascading impacts up the food chain. However, based on the modelling results, it is unlikely that the predicted general increase in salinity with dredging will result in a change to the Estuarine Health Score of the system. Instead, model results suggest that dredging will result in marginal improvements in the tidal prism and increased average salinity in the lower reaches of the system. The assessed positive impact is rated as Low positive post-mitigation.
	Impacts of a deeper channel at the mouth on nutrient-enriched fine sediments settlement and flushing The new, narrow dredged channel in the lower reaches of the system may concentrate any nutrient-enriched fine sediments that has been transported down the system, where the enhanced tidal prism will more readily flush it out through the mouth (with the overall larger volume flow rate in dredged area). Note however that this improvement will only likely be realised in the lower portions of the system towards the mouth given that there are limited impacts on tidal prism forcing further upstream. The assessed positive impact is rated as Very Low positive post-mitigation.
	Impacts of new exposed mudflat intertidal areas resulting from sand replacement By depositing the dredged increased sand in intertidal areas, means that more intertidal mud/sandflat area is exposed at low tide in the lower estuary. Assuming that the additional sediment is colonised by benthic macrofauna, this has the potential to expand the feeding area available to waders and other waterbirds that feed on the intertidal mud/sandflats. In addition, the creation of larger tidal flats adjacent to the dredge area will be exposed at low tide, along with any deposited material. Exposure to air may facilitate bioremediation benefits such as oxygenation of these sediments and exposure to sunlight may have a sterilising effect. The assessed positive impact is rated as Very Low positive post-mitigation.

1.7 Mitigation of impacts

This EMPr gives effect to the mitigation measures prescribed in the EIA, particularly for the Implementation (i.e., Dredging) Phase. Recommended mitigation measures prescribed by the specialists for the Implementation Phase are set out in **Table 1.2** below. Mitigation related to the post-dredging phase are accounted for, and will be managed in accordance with, the MMP (refer to **Annexure A**) – except for the immediate rehabilitation activities associated with the restoration of the dewatering park area along Marine Drive, which are provided for in **Section 6** of this EMPr.

Table 1.2. Key mitigation measures prescribed during the EIA process

Specialist study	Specialists' mitigation measures
Estuarine Impact Assessment	**Disturbance to and mortality of estuarine communities in the dredge footprint** • Constrain spatial extent of impacts to the minimum required. • Ensure equipment is thoroughly rinsed/cleaned prior to use to ensure no transfer of introduced species from other systems.
	Noise disturbance on surrounding estuarine habitats and species from dredging activities • Mobile equipment, vehicles and power generation equipment must be suitably maintained during the project. Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions and potential pollution events. • Constrain spatial extent of impacts to the minimum required. • Constrain highly disturbing (light, noise) activities to daytime where possible to minimise noise and light disturbance at night. • Inform all staff about sensitive estuarine species and suitable disposal of waste. • Investigate and employ all feasible measures for reducing noise during dredging.
	Smothering of estuarine fauna • Plan dredging and dewatering activities to minimise the duration and extent of the given area.
	Impacts on estuarine water quality • Plan dredging and dewatering to minimise the duration and extent of disturbance to water bodies. • For land-based activities that may result in erosion, contractors are to install erosion control barriers such as silt fences, sediment traps, drainage channels or sediment curtains to minimise sediment runoff into the water during proposed activities. This is pertinent if the proposed dredging is to take place during the wet season. **Monitoring requirements:** Dissolved Oxygen (DO) monitoring must take place in the lower reaches of the system, with control sites upstream of Woodbridge Island. Should the 95 %-ile DO levels in the lower system (i.e., most of the lower lagoon system) fall more than 10 % below that at control sites, additional management actions (such as oxygenation) may be required.

	Waste generation and disposal • Inform and train all staff about sensitive estuarine species and the responsible disposal of construction waste. This training must be integrated into toolbox talks or onsite awareness sessions to ensure that waste management practices are understood and followed diligently. Additionally, contractors must prepare a method statement outlining specific waste management procedures, which must be approved by the resident engineer before implementation activities commence. • Suitable handling and disposal protocols must be clearly explained, and sign boarded. • Reduce, reuse, recycle. • Waste disposal at licensed landfill sites by qualified contractors is mandatory, with proof of disposal submitted to the appointed Environmental Officer. Waste management certification must be obtained, and detailed records of all stored and disposed waste, including quantity, nature, and fate, must be maintained for auditing purposes. • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Enforcement of facility usage and cleanliness is crucial. **Additional waste management mitigation measures:** • Hazardous waste bins must be kept on an impermeable bunded surface capable of holding at least 110% of the volume of the bins. • Waste bins/skips must be provided with secure lids or covering that will prevent scavenging and windblown waste or dust. • Waste bins/skips must be regularly emptied and must not be allowed to overflow. • Workers must be instructed not to litter and to place all waste in the appropriate waste bins provided on site. • All waste, hazardous as well as general, that are generated by the proposed activities must be disposed of appropriately at a licensed Waste Disposal Facility (WDF).
Avifaunal Compliance statement	Possible mitigation of negative impacts (implementation) should include minimising the effective footprint of the project, minimising sources of noise and visual disturbance, and minimising the introduction of contaminants into the water system. The avifaunal specialist confirmed that provided the mitigation measures set out in the Estuarine Impact Assessment are fully adhered to, there is no reason to suspect that residual impacts of the dredging exercise will affect birdlife in an unsustainable way.

1.8 Authors of the EMPr

This EMPr has been compiled by the Environmental Assessment Practitioner (EAP) based on best practice environmental management requirements. Details of the EAP who prepared the EMPr are as follows:

Table 3: Authors of the EMPr

Authors	Qualification	Professional registrations	Years of experience	Relevant expertise
Jeremy Rose	B.Sc. (Hons) Environmental and Geographical Science	Registered E.A.P. 2019/1116 Member of IAIAsa	11+	More than 50 EIAs or EMPrs
Kelly Gilmour	M.Sc. Biological Sciences	Candidate E.A.P 2024/8037 Member of IAIAsa	2	3+ EIAs or EMPrs
Tayla Hobson	M.Sc. Environment, Society and Sustainability	Registered E.A.P 2019/1018 Member of IAIAsa	3+	More than 20 EIAs and EMPrs

Jeremy Rose has 12 years' experience in the field of environmental management and impact assessment and has managed multiple EIAs and Basic Assessments in South Africa. He holds an Honours degree in Environmental and Geographical Science and is an EAP duly registered with the Environmental Assessment Practitioners Association of South Africa. Refer to Annexure B for a Curriculum Vitae. Tayla Hobson is a Registered EAP and Kelly Gilmour is a Candidate EAP.

2 APPROACH AND STRUCTURE

2.1 Structure of EMPr

The EMPr is structured as a set of nested environmental management plans, as shown in **Figure 5** below. Aspects of these will be supplemented by more detailed levels of planning as and when the proposed development is implemented, as indicated.

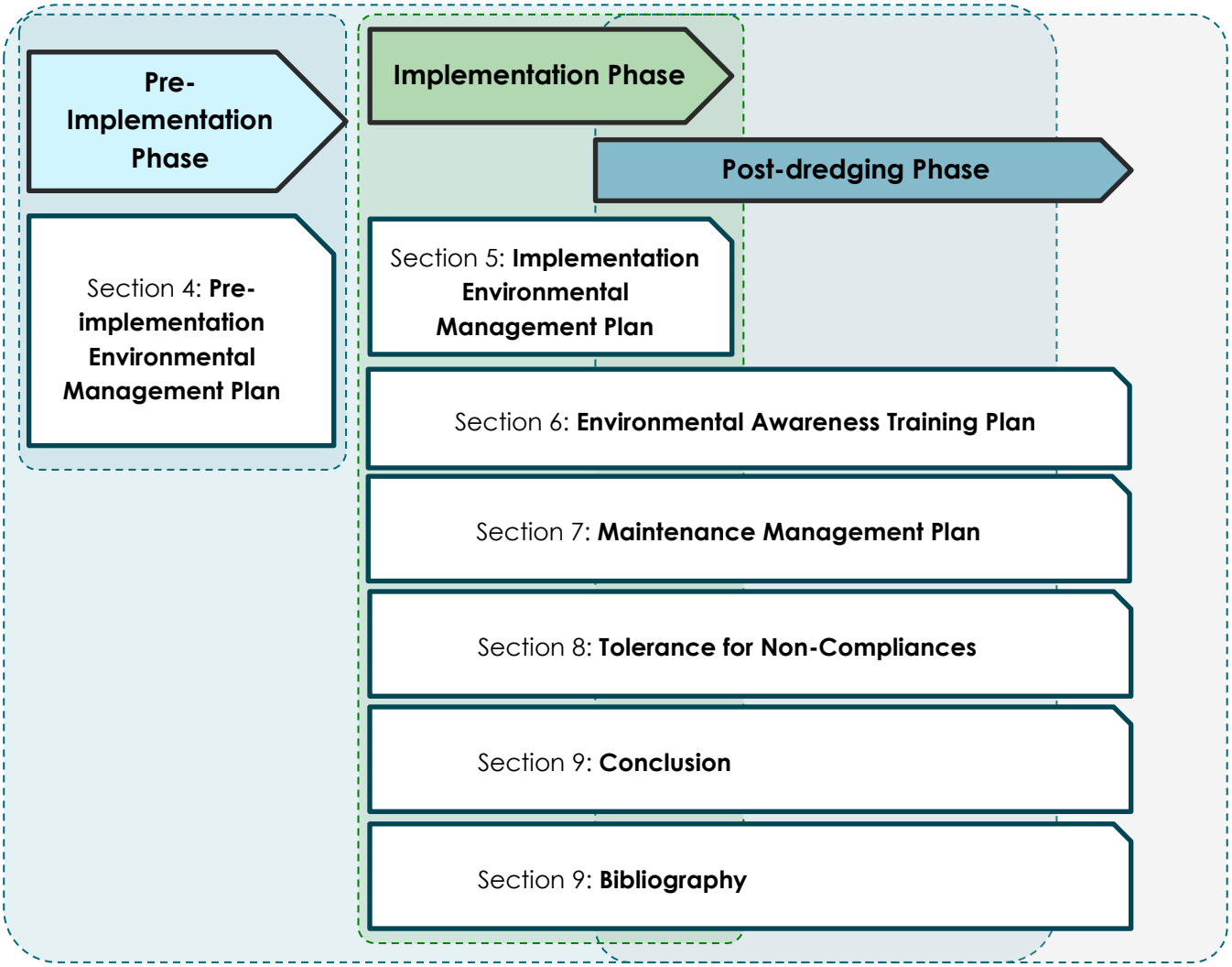

Figure 5: Schematic of the EMPr content and structure.

2.2 Legislative compliance

A key objective of the EMPr is to satisfy the requirements of Appendix 4 of the EIA Regulations of 2014, as amended, published in Government Notice No. R 326 of 7 April 2017. These regulations prescribe the content of the EMPr and specify the type of supporting information that must accompany the submission of this report to the competent authority. An overview of where the requirements are addressed in this EMPr is presented in **Table 4** below.

Table 4: Compliance with EIA Appendix 4 Requirements.

Appendix 4 of EIA Regulations	
1. An EMPr must include- (a) details of– (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.8 of EMPr
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1.1 and sections 4 to 6: 1st column of the relevant table
c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Figure 3
(d) a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including– (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Sections 4, 5 and 6: 2nd column of the relevant table
e) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Sections 4, 5 and 6: 3rd column of the relevant table

(f) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Sections 4, 5 and 6: 4th column of the relevant table
g) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Sections 4, 5 and 6: 5th column of the relevant table
(h) an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 3 and Sections 4, 5 and 6: 6th column of the relevant table
(i) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Sections 4, 5 and 6: 5th column of the relevant table
j) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Sections 4, 5 and 6: 4th column of the relevant table
(k) a programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 3
l) an environmental awareness plan describing the manner in which— (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 7
m) any specific information that may be required by the competent authority	Not applicable

2.3 Content of the EMPr

Where applicable, each section of the EMPr is divided into three phases of the project life cycle, namely:

- The Pre-implementation Phase;
- The Implementation Phase, which begins with commencement of physical activities on site and ends when the dredging has been fully complete; and
- The Post-dredging Phase, which begins when dredging has been completed and is ongoing.

There is likely to be overlap between the above phases. A decommissioning phase is not included, as there is no infrastructure or activities associated with the dredging that would need to be decommissioned. Once dredging is complete, the Post-dredging Phase begins and should include maintenance activities as described in the MMP (refer to **Annexure A** below).

The EMPr includes the findings and recommendations of the EIA process and specialist studies and/or compliance statements. The EMPr may be amended to include additional information or actions during the design, implementation, and post-dredging phases, if applicable. A standardised approach is followed, in which outcomes are set, followed by management actions aimed at achieving the objectives. Management actions are accompanied by monitoring requirements,

responsibilities, and targets where applicable. A tabular format is used for ease of reference.Key terms used in the EMPr include:

- **Impact:** The potential positive or negative impact of the development that needs to be enhanced, mitigated or eliminated (as appropriate) to a desired state.
- **Outcomes (objectives):** The desired state after mitigation or management.
- **Management Actions:** The actions needed to achieve the objectives of enhancing, mitigating or eliminating impacts; taking into consideration factors such as responsibility, methods, frequency, resources required and prioritisation.
- **Monitoring:** The key monitoring actions required to check whether the outcomes are being achieved, taking into consideration methodology, frequency and responsibility.

2.4 Amendment of this EMPr

» Amendments shall be made as and when required to keep this EMPr up to date, and to provide for adaptive management in support of the management outcomes set out in the approved EMPr and the EIA.
» The EMPr may be amended due to:
    - Legislative changes;
    - Changes to the roles and organisational structure set out in Section 3;
    - Amendments to the environmental authorisation;
    - Audits of the EMPr carried out in terms of the EIA Regulations of 2014 (as amended);
    - Based on the annual reviews as set out below; or
    - Whenever deemed necessary by the competent authority.
» Amendments will be numbered sequentially (e.g., Amendment 001, Amendment 002, Amendment 003 etc.). The status of a particular page shall be reflected in the appropriate space of each page. Each amendment shall also have an effective date (the date on which the amendment was made).
» Amendments to the impact management **actions** must be applied immediately by the authorisation holder and must be reflected in the next environmental audit report submitted to the competent authority in terms of Regulation 34 of the EIA Regulations of 2014 (as amended). The record of revisions must be updated accordingly, and the revision number and status of a particular page shall be reflected in the appropriate space of each page.

Amendments to the impact management **outcomes** stipulated in this EMPr are subject to an application for amendment to the competent authority, which must be submitted for approval by the authorisation holder and may require public participation. Such an amendment shall only become effective once approved by the competent authority.

2.5 Review of this EMPr

» The EMPr should be reviewed if and when deemed necessary.
» The Authorisation Holder will keep a record of all dates of review, even if review did not necessitate an amendment to the EMPr.
» The review may take the form of an internal audit or may form part of the external audit conducted in terms of Regulation 34 of the EIA Regulations of 2014 (as amended).
» The main aims of a review of the EMPr for purposes of a revision will, among other things, be to determine the following:

    - Ability of the EMPr to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis;
    - Conformity and adherence to the minimum legislative requirements;
    - Simplicity and clarity of the content and text; or
    - The incorporation of practical experience gained during implementation..

3 PROJECT ROLES AND STRUCTURE

The general roles to be defined are those of the:

- Authorisation Holder;
- Environmental Control Officer (ECO);
- Contractor (Principal Contractor / Project Manager); and
- Environmental Auditor.

The specific titles referred to may vary, but the intent of this section is to broadly define expectations and responsibilities for key role players in the implementation of the EMPr.

3.1 Authorisation Holder

The Applicant, the City of Cape Town, will be the holder of the Environmental Authorisation (EA), should it be issued, and will therefore be responsible for ensuring that the conditions of such authorisation are fully adhered to. It is expected that the authorisation holder will appoint the Environmental Control Officer (ECO) and Contractor during the implementation phase. The responsibility for the implementation of this EMPr lies with the Authorisation Holder. Commonly, responsibilities borne by the Authorisation Holder are delegated to a project manager.

Key responsibilities include ensuring that:

- The ECO is provided with the necessary information to adequately undertake their responsibilities;
- This EMPr is included in the contractual agreements with all Contractors and Sub-contractors;
- Method Statements requested by the ECO are provided timeously;
- Corrective action is implemented as required; and
- Appropriate records and information regarding compliance with the EMPr requirements are maintained and made available to the ECO.

3.2 Environmental Control Officer

The ECO is responsible for ensuring compliance with the EMPr and conditions of the EA during the implementation phase of the dredging and the immediate post-dredging phase rehabilitation (refer to **Sections 5** and **6** respectively). The ECO's role also includes monitoring compliance with other environmental legislation, the monitoring of environmental impacts, and the keeping of accurate records.

The ECO shall update the EMPr when necessary and shall compile a ECO Inspection Checklist based on the EMPr. The ECO's role includes the following aspects:

- Weekly environmental site inspections during the implementation phase of the proposed project to monitor and record environmental impacts and non-conformances and to monitor site activities to ensure adherence to the specifications contained in the EMPr. Issuance of a monthly ECO Inspection Checklist for the duration of the implementation phase.
- Maintain a record of site visits and audits, a copy of the EA (should it be granted) and other permits and licenses, a register of non-conformances, and a copy of previous environmental ECO Inspection Checklists.
- Prior to commencement, the ECO must meet on site with the Contractor's representative to confirm designated development and no-go areas and to confirm the Method Statements required.

- Request, review and approve Method Statements from the Contractor and Sub-Contractors prior to the commencement of the activities concerned.
- Ensure that the Contractors and Sub-contractors and their employees have received the appropriate environmental awareness training.
- Meet with the Contractors to discuss the implementation of this EMPr.
- Identify appropriate corrective measures if transgressions occur in accordance with Section 7 below.
- Keep a register of monitoring activities and results.
- Assist in finding environmentally acceptable solutions to implementation problems.
- Identify and make amendments to the EMPr, where appropriate.
  Conduct an environmental inspection one month after completion of the implementation phase, or more frequently if required, and prepare a Close-out Inspection Report.

3.3 Contractor

The role of the Contractor is as follows:

- The Contractor shall ensure that all employees, contractors and sub-contractors are made aware of the EMPr and their responsibilities.
- Prior to commencement, the Contractor must meet on site with the ECO representative to confirm designated development and no-go areas and to confirm the Method Statements required (if any Method Statements are required in addition to those listed below):
  - **Site establishment** including ablutions and a sketch of the site camp layout;
  - **Handling of fuel and hazardous substances**, if relevant;
  - **Waste management**;
  - **Equipment Maintenance Plan** - to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions and potential pollution events; and
  - **Stakeholder Communication Plan** – to establish cooperative relationships prior and through, implementation.
- Liaise with the ECO and Authorisation Holder (or representative) and ensure that works on site are conducted in an environmentally sensitive manner in accordance with this EMPr.
- Maintain a copy of this EMPr and all EAs and licenses pertinent to the development on site.
- Ensure that all appointed Contractors and Sub-Contractors repair, at their own cost, any environmental damage because of a contravention of the specifications contained in the EMPr, to the satisfaction of the Project Owner's ECO.
- Ensure that all employees (permanent and temporary) and all Sub-Contractors that work on the site for longer than two days, receive environmental awareness training within one week of being on site.
- Designate an Environmental Officer (or employ a designated suitably qualified individual to fulfil the role of an Environmental Officer) to monitor and report on the daily activities on-site during the implementation period. The Contractor and individual contractors may designate Environmental Officers to liaise with the ECO on environmental matters.
- Conduct the necessary immediate post-dredging rehabilitation of the dewatering area (alongside Marine Drive) should dewatering take place for the project.

3.4 Environmental Auditor

An independent Environmental Auditor must be appointed in compliance with Regulation 34 of the EIA Regulations of 2014 (as amended) at a frequency specified in the conditions of the EA. The Environmental Auditor must be appointed for the duration of the implementation phase of the

dredging and is responsible for assessing the ECO's and subsequently the Contractor's compliance with environmental regulations, policies, and standards as stipulated in the EMPr and ECO Reports.

It is recommended that the auditing frequency be undertaken every second month after the commencement of dredging activities and two months after the Implementation Phase is complete.

The auditor shall be independent from both the EAP and the ECO and shall not have any financial or other interest in the activities being audited, other than fair remuneration. The primary objective is to audit compliance with the EA and associated EMPr.

Key requirements for an audit report would typically include:

- Verifiable findings on the level of compliance with the authorisation conditions;
- Findings on the ability of the EMPr to provide for avoidance, management and mitigation of impacts; and
- Recommendations for corrective actions to rectify any shortcomings that may be identified.

The Environmental Auditor's shall:

- Review the EA, EMPr, and assessment reports contained in the Contractor's file to obtain an understanding of potential impacts, assessed significance and proposed avoidance, management and mitigation measures.
- Prepare an audit checklist against which audit findings can be determined, based on the conditions of the EA, the EMPr, and any other considerations relating to potential impacts.
- Conduct a site inspection to verify physical compliance during implementation.
- Conducting follow-up audits to ensure that corrective actions have been implemented and to verify ongoing compliance.
- Audit implementation-related documentation including ECO monitoring reports, dredging progress reports, the Contractor's environmental site records and files, and photographic records to identify any non-compliances and/or shortcomings.
- Prepare an audit report in line with the requirements of Appendix 7 of the EIA Regulations of 2014 (as amended) and the specific requirements of the EA.

4 PRE-IMPLEMENTATION ACTIVITIES

The outcomes, management measures, and monitoring requirements detailed in this section are applicable only to the pre-implementation phase of the proposed dredging, defined as including the phase of the project before which site establishment, the installation of temporary infrastructure, and the dredging of Milnerton Lagoon have commenced.

The proposed dredging of a channel in the lower lagoon is recommended as a short- to medium-term remediation measure to be implemented should the water quality in the lower lagoon improve, as indicated by increased dissolved oxygen levels exceeding 2 mg/l. This is to ensure that the intervention coincides with improvements in upstream water quality to maximise the ecological benefit rather than undertaking dredging while the source of pollution and cause of ecosystem deterioration remains unchanged.

This pre-implementation phase therefore should only commence once monitoring efforts confirm that dissolved oxygen within the lower lagoon exceed 2 mg/L.

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
4.1 Pre-Implementation phase fulfilment of the performance criteria regarding Dissolved Oxygen thresholds	Maximise ecological benefit for the lower lagoon through appropriately timed dredging activities by alignment with upstream water quality improvements.	4.1.1 **Dissolved Oxygen monitoring must take place in the lower reaches of the system, with control sites upstream of Woodbridge Island.** 4.1.2 **Schedule dredging <u>only</u> upon exceedance of 2mg/L of Dissolved Oxygen thresholds as measured from monitoring sites within the lower lagoon, to ensure maximum ecological benefit for the lagoon through coincidence with upstream water quality improvements.**	Weekly water samples must be collected to analyse and confirm dissolved oxygen levels within the lower reaches of the lagoon with control sites upstream of Woodbridge Island (i.e., upstream of the dredging activities). Record of such monitoring efforts and analysis must be maintained to demonstrate fulfilment of pre-implementation phase via dissolved oxygen threshold exceedance (should this occur).	Oxygen monitoring must take place in the lower reaches of the system for the duration of the pre-implementation phase of the dredging project to monitor these impacts.	Authorisation holder

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
4.2 Cooperative relationships with local authorities, communities, adjacent landowners and contractors to ensure transparency, minimise conflict, and support project success.	Ensure stakeholders are informed, engaged and supportive of the proposed dredging to reduce risks of dispute, objection or delay.	4.2.1 **Provide adjacent landowners with project information (scope, timing, potential impacts, and mitigation measures).** 4.2.2 **Timeously and adequately notify interested and affected parties (I&APs), including those registered as I&APs during the Basic Assessment, prior to commencement of the dredging operation.** 4.2.3 **Notification of I&APs must at minimum be conducted via signage adjacent the site at least 3 days prior to the dredging activity. In addition, contact can be made with I&APs via written notice to surrounding residents and businesses, where possible.** 4.2.4 **Notify I&APs of the relevant contact details to which any complaints regarding nuisances such as dust, noise and odour can be submitted during dredging activity.** 4.2.5 **Define the roles and responsibilities between contractors and landowners/I&APs and establish communication channels and escalation protocol(s) for communication through various scenarios.**	Records of communication should be kept (such as attendance registers, minutes and records of notices)	Notification must be undertaken once-off 3 days prior to dredging activity. Stakeholder Communication Plan must be compiled once-off before mobilisation, with additional ad-hoc engagements as required.	Authorisation holder and ECO
4.3 Communication with City of Cape Town's Scientific Services regarding H_2S monitoring.	Confirmation that CCT Scientific Services will undertake routine monitoring for the duration of the dredging implementation phase.	4.3.1 **Initiate engagement with the City of Cape Town's Scientific Services prior to the dredging activity commencing to ensure that open lines of communication are established between the relevant stakeholders.** 4.3.2 **Initiate engagement with the City's Scientific Services via email or cell phone number, with acknowledgement by the City's Scientific Services of such engagement.** 4.3.3 **The contact person for the City's Scientific Services is Ntombekhaya Khoza who can be contacted via email on: Ntombekhaya.Khoza@capetown.gov.za or via phone call on: 021 444 9145.**	Confirm that engagement has been initiated (meeting minutes / emails)	Prior to commencement	Authorisation holder and ECO

5 IMPLEMENTATION ENVIRONMENTAL MANAGEMENT PLAN

The outcomes, management measures, and monitoring requirements detailed in this section are applicable to the implementation phases of the proposed activity.

The term 'implementation phase' or 'dredging phase' is applied in place of the 'construction phase', which involves the activities of site set up and active dredging and/or placement of dredged material on the sides of the scoured channel since the proposed dredging does not entail conventional construction or development activities.

Site inspections by the Contractor are to occur weekly, and by the ECO monthly.

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	Frequency	Responsibility
GENERAL IMPLEMENTATION MANAGEMENT					
5.1 Implementation phase fulfilment of the performance criteria to avoid any habitat degradation, non-compliance with legislation and/or any delays	Contractor compliance with EMPr and Environmental Authorisation (EA) conditions to minimise environmental risk to acceptable thresholds and to correct performance where necessary.	5.1.1 **Contractor to maintain an Environmental File at the construction camp, which should include all relevant authorisations/permits, monitoring records, training logs, and incident reports.** 5.1.2 **Contractor must undertake regular toolbox talks on performance expectations and corrective measures.** 5.1.3 **Monitor construction work and ensure that contractors adhere to the guidelines in respect of littering, sanitation, spills of toxic substances and general behaviour.** 5.1.4 **ECO to issue Non-Compliance Fines and require corrective action plans, if criteria are not met in accordance with Section 7 of the EMPr.**	Contractor should keep a thorough record of any incidents and inform Authorisation holder and ECO of any anticipated delays in implementation performance. ECO to monitor implementation performance and issue fines for non-compliance to Contractor, where necessary.	Contractor must regularly train and educate personnel of the implications of non-compliance with performance criteria. Contractor should supervise worker behaviour on a daily basis and keep a thorough record of any incidents. Weekly ECO inspections and ad-hoc monitoring after any incidents occur.	Contractor and ECO
5.2 Delineation and demarcation of any no-go areas to protect sensitive dune habitat near-to the site.	All sensitive habitat is avoided during implementation and post-dredging (e.g., dune habitat on the banks of the estuary mouth).	5.2.1 **Any no-go areas (intertidal vegetation and sensitive dune habitat) must be clearly demarcated on the site prior to implementation, and** 5.2.2 **Details of "no-go" areas on site must be included in the Environmental Awareness**	Contractor and ECO should ensure delineation and demarcation of any no-go areas on site are in accordance with identified areas and should consult the	Once-off prior to implementation.	Contractor and. ECO

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		Training programme along with a motivation for preservation of such areas.	estuarine specialist, if necessary. ECO to ensure Environmental Awareness Training material includes explanation of no-go areas.		
5.3 Manage site establishment (i.e., construction office/camp set-up) to minimise environmental disturbance on site	Minimisation of impacts and disturbance caused to sensitive estuarine and riparian habitats due to controlled, safe and environmentally compliant construction site and office establishment.	5.3.1 **Compile Site Establishment Plan, which contains a layout sketch of site area for approval by the ECO.** 5.3.2 **Select site office and laydown areas in already disturbed and/or low-sensitivity areas outside of the estuarine functional zone, as approved by ECO.** 5.3.3 **Avoid setting up construction camp/site offices within "no-go" areas (which should be clearly fenced off or taped prior to set-up).** 5.3.4 **Provide screened portable toilets, waste collection facilities, and secure storage for hazardous materials.** 5.3.5 **Install spill kits and bunded fuel storage areas before equipment is used on site.** 5.3.6 **Ensure signage, fencing, and controlled access are in place to restrict unauthorised entry on site.** 5.3.7 **Designated access points to the beach must be clearly demarcated to ensure the public can safely access the coastal public property.**	ECO Inspection Checklist to ratify layout plan with photographic records of site layout and monitor compliance with required actions for duration of contract.	Once-off during establishment, with weekly ECO inspections during implementation phase.	Contractor and ECO
5.4 Manage and inform construction personnel to prevent and/or minimise adverse impacts on the environment	Instil environmental awareness in construction workforce to ensure compliance with site rules, protection of sensitive habitat from unauthorised access	5.4.1 **Conduct Environmental Awareness Training (induction) and toolbox talks for all personnel before starting work and more regularly, if needed, to ensure regular training and education of personnel on the implications of actions on the environment and inform personnel of measures to minimise and prevent environmental harm.**	ECO Site Inspections to monitor construction personnel during weekly Site Inspections and inform Contractor of any misconduct, where such arises.	Contractor must regularly train and educate personnel. ECO is to inform Contractor of environmental rules for	Contractor and ECO

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
	or disturbance and appropriate conduct on site to minimise impacts.	5.4.2 **Retain attendance register for environmental induction as well as complaints register, and any record of disciplinary action undertaken within the Environmental File to be kept on site.** 5.4.3 **Provide a Code of Conduct that prohibits activities such as poaching, fishing, plant collection, or harassment of wildlife.** 5.4.4 **Enforce penalties for non-compliance with environmental aspects on site such as avoidance of demarcated no-go areas.** 5.4.5 **Ensure sufficient toilets (at least one toilet per 15 construction personnel), potable water, and waste disposal facilities are provided and maintained on site.** 5.4.6 **Restrict access on site to authorised personnel only; enforce Personal Protection Equipment (PPE) and safety requirements.** 5.4.7 **Engage Authorisation Holder (an/or other communication liaison officer, if appointed) to address complaints or grievances quickly.**		conduct of personnel on site.	
BIOPHYSICAL IMPLEMENTATION MANAGEMENT					
5.5 Disturbance to and mortality of estuarine communities in the dredge footprint	Reduce unnecessary disturbance and mortality of fauna.	5.5.1 **Ensure that dredge operators undergo environmental awareness training that specifically includes an introduction to the estuary's faunal species.** 5.5.2 **Ensure equipment is thoroughly rinsed/cleaned prior to use to ensure no transfer of introduced species from other systems.** 5.5.3 **Constrain spatial extent of impacts to the minimum required through restriction of implementation works footprint.**	Contractor to ensure that registers and a record of the training material are kept on file. ECO to monitor and record non-compliance via site inspections.	Induction must be undertaken prior to any new dredge operators commencing work on site. Site Inspections.	ECO and Contractor
5.6 Smothering of fauna through dredging	Prevent unnecessary disturbance to sediment and	5.6.1 **Plan dredging activities to minimize the duration and extent of disturbance to water bodies.**	Contractor to inform the site manager and dredge operator(s) of the concerns around	Induction must be undertaken prior to any new dredge operators	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
	subsequent smothering of fauna. Minimise the duration of dredge operations to reduce temporal scale of the impact	5.6.2 **Dredge the scour channel in the lagoon, starting from upstream to downstream across the site, if possible.** 5.6.3 **Ensure dredge operators have sufficient experience to complete dredging operations in the most efficient manner possible.**	smothering during environmental awareness training. ECO to monitor and record non-compliance via site inspections.	commencing work on site. Site Inspections.	
5.7 Waste generation and improper disposal	Avoid/minimise negative impacts on estuarine ecosystem and species associated with waste	5.7.1 **Ensure that waste management practices are understood and followed diligently. Additionally, Contractors must prepare a method statement outlining specific waste management procedures, which must be approved by the resident/project engineer before construction activities commence.**	ECO to inform all staff during Environmental Awareness Training and toolbox talks about sensitive estuarine species and the responsible disposal of construction waste. Contractor Methods Statements should be used to guide activities on site.	Prior to any new dredge operators commencing work on site. Prior to commencement of dredging	ECO and Contractor
		5.7.2 **Suitable handling and disposal protocols must be clearly explained, sign boarded on site to guide personnel and included in a Waste Management Method Statement.** 5.7.3 **Reduce, reuse, recycle waste generated on site, as far as possible.**	Contractor to ensure waste protocols are included on sign boards and in Method Statements.	Prior to commencement of dredging.	ECO and Contractor
		5.7.4 **Waste disposal at a licensed Waste Disposal Facility (WDF) by qualified Contractors is mandatory. Waste management certification of the WDF must be obtained, and detailed records of all stored and disposed waste, including quantity, nature, and fate, must be maintained for auditing purposes (preferably within a disposal slip).** 5.7.5 **Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Enforcement of facility usage and cleanliness is crucial.**	Monitor record-keeping of waste disposal slips and waybills via site audits and record non-compliance and/or any related incidents.	Monthly ECO inspections and weekly inspections by Contractor.	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
	Prevent pollution (including litter) to surrounding environment	5.7.6 **Hazardous waste bins must be kept on an impermeable bunded surface capable of holding at least 110 % of the volume of the bins (detailed management actions relating to spill events must be outlined in a method statement prior to construction works).** 5.7.7 **Adequate waste bins/ skips must be provided on site with secure lids or covering that will prevent scavenging and windblown waste or dust.** 5.7.8 **Waste bins/skips must be regularly emptied and must not be allowed to overflow.** 5.7.9 **Workers must be instructed not to litter and to place all waste in the appropriate waste bins provided on site.** 5.7.10 **All waste, hazardous as well as general, which result from the proposed activities must be disposed of appropriately at a licensed WDF.**	Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Monthly ECO inspections and weekly inspections by Contractor.	ECO and Contractor
5.8 Impacts on estuarine water quality	Minimise negative impact of dredging on water quality in the lower lagoon	5.8.1 **Plan dredging activities to minimize the duration and extent of disturbance to water bodies.** 5.8.2 **For land-based activities that may result in erosion, Contractors are to install erosion control barriers such as silt fences, sediment traps, drainage channels or sediment curtains to minimise sediment runoff into the water during the proposed activities. This is pertinent if construction is to take place during the wet season.** 5.8.3 **Dissolved Oxygen monitoring must take place in the lower reaches of the system, with control sites upstream of Woodbridge Island.** 5.8.4 **Water samples must be collected to analyse dissolved oxygen within the lower reaches of the lagoon with control sites upstream of Woodbridge Island (i.e., upstream of the dredging activities). The estuarine specialist confirmed that the dissolved oxygen monitoring samples can be collected weekly**	Site inspections must confirm the DO levels and initiate necessary intervention action should the DO levels in the lower lagoon fall below 10% of the DO within the control sites.	Weekly oxygen monitoring must take place in the lower reaches of the system for the duration of the dredging process to monitor these impacts. ECO to report on monitoring efforts and outcomes within the monthly ECO Checklists.	ECO

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		by the ECO for the duration of the implementation phase. 5.8.5 **Should the 95 %-ile DO levels in the lower system fall below 10 % of the control sites, additional management actions may be required (such as oxygenation).**			
5.9 Noise-related disturbance of estuarine habitats and species caused by dredging	Minimise noise disturbance of estuarine habitats and species	**Essential mitigation measures:** 5.9.1 **Mobile equipment, vehicles and power generation equipment must be suitably maintained during the project. Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions and potential pollution events.** 5.9.2 **Constrain spatial extent of impacts to the minimum required.** 5.9.3 **Constrain highly disturbing (light, noise) activities to daytime, where possible, to minimise noise and light disturbance at night.**	Monitor and record non-compliance.	Monthly ECO inspections and weekly inspections by Contractor throughout implementation phase.	ECO and Contractor
		Recommended mitigation measures: 5.9.4 **Inform all staff about sensitive estuarine species and suitable disposal of waste.** 5.9.5 **Investigate and employ all feasible measures for reducing noise during dredging.**	ECO to include sensitive estuarine species and habitats in the Environmental Awareness Training and toolbox talks.	Induction must be undertaken prior to any new dredge operators commencing work on site.	ECO and Contractor
SOCIO-ECONOMIC IMPLEMENTATION MANAGEMENT					
5.10 Noise impacts on adjacent residents and businesses	Prevent unnecessary disturbance to residents and businesses close to the works area.	5.10.1 **All dredging equipment utilised, and activities undertaken must be compliant with the Western Cape Noise Control Regulations, P.N. 200/2013.** 5.10.2 **Restrict activities generating noise outputs of 85 dB (A) or more to stated working hours (i.e., assumed Monday – Fridays, 08h00 – 17h00). Should the Contractor need to conduct work outside of these hours, the approval of the ECO must be obtained, and surrounding land**	If two or more noise complaints are received, the ECO must investigate whether the noise generated on site exceeds thresholds outlined in the Western Cape Noise Control Regulations (P.N. 200/2013).	Ongoing throughout duration of works.	Contractor and ECO

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		users must be informed prior to the work taking place. 5.10.3 **A noise complaints register must be opened and complaints maintained on site. Excavations and earth-moving activities should be restricted to normal working hours as far as possible.** 5.10.4 **Noise levels must comply with the relevant health & safety regulations and South African National Standards (SANS) codes and should be monitored by the Health & Safety Officer as necessary and appropriate.** 5.10.5 **No unnecessary noise should be allowed on site, such as music, unnecessary shouting and similar.** 5.10.6 **No amplified music shall be allowed on site. The use of audio equipment shall not be permitted unless the volume is kept sufficiently low, so as to be unobtrusive. The Contractor shall not use sound amplification equipment on site, unless in emergency situations.**			
5.11 Odour impacts on adjacent residents associated with the disturbance of sediment during dredging	Minimise conflict with residential landowners and occupiers	5.11.1 **The Applicant must clearly communicate to potentially I&APs that odour impacts may last the duration of the project, but is expected to cause net benefit post-construction phase.** 5.11.2 **Maintain the complaints register for the duration of the dredging phase.** 5.11.3 **The intention of the proposed dredging is to avoid anaerobic decomposition by exposing the dredged sandbanks to air, particularly during low tide. Exposure of sandbanks to oxygen and sunlight is expected to encourage aerobic decomposition of organic material, thereby reducing the build-up of anoxic nutrient-enriched fine sediments in stagnant areas.** 5.11.4 **Undertake dredging activities during dry, low-flow summer months, and when overall water**	ECO to monitor maintenance of complaints register on site.	Ongoing throughout implementation.	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		quality has improved so as to ensure coincidence with improved conditions and thus, reduced risk of odour release. • **Should odour impacts significantly intensify or result in sustained complaints, additional mitigation measures may include relocating material to a more distant or submerged location, if feasible.**			
		5.11.5 **The continued monitoring of H_2S by City of Cape Town's Scientific Services during the implementation of dredging is recommended, with comparison to the World Health Organisation (WHO) guideline values and any relevant health-protective thresholds.** 5.11.6 **Any sustained exceedances must be communicated timeously to the AQM Unit, the Environmental Control Officer, Water and Sanitation, the contractor and the Milnerton Stakeholders forum, in order for any appropriate corrective measures to be implemented.**	Passive monitoring of air quality	Ongoing	City of Cape Town's Scientific Services
5.12 Construction related nuisance impacts including dust generation and risk of spills	Prevent contamination of surface water and soil	5.12.1 **The appointed Contractor shall compile a Method Statement for the refuelling of all watercraft and plant equipment under normal and emergency situations (i.e., a Spill Contingency Plan).** 5.12.2 **The dredging vessel should be equipped with sufficient and appropriate materials suitable for use in the denaturing of spilled hydrocarbons on a water body.** 5.12.3 **Refuelling of dredge machinery should take place under controlled conditions and outside of periods when wind or water action make refuelling difficult or likely to result in**	Contractor to ensure that the dredging vessel is equipped with spill materials. Contractor to ensure that refuelling takes place in controlled conditions.	Ongoing throughout implementation.	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		spillage. Record the occurrence of any spillages. 5.12.4 **Provide secure storage for fuel, oil, chemicals and other waste materials to prevent contamination of stormwater runoff. Fuels and chemicals (i.e., any hazardous materials and dangerous goods) used must be stored safely on site and in bunded areas.** 5.12.5 **Building materials that may generate dust, such as dry stockpiled dredged material or other (where stockpiling is required), must be covered or regularly moistened during windy conditions to prevent dust emissions.** 5.12.6 **The excavation of dredged material must be avoided during high wind conditions.**	Contractor to regularly monitor and inspect fuel and chemical storage containers to ensure that any leaks are detected early. ECO to monitor for any non-compliances in respect of the listed nuisances alongside for the duration of the contract.		
5.13 Visual impacts from site establishment	Minimise visual intrusion and disturbance on sense of place for nearby residents, businesses and other beach-goers.	5.13.1 **Manage laydown areas for cleanliness and appearance.** 5.13.2 **Roof and screen waste areas.** 5.13.3 **Avoid unnecessary signage or advertisement on site.** 5.13.4 **Works to be restricted to remain within boundaries of the site.** 5.13.5 **Consult with the ECO when determining the appropriate site for the site camp.** 5.13.6 **The site camp must be kept neat and tidy and free of litter <u>at all times</u>.** 5.13.7 **Waste must be managed according to the EMPr and the mitigation measures listed above in terms of waste management. Good housekeeping practices must be maintained to ensure the site is kept neat and tidy.** 5.13.8 **The site camp, storage facilities, stockpiles, waste bins, and any other temporary structures on site should be located in such a way that they will present as little visual impact to surrounding residents and road users as possible.** 5.13.9 **The site camp may require visual screening via shade cloth or other suitable material.**	Monitor compliance with the listed requirements by visual inspection and observations during site visits. Record non-compliance(s).	Ongoing throughout implementation	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	**Frequency**	**Responsibility**
		5.13.10 Dredging-related vehicles must enter and leave the site during working hours.			
5.14 Damage and/or the loss of valuable archaeological settings and artefacts.	Conserve and protect all archaeological settings on site, if discovered during implementation phase.	5.14.1 **Should any heritage resources, including evidence of any archaeological and palaeontological material being exposed during dredging activity, then all works must be stopped immediately and Heritage Western Cape (HWC) must be urgency notified.** 5.14.2 **If any heritage resources are uncovered during implementation, the following Fossil Finds Procedure must be instituted:** **1. Stop Work Immediately** • **If any fossil material (bones, teeth, shells, impressions, petrified wood, etc.) is uncovered during dredging or site activities, all work in the immediate area must cease.** **2. Protect the Find** • **The find must be clearly demarcated (e.g., with barrier tape) and protected from further disturbance, dust, or damage.** **3. Notify the ECO** • **The Contractor must inform the ECO immediately. The ECO will assess the situation and record details (GPS location, description, photographs).** **4. Specialist Assessment** • **The ECO must notify HWC and appoint a qualified heritage specialist to assess the significance of the find and provide further instructions.** **5. Implement Recommendations** • **Construction may only resume once HWC or the palaeontologist has issued formal clearance, and any recommended mitigation (collection,**	Contractor and ECO to monitor for any heritage finds and institute Fossil Finds Procedure .should any heritage resources be uncovered during the proposed dredging and placement of dredged material within the intertidal zone.	Weekly ECO site inspections.	ECO and Contractor

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	Frequency	Responsibility
		excavation, documentation) has been completed.			

6 IMMEDIATE POST-DREDGING PHASE REHABILITATION

The outcomes, management measures, and monitoring requirements detailed in this section are applicable to the immediate post-dredging phase of the proposed activity only, to ensure the restoration of any public spaces used during the dredging process to pre-disturbance conditions (should dewatering have been undertaken during the implementation phase).

The ECO must conduct a site inspection one month after dredging, or more frequently if needed, to verify that the Contractor has properly rehabilitated the dewatering park area. This monitoring should be documented in the final ECO Close-out report.

Refer to **Annexure A** of this EMPr for guidance on the post-dredging phase maintenance activities required to dredge up to 120 000 m^3 of sediment to maintain the scoured depth of the dredged channel and an open estuary mouth, with placement of this dredged sediment on the side(s) of the channel within the intertidal zone. These maintenance activities must be undertaken in accordance with the MMP (see **Annexure A**), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	Frequency	Responsibility
IMMEDIATE POST-DREDGING REHABILITATION MANAGEMENT					
6.1. Immediate post-dredging rehabilitation of dewatering park area		**6.1.1. Contractor to rehabilitate disturbed dewatering area, i.e., area used for dewatering activities alongside Marine Drive (should dredging with off-site disposal have been implemented for the project) as well restore the areas along the access route that were unavoidably impacted for use of the access route to the original condition to reduce long-term effects.** **6.1.2. The disturbed areas should be planted with suitable local indigenous vegetation to stabilise the bank(s). It is also essential that the clearing of invasive alien plants be undertaken during and after construction activities within the disturbed area(s).** **6.1.3. The soil and cover vegetation removed to excavate/establish this area for placement of geotextile tubes for dewatering activities should be replaced and restored to the**	Contractor to monitor suitability of rehabilitation efforts and replanting to the site. ECO to monitor implementation performance and issue fines for non-compliance to Contractor, where necessary.	Contractor must conduct rehabilitation efforts immediately once dredging phase is complete and dewatering activities are complete. Weekly ECO inspections and ad-hoc monitoring after any incidents occur.	Contractor and ECO

Environmental aspect or impact	Impact Management Outcomes	Impact Management Actions	Monitoring Actions		
			Method	Frequency	Responsibility
		same extent and level as the existing undisturbed park area. **6.1.4.** All dredged slurry must not be used for any other purpose than waste disposal and must be removed from this area by the Contractor at a suitably licensed WDF. Proof of disposal slips must be kept on site. **6.1.5.** Remove geotextile tubes and associated dewatering materials from the area and either dispose of them at an appropriate WDF, retaining proof of disposal for ECO review, or return them to the Contractor's offices if they are to be reused.			

7 ENVIRONMENTAL AWARENESS TRAINING PLAN

This section outlines the training by which the authorisation holder (via its appointed Contractor during the implementation phase) will inform its employees of environmental risks and the manner in which risks must be dealt with to avoid pollution or degradation of the environment. It may be adapted as needed to suit the circumstances in which it is implemented.

Course	Required attendees	Presented by	Course content	Timing	Records to be kept
Implementation phase Environmental Awareness Training for manager	• Project Manager appointed by the authorisation holder; • Principal contractor's contract manager, site agents, and assistant site agents (as applicable); and • Contractor's designated environmental officer or Safety, Health and Environment (SHE) representative.	ECO	• Overview of EAs and permits granted; • Basic environmental law; • Roles of the ECO, authorisation holder, project manager, and Contractor; • Purpose and content of method statements; • Site sensitivities, including locations and sensitivity of wetland areas and conservation area; • Management actions and measures for the construction phase as detailed in this EMPr; • Record keeping requirements; • Emergency procedures; and • Reporting and compliance monitoring.	Prior to commencement of construction.	• Declaration of adherence to Implementation phase EMPr, signed by Contractor's representative; and • Register of attendance.
Environmental Awareness Training for site personnel	• All site staff and personnel, including temporary staff and visitors to site; and • Maximum of 20 attendees at any one session.	Contractor's designated environmental officer	Environmental do's and don'ts, including: • Access to work areas, location and identification of no-go areas; • Estuarine species and environment; • Damage to or picking of vegetation; • Managing animals found on site; • Smoking and fires; • Storing and handling fuels and oils;	Before any staff member begins work on site.	• Register of attendance, identifying all attendees by name and ID number, the topics covered, the presenter, and the date and time.

Course	Required attendees	Presented by	Course content	Timing	Records to be kept
			• Storing and handling chemicals; • Management of cement, cement bags, slurry, and wash water; • Dust and noise; • Water wastage; • Waste management and litter; • Waste site management; • Ablution facilities; • Plant and machinery maintenance and load management; and • Accident and incident reporting.		

8 TOLERANCE FOR NON-COMPLIANCE(S)

The tolerance section is included in this EMPr to ensure that non-compliances with the EMPr, conditions of the EA and/or other statutory requirements are addressed in a fair, transparent, and enforceable manner. Where transgressions occur, the Authorisation Holder and/or the ECO has the authority to impose fines on the responsible Contractor and/or Sub-contractors, in addition to any remedial costs incurred for such incident. This process ensures accountability, prevents repeated infringements, and secures compliance with contractual and environmental obligations by deducting fines directly from monies due under the contract.

8.1 Guiding Principles

» All contractors and construction personnel must comply with the EMPr.
» Non-compliance will be recorded by the ECO in the Environmental Inspection Checklist and reported to the Authorisation Holder as well as the relevant authority, if serious.
» The Contractor is contractually liable for fines imposed for non-compliances as well as for any costs incurred as a result of the non-compliance/transgression/knock-on(related) incidents.

8.2 Tolerance and Escalation for non-compliance(s)

1. **First instance non-compliance** must be noted and handled via verbal warning to the Contractor from the ECO. The verbal warning must explain where in the EMPr/EA condition/other statutory requirement the non-compliance has occurred and involve agreement on corrective action within a specific timeframe.
2. **Second instance non-compliance** must be addressed via written warning with a deadline and key indicators for rectification.
3. **Third instance non-compliance** must involve a monetary fine imposed on the Contractor or relevant Sub-contractor, as per the fine schedule presented in section 7.3 below.
4. **Persistent or severe non-compliances** must involve a stoppage of implementation works should the non-compliance involve major consequences for the environment. Costs incurred for the delay in performance due to stoppage of works must fall on the implicated Contractor and/or sub-contractor. Works must be stopped only until such time that the non-compliance can be rectified.

8.3 Fine Schedule

The following non-compliances will incur the corresponding fine should non-compliance persist a third occurrence (in alignment with the Environmental Management Specification forming part of the Contractor contractual obligations).

- Vehicles, plant or materials related to the Contractor's operations, parked or stored outside the demarcated boundaries of the Site: R2 000.00 per incident.
- Persons, vehicles, plant or materials related to the Contractor's operations, found within the designated boundaries of a "no go" area: R4 000.00 per incident.

- Littering, poor housekeeping (including poor maintenance of toilets), or unauthorised waste disposal: R 1 000.00 per incident.
- Persistent and unrepaired oil leaks from machinery/not using a drip tray to collect waste oil and other lubricants/not using specified absorbent material to encapsulate hydrocarbon spillage/using inappropriate methods of refuelling (the use of a funnel rather than a pump): R3 000.00 per incident.
- Failure to provide spill kits, firefighting equipment, or sanitary facilities: R1 000.00 per incident.
- Nuisance factors such as excessive dust and/or noise emanating from site: R 1 000.00 per incident.
- Refuelling in areas not approved by the Employer's Agent: R 3 000.00 per incident.
- Individual not making use of the Site ablution facilities: R 1 000.00 per incident.
- Unwarranted erosion of the intertidal banks of the lower Milnerton lagoon: R5 000.00 per incident put rectification costs.
- Hydrocarbon or other spillage of water contaminated with pollutants such as cement, concrete, fuel etc., without adequate containment or reporting: R2 000.00 per incident plus clean-up costs.
- Deliberate lighting of illegal fires on site: R 5 000.00 per incident.
- Damage to trees not specified to be removed: R 5 000.00 per incident.
- Destruction of protected species, heritage resources, or significant environmental damage: R20 000.00 minimum, subject to legal action.
- Commencement of Works without an approved Method Statement: R 4 000.00 per incident.

8.4 Fine Administration

The ECO must identify any on-compliance instances on site and initiate the escalation for such non-compliance(s) as outlined in section 7.2 above.

The Contractor and/or Sub-contractor implicated for any non-compliances during the implementation phase must pay any fines issued to them due to the escalation of non-compliance to the third occurrence. Fines must be paid to the Authorisation Holder, who, together with the ECO, is responsible for monitoring the corrective actions to ensure the non-compliance is properly addressed.

The Authorisation Holder is responsible to enforce fines through contractual agreement(s), where necessary, and comply with any escalation consequences and for adhering to any escalation measures or other processes prescribed by the Competent Authority.

Fines must be deducted from the implicated Contractor and/or Sub-contractor's payment schedule. The payment of any fines does not absolve the implicated Contractor and/or Sub-contractor from the costs and actions required to correct and account for the non-compliance nor does the settlement of fines rectify the need for, or initiation of, any legal action under environmental or related legislation by any third party.

9 CONCLUSION

The recommendations and mitigation measures outlined in this EMPr have been developed to manage the potential environmental impacts of the activities concerning the pre-implementation phase and the implementation phase of the proposed dredging (with or without off-site disposal) within the lower Milnerton Lagoon. Specialist assessment(s) indicate that the impact of the maintenance activities to be conducted during these phases is of low-very negative to medium negative significance post-mitigation.

By ensuring that Contractors and all parties involved in implementation of the dredging activities understand and apply the provisions of this EMPr, the project can achieve environmental best practice, ensuring that the dredging activities support sustainable outcomes for improved hydrodynamic function within the lower lagoon and associated benefit of tidal flushing over time.

10 BIBLIOGRAPHY

City of Cape Town & Infinity Environmental. (2022). *Diep River Estuarine Management Plan*. City of Cape Town & Infinity Environmental.

Rose, J., Day, L., Basson, G., Clark, B. M., & Winter, K. (2023). *Water Quality Remediation Plan for the Milnerton Lagoon* (No. 19041/1). Infinity Environmental, Liz Day Consulting, Anchor Environmental Consultants, ASP Tech and the University of Cape Town.

ANNEXURE A: MAINTENANCE MANAGEMENT PLAN

ANNEXURE A: MAINTENANCE MANAGEMENT PLAN

Final Maintenance Management Plan

Proposed Dredging of the Milnerton Lagoon, Cape Town

PREPARED IN COMPLIANCE WITH THE REQUIREMENTS OF THE EIA REGULATIONS, GN 326 OF 2017 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT NO. 107 OF 1998

DEA&DP REF NO. 16/3/3/1/A1/18/3048/25

DATE: 28 January 2026

APPLICANT
City of Cape Town

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Written comments should be submitted to the Environmental Assessment Practitioner, Infinity Environmental, at the details below or online at

www.infinityenv.co.za

Infinity Environmental

Email: milnerton@infinityenv.co.za
Tel: 021 834 1600
Collingwood Building, Black River Park
2 Fir Street, Observatory, Cape Town

REPORT DETAILS

PROPOSED DREDGING OF THE MILNERTON LAGOON, CAPE TOWN: FINAL MAINTENANCE MANAGEMENT PLAN

APPLICANT

City of Cape Town
9 Dorp Street
Cape Town, 8000

ENVIRONMENTAL ASSESSMENT PRACTITIONER

Infinity Environmental (Pty) Ltd.
Collingwood Building
Black River Park
2 Fir Street, Observatory

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Authors

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J Rose B.Sc.Hons (Reg. E.A.P. #2019/1116)

Report purpose

This Maintenance Management Programme is prepared as part of a Basic Assessment in terms of the Environmental Impact Assessment Regulations, 2014 (as amended). It prescribes control methods to mitigate and manage negative environmental impacts and enhance positive impacts associated with the maintenance of the lower reaches of the Milnerton Lagoon post-dredging, and provides a programme for monitoring the performance of personnel in applying such methods.

DOCUMENT CONTROL

Date	Version
05 November 2025	Draft
28 January 2026	Final

DECLARATION OF EAP'S INDEPENDENCE

I, Jeremy Rose, appointed by the City of Cape Town as Environmental Assessment Practitioner for the Final Maintenance Management Plan, hereby declare that the information provided in this report and supporting documentation is complete and correct to the best of my knowledge; that other than fair remuneration for work performed in terms of this application I have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; that I have disclosed, to the Applicant, the specialist(s), the Competent Authority and registered interested and affected parties all material information that have or may have the potential to influence the decision of the Competent Authority; that I have ensured that information in respect of the application was distributed or was made available to registered interested and affected parties and that participation will be facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments; and that I am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations.

Jeremy Thembo Rose BSc (Hons), Reg. E.A.P. 2019/1116, Pr.Sci.Nat. 120148, IAIAsa member 5781
Infinity Environmental (Pty) Ltd: Director & Principal EAP

RECORD OF REVISIONS

Rev. No.	Reason for Revision	Section Revised	Revised By	Effective Date
00	DRAFT	ALL	T HOBSON	29 October 2025
00	FINAL	ALL	J ROSE	28 January 2026

MMP OVERVIEW

Section 1	**INTRODUCTION**
Section 2	**APPROACH AND STRUCTURE**
Section 3	**PROJECT ROLES AND ORGANISATIONAL STRUCTURE**
Section 4	**MAINTENANCE MANAGEMENT PLAN**
Section 5	**TOLERANCE FOR NON-COMPLIANCE**
Section 6	**CONCLUSION**
Section 7	**BIBLIOGRAPHY**

ANNEXURES

Annexure A	**ENVIROMENTAL AWARENESS TRAINING PLAN**

TERMS AND ACRONYMS

BAR	Basic Assessment Report
DO	Dissolved Oxygen
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry Fisheries and the Environment
MMP	Maintenance Management Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended
NEM: ICMA	National Environmental Management: Integrated Coastal Management Act, 2008 (Act 24 of 2008), as amended

INTRODUCTION

The Milnerton Lagoon ('lagoon' or 'estuary') is the lower section of the Diep River Estuary where the Diep River enters the sea at Lagoon Beach in Cape Town (refer to **Figure 1** below). Water quality in the lagoon has declined significantly in recent years due to high levels of pollution and other anthropogenic impacts. The effects of poor water quality in the estuary include a sulphurous odour and discoloured water, due to high levels of suspended solids and extremely low oxygen levels.

Sewage-derived pollution is a major contributor to water quality impacts in the estuary, and includes excessive loading of organic solids from the Potsdam wastewater treatment works (WWTW). During 2024 and 2025, the lagoon has also been affected by the discharge of large volumes of untreated sewage because of the episodic failure of the Koeberg Road sewage pump station and its resulting discharges into the Theo Marais stormwater canal upstream of Otto du Plessis Drive).

In addition to the ongoing effects of inflowing pollutants, water quality in the lower estuary is affected by the extent to which clean seawater can enter the lagoon during high tides, replacing polluted river flows with cooler, saline water with higher dissolved oxygen concentrations. This daily tidal exchange is dependent on the dynamics of the estuary mouth, coastal processes, and flows from the river. In general, greater tidal exchange has been associated with improved water quality in the lower lagoon (between the Loxton Road bridge and the mouth). Tidal exchange is reduced when the mouth is partially closed, which is influenced by many different factors including deposition of sediments at the mouth. Organic sediments derived from wastewater and urban runoff accumulate on the bed of the estuary over time and are periodically flushed out to sea in large flood events. Accumulated organic-rich sediments increase the demand for oxygen from the water column as microbes decompose the material. This process reduces the levels of dissolved oxygen concentrations in the estuary. If there is insufficient oxygen available in the water (as is often the case in the lagoon), conditions turn anoxic and bacteria produce hydrogen sulphide, resulting in characteristic foul odours. The proposed activity is the dredging of the lower section of the Milnerton Lagoon from just upstream of the Loxton Road bridge to the estuary mouth and the placement of dredged sediment along channel margins (refer to **Figure 2** below).

Up to 30 000 m^3 of material will be moved within the lagoon to achieve this during the dredging phase of the project, and up to 120 000 m^3 during the post-dredging phase to maintain the scoured depth of the dredged channel and an open estuary mouth in accordance with this MMP, as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

The main purpose of the dredging is to maximise tidal flushing and improve the hydrodynamics of the lower section of the lagoon. The dredged material is proposed to be placed on the sides of the dredge channel to form sandbanks. Additional benefits associated with this sediment placement on the sides of the channel include exposure of the deposited sediment to ultraviolet (UV) light and oxygen during low tide, which can reduce odours and increase the rate of decomposition of organic materials.

Figure 1: Locality map indicating the site located on Erf 20315, within the Milnerton Lagoon.

CURRENT & PLANNED POLLUTION REMEDIATION WITHIN THE GREATER DIEP RIVER ESTUARY

In response to the impacts on waterbodies caused by failing sewage infrastructure, the Applicant, the City of Cape Town ('the City'), has initiated a series of ongoing and planned projects to reduce pollution in the canal and estuary and to upgrade infrastructure across the catchment. Current pollution response actions include routine unblocking and repair of sewers, investigations and enforcement of pollution incidents, increased maintenance frequency at the Koeberg Pump Station, and water pressure reduction in parts of the catchment.

In addition, major infrastructure upgrades are underway or scheduled, including:

- the upgrading and expansion of the Potsdam Wastewater Treatment Works (scheduled for completion by December 2027);
- A capacity upgrade and construction of an overflow pond at Koeberg Road Pump Station (2027);
- Construction of the new Montague Gardens Bulk Sewer (2026);
- Rehabilitation of the Montague Drive Bulk Sewer (2027);
- Upgrades to the Phoenix Park Pump Station (2028); and
- Upgrades to the Sanddrif East Pump Station (June 2027).

PROJECT BACKGROUND AND MOTIVATION

The Diep River Estuarine Management Plan (adopted in 2022) includes a set of objectives and actions, of which Objective H1 and Action 12 involve the following, '*Assess the possible cost and benefit of dredging the lower lagoon to facilitate the release of sediments and nutrient loads and*

emulate natural scour and enable ingress of increased volumes of seawater into the system… Implement dredging if a significant benefit is anticipated.' (refer to pg 9. of the EMP (2022)).

A Water Quality Remediation Plan for the Milnerton Lagoon was prepared for the City of Cape Town in 2023 (Rose et al., 2023), 'the 2023 Remediation Plan', which assessed various short-, medium- and long-term remediation measures proposed for the lagoon and recommended that the primary focus of remediation of the pollution within the lagoon should be on reducing the sources of pollution into the estuary. Of the short-term remediation measures assessed in the 2023 Remediation Plan, one that was recommended for implementation was dredging of the lagoon to remove built-up organic sediments and increase tidal exchange in the estuary.

Hydrodynamic modelling of the proposed dredging has been conducted and found that the proposed dredging would facilitate greater saline intrusion during incoming and outgoing tides in the lower part of the lagoon. The dredging is expected to increase the exchange of saline and fresh water in the lower lagoon. The increased seawater intrusion is also expected to introduce dissolved oxygen into the lagoon, reducing chemical oxygen demand and disrupting anoxic conditions. During the dry season, average salinities near the mouth of the lagoon are modelled to increase by 11.6 %. During the wet season, average salinities near the mouth are modelled to increase by 54.0 % in the lower water column.

Since 2023, multiple flood events have naturally scoured the system, flushing significant quantities of sediment from the lagoon out to sea. The removal of organic sediments has become less of a priority, and dredging is instead proposed for its potential to improve the hydrodynamics and tidal exchange as a viable remediation measure.

Dredging alone is however not expected to achieve the desired permanent ecological, human health and/or aesthetic outcomes within the Milnerton Lagoon unless there is a significant reduction in polluted inflows into the Diep River. It is therefore proposed that the implementation of dredging be delayed until water quality inflows into the lagoon reach acceptable levels, defined here in terms of dissolved oxygen as the 90th percentile of oxygen concentrations in bottom waters being above the 1.0 mg/L threshold over a three-month period with weekly monitoring, and the 90th percentile in mid- and surface water concentrations being above 2.0 mg/L.

The proposed dredging of the lower reaches of the Milnerton Lagoon is the subject of this Maintenance Management Plan (MMP).

This report has been prepared to meet and support the requirements for MMP approval. The Department of Environmental Affairs and Development Planning (DEA&DP), as the competent authority, is requested to review this document and issue a decision on the adoption of this MMP.

1.1 ALTERNATIVES

The various sensitivities and contextual constraints presented by the site resulted in two potential design and layout alternatives, which together with the no-go alternative were considered for this application:

- **Alternative 1 *(Preferred Alternative)*- Dredging with placement of material within the lagoon:** This option involves dredging approximately 30,000 m³ of sediment from the channel and placing it on the sides of the dredged area to build up sandbanks within the intertidal zone – refer to **Figure 2** below. During the post-dredging phase of the project, up to 120 000 m^3 of sediment will be dredged from the channel and/or estuary mouth, and placed on the sides of the channel within the intertidal zone and an open estuary mouth maintained in accordance with the MMP (see **Appendix H2**), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

These sandbanks would be naturally exposed to cycles of oxygen and ultraviolet light (UV) through wetting and drying, assisting in the breakdown of organics. Importantly, this option does not require off-site disposal or dewatering, thereby will not take up scarce landfill space nor involve the excessive transport and loading to move sediment off-site to an appropriate and capacitated landfill site, making it the least costly and least disruptive alternative. Dredging could be completed in approximately five months, with impacts limited to the dredged footprint and without significant loss of public space.

This proposed intervention includes the creation of a berm upstream of the small island at the Wooden Bridge, using 600 m^3 of dredged material, as a means to potentially concentrate flows west of the island and increase flow velocities.

- **Alternative 5 *(Not Preferred)* – Dredging of the channel with partial off-site disposal:** This option involves dredging of up to 30,000 m^3 of material, which would be separated by cyclone, with clean sand returned to the lagoon (i.e., with placement of sediment particularly on the eastern bank of the channel) and only around 6 000 m^3 of nutrient-enriched fine sediments dewatered and removed off-site (refer to **Figure 3** below). During the post-dredging phase of the project, up to 120 000 m^3 of sediment will be dredged to maintain the scoured depth of the dredged channel and an open estuary mouth and placed on the eastern side of the channel within the intertidal zone in accordance with the MMP (see **Appendix H2**), as and when needed to ensure the hydrodynamic function of the lower lagoon is maintained.

  The intervention involves forming a berm upstream of the small island at the Wooden Bridge, using approximately 600 m^3 of dredged material, to help direct flows to the west of the island and enhance flow velocities.

- **The No-Go Alternative**: Entails maintenance of the *status quo* and therefore not implementing dredging in the Milnerton Lagoon. Under this option, the hydrodynamic functioning of the lagoon would remain dependent on natural processes, potentially with limited tidal flushing and increased retention of freshwater during summer. While winter flooding may cause natural and temporarily improved intertidal exchange, this has proven insufficient to support lasting ecological recovery.

Given the continued impacts on the lagoon, the No-Go Alternative is considered neither reasonable nor feasible. The implementation of the proposed dredging is therefore preferred, as it offers clear, potential short- to medium-term benefits for the hydrodynamic function of the lower lagoon, with the subsequent potential to pose a positive indirect impact both on estuary ecosystem health and upon local community well-being.

Figure 2: Schematic of the updated preferred alternative, illustrating the proposed dredging area (blue) in the Milnerton Lagoon, with the excavated material (yellow polygons) placed on either side of the channel. The proposed sand berm is highlighted in orange, while the dotted outline depicts the precise footprint of the dredged area. The design has been amended slightly since the draft BAR based on comments received, to maintain deeper water along the western bank immediately downstream of the Loxton Road bridge.

The main purpose of the dredging is to maximise tidal flushing and improve the hydrodynamics of the lower section of the lagoon. The creation of a dredge channel is intended to increase flow velocities and help keep fine material suspended so that it can be flushed out to sea during tidal cycles. The dredged material is proposed to be placed on the sides of the dredge channel to form sandbanks. Additional bioremediation benefits associated with this sediment placement on the side of the channel include exposure of the deposited sediment to ultraviolet (UV) light and oxygen during low tide, which can reduce foul odours, pathogens, and labile organics such as dissolved organic carbon.

Figure 3: This schematic presents the design and layout Alternative 5 – the proposed dredging with off-site disposal.

Limitations of dredging as a remediation measure

It must be clearly stated that dredging of the Milnerton Lagoon is not in itself expected to contribute significantly to improving water quality or amenity value of this waterbody other than by improving tidal exchange in the lower part of the lagoon. The causes of water quality impacts are well understood and include the discharge of wastewater at the Potsdam WWTW, the periodic discharge of substantial volumes of untreated sewage from failing pump stations and the ongoing low-level runoff of untreated wastewater from un-serviced areas of the catchment. As assessed in this report, the positive impacts of dredging as a remediation measure are likely to be limited in extent (since improvements to tidal exchange will occur mainly in the lower lagoon) and duration (as winter flooding may cause the channel to revert to its current channel). Therefore, the dredging of the lower lagoon is preferably recommended after some improvement in water quality occurs, ensuring that the intervention coincides with improvements in upstream water quality. Dredging is therefore recommended as a short- to medium-term intervention that can feasibly be implemented to help address pollution within the Milnerton Lagoon considering the complimentary maintenance activities ensuring the dredged channel depth is maintained and the estuary mouth kept open.

1.2 Environmental Sensitivities

The proposed site is the lower reaches of the Milnerton Lagoon: a part of the Diep River Estuary with significant tidal influence. Rietvlei wetland, fed by the Diep River habitat, is located north of the Milnerton Lagoon and is 5 km north-east of the Cape Town harbour. The Diep River originates from the Riebeek Kasteel Mountains north-east of the town of Malmesbury, flowing south-west for approximately 65 km towards the estuary in Cape Town. The lower catchment of the Diep River in Cape Town is highly urbanised, and the estuary is confined to a channel stabilised by road

embankments and bridges with a maximum width of 150 m. The estuary mouth naturally migrates between a gabion structure and concrete wall to the south and the Woodbridge Island, a naturally raised area approximately 250 m north of the mouth.

The City of Cape Town's Biodiversity Spatial Plan (BSP), specifically the 2018 BioNet and draft 2025 BSP, classifies the proposed site as a Protected Area, as it forms part of the Table Bay Nature Reserve (promulgated in Provincial Notice No. 175, published in Gazette No. 9345, 3 August 1984). The BSP objectives are to maintain the area as a Protected Area. The proposed dredging is a remediation measured intended to address certain impacts of pollution within the lagoon, which would contribute to the maintenance of the Protected Area.

The Estuarine Impact Assessment and the Avifaunal Compliance Statement describe in detail the fauna and their habitats in the lower Diep River Estuary:

The Estuarine Impact Assessment described the modification and domination of the Diep River Estuary by freshwater, and its degradation in water quality, reduced biodiversity, and a near-collapse of native fish populations because of agricultural runoff, effluent from the Potsdam WWTW, and stormwater inputs.

The specialist notes that the estuarine area below the Woodbridge Island bridge is highly disturbed, with the only remaining 'natural vegetation' of environmental significance is the vegetation downstream of the Woodbridge Island comprising a thin strip of dunes between the Woodbridge Island development and the beach itself (Anchor, 2025). This section of dune habitat is to be avoided during dredging, and any dredging-related activities should not impact this area of dune vegetation.

With regard to invertebrate fauna, it notes that there have been significant changes to the benthic macrofauna communities in the Diep River Estuary over time, specifically, a dramatic decline in species richness, and an increase in freshwater species. Species that have increased in abundance include insects (primarily freshwater species). Two alien invertebrates not previously reported from the system have also been introduced. These changes reflect the changing water quality profile of the system.

The Diep River Estuary system (including Rietvlei) is considered an important area for water birds in the region and is recognised as an Important Bird and Biodiversity Area (IBA) by Birdlife International.

While most of the information of bird abundance and species richness for the area is focused on Rietvlei, rather than the lower estuary, various sources have reported kelp gull *Larus dominicanus*, Hartlaub's gull *Chroicocephalus hartlaubii*, common tern *Sterna hirundo* and Cape shoveler *Spatula smithii*, as well as predominantly freshwater species such as red-knobbed coot *Fulica cristata* and African darter *Anhinga rufa*. Site visits undertaken by Anchor in December 2020 and February 2022 confirmed that the estuary is an important feeding and roosting area for many bird species, including greater flamingo *Phoenicopterus roseus*, white-breasted cormorants *Phalacrocorax lucidus* and pied avocets *Recurvirostra avosetta*. The avifaunal compliance statement confirms that, despite at least 14 different bird species potentially being affected by the proposed dredging, the post-mitigation impacts of this project on the local birdlife are likely to be of Low significance if all the mitigation measures recommended in the Estuarine Impact Assessment (Anchor 2025) are implemented.

Estuaries are considered critically important nursey habitat for fish, and the Diep Estuary historically represented some 10% of the nursery area for fish on the West Coast, including species such as the white steenbras *Lithognathus lithognathus*. However, there are clear declines in fish species richness over time. These changes are likely linked to changes in water quality, specifically increased ammonia levels linked to malfunctions in the Potsdam WWTW, as well as substantially reduced dissolved oxygen concentrations, which regularly drop below the 2 mg/l threshold for the survival of aquatic species. While many estuarine-associated species are adapted to hypoxia, an increased

frequency of low oxygen events (anoxia) has almost certainly negatively impacted benthic fish communities.

Dredging is expected to result in short-term disturbance and related impacts to birds and any fish remaining in the lower lagoon. Invertebrates will be impacted more directly, if present in the dredged areas, but are expected to recover from adjacent areas.

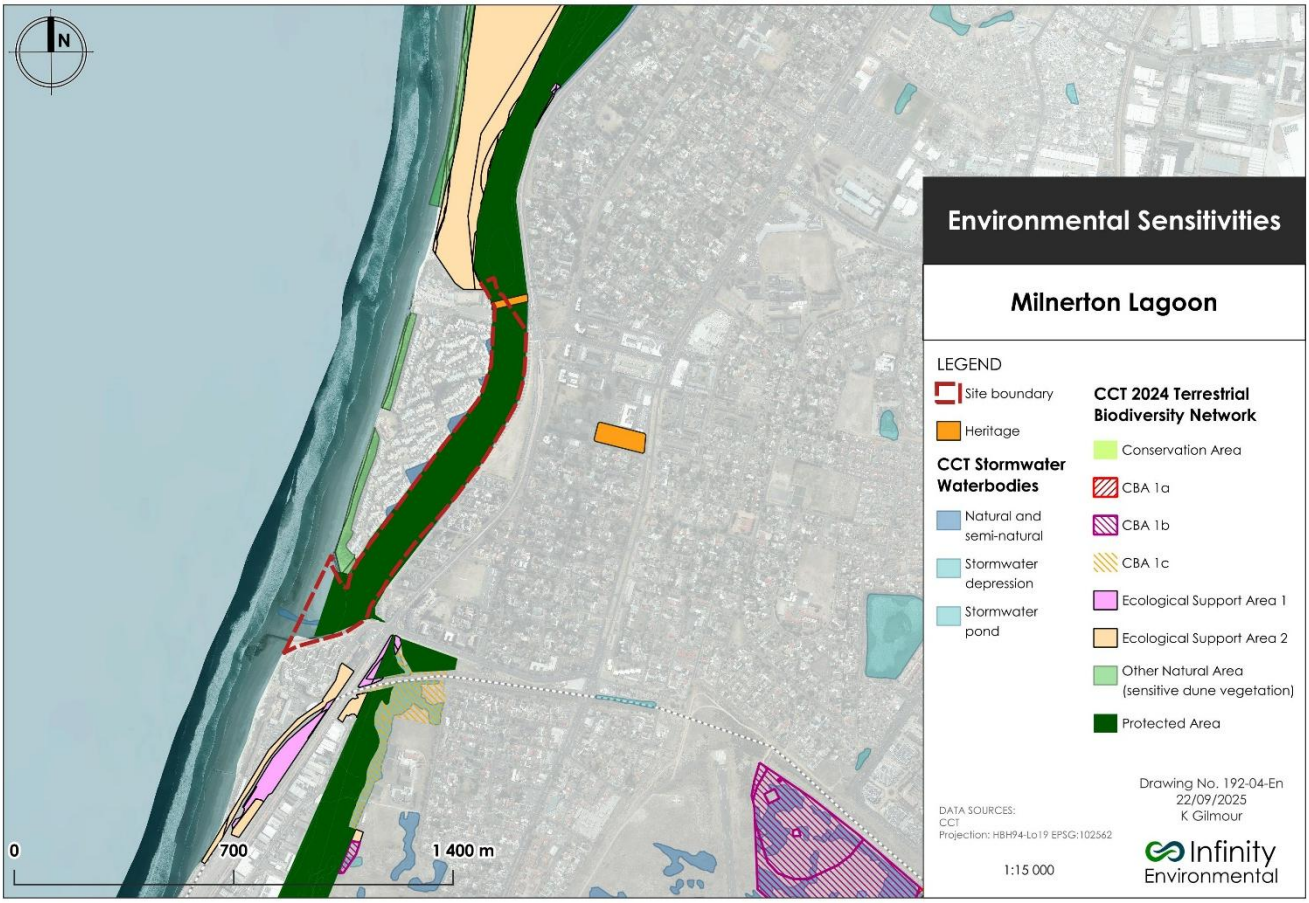

Figure 4: Site boundary of the proposed dredging of the Milnerton Lagoon superimposed on terrestrial and aquatic sensitivities.

1.3 Impacts identified during the Environmental Impact Assessment (EIA)

The impacts and management measures identified by the specialists (see **Table 1.** below) have been incorporated into the EMPr for the project (refer to Appendix G1 and G2 of the BAR) and are included here under to provide context to the impacts assessed for the implementation phase of the Milnerton Lagoon Dredging project.

This MMP applies to the post-dredging phase of the Milnerton Lagoon project, i.e., once the 'implementation phase' of the project is complete. It addresses the ongoing maintenance of the dredged channel to ensure the long-term sustainability of the benefits achieved through the dredging and should provide direction to manage impacts and monitor compliance during the maintenance work.

Table 1: Key Impacts identified during the EIA process.

Specialist study	Impacts identified and assessed (Implementation Phase)
Estuarine Impact Assessment	**Disturbance to and mortality of estuarine communities in the dredge footprint** Direct removal of some 30 000 m³ of estuarine channel sediments during the dredging phase and up to 120 000 m³ during the post-dredging phase, as part of dredge activities will lead to direct mortality of fauna associated with those sediments, namely macrofauna and epifaunal species present within the dredge area. The Milnerton Lagoon benthic macrofauna is very depauperate (i.e., lacking in variety, numbers and/or vitality), with a dramatic decline in species richness over time, and an increase in freshwater species. Of particular concern has been the declines and shifts in behaviour of the burrowing sand prawn, *K. kraussi*, which is an ecosystem engineer. The communities that are present are typical, albeit depauperate, communities that characterise estuaries of the west coast of South Africa. The estuarine specialist confirmed that there are no species of particular conservation concern within the lagoon. While fish are generally considered to be mobile, and will move away from the disturbance, benthic fish species as well as species that are dependent on the estuary for the completion of their life cycle were assessed to be potentially disproportionally affected by the proposed dredging activities. However, it is noted that, in tandem with the declines in macrofauna species, there has been a complete loss of species that depend on these invertebrate communities within the system (benthic goby species in particular), as well as drastic declines in the number of juveniles of linefish species that depend on estuarine habitat (white steenbras and white stumpnose). Therefore, it seems likely that there are very few fish species of sensitivity, conservation concern or commercial importance left in the system that require management. Although the majority of the benthic organisms are likely to die or be removed from the dredged areas, this should not have any repercussions at the population levels as the estuarine specialist affirmed that communities are likely to recover from other sites in the system relatively rapidly after the impact.

Specialist study	Impacts identified and assessed (Implementation Phase)
	Disturbance to estuarine habitat due to dewatering activities The proposed dewatering methodology (should the Design and Layout Alternative 5 be pursued) involves the use of large geotextile "geo-tubes" that will be placed in the grassy recreational space on the eastern side of the estuary body alongside Marine Drive, covering an area of about 0.025 km^2 (see **Figure 3** above). There is no functional estuarine vegetation on site, and the entire eastern bank of the estuary in that area is canalised. This means that the area has ceased to have any connectivity with the estuarine water body (for example, it is no longer inundated with tides and hosts no natural estuarine vegetation). Impacts on estuarine habitat resulting from the proposed dewatering activity is therefore considered to be Insignificant, and no mitigation is required.
	Noise impacts on surrounding estuarine ecology due to dredging activities Noise associated with dredging operations may have an impact on estuarine organisms in the vicinity. Noise generated by dredging activities may include noise associated with service vehicles, vessels, cranes, heavy machinery, generators, etc. Estuarine and marine invertebrates have been shown to be relatively insensitive to low frequency sound, whilst fish appear to be able to tolerate moderate sound levels (Keevin and Hempen, 1997). Waterbirds that use the intertidal flats in the lower estuary for foraging are expected to avoid the sound source should it reach levels sufficient to cause discomfort. The dredge area and area of sand enrichment will overlap with intertidal areas of known importance to avifauna like greater flamingos, white-breasted cormorants and pied avocets. The extent of the impact may extend beyond the local area (i.e., by affecting how migratory species use the system).
	Smothering of estuarine fauna Impacts of smothering related to dredging activities will affect most of the lower reaches of the system. For the Design and Layout Alternative 5, the enrichment of sediment back into the system will result in direct smothering of approximately 51 000 m^2 of lower estuarine habitat. The preferred Design and Layout Alternative 1 is likely to disturb the same area, and potentially even a greater area overall. Smothering occurs when sediments are disturbed and settle on the seabed, covering and potentially suffocating organisms (Wilber et al., 2005). Sediments stirred up by dredging activities can settle over large areas, smothering benthic organisms (Wilber et al., 2005, Pineda et al., 2017). This can lead to decreased oxygen levels in the sediment, suffocating organisms unable to escape or tolerate the changes. The impacts of smothering also have cascading effects on entire ecosystems. For example, changes in the abundance or distribution of key species can alter predator-prey dynamics, trophic interactions, and overall ecosystem function (Wilber et al., 2005). Again however, there is evidence that the benthic habitats of the estuary are depauperate, with significant changes in community composition and

Specialist study	Impacts identified and assessed (Implementation Phase)
	structure. In addition, the estuary is relatively turbid for periods with high flow rates (the wet season, for example), and any communities still present are likely adapted to occasional periods of high sediment load. The permanently open mouth of the system is likely to reduce the intensity of this impact, as is the generally low receptor sensitivity. While the dredging itself will take place over the short-term, and modelling results also indicate almost complete tidal flushing even before dredging during the dry season. Strong freshwater flow (i.e., complete flushing during the wet season), means that resuspended materials are likely to quickly leave the system during this time. Note that no mitigation is possible for smothering linked to the areas of enrichment, and the impact rating remains the same post-mitigation.
	Impacts on estuarine water quality This sedimentation can cloud the water (increased turbidity), reducing water clarity and light penetration and can disrupt the feeding and reproductive behaviours of various species that rely on clear water for survival. This may have negative implications for the primary productivity of microalgae (phytoplankton and microphytobenthos), and for invertebrates and fish. The response of larval fish to turbidity of the water column is generally species-specific (Harris et al., 1999) and estuarine fauna are generally well adapted to high levels of turbidity. However, fine particulate matter may result in the clogging of the feeding and breathing apparatus of certain organisms (e.g., filter feeding invertebrates and the gills of sensitive fish species) (Wenger et al., 2017). Released sediment can also introduce excess nutrients into estuarine waters (Kahn & Mohammad, 2014). Nutrient enrichment can lead to eutrophication, promoting algal blooms and reducing oxygen levels in the water. This can result in fish kills, habitat degradation, and the loss of biodiversity. Elevated nutrient levels associated with finer particle sizes have been reported by Gihwala et al., (2021) in the proposed dredging area. These nutrients will likely therefore be remobilised into the water column during dredging activities. Dredging can also release contaminants trapped in sediments, such as heavy metals, hydrocarbons, and other pollutants, into the water column (Eggleton & Thomas, 2004). These contaminants can have toxic effects on marine fauna, causing physiological stress, reproductive problems, and even death. There are elevated levels of trace metals in the sediments of the system, some of which (As, Cd, Ni, Zn) exceeded the South African and international sediment quality guidelines (Gihwala et al., 2021). Indeed, the average trace metal concentrations for Cd, Ni and Zn within the Diep Estuary were relatively high in comparison to other local and international estuaries (Gihwala et al., 2021). These trace metals will also therefore be remobilised into the water column during dredging activities. It is important to note that just because a trace metal is present within sediment at a specific concentration does not mean that the metal is in a bioavailable (i.e., harmful) form, nor that the concentration in the sediment translates to a 100 % resuspension to a dissolved form. Indeed, it has been suggested by previous sediment transport studies that a small fraction (0.5 %)

Specialist study	Impacts identified and assessed (Implementation Phase)
	of trace metals bound to benthic sediment enters the water column as dissolved trace metals during large scale disturbance of the sediment such as dredging (Van Ballegooyen et al., 2023). Therefore, while resuspension of trace metals into the water column due to dredging is noted, the magnitude of the impact is likely tempered by lower bioavailability. The preferred Design and Layout Alternative 1 will likely have the high intensity, immediate impacts on estuarine water quality through sediment disturbance and remobilisation. For this option, the sediment will essentially be redistributed to create 'intertidal' areas along the eastern edge of the lower system. Any organic matter or other containments present in the sediment will therefore be remobilised within the system, and not physically removed — this will likely result in higher intensity short term impacts on water quality, especially in terms of oxygen levels, given that the dredging cannot be planned for times of optimal flushing (i.e., the wet season). This option does not result in any long-term removal of organic material from the lower estuary. The material that remains on the created intertidal flats will be inundated at high tide, likely resulting on continued 'leeching' of organic material to the water column. The impact is therefore assessed as of a medium-term duration. The Design and Layout Alternative 5 involves a dewatering process, which involves the use of large geotextile "geo-tubes" that contain the material and filter the water as it permeates through the bag. This water will ultimately flow from the geo-tubes and will re-enter the estuary. The volumes of water re-entering the system will be relatively small and will be released over the course of around eight months. It is anticipated that most of the sediments and organic matter present in this dewatering process will be contained within the geo-textile bags. It is also anticipated then that the water re-entering the estuary will be of sufficient quality to not pose a risk to the health of the system in terms of suspended solids and organic material. The impact is therefore assessed as of a short-term duration. There is some risk that sediment disturbance and remobilisation of organic material will have implications for oxygen level in the system. While low oxygen levels do occur within the system (due to organic enrichment), it is important to ensure that additional low oxygen events are suitably managed (and preferably prevented). It is proposed that oxygen monitoring take place in the lower reaches of the system for the duration of the dredging process to monitor these impacts, with control sites upstream of Woodbridge Island. Should the 95th percentile Dissolved Oxygen levels in the lower system fall below 10 % of the control sites, additional management actions may be required (such as oxygenation). The project engineers have stated that dredging cannot be scheduled for the wet season, which is characterised by almost complete tidal flushing, and strong freshwater flow, with complete flushing, during which resuspended materials are likely to quickly leave the system. While the dredging itself will take place over the short-term, modelling results indicate that there is limited tidal exchange with water in the lower estuary (even before dredging) in the dry season. Indeed, there are potential risks that dredging may result in increased deposition of organic material in the

Specialist study	Impacts identified and assessed (Implementation Phase)
	dredge channel in the dry season; however, these are likely to be mitigated by the increased tidal flushing, provided that the mouth stay open.
	Waste generation and disposal The problem of litter entering the environment has escalated dramatically in recent decades, with an ever-increasing proportion of litter consisting of non-biodegradable plastic materials. South Africa has laws against littering, both on land and in the coastal zone, but they are seldom rigorously enforced. Objects that are particularly detrimental to aquatic fauna include plastic bags and bottles, pieces of rope and small plastic particles. Large numbers of aquatic organisms are killed or injured daily by becoming entangled in debris or as a result of the ingestion of small plastic particles (Gregory, 2009; Wright et al., 2013). These materials, being largely plastics, may be transported by currents for long distances out to sea or around the coast. The impact on certain forms of marine life by floating or submerged solid materials cannot be overstressed. Most at risk are seabirds and fish, including possibly rare or even endangered species. Poor management of the dredging and dewatering operations site can also have impacts on water quality. For example, uncontrolled runoff of sewage and other organic wastes is harmful to biota due to high concentrations of nutrients which stimulate primary production that in turn leads to changes in species composition and changes to biodiversity, toxicity effects and impacts on water quality parameters like oxygen (Cloern, 2001). Dredging will also involve the presence of vehicles on the intertidal areas of the estuary. Spills or improper disposal of waste associated with the full project operation on site can lead to water contamination, posing risks to aquatic life and human health. Pollutants can bioaccumulate in the food chain and have long-lasting impacts on ecosystems. To reduce this, all domestic and general waste generated during construction must be disposed of responsibly. All reasonable measures must be implemented to ensure there is no littering and that construction waste is adequately managed. Staff must be regularly reminded about the detrimental impacts of pollution on aquatic species, and suitable handling and disposal protocols must be clearly explained, and sign boarded. The 'reduce, reuse, recycle' policy must be implemented. This impact is rated as Medium without mitigation and is reduced to Very Low with appropriate mitigation actions (for all dredge options).
Avifaunal Compliance Statement	The impacts on birds of the dredging project are likely to include disturbance and degradation of habitat during the construction phase (negative), and ultimately the improvement of habitat in the long-term during operation (positive), as identified in the original estuarine impact assessment. The affected avifauna could include at least 14 regionally and/or globally red-listed species, the most likely and significant of which are Hartlaub's Gull *Chroicephalus hartlaubii*, Cape Cormorant *Phalacrocorax capensis*, Caspian Tern *Hydroporogne caspia*, Great Crested Grebe *Podiceps cristatus*, Grey Plover *Pluvialis squaterola*, Sanderling *Calidris alba*, and

Specialist study	Impacts identified and assessed (Implementation Phase)
	Yellow-billed Duck *Anas undulata*. Three species – African Marsh Harrier *Circus ranivorus*, Great White Pelican *Pelecanus onocrotalus*, and Caspian Tern - are identified as species of conservation concern (SCC) by the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool. This impact is expected to be of low significance post mitigation according to the avifaunal compliance statement.
Specialist study	**Impacts identified and assessed (Post-dredging Phase)**
Estuarine Impact Assessment	**Impacts of proposed dredging on magnitude of the estuarine tidal prism** Model results for both the low flow and high flow scenarios indicate that the dredging increases tidal exchange between the study area and the ocean. This increased salinity is indicative of tidal flushing — there is more ocean water pushed into the lower system by the tides (in particular, at spring high tide) after dredging. This improvement in tidal flux (as demonstrated by saline inflow) does not appear to increase modelled upstream saline intrusion and any positive impacts appear to be limited to the lower reaches of the system. In the case of this fresher dominated system, increased salinity would ideally result in a more brackish system, which would better support estuarine communities (such as sand prawns). This would also potentially result in potential improvements in water quality, improved habitat for benthic organism and fish, with positive cascading impacts up the food chain. However, based on the modelling results, it is unlikely that the predicted general increase in salinity with dredging will result in a change to the Estuarine Health Score of the system. Instead, model results suggest that dredging will result in marginal improvements in the tidal prism and increased average salinity in the lower reaches of the system. The assessed positive impact is rated as Low positive post-mitigation.
	Impacts of a deeper channel at the mouth on nutrient-enriched fine sediments settlement and flushing The new, narrow dredged channel in the lower reaches of the system may concentrate any nutrient-enriched fine sediments that has been transported down the system, where the enhanced tidal prism will more readily flush it out through the mouth (with the overall larger volume flow rate in dredged area). Note however that this improvement will only likely be realised in the lower portions of the system towards the mouth given that there are limited impacts on tidal prism forcing further upstream. The assessed positive impact is rated as Very Low positive post-mitigation.
	Impacts of new exposed mudflat intertidal areas resulting from sand replacement By depositing the dredged increased sand in intertidal areas, means that more intertidal mud/sandflat area is exposed at low tide in the lower estuary. Assuming that the additional sediment is colonised by benthic macrofauna, this has the potential to expand the feeding area available to waders and other waterbirds that feed on the intertidal mud/sandflats. In addition, the

Specialist study	Impacts identified and assessed (Implementation Phase)
	creation of larger tidal flats adjacent to the dredge area will be exposed at low tide, along with any deposited material. Exposure to air may facilitate bioremediation benefits such as oxygenation of these sediments and exposure to sunlight may have a sterilising effect. The assessed positive impact is rated as Very Low positive post-mitigation.

1.4 Mitigation of impacts

This MMP gives effect to the mitigation measures prescribed in the EIA, particularly for the post-dredging phase. Recommended mitigation measures prescribed by the specialists for the post-dredging phase are set out in **Table 1** below.

Table 2: Key mitigation measures prescribed during the EIA process.

Specialist study	Specialists' mitigation measures
Estuarine Impact Assessment	**Impacts of a deeper channel at the mouth of nutrient-enriched fine sediments settlement and flushing** - The channel must be maintained at this depth. - The mouth must be kept open.

Note: The frequency of mouth management and maintenance of the depth of the scoured channel have specifically been left undefined and rather indicated as proposed for implementation only if sand or sediment accumulates within the lower lagoon and near the mouth to the extent that it restricts tidal flushing and is deemed by the City's Coastal Management and Biodiversity Management Branches to be unlikely to be reopen without intervention.

1.5 Motivation for Maintenance Activities

Whilst the proposed dredging is intended as a once-off remediation measure due to its high cost, it is recommended that the scoured channel depth and the estuary mouth be actively maintained into perpetuity. Relying solely on natural processes to maintain the desired depth of the scoured channel and opening of the mouth is unreliable. Instead, hydraulic management (flow manipulation) options should be considered to enhance inflows and promote sediment movement.

One of the priority management objectives and associated action items and timeframes for the Diep River Estuary presented in the Diep River Estuary Management Plan (2022) is the development of a 'Mouth Management Plan' and accompanying MMP for the manipulation of the estuary mouth in situations where upstream flooding or other circumstances require it (refer to pg. 68 of the Diep River Estuary Management Plan, 2022).

In alignment with this requirement of the 2022 Diep River Estuary Management Plan, this MMP has been developed as part of the Basic Assessment application undertaken to ensure the ongoing maintenance of both the mouth and the depth of the scoured channel for continued function and associated benefit of tidal flushing over time.

1.6 Description of maintenance activities

Maintenance work associated with post-dredging of the lower section of the lagoon is anticipated to include mechanical mouth management (refer to **Figure 4** below) and maintenance of the depth of the scoured channel. Due to the lower bed shear stress within the proposed new dredge channel, there is a risk of organic matter accumulating under low flow conditions. Therefore, the estuary mouth is to be kept open, and the depth of the dredged channel maintained using an excavator or

bulldozer to prevent sediment and organic matter accumulation, which is likely to occur under low flow conditions and if tidal flushing is restricted. Tidal flushing is critical within the lagoon to improve hydrodynamic function of the lagoon, prevent organic sediment build-up and thereby enhance water quality.

The maintenance activities are expected to be restricted to the mouth of the estuary and the section of the lagoon scoured during the implementation phase of the Milnerton Lagoon Dredging project, i.e., from 1.12 km lower section of the lagoon, located within Erf 20315, that extends from the lagoon mouth, south-west of Woodbridge Island, to just north of the Wooden Bridge.

Maintenance will involve the movement of sand/sediment using a bulldozer/excavator to ensure that the mouth is opened when required and the depth of the scoured channel is maintained to 1 m below land levelling datum (LLD).

Figure 5: Milnerton Lagoon mouth maintenance area.

APPROACH AND STRUCTURE

1.7 Content of the MMP

This MMP forms part of the post-dredging phase of the project life cycle.

A decommissioning phase is not included, as there is no infrastructure or activities associated with the dredging that would need to be decommissioned. Once dredging is complete (i.e., the implementation phase of the Milnerton Lagoon Dredging project implementation phase is finished), the post-dredging phase begins and involves maintenance activities as described in this MMP.

The MMP includes the findings and recommendations of the EIA process and specialist studies and/or compliance statements relevant to the post-dredging Phase. The MMP may be amended to include additional information or actions identified during the implementation phases, if applicable. A standardised approach is followed, in which outcomes are set, followed by management actions aimed at achieving the objectives. Management actions are accompanied by monitoring requirements, responsibilities, and targets, where applicable. A tabular format is used for ease of reference (refer to **Section 4.3** below).

1.8 Overarching objective

Maintaining an open estuary mouth is essential to allow tidal exchange, which brings in cleaner, oxygen-rich seawater and flushes out polluted river flows and organic sediments. Without adequate tidal exchange, sediment build-up and reduced oxygen levels create anoxic conditions, leading to foul odours and poor water quality in the lower lagoon. The frequency of mouth management and maintenance of the depth of the scoured channel have specifically been left undefined and rather indicated as proposed for implementation only if sand or sediment accumulates within the lower lagoon and near the mouth to the extent that it restricts tidal flushing and is deemed by the City's Coastal Management and Biodiversity Management Branches to be unlikely to be reopen without intervention.

The terms of reference for this MMP are as follows:

- Describe the site sensitivities based on the specialist assessments (Estuarine and Avifaunal);
- Identify the environmental risks associated with the maintenance management activities; and
- Identify and recommend measures for implementation to avoid or reduce the negative impacts of maintenance activities on the lagoon.

The post-dredging phase of the project involves maintenance activities that involve activities listed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), and the Environmental Impact Assessment (EIA) Regulations of 2014, as amended.

This report has been prepared to meet and support the requirements for MMP approval. The Department of Environmental Affairs and Development Planning (DEA&DP), as the competent authority, is requested to review this document and issue a decision on the adoption of this MMP.

1.9 Scope of the MMP

This MMP is intended to govern the implementation of maintenance activities in and around the lower section of the Milnerton Lagoon with the aim of preventing, minimising and/or mitigating negative impacts and risks. Maintenance activities are, as defined in the EIA Regulations of 2014, as

amended, actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint. This MMP is applicable to the maintenance activities related to the dredging of the lower reaches of Milnerton Lagoon.

The Milnerton Lagoon Dredging project and its associated maintenance activities trigger the following listed activities identified in terms of the NEMA EIA Regulations of 2014, as amended:

Table 3: Listed activities triggered by the Milnerton Lagoon Dredging project.

Listed activity		Activity Description
19A(ii) of Listing Notice 1 (GNR 327 of 2017), as amended	The **infilling or depositing of any material of more than 5 cubic metres into**, or the **dredging, excavation, removal or moving of soil**, **sand,** shells, shell grit, pebbles or rock **of more than 5 cubic metres from –** **an estuary**.	The activities considered in this Maintenance Management Plan (MMP) concern the maintenance of the dredged channel depth and an open estuary mouth during the post-dredging phase. These maintenance activities involve the dredging and moving of up to 120 000 m^3 in future maintenance to maintain a scour channel and open estuary mouth in accordance with this MMP. The width of the dredged channel will be approximately 20 m, with its bottom at 1 m below land levelling datum (LLD) and side slopes with a 1:5 slope. Excavated material is to be placed and spread at 0.5 m above LLD to create flats in the intertidal zone on the sides of the channel. Sandbags may be needed at the site access point(s) - especially at the existing ramp from the main beach parking area - to address natural scouring and improve stability, as soft sand and erosion may hinder site access. Thus, the maintenance activities will result in the infilling, depositing of dredged material into, and the dredging of more than 5 m^3 from, the lower section of the Milnerton Lagoon, which forms part of the Diep River Estuary, as part of maintenance or repeated dredging efforts in the future.

1.10

1.11 Authors of the MMP

This MMP has been compiled by the Environmental Assessment Practitioner (EAP) based on best practice environmental management requirements. Details of the EAP who prepared the MMP are as follows:

Table 4: Authors of this MMP.

Authors	Qualification	Professional registrations	Years of experience	Relevant expertise
Jeremy Rose	B.Sc. (Hons) Environmental and Geographical Science	Registered E.A.P. 2019/1116 Member of IAIAsa	12+	More than 50 EIAs or EMPrs
Kelly Gilmour	M.Sc. Biological Sciences	Candidate E.A.P 2024/8037 Member of IAIAsa	2	3+ EIAs or EMPrs
Tayla Hobson	M.Sc. Environment, Society and Sustainability	Reg. E.A.P. 2019/1018	3+	20 + EIAs or EMPrs

Jeremy Rose has 12 years' experience in the field of environmental management and impact assessment and has managed multiple EIAs and Basic Assessments in South Africa. He holds an Honours degree in Environmental and Geographical Science and is an Environmental Assessment Practitioner duly registered with the Environmental Assessment Practitioners Association of South Africa. Tayla Hobson is also a Registered EAP, and Kelly Gilmour is a Candidate EAP.

1.12 Legal status

This MMP forms part of, and should be read in conjunction with, the EMPr compiled for the Basic Assessment processes. The MMP is a working document for the maintenance of the depth of the scoured channel and the management of an open estuary mouth, which does not itself require EA since the Basic Assessment process, if granted for the Milnerton Lagoon Dredging project, has assessed the impacts for the post-dredging phase of the project and included a review of all applicable and triggered listed activities.

The MMP may also be defined or adopted by the competent authority in terms of the NEMA EIA Regulations of 2014, as amended. Any other applicable statutory requirement must also be complied with, including any obligations under the National Environmental Management: Integrated Coastal Management Act, 2008 (Act 24 of 2008), as amended (NEM: ICMA).

1.13 Maintenance Management Principles

Effective management maintenance activities reduce their potential impacts. All such activities should be directed by a well-structured MMP, guided by the principles outlined in the DEA&DP's Information Document for the Development of a Maintenance Management Plan (March, 2017). This document highlights the need to assess the level of risk to the receiving environment, identify appropriate mitigation measures, and categorise maintenance activities into four classes (A–D), for which the maintenance of the depth of the scoured channel and the management of an open estuary mouth fall within *Category D: Rehabilitation and restoration activities for maintaining ecological infrastructure*.

1.14 Public Participation

The BAR compiled for the Milnerton Lagoon Dredging project, includes this MMP as an appendix for public review and comment, and has been distributed in terms of Regulation 41 of the EIA Regulations of 2014, as amended, as follows:

- An initial database of potential I&APs was compiled. The database included known adjacent landowners, ward councillors, municipal officials, relevant state departments and organs of state.
- Post, email, and/or telephonic methods were used to reach the adjacent landowners and/or occupiers.
- A notice was placed in a weekly local-circulating newspaper (the *Tabletalk*) on Wednesday, 05 November 2025.
- A1-sized site notices were placed on the site boundaries by the EAP, complying with the relevant regulatory requirements.
- The Draft BAR was made available for download at **www.infinityenv.co.za/public/milnertondredging**.
- A hard copy of the DBAR and its appendices was made available in the Milnerton Public Open Library from Thursday, 06 November 2025.
- Members of the public were also invited to the Public Open House, which took place on 19 November 2025 at the Italian Club of Cape Town (see **Appendix F9** for proof).
- Comments have been accepted via a website form, by email, or via text messaging and addressed in the Public Participation Report (see **Appendix F9** for reference).
- All comments received during the commenting period have been included and addressed under **Appendix F9** of the Final BAR, and submitted to the competent authority for decision-making.

Confirmation and proof of compliance with the PPP requirements is provided under **Appendix F** of the Final BAR, including all supporting documentation and stakeholder engagement records, on submission of the Final BAR for decision-making.

PROJECT ROLES AND STRUCTURE

The general roles to be defined are those of the:

- Authorisation Holder;
- Contractor (Principal Contractor / Project Manager).; and
- Estuarine Specialist / Ecologist.

The specific titles referred to may vary, but the intent of this section is to broadly define expectations and responsibilities for key role players in the implementation of the MMP.

1.15 Authorisation Holder

The **Authorisation Holder** (or its successor in title) will be responsible for the maintenance work. The Authorisation Holder will also ensure, as a signatory to the MMP, that the Contractors fulfil their obligations in terms of this MMP. The Authorisation Holder will adhere to the conditions of this MMP and ensure that all its Contractors, Sub-contractors, employees, suppliers, agents and so forth, for whom it is fully responsible, are aware of this MMP, its requirements and consequences for non-compliance(s) as laid out in **Section 5** below.

The Authorisation Holder is fully responsible for implementing the MMP. The Authorisation Holder will ensure that works on site are conducted in an environmentally responsible manner and in accordance with the requirements of this MMP.

Key responsibilities include ensuring that:

- The Contractor and/or Sub-contractor (or similar) is provided with the necessary information to adequately undertake their responsibilities;
- This MMP is included in the contractual agreements with all Contractors and Sub-contractors;
- Method Statements requested of the Contractor and/or Sub-contractor are provided timeously;
- Corrective action is implemented where required; and
- Appropriate records and information regarding compliance with the MMP requirements are maintained and made available to the Authorisation Holder and/or Competent Authority if requested.

1.16 Contractor

The role of the Contractor is as follows:

- The Contractor shall ensure that all employees, Contractors and Sub-contractors are made aware of the MP and their responsibilities outlined in this document.
- Prior to commencement, the Contractor must meet on site with the Authorisation Holder representative (and/or the Estuarine Specialist / Ecologist who compiled the Estuarine Impact Assessment) to confirm designated development and no-go areas and to confirm the method statements required.
- Liaise with the Authorisation Holder (or representative) and ensure that works on site are conducted in an environmentally sensitive manner in accordance with this MMP.
- Maintain a copy of this MMP and all EAs, management plans and licenses pertinent to the maintenance work on site.
- Ensure that all appointed Contractors and Sub-contractors repair, at their own cost, any environmental damage because of a contravention of the specifications contained in this MMP, to the satisfaction of the Authorisation Holder.
- Ensure that all employees (permanent and temporary) and all Sub-contractors that work on the site for longer than two days, receive environmental awareness training within one week of being on site.

- Designate an Environmental Officer (or employ a designated suitably qualified individual to fulfil the role of an Environmental Officer) to monitor and report on the daily activities on-site during the maintenance work period. The Contractor and individual Sub-contractors may designate Environmental Officers to liaise with the Authorisation Holder (or their representative) on environmental matters.

1.17 Environmental Assessment Practitioner/ Estuarine Specialist/ Ecologist

The EAP/ Estuarine Specialist/ Ecologist is responsible for advising the Contractor, Sub-contractor, and/or Authorisation Holder on the appropriate demarcation of the site for maintenance activities, with particular emphasis on identifying and avoiding sensitive habitats.

This guidance should be obtained during the demarcation phase, prior to the commencement of maintenance activities, and may also be sought on an ad-hoc basis if uncertainties arise during implementation.

It must be noted, however, that the Estuarine Specialist / Ecologist is not formally contracted to provide this service. Guidance will therefore be provided only when time permits and, in most cases, telephonically, to direct the Contractor, Sub-contractor, and/or Authorisation Holder on the appropriate working footprint for the site.

MAINTENANCE MANAGEMENT PLAN

The maintenance work must be conducted in accordance with the provisions outlined below.

1.18 Environmental awareness

Before work is conducted in accordance with this MMP, persons who will be conducting the work must undergo environmental awareness training as outlined in Section 6 of the EMPr and attached to this MMP as **Annexure A**. Attention should be focused on the following areas of sensitivity:

- Beach and sandflat habitat disturbance;
- Soil erosion and sedimentation; and
- Water quality degradation due to siltation and debris.

1.19 General best management practices

The following general management best practices should be implemented where required during the maintenance management activities:

1.19.1 Site boundaries and no-go areas

The Contractor responsible for the post-dredging activities must demarcate the boundaries of the site or area designated for maintenance prior to mouth management and dredged channel depth maintenance. The area demarcated for the maintenance activities should be minimised in extent, as far as possible.

The demarcated maintenance footprint and other sensitive areas to be avoided on site must be undertaken with the guidance of the Authorisation Holder and/or the Estuarine Specialist / Ecologist who compiled the Estuarine Impact Assessment for the project prior to the commencement of any maintenance work on site and must include any dune habitat along the banks of the estuary mouth for avoidance. Access routes to the mouth of the estuary should also be demarcated to ensure avoidance of sensitive dune vegetation. To ensure the public have safe access to public coastal property, in accordance with Section 13 of the ICM Act, designated access points to the beach must be clearly demarcated.

1.19.2 Timing of maintenance works

Mouth management and maintenance of the depth of the scoured channel should be undertaken when sand or sediment accumulates within the lower lagoon (particularly within the 1.12 km lower section of the lagoon, located within Erf 20315, that extends from the lagoon mouth, south-west of Woodbridge Island, to just north of the Wooden Bridge) and near the mouth, restricting tidal flushing. This is most likely to occur during the summer months (dry season) when low flows occur.

1.19.3 Machinery and chemical management

Handling and storage of any pollutants may not take place near or within the lagoon, sea or beach. Instead, machinery must be stored and managed within an area consistent with the area used for the site camp and laydown during the implementation phase of the dredging, and as directed by the Authorisation Holder.

When machinery is used in maintenance works, ensure effective operation of such machinery and equipment with no leaking parts, and refuel at a safe distance from the lagoon and sea to prevent any accidental spillages and pose no threat of pollution.

1.20 Method statements describing proposed maintenance activities

The following sections are Method Statements required of the relevant Contractor and/or Sub-contractor for the types of maintenance activities anticipated to occur in and around the estuary mouth during the maintenance phase of the proposed dredging. It is anticipated that the Authorisation Holder will oversee the works and provide for additional mitigation of specific impacts, should this be required.

1.20.1 Monitoring and inspections of estuary mouth conditions

Description of maintenance activity	Routine monitoring and site inspections of the estuary mouth to confirm whether the estuary mouth is at risk of closure.	
Responsible person(s)	Authorisation holder	
Actions	• Pre-empt potential high-risk mouth closure periods based on desktop analysis of season and weather forecast. For example, mouth closure is more likely under low flow conditions (associated with dry season) and low tide. • Undertake regular visual inspections to ensure that flows out of the lagoon are not blocked by sediment build-up.	
Impacts	Not applicable	
Significance of impacts	Not applicable	Not applicable
Mitigation measures	Not applicable	
Remedial measures	Not applicable	
Time period for maintenance actions	Regular monitoring and identification of potential periods of mouth closure, especially after significant rainfall events to monitor changes in mouth condition and during summer when flows are low. Site inspections should not exceed 2-3 hours.	

1.20.2 Mechanical opening of the estuary mouth

Description of maintenance activity	Mechanical movement of sediment using a bulldozer or excavator to cut a channel connecting the lagoon to the sea.
Responsible person(s)	Authorisation holder
Actions	• Use an excavator or bulldozer to cut a channel in the sand berm at low tide; and • Move sand to the sides of the channel scoured during the implementation phase of the Milnerton Dredging project. Do not place scoured material on the beach.
Impacts	The Estuarine Specialist/ Ecologist assessed the following positive impacts associated with the mouth maintenance activity: • Impacts of proposed dredging on magnitude of the estuarine tidal prism;

<table>
<tr><td></td><td colspan="3">• Impacts of a deeper channel at the mouth on nutrient-enriched fine sediments settlement and flushing ; and
• Impacts of new exposed mudflat intertidal areas resulting from sand replacement.</td></tr>
<tr><td rowspan="2">Significance of impacts</td><td>Impacts of proposed dredging on magnitude of the estuarine tidal prism</td><td>Impacts of a deeper channel at the mouth on nutrient-enriched fine sediments settlement and flushing</td><td>Impacts of new exposed mudflat intertidal areas resulting from sand replacement</td></tr>
<tr><td>Low positive</td><td>Very Low positive</td><td>Very Low positive</td></tr>
<tr><td>Mitigation measures</td><td colspan="3">The impact of the bulldozer or excavator used for maintenance work on any benthic macrofauna and birds is expected to be highly localised and insignificant. Birds are likely to temporarily move away when the bulldozer or excavator is operating, and only a small area of benthic habitat is anticipated to be disturbed when the estuary mouth is reshaped or opened.

This disturbance and limited degradation of ecological and avifaunal habitat will be short-lived and ultimately improve any temporarily disturbed habitat once the maintenance activities are complete. Therefore, the Estuarine Specialist/ Ecologist assessed that there is no feasible mitigation to enhance the direct positive impacts of the mouth maintenance on magnitude of the estuarine tidal prism, nutrient-enriched fine sediments settlement and flushing nor on exposure of mudflat intertidal areas from sand replacement.</td></tr>
<tr><td>Remedial measures</td><td colspan="3">Not applicable</td></tr>
<tr><td>Time period for maintenance actions</td><td colspan="3">The frequency of mouth management and maintenance of the depth of the scoured channel have specifically been left undefined and rather indicated as proposed for implementation only if sand or sediment accumulates within the lower lagoon and near the mouth to the extent that it restricts tidal flushing and is deemed by the City's Coastal Management and Biodiversity Management Branches to be unlikely to be reopen without intervention.</td></tr>
</table>

1.20.3 Monitoring and inspections of the dredged channel conditions

Description of maintenance activity	Routine monitoring and site inspections of the lower lagoon to confirm whether the water quality in the lower lagoon is at risk of increased pollution and odour release due to restricted flushing of the lower lagoon in low flow conditions and consequent accumulation of organic sediment.
Responsible person(s)	Authorisation holder
Actions	• Pre-empt potential high-risk periods based on desktop analysis of season and weather forecast. For example, sediment buildup within

	the lagoon and restricted tidal flushing is more likely under low flow conditions (associated with dry season) and low tide. • Undertake regular visual inspections to ensure that flows out of the lagoon are not blocked by sediment build-up.	
Impacts	Not applicable	
Significance of impacts	Not applicable	Not applicable
Mitigation measures	Not applicable	
Remedial measures	Not applicable	
Time period for maintenance actions	Regular monitoring and identification of potential periods of organic sediment accumulation, especially during summer when flows within the lagoon are low. Site inspections should not exceed 2-3 hours.	

1.20.4 Mechanical opening of the dredged channel conditions

Description of maintenance activity	Mechanical movement of sediment using a bulldozer or excavator to reestablish the depth of the scoured channel (i.e., the channel dredged within the implementation phase of the Milnerton Lagoon Dredging project). The area designated for maintenance of the depth of the scoured channel must be restricted to the 1.12 km lower section of the lagoon, located within Erf 20315, that extends from the lagoon mouth, south-west of Woodbridge Island, to just north of the Wooden Bridge. The channel must be maintained to a depth that is consistent with the channel that was scoured during the implementation phase, i.e., with its bottom at 1 m below land levelling datum (LLD).		
Responsible person(s)	Authorisation holder		
Actions	• Use an excavator or bulldozer to cut the depth of the channel in the sand berm at low tide; and • Move sand to the banks of the scoured channel.		
Impacts	The Estuarine Specialist/ Ecologist assessed the following positive impacts associated with the scoured channel depth maintenance activity: • Impacts of proposed dredging on magnitude of the estuarine tidal prism; • Impacts of a deeper channel at the mouth on nutrient-enriched fine sediments settlement and flushing ; and • Impacts of new exposed mudflat intertidal areas resulting from sand replacement.		
Significance of impacts	**Impacts of proposed dredging on**	**Impacts of a deeper channel at the mouth on**	**Impacts of new exposed mudflat intertidal areas**

	magnitude of the estuarine tidal prism	**nutrient-enriched fine sediments settlement and flushing**	**resulting from sand replacement**
	Low positive	Very Low positive	Very Low positive
Mitigation measures	The impact of the bulldozer or excavator used for maintenance work on any benthic macrofauna and birds is expected to be highly localised and insignificant. Birds are likely to temporarily move away when the bulldozer or excavator is operating, and only a small area of benthic habitat is anticipated to be disturbed when the scoured channel depth is reestablished. This disturbance and limited degradation of ecological and avifaunal habitat will be short-lived and ultimately improve any temporarily disturbed habitat once the maintenance activities are complete. Therefore, the Estuarine Specialist/ Ecologist assessed that there is no feasible mitigation to enhance the direct positive impacts of the scoured depth maintenance on magnitude of the estuarine tidal prism, nutrient-enriched fine sediments settlement and flushing nor on exposure of mudflat intertidal areas from sand replacement.		
Remedial measures	Not applicable		
Time period for maintenance actions	Maintenance of the scoured channel depth should occur whenever the sedimentation restricts tidal flushing and the flow of lower lagoon.		

TOLERANCE FOR NON-COMPLIANCE

The MMP is a legally binding document. Non-compliance with the MMP will result in disciplinary action being taken against the perpetrator/s. Such action may take the form of (but is not limited to) financial penalties, legal action, fines, stop work and rehabilitation at own cost, and/or dismissal.

A variety of legislation dictates behaviour/action associated with environmental management and identifies suitable action in the event of non-compliance. That which is to be considered in the event of non-compliance or contravention of the MMP includes:

- The NEMA (particular section 28 of NEMA regarding the '*duty of care*' principle);
- NEM:ICMA;
- The National Water Act, 1998 (Act No. 36 of 1998), as amended; and
- The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended.

The Contractor and/or Sub-contractor will be deemed to have not complied with the MMP if:

- Within the boundaries of the site there is evidence of contravention of the MMP and its associated and approved Method Statements;
- Environmental damage ensues due to negligence.
- The Contractor fails to comply with corrective or other instructions issued by the Authorisation Holder or DEA&DP (where relevant) within a specified time.
- The Contractor fails to respond adequately to complaints from the public.

The disciplinary action shall be determined according to the nature of the non-compliance or crime, and exact penalties determined by the Authorisation Holder.

If the Contractor is being prosecuted by the DEA&DP or other organ of state in terms of the NEMA or similar act, then the courts will apply penalties in terms of such legislation, taking into account the severity of the incident.

CONCLUSION

The recommendations and mitigation measures outlined in this MMP have been developed to manage the potential environmental impacts of the maintenance activities concerning the lower Milnerton Lagoon dredged channel depth and estuary mouth. Specialist assessment(s) indicate that the impact of the maintenance activities to be conducted during the post-dredging phase is of low-very low positive significance.

By ensuring that Contractors and all parties involved in implementation of the maintenance activities understand and apply the provisions of this MMP, the project can achieve environmental best practice, ensuring that the ongoing maintenance of both the mouth and the depth of the scoured channel support sustainable outcomes for continued hydrodynamic function within the lower lagoon and associated benefit of tidal flushing over time.

This report has been prepared to meet and support the requirements for MMP approval. The DEA&DP, as the competent authority, is requested to review this document and issue a decision on the adoption of this MMP.

BIBLIOGRAPHY

City of Cape Town & Infinity Environmental. (2022). *Diep River Estuarine Management Plan*. City of Cape Town & Infinity Environmental.

Rose, J., Day, L., Basson, G., Clark, B. M., & Winter, K. (2023). *Water Quality Remediation Plan for the Milnerton Lagoon* (No. 19041/1). Infinity Environmental, Liz Day Consulting, Anchor Environmental Consultants, ASP Tech and the University of Cape Town.

ANNEXURE A: ENVIRONMENTAL AWARENESS TRAINING PLAN

ANNEXURE A: ENVIRONMENTAL AWARENESS TRAINING PLAN

This section outlines the training by which the authorisation holder (via its appointed Contractor during the implementation phase) will inform its employees of environmental risks and the manner in which risks must be dealt with to avoid pollution or degradation of the environment during the maintenance phase of the dredging project. It may be adapted as needed to suit the circumstances in which it is implemented.

Course	Required attendees	Presented by	Course content	Timing	Records to be kept
Implementation phase Environmental Awareness Training for manager	• Project Manager appointed by the authorisation holder; • Principal contractor's contract manager, site agents, and assistant site agents (as applicable); and • Contractor's designated environmental officer or Safety, Health and Environment (SHE) representative.	ECO	• Overview of EAs and permits granted; • Basic environmental law; • Roles of the ECO (if appointed), authorisation holder, project manager, and Contractor; • Purpose and content of method statements; • Site sensitivities, including locations and sensitivity of wetland areas and conservation area; • Management actions and measures for the construction phase as detailed in this EMPr; • Record keeping requirements; • Emergency procedures; and • Reporting and compliance monitoring.	Prior to commencement of construction.	• Declaration of adherence to Implementation phase EMPr, signed by Contractor's representative; and • Register of attendance.
Environmental Awareness Training for site personnel	• All site staff and personnel, including temporary staff and visitors to site; and • Maximum of 20 attendees at any one session.	Contractor's designated environmental officer	Environmental do's and don'ts, including: • Access to work areas, location and identification of no-go areas; • Estuarine species and environment; • Damage to or picking of vegetation; • Managing animals found on site; • Smoking and fires;	Before any staff member begins work on site.	• Register of attendance, identifying all attendees by name and ID number, the topics covered, the presenter, and the date and time.

Course	Required attendees	Presented by	Course content	Timing	Records to be kept
			• Storing and handling fuels and oils; • Storing and handling chemicals; • Management of cement, cement bags, slurry, and wash water; • Dust and noise; • Water wastage; • Waste management and litter; • Waste site management; • Ablution facilities; • Plant and machinery maintenance and load management; and • Accident and incident reporting.		

ANNEXURE B: CURRICULUM VITAE

Infinity Environmental

JEREMY ROSE

Environmental Assessment Practitioner | Environmental Scientist

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Professional bodies
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SACNASP
IAIAsa

Professional Reg. No.
Reg. E.A.P. 2019/1116
Pr.Sci.Nat. 120148
IAIAsa 5781

Years' experience
Eleven

Education and Certifications
- B.Sc. Hons Environmental and Geographical Science
- B.Sc. Environmental and Geographical Science & Biochemistry
- Remote Pilot

Date of Birth
7 December 1991

Nationality
South African

Languages
English
Afrikaans
isiXhosa

Environmental scientist, stakeholder engagement and policy professional. Experienced in leading and participating in multi-disciplinary specialist teams for resource management, policy development, and strategic planning projects in both public and private sectors.

One of Infinity's two principals, responsible for project management and business development, including consulting services associated with:

- Advising public and private-sector clients on environmental feasibility, legislation, and risks
- Managing Environmental Impact Assessment (EIA) and Basic Assessment processes for environmental authorisation
- Development of environmental policy and strategic and spatial planning instruments
- Geographic information systems (GIS), including spatial data management, digitisation and analysis, and production of static and web-based drawings and maps
- Planning for construction- and operation-phase environmental management, including preparation of site-specific environmental management programmes (EMPr)
- Management of permitting and licensing processes for air emissions, water uses, waste management, and mining
- Monitoring and auditing of environmental compliance as an Environmental Control Officer (ECO) or independent auditor
- Management of multidisciplinary teams for complex remediation and rehabilitation projects
- Lifecycle environmental compliance, including the management of decommissioning and contaminated land processes
- Public participation and stakeholder engagement, including planning and facilitation of consultation
- Drone-based aerial imaging and data capturing as a certified and licensed remote pilot.

SELECTED PROJECT EXPERIENCE	DATE	CLIENT
INTEGRATED ENVIRONMENTAL MANAGEMENT		
Water Use Licence applications for coastal groundwater use for dune rehabilitation at Table View	2023	CCT
Environmental impact assessment and stakeholder engagement process for redevelopment of the Strand Street Quarry national heritage site	2023-2025	CCT
Basic Assessment for a new operations centre for Biodiversity Management at the Westlake Conservation Centre	2025	CCT
Basic Assessment for the expansion of the Kuils River Cemetery	2024	CCT
Basic Assessment for the expansion of the Rusthof Cemetery, Strand	2024	CCT
Basic Assessment for the proposed Vaalfontein Cemetery	2024-2025	CCT
Basic Assessment for the proposed Tafelsig Cemetery	2024-2025	CCT
Section 24G Application for unlawful vegetation clearing in Scarborough Cape Town	2025	Private
Water Use Licence applications for coastal groundwater use for dune rehabilitation at Fish Hoek	2023	CCT
Water Use Licence applications for coastal groundwater use for dune rehabilitation at Fleur Park	2023	CCT
Renewal of the atmospheric emissions licence for the Cape Town International Airport	2025	Airports Company South Africa
Basic Assessment for the realignment of Protea Road in Klapmuts	2025	Heineken
Basic Assessment for the upgrading of the N1 / R44 interchange in Klapmuts	2025	Heineken
Basic Assessment for the modification of the Zeekoevlei Weir in the False Bay Nature Reserve	2024	City of Cape Town
Basic Assessment for a proposed residential development in Bishopscourt	2022-present	Private
Basic Assessment for a proposed residential development and river rehabilitation in Bellville	2023-present	City of Cape Town
Basic Assessment for proposed infrastructure upgrades on Porter Estate	2023-present	WCG
Basic Assessment for proposed dredging remediation of the Zeekoevlei	2023	City of Cape Town
Basic Assessment for the upgrading of the M3 highway in Cape Town	2021-2023	City of Cape Town
Basic Assessment and amendments of a water use licence and environmental authorisation for an industrial facility in Springs, Ekurhuleni	2021-2022	Distell
Basic Assessment for a new bulk sewer in Montague Gardens, Cape Town	2021-22	City of Cape Town
Section 24G application to rectify historical unlawful cultivation and construction of dams on a farm in the Western Cape	2021	Private

SELECTED PROJECT EXPERIENCE	DATE	CLIENT
Basic Assessment for a proposed high-density social housing and mixed-use development in Salt River, Cape Town	2020-2021	City of Cape Town
Basic Assessment for the proposed expansion of an industrial development	2020-21	Bowler Plastics
Basic Assessment for the proposed expansion of a municipal cemetery in Struisbaai	2020-21	Cape Agulhas Municipality
Basic Assessment for the proposed expansion of a municipal resort in Struisbaai	2020-21	Cape Agulhas Municipality
Scoping and EIA for an urban development framework on the 500-ha Swartklip site, Khayelitsha, Cape Town	2020-present	Airports Company SA
Water Use Licence Application for a pharmaceutical production facility in Atlantis, Cape Town	2019-20	Canopy Growth
Basic Assessment for in-fill housing developments in Bonteheuwel	2018-19	City of Cape Town
Scoping and environmental impact assessment for a 200-hectare agro-industrial and mixed-use development in Klapmuts North	2017-18	Distell
Environmental Impact Assessments (Basic Assessments) for two proposed Integrated Rapid Transit Phase 2A West Trunk Routes in Cape Town	2016	City of Cape Town/SMEC
Environmental Impact Assessment (Basic Assessment) for a proposed filling station in Bellville, Cape Town	2016	City of Cape Town
Environmental Impact Assessment and Water Use Authorisation for the proposed upgrading of the Elizabeth Park and Elsieskraal River, Bellville	2016	City of Cape Town
Amendment to the Environmental Authorisation for a fishmeal processing plant in Saldanha Bay	2014	Sea Harvest
Environmental assessment of proposed maintenance dredging within the Mitchell Channel log handling facility on the Fraser River, Vancouver, Canada	2015	Fraser River Pile & Dredge
Environmental Impact Assessment for the proposed extension of the Vygekraal Cemetery in Rylands, Cape Town	2014	Private
Basic Assessment and Atmospheric Emissions Licence application for the proposed additional jet fuel tank, Cape Town International Airport	2013-14	Airports Company SA
ESTUARINE MANAGEMENT AND WATER QUALITY REMEDIATION		
Remediation Planning for the Milnerton Lagoon, including hydrodynamic modelling and ecological assessments of dredging options	2023	City of Cape Town
Rehabilitation Plan for the Theo Marais Canal in Montague Gardens	2025	City of Cape Town
Remediation Planning for the Zandvlei recreational waterbody, including hydrodynamic modelling and ecological assessments of dredging options	2022	City of Cape Town
Remediation Planning for the Rietvlei recreational waterbody, including hydrodynamic modelling and ecological assessments of dredging options	2022	City of Cape Town
Review of the Zandvlei Estuarine Management Plan and Situation Assessment	2022-2023	City of Cape Town
Management options advisory for the Lourens River Protected Natural Environment	2021	City of Cape Town

SELECTED PROJECT EXPERIENCE	DATE	CLIENT
Review of the Diep River Estuarine Management Plan	2021	City of Cape Town
Rehabilitation Plan for sewage spill events in the False Bay Nature Reserve	2022	City of Cape Town
Field sampling programme for marine water quality monitoring following a pollution incident in Howe Sound estuary, Canada. Preparation of a long-term Ecological Receptor Monitoring Plan for the estuary.	2016	Private
ENVIRONMENTAL AND WATER QUALITY MONITORING		
Pollution monitoring in the Milnerton Lagoon in response to sewage spill events	2024-2025	City of Cape Town
Real-time monitoring of oxygen levels in the Milnerton Lagoon for tracking of aeration success	2024	City of Cape Town
Development of a Receiving Environment Monitoring Programme for the marine sewage outfalls at Green Point, Camps Bay, and Hout Bay	2024	City of Cape Town
Implementation of coastal and nearshore water quality and environmental monitoring for the coastal outfalls and wastewater treatment works in Cape Town	2024-2025	City of Cape Town
Pollution tracking and water quality assessment for the Diep River and Potsdam WWTW for a remediation plan for the Milnerton Lagoon	2022-2023	City of Cape Town
CONSERVATION PLANNING AND INVASIVE SPECIES		
Conservation Development Framework for the Macassar Conservation Area	2025	CCT
Report on the condition, importance, and threats to wetlands in Cape Town, with a focus on seasonal wetlands	2024-2025	CCT
Preparation of a Municipal Invasive Species Monitoring, Control and Eradication Plan for the Bergrivier Local Municipality	2019	Bergrivier Municipality
Development of a Conservation Area Management Plan including rehabilitation planning, fire management planning, and invasive species management for a 200-ha property in Klapmuts	2019-2020	Distell
Preparation of a Municipal Invasive Species Monitoring, Control and Eradication Plan for the Garden Route District Municipality	2019	Garden Route District Municipality
Preparation of an Invasive Species Control Plan in terms of the NEMBA AIS Regulations for a private landowner, Hoekwil	2017	Private
Monitoring of implementation of a control plan for the invasive alien Japanese knotweed along a river corridor in West Vancouver, Canada	2015	Private
Environmental offset rehabilitation planning for a residential development on Glenlyon Creek in North Vancouver, Canada	2015	Private
Implementation of the invasive alien Guttural Toad eradication project in Cape Town	2013	City of Cape Town

STRATEGIC AND POLICY PROJECTS

Sustainability assessment of the coastal dune rehabilitation projects at Hout Bay, Table View, Fish Hoek, Gordons Bay, and Glencairn in Cape Town	2024-2025	City of Cape Town (CCT)
Facilitation of an international expert workshop to assess the causes and contributors of aggression in Cape Fur Seals and the implications and management of the rabies outbreak	2024	CCT
Environmental aspects of a policy for small-scale wind generation in the City of Cape Town	2022	CCT
Heritage and stakeholder engagement for the Langa Living Streets public places programme	2025	CCT
Geographic information systems services and mapping for a risk and wildfire plan for the Robben Island World Heritage Site	2023	Western Cape Government
Environmental feasibility assessment for the Potsdam Sustainability Campus in Killarney Gardens, Cape Town	2022	CCT
Heritage study of the Philippi, Nyanga East and Crossroads area in Cape Town	2021	CCT
Heritage study of the Bellville CBD in Cape Town	2021	CCT
Environmental feasibility and project management for a housing programme in the Philippi Opportunity Area in Cape Town	2021	CCT
Environmental and stakeholder engagement component of a masterplan for the Foreshore precinct in Cape Town	2021	CCT
Environmental aspects of a local area spatial development framework for the Adam Tas Corridor in Stellenbosch	2021	Stellenbosch Municipality
Environmental and GIS component of a precinct plan for the Robertson-Nkqubela precinct	2020	Langeberg Municipality
Development of a GIS-based online web mapping tool for the display of risk and disaster management data for the Witzenberg Municipality	2020	Santam / Vulcan Wildfire
Environmental and GIS component of the review of the Witzenberg Spatial Development Framework, 2019-2024	2019	Witzenberg Municipality
Environmental component of the Stellenbosch Municipal Spatial Development Framework, 2018-2023	2018	Stellenbosch Municipality
Environmental, GIS and stakeholder engagement components of the Paarl CBD Local Spatial Development Framework	2017	Drakenstein Municipality
Environmental and GIS components of the Cape Agulhas Municipality Spatial Development Framework 2017-2022.	2017	Cape Agulhas Municipality
Environmental status quo investigation for the draft Urban Design Framework for Masiphumelele	2016	CCT / AECOM
Environmental feasibility assessments of 31 sites for human settlements masterplanning and land disposal	2013-2014	WCG / AECOM
Environmental Feasibility for housing developments in Sir Lowry's Pass Village	2013-2014	CCT / AECOM

ENVIRONMENTAL MANAGEMENT, MONITORING AND AUDITING

Environmental Control Officer services for a new warehouse and distribution centre in Stikland Industria	2025	Zenprop
Environmental Control Officer services for a new warehouse and distribution centre in Stikland Industria	2025	Zenprop
Environmental Control Officer services for the replacement of a scour chamber on the bulk water pipeline at Meerlust	2025	City of Cape Town
Environmental Control Officer services for the new sludge handling facility at the Wildevoelvlei wastewater treatment works, Cape Town	2025	City of Cape Town
Environmental Control Officer services for the rehabilitation of Jakes Gerwel Drive in Cape Town	2021	City of Cape Town
Environmental Control Officer services for an industrial development in Philippi	2021	Bowler Plastics
Independent environmental compliance audit of construction and operation of the Touwsrivier CPV 1 Concentrated Photovoltaic solar plant	2020	CPV 1
ECO services for the construction of a new parking area at the University of Cape Town	2020	University of Cape Town
ECO services for the construction of a pedestrian bridge over the N2 at De Beers Ave, Somerset West	2019-2021	Western Cape Government
ECO services for sewerage infrastructure upgrades in Gordon's Bay, Cape Town	2018-present	City of Cape Town / Delta
ECO services for infrastructure developments for the new administration building, Kirstenbosch National Botanical Garden	2018-present	SANBI/Aurecon
ECO services for the upgrading of Sir Lowry's Pass Road and Old Sir Lowry's Pass Road, Cape Town	2017-present	City of Cape Town / SMEC
ECO services for the replacement of culverts beneath the R44 near Somerset West	2016	Western Cape Government
ECO services for the upgrade of the N1 between Plattekloof and R300	2016-2017	Western Cape Government
ECO services for upgrades to the water distribution system at Klawer Valley, Simonstown, Cape Town	2016-2017	Department of Public Works
Environmental construction monitoring for the widening of the Braid Street Bridge over the Fraser River, Burnaby, BC, Canada	2015-2016	Metro Vancouver
Environmental construction monitoring for the construction of the Glenlyon Business Park, Burnaby, BC, Canada	2015-2016	Private developer
Environmental construction monitoring for the construction of the New Haven commercial development, Burnaby, BC, Canada	2015-2016	Private developer
Environmental construction monitoring for the construction of the RedBrick residential development, Burnaby, BC, Canada	2015-2016	Private developer
Environmental construction monitoring for the construction of the Philip Avenue road-over-rail overpass, North Vancouver, Canada	2015-2016	District of North Vancouver
Environmental construction monitoring for the soil contamination remediation works and construction of a quay at Lonsdale Quay, North Vancouver, Canada	2015-2016	City of North Vancouver
Environmental construction monitoring for road widening at 160th Street, Surrey, Canada.	2016	City of Surrey

ENVIRONMENTAL MANAGEMENT, MONITORING AND AUDITING (*cont.*)

Environmental construction monitoring for upgrades to various culverts, drainage channels, and stormwater infrastructure in Surrey, Canada.	2015-2016	City of Surrey
ECO services for the upgrading of the Stellenbosch Arterial Road, Cape Town	2014	Western Cape Government
ECO services for emergency works on the Franschhoek Pass	2014	Western Cape Government
ECO services for the upgrade of Philippi Rail Station	2014	PRASA
ECO services for the construction of a Shared Services Office Building in Khayelitsha, for the Western Cape Department of Transport and Public Works and the Western Cape Department of Health.	2014	Western Cape Government
Environmental monitoring for various private residential developments in Squamish, Coquitlam, and Burnaby, Canada.	2015-2016	Private
ECO services for the construction of the Southbreak / Dune Crest residential developments in Muizenberg	2013-2017	Private
ECO services for the construction of the Joe Slovo Phase 3 housing development in Langa	2013-2014	City of Cape Town
ECO services for the construction of the Nuutgevonden residential development in Stellenbosch	2014	Private