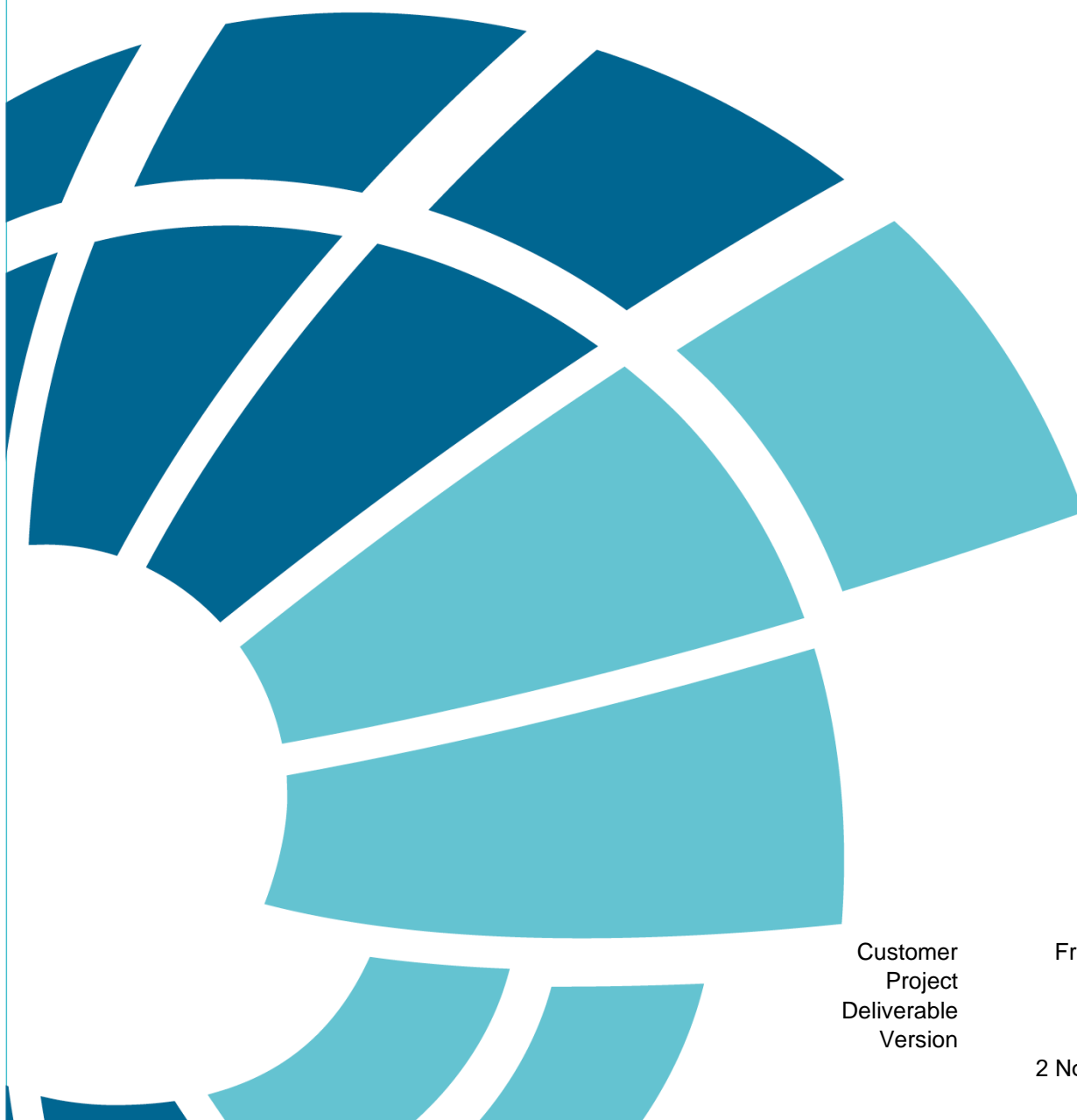


# Inner Harbour Maintenance Dredging

Environmental Management Plan



Customer  
Project  
Deliverable  
Version

Fremantle Ports  
A11513  
R-11513-6  
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2 November 2022

## Document Control

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Author	B Coelho
Reviewed By	R De Roach, S Scott
Project Manager	S Scott

### Amendment Record

The Amendment Record below records the history and issue status of this document.

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## Acronyms

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Acronym	
BCH	Benthic Communities and Habitats
DEMP	Dredging Environmental Management Plan
DWER	Department of Water and Environmental Regulation
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EQO	Environmental Quality Objective
ERD	Environmental Review Document
ha	Hectare
TSS	Total Suspended Solids
WA	Western Australia
ZoHI	Zone of High Impact
ZoI	Zone of Influence
ZoMI	Zone of Moderate Impact

## Executive Summary

Project name	Inner Harbour Maintenance Dredging
Proponent name	Fremantle Ports
Purpose of the Plan	This DEMP outlines the approach to monitoring and/or management of potential environmental impacts associated with the implementation of the Project on EPA's environmental factors. The potential environmental impacts requiring monitoring and/or management were identified in the Project's Environmental Review Document (BMT 2022a). Following the implementation of this DEMP it is expected that the EPA's objectives for environmental factors will be met.
Environmental factors	<p>The following key environmental factors that may be affected by potential environmental impacts associated with the Project have been assigned outcome-based conditions:</p> <ul style="list-style-type: none"> <li>marine environmental quality</li> <li>benthic communities and habitats</li> <li>social surroundings.</li> </ul> <p>In addition, the following 'other factors' have outcome based provisions (monitoring and management actions and targets) assigned to provide further mitigation against impacts</p> <ul style="list-style-type: none"> <li>marine fauna</li> </ul>
Project commencement timing	The scheduled timing for Project commencement is in April 2023 over 10 days to remove 60,000 m <sup>3</sup> initially and additional 5,000 m <sup>3</sup> per year until 2027.
Plan required prior to Project commencement	Yes. The DEMP includes monitoring that is required prior to Project commencement.

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## 1 Context, Scope and Rationale

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BMT was commissioned by Fremantle Ports to assist in environmental approvals and provide technical support to enable their Inner Harbour maintenance dredging program (hereafter; Project) to proceed in accordance with State (Western Australian Environmental Protection Authority – WA EPA) and Federal (Commonwealth Department of Climate Change, Energy, the Environment and Water - CDCCEEW) regulatory requirements.

Fremantle Ports plan to carry out an initial maintenance dredging campaign in April 2023. An estimated volume of 60,000 m<sup>3</sup> will be required to be dredged in order to restore the Inner Harbour to its design depth. Over the subsequent four years, a further volume of 5,000 m<sup>3</sup> is planned to be removed per year. The designated disposal site, within the anchorage area west of Gage Roads, is the same site used and approved for disposal during the 2009-2011 Inner Harbour capital dredging campaign. Approximately 3.1 million cubic metres of limestone and sand was dredged to allow deeper (14-metre) draft ships and provide material for land reclamation at Rous Head.

### 1.1 Purpose of this document

This Dredging Environmental Management Plan (DEMP) provides details on the monitoring and management of potential environmental impacts on the relevant environmental factors (key and other environmental factors) associated with the implementation of the Project. The key and other environmental factors are:

- Marine environmental quality (key environmental factor)
- Benthic communities and habitats (key environmental factor)
- Social surroundings (key environmental factor)
- Marine fauna (other environmental factor)

This DEMP has been prepared in accordance with EPA (2021a, b, c, d). The potential environmental impacts requiring monitoring and management in this DEMP were identified in the Project's Environmental Review Document (ERD; BMT 2022a). Following the implementation of this DEMP, it is expected that the Western Australia (WA) Environmental Protection Authority (EPA) objectives for the relevant environmental factors will be met.

### 1.2 Proponent details

Relevant Fremantle Ports proponent details for this Proposal are provided in Table 1.1.

Table 1.1 Proponent details for the Inner Harbour Maintenance Dredging Project

Detail	Proponent
<b>Proponent name:</b>	Fremantle Ports
<b>Proponent address:</b>	1 Cliff Street, Fremantle WA 6160
<b>Australian Business Number:</b>	78 187 229 472
<b>Key contact name:</b>	Melissa Manns
<b>Key contact details:</b>	Phone: 0439 698 715 Email: melissa.manns@fremantleports.com.au

### 1.3 Project description

#### 1.3.1 Dredging and disposal

Recent hydrographic surveys of the seabed show approximately 60,000 m<sup>3</sup> of material has accumulated within the Inner Harbour since the capital dredging in 2010. The Port currently uses a sweep bar to maintain water depths within the Inner Harbour and material is redistributed to deeper areas of seabed. The Port is proposing to complete small-scale maintenance dredging campaigns over the next 5 years to remove larger volumes of material accreted since 2010, 60,000 m<sup>3</sup> in the first year and future accretion of 5,000 m<sup>3</sup> a year for four years based on known sedimentation rates in the Inner Harbour. It is proposed material from the Inner Harbour will be disposed at the historical Gage Roads offshore disposal area located southwest of the Deep-Water Channel and utilised in the 2010 capital dredging campaign (hereafter; Disposal Area).

A summary of the Project is provided in Table 1.2 and the key elements of the Project are provided in Table 1.3.

Table 1.2 Summary of the Inner Harbour Maintenance Dredging Project

<b>Project title</b>	Inner Harbour Maintenance Dredging
<b>Proponent name</b>	Fremantle Ports
<b>Short description</b>	The maintenance dredging project intends to remove accumulated sediment from the Swan River deposited within the Inner Harbour and the Entrance Channel (since capital dredging in 2010) to ensure the navigational safety standards are met. An initial volume of 60,000 m <sup>3</sup> is expected to be dredged in April 2023, with a further volume of 5,000 m <sup>3</sup> dredged each year until 2027.

Table 1.3 Key elements of the Inner Harbour Maintenance Dredging Project

Element	Location	Proposed extent
<b>Physical elements</b>		
Not applicable	Not applicable	There are no new physical elements associated with the Proposal
<b>Construction elements</b>		
Dredging	Inner Harbour (Figure 1.1)	Removal of 60,000 m <sup>3</sup> of sediment in order to restore the Inner Harbour to its design depth of -14.7 metres Chart Datum (CD), and a further 5,000 m <sup>3</sup> /year to be removed over the subsequent years.



Element	Location	Proposed extent
Disposal	Gage Roads offshore disposal area (Figure 1.1)	Disposal of 60,000 m <sup>3</sup> of sediment within the anchorage area west of Gage Roads. It is noted that the disposal locations designated for this dredging campaign is the deep area from -18 to -22 metres deep within the offshore Gage Roads disposal area.
Operational elements		
Not applicable	Not applicable	There are no operational elements associated with the Proposal



Figure 1.1 Dredging plan within the Inner Harbour (yellow polygon) and disposal plan west of Gage Roads (red rectangular).

## 1.4 Condition requirements

This DEMP may be used to support the Project's sea dumping permit application to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

## 1.5 Relevant environmental factors

An assessment of potential environmental factors against the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2021a) was provided in the Project's ERD (BMT 2021) to identify the environmental factors that are relevant to the Project. Based on the assessment of the potential environmental impacts, the following key and other environmental factors were identified as requiring monitoring and/or management and are applicable to this DEMP:

- marine environmental quality (key environmental factor)
- benthic communities and habitats (key environmental factor)
- social surroundings (key environmental factor)
- marine fauna (other environmental factor)

The relevant environmental factors, associated objectives, site-specific environmental values and potential environmental impacts relevant to this DEMP are summarised in Table 1.4.

**Table 1.4 Environmental factors, objectives and potential environmental impacts relevant to the Inner Harbour Maintenance Dredging Environmental Management Plan**

Environmental factor	EPA Objective	Proposed activities affecting the environmental factor	Potential environmental impacts to the environmental factor
Marine environmental quality	To maintain the quality of water, sediment and biota so that environmental values are protected	The dredging and disposal activities associated with the Project have the potential to modify water quality from increased water column turbidity and release of potential contaminants	Increased water column turbidity and potential contaminants
Benthic communities and habitats	To protect benthic communities and habitats (BCH) so that biological diversity and ecological integrity are maintained	The dredging and disposal activities associated with the Project have the potential to result in direct and indirect impacts to benthic communities and habitats occurring in the vicinity of the Project area	Direct loss Indirect loss
Social surroundings	To protect social surroundings from significant harm	The dredging and disposal activities associated with the Project has the potential to reduce aesthetic and amenity values in the local area.	Reduced public amenity Navigational hazards Odour generation

Environmental factor	EPA Objective	Proposed activities affecting the environmental factor	Potential environmental impacts to the environmental factor
Marine fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained	The operation of the dredge and associated support vessels poses a potential risk of marine mammal collision	Marine mammal collision
		The mobilisation of the dredge and associated support vessels to the Project area poses a potential risk of the introduction of marine species	Introduction of invasive marine species

## 1.6 Rationale and approach

This section provides the Proponent's rationale and approach for the development of this DEMP. This DEMP has been prepared based on the potential impacts identified in the Inner Harbour Maintenance Dredging ERD (BMT 2022a) and outlines the environmental management actions and any associated monitoring and reporting to be implemented during the marine dredging and disposal works associated with the Project. For factor-specific descriptions of environmental impact assessment findings and associated assumptions/uncertainties, refer to BMT (2022a).

### 1.6.1 Key assumptions and uncertainties

This DEMP has been informed by findings of field surveys, hydrodynamic modelling, and environmental impact assessments.

In accordance with EPA's Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals (EPA 2021b), impact zones have been conservatively established to determine the potential extent and significance of direct and indirect impacts to BCH as a consequence of the dredging and disposal activities (BMT 2022a), based on predictive modelling of the dredge / disposal turbid plume intensity, extent and duration (BMT 2022b) and the tolerances of benthic primary producers (EPA 2021b). The established impact zones are presented in Table 1.5 and depicted in Figure 1.2 for the disposal area and Figure 1.3 for the dredging area.

**Table 1.5 Impact zones, definitions, and boundary thresholds**

Impact zone	Definition	Boundary threshold
Zone of High Impact (ZoHI)	The area where impacts on BCH are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'. Areas within and immediately adjacent to proposed dredge and disposal sites are typically within the ZoHI.	<ul style="list-style-type: none"> <li>Boundary of the dredging area within the Inner Harbour entrance channel, where the target depth is 14.7 metres chart datum.</li> <li>Boundary of the disposal area where modelled sedimentation &gt;0.1 m.</li> </ul>

Impact zone	Definition	Boundary threshold
Zone of Moderate Impact (ZoMI)	The area within which predicted impacts on BCH are recoverable within a period of five years following completion of the dredging and disposal activities. The ZoMI abuts and lies immediately outside of the ZoHI.	<b>Environmental Protection Outcome</b> <ul style="list-style-type: none"> <li>The area where the modelled 95<sup>th</sup> percentile of the TSS concentration is &gt;10 mg/L .</li> <li>At the Gage Roads offshore disposal area, the ZoMI has a 100 m buffer zone surrounding the ZoHI at the east and the west.</li> <li>At the Inner Harbour, the ZoMI has a 100 m buffer zone surrounding the ZoHI at the west of the river mouth.</li> </ul>
Zone of Influence (Zol)	The area within which changes in environmental quality associated with turbid plumes are predicted and anticipated during dredging and disposal activities, but where these changes would not result in a measurable impact on BCH.	<ul style="list-style-type: none"> <li>The area where the modelled 95<sup>th</sup> percentile of the TSS concentration was 2 to 10 mg/L.</li> </ul>



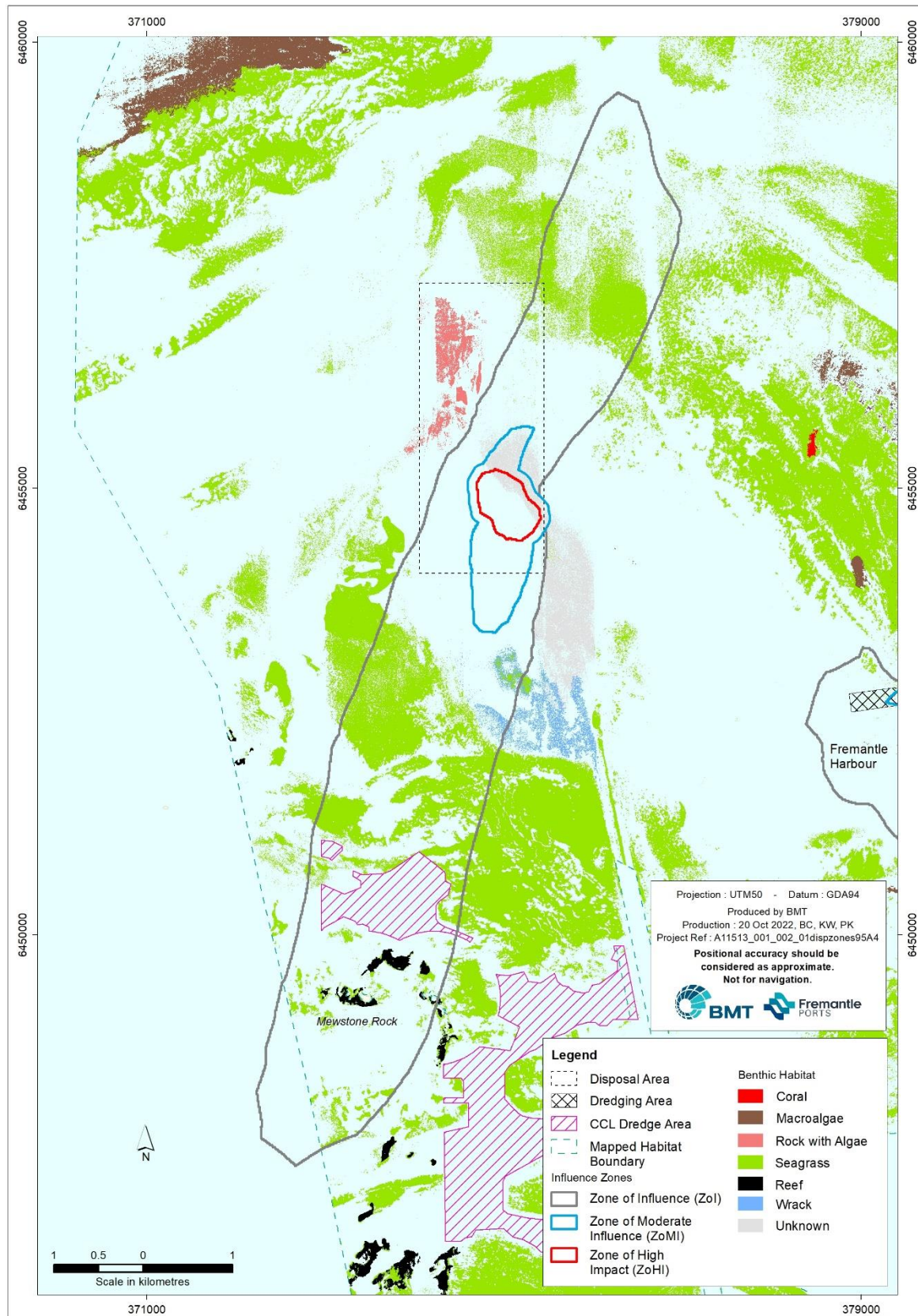


Figure 1.2 ZoHi, ZoMi and Zol defined for the Gage Roads offshore disposal area

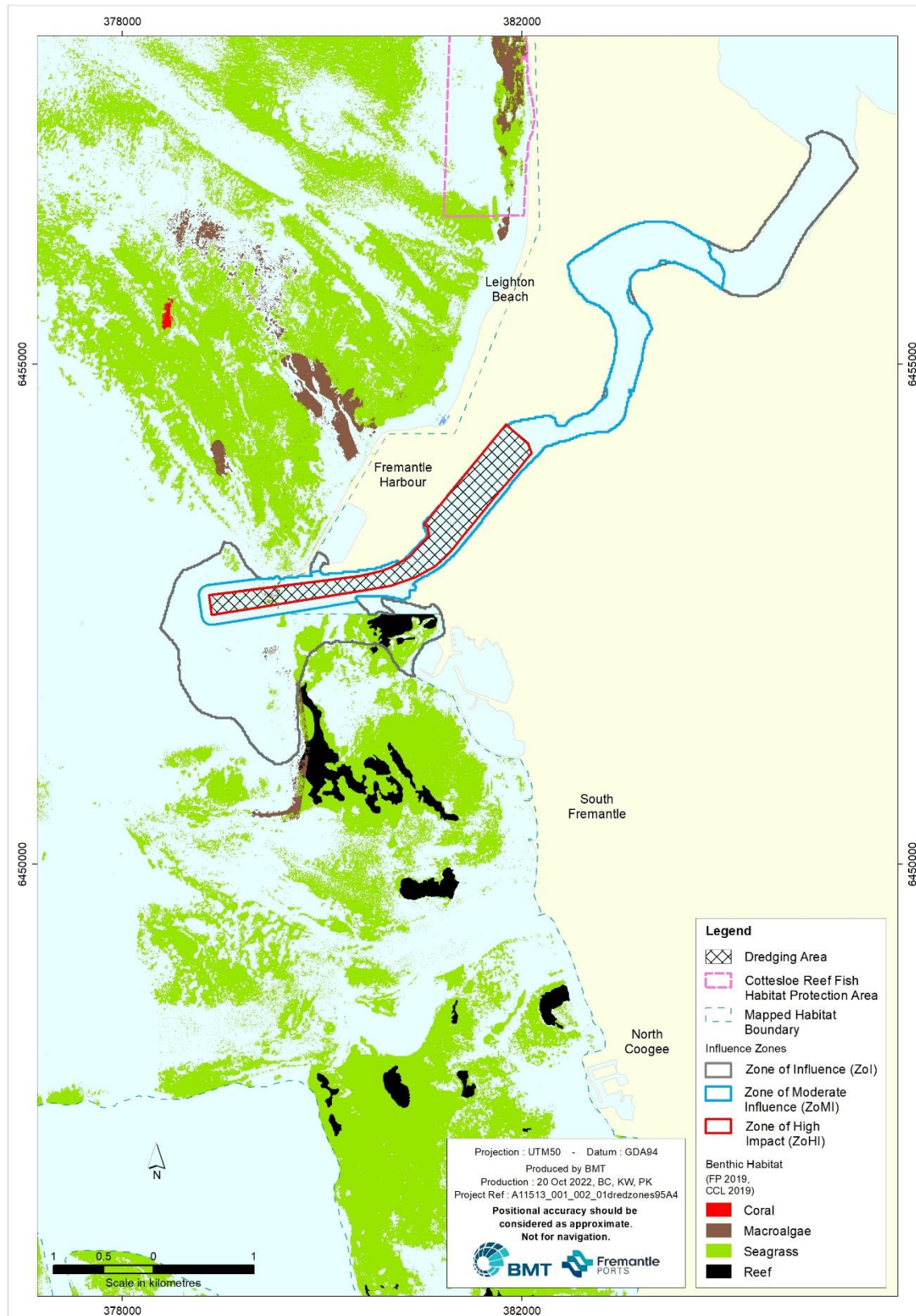


Figure 1.3 ZoHI, ZoMI and ZoI defined for the dredging area



The Proponent considers that this DEMP is based on the best available information. The adaptive management process adopted by this DEMP allows for management actions and monitoring to be revised if new information becomes available.

### 1.6.2 Monitoring and management approach

The Inner Harbour Maintenance Dredging ERD (BMT 2022a) and this DEMP were developed via a risk-based approach and apply the mitigation hierarchy – avoid, minimise, management and monitoring – to ensure that environmental factors are protected.

### 1.6.3 Rationale for provisions

This DEMP has been prepared in accordance with EPA (2021b) instructions on how to prepare dredging environmental management plans, including the following:

- outcome-based provisions: performance-based and may be used where the part of the environment is capable of objective measurement and reporting, and
- management-based provisions: relate to management actions and may be used where the part of the environment is not capable of objective measurement and reporting.

All environmental factors (marine environmental quality, benthic communities and habitats, social surroundings and marine fauna) have management-based provisions. The environmental factors of marine environmental quality, BCH and social surroundings have additional outcome-based provisions, for which conservatively derived criteria were developed based on:

- published tolerances of seagrasses to turbidity and sedimentation (Chisholm 2009, Collier *et al.* 2009, Lavery *et al.* 2009, Lavery *et al.* 2019)
- laboratory testing of sediments from the Proposal area (BMT 2022c and O2M 2022).

In accordance with the Environmental Factor Guideline – Marine Environmental Quality (EPA 2016a), a review of the environmental values was undertaken and relevant environmental quality objectives (EQOs) were proposed (Table 1.6). The review identified two environmental values (ecosystem health, recreation and aesthetic values) and three corresponding EQOs that are considered applicable to the Proposal and in turn, have dedicated monitoring and management actions to ensure EQOs are being achieved (Table 1.6). The review identified a further three environmental values (fishing and aquaculture, cultural and spiritual, and, industrial water supply values) that will be protected, but are not considered applicable to the DEMP as they will be protected by ensuring maintenance of ecosystem integrity (Table 1.6).

**Table 1.6 Environmental values and environmental quality objectives applicable to the Proposal area**

Environmental value	Environmental quality objective (EQO)	Applicability to the Proposal	Reasoning
Ecosystem health (ecological value)	Maintenance of ecosystem integrity	Applicable	The Proposal may result in impacts to ecosystem integrity from the effects of potential physical and chemical stressors and from the effects of potential toxicants in marine waters and/or sediments and requires assessment.



Environmental value	Environmental quality objective (EQO)	Applicability to the Proposal	Reasoning
Fishing and aquaculture (social use value)	Maintenance of seafood safe for human consumption	Not applicable	Maintenance of ecosystem integrity is an adequate proxy.
	Maintenance of aquaculture	Not applicable	Maintenance of ecosystem integrity is an adequate proxy. There are no aquaculture leases within the Proposal area.
Recreation and aesthetics (social use value)	Maintenance of aesthetic values	Applicable	The Proposal will cause temporary increased water column turbidity resulting in reduced visual clarity of waters at the dredging and disposal areas, and potentially at surrounding areas. The significance of reduced visual clarity of water associated with the implementation of the Proposal will depend on the intensity, extent and duration of turbid plumes generated during the Proposal and requires assessment.
	Maintenance of secondary contact recreation values	Applicable	
	Maintenance of primary contact recreation values	Not applicable	Maintenance of secondary contact recreation values is an adequate proxy, as there is a very low risk of primary contact within the Inner Harbour, Entrance Channel, or disposal area.
Cultural and spiritual (social use value)	Cultural and spiritual values of the marine environment are protected	Applicable	Maintenance of ecosystem integrity is an adequate proxy. The Swan River site will be directly affected.
Industrial water supply (social use value)	Maintenance of water quality for industrial use	Not applicable	Maintenance of ecosystem integrity is an adequate proxy. There is no industrial water supply in the Proposal area.

## 2 Monitoring and Management Framework

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To mitigate effects associated with the proposal, the Proponent has identified proposed outcome-based conditions for protecting marine environmental quality, benthic communities and habitats and social surroundings during implementation of the Proposal (BMT 2022a). Outcome-based conditions have been developed in accordance with EPA (2021c), as presented in detailed in Sections 2.1 to 2.3.

### 2.1 Outcome-based provisions

The following key environmental factors that may be affected by potential environmental impacts associated with the Project have been assigned outcome-based provisions:

- marine environmental quality
- benthic communities and habitats
- social surroundings.

The outcome-based provisions are outlined in Table 2.2. Monitoring methods associated with the outcome-based provisions are detailed in Section 2.3.

Table 2.1 Outcome-based provisions of the Inner Harbour Maintenance Dredging Environmental Management Plan

Environmental protection outcome	Environmental criteria	Response	Monitoring			Reporting	
		Action	Responsibility	Action	Timing/frequency	Responsibility	
Marine environmental quality							
Increased water column turbidity							
<b>Environmental protection outcome #1:</b>  Maintain water clarity to meet the environmental criteria at boundary of ZoMI/ZoI to minimise social impacts on aesthetic quality from increased water column turbidity associated with dredging activity	Surface or bottom TSS (mg/L) at any individual impact site is 10 mg/L above the reference site data on the dredging activity sampling occasion	Determine if exceedance is due to dredging: Continue monitoring and reporting.  If there is an exceedance, the dredging operations will be analysed and this DEMP shall be revised for the next campaign od dredging operations in subsequent years.	Environmental Consultant	In-water plume monitoring  (Section 2.3.1))	~1 week before, during and ~1 week after dredging operations  Field data will be registered in Annex A	Environmental Consultant	<ul style="list-style-type: none"><li>Monitoring data collected by the Contractor will be submitted weekly to the Environmental Consultant for review</li><li>The Environmental Consultant will report on the receipt and/or results of monitoring data in a once-off environmental monitoring checklist (template provided in Annex B) after the dredging is completed.</li><li>Reporting against the environmental criteria will be included in a Dredging Environmental Management Plan (DEMP) compliance report prepared by the Environmental Consultant and provided to Fremantle Ports for compliance within 6 months of Project completion</li></ul>
	Median Secchi depth from Impact sites must not be:	<ul style="list-style-type: none"><li>The available remote imagery, site photographs, plume sketches and drone aerial photography from the relevant monitoring period will be reviewed to ascertain whether the exceedance is in relation to the dredging or disposal operations</li><li>If it is found that the exceedance is in relation to the dredging or disposal operations, the Environmental Consultant will be informed of the trigger criteria exceedance and their requirement to consult with the Contractor to determine and implement measures to reduce the intensity/extent of turbid plumes from dredging and disposal operations</li></ul> Continue the water clarity monitoring	Environmental Consultant	Water clarity monitoring (Section 2.3.2)			
	<ul style="list-style-type: none"><li>reduced by 20% (equivalent to the EPA [2017] water clarity Environmental Quality Guideline [EQG] for the maintenance of aesthetic quality) during the sampling occasion.</li></ul>		Remote imagery (Section 2.3.3)	Every 30 minutes during daylight hours (0700–1900) throughout the duration of dredging operations	Environmental Consultant		
			Site photographs (Section 2.3.4)	In the event of remote imagery unit malfunction, once daily on every operational dredging day	Contractor		
			Plume sketches (Section 2.3.5)	Once at the last day of the operational dredging (template provided in Annex B)	Contractor		
			Drone aerial photography (Section 2.3.6)	Once at the last day of the operational dredging	Environmental Consultant		
Benthic communities and habitat							
Indirect loss							
<b>Environmental protection outcome #2:</b>  Maintain turbidity levels to meet the environmental criteria at the ZoMI/ZoI boundary to avoid indirect loss of seagrass from increased water column turbidity associated with sediment disposal	Refer to the potential environmental impact of increased water column turbidity for the environmental factor of marine environmental quality.  It is noticed that the Dredge Plume Report (BMT 2022b) assumed an overflow of 30 minutes during the dredging operation, and it is recommended to utilise a green valve during the overflow.						
Social surroundings							
Disturbance to heritage (Aboriginal, European or Maritime)							
<b>Environmental protection outcome #3:</b>  No dredging operations to be undertaken without public consultation	Refer to the Fremantle Ports Communication Plan for the Project.  The relevant registered Aboriginal heritage site to this proposal is the Swan River - 3536. Fremantle Ports hold a section 18 approval under the <i>Aboriginal Heritage Act</i> 1972 for the purpose of dredging and maintenance of the Inner Harbour and disposal of dredge spoil at Gage Roads anchorage. This approval was in place for the capital dredging project undertaken in 2010 which shares the same footprint as this maintenance dredging proposal. Due to the associated consultation occurring in 2007, Fremantle Ports plans to undertake stakeholder consultation with identified Aboriginal representatives for the Swan River site. There are no Maritime heritage sites located in the dredging and disposal areas that could be potentially impacted by the Proposal.						

## 2.2 Management-based provisions

The following relevant (key and other) environmental factors that may be affected by potential environmental impacts associated with the Project have been assigned management-based provisions:

- marine environmental quality (key environmental factor)
- benthic communities and habitats (key environmental factor)
- social surroundings (key environmental factor)
- marine fauna (other environmental factor)

The management-based provisions are outlined in Table 2.2. Monitoring methods associated with the management-based provisions are detailed in Section 2.3.

Table 2.2 Management-based provisions of the Inner Harbour Maintenance Dredging Environmental Management Plan

Environmental protection objective	Management			Monitoring			Reporting
	Target	Action	Responsibility	Action	Timing/frequency	Responsibility	
Marine environmental quality							
Hydrocarbon spills and waste generation							
<b>Environmental protection objective #1:</b> No hydrocarbon spills or release of waste into the environment from dredging and sand disposal	No reported hydrocarbon spills or release of waste into the environment from dredging and sand disposal	A clean and tidy work area will be maintained with safe storage of all potentially hazardous substances	Contractor	Inspections will be completed during site visits	Weekly or once off throughout the duration of dredging and disposal operations	Proponent	<ul style="list-style-type: none"><li>Review records and site inspection logs will be maintained by the Proponent and submitted to the Environmental Consultant within a month of completion of the project.</li><li>Reporting against the management target will be included in a Dredging Environmental Management Plan (DEMP) compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li><li>In the event of a hydrocarbon spill that is likely to impact on coastal waters, Fremantle Ports' Vessel Traffic Service (VHF Channel 12 or 08 9431 6333) and/or Department of Transport's (DoT's) Maritime Environmental Emergency Response Unit (24-hour reporting number: 08 9480 9224) will be notified immediately (within 1-hour of receiving notification of the incident)</li></ul>
		Fuels and oils will be stored in contained areas and any fuelling will occur within a bunded area.	Contractor	Inspections will be completed during site visits	Weekly or once off throughout the duration of dredging operations	Proponent	
		There will be a spill kit available on site with all necessary materials for mitigating an accidental hydrocarbon spill	Contractor	Inspections will be completed during site visits	Weekly or once off throughout the duration of dredging operations	Proponent	
		The Contractor will prepare a Construction Environmental Management Plan (CEMP) that includes oil spill contingency procedures to be implemented in the event of an accidental hydrocarbon spill	Contractor	Review of the CEMP provided by the Contractor will be completed	Once-off prior to the commencement of dredging operations	Proponent	
		Work areas will be clear of waste/rubbish following demobilisation from site	Contractor	Inspections will be completed during site visits	Once-off following completion of dredging operations	Project Management Consultant (or delegate)	
		The dredge and any associated support vessels will be required to obtain a low-risk rating from the Department of Primary Industries and Regional Development (DPIRD) risk assessment tool ( <a href="https://vesselcheck.fish.wa.gov.au/">https://vesselcheck.fish.wa.gov.au/</a> ) prior to mobilising to site from an interstate or international location	Contractor	Review of the DPIRD risk assessment tool reports provided by the Contractor will be completed	Once-off prior to the dredge and any associated support vessels mobilising to site	Project Management Consultant	
Benthic communities and habitat							
Direct loss							
<b>Environmental protection objective #2:</b> Ensure no permanent loss of BCH outside of the zone of high impact (ZoHI)	No dredging and sediment disposal outside of the defined areas (as described in Section 1.4)	The dredge will have an accurate positioning system installed and the position of the dredge will be monitored during dredging operations	Contractor	Review of the dredge position data provided by the Contractor will be completed	Weekly or once off throughout the duration of dredging operations	Environmental Consultant	<ul style="list-style-type: none"><li>The Environmental Consultant will report on the receipt and/or results of the dredge position data in a once-off monitoring checklist after the dredging is completed (template provided in Annex A)</li><li>Reporting against the management target will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li></ul>
		Disposal position logs including details of the timing and position will be maintained	Contractor	Review of the disposal position logs provided by the Contractor will be completed	Weekly or once off throughout the duration of dredging operations	Environmental Consultant	

Environmental protection objective	Management			Monitoring			Reporting
	Target	Action	Responsibility	Action	Timing/frequency	Responsibility	
Social surroundings							
Public and navigational safety							
<b>Environmental protection objective #3:</b> No public or navigational safety incidents from dredging and sand disposal	Any / all reported community concerns about a potential safety hazard, near miss, or incident as a result of public or navigational safety issues associated with dredging and sand disposal are addressed in-line with the Community Engagement and Communications Management and Implementation Plan (CECMIP)	A public complaints register will be developed and maintained with responses provided to any public complaints within 1 week of receipt	Proponent	Review of the public complaints register will be completed	As required (in the event of receiving notification that a public complaint has been received)	Proponent	<ul style="list-style-type: none"><li>Site inspection logs will be maintained by the Contractor and provided to the Environmental Consultant (Annex C)</li><li>The Proponent will provide the Environmental Consultant a summary of any public complaints received after the dredging is completed</li><li>Reporting against the management target will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li><li>In the event of a navigational safety incident, Fremantle Ports’ Vessel Traffic Service (VHF Channel 12 or 08 9431 6333) will be notified immediately (within 1-hour of receiving notification of the incident)</li><li>In the event of public or navigational safety incident, the relevant dredging and/or disposal activities will be suspended until the appropriate measures are implemented to prevent further related incidents from arising again</li></ul>
		A Temporary Notice to Mariners (TNTM) from DoT’s Marine Safety Branch will be obtained at least 14 days prior to the commencement of works to inform the public of potential navigational hazards associated with dredging and disposal. The contractor is also to consult with Fremantle Ports in relation to this notice.	Proponent	Review of the TNTM published on DoT’s website will be completed	Once-off prior to the commencement of dredging operations	Proponent	
		The dredge, associated support vessels and any associated marine equipment will be fitted with the appropriate marine safety equipment, markers and/or lighting to the satisfaction of Fremantle Ports’ Harbour Master	Contractor	Review of the inspection logs provided by the Contractor will be completed	Once-off prior to the commencement of dredging operations	Project Management Consultant	
		The Contractor will comply with the relevant requirements in Fremantle Ports’ Port Information Guide (Fremantle Ports 2018) while operating in Fremantle Ports’ limits	Contractor	Inspections will be completed during site visits	Weekly or once off throughout the duration of dredging operations	Project Management Consultant (or delegate)	
Reduced visual amenity, odour generation and noise							
<b>Environmental protection objective #4:</b> Minimise social impacts from potential reduced public amenity, odour generation or noise associated with dredging and sediment disposal	Any / all community concerns raised in relation to reduced public amenity, odour generation or noise associated with dredging and sediment disposal are addressed in-line with the Community Engagement and Communications Management and Implementation Plan (CECMIP)	A public complaints register will be developed and maintained with responses provided to any public complaints within 1 week of receipt	Proponent	Review of the public complaints register will be completed	As required (in the event of receiving notification that a public complaint has been received)	Proponent	<ul style="list-style-type: none"><li>Review records will be maintained by the Proponent and provided to the Environmental Consultant</li><li>The Proponent will provide a summary of any public complaints received after the dredging is complete</li><li>Reporting against the management target will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li></ul>
		Change management provisions to allow moving of the dredge to a different site if there is actual or anticipated feedback from the community	Proponent	Review of the public complaints register will be completed	As required (in the event of receiving notification that a public complaint has been received)	Proponent	
		The operation of machinery associated with dredging and sediment disposal activities will occur within an active port area and noise generation should be overseen by the Noise Management Plan (NMP)	Contractor	Review of the Noise Management Plan and approval provided by the Contractor will be completed	Once off prior to the operation of machinery associated with dredging and sediment disposal in accordance with Australian Standards 1269 and 2436 and Environmental Protection (Noise) Regulations 1997 (DEP 1997)	Proponent	
Marine fauna							



Environmental protection objective	Management			Monitoring			Reporting
	Target	Action	Responsibility	Action	Timing/frequency	Responsibility	
Introduced marine species (IMS)							
<b>Environmental protection objective #5:</b> No introduction of IMS to the Project site from the arrival of the dredge and any associated support vessels	No reported observations of IMS on the dredge and any associated support vessels at the Project site	The dredge and any associated support vessels will be cleaned and/or visually inspected for IMS prior to mobilising to the Project site from any location	Contractor	Review of the inspection logs provided by the Contractor will be completed	Once-off prior to the dredge and any associated support vessels mobilising to site	Proponent	<ul style="list-style-type: none"><li>Review records will be maintained by the Proponent and submitted to the Environmental Consultant</li><li>Reporting against the management target will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li><li>In the event of a sighting of suspected IMS, the suspected IMS will be isolated and reported to DPIRD’s FishWatch (24-hour reporting number: 1800 815 507) immediately (within 24-hours of receiving notification of the sighting) and actions will be taken as directed by DPIRD</li></ul>
		The dredge and any associated support vessels will be required to obtain a low-risk rating from the Department of Primary Industries and Regional Development (DPIRD) risk assessment tool ( <a href="https://vesselcheck.fish.wa.gov.au/">https://vesselcheck.fish.wa.gov.au/</a> ) prior to mobilising to site from an interstate or international location	Contractor	Review of the DPIRD risk assessment tool reports provided by the Contractor will be completed	Once-off prior to the dredge and any associated support vessels mobilising to site	Proponent	
Marine mammal collision							
<b>Environmental protection objective #6:</b> No collision with marine mammals from the operation of the dredge	No reported collision incidents with marine mammals from the operation of the dredge	Vessel Masters responsible for operating the dredge will be suitably trained to understand marine mammal behaviours, actions and reporting requirements in the event of marine mammal injury or mortality and provisions under <i>Environmental Protection and Biodiversity Conservation Regulations – Part 8 Division 8.1: Interacting with cetaceans</i>	Contractor	Review of the training records provided by the Contractor will be completed	Once-off prior to the commencement of dredging operations	Proponent	<ul style="list-style-type: none"><li>Site inspection logs (Annex D) will be maintained by the Proponent and provided to the Environmental Consultant</li><li>The Environmental Consultant will report on the receipt and/or results of the mammal observation and interaction logs in a once-off environmental monitoring checklist after the dredging is complete (template provided in Annex C)</li><li>Reporting against the management target will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion</li><li>In the event of marine mammal injury or mortality resulting from a reported collision including from the operation of the dredge, the contractorwill advise the Proponent immediately. The incident will be noted in Fremantle Ports Incident Management System and a record of the incident provided to the Environmental Consultant. The Proponent will contact DBCA and DWER regarding the incident.</li></ul>
	Monitor fauna behaviour and movement <ul style="list-style-type: none"><li>If fauna proceeds towards dredge, cease dredging until fauna is outside of monitoring zone</li><li>Implement soft-start procedures on recommencement of dredging</li></ul>	The suitably trained Vessel Master(s) responsible for operating the dredge will document any observations and/or interactions with marine mammals within the monitoring zone (area within a 300 m radius from the dredge) and the corrective actions taken using the marine mammal observation and interaction logs (templates are provided in Annex D)	Contractor	Marine fauna observation monitoring	Continuous: presence of significant marine fauna enters the 300 m monitoring zone (Section 2.3.8)	Contractor	
	Monitor fauna behaviour and movement <ul style="list-style-type: none"><li>Delay commencement of dredging until fauna is outside of monitoring zone</li></ul>				Daily/pre-start	Contractor	

## 2.3 Monitoring methods for first dredging campaign (removal of 60,000m<sup>3</sup> of sediment)

### 2.3.1 In-water plume monitoring

Water sampling for turbidity will be completed ~1 week before, during and ~1 week after the dredging campaign. Prior to dredging, the correlation between TSS and Nephelometric Turbidity Unit (NTU) will be defined such that real-time turbidity measures may be assessed against modelled / predicted TSS contours, using samples collected from the Project area. The in-water monitoring program will comprise:

- monitoring of NTU one week before dredging / disposal activities
- monitoring of NTU once during dredging / disposal activities
- monitoring of NTU one week after the completion of dredging / disposal activities.

Monitoring will involve the lowering of a sensor through the water column three times to calculate a median value for surface and bottom NTU, at each Impact and Reference site (to be confirmed following the ground truthing of the 'unknown' area). To determine an exceedance of the criterion, median TSS (converted from NTU using the laboratory defined relationship) will be compared to trigger thresholds defined in Table 2.1.

The Environmental Consultant will process the data to determine whether the criteria have been exceeded (Table 2.1). An exceedance will be confirmed by using the following multiple lines of evidence approach to determine whether there is a link between dredging and disposal activities and elevated turbidity at sensitive receptor monitoring locations:

- analysis quality assurance and quality control (i.e. human error)
- function checks on the multi parameter water sensor
- comparison of data to modelled parameters within the Zol i.e. >2 mg/L above background (reference sites) and/or baseline (pre-dredging baseline data collected at the same site)
- effects of natural metocean or weather conditions that could be affecting this site that are not related to dredging and disposal (e.g. storm activity).

Detailed sampling and analysis procedures will be provided to field personnel as part of Turbidity Sampling and Analysis Plan. The proposed field points are detailed in Table 2.3 and shown in Figure 2.1.

**Table 2.3 Proposed field points**

Field point	Acronym	Site	Positioning	E	N
Offshore Site	OS	Reference	1 km northeast from disposal Zol	375170.4994	6459810.374
Disposal Impact 1	DI1	Impact	Disposal ZoMI	374927.2023	6453949.832
Disposal Impact 2	DI2	Impact	Disposal Zol	375525.0489	6455931.233
Reference Dredge	RD	Reference	2 km south of dredging Zol and 2.2 km east from disposal Zol	379701.5461	6448172.416



Field point	Acronym	Site	Positioning	E	N
Dredge Impact 1	DR1	Impact	Dredging ZoMI downstream	379188.6031	6452483.597
Dredge Impact 2	DR2	Impact	Dredging ZoMI upstream	382137.6848	6454321.013
Swan River	SR	Reference	0.5 km downstream of dredging Zol	386126.708	6458010.061

Note: coordinates are displayed in UTM50\_GDA94

The impact sites at the dredging area were positioned upstream and downstream the dredging design, while the impact sites at the disposal area were positioned at the north and at the south of the target disposal area, where the sediment plume is expected to reach the high TSS concentrations. The reference sites were positioned in areas where no sediment plume is expected to reach, and the environment are similar to those where the Proposal will be developed.

### 2.3.2 Water clarity monitoring

Secchi depth measurements will be taken at the disposal and dredge areas and at a reference area to monitor water clarity during dredging and disposal operations. Secchi depth measurements will be taken on three occasions: one week before the commencement of dredge; on the last day of the dredging operation; one week after the dredging is finished.

Secchi depth measurements will be taken at all field points shown in Figure 2.1. Secchi depth measurements will be taken between 1100hrs and 1300hrs when sun glint on the water surface is minimal, where practical.

The Environmental Consultant will be responsible for taking the Secchi depth measurements in accordance with the following procedure:

- (1) arrive at site and collect a Global Positioning Unit (GPS) coordinate to provide evidence of the actual location where the Secchi depth measurement was collected
- (2) lower the Secchi disk over the sunny side of the boat to avoiding shading which could impact on the visibility of the Secchi disk through the water
- (3) lower the Secchi disk slowly through the water column and look (without sunglasses) directly down the cord until the black and white quadrants on the Secchi disk are no longer visible
- (4) record the depth (to the nearest 0.1 m) of the Secchi disk (where the black and white quadrants are no longer visible) from the water surface using the markings on the attached rope for reference (each marking is 0.1 m apart)
- (5) if the black and white quadrants on the Secchi disk are still visible when the Secchi disk reaches the seafloor, then the depth of the Secchi disk from the water surface should be recorded with a ">" symbol before the depth (e.g., where the depth of the Secchi disk from the water surface is 2.3 m, the Secchi depth measurement should be recoded as ">2.3 m")
- (6) ensure Secchi depth measurements and GPS coordinates are recorded on the Secchi depth measurement field sheet provided in Annex A.

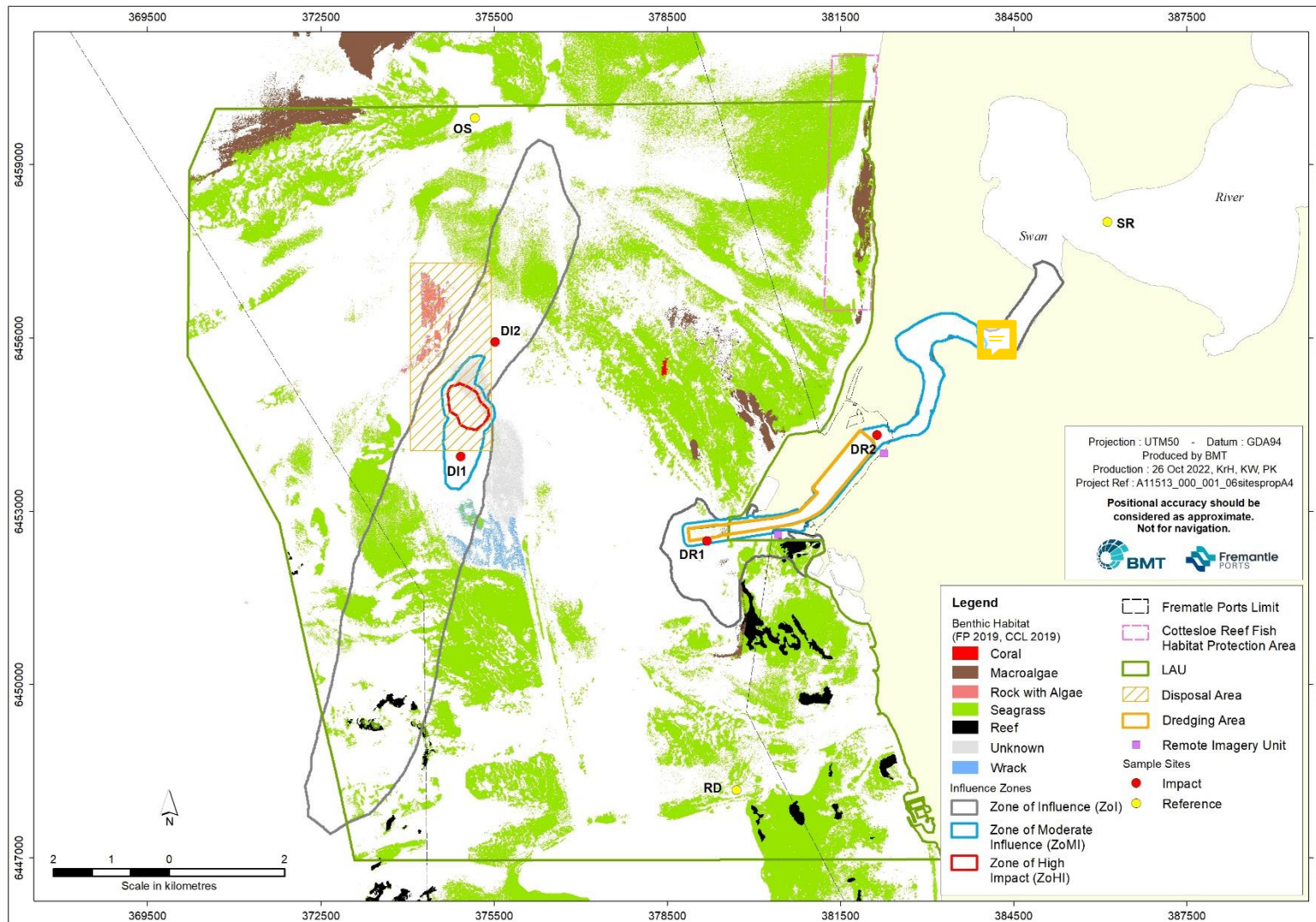


Figure 2.1 Proposed location for field points

### 2.3.3 Remote imagery

Remote imagery units (RIUs) will be installed to monitor turbid plumes associated with the dredging and disposal operations. The RIUs will capture time- and date-stamped images to a resolution of  $\geq 12$  megapixels every 30 minutes during daylight hours (0700hrs–1900hrs) throughout the duration of the dredging and disposal operations. Each image captured by the RIUs will be forwarded to the Environmental Consultant in real-time. The Environmental Consultant will be responsible for coordinating installation of RIUs, reviewing the RIU imagery weekly, and notifying the Project Management Consultant in the event of a RIU malfunction (site photographs will be captured by the Contractor in contingency, as outlined in Section 2.3.3). Two RIUs will be installed within the Inner Harbour area (Figure 2.1) and one RIU will be installed on the dredge vessel.

The RIUs installed within the Inner Harbour area will be positioned to capture images of the downstream and upstream of the dredging design, to register the behaviour of the plume during the dredging operations.

### 2.3.4 Site photographs

Site photographs of the dredging and/or disposal area will be captured in the event of RIU malfunction to monitor turbid plumes associated with the dredging and disposal operations. When required, site photographs will be time- and date-stamped and captured once daily on every operational dredging day throughout the duration of the Project. Site photographs will be taken at a time (nominally between 1100hrs and 1300hrs) and in a direction to minimise sun glint from the water surface, where practical. A digital camera with a resolution of  $\geq 12$  megapixels will be used to take the photographs. The Contractor will be responsible for capturing site photographs, when communicated of the requirement from the Environmental Consultant. The Contractor will be required to submit site photographs weekly to the Environmental Consultant for review.

### 2.3.5 Plume sketches

Plume sketches recording the extent of visible turbid plumes at the dredging and disposal area will be completed once daily on every operational dredging day throughout the duration of the Project. Plume sketches will be completed on a pre-designed plume sketch template (Annex B) between 1100hrs and 1300hrs when sun glint on the water surface is minimal, where practical. The Contractor will be responsible for completing the plume sketches and will be required to submit the completed plume sketch templates weekly to the Environmental Consultant for review.

### 2.3.6 Drone aerial photography

Drone aerial photography of the dredging area will be captured to monitor turbid plumes associated with the dredging operations within the Inner Harbour and Entrance Channel. However, drone aerial photography will not be captured at the disposal area where line-of-vision (pilot requirements) of a drone cannot be maintained from shore.

Drone aerial photography will be captured at least once after 1 week of works on an operational dredging day during the Project to provide a large-scale visual record of the dredging operations and to provide a view of the full extent of associated turbid plumes. The Environmental Consultant will be responsible for coordinating the drone aerial photography flights and reviewing the imagery.

### 2.3.7 Marine fauna observation monitoring

Prior to the commencement of dredging, vessel operators will be required to undergo training to minimise the risk of marine fauna interactions during dredging and disposal activities. The training would include marine fauna behaviour and actions, and reporting requirements in the event of marine fauna injury or mortality. *EPBC Regulations 2000 – Part 8 Division 8.1, Interacting with cetaceans* will be included in training and adhered to, as required.

A suitably trained Marine Fauna Observer (MFO) is required to be on location during dredging and disposal activities. The MFO will be in a position to make continuous observations for the duration of works and must be trained in marine fauna observation, behaviour, and distance estimation and reporting. The MFO will have equipment suitable to detect, monitor and record marine mammals (i.e. binoculars, inclinometer, Marine Fauna Log Sheets) prior to the commencement of the works.

The Dredge Contractor will complete a pre-start (20 minutes) visual survey to ensure no marine fauna are present at the time of dredge start-up or at the time of the disposal and will be reported in a daily log. If marine fauna is sighted in the monitoring zone (the area within a 300 m radius of the dredge) during the pre-start survey, the monitoring and management actions listed in Table 2.2 must be adhered to prior to start-up procedures commencing. The MFO will record the weather conditions (i.e. sea state, wind speed and direction, cloud cover, swell, visibility) daily during dredging and disposal at the beginning and end of each shift, and at any time there is a change in conditions.

If marine fauna is sighted inside the monitoring zone, the behaviour and direction of their movement will be monitored and recorded by the MFO on the Marine Fauna Observation Log (Annex D), and actions will be taken to cease dredging should the marine fauna continue towards the dredge plant. If an interaction with marine fauna occurs (i.e. vessel strike, interaction with dredging equipment, entering the agreed monitoring zone, injured or dead marine fauna), the MFO will complete the Marine Fauna Interaction Log (Annex D) and follow the actions listed in Table 2.2. The Marine Fauna Interaction Log will document the date, time, location, tide and weather conditions, number of individuals involved, corrective action(s) undertaken, and proposed preventative action(s) to be implemented.

During night-time and low visibility operations the following procedures for commencement of dredging will be implemented:

- The dredging activity cannot commence low visibility operations if there have been three or more marine fauna instigated shutdowns during the proceeding 24 hours. If operations were not underway during the previous 24 hours, at least 2 hours of observation (under good visibility conditions) must be undertaken with no fauna sightings recorded.
- Continuous observations are maintained with a focus on the applicable 300 m monitoring zone and if marine fauna is detected the stop work procedures apply.
- If sightings of marine fauna have been frequent or higher than anticipated during planning, the proponent will consider whether additional management measures should be employed for low visibility operations.

The Dredging Contractor will maintain all observation logs for the duration of the Project and will be submitted to the Environmental Consultant for further reporting to regulatory authorities, as required.

## **2.4 Monitoring methods for subsequent four dredging campaigns (removal of 5,000m<sup>3</sup> of sediment)**

The subsequent four dredging campaigns to remove additional 5,000 m<sup>3</sup> per year from 2024 to 2027 are expected to be completed over one operational day. The environmental impacts are expected to be insignificant due to the small volume compared to the first dredging campaign in April 2023 to remove 60,000 m<sup>3</sup>, as detailed by BMT (2022a). It is expected that the sediment plume during the additional dredging campaigns will be limited to the immediate surroundings of the operations on a short-term duration basis, similar to the sediment plumes that arise from routine port operations.

The in-water plume monitoring (Section 2.3.1), water clarity monitoring (Section 2.3.2), remote imagery monitoring (Section 2.3.3) and drone aerial photography (Section 2.3.6) are not considered necessary

for the small scale dredging. Monitoring proposed for the small scale dredging is: site photographs (Section 2.3.4); plume sketches (Section 2.3.5); and marine fauna observation monitoring (Section 2.3.6).

Considering the very low risk of the additional dredging campaigns and insignificant potential environmental impacts, there is no need to restrict dredging to a particular time of year to minimise impacts.

### 3 Roles and Responsibilities

The roles and responsibilities for the implementation of the objective-based and outcome-based provisions detailed in Section 2 of this DEMP are summarised in Table 3.1.

**Table 3.1 Roles and responsibilities of the Inner Harbour Maintenance Dredging Environmental Management Plan**

Role	Responsibility
Proponent	<ul style="list-style-type: none"> <li>Responsible for the overall implementation and compliance of this Dredging Environmental Management Plan (DEMP)</li> <li>Responsible for the management of contractors</li> </ul>
Environmental Consultant	<ul style="list-style-type: none"> <li>Delegate of the Proponent</li> <li>Responsible for the provision of specialist environmental advice, as required</li> <li>Responsible for liaison with the relevant environmental regulators, as required</li> <li>Responsible for the implementation and compliance with the relevant items of this DEMP</li> </ul>
Contractor	<ul style="list-style-type: none"> <li>Selected contractor/s engaged to undertake all, or part, of the dredging and sediment disposal</li> <li>Responsible for the implementation and compliance with the relevant items of this DEMP</li> </ul>



## 4 Adaptive Management and Review

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### 4.1 Adaptive management

Adaptive management is a systematic process for improving management practices by using the outcomes of monitoring and evaluation and incorporating learnings from these outcomes into revised management actions as necessary.

In relation to this DEMP, the Proponent is committed to:

- implementing the environmental management and monitoring actions outlined in Section 2 during the first round of dredging planned for April 2023, targeting a total volume of 60,000m<sup>3</sup> of sediment to be removed from Inner Harbour and Entrance Channel.
- evaluating the results of the first round of monitoring during the dredging planned for April 2023 against the environmental protection objectives and outcomes in accordance with the timings and frequencies described in Section 2
- adjusting monitoring or management actions to subsequent years of dredging (2024 to 2027, in which the total volume to be removed is 5,000 m<sup>3</sup> per year), if required, to meet the environmental protection management or outcomes defined in Section 2.

### 4.2 Reporting and auditing

Reporting against the management targets for evaluation against the environmental protection objectives in Table 2.2 and the environmental criteria for evaluation against the environmental protection outcomes in Table 2.1 will be included in a DEMP compliance report prepared by the Environmental Consultant and provided to Fremantle Ports within 6 months of Project completion.

### 4.3 Review

Review and revision of this DEMP will be undertaken following the main dredging campaign of 60,000 m<sup>3</sup> proposed to be undertaken in April 2023, and then on an annual basis. It is considered that review and revision of this DEMP should occur in response to the following circumstances:

- further knowledge becomes available on environmental management or monitoring practices to more effectively meet the environmental protection management or outcomes
- further knowledge becomes available in relation to identified potential environmental impacts associated with the Project
- new potential environmental impacts associated with the Project are identified
- there are significant changes to the dredging and/or disposal methods
- to address any conditions imposed by relevant regulatory authorities
- if required to address any concerns identified by stakeholders.

Upon review and revision of this DEMP, the changes made will be documented in a document revision register to be appended to the DEMP and the revision status of the document will be updated and changes communicated to relevant stakeholders as required.

The diagram of the adaptive management and review of DEMP is presented in Figure 4.1.

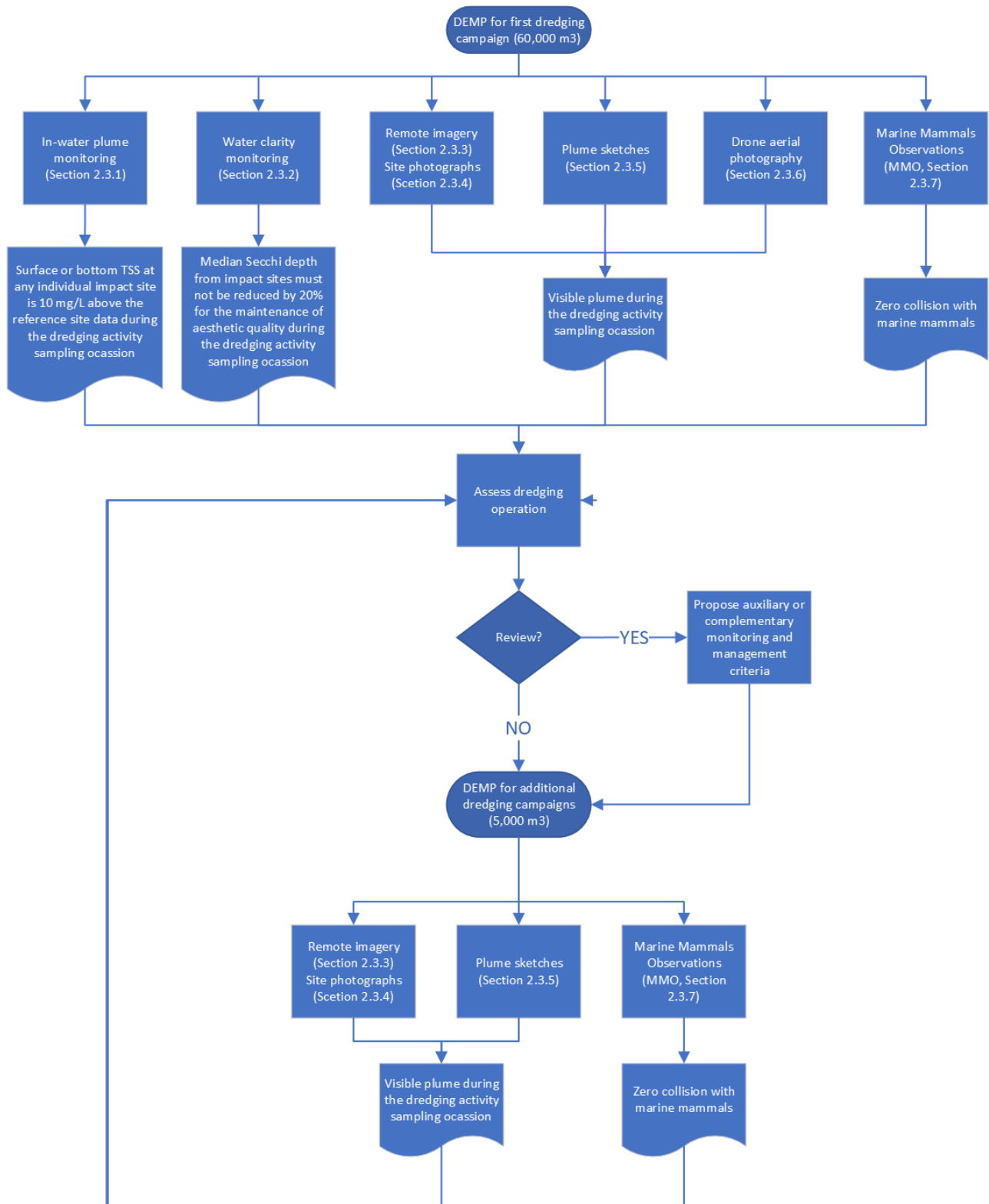


Figure 4.1 Diagram of adaptive management and review of DEMP



## 5 Stakeholder Consultation

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The Proponent will undertake stakeholder consultation for the Project that will include relevant regulatory, industry and community stakeholders. For a description of the stakeholder consultation process, refer to Fremantle Ports Communications Plan for the Project.

Stakeholder consultation in relation to this DEMP will occur before, during and after the implementation of the Project. The Proponent will develop and maintain public complaints register for the Project with responses provided to any public complaints within 1 week of receipt as detailed in Table 2.2. In event of an environmental incident, the incident will be added and managed in Fremantle Ports Incident Management System. The relevant regulatory authorities will be notified and consulted with as required.

## 6 References

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EPA (2021c) Environmental outcomes and outcomes-based conditions: Interim Guidance. Environmental Protection Authority, Perth, Western Australia, October 2021

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## **Annex A   Secchi Depth Measurement Field Sheet**

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[illegible]

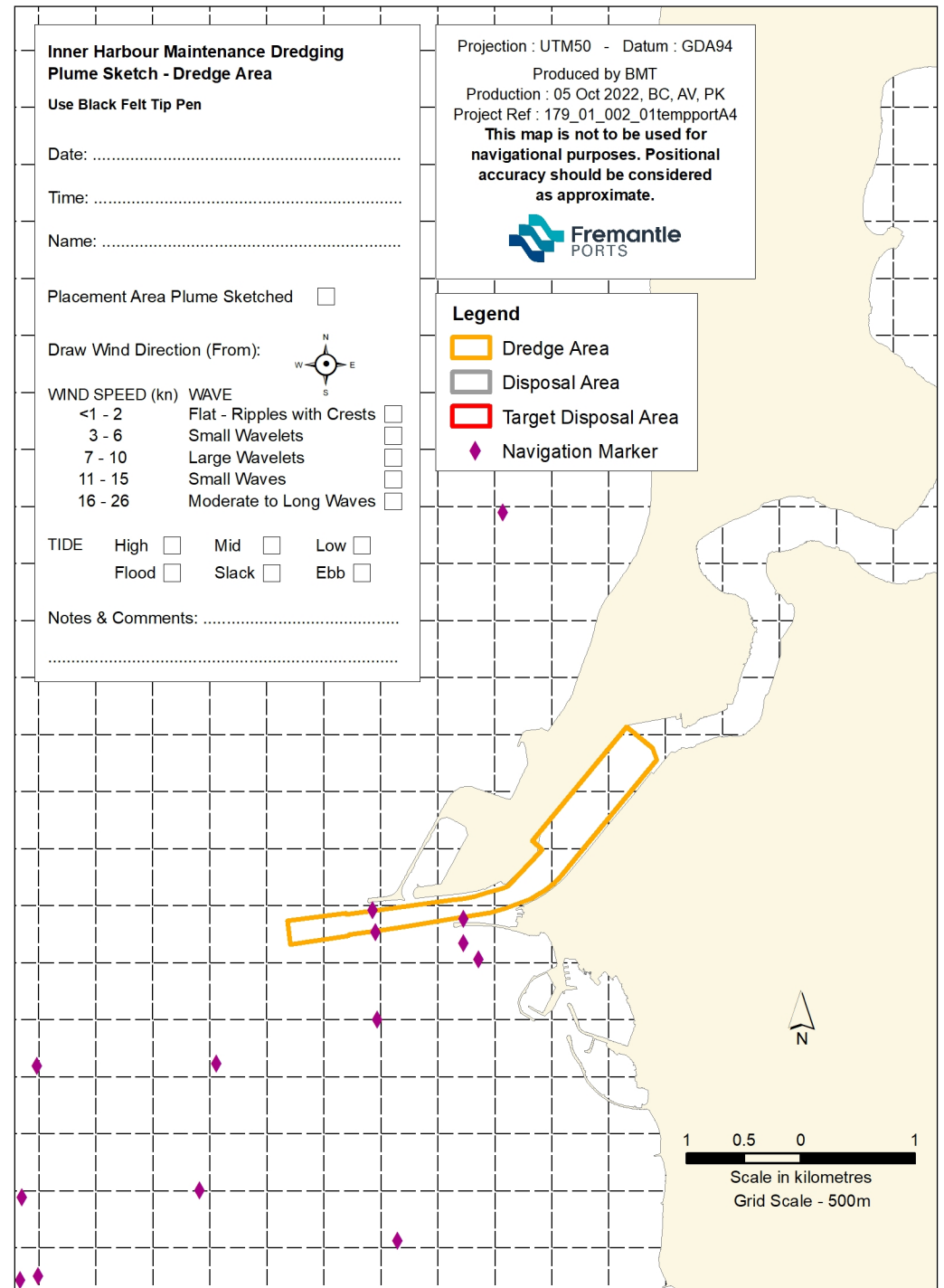
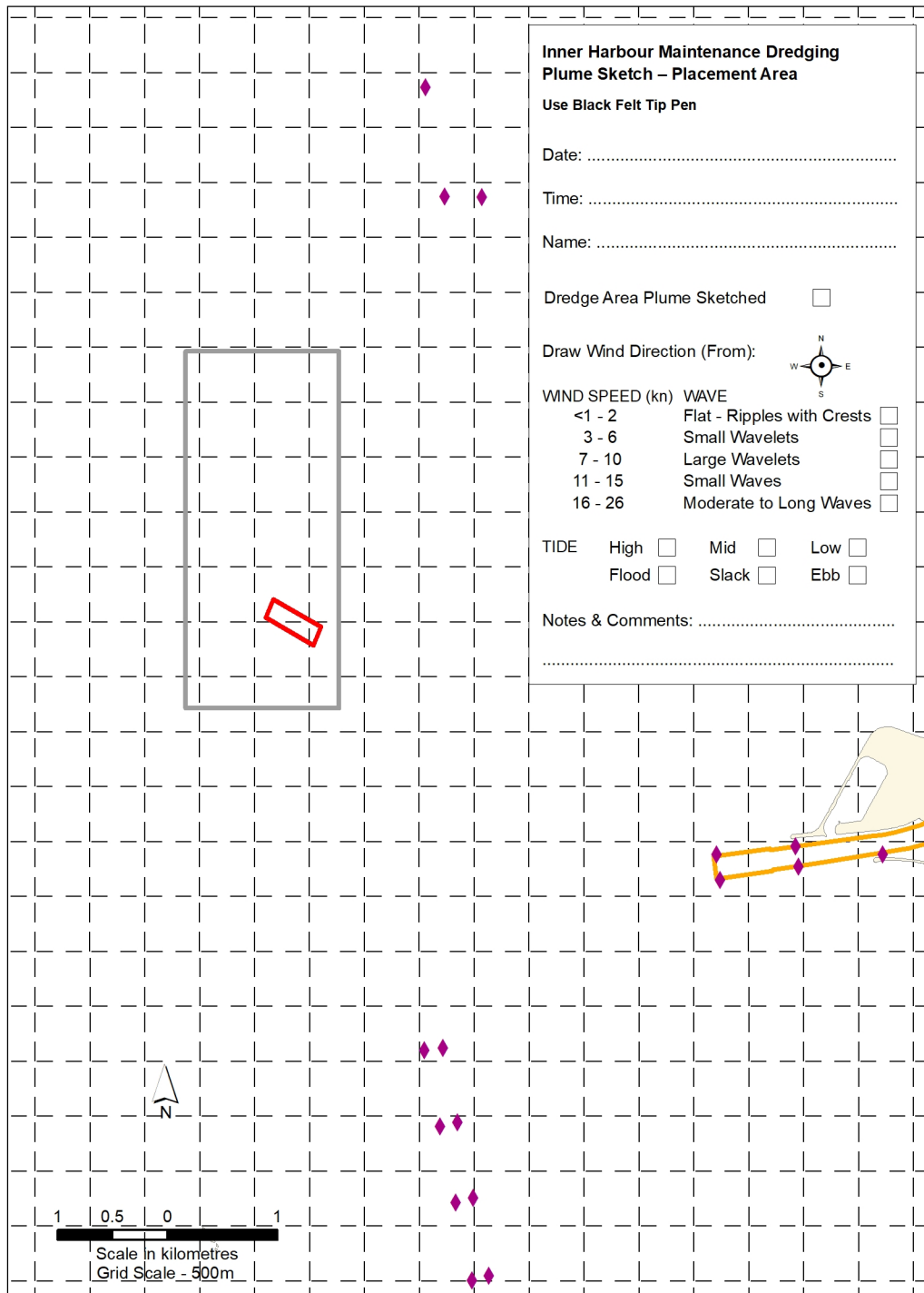
Client		Project #	
Field date(s)		Project title	
Location		Job description	
Personnel		Vessel	

FLAG and NAME	Spoken	Written	FLAG and NAME	Spoken	Written	FLAG and NAME	Spoken	Written
 A	ALFA	A	 M	MIKE	M	 Y	YANKEE	Y
 B	BRAVO	B	 N	NOVEMBER	N	 Z	ZULU	Z
 C	CHARLIE	C	 D	OSCAR	O	 1	ONE	1
 D	DELTA	D	 P	PAPA	P	 2	TWO	2
 E	ECHO	E	 Q	QUEBEC	Q	 3	THREE	3
 F	FOXTROT	F	 R	ROMEO	R	 4	FOUR	4
 G	GOLF	G	 S	SIERRA	S	 5	FIVE	5
 H	HOTEL	H	 T	TANGO	T	 6	SIX	6
 I	INDIA	I	 U	UNIFORM	U	 7	SEVEN	7
 J	JULIETT	J	 V	VICTOR	V	 8	EIGHT	8
 K	KILO	K	 W	WHISKEY	W	 9	NINE	9
 L	LIMA	L	 X	XRAY	X	 0	ZERO	0

Force	Description	Specification for use at sea*	Equivalent speed at 10 metres above sea level				Description in forecast	State of sea	Probable height of waves* /metres
			Mean		Limits				
			/knots	/ms <sup>-1</sup>	/knots	/ms <sup>-1</sup>			
0	Calm	Sea like a mirror	0	0.0	<1	0.0 to 0.2	Calm	Calm	0.0
1	Light air	Ripples with the appearance of scales are formed, but without foam crests	2	0.8	1 to 3	0.3 to 1.5	Light	Calm	0.1 (0.1)
2	Light breeze	Small wavelets, still short but more pronounced. Crests have a glassy appearance and do not break	5	2.4	4 to 6	1.6 to 3.3	Light	Smooth	0.2 (0.3)
3	Gentle breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses	9	4.3	7 to 10	3.4 to 5.4	Light	Smooth	0.6 (1.0)
4	Moderate breeze	Small waves, becoming longer, fairly frequent white horses	13	6.7	11 to 16	5.5 to 7.9	Moderate	Slight	1.0 (1.5)
5	Fresh breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray	19	9.3	17 to 21	8.0 to 10.7	Fresh	Moderate	2.0 (2.5)
6	Strong breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray	24	12.3	22 to 27	10.8 to 13.8	Strong	Rough	3.0 (4.0)
7	Near gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind	30	15.5	28 to 33	13.9 to 17.1	Strong	Very rough	4.0 (5.5)
8	Gale	Moderate high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind	37	18.9	34 to 40	17.2 to 20.7	Gale	High	5.5 (7.5)
9	Strong gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility	44	22.6	41 to 47	20.8 to 24.4	Severe gale	Very high	7.0 (10.0)
10	Storm	Very high waves with long over-hanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected	52	26.4	48 to 55	24.5 to 28.4	Storm	Very high	9.0 (12.5)
11	Violent storm	Exceptionally high waves (small and medium-sized ships might be for a time lost behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected	60	30.5	56 to 63	28.5 to 32.6	Violent storm	Phenomenal	11.5 (16.0)
12	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected	-	-	64 and over	32.7 and over	Hurricane force	Phenomenal	14.0 (-)

## Annex B Plume Sketch Template

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## **Annex C Environmental Monitoring Checklist Template**

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## Weekly Environmental Monitoring Inner Harbour Maintenance Dredging – Week #X

Environmental monitoring of the Inner Harbour Maintenance Dredging between XX–XX MONTH 20XX is to be in accordance with the Inner Harbour Maintenance Dredging Environmental Management Plan (DEMP; BMT 2022). See table and comments below for results of the required environmental monitoring tasks.

### Environmental Monitoring Checklist

Monitoring task	Monday (XX/XX/20XX)		Tuesday (XX/XX/20XX)		Wednesday (XX/XX/20XX)		Thursday (XX/XX/20XX)		Friday (XX/XX/20XX)		Saturday (XX/XX/20XX)		Sunday (XX/XX/20XX)	
	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?
Plume sketch (dredging area)														
Plume sketch (placement area)														
Remote imagery (placement area)														
Site photograph (dredging area)														
Site photograph (placement area)														
Dredge position log														

Monitoring task	Monday (XX/XX/20XX)		Tuesday (XX/XX/20XX)		Wednesday (XX/XX/20XX)		Thursday (XX/XX/20XX)		Friday (XX/XX/20XX)		Saturday (XX/XX/20XX)		Sunday (XX/XX/20XX)	
	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?	Received?	Correct?
Placement position log														
Marine mammal observation log														
Marine mammal interaction log														
Secchi depth measurements														

Notes:

1. **Red text** indicates a non-conformance with requirements outlined in the DEMP (BMT 2021)
2. **Red italicised text** indicates partial non-conformance with requirements outlined in the DEMP (BMT 2021)
3. **Black bold text** indicates that data was not collected for a valid reason e.g. non-operational machinery, poor weather
4. 'N/A' indicates there was no requirement for data to be collected in accordance with the requirements of the DEMP (BMT 2021)

**Comments on environmental monitoring non-conformances:**

**Comments on other environmental issues:**

**Environmental monitoring data still to be received:**

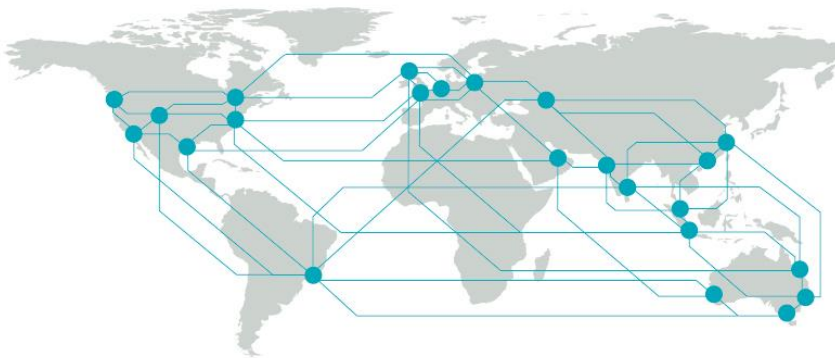
**References:**

BMT (2022) Inner Harbour Maintenance Dredging Environmental Management Plan. Prepared for Fremantle Ports by BMT Commercial Australia Pty Ltd, Report No. R-11513-6, Perth, Western Australia, October 2022.

## **Annex D Marine Mammal Observation and Interaction Logs**

Date		Location		Page #		Of	
MFO(s)		Skipper		Vessel			
Shift start time		Operation in progress at shift start	<input type="checkbox"/> Dredging <input type="checkbox"/> Dumping <input type="checkbox"/> Transit			Shift end time	
Interactions this shift?	<input type="checkbox"/> Y <input type="checkbox"/> N	If yes, how many interaction logs?					

Position			Pod Information								Comments	Weather Conditions								<div>Relative bearing – bow of the vessel is 0°</div> <div>Actual swim direction Where the fauna is headed, N, S, E, W – based on true north</div> <div>Fauna type: HB - Humpback WH - Other whale T - Turtle DO - Dolphin DU - Dugong S - Shark U - Unknown</div> <div>Glare levels: 0 – No glare 1 – Gentle glare 2 – Brighter glare 3 – Mirror like glare</div> <div>Visibility: 0 – No visibility 1 – Limited visibility 2 – Visibility ok 3 – Visibility perfect</div>	
GPS Waypoint	Time	Vessel Heading(°)	Cue	Relative Bearing	Distance	Actual Swim dir.	Fauna type	# of fauna	od number	Observer (initials)		Glare			Sea state	Wind speed (kts)	Wind direction	Cloud cover (0–8)	Swell		Visibility (0–3)
												From	To	Strength (1–3)							



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