Pilbara Ports Authority

Port of Dampier

Long Term Dredge Management Plan

May 2021

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1. Background

1.1 Purpose and Content of this Plan

In order to maintain safe navigation within the Port of Dampier (**Port**), Pilbara Ports Authority (**PPA**) is required to undertake periodic maintenance dredging of the shipping channels, swing basins and berths under PPA's operational control. This includes the Facilities Channel, swing basin, holding area and berth pockets which, enable vessel access to the Dampier Cargo Wharf (**DCW**), Dampier Bulk Liquids Berth (**DBLB**) and Heavy Load-Out Facility (**HLO**) (Figure 1).

Maintenance dredging has not occurred within PPA's Facilities Channel, swing basin, holding area and associated berth pockets since these areas were first dredged through their respective capital dredging programs. In the intervening time sediments have built up in these areas and as such, PPA plans to undertake maintenance dredging in 2019 to return each of these areas of seabed to their approved design depths.

PPA is seeking to obtain a five-year Commonwealth Sea Dumping Permit (**SDP**) to ensure the critical depths required for safe navigation in the Port are maintained. This Long-Term Dredge Management Plan (**LTDMP**) forms a part of the SDP application as well as providing the framework for maintenance dredging and ocean disposal activities by PPA over the lifetime of the SDP, including:

- Overall management framework;
- The areas where dredging is to occur;
- Type of materials to be dredged;
- Offshore disposal locations and activities;
- Legislation and regulations that apply to the maintenance dredging program;
- Environmental values to be protected, the risks that dredging may pose, and the mechanisms to be implemented to mediate these risks (Management Strategies);
- Responsible parties;
- Monitoring and reporting; and
- Consultation.

This LTDMP also provides the framework to guide the preparation of a detailed operational dredge management plan to be developed by the appointed dredge contractor(s) or included within specific contract conditions accepted by the dredge contractor(s), prior to the commencement of the dredging activities.

This LTDMP, in accordance with leading practice for dredging projects internationally, uses risk-informed decision making as the basis for the management framework. The dredging Environmental Risk Assessment and supporting process which forms the foundation of this LTDMP, was transparent and interactive through engagement with the Port of Dampier's Technical Advisory and Consultative Committee (**TACC**) and sought to draw upon the best available information.

The information provided in this LTDMP has been prepared in accordance with the National Assessment Guidelines for Dredging (**NAGD**) (Commonwealth of Australia, 2009) using guidance from the Commonwealth Department of Agriculture, Water and the Environment and Energy (**DAWE**).

1.2 Management Framework

PPA is the proponent for the maintenance dredging program in the Port. PPA's Dredging and Survey Manager has overall responsibility for dredging at the Port.

The five-year maintenance dredging program is conducted in accordance with conditions of the SDP and the requirements of PPA as detailed in the contract between PPA and the dredging contractor(s) undertaking the maintenance dredging works.

The dredging contractor is responsible for the implementation of the dredging campaigns within the constraints of the requirements of PPA and the SDP including this LTDMP.

1.3 Regulatory Framework

The DAWE is the primary Determining Authority for the assessment of any approvals under the *Environmental Protection (Sea Dumping) Act 1981* (*Sea Dumping Act*) which may relate to the loading and any offshore disposal of sediments dredged up during maintenance dredging at the Port of Dampier.

The following sections provide a brief overview of key Commonwealth and State legislation pertinent to this LTDMP.

1.3.1 Commonwealth legislation, regulation and guidelines

Commonwealth Environment Protection (Sea Dumping) Act 1981

In Australia, ocean disposal of dredged material within and outside of State and Territory waters is regulated by the DAWE under the Commonwealth *Environment Protection (Sea Dumping) Act 1989* and the National Assessment Guidelines for Dredging 2009 (NAGD). The development of this legislation and guidelines has been guided by the *Convention on the* Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention) and the more recent 1996 Protocol to the London Convention, to which Australia is a signatory. These agreements aim to prevent pollution of the sea from the disposal of wastes or other matter, including dredged material.

The NAGD contains provision for the granting of permits for dredging on the following basis:

- An assessment of the applicant's capacity to meet their obligations under the *Environment Protection (Sea Dumping) Act* and any permit granted under this Act;
- Establishment of a Technical Advisory and Consultative Committee (TACC) to advise on long-term management of dredging activities and to provide ongoing stakeholder consultation; and
- Development and the implementation of a satisfactory Environment Management Plan for the loading and disposal activities, which provides for sampling and analysis to support any future permit applications.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for the assessment and approval of proposed actions that are likely to have a significant impact on matters of national environmental significance or on Commonwealth land.

Other Commonwealth legislation, regulation and guidelines

Other applicable Commonwealth legislation and guidelines include, but are not limited to, the following Acts, Regulations (and relevant amendments):

- *Protection of the Seas (Prevention of Pollution from Ships) Act 1983*;
- Australian Ballast Water Management Requirements Version 7 2017;
- *Biosecurity Act 2015;*
- Biosecurity Regulations 2016; and
- National Water Quality Management Strategy (Commonwealth Government of Australia 1992).

1.3.2 State legislation, regulation and guidelines

The key Western Australian legislation, regulation and guidelines relevant to dredging at the Port include:

- *Port Authorities Act 1999;*
- Navigable Waters Regulations 1958;
- Shipping and Pilotage (Port and Harbour) Regulations 1966;
- *Western Australian Marine Act 1982;*
- *Pollution of Waters by Oil and Noxious Substances Act 1987*;
- *Marine and Harbours Act 1981;*
- *Environmental Protection Act 1986;*
- Environmental Protection Regulations 1987;
- *Fisheries Resource Management Act 1994* (the State Act addressing Introduced Marine Pests);
- Western Australia Environmental Protection Authority Technical Guidance - Assessment Guidelines of Marine Dredging Proposals (WA EPA, 2016);
- Western Australia Environmental Protection Authority Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (WA EPA, 2016a); and
- Western Australia Environmental Protection Authority Technical Guidance – Protection of Benthic Communities and Habitats (WA EPA, 2016b).

1.4 Other Requirements

1.4.1 Health and Safety

The maintenance dredging campaigns shall be carried out in accordance with PPA health and safety requirements and a Health and Safety Management Plan shall be prepared by the dredging contractor(s) and approved by PPA prior to the commencement of each campaign.

1.4.2 Quality Assurance

PPA, and the dredging contractor(s) undertaking each campaign, shall have a Quality System certified by a third party to be compliant with ISO 9001, or equivalent. Quality records shall be kept for dredging and surveys, data management presentation and interpretation.

1.4.3 Survey

Hydrographic survey works will be the ultimate responsibility of PPA, however progress survey work may be undertaken by the dredging contractor(s) depending on the terms of the dredging contract. Surveys will be carried out in accordance with the requirements of the

latest revision of the PPA's Hydrographic Survey Standards and Deliverables and with the requirements of the contract between PPA and the dredging contractor(s).

1.4.4 Port Operations

The maintenance dredging campaigns will be carried out within an operating Port and channel. The requirements for operating in the Port are outlined in PPA's *Port of Dampier Handbook*, the *Contractor's Handbook and Port Facility Users Handbook*, the *Dampier Cargo Wharf Handbook* and in consultation with the Port of Dampier Harbour Master. The requirements of PPA shall be adhered to whilst any vessels associated with the dredging campaigns operate within Port Waters.

1.5 Stakeholder Consultation and Availability of the LTDMP

PPA hosts a long standing TACC for the Port of Dampier which meets at least twice per annum to discuss all matters relating to dredging in the Port.

In accordance with the *NAGD (2009)*, the intent and purpose of the TACC is to:

- Provide continuity of direction and effort in protecting the local environment of the Port of Dampier in relation to dredging and dredged material disposal;
- Aid communication between stakeholders and provide a forum where points of view can be discussed, and conflicts resolved;
- Assist in the establishment, as appropriate, of longer term permitting arrangements through activities such as the provision of comments, review of plans and integration of activities;
- Review ongoing management of dredging and dumping activities in accordance with the guidelines and permitting arrangements;
- Make recommendations to PPA, State agencies and/or relevant Commonwealth agencies as necessary in relation to the above as appropriate.

The main objective of the TACC is to ensure a transparent process with respect to dredging and ocean disposal of dredged material.

The TACC is representative of industry, community and government at all levels, including the following organisations:

- PPA (Environment and Heritage Manager, Harbour Master and Dredging and Survey Manager, or their representatives);
- Government organisations:
    - Commonwealth DAWE;
    - Western Australian Department of Water and Environmental Regulation (DWER);
    - Western Australian Department of Planning, Lands and Heritage (**DPLH**);
    - Western Australian Department of Jobs, Tourism, Science and Innovation (**DSJTSI**);
    - Western Australian Department of Primary Industries and Regional Development (**DPIRD**) Aquatic Biosecurity;
    - Western Australian Department of Biodiversity Conservation and Attractions (**DBCA**) Parks and Wildlife Service; and

- Western Australian Department of Transport (DoT);

- Community Stakeholders:
  - Hampton Harbour Boat and Sailing Club; and
  - Murujuga Aboriginal Corporation;
- Port Industry and Users:
  - Rio Tinto;
  - Water Corporation;
  - Woodside; and
  - Toll Dampier Supply Base;

1.5.1 Availability of the LTDMP

This LTDMP will be made available on PPA's website (www.pilbaraports.com.au).

2. The Port of Dampier

2.1 Location

The Port of Dampier is located on the western side of the Burrup Peninsula on the west Pilbara coastline, approximately 20km west of Karratha and 1,550km north of Perth (Figure 1). The Port of Dampier is sheltered to the east and west by the Burrup Peninsula and 42 islands of the Dampier Archipelago. Unlike many other ports around Australia, the Port of Dampier is not situated at the mouth of a major river or estuary.

2.2 Existing Port Facilities

The Port consists of 11 terminals with separate shipping channels, which facilitate the export of iron ore, salt, gas products and the transfer of general cargo, break-bulk and diesel fuels. PPA is responsible for managing Port waters and vessel traffic and operates three of these terminals, which are multi-user facilities that support the movement of various cargoes, import of diesel and export of anhydrous ammonia. The remaining terminals are private, being operated by Rio Tinto, Woodside and Toll Global Logistics.

2.3 Future Port Development

The PPA Port Development Strategy 2030 identifies that the Port of Dampier *"will be a leading multi-commodity port in the Pilbara region with a focus on general cargo trading and facilitation of land use, infrastructure and systems to support the marine services sector and resources industry"*. It also states that *"there are opportunities for growth in the future including development of a general cargo logistics hub, enhanced supply base and marine services facilities, and expansion of the Port's fuel and hydrocarbon importation and landside distribution facilities."* To achieve this, ongoing maintenance dredging will be required to maintain the designed depths throughout the life of PPA's terminals within the Port of Dampier.

2.3.1 Ongoing maintenance dredging

PPA's Facilities Channel, swing basin, holding area and associated berth pockets have not been maintenance dredged since they were established through their respective capital dredging programs. PPA plans to undertake maintenance dredging in 2019 to return each of these areas of seabed to their design depths. It is estimated that material will infill into these areas in each subsequent year after 2019, and therefore further maintenance dredging is expected to be undertaken until 2024. On the basis of PPA's most recent hydrographic survey, it is calculated that up to 450,000 m^3 of sediment will need to be dredged and disposed of between 2019 and 2024.

This LTDMP applies to the scope of maintenance dredging of PPA's Facilities Channel, swing basin, holding area and associated berth pockets, under PPA's 5-year Sea Dumping Permit for maintenance dredging.

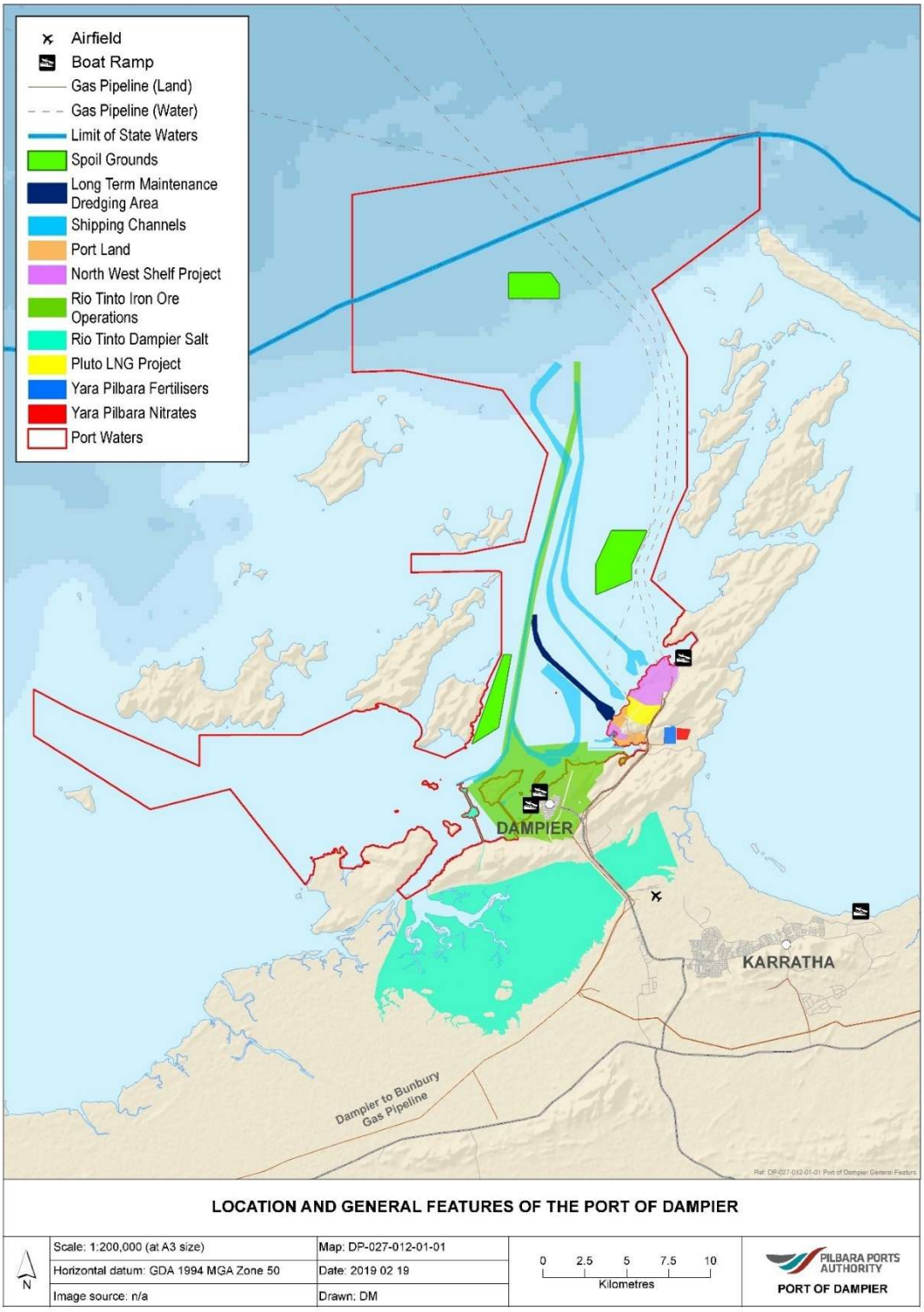


Figure 1: Location and general features of the Port of Dampier

3. Dredging and Spoil Disposal Activities

3.1 History of Dredging at the Port

There have been a number of capital and maintenance dredging programs undertaken by PPA and other proponents to facilitate expansion projects In the Port of Dampier (Table 1). PPA's Facilities Channel, swing basin, holding area and associated berth pockets have not been 'maintenance dredged' since they were established however, it is expected that maintenance dredging will be required in these areas to re-establish and maintain design depths from 2019 until 2024.

Table 1: Previous approved and permitted dredging activities at the Port of Dampier

Permit No.1	Year	Type of Dredging	Proponent[2]	Volume (m^3)
*	1984	Capital - to support construction of the Dampier Cargo Wharf and berths	PPA	~100,000
*	1986-1987	Capital dredging to establish the new LNG shipping Channel	Woodside	6,600,000
*	1989	Maintenance Dredging of the LNG Channel	Woodside	149,700
*	1994	Capital dredging for to establish a new berth pocket for LNG ships	Woodside	700,000
*	1998	Capital dredging for shipping channel and maintenance dredging around Parker Point and East Intercourse Island berths.	Rio Tinto	2,000,000 (capital) 800,000 (maintenance)
*	2003	Capital Dredging for the Trunkline Systems Expansion Project	Woodside	1,060,000
DPA 2003/1 and 2003/2	2004	Capital - to support construction of the Dampier Bulk Liquids Berth and Facilities Channel	PPA	4,609,000
SD2005/0031 and SD2006/0036	2006	Maintenance and Capital dredging for additional berths at Parker Point	Rio Tinto	~3 million
SD2006/0033	2006	Pluto LNG Development	Woodside	14.1 million
SD2008/0742	2008	Pluto LNG Development	Woodside	219,000

Permit No.1	Year	Type of Dredging	Proponent[2]	Volume (m^3)
SD2009/1122	2010-2012	Maintenance dredging at Parker Point and East Intercourse Island	Rio Tinto	600,000
SD2012/2262	2012	Capital dredging to support the Heavy Load Out Berth and Swing Basin Expansion Project	PPA	98,300
SD2014/2742	2014	Maintenance Dredging of Mermaid Supply Base berth and shipping channel	Mermaid Supply Base	150,000
SD2015/3122	2015	Maintenance dredging at Parker Point, East Intercourse Island and departure channels	Rio Tinto	650,000
SD2016/3262	2017	Maintenance dredging within the North West Shelf Shipping Channel and King Bay Supply Facility	Woodside	400,000
SD2016/3462	2016-2025	Maintenance dredging at Parker Point, East Intercourse Island and departure channels.	Rio Tinto	1,225,000
SD2019/3962	2019-2024	Maintenance dredging at PPA's Facilities Channel, swing basin, holding area and associated berth pockets.	PPA	450,000

[1] PPA includes the predecessor organisation Dampier Port Authority; References to Rio Tinto includes permits issued to Pilbara Iron and Hammersley Iron.

[2] Permits issued prior to 2004 did not have a permit number

3.2 Proposed Dredging Activity and Volumes

Unlike many other ports around Australia, the Port of Dampier is not situated at the mouth of a major river or estuary. With low annual average rainfall and only periodic intense flows (typically associated with cyclones) sediment flows into the Port from surrounding catchments are low. The location, orientation and local seabed conditions also contribute to minimal accretion of sediments within PPA's Facilities Channel, swing basin, holding area and associated berth pockets.

PPA estimates that to return the proposed dredging areas (described in Table 2 and illustrated in Figures 2 and 3) to their design depths, maintenance dredging of up to 153,282 m^3 in the first year will be required (which includes an allowance for up to 0.5m of vertical over-dredge to practically achieve design depths). It is estimated that up to 58,043 m^3 of material will infill into PPA's Facilities Channel, holding area, swing basin and associated berths in each subsequent year after 2019 (i.e. Years 2, 3, 4 and 5). This annual infill volume estimate has been derived from calculations comparing PPA's 2015 and 2017 hydrographic surveys. The total volume of material over the five-year period between July 2019 and July 2024 is therefore estimated to be 385,456 m^3. PPA has added a 15% contingency to this volume estimate (to account for survey error), which provides a value of up to 450,000 m^3.

The Port of Dampier has experienced numerous tropical cyclones since the PPA Facilities Channel, holding area, swing basin and associated berths were established through capital dredging. As such, the total volume of 450,000 m^3 over the five-year term of the proposed maintenance dredging incorporates expected infill volumes from tropical cyclone activity.

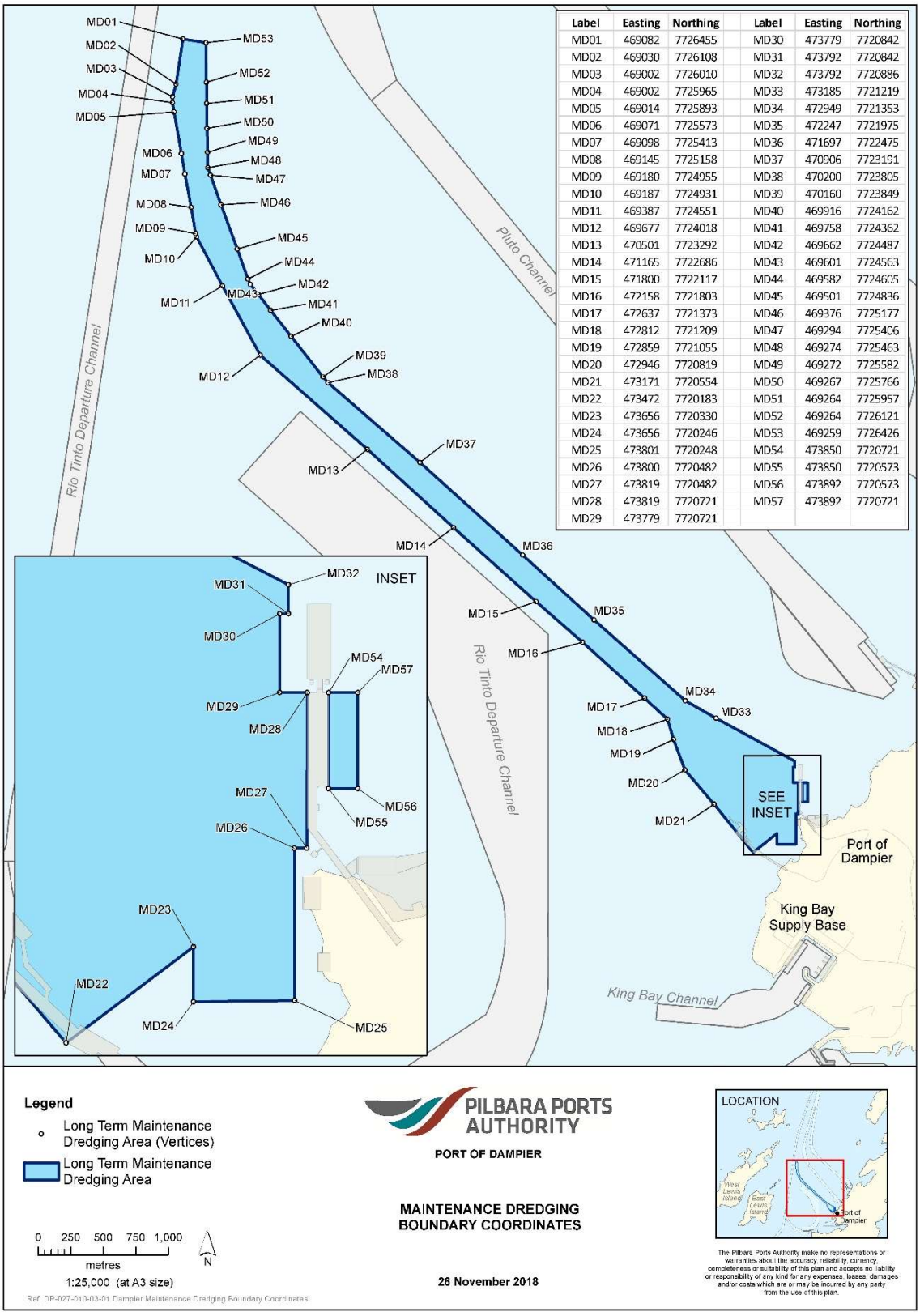
This siltation (if unmanaged) will limit navigational areas in terms of manoeuvring areas and depth and thereby increase the risk of a vessel grounding. Hence maintenance dredging is, and will continue to be, required to return and maintain the proposed dredging areas, as shown in Table 2, to their design depths.

Table 2: Design depths for the long-term maintenance dredging areas.

Location	Desired Depth to be Maintained[1] (m CD)
Facilities Channel (including swing basin)	-11.5
Heavy Load-Out Facility (HLO) holding area	-10.75
Dampier Cargo Wharf (DCW) West Face	-10.5
Dampier Cargo Wharf (DCW) East Face	-7.5
Dampier Bulk Liquids Berth (DBLB)	-13.5
Heavy Load-Out Facility (HLO)	-12.0

[1] Note: These depths include an allowance of 0.5 m extra depth for over dredging. .

The actual dredging footprints for each annual maintenance campaign between 2019 and 2024 to be covered by this LTDMP and SDP have not been determined at this stage as they are likely to vary from year to year, but will only occur within the approved footprint as set out in Figure 2. The precise area to be dredged under each campaign will be defined prior to each annual maintenance dredging campaign based on up-to-date survey results. This approach minimises the amount of dredging required.



Label	Easting	Northing	Label	Easting	Northing
MD01	469082	7726455	MD30	473779	7720842
MD02	469030	7726108	MD31	473792	7720842
MD03	469002	7726010	MD32	473792	7720886
MD04	469002	7725965	MD33	473185	7721219
MD05	469014	7725893	MD34	472949	7721353
MD06	469071	7725573	MD35	472247	7721975
MD07	469098	7725413	MD36	471697	7722475
MD08	469145	7725158	MD37	470906	7723191
MD09	469180	7724955	MD38	470200	7723805
MD10	469187	7724931	MD39	470160	7723849
MD11	469387	7724551	MD40	469916	7724162
MD12	469677	7724018	MD41	469758	7724362
MD13	470501	7723292	MD42	469662	7724487
MD14	471165	7722686	MD43	469601	7724563
MD15	471800	7722117	MD44	469582	7724605
MD16	472158	7721803	MD45	469501	7724836
MD17	472637	7721373	MD46	469376	7725177
MD18	472812	7721209	MD47	469294	7725406
MD19	472859	7721055	MD48	469274	7725463
MD20	472946	7720819	MD49	469272	7725582
MD21	473171	7720554	MD50	469267	7725766
MD22	473472	7720183	MD51	469264	7725957
MD23	473656	7720330	MD52	469264	7726121
MD24	473656	7720246	MD53	469259	7726426
MD25	473801	7720248	MD54	473850	7720721
MD26	473800	7720482	MD55	473850	7720573
MD27	473819	7720482	MD56	473892	7720573
MD28	473819	7720721	MD57	473892	7720721
MD29	473779	7720721			

Figure 2: Detail of long-term maintenance dredging areas.

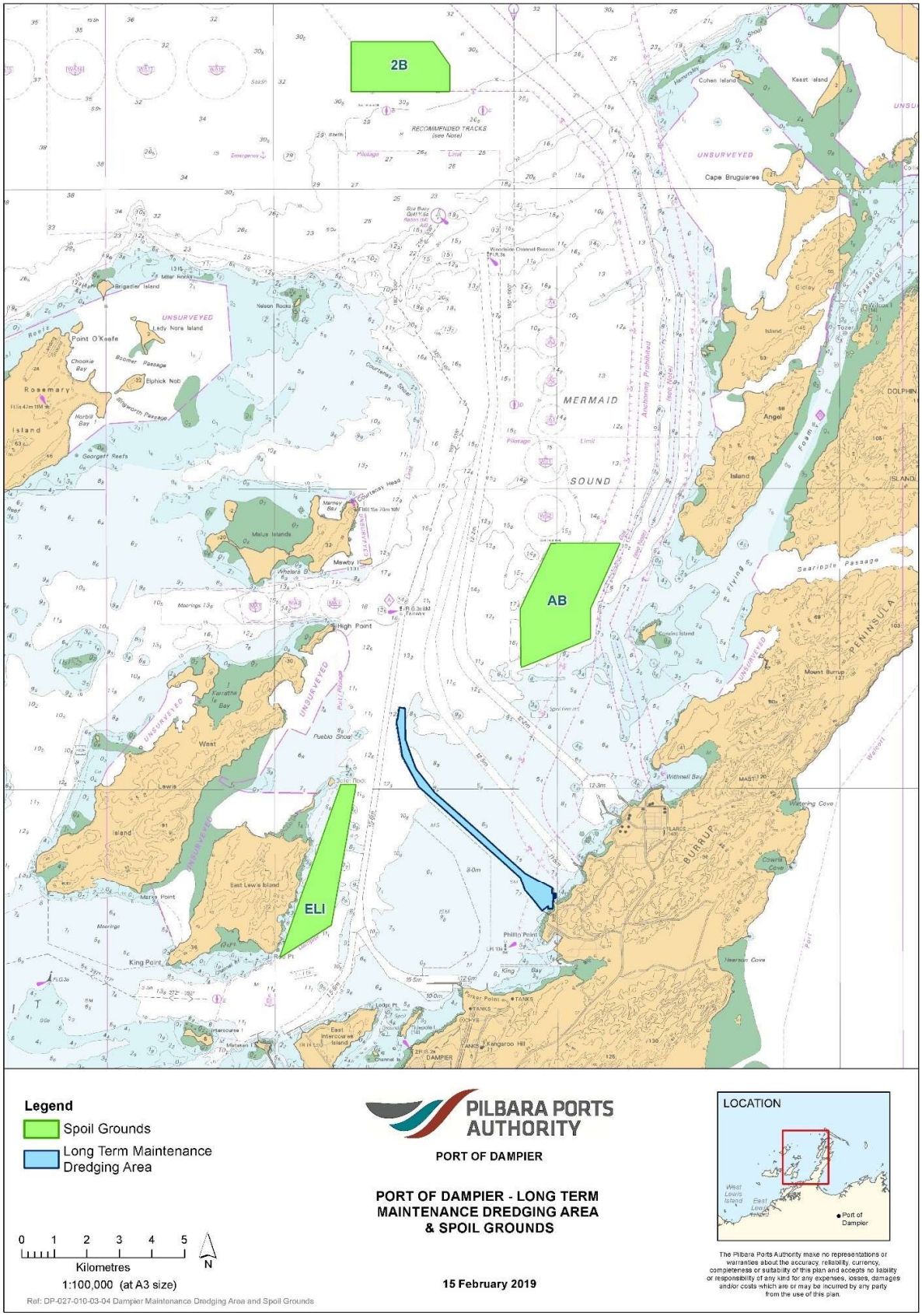


Figure 3: Port of Dampier long-term maintenance dredging areas and spoil grounds.

3.2.1 Dredging Methods

The details of the actual dredging equipment that will be used, and the methods applied, will be dependent on the dredging requirements for a particular year and the availability of dredging equipment that may vary from year to year. PPA's approach would be to use the same equipment which is to be contracted to carry out maintenance dredging in other PPA operated ports, e.g. the ports of Port Hedland and Ashburton.

Whilst dredging in the Facilities Channel and swing basin will likely be undertaken by a Trailing Suction Hopper Dredge (**TSHD**), a backhoe, back-actor or Cutter Suction Dredge (**CSD**) in combination with barges and a sweep vessel may be employed in areas where a TSHD access is limited (e.g. in shallow or confined areas close to infrastructure). The impact associated with all dredging methods have been considered in this Long-Term Dredge Management Plan (LTDMP) and supporting Environmental Risk Assessment.

Additional dredging methods may be needed in confined areas close to existing infrastructure. These methods incorporate smaller types of conventional dredging equipment that have the appropriate dimensions to access and manoeuvre within niche areas (i.e. a small cutter suction dredge or submersible dredge pump). This equipment would dredge accreted sediments and transport (pump) it to a deeper seabed location within PPA's approved maintenance dredging footprints (i.e. berth pockets or approach channels), where it will be discharged below water level to the seabed to limit turbidity. The temporarily relocated dredge material would then be collected using a TSHD as part of PPA's maintenance dredging campaign in a timely manner. No dredged materials will be temporarily relocated to a seabed location that is outside the existing approved footprint for maintenance dredging. Such maintenance dredging methods are not normally seen at PPA's port locations, but are commonly used within Australia and internationally.

3.2.2 Dredging Schedule

The maintenance dredging schedule may change from year to year depending upon conditions at the time, contingencies due to weather or equipment delays, or dredging works in other PPA operated ports. PPA is proposing to commence the dredging program associated with this LTDMP (and associated SDP application) in June/July 2019, with dredging being undertaken for a period of approximately one to two weeks. A similar maintenance dredging cycle may be undertaken annually for the period of the SDP.

3.2.3 Dredge Spoil Disposal

Material dredged as part of PPA's maintenance dredging program will be placed within the three established spoil grounds within the Port of Dampier depending of the method of dredging to be used. These spoil grounds are named East Lewis Island Spoil Ground, Spoil Ground A/B and Spoil Ground 2B (location displayed in Figure 3 and detailed in Appendix A).

Management and allocation of space within existing spoil grounds is the responsibility of PPA and is subject to consultation with its Technical Advisory Consultative Committee (**TACC**). The precise location of dumping within each spoil ground during the term of the SDP will be dependent on the dredge vessel(s) used, sea conditions and will be determined in consultation between the PPA Harbour Master, Dredging and Survey Manager and Environment and Heritage Manager.

Coordinates for each of the three established spoil grounds in the Port of Dampier are provided in Table 3. Table 4 provides a brief overview of each spoil ground, including remaining capacity for future dredged material.

East Lewis Island Spoil Ground

Dredged material has been placed within the East Lewis Island Spoil Ground since the establishment of the Port of Dampier as an Iron Ore Port in the 1960s. PPA currently maintains an agreed upper 'ceiling' depth of -6m CD in consultation with the TACC for the East Lewis Island Spoil Ground. Based on the most recent hydrographic survey data available for this area, there is approximately 6.7 Mm^3 of capacity remaining within this spoil ground to the -6m CD ceiling.

The remaining capacity of this spoil ground is typically reserved by PPA (in consultation with the TACC) for smaller (low volume) dredging campaigns, particularly where smaller dredging plant (e.g. split hopper barges or shallow draft TSHD) are used. Due to its shallow depths, it is often not possible / practical for a larger TSHD to utilise this spoil ground to place dredged materials in.

It is possible that up to 20% (~90,000m^3) of the total material dredged by PPA during the five-year term of the SDP may be placed within the East Lewis Island Spoil Ground. This estimate is made on the basis that only a small proportion of the material to be dredged by PPA exists within the dredging areas that are unable to be reached by a large TSHD (e.g. areas close to wharf infrastructure, corners within the Facilities Channel and swing basin) and may be removed using a backhoe or CSD, in combination with barges that have a sufficiently shallow loaded draft to place dredged material in this spoil ground. There is ample capacity within the spoil ground to receive this quantity of material and there is no current approved or planned use of the spoil ground by other Port proponents.

Spoil Ground A/B

Spoil Ground A/B was originally established in 1986 by Woodside for the disposal of dredged material from several capital and subsequent maintenance dredging programs. It has been used extensively by Rio Tinto, Woodside and PPA since that time. More recently, Spoil Ground A/B was utilised in 2016 as part of two separate maintenance dredging campaigns:

- Rio Tinto (5-year Sea Dumping Permit SD2016/3462) – 500,000m^3 of 1,225,000m^3 (total permitted volume over 5 years) placed within Spoil Ground A/B;
- Woodside (Sea Dumping Permit SD2016/3262) - 333,400m^3 of 400,000m^3 (total permitted volume) placed within Spoil Ground A/B.

Following its use in 2017, PPA has determined that Spoil Ground A/B has a remaining capacity of 6.7Mm^3. Under their Long-Term Sea Dumping Permit SD2016/3462, Rio Tinto are permitted to place a further 725,000m^3 of material derived from their maintenance dredging either wholly within or split between Spoil Grounds A/B and 2B. Even if the full 725,000m^3 from Rio Tinto's remaining dredging program was placed wholly within Spoil Ground A/B, there is ample remaining capacity to accommodate the entire volume of PPA's maintenance dredging program (450,000m^3) over the term of PPA's Sea Dumping Permit, as well as future proponents' dredging programs.

The remaining capacity in this spoil ground has been largely reserved by PPA (in consultation with the TACC) for use by ongoing maintenance dredging programs, with the possibility of some use by smaller capital programs (in consultation with the TACC). Hydrographic survey and sediment flux modelling (RPS APASA 2016) indicate that Spoil Ground A/B is largely

retentive under ambient conditions at PPA's current agreed upper ceiling depth of -10.5m CD (RPS APASA 2016).

Spoil Ground 2B

Spoil Ground 2B was developed for the capital dredging activities associated with Woodside's Pluto LNG Development (2007 – 2010). Spoil Ground 2B was established as the result of an extensive options investigation to provide a site distant from sensitive habitats. Accordingly, this site is located outside the mouth of Mermaid Sound and away from shallow reefs. The Pluto capital dredging program has been the only use of Spoil Ground 2B to date. In consultation with the TACC, the current capacity of Spoil Ground 2B is 38.5Mm^3, calculated to an agreed ceiling of -23.5mCD.

Under their Long-Term Sea Dumping Permit SD2016/3462, Rio Tinto are permitted to place the remaining volume of maintenance dredging material (~725,000m^3) either wholly within or split between Spoil Grounds A/B and 2B. Even if the full 725,000m^3 from Rio Tinto's remaining dredging program was placed wholly within Spoil Ground 2B, there is significant remaining capacity to accommodate the entire volume of PPA's maintenance dredging program (450,000m^3) over the term of PPA's SDP, as well as future proponents.

Hydrographic survey and modelling (RPS APASA 2016) undertaken by PPA and proponents indicate that Spoil Ground 2B is largely retentive under ambient conditions (RPS APASA 2016).

Table 3: Coordinates of the established spoil grounds within the Port of Dampier (Datum GCS WGS 1984).

Spoil Ground	Latitude	Longitude
East Lewis Island Spoil Ground	20° 34.926' S	116° 41.174' E
	20° 34.927' S	116° 41.427' E
	20° 37.266' S	116° 40.985' E
	20° 37.793' S	116° 40.093' E
Spoil Ground A/B	20° 30.912' S	116° 44.898' E
	20° 30.912' S	116° 46.104' E
	20° 31.998' S	116° 45.576' E
	20° 31.998' S	116° 44.358' E
	20° 32.491' S	116° 45.573' E
	20° 32.963' S	116° 44.368' E
Spoil Ground 2B	20° 22.556' S	116° 41.380' E
	20° 22.558' S	116° 42.817' E
	20° 22.938' S	116° 43.104' E
	20° 23.372' S	116° 43.103' E
	20° 23.369' S	116° 41.378' E

Table 4: Summary of Established Spoil Grounds – Port of Dampier

Spoil Ground	Ceiling Depth (m CD) [1]	Area (ha)	Proportion of material from PPA 5-year dredging	Remaining Capacity (Mm^3)[2]	Description
East Lewis Island Spoil Ground	-6	413	Up to 20%	6.7	Initially established in the 1960s as a disposal site for material from Rio Tinto's capital dredging programs. Most recently used during maintenance dredging of Mermaid Marine Supply Base in 2015 (via a small TSHD) and capital dredging by PPA in 2012 (via Split Hopper Barges (SHB) used in conjunction with a back-actor).
Spoil Ground A/B	-10.5	705	~40%	6.7	Established in 1986 to receive material from Woodside's LNG project (capital dredging to establish he Woodside channel, swing basin and berth pockets). Most recently used by Rio Tinto and Woodside in their 2017 maintenance dredging campaigns.
Spoil Ground 2B	-23.5	432	~40%	38.5	Established in 2007 to accommodate dredged material from Woodside's Pluto LNG development. Only received material from capital dredging of Pluto between 2007 and 2010 (no use since).

[1]Nominated ceilings have been historically set by PPA (in consultation with the Dampier TACC) based on limits set for safe navigation (for transit over the spoil grounds) and sediment dispersion modelling / assessments.

[2]Capacities derived from calculations undertaken by PPA using most recent hydrographic survey available for each spoil ground – ELISG (GIS ref: DP-026-009-02-01); SG A/B (GIS Ref: DP-026-008-02-01) and SG 2B (GIS ref: PD-032-060 Rev 1)

4. Potential Impacts - Environment, Social and Amenity Considerations

Characterisation of the existing marine environments at the Port of Dampier and an assessment of the potential impacts of the proposed maintenance dredging and disposal operations were undertaken based on existing knowledge and available historic data of the dredging areas. PPA also implemented a Sampling and Analysis Plan (**SAP**) in January 2019 at selected locations within the maintenance dredging area and soil grounds to reconfirm sediment quality data collected previously (WorleyParsons 2019). An overview of the marine environment within and surrounding the Port of Dampier is provided below.

4.1 Physical Environment

4.1.1 Coastal Geomorphology and Hydrodynamic Processes

The *Geology, Geomorphology and Vulnerability of the Pilbara Coast* was commissioned by the Department of Planning in 2013. This report describes Dampier coast as a "rocky shoreline, with low sediment supply", with further details as follows:

- *"The Dampier coast is located along the western side of the Burrup Peninsula strike ridge, which runs approximately in a northeast direction. Further expressions of the Precambrian geological formation occur as islands and offshore shoals. The older base is overlain in parts by Pleistocene limestone which forms several of the outer islands and is common on the modern coast. These rocky features are in turn overlain by mobile sediments, with a mixture of gravel, sand, silt and clay reflecting the degree of shelter and the focusing of tidal currents generated by offshore features."*

- *"Sediment supply to the Dampier area is limited, with the Maitland River providing a low supply of material, with the finer fraction dispersed via tidal currents and the coarser material distributed in Regnard Bay. As a consequence, West Intercourse Island marks a distinct change from sandy to rocky coast. Sedimentary features within Mermaid Sound reflect the level of local sheltering, with silty seabed, muddy inlets including King Bay, through to small coarse sand perched beaches held in place by rock headlands. Modification of the coast has been undertaken, including construction of causeways, revetments, reclamation and extensive bunding of the mudflats south of Dampier town site to form salt ponds."*

Geology, Geomorphology and Vulnerability of the Pilbara Coast (Department of Planning, 2013) also states that:

- *"Imagery for the Dampier Coast illustrates the shoreline has historically been relatively stable and is strongly controlled by underlying, alongshore and supratidal rock features; which has been described in greater detail by Damara WA (2011)."*

- *"Very little coastal change is apparent to the vegetation line, with mild accumulation along the Hampton Harbour shore and slight erosion west of Parker Point. The majority of observed change is in response to human interventions, including boating facilities and coastal protection works. Erosion is occurring at coastal road embankments and at eastern areas of embayments associated with terrestrial runoff."*

- *"Dampier coast is relatively insensitive to weather systems and environmental change, due to the presence of high mainly rocky topography. Exceptions largely occur at artificial or highly modified sections of coast, including sites where coastal dunes were flattened to provide the town's sporting ovals and reclaimed Port areas."*

4.1.2 Marine Water Quality

The waters of the Dampier Archipelago, including those of Mermaid Sound, are characterised as having naturally higher levels of turbidity than the clearer, offshore environment (MScience 2016). This increase in suspended matter in the water column is predominantly related to the continual resuspension of fine sediment as a result of natural events such as winds, tidal currents and wave energy, which is exacerbated in shallow areas where strong tidal flows exist (such as through Flying Foam Passage). Periodic events, such as major sediment transport associated with tropical cyclones, may influence turbidity on a regional scale (MScience, 2016).

During dredging and disposal activities, the primary sources impact to water quality will be turbidity (plumes of sediment) generated by the drag head, overflow and, depending on depth, the propeller wash of the dredge vessel. During disposal, plumes of turbid water are generated as the material from the dredge or hopper barge is released and settles to the seafloor, interacting with the seabed sediments. Finer sediments can be entrained in the water column by prevailing surface currents while heavier material will settle directly to the seafloor.

As determined through the dredging risk assessment, the increase in suspended sediments caused by dredging and disposal is expected to be limited temporally and spatially as:

- The duration of each dredging campaign is anticipated to be very short (1-2 weeks), due to the limited quantity of material to be dredged on an annual basis;
- Previous dredging campaigns in the Port of Dampier of a far greater size than the program that is proposed in this LTDMP have demonstrated turbidity returns to background level within one tidal cycle and the spatial extent of the plume is limited to one kilometre from the dredge footprint and disposal area.

4.1.3 Sediments

Sediment sampling of the past ten years in the Port of Dampier has shown that the sediments are generally clean and free of of contaminants, apart from some naturally-occurring nickel. Implementation of the SAP for this maintenance dredging program was undertaken in January 2019 (Advisian, 2019). The outcomes of this sampling are summarised as follows and are consistent with the results of historic sampling programs in the Port of Dampier.

Advisian (2019) reported that sediment particle size distribution was generally consistent between the locations sampled within the dredge footprint with almost all sites being predominantly silt and sand. One site has a high proportion of gravel, this being Location 7, which is in the Facilities Channel, adjacent to the BLB berth pocket.

Of the contaminants of concern tested, only nickel concentrations exceeded the relevant NAGD (low) screening levels. The calculated 95% UCL of the mean was 22.1 mg/kg compared to the NAGD (low) screening level of 21 mg/kg. This is consistent with previous assessments undertaken in the Port of Dampier and elsewhere in the Pilbara where naturally occurring elevated levels of nickel are regularly reported.

Concentrations of organotin compounds, Total Recoverable Hydrocarbons (**TRH**) and Polycyclic Aromatic Hydrocarbons (**PAH**) were all very low and below the Practical Quantitation Limits (**PQL**) for most locations tested.

Sediment sampling and testing was also undertaken within the three spoil grounds (East Lewis Island, 2B and A/B). Metal concentrations in the spoil grounds were generally very low with the only exceedance recorded at one location in Spoil Ground A/B for nickel and a further six locations from East Lewis Island Spoil Ground that also exceeded the screening level for nickel.

It was concluded by Advisian (2019) that although the 95% UCL for nickel exceeded the NAGD (low) screening level, the elevated levels in the Port of Dampier maintenance dredging area and spoil grounds are due to naturally elevated ambient baseline levels. This was confirmed by undertaking normalisation of both nickel concentrations to a non-anthropogenic lithogenic reference element (aluminium) as recommended in the NAGD and by also comparing values with historical results.

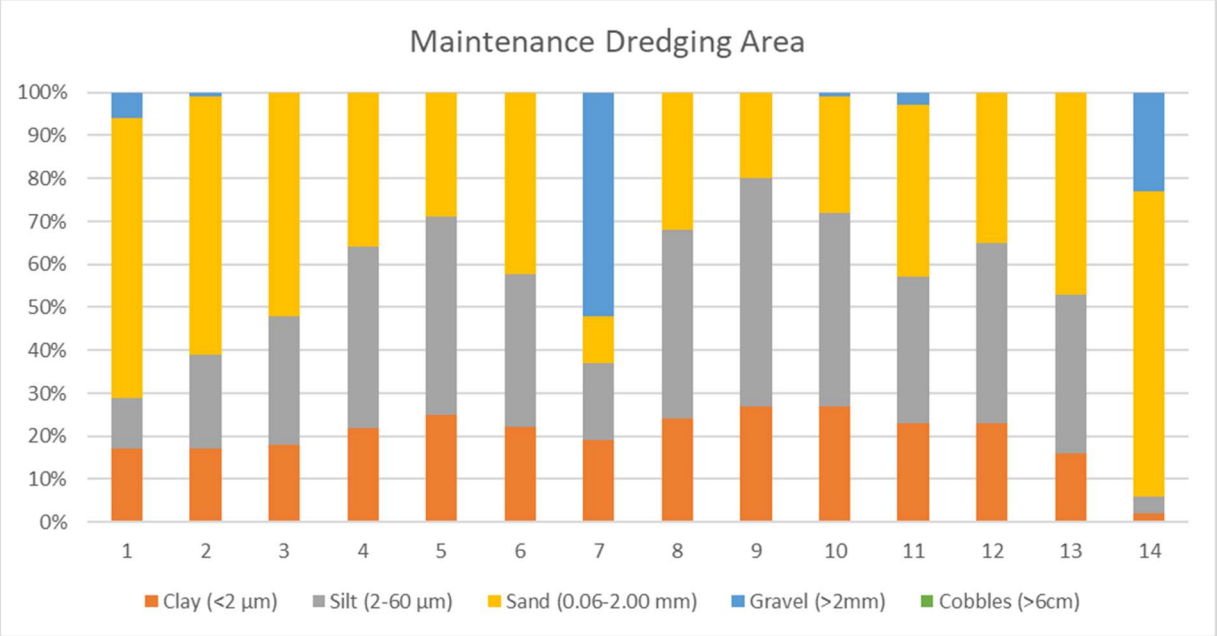


Figure 4: Particle size distribution, maintenance dredging area, January 2019 (from Advisian, 2019)

4.2 Biological Environment

4.2.1 Marine Habitats

There are five key types of Benthic Primary Producer Habitats (**BPPH**) likely to be present within the Port of Dampier (WorleyParsons, 2009; MScience, 2014). These habitats include:

- Coral;
- Seagrass;
- Macroalgae;
- Mangroves and Saltmarsh; and

- Mixed Community.

The dominant habitat (by area) on the seabed within the Port of Dampier is soft sediment largely composed of sand and silt (Bancroft and Sheridan, 2000) as demonstrated by the results presented in Figure 4. This habitat is typically bare however in patches there may occur seasonal macroalgae, patches of seagrass, macroalgae and invertebrate infauna (WorleyParsons, 2009; MScience, 2014). The silty subtidal habitats of the Dampier Archipelago are in more sheltered areas around the shorelines of the island and mainland coast of the Burrup Peninsula, and it is in these locations that the seagrasses and corals generally occur.

Coral

The waters in and around the Port of Dampier and Dampier Archipelago support more than 120 species of scleractinian coral from 43 genera (Blakeway and Radford, 2005). These corals generally occur in narrow linear features fringing the shorelines of islands and the Burrup Peninsula typically between 2 m and 10 m mean low water (Blakeway and Radford, 2005; Jones, 2004). The fringing reefs are not true coral reefs in that they establish and grow on existing hard substrata (Jones, 2004; WorleyParsons 2009).

There are no corals within the maintenance dredging area or established spoil grounds. Coral communities within one kilometre of the dredging area (along the coastline of the Burrup Peninsula) have been shown to be tolerant of short term elevated turbidity levels, as demonstrated by monitoring associated with previous dredging campaigns conducted in the area (MScience 2010a).

The coral communities nearest to dumping activities at Spoil Ground A/B are those surrounding Conzinc Island, Angel Island and within Conzinc Bay. These communities have been shown to experience repeated elevated sedimentation as a result of sediment plumes emanating from disposal of spoil at Spoil Ground A/B (i.e. from much larger and protracted dredging campaigns). Historically, these elevations have not resulted in detectable coral mortality (MScience 2010b).

No coral reefs are present within Spoil Ground 2B. Video transects identified soft sand with isolated low density epibiota such as seapens, macroalgae and seawhips. Monitoring of nearby coral habitats (e.g. Nelson Rocks, Hamersley Shoals) as part of the Pluto LNG Development dredging program found that dredging or spoil disposal operations at Spoil Ground 2B had no effect on coral mortality (MScience 2010c).

Seagrass

Seagrasses in the Dampier Archipelago are generally sparse, occurring in low abundance on shallow sandy sediments in sheltered areas and interspersed with other benthic communities and habitats (CALM, 2005; Jones, 2004; MScience, 2014). Surveys and studies of the region have identified nine species: *Cymodocea angustata, Enhalus acoroides, Halophila decipiens, Halophila minor, Halophila ovalis, Halophila spinulosa, Halodule uninervis, Thalassia hemprichii* and *Syringodium isoetifolium* (McMahon et al., 2017; Woodside, 2006). However, Halophila is the predominant species and is typically restricted to the 6 m (CD) depth contour (MScience, 2014).

Surveys conducted by Bertolino (2006) reported seagrass in Conzinc and Withnell Bays, southern side of East Lewis Island and between the causeways connecting East Intercourse Island and Mistaken/East Middle Intercourse Islands (MScience, 2014). Sparse patches of seagrass have also been recorded throughout Mermaid Strait and in the nearshore

environments of the bordering islands (MScience, 2014; Huisman and Borowitzka, 2003; Waycott *et al.,* 2004).

The most significant areas of seagrass in the Dampier Archipelago are found between Keast and Legendre Islands to the north of the Burrup Peninsula (outside Port waters), and between West Intercourse Island and Cape Preston. Recorded occurrences of *Halophila* species in the Dampier Archipelago fluctuate depending on a variety of factors such as salinity, success of seed set and colonisation, temperature and grazing by dugongs (Woodside, 2006). Furthermore, this fluctuation may indicate the presence of transitory communities, which are annual meadows that develop from the seed bank, grow flower, set seed and die back each year (McMahon *et al.,* 2017).

There are no established seagrass beds within or adjacent to the proposed maintenance dredging areas or established spoil grounds.

Macroalgae

Macroalgae are normally found on hard substrata as they need something to attach to. Macroalgal assemblages in the Pilbara have tended to display be ephemeral and not present year-round (Jones, 2004). Macroalgae in the vicinity of the Port of Dampier largely occurs in shallow waters on rocky substrata. The soft sediments that characterise most of the habitat in Mermaid Sound do not generally support macroalgae.

Mangroves and Salt Marsh

Mangroves and salt marsh communities occur in intertidal areas and are generally located away from the area where maintenance dredging is proposed to occur under this LTDMP. The nearest communities to the areas where maintenance dredging is proposed to be conducted is a stand of mangroves (*Avicennia* and *Rhizophera*) inhabiting sandy pockets at No Name Bay, directly to the north of the proposed dredging areas. There is no direct environmental impact pathway envisaged from the proposed maintenance dredging activities on these or any other mangrove communities.

Mixed Community

Most of the sea floor within the bounds of the Port of Dampier and adjacent Dampier Archipelago is soft sediment (WorleyParsons 2009). This habitat type can support areas of 'mixed communities' including invertebrates such as polychaetes, crustaceans and molluscs as well as isolated soft corals and sponges. The invertebrates tend to be short lived and able to adjust to disturbance of the benthic environment.

Benthic Habitats – Dredging Areas and Spoil Grounds

The benthic habitats at East Lewis Island Spoil Ground, Spoil Ground A/B and Spoil Ground 2B are likely to have been smothered during approved historic dredge disposal activities associated with previous dredging programs. As such, any benthic communities within the spoil ground footprints will be limited to resilient species which have managed to colonise the area since the last dredging program conducted within the Port of Dampier that utilised these spoil grounds.

The benthic habitats within the proposed maintenance dredging area are comprised of bare sediments, which are routinely disturbed through the passage of large vessels (propeller wash).

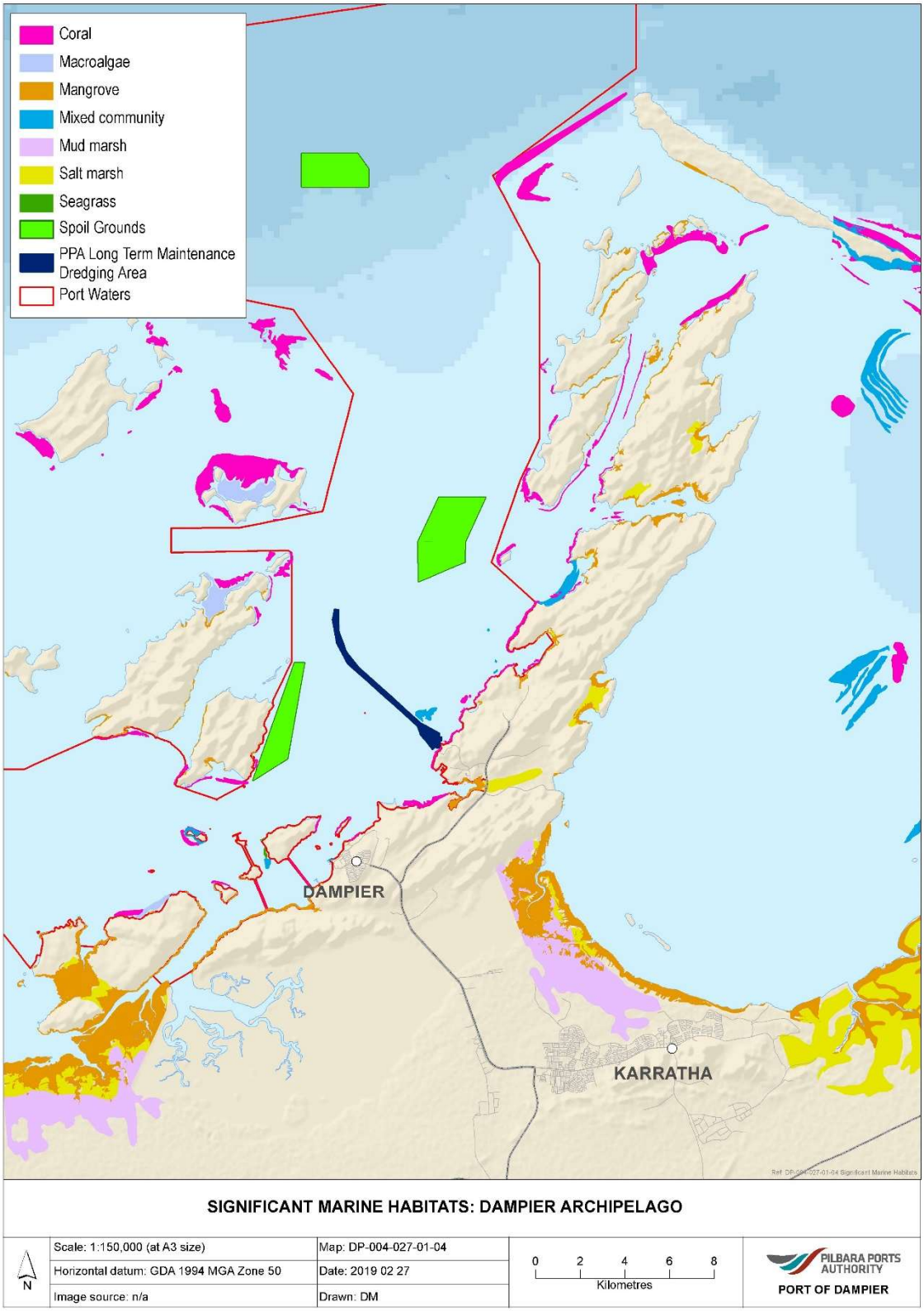


Figure 5: Significant marine habitats within the Port of Dampier and surrounds.

4.2.2 Marine Megafauna (including turtles)

The marine megafauna of the area includes species that are listed as of conservation significance and non-listed species. Of particular interest to the maintenance dredging program are whales, dolphins, dugongs and several marine turtle species. Many species of megafauna potentially occur in or migrate through the Dampier Archipelago area but are unlikely to be dependent upon habitat within the dredging areas or spoil grounds for population maintenance.

Dolphins and Dugongs

Dolphins are likely to occur in the area but are generally not considered at threat from dredging operations. Dugongs (*Dugong dugon*) are also common in the Dampier Archipelago however, their distribution is directed towards seagrass beds (Wells and Walker 2003). Dugongs are not known to frequent the dredging or spoil grounds as there is no adjacent seagrass.

Humpback Whales

Humpback whales migrate annually from feeding grounds in the Antarctic to the breeding grounds in Camden Sound in the Kimberley region of Western Australia. The north bound migration peaks adjacent to the Port of Dampier between approximately the last week of July and the first week of August. The peak of the south bound migration occurs during the last week in August and the first week of September. Jenner *et al.* (2001) suggested that the majority of migrating whales are found in waters deeper than 50 m; however, some individuals come closer to shore, particularly during the southern migration.

The Dampier region is not an aggregation or calving area for this species, although there is some recent suggestion that Nickol Bay (between Dampier and Karratha, outside the Port of Dampier) may constitute some form of milling area during the southern migration (Jenner and Jenner 2009; Jenner and Jenner 2011). More recent surveys indicate that Nickol Bay is used as a single day staging post, mainly by pods with calves using the areas close to shore during the southern migration (BMT Oceanica 2015). Whales may be present in the outer Mermaid Sound and around Spoil Ground 2B during the known migrations but are unlikely to be present in the proposed dredging areas.

Marine Turtles

Five of the six species of marine turtles in Australia are known to occur in the Dampier Archipelago. In addition to nesting beaches, the Archipelago includes inter-nesting habitat. Satellite tracking of turtle nesting from 2010 to 2013 (ongoing), showed no use of the disposal sites by inter-nesting turtles, indicating that the operational areas of the Port of Dampier, including the spoil grounds, are not actively used for inter-nesting or foraging activities. The spoil grounds consist of soft substrate with no reefs or benthic primary producer habitat and subsequently has limited food sources available. The spoil grounds do not appear to be suitable inter-nesting habitat. Seagrass beds have not been recorded within the vicinity of the disposal sites, and studies have shown the habitat of the Port of Dampier does not appear to be a key location for foraging behaviour. Appropriate management measures, as detailed in this LTDMP, should minimise potential impacts to inter-nesting turtles from the proposed dredged material disposal.

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) identified dredging as a potential source of turtle injury and/ or mortality. There are a number of mechanisms for potential impact on turtles, and other marine megafuna, including:

- Direct impacts through entrainment, where animals are drawn into the dredge's systems through the drag heads as a result of the suction used to collect sediments;
- Direct impacts though vessel strike where animals are physically struck by the dredge or associated vessels;
- Indirect impacts through destruction of food resources either through removal by the dredge or smothering with dredged material; and / or
- Indirect effects through increased turbidity or release of contaminants into the water column.

Entrainment is likely to be the only feasible pathway of impact on turtles and to a lesser extent other marine megafauna associated with maintenance dredging at the Port of Dampier. Direct mortality of marine turtles through entrainment in dredge equipment is only likely to affect individual turtles rather than impact species stocks (DotEE, 2017). The Environmental Risk Assessment addressed this issue and considered that with the implementation of appropriate mitigation measures including Marine Fauna Observers (**MFO**), tickler chains and avoidance of pumping unless drag head is on sea floor, then this risk would be low. This is supported by the Recovery Plan for Turtles (DotEE, 2017).

The provision of MFOs allows the dredge to move away from areas when turtles, and other marine fauna are observed in the area. This technique has generally been widely adopted as a condition of all dumping permits issued in Australia to minimise the risk of dredging impacts.

The use of flexible chain deflectors (tickler chains) attached to the TSHD's suction pipes in front of the drag heads to prevent entrainment of sea turtles during dredging operations has been widely adopted. These devices come into contact with any turtles that are on the sea floor in the pathway of the drag head. These turtles are then disturbed and swim away from the slow-moving drag head thus reducing the potential for entrainment into the dredge's systems.

Habitat modification was not considered a key risk for maintenance dredging through the environmental risk assessment, as all dredging is being undertaken in previously disturbed areas and dumping is occurring in established spoil grounds that have been selected based on their low environmental value.

Little research has been undertaken on the impacts of dredge spoil disposal as a direct form of impact on marine megafauna as it has been generally considered that this pathway of impact was very unlikely. The Great Barrier Reef Marine Park Authority (**GBRMPA**) in their publication Synthesis Report on the Effects of Dredging on the Great Barrier Reef by an Independent Expert Panel (McCook *et al.*, 2015 Table 5 p. 44) rated the potential for burial of megafauna as "not applicable". Thus, the independent panel GBRMPA assembled to consider this matter, did not consider that burial of turtles at the site of disposal was a plausible mechanism of impact. Whitlock *et al.* (2017) in their study of the effects of dredging on turtles in the Pilbara did not mention burial of turtles as an impact but referred to burial of habitat.

Light and noise generated from dredging activities has only limited potential to impact marine turtles. These impacts are not considered to be significant in the context of existing lighting from ships and industry.

Finally, where practicable, PPA will plan dredging activities such that they do not overlap the key turtle nesting and hatching periods (October to April).

4.2.3 Introduced Marine Pests

Extensive sampling for marine invasive pests has been undertaken over the past 20 years at all ports in the Pilbara including the Port of Dampier (Wells, 2018). Wells *et al*., (2009) stated that "the most detailed list [of marine introduced pests] for any area of Western Australian has been developed for the Dampier Archipelago and the Burrup Peninsula by the WA Museum".

Although the Pilbara is considered a high-risk area for Introduced Marine Pests (**IMP**) because of the very large number of international shipping visits from a wide variety of ports, the number of IMP that have been detected are, in fact, low. Wells (2018) undertook a detailed literature search of marine biodiversity studies in the Pilbara and developed a database of 5,532 species that have been recorded by previous surveys of IMP in the Pilbara. Wells (2018) reports that, despite all of the survey work that has been done, only one species on the Australian national and WA IMP register, the ascidian *Didemnum perlucidum*, also known as the white sea squirt, has been found in the Pilbara. This species was first detected in 2012 and was detected over some 2 800 km of WA coastline (Muñoz and McDonald, 2014). Eradication of this species is thought to be impractical and control of any further distribution is the current management target.

The Port of Dampier has also been part of the Western Australian State-Wide Array Surveillance Program (**SWASP**) that has been operating in Western Australian Ports since August 2016. The SWASP is a collaborative effort between all the WA Port Authorities and the WA Department of Primary Industries and Regional Development's Aquatic Biosecurity section.

There were no detections of IMPs in the Port of Dampier during the summer 2018 sampling period.

Strict adherence to biosecurity and IMP management conditions will be a necessary requirement for any operations in the Port of Dampier. PPA will continue to implement its Introduced Marine Pest Risk Assessment Procedure for all non-trading vessels (including dredgers and support vessels) entering the Port, as well as collaborate with the Aquatic Biosecurity unit of the Department of Primary Industries and Regional Development (**DPIRD**) in implementing the SWASP for IMPs.

4.3 Social and Economic Uses of the Area

The areas where maintenance dredging is proposed to occur are within Facilities Channel, holding area, swing basin and berths which enable vessel access to the DCW, DBLB and HLO. As such these are industrial areas with the main use being shipping traffic and cargo handling. There are very limited other uses for these areas

4.3.1 Fisheries

There are a number of Commercial Fisheries that occur near to the proposed dredging areas and spoil grounds. Recreational fishing is popular in the region and some activity may occur in the areas proposed to be dredged. Large vessels (including dredges) have priority and 'right of way' in these areas and the proposed dredging program should not have an adverse impact upon recreational or commercial fishing activities.

5. Impact Assessment

5.1 Environmental objectives

The potential impacts of maintenance dredging on environmental, social and amenity values of the area were documented in an Environmental Risk Assessment.

Environmental objectives, or management goals were drawn from the Western Australian Government's Statement of Environmental Principles, Factors and Objectives (WA EPA 2016a) and the Technical Guidelines Environmental Impact Assessment of Marine Dredging Proposals (WA EPA, 2016b). These objectives provide a framework against which the environmental performance of the proposed dredging can be measured (Table 5).

These Objectives seek to minimise the impact of dredging on e.g.:

- direct loss of benthic communities and habitats by removal or burial;
- indirect impacts on benthic communities and habitats from the effects of sediments introduced to the water column by the dredging and disposal;
- shorelines, bathymetry and habitats through modified ecological and physical processes;
- introduction of invasive pest species translocated in dredging (or ancillary) equipment that can have both ecological and economic consequences;
- adverse effects of contaminant release and dispersion (including impacts associated with reclamation or onshore disposal of acid sulphate soils) on marine environmental quality;
- conflict with fisheries and impacts on fish, their habitats and fisheries production;
- changes to coastal processes and water circulation that impact on the environmental values of the coast and coastal waters; and
- impacts on the behaviour and survival of marine wildlife, including specially protected species.

Table 5: Environmental Factors and Objectives that may be influenced by maintenance dredging[1]

Theme	Factor	Objective
Sea	**Benthic Communities and Habitat**	To protect benthic communities and habitats so that biological diversity and ecological integrity is maintained.
	Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.
	Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.
	Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.
People	**Social surroundings**	To protect social surroundings from significant harm.
	Human Health	To protect human health from significant harm.
	Heritage	To ensure that historical and cultural associations are not adversely affected.

5.1.1 Risk to Environmental Objectives

Drawing upon existing data and information, and consultation with stakeholders and specialists, the Environmental Risk Assessment was conducted to analyse the potential risks to identified environmental receptors from the maintenance dredging activities. The risk assessment considered the proposed maintenance dredging program for the Port of Dampier, and the contingency scenarios to identifying the risks and control actions. The environmental quality objectives identified in Table 5 were considered through evaluation of existing information and in the risk assessment process, and subsequently the risk of a failure to meet the objectives was determined. Management actions are detailed in Section 6.

[1] Themes factors and objectives are adapted from: (a) WA EPA Technical Guidance – Protection of Benthic Communities and Habitats; and (b) WA EPA Technical Guidance – Protecting the Quality of Western Australia's Marine Environment.

6. Monitoring and Management Plans

The following sections detail specific actions for the management of environmental values and receptors during the maintenance dredging campaigns. The only risk which may require management actions in excess of standard operational procedures was entrainment of turtles and other marine megafauna during dredging operations. All other environmental values identified were considered to be at low risk and can be suitably managed through standard best practice procedures under a business-as-usual model. Table 6 provides the framework for each monitoring and management plan.

Table 6: Environmental monitoring and management plan framework

Element	Description
Objective	What is intended to be achieved.
Management Action	The actions required to assist in meeting the objective. These can be single actions or multiple liked actions to address the objective.
Responsibility	Who is responsible for implementing the actions.
Timing	The time period when the management actions need to be implemented.
Measures	The metrics for recording the outcomes.
Reporting	The way in which the compliance with the management actions and outcomes are reported.
Target	The thresholds, which, if exceeded, require differed management actions (contingency) to be implemented.
Contingency	Actions to be undertake if the management action is not met.

Using the framework presented in Table 6, six environmental management plans (Section 6.1 to Section 6.5) have been developed to guide the maintenance dredging programs. These include:

- Marine megafauna (including turtles);
- Benthic communities and habitats;
- Marine hydrocarbon pollution;
- Marine water and sediment quality;
- Introduced marine pests; and
- Shipboard waste.

6.1 Environmental management plan for marine megafauna (including turtles)

Risk Area	Marine megafauna (including turtles)
Value(s)	Marine fauna
Objective(s)	To protect marine fauna so that biological diversity and ecological integrity are maintained

Task	Action	Responsibility	Timing
Management Actions	Internal training of Marine Fauna Observer(s) (MFO), which provides clear direction on: • The area that comprises the 'monitoring zone'[2], being the area within a 300 metre radius of the dredge vessel; • How to identify marine megafauna (i.e. whales, dolphins, dugong, turtles) that are known or likely to be encountered within the Port; • The actions to be undertaken by the observer in the event of marine fauna being sighted within the monitoring zone; and • The actions to be undertaken by the observer in the event of an incident resulting in injury or death of a marine species.	Dredging Contractor	Prior to commencement of dredging project
	Minimise impacts of the dredge through underwater noise through proper maintenance of equipment.	Dredging Contractor	At all times throughout dredging project
	Minimise impacts of light on fauna through the minimisation of unnecessary light sources not required for safe operation of the dredge.	Dredging Contractor	At all times throughout dredging project
	Prior to the commencement of the dumping activities, the dredging contractor must ensure that a check is undertaken, using binoculars from a high observation platform, for marine megafauna within the 'monitoring zone'. If any marine megafauna are sighted in the 'monitoring zone', dumping activities must not commence until the marine megafauna is no longer observed in the monitoring zone, or the vessel is to move to another area of the disposal site to maintain a minimum distance of 300 metres between the vessel and any marine species.	Dredging Contractor	Prior to dredging activities, during daylight hours only

[2] Refers to the area within a 300 metre radius of the vessel

Task	Action	Responsibility	Timing
	Entrainment of turtles will be mitigated through fitting of TSHD drag heads with turtle tickler chains or similar.	Dredging Contractor	Prior to commencement of dredging project
	Dredge pumps will be stopped as soon as practicable after the drag head is lifted from the sea floor to minimise potential for intake of marine megafauna, and then only re-engaged once in close proximity to the seabed floor.	Dredging Contractor	During dredging
	Ongoing internal training of MFOs as required to ensure that a trained MFO is always available.	Dredging Contractor	At appropriate times throughout dredging project
Measures	Number of reported incidents involving marine megafauna.	Dredging Contractor	During Dredging
Reporting / Evidence	MFO training package and training/attendance record for each MFO.	Dredging Contractor	Prior to and throughout project
	A log detailing all marine fauna observations within the monitoring zone (during daylight operations only) shall be maintained. The log shall include (as a minimum) the following information: date, name of MFO, time (commencement of pre-dumping observations), time (completion of pre-dumping observations), whether marine megafauna was sighted in the monitoring zone during the pre-dumping monitoring period, type of marine species identified (where possible), general comments on animal behaviour, description of mitigation measures undertaken (e.g. location of fauna monitored until it exited the monitoring zone. Dumping did not occur until fauna exited the monitoring zone), time (commencement of dumping) and time (completion of dumping).	Dredging Contractor	Throughout dredging and disposal activities
	Report any incidents involving the dredging or dumping activities that result in injury or death to any marine megafauna to PPA Dredging and Survey Manager and PPA Environment and Heritage department *as soon as practicable but within 12 hours*. Record the date, time and nature of each incident as well as a description of the species involved.	Dredging Contractor	As soon as practicable after an incident is observed, but within 12 hours
	Notify DAWE of any incidents involving the dredging or dumping activities that result in injury or death to any marine megafauna.	PPA Environment and Heritage Manager	Within 48 hours from the time that the incident occurred.
Target	No injury or death to any marine megafauna.	Dredging Contractor	Throughout the project

Task	Action	Responsibility	Timing
Contingency	Completion of detailed incident analysis and implementation of any corrective measures in consultation with DAWE.	PPA Environment and Heritage Manager	ASAP after an incident has occurred

6.2 Environmental management plan for benthic communities and habitats

Risk Area	Benthic habitats
Value(s)	1. Marine Environmental Quality 2. Benthic Communities and Habitat 3. Marine Fauna
Objective(s)	1. To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected. 2. To protect benthic communities and habitats so that biological diversity and ecological integrity is maintained. 3. To protect marine fauna so that biological diversity and ecological integrity are maintained.

Task	Action	Responsibility	Timing
Management Actions	Dredge hopper doors and seals to be inspected and maintained to prevent loss of dredge spoil during transport.	Dredging Contractor	Prior to dredging commencing
	Dredge spoil to only be dumped within the area allocated by PPA, inside the designated spoil grounds listed within the SDP.	Dredging Contractor	Throughout project
	Dredge spoil shall be dumped in a manner such that is minimises mounding and optimises spoil ground utilisation for the proposed, and future, maintenance dredging program(s)	Dredging Contractor	Throughout project
	Dredge hoppers to only be washed within boundaries of the designated spoil grounds.	Dredging Contractor	Throughout project
Measures	Dredging only occurs within nominated footprint, in accordance with the SDP.	Dredging Contractor	Throughout project
	All dredge spoil dumped within designated spoil grounds.	Dredging Contractor	Throughout project
Reporting / Evidence	Plotting sheets or a certified extract of the ship's log which shall include (as a minimum): • the dates and times of when each dumping run commenced and finished; • the track of all dredge vessels (as determined by GPS) during: (a) dredging activities, and (b) transit between the dredging area(s) and the nominated spoil ground (s); and • the position (as determined by GPS) of the dumping vessel at the commencement of dumping (i.e. hopper doors opened) and at the completion of	Dredging Contractor	Throughout project

Task	Action	Responsibility	Timing
	dumping (i.e. hopper doors closed), including the path / track taken during dumping.		
	A documented report provided to the PPA Dredging and Survey Manager on the incident (i.e. dredging or dumping outside footprint), including (as a minimum) details of the incident, the measures taken, the success of those measures in addressing the incident or risk and any additional measures proposed to be taken.	Dredging Contractor	Throughout project
	Undertake bathymetric survey of the disposal site (by a suitably qualified person).	PPA Dredging and Survey Manager	Prior to dredging; and Following completion of all dumping under the proposed dumping permit
Target	No direct disturbance outside approved dredging footprint and designated spoil grounds with minimal mounding of spoil within the spoil grounds	Dredging Contractor	Throughout project
Contingency	Investigate and report any breaches of dredge material placement to DAWE and commence processes to investigate any impact.	PPA	ASAP after breach is identified

6.3 Environmental management plan for marine hydrocarbon pollution

Risk Area	Marine hydrocarbon pollution
Value(s)	1. Marine Environmental Quality 2. Benthic Communities and Habitat 3. Marine Fauna
Objective(s)	1. To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected. 2. To protect benthic communities and habitats so that biological diversity and ecological integrity is maintained. 3. To protect marine fauna so that biological diversity and ecological integrity are maintained.

Task	Action	Responsibility	Timing
Management Actions	Dredge vessels shall have and implement a Ship Oil Pollution Emergency Plan (SOPEP), including having spill control equipment/materials available on board.	Dredging Contractor	Throughout project
	All equipment on board to be maintained and inspected in accordance with the manufacturer's recommendations or dredging contractor's vessel management systems in order to minimise the risk of hydrocarbon leaks.	Dredging Contractor	Throughout project
Measures	Number of hydrocarbon spills to harbour.	Dredging Contractor	Throughout project
Reporting / Evidence	Report any discharge of hydrocarbons to the marine environment (irrespective of quantity / volume) to PPA Vessel Traffic Services *without delay* on 08 9159 6556 or VHF Ch 11 or 16.	Dredging Contractor	Immediately
	All reports provided to WA DoT electronically via "Pollution Report" (POLREP) form.	Dredging Contractor	Immediately (but no later than 12 hours from the incident occurring)
	A documented report provided to the PPA Dredging and Survey Manager on the incident, including (as a minimum) details of the incident, the measures taken, the success of those measures in addressing the incident or risk and any additional measures proposed to be taken.	Dredging Contractor	Immediately (but no later than 24 hours from the incident occurring)
Target	No discharges of hydrocarbons to the marine environment.	Dredging Contractor	Throughout project

Contingency	Implement oil spill response measures in accordance with the requirements of PPA's *Marine Pollution Contingency Plan* for the Port of Dampier.	PPA	Immediately on notification of spill incident

6.4 Environmental management plan for Introduced Marine Pests

Risk Area	Introduced Marine Pests
Value(s)	1. Benthic Communities and Habitat 2. Marine Fauna 3. Marine Environmental Quality
Objective(s)	1. To protect benthic communities and habitats so that biological diversity and ecological integrity is maintained. 2. To protect marine fauna so that biological diversity and ecological integrity are maintained. 3. To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected.

Task	Action	Responsibility	Timing
Management Actions	WA DPIRD's 'Vessel Check' risk assessment (https://vesselcheck.fish.wa.gov.au) submitted to PPA (including supporting documentation) for all dredging and support vessels that mobilise to the Port of Dampier from interstate or international waters. Risk assessment must indicate that the vessel poses a low risk of IMP to Port of Dampier waters.	Dredging Contractor	Prior to vessel(s) entering Australian / Western Australian waters
	All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMO requirements and the Commonwealth *Biosecurity Act 2015*.	Dredging Contractor	Prior to vessel(s) entering Australian waters
Measures	Vessel IMP risk assessment undertaken for all vessels entering Port of Dampier waters.	Dredging Contractor	Prior to vessel(s) entering the Port of Dampier
	Ballast water management undertaken in accordance with IMO and Commonwealth *Biosecurity Act 2015* requirements.	Dredging Contractor	Prior to vessel(s) entering the Port of Dampier
Reporting / Evidence	Vessel IMP risk assessment report (including supporting documentation).	Dredging Contractor	Prior to vessel(s) entering the Port of Dampier
Target	No introductions or movement of IMPs.	Dredging Contractor	Throughout project.
Contingency	Notify DPIRD if the introduction of IMPs is suspected.	Dredging Contractor	Immediately

6.5 Environmental management plan for shipboard waste

Risk Area	Discharge of Shipboard Waste
Value(s)	1. Marine Environmental Quality 2. Benthic Communities and Habitat 3. Marine Fauna
Objective(s)	1. To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected. 2. To protect benthic communities and habitats so that biological diversity and ecological integrity is maintained. 3. To protect marine fauna so that biological diversity and ecological integrity are maintained.

Task	Action	Responsibility	Timing
Management Actions	All vessels to comply with the requirements of the Port of Dampier Handbook Section 39.1 *Management and Discharge of Shipboard Wastes*. This includes sewage, grey water, oil or oily mixtures, garbage, cargo hold and deck washing / cleaning and waste incineration.	Dredging Contractor	Duration of dredging operations
	Vessels from international waters must comply with the Department of Agriculture and Water Resources biosecurity requirements with regards to garbage disposal.	Dredging Contractor	Duration of dredging operations
	Controlled waste, including hydrocarbons and oily water, shall be stored in appropriately labelled receptacles and be correctly disposed of ashore not to be discharged to sea. Controlled waste shall be disposed of ashore (as required) via licenced controlled waste contractor, and waste tracking sheets to be retained.	Dredging Contractor	Duration of dredging operations
	Solid and liquid wastes and hazardous materials shall be stored in appropriately labelled receptacles and be correctly disposed of ashore (as required) through a licenced waste contractor, and waste tracking sheets to be retained.	Dredging Contractor	Duration of dredging operations
Measures	Number of incidents where waste has entered the marine environment, or incorrect storage / segregation.	Dredging Contractor	Duration of dredging operations

Reporting / Evidence	Certificate to demonstrate sewage treatment / disinfection system is approved in accordance with MARPOL and International Sewage Prevention Certificate provided to PPA.	Dredging Contractor	Prior to sewage discharge
	Vessel garbage disposal log for all discharges to shore.	Dredging Contractor	Duration of dredging operations
	Waste delivery receipts for all discharges to shore.	Dredging Contractor	Duration of dredging operations
	Controlled waste tracking forms for controlled waste (hydrocarbons and oily water).	Dredging Contractor	Duration of dredging operations
	Any incident of discharge (eg. uncontrolled or unauthorised) of solid or liquid wastes to the marine environment (irrespective of quantity / volume) shall be reported to PPA Vessel Traffic Services without delay on 9159 6556 or VHF Ch 11 or 16.	Dredging Contractor	Immediately
	A documented report on any solid or waste spill incident shall be submitted to PPA's Dredging and Survey Manager, including (as a minimum) details of the incident, the response measures taken, the success of those measures in addressing the incident or risk and any additional measures proposed to be taken.	Dredging Contractor	Within 24 hours of a reportable incident.
Target	No unauthorised discharges of wastes to the marine environment.	Dredging Contractor	Throughout project
Contingency	Implement waste clean-up and/or other corrective actions as required by PPA.	Dredging Contractor	Throughout project

7. Overall Roles and Responsibilities

Roles and responsibilities are described in Table 7. The dredging contractor(s) is responsible for the organisation of the environmental management including appropriate staffing of the dredge in accordance with PPA contract conditions, the LTDMP and the Sea Dumping Permit.

Table 7: Positions and responsibilities for the maintenance dredging operations at the Port of Dampier

Position	Responsibility
PPA Dredging and Survey Manager	• Overall responsibility for implementation of the LTDMP. • Overall responsibility for compliance with relevant legislation, standards and guidelines. • Ensures dredging activities are conducted in an efficient and safe manner.
PPA Environment and Heritage Manager	• Overall responsibility for environmental monitoring and reporting. • Responsible for notifying DAWE for any non-compliances with the SDP. • Responsible for providing advice on compliance with relevant legislation, standards and guidelines. • Responsible for undertaking audits to ensure compliance with the SDP and this LTDMP.
Dredge Contractor(s)	• Develops and implements an operational environmental management plan consistent with and aligned to this LTDMP. • Ensures adequate staffing levels and that all personnel are equipped with training appropriate to their area of responsibility. • Compliance and reporting with the requirements of the LTDMP, SDP and the contract with PPA. • Ensures that all equipment is adequately maintained and properly operated to minimise risk of environmental or safety incident.
Project Personnel	• Act in accordance with the requirements of the LTDMP. • Exercise a Duty of Care to the environment at all times. • Report all environmental incidents to supervisor immediately.

8. Audit and Review

PPA will undertake audits of the dredge contractor(s) and their operations as required throughout the project, to assess compliance against this LTDMP and the SDP.

The performance of the dredging operations against these requirements will be reported to the PPA TACC at scheduled meetings of the TACC.

This LTDMP will be reviewed as required and any material changes submitted to DAWE for consideration and approval.

9. References

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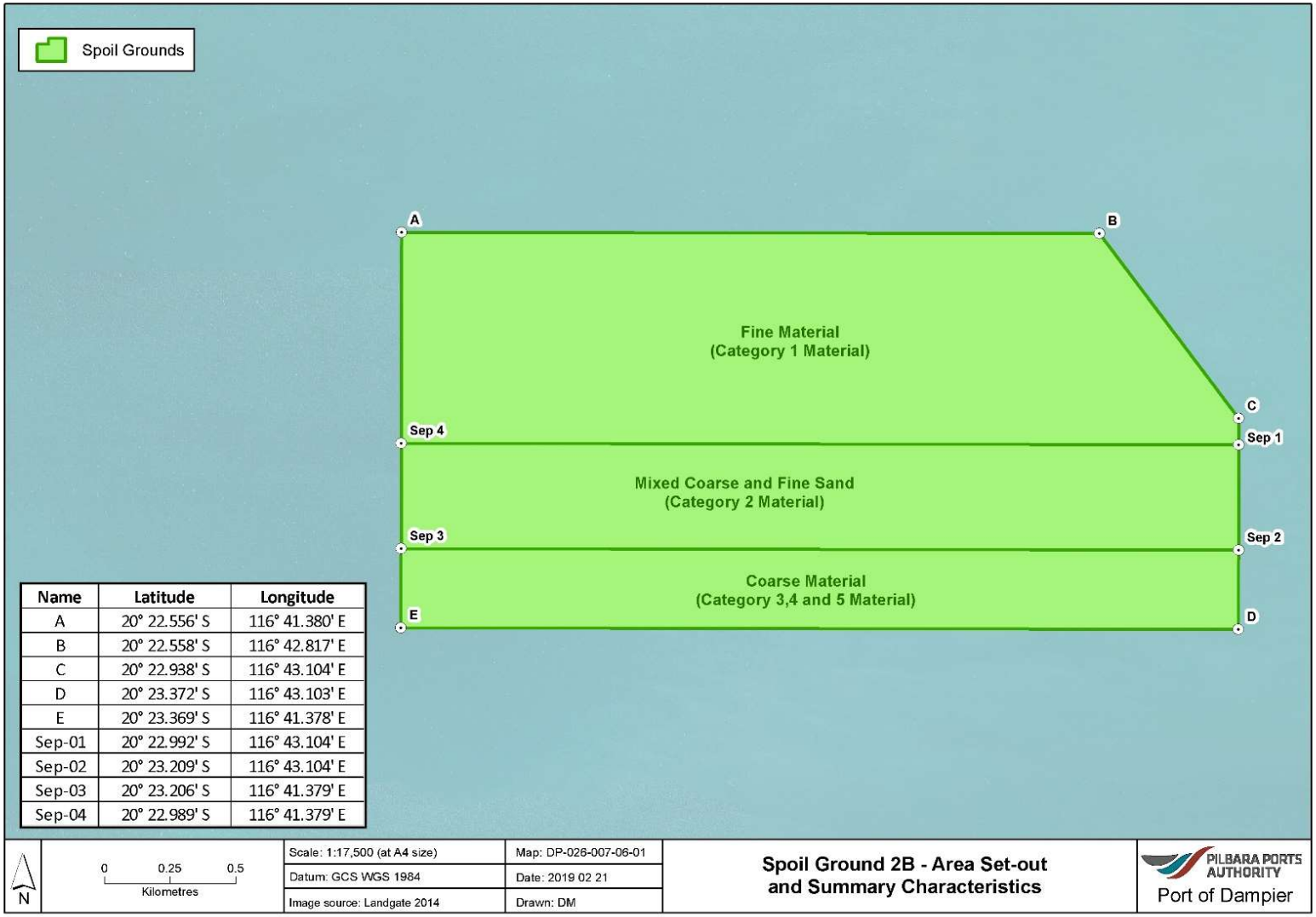
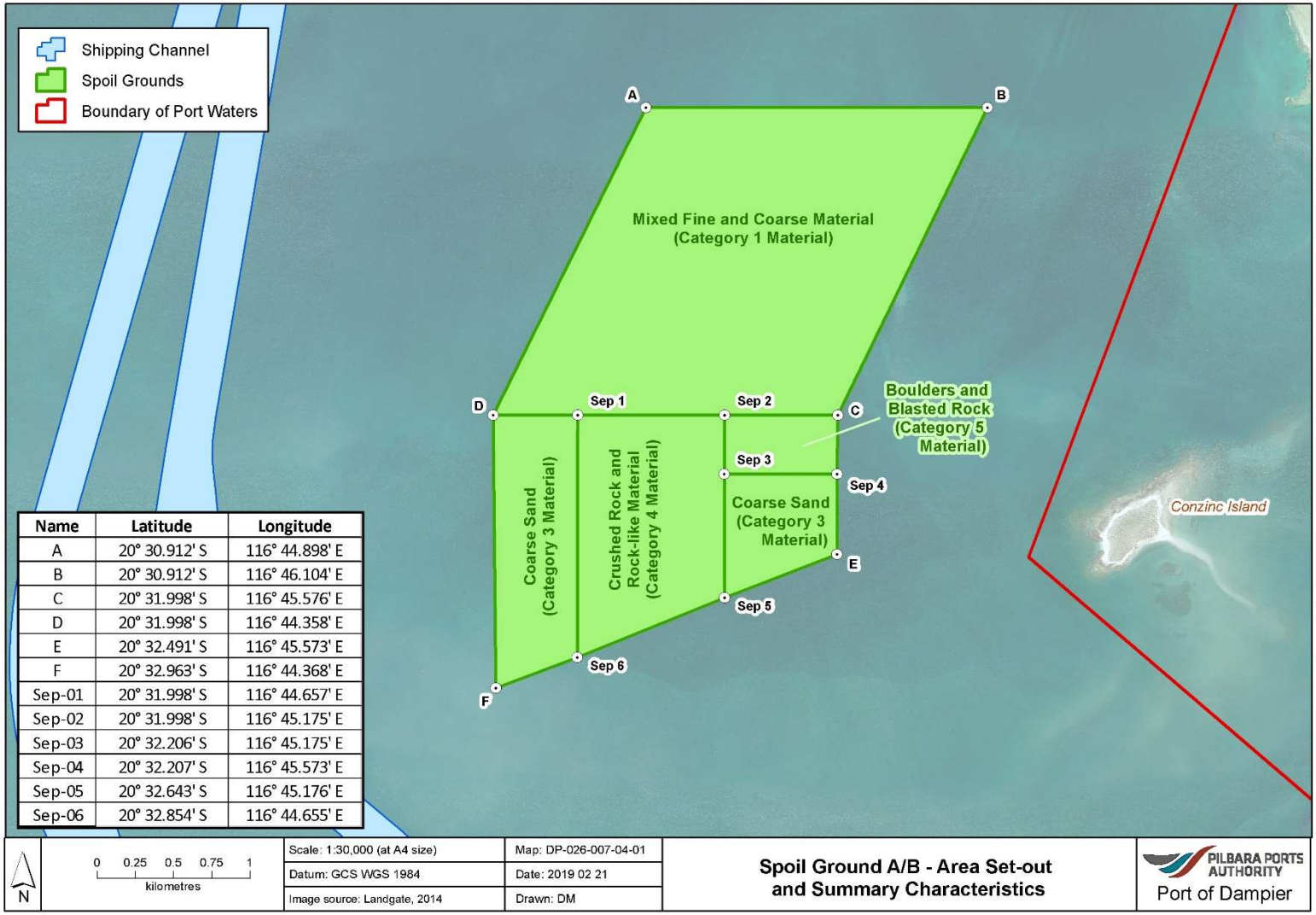
Appendix

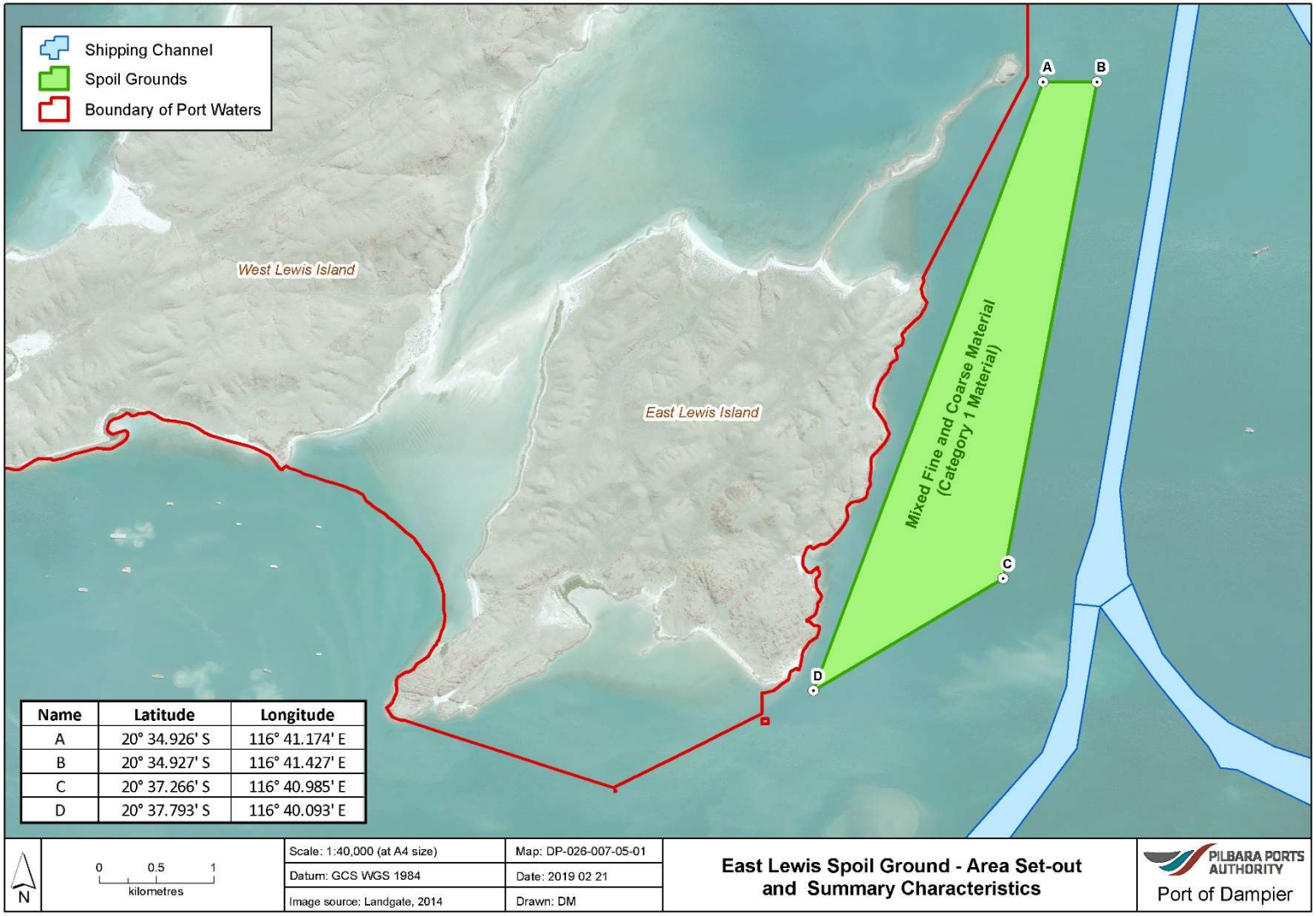
Appendix A – Details of the Spoil Grounds



Name	Latitude	Longitude
A	20° 22.556' S	116° 41.380' E
B	20° 22.558' S	116° 42.817' E
C	20° 22.938' S	116° 43.104' E
D	20° 23.372' S	116° 43.103' E
E	20° 23.369' S	116° 41.378' E
Sep-01	20° 22.992' S	116° 43.104' E
Sep-02	20° 23.209' S	116° 43.104' E
Sep-03	20° 23.206' S	116° 41.379' E
Sep-04	20° 22.989' S	116° 41.379' E



Name	Latitude	Longitude
A	20° 30.912' S	116° 44.898' E
B	20° 30.912' S	116° 46.104' E
C	20° 31.998' S	116° 45.576' E
D	20° 31.998' S	116° 44.358' E
E	20° 32.491' S	116° 45.573' E
F	20° 32.963' S	116° 44.368' E
Sep-01	20° 31.998' S	116° 44.657' E
Sep-02	20° 31.998' S	116° 45.175' E
Sep-03	20° 32.206' S	116° 45.175' E
Sep-04	20° 32.207' S	116° 45.573' E
Sep-05	20° 32.643' S	116° 45.176' E
Sep-06	20° 32.854' S	116° 44.655' E


Shipping Channel
Spoil Grounds
Boundary of Port Waters
West Lewis Island
East Lewis Island
Mixed Fine and Coarse Material (Category 1 Material)
A
B
C
D
Name | Latitude | Longitude
A | 20° 34.926' S | 116° 41.174' E
B | 20° 34.927' S | 116° 41.427' E
C | 20° 37.266' S | 116° 40.985' E
D | 20° 37.793' S | 116° 40.093' E
N
0 0.5 1
kilometres
Scale: 1:40,000 (at A4 size)
Datum: GCS WGS 1984
Image source: Landgate, 2014
Map: DP-026-007-05-01
Date: 2019 02 21
Drawn: DM
East Lewis Spoil Ground - Area Set-out and Summary Characteristics
PILBARA PORTS AUTHORITY
Port of Dampier

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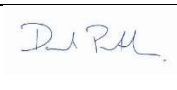
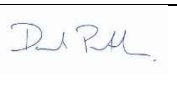
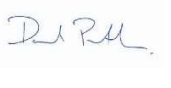
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J Munro	D Petch		D Petch		27/02/19
0	J Munro	D Petch		D Petch		6/11/20

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