PORT DEVELOPMENT GUIDELINES

Appendix B
Marine Engineering and Construction Technical Standards

PILBARA PORTS

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1. APPLICATION OF THIS DOCUMENT

This document outlines Pilbara Ports' technical standards for marine construction and applies to all works undertaken on port tenure by proponents and is to be read in conjunction with the Port Development Guidelines (PDG) Application Guide.

2. DEFINITIONS

Refer to the PDG Application Guide for definitions and acronyms.

3. TECHNICAL STANDARDS

These technical standards are provided to assist proponents in meeting the expected minimum design standards for marine works within Pilbara Ports' land, waters or seabed.

They are intended to complement (rather than override) accepted Australian Standards or legislation. If there is any inconsistency between the technical standards and State/Commonwealth legislation, the order of precedence is as follows: (1) State/Commonwealth legislation; (2) Australian Standards; and (3) technical standards.

Please note that some components of commentary in these technical standards may not be applicable to your development or operations. If you are unsure about the applicability of specific advice in the technical standards, please contact Pilbara Ports' Port Development team.

The accurate location of any installed maritime structures and other elements such as moorings, channels, breakwaters, and revetments must be provided to Pilbara Ports as as-built surveys and in spatial digital data format (refer to PDG Appendix F - Land Survey Technical Standards, and Appendix G - Spatial Data Technical Standards).

All hydrographic surveys must be conducted in accordance with PDG Appendix C - Hydrographic Survey Technical Standards. Proponents must consult with the Harbour Master prior to conducting any hydrographic surveys.

3.1 Coastal and environmental impacts

3.1.1 Metocean studies

In situations where consideration of metocean conditions will form a significant part of the design of any maritime structure or facility and the Average Recurrence Interval (ARI) has been considered to arrive at a design force or forces, the basis of design must be discussed and agreed with Pilbara Ports.

3.1.2 Consideration of coastal impacts

Construction of infrastructure must minimise impacts on natural coastal processes.

Where the proponent's development has the potential to impact on coastal processes including, but not limited to, the wave climate, current climate, seabed flora, ocean fauna, water turbidity, depth to seabed, shoreline alignment or sediment transport characteristics within or adjacent to port waters, the proponent must submit a coastal impact assessment and a coastal monitoring and management plan.

The coastal impact assessment must provide information on the expected impacts from the proposed development, to be determined by numerical and/or physical modelling undertaken by coastal engineering experts.

The coastal monitoring and management plan must propose a regime of monitoring and management (to be undertaken by the proponent) that will be in effect prior to, during and post construction. The plan must:

- Be updated in a timeframe agreed with Pilbara Ports, once construction has commenced.
- Propose a regime of monitoring that includes both land and hydrographic surveys, prior to, during and post construction.
- Identify remedial actions to be undertaken, such as dredging and/or sand bypassing or other works; and detail mitigation strategies including actions and timeframes.
- If sand bypassing is required, the plan must include the methodology, volumes and timing, types of equipment to be used, the nature of any fixed plan, onshore transport routes and proposed contracting strategies to ensure speedy remedial action can be undertaken if required.
- Propose methods for maintaining adequate navigable depth in channels.
- Identify any expected long term or ongoing maintenance requirements and they method for undertaking the works.
- Comply with all relevant legislation and statutes, and with any other relevant approvals. Copies of these approvals are to be attached to the written application.

Pilbara Ports will not accept roles or responsibilities in any management and monitoring plan without prior agreement.

3.1.3 Waste management plan and infrastructure

Adequate waste reception facilities must be provided in accordance with MARPOL requirements. The reception facilities must comply with the guidance in MEPC.1/Circ.834.Rev.1 and relevant Commonwealth and State legislation.

Adequate port waste reception facilities can be defined as those which:

- mariners use;
- fully meet the need of ships normally using them;
- do not provide mariners with a disincentive to use them; and
- contribute to the improvement of the marine environment.

The facilities provided must allow for the ultimate disposal of ships' generated wastes and residues to take place in an environmentally sound manner. Failure to establish adequate facilities is a breach of international obligations and increases the risk of illegal discharges.

3.1.4 Oil spill management plan and infrastructure

Marine pollution emergencies must be managed in accordance with Commonwealth and State arrangements, and the proponent must meet its obligation for preparedness under international conventions, Commonwealth and State legislation.

Proponents must ensure that adequate resources, a first strike response plan and a marine oil pollution management plan (refer to Pilbara Ports' Marine Oil Pollution Management Plan Guide) must be prepared in accordance with the guidance provided in Australian Maritime Safety Authority Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities and International Tanker Owners Pollution Federation Limited Technical Information Paper 17 Response to Marine Chemical Incidents.

- The Marine Oil Pollution Management Plan must be consistent with the National Plan, the State Hazard Plan - Maritime Environmental Emergencies (MEE), Australian Marine Oil Spill Plan (AMOSPlan), the Department of Transport Western Australia State Oil Spill Contingency Plan (OSCP) and Pilbara Ports' site plan, as well as any additional Pilbara Ports' requirements.
- All equipment and plans must be based on risk and be appropriate for the oil or hazardous or noxious substance being handled at the proponent's facility.
- Pilbara Ports must be invited to attend the risk assessment that will be carried out as part of developing the Marine Oil Pollution Management Plan.

Where appropriate the proponent must have and maintain a trained response team capable of conducting the first strike response plan.

3.1.5 Cyclone response plan and infrastructure

A cyclone response plan must be established in consultation with the Harbour Master (refer to Pilbara Ports' Cyclone Response Plan Guide), and submitted to Pilbara Ports as part of the construction application; and updated and submitted to Pilbara Ports on 1 October each year in accordance with Pilbara Ports' overarching cyclone response plan for the respective port.

The proponent must ensure that their cyclone response plan references:

- the mandated governance role of Pilbara Ports over the port;
- is consistent with Pilbara Ports' Cyclone Response Plan for the respective port;
- acknowledges that Pilbara Ports has ultimate sanction on port closure; and
- details the proponent's commitment to ensuring very clear lines of 24-hour communication between Pilbara Ports and the proponent prior to, during and post a cyclone event.

The proponent must also incorporate the individual cyclone response plans for each of its contractors and sub-contractors (if they are operating distinct to the proponent's cyclone response plan) upon commencement of their operations within Pilbara Ports and thereafter as requested.

The proponent's cyclone response plan shall comply with all relevant legislation and statutes, and any other relevant approvals.

The design of marine infrastructure must align with the cyclone response plan in terms of provided equipment, storage, structural loading and end usage during cyclones.

3.1.6 Transfer of hydrocarbons or noxious substances

Offshore receival of fuel must not pose a safety, environmental or health threat to any adjoining areas or people.

Hydrocarbon and noxious substance transfers including ship-to-ship transfers (STS), bunkering and cargo operations must be conducted safely and managed to minimise the risk to the environment, social amenity and/or economic resources.

The STS of hydrocarbons or noxious substances must be appropriately separated from surrounding land and water users, and must comply with all local, State and Commonwealth legislation and/or requirements.

A hazard identification and risk analysis must be undertaken for any proposed transport and handling operations relating to STS of hydrocarbons or noxious substances, and the resulting safety/hazard management plan must be implemented. Hydrocarbons or noxious substances must be transported and handled in accordance with AS 3846.

STS checklists and procedures must be based on the guidance in STS Guide for Petroleum, Chemicals and Liquefied Gases, and must be approved by the Harbour Master.

International Safety Guide for Oil Tankers and Terminals guidance must be complied with for all cargo operations. This is to include the pre-arrival information, ship to shore check list and the requirement for emergency shutdowns to be tested prior to transfers commencing.

Marine pollution response equipment appropriate to the risk, and the terminal or ships obligations must be readily available for an initial response.

3.1.7 Seismic design

Maritime structures must be designed and constructed consistent with Australian Standards and other relevant standards or guidelines.

Seismic loads must be determined in accordance with AS 1170.4. The minimum Hazard Factor (Z) used in determining seismic loads must be 0.12.

Maritime structures must be designed to accommodate:

- Ultimate limit state seismic loads based on the annual probability of exceedance stipulated in AS 1170.4 without catastrophic failure or collapse.
- Appropriate serviceability limit state seismic loads adopted based on engineering judgment.

Section 5.14 of AS 4997-2005 discusses ultimate earthquake loads but is not prescriptive with respect to load combinations associated with seismic events. Engineering judgement must be used in determining the environmental and applied/operational loads that are taken to act simultaneously with the design seismic loads. The proponent must obtain Pilbara Ports' approval in writing of the proposed simultaneous loads prior to proceeding with the design of the marine structure.

3.2 Marine infrastructure

The standard reference for the design of maritime structures is the latest version of Australian Standards AS 4997 – Guidelines for the Design of Maritime Structures. Maritime structures include (but are not limited) to wharves, jetties, mooring structures, navigation structures, seawalls, barge ramps, floating platforms, catwalks, and walkways.

Other marine developments and infrastructure covered by this guideline includes dredging, land reclamation, breakwaters, revetments, training walls and spilling beaches. For structures or facilities not covered by AS 4997, other design references appropriate to the structure or facility must be referred to, such as,

- AS 3962 – Guidelines for Design of Marinas.
- BS 6349 – Maritime Structures.
- CIRIA Rock Manual (C683).
- The Coastal Engineering Manual (CEM) EM1110-2-1100, USACE.
- PIANC Guidelines and technical reports, or any other relevant international standard or industry best practice guidelines or technical reports.
- National Construction Code (NCC).

To ensure alignment of expectations between proponents and Pilbara Ports, it is recommended that the basis of design is discussed and agreed with Pilbara Ports in advance of the design commencing. The basis of design must address relevant design requirements contained in this standard.

For situations where codes, standards and guidelines are insufficient to guide the design of a marine infrastructure, Pilbara Ports may require the proponent to undertake physical modelling, numerical modelling, vessel simulations or the like to provide reliable data for the design.

In situations where it is necessary or would be appropriate for marine infrastructure to carry any kind of service (water, power, lighting, telecommunications, wastewater, fuel), provisions for such services must be discussed and agreed in advance with Pilbara Ports.

3.2.1 General considerations for marine structures

The design life for all maritime structures must as a minimum comply with the 'Design Life of Structures' given in Table 6.1 of AS4997-2005.

The proposed drainage capture and treatment system for maritime structures must be discussed and agreed with Pilbara Ports.

The minimum design loads for general cargo wharves must be Class 25 as defined in Table 5.1 of AS 4997-2005, plus any specific vehicle and equipment loads that the maritime structure will be subject to, either during construction or in service. Regardless of any minimum design load stipulated in AS 4997, Pilbara Ports reserves the right to stipulate a greater design load if, in the opinion of Pilbara Ports, the proposed use of the structure or facility requires it.

Where a building is supported by a maritime structure and the design annual probability of exceedance of ultimate environmental and seismic design load conditions given in Australian Standards for the maritime structure, differs to that given for buildings in the NCC, the most onerous condition must be used for the design of the maritime structure.

The design annual probability of exceedance of design wave events must be as stipulated in Table 5.4 of AS 4997-2005 based on Function Category 3 (high property value or high risk to people) except that Function Category 2 can be adopted for minor maritime structures. The design function category may only be lowered with the prior written approval of Pilbara Ports.

Design wave parameters and still water levels for ultimate design conditions must be based on available site-specific records and/or appropriate wave climate modelling, with a water level to match the design wave ARI. However, the design water level must be a minimum of Mean High Water Springs (MHWS), in accordance with table 5.4 of AS 4997-2005. Furthermore, design water levels, and corresponding wave conditions, shall allow for sea level rise over the design life of the structure.

Maritime structures incorporating monopiles piles or columns exposed to currents must be designed to ensure that the critical flow velocity at which flow-induced oscillations can commence, as described in BS 6349-1-2:2016, always exceeds the maximum design current velocity for the maritime structure.

Piles must be designed and tested in accordance with the latest version of AS 2159. All pile test results used to verify pile performance must be provided to Pilbara Ports.

Buried tie rods must be protected from loads induced by settlement of the soil using suitable and adequately sized settlement sleeves. All tie rods must be adequately protected from corrosion through the use of wraps, paints and other methods acceptable to Pilbara Ports.

3.2.2 Fenders

Fenders must be designed and constructed consistent with Australian Standards or other relevant standards or guideline. Fenders are to be designed in accordance with BS 6349-4:2014. Fenders are to be material and compression tested. All fenders are to be provided with a written rating specification.

Navigation conditions for berthing must be based on engineering judgment, taking into account the exposure and geometry of the berth.

The design contact point during berthing used in determining design berthing energies must be suitable for the fender arrangement, for instance, quarter point berthing may be suitable for the continuous wharf face with fenders spaced to prevent vessels contacting the wharf structure, however island type berth arrangements will allow other, more severe berthing configurations.

Suitable low friction facings must be used on the contact faces of fender assemblies, with the design to consider ease of replacement of these wear items.

The design of fenders must allow for detrimental effects of overhanging vertical hull angles or slopes (due to bow flare, vessel hull profile and/or listing or heeling of the vessel when berthing) and vessels with low freeboards contacting the fenders or fender frames near the base or part way up when berthing at low tides. Such detrimental effects include reduction in the energy absorption capacity of the rubber fender and increase in the projection of the vessel hull behind the fender face when the fenders are placed significantly below the maritime structure deck level.

Fenders must be resistant to localised damage due to belting or sponsons on vessels' hulls, in particular for smaller vessels less than 5,000 DWT.

The fender design must not allow vessel hull and/or belting, sponsons or other hull projections and mooring lines to catch on top, underneath on the sides of the fender system and must be resistant to damage due to this. Such measures may include ensuring the fender frame covers the anticipated range of hull heights and belting/sponson levels for the different design vessel sizes and tide levels, minimising the gap between the base of the fender frame and low tide level, using tapered edges to the fender frames and using shear, weight and uplift chains.

Fenders must be adequate to accommodate forces imposed by moored vessels obtained from a suitable mooring analysis.

Relevant industry guidance must be incorporated into the design of fenders with regard to temperature effects, angle effects, compression speeds and manufacturers' tolerances.

The accurate location of any installed maritime structures, especially the outer 'fender line' must be provided to Pilbara Ports as as-built surveys and in spatial data format.

3.2.3 Bollards and quick release hooks

Bollards and quick release hooks (QRH) must be designed and constructed consistent with Australian Standards or other relevant standards or guidelines. Bollards and QRH are to be provided with written rating specification and tested if necessary. Suitable corrosion protection must be provided. Adequate QRH must be provided to allow for one mooring line per hook.

Mooring line loads must be determined in accordance with suitable design guidance documents. In particular:

- Required bollard and QRH capacities for mooring arrangements not subject to significant dynamic effects due to waves and current can be determined using static mooring analysis.
- The required bollard and QRH capacities for mooring arrangements subject to significant dynamic effects due to wave and current must be determined by suitable dynamic mooring analyses.
- In all cases, notwithstanding the conclusions of the mooring analyses, if the bollards or QRH will be subject to vessel manoeuvring loads, the bollard and QRH capacities must not be less than those stipulated in Table C1 of AS 4997.
- Where the risk of interaction or environmental conditions necessitate the use of tension monitoring sensors, the sensors must be fitted to mooring hooks and monitoring equipment must be available to shore and ship-based personnel.

3.2.4 Durability

The durability requirements stipulated in Section 6 of AS 4997 must be complied with.

Protective coating systems are to be provided for steel piles and other structural steel components. The design life for the coating systems is to be a minimum of 15 years to first maintenance.

Cathodic protection systems (either sacrificial anodes or impressed current) must be installed for all permanently immersed steel components. Protective coatings must be suitable for use with the cathodic protection system. It should be noted that waters along the Pilbara coast may promote greater annual corrosion rates than those indicated in Table 6.7 of AS 4997, and the possibility of microbiologically induced corrosion should be thoroughly examined to establish a reliable estimate of annual corrosion rates.

The corrosion allowance for steel elements that form critical elements/members of the maritime structure must not be less than 2mm for any member.

If prestressing steel is used, then it must be designed in accordance with both the requirements and the recommendations made in section 6.3.5 of AS 4997-2005.

Measures additional to the use of concrete covers must be used to ensure that the required design life is achieved where the design life of the maritime structure exceeds 25 years. Such additional measures can include the use of stainless steel or galvanized reinforcement and/or the use of suitable concrete additives or coatings, such as organic or inorganic pore blocker concrete admixtures, chemical corrosion inhibitor admixtures, hydrophobic surface sealants (silanes) and/or cathodic protection systems. Adequate supporting documentation confirming that the proposed measures are suitable for the nominated design life must be provided to Pilbara Ports.

In the event that a new concrete structure requires patch repair, cold galvanised reinforcement and embedded anodes must be used to avoid patch accelerated corrosion/halo effect/ring-anode corrosion. Patch repairs must be coated or treated with a suitable chloride resisting product.

3.2.5 Scour

Maritime structures must be designed and constructed consistent with Australian Standards and other relevant standards or guidelines.

Consideration of scour effects must be in accordance with Clause 4.5 of AS 4997 in situations where it applies.

Scour may occur due to waves, current and propeller/thruster wash, or a combination of these effects.

Where scour protection is not provided, adequate allowances for scour are to be made in the design of maritime structures based on analysis, but in all cases a minimum scour allowance of 1.0m must be adopted.

Where scour is provided to ensure the structural stability of a marine structure, adequate measures must be used (e.g. rock armouring). Rock material for scour protection must comply with the requirements of British Standard 6349.

3.3 Coastal structures

Coastal structures must be designed and constructed consistent with Australian Standards or other relevant standards or guidelines.

The installation of new breakwaters and armoured slopes may impact the wave and current climate at other locations. For example, impacts at other locations may occur due to wave reflection, wave seiches or the narrowing of channels. Where changes to the operating environment may occur due to the addition of new infrastructure, the proponent is required to undertake coastal modelling to determine the likely impacts to the operating conditions.

The design life for all coastal structures must as a minimum comply with the Design Life of Structures in Table 6.1 of AS4997-2005.

The design annual probability of exceedance of design wave events must be as stipulated in Table 5.4 of AS 4997-2005 based on Function Category 3 (high property value or high risk to people) except that Function Category 2 can be adopted for minor structures. The design function category may only be lowered with the prior written approval of Pilbara Ports.

Design wave parameters and still water levels for ultimate design conditions must be based on available site-specific records and/or appropriate wave climate modelling, with a water level to match the design wave ARI, using joint probability.

However, the design water level must be a minimum of MHWS, in accordance with table 5.4 of AS 4997-2005. Furthermore, design water levels, and corresponding wave conditions, shall allow for sea level rise over the design life of the structure.

Coastal structures must be designed to accommodate:

- Ultimate limit state seismic loads based on the annual probability of exceedance stipulated in AS 1170.4 without catastrophic failure or collapse.
- Appropriate serviceability limit state seismic loads adopted based on engineering judgment.
- Seismic loads during construction.

Section 5.14 of AS 4997-2005 discusses ultimate earthquake loads but is not prescriptive with respect to load combinations associated with seismic events. Engineering judgement must be used in determining the environmental and applied/operational loads that are taken to act simultaneously with the design seismic loads. The proponent must obtain Pilbara Ports' approval in writing of the proposed simultaneous loads prior to proceeding with the design of the marine structure.

- Rubble mound breakwater side slopes and armoured slopes must not be steeper than 1:1.5 or less than 1:6 (vertical to horizontal).
- Slopes must be hydraulically and geotechnically stable.
- Rock material must comply with the requirements of Clause 57 of BS 6349-1:2000, Clause 4.10.1 of BS 6349-7:1991 and Chapter 3 (Materials) of CIRIA C683 (2007).

Breakwaters and armoured slopes must be designed to provide protection against:

- initial damage;
- intermediate damage at a level requiring repair; and
- failure as defined in the design method for waves with a probability of exceedance during the life of the structure that has the prior approval of Pilbara Ports.

Example probabilities of exceedance are 50% probability of exceedance during the design life for initial damage, 10% of exceedance during the design life for intermediate damage requiring repair and the probability of exceedance of the design wave stipulated in Table 5.4 of AS 4997 for failure. It is anticipated that the adopted design wave conditions will be influenced by:

- The availability and cost of rock or armour units of the required sizes.
- The difficulty and cost of undertaking repairs.
- The magnitude of the detrimental effects that will arise because of the failure of the breakwater or armoured slope.

Breakwaters and seawalls must be designed to provide a wave overtopping rate that is suitable for the activities taking place or for structures located in the area at the top of the breakwater or seawall slope as approved by Pilbara Ports. Furthermore, the wave overtopping shall be such that it will not affect the stability of the structure. Guidance on overtopping calculations and criteria can be found in the EurOtop manual (2018).

Scour at the toe of slopes must be considered in the design using references such as the Rock Manual (CIRIA C683) (2007) or the Coastal Engineering Manual USACE (EM1110-2-1100) (2002).

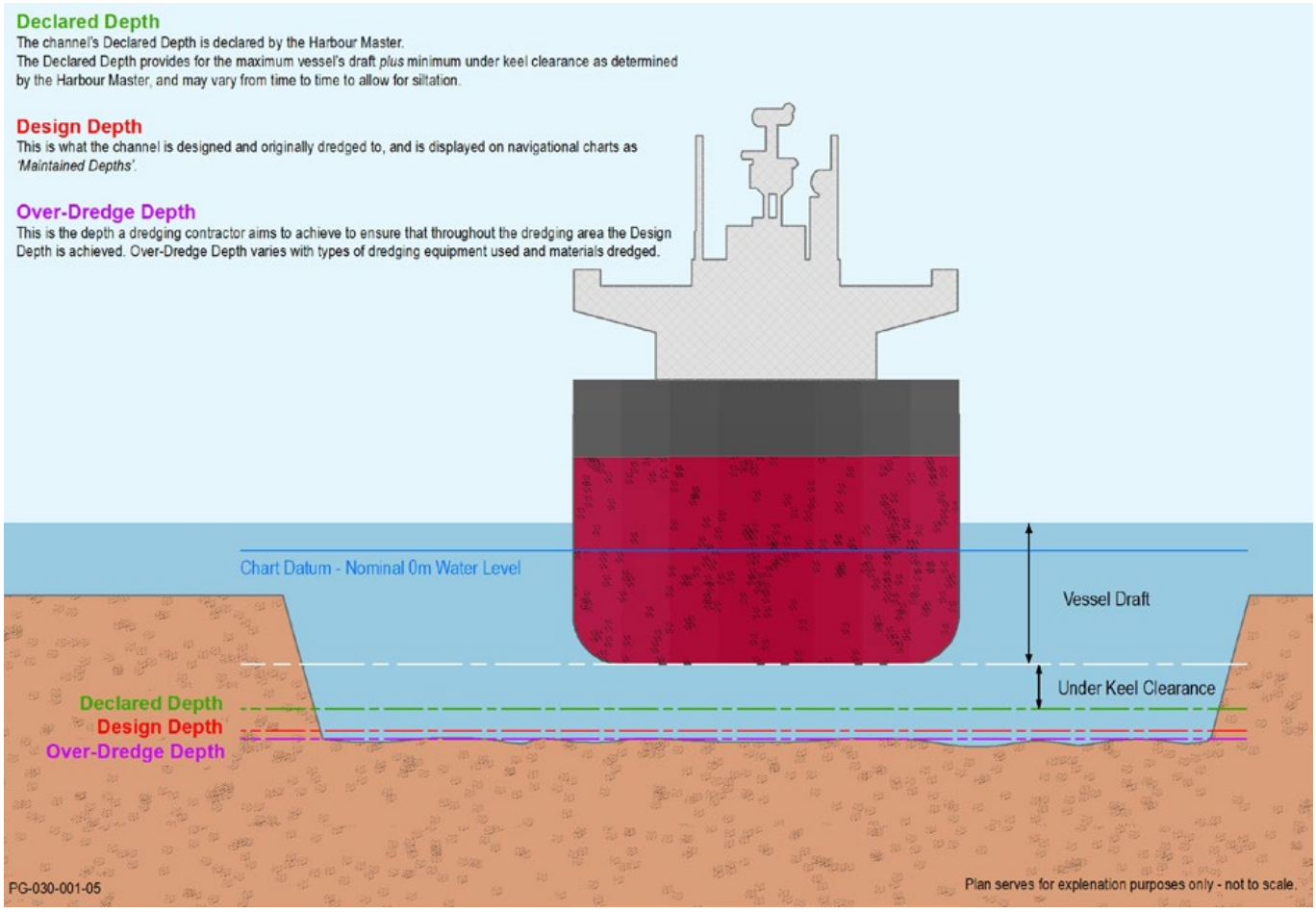
3.4 Channel and manoeuvring areas

3.4.1 Navigation channels, dredging depths and under keel clearance (UKC)

The design of channels and dredged areas must have adequate navigation and vessel manoeuvring and under keel clearances. The Harbour Master must be provided with the design and details for final approval. Pilbara Ports recommends that proponents engage in discussion with the Harbour Master at an early stage in the design to ensure alignment of expectations.

Navigation channels must be designed and constructed in accordance with PIANC Guidelines.

To avoid confusion in the use of terminology that may not have universal acceptance, Pilbara Ports requires proponents to present drawings of navigation channels and use the terminology as shown below:



UKC must comply with the clearance rules or local rules as determined by the Harbour Master.

To assist in determining UKC rules for a new proposed area of use by vessels or modified use of an existing area, the Harbour Master may require proponents to undertake studies which recommend a suitable static or dynamic UKC (DUKC). Please refer to the relevant Pilbara Ports' Port Handbook for approval procedures for the UKC/DUKC. The value of UKC requires review and acceptance by the Harbour master.

Pilbara Ports recommends that proponents engage in discussion with the Harbour Master at an early stage in the design to ensure alignment of expectations.

3.4.2 Aids to navigation

Aids to Navigation (AtoN) are to be designed, constructed and installed in accordance with the relevant Australian Standards, International Guidelines and in accordance with Pilbara Ports' requirements.

The Harbour Master must be consulted during the design phase and will give final approval for AtoN design and placement. Pilbara Ports recommends that proponents engage in discussion with the Harbour Master at an early stage in the design to ensure alignment of expectations.

The Harbour Master may direct any new AtoN be integrated into the existing AtoN network.

Navigation aid placement and selection should generally be determined in accordance with IALA Guidance 1078 on the Use of Aids to Navigation in the Design of Fairways. However, in consideration of other port users and future planning, the Harbour Master may direct AtoN requirements that are not in accordance with normal design standards or IALA guidelines.

Should the proposed development require changes to existing AtoNs; then the proponent will be responsible for the cost of design, modification or upgrade of existing infrastructure.

AtoN must be designed and constructed in accordance with IALA Standards, recommendations and guidelines, as well as Pilbara Ports' requirements.

All fixed and floating navigation aids and associated equipment that are critical to port operations, must:

- Have a minimum design life of 25 years (unless a shorter design life is agreed to by Pilbara Ports).
- Be designed to survive a combination of wind, wave, surge and currents with a joint probability of recurrence of 200 years (ultimate limit states). The design should also be checked for survivability for individual events of 200 years recurrence.
- Be designed to be operational under the worst case of wind, wave and currents within a design event of minimum ARI of one year (events assumed to be acting concurrently) unless otherwise agreed by Pilbara Ports.
- Have an adequate design/anchoring arrangement for cyclonic conditions experienced in the Pilbara.

All other fixed and floating navigation aids and associated equipment must:

- Have a minimum design life of five (5) years (unless a shorter design life is agreed to by Pilbara Ports).
- Be designed to survive a combination of wind, wave, surge and currents with a joint probability of recurrence of 20 years (ultimate limit states) unless otherwise agreed by Pilbara Ports. The design should also be checked for survivability for individual events of 10 years recurrence.
- Be designed to be operational under the worst case of wind, wave and currents within a design event of minimum ARI of one year (events assumed to be acting concurrently) unless otherwise agreed by Pilbara Ports.

Chain and anchor type mooring buoys shall only be allowed in the following circumstances:

- Only in areas with smaller vessels.
- Non-critical points in the channel where the watch circle doesn't unduly impede on navigation.
- Only in areas that do not cause significant damage to reef and coral systems.
- Only with the permission of Pilbara Ports.

All beacons on a channel must have the same focal height of the light. Beacons (including ladders and railings) must be painted as per IALA buoyage system A above + 1m HAT. Beacons must be painted black or grey below + 1m HAT.

All lights marking channels must be synchronised. Consideration must be given to the beacon or buoy immediately prior to a navigational turn being a different characteristic to the other channel markers in order to indicate the turn.

Buoys should be an appropriate size for the purpose and consideration given to the distance at which the buoy and light needs to be visible to allow sufficient time for the user to assess the situation. Buoys should not be larger than the required size.

The following IALA Standards, Guidelines and Recommendations must be used for design and specifications:

- 1078 Minimum comprehensive range of AtoNs in fairways including dredged channels and canals.
- 1033 Provision of AtoNs for different classes of vessels including high speed craft.
- 1069 Synchronisation of lights.
- 1038 Ambient Light levels at which AtoNs should switch on and off.
- 1073 Conspicuity of AtoN signal lights at night.
- 1041 Sector lights.
- 1094 Day marks for AtoNs.
- 1066 The design of floating aids to navigation moorings.
- E112-2 and E112-2 relating to Leading Lights.

The accurate location, heights, lighting characteristics, as-built drawings and other reasonably requested information on any installed AtoN must be provided to Pilbara Ports in spatial data format (refer to PDG Appendix G - Spatial Data Technical Standards).

Wind and waves for the given design events should be determined through an appropriate analysis. If maintenance is likely to be required in order to reach the given design life, the proposed maintenance program must be developed and submitted to Pilbara Ports for approval.

The design of an AtoN must be suitable for its intended purpose and should allow for the collection of data for statistical purposes.

3.4.3 Vessel simulation and modelling

Validation simulations and modelling must be carried out at Pilbara Ports' request.

- The proponent must demonstrate to the satisfaction of the Harbour Master that the proposed configuration of maritime structures provides for adequate navigation and vessel manoeuvring clearances and is safe (this includes feasibility studies).
- Pilbara Ports may require the proponent to carry out vessel simulations, modelling and the like of maritime structures and may require a representative of Pilbara Ports to be present during the undertaking of such studies or tests. The costs of such attendance, including travel and accommodation, will be at the proponent's cost.

Marine pilot simulation training must be carried out at Pilbara Ports' request.

- The proponent must provide all necessary data to allow for simulation modelling. Where the ships calling at the proponent's berth fall outside the normal callers for the port, the proponent must pay for the development of the ship model for pilot training.

Any changes to the proponent's facility effecting simulation training must be provided to Pilbara Ports as soon as practicable to ensure the accuracy of the simulation training.

3.4.4 SIMOPS

Simultaneous operations (SIMOPS) in a marine environment must be managed in an agreed manner outside of the Vessel Traffic Services (VTS) area, or inside VTS area with the Harbour Master's approval.

SIMOPS are to be managed in an agreed manner outside of VTS area, or inside VTS area with the Harbour Master's approval.

The SIMOPS must include the following:

- Regular meetings.
- Include all interested parties (e.g. not limited to only proponent and contractors).
- A daily SIMOPS plan issued to all stakeholders including the relevant VTS and marine operations team.
- A designated co-ordinator.
- Comply with local rules and regulations.
- Communications plan.

Business rules for reporting conflicts and a process to stop work and recommence work in the event of a conflict.

3.4.5 Anchorages

Anchorages must be designed in consultation with Pilbara Ports.

Anchorage locations are to be determined in consultation with the Harbour Master and any other relevant authorities. The requirement for surveys, swinging circle, bottom type and holding ground must be taken into consideration.

3.4.6 Moorings

Mooring areas are to be specified by Pilbara Ports. Moorings must be laid and maintained in consultation with Pilbara Ports. All moorings within port waters must be licensed by Pilbara Ports and require the Harbour Master's prior approval on their design, installation and usage.

All moorings are to be installed, inspected and maintained in accordance with Pilbara Ports' Moorings Handbook (Ports of Dampier and Ashburton) or Pilbara Ports' Port User Guidelines and Procedures (Port of Port Hedland), and the Mooring Licence terms and conditions on the Pilbara Ports website.

Reflective tape/markers are to be installed over underground services prior to back-filling.

Any information gathered that improves the location accuracy of existing services must be provided to Pilbara Ports. If local surveys are required to verify buried service locations, this survey data must be provided to Pilbara Ports in spatial (digital) data format.

Document amendment table

VERSION	PREPARED BY	DATE	AMENDMENT DETAILS
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Document owner

The Developments Manager is responsible for the Port Development Guidelines.

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