New Marine Facilities to Service
Mandorah and Cox Peninsula

APPENDIX D

ENVIRONMENTAL RISK ASSESSMENT

Table 1: Consequence categories and ratings

Score	Consequence or severity of impacts	Description
5	Severe	A Severe impact has two or more of the following characteristics: Widespread - Impact occurs at a NT, national, international or global scale High Intensity - Impact irreversibly compromises the integrity of environmental values Permanent - environmental values will not recover on human time scales
4	Major	A Major impact has two or more of the following characteristics: Regional - Impact extends to the Darwin/ Palmerston region, and/ or greater Darwin Harbour Moderate - Integrity of environmental values altered but impact can practicably be reversed Long term - Impact that is measurable post-Project
3	Moderate	A Moderate impact has two or more of the following characteristics: Localised - Impact is confined to the Site and areas directly adjacent to the Site, such as other allotments, Elizabeth River, and estuarine watercourses adjacent to the S Low - Impact alters the quality, abundance or distribution of environmental values without compromising their integrity, and can be easily and cheaply reversed Medium term - Impact that is felt up to completion of operations
2	Minor	A Minor impact has two or more of the following characteristics: Limited - Impact limited to the Site Very Low - Impact does not significantly alter the quality, distribution or abundance of environmental values Short term - Impact that is felt up to completion of construction
1	Insignificant	Insignificant No noticeable/ measurable impact to values

Table 2: Likelihood categories

Liklihood Category	Description
Almost certain	The event/ impact will occur or is expected to occur. The impact occurs regularly in association with similar projects and/ or in similar environments.
Likely	The impact will probably occur in most circumstances but there is some uncertainty about the likelihood. The impact has occurred on more than one occasion in association with similar projects and/ or in similar environments.
Possible	The impact could occur in some circumstances. The impact has occurred infrequently on similar projects and/ or in similar environments.
Unlikely	The impact is not expected to occur. The impact occurs very infrequently on similar projects and/ or in similar environments.
Rare	The impact is very unlikely to occur. The impact has not occurred on similar projects and/ or in similar environments.

Table 3: Risk level definitions and responses

Risk Level	Response
Very High	*Risk is unacceptable. Specific action plans required to reduce risk to an acceptable level. Director/ CEO level management attention required.*
High	*Risk is generally unacceptable without action. Specific action plans required to reduce risk to 'as low as is reasonably practicable' (ALARP). Senior management attention r*
Medium	*Risk is generally acceptable. Proactive action is required to reduce risk to ALARP. Requires routine monitoring and adaptive management in accordance with Environmenta Management Plan. Line management attention required.*
Low	*Risk is acceptable. Management by routine policies and procedures.*

Table 4: Risk rating matrix

Likelihood		Consequence				
		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Severe
5	Almost Certain	Medium	Medium	High	Very High	Very High
4	Likely	Medium	Medium	High	Very High	Very High
3	Possible	Low	Medium	Medium	High	Very High
2	Unlikely	Low	Low	Medium	Medium	High
1	Rare	Low	Low	Low	Medium	High

Table 5: Level of certainty categories

Level of Certainty	Description
High	Risk rating is based on testing, modelling or experiments. Baseline information is complete and an appropriate level of analysis has been undertaken. Proposed mitigation were recommended by technical specialists and are well developed with demonstrated efficacy. Minimal further work is required to adequately understand risk.
Medium	Risk rating is based on similar conditions being observed previously on a similar project and/ or in a similar environment. Baseline information has some gaps that are cons minor, and further work is unlikely to significantly alter the risk rating. While the efficacy of proposed mitigation measures has been demonstrated, some further work is req provide details of implementation prior to commencement of the Project.
Low	Risk rating is based on professional opinion. Limitations in baseline information require that some assumptions are made, which introduces a level of uncertainty. Effectiver proposed controls and/ or the likelihood of implementation cannot be reliably assessed at this point in time. A substantial amount of further work is required to adequately m prior to commencement of the Project.

Consequence or severity of Impacts	Score	Terrestrial Environmental Quality	Terrestrial Ecosystems	Coastal Processes	Marine Environmental Quality	Marine Ecosystems	Community and the Economy	Cultural and Heritage
Severe	5	Soil disturbance, erosion or contamination that is measurably and permanently impacting environmental values that rely on good soil quality throughout the NT	Extinction of terrestrial flora, vegetation or fauna	Permanent and widespread disturbance to the coastal processes within Darwin Harbour, such as tides and currents	Exceedance of baseline water quality that permanently alters the ecological functioning and/ or amenity of Arafura Sea	Complete loss of a benthic habitat or community type	Permanent impact that is felt by the majority of the NT population Unauthorised destruction of Aboriginal heritage item and/ or sites of world or national heritage significance	Unauthorised destruction of Aboriginal heritage item and/or sites of world or national heritage significance
Major	4	Soil disturbance, erosion or contamination that compromises regional environmental values that rely on good soil quality, and would be costly and technically challenging to remediate	Regional scale impacts on terrestrial flora, vegetation or fauna that compromise post-Project biodiversity and/ or ecological integrity	Permanent and localised disturbance to the coastal processes within Darwin Harbour, such as tides and currents	Exceedance of baseline Darwin Harbour water quality that continues for many years post-Project	Regional scale impacts on benthic habitat or community that compromise post-Project biodiversity and/ or ecological integrity	Impact that is felt by a majority of the regional population post-Project Unauthorised damage/ desecration of Aboriginal heritage item and/ or sites of regional heritage significance such that integrity is lost	Unauthorised damage / desecration of Aboriginal heritage item and/or sites of regional heritage significance such that integrity is lost
Moderate	3	Medium term soil disturbance, erosion or contamination in the vicinity of the Site that that alters soil characteristics but with no measurable impact to environmental values that rely on good soil quality, and can be remediated	Localised impact to flora, vegetation or fauna that alters the quality, abundance or distribution but with no measurable impact on biodiversity and/ or ecological integrity within months of the Project concluding	Permanent localised disturbance to the sediment transport within Darwin Harbour, temporary distrubance to tides and currents in Darwin Harbour	Localised exceedances of baseline marine water quality that occurs throughout operations but ceases within months of the Project concluding	Localised impact to benthic habitat or community that alters the quality, abundance or distribution but with no measurable impact on biodiversity and/ or ecological integrity within months of the Project concluding	Impact that is felt by a small number of people during the Project, ceasing within months of the Project concluding Unauthorised activity but with no physical impact to a heritage item, or minor physical impact such that integrity is not lost	Unauthorised acitvity but with no physical impact to a heritage item, or minor physical impact such that integrity is not lost
Minor	2	Short term soil disturbance, erosion or contamination in the vicinity of the Site that is reversible without significant remedial works	Impacts on flora, vegetation or fauna that do not measurably alter environmental values outside of the Site after construction concluding	Short term soil disturbance of coastal	Exceedances of baseline marine water quality at the Site ceasing within months of construction concluding	Impacts on benthic habitat or community that do not measurably alter environmental values outside of the Site after construction concluding	Impact felt by a small number of people at the Site during construction Unauthorised activity but with no physical impact to a heritage item	Unauthorised activity but with no physical impact to a heritage item
Insignificant	1	No measurable soil disturbance, erosion or contamination	No measurable impact on terrestrial flora, vegetation or fauna	No measurable impact on coastal processes	No significant change to baseline marine water quality	No measurable impact on benthic habitat or communities	No noticeable impact to stakeholder or community values No impact to Aboriginal Sacred or other heritage sites	No impact to Aboriginal sacred or other heritage sites

Theme	Environmental Aspect	Risk Pathway(s)	Potential Impacts	Likelihood	Potential Consequence	Inherent Risk Rating	Risk Management/Mitigation	Residual Likelihood	Residual Consequence	Residual Risk Rating	Level of Certainty	Project Phase
LAND	*Environmental Factor: Landforms*											
	Construction of landforms	Breakwaters (and to a lesser degree, causeway and boat ramp) are large structures that could be considered as new landforms	Significant change to the existing nearshore morphology at the site	Almost Certain (5)	Moderate (3)	Very High	> Design to minimise size of breakwaters, causeway and boat ramp limited to maintaining functionality and safety.	Possible (3)	Insignificant (1)	Low	Medium	Operations
	Changes to local shoreline	Construction of breakwaters disrupts the natural longshore drift of sediment down the adjacent coastline	> Disruption of net south migration of sediment > Increase in beach width north of the facilities, smothering the existing benthic communities > Erosion immediately south of the facilities due to blocking of usual sediment feed	Likely (4)	Moderate (3)	High	> Design to maximise natural bypassing mechanism > Understanding (investigation and modelling) of expected sedimentation volumes and locations > Allowance for ongoing sand bypassing that transfers sand past the marine facilities maintaining the net annual sediment transfer volumes	Possible (3)	Insignificant (1)	Low	Medium	Operations
	Environmental Factor: Terrestrial Environmental Quality											
	Exposure of contaminants during earthworks	> Exposure of potential Acid Sulfate Soils (ASS) > Exposure of potential metals or hydrocarbons > Exposure of asbestos containing soil	> Negative impacts to soil quality, stability and fertility > Acidic runoff discharging into Darwin Harbour > Invasion of acid-tolerant water plants and plankton species	Unlikely (2)	Major (4)	Medium	> Stop works if ASS is encountered, implement ASS management measures before works continue > Stop works if suspected asbestos material is encountered, implement asbestos removal management measures before works continue > Limit the area of exposed earth and period of exposure.	Rare (1)	Moderate (3)	Low	Medium	Construction
	Contaminants released during construction activities	Spills/leaks of petrol, oils, lubricants, hazardous materials, paints, thinners and litter	Adverse impact on soil quality within and adjacent to project footprint	Possible (3)	Moderate (3)	Medium	Contractor to develop a Hazardous Material Management Procedure including but not limited to the following: > Ensure stockpiles of bulk materials are well contained separated from exposed soils; > Training for personnel in implementation of safe work practices to minimise risks and impacts of spillage of fuels, chemicals and other contaminants; > Record and report all POL, chemical and hazardous substance spills; and > Ensure personnel have access to spill kits that contain an absorbent material and contaminated disposal sites.	Unlikely (2)	Minor (2)	Low	High	Construction
	Clearing areas of existing vegetation	Removal of vegetation and topsoil leaves area susceptible to erosion	> Loss of topsoil during overland flows > Eroded topsoil causing sedimentation in Darwin Harbour	Possible (3)	Minor (2)	Medium	> All clearing to be undertaken in accordance with Land Clearing Guidelines (DENR, 2019) > Cleared land outside of the direct footprint is to be rehabilitated using appropriate soils and vegetation	Rare (1)	Moderate (3)	Low	Medium	Construction
	Contaminants released during operations	> Chemical toilet leak to environment > Fly tipping	> Hazardous substances contaminating soils	Possible (3)	Moderate (3)	Medium	> Regular maintenance to be carried out on toilets > Adequate lighting and cctv to prevent illegal disposal	Unlikely (2)	Minor (2)	Low	Medium	Operations
	Environmental Factor: Terrestrial Ecosystems											
	Removal of vegetation due to land clearing of site for construction footprint and temporary work areas	Removal of native flora including: Eucalyptus spp over woodland over grassland	Loss of biodiversity on the Cox Peninsula	Unlikely (2)	Moderate (3)	Medium	> Land clearing only to be undertaken in approved areas and as per NT land clearing guidelines > Avoidance of significant and valuable vegetative communities > Any areas temporarily cleared are to be rehabilitated using native seed	Rare (1)	Moderate (3)	Low	Medium	Construction
	Clearing of potential fauna habitat for construction footprint and temporary work areas	Removal of fauna habitat	Injury of death of fauna or destruction of habitat	Unlikely (2)	Moderate (3)	Medium	> Land clearing only to be undertaken in approved areas and as per NT land clearing guidelines > Pre-clearance trapping and relocation of identified fauna	Rare (1)	Moderate (3)	Low	Medium	Construction
	Noise, vibrations and lighting at Mandorah due to construction activities	Noise, vibrations and lighting impacting fauna	Loss of habitable area for fauna	Unlikely (2)	Minor (2)	Low	> Contractor to develop a Noise Management Plan > Lighting only focused on works, not surrounding habitat, light shields if needed	Rare (1)	Minor (2)	Low	Medium	Construction
	Fire ignition due to construction activities	Uncontrolled fire	Loss or damage to terrestrial ecosystems	Possible (3)	Minor (2)	Medium	Contractor to develop a Fire Management Plan	Unlikely (2)	Minor (2)	Low	Medium	Construction
	Dust generation due to construction activities	Generated dust settling on terrestrial ecosystems	Adverse health impacts to local flora if dust settles on foliage	Likely (4)	Minor (2)	Medium	Contractor to develop a Dust Management Plan including but not limited to the following: > Watering of temporary roads and stockpile areas; > Watering down affected vegetation; > Use of dust suppression equipment; and > Speed limits within on site roads.	Unlikely (2)	Minor (2)	Low	Medium	Construction

Theme	Environmental Aspect	Risk Pathway(s)	Potential Impacts	Likelihood	Potential Consequence	Inherent Risk Rating	Risk Management/Mitigation	Residual Likelihood	Residual Consequence	Residual Risk Rating	Level of Certainty	Project Phase
LAND	Vehicular movement into site carrying weed species	Introduction of weeds to site	Loss of native biodiversity on the Cox Peninsula due to pressure from introduced species	Possible (3)	Moderate (3)	**Medium**	Contractor to develop a Weed Management Plan including but not limited to the following: > Review and relevant weed mapping and signpost areas of significant weed infestation; > Vehicle washdown stations; and > Routine monitoring of infestations and controls.	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Application of water as a dust control measure	Contaminated water from water storage facilities or dust suppression measures adversely impacting vegetation	Loss of vegetation if contaminants leach into soils	Unlikely (2)	Minor (2)	**Low**	> Water storage facilities to be located away from vegetation > Water used for dust suppression shall be of suitable quality	Rare (1)	Minor (2)	**Low**	Medium	Construction
	Increased vehicle traffic during construction activities	Increased likelihood of vehicle strike	Death or injury to fauna	Possible (3)	Moderate (3)	**Medium**	> Training for all drivers and operators on local fauna most likely to be encountered > Suitable speed limits into and around site	Rare (1)	Moderate (3)	**Low**	Medium	Construction
	Increased vehicle traffic during operations	Increased likelihood of vehicle strike	Death or injury to fauna	Possible (3)	Moderate (3)	**Medium**	> Signage to watch out for wildlife > Suitable speed limits into and around site	Rare (1)	Moderate (3)	**Low**	Medium	Operations
	Asbestos contamination encountered on Lot 50	Expose asbestos fibres to ecosystems	Adverse health impacts to local fauna	Unlikely (2)	Minor (2)	**Low**	> If asbestos is encountered when clearing Lot 50, material is to be removed and disposed of by trained personnel	Rare (1)	Minor (2)	**Low**	Medium	Construction
	Increase in noise due to increased patronage	Noise impacting fauna	Loss of habitable area for fauna	Possible (3)	Minor (2)	**Medium**	> Fencing/pathways designed to keep pedestrians away from bush	Rare (1)	Minor (2)	**Low**	Medium	Operational
	Increase in litter due to increased patronage	Fauna mistaking little for food source	Death or injury to fauna	Possible (3)	Minor (2)	**Medium**	> Adequate number of well lit bins provided	Rare (1)	Moderate (3)	**Low**	Medium	Operational
	Lighting at extended car park and ferry terminal	Light impacting fauna	Loss of habitable area for fauna	Possible (3)	Minor (2)	**Medium**	> Lights to focus on car park and ferry terminal > Minimise light intrusion into surrounding environment	Rare (1)	Minor (2)	**Low**	Medium	Operational
WATER	*Environmental Factor: Hydrological Processes*											
	Construction of expanded carpark and ferry terminal adding to the impermeable surfaces	Increase in the quantity of surface water runoff	Localised flooding	Rare (1)	Insignificant (1)	**Low**	No treatment needed. Runoff flows directly into Darwin Harbour in pre- and post-development scenarios	Rare (1)	Insignificant (1)	**Low**	Medium	Construction and Operations
	Environmental Factor: Inland Water Environmental Quality											
	Construction activities including earthworks and building works	Construction materials, sediment and / or contaminants entering surface water features or groundwater	No notable surface water features in proximity to works, runoff to be discharged directly to Darwin Harbour and not expected to infiltrate into groundwater	Rare (1)	Insignificant (1)	**Low**	No treatment needed. Runoff flows directly into Darwin Harbour in pre- and post-development scenarios	Rare (1)	Insignificant (1)	**Low**	High	Construction
	Environmental Factor: Aquatic Ecosystems											
	N / A											
	Environmental Factor: Coastal Processes											
	Changes to local coastal processes	> Installation of breakwaters will interrupt nearshore hydrodynamics, wave and sediment transport, altering erosion > Localised changes to nearshore hydrodynamic wave climate due to installation of the harbour	> Changes to local hydrodynamics and wave climate may impact marine ecosystems, flora and fauna.	Possible (3)	Minor (2)	**Medium**	Intended effect of facility. Design to minimise footprint and interruption of coastal processes outside of harbour.	Unlikely (2)	Minor (2)	**Low**	Medium	Operations
	Environmental Factor: Marine Environmental Quality											
	Disturbance of marine sediments (fines)	Dredging actions, spoil transfer and disposal, rock placement and piling	> Elevated suspended sediment concentration in marine water > Sedimentation in marine environment > Potential impact to benthic communities and other biota	Likely (4)	Moderate (3)	**High**	> Model dredging and disposal actions to properly understand dredge plume dispersion > Gain an understanding of sensitive marine environmental receptors and their tolerance > Control actions to maintain water quality below appropriate thresholds (i.e. altering dredging activities [e.g. volumes, locations] to limit sediment resuspension, dredging only on certain tides etc.)	Unlikely (2)	Minor (2)	**Low**	High	Construction

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SEA	Release of contaminants from marine sediments	As per actions above - predominantly dredging and disposal	> Toxic contaminants made available to marine ecosystem for biological uptake and bioaccumulation > Potential impact to ecosystem health	Possible (3)	Moderate (3)	**Medium**	> Characterise material to be disturbed to understand locations and levels of contamination > Assess levels of contamination against appropriate thresholds, given the nature of the receiving environment > Isolate, remove and confine areas where contamination is potentially toxic to the marine environment	Unlikely (2)	Minor (2)	**Low**	High	Construction
	Introduction of contaminants/pollution to marine environment	Construction activities - inappropriate waste disposal, accidental oil/chemical spill	> Toxic contaminants introduced to marine ecosystem for biological uptake and bioaccumulation > Potential impact to ecosystem health	Possible (3)	Moderate (3)	**Medium**	> Inspection and audit of vessels and plant, controlled via DSDMP and CEMP > Reporting and response protocols should a spill occur - oil/chemical spill response etc.	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Release of sediments from land	Disturbance/stockpiling of material on land, lost due to run-off, wind etc.	> Elevated suspended sediment concentration in marine water > Sedimentation in marine environment > Potential impact to benthic communities and other biota	Possible (3)	Minor (2)	**Medium**	> Controlled by CEMP > Appropriate stockpiling technique and location > Prevention by bunding, erosion control etc. > Response plan for release of material	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Disturbance of marine sediments (fines)	Rock placement and piling	> Elevated suspended sediment concentration in marine water > Sedimentation in marine environment > Potential impact to benthic communities and other biota	Almost Certain (5)	Minor (2)	**Medium**	> Model dredging and disposal actions to properly understand dredge plume dispersion > Gain an understanding of background conditions > Gain an understanding of sensitive marine environmental receptors and their tolerance > Control actions to maintain water quality below appropriate thresholds	Possible (3)	Insignificant (1)	**Low**	High	Construction
	Release of contaminants from marine sediments	Rock placement and piling	> Toxic contaminants made available to marine ecosystem for biological uptake and bioaccumulation > Potential impact to ecosystem health	Possible (3)	Moderate (3)	**Medium**	> Characterise material to be disturbed to understand locations and levels of contamination > Assess levels of contamination against appropriate thresholds, given the nature of the receiving environment > Isolate, remove and confine areas where contamination is potentially toxic to the marine environment	Possible (3)	Insignificant (1)	**Low**	High	Construction
	Introduction of contaminants/pollution to marine environment	Construction activities - inappropriate waste disposal, accidental oil/chemical spill	> Toxic contaminants introduced to marine ecosystem for biological uptake and bioaccumulation > Potential impact to ecosystem health	Possible (3)	Moderate (3)	**Medium**	> Inspection and audit of vessels and plant, controlled via DSDMP and CEMP > Reporting and response protocols should a spill occur - oil/chemical spill response etc.	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Release of sediments from land	Disturbance/stockpiling of material on land, lost due to run-off, wind etc.	> Elevated suspended sediment concentration in marine water > Sedimentation in marine environment > Potential impact to benthic communities and other biota	Possible (3)	Minor (2)	**Medium**	> Controlled by CEMP > Appropriate stockpiling technique and location > Prevention by bunding, erosion control etc. > Response plan for release of material	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Siltation of harbour	Proposed breakwaters lower velocities in the harbour and allow the settlement of suspended particles	> Smothering of seabed with fine particles impacting marine flora / fauna	Almost Certain (5)	Minor (2)	**Medium**	> Siltation modelling undertaken to estimate rates of accumulation > Benthic habitat has already been identified and removed as part of initial dredging campaign	Unlikely (2)	Minor (2)	**Low**	High	Operations
	Introduction of contaminants/pollution to marine environment	Boat ramp use - inappropriate waste disposal, accidental oil/chemical spill	> Toxic contaminants introduced to marine ecosystem for biological uptake and bioaccumulation > Potential impact to ecosystem health	Possible (3)	Moderate (3)	**Medium**	> Inspection and audit of vessels and plant, controlled via DSMP and CMP > Reporting and response protocols should a spill occur - oil/chemical spill response etc.	Unlikely (2)	Minor (2)	**Low**	Medium	Operations
	Environmental Factor: Marine Ecosystems											
	Dredger/vessel movement	> Vessel strike of marine fauna such as dugongs, turtle, dolphins > Underwater noise impacts due to dredging and piling > Direct impact to seabed - marine ecosystems	> Vessel strike of marine fauna > Injury to marine fauna > Damage to ecosystems	Possible (3)	Moderate (3)	**Medium**	> Vessel movement controls, speed limits, no-go zones > Marine fauna observation and avoidance > Piling controls (soft start) to allow fauna to leave area	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Dredging	Direct removal of benthic communities and habitat	> Permanent removal/destruction of BCH such as seagrass and coral	Almost Certain (5)	Major (4)	**Very High**	> Characterise BCH in direct impact footprint > Minimise footprint and avoid sensitive receptors/important BCH where possible	Likely (4)	Moderate (3)	**High**	High	Construction
	Dredging	Elevated suspended sediment concentration (turbidity) in vicinity of project	> Impact to sensitive BCH such as coral and seagrass (blocking of light) > Impact to marine fauna due to ingestion/dermal contact	Likely (4)	Moderate (3)	**High**	> Characterise BCH in vicinity of project > Characterise dredge plume dispersion to understand changes to water quality with respect to tolerance of BCH/fauna > Implement dredging controls and reactive monitoring to maintain levels below thresholds	Unlikely (2)	Minor (2)	**Low**	Medium	Construction

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SEA	Dredging	Sedimentation of seabed in vicinity of project	> Impact to sensitive BCH such as coral and seagrass (smothering)	Likely (4)	Moderate (3)	**High**	> Characterise dredge plume dispersion to understand sedimentation levels with respect to tolerance of BCH/fauna > Implement dredging controls and reactive monitoring to	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Dredge spoil disposal	Elevated suspended sediment concentration (turbidity) at disposal site	> Impact to sensitive BCH such as coral and seagrass (blocking of light) > Impact to marine fauna due to ingestion/dermal contact	Likely (4)	Moderate (3)	**High**	> Select disposal area for optimum dispersion and minimum sensitive receptors > Characterise disposal dispersion to understand changes to water quality with respect to tolerance of BCH/fauna > Implement dredging disposal controls and reactive monitoring to maintain levels below thresholds	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Dredge spoil disposal	Sedimentation of seabed at disposal site	> Impact to sensitive BCH such as coral and seagrass (smothering)	Likely (4)	Moderate (3)	**High**	> Select disposal area for optimum dispersion and minimum sensitive receptors > Characterise disposal dispersion to understand sedimentation levels with respect to tolerance of BCH/fauna > Implement dredging controls and reactive monitoring to maintain levels below thresholds	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Dredger/vessel movement	> Vessel strike of marine fauna such as dugongs, turtle, dolphins > Underwater noise impacts due to dredging and piling > Direct impact to seabed - marine ecosystems	> Vessel strike of marine fauna > Injury to marine fauna > Damage to ecosystems	Possible (3)	Moderate (3)	**Medium**	> Vessel movement controls, speed limits, no-go zones > Marine fauna observation and avoidance > Piling controls (soft start) to allow fauna to leave area	Unlikely (2)	Minor (2)	**Low**	Medium	Operations
	Construction activities including earthworks, building works and transport to site	Construction materials and /or general litter entering marine environment	> Ingestion/injury of waste by marine fauna > Damage to marine ecosystems	Possible (3)	Moderate (3)	**Medium**	> Control of waste as per CEMP > Reporting and response to pollution events > Control of construction access/activities	Rare (1)	Moderate (3)	**Low**	Medium	Construction
	Rock placement and piling	Direct removal of benthic communities and habitat	> Permanent removal/destruction of BCH such as seagrass and coral	Almost Certain (5)	Moderate (3)	**High**	> Characterise BCH in direct impact footprint > Minimise footprint and avoid sensitive receptors/important BCH where possible	Likely (4)	Minor (2)	**Medium**	High	Construction
	Rock placement and piling	Elevated suspended sediment concentration (turbidity) in vicinity of project	> Impact to sensitive BCH such as coral and seagrass (blocking of light) > Impact to marine fauna due to ingestion/dermal contact	Likely (4)	Moderate (3)	**High**	> Characterise BCH in vicinity of project > Characterise dredge plume dispersion to understand changes to water quality with respect to tolerance of BCH/fauna > Implement dredging controls and reactive monitoring to maintain levels below thresholds	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Rock placement and piling	Sedimentation of seabed in vicinity of project	> Impact to sensitive BCH such as coral and seagrass (smothering)	Likely (4)	Moderate (3)	**High**	> Characterise BCH in vicinity of project > Characterise dredge plume dispersion to understand sedimentation levels with respect to tolerance of BCH/fauna > Implement dredging controls and reactive monitoring to maintain levels below thresholds	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
AIR	*Environmental Factor: Air Quality*											
	Dust generated by construction activities including earthworks, building works and transport to site.	Decrease in local air quality	Impacts to local fauna and human health through inhalation of particles	Almost Certain (5)	Minor (2)	**Medium**	Integration of dust management measures in construction management plan including: > Watering of temporary roads and stockpile areas; > Use of dust suppression equipment; and > Speed limits on site roads.	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Mobile plant at site and trucking of materials to site	Carbon dioxide emissions	Impacts to local fauna and human health through inhalation of emissions	Almost Certain (5)	Minor (2)	**Medium**	Integration of air quality measures in construction management plan including: > Isolating plant from workers where possible; and > PPE	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Environmental Factor: Atmospheric Processes											
	Energy usage during construction of facilities	Direct emissions from mobile plant, dredger, generators etc.	Cumulative impact of carbon emissions to global climate change	Likely (4)	Insignificant (1)	**Medium**	> Effeciency in design to minimise quantity of rock needed in breakwaters, causeway and boat ramp; > Materials should be transported to site with the minimum number of vehicles required; and > Reuse of existing building onsite for ferry terminal to reduce new materials required;	Possible (3)	Insignificant (1)	**Low**	Medium	Construction
	Future power usage at the ferry terminal	Indirect emissions from use of electricity	Cumulative impact of carbon emissions to global climate change	Likely (4)	Insignificant (1)	**Medium**	Integration of electricity reduction measures in construction management plan including: > Energy saving devices; and > Consideration of alternative energy sources where possible	Possible (3)	Insignificant (1)	**Low**	Medium	Operations
	Environmental Factor: Community and Economy											

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PEOPLE	Construction activities including earthworks and building works	Noise generated	Decrease in liveability for nearby residents, ferry users or tourists	Possible (3)	Minor (2)	Medium	Integrate noise management measures within the construction management plan	Unlikely (2)	Minor (2)	Low	Medium	Construction
	Trucking in of construction materials	Increase in traffic along Cox Peninsula Road and Charles Point Road	Traffic delays and increased risk of accident for local residents of the Cox Peninsula	Likely (4)	Minor (2)	Medium	> Traffic management plan to be implemented to manage any disruptions to local traffic > Staggering of heavy vehicles throughout the day to minimise congestion	Unlikely (2)	Minor (2)	Low	Medium	Construction
	Construction activities including earthworks and building works	Loss of access to existing carpark	Decrease in liveability for users of existing boat ramp or carpark	Almost Certain (5)	Minor (2)	Medium	> Stakeholder engagement with current uses of facilities to inform of access issues during construction	Almost Certain (5)	Minor (2)	Medium	High	Construction
	Environmental Factor: Culture & Heritage											
	Aboriginal sacred sites	Construction activities disturbing or destroying Aboriginal Sacred Sites south of the works	Permanent or temporary damage or contamination of Sites	Possible (3)	Moderate (3)	Medium	> Response and reporting procedures should a site or obje	Rare (1)	Moderate (3)	Low	High	Construction
	Cultural heritage sites / artefacts	Dredging, disposal and associated actions	Disturbance of known or unknown cultural heritage areas during dredging	Possible (3)	Moderate (3)	Medium	> Gain understanding of cultural heritage of the site and establish no work areas around heritage sites > Response and reporting procedures should a site or object be encountered	Unlikely (2)	Moderate (3)	Medium	High	Construction
	Increased patronage in the area due to upgraded marine facilities	Disturbance or destruction of Aboriginal Sacred Sites south of the works	Permanent or temporary damage or contamination of Sites	Unlikely (2)	Moderate (3)	Medium	> Signage to alert the public of private driveways and land to the south of the carpark	Rare (1)	Moderate (3)	Low	Medium	Operations
	Environmental Factor: Human Health											
	Asbestos contamination encountered on Lot 50	Inhalation of airborne asbestos	Adverse health impacts to site workers and users of facility	Possible (3)	Moderate (3)	Medium	> Staff to have sufficient training in handling asbestos > Appropriate PPE provided to all staff working with, or suspected to be working with asbestos	Rare (1)	Moderate (3)	Low	Medium	Construction
	Personnel working outside	Exposure	> Sunburn and heat stress > Injury due to cyclone or storm whilst on site	Likely (4)	Moderate (3)	High	> Staff to have appropriate PPE (long sleeved shirt, pants, hats, sunscreen etc.) to minimise risk of sunburn and heat stress > First aid kits located around site for initial response > Development of a cyclone response plan and regular monitoring of local news channels	Possible (3)	Moderate (3)	Medium	Medium	Construction
	Personnel working outside	Biting insects, snakes, crocodiles	> Injury due to bite/attack > Disease transmitted by biting insect	Possible (3)	Moderate (3)	Medium	> Staff to have appropriate PPE (long sleeved shirt, pants, repellent etc.) to minimise risk of biting insects > Staff to have sufficient training on the identification of reptiles likely to be encountered on site > If a problem crocodile is encountered it should be reported to (08) 8983 2475 > First aid kits located around worksite to provide initial response to incidents	Unlikely (2)	Moderate (3)	Medium	Medium	Construction
	Construction activities including earthworks and building works	Open fire ignited by construction activities	> Minor, serious or fatal burns to personnel > Smoke inhalation	Unlikely (2)	Moderate (3)	Medium	> Staff to have sufficient training in fire management > Fire extinguishers located around site > Smoking and hot works in permitted areas only	Rare (1)	Major (4)	Medium	Medium	Construction
	Proximity to vegetation	Exposure to bushfire	> Minor, serious or fatal burns to personnel > Smoke inhalation	Unlikely (2)	Major (4)	Medium	> Creation of a bushfire evacuation plan > Staff to have sufficient training in fire management > Regular monitoring of local news channels	Rare (1)	Moderate (3)	Low	Medium	Construction
	Public accessing breakwaters and / or jetty during construction	Slip, trip or fall into water above head height	> Accidental entry to deeper water leading to drowning hazard	Unlikely (2)	Major (4)	Medium	> Fencing and signage to prevent public access to breakwater and jetty	Rare (1)	Major (4)	Medium	Medium	Construction
	Dredging and disposal of contaminated sediments	> Disturbance/release during extraction, transport and placement stages > Release to the marine environment following placement, then bioaccumulation and biomagnification in the food chain	> Dermal contact > Inhalation > Ingestion	Possible (3)	Moderate (3)	Medium	See management measures relating to marine environmental quality. These apply to risk to humans also, with risk to human health considered a lower risk.	Rare (1)	Moderate (3)	Low	Medium	Construction
	Dredging and disposal of fine sediments	> Disturbance/release during extraction, transport and placement stages	> Dermal contact > Inhalation	Possible (3)	Moderate (3)	Medium	> Sediments to remain wet or be contained as part of disposal > Segregation of work area and material from general public	Rare (1)	Moderate (3)	Low	Medium	Construction
	Public accessing breakwaters and / or jetty during construction	Slip, trip or fall into water above head height	> Accidental entry to deeper water leading to drowning hazard	Unlikely (2)	Major (4)	Medium	> Fencing and signage to prevent public access to breakwater and jetty	Rare (1)	Major (4)	Medium	Medium	Operations

Theme	Environmental Aspect	Risk Pathway(s)	Potential Impacts	Likelihood	Potential Consequence	Inherent Risk Rating	Risk Management/Mitigation	Residual Likelihood	Residual Consequence	Residual Risk Rating	Level of Certainty	Project Phase
	Emissions from construction plant	Exposure of workers to emissions	Irritation to workers	Possible (3)	Minor (2)	**Medium**	> Avoiding idling of construction plant > Isolating workers from fumes > PPE such as masks and faceshields > Alternative power source	Unlikely (2)	Minor (2)	**Low**	Medium	Construction
	Public access to breakwaters and jetty	Slip, trip or fall into water above head height	> Accidental entry to deeper water leading to drowning hazard	Possible (3)	Major (4)	**High**	> Signage to notify public of dangers and that the breakwaters should not be accessed during dangerous conditions	Unlikely (2)	Major (4)	**Medium**	Medium	Operations