

East Arm Wharf Expansion Project

ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT



OCTOBER 2011

Prepared for Northern Territory Department of Lands and Planning



Northern
Territory
Government

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Units, Symbols and Abbreviations

The technical units of measurement in this report are based on the International System of Units (SI) wherever possible. These technical units may be broadly grouped as prefixes and units.

A prefix applies to the unit of measurement that immediately follows it—for example, milligram is abbreviated as mg.

Superscripts ² and ³ following a linear unit indicate area and volume respectively—for example, m² (square metres) and m³ (cubic metres).

Different units are combined by a full stop (.) to differentiate units of the same exponential sign, and a solidus (/) to indicate 'per'. For example, a kilometre per hour is abbreviated as km/h, while megalitres per day per square kilometre are ML/d.km².

Prefixes

M	mega	1,000,000	m	milli	0.001
k	kilo	1,000	μ	micro	0.000001

Units

a	year (annum)	L	litre
°C	degrees Celsius	m	metre
d	day	t	tonne
g	gram	hr	hour
ha	hectare		

Chemical Symbols and Formulae

CO ₂	Carbon dioxide	NO ₂	Nitrogen dioxide
CO ₂ -e	CO ₂ equivalent	SO ₂	Sulphur dioxide

Units, Symbols and Abbreviations

Abbreviations

Abbreviation	Description
>	Greater than
<	Less than
AAPA	Aboriginal Areas Protection Authority
AFANT	Amateur Fishing Association of the Northern Territory
ANZECC	Australia and New Zealand Environment Conservation Council
AQIS	Australian Quarantine and Inspection Service
AQMP	Air Quality Management Plan
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulphate Soils
ASSMP	Acid Sulphate Soils Management Plan
BOM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CBD	Central Business District
CCI	Coastal Catchment Initiative
CEMP	Construction Environment Management Plan
CSD	Cutter Suction Dredge
CSHD	Cutter Suction Hopper Dredge
DCC	Darwin City Council
DCI	Department of Construction and Infrastructure
DCM	Department of the Chief Minister
Defence	Department of Defence
DEIS	Draft Environmental Impact Statement
DHAC	Darwin Harbour Advisory Committee
DLP	Northern Territory Department of Lands and Planning
DMP	Dredge Management Plan
DoH	Department of Health
DoR	Department of Resources
DPC	Darwin Port Corporation
DPI	Department of Planning and Infrastructure
Draft Water Mouse Guidelines	Draft EPBC Act Policy Statement – Significant Impact Guidelines for the Vulnerable Water Mouse <i>Xeromys myoides</i>
EAW	East Arm Wharf
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environment Management Plan
EMS	Environment Management System
HAT	Highest Astronomical Tide
LDC	Land Development Corporation
MNES	Matters of National Environmental Significance
MSB	Marine Supply Base
NOI	Notice of Intent

Units, Symbols and Abbreviations

Abbreviation	Description
NRETAS	Department of Natural Resources, Environment, The Arts and Sport
NT	Northern Territory of Australia
NTG	Northern Territory Government
OEMP	Operational Environment Management Plan
PASS	Potential Acid Sulphate Soils
PM	Particulate Matter
PM ₁₀	Particulate Matter with an Average Aerodynamic Diameter of 10 µm and Less
PAH	Polycyclic Aromatic Hydrocarbons
PQL	Practical Quantitative Limits
ppb	Parts Per Billion
PWC	Power and Water Corporation
SEA	Strategic Environmental Assessment
SEDMP	Soil Erosion and Drainage Management Plan
SEIS	Supplement to the DEIS
SEL	Sound Exposure Level
SI	International System of Units
the Minister	Northern Territory Minister of Natural Resources, the Environment and Heritage
TSS	Total Suspended Solids
TSHD	Trailer Suction Hopper Dredge
Water Act	<i>Water Act 1992</i>
Water Regulations	<i>Water Regulations 1992</i>
WMSMP	Water and Marine Sediments Management Plan
WSSS Act	<i>Water Supply and Sewerage Services Act 2000</i>
WSUD	Water Sustainable Urban Design
WWMP	Wastewater Management Plan

Introduction

1.1 Background

The Northern Territory Government (NTG) proposes to expand existing facilities at East Arm Wharf (EAW) to address increased demands on the wharf for export of bulk minerals (including storage). The Department of Defence (Defence) also requires a ramp and hardstand area (SKM 2009, AECOM 2009a).

The proposed EAW Expansion (the Project) includes:

- Developing a Marine Supply Base (MSB) adjacent to EAW, primarily to service the existing and developing oil and gas industries in the Timor Sea, Browse Basin and adjacent areas.
- Constructing a barge ramp and hardstand area, including berthing for barges and facilities for loading and unloading.
- Extending the EAW quay, and construction of moorings to accommodate tugs, customs boats and other smaller vessels.
- Establishing a rail loop enabling rakes of rail wagons carrying bulk material to be manoeuvred through the port, and unloading material through a proposed rail dump facility to the adjacent stockpile areas.

The Proponent of the proposed EAW Expansion Project is the NT Department of Lands and Planning (DLP), which is responsible for developing and providing the strategic planning, growth frameworks and infrastructure plans required to sustainably develop the NT. For this particular project DLP is acting on behalf of the:

- Darwin Port Corporation (DPC), a NTG body responsible for the control and management of the land, waterways and facilities within the Port of Darwin; and
- Department of the Chief Minister (DCM) who are seeking to collaborate with a single operator or an operator-led consortium with experience in developing and operating a MSB to service the offshore oil and gas exploration and production industries.

A Draft Environmental Impact Statement (DEIS) (DLP, 2011) was prepared to identify the environmental and related impacts that could potentially occur as a result of the proposed expansion. It also describes management strategies and plans that will be employed to manage and mitigate those impacts.

This DEIS is based on the Department of Natural Resources, Environment, The Arts and Sport (NRETAS) *Guidelines for Preparation of a Draft Environmental Impact Statement for the Expansion works at East Arm, Northern Territory*, Department of Planning and Infrastructure (DPI) December 2009 (the Guidelines). The DEIS was released for review on 17 June 2011, and was open for comment until 5 August, 2011. This Supplement to the DEIS (SEIS) responds to comments received on the DEIS.

Although listed as part of the proposal in the Notice of Intent (NOI) and the Guidelines, this DEIS does not include the Land Development Corporation (LDC) subdivisional works and filling proposed for the area adjacent to the new East Arm Boat Ramp and Muramats Road. The NOI also indicated that the entire area north of the wharf, up to approximate alignment with Bleasers Creek, will be filled; however the only works north of the wharf within the scope of this DEIS will be associated with the proposed rail loop spur.

Introduction

The Proponent formally advised NRETAS of the alteration to the proposed action, consistent with the requirements of the Northern Territory Environmental Assessment Administrative Procedures, clause 14A (2003) in May 2011. A similar notification has been sent to Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) requesting a variation in accordance with Section 156A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The LDC is a significant NTG industrial land developer and has an integral role in the development of the EAW area. The LDC has been involved with the East Arm Marine Services Precinct, Common User Area and Darwin Business Park.

1.2 Respondents

Ten responses were received commenting on the DEIS. Responses were received from:

- Aboriginal Areas Protection Authority (AAPA).
- Amateur Fishing Association of the Northern Territory (AFANT).
- Environment Centre NT.
- Darwin City Council (DCC)
- Darwin Harbour Advisory Committee (DHAC).
- Department of Health (DoH).
- DoH (Centre for Disease Control).
- DLP (Road Network Division).
- DLP (Strategic Lands Planning).
- NRETAS.
- Department of Resources (DoR).
- Dr. Ian Hollingsworth.

In addition to the above, a Preamble to the responses was received, written by NRETAS. The comments included in the Preamble also responded to in this Supplement.

1.3 Process Used to Summarise the Submissions

Upon receipt from the EPA, URS recorded all responses commenting on the DEIS. The submissions were edited to present comments on key issues for inclusion in the Supplementary EIS. Copies of the comments on key issues were forwarded to the NRETAS for review to ensure that the comments adequately represented the key issues made in the submissions.

The comments on key issues, along with the responses to them, make up the main body of text in the following chapters of this Supplementary EIS.

1.4 Structure and Scope of the Supplementary EIS

Comments were received on most of the chapters of the DEIS. For ease of reference, the environmental aspects commented upon are presented in alphabetical order. Where comments relate to common aspect, they have been addressed within the one response where possible so as to avoid repetition.

Throughout the text, the respondents and comments on key issues are presented in box outline. Each box is followed by responses to the comments in plain text.

This Supplementary EIS includes the following appendices:

Introduction

- Appendix A: Darwin Harbour Environmental Monitoring Program Outline 2010-2013 (Coffey Environments 2010a).
- Appendix B: EAW Drainage Strategy (Aurecon 2011a).
- Appendix C: Retention Pond Design Summary Report (Aurecon 2011b).
- Appendix D: Dredge Management Plan (DMP) (AECOM 2011a).
- Appendix E: MSB Concept Stormwater Management Plan.
- Appendix F: Aboriginal Areas Protection Authority.
- Appendix G: 1995 Earth Awards Submission – EAW.

As discussed with NRETAS, the following is attached to the Supplementary EIS in CD format due to the size of the printed document:

- Darwin Harbour Vibrocore Sample Acquisition and Analysis Report (Seas Offshore 2010).

Historical water quality monitoring data is included in electronic format as Attachment 2, due to the large size of the document.

1.5 Project Changes in Response to Comments

In response to comments received on the DEIS, DLP has made amendments to the proposal as set out in the DEIS, and commits to the following:

- Substantially revised MSB access channel design, reducing the potential impacts to South Shell Island, benthic habitat, and the greater Darwin Harbour (refer Section 6.1).
- An environmental monitoring program for Darwin Harbour has been prepared (Coffey Environments 2010a) (refer Appendix A).
- Onshore disposal of all dredged spoil, resulting in substantially reduced impacts to the marine environment (refer section 7.2).

Air Quality

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Although not listed, vessels at berth also produce significant levels of PM₁₀. During the months June – July for varying periods of time, the levels of PM₁₀ and PM_{2.5} can be considerably higher than 33 µg/m³ levels due to burning off measures to reduce the possibility of wildfires later in the season. The air quality management plan should take into account the significant higher levels of background particulates in those months and plan to minimise construction activities in June and July. Alternatively, construction may need to be halted on severe smoke days. The references to the URS reports (generated for Conoco Phillips) as the background levels of NO₂ and SO₂ are in units not commonly used. They should be converted from µg/m³ to ppb as represented in the Ambient Air NEPM. There is an incorrect reference (Pg 172) to a NEPM standard exposure to NO₂. The report refers to 62 µg/m³ for a 24 hour averaging period whereas it is actually is for a 1 year period. It is correctly labelled in Table 11-2. In Table 11-2 overlooks the fact that construction and Operation – both Dry Bulk Facilities and Vessel at Berth can all occur concurrently. The first two when added would push PM₁₀ levels over the criteria or standard. Clarify why Kormilda College was chosen as a sensitive receptor when south westerly winds are rare in Darwin area. SE winds are dominant especially during the dry season thus more emphasis should be placed on Receptor 1 and the Darwin CBD directly downwind. There are no details about the actual TAPM and Ausplume models used and contour maps should be included to determine whether there are peak locations in other populated areas other than the 2 receptors selected. There is no detail of the type of the dust monitoring at the boundaries of the site and the results of the current quarterly dust monitoring program at EAW. The management plan should include live monitoring of PM₁₀ levels incorporating trip points where actions should be taken to identify the source(s) and organise mitigation.

The EAW air quality monitoring plan (AQMP) is described in the DPC Environmental Monitoring Program, which is included at Appendix A.

It is acknowledged that local sources such as vessel emissions and regional sources such as back burning can combine to result in cumulative concentrations above guidelines. As per the EIS, dust measurement instruments would be used to assess the dust impacts of the operation. This would include monitoring at selected locations during the construction and operational phase of the project to assess the relative impact of particulate matter from the operations, compared with background sources. Whilst the impact on sensitive receptors of particulate matter from construction or operational activities is likely to be low, regional sources could elevate levels to concentrations above NEPM guidelines. Should this occur, consideration would be given to stopping significant dust generating activities on site until levels have fallen to levels below appropriate guidelines. Dust management measures, such as watering, would also be considered.

Air Quality

Concentrations of pollutants in parts per billion (ppb) are provided as follows:

Oxides of Nitrogen

NO_x monitoring has been undertaken as part of the environmental studies conducted for the ConocoPhillips Darwin LNG Facility. URS (2005) presents baseline monitoring data of Nitrogen Oxides with subsequent monitoring being presented in URS (2008a). These studies provided concentration data for two locations: the Darwin central business district (CBD) and Middle Arm Peninsula. URS (2005) presented the following results for the dry season in 2004:

- Maximum 1 hour average NO₂ levels in Darwin CBD were observed to vary between 11–71 µg/m³ (5–35 ppb).
- Maximum 1 hour average NO₂ levels at the Middle Arm Peninsula ranged from 2 – 24 µg/m³ (1–12 ppb).

URS (2005) also presented the following results for the wet season in 2005:

- Existing maximum 1 hour average NO₂ levels in Darwin CBD were observed to vary between 2–34 µg/m³ (1–17 ppb).
- Maximum ambient 1 hour average NO₂ levels at Middle Arm Peninsula ranged from 1–16 µg/m³ (0.5–8 ppb).

Subsequent monitoring conducted presented in URS (2008a) is detailed below:

- Maximum 1 hour average NO₂ levels in Darwin CBD during the wet season were between 1–46 µg/m³ (0.5–22 ppb), as compared with levels at the Middle Arm Peninsula between 1–22 µg/m³ (0.5–11 ppb).
- Maximum 1 hour average NO₂ levels in Darwin CBD during the dry season were between 6–138 µg/m³ (3–67 ppb), as compared with levels at the Middle Arm Peninsula between 4–85 µg/m³ (2–41 ppb).

Sulphur Dioxide

SO₂ monitoring was also presented within URS (2005) and URS (2008a). As with the NO_x monitoring, the SO₂ monitoring station was situated in the Darwin CBD and at the Middle Arm Peninsula. URS (2005) presented the following results for the dry season in 2004:

- Maximum 1 hour average SO₂ levels in Darwin CBD were observed to vary between 0–42 µg/m³ (0–15 ppb).
- Maximum 1 hour average SO₂ levels at the Middle Arm Peninsula ranged from 0–8 µg/m³ (0–3 ppb).

URS (2005) also presented the following results for the wet season in 2005:

- Existing maximum 1 hour average SO₂ levels in Darwin CBD were observed to vary between 0–41 µg/m³ (0–14 ppb).
- Maximum ambient 1 hour average SO₂ levels at Middle Arm Peninsula ranged from 0–5 µg/m³ (0–2 ppb).

Air Quality

Subsequent monitoring conducted presented in URS (2008a) is detailed below:

- Maximum 1 hour average SO₂ levels in Darwin CBD during the wet season were between 0–415 µg/m³ (0–145 ppb) as compared with levels at the Middle Arm Peninsula between 2–23 µg/m³ (1–8 ppb).
- Maximum 1 hour average SO₂ levels in Darwin CBD during the dry season were between 1–71 µg/m³ (0–25 ppb) as compared with levels at the Middle Arm Peninsula between 4–34 µg/m³ (1–12 ppb).

The reference on Pg 172 of the DEIS to a NEPM standard exposure to NO₂ is erroneous and refers to “annual average” exposure.

Whilst some construction and operational sources may occur concurrently, the two particulate matter modelling scenarios considered (construction of the wharf areas & operation of the dry bulk facilities) incorporate sources that couldn't physically occur at concurrent times. All laydown areas (for the dry bulk facilities) would need to be in place before these areas are constructed and then operated. Thus a majority of material handling sources that may emit particulate matter during construction would be ceased prior to the construction and operation of the dry bulk facility. As such the impacts of the two scenarios cannot simply be added together. Furthermore the dry bulk facility will incorporate specific control measures (to be determined in the design and assessment stage of these areas) that would limit particulate matter releases.

The two receptors (Kormilda College and Government House / Darwin Waterfront) were chosen as the closest locations to the proposed development located in the north west and north east quadrants surrounding the development. Sensitive receptors located in close proximity to the proposed development to the south west and south east quadrants were not identified. Thus the identified receptors are considered to be the closest to the proposed development, and given the emissions plumes are primarily non-buoyant, they are likely to be the most impacted.

Modelled concentrations of assessed pollutants at Receptor 1 did not show exceedances, which implies that locations further downwind such as the Darwin CBD would subsequently receive reduced concentrations, negating the need for further assessment. Whilst south east winds are more frequent compared to south west winds in Darwin, the criteria at both locations were met. Further investigations, such as within the Darwin CBD, are therefore considered unnecessary.

Contour maps for maximum modelled PM₁₀ concentrations generated by the Project during construction and operation are shown at Figure 2-1 and Figure 2-2. A sample Ausplume output file is included at Appendix B. It should be noted that receptors were chosen to be representative of the current population exposed to air quality impacts of the proposed development and peak locations in other populated areas were not identified by URS during the assessment.

Dust monitoring details are provided in the DPC Environmental Monitoring Program (refer Appendix A). The monitoring comprises two high volume air sampling units measuring Total Suspended Particulates and metals. URS has not been provided with recent quarterly data, thus a discussion of the results cannot be provided.

It is agreed that particulate monitoring incorporate “trip points” or “action levels”. Ideally, the monitoring should commence prior to construction and continue until the early stages of operation to ensure PM₁₀ levels are within acceptable ranges.

Air Quality

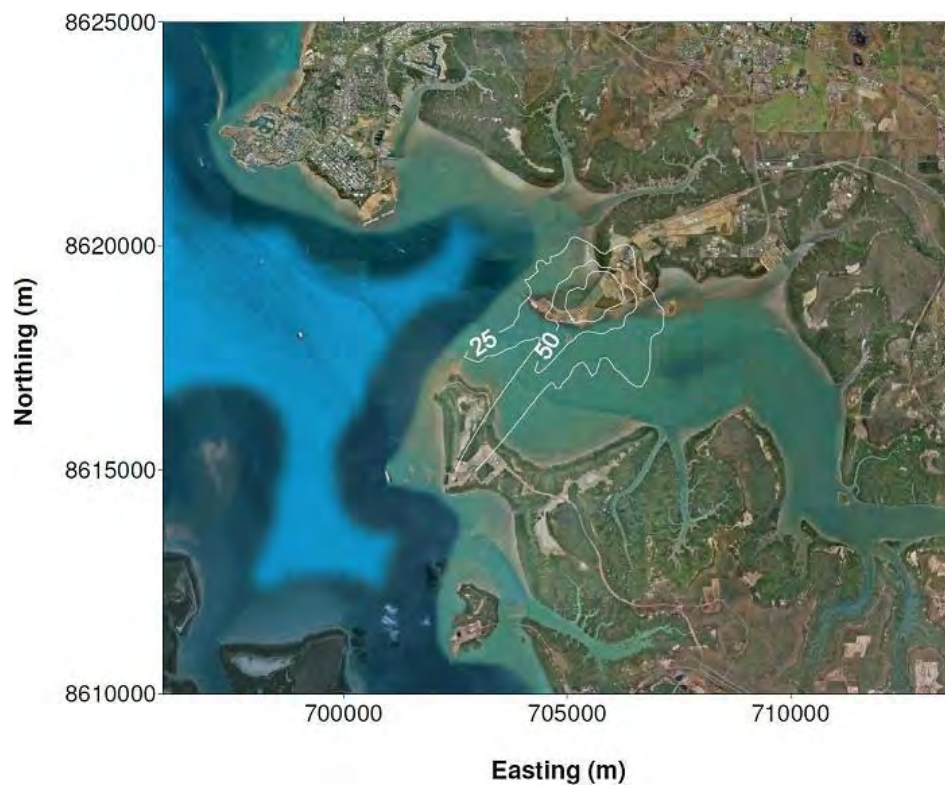


Figure 2-1 Maximum PM₁₀ concentration air quality contours - Construction

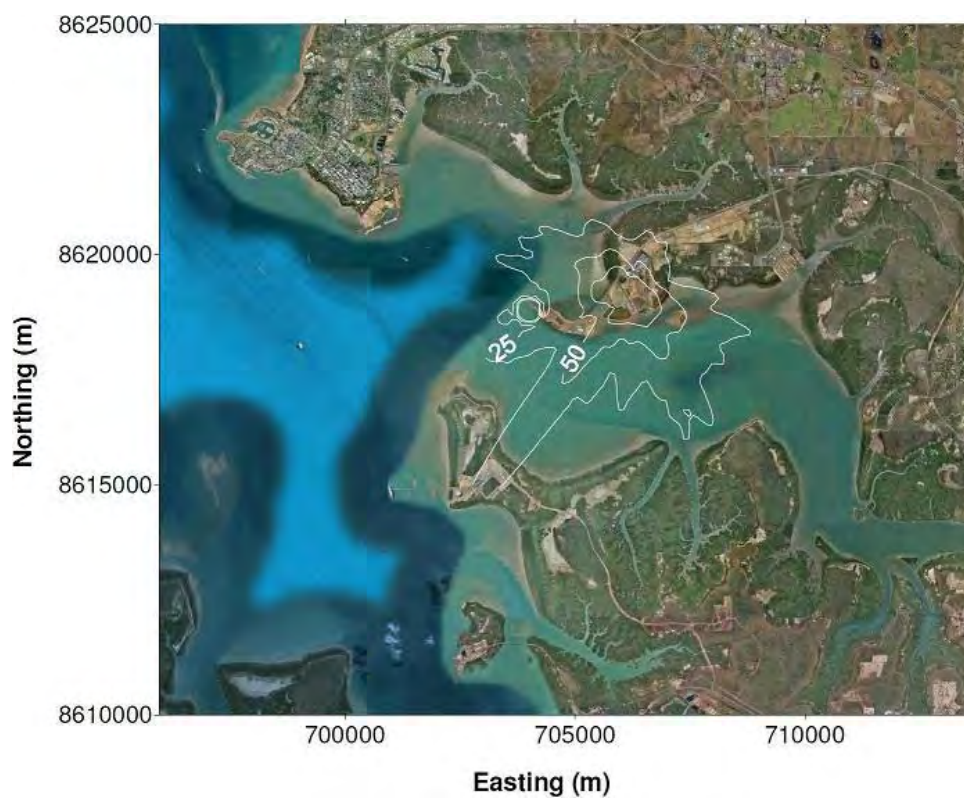


Figure 2-2 Maximum PM₁₀ concentration air quality contours - Operation

Biting Insects

Respondent:	Department of Health (Centre for Disease Control)
Comment:	There are no Medical Entomology comments.

Noted.

Climate

Respondent:	Darwin City Council
Comment:	... the most contemporary available information is critical to the development of the EAW Expansion Project.

The most contemporary available information (VIPAC 1994) was referenced for the DEIS. As stated in the DEIS, the VIPAC (1994) storm surge study is currently under review, and the proposed development will be designed in accordance with the findings of this review.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	A map should indicate the significance of these figures, with respect to the existing and proposed landscape. More details are to be provided in the Supplement.

Figure 4-1 shows the likely inundation zones in the event of a 1 in 10 year or 1 in 100 year storm surge occurring.

Respondent:	Environment NT
Comment:	Limited details have been provided about cyclone management strategies and preparedness. We request that more specific information be given in the Supplementary EIS, especially the capacity for securing and containing hazardous materials on-site during cyclonic conditions.

Hazardous materials will be stored under cover in appropriately sealed and secured containers during cyclonic conditions. Hazardous material storage areas will be covered and bunded. The available bund capacity will be equal to at least 100% of the capacity of the largest container of hazardous goods, plus 10% of the capacity of the second largest container.

All buildings, storage facilities and other structures will be designed and constructed in compliance with the relevant Australian building codes and standards.

During cyclonic conditions extra precautions will be undertaken in accordance with the DPC Cyclone Management Procedures (DPC 2010).

4 Climate

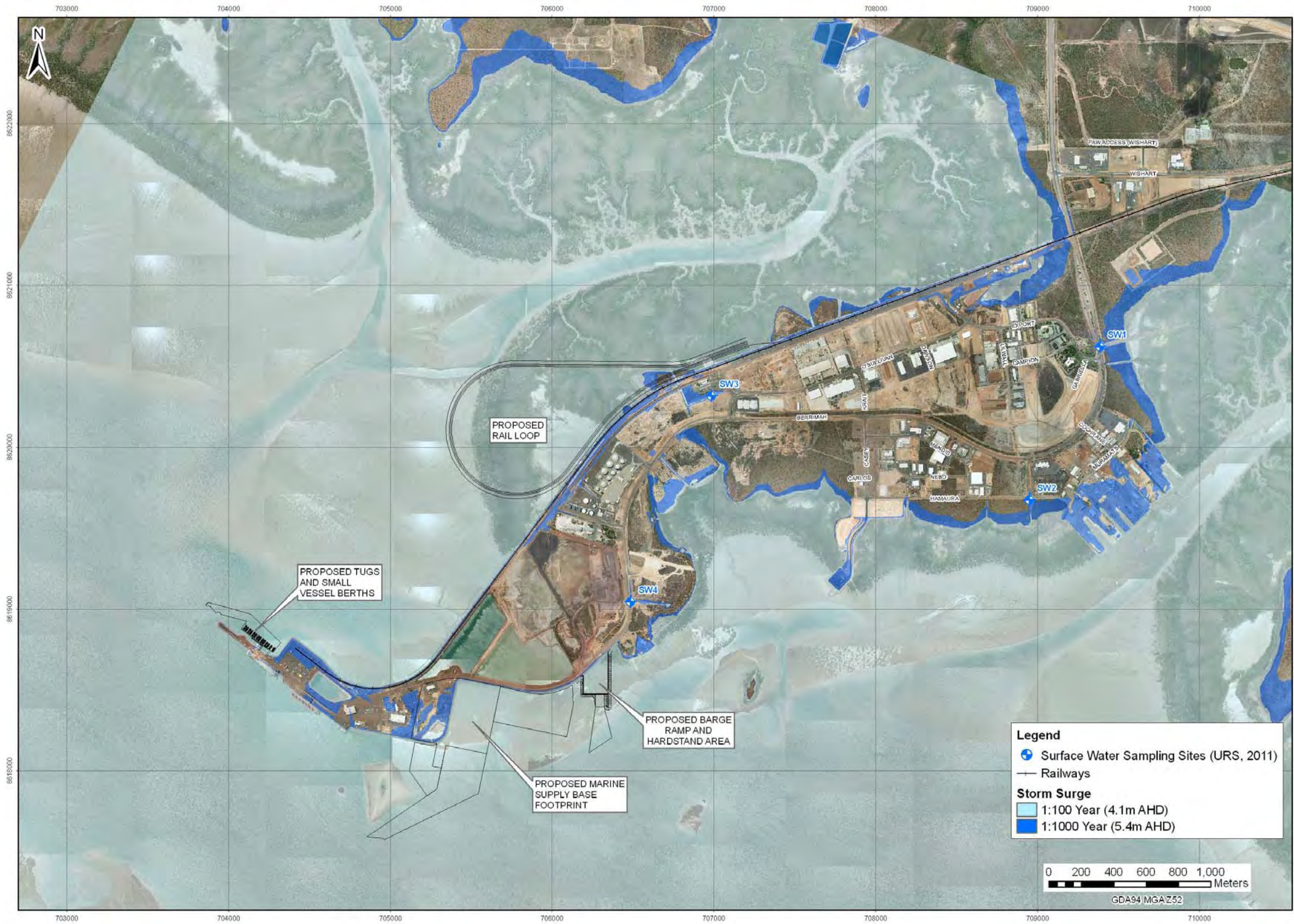


Figure 4-1 Projected areas of inundation in the event of a 1 in 10 year or 1 in 100 year storm surge occurring

Description of Proposal

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The Supplement document should also include the following maps: - One map of only the actions proposed to be taken as part of this approval. - Another map showing all actions that may be undertaken or are proposed to be undertaken as a result of the proposed East Arm Wharf Expansion Project, but are not part of this project.

A map of only the actions proposed to be taken as part of this approval is shown at Figure 5-1. Actions which may or may not be undertaken in the future as a result of the Proposed Development are at this stage unknown to the Proponent. A general indication of potential future EAW development directions and growth opportunities, however, may be ascertained from the EAW Masterplan 2030 [<http://www.darwinport.nt.gov.au/port-trade-development/masterplan-2030>].

The environmental assessment for the current EAW (Acer Vaughan 1993) also provides potential options for further development of EAW.

5.1 Marine Supply Base

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Ensure all figures are readable...

Refer to Figure 6-1.

5.2 Rail Loop and Spur

Respondent:	Amateur Fishing Association of the NT
Comment:	We do not believe that there is sufficient detail about the intended use, the wider land and harbour transport implications, its actual location and construction or the associated infrastructure that would be required for its use to make any meaningful assessment of the Rail Loop proposal. We would be concerned if this part of the project was given approval before such details are fully examined.

The objectives and intended use of the proposed rail loop are discussed at sections 2.1.3 and 2.2.3 of the DEIS. The Adelaide-Darwin railway is currently utilised for both freight and passenger transport services, and it is anticipated that both uses will continue into the foreseeable future. In addition to current use, increased future demand for extra rail access, storage areas and land to ship transport infrastructure (conveyors) is projected. The proposed rail loop will support both current EAW usage and future demand by providing additional capacity for trains to unload within the EAW precinct whilst reducing rail and traffic congestion.

Figure 6-4 shows the proposed location and design of the rail loop, which has been further refined since publication of the DEIS. Additional construction details are provided at section 6.2. The major additional infrastructure associated with the proposed rail loop will be an additional rail dump facility. The favoured location for the new dumping facility, and associated conveyor, is also shown at Figure 6-4. Construction of the rail loop is likely to commence 10 to 15 years from the present, and the preferred location may change during this period. Nevertheless, the Proponent has provided the most up to date information on the rail loop that is available. The proposed rail loop has been sited as close to degraded areas as possible.

Description of Proposal

Respondent:	Amateur Fishing Association of the NT
Comment:	Despite this project proposal there is still no final agreed design for the expansion of EAW facilities and, as far as we can ascertain, there is still no overall plan for the shipping of bulk minerals from Territory mines. There have been indications that the NT Government has doubts about the overall capacity of East Arm to become a major bulk minerals shipping port and we share those doubts. Given these uncertainties it is not clear why the rail loop is included under this assessment process.

One of the purposes of the DEIS assessment process is to determine the capacity of EAW to handle increased traffic loads and frequency. Alternative project components were considered, with the configuration considered most likely to be functional and viable assessed through the DEIS. At this stage in the assessment process, the Proponent considers that EAW has substantial capacity to increase traffic (both incoming and outgoing freight and other goods) if expanded as described in the DEIS. The proposed rail loop will expand the bulk mineral export capacity, and also support and improve the efficiency of other rail utilisation of EAW, and also of passenger transport.

As noted in Section 19.1, it is considered appropriate that the rail loop should be considered in the EIA at this time, as it is part of present planning. To not include it could give rise to accusation of incremental development approval ('development approval by stealth').

It would be remiss of the Proponent not to undertake planning for future expansion of EAW. The exact quantum of future bulk mineral trade over EAW may not be known but the Proponent must provide for expansion of trade. It is noted that significant infrastructure expansion (beyond that contemplated by the DEIS) would be required if BHP commences export of copper concentrate over EAW. The NTG considers that there are ample opportunities for the Port of Darwin to become major gas hub and exported of bulk minerals, and the source of "doubts about the overall capacity of East Arm to become a major bulk minerals shipping port" is unknown.

5 Description of Proposal

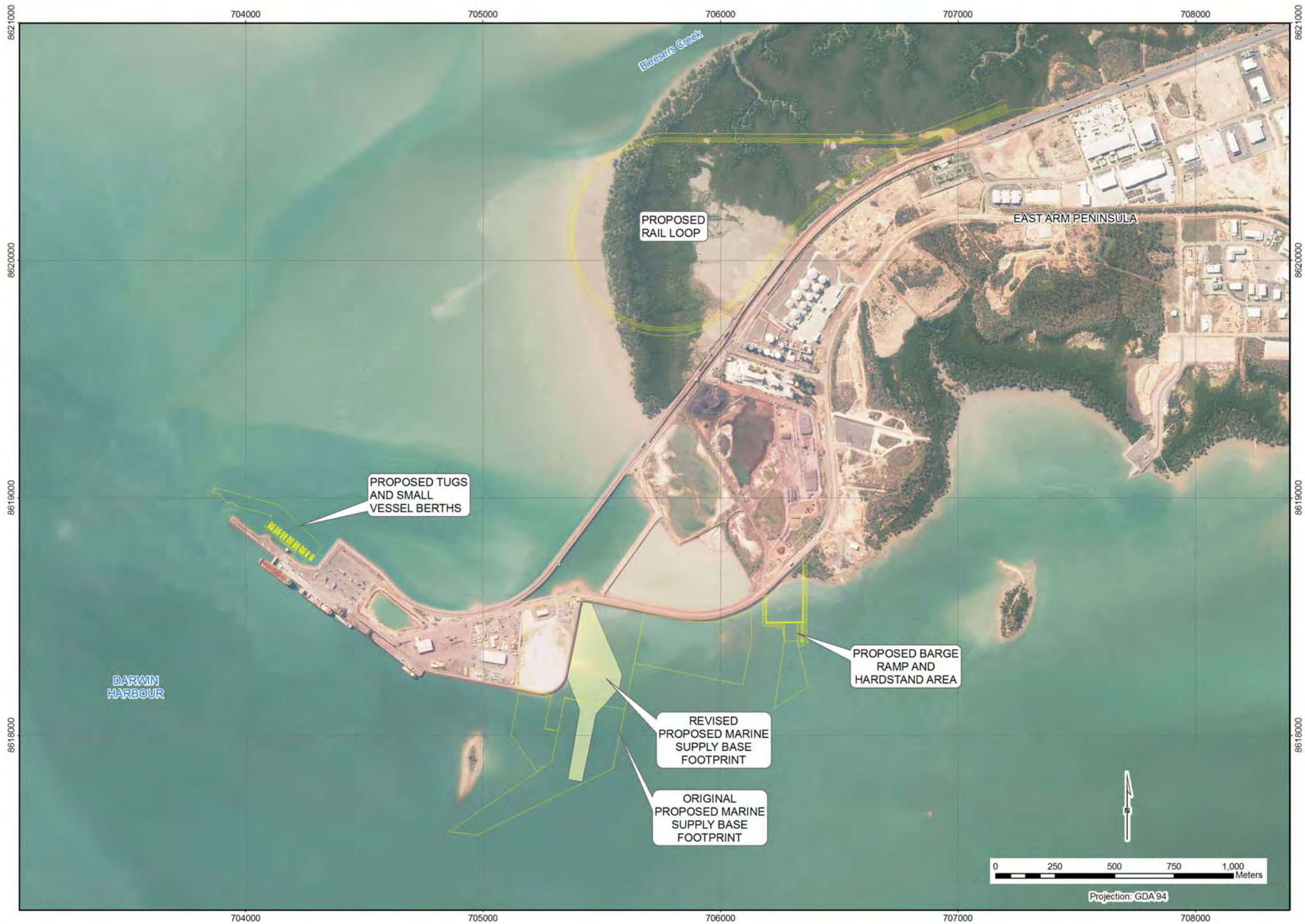


Figure 5-1 Map of the four project components (marine supply base, barge ramp, small vessel berths and rail loop) comprising the Proposed Development.

Description of Proposal

Respondent:	Amateur Fishing Association of the NT
Comment:	There are serious questions as to how a meaningful environmental assessment of the rail loop proposal can be undertaken in isolation from any consideration of what may or may not be required for the proposed Olympic Dam Expansion Northern Territory Transport Option and in isolation from any consideration of what and what quantity of bulk minerals the rail loop would be used for and how those minerals will be stockpiled and loaded.

Apart from the additional dumping facility and conveyors associated with the proposed rail loop, bulk material stockpiling and loading operations will be undertaken as per the current arrangements at EAW. It is not possible at this stage to comment on the specific bulk minerals which will be received, and what quantities will be handled, as these aspects would be subject to future contractual arrangements between DPC, the rail operator, and primary (mineral) producers. As the efficient capacity of the current rail spur is neared, however, the proponent will not be in a position to explore new bulk mineral export opportunities unless a plan for increased rail capacity at EAW has been assessed and approved.

The proposed rail loop, however, is not intended for the Olympic Dam bulk trade as copper concentrate is loaded, railed, unloaded, and stockpiled under very strict conditions. Specifically, Olympic Dam copper concentrate needs to be stored in an enclosed shed with negative pressure. Such a storage facility, if situated at the proposed rail loop, would be too far away from the wharf face and hence would likely not represent a suitable storage option.

As also noted at section 19.2 the EIA process for the EAW Expansion Project includes the construction of the rail loop and generalised operation of the expanded EAW facilities. Assessment of impacts directly associated with any specific mining operation would be within the scope of the EIA process required by the NTG as part of the development application for that particular proposal. In this respect the Olympic Dam Expansion EIS process includes the NT Transport Option (refer Main Report and Appendix E of the Olympic Dam Expansion Draft EIS (BHP Billiton 2009) and Chapter 20 of the Olympic Dam Expansion Supplementary EIS (BHP Billiton 2011).

5.3 Berthing Infrastructure

Respondent:	Amateur Fishing Association of the NT
Comment:	We assume that the proposed rail loop would only be viable with a significant increase in bulk minerals handling through East Arm and there is no consideration in this EIS of that magnitude of increased shipping and what additional major infrastructure such as ship berthing would be required. The draft EIS does indicate that a conveyor will be used to transport bulk minerals to the existing ore stockpile but we believe this is unlikely for a major expansion and that new and relocated stockpile facilities will be inevitable. Certainly, any such expansion would require new bulk loading facilities and there is no consideration of this in the Draft EIS.

The existing berthing infrastructure at EAW is considered to carry sufficient excess capacity that increased bulk minerals handling requirements could be serviced without the need for substantial upgrades (apart from the proposed rail loop, additional dumping facility, and additional conveyors described in the DEIS and this SEIS).

Description of Proposal

In other words, it is considered that bulk minerals handling at efficiency at EAW will be constrained in the future by rail movements rather than berthing infrastructure capacity limits. It is for this reason that the DEIS assessed the construction and operation of a rail loop rather than upgraded berthing infrastructure.

Design and Construction Methodology

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The Supplement needs to be clear on proposed upgrades/replacement of loading infrastructure prior to any increase in copper or hazardous bulk mineral loads commencing.

Upgrades / replacement of loading infrastructure are outside of the scope of the Proposed Development.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The intent of the Environmental Impact Assessment (EIA) is to describe the existing environment and locate and / or design infrastructure in areas that minimise environmental impact (e.g. avoiding sensitive marine habitat) – this is not clear in this statement.

Refer to sections 6.1 - 6.4 below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	Detailed design information and environmental management is currently unavailable and significant factors impacting environmental outcomes such as final configurations and construction timing are to be determined through the Expression of Interest (EOI) process.

Refer to sections 6.1 - 6.4 below.

6.1 Marine Supply Base

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Alternative construction methodologies have been described – but which one will result in best environmental outcome?

The design of the MSB has been revised significantly since publication of the DEIS. The proposed general layout of the revised MSB is shown at Figure 6-1. The location of the MSB access channel has also been revised, as shown at Figure 6-2.

The design of the MSB access channel has been revised so as to reduce the potential of negative impacts on the marine environment associated with dredging, and particularly impacts on South Shell Island. The western edge of the revised dredged channel alignment is now at least 300 m from South Shell Island.

In addition to avoiding impacting upon South Shell Island, the revised MSB access channel design has resulted in a significant decrease in required dredging volumes, from 1,008,320 m³ as published in the DEIS to 640,000 m³. The channel footprint has also been decreased significantly to approximately 84,000 m², resulting in reduced impact to the benthic environment. The location of the revised MSB access channel relative to the former design is shown at Figure 6-3.

Design and Construction Methodology

6.2 Rail Loop

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	(A major area of concern is) the implications of including the rail loop in this approvals process without consideration of all of the major issues associated with it that would be required for even the most rudimentary environmental assessment.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The proposal and commitment on this point (rail loop culverts) needs to be clarified and strengthened to optimise environmental outcomes. Engineering solutions exist, and should be clearly committed to at this stage of assessment. The proposal is unclear as to the future plans for the area enclosed by the rail loop, and whether the whole enclosed area, or just the rail corridor is being cleared. Impacts upon mangroves must be minimised as far as possible.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	How wide will the area of reclamation be? What will happen to current movements / hydrodynamics to the area enclosed by the loop? The Executive summary mentioned 74 Ha mangrove loss. How does this fit in? The rail loop is an example of lack of design detail making it difficult to assess the potential impacts. Commitment is required as to how the rail loop will be designed to ensure that the best environmental outcome and that these details are stipulated in the environmental assessment process.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	... culverts and other structures to mitigate the impact to mangroves inside the rail loop need commitment that they will ensure the contractor incorporates them into final design of the rail loop. The Proponent needs to provide more description of the design of the rail loop due to potential impacts to mangroves through loss of habitat, management of acid sulphate soils, and run-off.

The design of the proposed rail loop has been further progressed and refined since publication of the DEIS, with consideration given to stakeholder comments. The current preferred design is shown at Figure 6-4. The current proposal is to retain the mangroves encircled by the loop, and clear the rail loop corridor (and a service road). A trench along the offshore section of the proposed rail loop alignment will be excavated and a bund constructed within the trench, atop of which the rail line will be placed. The rail line bund will be approximately 60 m wide at the widest point.

Design and Construction Methodology

Culverts are now shown installed beneath the western end of the rail line bund. These culverts will allow tidal exchange of sea water between the enclosed mangroves and Darwin Harbour, which would aid mangrove health.

The EIS recognises that within the rail loop there is likely to be some alteration of the hydrological regime maintaining mangroves due to either restriction of tidal flows and / or the impoundment of tidal waters (i.e. ponding effects). However, the presence of the rail loop is not expected to alter the hydrological regime that is responsible for maintaining the mangrove systems outside of the rail loop in adjacent areas such as Bleesers Creek or the nearby mangroves of the Charles Darwin National Park. Tidal flows and water quality to these nearby mangrove areas are not expected to be modified by the presence of the rail loop. The lack of evidence of indirect impacts to nearby mangroves (from water quality related factors) that may be related to the existing EAW infrastructure provides support for the above assessment.

It is possible that sedimentation rates within the proposed rail loop may be altered compared to the current state. The mangroves are, however, located within a depositional environment, and a possible increase in sedimentation rates is considered unlikely to negatively impact the community.

In the longer term, filling of the land inside the rail loop is an option, in which case the mangroves within the loop would be cleared (as contemplated in the EIS for the current EAW configuration (Acer Vaughan 1993) and the DEIS), and the culverts would not be required. The figure for mangrove clearance provided in the DEIS (74 ha) included possible clearance of the mangroves within the proposed loop, although this is not planned at this point in time. Any mangroves which could potentially be cleared for the Project are located within a Development Zone.

The revised rail line alignment and associated corridor avoids the Aboriginal cultural site (East Arm 3 - shell midden) and World War Two historical sites identified in the DEIS (refer DEIS section 18).

The seaward bund wall has been widened for increased strength and stability.

The nature of the revisions made to the proposed rail loop since the publication of the DEIS provide more detail as to the final design. These revisions are not considered likely to result in impacts other than those discussed in the DEIS.

6 Design and Construction Methodology

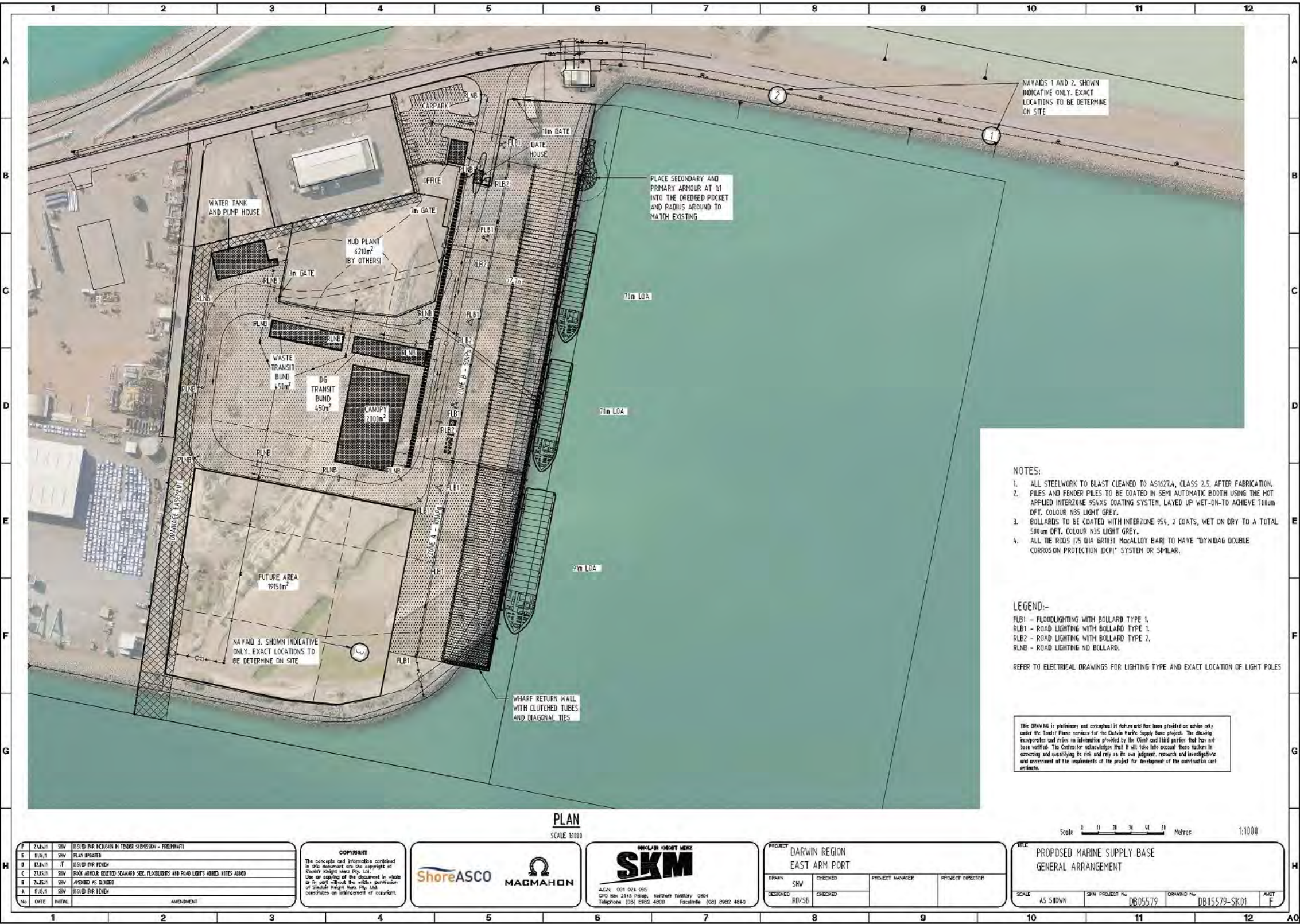


Figure 6-1 Revised Marine Supply Base layout

6 Design and Construction Methodology

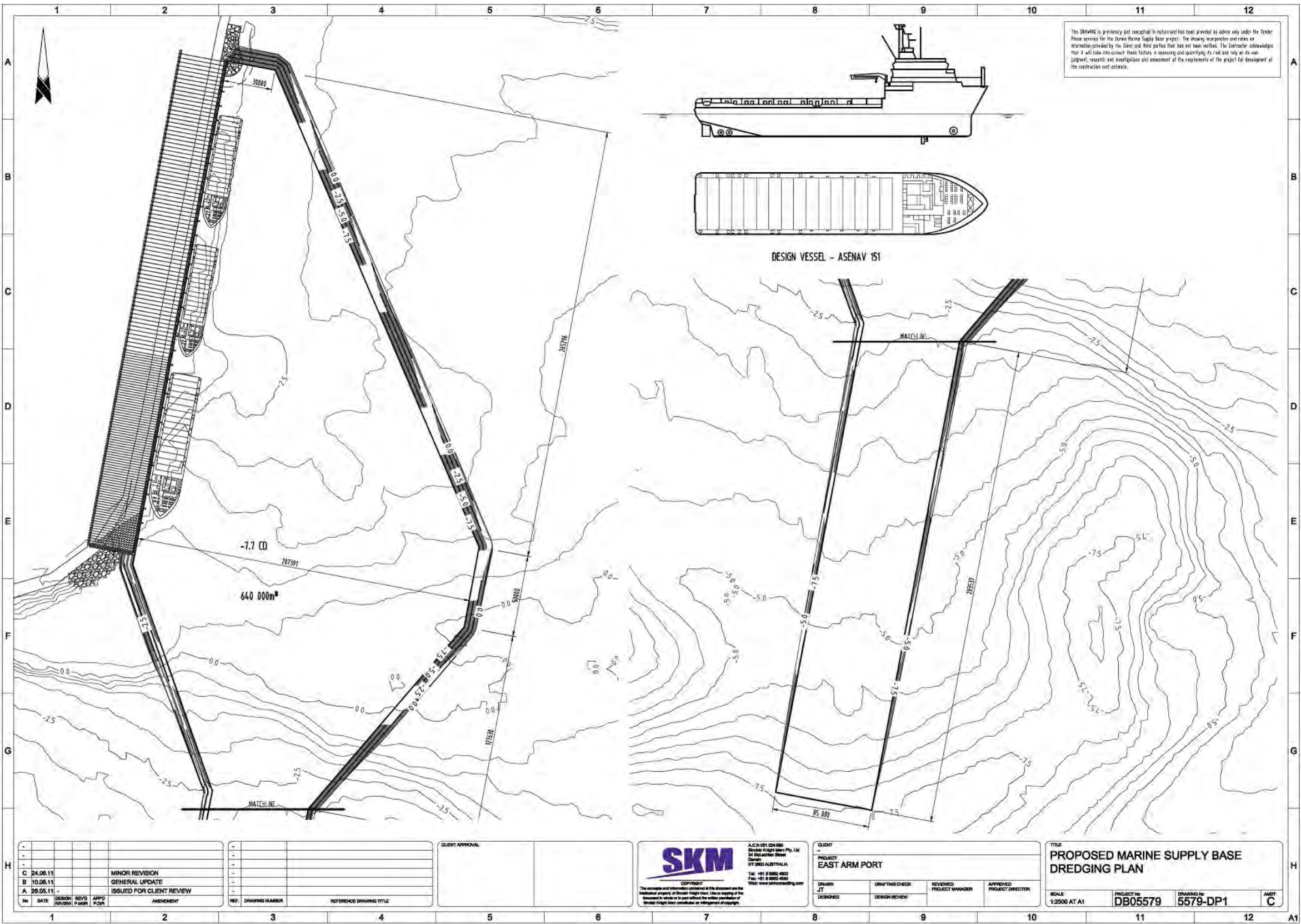


Figure 6-2 Revised Marine Supply Base access channel

6 Design and Construction Methodology

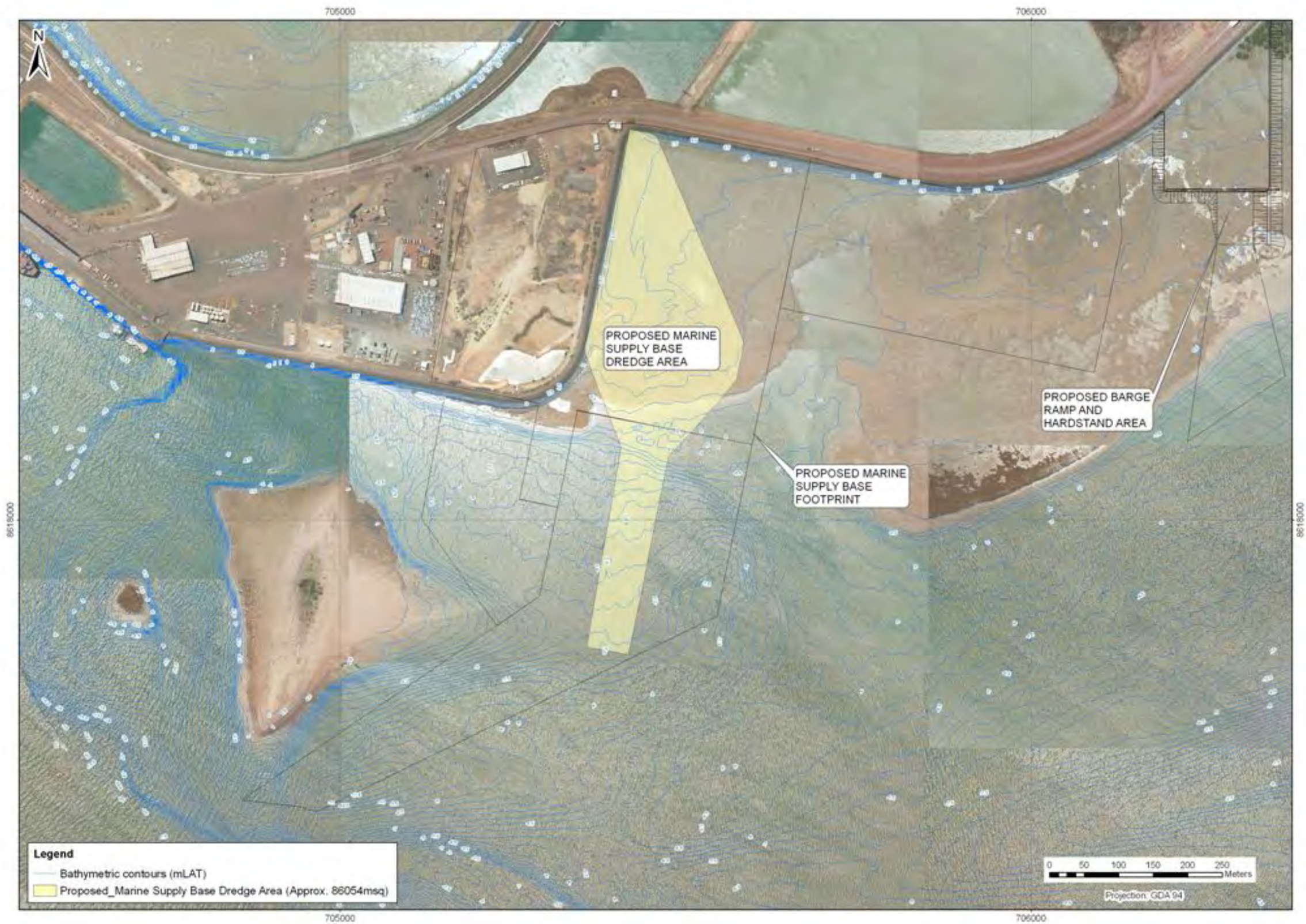


Figure 6-3 Revised Marine Supply Base access channel relative to former channel design and South Shell Island

6 Design and Construction Methodology

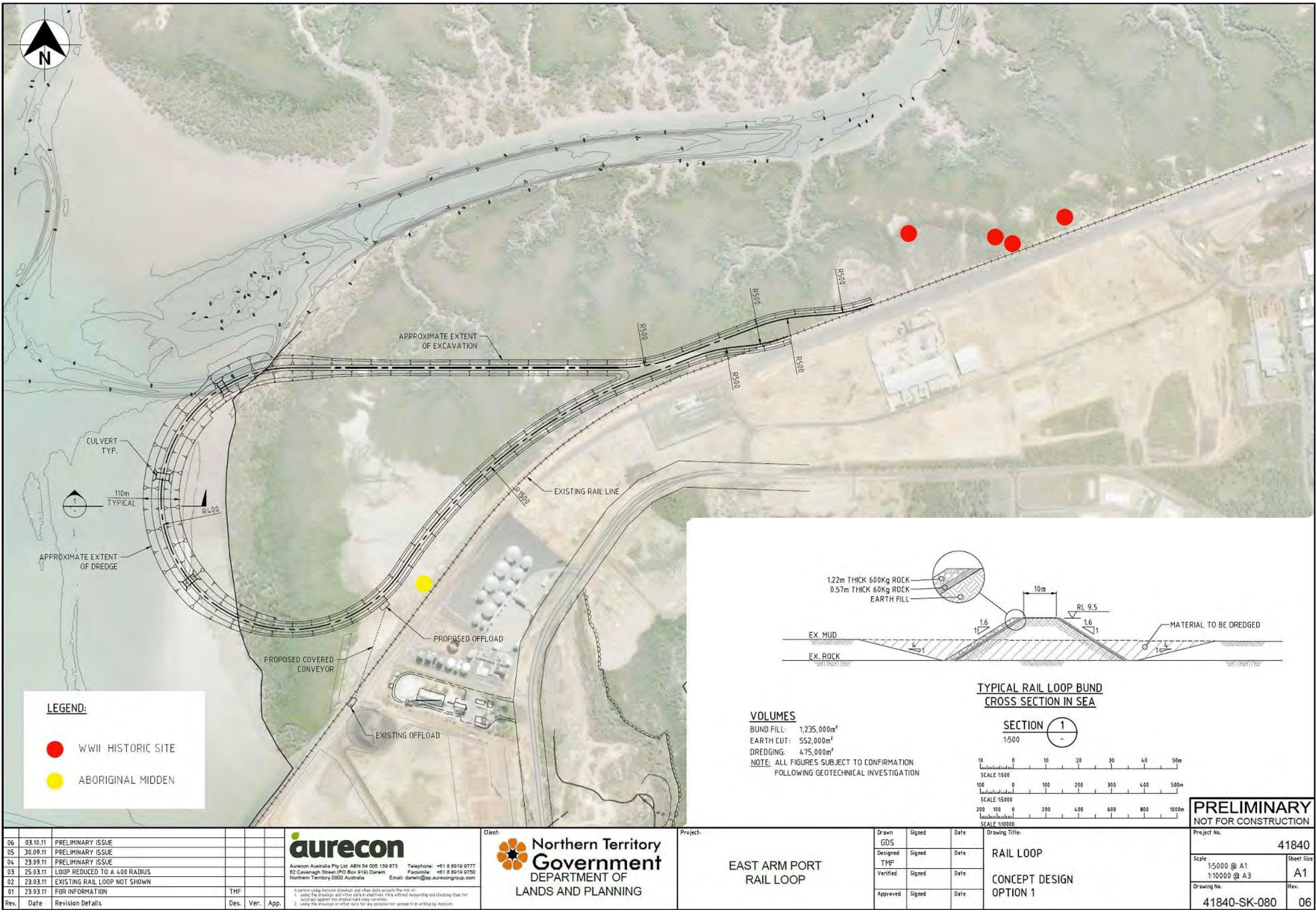


Figure 6-4 Revised rail loop design.

Design and Construction Methodology

6.3 Design

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	We request that there should now be assurances that any further expansion or development in the area will, as far as possible, be planned around continued recreational fishing access to (Bleesers and Reichardt) creeks.

Access to Bleesers Creek and Reichardt Creek will not be compromised, relative to current accessibility, during the operational phase of the Project. Access to Bleesers Creek may be restricted for limited periods during construction, when required due to safety or other considerations.

Respondent:	Darwin Harbour Advisory Committee
Comment:	DHAC's main concern at this stage of the project is that there remains a large degree of uncertainty about the final design and development making it very difficult for DHAC to provide informed comment regarding environmental impact. For example, there is no final determination on: • Dredging areas and depths for the project. • Size of the tug berth component. • Barge landing design and use. • Stormwater quality standards at discharge points.

Approximate dredging areas and depths will be as per the DEIS with the exception of the MSB. The revised MSB dredging requirements are detailed in Chapter 7 of this SEIS. The small vessel berth and barge ramp design concepts have not been revised since publication of the DEIS. The revised rail loop design is discussed in section 5.2 and shown in Figure 6-4 of this SEIS.

Stormwater management is discussed in Chapter 22 of this SEIS. Additional detail is provided in the DPC Environmental Monitoring Program (refer Appendix A), Aurecon (2011a) EAW Drainage Strategy (refer Appendix C), and Aurecon (2011b) Retention Pond Design report (refer Appendix D).

Prior to preparation of the DEIS an agreement was reached between the Proponent and NRETAS that it would not be possible to show actual details of the final project component designs, but rather the development envelopes would be shown. Although the exact layout of each project component cannot yet be confirmed, the DEIS provides a comprehensive understanding of the infrastructure likely to be present within each project component, such as wharves, pipelines, sheds and dredged channels.

Design and Construction Methodology

6.4 Construction Methods

Respondent:	Darwin Harbour Advisory Committee
Comment:	DHAC's main concern at this stage of the project is that there remains a large degree of uncertainty about the final design and development making it very difficult for DHAC to provide informed comment regarding environmental impact. For example, there is no final determination on rail loop construction.

The construction of the railway loop is anticipated to be carried out in the following sequence:

1. Clearing and grubbing (land sections)

To prepare the site for construction, general clearing and grubbing will be carried out along the route where necessary.

2. Excavation (marine sections)

The marine muds need to be removed completely in order to provide a stable foundation of bedrock for the rail loop embankment. It is anticipated that excavators will be utilised to carry out the dredging process.

Excavators would operate from each end of the rail line bund as it extends out into the marine environment. Spoil would be transferred directly to dump trucks and then transported to the onshore disposal site, most likely one of the ponds at EAW. It is estimated that 475,000 m³ of marine sediments would be dredged for the rail loop bund.

3. Earth Cut

Earth cut will be required to excavate the existing unsuitable material along the terrestrial section of the loop alignment. This will be carried out by employing a suitable excavator, depending on soil stability. The unsuitable fill will be sent to an agreed storage, again likely to be one of the existing ponds at East Arm Wharf.

4. Earth fill

Earth fill of approximately 1,235,000 m³ of imported material will be required to form the railway embankment. This will be constructed by directly dumping the material at the point necessary and pushing out with a dozer. Similar construction methods were utilised for the previous rail embankment at East Arm and more recently the breakwater at the Darwin City Waterfront.

5. Rock armour placing

The armour rock will be sourced and transported to the site by vehicle (triple trailer road trains). Different grades of rocks will be used to protect the embankment. The rock armour will be placed by suitable excavators, generally one rock at a time.

6. Railway installation

Installation of the railway will be carried out once the embankment is finished. Railway tracks are generally laid on a bed of stone track ballast or track bed, which in turn is supported by prepared earthworks, known as the formation. The formation comprises the subgrade and a layer of sand or stone dust (often sandwiched in impervious plastic), known as the blanket, which restricts the upward migration of wet clay or silt.

Design and Construction Methodology

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Certain risks are dependent upon the type and location of material being sourced... quality of the material in terms of erosion and sediment control of the extraction and stockpile sites; transport impacts and costs; potential Acid Sulphate Soil disturbance if rocks are extracted locally; any habitat damage at extraction sites.

Fill materials required for the Proposed Development, other than dredged spoil, will likely be sourced from existing quarries local to Darwin, as described in Section 2.8.1 of the DEIS. Construction contractors for each project component will select the actual quarries to be utilised based on suitability of materials, proximity to EAW, price, and other considerations.

The quality of quarried material in terms of erosion and sediment control of the extraction site/s, and potential habitat damage at the extraction site/s, is the responsibility of the quarry operator/s and / or the contractors, and is beyond the scope of this EIA. Transport impacts and costs associated with quarry fill will be addressed in each construction contractor submission, and considered by the Proponent when awarding contracts.

The project component specific Construction Environmental Management Plans (CEMPs) will each address fill stockpiling requirements, including stockpile location/s, bunding, covering, and air quality.

6.5 Over-Water Maintenance

Respondent:	Environment NT
Comment:	It is mentioned that "procedures" have been previously developed for minimising the quantity of particulates entering the water during over-water maintenance of steel structures. Further details should be provided about these procedures and whether they have been successfully employed to date.

The preferred design of the Project no longer uses sheet and pile construction. The over-water maintenance referred to in the DEIS will therefore not be required.

Dredging

Respondent:	Darwin City Council
Comment:	... it is not clear as to what extent, depth and type of dredging will be undertaken...

A revised DMP is included at Appendix E of this SEIS.

7.1 Dredging Design Factors

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Clarify whether locations and related channels were also chosen with consideration of avoiding sensitive habitat, avoiding disturbance of Acid Sulphate Soils or minimising the requirement for maintenance dredging. Will reducing the duration of the dredging reduce environmental impact – is this DLP's preference and has it been included in their Expression of Interest process? If this scenario is an option, present appropriate details of temporary and permanent disposal sites and management of risk. Double handling dredge spoil material seems a costly option and increases environmental risk – more details are required in the Supplement if this is a likely scenario. It is expected that all dredging alternatives and management be adequately described in the Supplement. Include any additional modelling of alternative dredging scenarios in the Supplement.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	If alternative dredging scenarios are considered – modelling of the proposed methodology must be included in the Supplement.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Management methods should be summarised in the main EIS and discussed with regard to their effectiveness. The current abstract dot points in the Appendix B are insufficient.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Management controls are not listed or detailed in App. E, or in the Risk Assessment section (App. Q and Chapter 25). They should be defined and discussed in this chapter, as part of the risk management discussions around individual impacts. In App. E (Dredge Dispersion Modelling) the only impacts discussed are estimates of sediment deposition and suspension. No biological impacts or residual risks are discussed. App. B (Dredge Management Plan), not cited here, discusses management controls

Dredging

	in abstract terms, but defers definition of triggers, thresholds and actual proposed actions to be developed prior to dredging (i.e. App. B, Sub-plans 1,2,3,4,5,6 & 7). Without management controls actually defined, prediction of the residual risk is not possible. Deferring the prediction of impacts to outside the period of public exhibition of the EIS defeats the purpose of an EIA. The subjective statement 'After implementation of controls, potential impacts from dredge spoil disposal are considered to be a "moderate" risk', is unjustified. Defined management actions need to be presented in the Supplement, and demonstration made that these will be effective at achieving their objectives. The proponent needs to stipulate in the Supplement that dredging will not occur close to the South Shell Island coral community during ebb tides.
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Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	As dredging and its associated water quality and ecological impacts are key risks of the proposal, their management should be detailed and discussed in the main document. The EIS Guidelines require that demonstration be made: That proposed activities can be managed to ensure that significant impacts to the ecological environment in Darwin Harbour, including impacts to NES matters, do not occur.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	It is expected that the EIS would have identified the dredging type required that has the minimal amount of environmental impact to make an informed decision.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	A draft Dredge Management Plan was included in the draft EIS however it stated that the "proponent may investigate other alternatives to the dredging processes described within". This means the dredging disposal modelling that has been conducted in the draft EIS may not be relevant if the final contractor uses alternative equipment or alters construction timing and duration of the modelled 64 days. This degree of uncertainty in the final design, development and management of the expanded works, makes it difficult to adequately assess the potential environmental impacts.

The locations of each proposed project component and the associated dredged channels were selected with consideration given to a range of factors including environmental impacts, available space, and proximity to existing infrastructure. Where dredged channels are required, site proximity to deep water was a key consideration so as to minimise the volume of dredging required and the footprint of the dredged channel. By minimising the dredged volumes and channel footprints the

Dredging

environmental impacts of dredging these channels is reduced. Acid sulphate soils will be avoided with the exception of the proposed rail loop.

The design of the dredged channel for the proposed MSB has been revised since publication of the DEIS in response to concerns over potential impacts to South Shell Island. The revised MSB dredged channel design in relation to South Shell Island is shown at Figure 6-3. The revised design for this channel has also resulted in a reduction in the volume of material dredged from the MSB access channel, now 640,000 m³ (compared with 1,008,320 m³ for the design provided in the DEIS), with resultant mitigation of dredging impacts.

Assuming the same dredging plant is utilised, a reduction in the duration of the dredging program will result in a reduction in some impacts associated with dredging, including a reduced period of increased turbidity in the vicinity of dredging activities. The key determinant of dredging duration, however, will be the type of dredge utilised (small or medium cutter suction dredge (CSD)).

Alternative dredging methodologies which were being considered during preparation of the DEIS have since been ruled out. Dredging will be undertaken utilising a CSD, and the potential environmental impacts of this methodology were modelled and described in the DEIS. No modelling of other dredging scenarios has therefore been undertaken.

Dredging will not occur close to the South Shell Island coral community during ebb tides.

The revised DMP is included at Appendix E of this SEIS. The DMP provides a framework for dredging activities related to the proposed EAW Expansion Project. It is recognised that the proposed development may take place concurrently with the proposed INPEX Ichthys Gas Field Development project. With the aim of adopting a consistent approach between the aforementioned INPEX project and the proposed development, the proponent proposes to amend the DMP in consultation with NRETAS prior to finalising the proposed plan. The objective of this review is for consistency between the proposed development DMP and the DMP for the INPEX project.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport (Preamble)
Comment:	The DEIS has not adequately addressed the impacts from dredging, dredge spoil disposal, increased, suspended sediments and changes in light attenuation associated with the trophic component of the Darwin Harbour ecosystem. In general terms, the draft EIS has not provided a comprehensive review of existing information and presented these data. No suitable marine monitoring control sites are proposed, and South Shell Island and Old Man Rock (areas of zone of effect) should be included in the monitoring program. Without suitable control sites, any localised or, regional impact, such as coral bleaching caused by a warm water event, could be attributed to the project. Management contingencies will need to be developed to protect significant habitats in the event that observed sediment parameters (sedimentation and turbidity), arising from dredging activities stray outside of the predicted values. The processes for developing contingencies and establishing triggers for implementing contingency action should be discussed in the EIS.

This information was unavailable at the time of submission of the DEIS, however the revised DMP now addresses these comments. A copy of the revised DMP is included at Appendix E of this SEIS.

Dredging

7.2 Spoil Disposal

Respondent:	Department of Resources
Comment:	The proposal to dump dredge spoil at sea... is supported...

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	It is not clear whether the 80/20% disposal option may impact adjacent mangrove vegetation not part of the detailed 74 ha of potential loss of mangroves. This will need to be assessed prior to choosing that dredge spoil disposal option.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	An explanation is required for the 93,000m ³ of dredge spoil not accounted for in the disposal amount. Provide details on the cumulative impacts of the disposal of 1.3m ³ of dredge soil if the same dredge spoil ground is used at around the same time as INPEX dredging works.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	There are two dredge material disposal options provided in the draft EIS - 100% offshore and 80/20% offshore-onshore disposal. The 80/20 option assumes that any material disposed of to shore will be high quality material suitable for onshore disposal. The Supplement requires more detail on whether this material is suitable for disposal onshore.

The Proponent is now proposing that all dredged spoil will be disposed of onshore within an existing pond at EAW (Pond K). Dredged spoil disposal will therefore have no impact on local mangrove habitat. There will also be no cumulative impacts (in addition to potential impacts associate with the INPEX project) of offshore disposal. The revised dredging volume for the Project is now 802,000 m³.

Environment Management System and Environment Management Plans

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The <i>Supplement</i> should clearly 'describe proposed mitigation measures and the efficacy of these.

Proposed impact prevention, management and mitigation measures are described throughout the DEIS where appropriate. Environment management plans (EMP) are described at Chapter 26 of the DEIS. Measures specifically related to dredging are included in the revised draft DMP at Appendix E.

8.1 Environment Management System

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	Annual reporting conducted by Darwin Port Corporation should also include reporting on environmental performance and be provided for assessment in the Supplement... require that annual reporting by the Darwin Port Corporation include reporting on environmental performance.

DPC annual reports include environmental performance. Copies of these reports are available online [<http://www.darwinport.nt.gov.au/media-and-publications>].

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This response regime (two-phase response to noise complaints) should be maintained during operations as well as construction.

This two-phase response regime to noise complaints will be maintained during operations as well as construction.

Respondent:	Environment NT
Comment:	We emphasise the need to commit to rigorous follow-up, investigation and monitoring of works undertaken by contractors and sub-contractors, to ensure that they adequately follow any commitments outlined in their CEMP.

Monitoring of DPC and contractor environmental performance will be undertaken in accordance with the DPC EMS, with particular reference to EMS Procedure 8 (Monitoring and Measurement).

Respondent:	Environment NT
Comment:	We... call for transparent reporting with respect to the various environmental management and mitigation commitments that the DLP has made throughout the Main Report.

Reporting associated with environmental management will be undertaken in accordance with the DPC EMS, with particular reference to EMS Procedure 5 (Communication and Reporting).

Environment Management System and Environment Management Plans

Respondent:	Environment NT
Comment:	Further details need to be provided about the documenting and management of complaints via DPC's incident reporting procedure (p. 474-475, Main Report). In particular, we would like to know if serious complaints and issues will be made public; and who will be responsible for overseeing the resolution process.

Documentation and management of observations and complaints will be undertaken in accordance with the EAW EMP (Coffey Environments 2010a), in particular Chapter 6. DPC Environmental Services is responsible for reviewing Incident / Accident reports, audit reports and appropriate documents and reporting on non-conformances and corrective / preventative actions to the Chief Executive Officer CEO. The relevant General Manager is responsible for preparing objectives and targets for non-conformances assigned to their Department. The Environmental Manager is accountable for ensuring that required actions are identified and solutions are effectively implemented (Coffey Environments 2010a).

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	To whom would DLP Project Manager be required to report regularly on environmental performance, define "regularly", where is procedure for incident reporting and corrective actions? Is any monitoring conducted during the annual dredging maintenance that can inform the potential impacts of dredging? Including a brief description of benthic habitat monitoring in "long term performance of dredge activities".

Environment management representatives for each project component will report to the DPC environment manager. The DPC environment manager reports on EAW environmental performance to the DPC General manager.

Monitoring will not be undertaken during maintenance dredging. The potential impacts of maintenance dredging are likely insignificant compared to the potential impacts of channel dredging, which have already been assessed to be acceptable.

Environment Management System and Environment Management Plans

8.2 Environment Management Plans

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	These plans (DMP, Oil Spill Contingency Plan, Stormwater Management Plan) need to be provided in the SEIS.

Management plans provided with this SEIS are as follows:

- Appendix C: EAW Drainage Study.
- Appendix D: Retention Pond Design Summary Report.
- Appendix E: Revised DMP.
- Appendix F: MSB Stormwater Plan.

Spill management procedures will be included in the EMPs for each EAW user. The overall spill management framework for EAW is described at section 5.1.1 of the EAW EMP (Coffey Environments 2010) (Appendix S of the DEIS).

Respondent:	Environment NT
Comment:	We recommend all environmental management plans (e.g. Dredge Management, Soil Erosion and Drainage Management, Acid Sulphate Soils Management, Oil Spill Contingency Plan, Water Management) associated with the EAW Expansion be finalised and reviewed by an independent party well in advance of the development going ahead.

The construction and operations EMPs for the Project will be completed and reviewed by NRETAS prior to commencement of construction and operations, respectively.

Respondent:	Environment NT
Comment:	It needs to be clarified whether all proposed environmental management plans will include triggers and management response actions that will be undertaken in collaboration with NRETAS and / or independent scientists. We note that draft management trigger criteria have been incorporated in the DMP, and we expect similar triggers to be developed for other aspects of the development proposal.

The format of the DMP, and specifically the inclusion of 'Triggers', is not necessarily directly transferrable and appropriate for the EMP and management plans for environmental aspects specified by the EMP (e.g. Soil Erosion and Drainage Management Plan (SEDMP), Acid Sulphate Soils Management Plan (ASSMP)).

However, triggers would be included in the various management plans where there are appropriate criteria against which the triggers can be set, and where they are appropriate. For example, triggers for aspects such as communication and air quality are effectively integrated into the procedures for non-conformances. Triggers might be included in some management plans additional to the DMP, however, where non-conformances are defined by quantitative values.

Existing and Surrounding Land Uses

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Does Ranger uranium mine export through EAW?

Uranium from the Ranger mine is currently exported through EAW.

Geology, Landform and Soils

10.1 Investigations

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Any geotechnical investigations and the implications of the results for managing environmental impacts should be included in the Supplement.

A geotechnical investigation at the location of the proposed MSB is currently underway. The findings of this investigation will inform the final design of the MSB. Additional geotechnical investigations will be undertaken at the locations of the proposed barge ramp, small vessel berths and rail loop prior to construction of these project components.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide details of marine investigations that have been undertaken, will be undertaken, as part of the design process.

No additional marine investigations have been undertaken since publication of the DEIS other than the aforementioned additional geotechnical investigation.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The site specific geotechnical and soil investigation, including recommended drilling of boreholes is to be provided in the Supplement. The result of these investigations (local borehole and sediment grab samples) should be used in hydrodynamic modelling of potential dredging impacts.

The geotechnical report is attached to this SEIS in CD format.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	AECOM (2011) [i.e. App. B] section 1.8.1.4 states: 'Sediment quality information has been derived from historical environmental and geotechnical reports and investigations, and includes results from sampling events from 1984 through to 2009 in Darwin Harbour.' This is not sufficient to define on-site sediment quality. The most relevant study presented by Warren in 2001 sampled off the face of the EAW and in the embayment. Neither site corresponds to the areas to be dredged. Sampling conducted in 1999 may not be relevant 11 years later given the public history of spills to the marine environment (e.g. copper concentrate incident, April 2010). A recent on-site sediment sampling and testing survey is required to identify the quality and potential contaminant loads contained within sediments to be dredged. Clarify the conflicting information about metal loads in the sediment between the Main Report and Appendix B.

Sediment quality information has been derived from historical environmental and geotechnical reports and investigations, and includes results from sampling events from 1984 through to 2009 in Darwin Harbour. The most relevant study presented by Warren (2001) sampled near EAW and, while

Geology, Landform and Soils

generally in the embayment, sites did not correspond directly to the areas proposed to be dredged. Given the age of Warren (2001) data, these results will need to be confirmed and the area of testing extended by implementing an on-site sediment sampling and testing survey to identify the quality and potential contaminants contained within target dredged sediments.

10.2 Source of Materials

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Certain risks are dependent upon the type and location of material being sourced. These need to be defined in the Supplement, and risk identification / management detailed. Consideration include: Acid and / or Metalliferous drainage, quality of the material in terms of erosion and sediment control of the extraction and stockpile sites; transport impacts and costs; potential Acid Sulphate Soil disturbance if rocks are extracted locally; any habitat damage at extraction sites.

A proportion of the fill requirements for the Proposed Development will be met using dredged spoil. All dredged spoil will be disposed of onshore. Dredged material which is assessed to be geotechnically suitable may be utilised for construction purposes (e.g. bund construction). The remainder will be disposed of into Pond K (and potentially a portion of Pond E), where it will settle over time. The locations of Ponds E and K are shown at Figure 10-1.

Soil and sediment investigations relevant to the Proposed Development were summarised in section 6.2 of the DEIS. Potential Acid Sulphate Soil (PASS) was identified in 12 samples (of 40 samples in total) collected from the vicinity of the proposed rail loop (Melville, Macdonald and Keene, 1999). Weakly reactive PASS was encountered in three (of four) core samples taken from an area approximately 1-2 km east of the proposed small vessel berths, to the south of the rail line (Acer Vaughan, 1995a).

No other PASS or acid sulphate soils (ASS) have been identified in marine sediments in the vicinity of the Proposed Development. Based on the findings of these investigations, it is therefore considered highly unlikely that dredged spoil will contain ASS or PASS as the proposed dredged channels are not in areas where ASS / PASS sediments have been encountered previously.

Metalliferous and other contaminants within marine sediments in the vicinity of EAW and the proposed dredging locations are discussed in Section 9.1.2 and Appendix B (Section 1.8.1.4) of the DEIS.

Iron, manganese, cobalt and nickel were observed at relatively consistent concentrations throughout Darwin Harbour, including at two East Arm sampling sites (off the wharf face and in the embayment). Warren (2001) found that most of the trace metals are bound in the inert phases of the sediments. Lead, however, was found in high concentrations in sediments in a potentially more bio-available phase. East Arm sediments were also found to contain C₁₅-C₂₈ total petroleum hydrocarbons (TPH) above laboratory detection limits.

Fortune (2006) found that arsenic was the only metal notably higher in the East Arm area. Observed elevated levels of arsenic within East Arm sediments and other parts of the harbour are believed to be a result of local geology rather than anthropogenic sources (Fortune 2006). URS (2008b) collected sediment samples from 145 sites throughout East Arm and the main body of Darwin Harbour. Metals levels recorded in East Arm were generally below screening levels, with the exception of arsenic, chromium and mercury. Slightly elevated nickel levels were recorded at one site.

Geology, Landform and Soils

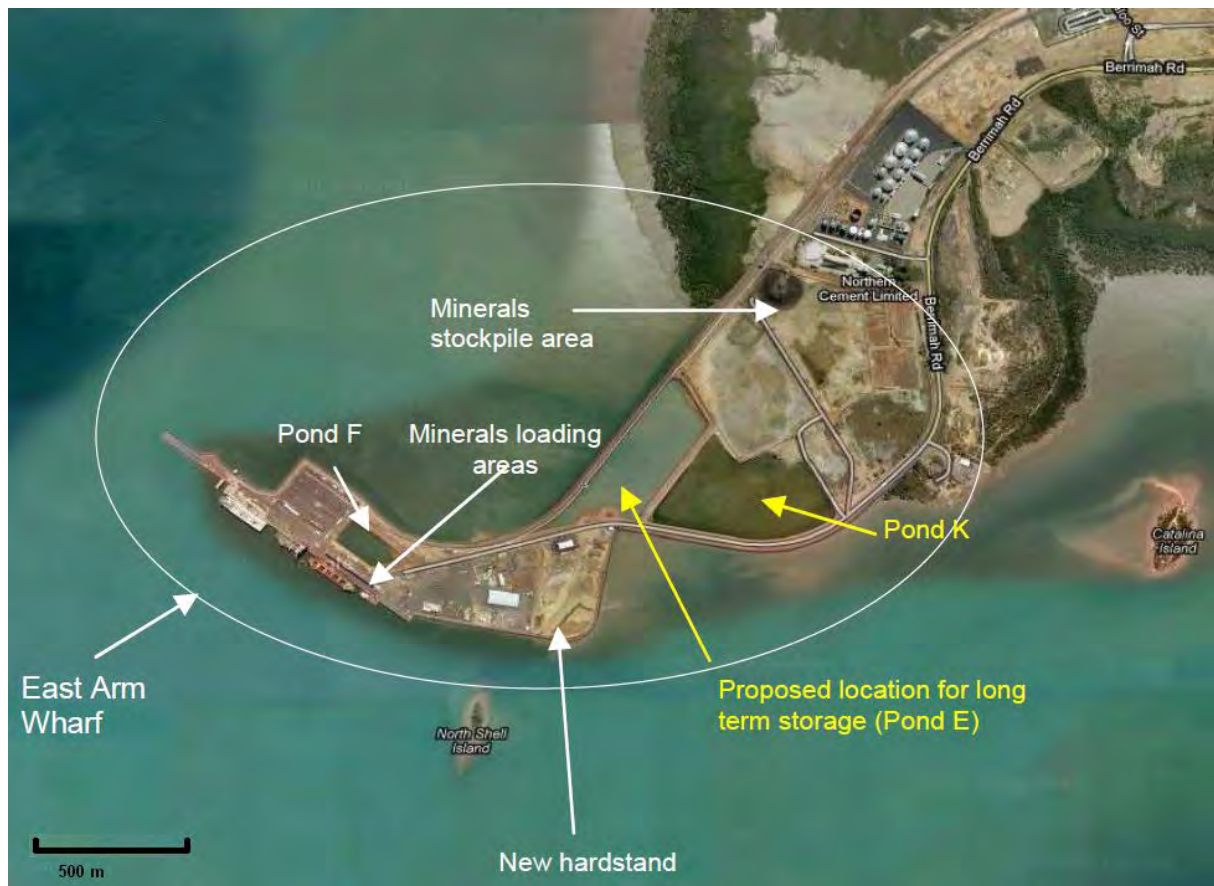


Figure 10-1 Locations of Ponds E and K. (Source: Aurecon 2011b)

In sampling conducted in 2008, URS detected $C_{15}-C_{28}$ TPH in surface sediments at a number of sites in East Arm. However, benzene, toluene, ethylbenzene and xylene (BTEX) compounds were below practical quantitative limits (PQL) at all sites, as were polycyclic aromatic hydrocarbons (PAH) at the majority of sites (URS 2008b). A survey of marine sediment quality by URS (2004) found detectable levels of TBTs across Darwin Harbour.

Sediment sampling indicated average total nitrogen levels of 355.6 mg/kg at East Arm and mean total phosphorus concentration of 508.5 mg/kg at East Arm (URS, 2008b).

The DPC Environmental Monitoring Program (refer Appendix A) includes analysis of the metals, hydrocarbons and nutrients as per those discussed above. Comparison of these results with background marine water quality data will provide evidence as to whether acid and / or metalliferous drainage may be occurring.

Geology, Landform and Soils

10.3 Acid Sulphate Soils

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Has the potential for disturbance of ASS at this construction stage been considered?

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide an ASS Management Plan in the Supplement.

Refer to response below.

Respondent:	Dr. Ian Hollingsworth
Comment:	No plan is presented to mitigate significant potential and actual acid sulfate soil risks that are identified with the project. The investigation of this aspect of the project refers to legacy soil mapping and is inadequate. The risk mitigation needs to refer to a reasonable risk assessment, following NT and national acid sulfate soil assessment guidelines, and identify reasonable mitigation, avoidance and disposal strategies.

The Proponent is aware of the presence of ASS within the rail loop footprint, and acknowledges the possibility of disturbance to these soils during construction of this project component. A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This is a very reactive way of dealing with potential acidic dredge spoil. Sediment should be characterised prior to disposal on land to determine whether it will be acid producing. Mixing acid producing sediment with clean material will contaminate spoil resulting in more costly treatment options. More details, including an ASS Management Plan are to be provided in the Supplement.

It is not anticipated that PASS or ASS will be excavated for project components other than the proposed rail loop (refer section 7.1). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements.

10 Geology, Landform and Soils

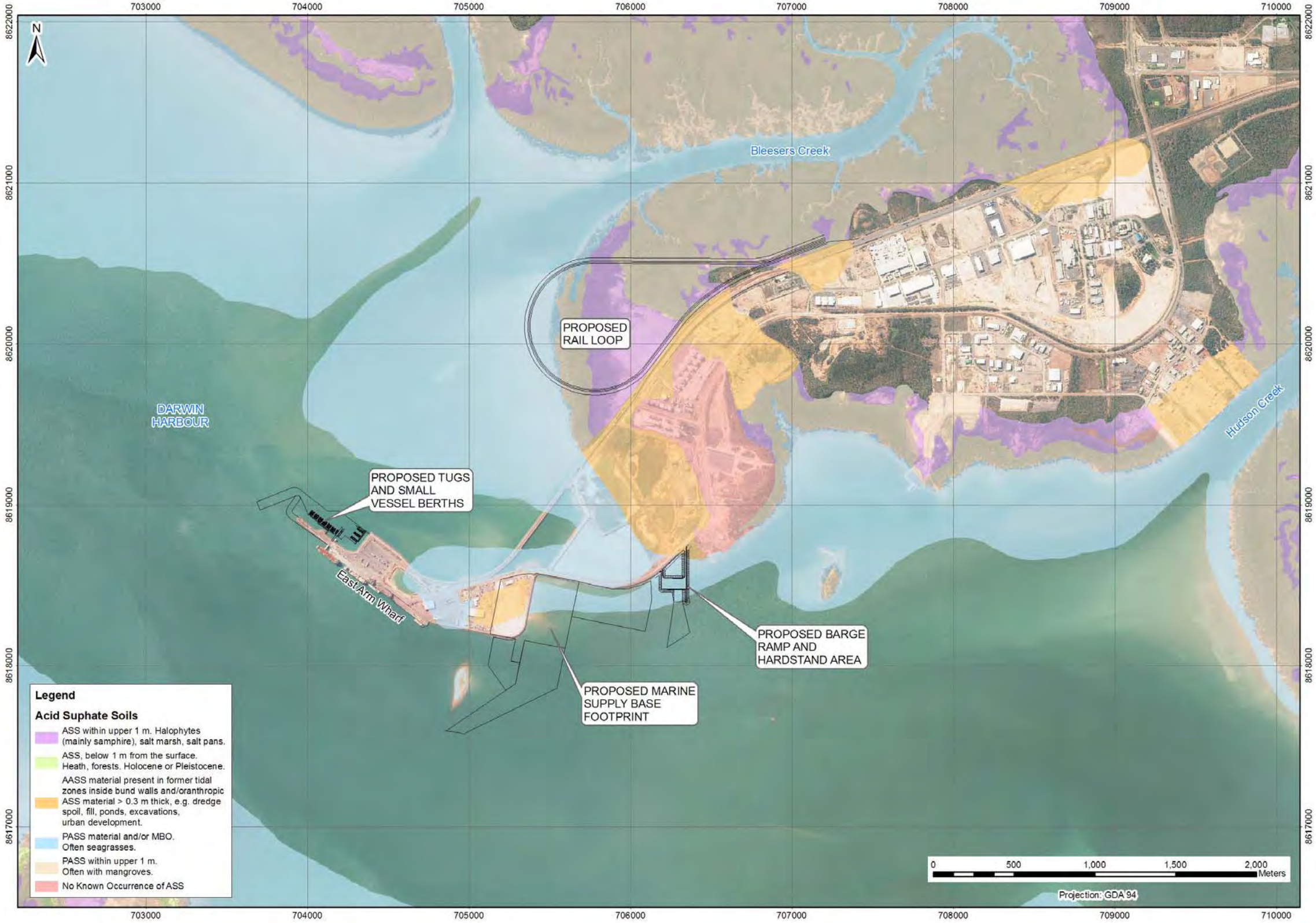


Figure 10-2 Acid sulphate soils and potential acid sulphate soils in the vicinity of East Arm (Source: Fogarty, Lynch and Wood, 1984)

10 Geology, Landform and Soils

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Greenhouse Gases and Climate Change

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Consideration could be made of installing wind-turbine and / or solar panels at or near the East Arm site.

Potential generation of some or all of EAW energy requirements using solar and / or wind powered technology has been investigated. Currently available solar and wind technology is not compatible with space constraints at EAW, and installation would require clearance of mangroves or other habitat. Installation and operation of large scale solar or wind powered electricity generation infrastructure is also cost prohibitive. It is likely that solar panels may be installed within some project components, such as hot water plants for administration buildings. The decision to install solar powered hot water systems and / or other solar powered infrastructure will be made by the individual project component operators.

Respondent:	Environment NT
Comment:	We strongly recommend that DLP works toward leading the way in eco-industrial design and focuses on establishing power supply infrastructure that incorporates the use of renewable energy technologies.

Design, construction and operation of power supply infrastructure in the NT is the responsibility of Power and Water Corporation (PWC).

As noted above, it is likely that solar panels may be installed within some project components, such as hot water plants for administration buildings. The decision to install solar powered hot water systems and / or other solar powered infrastructure will be made by the individual project component operators.

Respondent:	Environment NT
Comment:	DLP should not only look at minimising emissions but also commit to carbon offsets, during both the construction and operational phases of EAW. Leadership on, and commitment to, offsets is expected from any Government agency or industry that aims to be a good corporate citizen. A pro-active offsetting approach is also expected of a Government that claims to be committed to a safe climate future. The development of a Territory- based offsets package by the DLP could also provide an excellent example of how to put the Draft Northern Territory Environmental Offsets Policy into action.

Carbon emissions associated with construction and operation of the proposed development may be offset. The decision as to whether emissions will be offset will depend on a several factors, including financial viability and government policy.

Historical and Cultural Heritage Values

Respondent:	Aboriginal Areas Protection Authority
Comment:	The inclusion of only one Authority Certificate in the DEIS does not adequately identify the issues for sacred site protection in the area, and nor any risks that may be involved in the project. For example, it would appear that the Dredged Access Channel and Proposed Tugs and Small Vessel Berths are not in the Subject Land which is covered by the Authority Certificate C1994/09. There is inadequate representation of sacred site avoidance and protection issues, and of the (likely) intended use of multiple Authority Certificates by the Project. This should be clarified by the proponents in the Executive Summary and Main Body of the DEIS. Further the provision by the AAPA of updated mapping, overlaying areas on that originally issued C1994/02 constitutes a "verification" only of areas and works proposed in that 1994 Certificate.

Refer to response below.

Respondent:	Aboriginal Areas Protection Authority
Comment:	This application is for part of Area 1. It appears to include areas for the proposed rail loop, but the mapping provided by the Department is unclear with regard to the inclusion of all the proposed tug berth area. Consultations with Aboriginal custodians have commenced.

The proponent has applied for a new AAPA Certificate, which is included at Appendix G.

Respondent:	Aboriginal Areas Protection Authority
Comment:	The works proposed in the Project do not appear to directly impact on Yirra (Catalina Island) or Old man Rock. However, their existence and the significant protective measures that are in place should be acknowledged in any documentation for the Project, due to the likely proximity of the works associated with the Project to Yirra and Old Man Rock.

It is acknowledged that restricted areas exist surrounding Yirra, as is shown on Authority Certificate C1994/02, and also surrounding Old Man Rock, which is outside of the Subject Land of the Certificate. Under the provisions of the *Northern Territory Aboriginal Sacred Sites Act 1989* (the NT Sacred Sites Act) and Authority Certificate C1994/02 limited works that do not disturb the existing mud flat and natural features on and surrounding Yirra are allowed.

It is acknowledged that significant restrictions have been placed on works of any kind occurring on Yirra, and that water flows around Yirra must be maintained. CEMPs and Operational Environmental Management Plans (OEMPs) will clearly describe these restrictions.

Respondent:	Aboriginal Areas Protection Authority
Comment:	It should be noted that there have been assertions from Aboriginal custodians with regard to the sacred nature of South Shell Island.

12 Historical and Cultural Heritage Values

Assertions from Aboriginal custodians with regard to the sacred nature of South Shell Island are noted.

Respondent:	Aboriginal Areas Protection Authority
Comment:	The final paragraph (of section 18.1.2) should be amended...

The suggested amendment is noted and acknowledged.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Old Man Rock and Yirra are recorded sacred sites that need acknowledgement in the EIS and the proponent needs to demonstrate existing patterns of water flow around Yirra are not disturbed.

The areas affected due to the proposed dredging and/or construction are mapped in Figures 4-3 – 4-6 of DEIS Appendix D Hydrodynamic and Wind Wave Modelling, and Shear Stress Estimates. The provided estimates suggest that differences in bed shear stress between the present day scenario and modified bathymetry and coast line scenario would be slightly negative (indicated by green in the mentioned figures). The small values of negative differences indicate the possibility for erosion of unconsolidated fine material (clay, silt), which might occur at the south-western, southern and south-eastern shores of Yirra.

The obtained results has not indicated any noticeable change to the current, wind wave or bed shear stress patterns at the Old Man Rock location due to the Projects.

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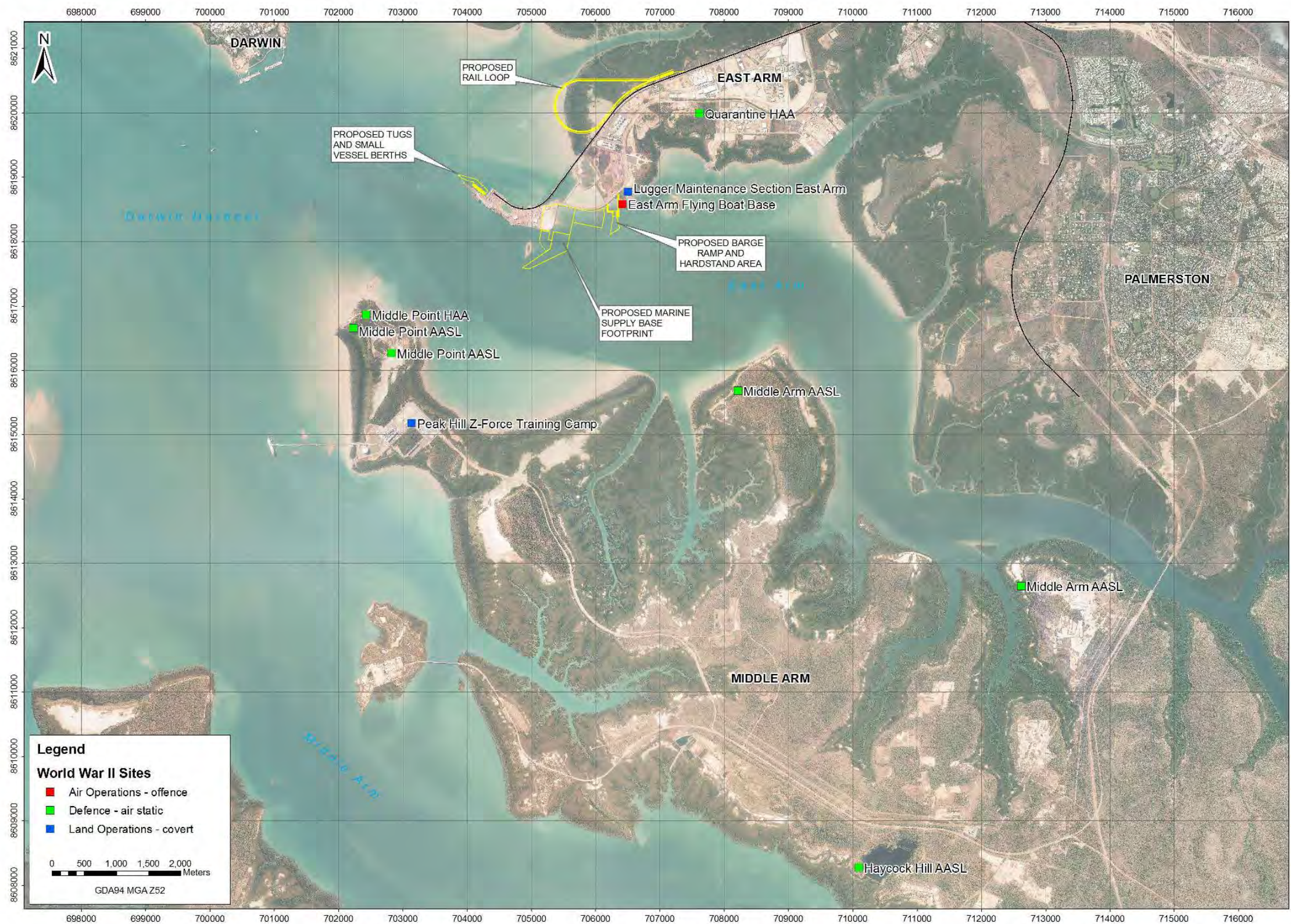


Figure 12-1 Regional World War II Sites.

12 Historical and Cultural Heritage Values

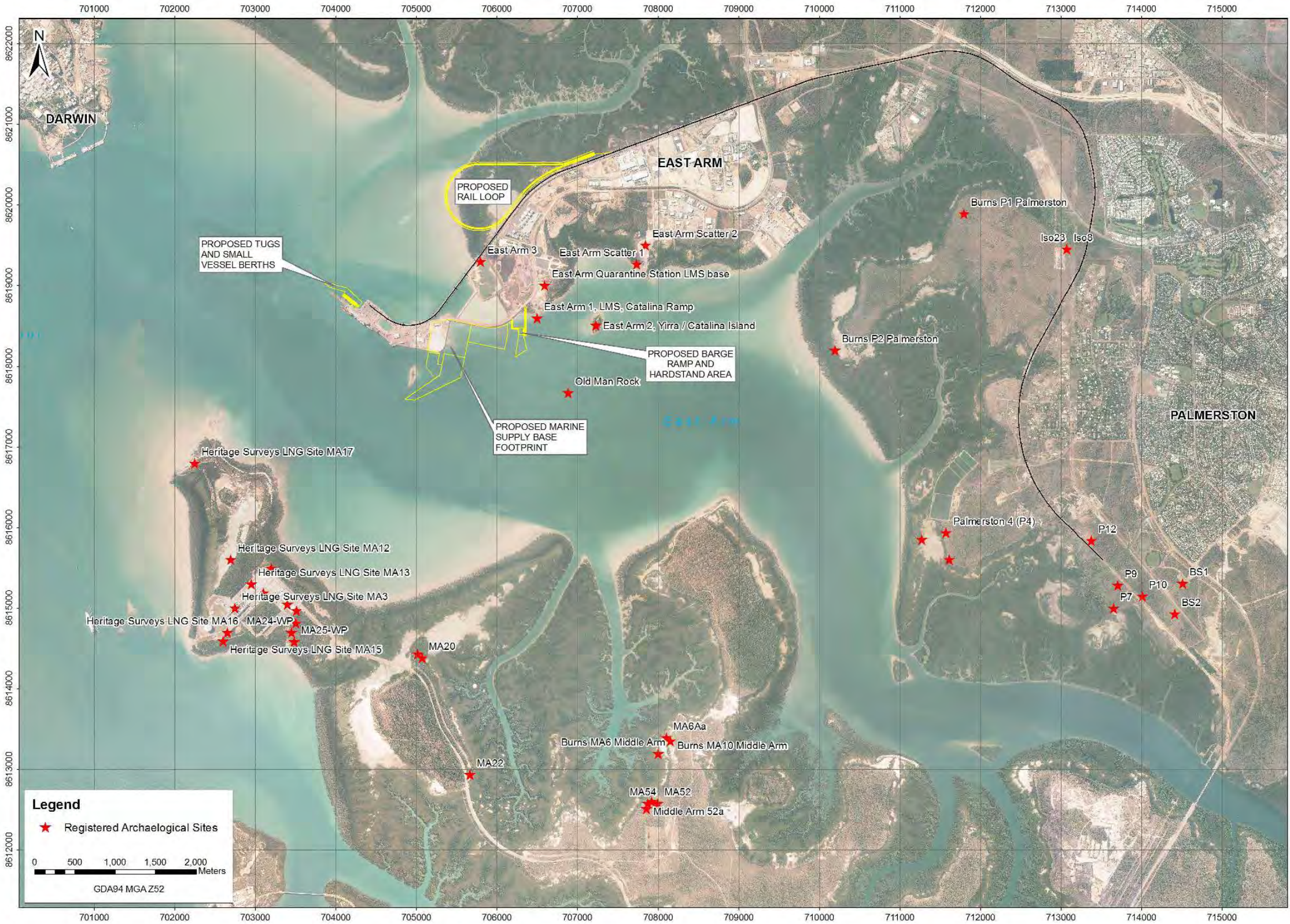


Figure 12-2 Regional archaeological sites.

12 Historical and Cultural Heritage Values

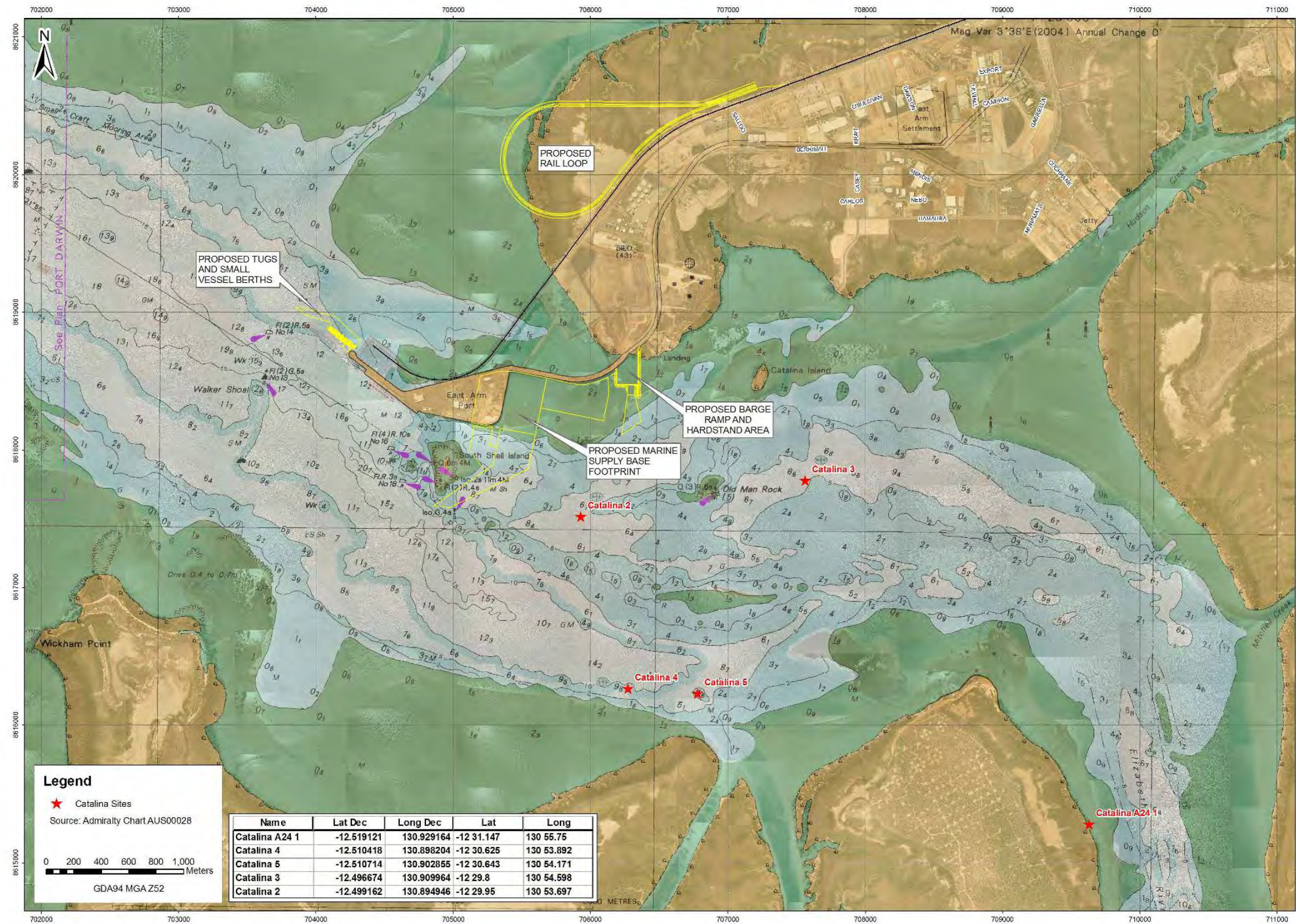


Figure 12-3 Regional Catalina sites.

12 Historical and Cultural Heritage Values

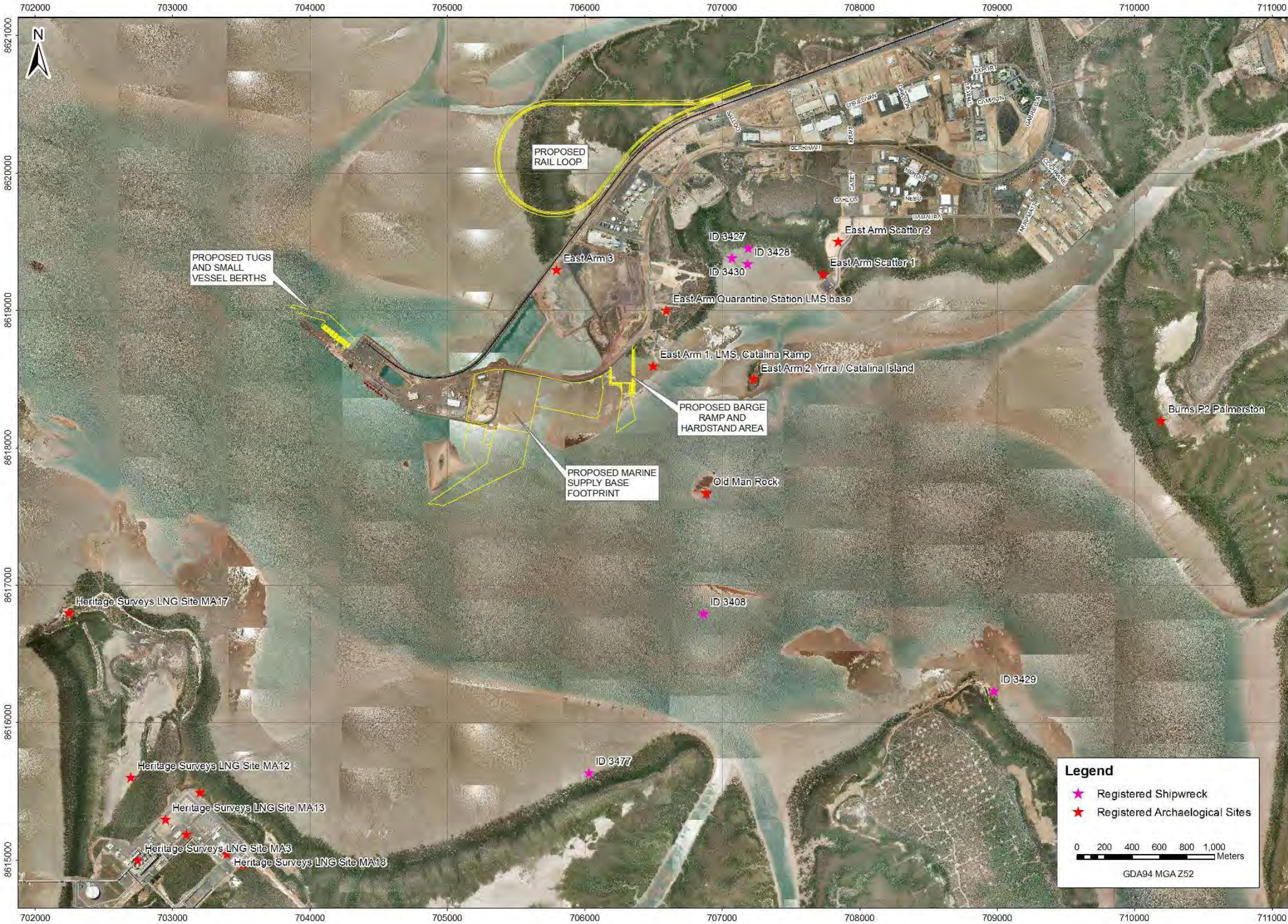


Figure 12-4 Regional shipwreck and archaeological sites.

12 Historical and Cultural Heritage Values

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	In relation to the terrestrial heritage matters, the cultural heritage management plan makes reference to the mitigation of disturbance for 'Indigenous Site 1' (Table 26.5.15, p. 475). The first action in this list should be 'Establish a protective buffer zone around the site of 100 m until Ministerial approval has been obtained for the disturbance of these sites'.

A protective buffer zone around Indigenous Site 1 of 100 m will be established until a decision has been made regarding the future of the site.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	There may be a need for more substantial remote surveys which could better capture any potential underwater heritage sites, prior to any dredging activities. In the Supplement, qualify what remote sensing data was collected of this combined footprint (for example side scan sonar, magnetometer, DPR), and qualify whether this data has been reviewed for possible cultural anomalies given that there may be unrecorded but significant cultural material in dredging and landfill areas.

Remote sensing using side scan sonar was undertaken and no anomalies were detected. In addition to the remote sensing undertaken, the historical and cultural heritage sites in the heavily developed East Arm region are already well documented.

Infrastructure and Transport

13.1 Traffic

Respondent:	Department of Lands and Planning (Road Network Division)
Comment:	Sections describing the transport systems and methods to convey site traffic should contain additional detail on the scale of the project, including: • Type, size and number of vehicles required during all phases of the proposal (such as the transport of 'significant quantities of hard rock and riprap' from quarries at Mount Bundy and Katherine); • The estimated volumes, tonnage, composition, origin of traffic generated by the proposal (ditto); • Estimated times of travel (ditto); • Impact of this transport on local communities; • Safety measures to be employed (including driver fatigue management); and • Any additional road infrastructure works that may be required, including changes to site access and signage.

The following information is not known at this stage of the Project, and will be determined by individual Contractor decisions:

- Type, size and number of vehicles required during all phases of the proposal (such as the transport of 'significant quantities of hard rock and riprap' from quarries at Mount Bundy and Katherine).
- The estimated volumes, tonnage, composition, origin of traffic generated by the proposal.
- Estimated times of travel.
- Impact of this transport on local communities.
- Any additional road infrastructure works that may be required, including changes to site access and signage.

Safety measures to be employed will be detailed in project component specific construction health and safety plans.

Respondent:	Environment NT
Comment:	The Main Report acknowledges the poor condition of the Berrimah Road but does not give any indication as to whether all road upgrades will be completed before the EAW Expansion gets underway

It is unlikely that all road upgrades described in the DEIS will be complete prior to commencement of construction of the Project. Road maintenance and upgrades in the NT are the responsibility of the Road Networks division of DLP.

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Respondent:	Environment NT
Comment:	Increasing attention is being drawn to safety issues associated with the transport of rock and riprap from local quarries, following a recent fatal accident which involved a tourist being hit by a rock on the Arnhem Highway. This Highway is set to come under increasing pressure, especially given INPEX's demands for construction materials and the proposed expansion activities at Ranger Uranium mine. The capacity of this road needs to be seriously assessed, in light of the EAW Expansion and other regional developments.

The NTG has committed \$5 million to upgrade the Arnhem Highway during the 2011/12 financial year, and pavement upgrade works are currently underway including pavement and seal widening of sections, reconstruction and strengthening sections of pavement, and widening of culverts. Locations of these works, which are currently underway or have been completed, are (Department of Construction and Infrastructure (DCI) 2011):

- Between 62 km and 63 km (from Stuart Highway).
- Adelaide River Floodplain from the Adelaide River Bridge east for approximately 4 km.
- 12 floodways at various locations between 38 km and 77 km (from Stuart Highway).

The NTG has also allocated \$2.2 million for the 2011/12 financial year on repairs and maintenance along the Arnhem Highway including resealing, shoulder and drainage maintenance, pothole patching and minor pavement repairs (NTG 2011).

The Arnhem Highway has been designed to function as the primary transport corridor between Darwin and Jabiru, and the upgrades being implemented will improve flood defence, safety, and traffic flow. It is considered that when the current upgrades are completed the Arnhem highway will have sufficient capacity for the transport of materials required for the Project. The capacity of the Arnhem Highway to transport materials required for other developments is beyond the scope of this EIA, and such assessment would be the responsibility of the DCI and programmed by of the Road Networks division of DLP.

13.2 Waste Water

Respondent:	Department of Health
Comment:	DOH requests further clarification about the proposed upgrades to the sewer infrastructure at EAW as Figure 5.5 indicates that possibly only 30% of all East Arm allotments are currently serviced by sewerage, i.e. O'Sullivan Circuit, Export Drive, Campion Road, and Lilwall Road. The DEIS states that "there will be no requirement for operators of the MSB to have their own waste water systems or waste water pre-treatment systems. Unfortunately the DEIS does not detail how wastewater will be managed at the MSB, nor the extent of sewerage to this area.

The Proponent is assessing the viability of providing mains sewer connections to the allotments at which the MSB, Barge Ramp, Small Vessel Berths and Rail Loop will be constructed. If connection of the Proposed Development to the mains sewer is not determined to be viable, wastewater will be collected in on-site tanks, pumped as required, and disposed of to a licensed waste water treatment facility. The operators of each project component would prepare facility-specific wastewater

13 Infrastructure and Transport

management plans (WWMP). Wastewater management for the MSB is discussed further in Chapter 24.

Respondent:	Environment NT
Comment:	The proposed upgrades to sewer infrastructure (should) include an investigation of options for reducing demand on Power and Water Corporation's scheme water via waste water reuse and on-site stormwater harvesting and reuse. Recycled water could be used for water sprays on open areas and stockpiles, wheel washes etc.

Options for stormwater / wastewater recycling and reuse during construction and operation of the Project will be investigated.

Marine Ecology

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	Survey techniques were unclear...

The survey techniques varied depending on the environmental aspects being studied. Marine and benthic communities within the vicinity of East Arm and the greater Darwin Harbour region were surveyed by URS (2009a) using remote operated vehicles (ROV), diving survey techniques, remote drop camera habitat surveys, and Van-veen grab samplers. The survey locations for each of these methodologies are shown at Figure 14-2 to Figure 14-5.

East Arm benthic habitat classes were mapped by BMT-WBM (2011), as shown at Figure 15-1 of the DEIS.

Dolphin surveys specific to the Proposed Development were not undertaken. GHD (2011a, 2011b, 2011c) undertook three marine mammal (and other marine megafauna) surveys, and the findings of these surveys informed the INPEX Browse (2011) EIS Supplement and the EAW DEIS. Surveys were undertaken in January (Block one), February (Block two), and March (Block three) 2011.

The GHD (2011a, 2011b, 2011c) surveys were boat-based surveys along transects. The transects utilised by GHD are shown at Figure 14-6 to Figure 14-8. Marine mammal sightings are shown at Figure 14-9 to Figure 14-11, and non-mammalian marine megafauna sightings are shown at Figure 14-12 to Figure 14-14.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	In particular, further assessment of impacts to listed species is required for: • The potential impact of the dredging plume on listed species, including from the plume affecting species' habitat, including foraging habitat. This should also consider the impact of any 'double handling' that may be proposed. • The potential impact of the release of potential acid sulphate soils or acid sulphate soils on listed marine species or their habitat. • The potential impact, of any increase in lighting during construction or operations on listed species, including... marine turtles. • The potential impact of over-water maintenance, including the clean-up of anti-fouling coatings from steel structures on listed marine species or their habitat. • The potential impacts of removal of habitat. • The potential impact of increased vessel traffic for EPBC listed marine species. • The potential impact of piling noise on listed marine species. In order to assess this impact, the duration of piling taking place is required. The assessment documentation needs to provide transparent links to monitoring and mitigation measures. A discussion of the likely effectiveness of each of these measures in relation to the species and their habitat should also be provided... Therefore where appropriate, for the potential impacts listed above, the Supplement should clearly 'describe proposed mitigation measures and the efficacy of these. The above information for the following EPBC listed threatened and/or migratory species and their habitats is required to complete the assessment: • Australia Snubfin Dolphin (<i>Orcaella heinsohni</i>). • Spotted Bottlenose Dolphin (<i>Tursiops aduncus</i> (Arafura/Timor Sea populations)).

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	• Indo-pacific Humpback Dolphin (<i>Sousa chinensis</i>). • Dugong (<i>Dugong dugon</i>). • Sawfish (<i>Pristis</i> spp). • Marine turtles likely to be in the area according to the DSEWPac Protected Matters Search Tool.
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Australia Snubfin Dolphin (Orcaeila heinsohni)

Dredging plume impact: The potential impacts of dredging on marine mammals including dolphins are discussed at section 15.5.3 of the DEIS. The waters of Darwin harbour are a naturally turbid environment, and dolphins are frequently seen in turbid areas (Mustoe 2006). Australian snubfin dolphins in particular have frequently been observed feeding in turbid shallow areas near river mouths where the water is less than 20 m deep (Parra 2006).

The Australian snubfin forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs (SEWPAC 2011). With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour.

The extent of the sediment plume resulting from MSB, barge ramp, and small vessel berth dredging operations is discussed at section 8.2.2 and Appendix D of the DEIS. The highest concentrations of suspended sediment resulting from MSB and small vessel berth dredging operations would occur around the dredging sites and along EAW, with 95th percentile concentrations of 2.0-5.0 mg/L on top of background concentrations. Barge ramp dredging operations would produce a suspended sediment plume with 95th percentile values of 1.0-2.0 mg/L on top of background concentrations, which drop to 0.2 mg/L within a distance of 100 m from the dredging plant. The modelled values suggest that suspended sediment concentrations due to the dredging operations would stay below the average Darwin Harbour values (approximately 14.0 mg/L, refer Chapter 9 of the DEIS).

The area to be affected by dredging for the EAW Project represents a small proportion of the total available Australian snubfin habitat, the effects of dredging will be relatively short term, suspended sediment concentrations resulting from dredging operations will remain below the average for Darwin Harbour, and Australian snubfins are known to inhabit naturally turbid environments. Therefore it is considered that sediment plumes associated with the Proposed Development will not measurably impact the Australian snubfin dolphin population.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS

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survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or the Australian snubfin specifically.

Impact of increased lighting: Artificial lighting is not known to negatively impact the Australian snubfin dolphin.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: The Australian snubfin forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs (SEWPAC 2011). With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour.

Australian snubfin habitat which will be removed is limited to the sections of sea floor which will be dredged to provide access channels for the MSB, barge ramp, and small vessel berths, and a negligible area which will be excavated for the seaward section of rail loop bund. The total dredged area is approximately 16.6 ha, which represents an extremely small portion of the approximately 1,000 km² area of the Port of Darwin (DPC Undated), much of which is suitable dolphin habitat (refer Figure 14-9 to Figure 14-11).

Impact of increased vessel traffic: The proponent is not aware of any recorded collisions between vessels in Darwin Harbour and Australian snubfin dolphins. Based on the likely incremental increase in harbour traffic associated with the proposed development, relative to the considerable traffic within Darwin Harbour at present, it is considered highly unlikely that increased traffic will significantly impact the species. Other potential impacts associated with increased traffic, such as increased marine noise and occasional discharges, are likely to be negligible in the context of the existing developed harbour environment.

The potential impact of piling noise: Noise levels associated with piling activities, and noise sensitivity of cetaceans, are detailed at Chapter 13 of the DEIS. Additional comment is provided at Chapter 15. In general, pile driving noise would only negatively impact dolphins in the immediate vicinity of activities. Dolphins are likely to avoid areas where these activities are taking place and no physical injuries to individuals are expected to occur.

Spotted Bottlenose Dolphin (Tursiops aduncus)

Dredging plume impact: The potential impacts of dredging on marine mammals including dolphins are discussed at section 15.5.3 of the DEIS. The waters of Darwin harbour are a naturally turbid environment, and dolphins are frequently seen in turbid areas (Mustoe 2006). Mustoe (2006) notes, for example, that dolphins are commonly observed in turbid waters, feeding by stirring up sediments seeking benthic fish and crustaceans. Similarly, they have been observed feeding in plumes created by vessels, possibly seeking demersal organisms exposed by propeller wash (Mustoe 2006).

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The extent of the sediment plume resulting from MSB, barge ramp, and small vessel berth dredging operations is discussed at section 8.2.2 and Appendix D of the DEIS. The highest concentrations of suspended sediment resulting from MSB and small vessel berth dredging operations would occur around the dredging sites and along EAW, with 95th percentile concentrations of 2.0-5.0 mg/l on top of background concentrations. Barge ramp dredging operations would produce a suspended sediment plume with 95th percentile values of 1.0-2.0 mg/L on top of background concentrations, which drop to 0.2 mg/L within a distance of 100 m from the dredging plant. The modeled values suggest that suspended sediment concentrations due to the dredging operations would stay below the average Darwin Harbour values (approximately 14.0 mg/L, refer Chapter 9 of the DEIS).

The area to be affected by dredging for the EAW Project represents a small proportion of the total available spotted bottlenose habitat, the effects of dredging will be relatively short term, suspended sediment concentrations resulting from dredging operations will remain below the average for Darwin Harbour, and spotted bottlenoses are known to inhabit naturally turbid environments. Therefore it is considered that sediment plumes associated with the Proposed Development will not measurably impact the spotted bottlenose dolphin population.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or the spotted bottlenose specifically.

Impact of increased lighting: Artificial lighting is not known to negatively impact the spotted bottlenose dolphin.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: Spotted bottlenose dolphin habitat which will be removed is limited to the sections of sea floor which will be dredged to provide access channels for the MSB, barge ramp, and small vessel berths, and a negligible area which will be excavated for the seaward section of rail loop bund. The total dredged area is approximately 16.6 ha, which represents

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an extremely small portion of the approximately 1,000 km² area of the Port of Darwin (DPC Undated), much of which is suitable dolphin habitat (refer Figure 14-9 to Figure 14-11).

Impact of increased vessel traffic: The proponent is not aware of any recorded collisions between vessels in Darwin Harbour and spotted bottlenose dolphins. Based on the likely incremental increase in harbour traffic associated with the proposed development, relative to the considerable traffic within Darwin Harbour at present, it is considered highly unlikely that increased traffic will significantly impact the species. Other potential impacts associated with increased traffic, such as increased marine noise and occasional discharges, are likely to be negligible in the context of the existing developed harbour environment.

The potential impact of piling noise: Noise levels associated with piling activities, and noise sensitivity of cetaceans, are detailed at Chapter 13 of the DEIS. Additional comment is provided at Chapter 15. In general, pile driving noise would only negatively impact dolphins in the immediate vicinity of activities. Dolphins are likely to avoid areas where these activities are taking place and no physical injuries to individuals are expected to occur.

Indo-pacific Humpback Dolphin (Sousa chinensis)

Dredging plume impact: The potential impacts of dredging on marine mammals including dolphins are discussed at section 15.5.3 of the DEIS. The waters of Darwin harbour are a naturally turbid environment, and dolphins are frequently seen in turbid areas (Mustoe 2006). Indo-Pacific humpback dolphins tend to be found in slightly deeper areas than Australian snubfins, including dredged channels (Parra, 2006).

The Indo-pacific humpback dolphin forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs (SEWPAC 2011). With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour.

The extent of the sediment plume resulting from MSB, barge ramp, and small vessel berth dredging operations is discussed at section 8.2.2 and Appendix D of the DEIS. The highest concentrations of suspended sediment resulting from MSB and small vessel berth dredging operations would occur around the dredging sites and along EAW, with 95th percentile concentrations of 2.0-5.0 mg/L on top of background concentrations. Barge ramp dredging operations would produce a suspended sediment plume with 95th percentile values of 1.0-2.0 mg/L on top of background concentrations, which drop to 0.2 mg/L within a distance of 100 m from the dredging plant. The modeled values suggest that suspended sediment concentrations due to the dredging operations would stay below the average Darwin Harbour values (approximately 14.0 mg/L, refer Chapter 9 of the DEIS).

The area to be affected by dredging for the EAW Project represents a small proportion of the total available Indo-pacific humpback habitat, the effects of dredging will be relatively short term, suspended sediment concentrations resulting from dredging operations will remain below the average for Darwin Harbour, and Indo-pacific humpback are known to inhabit naturally turbid environments. Therefore it is considered that sediment plumes associated with the Proposed Development will not measurably impact the Indo-pacific humpback dolphin population.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not

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result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / PASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or the Indo-Pacific humpback specifically.

Impact of increased lighting: Artificial lighting is not known to negatively impact the Indo-Pacific humpback dolphin.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: The Indo-Pacific humpback forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs (SEWPAC 2011). With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour.

Indo-Pacific bottlenose habitat which will be removed is limited to the sections of sea floor which will be dredged to provide access channels for the MSB, barge ramp, and small vessel berths, and a negligible area which will be excavated for the seaward section of rail loop bund. The total dredged area is approximately 16.6 ha, which represents an extremely small portion of the approximately 1,000 km² area of the Port of Darwin (DPC Undated), much of which is suitable dolphin habitat (refer Figure 14-9 to Figure 14-11).

Impact of increased vessel traffic: The proponent is not aware of any recorded collisions between vessels in Darwin Harbour and Indo-Pacific humpback dolphins. Based on the likely incremental increase in harbour traffic associated with the proposed development, relative to the considerable traffic within Darwin Harbour at present, it is considered highly unlikely that increased traffic will significantly impact the species. Other potential impacts associated with increased traffic, such as increased marine noise and occasional discharges, are likely to be negligible in the context of the existing developed harbour environment.

The potential impact of piling noise: Noise levels associated with piling activities, and noise sensitivity of cetaceans, are detailed at Chapter 13 of the DEIS. Additional comment is provided at Chapter 15. . In general, pile driving noise would only negatively impact dolphins in the immediate vicinity of activities. Dolphins are likely to avoid areas where these activities are taking place and no physical injuries to individuals are expected to occur.

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Dugong (Dugong dugon)

Dredging plume impact: The potential impacts of dredging on marine mammals including dolphins are discussed at section 15.5.3 of the DEIS. The waters of Darwin harbour are a naturally turbid environment, indicating that dugongs inhabiting Darwin harbour are at least tolerant of turbid water. Dugong feeding in Darwin Harbour is concentrated in areas such as the rocky reefs at Weed Reef, Channel Island and sea grass beds, none of which are near EAW; dugong feeding is therefore not expected to be affected by the dredging program.

Although dugongs regularly inhabit Darwin Harbour, it is not the most important dugong habitat in the region, possibly due to limited sea-grass communities. Within the Anson-Beagle bio-region the Vernon Islands and Gunn Point are more significant dugong habitats and are known to support relatively large populations (Inpex Browse 2009).

The extent of the sediment plume resulting from MSB, barge ramp, and small vessel berth dredging operations is discussed at section 8.2.2 and Appendix D of the DEIS. The highest concentrations of suspended sediment resulting from MSB and small vessel berth dredging operations would occur around the dredging sites and along EAW, with 95th percentile concentrations of 2.0-5.0 mg/L on top of background concentrations. Barge ramp dredging operations would produce a suspended sediment plume with 95th percentile values of 1.0-2.0 mg/L on top of background concentrations, which drop to 0.2 mg/L within a distance of 100 m from the dredging plant. The modeled values suggest that suspended sediment concentrations due to the dredging operations would stay below the average Darwin Harbour values (approximately 14.0 mg/L, refer Chapter 9 of the DEIS).

The area to be affected by dredging for the EAW Project represents a small proportion of the total available dugong habitat, and does not include primary regional habitat at all (i.e. Gunn Point and Vernon Islands), the effects of dredging will be relatively short term, and suspended sediment concentrations resulting from dredging operations will remain below the average for Darwin Harbour. Therefore it is considered that sediment plumes associated with the Proposed Development will not measurably impact the dugong population.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / PASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

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With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or the dugong specifically.

Impact of increased lighting: Artificial lighting is not known to negatively impact the dugong.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: The dugong prefers to forage in seagrass and macro-algal beds, which do not occur at the project site and are relatively rare within Darwin Harbour. The most important dugong habitats within the region are at Gunn Point and the Vernon Islands. Within Darwin Harbour the most extensive sea grass beds are located at Casuarina Beach, and are not known to occur further south than Fannie Bay. The Proposed Development will therefore not require removal of dugong habitat.

Impact of increased vessel traffic: The proponent is not aware of any recorded collisions between vessels in Darwin Harbour and dugongs. Based on the likely incremental increase in harbour traffic associated with the proposed development, relative to the considerable traffic within Darwin Harbour at present, it is considered highly unlikely that increased traffic will significantly impact the species. Other potential impacts associated with increased traffic, such as increased marine noise and occasional discharges, are likely to be negligible in the context of the existing developed harbour environment.

The potential impact of piling noise: Noise levels associated with piling activities, and noise sensitivity of sirenians, are detailed at Chapter 13 of the DEIS. Additional comment is provided at Chapter 15. In general, pile driving noise would only negatively impact dugongs in the immediate vicinity of activities. Dugongs are likely to avoid areas where these activities are taking place and no physical injuries to individuals are expected to occur.

Sawfish (Pristis spp).

Dredging plume impact: The freshwater sawfish (*Pristis zijsron*) and green sawfish (*Pristis microdon*) are not known to have been recorded in Darwin Harbour (INPEX Browse 2009). From this it can be inferred that the majority of Darwin Harbour does not represent favoured sawfish habitat, and hence it would be extremely unlikely that any inhabit the dredge plume impact zone. The dredging plume is therefore considered extremely unlikely to significantly impact the freshwater sawfish or green sawfish.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

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The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general. Any impact on the sawfish is extremely unlikely as they have not been recorded within Darwin Harbour.

Impact of increased lighting: Artificial lighting is not known to negatively impact the sawfish.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: The freshwater sawfish (*Pristis zijsron*) and green sawfish (*Pristis microdon*) are not known to have been recorded in Darwin Harbour (INPEX Browse 2009). The Proposed Development therefore does not represent removal of sawfish habitat.

Impact of increased vessel traffic: The freshwater sawfish (*Pristis zijsron*) and green sawfish (*Pristis microdon*) are not known to have been recorded in Darwin Harbour (INPEX Browse 2009). Increased vessel traffic is therefore extremely unlikely to impact these species.

The potential impact of piling noise: The freshwater sawfish (*Pristis zijsron*) and green sawfish (*Pristis microdon*) are not known to have been recorded in Darwin Harbour (INPEX Browse 2009). Pile driving noise is therefore extremely unlikely to impact these species.

Marine Turtles

Dredging plume impact: The potential impacts of dredging on marine reptiles including turtles are discussed at section 15.5.3 of the DEIS. Green, hawksbill and flatback turtles are the most common species of turtles in Darwin Harbour (Whiting 2001).

The waters of Darwin harbour are a naturally turbid environment, indicating that turtles inhabiting Darwin harbour are at least tolerant of turbid water. In particular, flatback turtles habitually feed in shallow, turbid waters (DSEWPC, 2011) and are unlikely to be affected by the turbid plumes created by dredging.

The extent of the sediment plume resulting from MSB, barge ramp, and small vessel berth dredging operations is discussed at section 8.2.2 and Appendix D of the DEIS. The highest concentrations of suspended sediment resulting from MSB and small vessel berth dredging operations would occur around the dredging sites and along EAW, with 95th percentile concentrations of 2.0-5.0 mg/L on top of background concentrations. Barge ramp dredging operations would produce a suspended sediment plume with 95th percentile values of 1.0-2.0 mg/L on top of background concentrations, which drop to 0.2 mg/L within a distance of 100 m from the dredging plant. The modeled values suggest that suspended sediment concentrations due to the dredging operations would stay below the average Darwin Harbour values (approximately 14.0 mg/L, refer Chapter 9 of the DEIS).

The area to be affected by dredging for the EAW Project represents a small proportion of the total available marine turtle habitat, the impacts of dredging will be relatively short term, and suspended

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sediment concentrations resulting from dredging operations will remain below the average for Darwin Harbour. Therefore it is considered that sediment plumes associated with the Proposed Development will not measurably impact the marine turtle population.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or marine turtles specifically.

Impact of increased lighting: Artificial lighting has been reported to disorientate marine turtles, in particular hatchlings and female adults returning to the sea from onshore nesting areas (Pendoley 2005). The only significant turtle nesting beach in Darwin Harbour is Casuarina Beach (refer Figure 14-1). Casuarina Beach is not located within the viewshed of the Proposed Development, so it is considered extremely unlikely that lighting associated with the Proposed Development will affect marine turtles. It is also noted that Darwin and the surrounding areas are already developed, with significant artificial light sources already present.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: Six marine turtle species have been recorded in NT waters (INPEX Browse 2009). The green turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*), and flatback Turtle (*Natator depressus*) are known to utilise Darwin Harbour regularly. The loggerhead turtle (*Caretta caretta*) and Pacific ridley turtle (*Lepidochelys olivacea*) are likely to be occasional visitors to the harbour, while the leatherback turtle (*Dermochelys coriacea*) is considered to be an open ocean species and unlikely to occur within the harbour (Whiting 2001).

Of the aforementioned species, only the flatback is known to nest within Darwin harbour, at Casuarina beach. There are no other known turtle nesting sites in Darwin Harbour as the mangroves and mudflats do not provide suitable nesting grounds.

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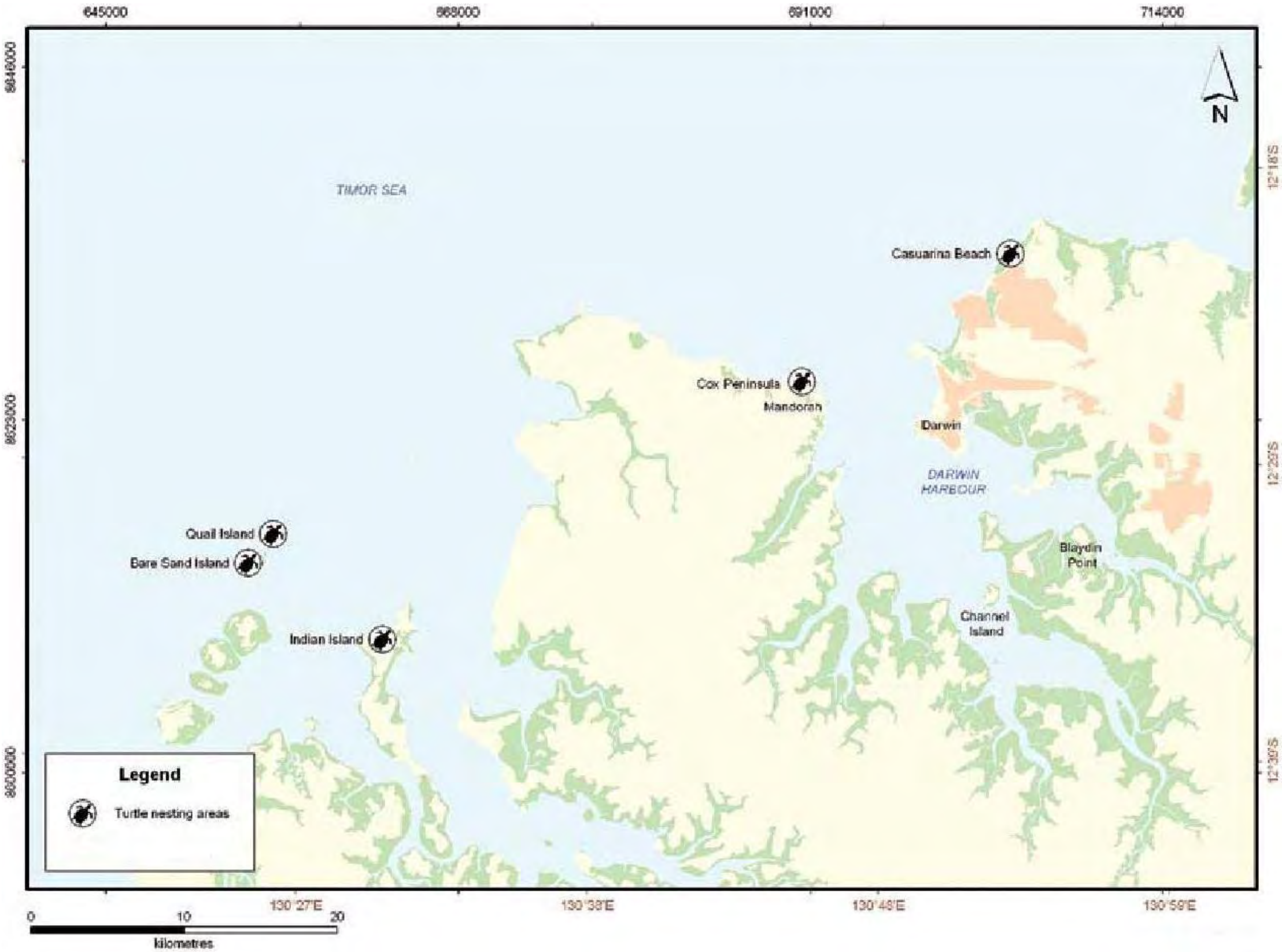


Figure 14-1 Harbour turtle nesting sites (Source: INPEX Browse 2009)

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Marine habitat removal is limited to the sections of sea floor which will be dredged to provide access channels for the MSB, barge ramp, and small vessel berths, and a negligible area which will be excavated for the seaward section of rail loop bund. The total dredged area is approximately 16.6 ha, which represents an extremely small portion of the approximately 1,000 km² area of the Port of Darwin (DPC Undated), much of which is suitable turtle habitat (refer Figure 14-9 to Figure 14-11). Removal of habitat is therefore considered extremely unlikely to have a significant effect on marine turtle species.

Impact of increased vessel traffic: The proponent is not aware of any recorded collisions between vessels in Darwin Harbour and marine turtles. Based on the likely incremental increase in harbour traffic associated with the proposed development, relative to the considerable traffic within Darwin Harbour at present, it is considered highly unlikely that increased traffic will significantly impact the six turtle species known to inhabit NT waters. Other potential impacts associated with increased traffic, such as increased marine noise and occasional discharges, are likely to be negligible in the context of the existing developed harbour environment.

The potential impact of piling noise: Noise levels associated with piling activities, and noise sensitivity of turtles, are detailed at Chapter 13 of the DEIS. Additional comment is provided at Chapter 15. In general, pile driving noise would only negatively impact turtles in the immediate vicinity of activities. Turtles are likely to avoid areas where these activities are taking place and no physical injuries to individuals are expected to occur.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	There is the potential for marine turtles to become entrained in the cutter suction hopper dredge (CSHD) resulting in injury or death. Marine turtles are listed as threatened under the EPBC Act and, the <i>Territory Parks and Wildlife Conservation Act</i> and four turtle species are known to occur in Darwin Harbour. Although the risk of entrainment has been acknowledged in the draft EIS, the actions committed to managing the risk is inadequate. There are methods available that have been used on other dredging projects to mitigate against entrainment and to detect turtles that do get entrained. The detection of turtles sucked through into the hopper is low due to the relative small size of turtles in comparison to the volumes of sediment. If there is no active monitoring, or ability to detect entrained wildlife, these entrainments will be unreported and mitigation of impacts not activated. The proponent must address these issues in the Dredge and 'Dredge Spoil Management Plan and include mitigation methods such as chains attached ahead of the drag head to alert turtles and screens on the in-flow and out-flow to enable detection of turtles or turtle 'remains. The <i>Supplement</i> requires commitment to manage and monitor this potential impact. A monitoring program identifying injured or dead marine megafauna within Darwin Harbour during dredging operations should be implemented. This should include procedures for rescue and post-mortem. The management plan must demonstrate, through sound scientific studies, the effectiveness of measures to minimise risks, detect fauna and manage impacts.

Refer to response below.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	There is the potential for marine turtles to become entrained in the cutter suction hopper dredge (CSD) resulting in injury or death

The reviewer is confusing two types of dredge – a CSD and a trailer suction hopper dredge (TSHD). The use of CSDs is proposed for the Project. Whilst the draft DMP discussed TSHDs, these were included “for completeness”, and are not proposed to be used for the Project.

There have been occurrences elsewhere of turtles being entrained into mobile TSHDs, presumably as they have not moved away from the path of the oncoming dredge. However, CSDs are stationary, with only the cutter head moving laterally across the face of the cut. Given the noise generated as the teeth of the cutter head grind their way through the rock substrate, it is considered highly unlikely that any turtles would approach within sufficient proximity to the dredge to become entrained within the suction mechanism, which is located directly behind the cutter head.

Backhoe dredges are also stationary and do not have any suction mechanism.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Dugongs are known to feed on the sponge gardens beside South Shell Island.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The South Shell coral and sponge community is a known dugong feeding area, as is the area around the channel island bridge. Dugongs in this area are recognised to feed on the sponge gardens (i.e. not just seagrass beds, of which there are a few in the harbour).

The Proponent remains unaware of recorded dugong feeding on the South Shell Island coral and sponge community in the published literature. It is considered likely that the reviewer’s statement is based upon anecdotal evidence. If regular Dugong feeding events at South Shell Island can be verified, the Proponent will take this into consideration during finalisation of the DMP.

It is noted that the new alignment of the MSB access channel reduces the area of direct impact upon the sponge communities around South Shell Island, and increases the separation distance between South Shell Island and construction activities associated with the Project.

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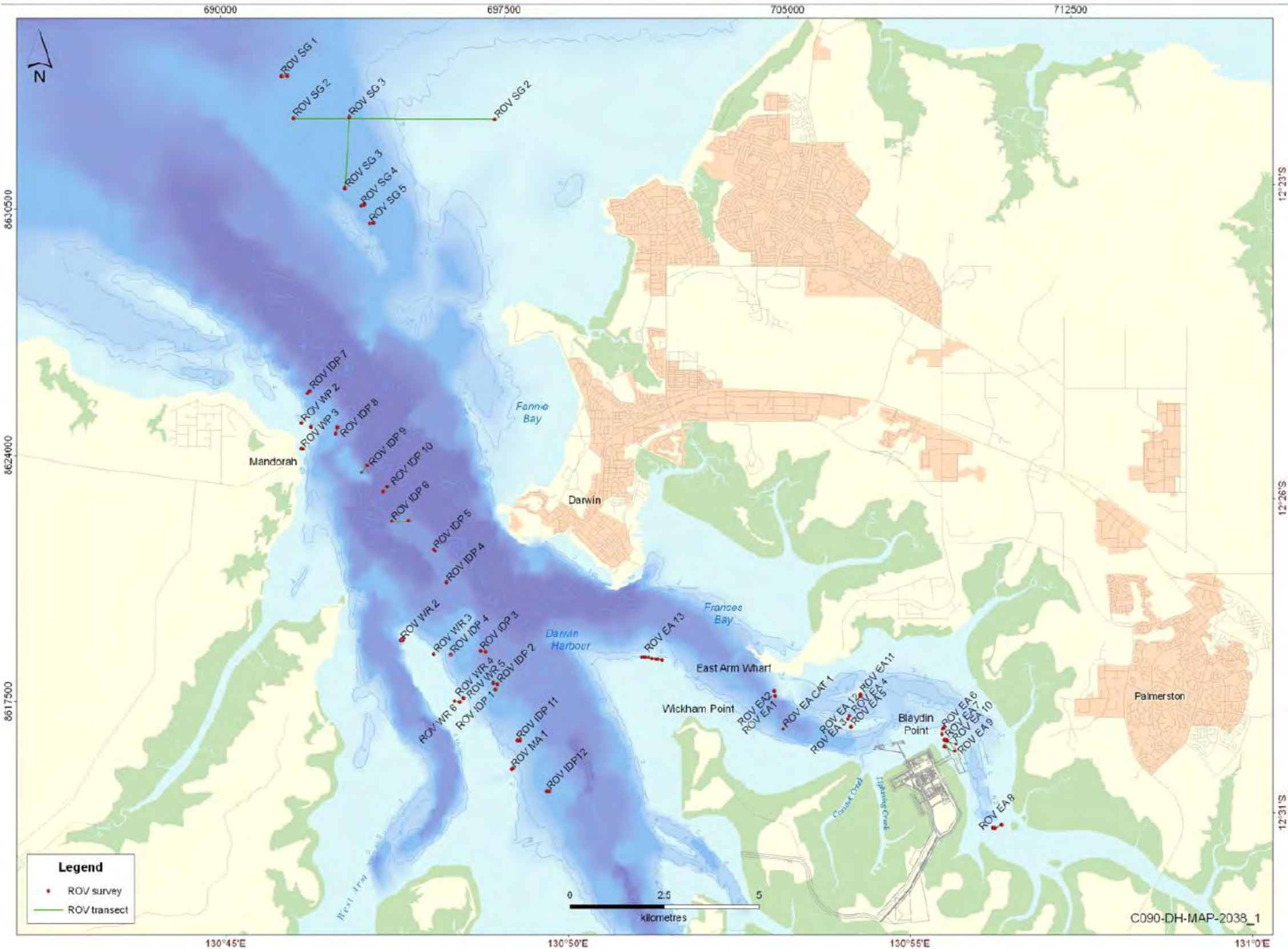


Figure 14-2 URS (2009a) Marine and Benthic Community Survey Sites: Remote operated vehicles

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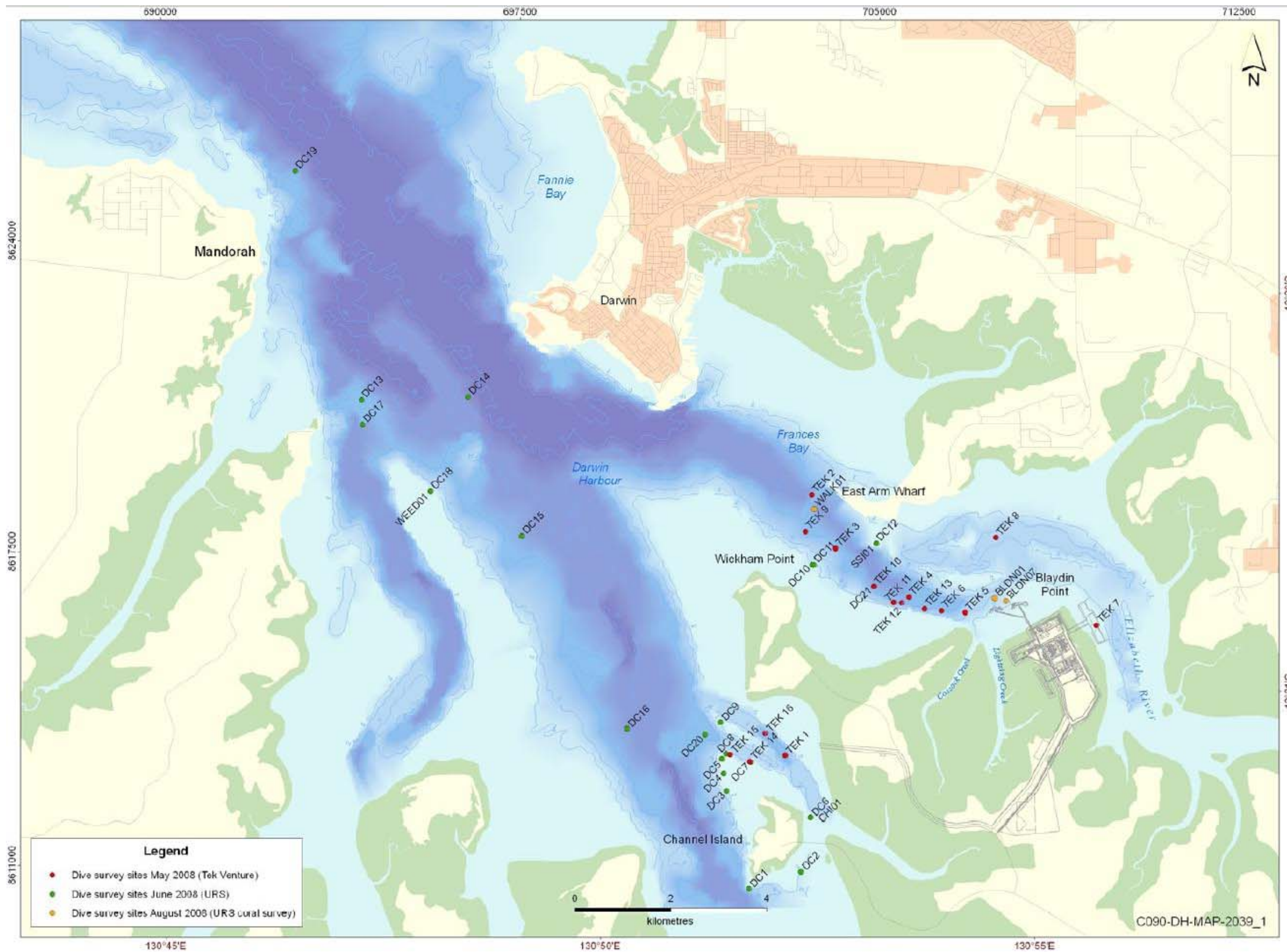


Figure 14-3 URS (2009a) Marine and Benthic Community Survey Sites: Dive sites.

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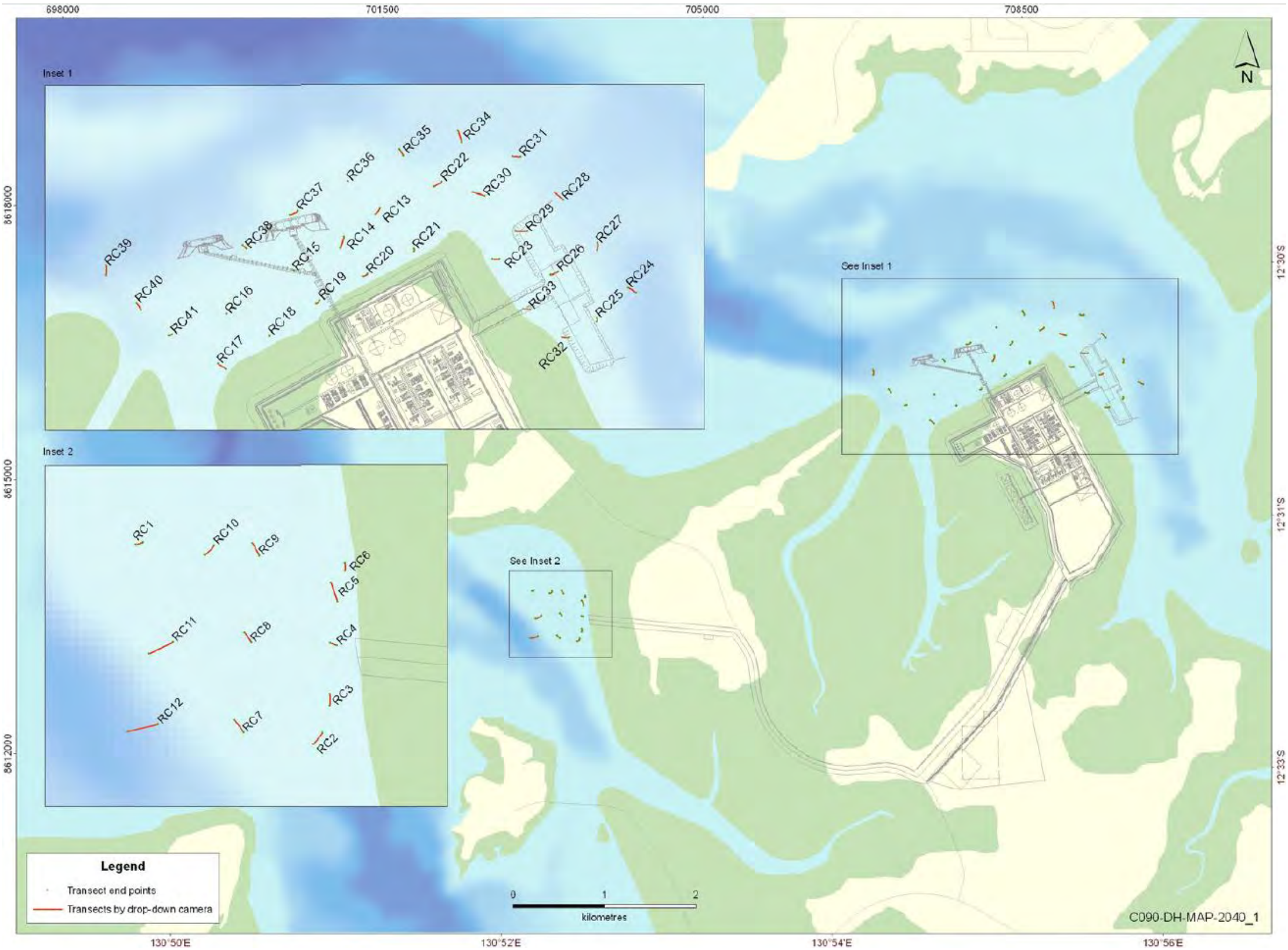


Figure 14-4 URS (2009a) Marine and Benthic Community Survey Sites: Drop-down camera sites.

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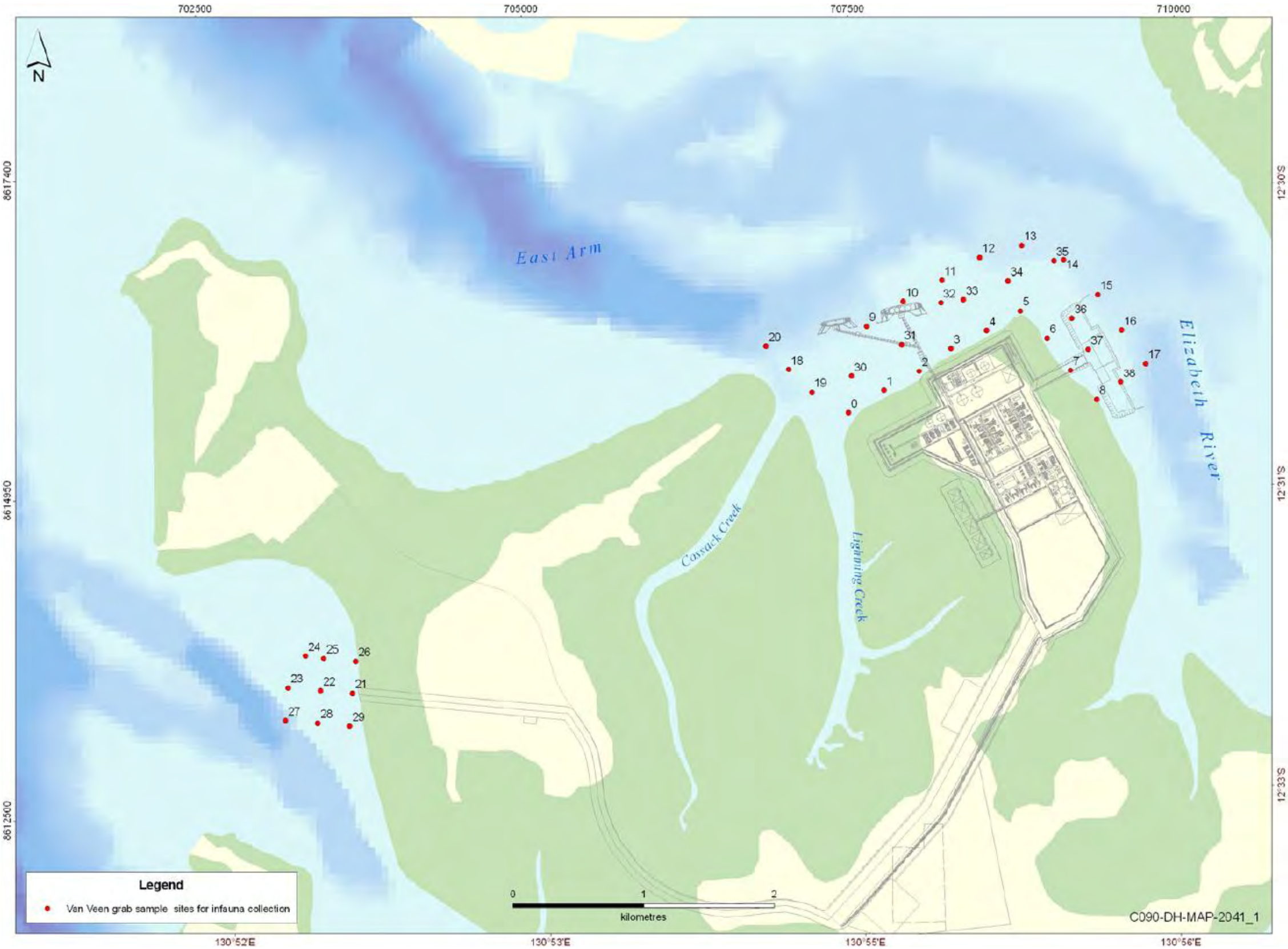


Figure 14-5 URS (2009a) Marine and Benthic Community Survey Sites: Van-veen grab sampler sites.

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Figure 14-6 GHD (2011) Dolphin Survey Transects: survey block one.

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Figure 14-7 GHD (2011) Dolphin Survey Transects: survey block two.

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Figure 14-8 GHD (2011) Dolphin Survey Transects: survey block three.

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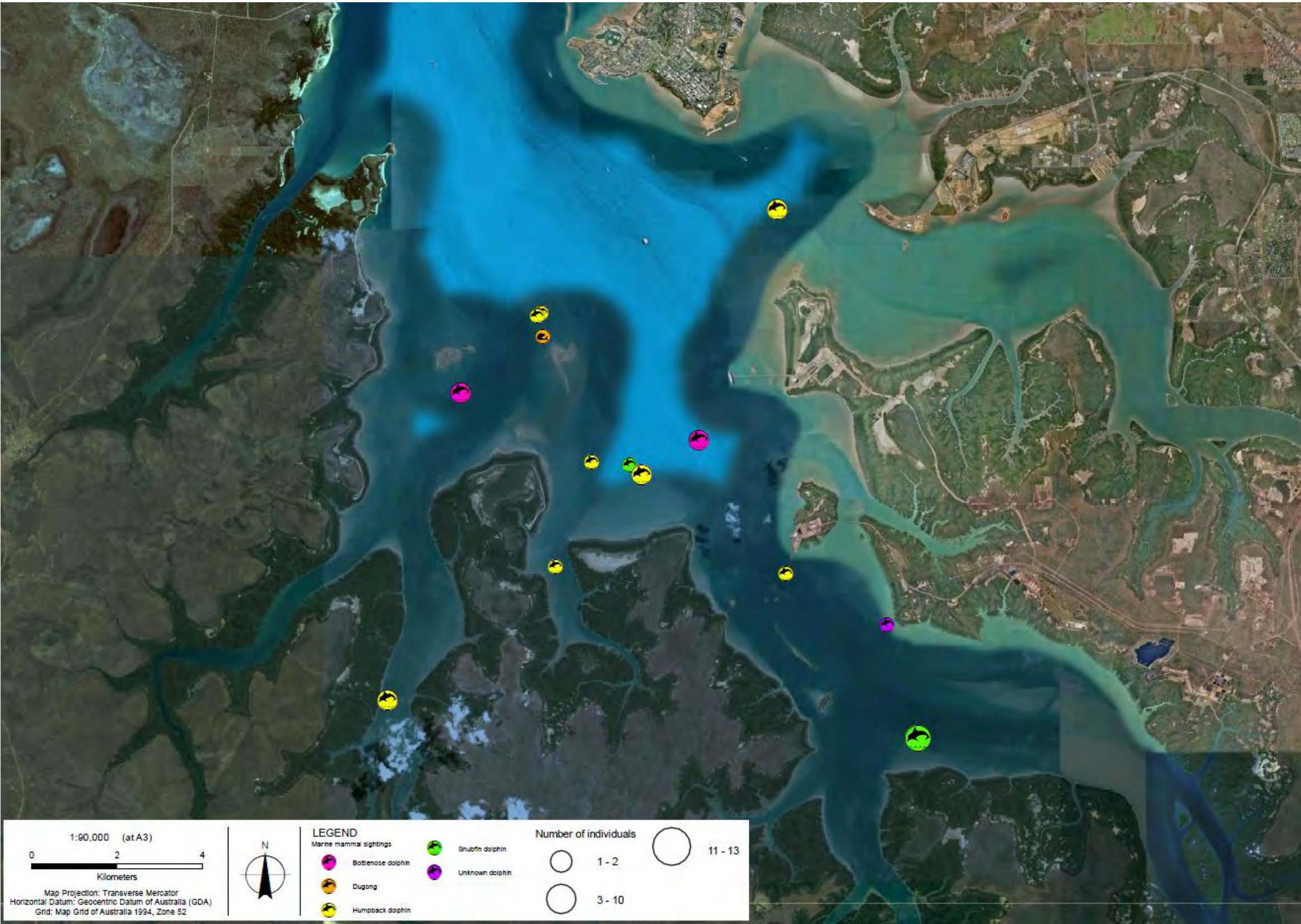


Figure 14-9 GHD (2011) Marine mammal sightings: survey block one.

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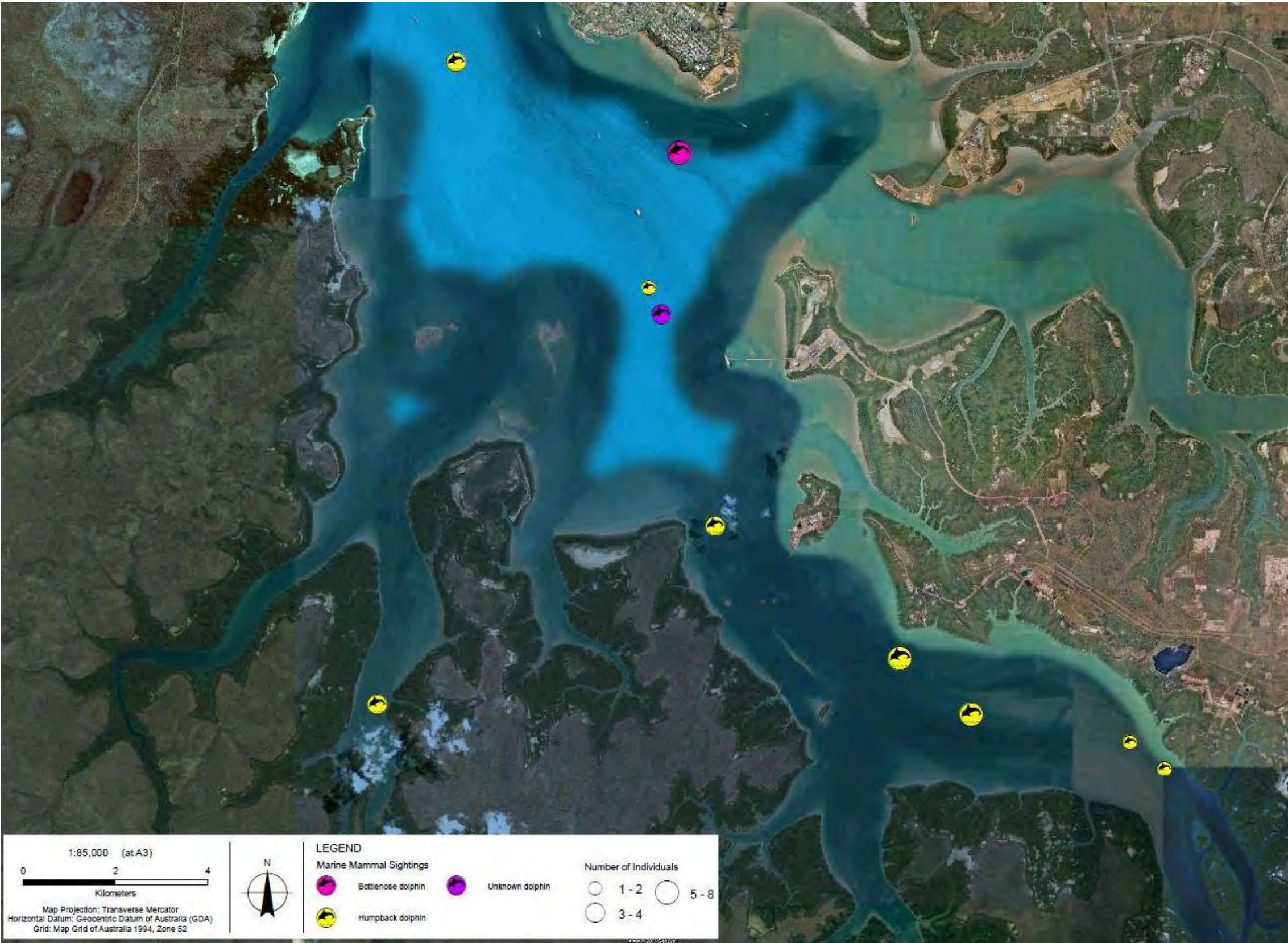


Figure 14-10 GHD (2011) Marine mammal sightings: survey block two.

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Figure 14-11 GHD (2011) Marine mammal sightings: survey block three.

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Figure 14-12 GHD (2011) Marine megafauna sightings (excluding mammals): survey block one.

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Figure 14-13 GHD (2011) Marine megafauna sightings (excluding mammals): survey block two.

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Figure 14-14 GHD (2011) Marine megafauna sightings (excluding mammals): survey block three.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport (preamble)
Comment:	The draft EIS should describe seabed communities within all areas that can be identified through sediment dispersion modelling as possible impact areas.

Refer Figure 14-15, and Figure 8-5 of the DEIS.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (preamble)
Comment:	Section 8 of the EIS Guidelines, requires mapping of all benthic habitat for the development site and any other area which may be impacted on. Each EPBC listed threatened and / or migratory species habitat, including potential foraging areas, in the vicinity of the project should be mapped, including areas outside the immediate project area which may be impacted by project activities, and the importance of this habitat for the species described.

Mapping of all benthic habitat for the development site and any other area which may be impacted is shown at Figure 14-15. Potential impacts on EPBC species and habitat are discussed above.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (preamble)
Comment:	For monitoring purposes, species specific information is required to allow development of robust monitoring programs that can deliver impact assessments and management actions.

Marine species specific information is included at Chapter 15 of the DEIS, and Chapter 14.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The fauna report summarised in the next section (1.12.11) states: 'An additional marine mammal, the Indo-Pacific Hump-back Dolphin (<i>Sousa chinensis</i>), was also observed in offshore habitat adjacent to the study area'. This indicates the assumption "there are no known habitats of significance to these species" is unsubstantiated.

The Proponent contends that the observation of any species of animal in a given area does not mean that the area is necessarily a "habitat of significance" for that species.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	A buffer needs to be considered to protect South Shell Island benthic communities (sponge gardens and rocky reef) which represent a significant hotspot of diversity for Darwin Harbour, as well as dugong feeding ground. The intertidal / subtidal sponge beds around the old East Arm boat ramp also should be considered for buffer protection due to the high diversity values. Consultation should occur with the NT Museum (Natural Sciences) and Biodiversity/NRETAS to determine areas of particular diversity value needing protection.

The old East Arm boat ramp is a privately owned and operated facility, currently owned by Paspaley Pearls. The Proponent does not have jurisdiction over the implementation of a buffer zone surrounding this facility. Establishment of a buffer zone around South Shell Island would be the responsibility of NRETAS.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Which specific EIAs describe marine ecology relevant to the proposed expansion works? The draft EIS has not dedicated a section to describing in detail the fauna and flora present (to family if not species level); discussed its importance/relevance within the Darwin Harbour ecosystem; or the likely implications of loss of biodiversity for Darwin Harbour.

Environmental impact assessments describing marine ecology relevant to the proposed expansion works include INPEX Browse (2009) and URS (2002), both of which are cited in Chapter 15 of the Draft EIS. The Proponent considers that the level of detail at which the flora and fauna have been described is appropriate for the purposes of environmental impact assessment, but will assess the need for more detailed studies following consultation with MAGNT and NRETAS (Biodiversity).

The importance and relevance of the types of benthic communities present in the vicinity of the project area, and the implications for the loss of biodiversity that may occur during dredging activities within East Arm, are discussed in AECOM (2011b) and INPEX (2011). Both of these publications are readily available from either the NRETAS or INPEX websites and the discussion is not replicated here. The relative scales of the INPEX and EAW dredging programs should be considered when referencing these documents.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	A study of scientific literature would be appropriate, with the intent to clarify: 1. Dredging works is likely to correlate with the timing of spawning in Darwin Harbour; 2. Turbidity generated from dredging would be expected to impact upon success of spawning/recruitment from/to affected reefs; and 3. Dredging activities should be stopped around the spawning and/or recruitment period.

The phrase “Coral spawning is not known to have been observed in Darwin Harbour” was included in the DEIS on the basis of a search of published scientific literature, plus consultation with academics in Darwin and elsewhere. Whilst captive corals in North Queensland have been observed to spawn at the same time as those in adjacent waters (INPEX Browse 2009), the Proponent has found no evidence that this is the case in Darwin Harbour. Hence the potential for dredging to occur at the same time of coral spawning cannot be assessed.

The potential effects of dredging activities upon coral spawning and recruitment are discussed in detail by Stoddart & Gilmour (2005). The potential effects (upon spawning success) of the concentration of suspended sediments generated by dredging (up to 5 mg/l), when added to background concentrations (mean of 15 mg/L in East Arm, URS (2009b)), cannot be accurately predicted. However, given that the duration of dredging is to be less than one year, it is considered unlikely that diminished spawning success within a single year has the potential to significantly impact upon the long-term viability of the East Arm coral communities. That is, in the absence of large scale coral mortality (which is not predicted to occur as a result of the Project – refer section 15.5.3 of the DEIS), it could reasonably be considered that coral spawning in years subsequent to that in which dredging takes place will enable continued viability of the coral communities. Hence it is considered that cessation of dredging around the periods of coral spawning and recruitment is unwarranted.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Cite Alvarez et al. (2002) and Hooper et al. (2002) regarding sponge diversity. High biodiversity values, combined with a high percentage of undescribed species indicate high conservation value, by rights of Ecology Sustainable Development. Please cite Metcalf and Glasby (2008) regarding an updated number of worm species – estimated twice the number cited in the draft EIS. Biodiversity in Darwin Harbour has potential medical value to future generations. Sponges and other benthic fauna of Darwin Harbour are the subject of current Bioprospecting research by the American National Cancer Institute in alliance with the NT Museum and Art Gallery, seeking potential cures to AIDS and cancer. Loss of undescribed and potentially local species by habitat destruction in Darwin Harbour, such as proposed by this development, risk loss of potential benefits to future generations from such research. A clear statement on the residual detriment expected from the project must be provided, and include consideration of secondary impacts to Stakeholders, including future generations.

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Whilst it is acknowledged that there is a risk of loss of biodiversity associated with developments in the region, it is considered that there is only a low risk of significant loss occurring as a result of this Project. It is also noted that the loss of benefits to future generations should the Project not proceed is more certain than the prospective loss of the potential benefits described by the reviewer.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The draft EIS does not present a description of the species assemblages found, in the impact areas and reference areas. The community habitat data is general in nature, and does not allow a robust assessment of biodiversity importance / uniqueness nor does it allow a comparison between sites within impacted and non- impacted areas. It is essential to have site-specific species information. The level of species, identification should be described to at least family if not genus level. Dedicated field surveys do not appear have been undertaken of these habitats (no appendix for marine flora/fauna surveys). Significant data sets exist for important hotspots of biodiversity such as those around South Shell Island and the proponent is able to access relevant Museum and Art Gallery NT (MAGNT) records for that region (pers. comment Chris Glasby, MAGNT). A lack of understanding of habitat extent in the harbour means that predictions of potential impact are not substantiated. For example, the proportion of the total hard substrate or coral communities in the harbour is unknown so there can be little understanding about how these communities will be impacted or the implications that impacts to one area might have on the sustainability of that habitat type in the 'harbour. There is little information provided on how the proponent constructed the benthic habitat map on page 230. They are inadequate for the intended purpose and give the impression of comprehensive habitat mapping. The most likely marine benthic area to be' impacted by this project is South Shell Island because of its close proximity to East Arm Wharf and high 'diversity of sensitive filter-feeding sponges and other communities (Alarez et al, 2002). Its exact location has not been highlighted in the Executive Summary and the potential impacts of dredging on benthic communities of South Shell Island are only discussed with reference to hard corals. South Shell Island has 'the highest diversity of sponges and soft corals in Darwin Harbour and almost the entire diversity of sponges in the harbour is represented at South Shell Island (B. Glasby, pers. comm.; MAGNT database) The Dredge Management and Environmental Management Plans need to focus on minimising the impacts of dredging and other operations of the project in this area.

Refer to response below.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This is a significant under-estimation, with at least 49 species that have been recorded there (GHD 2006) and it is one of the most significant hard coral communities in Darwin Harbour. Based on Figure 15-1 showing benthic habitat classes – discuss whether consideration has been given to an alternative rock loadout wharf location that does not directly disturb a reef community.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Reference the survey conducted in 2010. Figure 15-1 shows the MSB and its dredged access channel directly overlaying areas of high value marine habitat. Provide details on whether consideration has been given to reconfigure alignment to minimise this habitat loss.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Monitoring programs would not prevent habitat loss, which is the core issue with respect to aligning the footprint of the MSB and its dredged access channel over the top of high-diversity-value marine habitats.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Impacts on the important sponge and coral beds immediately adjacent to the proposal have been underestimated in this assessment of the 'environmental impacts' of the proposal. Dredging and constructing through the sponge beds and coral communities will cause a clear, direct loss of sensitive, highly bio-diverse and important habitat, and should be avoided at all reasonable costs. Recovery and recruitment onto a new artificial structure cannot be considered to replace or off equivalent biodiversity values to the existing reef which may have taken 6,000+ years to establish (ref. section 8.1). The significant age of this reef is suggested by its high biodiversity values, which contrast the values of younger hard-substrate sites in the harbour, such as the WWII shipwrecks. MSB footprint and channel dredging pathways should be aligned away from this unique natural feature, and the dredging managed to minimise impact on this reef. The reef is currently partly within the channel pathway, and otherwise within metres of the channel alignment. Figure 15-1 shows the impacting dredging pathways, and layout of the MSB.

The value and significance of Darwin Harbour's benthic ecology is acknowledged by the Proponent. While the placement of the MSB has been largely dictated by logistical requirements (such as proximity to deep water, road access, turn-around space and fuel supply), the MSB access channel

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has been significantly realigned so as to pass South Shell Island at a greater distance (refer Figure 6-3). The channel footprint and dredged footprint have also been reduced substantially, all of which will reduce impacts on the South Shell Island sponge and hard coral communities.

The preferred alternative MSB access channel location is discussed in detail at section 6.1.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This conclusion is not accurate. The INPEX surveys recorded lower densities of all three species in West Arm and based on photo-identification of dorsal fins, the majority of individual dolphins occur in both the eastern and western part of Darwin Harbour.

The lower recorded lower densities of all three dolphin species in West Arm, and the presence of the majority of individual dolphins in both the eastern and western part of Darwin Harbour is noted and acknowledged. This aspect does not materially affect the findings and recommendations of the DEIS.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Figure 15-1 shows that the extent of impacts upon important marine habitats is being discounted in this EIS. The sponge gardens and hard coral habitats lie along the entire >1500m SW aligned front of the existing wharf; not just 'in the areas surrounding South Shell Island and Old Man Rock.' Detail why alternative configurations were not considered to avoid and minimise impacts in these areas.

It is acknowledged that Figure 15-1 shows sponge and soft (not hard) coral beds to the south-west of the existing wharf face. However, the mapped areas were extrapolated from only two data points, one off the north-western end of the wharf and one off the south-eastern end of the wharf and anecdotal evidence from the Proponent's consultants is that moderate to high density beds of these taxa are not present across the broad area shown. It should be noted that habitat mapping was focussed upon the area in which the potential for direct impacts is highest (refer Figure 14-15). As described above, the MSB access channel has been significantly realigned so as to pass South Shell Island at a greater distance (refer Figure 6-3).

Respondent:	Department of Resources
Comment:	It is recommended that the Proponent discuss the proposal with officers from the Aquatic Biosecurity Unit of the Fisheries Division with a view to developing additional marine pest monitoring and management actions for the project which are commensurate with the risks.

The Proponent is aware of the marine biosecurity requirements for ballast water and biofouling for vessels entering Australian and Territory waters, and all vessels to be utilised on the project will comply with the requirements of the AQIS and the Northern Territory Fisheries division. AQIS administers the *Commonwealth Quarantine Act 1908*, and performs all pre-border quarantine checks and ballast water compliance audits for international vessels. The NT Fisheries group performs risk assessment (and if necessary inspection and / or treatment) on all vessels entering Darwin marinas,

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and has a comprehensive marine pest monitoring program throughout Darwin and surrounds, including EAW. They also administer the regulations (*Fisheries Act 1988*) that detail prohibited marine pest species, under which a vessel can be ordered to leave if found with a marine pest.

As detailed in Chapter 15.4 of the DEIS, the Proponent will discuss the project with the Aquatic Biosecurity unit and NRETAS representatives to determine whether the existing marine pest monitoring program and vessel risk assessment program run by Fisheries sufficiently covers the EAW development, or if additional monitoring or risk mitigation actions are required for the EAW Expansion Project.

Respondent:	Environment NT
Comment:	(The need for) A Darwin Harbour Marine Wildlife Sanctuary.

Creation of a marine wildlife sanctuary within Darwin Harbour would be the responsibility of NRETAS, not the Proponent.

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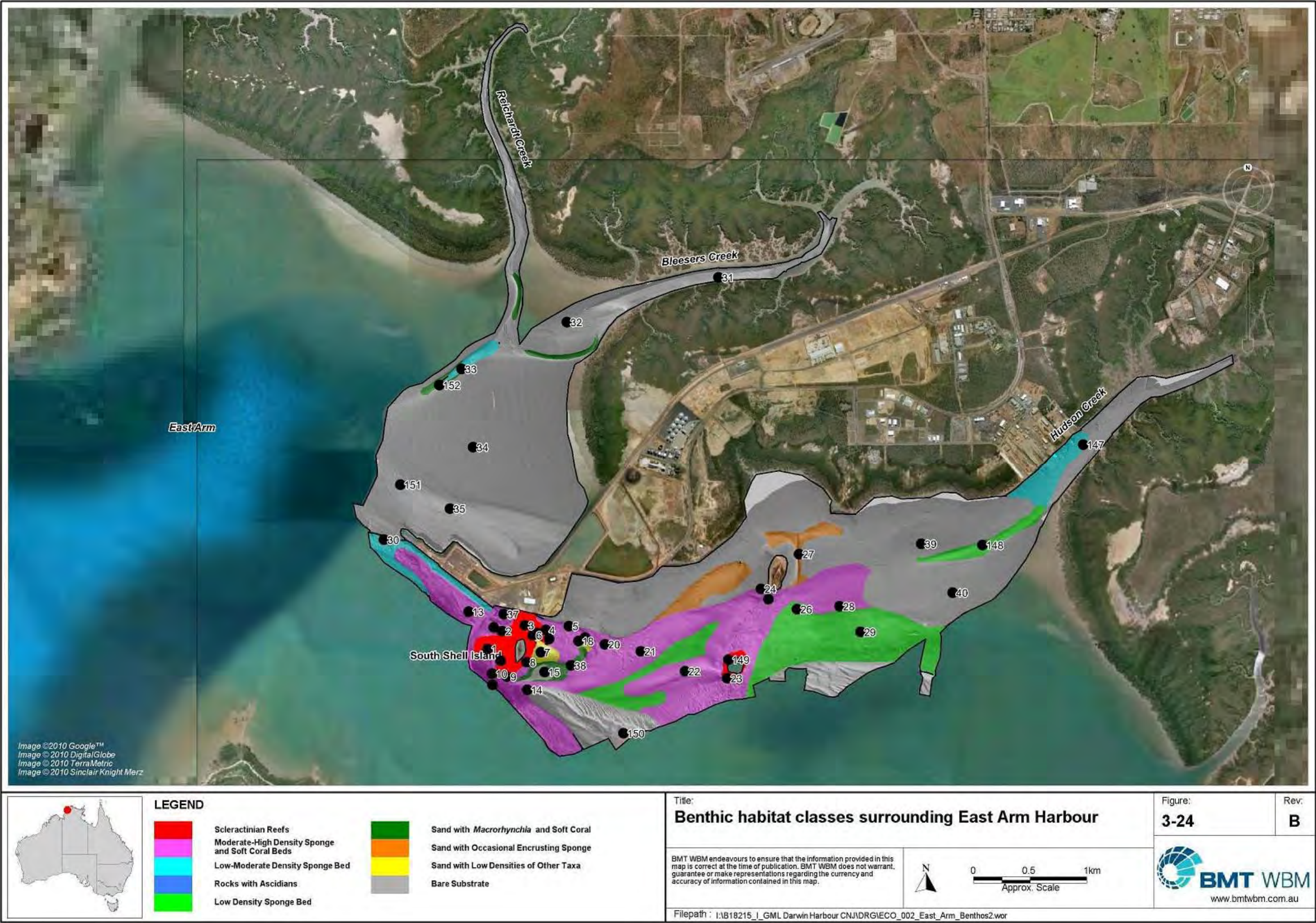


Figure 14-15 Benthic habitat map and sampling site locations. (Source: BMT WBM)

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Respondent:	Environment NT
Comment:	We strongly recommend that channel dredging pathways be aligned away from these (sponge and coral community) habitats and that dredging be very carefully managed to minimise long-term negative impacts.

Channels requiring dredging have been aligned so as to reach the required depth over the shortest practicable distances. The proposed MSB access channel has been significantly redesigned to reduce the potential impact to benthic habitats, and to those around South Shell Island in particular (refer section 6.1). This approach will minimise the footprint of dredged channels, which in turn will reduce the risk of impacts to nearby marine habitats.

Marine Noise

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Underwater noise has not been adequately dealt with, particularly in regards to piling and dredging....

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Noise modelling must be conducted for Darwin Harbour. Methodologies must be based on best practice and exclusion zones must be determined using current and empirical scientific evidence as well as biological variables of species concerned. If current technology or current knowledge is inadequate then a report explicitly identifying the gaps and data needed should be produced. Clarify why there are no marine noise commitments included in the draft EIS.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Any marine noise survey conducted for INPEX should assist in determining impacts.

Darwin Harbour contains a number of variables that make underwater noise modelling difficult. Each of these factors adds a degree of uncertainty to predictions of underwater noise and a predictive model would need to make generalisations and assume homogeneous states, although they may not exist. These variables are as follows:

- Shallow water.
- The variable depth of water because of the large tidal range.
- Naturally occurring underwater noise caused by the flow of large volumes of water during tidal movements.
- The variation in bottom type, affecting the reflection or adsorption of noise.
- The variation in salinity, particularly between Middle Arm and East Arm and the main body of the Harbour.
- The proximity and volume of existing anthropogenic noises.
- Local weather conditions (e.g. thunderstorms and lightning) that can also produce underwater noise.

Underwater noise propagation modelling is not considered appropriate for the EAW project as predictions would be confounded by these large numbers of variables in the Darwin Harbour environment. It is considered that the potential impacts of noise from key project activities can be assessed adequately through the literature review in the DEIS augmented by the publicly available noise modelling undertaken for the INPEX Supplement to the Draft EIS (INPEX Browse 2011).

As determined in the INPEX Browse (2011) underwater noise assessment, the change in predicted received levels from pile driving as a result of tidal fluctuations shows shallow water significantly reduces the predicted received levels, particularly in the far field where acoustic propagation has more interaction with the seafloor under the lower tidal heights. By comparison, the data presented in INPEX Browse (2011) were calculated assuming a constant tidal height of 6 m (highest astronomical tide (HAT)), which is demonstratively an artificial artefact for the dynamic tidal environment of Darwin Harbour. The use of a constant maximum tide height overstates the actual Sound Exposure Level (SEL) that would be received in almost all circumstances because the tide height falls and rises twice

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over a daily cycle, and thus the received sound level at any given location would fluctuate widely. The conservative, 'worst case' noise modelling, using the artificial constant high tide condition and the associated impact evaluation, indicated that the proposed INPEX pile driving program could be managed so that it is unlikely to have unacceptable impacts on marine fauna, and particularly any beyond a distance of around 500 m of a pile being driven into the substrate. This is the case for the assumed 'worst case' (i.e. best acoustic propagation conditions), and this forms a valid basis for the assessment of noise exposure from similar activities for the Project.

Outcomes of the dredging noise exposure modelling for INPEX Browse (2011) was compared to the exposure criteria and the predicted safe ranges for marine mammals, turtles and fish as for pile driving. At no point was it predicted that noise from jumbo CSD operations would exceed the underwater noise criteria.

It is considered that underwater noise modelling for the Project would in no way alter the proposed conservative mitigation methods outlined in the DEIS. These methods are based on current empirical scientific evidence and account for 'worst case' pile driving and dredging generated noise in Darwin Harbour.

In summary, underwater noise modelling could indeed be undertaken and would generate a 'result'. This would be of limited use, however, and provide no further information of any valid use for acoustic risk management or risk assessment beyond what is already known and available from other sources. Furthermore, modelling would not substantively alter the understanding, characterisation or management of the noise exposure risk beyond the rational, scientifically informed risk-based assessment methodologies employed in the DEIS, nor result in any additional protection for species of concern beyond that already intended. The limited reliability and utility of any of the results of modelling in no way justifies the scale of resources and the expenditure of public funds which would be required to undertake the suggested modelling. It is therefore considered that modelling is not justified on grounds of either cost or outcomes.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The draft EIS describes that a number of species of marine megafauna are present in the project areas and may be impacted by the development. All species listed as matters of, National Environmental Significance (NES) under the EPBC Act are iconic species in the Northern Territory. The project has the potential to impact on these during construction (dredging and pile driving) and operation (boat strikes, maintenance dredging). The draft EIS contains a number of management actions relating to the use of exclusion zones to manage the risk of marine megafauna during dredging and pile driving. The use of observers is relied upon to monitor the presence of marine megafauna during dredging and pile driving. Commitment is required in the <i>Supplement</i> that all observers are dedicated with the sole duty to observe, be trained in identification of marine megafauna be rotated regularly to avoid fatigue and all observations be reported to NRETAS.

Refer to response below.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Use of cetacean acoustic monitoring equipment could potentially enhance the effectiveness of the proposed surveillance for cetaceans. Ancillary monitoring methods such as this may be of particular assistance during windy or low visibility conditions. Effectively, the proposed surveillance procedures can lead to un-monitored night-time dredging, unless the threshold from the previous day of stoppage s due to fauna sightings has been met. Demonstrate with evidence why this exclusion clause is appropriate (particularly where the option of acoustic monitoring exists)? This will require a dedicated expert observer trained in identification of marine megafauna, be rotated regularly to avoid fatigue and all observations must be reported to Biodiversity NRETAS.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Clarify how marine fauna will be detected during low visibility if the Additional Operating Procedure is to use additional observers to identify important marine fauna within the exclusion zones.

It is agreed that the use of cetacean acoustic monitoring equipment could potentially enhance the effectiveness of proposed surveillance for cetaceans, but with limitations. Acoustic monitoring equipment would assist in recording the echolocation clicks of toothed whales (such as dolphins), but not of all cetaceans. Detection of a vocalising dolphin is, however, only the first step in the application of acoustic monitoring. To have any worthwhile effect, it is also necessary to be able to localise the vocalising contact, in relation to both range and bearing, and this would depend upon the localisation capability and accuracy of the equipment in use.

It is likely that the range to the vocalising contact could be predicted, but this would rely upon estimates of vocalisation source level, directionality and propagation losses. In respect of the latter, given the heterogeneous and dynamic character of acoustic propagation conditions of the waters of Darwin Harbour, estimates would often be unreliable and characterised with limited confidence. This situation would invariably result in some confusion concerning whether the cetaceans were near the dredging or piling operations, or in fact well away from the activities; a situation which does not augur well for the implementation of effective and reliable mitigation measures.

While cetacean acoustic monitoring equipment could determine the presence of some marine megafauna within the Harbour, this would only be the case for vocalising species and only those individuals which were actively vocalising. Even with vocalising individuals, it would ultimately provide minimal benefit in determining their presence, but not necessarily their location, and would provide no benefit at all in relation to other species such as dugongs and turtles. In summary, acoustic monitoring is of questionable value, particularly in the complex and enigmatic acoustic environment of Darwin Harbour. It is unlikely if the marginal improvement in the application of mitigation measures would be commensurate with the costs involved, or lead to any substantive reduction in what are arguably minimal risks in the first instance.

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Cetacean acoustic monitoring equipment would also prove to be of limited use in Darwin Harbour during windy or low visibility conditions. During windy and rainy conditions subsurface sound is generated via the production of breaking waves and sub-surface bubbles, thus creating more background noise. The relative noise effect from dredging during these periods would actually be likely to have less potential for impact on cetaceans due to the masking of the dredging noise.

As noted in Section 13.5 (page 196), the peak audio-sensitivity of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) is from 10 kHz to 100 kHz (Johnson 1967), compared 160-180 dB at 100 Hz propagated from a dredging barge. Much of the sound generated by dredging is thus below the audible range of Indo-Pacific bottlenose dolphins (and other dolphins) and those audible sounds would be at low intensity compared to their threshold of hearing (130 dB at 100 Hz). Therefore, it is unlikely that significant disturbances to dolphins would be caused by underwater noise from dredging activities, either during the day or night.

Employment of 'expert' marine mammal observers (MMO) trained in the identification of marine megafauna to species level is not considered necessary for the intended mitigation programme. It is proposed, however, to employ dedicated observers for the duration of the marine operations, with these individuals appropriately educated in the techniques to locate cetaceans and other marine megafauna within Darwin Harbour. Observers will need to know how to scan the area and maintain a watch for known characteristics as they come to the surface (i.e. maintaining a watch for the dorsal fin, brow of the head and / or tail of a dolphin). It is not necessary for the application of the intended mitigation measures to know what sort of dolphin has been observed, but rather that a dolphin has been observed – this does not require an expert in marine mammal identification, but rather an individual competent in standing a watch. The proposed use of dedicated observers with the required competencies will allow more individuals to be trained and rotated regularly, providing for more reliable, meaningful and effective application of the required mitigation measures.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The actual DMP in Appendix B describes significantly less-conservative exclusions zones and periods: i.e. 300 m, and 10 minutes, respectively and 'If the turtle(s) are within 20 m of the dredge vessel, then dredge operations are to cease immediately.' (etc.) the DMP (and all other EMPs) must be consistent with all related environmental management commitments made elsewhere in the EIS. Current and up-to-date specific locations indicate that the Indo-Pacific humpback dolphins have been predominantly recorded around East Arm and at the mouth of Reichardt and Blessers Creeks (also Howard River and Hope Inlet, Shoal Bay) and foraging was the dominant behaviour (Fortune et al 2009; Palmer 2010). Snubfin have been recorded at East Arm, Woods Inlet and in Fannie Bay.

The DMP will be amended to include the more conservative exclusion zones:

- It is proposed that prior to the commencement of any noise-intensive activity, a marine fauna exclusion zone extending 500 m in all seaward directions from the noise source should be established.

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- From one hour prior to the commencement of any noise-intensive activity, vessel and/or landbased observers should monitor the exclusion zone to check for the presence of any important marine fauna species (e.g. dolphins and dugongs).
- Activities may commence if no important marine fauna have been sighted within the exclusion zone 30 mins prior to the commencement of the activity.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Use of bubble curtain technology could be investigated as a potential means of reducing marine noise propagation, and of discouraging entry of fish and marine mammals, etc. into the exclusion zone around the pile-driving activity.

It is anticipated that the noise generated by pile driving activities will temporarily (i.e. until pile driving activities are finished) discourage marine animals from entering the exclusion zone. The efficacy of bubble curtains at reducing underwater sound propagation is uncertain.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The measure being proposed here of a substantial influence on the trophic structure within Darwin Harbour is so gross and would require such an ecological disaster that it has little relevance to an appropriate test of ecological significance. The statement implies that the ecological balance (trophic structure) would have to be affected by an action before a 'significant' impact would be registered. A change in trophic structure would require an event in the scale of, for example, the death of all plants and algae (primary producers) in the Harbour. 'Significance' can and should have a finer resolution than this measure. Many lesser levels of impact would still be considered unacceptable. The EPBC Act defines 'significant impact' as: 'An impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on the environment.' The accumulation of impacts from this and other projects (particularly INPEX) on this reef need to be considered. Apart from any direct habitat loss, indirect losses and declines may be expected over the longer term to local benthic organisms from the indirect impact of dredging, including smothering, reduced recruitment and light attenuation (affecting corals and algae, as discussed in Potential Impacts on Hard Coral Communities, p.244/245). Coral communities are confined to only a few locations with relatively low water turbidity and low sedimentation rate/high hydrodynamics – "refuges" where coral can grow. Alteration of water quality resulting from dredging may degrade coral communities in these locations.

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The Proponent did not intend the statement to imply that trophic structure would have to be affected before a significant impact would be registered.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Clarify this statement given the habitat map (Figure 15-1) of the area shows the EAW surrounded by areas of sponge and soft coral.

The benthic habitat map shown at Figure 15-1 of the DEIS does not show EAW “surrounded by areas of sponge and soft coral”. As can be seen at Figure 14-15, the map shows a large area comprised of bare substrate directly to the north of EAW, and another large area comprised of bare substrate to the east of EAW. It is acknowledged that an area supporting sponges and soft corals is present to the south of EAW, but this area is relatively narrow and limited in area in comparison to the dominant bare substrate in the East Arm area.

The benthic habitat map also indicates that the habitats of maximum biodiversity at East Arm surround South Shell Island. The Project has been revised, specifically the MSB access channel alignment (refer section 6.1), so as to mitigate the potential impacts to this area to the extent practicable.

Marine Water

16.1 Marine Surveys

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Detail the types of marine surveys proposed. Clarify how the ten year requirement for maintenance dredging was determined.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	To adequately assess the cumulative impacts of the expansion works – an indication of frequency of maintenance dredging should be provided –e.g. what happens if maintenance dredging is required every 5 years instead of 10?

The bathymetry of Darwin Harbour in general and the vicinity of EAW specifically is monitored regularly. These surveys evaluate the degree to which the bathymetry of dredged areas has changed due to siltation / sediment accretion and / or erosion over time.

Maintenance dredging at EAW is currently undertaken approximately once every 10 years. The hydrodynamic modelling undertaken for the DEIS did not indicate that sedimentation or other oceanic processes would be impacted to the extent that dredging intervals would need to be lengthened or shortened by any substantial degree. It is therefore assumed that future maintenance dredging would continue at intervals of approximately one dredging event every ten years.

The actual period between future maintenance dredging operations may vary, as it will be determined by metocean conditions, such as extreme storm events, which may contribute to unusually high sediment accumulation in some areas of Darwin Harbour, including the dredged areas. The actual requirement for dredging (and hence maintenance dredging intervals) will be determined from the outcomes of the aforementioned bathymetric surveys. Historically, however, maintenance dredging has been required at approximate ten yearly intervals since establishment of EAW.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Appendix E does not contain these (soil survey) results, and doesn't mention the study (nor does Appendix B).

Results of the soils surveys referenced are summarised at section 9.1.2 of the DEIS.

16.2 Marine Impacts

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	To adequately assess the impacts of the project on water quality, this information (actual suspended sediment or turbidity levels likely to be generated from this project, or the exact frequency and duration of these activities, as well as the time of year these activities are likely to occur) is required in the Supplement.

The best estimates available at the stage of DEIS preparation were used for formulating inputs for the used sediment transport model. The impacts on water quality are based on the findings of the dredge

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dispersion modelling undertaken. The findings of the modelling undertaken are detailed at Appendix E of the DEIS (Dredge dispersion and spoil disposal modelling for the EAW).

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Is this figure (i.e. up to 5 mm sediment deposition) OK for benthic communities and what is the spatial extent of the 5 mm deposition (i.e. will it occur over hard corals or other sensitive habitats)?

Areas of sediment deposition resulting from dredging activities associated with construction of the MSB, barge ramp, and small vessel berths are illustrated at Appendix E of the DEIS (Dredge dispersion and spoil disposal modelling for EAW). Modelling indicated that the greatest potential impacts would be associated with the MSB, as the dredged area and volume of dredged material required are greater than that of the other project components. The DEIS Appendix E map showing modelled potential deposition resulting from MSB dredging activities is reproduced at Figure 16-1 below. Modelling showed that potential sedimentation resulting from construction of the barge ramp and small vessel berths would be substantially less, with the modelled MSB potential sedimentation impacts effectively presenting a 'worst case' scenario.

The potential effects of sedimentation on benthic fauna are discussed in detail by AECOM (2011b). This report describes the high degree of variability in tolerances of benthic fauna to sediment deposition, though it is notable that adverse effects (in field and laboratory settings) have typically only been recorded in situations where deposition in the order of centimetres, rather than millimetres, has occurred. For mangrove communities, mortality from sedimentation has only been recorded at depositions of >120 mm (Ellison 1998 cited in Chapter 15 of the DLP (2011) EIS).

Figure 16-1 shows that sediment deposition is most significant to the north of EAW, within Frances Bay and around the northern perimeter of Hudson Creek. Deposition up to 1.0-5.0 mm thick is likely within these areas.

Chapter 3 of the Ichthys Gas Field Development Project DEIS (INPEX Browse 2009) discusses the marine communities of Darwin Harbour, and shows that the areas likely to be most significantly impacted by sedimentation shallow inter-tidal flats (refer Figure 16-2). The sea floors in these areas is comprised of soft sediment substrates, which are estimated to cover approximately 80% of the Darwin Harbour sea floor (McKinnon et al. 2006 cited by INPEX Browse 2009).

When considered in the context of the habitat mapping presented in Geo Oceans (2011), it is clear that sediment deposition of >0.1 mm typically occurs either within mangrove communities or on the sand / mudflats in front of the mangroves. No deposition of >0.1 mm is predicted to occur on hard coral or filter-feeder communities.

The soft muds and fine sands making up the intertidal flat substrates are of similar origin and composition to those that will be dredged from the EAW area, and which would be deposited as a result of dredging activities. The marine community within the intertidal flats of Frances Bay and Hudson Creek is therefore established on soft deposited sediments, and mainly includes infauna dominated by polychaete worms (INPEX Browse 2009). Additional sediment deposition in the order of 1.0-5.0 mm is unlikely to have significant negative impacts on such a community.

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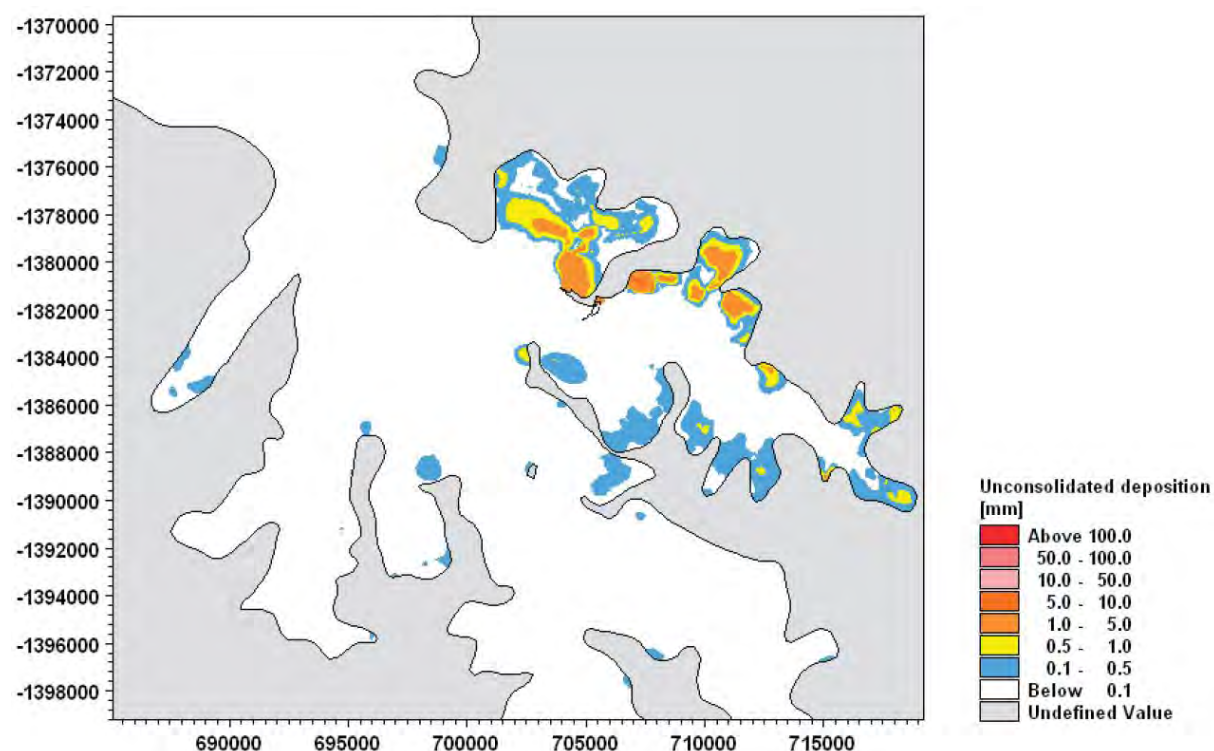


Figure 16-1 Potential unconsolidated fine sediment deposition associated with marine supply base dredging activities.

It is noted that the soft substrate intertidal flats were formed and continue to exist within a relatively turbid, depositional environment. Plumes of sediment are carried out of the local mangroves and tributaries, including Hudson Creek, into Darwin Harbour, where some of the material settles to the harbour floor. Such sediment plumes are shown at Figure 16-3. In the context of the existing physical conditions, and marine communities adapted to a habitat of deposited sediments, the projected increase in sedimentation associated with the Project will not significantly impact Darwin harbour biota.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	No sampling of phytoplankton through chlorophyll measurements was undertaken for the East Arm specifically. Monitoring of these parameters needs to be conducted prior to and during the construction phase.

Baseline sampling of chlorophyll, and chlorophyll sampling during dredging activities, will be undertaken. The revised DMP details the dredging water quality monitoring program, including chlorophyll.

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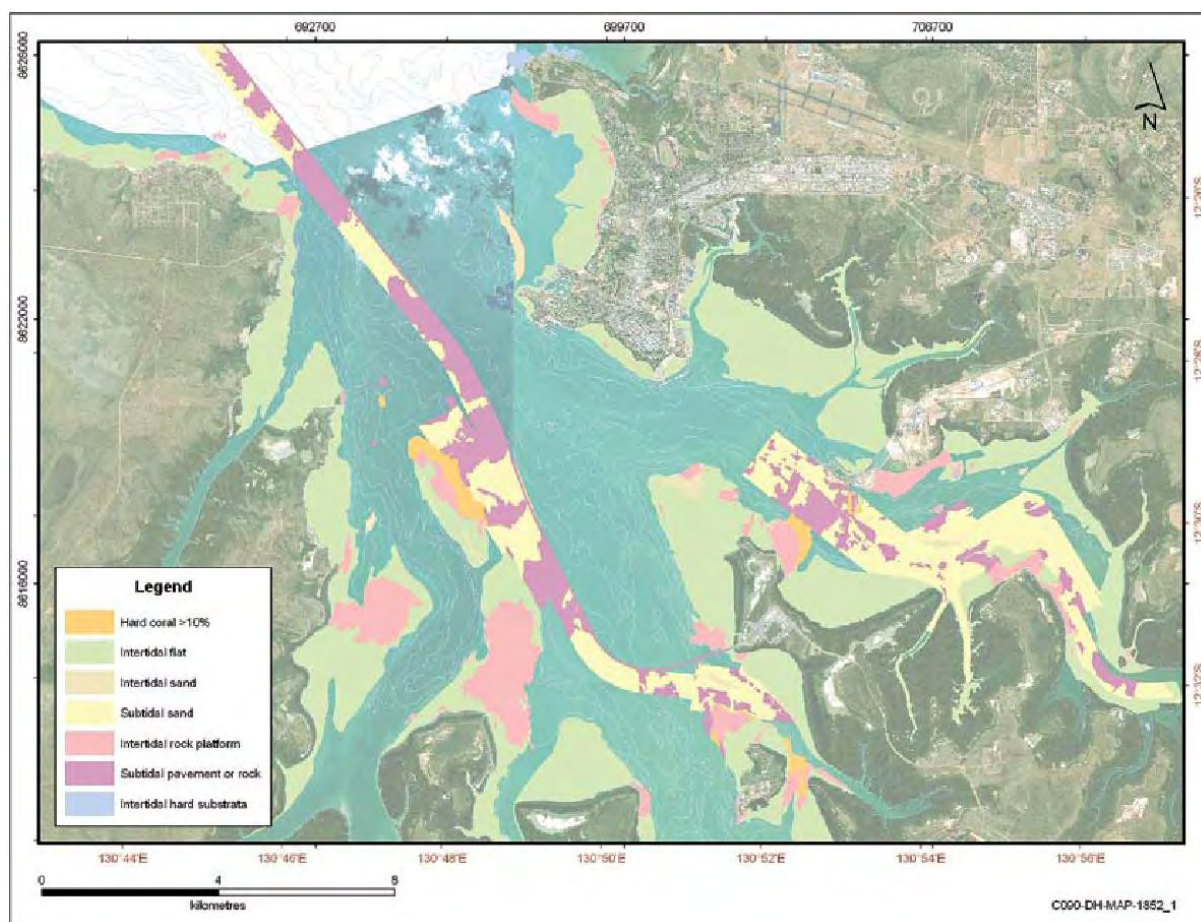


Figure 16-2 Darwin Harbour marine communities. (Source: INPEX Browse 2009)

16.2.1 Water Quality Monitoring

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	There is a need for development of a suite of relevant ecotoxicological tests for water and sediment for use in the event of spill of wastewater discharges.

In the case of a spill, the ecotoxicological soil and water test suite would be determined according to the chemical and physical nature of the spilled material/s. Spill management procedures are included in the EMPs for each EAW user. The overall spill management framework for EAW is described at section 5.1.1 of the EAW EMP (Coffey Environments 2010a).

16 Marine Water



Figure 16-3 Sediment plumes entering Darwin Harbour. (Source: Aurecon 2011a)

16 Marine Water

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This existing and ongoing study provides an invaluable broad baseline context to the project. Clarify the number of samples used in Table 9-1 that provided the average water quality levels recorded at the East Arm. Impact and control monitoring locations closer to and within the proposed infrastructure and operations also need to be established prior to any construction, to obtain a suitable baseline and ongoing monitoring dataset which will enable detection of any change in local water quality over time, due to the project. Local sensitive receptor sites need to also be identified and included in the monitoring program (e.g. South Shell Island, Old Man Rock). Monitoring programs should be designed to be able to detect at least the obvious potential impacts, such as copper concentrate spills; effluents/Tributyl tin; hydrocarbon spills; and contaminated first-flush discharges of stormwater run-off. NRETAS – Environmental Operations should be consulted with regard to suitability of proposed monitoring sites.

The surveys from which the data summarised in Table 9-1 of the DEIS were derived are described in URS (2009b). In addition to the baseline study described at section 9.1.1 of the DEIS, additional marine water quality and marine sediment quality monitoring will be undertaken, as described by the Coffey Environments (2011) DPC Environmental Monitoring Program, with the objective of detecting change in local water quality over time. The DPC marine water quality monitoring sites are shown in Figure 16-4, and marine sediment monitoring sites are shown in Figure 16-5.



Figure 16-4 DPC marine water quality monitoring locations. (Source: Coffey Environments 2011)

16 Marine Water



Figure 16-6 DPC stormwater quality monitoring locations. (Source: Coffey Environments 2011)

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	It appears the existing surface water environment at EAW has been described using four samples collected shortly after the Cyclone Carlos. It is noted in Table 10-2 that of the four samples that were taken – dissolved cobalt, zinc, copper and manganese did exceed adopted trigger values – even after 700 mm of rain. It is expected that Darwin Port samples surface water at regular intervals than what is provide from the four surface water sites illustrated in Figure 10-1 and these monitoring results and analysis should be discussed in the Supplement.

Refer to response below.

16 Marine Water

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide a map of proposed SW monitoring program at these collection points. Provide the results of the regular monitoring to date so it can be assessed whether surface water is currently being adequately managed to provide confidence expanded project areas can also be adequately managed. Rather than reporting to NRETAS annually – commitment is required that groundwater and surface water monitoring results undertaken as part of the project and general environmental performance are reported annually on the DPC website (EPA NT, 2011).

The DPC Environmental Monitoring Program (Coffey Environments 2010b) is included as Appendix A. Additional surface water monitoring points are suggested in Figure 9 of the Aurecon (2011a) EAW Drainage Strategy, included as Appendix C.

Oceanic Processes

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Clarify which Cyclone Tracy wind conditions were used in the model given that the official recorded winds were 217 km/h prior to the instrumentation being blown away and the Bureau of Meteorology's official estimates suggests the gusts may have reached 240 km/h.

Bureau of Meteorology (BOM) wind data for Cyclone Tracy were used to model the waves (as summarised in BOM (1977).

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	One of the major impacts of dredging is turbidity – it is not clear the extent and duration the elevated suspended sediment concentration 2.0 – 5.0mg/l, 1.0 -5.0mm) would last and whether that differs at different tidal states and / or different dredging equipment. Who regulates whether monitoring data is in compliance and who looks at annual reports? The management of potential impacts during dredging and construction need to be addressed in the Supplement.

Appendix E of the DEIS (Dredge dispersion and spoil disposal modelling for EAW) presents sediment transport modelling results for both the 95th percentile of the suspended sediment concentrations, and the total unconsolidated sediment deposition from the dredging operations at each of the dredging locations and at the (no longer proposed) spoil disposal ground.

The modelling results presented in the DEIS account for both different tidal phases as well as different dredging equipment used at the sites. The typical extents of the dredging plumes for different locations as well as time series of suspended sediment concentrations and deposition thicknesses are also presented for ten receptor locations in Darwin Harbour.

The service provider responsible for monitoring of the dredging operations would be responsible for reporting monitoring outcomes after each component of the proposed field monitoring program, and also for checking compliance of the monitored environmental parameters and reporting results of the conducted checks.

The management of potential impacts to the marine environment construction phases is addressed within the DMP and project component specific CEMPs.

Refer also to the responses in section 16.2 of this report.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	What effect will these changes to hydrodynamics have? Will any beaches or sand bars be washed away or created? Will harbour dredging requirements be altered/ which sites will be affected (map)? How?

The hydrodynamic and wind wave model results and calculated bed shear stress estimates suggest that noticeable effects would be observed at / in the direct vicinity of the proposed dredged areas and

17 Oceanic Processes

coastal structures only. This is an expected outcome of any dredging and / or coastal / marine construction activity.

There was no effect indicated for the larger harbour hydrodynamic patterns, and therefore no impact onto beaches / sand bars.

The obtained results did not suggest there would be any change to harbour dredging requirements due to the proposed dredging and / or construction.

The areas which would be affected due to the proposed dredging and / or construction are mapped in Figures 4-3 – 4-6 of DEIS Appendix D Hydrodynamic and Wind Wave Modelling, and Shear Stress Estimates. The provided estimates and differences in bed shear stress suggest that some accretion and erosion of unconsolidated fine material (clay, silt) might be periodically occurring at / in the direct vicinity of the proposed dredged areas and coastal structures.

In general, DEIS Appendix D Hydrodynamic and Wind Wave Modelling, and Shear Stress Estimates provides answers to this Comment.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	What are the ambient background levels for the arbitrary selected receptor points considered in the modelling (Figure 2-1)?

A recent study of the background sediment concentrations in East Arm (in the vicinity of Blaydin Point) indicated that total suspended solids (TSS) concentrations may vary from 1.5 mg/l to 83 mg/l (INPEX Browse 2009). Within Darwin Harbour, natural TSS concentrations (i.e. without any ongoing dredging operations) may be as high as 250 mg/l (Williams, Wolanski & Spagnol 2006). Such highly variable background concentrations are difficult to account for in any modelling exercise; therefore, DEIS Appendix E Dredge dispersion and spoil disposal modelling for EAW presented sediment estimates from the simulated dredging and spoil disposal operations only.

Offsets

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	Where impacts are reasonably unavoidable or cannot be mitigated, offsets should be proposed. The NT Government's draft environmental offsets policy for the NT should be used to inform the types of offsets worthy of consideration to discuss in the Supplement.

The NTG will explore opportunities to implement water sustainable urban design (WSUD) in future developments. WSUD will improve the quality of stormwater entering Darwin Harbour, thus offsetting water quality impacts potentially associated with the Project.

WSUD is a key requirement of the Australian Government's National Water Initiative and has been supported by funding in all State and Territories, as well as through the Australian Government's Coastal Catchment Initiative (CCI) program. The CCI targets key priority coastal waterways, determined by conservation significance or the icon value of a coastal jurisdiction, that are threatened by land based activities.

Darwin Harbour has been identified as a priority coastal waterway, and a WSUD Strategy has been developed for Darwin Harbour. The Strategy includes the following:

- A definition of WSUD, including a set of guiding principles.
- Clear quantifiable objectives and enforceable targets.
- WSUD policy.
- Guidelines and tools for WSUD concept development, technical design, operation and maintenance.
- Training programs.
- WSUD showcase development.

The Bellamack, Johnston and Zuccoli subdivisional developments each incorporate WSUD. Bellamack includes a stormwater treatment system to minimise pollution to local creeks and Darwin Harbour and a recycled pipe network, also known as a "third-pipe", constructed throughout the subdivisional road networks, which reduces the amount of potable water consumed. The third pipe is being initially supplied with bore-water to irrigate open space areas within the subdivision however it has the potential to be plumbed to individual houses at some time in the future. WSUD has being applied to the Johnston and Zuccoli subdivision, and the NTG intends that future developments incorporate WSUD where practicable.

The CCI project was completed over a three year timeframe with regular reporting to the Federal Government on progress against 18 activities. These activities commenced with desktop studies and finished with fact sheets, guidelines and design manuals. The incorporation of WSUD into NT Government planning policies, strategic plans and development approval processes as well as local government instruments was also a requirement. Signoff following the provision of final reports was achieved with the Commonwealth Government in September 2009.

The NTG has also installed several artificial reefs throughout Darwin Harbour, and intend to install additional artificial reefs in the future. These reefs provide habitat for many marine species, offsetting potential impacts on Darwin Harbour marine biodiversity associated with the Project.

Regulation and Environmental Impact Assessment Process

19.1 General

Respondent:	Amateur Fishing Association of the NT
Comment:	There is a comment in the Draft EIS that the rail loop will not be required for "...5-10 years, so details of the design are currently limited." (Draft EIS p. 26) If this is so, there would appear to be no pressing reason for it to be included in this project assessment. If, however, there is actually potential or rising demand for East Arm to be used to ship increased amounts of bulk minerals in the near future then a comprehensive environmental assessment should be conducted urgently covering all aspects of such a project.

Current demand on the EAW bulk mineral stockpile, handling, and export infrastructure does not warrant construction of the proposed rail loop at the present time. It is anticipated that the demand for bulk mineral export facilities will increase in the next 5-10 years, however, resulting from the establishment of new mines and the expansion of existing mines within the central Australian region. Should the anticipated increased demand for bulk mineral export infrastructure not eventuate, then construction of the proposed rail loop would not be required.

It is considered appropriate that the rail loop should be considered in the EIA at this time, as it is part of present planning. To not include it could give rise to accusation of incremental development approval, often referred to as 'development approval by stealth'.

Respondent:	Amateur Fishing Association of the NT
Comment:	The NT Government needs to urgently initiate a detailed and effective recreational boating safety awareness program for recreational boaters in Darwin to make them aware of navigational rules and aids that will allow them to safely navigate in Darwin Harbour in general and East Arm in particular.

The proponent understands the high importance of maritime safety and encourages the NTG to implement a boat safety awareness program for recreational boat users.

Respondent:	Darwin Harbour Advisory Committee
Comment:	... the Darwin Harbour Strategy establishes principles, goals and guidelines for development and activities in the Darwin Harbour region. This strategy should be applied in the design, development and operation of this project.

The principles, goals and guidelines of the Darwin Harbour Strategy have been applied to the Proposed Development where relevant. It is referenced within the DEIS as follows:

- Table 1-1 (p 16)
- Section 2.4.1 (p 33)
- Section 4.3.1

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	Definitions of categories need to be specified. For example, “important marine fauna species” should have a definition outlining the species that are included in this statement.

Key definitions are included in the Glossary of the DEIS. A list of abbreviations are also included in the DEIS. The example cited is not a formal category, and hence is not defined. Additional discussion of matters of national environmental significance (MNES) is provided at sections 14 and 21 of this SEIS.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The Main Report on pages 106 to 144 identifies various reports and summarises them. The key points to be derived from these reports, and the relevance to this project and the assessment of impacts should be provided in the Supplement.

Key points from the reports referred above have informed the DEIS. The relevance of these reports and the assessment of potential impacts associated with the Proposed Development are therefore captured within the DEIS Chapters referred to (i.e. DEIS Chapters 6-8). Republishing those chapters in this SEIS would be of no value.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Note that under a bilateral agreement, the proposed action still requires approval from the Australian Minister for Environment Minister under the EPBC Act which occurs during the “approval phase”.

The Proponent notes that under a bilateral agreement, the proposed action still requires approval from the Australian Minister for the Environment.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The Environment Protection (Sea Dumping) Act 1981 is not referenced, however it is a relevant legislation to this action and an application for Sea Dumping Permit must be submitted to the Commonwealth Government.

The preferred dredging methodology has been revised since publication of the DEIS. All dredged spoil will be disposed of onshore, into ponds at EAW. A sea dumping permit will therefore no longer be required.

Respondent:	Environment Centre NT
Comment:	(The need for) a more effective, transparent EIA process, with the Minister for Natural Resources, Environment and Heritage being the key decision making Minister.

This is a matter for response by the NTG, not the Proponent. However it is noted that the EIA process in the Northern Territory is administered under the *Environmental Assessment Act 1982* and the

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Environmental Assessment Amendment Act 1994 (together referred to here as the EA Act) and their Administrative Procedures. The Act and Procedures establish the framework for EIA, including the decision making process. The Proponent does not determine the EIA process applied to this development, or the elements of that process.

Respondent:	Environment Centre NT
Comment:	(The need for) clear, precautionary principle-based policies addressing dredging, stormwater management and mangrove protection.

Development of environmental policies is the responsibility of NRETAS, not the Proponent.

Respondent:	Environment Centre NT
Comment:	The Northern Territory Climate Change Policy was omitted from the list of relevant strategies / plans that are being considered in planning for the EAW Expansion. We strongly recommend that this Policy document be taken into account, especially given the location of EAW and the potential for future operations to be impacted by climate change.

Construction and operation of the Project will be undertaken with reference to the Northern Territory Climate Change Policy. This includes preparation of the CEMP for the MSB (refer Appendix H) construction and operational EMPs for the Project, and also project component specific EMPs.

Respondent:	Environment Centre NT
Comment:	Only economic-related objectives and targets (of the Territory 2030 Strategic Plan were) identified as being relevant to the EAW expansion. There are some equally-important environment-related objectives and targets: Objective 1: Custodians of our natural heritage. Objective 2: Sustainable living.

It is agreed that the quoted objectives are equally important, and these objectives have been taken into account in the DEIS. Objective 1 of the Territory 2030 Strategic Plan refers to activities undertaken to enhance the natural heritage of the NT. The primary purpose of the Proposed Development is to facilitate economic and social growth; the purpose of the EIA process is to ensure that the natural heritage of the NT is protected as much as is practicable in the construction and operation of the project.

Objective 2 has been considered during the development of the design concept, and will continue to be considered during the design finalisation, construction, and operation of the Proposed Development. Water saving measures, such as stormwater recycling, dual flush toilets, and low flow taps will be utilised where practicable. Construction and operation of the Proposed Development will comply with national environmental standards, and constructed buildings will comply with the Building Code of Australia. Increased greenhouse gas emissions associated with greater marine, rail and road

19 Regulation and Environmental Impact Assessment Process

traffic at EAW will be partly offset by increased efficiency of operations (e.g. fewer shunting activities required and fewer cars banked up along Berrimah Road due to rail operations).

Respondent:	Environment Centre NT
Comment:	We recommend that reporting on marine community health be included in the annual Darwin Harbour Region Report Cards.

All environmental monitoring data will be provided to NRETAS for review. NRETAS are represented on the Darwin Harbour Advisory Committee (DHAC), which produces the Darwin Harbour Region Report Cards.

Respondent	Department of Resources
Comment	The DEIS incorrectly places responsibility for marine pest monitoring and management with NRETAS. This responsibility rests with the Fisheries Division.

The responsibility of Fisheries Division to monitor and manage marine pests is noted.

19.2 Cumulative Impacts

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	... we are aware that at least one potential iron ore miner with prospects in the Roper River region is considering transporting between one and two million tones of iron ore per year by road / rail to Darwin and then shipping it over EAW... We are unclear as to the implications for other key issues such as increased shipping traffic in Darwin Harbour, the need for a much more extensive dredging program at East Arm for larger-capacity bulk ships and the need for dredging to allow larger bulk ships to actually access Darwin Harbour. These are all issues that should be part of a comprehensive environmental assessment and consideration of the rail loop in isolation has little value.

The EIA process for the EAW Expansion Project includes the construction of the rail loop and generalised operation of the expanded EAW facilities. Assessment of impacts directly associated with any specific mining operation would be within the scope of the EIA process required by the NTG as part of the development application for that particular proposal.

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	Our view is that any expansion of bulk minerals handling over EAW should be the subject of a separate EIS which considers all aspects including land transport, stockpiling, ship loading infrastructure, shipping movements in Darwin Harbour, suitable ship berthing, dredging requirements, dust management and storm water management.

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Potential impacts associated with these activities have been assessed by the DEIS and the SEIS, and will be managed under the DPC Environment Management System (EMS). Plans detailing the management of these issues have been prepared (refer Chapter 26 of the DEIS, and Chapter 8 and Appendix A of this SEIS), or will be prepared by contractors prior to commencement of construction and operation of the various project components. As noted in the previous response, any specific operation may also be subject to an EIA process required by the NTG as part of the development application for that particular proposal.

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	This submission should be read in conjunction with AFANT's submissions on the Ichthys Gas Field Development Project Draft EIS and the proposed Olympic Dam Expansion Northern Territory Transport Option Draft EIS. With the EAW Expansion these project potentially overlay each other spatially and/or temporally and it is not possible to carry out a viable assessment of environmental impact without considering them as a whole.

Refer to response below.

Respondent:	Amateur Fishing Association of the Northern Territory
Comment:	(Major areas of concern are): The requirements for channel and berth dredging and their cumulative impacts when considered in combination with the dredging program for the Ichthys Project The cumulative impacts of increased shipping and other boat traffic in Darwin Harbour. Monitoring the cumulative impacts of development in the Darwin Harbour area on recreational fishing.

Refer to response below.

Respondent:	Darwin City Council
Comment:	It appears that the East Arm Wharf Expansion Project development may be going to be undertaken in the harbour within a similar timeframe as the INPEX Browse Ltd Ichthys Gas Field Development Project. As such our response may need to be considered within a broader framework rather than in terms of this being a single harbour project, given the potential cumulative effects of several projects happening in the harbour at the same time and of the magnitude of the Inpex and East Arm Wharf project developments.

Refer to response below.

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Respondent:	Darwin City Council
Comment:	Whilst the amount of dredging required for the East Arm Wharf Expansion Project along with the depth and distance of the dredging may vary between the two projects, this does not negate the fact that there will be an additional and cumulative effect of churn happening in the harbour.

Refer to response below.

Respondent:	Darwin Harbour Advisory Committee
Comment:	DHAC believes that the impacts of this project should not be considered in isolation given the potential cumulative effects from other projects such as the Inpex Browse Ltd Ichthys Gas Field Development Project, Olympic Dam Expansion (NT Transport Option) project, the Darwin Shipping Proposal and marine traffic management.

Refer to response below.

Respondent:	Environment NT
Comment:	No discussion is entered into about possible cumulative effects that might arise as a result of the large-scale INPEX project, the EAW Expansion and the Port of Darwin (All Tides Access) Project getting underway in the next few years.

Refer to response below.

Respondent:	Dr. Ian Hollingsworth
Comment:	Cumulative impacts to Darwin harbour arising from this development are not assessed. For instance the extent of mangrove clearing associated with the project was assessed against the current area of mangroves in Darwin Harbour rather than a reasonable scientific baseline combined with reference to local conditions or the NT governments own water quality monitoring objectives in this part of Darwin harbour.

The EIA process for the EAW Expansion Project covers the construction and generalised operation of the expanded EAW facilities. Cumulative impacts have been assessed to the extent possible with the information available at the time of preparation, but as stated in the Guidelines (Section 7.5), the proponent will not have a detailed understanding of all future users of the expanded site. As also noted above, any specific operation may also be subject to an EIA process required by the NTG as part of the development application for that particular proposal.

19.3 Stakeholder Consultation

Respondent:	Darwin City Council
Comment:	... the DEIS was placed on public exhibition from 17 June to 5 August. However, we do not think this was well known by the wider community.

Noted.

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19.4 Strategic Environmental Assessment

Respondent:	Darwin Harbour Advisory Committee
Comment:	I once again stress the need to conduct a Strategic Environmental Assessment (SEA) of the Harbour region to support the purpose and application of the Darwin Harbour Strategy.

Refer to response below.

Respondent:	Darwin City Council
Comment:	Further and in view of such major projects as yours coming on stream during similar timeframes to other major harbour developments, this clearly demonstrates that in order to comply with assuring the good future health of the harbour region, there is now a critical need for a Strategic Environmental Assessment (SEA) for the harbour. A single SEA would provide a much stronger and more informed development framework for the cumulative impacts of developments in the Darwin Harbour region.

Refer to response below.

Respondent:	Environment Centre NT
Comment:	(The need for) Strategic Environmental Assessment of the Darwin Harbour region.

Strategic environmental assessment (SEA) as described (for the Darwin Harbour region) is the responsibility of NRETAS, not the Proponent. No legislation governing SEA exists within the NT at present. The EIA process for the EAW Expansion Project covers the construction and generalised operation of the expanded EAW facilities.

Risk Assessment

Respondent	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment	In the main part, DLP has relied on unsubstantiated assumptions to inform risk. Robust baseline surveys may be required as indicated throughout this submission. It is difficult to determine the extent to which information requirements outlined in section 6 of the draft EIS guidelines relating to Risk Assessment were addressed. Chapter 25 and Appendix Q of the Draft EIS contain very little detail and only briefly and generally acknowledge the inherent levels of uncertainty. The risk assessment components of subsequent draft EIS chapters contain little to no discussion of the residual risk (with the exception of marine pests, water quality and fire) that would be expected to be borne by the community.

The risk assessment was undertaken in accordance with the requirements of AS/NZS 31000:2009. This methodology relies to a degree upon assessment of activities based on assumptions made by experienced and qualified individuals. Where assumptions could not be made with a sufficient degree of certainty, review of technical literature was undertaken to better inform the assessment. Where suitable literature was not available, technical studies were undertaken.

Respondent	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment	Data in table 25-3 is unclear in its derivation, but in effect shows that the consequence of removing marine habitat with high biodiversity values has been applied a rating of low consequence, leading to the issue not having a significant end risk rating worthy of further consideration. This is an inappropriate rating, given the importance of the reef. It is also not consistent with rating the loss of mudflat-mangrove habitat ten times higher in the same table. Both habitats are important. This example shows the vulnerability/subjectivity of this risk evaluation methodology.

The relatively low impact rating assigned to removal of marine habitat reflects the small area of habitat which will be impacted, and also the known ability of benthic habitats to re-establish over time. This contrasts with the relatively large area of mudflat / mangrove habitat which would be removed (although small relative to the total habitat area in the region) and the fact that loss of the mangroves at the rail loop site would be permanent.

Respondent	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment	The risk assessment has rated impact of smothering of sediment mobilised by dredging operations on marine habitats as “minor”, which includes hard coral communities of South Shell Island and Old Man Rock. Modelling does not include coarse sediments and therefore there is uncertainty associated with the amount of sedimentation associated with dredging at the MSB making the risk of significant impact on coral communities “high”.

The risk assessment process determined that the major risk associated with sediment deposition was associated with fine sediments due to the composition of sea-floor sediments at the project site (refer Chapter 6 of the DEIS).

20 Risk Assessment

Respondent	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment	The guidelines for preparation of an EIS state “Any and all unknown variables or assumptions made in the assessment must be clearly stated and discussed. The extent to which the limitation, if any, of available information may influence the conclusions of the environmental assessment should also be discussed.”

Variables and assumptions are specifically noted with the revision of the following:

- Revised MSB access channel design, reducing the potential impacts to South Shell Island, benthic habitat, and the greater Darwin Harbour (refer Section 6.1).
- An environmental monitoring program for Darwin Harbour has been prepared (Coffey Environments 2010a) (refer Appendix A).
- Revision of dredged channel design resulting in a reduction of material dredged and duration of dredging (refer section 7.1).
- Onshore disposal of all dredged spoil, resulting in substantially reduced impacts to the marine environment (refer section 7.2).

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The draft EIS draws conclusions on a range of issues. These conclusions often appear to be based on assumptions that are implicit, rather than clearly expressed. The uncertainties that are associated with some of the concluding remarks in the text should have been explicitly documented throughout the draft EIS so that readers were able to ascertain the strength of conclusions drawn. For some of the key issues, this identification of uncertainties and assumptions could help to inform further studies or research that might need to be undertaken to reduce uncertainty. The <i>Supplement</i> should provide a comprehensive list of assumptions made against the conclusions they inform.

The DEIS is by its nature, a document that includes conclusions drawn by environmental and other professionals with extensive experience in their field. The conclusions drawn are based on information available at the time, including existing information from government and other EIS studies, and any particular field work undertaken in the preparation of the draft EIS.

The field work undertaken for a draft EIS aims to reduce any uncertainties in the conclusions drawn, as much as is practicable. However, ultimately a professional opinion on the potential impacts may need to be expressed, based on all the available information.

Contextual text on any uncertainties in the conclusions drawn is provided or is implicit in the relevant sections of the draft EIS text. There have been a number of significant EIS studies undertaken in the Darwin Harbour and other areas in the NT, including for projects constructed and in operation, that provide a good database for determining professional opinions.

It is noted that four examples of some of the assumptions in relation to dredging impacts were listed as part of this comment; these have been responded to in Section 7.2 of this Supplement.

Terrestrial Ecology

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The Supplement should provide specific details regarding Water Mouse survey techniques...

Methodologies utilised for the terrestrial flora and terrestrial fauna surveys undertaken were described in the Ecological Management Services (2011) Terrestrial Flora and Fauna Assessment, which was included as Appendix M of the DEIS. This includes the Water Mouse (*Xeromys myoides*), which was surveyed using trapping and hair funnel techniques, as well as searches for nests and other signs of habitation.

The Draft EPBC Act Policy Statement – Significant impact guidelines for the vulnerable water mouse *Xeromys myoides* (draft water mouse guidelines) recommend that a minimum survey effort required to trap the water mouse is 400 Elliott trap nights per four to five hectares of potential water mouse habitat. There is approximately 133 ha of potential habitat at the site of the Proposed Development, which equates to 10,640 Elliott trap nights required. Ecological Management Services (2011) trapping included 320 Elliott trap nights, which is less than that suggested by the draft water mouse guidelines.

It is noted that the draft water mouse guidelines are a draft document, and have not been finalised. It is also noted that:

- Additional recognised survey techniques were utilised (hair funnel techniques, as well as searches for nests and other signs of habitation).
- Previous assessments (Acer Vaughan 1993) did not detect the water mouse at the site.
- The species was not identified by Ecological Management Services as a priority species of interest as it has never been observed within Darwin Harbour by any previous studies (Ecological Management Services pers. comm. 28 October 2011).
- The study area (and associated water mouse habitat) is considerably larger than the proposed impact area.

Regardless of the above points, it is acknowledged that the presence of *Xeromys myoides* at EAW, although extremely unlikely, cannot be ruled out completely. Staff and contractor environmental inductions will therefore include details about the water mouse, and signs of potential habitation. If site personnel encounter a water mouse work will be stopped and the environmental management representative consulted. Where practicable the water mouse would be relocated away from the work zone into appropriate habitat.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	The Supplement should evaluate impacts of the proposal on migratory bird populations in the context of cumulative impacts from existing and other proposed developments within the whole harbour area.

Ecological Management Services (2011) stated that the project site does not qualify as an internationally important wetland, but that some migratory species, such as the Far Eastern Curlew (*Numenius madagascariensis*) are present at numbers approaching significant populations according to Ramsar criteria.

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Of the various bird survey sites at EAW, the overwhelming majority of individuals were observed at Pond D (2159 sightings at Pond D of 3722 total sightings at 14 sites in total). The artificial ponds at EAW, and Pond D in particular, therefore, represent more significant habitat for migratory bird species at EAW than other habitat types. The Proposed Development will not impact Pond D. Some reduction in pond area at EAW will be experienced, however, as a result of filling of dredge spoil ponds (refer section 7.2).

The only natural terrestrial habitat which will be impacted by the Proposed Development to any notable degree is mangroves / saltpan (of which 74 ha would be cleared for the proposed rail loop), at which 111 bird sightings were recorded. The 74 ha of clearance does not represent a significant loss in the context of the total Darwin Harbour mangrove extent.

In the context of cumulative impacts from existing and other proposed developments within the whole harbour area, it is difficult to comment with certainty on the potential cumulative impacts to migratory bird populations as details of proposed and future developments within and around Darwin Harbour are unknown to the Proponent. One could reasonably surmise from the findings of Ecological Management Services (2011), however, that any future pond construction associated with Darwin Harbour developments would be likely to create additional habitat for migratory bird species.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	In particular, further assessment of impacts to listed species is required for: • The potential impact of the dredging plume on listed species, including from the plume affecting species' habitat, including foraging habitat. This should also consider the impact of any 'double handling' that may be proposed. • The potential impact of the release of potential acid sulphate soils or acid sulphate soils on listed marine species or their habitat. • The potential impact, of any increase in lighting during construction or operations on listed species, including... marine turtles. • The potential impact of over-water maintenance, including the clean-up of anti-fouling coatings from steel structures on listed marine species or their habitat. • The potential impacts of removal of habitat. • The potential impact of increased vessel traffic for EPBC listed marine species. • The potential impact of piling noise on listed marine species. In order to assess this impact, the duration of piling taking place is required. The assessment documentation needs to provide transparent links to monitoring and mitigation measures. A discussion of the likely effectiveness of each of these measures in relation to the species and their habitat should also be provided... Therefore where appropriate, for the potential impacts listed above, the Supplement should clearly 'describe proposed mitigation measures and the efficacy of these. The above information for the following EPBC listed threatened and/or migratory species and their habitats is required to complete the assessment: • Migratory birds likely to be in the area according to the DSEWPaC Protected Matters Search Tool. • Water Mouse (<i>Xeromys myoides</i>).

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Migratory Birds

Dredging plume impact: The dredging plume is extremely unlikely to have any significant impacts on migratory bird species.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

With construction of the proposed rail loop undertaken in accordance with an NRETAS approved ASSMP, it is considered that ASS / PASS are unlikely to significantly impact the marine environment in general, or the Australian snubfin specifically.

Impact of increased lighting: Evans Ogden (1996) showed that sources of artificial lighting can potentially be hazardous to migratory birds. It is noted, however, that the EAW is an existing operational industrial and commercial port and already operates night lighting with no detrimental effects on migratory birds observed. Additional lighting associated with the Proposed Development represents an incremental increase over the lighting already operating, and a negligible increase in the context of the existing light sources present at Darwin, Palmerston, and the developed Darwin Harbour in general.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: Ecological Management Services found that several migratory bird species utilise the dredge spoil ponds at EAW for roosting habitat. Some reduction in pond area at EAW will be experienced as a result of filling of dredge spoil ponds (refer section 7.2).

Of the various bird survey sites at EAW, the overwhelming majority of individuals were observed at Pond D (2159 sightings at Pond D of 3722 total sightings at 14 sites in total). The Proposed Development will not impact Pond D. It is likely that birds that might otherwise have utilised Pond K will, once pond K is filled, utilise Pond D instead, or utilise natural habitat types within Darwin Harbour.

The only natural terrestrial habitat which will be impacted by the Proposed Development to any notable degree is mangroves / saltpan (of which 74 ha would be cleared for the proposed rail loop), at which 111 bird sightings were recorded. The 74 ha of clearance does not represent a significant loss in the context of the total Darwin Harbour mangrove extent.

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As migratory birds are mobile by nature, and can shift from Pond K to Pond D or natural habitats, and the amount of mangrove clearance associated with the Proposed Development is minor in the context of the region, habitat removal is not considered likely to significantly impact migratory bird species.

Impact of increased vessel traffic: Increased vessel traffic is extremely unlikely to impact migratory bird species.

The potential impact of piling noise: Piling noise is extremely unlikely to impact migratory bird species.

Water Mouse (Xeromys myoides)

Dredging plume impact: The water mouse (*Xeromys myoides*) has never been recorded at Darwin Harbour (Ecological Management Services pers. comm. 28 October 2011). The dredging plume is therefore extremely unlikely to impact this species.

Impact of ASS / PASS release: Risk of ASS / PASS disturbance is only associated with excavation of the bund wall for the proposed rail loop (refer section 10.3, and chapter 6 of the DEIS). Disturbance of ASS / PASS within marine sediments (i.e. beneath the seaward section of the bund wall) would not result in the release of acid to the marine environment as when submerged ASS / PASS will not oxidise and form sulphuric acid.

The Proponent acknowledges the possibility of disturbance of terrestrial ASS / ASS during construction of this project component, and that there is the potential for acid generated by these soils (if oxidised) to impact the marine environment through surface run-off (in the event of a rain event, for example). A detailed ASS survey of the proposed rail loop site will be undertaken prior to commencement of rail loop construction.

The CEMP for the proposed rail loop, to be prepared prior to commencement of rail loop construction, will include an Acid Sulphate Soils Management Plan (ASSMP) based on the findings of the ASS survey and prepared in accordance with current NRETAS requirements. Management of ASS / PASS will generally be in accordance with the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines (Department of Natural Resources and Mines 2002), which includes measures such as earthworks and stockpiling strategies.

Regardless of management measures, as the water mouse has never been recorded at Darwin Harbour (Ecological Management Services pers. comm. 28 October 2011) ASS / PASS is extremely unlikely to impact this species.

Impact of increased lighting: Artificial lighting is not known to negatively impact the water mouse.

Impact of over-water maintenance: It is not anticipated that anti-fouling coatings will be required for the structure comprising the Proposed Development.

The potential impacts of removal of habitat: The water mouse (*Xeromys myoides*) has never been recorded at Darwin Harbour (Ecological Management Services pers. comm. 28 October 2011). It is acknowledged, however, that the mangrove / salt pan habitat at EAW is similar to water mouse habitat in other parts of Australia. Impacts on the species associated with habitat removal are extremely unlikely, but proposed management measures are nonetheless described above.

Impact of increased vessel traffic: Increased vessel traffic is extremely unlikely to impact this species.

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The potential impact of piling noise: Piling noise is extremely unlikely to impact this species.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This statement (it is likely that mangroves will recolonise this area naturally) is also an assumption that the mangroves will recolonise the area naturally – over what time? What is proposed to facilitate the natural recolonisation of mangroves?

Natural mangrove recruitment is likely to occur in areas where suitable conditions become available as result of the project. For example, in some areas along the seaward edge of perimeter bunds (rock walls), substrate and salinity conditions suitable for mangrove recruitment and survival are likely to occur at the appropriate elevation (between Mean Sea Level and Mean High Water Springs).

Perimeter bunds are also likely to form deposition areas for mangrove seed (propagule) dispersal. Mangrove propagules become entrained in tidal waters and, during high tides, may be deposited at the base of the bunds which form a barrier to further entrainment. The extent and timing of such mangrove recruitment and colonisation is dependent on a range of site factors. Based on monitoring of mangrove recruitment (similar recruitment process to that described above) into the Darwin Liquid Natural Gas pipeline shore crossing at Wickham Point, mangrove seedling recruitment and growth to sapling / small tree height (1-3 m high) is projected to take 5-10 years.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	It may be true in a broad regional scale that 74 ha is not a great deal but in a local context, these mangroves may be critical in assisting in achieving local water quality objectives for this part of the harbour.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts, and Sport
Comment:	Figure 15-1 shows impacts upon important marine habitats from the footprint of the MSB (alternative rock loadout facility/wharf?), and the alignment of its dredged approach channel. A single spur arrangement may be less efficient than a rail loop but it could mean that impact to 58 ha of mangroves inside the rail loop is avoided. Alternative configurations need to be considered to avoid and minimise impacts from loss of marine habitats with high biodiversity value.

The EIS predicts that the maximum extent of potential mangrove loss from the project footprint is 74 ha with this loss being largely related to the rail loop. The 74 ha of mangrove loss is comprised of 22 ha from the placement of the rail corridor and loop (i.e. direct clearing of mangroves) and 52 ha from the impoundment of mangrove habitat within the rail loop (potential indirect loss).

It is acknowledged that a single spur would impact the mangroves at East Arm to a lesser degree than the proposed rail loop. However the benefits of a loop (refer Chapter 2 of the DEIS) are considerably greater than that of a spur line, and are considered significant enough to justify clearance and potential indirect loss of up to 74 ha of mangroves.

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While the loss of mangroves from the rail loop is regrettable it should be noted that the expansion area falls within the Development Zone of the NT Planning Scheme (DPI 2008) which provides for “areas in, and around, which human developments and activities may occur, with accepted non-reversible changes to mangroves areas as required for the success of the development”. That is to say, the intent of the NT Planning Scheme is that this area will be developed.

Respondent:	Environment NT
Comment:	We expect mangrove extent and health to be carefully monitored and recorded, not only during EAW Expansion construction but during the Port's ongoing operation as well.

A specific mangrove monitoring program is not undertaken at East Arm. The soil monitoring program, however, includes three monitoring locations on the eastern perimeter of the mangroves to the north of EAW. Any visible impacts to the mangrove community at these sites would be noted by an experienced DPC environmental professional and raised as an environmental observation. These observations will then be investigated as per DPC's Environmental Management System (EMS) procedures. However it is noted that no impact to mangrove health outside of the proposed rail loop is expected, based on the negligible impact to mangrove health associated with the current EAW development.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The DPC Masterplan 2030 indicates a conceptual layout for ponds and drainage is being developed and will be released in 2010. This information must be provided in the Supplement. In the draft EIS it was stated that a stormwater strategy for new and existing areas of the wharf was being developed. It is expected this strategy is included as part of the <i>Supplement</i> to assess whether stormwater management will be adequately implemented to protect Darwin Harbour water quality.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	More detail is required on overall site management of stormwater for the proposed projects. Detail what happens after the 'first flush' and what rainfall event constitutes a first flush. What happens to oil spills that happen during the wet season?

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Clarify overall site management of stormwater at all the proposed developments.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	More detail is required on stormwater management on site incorporating the expanded developments – a conceptual layout of location and capacity of drains, sediment ponds water flow directions, discharge points etc is required to be provided in the Supplement.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide more detail on stormwater management and why only interim measures rather than permanent measures are being integrated into the drainage system for the propose works.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide details in the Supplement that indicate the existing stormwater system at EAW has sufficient capacity for the proposed expanded developments.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	A conceptual layout map should be included to show surface water flows.

Refer to response below.

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The plans to improve existing stormwater management should be committed to the Supplement as part of the expansion works.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Demonstrate consideration and management of potential for impacts to surface-water quality from: Proposed and existing ore stockpiles. Metalliferous dust is likely to be washed into waterways; Acidic and / or metalliferous drainage potential may exist in stockpiles, leading to contamination of stormwater run-off; ASS / PASS soils disturbed by construction activities may release acidic and / or metalliferous run-off.

Refer to response below.

Respondent:	Environment Centre NT
Comment:	We emphasise the need for strict controls to manage potential on-site stormwater contaminants. We note that plans are underway to improve stormwater management, but there is still some uncertainty regarding what mitigation and control measures will actually be employed. This uncertainty must be resolved, with measures detailed in the Supplementary EIS, to demonstrate that any discharge from the development site will not impact on water quality, and in turn, marine life.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Stormwater and Wastewater Management Plans are to be included in the Supplement.

Refer to response below.

Respondent:	Dr. Ian Hollingsworth
Comment:	The links between the risk assessment results and project commitments are weak. For instance commitments made to manage high profile risks to water quality from contaminated water runoff from ship loading operations and hardstands refer to monitoring and stormwater management, rather than avoidance though adequate specification of on-shore facilities.

A Water and Marine Sediments Management Plan (WMSMP) was included in the DEIS, which detailed the proponent's commitments to managing impacts to the marine environment of surface water runoff. The WMSMP was written at a necessarily high level as the scope includes the entire Project.

The constructors and operators of each component of the Project will prepare site specific construction and operational Stormwater Management Plans for each component of the Project. It is not possible to specify the individual stormwater management measures specific to each project

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component at the planning stage, but the final design and construction methodology for each component will be required to comply with the DPC EMP and also the EMP for the Project (i.e. Chapter 26 of the DEIS).

A Drainage Strategy has been prepared for the whole of EAW (Aurecon 2011a). The EAW Drainage Strategy is included as Appendix C of this SEIS. Implementation of the Aurecon (2011a) EAW Drainage Strategy is subject to review and approval by NRETAS prior to commencement of construction.

Options assessed when preparing the Drainage Strategy address outcome based criteria, opportunities and constraints, existing data, and activities and controls in place at the EAW. The Strategy then considers further management and engineering options to address minimisation, management, monitoring and response actions in relation to improving stormwater management, and provides recommendations for marine water quality monitoring with regard to Australia and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guideline values.

The Darwin climate has very high rainfall with most falling during intense rain periods between December and March, and, given space limitations at the EAW, containment of all stormwater is not feasible. A risk based approach was therefore utilised by Aurecon (2011a) to reduce the potential for contamination of stormwater, and to reduce the potential of contaminated stormwater to enter the marine environment.

Aurecon (2011a) have recommended a combination of engineering and preventative measures to manage and / or mitigate potential surface water contamination, and subsequent impacts to local marine water. A water quality monitoring program will assess the efficacy of the engineering and preventative measures over time. The recommended water quality impact management / mitigation measures are detailed at section 5.2 of the Aurecon (2011a) Drainage Strategy. Both short term and longer term actions are included.

A key recommendation of the Drainage Strategy, which will be implemented, is the diversion of stormwater from mineral loading areas to retention ponds instead of discharging untreated stormwater to Darwin harbour. Aurecon (2011b) have also prepared a Retention Pond Design Summary Report, which details the proposed designs of the pump storage, settlement and retention ponds, and also includes a stormwater management concept plan for EAW.

This report shows that site surfaces will be graded to direct untreated surface water away from the marine environment and towards ponds (refer Figure 22-1). The Aurecon (2011b) report is included as Appendix D of this SEIS. Implementation of the Aurecon (2011b) Retention Pond Design Summary Report is subject to review and approval by NRETAS prior to commencement of construction.

As the MSB is anticipated to be the first component of the project to be constructed and operational, a project component specific stormwater management plan has been prepared for this project component. The MSB plan is more detailed than that for the whole EAW plan (Aurecon 2011b) as it presents design detail of a component of the overall EAW. It has been prepared by the contractor to inform construction of the MSB. Similarly detailed stormwater management plans will be prepared for the remaining project components and approved by NRETAS prior to construction.

It is noted that the draft MSB stormwater plan shown at Figure 22-2 and Figure 22-3 presently shows treated stormwater being discharged via two culverts to Darwin Harbour. This design will be revised

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prior to construction such that the MSB stormwater system will discharge into the EAW stormwater system, and ultimately to Pond E.

The reference in the DEIS to “interim measures” refers to temporary stormwater management measures which may be implemented during the construction phase of the Project.

Management of potential water quality impacts associated with excavation and stockpiling of PASS and / or ASS will be addressed in the CEMP and ASSMP for the proposed rail loop (as ASS or PASS are not expected to be encountered at the other project component sites).

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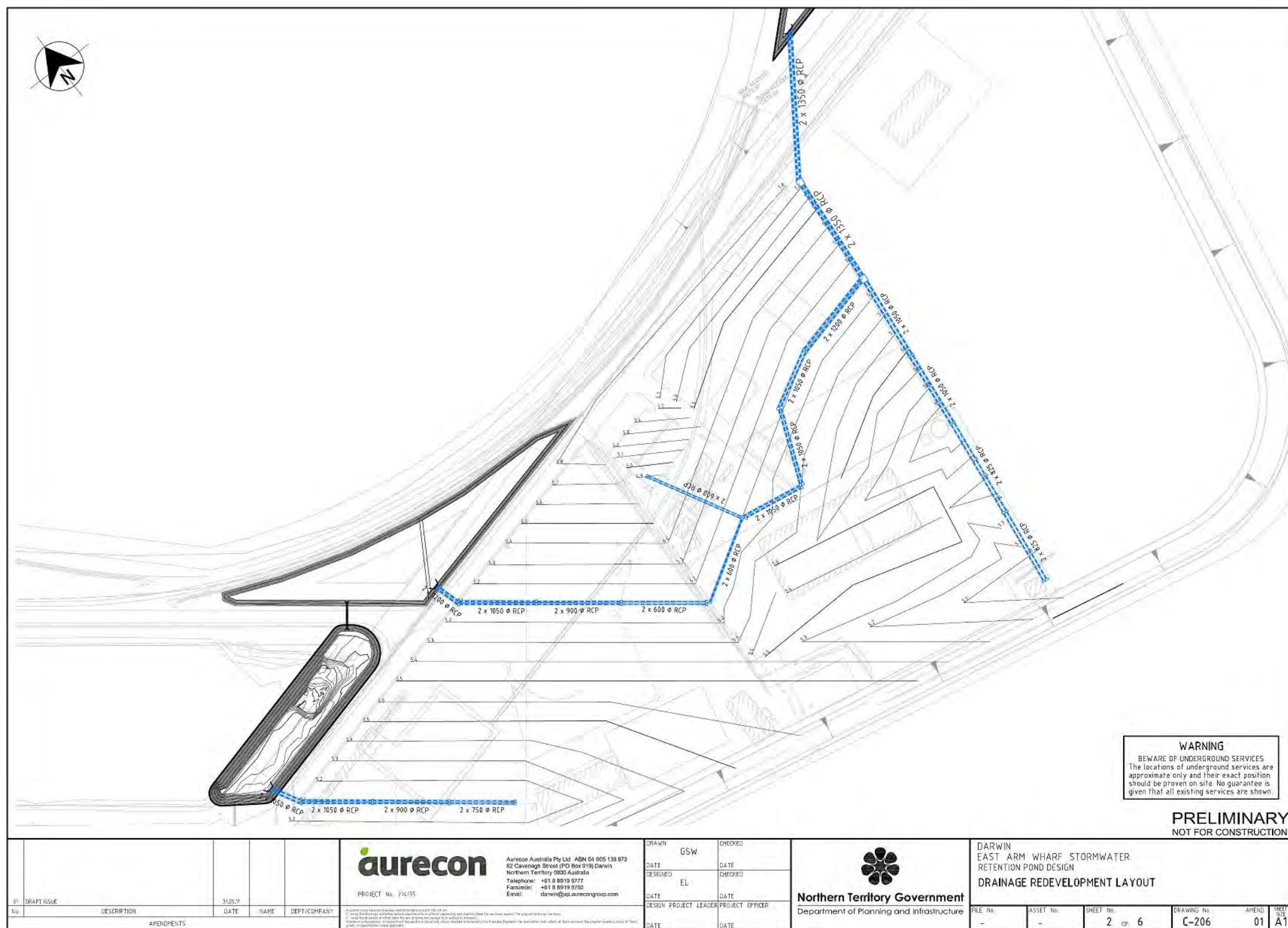


Figure 22-1 East Arm Wharf concept stormwater plan (excluding Marine Supply Base).

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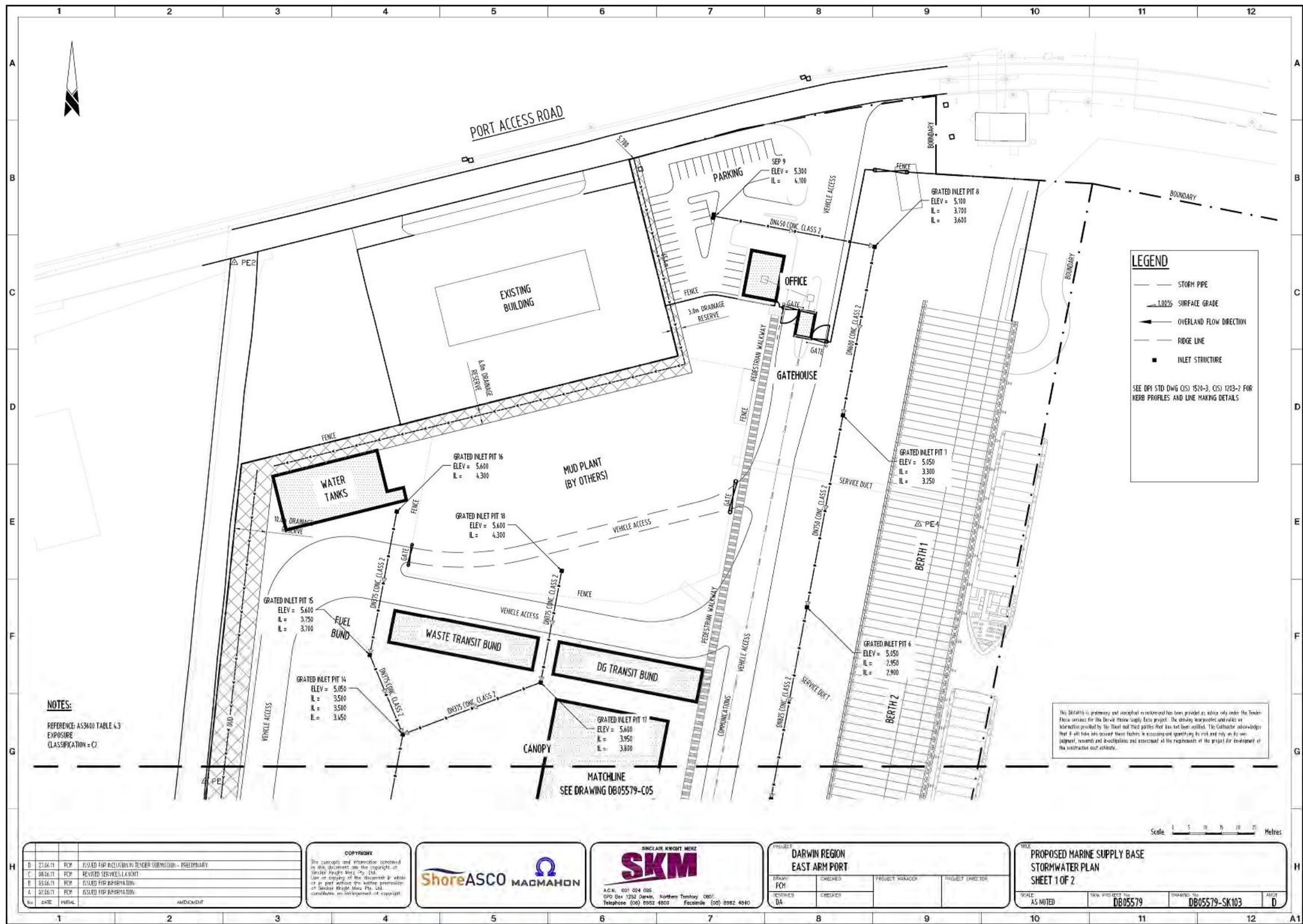


Figure 22-2 Marine Supply Base concept stormwater plan excluding (1 of 2).

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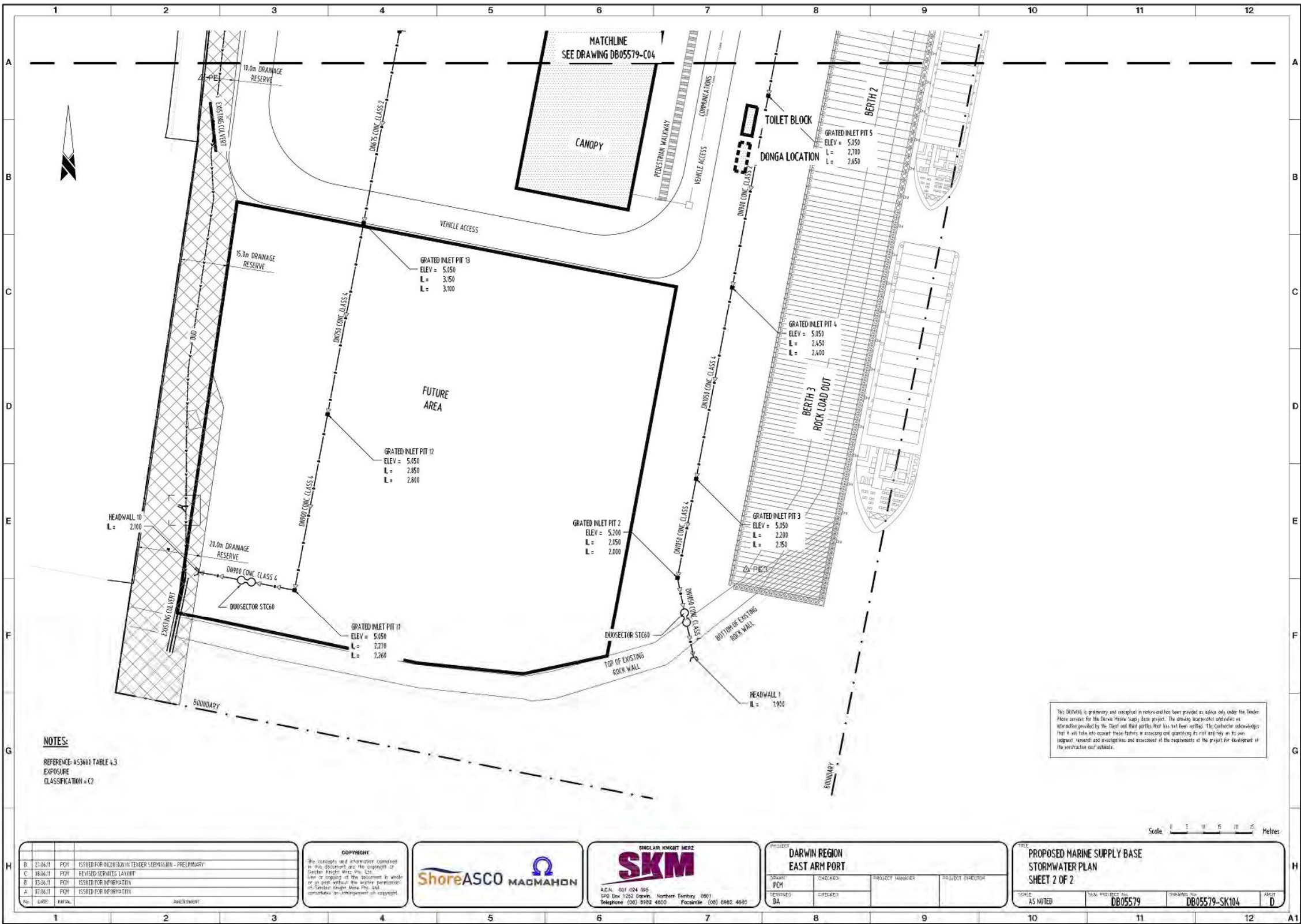


Figure 22-3 Marine Supply Base concept stormwater plan excluding (2 of 2).

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Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	A better commitment would be to take on the EPA's recommendation (EPA: Final Inquiry Report: East Arm Copper Concentrate Incident, March 2011) that the groundwater and surface monitoring performance is reported annually in the public domain.

All environmental monitoring results will be provided to NRETAS.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Provide more detail on pond location – it is not clear in Figure 12, Appendix B.

A revised DMP is provided at Appendix E.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport (Preamble)
Comment:	... any monitoring results and analysis that has been conducted over the last 16 years should be provided in the Supplement. The recommendation for a stormwater management plan from the 1994 EIA remains a requirement to be included the 2011 Supplement incorporating the expanded works.

Historical water quality monitoring data is included in electronic format as Attachment 2. The current DPC environmental monitoring program, which includes surface water monitoring, is included at Appendix A.

22.1 Groundwater

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	This is very reactive and relies on a robust monitoring program to detect water management issues and then actively control measures in a timely manner. Provide groundwater quality objectives in the Supplement.

Sources of relevant quality objectives for groundwater monitoring are listed at section 10.3.1 of the DEIS.

Respondent:	Environment NT
Comment:	Uncertainty also exists about the site's groundwater hydrology and hydraulics. Further information needs to be provided in the Supplementary EIS to demonstrate that the proponent will be effectively monitoring groundwater quality and ensuring that local ecosystems are not being adversely affected.

The proposed groundwater monitoring program is described in detail at page 168 of the DEIS. Final numbers and locations of boreholes will depend on the final design of the Project, specifically the

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locations of bare and paved areas throughout the site. Monitoring of groundwater wells will be undertaken.

The proponent and all contractors will act in accordance with the *Water Act 1992* (Water Act), *Water Regulations 1992* (Water Regulations), and *Water Supply and Sewerage Services Act 2000* (WSSS Act).

Visual Amenity

Respondent:	Department of Lands and Planning (Strategic Lands Planning)
Comment:	The site is clearly visible from Stokes Hill Wharf and the lighting very intrusive. Any expansion of the lighting on the future Port may have an even greater impact on the tourism and local visitors at The Wharf. It is recommended that an assessment of light impacts on Stokes Hill Wharf be undertaken and measures identified to address this issue.

Refer to response below.

Respondent:	Dr. Ian Hollingsworth
Comment:	The visual impact assessment is inadequate. The assessment provided is essentially that for the INPEX Blaydin Point project with the objective reference point changed to East Arm. Ship loading operations, which I understand from the documentation to be mainly dry particular bulk materials, could be highly sensitive. No information to assess the implications of a very high impact development immediately adjacent to the metropolitan area have been presented

The EAW precinct is approximately 10 km from Stokes Hill Wharf. While it is acknowledged that light emitted from the EAW is visible from Stokes Hill Wharf under certain conditions, the statement that the impact of this light is “very intrusive” is disputed. There are several locally emitted light sources at Stokes Hill Wharf after dark (the only time the EAW lights are visible):

- Street lights.
- Other outdoor lights such as those illuminating fishing areas.
- Stokes Hill Wharf tourism precinct lighting.

The nearby Waterfront Precinct and the Darwin CBD also contribute significantly to ambient light at Stokes Hill Wharf. Locally emitted ambient light at Stokes Hill Wharf is therefore sufficiently bright that the light emitted from EAW represents a negligible proportion of visible light, and is not an obvious presence from the vast majority of viewpoints. It is also noted that light emitted from other Darwin Harbour developments, such as the ConocoPhillips facility at Middle Arm, is also visible from Stokes Hill, reducing the visual impact of EAW relative to it being an isolated light source.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	The INPEX and EAW sites are ~3 km apart, which may be significant at some of the viewpoints. The assumption (that the same sites will be screened from the Proposed EAW project as are screened from the INPEX site) could be validated with photographic evidence.

It is considered that differences in visual impact at the major local visual impact receptor (i.e. Darwin) between the Project and the proposed INPEX project will be negligible.

Waste and Hazardous Materials

24.1 Waste

Respondent:	Environment NT
Comment:	We recommend that reporting on waste outputs, recycling and disposal be done as part of the environmental management program.

The EAW EMP (Coffey Environments 2010a) includes the following waste management targets:

- Recycling facilities and systems in place to allow the separation and recycling of materials (including, paper, cardboard, drink containers, scrap metal, waste oil, lead acid batteries and printer cartridges).
- Manage quarantine waste in accordance with AQIS requirements
- Manage general waste to prevent litter, odour and pest infestations.

A recycling program (for office paper and cardboard, plastics, glass, batteries, and scrap metal) will be implemented during construction and operation of the Project. Quantification of all waste outputs and recycled materials from the expanded EAW, however, will not be practicable.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	How many portable toilets will need to be provided during construction and has the option to connect to sewer been considered? If mains connection is not an option, a wastewater management plan (WWMP), including location of wastewater system is required.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	As the expansion works will result in at least 20 permanent employees, the option of connecting the whole area to the sewer must be considered to minimise issues with waste water. Effluent from the 50EP treatment plant should be tested to establish its quality and a flow monitor used to determine the amount of water the system is treating. The system treats the wastewater and discharges to the harbour via the stormwater drain located at the front of the large holding tanks. The connection to sewer should not be limited to buildings associated with the MSB and tug berth areas but also incorporate administrative buildings on the original handstand area of the wharf. If sewer is ruled out as an option then the port will need to work on a wastewater management plan. This will need to include the location of the wastewater systems. A waste discharge license for the treatment plant that discharges to the harbour would be required.

Refer to response below.

24 Waste and Hazardous Materials

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Detail management of the following to prevent its entry into Darwin Harbour: Sewage from vessels docked at the wharf; Litter including plastics from vessels; and Contaminated stormwater. Identify and detail expected routine vessel and wharf discharges into the marine environment, and demonstrate management to prevent significant environmental impacts from these practices in the short and long term. Consider discharges, such as vessel internal-pipe-flushing solutions, oily bilge waters, fuel spills, ballast waters and mineral ores.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Sewage is to be made available to all allotments in the EAW to mitigate public health and environmental issues resulting from the effluent discharges from onsite wastewater systems.

Refer to response below.

Respondent:	Department of Natural Resources, Environment, The Arts and Sport
Comment:	Stormwater and Wastewater Management Plans are to be included in the Supplement.

Sewage generated during the construction and operational phases of the Project, including that generated from docked vessels, will be collected in storage tanks and disposed of offsite at a licensed wastewater treatment facility. Four portable toilets (three male, one female) will be temporarily installed at the worksites during construction of each project component. The portable toilets will discharge to storage tanks (one tank will be located within each project component work zone), which will be pumped to a tanker truck and disposed of by licensed waste disposal contractors.

The CEMPs, to be produced by contractors for each project component will include WWMPs. As the work zone layouts for each project component have not yet been finalised, the specific locations of toilets, basins, storage tanks and other wastewater infrastructure are currently unknown. The construction WWMPs for each project component will include work zone plans showing the location of wastewater infrastructure.

During the operational phase of the Project toilets, bathrooms, and kitchen facilities will be installed within each project component by the contractors as required. All wastewater will discharge to storage tanks and be disposed of off site at a licensed wastewater treatment facility. The wastewater infrastructure design for the proposed MSB is shown at Figure 24-1 and Figure 24-2.

Litter generated by vessels docked at the MSB will be transferred in sealed bags or lidded containers from the vessel to the waste transit bund (refer Figure 24-2). Waste from the waste transit bund will be collected regularly by a licensed waste disposal contractor. A similar arrangement will be utilised at the barge ramp (i.e. covered and bunded litter storage area).

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Stormwater management is discussed at Chapter 22. There will be no discharges from the Project or docked vessels into the marine environment.

24 Waste and Hazardous Materials

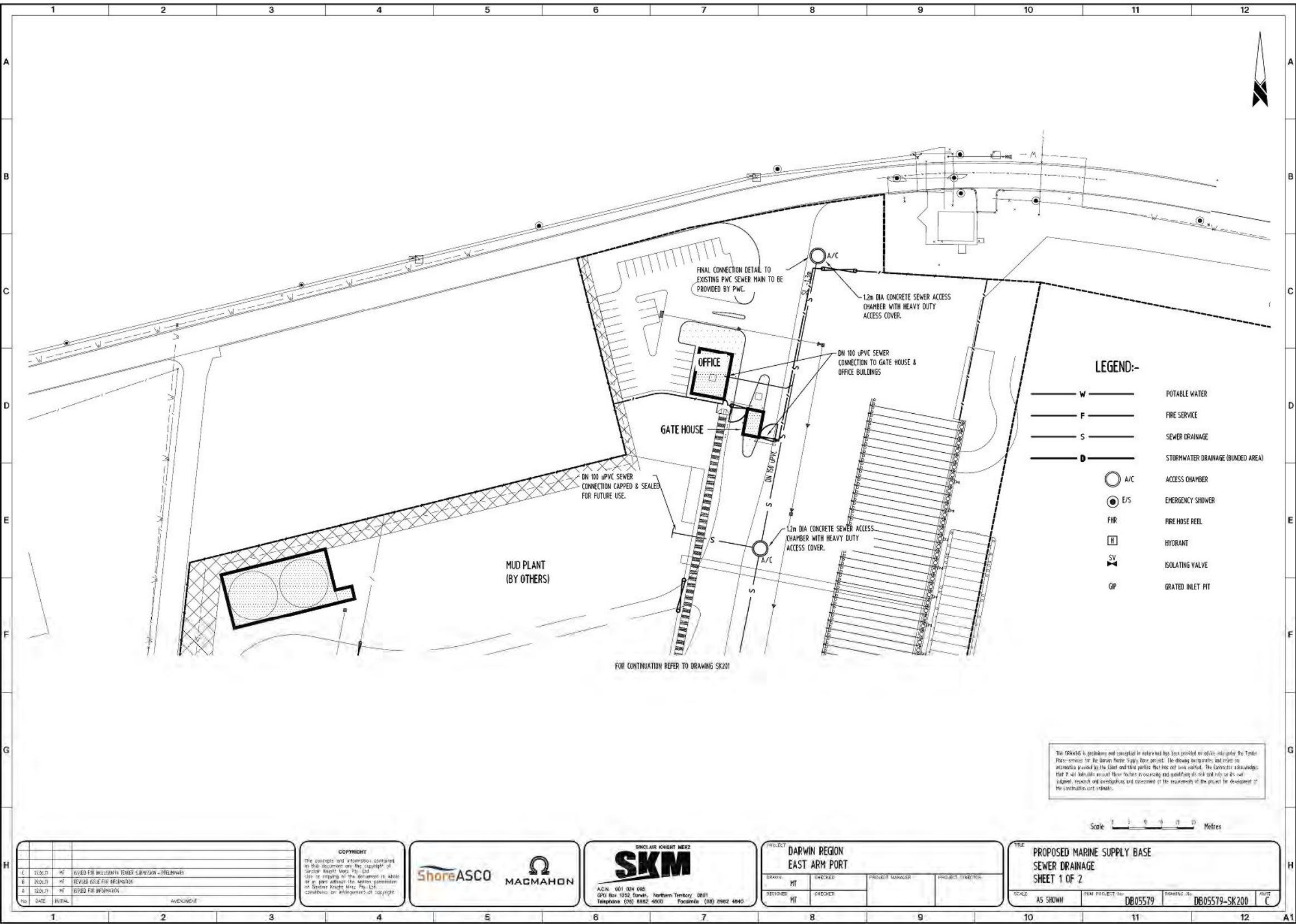


Figure 24-1 Marine Supply Base wastewater management infrastructure (1 of 2).

24 Waste and Hazardous Materials

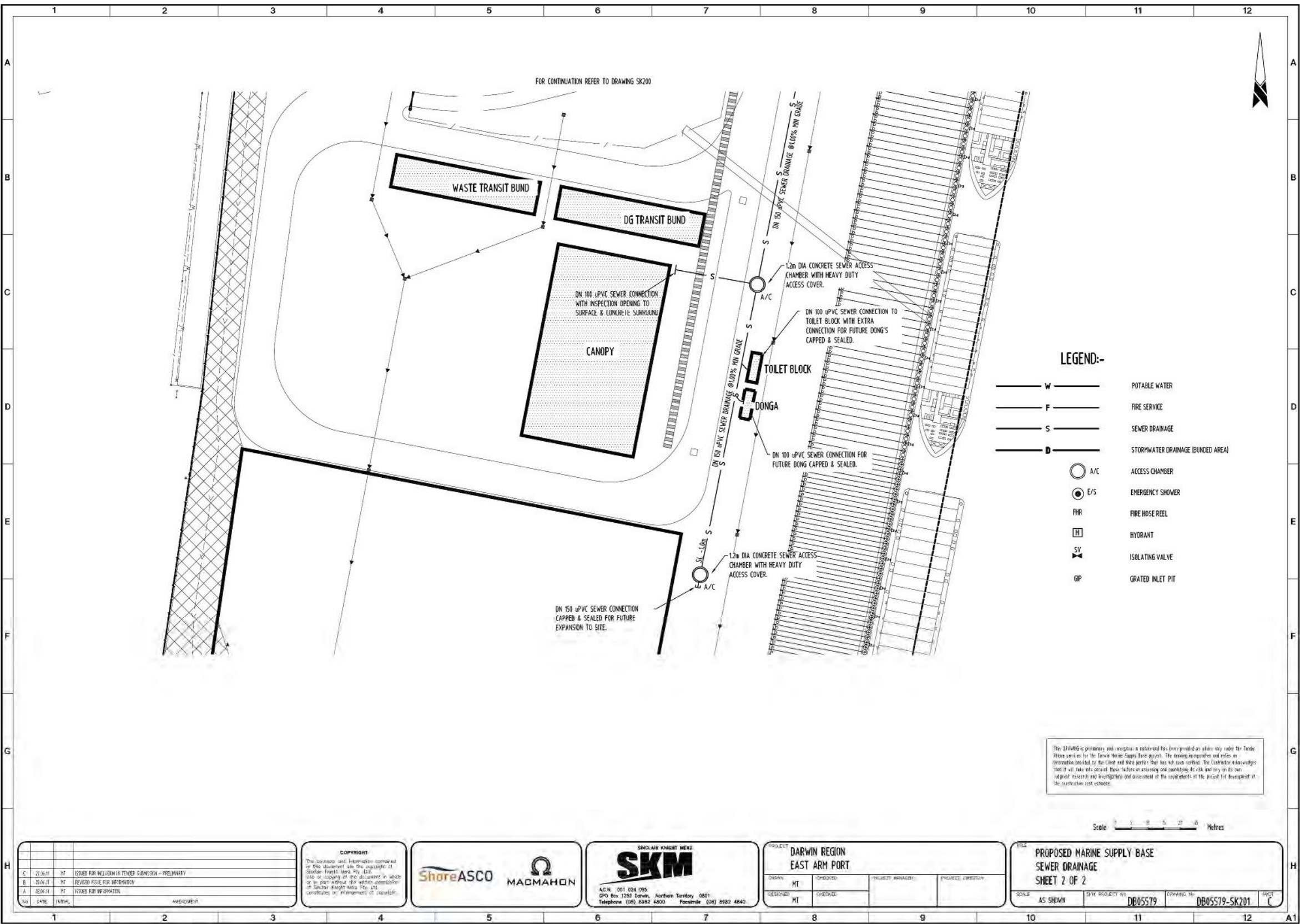


Figure 24-2 Marine Supply Base wastewater management infrastructure (2 of 2).

24 Waste and Hazardous Materials

24.2 Hazardous Materials

Respondent:	Environment NT
Comment:	We recommend that conservative absolute limits be set for the volume or quantity of certain materials (e.g. fuels, acids, lubricants) stored on-site, particularly those materials that will pose a threat to Harbour health in the event of storage structures being compromised. Importantly, the establishment of storage limits will also allow for better emergency response planning, particularly for worst-case scenarios.

The exact quantities of hazardous materials to be stored at the barge ramp and MSB are not known at this stage. Quantities will be relatively low, however, and the hardstand will only be used for short term storage and materials in general will be delivered on a 'just in time' basis. Fuel will not be stored at the MSB as the bowsers will be plumbed in directly to the existing fuel pipeline at EAW (refer Figure 24-3). Fuel supply to the barge ramp, if required, is likely to be provided using a similar design.

Hazardous materials stored at the proposed MSB and / or barge ramp, in addition to fuel, are likely to be limited to drilling mud, lubricants, and cleaning products. Hazardous fuels will not be stored in significant quantities at either the proposed small vessel berths or the rail loop.

24 Waste and Hazardous Materials

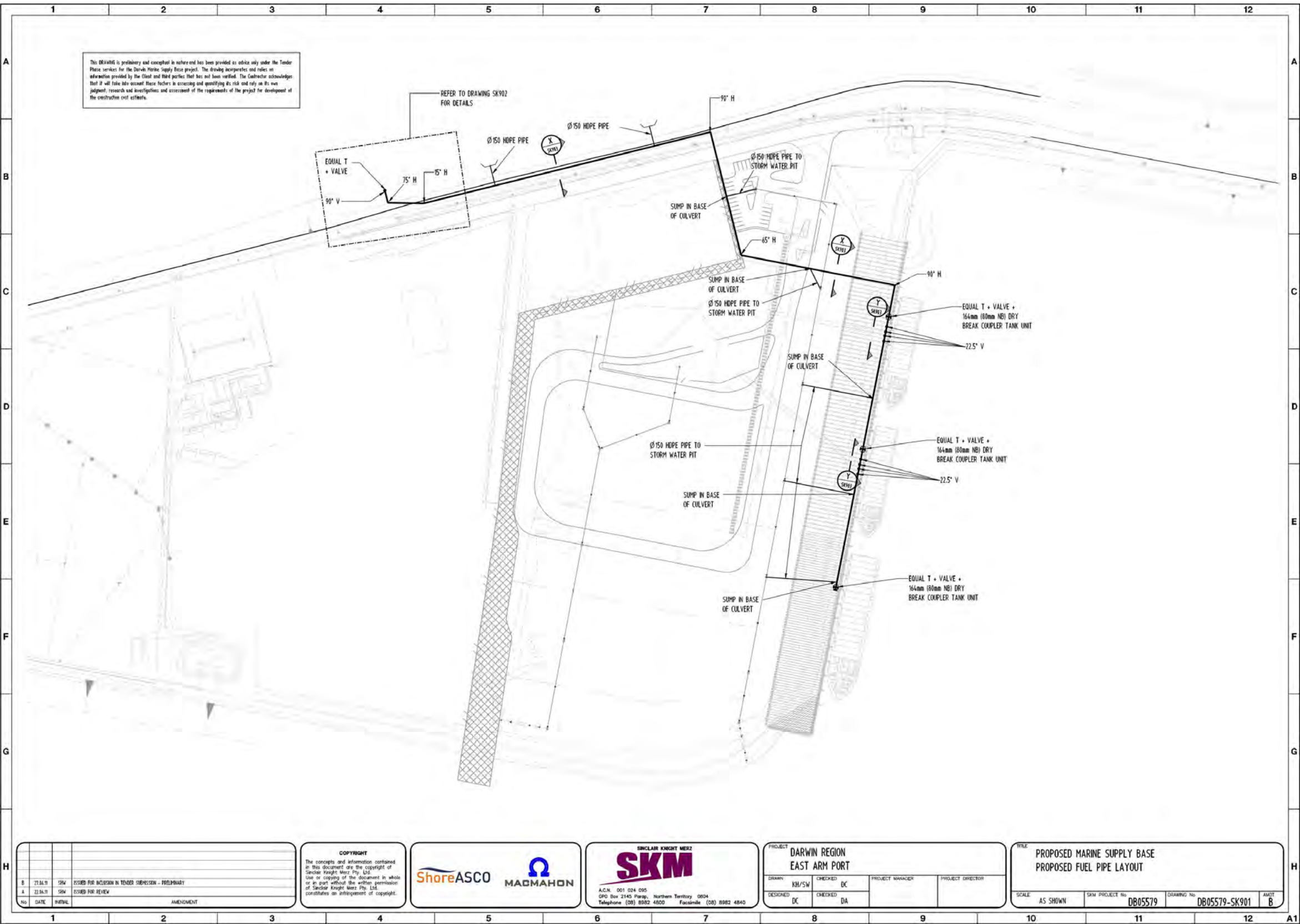


Figure 24-3 Marine Supply Base fuel supply infrastructure.

24 Waste and Hazardous Materials

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References

- Acer Vaughan, 1993a, *Draft Environmental Impact Statement. Darwin Port Expansion- East Arm*.
- Acer Vaughan (1995) *Assessment of Acid Leachate in Marine Sediments Geotechnical Investigation. East Arm Port Alternative Development Stage 1A Including Long Term Alternative Masterplan*. Report prepared for the Northern Territory Department of Transport and Works.
- AECOM (2009a) *Notice of Intent for the Proposed Expansion Works at East Arm*. Prepared for the Northern Territory Department of Planning and Infrastructure.
- AECOM (2011a) *Dredge Management Plan*. Report prepared for DPC.
- AECOM (2011b) *The benthic environment of the Ichthys Gas Field Development Project: invertebrate fauna, habitats and impacts*. Report prepared for INPEX Browse.
- Aurecon (2011a) *East Arm Wharf Drainage Strategy: Issues, Options and Guideline Recommendations*. Report prepared for DPC.
- Aurecon (2011b) *Retention Pond Design Summary Report*. Report prepared for DPC.
- BHP Billiton (2009) *Olympic Dam Expansion Draft Environmental Impact Statement 2009*. Accessed online 23 February 2011 at (<http://www.bhpbilliton.com/bb/odxEis/downloads/draftEisDocuments.jsp>).
- BHP Billiton (2011) *Olympic Dam Supplementary Environmental Impact Statement 2011*. Accessed online 13 October 2011 at (<http://www.bhpbilliton.com/home/aboutus/regulatory/Documents/Olympic%20Dam%20Supplementary%20EIS/Documents/1%20Supplementary%20EIS%20-%20Front%20Pages.pdf>).
- BOM (1977) *Report on Cyclone Tracy December 1974*. Department of Science, Bureau of Meteorology, AGPS, Canberra.
- Coffey Environments (2010a) *Darwin Port Corporation Environmental Monitoring Program Outline*. Report produced for DPC.
- Coffey Environments (2010b) *East Arm Wharf Environmental Management Plan*. EMP produced for DPC, accessed 23 September 2011 at (http://www.darwinport.nt.gov.au/sites/default/files/documents/enviro/dpc_enviro_managment_plan_eaw_122010.pdf).
- DCI (2011) *Arnhem Highway Road Works*. Accessed online 23 September 2011 at (<http://www.nt.gov.au/infrastructure/projects/arnhemhighway/documents/Fact-Sheet-Arnhem-Hwy-Seal.pdf>).
- DLP (2011) *East Arm Wharf Expansion Project Draft Environmental Impact Statement*. Report prepared for DLP, Darwin, Northern Territory, for the Commonwealth Government, Canberra, ACT, and the Northern Territory Government, Darwin, Northern Territory.
- DPC (2010) *Cyclone Management Procedures 2010-11*. Accessed online 19 October 2011 at (http://www.darwinport.nt.gov.au/sites/default/files/documents/policies/cyclone_management_procedures%202010_11.pdf).
- DPC (Undated) *Port of Darwin Fact Sheet 1*. Accessed 30 October 2011 at (http://www.darwinport.nt.gov.au/sites/default/files/documents/publications/DPC_fact_sheet1x.pdf).

25 References

- Department of Natural Resources and Mines (2002) *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Accessed online 26 October 2011 at [http://www.derm.qld.gov.au/land/ass/pdfs/soil_mgmt_guidelines_v3_8.pdf].
- Ecological Management Services (2011) *East Arm Wharf Expansion Project Terrestrial Flora and Fauna Assessment*. Report prepared for URS Australia / DLP.
- Evans Ogden, L.J. (1996) *Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds*. World Wide Fund for Nature, Canada.
- Fogarty, P. J., Lynch, B. & Wood, B., 1984, *The Land Resources of the Elizabeth, Darwin and Blackmore Rivers, Technical Report – Number 15*.
- Fortune, J. (2006) *The grainsize and heavy metal content of sediment in Darwin Harbour*. Environmental Protection Agency, NRETAS. Report No. 14/2006D.
- Geo Oceans (2011) *Ichthys Gas Field Development Project: benthic habitat mapping of the Darwin region—methods of data collection, collation and map production*. Report prepared for URS Australia Pty Ltd and INPEX Browse.
- GHD (2011a) *Report for Inshore Dolphin Survey, Darwin Harbour (Middle and West Arm): Summary Report for Survey Block 1 (28-31 January, 2011)*. Report prepared for INPEX Browse.
- GHD (2011b) *Report for Inshore Dolphin Survey, Darwin Harbour (Middle and West Arm): Summary Report for Survey Block 2 (9-11 February, 2011)*. Report prepared for INPEX Browse.
- GHD (2011c) *Report for Inshore Dolphin Survey, Darwin Harbour (Middle and West Arm): Summary Report for Survey Block 3 (6-8 March, 2011)*. Report prepared for INPEX Browse.
- INPEX Browse (2009) *Ichthys Gas Field Development Project Draft Environmental Impact Statement*.
- INPEX Browse (2011) *Ichthys Gas Field Development Project Draft: supplement to the draft environmental impact statement*. Report prepared for INPEX Browse, Ltd., Perth, Western Australia, for the Commonwealth Government, Canberra, ACT, and the Northern Territory Government, Darwin, Northern Territory.
- Johnson, C. S. (1967) Sound detection thresholds in marine mammals, in '*Marine Bioacoustics II*' (Ed W. N. Tavolga), Pp 247–60, Pergamon, Oxford.
- Melville, M.D., B.C.T Macdonald & A.F. Keene (1999) *Testing of Potential Acid Soil Samples from Railway and Marshalling Yards, East Arm Port Development Site*. Report prepared for Dames & Moore.
- Mustoe, S. (2006) *Penguins and marine mammals: final report*. Report prepared for Port of Melbourne Corporation.
- Parra, G.J. (2006) *Resource partitioning in sympatric delphinids: space use and habitat preferences of Australian snubfin and Indo-Pacific humpback dolphins*. *Journal of Animal Ecology* 75: 862-874.
- Pendoley, K. L. (2005) *Sea Turtles and the environmental management of industrial activities in north-west Western Australia*. PhD thesis. Murdoch University, Perth, Western Australia.
- Seas Offshore (2010) *Darwin Harbour Vibrocore Sample Acquisition and Analysis Report*. Report prepared for DPC.

25 References

- SEWPAC (2011) Species profile and threats database, accessed 4 February 2011 at (<http://www.environment.gov.au/cgibin/sprat/public/sprat.pl>).
- SKM (2009) *East Arm Wharf Expansion – Gap Analysis*. Prepared for DPI.
- Stoddart, J. A. & Gilmour, J. (2005) Patterns of reproduction of in-shore corals of the Dampier Harbour, Western Australia, and comparisons with other reefs. In: Stoddart, JA & Stoddart, SE (Eds.) *Corals of the Dampier Harbour: Their Survival and Reproduction During the Dredging Programs of 2004*. Mscience.
- URS (2002) *Darwin 10 MTPA LNG facility: public environmental report*. Prepared for Phillips Petroleum Company Australia Pty Ltd.
- URS (2004) *Darwin City Waterfront Redevelopment Project Draft Environmental Impact Statement*. Prepared for Department of Infrastructure, Planning and Environment.
- URS (2005) *Summary Report Darwin LNG Project – Environmental Monitoring Studies and Results for Annual Reporting Period 23 June 2004 to 22 June 2005*.
- URS (2008a) *Darwin LNG Plant – 2008 Ambient Air Monitoring Programme*.
- URS (2008b) *Marine Water and Sediment Quality Study*. 42906729-1892: R1359. Prepared for INPEX Browse Ltd, Perth.
- URS (2009a) *Ichthys Gas Field Development Project: Nearshore marine ecology and benthic communities study*. Report prepared for INPEX Browse Ltd.
- URS (2009b) *Ichthys Gas Field Development Project: nearshore marine water quality and sediment study*. Report prepared for INPEX Browse.
- VIPAC (1994) *Tropical cyclone storm surge risk for the Greater Darwin Region (Volumes 1 & 2)*. Prepared for NT Dept Lands, Housing and Local Government.
- Warren, J.H. (2001) *Sediment Quality of Ports and Marinas in Darwin Harbour*. Report prepared for the Environmental and Heritage Division, Department of Lands, Planning and Environment.
- Whiting, S. D. (2001) *Preliminary Observations of Dugongs and Sea Turtles around Channel Island, Darwin Harbour*. Report to Power and Water Authority Darwin, Biomarine International.
- Williams, D., Wolanski, E. and Spagnol, S., 2006, *Hydrodynamics of Darwin Harbour*, The environment in Asia Pacific harbours, Springer, Dordrecht, 461-476.

Glossary

Bund - An earth, rock or concrete wall constructed to retain a reclaimed area, or to prevent the inflow or outflow of liquids.

Just in Time - a process strategy that reduces in-process inventory and associated carrying costs.

Particulate matter (PM) - Small discrete masses of solid or liquid matter that remain individually dispersed in emissions to atmosphere.

Particulate Matter (PM) - A small discrete mass of solid or liquid matter that remains individually dispersed in gas or liquid emissions (usually considered to be an atmospheric pollutant).

PM₁₀ - Particulate matter with an average aerodynamic diameter of 10 micrometers [10µm] and less.

Rip-rap - A layer of coarse rock used to line or protect earthen embankments from erosion.

Rock Armour – see Rip-rap

Storm surge - A raised mass of water, generally 2–5 m higher than normal tide levels, which results from strong onshore winds and reduced atmospheric pressure.

Viewshed - an area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point.