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Appendix D East Arm Wharf Retention Pond Design Report

Retention Pond Design Summary Report
East Arm Wharf Stormwater
Department of Planning and Infrastructure

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1. Introduction

1.1. Background

The Darwin Port Corporation, part of the Northern Territory Government, manages land within the Port of Darwin, including the East Arm Wharf, under a Board of Directors that was established pursuant to the *Darwin Port Corporation Act 2005*. The East Arm Wharf (EAW) is a major facility for the Darwin Harbour, providing services including berthing for ships carrying bulk dry minerals as well as livestock, bulk liquids and general cargo. The East Arm Wharf Facilities Masterplan 2030 is a plan to guide future development and upgrades to existing facilities at the EAW to accommodate anticipated trade and vessel demands. The current facility has direct road and rail access to the EAW with ship loading and conveyor systems for loading the bulk dry materials onto ships.

Following a rainfall event that resulted in a visible plume in the Darwin Harbour extending from a stormwater outfall at the wharf approximately 80 m to sea, the Northern Territory Government's Department of Natural Resources, Environment, The Arts and Sport (NRETAS) issued the Darwin Port Corporation (DPC) with two separate pollution abatement notices (PANs) pursuant to Section 77 of the *Waste Management and Pollution Control Act 1998* (the *WMPC Act*):

- PAN No 2010/2: requires DPC to take immediate steps to ensure that loading of copper concentrate does not cause harm in breach of section 83(4) or 83 (5) or in non-compliance with section 12(1)
- PAN EN2010/3: requires DPC to take all reasonable measures to ensure that runoff discharged into Darwin Harbour does not contain contaminants at levels that exceed the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC Guidelines)

An investigation of water and sediment quality at the East Arm Wharf was undertaken in April 2010 by the Australian Institute for Marine Science (AIMS) for NRETAS. A Drainage Strategy report was prepared by Aurecon in February 2011, which includes options and recommendations for short and longer term management and engineering measures for the EAW in order to address the issues raised by these PANs and improve stormwater management at the EAW in general.

According to the findings of these reports, treating runoff to improve the water quality is required prior to discharge the runoff to the harbour. Some rainfall runoff is currently captured and stored in Pond F (refer to Figure 1.2.1 for location) where the sediments can settle out. However this pond is to be partially reclaimed to provide much needed hardstand for the working Port.

1.2. Scope of this report

This report discusses the environmental impacts of the ore sediments and potential treatment options to improve the quality of the runoff or eliminate runoff altogether. The report also discusses the existing site drainage network and determines the peak flow and volume of stormwater runoff from the mineral loading areas to ensure the treatment options are able to treat all runoff.

The treatment options considered range from cleaning the runoff to an acceptable quality to allow the runoff to discharge directly to the harbour, through to retaining all runoff in retention ponds. The report looks at the requirements for retention ponds (from short-term to long-term) including the location, pond sizing and associate infrastructure.

Preliminary cost estimates are provided for short-term, mid-term and long-term options. The report also briefly discusses the impacts to the proposed storages regarding the future developments onsite.

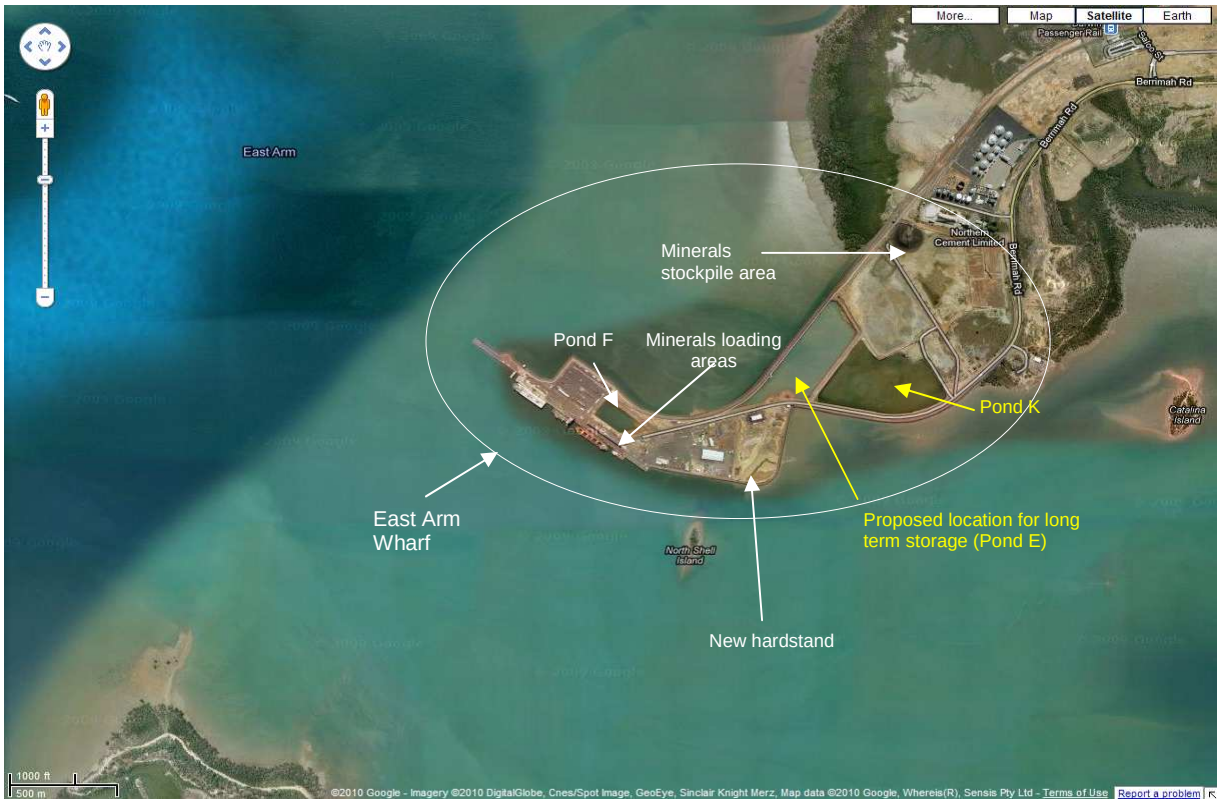


Figure 1.2.1 Locality Plan

2. Potential treatment options

There are no ANZECC\ARMCANZ (2000) ecological protection level guidelines for iron, since there is insufficient data at this stage to derive a reliable trigger value for iron. According to the United States guidelines, iron ore particles do not have an adverse public health if the concentration is less than 0.3 mg/L. Iron in excess of the suggested maximum contaminant levels (MCL) usually results in discoloured water. A number of onsite treatment/filtration options may be considered to improve the quality of the runoff prior to discharge to the harbour, which are discussed below.

2.1. Filtration tank

A filtration tank system may be used to treat the runoff (at each outlet and/or at a central location) to mitigate the visual impact of the iron ore particles and alleviate concentrations prior to discharging to the sea. Typically filtration tanks consist of a series of geotextile baffles designed to capture the suspended solids as the water passes through them. The baffles are designed to be overtopped as they begin to clog, allowing the next baffle in the series to become the primary capture point without compromising the operation of the system.

Although filtration tanks are easy and quick to install on site, the size of the tank and the treatment efficiency are the main constraints in using filtration tanks as the principle treatment option. This is compounded when treating stormwater runoff as this commonly peaks at very high flow rates requiring a very large and complex tank system.

As a result, the size and efficiency of such works needs to be investigated further to confirm its suitability in this situation. In addition to the size and treatment efficiency, regular maintenance is required to keep the baffles clean and a method of doing this and dealing with the concentrated silt from the baffles would need to be developed. On a whole of life cost basis it may not be more economical than the retention pond, but could be easier and quicker to install.

2.2. Silt curtains

A silt curtain is a temporary sediment control device commonly used on marine construction sites to prevent sediment plumes polluting waterways. Silt curtains are widely used due to their low cost and simple design. However, their effectiveness in controlling sediment in the field is often rather limited.

Silt curtain fabrics (geotextiles) tested in laboratory settings have been shown to be effective at trapping sediment particles. Although there have been few field tests of silt curtain installed at construction sites, these tests have shown generally poorer results. Effectiveness testing involved measurements for both total suspended solids and turbidity. Other studies and articles about silt curtain usage and practice also document problems with installation and maintenance, implying poor performance. Silt curtains may perform poorly for a variety of reasons, including improper location, improper installation and lack of maintenance. In rough waters, the fabric may also become damaged with holes and tears. Location of curtains in areas with high flows/currents may lead to curtain failures.

Although silt curtains could potentially be used at the stormwater outlets to reduce the amount of ore particles discharging to the harbour, this is quite costly and is not recommended as a long term solution, especially when considering the regular maintenance requirements for cleaning the curtain. In addition, the effectiveness of filtration using silt curtains for high flow rates is limited and therefore unlikely to achieve the desired results.

2.3. Geotex tube dewatering system

Sediment in rainfall runoff could be captured by pumping the water into a geotex tube dewatering system. These are manufactured from purpose designed high strength woven polypropylene geo-textiles. The geotex tubes can be use for ore particles / fine silt dewatering. The tube filling process requirements are as follows;

- A sufficiently large area for the dewatering tubes is required with an effective drainage blanket (such as aggregate) below the tubes. Adequate area for access to the tubes is to be allowed for maintenance. Additional space will also be required for future tubes as each fills up and the solid material is later removed.
- The tube is filled over time as the stormwater runoff is pumped through it.
- Once full of sediment, the tube is detached form the pumping system and left to drain under gravity over time. The pumping system is then attached to the next tube in the system.
- The drained tube of sediment then has to be removed and disposed of (tubes generally cannot be re-used).

Geotex tubes are typically used for low flow rates with high suspended solids levels, for example slurries from mine tailings. The effectiveness of using the tubes for high flow rates with low suspended solid content, needs to be investigated. It is expected that to treat the full flow expected in this case, extremely large tubes will be required, both increasing the costs and taking up valuable space on land.

2.4. Retention ponds

Retention ponds are not strictly a treatment option, but considered as an alternative to the above treatment options. The purpose of the retention pond is to capture and store all runoff within closed ponds thereby preventing pollutants/sediment from entering the harbour. The retention pond will gradually empty through evaporation and percolation of the water over the dry season. As a result, there will be no contaminated stormwater runoff into Darwin Harbour.

Due to their design they are very effective and reliable with reasonably low ongoing maintenance costs. However they require large areas to be constructed, particularly if designed to capture all runoff.

2.5. Summary

The treatment of the rainfall runoff would be the preferred alternative to storing all runoff on site, if this were practical and cost effective. However, due to the limited available information for the water quality treatment options discussed above when used in these circumstances, it is not possible to recommend any of them. Further work is required to confirm that these can be made to work with the high flows expected at the Port.

The retention pond option, however, is a tried and tested solution for these sorts of applications and therefore this report adopts the retention pond as the primary treatment option (base case) to develop in further in detail.

3. Existing drainage network

3.1. Existing drainage

The existing East Arm Wharf stormwater drainage system discharges captured stormwater directly into the harbour without in-line screening, filtration or chemical treatment. Due to occasional quantities of contaminants/ores on the wharf surface, stormwater runoff has produced plumes of sediments that are clearly visible at the stormwater outlets during storm events. An assessment of these plumes by NRETAS has concluded that the existing East Arm Wharf stormwater system is non-compliant with the requirements of discharge quality.

The existing drainage system consists of a combination of pits and grates connected through a piped system which lead to open outlets into the harbour. Stormwater not captured by the drainage networks falls off the unbounded surface of the wharf, into the harbour.

East Arm Wharf is primarily constructed on reclaimed land which has been subject to uneven settlement. Several surface levels have changed significantly since construction, causing ponding and undesirable flow paths. For this reason, several drains have become misaligned and are no longer as effective as initially designed.

Recent alterations to the drainage system have directed some of the rainfall runoff from the minerals loading areas back into Pond F as a temporary partial fix to the sediment plume problem in the Harbour.

Figure 2.1.1 Pond F at EAW looking southward

Stormwater runoff from the ore stockpiles, in the vicinity of Pond B on the north-eastern side of the site, currently drains to through Pond D into Pond K (refer to Figure 1.2.1 in Section 1.2). Pond K has an overflow connection to Pond E which is effectively open to the harbour through the porous rock rail bund.

4. Retention Basin Design

4.1. Retention basin methodology

The proposed retention pond is intended to store all the stormwater runoff generated from the minerals loading areas (refer to Drawing C-201 in Appendix A for catchment details) during the wet season (November to April). This retention pond will then gradually empty through evaporation and percolation of the water over the dry season.

Whilst it is desirable to store 'all' the rainfall runoff, a statistical approach needs to be undertaken in determining reasonable limits on peak flows, for the design of the infrastructure (pipes and pumps) that will satisfy the requirements of the EPA. Standard engineering practise and the Australian Rainfall and Runoff Guidelines generally call for the 10 year ARI storm to be captured in piped infrastructure and additional rainfall runoff up to the 100 year ARI storm event to be safely conveyed as overland flow. If this were to be adopted at the Port, stormwater runoff for events in excess of the 10 year ARI storm would then overflow into the harbour. Under normal circumstances this would be a sound engineering solution. However, due to the sensitivity of the harbour and its high public profile it was decided that a more conservative approach was needed and the limit was raised to that of the 100 year ARI storm. This translates to there being a 1% chance in any one year that the rainfall runoff will exceed the proposed infrastructure limits and some spillage of runoff will overflow into the harbour. It is expected however, that antecedent rainfall will have washed the majority of minerals/pollutants off the hardstands and into the retention pond before the storm intensity reaches a point that the infrastructure capacity is exceeded.

The mean average rainfall data for Darwin has been used to determine the total wet season rainfall runoff (refer to Section 4.2 for details). The design rainfall runoff for the 1 in 100 year ARI storm event was calculated in accordance with Australian Rainfall and Runoff guidelines. This also ensured that both short-term (during a storm event up to 72 hours) and long-term (total rainfall through the wet season) rainfall patterns were considered in the calculation of rainfall runoff storage volume. The critical situation governs the required pond size. The runoff figures together with the evaporation and percolation data were used to perform an iterative process to determine the required storage volume (and the corresponding dimensions).

As the build-up of the mineral ore particles as they settle out of suspension will affect the permeability of the pond significantly, the pond design is separated into two different scenario;

1. Short-term (up to a year, assuming no impacts from sedimentation in the base of the pond).
2. Mid-to Long-term (longer than a year as the pond's permeability starts to reduce).

Associated infrastructure (pump stations and pipe works) have been sized to accommodate these flows and transfer the rainfall runoff to the retention pond. Preliminary cost estimates for the short-term, mid-term and long-term scenarios have been prepared, based on recent project experience and figures from Rawlinsons Australian Construction Handbook 2011.

4.2. Rainfall and evaporation data

The following rainfall and evaporation data was obtained from the Bureau of Meteorology website, and adopted for the design purpose in this report. These figures are using to calculate the total runoff within the site during the whole wet season in an average rainfall year.

Table 3.1.1 Mean rainfall data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall (mm)	426.2	376.1	317.8	101.7	21.1	1.9	1.2	5.1	15.8	70.0	140.0	252.4

Note: Site Name: Darwin Airport, Site Number: 014015

Table 3.1.2 Mean daily evaporation data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Daily Evaporation (mm)	6.0	5.7	5.8	6.4	6.8	6.8	6.8	7.2	7.7	8.0	7.4	6.6

Note: Site Name: Darwin Airport, Site Number: 014015; Numbers are pan evaporation without applying any pan factor

4.3. IFD parameters

The following IFD parameters have been taken from Australian Rainfall and Runoff, relevant to the East Arm Wharf site. These parameters were used in calculating the design stormwater runoff for the different return periods.

$^{2}Y_{1hr}$ = 63.0 mm/hr	$^{2}Y_{12hr}$ = 9.8 mm/hr	$^{2}Y_{72hr}$ = 3.0 mm/hr
$^{50}Y_{1hr}$ = 100.0 mm/hr	$^{50}Y_{12hr}$ = 16.0 mm/hr	$^{50}Y_{72hr}$ = 6.0 mm/hr
Skewness (G) = 0.37	F2 = 4.37	F50 = 18.5

4.4. Catchment details

There are ten catchments in the mineral loading areas, named as CAT 5A, CAT 5B, CAT 6, CAT 7, CAT 8A, CAT 8B, CAT 9A, CAT 9B, CAT 10 and CAT 12A (Refer to Drawing C-201 in Appendix A). The total area of these catchments is approximately 13.85 ha. These catchments are considered to be mostly impervious with a time of concentration (t_c) typically of 6 minutes. In accordance with Section 1.4.8 of book IV of Australian Rainfall and Runoff, runoff coefficients of 0.9 and 1.0 were adopted for the 1 in 10 year and 1 in 100 year storm events respectively.

4.5. Peak catchment flows

The peak flow from the mineral loading areas for a 1 in 100 year storm event was calculated to be 13.21 m^3/s. This figure was calculated by the formula below.

Peak Flow (Q, m^3/s) = Runoff Coefficient (C_{10}) x Rainfall Intensity (I, mm/hr) x Catchment Area (A, ha) / 360

= 1.0 x 343.44 x 13.85 / 360

= 13.21 m^3/s

4.6. Total wet season runoff

The total mean rainfall during the wet season is approximately 1610 mm (1.61 m). With a catchment size of 13.85 ha (138,500 m^2) and a runoff coefficient of 1.0, the total rainfall runoff generated during the wet season was calculated using the following equation:

Total Runoff = Runoff Coefficient x Total Mean Rainfall x Total Catchment Size

Therefore, the total runoff from the mineral loading areas (during the wet season) is 222,985 m^3 (223 ML).

4.7. Evaporation loss and percolation

Based on the mean daily evaporation data obtained from the Bureau of Meteorology, the total evaporation during the wet season was calculated to be 1144 mm (1.14 m), an average of 6.32 mm per day.

Due to the limited knowledge of the in-situ soil properties, the hydraulic conductivity (k value) of the material was assumed based on the typical soil properties, summarised as following:

- Existing base of Pond F (silt – without sedimentation of iron ore): $8x10^{-4}$ m/s
- Base of Pond F (after impacted by the sedimentation of iron ore): $1.25x10^{-6}$ m/s
- Drainage Layer: $1.0x10^{-2}$ m/s
- Engineering Fill / Sand: $1x10^{-5}$ m/s
- Earth Fill: $1.0x10^{-7}$ m/s

Based on the assumed conductivity figures, the seepage losses through the existing base of Pond F is approximately 8,640 mm (8.64 m) per day. This will be reduced significantly to approximately 108 mm (0.11 m) as a result of the sedimentation of iron ore particles over time. This impact was assumed to occur over approximately one year (that is, after one year of operation, permeability of the pond will be reduced to $1.25x10^{-6}$ m/s if the sediment deposits are not removed from the pond).

4.8. Preliminary pond sizing

As discussed in Section 4.7, seepage through the pond base will be significantly different between the short-term (up to a year) and mid-to long-term (longer than a year) due to the sedimentation of the ore particles. Therefore, the required size of the retention pond will be significantly different in the short-term and the mid-to long-term scenarios. The design of the required storage is discussed below:

4.8.1. Scenario 1 (Short-term: Up to 1 year)

The required size of a retention pond is controlled by the difference between the rate of inflow into the pond and the losses through percolation and evaporation. There are a number of possible inflow patterns (depending on the storm event duration). The design events for storm durations up to 72 hours (in accordance with Australian Rainfall and Runoff) and mean rainfall data for the entire calendar months (from Bureau of Meteorology) were considered. Losses from the pond are the sum of the evaporation loss (which is controlled by surface area of the stored water) and the seepage loss (which is controlled by the surface area of the base and sides of the pond).

Through a number of iterative processes using a DRAINS model, the critical event was found to be a storm of 1 hour duration for the 1 in 100 year ARI. The required pond size would be 6.0 ML (with a base area of 3,600 m^2) (refer to Drawing C-202 in Appendix A). This pond will be 1.5 m in depth with 1 in 2 batter slopes. The Full Service Level of the pond was designed to be at 4.5 m AHD. An additional 0.5 m free board has been allowed to avoid overflow to the surrounding areas (which has the ground level around 5.0 m AHD). This pond will require approximately 5,100 m^2 of land.

4.8.2. Scenario 2 (Mid-to Long-term: Longer than 1 year)

The critical event for this scenario was found to be a storm of 72 hour duration for the 1 in 100 year ARI. The required pond size would be 47.3 ML (with a base area of 30,000 m^2). This pond would again be 1.5 m in depth with 1 in 2 batter slopes. As before the Full Service Level of the pond was designed to be at 4.5 m AHD with an additional 0.5 m free board. This pond will require approximately 33,500 m^2 of land.

The proposed pond requires an area larger than that available in Pond F (both existing area and after reclamation) and therefore this retention pond will need to be located at another location.

It is proposed to construct the new retention pond in Pond E (Refer to Drawing C-203 in Appendix A for the preliminary layout). To reduce capital expenditure, the boundary of the pond could be formed by a silt curtain for the mid-term scenario. This will allow the proposed pond to be relocated to an alternate area (for example within the future rail loop bund) in the future. The final location of the proposed retention pond will be subject to the result of discussions between Department of Planning and Infrastructure, Darwin Port Corporation and Stakeholders.

For the purposes of costing comparisons, in all sections of this report, the long-term location of the proposed retention pond is assumed to be remaining in the Pond E area.

Two separate sets of cost estimate were prepared for the mid-term and long-term scenarios. The long-term scenario is based on the assumption that the silt curtain will be replaced by a permanent bund.

4.9. Pumping station and associated temporary storage

Due to the level difference between the proposed mineral loading area drainage system and the full service level of the proposed retention pond, a pumping station will be required to transfer the stormwater runoff from the mineral loading area to the proposed retention pond.

Following discussions with DCI and DPC, an area of land to the north of Pond F has been identified for a small detention basin and pump station. Using a live storage depth of 1.5 m with a 1 in 2 batter slope and allowing for an additional 0.5 m free broad, approximately 3,500 m^2 can be used to provide the temporary storage for the proposed pump station, giving a storage volume of 3.9 ML. The required peak pump rate for the pump station would be around 4,300 L/s in this case.

To construct a pumping station to cater for a 4,300 L/s peak pump rate is not economical. Therefore, the option of occupying 100% of the vacant land (approximately 7,500 m^2, refer to Drawing C-204 in Appendix A for details) was considered. Based on the same assumptions as above, the detention pond could provide 9.2 ML of temporary storage for the pumping station. For this situation, the required peak pump rate would be reduced significantly to 1,300 L/s.

Furthermore, if part of Pond F is retained as a detention basin after partially reclamation (that is 6.0 ML as per short-term scenario) and also used as part of the temporary storage for the pump station, the required pump rate would be reduced further to 320 L/s. This is the recommended option (refer to Drawing C-204 in Appendix A for details).

There are associated electrical and mechanical works to the pumping station, including but not limited to, power supply to the pumps, light and switch board etc. There is an existing substation onsite approximately 100 metres to the southern end of Pond F. Initial investigations suggest that this substation should be able to supply power for the proposed pumping station with minimal upgrades.

4.10. Associated infrastructure

In order to pump the runoff from the temporary storage detention ponds to the proposed retention pond (based on the peak pump rate of 320 L/s), four 300 mm internal diameter HDPE rising mains would be required. The total length of the rising mains is approximately 1,600 m (4 x 400 m).

For both the short-term and long-term storage, an overflow structure will be provided as an emergency outlet to the sea to prevent flooding of surrounding areas. The proposed overflow structures are summarised as follows:

- Short-term Scenario
    - 80 m length of 525 mm diameter pipe outlet from Pond F
    - 1 No. concrete headwall for 525 mm diameter pipe
- Medium-term and Long-term Scenario
    - 30 m length of 525 mm diameter pipe outlet from temporary storage area for pump station
    - 100 m length in total of 2 x 525 mm diameter pipe (i.e. 2 x 50 m) pipe outlet from proposed retention pond
    - 1 No. concrete headwall for 525 mm diameter pipe
    - 1 No. concrete headwall for 2 x 525 mm diameter pipe
    - 4 No. 900 mm x 900 mm internal diameter grated pit with cover
    - 60 m length in total 375 mm x 1200 mm (2 cells of 600 mm each) Reinforced Concrete Box Culvert

4.11. Redevelopment of the drainage systems

In order to drain the runoff from the existing catchments to the proposed retention pond, the existing drainage system needs to be upgraded and in some instances, the hardstand surfaces need to be re-graded.

To assess the extent of the revised drainage systems required, a 12d model of the site was generated using the site contours from design contours shown on drawing 43-21600-SK009B of GHD's report, Report for East Arm Wharf Stormwater Master plan, September 2009. The accuracy of the design levels is limited to that of the GHD concept only and should not be used for construction purposes.

Data provided from detailed surveys of the wharf quay itself show a trend of approximately 50 mm of long term settlement over the entire wharf with areas of additional settlement scattered across the quay area. Settlement of 100 – 150 mm is evident to the east of the copper shed. Therefore, for the purposes these initial cost estimates, and in lieu of undertaking a detailed survey of the entire port, it has been assumed that in general a regrading (lifting) of the hardstand areas will be required to an average height of 100 mm. This would be required for the catchment areas CAT 9A, CAT 9B, CAT 10, CAT 11, CAT 12A, CAT 12B and CAT 13.

The proposed drainage system is designed to drain up to 10 year ARI flows. Flows above 10 year ARI (up to 1 in 100 year ARI) will flow to the pond via overland flow. Pits and pipes were sized based on standard road design guidelines (final design will need to be modelled). Due to depth cover constraints, dual pipes have been used in some cases.

Cost estimates have been prepared for the proposed drainage system (refer to Drawing C-206 in Appendix A for the concept alignments). Since redeveloping the drainage system is not part of the scope of this report, the proposed system is prepared for providing an indicative cost for the redevelopment works only. A detailed study will be required to confirm the alignment, pipe size and gradients for the proposed systems.

4.12. Silt curtains

As discussed in Section 4.8.2, silt curtains are proposed to be used to form the boundary of the proposed new retention pond, as a medium term solution allowing flexibility in the final location of the retention pond. Approximately 5,000 m^2 of silt curtain will be required to form the boundary of the pond, with an estimated cost of approximately $3,000,000 (excluding GST). This cost has been included as part of the total estimated cost of the mid-term scenario prepared in Section 6.1.

Similarly, silt curtains could also be considered as a pollutant control around the current stormwater outfalls to provide some filtration to the discharges prior to discharging to the sea. Although this is not a desirable long term solution, installing the silt curtains should reduce the amount of iron ore particles discharging directly to the harbour. Approximately 2,000 m^2 of silt curtain would be required to form the boundary around the current outfalls (500 m^2 per outfall). The cost of installing the silt curtains at the four current outfalls would be about $1,755,000 (excluding GST). Note that the effectiveness of this option would be limited as they are not designed to handle high flows.

4.13. Sealing of the rail bund (Pond E north-western wall)

As discussed in Section 4.8.2, the new retention pond is proposed to be located within Pond E for the long-term scenario. In this situation, the existing rail bund (Pond E north western wall), which is currently quite porous, will need to be sealed to prevent contaminates migrating into the harbour. This can be achieved by placing a sealing fill layer on the inside of the bund. Typically this would consist of layers of rock reducing to soil layers to form a filter with a sealing clay liner on the inside of the pond, (refer to Section 2 of Drawing C-204 in Appendix A). Geotextile may also be used to form the filter to prevent fines being washed through the rail bund. As the rail bund has to be widened (by about four metres) to support the proposed new conveyor from the bulk ore stockpiles, this widening would include the required sealing for the retention pond.

The estimated cost of widening and sealing the rail bund is about $6,301,000 (excluding GST). Some of this cost can be saved if the long-term scenario retention pond (with internal bunds rather than silt

curtains is constructed up front (e.g. environmental management, provision for traffic and fencing etc). The cost estimate of the long-term scenario retention pond prepared in Section 6.1 has included the cost of sealing and widening the rail bund.

5. Potential impacts of future developments onsite

This section discusses the potential impacts of draining other catchment areas around East Arm Wharf to the proposed retention pond. These areas have not been included in the initial retention pond design as they do not contribute to the current pollution issues. The outcomes discussed in this section are only at concept stage to provide an overview regarding the impacts. The treatment of stormwater runoff from these areas is currently been undertaken by other means as part of separate contracts.

5.1. CASE 1 – Catchment eastern to the mineral loading area

This case considers the impacts of the future development of the catchment east of the mineral loading area. These catchments are referred as CAT 11, CAT 12B and CAT 13 (refer to Drawing C-201 in Appendix A for details). The total size of the catchments is approximately 5.25 ha. The catchments will generate an additional 5.0 m^3/s peak flow rate of runoff on top of the current mineral loading area figure. This figure was calculated based on the assumption that the future drainage network within these catchments will directly drain towards the temporary storage for the pumping station where the time of concentration for the system was calculated to be 6 minutes.

To transfer the runoff from the original catchments and the proposed additional catchments, the peak pump rate will increase to about 980 L/s. The available temporary storage for the pump station is limited (that is 9.2 ML plus 6.0 ML from Pond F). In addition to the pump rate, the required volume for the long-term storage will also be increased to 65.5 ML (with a pond base area of 42,000 m^2). The retention pond will require approximately 46,100 m^2 of land. This size is based on the pond being 1.5 m in depth with 1 in 2 batter slope and an additional 0.5 m free board.

In order to prevent the significant impact to the required peak pump rate for the pump station, a detention basin within the further development site is recommended to minimize the peak flow rate. It may also be practical to provide a separate pump station for these catchments, pumping directly to the proposed retention basin.

5.2. CASE 2 – MSB site

The Marine Supply Base (MSB) site is considered as another potential development that may be drained into the proposed retention pond. The MSB catchments are referred as CAT 14A and CAT 14B (refer to Drawing C-201 in Appendix A for details). The total size of the MSB catchment is approximately 8.21 ha. The peak runoff from these catchments is approximately 5.96 m^3/s. Although it is preferable to have only one pumping station, it is not practical to get the runoff water from the MSB site back to the proposed pump station. Therefore, to get the runoff from the MSB back to the proposed retention basin in Pond E will require a second pumping station in the MSB site.

The required volume of the retention pond for the long-term storage will increase to 86.5 ML (with a pond base area of 57,500 m^2). This pond will require approximately 62,200 m^2 of land overall. This figure is calculated based on the pond being 1.5 m in depth with 1 in 2 batter slopes and an additional 0.5 m free board.

Similar to Case 1, a retention basin within the MSB site to minimize the peak flow rate for the pump station is recommended.

6. Cost estimation

6.1. Summary of cost estimation

A cost estimate has been prepared and presented in Appendix B. Table 6.1.1 below gives a summary of the cost estimates.

Table 6.1.1 Summary of cost estimation

Item	Cost (Excl. GST)	GST	Total Cost (Inc. GST)
Short-term Scenario	$ 271,000	$ 27,100	$ 298,100
Mid-term Scenario	$ 11,748,000	$ 1,174,800	$ 12,922,800
Long-term Scenario	$ 15,715,000	$ 1,571,500	$ 17,286,500
Redevelopment of Drainage System	$ 18,638,000	$ 1,863,800	$ 20,501,800
Total	**$ 46,372,000**	**$ 4,637,200**	**$ 51,009,200**

6.2. Basis of cost estimate

This report includes both the short-term and long-term storage scenario and provides preliminary cost estimation. Potential works include:

6.2.1. Short-term scenario

- Laying 5,000 m^2 geofabric for the following area (refer to Drawing C-202 in Appendix A for details):
    - Bottom of Pond F (area after reclamation only)
    - Along the side of the batter of Pond F (after reclamation) adjacent to the reclaimed land
- 80 m length of 525 mm diameter Class 2 Reinforced Concrete Pipe
- 1 No. concrete headwall for 525 mm diameter pipe

6.2.2. Mid-term scenario

- A new 47.3 ML retention pond
- 5,000 m^2 of silt curtain along the boundary as the wall of the pond (refer to Drawing C-203 in Appendix A for details)

- 1 No. of 320 L/s pumping station and associated electrical and mechanical works and power supply
- 1600 m length of 300 mm internal diameter HDPE rising main
- 7.3 ML pond to provide temporary storage for pumping station
- 60 m length of 300 mm x 1200 mm (2 cells of 600 mm each) Reinforced Concrete Box Culvert
- 30 m length of 525 mm diameter Class 2 Reinforced Concrete Pipe
- 4 No. 900 mm x 900 mm grated inlet pits with Cover
- 1 No. concrete headwall for 525 mm diameter pipe
- 1 No. concrete headwall for 2 x 525 mm diameter pipe
- Laying 8,000 m^2 geofabric for the bottom and all sides of batter of the temporary storage for the pumping station (refer to Drawing C-203 in Appendix A for details)
- 8,000 m^2 of clay lining for the bottom and all sides of batter of the temporary storage for the pumping station (refer to Drawing C-203 in Appendix A for details)

6.2.3. Long-term scenario

- Construct bund wall along eastern side of the pond (refer to Drawing C-203 in Appendix A for details)
- Laying 11,000 m^2 geofabric for the side of the batter along the railway line for the proposed 47.3 ML pond (refer to Drawing C-203 in Appendix A for details)
- 11,000 m^2 clay lining for the side of the batter along the railway line for the proposed 47.3 ML pond (refer to Drawing C-203 in Appendix A for details)

6.2.4. Redevelopment of drainage system

- Construct a total of 2,200 m length of pipe works. Pipe sizes from 600 mm diameter to 1350 mm diameter
- 36 No. grated inlet pits
- 1 No. concrete headwall for 2 x 1050 mm diameter pipe
- 1 No. concrete headwall for 2 x 1200 mm diameter pipe
- 1 No. concrete headwall for 2 x 1350 mm diameter pipe

In preparing the cost estimates for the short-term and long-term scenario, the following assumptions were made:

- Construction cost estimates are based on a combination of Aurecon's recent experience and Rawlinsons Australian Construction Handbook 2011.
- Land Purchase (if any) costs are excluded.

- Construction cost of the pumping station is assumed as $ 3,000,000 for the 350 L/s pumping station option.
- No substation is required, power supply to the proposed 320 L/s pumping station is available from the existing substation onsite.
- No clay lining is provided to the base of Pond F or the new 47.3 ML retention pond. This also implies that the base of these ponds will not be drivable/walkable and clean out / maintenance of the ponds will need to be done from the edge of ponds.
- The new 47.3 ML retention pond will be located within Pond E under the long-term scenario.
- Design contingency is assumed to be 30% of capital cost.
- Cost of reclamation of the existing Pond F excluded.
- Cost of reclamation of the Pond F area (for storage at short-term scenario) excluded.
- It is assumed that rock will not be encountered.
- The cost estimates have not taken into account the likely increases in demand for labour expected over the next few years as a result of the INPEX project.

6.3. Qualifications

The cost estimates prepared are based on the concepts proposed for this project. In setting project budgets, Department of Construction and Infrastructure – Darwin Port Corporation should allocate an allowance for anticipated on-costs based on their experience of historical projects.

Any opinion or estimate of costs by Aurecon is made on the basis of Aurecon's experience and qualifications and will represent Aurecon's judgement as an experienced and qualified professional engineer, familiar with the construction industry. However, Aurecon has no control over the cost of labour, materials, equipments or services furnished by others or over Contractor's method of determining prices or over competitive bidding or market conditions. Therefore, Aurecon cannot and does not guarantee that proposals, bids or actual construction costs will not vary from Aurecon's estimates.

Suppliers have not been contacted to confirm their current materials supply costs.

7. Conclusion

According to the outcomes of previous studies, a retention pond to store the stormwater runoff from the minerals loading area is recommended. Runoff from part of the catchments is currently stored and settled in Pond F, which will be partially reclaimed due to the site development. Therefore, a number of storage options (short-term to long term) have been considered.

The mean rainfall data of Darwin was adopted to determine the total wet season runoff. Design runoff was also calculated in accordance with Australian Rainfall and Runoff to ensure that both short-term and long-term rainfall patterns were considered in the calculation of the required storage volumes. The runoff figures together with the evaporation and percolation data were used to determine the critical storage volume. The required storage (and the rainfall event governing its size) and associated infrastructures are different under the short-term and long-term scenario, which are summarised as follows:

- Short-term Scenario (Up to 1 year)
    - Pond size governed by design event of 1 hour storm duration for 1 in 100 year ARI
    - Required pond size is 6.0 ML
    - Base area of the pond is 3,600 m^2
    - The overall pond requires approximately 5,100 m^2 of land
- Mid-to Long-term Scenario (Longer than 1 year)
    - Pond size governed by design event of 72 hour storm duration for 1 in 100 year ARI
    - Required pond size is 47.3 ML
    - Base area of the pond is 30,000 m^2
    - The overall pond requires approximately 33,500 m^2 of land
    - A 320 L/s pumping station will be required (based on a detention of 6.0 ML Pond F will be retained and an extra 9.2 ML storage (i.e. 15.2 ML in total) will be used as temporary storage for the pumping station)

Preliminary cost estimates for the short-term, mid-term and long-term scenario were prepared based on the recent project experience and the figures from Rawlinsons Australian Construction Handbook 2011, which are $ 271,000, $ 12,923,000 and $ 15,715,000 respectively (excl. GST).

This report also discussed the environmental impacts of the iron ore and some potential treatment options to improve the quality if the runoff. The treatment of the rainfall runoff would be a preferred alternative to storing all runoff on site, but current options are unlikely to be practical and/or cost effective.

The report also looked at the impacts on the proposed retention pond size should runoff from two potential future developments on site (CASE 1 – Catchment Eastern to the Mineral Loading Area and CASE 2 – MSB site) are included. In these scenario, the proposed retention pond would need to be increased to 65.5 ML and 86.5 ML respectively.

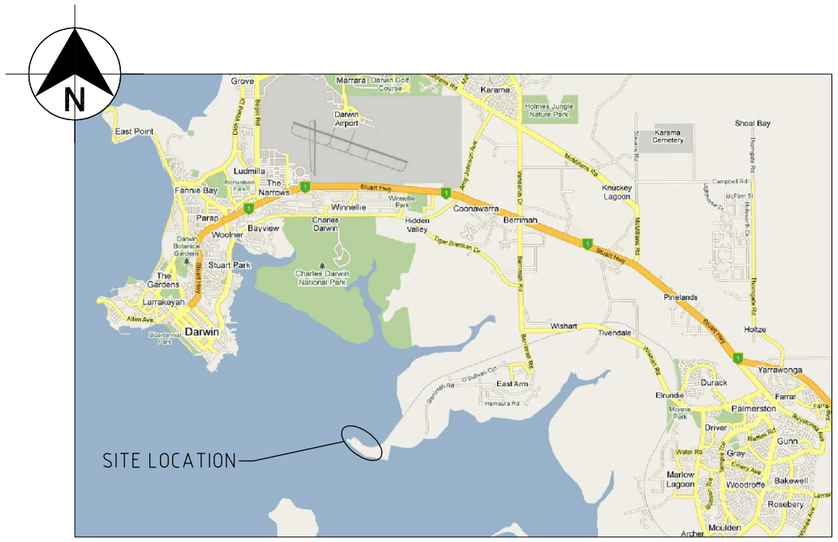
Appendix A
Drawings

DARWIN EAST ARM WHARF
RETENTION POND DESIGN

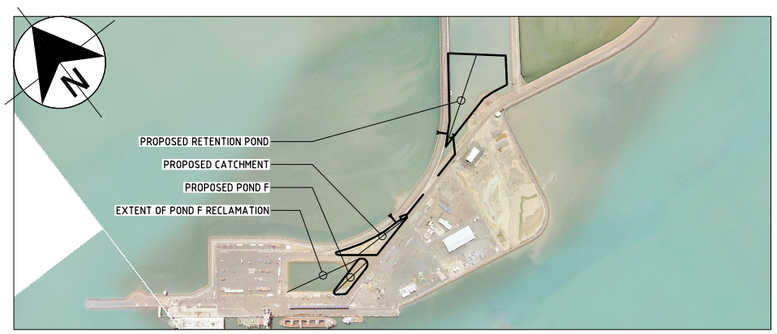
DARWIN PORT CORPORATION

DRAWING INDEX

DRG No.	TITLE
214135–DW–C–200	LOCALITY MAP AND DRAWING INDEX
214135–DW–C–201	CATCHMENTS LAYOUT
214135–DW–C–202	POND F - SHORT TERM STRATEGY
214135–DW–C–203	RETENTION POND LAYOUT
214135–DW–C–204	PUMPING STATION AND RISING MAIN PLAN
214135–DW–C–205	RETENTION POND LAYOUT - ALTERNATIVES
214135–DW–C–206	DRAINAGE REVELOPMENT LAYOUT



LOCALITY MAP



SITE MAP

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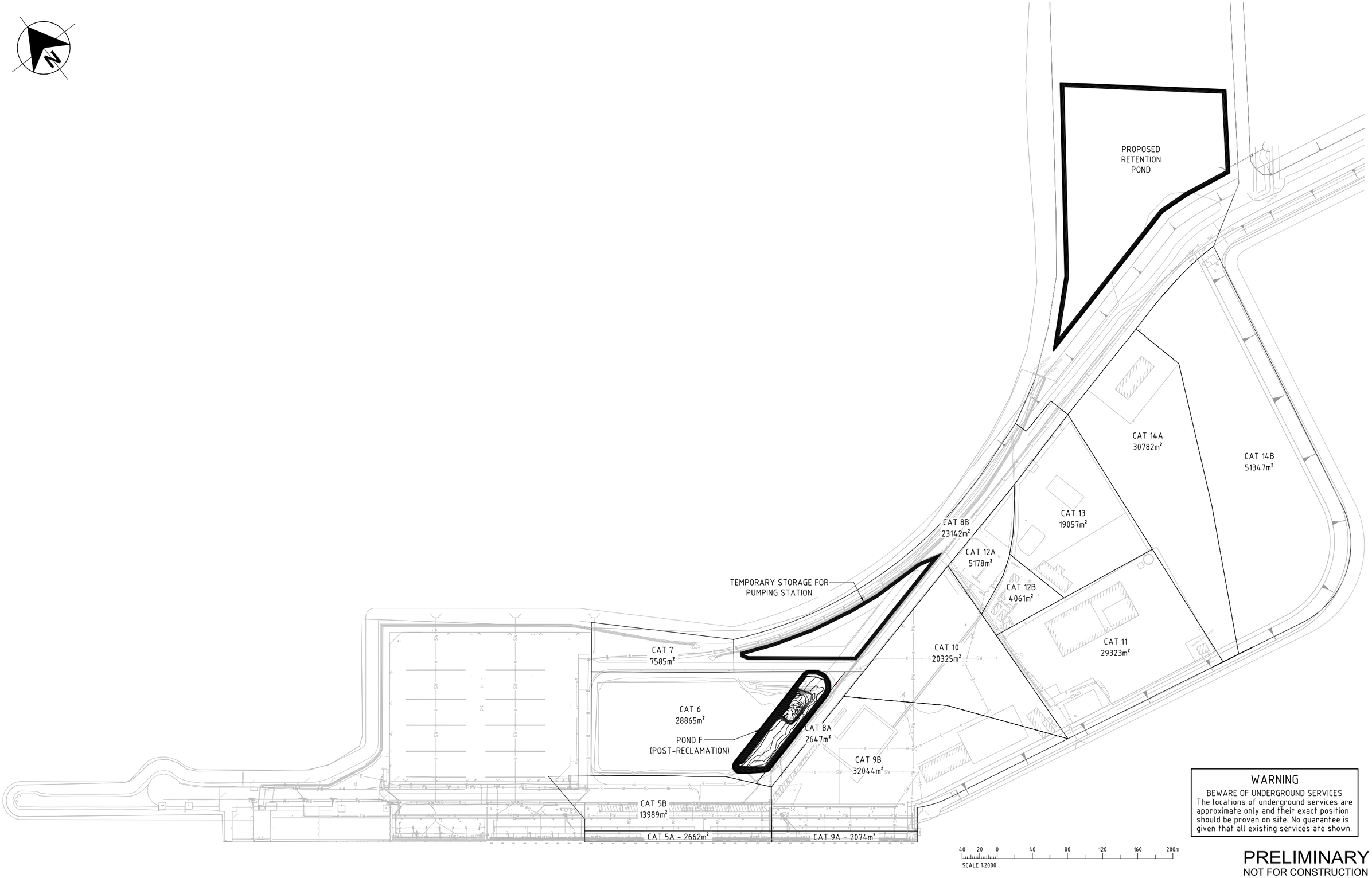
Department of Planning and Infrastructure

DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN

LOCALITY MAP AND DRAWING INDEX

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	1 OF 6	C-200	01	A1



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BEWARE OF UNDERGROUND SERVICES
The locations of underground services are approximate only and their exact position should be proven on site. No guarantee is given that all existing services are shown.

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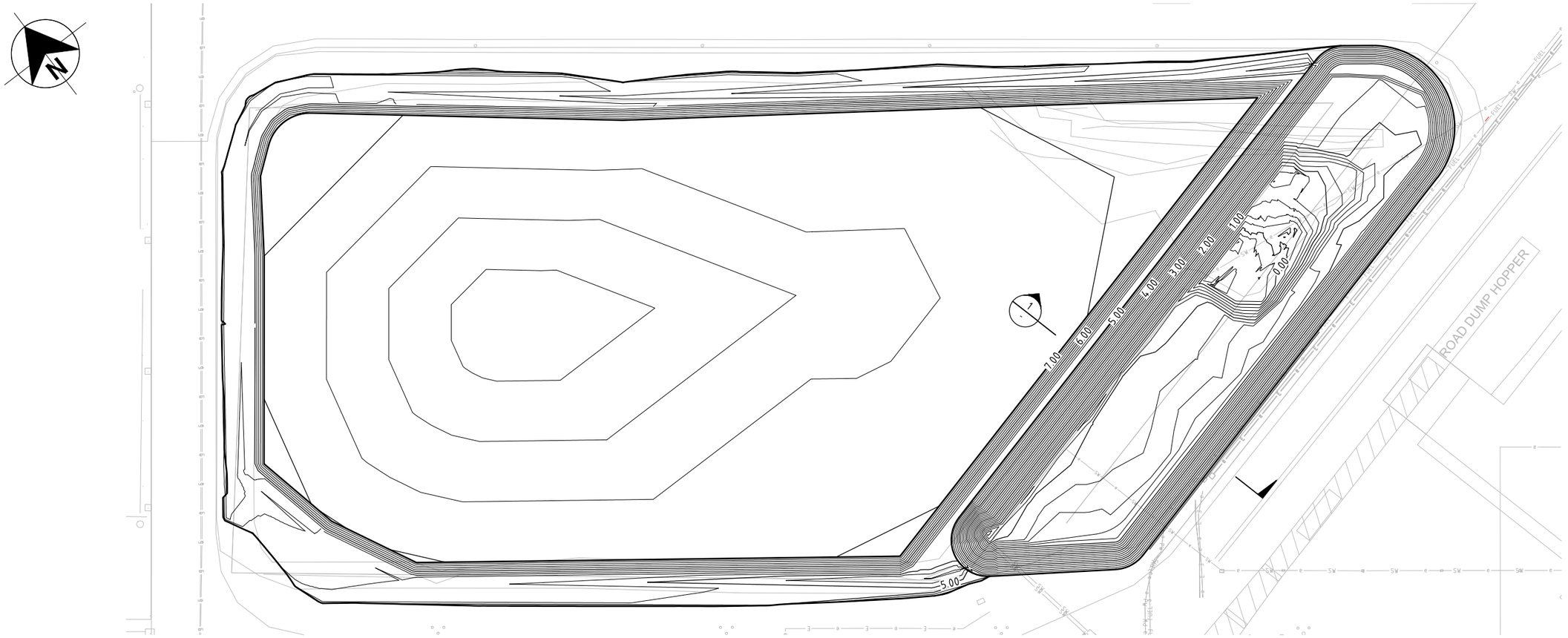
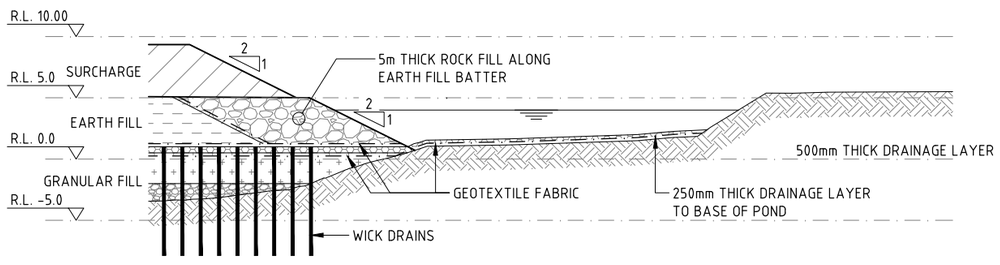
DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN
CATCHMENTS LAYOUT

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	2 OF 6	C-201	01	A1



POND F PLAN
1:500



TYPICAL DETENTION POND DETAIL

SECTION 1
1:250

5 0 5 10 15 20 25m
SCALE 1:250

10 0 10 20 30 40 50m
SCALE 1:500

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DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN
POND F - SHORT TERM STRATEGY

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
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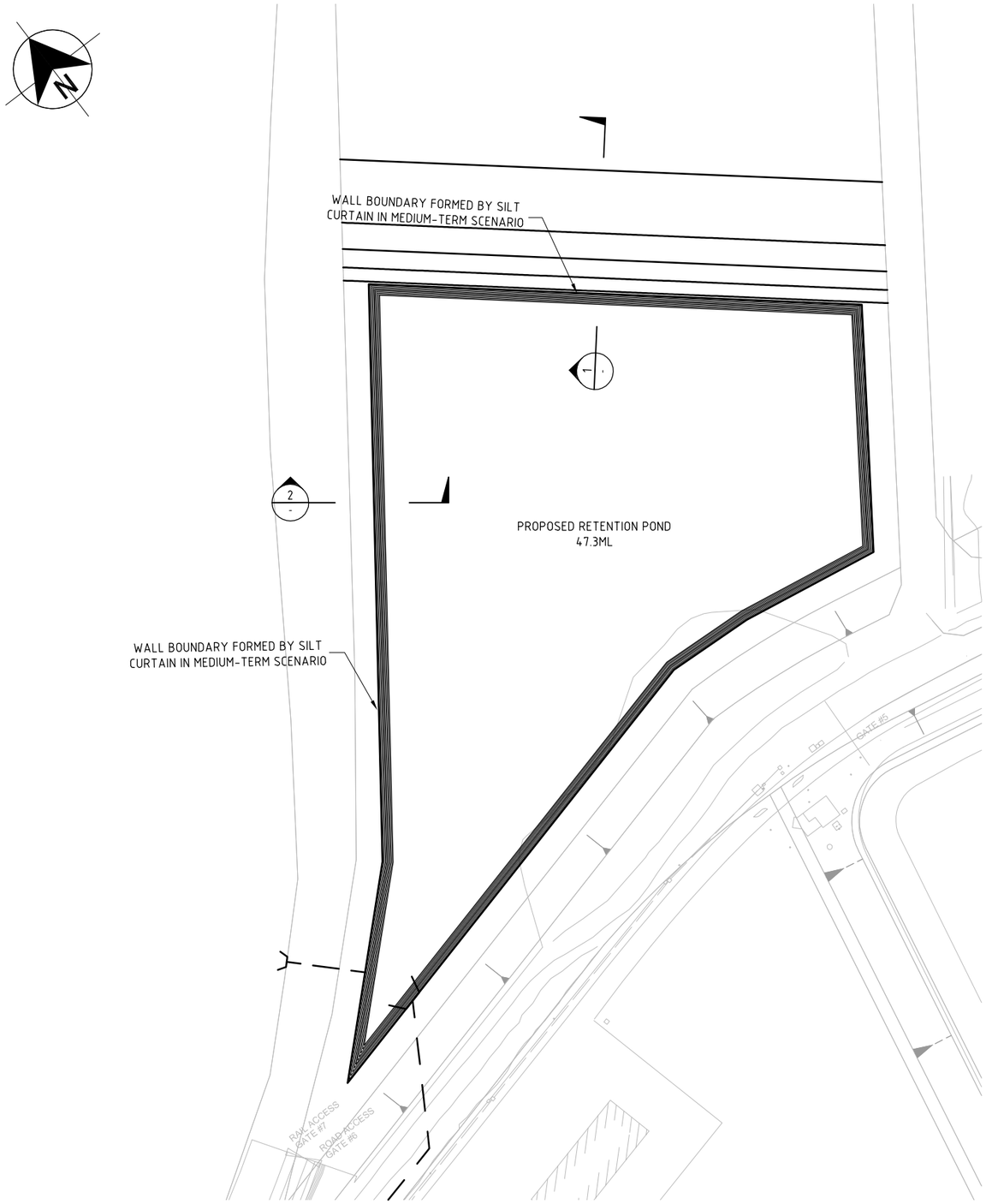
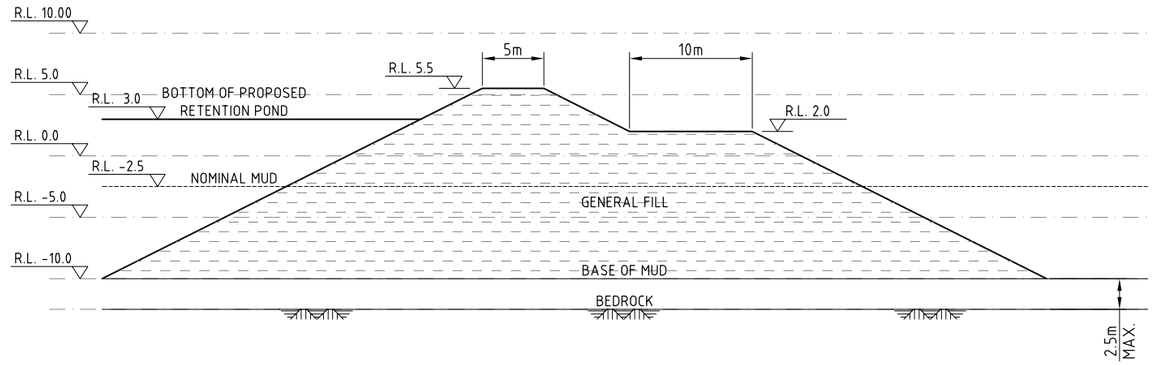
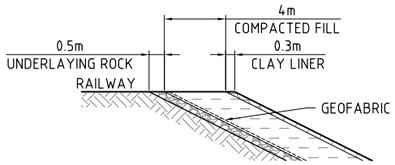


PROPOSED RETENTION POND PLAN
1:500



TYPICAL BUNDWALL DETAIL

SECTION 1
1:250



SECTION 2
1:100

2 1 0 2 4 6 8 10m
SCALE 1:100

5 0 5 10 15 20 25m
SCALE 1:250

10 0 10 20 30 40 50m
SCALE 1:500

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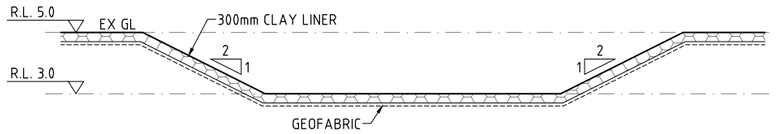
DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN

RETENTION POND LAYOUT - LONG TERM SCENARIO

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	4 OF 6	C-203	01	A1



TYPICAL STORAGE FOR PUMP STATION

SECTION 1
NTS -

RISING MAIN PLAN
1:500

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EAST ARM WHARF STORMWATER
RETENTION POND DESIGN

PUMPING STATION AND RISING MAIN PLAN

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	5 OF 6	C-204	01	A1

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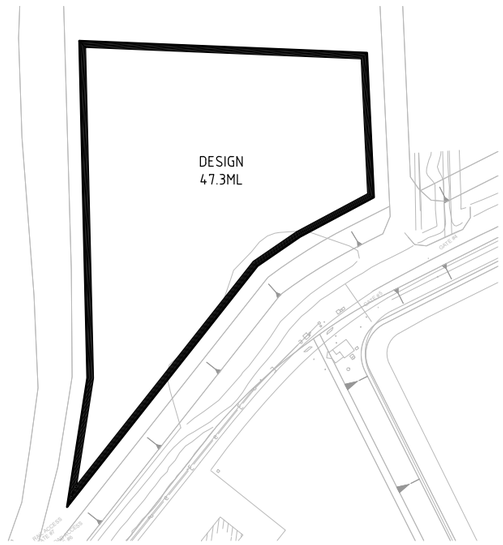
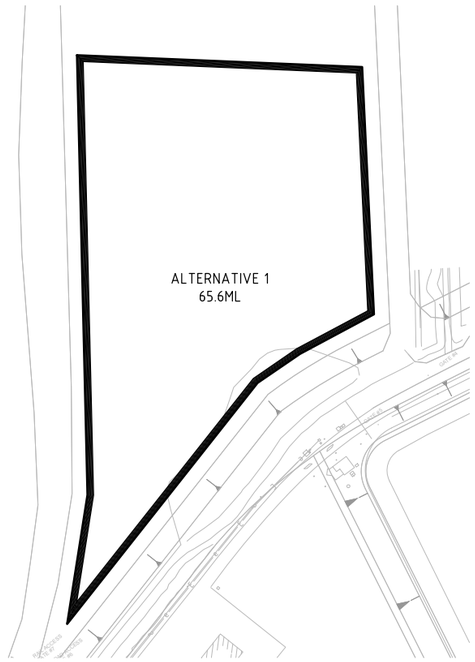
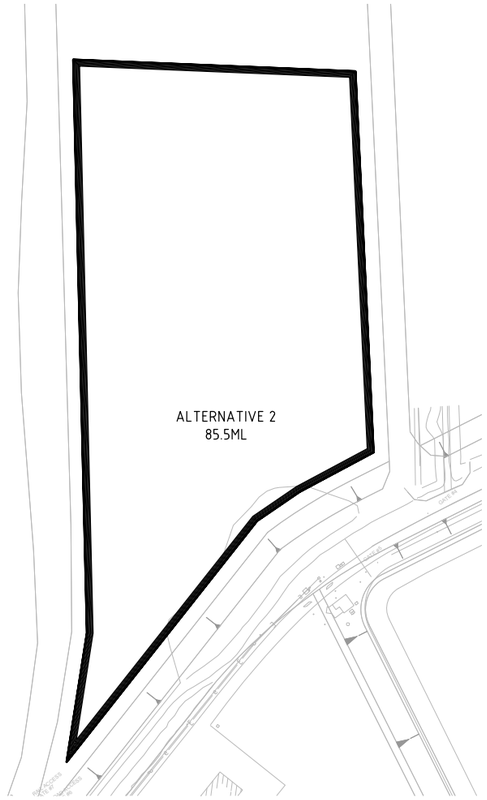


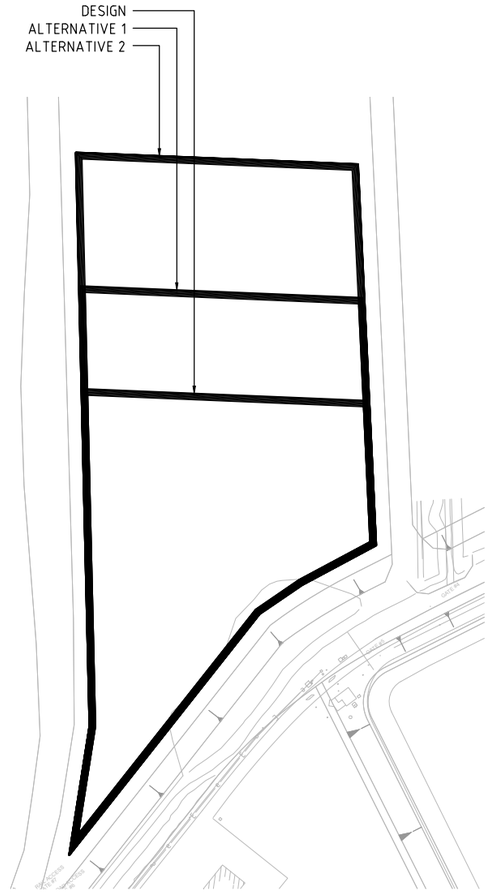
PROPOSED RETENTION POND PLAN – DESIGN
1:2000



PROPOSED RETENTION POND PLAN – ALTERNATIVE 1
1:2000



PROPOSED RETENTION POND PLAN – ALTERNATIVE 2
1:2000



PROPOSED RETENTION POND PLAN – COMBINED
1:2000

WARNING

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40 20 0 40 80 120 160 200m
SCALE 1:2000

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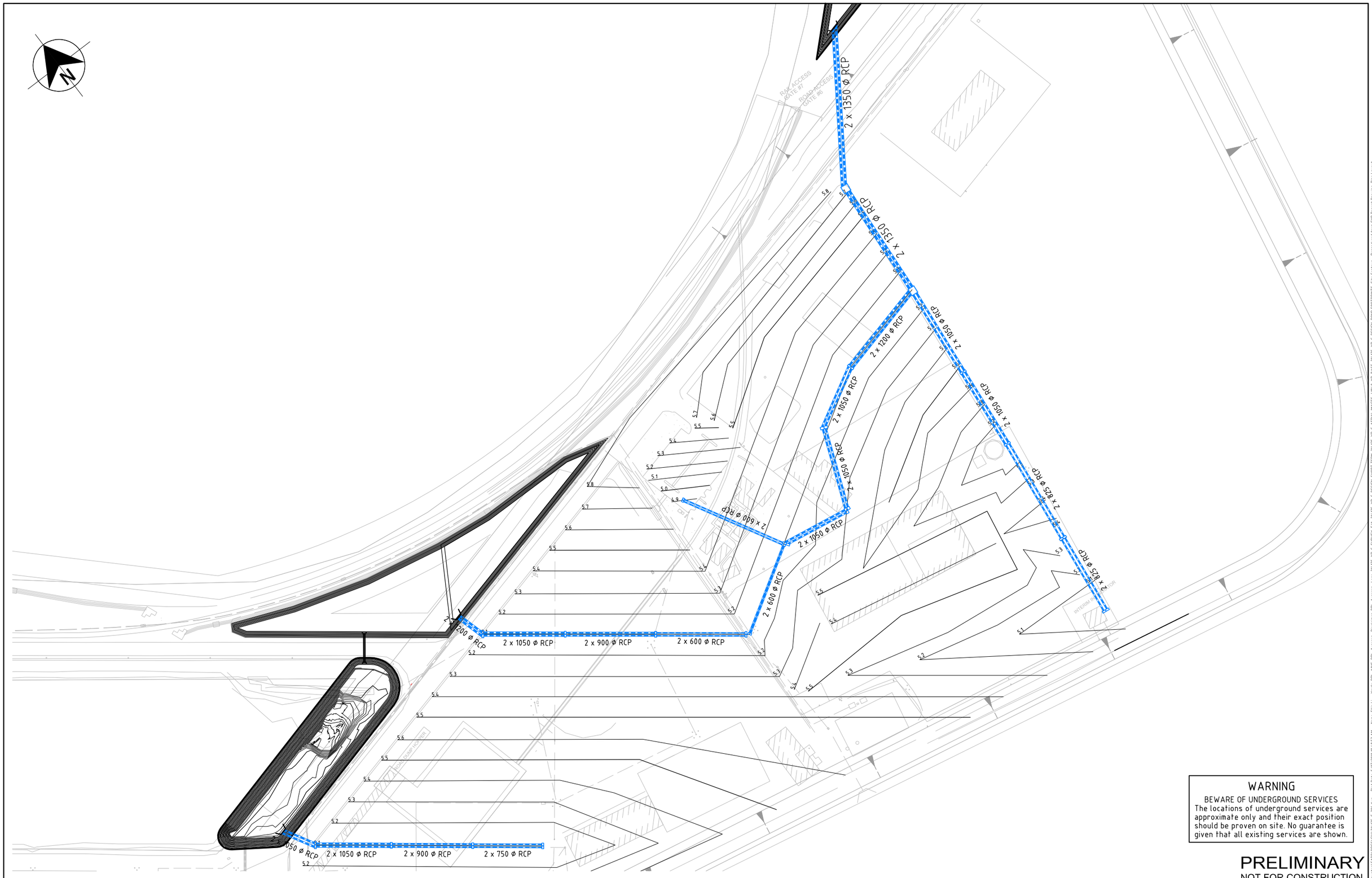
DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN

RETENTION POND LAYOUT – ALTERNATIVES

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	6 OF 6	C-205	01	A1



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DARWIN
EAST ARM WHARF STORMWATER
RETENTION POND DESIGN

DRAINAGE REDEVELOPMENT LAYOUT

FILE No.	ASSET No.	SHEET No.	DRAWING No.	AMEND.	SHEET SIZE
-	-	2 OF 6	C-206	01	A1

Appendix B
Details of Cost Estimation

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Rentention Pond Cost Estimate (Short-term)

Date: 3/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	21,000
2	MISCELLANEOUS PROVISIONS	$	31,100
3	PROVISION FOR TRAFFIC	$	7,000
4	CLEARING & GRUBBING & REHABILITATION	$	-
7	EARTHWORKS	$	107,500
8	PAVEMENTS	$	-
	SUB-TOTAL	$	208,600
	CONTINGENCY @ 30%	$	62,580
	TOTAL	$	271,180
	ROUNDED ESTIMATE	$	271,000
	GST	$	27,100
	TOTAL ESTIMATE	$	298,100

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
(i)	Sediment Fence	500	m	30	$15,000
(ii)	Shaker	1	No.	1000	$1,000
(iii)	Rock Check Dams	0	No.	1000	$0
(iv)	Inlet Sediment Traps	0	No.	500	$0
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
(i)	Mobilisation	1	Item	50% Estab	$8,500
(ii)	Demobilisation	1	Item	15% Estab	$2,600
(iii)	On Going Costs	1	Item	35% Estab	$6,000
2.2	Project Notice Boards	1	No.	2000	$2,000
2.3	Level Checking	1	Item	5,000	$5,000
2.4	Control Station Check Survey	1	Item	500	$500
2.5	Indigenous Training and Employment	100	hrs	35	$3,500
2.6	As Constructed Drawings	3	Dwgs	1000	$3,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	2,000	$2,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	5,000	$5,000

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
7	**EARTHWORKS**				
7.1	Earthworks in cut	0	m^3	25	$0
7.2	Earthworks in fill	1000	m^3	35	$35,000
7.3	Rock protection	500	m^3	25	$12,500
7.4	Geofabric				
	(i) Bidim A44	5000	m^2	12	$60,000
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
8	**PAVEMENTS**				
8.1	FCR Base,				
	(160 mm compacted thickness)		m^2	35	$0
8.2	FCR Shoulder				
	(160 mm compacted thickness)	0	m^2	35	$0
8.3	FCR Sub Base,				
	(300 mm compacted thickness)	0	m^2	60	$0
9	**SPRAY SEALING**				
9.1	Preparation of Pavement		m^2	.20	$0
9.2	Prime coat	0	Litres	2.00	$0
9.3	1st Coat Seal	0	Litres	2.20	$0
	2nd Coat Seal	0	Litres	2.20	$0
9.4	Precoat applied to aggregate	0	Litres	2.50	$0
9.5	Supply and Delivery of Aggregate				
	Aggregate 10mm	0	m^2	2.50	$0
	Aggregate 14mm	0	m^2	2.50	$0
11	**CONCRETE WORKS**				
11.1	Kerbs & Gutters				
	(i) Mountable Kerb		m	50	$0
	(ii) Mountable Kerb and Gutter		m	55	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) Reinforced Concrete Pipes				
	525 mm dia Class 2, RRJ	80	m	450	$36,000
	1350 mm dia Class 2, RRJ	0	m	750	$0
	1500 mm dia Class 2, RRJ	0	m	900	$0
	1650 mm dia Class 2, RRJ	0	m	1,050	$0
	1800 mm dia Class 2	0	m	1,200	$0
12.2	Concrete Headwalls				
	525 mm dia.pipe	1	No.	6,000	$6,000
	1800 mm dia.pipe	0	No.	6,000	$0
12.3	New Inlet Pits Complete				
	(i) GIP	0	No.	8,000	$0
12.4	Demolish and remove existing drainage structures	0	Item		$0
12.5	Oil/Sediment Trap		No.	70,000	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			208,600.

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Rentention Pond Cost Estimate (Medium-term)

Date: 3/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	22,000
2	MISCELLANEOUS PROVISIONS	$	884,000
3	PROVISION FOR TRAFFIC	$	15,000
4	CLEARING & GRUBBING & REHABILITATION	$	4,000
5	SEAWALLS / BREAKWATERS	$	3,000,000
6	BERTHS	$	-
7	EARTHWORKS	$	1,258,000
8	PAVEMENTS	$	-
9	SPRAY SEALING	$	-
10	ASPHALT SURFACING	$	-
11	CONCRETE WORKS	$	2,500
12	DRAINAGE WORKS	$	3,639,500
13	FENCING	$	7,700
14	ROAD FURNITURE AND TRAFFIC CONTROL DEVICES	$	-
15	POWER SUPPLY	$	136,800
16	LIGHTING	$	17,100
17	SERVICE RELOCATION	$	50,000
18	WAREHOUSING	$	-
19	OFFICE BUILDING	$	-
20	POTABLE WATER	$	-
21	FIRE WATER	$	-
22	FUEL SUPPLY	$	-
	SUB-TOTAL	$	9,036,600
	CONTINGENCY @ 30%	$	2,710,980
	TOTAL	$	11,747,580
	ROUNDED ESTIMATE	$	11,748,000
	GST	$	1,174,800
	TOTAL ESTIMATE	$	12,922,800

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
(i)	Sediment Fence	500	m	30	$15,000
(ii)	Shaker	1	No.	1000	$1,000
(iii)	Rock Check Dams	0	No.	1000	$0
(iv)	Inlet Sediment Traps	2	No.	500	$1,000
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
(i)	Mobilisation	1	Item	50% Estab	$409,800
(ii)	Demobilisation	1	Item	15% Estab	$122,900
(iii)	On Going Costs	1	Item	35% Estab	$286,800
2.2	Project Notice Boards	2	No.	2000	$4,000
2.3	Level Checking	1	Item	10,000	$10,000
2.4	Control Station Check Survey	1	Item	500	$500
2.5	Indigenous Training and Employment	1000	hrs	35	$35,000
2.6	As Constructed Drawings	15	Dwgs	1000	$15,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	5,000	$5,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	10,000	$10,000
4	**CLEARING & GRUBBING & REHABILITATION**				
4.1	Clearing and Grubbing includes, removing of vegetation stripping and stockpiling, top soil respreading, removal of unrecoverable fencing, drainage structures, old road surfaces, and other obstacles.	10,000	m^2	0.4	$4,000
4.2	Mulching	0	m^2	0.1	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
5	**SEAWALLS / BREAKWATERS**				
5.1	Dredging	0	m^3	30	$0
5.2	Silt Curtain	5000	m^2	600	$3,000,000
5.3	Rock underlay	0	m^3	112	$0
5.4	Geofabric				
(i)	Bidim A44	0	m^2	12	$0
7	**EARTHWORKS**				
7.1	Earthworks in cut	33000	m^3	25	$825,000
7.2	Earthworks in fill	3000	m^3	35	$105,000
7.3	Clay liner	8000	m^2	25	$200,000
7.4	Geofabric				
(i)	Bidim A64	8000	m^2	16	$128,000
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
11	**CONCRETE WORKS**				
11.1	Kerbs & Gutters				
(i)	Mountable Kerb	50	m	50	$2,500
(ii)	Mountable Kerb and Gutter		m	55	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) HDPE flanged pipe				
	300 mm ID	1,600	m	300	$480,000
	525 mm dia Class 2, RRJ	30	m	450	$13,500
	750 mm dia Class 2, RRJ	0	m	900	$0
	825 mm dia Class 2, RRJ	0	m	1,050	$0
	1800 mm dia Class 2	0	m	1,200	$0
12.2	Concrete Headwalls				
	4 x 300 mm dia. pipe	1	No.	6,000	$6,000
	525 mm dia, pipe	2	No.	6,000	$12,000
	2 x 525 mm dia, pipe	1	No.	6,000	$6,000
12.3	New Inlet Pits Complete				
	(i) Grated Pit 900 x 900mm internal diameter	4	No.	8,000	$32,000
12.4	Box Culvert				
	375mm x 1200mm	60	m	1,500	$90,000
12.5	Pump station	1	No.	3,000,000	$3,000,000
13	**FENCING**				
13.1	Perimeter fence 2100 high 3 strands barb	50	m	105	$5,250
13.2	Gates 5 m wide plus separate ped gate	1	set	2,450	$2,450
15	**POWER SUPPLY**				
21.1	Excavation	340	m^3	70	$23,800
21.2	HV Cable in duct	500	m	200	$100,000
21.3	Power supply boxes and controls	2	No.	1,500	$3,000
21.4	Connection from exsiting substation	1	No.	10,000	$10,000
16	**LIGHTING**				
16.1	Poles	1	No.	6,000	$6,000
21.1	Excavation	30	m^3	70	$2,100
21.2	HV Cable in duct	50	m	180	$9,000
17	**SERVICE RELOCATION**				
17.1	Allowance	5	Item	10,000	$50,000

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			9,036,600.

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Rentention Pond Cost Estimate (Long-term)

Date: 3/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	22,000
2	MISCELLANEOUS PROVISIONS	$	1,161,400
3	PROVISION FOR TRAFFIC	$	15,000
4	CLEARING & GRUBBING & REHABILITATION	$	4,000
5	SEAWALLS / BREAKWATERS	$	10,180,000
6	BERTHS	$	-
7	EARTHWORKS	$	696,000
8	PAVEMENTS	$	-
9	SPRAY SEALING	$	-
10	ASPHALT SURFACING	$	-
11	CONCRETE WORKS	$	2,500
12	DRAINAGE WORKS	$	-
13	FENCING	$	7,700
14	ROAD FURNITURE AND TRAFFIC CONTROL DEVICES	$	-
15	POWER SUPPLY	$	-
16	LIGHTING	$	-
17	SERVICE RELOCATION	$	-
18	WAREHOUSING	$	-
19	OFFICE BUILDING	$	-
20	POTABLE WATER	$	-
21	FIRE WATER	$	-
22	FUEL SUPPLY	$	-
	SUB-TOTAL	$	12,088,600
	CONTINGENCY @ 30%	$	3,626,580
	TOTAL	$	15,715,180
	ROUNDED ESTIMATE	$	15,715,000
	GST	$	1,571,500
	TOTAL ESTIMATE	$	17,286,500

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
(i)	Sediment Fence	500	m	30	$15,000
(ii)	Shaker	1	No.	1000	$1,000
(iii)	Rock Check Dams	0	No.	1000	$0
(iv)	Inlet Sediment Traps	2	No.	500	$1,000
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
(i)	Mobilisation	1	Item	50% Estab	$548,500
(ii)	Demobilisation	1	Item	15% Estab	$164,500
(iii)	On Going Costs	1	Item	35% Estab	$383,900
2.2	Project Notice Boards	2	No.	2000	$4,000
2.3	Level Checking	1	Item	10,000	$10,000
2.4	Control Station Check Survey	1	Item	500	$500
2.5	Indigenous Training and Employment	1000	hrs	35	$35,000
2.6	As Constructed Drawings	15	Dwgs	1000	$15,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	5,000	$5,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	10,000	$10,000
4	**CLEARING & GRUBBING & REHABILITATION**				
4.1	Clearing and Grubbing includes, removing of vegetation stripping and stockpiling, top soil respreading, removal of unrecoverable fencing, drainage structures, old road surfaces, and other obstacles.	10,000	m^2	0.4	$4,000
4.2	Mulching	0	m^2	0.1	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
5	**SEAWALLS / BREAKWATERS**				
5.1	Dredging	0	m^3	30	$0
5.2	Bund	150000	m^2	66	$9,900,000
5.3	Rock underlay	2500	m^3	112	$280,000
5.4	Geofabric				
(i)	Bidim A44	0	m^2	12	$0
7	**EARTHWORKS**				
7.1	Earthworks in cut	0	m^3	25	$0
7.2	Earthworks in fill	7000	m^3	35	$245,000
7.3	Clay liner	11000	m^2	25	$275,000
7.4	Geofabric				
(i)	Bidim A64	11000	m^2	16	$176,000
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
11	**CONCRETE WORKS**				
11.1	Kerbs & Gutters				
(i)	Mountable Kerb	50	m	50	$2,500
(ii)	Mountable Kerb and Gutter		m	55	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) HDPE flanged pipe				
	300 mm ID	0	m	300	$0
	525 mm dia Class 2, RRJ	0	m	450	$0
	750 mm dia Class 2, RRJ	0	m	900	$0
	825 mm dia Class 2, RRJ	0	m	1,050	$0
	1800 mm dia Class 2	0	m	1,200	$0
12.2	Concrete Headwalls				
	4 x 300 mm dia. pipe	0	No.	6,000	$0
	525 mm dia, pipe	0	No.	6,000	$0
	2 x 525 mm dia, pipe	0	No.	6,000	$0
12.3	New Inlet Pits Complete				
	(i) Grated Pit 900 x 900mm internal diameter	0	No.	8,000	$0
12.4	Box Culvert				
	375mm x 1200mm	0	m	1,500	$0
12.5	Pump station	0	No.	3,000,000	$0
13	**FENCING**				
13.1	Perimeter fence 2100 high 3 strands barb	50	m	105	$5,250
13.2	Gates 5 m wide plus separate ped gate	1	set	2,450	$2,450
15	**POWER SUPPLY**				
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	200	$0
21.3	Power supply boxes and controls	0	No.	1,500	$0
21.4	Connection from exsiting substation	0	No.	10,000	$0
16	**LIGHTING**				
16.1	Poles	0	No.	6,000	$0
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	180	$0
17	**SERVICE RELOCATION**				
17.1	Allowance	0	Item	10,000	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			12,088,600.

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Install Silt Curtain for Current Outfalls

Date: 3/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	5,000
2	MISCELLANEOUS PROVISIONS	$	130,300
3	PROVISION FOR TRAFFIC	$	15,000
4	CLEARING & GRUBBING & REHABILITATION	$	-
5	SEAWALLS / BREAKWATERS	$	1,200,000
6	BERTHS	$	-
7	EARTHWORKS	$	-
8	PAVEMENTS	$	-
9	SPRAY SEALING	$	-
10	ASPHALT SURFACING	$	-
11	CONCRETE WORKS	$	-
12	DRAINAGE WORKS	$	-
13	FENCING	$	-
14	ROAD FURNITURE AND TRAFFIC CONTROL DEVICES	$	-
15	POWER SUPPLY	$	-
16	LIGHTING	$	-
17	SERVICE RELOCATION	$	-
18	WAREHOUSING	$	-
19	OFFICE BUILDING	$	-
20	POTABLE WATER	$	-
21	FIRE WATER	$	-
22	FUEL SUPPLY	$	-
	SUB-TOTAL	$	1,350,300
	CONTINGENCY @ 30%	$	405,090
	TOTAL	$	1,755,390
	ROUNDED ESTIMATE	$	1,755,000
	GST	$	175,500
	TOTAL ESTIMATE	$	1,930,500

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
(i)	Sediment Fence	0	m	30	$0
(ii)	Shaker	0	No.	1000	$0
(iii)	Rock Check Dams	0	No.	1000	$0
(iv)	Inlet Sediment Traps	0	No.	500	$0
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
(i)	Mobilisation	1	Item	50% Estab	$61,200
(ii)	Demobilisation	1	Item	15% Estab	$18,300
(iii)	On Going Costs	1	Item	35% Estab	$42,800
2.2	Project Notice Boards	2	No.	2000	$4,000
2.3	Level Checking	0	Item	10,000	$0
2.4	Control Station Check Survey	0	Item	500	$0
2.5	Indigenous Training and Employment	0	hrs	35	$0
2.6	As Constructed Drawings	4	Dwgs	1000	$4,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	5,000	$5,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	10,000	$10,000
4	**CLEARING & GRUBBING & REHABILITATION**				
4.1	Clearing and Grubbing includes, removing of vegetation stripping and stockpiling, top soil respreading, removal of unrecoverable fencing, drainage structures, old road surfaces, and other obstacles.	0	m^2	0.4	$0
4.2	Mulching	0	m^2	0.1	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
5	**SEAWALLS / BREAKWATERS**				
5.1	Dredging	0	m^3	30	$0
5.2	Silt Curtain	2000	m^2	600	$1,200,000
5.3	Rock underlay	0	m^3	112	$0
5.4	Geofabric				
(i)	Bidim A44	0	m^2	12	$0
7	**EARTHWORKS**				
7.1	Earthworks in cut	0	m^3	25	$0
7.2	Earthworks in fill	0	m^3	35	$0
7.3	Clay liner	0	m^2	25	$0
7.4	Geofabric				
(i)	Bidim A64	0	m^2	16	$0
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
11	**CONCRETE WORKS**				
11.1	Kerbs & Gutters				
(i)	Mountable Kerb	0	m	50	$0
(ii)	Mountable Kerb and Gutter		m	55	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) HDPE flanged pipe				
	300 mm ID	0	m	300	$0
	525 mm dia Class 2, RRJ	0	m	450	$0
	750 mm dia Class 2, RRJ	0	m	900	$0
	825 mm dia Class 2, RRJ	0	m	1,050	$0
	1800 mm dia Class 2	0	m	1,200	$0
12.2	Concrete Headwalls				
	4 x 300 mm dia. pipe	0	No.	6,000	$0
	525 mm dia, pipe	0	No.	6,000	$0
	2 x 525 mm dia, pipe	0	No.	6,000	$0
12.3	New Inlet Pits Complete				
	(i) Grated Pit 900 x 900mm internal diameter	0	No.	8,000	$0
12.4	Box Culvert				
	375mm x 1200mm	0	m	1,500	$0
12.5	Pump station	0	No.	3,000,000	$0
13	**FENCING**				
13.1	Perimeter fence 2100 high 3 strands barb	0	m	105	$0
13.2	Gates 5 m wide plus separate ped gate	0	set	2,450	$0
15	**POWER SUPPLY**				
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	200	$0
21.3	Power supply boxes and controls	0	No.	1,500	$0
21.4	Connection from exsiting substation	0	No.	10,000	$0
16	**LIGHTING**				
16.1	Poles	0	No.	6,000	$0
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	180	$0
17	**SERVICE RELOCATION**				
17.1	Allowance	0	Item	10,000	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			1,350,300.

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Seal and Widen Rail Bund Cost Estimate

Date: 30/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	22,000
2	MISCELLANEOUS PROVISIONS	$	245,700
3	PROVISION FOR TRAFFIC	$	15,000
4	CLEARING & GRUBBING & REHABILITATION	$	4,000
5	SEAWALLS / BREAKWATERS	$	280,000
6	BERTHS	$	-
7	EARTHWORKS	$	1,441,000
8	PAVEMENTS	$	-
9	SPRAY SEALING	$	-
10	ASPHALT SURFACING	$	-
11	CONCRETE WORKS	$	-
12	DRAINAGE WORKS	$	-
13	FENCING	$	7,700
14	ROAD FURNITURE AND TRAFFIC CONTROL DEVICES	$	-
15	POWER SUPPLY	$	-
16	LIGHTING	$	-
17	SERVICE RELOCATION	$	-
18	WAREHOUSING	$	-
19	OFFICE BUILDING	$	-
20	POTABLE WATER	$	-
21	FIRE WATER	$	-
22	FUEL SUPPLY	$	-
	SUB-TOTAL	$	2,015,400
	CONTINGENCY @ 30%	$	604,620
	TOTAL	$	2,620,020
	ROUNDED ESTIMATE	$	2,620,000
	GST	$	262,000
	TOTAL ESTIMATE	$	2,882,000

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
	(i) Sediment Fence	500	m	30	$15,000
	(ii) Shaker	1	No.	1000	$1,000
	(iii) Rock Check Dams	0	No.	1000	$0
	(iv) Inlet Sediment Traps	2	No.	500	$1,000
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
	(i) Mobilisation	1	Item	50% Estab	$90,600
	(ii) Demobilisation	1	Item	15% Estab	$27,200
	(iii) On Going Costs	1	Item	35% Estab	$63,400
2.2	Project Notice Boards	2	No.	2000	$4,000
2.3	Level Checking	1	Item	10,000	$10,000
2.4	Control Station Check Survey	1	Item	500	$500
2.5	Indigenous Training and Employment	1000	hrs	35	$35,000
2.6	As Constructed Drawings	15	Dwgs	1000	$15,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	5,000	$5,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	10,000	$10,000
4	**CLEARING & GRUBBING & REHABILITATION**				
4.1	Clearing and Grubbing includes, removing of vegetation stripping and stockpiling, top soil respreading, removal of unrecoverable fencing, drainage structures, old road surfaces, and other obstacles.	10,000	m^2	0.4	$4,000
4.2	Mulching	0	m^2	0.1	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
5	**SEAWALLS / BREAKWATERS**				
5.1	Dredging	0	m^3	30	$0
5.2	Bund	0	m^2	66	$0
5.3	Rock underlay	2500	m^3	112	$280,000
5.4	Geofabric				
(i)	Bidim A44	0	m^2	12	$0
7	**EARTHWORKS**				
7.1	Earthworks in cut	0	m^3	25	$0
7.2	Earthworks in fill	15000	m^3	66	$990,000
7.3	Clay liner	11000	m^2	25	$275,000
7.4	Geofabric				
(i)	Bidim A64	11000	m^2	16	$176,000
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
11	**CONCRETE WORKS**				
11.1	Kerbs & Gutters				
(i)	Mountable Kerb	0	m	50	$0
(ii)	Mountable Kerb and Gutter		m	55	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) HDPE flanged pipe				
	300 mm ID	0	m	300	$0
	525 mm dia Class 2, RRJ	0	m	450	$0
	750 mm dia Class 2, RRJ	0	m	900	$0
	825 mm dia Class 2, RRJ	0	m	1,050	$0
	1800 mm dia Class 2	0	m	1,200	$0
12.2	Concrete Headwalls				
	4 x 300 mm dia. pipe	0	No.	6,000	$0
	525 mm dia, pipe	0	No.	6,000	$0
	2 x 525 mm dia, pipe	0	No.	6,000	$0
12.3	New Inlet Pits Complete				
	(i) Grated Pit 900 x 900mm internal diameter	0	No.	8,000	$0
12.4	Box Culvert				
	375mm x 1200mm	0	m	1,500	$0
12.5	Pump station	0	No.	3,000,000	$0
13	**FENCING**				
13.1	Perimeter fence 2100 high 3 strands barb	50	m	105	$5,250
13.2	Gates 5 m wide plus separate ped gate	1	set	2,450	$2,450
15	**POWER SUPPLY**				
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	200	$0
21.3	Power supply boxes and controls	0	No.	1,500	$0
21.4	Connection from exsiting substation	0	No.	10,000	$0
16	**LIGHTING**				
16.1	Poles	0	No.	6,000	$0
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	180	$0
17	**SERVICE RELOCATION**				
17.1	Allowance	0	Item	10,000	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			2,015,400.

NORTHERN TERRITORY OF AUSTRALIA

DEPARTMENT OF CONSTRUCTION AND INFRASTRUCTURE

DARWIN PORT CORPORATION

Redevelopment of Drainage System

Date: 30/06/2011

No.	DESCRIPTION		AMOUNT $
1	ENVIRONMENTAL MANAGEMENT	$	5,000
2	MISCELLANEOUS PROVISIONS	$	1,310,900
3	PROVISION FOR TRAFFIC	$	15,000
4	CLEARING & GRUBBING & REHABILITATION	$	-
5	SEAWALLS / BREAKWATERS	$	-
6	BERTHS	$	-
7	EARTHWORKS	$	14,000
8	PAVEMENTS	$	-
9	SPRAY SEALING	$	-
10	ASPHALT SURFACING	$	-
11	PAVEMENT	$	9,660,000
12	DRAINAGE WORKS	$	3,332,000
13	FENCING	$	-
14	ROAD FURNITURE AND TRAFFIC CONTROL DEVICES	$	-
15	POWER SUPPLY	$	-
16	LIGHTING	$	-
17	SERVICE RELOCATION	$	-
18	WAREHOUSING	$	-
19	OFFICE BUILDING	$	-
20	POTABLE WATER	$	-
21	FIRE WATER	$	-
22	FUEL SUPPLY	$	-
	SUB-TOTAL	$	14,336,900
	CONTINGENCY @ 30%	$	4,301,070
	TOTAL	$	18,637,970
	ROUNDED ESTIMATE	$	18,638,000
	GST	$	1,863,800
	TOTAL ESTIMATE	$	20,501,800

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
1	**ENVIRONMENTAL MANAGEMENT**				
1.1	Environmental Management Plan	1	Item	5000	$5,000
1.2	Erosion and Sediment Control Devices				
(i)	Sediment Fence	0	m	30	$0
(ii)	Shaker	0	No.	1000	$0
(iii)	Rock Check Dams	0	No.	1000	$0
(iv)	Inlet Sediment Traps	0	No.	500	$0
2	**MISCELLANEOUS PROVISIONS**				
2.1	Establishment				
(i)	Mobilisation	1	Item	50% Estab	$651,500
(ii)	Demobilisation	1	Item	15% Estab	$195,400
(iii)	On Going Costs	1	Item	35% Estab	$456,000
2.2	Project Notice Boards	2	No.	2000	$4,000
2.3	Level Checking	0	Item	10,000	$0
2.4	Control Station Check Survey	0	Item	500	$0
2.5	Indigenous Training and Employment	0	hrs	35	$0
2.6	As Constructed Drawings	4	Dwgs	1000	$4,000
3	**PROVISION FOR TRAFFIC**				
3.1	Traffic Management Plan	1	Item	5,000	$5,000
3.2	Provision for traffic includes, detours, temporary connections, access to adjacent properties, traffic control devices, temporary bridging, warning devices, maintenance and restoration	1	Item	10,000	$10,000
4	**CLEARING & GRUBBING & REHABILITATION**				
4.1	Clearing and Grubbing includes, removing of vegetation stripping and stockpiling, top soil respreading, removal of unrecoverable fencing, drainage structures, old road surfaces, and other obstacles.	0	m^2	0.4	$0
4.2	Mulching	0	m^2	0.1	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
5	**SEAWALLS / BREAKWATERS**				
5.1	Dredging	0	m^3	30	$0
5.2	Silt Curtain	0	m^2	600	$0
5.3	Rock underlay	0	m^3	112	$0
5.4	Geofabric				
(i)	Bidim A44	0	m^2	12	$0
7	**EARTHWORKS**				
7.1	Earthworks in cut	0	m^3	25	$0
7.2	Earthworks in fill	400	m^3	35	$14,000
7.3	Clay liner	0	m^2	25	$0
7.4	Geofabric				
(i)	Bidim A64	0	m^2	16	$0
7.5	Wick drains	0	No.	200	$0
7.6	Trim and Compact Unpaved Areas	0	m^2	2	$0
11	**PAVEMENT**				
11.1	Reporfiling Pavement (Top Only 100mm thick)	115,000	m^2	84	$9,660,000

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
12	**DRAINAGE WORKS**				
12.1	Supply, load, transport, excavate, bed, lay and backfill				
	(i) HDPE flanged pipe				
	600 mm dia Class 2, RRJ	370	m	600	$222,000
	750 mm dia Class 2, RRJ	90	m	900	$81,000
	825 mm dia Class 2, RRJ	240	m	1,050	$252,000
	900 mm dia Class 2, RRJ	210	m	1,200	$252,000
	1050 mm dia Class 2, RRJ	760	m	1,500	$1,140,000
	1200 mm dia Class 2, RRJ	120	m	1,800	$216,000
	1350 mm dia Class 2, RRJ	340	m	2,000	$680,000
12.2	Concrete Headwalls				
	2 x 1050 mm dia. pipe	1	No.	15,000	$15,000
	2 x 1200 mm dia, pipe	1	No.	15,000	$15,000
	2 x 1350 mm dia, pipe	1	No.	15,000	$15,000
12.3	New Inlet Pits Complete				
	(i) Grated Pit 1000 x 1000mm internal diameter	2	No.	8,000	$16,000
	(i) Grated Pit 1000 x 1500mm internal diameter	18	No.	8,000	$144,000
	(i) Grated Pit 1000 x 2000mm internal diameter	8	No.	10,000	$80,000
	(i) Grated Pit 1500 x 1500mm internal diameter	3	No.	10,000	$30,000
	(i) Grated Pit 1500 x 2000mm internal diameter	2	No.	12,000	$24,000
	(i) Grated Pit 4500 x 4500mm internal diameter	3	No.	50,000	$150,000
12.4	Box Culvert				
	375mm x 1200mm	0	m	1,500	$0
12.5	Pump station	0	No.	3,000,000	$0
13	**FENCING**				
13.1	Perimeter fence 2100 high 3 strands barb	0	m	105	$0
13.2	Gates 5 m wide plus separate ped gate	0	set	2,450	$0
15	**POWER SUPPLY**				
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	200	$0
21.3	Power supply boxes and controls	0	No.	1,500	$0
21.4	Connection from exsiting substation	0	No.	10,000	$0
16	**LIGHTING**				
16.1	Poles	0	No.	6,000	$0
21.1	Excavation	0	m^3	70	$0
21.2	HV Cable in duct	0	m	180	$0
17	**SERVICE RELOCATION**				
17.1	Allowance	0	Item	10,000	$0

No.	DESCRIPTION	QTY	UNIT	RATE $	AMOUNT $
		TOTAL			14,336,900.