Section 3
Land

3. LAND

3.1 Rehabilitation

The rehabilitation strategy, including objectives and commitments described in the Western Cape Communities Coexistence Agreement (WCCCA), were described in Section 3.10 of the EIS. However, at the request of DEEDI, this information has been repeated in the following sections, with proposed draft objectives, indicators and completion criteria (where possible). The proposed rehabilitation objectives and indicators are reflected in the proposed conditions in the Environmental Management Plan (refer to **Appendix 3** of this Supplementary report). Further consultation will be carried out with key stakeholders, including Traditional Owners, prior to finalisation.

3.1.1 Rehabilitation at Existing Operations

A number of submissions recommended that forestry or other commercial plantations be established post-mining. Environmental Authority MIN100939109, which applies to ML7024 and ML6024, requires all land subject to mining activities to be rehabilitated to meet the requirements of the Queensland Department of Environment and Resource Management (DERM) Guideline *Rehabilitation requirements for mining projects*. These guidelines state that the administering authority will have regard to a hierarchy that considers "natural ecosystems" above developing alternative, higher economic value land uses. It is understood that DERM and DSEWPaC favour the establishment of a native species ecosystem over commercial forestry plantations.

RTA's existing East Weipa and Andoom operations have implemented a variety of post-mining rehabilitation objectives since mining commenced in the 1960's, including pasture, horticulture, native and non-native forestry and native vegetation. Now wholly dedicated to returning a native rehabilitated ecosystem to the post mining landscape, RTA continues to use trials and monitoring outcomes to improve the establishment and maintenance techniques required to routinely achieve this. Specific completion criteria for the various post-mining domains at East Weipa and Andoom are being developed in accordance with the requirements of the recently issued Environmental Authority.

Monitoring undertaken in rehabilitated areas in the existing operations at East Weipa, indicates successful establishment of framework species in both wet (*Melaleuca* and/or *Lophostemon* species) and dry (*Eucalypts, Corymbias, Erythrophleum*, etc species) post-mining landscapes. Monitoring of site establishment (8–10 months after seeding) over three years between 2008 and 2010 demonstrated that in areas where the objective was to establish a 'dry woodland' community, the average stems per hectare of framework species was between 1000 and 1400 and between 43.5%–73.4% of sites had more than 500 stems per hectare of the framework species. An average of 12–18 species were present in each 500m^2 plot, with a total of between 75 and 117 species being recorded per annum. In seasonally inundated areas, where the objective was to establish a wetland community, monitoring in 2008/09 and 2010/11 demonstrated between 80% and 100% of sites had more than 500 stems per hectare of the framework species. Rehabilitated areas are monitored for their establishment and ongoing development. Areas that are not performing are included in our maintenance (remediation) program; for example an area where weeds may have intruded will be added to our weed control program, and an area where the establishment rates of framework species has been low may be retreated in the following rehabilitation season with additional seed and fertiliser and/or remediated with supplementary planting of seedlings of the framework species.

3.1.2 Rehabilitation Objectives

As stated in Section 3.10.1 of the EIS, the overall goal of the rehabilitation program for the South of Embley Project would be to return the land to a post-mining land use that will be safe, stable, protects downstream water quality, and is self-sustaining. This is consistent with the current objectives for rehabilitation of East Weipa and Andoom.

The proposed rehabilitation objectives for each mine domain are proposed in **Table 3-A**. Generally, the objectives for the rehabilitation of areas disturbed by mining would be:

- to establish a self-sustaining vegetation community using appropriate local native tree, shrub and grass species; and
- to ensure land is made stable – in both geotechnical and erosion terms – to ensure post-mine land use is not compromised by site instability.

Unlike the current East Weipa post-mining areas, only a small proportion (less than 5%) of the post-mining areas in the South of Embley area are expected to be affected by groundwater to the degree that they would be suitable support a native wetland community dominated by *Melaleuca* and/or *Lophostemon* species. Therefore most post-mining landscapes in the South of Embley area are expected to be suitable to support native dry woodland vegetation dominated by *Eucalypts, Corymbias, Erythrophleum* and other framework species.

At the request of the WCCCC, RTA may establish post-mining land use options other than those required by regulation, subject to obtaining all necessary government approvals.

Table 3-A Draft Rehabilitation Objectives, Indicators and Completion Criteria

Mine Domain	Rehabilitation Goal*	Rehabilitation Objective/s*	Indicators*	Completion Criteria*
Mined area	Safe	The site is safe for humans and animals, now and in the foreseeable future.	Presence of hazards	TBD
	Non-polluting	Surface and groundwater remains uncontaminated.	Surface and groundwater monitoring	TBD
	Stable Landform	Landform design achieves appropriate erosion rates.	No active erosion	TBD
			Ground cover	Percentage ground cover (vegetation, litter and rocks combined) (TBD)
	Sustainable Land Use - Native, self-sustaining vegetation meeting criteria derived from reference sites and trials A. *Self-sustaining native dry woodland vegetation dominated by Eucalypts, Corymbias, Erythrophleum and other framework spp.*	Soil health – suitable growth medium established	Soil chemical, physical and/or biological properties	TBD
		Self-sustaining dry woodland vegetation and habitat established	Framework species presence	TBD: e.g. Minimum number of framework species present; target tree density range for all framework spp. combined
			Species richness	Species richness (number) (TBD)
			Presence of weed species	No declared noxious weeds present
			Structural composition	TBD: e.g. Percentage Foliage Projective Cover (FPC)
		Faunal species using site (or likely to)	Fauna	TBD: e.g. Fauna habitat development and/ or evidence of fauna utilisation.
		Land use is established with comparable management requirements to similarly used un-mined land.	Health and resilience of vegetation	TBD: e.g. Evidence of growth and good health; Evidence of recovery following fire.
	Sustainable Land Use - Native, self-sustaining vegetation meeting criteria derived from reference sites and trials) B. *Self-sustaining native wetland community dominated by Melaleuca and/or Lophostemon species*	Soil health – suitable growth medium established	Soil chemical, physical and/or biological properties	TBD
		Self-sustaining wetland vegetation and habitat established in seasonally inundated areas	Framework species presence	TBD: e.g. Minimum number of framework species present; target tree density range for all framework spp. combined
			Presence of weed species	No declared noxious weeds present
			Structural composition	TBD: e.g. Percentage Foliage Projective Cover (FPC)
		Land use is established with comparable management requirements to similarly used un-mined land.	Health and resilience of vegetation	TBD: e.g. Evidence of growth and good health; Evidence of recovery following fire.

Table 3-A Draft Rehabilitation Objectives, Indicators and Completion Criteria

Mine Domain	Rehabilitation Goal*	Rehabilitation Objective/s*	Indicators*	Completion Criteria*
Tailings storage facilities	Safe	The site is safe for humans and animals, now and in the foreseeable future.	Presence of hazards	TBD
	Non-polluting	Surface and groundwater remains uncontaminated.	Surface and groundwater monitoring	TBD
	Stable Landform	Landform design achieves appropriate erosion rates.	Slope angle and length	TBD
			Ground cover	Percentage ground cover (vegetation, litter and rocks combined): TBD
	Sustainable Land Use –Self-sustaining vegetation meeting criteria derived from monitoring and research of existing rehabilitation on TSFs	Soil health – suitable growth medium established	Soil chemical, physical and/or biological properties	TBD
		Self-sustaining vegetation and habitat established	Framework species presence	TBD: e.g. Minimum number of framework species present; target density or cover for all framework spp. combined
			Presence of weed species	No declared noxious weeds present
			Structural composition	TBD: e.g. Percentage Foliage Projective Cover (FPC)
			Health and resilience of vegetation	TBD: e.g. Evidence of growth and good health; Evidence of recovery following fire.
Infrastructure - Plant	Safe	The site is safe for humans and animals, now and in the foreseeable future.	Presence of hazards	TBD
	Non-polluting	Surface and groundwater remains uncontaminated.	Surface and groundwater monitoring	TBD
	Stable Landform	Landform design achieves appropriate erosion rates.	No active erosion	TBD
			Ground cover	Percentage ground cover (vegetation, litter and rocks combined): TBD
	Sustainable Land Use - Native, self-sustaining vegetation meeting criteria derived from appropriate reference sites and trials	Self-sustaining vegetation and habitat established	Framework species presence	TBD: e.g. Minimum number of framework species present; target density or cover for all framework spp. combined
			Presence of weed species	No declared noxious weeds present
			Structural composition	TBD: e.g. Foliage Projective Cover
		Land use is established with comparable management requirements to similarly used un-mined land.	Health and resilience of vegetation	TBD: e.g. Evidence of growth and good health; Evidence of recovery following fire.

Table 3-A Draft Rehabilitation Objectives, Indicators and Completion Criteria

Mine Domain	Rehabilitation Goal*	Rehabilitation Objective/s*	Indicators*	Completion Criteria*
Infrastructure – transport	Transport infrastructure such as the Port, ferry and barge terminals, mine access road, may be left in place.	Subject to agreement with regulators and Traditional Owners some facilities such as the transport infrastructure may be left in place. The Final Rehabilitation Report will address any on-going maintenance, management and funding requirements and shall be approved by DERM	NA	NA
Water supply dam (including the fishway structure) and other water infrastructure	Water infrastructure, such as the water supply dam, may be left in place.	Subject to agreement with regulators and Traditional Owners some facilities such as the water storage dam may be left in place. The Final Rehabilitation Report will address any on-going maintenance, management and funding requirements and shall be approved by DERM	NA	NA

* Draft rehabilitation goals, objectives, indicators and completion criteria only. These will be further developed through consultation, research, on-going monitoring, and site specific trials and included in a Rehabilitation Management Plan which will be developed, implemented and submitted to DERM within three years of the commencement of mining.

3.1.3 Rehabilitation Indicators

Rehabilitation indicators are parameters that can be measured and monitored to track the performance of rehabilitation against a given objective. A range of indicators can be chosen for monitoring and **Table 3-A** shows those indicators currently proposed for the SoE Project. These may be improved on in the future as site-specific research trials, the findings of on-going monitoring, and consultation outcomes become available. For example, trials will be undertaken to determine if use of some felled timber for fauna refuge in rehabilitation areas is feasible, including monitoring to determine increase of faunal recolonisation/utilisation.

A monitoring program would be developed to regularly assess the success of rehabilitation. The monitoring methodology would be likely to be similar to that currently used for operations north of the Embley River and include:

- monitoring in the first year after establishment at a scale of one 500m^2 transect plot per 10ha of rehabilitation; and
- follow-up monitoring, for example 4, 8 and 12 years after establishment.

Performance against indicators would be used to inform an adaptive management approach.

RTA undertakes a range of research projects at its existing operations. One of the submissions requested information on the implementation of recommendations by Winter and Alford (1999), a research study of fauna colonisation of rehabilitated areas in the existing Weipa operations which was funded by Comalco Aluminium Limited (now Rio Tinto Aluminium Limited). The status of these recommendations and further planned work, some of which would be associated with the SoE Project are presented in **Table 3-B**.

Table 3-B Status of Winter and Alford (1999) Recommendations

Recommendation	Current Status of Implementation
1. That patches of vine forest be established as part of the regeneration – patches to be larger than two hectares to provide a reasonable core to edge ratio.	Vine forests are not disturbed as part of the mining process. The rehabilitation program focuses on establishing native ecosystems suited to the post-mining landscape.
2. That wetland areas be established within the rehabilitated mine area to include drainage lines, seasonal wetlands and permanent swamps, each with its appropriate vegetation.	Some areas of rehabilitation, in particular areas in Weipa that are seasonally inundated, are dominated by native Melaleucas and other species and are similar to natural seasonally inundated, or tree swamp, ecosystems in the region. Some post-mining residual voids (e.g. slots or borrow pits) will contain permanent (or semi-permanent) water once mining has ceased and there is an opportunity to develop these as wetland environments suited to wetland vegetation and related fauna. Further work planned: • Establishment and management requirements will be incorporated into the Rehabilitation Management Plan for SoE Project area. • Specific completion criteria for these areas to be developed for SoE Project area.
3. That log piles be established within the regeneration, using trees felled ahead of mining. Their configuration should consist of a few large piles and numerous smaller piles in each regeneration section.	Prior to clearing, a timber salvaging operation is conducted which removes all trunks suited to milling. Recent attempts to salvage and stockpile felled trees for future replacement in the rehabilitation were unsuccessful as stockpiled logs caught fire from wildfires. Further work planned: • Undertake trial, to determine if use of some felled timber for fauna refuge in rehabilitation areas is feasible, including monitoring to determine increase of faunal recolonisation/ utilisation.
4. That rock piles be established within the regeneration, using boulders uncovered during mining. Their configuration should consist of a few large piles and numerous smaller piles in areas where boulders are numerous.	Boulders are not common at Weipa, only relatively small 'oversize reject' stones are routinely available and these are generally used in construction. Further planned work: • Depending on likely nature and availability of any rock material, an investigation will be conducted into the feasibility of utilising it for rock piles in new or existing rehabilitation.
5. That break-aways (vertical surfaces) be incorporated into land rehabilitation following mining.	Mining has not affected any areas that naturally contain these features. Mining occurs over a relatively flat landscape and RTA aims to minimise erosion potential of newly rehabilitated surfaces by actively reducing break-aways and vertical surfaces.
6. That control burning be incorporated in the management procedures which aim to establish self-sustaining native woodland within regenerated areas.	The current aim of post-mining rehabilitation at Weipa is for self-sustaining native ecosystems which, by definition, must be resilient to the natural fire regime of the region. Further planned work: • Include criteria related to resilience to fire in completion criteria for rehabilitation.

Table 3-B Status of Winter and Alford (1999) Recommendations

Recommendation	Current Status of Implementation
7. That extensive areas of contiguous old-growth Darwin Stringybark woodland be retained in the vicinity of the mine as source habitat for fauna colonising regeneration. 8. Maintain the current policy of retaining native vegetation along watercourses (riparian) and associated woodland (ecotone with Darwin Stringybark) as a network of native habitat throughout the mine. 9. That the Conservation Strategy be updated to cover Comalco's area of responsibility at two scales: i. The area expected to be affected by mining within the life of the current Environmental Management Overview Strategy (EMOS) which is to 2015 and ii. Comalco's entire mining lease on Cape York Peninsula (leases ML 7024 & 6024) together with Alcan's mining lease (ML 7031).	The existing disturbed mining area and the proposed SoE mining areas are surrounded by thousands of hectares of Darwin Stringybark which provides source habitat for colonising fauna. Further planned work: • Sensitive vegetation (riparian, wetland, estuarine, vine forest and coastal vegetation on sand) would be buffered from mining by Darwin Stringybark woodland in the SoE Project area (refer Section 7.9.2 of the EIS). • Establish monitoring locations and conduct monitoring of target fauna communities in SoE Project area (refer Section 7.9.2 of the EIS and restated in **Section 8.1** of this Supplementary report).
10. That a pilot study be undertaken to harvest fauna prior to woodland clearing for mining, and use these animals to populate log and rock piles, in order to determine if this enhances the colonisation of regeneration.	Manual trapping and relocation of fauna from mine development areas would not be undertaken as it is considered inappropriate to relocate fauna into developing rehabilitation. RTA is committed to continuing to enforce, improve and extend the existing protected sensitive vegetation networks across the mining leases. This will provide refugial habitat for faunal communities and source populations for colonisation of rehabilitation. Further planned work: • Sensitive vegetation (riparian, wetland, estuarine, vine forest and coastal vegetation on sand) would be buffered from mining by Darwin Stringybark woodland in the SoE Project area (refer Section 7.9.2 of the EIS and restated in **Section 8.1** of this Supplementary report).
11. That a pilot study be undertaken to erect artificial hollows for birds and mammals in remnant islands of old-growth Darwin Stringybark woodland within the mine, to determine if they are occupied by species which are then capable of recolonising neighbouring regeneration.	Nest boxes are high maintenance, not certain to be utilised by target fauna, and capable of creating adverse impacts on existing fauna. The current focus is to improve the quality of rehabilitation, including linkages between sensitive vegetation networks.
12. That changes in composition of the faunal community within regeneration be monitored, to ascertain when the new faunal community attains the woodland stage.	Comprehensive fauna surveys are undertaken periodically at the existing RTA operations in rehabilitation and representative reference sites within natural ecosystems regularly. Further planned work: • Establish monitoring locations and conduct monitoring of target fauna communities in SoE Project area (refer Section 7.17.2 of the EIS).
13. That a study be undertaken of the faunal community in native woodland on ironstone in order to establish a benchmark for the anticipated mature faunal community in regeneration.	Rehabilitation fauna surveys undertaken at the existing RTA operations include representative reference sites within natural ecosystems. At least three of the land units associated with the Bulimba formation are included in these surveys.

Table 3-B Status of Winter and Alford (1999) Recommendations

Recommendation	Current Status of Implementation
14. That the ecology of Woodland Indicator Species be studied to determine their specific habitat requirements, and to find ways to provide these requirements in the rehabilitation process.	The concept of indicator species is being considered in the current research underway to develop completion criteria for rehabilitation. Some species nominated by Winter and Alford may be too infrequent to be indicator candidates, but the ongoing fauna monitoring program continues to develop understanding of these and other species found in the rehabilitation and reference ecosystems. Further planned work: • Establish monitoring locations and conduct monitoring of target fauna communities in SoE Project area (refer Section 7.9.2 of the EIS and restated in **Section 8.1** of this Supplementary report).

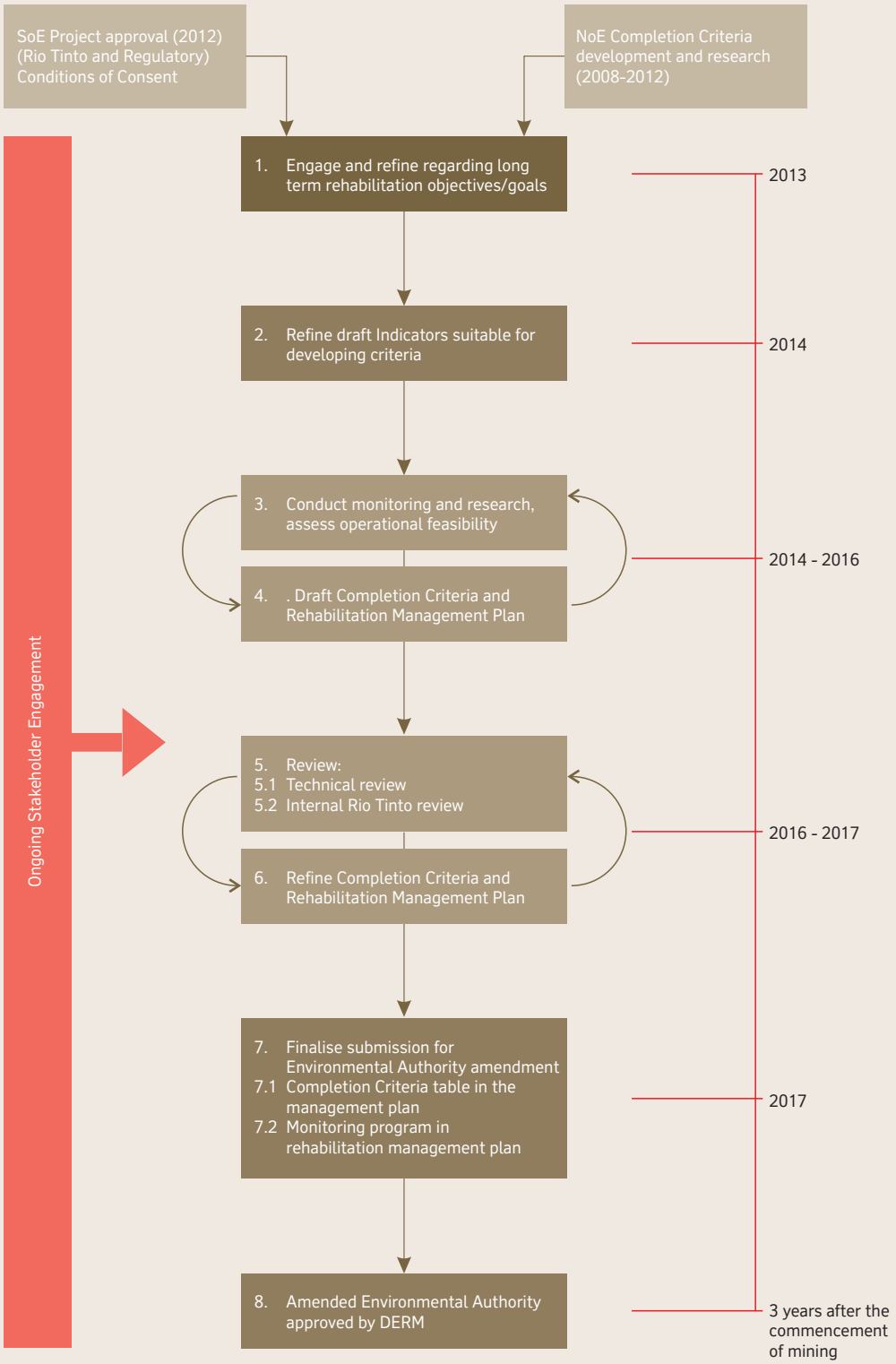
3.1.4 Rehabilitated land completion criteria

Building on existing techniques, on-site revegetation trials would be undertaken to test selected species, seeding rates and establishment methodologies. Vegetation transects in various reference sites in appropriate unmined ecosystems, would be undertaken in the SoE Project area. Differences in the behaviour of the shallow groundwater table and in the lateritic profile mean that it cannot be assumed that revegetation outcomes at the South of the Embley will be identical to those at existing operations, or that reference sites are the same as those north of the Embley River. RTA has committed to consulting with the Traditional Owners and the relevant Western Cape Communities Consultative Committee (WCCCC) sub-committee regarding timelines for development of rehabilitated land completion criteria, aiming to have these developed within three years of commencement of mining. The completion criteria would form the standard against which rehabilitation is measured in a Progressive or Final Rehabilitation Report under the EP Act.

Figure D indicates the steps for development of criteria within this timeframe, taking into account previous experience at Andoom and Weipa; outcomes from on-going monitoring, trials and research projects on the South of Embley site; as well as stakeholder engagement. This feedback of information forms part of a continuous improvement loop which will continue to occur throughout operations.

Rehabilitation performance would be measured against the adopted criteria. The final completion criteria may be reviewed over time as more rehabilitation knowledge relevant to the Project area is gained. In order to help ensure that rehabilitated areas maintain a trajectory towards the completion criteria, regular monitoring of relevant indicators shall be undertaken (see Sections 3.1.2 and 3.1.4) and remediation measures taken where necessary.

Figure D
Rehabilitation Management Plan Development Flowchart



3.1.5 Rehabilitation Management Plan

The Environmental Authority (MIN100939109) issued on 30 August 2011 requires RTA to submit a Rehabilitation Management Plan for the existing East Weipa and Andoom operations by 30 August 2013 and work on the development of this plan has commenced. Many elements of this plan will be directly adaptable for the South of Embley operations, including slope and drainage design, and erosion controls. However, other aspects such as agreed post mining land use, revegetation methods, and completion criteria will be subject to the findings of further consultation with key stakeholders, site-specific revegetation trials and further research.

RTA would prepare and submit to DERM a Rehabilitation Management Plan for the SoE Project within 3 years of the commencement of bauxite mining. The Rehabilitation Management Plan will include:

a. schematic representation of final land form inclusive of drainage features;

b. slope and cover designs;

c. drainage design;

d. erosion controls proposed on reformed land;

e. revegetation methods inclusive of plant species selection, re-profiling, soil handling (including stockpiling), soil ameliorants/amendments, surface preparation and method of propagation;

f. materials balance including available topsoil and low permeability capping material;

g. geotechnical, geochemical and hydrological studies;

h. chemical, physical and biological properties of soil and water;

i. agreed post mining land and/or infrastructure use with the landowner/holder and the administering authority;

j. rehabilitation goal, rehabilitation objective, indicators and measurable completion criteria for each agreed post mining land use within each domain that enables determination of rehabilitation success;

k. description of experimental design for monitoring of reference and rehabilitated areas inclusive of statistical design;

l. a rehabilitation monitoring program based on a statistically sound, mutually agreed sampling design;

m. research program and associated milestones; and

n. programs for maintenance of rehabilitation as required to achieve the nominated rehabilitation objective.

3.1.6 Consultation on Rehabilitation

RTA has engaged and continues to engage with a range of stakeholders throughout the development of the Project. The WCCCA SoE sub-committee has reviewed the proposed rehabilitation objectives in the EIS and have provided comment on the process for finalising aspects of the rehabilitation process. RTA has committed to jointly developing a rehabilitation process with the Traditional Owners and relevant WCCCC sub-committee prior to the commencement of mining (refer to Section 3.10.1 of the EIS). However, a draft flowchart has been provided in **Figure D** to demonstrate the possible steps to finalising the Rehabilitation Management Plan and stakeholder engagement throughout the process.

A specific engagement plan would be developed and implemented to support planning and implementation of the rehabilitation program. Relevant stakeholders would include:

- Traditional Owners (the WCCCC and the relevant sub-committee would continue to provide the primary consultative mechanism);
- Queensland and Commonwealth Government (in particular DERM and DSEWPaC);
- Regional neighbours (e.g. neighbouring pastoral, mining, conservational land holders).

This engagement program may form part of the proposed Communities, Heritage, and Environment Management Plan (CHEMP) proposed in the Section 16.3.2 of the EIS. Further information on the proposed CHEMP is also available in the Social Impact Management Plan (**Appendix 6**).

RTA would continue to report annually to the relevant WCCCC sub-committee on rehabilitation programs, including an inventory of areas disturbed by mining, timeframes for rehabilitation, and supporting reports pertaining to the monitoring of rehabilitated areas. Ongoing community engagement, including engagement with Traditional Owners, is discussed in the Social Impact Management Plan (provided in full in **Appendix 6**).

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Section 4
Climate

4. CLIMATE

The floating pontoon on the temporary passenger jetty would be designed in a manner that it could be removed in the event of a cyclone warning.

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Section 5
Water Resources

5. WATER RESOURCES

5.1 Water Supply

The water balance has been updated based on the revised startup capacity (22.5Mpdtpa) and is provided in **Table 5-14(sup.)**.

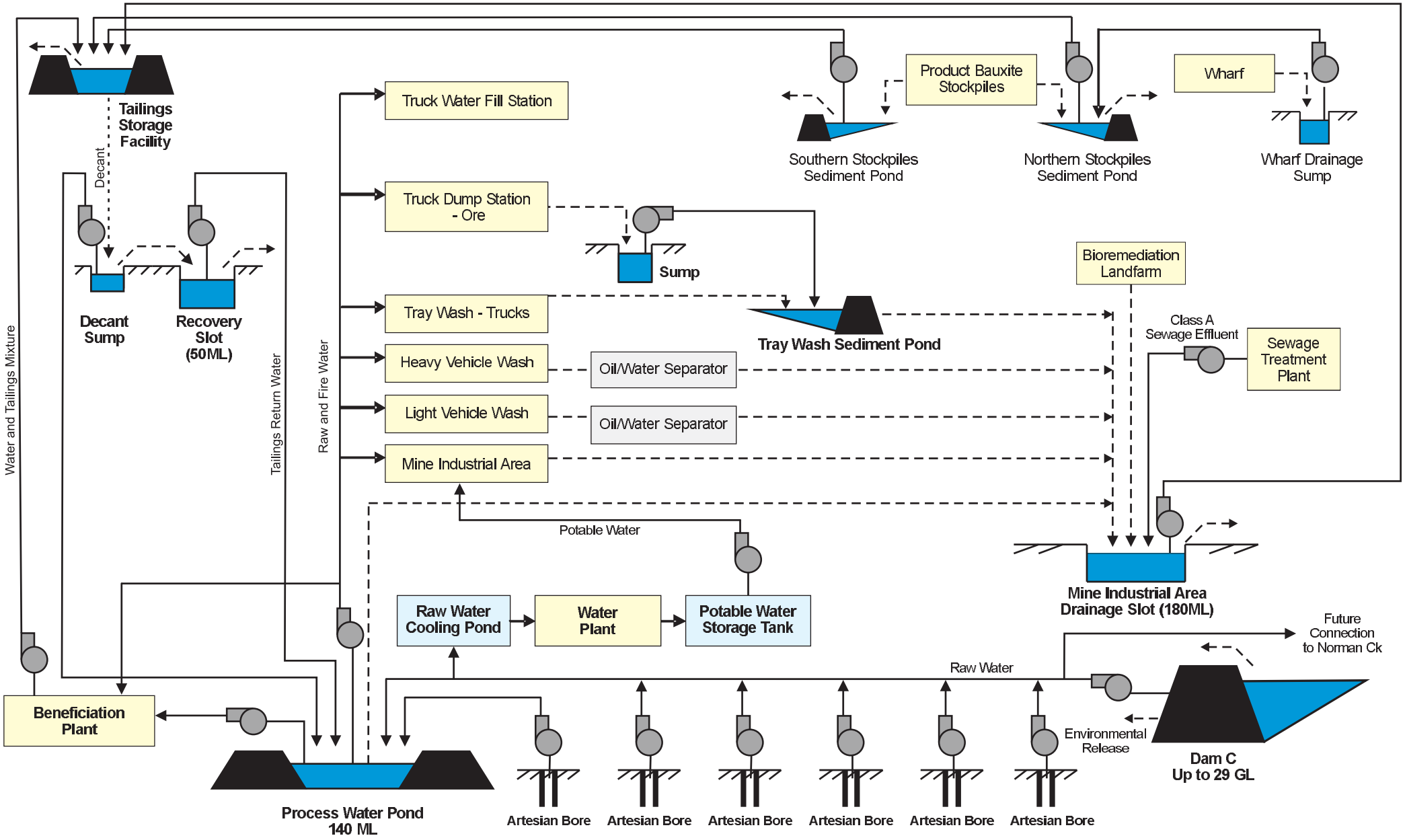
Table 5-14 (sup.) Average Annual Water Balance

Production Rate	Average Annual Demand (GL)	Average Annual Supply (GL)					
		Recycle from tailings	Artesian	Dam C	Slots*	River	Total Supply
22.5Mdptpa	24.8	7.1	4.9 (7.8 peak)	12.0 (Stage 1)	0.8	0	24.8
30Mdptpa	33.0	9.4	6.0 (10.6 peak)	13.8 (Stage 2)	1.6	2.2	33.1
50Mdptpa	63.7	22.1	11.9 (15 peak)	25.4 (Stage 2)	1.6	2.5	63.5

* Trenches dug adjacent to tailings storage facilities to recover water

5.2 Site Water Management

DERM raised a number of questions regarding the site water management system. **Figure 5-8(sup.)** and **Figure 5-9(sup.)** have been provided to address these concerns and reflect minor changes as a result of design refinements. Further information regarding stormwater management in the mine infrastructure area is also provided in the Environmental Management Plan (refer to **Appendix 3)**.



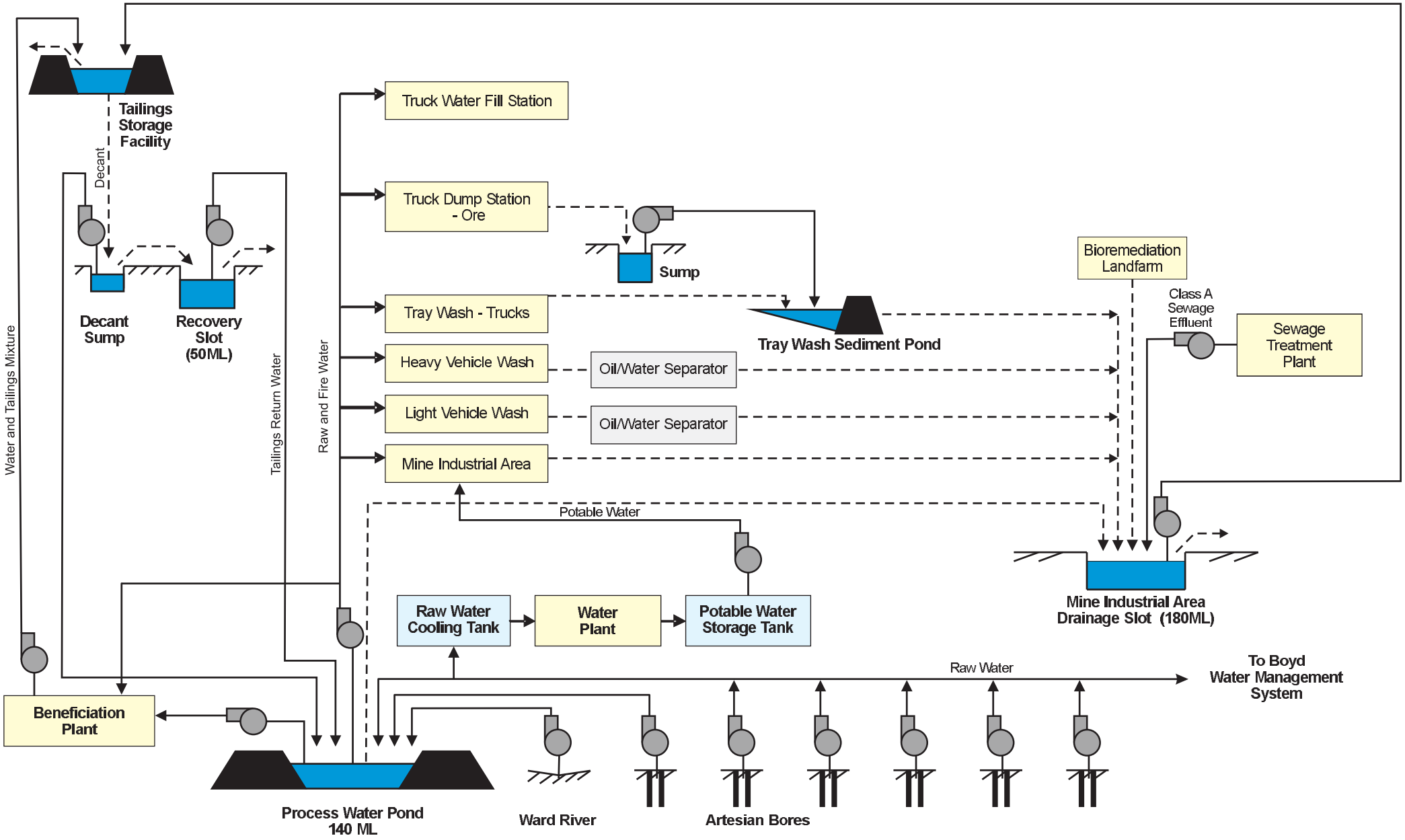
Gravity flow

Pipeline

South of Embley Project

Fig. 5-8(sup.): Boyd Water Management System

Date: 13/12/2011



RioTintoAlcan

South of Embley Project

Fig. 5-9(sup.): Norman Creek Water Management System

Date: 15/12/2011

5.3 Dam C Fishway Design

Design of the fishway structure within the Dam C spillway has progressed since the EIS with consultation commencing with DEEDI Fisheries Queensland (FQ) on determining an appropriate design. RTA will continue to engage in a phased design process through consultation with DEEDI FQ aiming to:

i. establish fish passage design principles, objectives and criteria specific to the Dam C site;

ii. assess suitability of fishway options (potential options currently identified are assessed below); and

iii. determine a suitable monitoring and management program for the fishway.

Consultation would also be undertaken with Traditional Owners.

DEEDI FQ identified the main concern is that the current proposal for Dam C presented a barrier to fish passage at times when there will be downstream flow in Norman Creek. In a submission on the EIS, DEEDI FQ indicated the provision of fish passage during non-spill periods whenever there is an environmental release from the dam would be beneficial. The submission identified that this would necessitate a fishway that is operable over a range of headwater and tailwater conditions.

Assessment of identified fishway options to provide fish passage has been conducted **(Table 5-A)**. A change in fishway configuration is being assessed, which would integrate the fishway into the Dam C low gradient spillway channel in place of the spillway bypass channel fishway identified in the EIS. The configuration of this is shown in **Figure 5-11(sup.)**.

Figures E to G show the fluctuations in modelled Dam C water level along with the evaporation rate for 15, 30 and 50Mdptpa production scenarios. The figures show the water level in Dam C is seasonal, rising quickly at the start of dam filling to maintain an extended period at the maximum level and then followed by a slower lowering of water level. Spillway discharge is currently proposed while the dam is at maximum level. Given the seasonal dam level fluctuation, potential exists to extend the duration of flow through the spillway integrated fishway to some extent. An extension of this spillway discharge would reduce the requirement for a separate environmental release from the dam during non-spill periods.

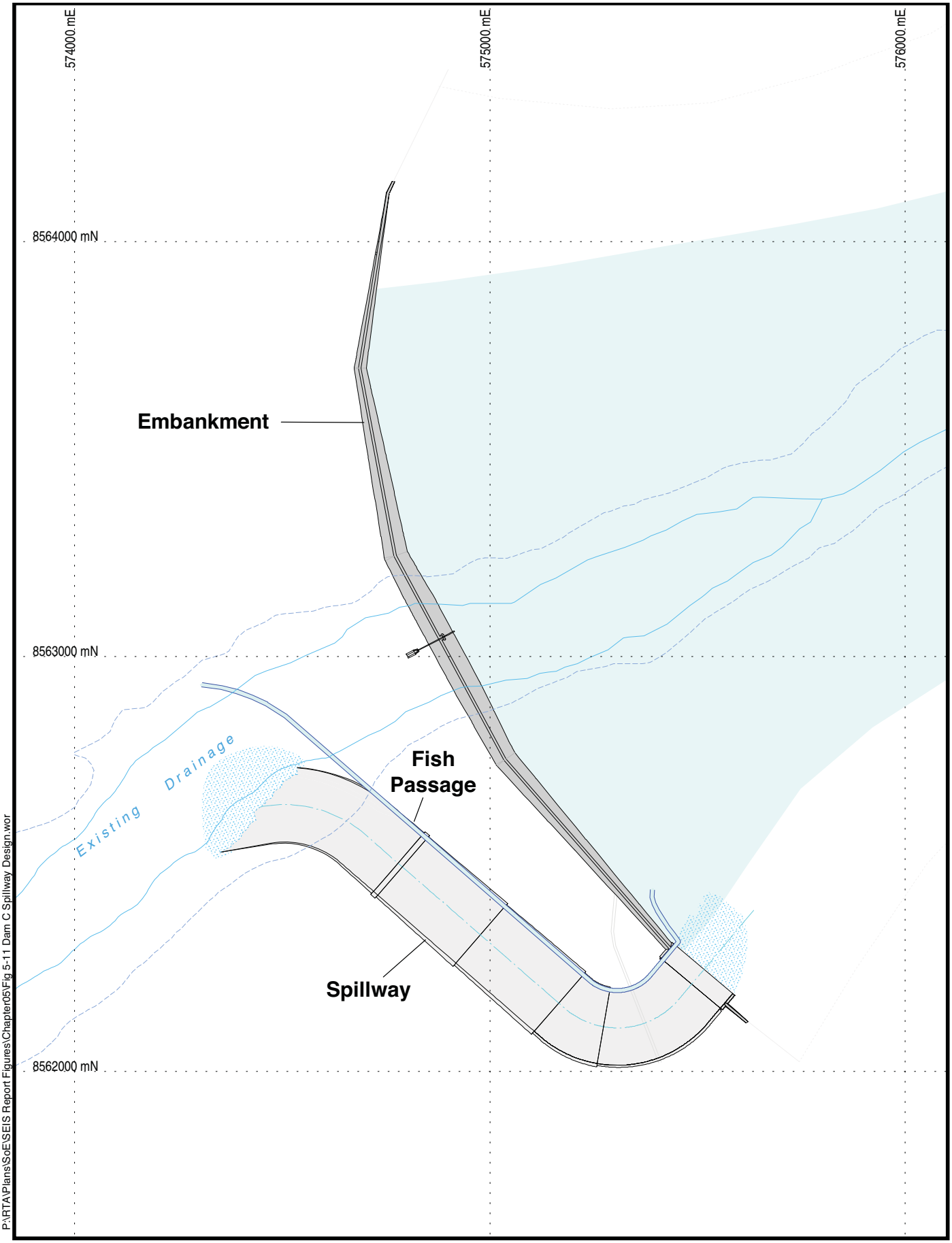
Based upon the assessment above it is the preferred option to modify the design of the current proposed fishway to address DEEDI's concern rather than provide a second mechanical fishway. The above options will however be further investigated and assessed in consultation with DEEDI FQ through the design process.

Further assessment of the potential impacts to the fish community present in the Dam C catchment from Dam C construction is considered in **Section 8.2**.

Table 5-A Dam C Fishway Options

High Level Spillway bypass Channel – EIS Case	"Nature like" Fishway Integrated into High Level Spillway Channel	Fish Lock/Fish Lift
Benefits		
Volitional* fishway with limited requirement for mechanical operation and which is not limited by cycle frequency or capacity	Volitional* fishway with limited requirement for mechanical operation and which is not limited by cycle frequency or capacity	Operates over wide range of headwater conditions
Minimal impact on spillway design	Operates over large range of fishway design flows	Suitable for higher barriers
Design incorporates proven and "nature like" fishway components (e.g. rock/ block ramps, chutes and staging pools within ramp structures and open channel sections within low flow channel)	Design incorporates proven and "nature like" fishway components (e.g. rock/ block ramps, chutes and staging pools within ramp structures and open channel sections within low flow channel)	Flexibility in location of fishway entrance location at the barrier
	Fishway and adjoining channel capture majority of annual spillway discharge flows	Allows limited discharge of environmental flows downstream through fishway entrance
	Potential for delivery of increased range of environmental flows through fishway entrance for increased tailwater operation range	
	Suitable for downstream fish passage through fishway channel and auxiliary channels for large range of spillway overflow conditions	
Problems		
Operates over a reduced range of headwater conditions	Operates over a reduced range of headwater conditions unless additional flow outlets/fishway exits are incorporated	Automated mechanical operation with fish passage capacity limited by physical volume and cycle rate
No high level spillway "nature like" fishways in Queensland	No high level spillway "nature like" fishways in Queensland	High capital cost
Smaller design flow range for fish passage		Low reliability
No partitioning of spillway discharge into multiple fishway components		High operation and maintenance costs
Competing attractant flows between the fishway entrance and the spillway discharge		Likely to be required in addition to a spillway-integrated fishway to achieve upstream and downstream fish passage at a full range of flows
Limited suitability for downstream fish passage through the bypass channel		Post mining operational legacy

* A volitional fishway facilitates fish passage through movement of the individual rather than through automated processes.



P:\RTA\Plans\SoE\SEIS Report Figures\Chapter05\Fig 5-11 Dam C Spillway Design.wor

Note: Design is conceptual

South of Embley Project

Fig. 5-11(sup.): Dam C Spillway Design

N

0 500m

Datum/Projection: GDA94/MGA Zone 54 Date: 12/12/2011

Rio Tinto Alcan

Figure E
Fluctuation in Dam C Level at 15 Mdptpa

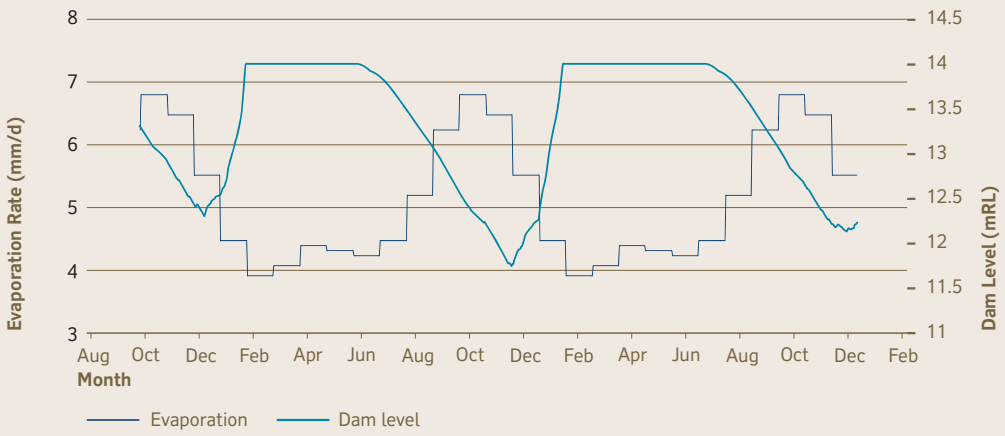


Figure F
Fluctuation in Dam C Level at 30 Mdptpa

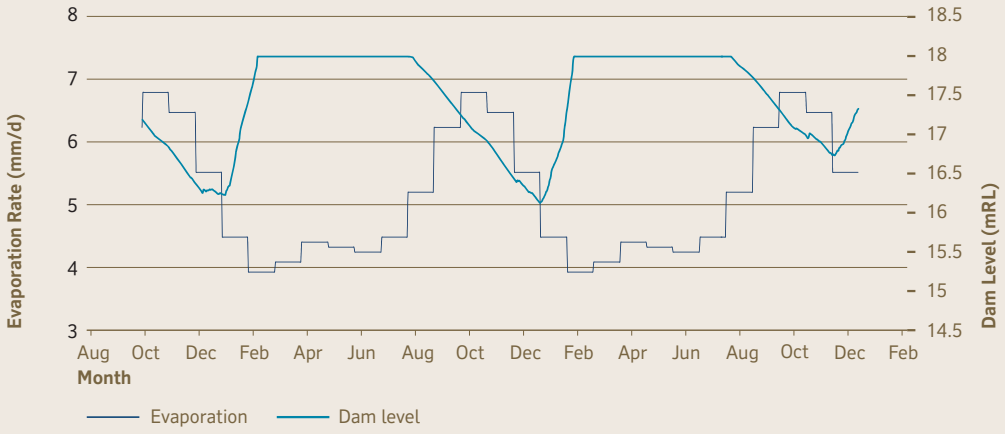
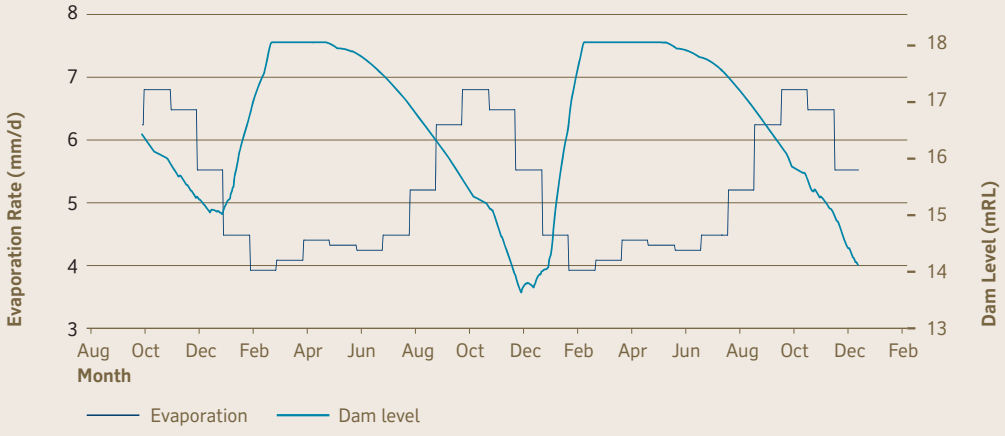


Figure G
Fluctuation in Dam C Level at 50 Mdptpa



5.4 Existing Groundwater Use

The EIS identified that there were a small number of stock and domestic bores that access the GAB aquifers in the areas of outcrop to the east. Two bores, which take water from the Gilbert River Formation, were identified: Sudley Station and Batavia Downs. Further assessment has identified one additional bore, Bramwell Roadhouse (also known as Bramwell Junction), which also takes water from the Gilbert River Formation. Peak drawdown at these bores have been determined from the EIS groundwater model and are presented in **Table 5-B**.

Table 5-B Pre-existing Bores

Bore name	Used as a water source	Artesian or sub-artesian	Monitoring bore designated in Water Licence 179696	Maximum drawdown as stipulated in Water Licence 179696	Predicted peak drawdown (m)	"Unduly affected" status
Batavia Downs	Yes Used for Irrigation & livestock water source	Sub-artesian	Yes	-5.0	-3.7	Unlikely
Bramwell Junction/ Roadhouse	Yes Used for Irrigation & campground water source	Sub-artesian	No	n/a	-1.4	Unlikely
Sudley Station	No Potential use for livestock water source	Artesian	No	n/a	-10	Possible after year 25

Predicted drawdown at the Sudley Station bore may materially reduce the supply of water through a change in the piezometric head from Artesian to Sub-artesian. This impact is predicted to occur after approximately 25 years of abstraction. The Sudley Station bore was identified in the EIS as being used for stock watering however observations during recent monitoring identified that the Sudley Station bore is not currently used as a water source.

Section 6
Marine

6. MARINE

6.1 Inshore and Offshore Reef Habitats

The EIS described areas of inshore reef and extent of benthic assemblages in the Project area. In response to a query raised by the DERM, a review of the drop camera and video transects was carried out to clarify the extent and type of inshore reef environment adjacent to the proposed Port.

The review found that Figure 6-19 presented in the EIS contained an error. The habitat closest to the Port contains a soft coral-sponge assemblage as shown on Figure 6-18 of the EIS. This area was found to contain approximately 13.7ha of soft coral-sponge habitat with <2% live cover, a much lower percentage than had been identified in the EIS.

Section 6.9.2.5 and Figure 6-64 of the EIS indicate these areas would receive greater than 2.5mg/cm^2/day during Periods 2 and 3 of the Stage 1 capital dredge program and some loss of habitat at these locations may be expected. A navigational aid would be installed adjacent to this habitat during the construction for Stage 1. Later, if Stage 2 of the Port is constructed (should market conditions allow), the portion of habitat closest to the Port (6ha habitat containing <2% live cover) would be dredged to provide a turning area for ships entering and exiting the berths closest to shore. As a result of the discrepancy found in this survey, the drop camera and video surveys at Boyd Point and Pera Head were also reviewed to ensure accuracy.

6.1.1 Drop Camera Surveys

The area calculated for available reef area was determined by reviewing aerial photography and confirmed by the drop camera surveys. Each drop camera point represents one photographic frame of approximately 0.5 x 0.5 m (i.e. 0.25m^2). Each drop camera frame was analysed using the Coral Point Count with Excel Extensions software (CPCe, Version 3.4). This software randomly selects 20 points from each frame and the underlying benthic cover is recorded. Thus for each drop camera point, percentage cover will be recorded for a number of benthic habitats (including hard coral, soft coral, sponges, algae, rock, sand, mud).

In the Boyd Point and the Pera Head areas, a total of 94 and 269 locations were sampled, respectively, using a drop camera (marked in red on **Figure 6-19(sup.)**). At Boyd Point, 26 of the 94 locations recorded habitat suitable for colonisation (i.e. rock and/or other cover such as algae). Most of the drop camera points recorded 0% cover for hard coral, soft coral and sponges. Seven locations recorded hard coral, soft coral and/or sponge cover ranging from 10% to 45% cover at individual sampling locations (three locations where hard coral was detected (30%, 40% and 40%); two where soft coral was detected (25% and 45%); and two where sponges were detected (10% and 45%)). To calculate mean live cover of hard coral, soft coral and sponges, the following example calculation for overall estimated mean live cover for hard corals at Boyd Point is presented:

Percentage live cover of hard coral = ([23 × 0] + 30 + 40 + 40)/26 = 4.23%.

The same methodology was used for soft coral and sponges at Boyd Point and for hard and soft corals and sponges at Pera Head (see **Table 6-3 (sup.)**).

At Pera Head, 49 of the 269 locations recorded habitat suitable for live cover (i.e. rock) and 26 of the locations recorded live cover ranging from 5% to 100% cover at individual sampling locations. The results are presented in **Table 6-3(sup.)** and **Figure 6-19(sup.)**.

LEGEND

- Proposed dredge area (stage 1)
- Proposed dredge area (stage 2)
- Drop camera location
- Drop video location
- Live cover
- Potential habitat

0 0.5 1km

SCALE - 1:30,000 (at A3)

Map Grid of Australia - Zone 54
Geocentric Datum of Australia 1994

Rev	Date	Revision Description	DRN	CHK	ENG	CHK ENG	APPD
B	19/12/2011	Re-issued for review	KK	KM			
A	01/12/2011	Issued for review	KK	KM			

WorleyParsons resources & energy

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SOUTH OF EMBLEY PROJECT

Figure 6-19 (sup): Reefal habitat between Pera Head and Boyd Point

Project No: 301001-01069	Figure: 01069-00-GM-DAL-0045	Rev: B

Compiled by BRISBANE GEOMATICS

K:\RTA\301001-01069\GM\DAL\01069-00-GM-EN-0045-B(Live_Cover_habitat).wor

Table 6-3 (sup.) Inshore Reef Areas and Extent of Dominant Benthic Assemblages

Location	Total Estimated Substrate Available for Reefal Colonisation (ha)	Estimated % Hard Coral Cover	Estimated Total Hard Coral (ha)	Estimated % Soft Coral Cover	Estimated Total Soft Coral (ha)	Estimated % Sponge Cover	Estimated Total Sponges (ha)
Boyd Point	49	4.2%	2.1	2.7%	1.3	2.1%	1.0
Port area (between Boyd Point to Pera Head)[1]	23	0.0%	0.0	1.0%	0.2	1.8%	0.4
Pera Head	72	6.2%	4.5	6.3%	4.5	3.7%	2.7
South from Pera Head to Thud Point (inferred)[2]	274	6.2%	16.9	6.3%	17.2	3.7%	10.2

1 The estimate of reefal area available, and estimates of live cover for the Port area were based on a review of only six videos (with limited resolution). See Section 6.1.2 for details.

2 The estimated reefal area available for colonisation south from Pera Head to Thud Point was inferred from analysis of aerial photographs. As there are no direct data on live cover from this area, the estimates are based on the maximum percentage cover from the areas where data were available.

The EIS presented much higher live cover estimates in Table 6-3 and Figure 6-19. Table 6-3 only recorded the total available area for reefal colonisation, without incorporating the actual results of analysis of the drop camera locations. Figure 6-19 displayed the individual locations where live cover was recorded as 'flowers' and extrapolated the cover outwards from these points, diminishing with distance. The individual drop camera samples only covered an area of approximately 50 x 50 cm, however, the 'flowers' cover an area of approximately 200 m across. This greatly distorts the actual results and gives the perception that live cover is much higher than actually recorded. **Figure 6-19(sup.)** shows the locations where live cover (green dots) and suitable habitat (black dots) were recorded and **Table 6-3(sup.)** displays the estimates of cover derived from the data collected.

6.1.2 Video Surveys

There were four locations where towed video transects were undertaken (marked with yellow triangles on **Figure 6-19(sup.)**. At each location, three transects were recorded, ranging in length from approximately 25m to approximately 50m. Depending on the length of the transect, between 26 and 50 frames were selected from each video transect. Each frame was analysed using the Coral Point Count with Excel Extensions software (CPCe, Version 3.4). The software randomly selected 10 points from each frame and the underlying benthic cover was recorded. Thus for each frame, percentage cover will be recorded for a number of benthic habitats (including hard coral, soft coral, sponges, algae, rock, sand, mud). Each transect is considered as one sampling unit and information presented below has the mean and standard error of the three transects from each location.

At the sites labelled 'PAR1':

- no data was collected due to very poor underwater visibility.

At the sites labelled 'PAR2':

- hard coral cover ranged between 0% and 0.6% cover (mean = 0.40% ± 0.20%);
- soft coral cover ranged between 17.8% and 18.7% (mean = 18.25% ± 0.25%); and
- sponge cover ranged between 0 and 1.4% (mean = 0.92% ± 0.46%).

At the sites labelled 'PAR3':

- no hard coral cover was recorded;
- soft coral cover ranged between 0.3% and 1.84% (mean = 0.87% ± 0.49%); and
- sponge cover ranged between 0% and 8.9% (mean = 3.44% ± 2.76%).

At the sites labelled 'PAR4':

- no hard coral cover was recorded;
- soft coral cover ranged between 0.24% and 2.07% (mean = 1.10% ± 0.53%); and
- sponge cover ranged between 0% and 0.74% (mean = 0.25% ± 0.25%) (only one transect recorded sponge cover).

For 'Port area' calculations in **Table 6-3(sup.)**, the average of all 'PAR3' and 'PAR4' sites was used:

- no hard coral cover was recorded;
- soft coral cover ranged between 0.24% and 2.07% (mean = 0.96% ± 0.33%); and
- sponge cover ranged between 0% and 8.9% (mean = 1.84% ± 1.43%).

Overall, the above estimates align with the estimates from the drop camera surveys, with the exception of soft coral cover at the PAR2 sites at Boyd Point. The three transects recorded 18.70%, 17.84% and 18.20%, with a mean of 18.25% and a very small error. This is significantly higher than the estimate gained from the drop camera survey, which recorded a mean of 2.7%. This may reflect that there is more soft coral in this area, or may reflect the lower sensitivity of the drop camera survey method. The drop camera location closest to the video locations recorded no soft coral. However, the next closest site recorded 45% soft coral cover. This is typical of patchy reef environments where quite high live cover can be recorded where there is suitable habitat.

6.2 Altered Coastal Processes

The submission from DERM requested further information to support the statement in the EIS that proposed open piled wharf jetty and berth pockets have low potential to impact alongshore transport of sediment and a greater potential for impact to the longshore beach profile and cliffs due to the increased depth of the proposed berth and departure area. Assessment of the risk to the proposed structures and the coastal morphology posed by the predicted impacts was required as well as an outline of potential corrective actions should adverse impacts occur.

In the Port facility area sediment moves along the shoreline driven principally by waves and to a lesser extent by currents. The Gulf of Carpentaria is a low wave environment (significant wave height (Hs) is <1m 95% of the time and the majority of sediment transport occurs during storm events such as tropical cyclones which generate large waves (Hs up to 7m) and elevated water levels.

6.2.1 Risk to Coastal Morphology

Numerical modelling was conducted to assess the two ways in which the proposed port facility could impact upon coastal morphology through changes to shoreline sediment transport processes:

- Interruption of along-shore sediment transport by blocking or capturing sediment moving along the coast and altering shoreline profile; or
- Larger storm waves reaching the shoreline through the deepened dredge area, increasing cross-shore sediment movement and leading to beach and/or cliff erosion.

Impact on Along-shore Sediment Transport

Annual along-shore transport was estimated through wave, current and sediment transport modelling for 15 historical storm events over an 18 year period. The results of the modelling show that alongshore transport rates vary considerably (100 to 80,000m^3 per event) dependent upon wave height, approach direction and storm duration. The material being transported in storm events can move north or south along the coast depending on the storm track and mean wave direction. However net transport of sediments occurs towards the north (towards Boyd Point). Results of modelling indicate that for even the largest of the modelled storms, along-shore sediment transport occurred within the 350m of the shoreline.

The dredge area and Port facility structure may alter current and wave movements and interrupt this sediment movement. As the dredge area commences over 500m from the shoreline, outside of the zone of along-shore sediment transport negligible impact on coastal morphology from the dredge area is expected. It is concluded that the open trestle design proposed for the marine loading facility would not significantly impede or capture sediment moving along the shoreline. Therefore the structure may result in only minor local changes, including changes to sand shoals in the nearshore zone and localised scour around the individual legs of the trestle. Along-shore transport on the beach is not predicted to be impacted.

Impact on Cross-shore Sediment Transport

The impact of the proposed dredge area on the nearshore wave climate was assessed through wave modelling of both existing and design cases for a range of wave directions. Under natural coastal processes sediments are eroded from the beach and cliffs and deposit in offshore sand bars. During subsequent periods of calmer weather, smaller waves may move some of the sediment in the bars back onto the beach. Modelling assessed the potential for:

i. increased wave heights to increase beach and cliff erosion; and
ii. for the dredged area to act as a sediment sink where eroded sediment is deposited and cannot return to beach, leading to progressive erosion of the beach.

Results indicate that wave heights are not expected to change by more than 4%. The greatest increases are expected around the berth area for waves approaching from the north and south southwest, a decrease in wave height is expected in the lee of the dredge area for the case of waves approaching

along the departure channel alignment. Closer to the shoreline wave height changes are expected to be less than 1%. Modelling indicates that changes to the wave climate are predominantly confined to the area around the proposed berth.

Due to the predicted minor changes in wave height in the nearshore area storm wave penetration to the shore is not predicted to be significantly increased by the dredge area and therefore minimal increase in beach and cliff erosion is expected. Sand bars are predicted to form inshore of the dredge area and no beach sediment is lost into the berth pockets in this simulation. Modelling predicted that negligible change to coastal morphology occurs for both existing and dredged cases.

Simulations assessed the impact of the dredged berth profile under a range of possible offshore wave conditions with no discernible change in ocean bed level observed. Minor changes were observed in sand transport rates, inferring that sand shoal movements could result in the nearshore zone in the vicinity of the trestle. A sensitivity analysis was undertaken for the sediments sizes occurring at the site to determine the extent of cross-shore sediment transport. Results of the sensitivity tests indicate that fine sand (d=0.2mm) present in the nearshore area could be mobilised and transported further offshore than the coarse sand (d=0.6mm) found on the beach. Under extreme conditions, fine sand was deposited up to 400m offshore, approximately 100m landward of the berth pocket. As indicated above, this is considered to be a negligible impact.

Open trestle structures as proposed generally allow transitions of >90% of wave energy and therefore have minimal impact on wave climate. Predicted changes from impacts to along shore sediment movements above would not be increased due to the slight reduction in wave energy transition under the jetty.

6.2.2 Impacts to Proposed Structures

Coastal processes could impact on proposed port structures in a number of ways including direct wave attack, scour, inundation, erosion and deposition.

Wave heights are not predicted to be significantly increased with maximum increase (4%) predicted around the berth pockets. Wharf berth design would allow for this additional wave height to minimise risk of inundation. Scour, erosion and deposition is likely to occur mainly around piles in the nearshore zone landward of the berth pockets. Design of piles would need to make allowance for local scour as well as the possibility of erosion of the entire beach profile by several vertical metres during a large storm event. These impacts are not predicted to be significantly increased due to the altered coastal processes identified.

6.2.3 Proposed Mitigation Measures

Although impacts are predicted to be minor or negligible, coastal processes are complex and non-linear. The erosion monitoring procedure (refer Section 3.6.3 of the EIS) would incorporate the cliff and beach areas adjacent to the port. Monitoring would occur after the end of the wet season. If required, mitigations would be targeted to the nature and extent of any erosion that occurred and could be addressed through measures such as toe-armouring of the cliff.

The impacts of the open trestle structure and dredge area on the sediment movements in the coastal zone are also predicted to be minor local changes. The wharf design would minimise this impact through utilising the maximum spacing between piles and minimising the dredge area. Appropriate allowances would be made in the design of structures for the altered coastal processes.

6.3 Marine Fauna

Comments regarding impacts on marine fauna and mitigation measures were received from DERM. Additional information is provided in the following sections in response to these comments.

6.3.1 Dugong

Seagrass habitat is discussed in Section 6.3.4 of the EIS - the main species present in the Embley and Hey River estuaries is *Enhalus acoroides*, which is not the preferred species in the Dugong diet. Available Dugong population data are provided in Section 6.6.3 of the EIS. In a 1997 survey (Saalfeld and Marsh 2004), the following number of Dugongs were sighted within the vicinity of the Project area.

- two Dugongs within Albatross Bay;
- three Dugongs at sea adjacent to Albatross Bay;
- one Dugong near Aurukun; and
- one Dugong to the north of Jantz Point.

However, current scientific evidence suggests that death and injury caused by boat strike has a significant impact on Dugong populations in Queensland (refer to Section 6.9.4.1 of the EIS). RTA has therefore taken a conservative approach and rated the operation of the ferry as posing a moderate risk to Dugong in the Embley estuary where seagrass beds are present. Transit lanes would be defined to reduce the overall area of disturbance from vessel activities. Where possible, these transit lanes would follow greatest water depths to avoid significant meadows of seagrasses. Slow moving displacement vessels such as bulk carriers, barges and tugs do not pose a boat strike risk and as such are not considered a risk in the operational phase of either the port area or in the Embley and Hey Rivers.

Other mitigation measures for potential impacts on Dugong identified in the EIS include:

- Observation (during daylight hours) prior to commencement of Trailing Suction Hopper Dredge (TSHD) dredging and dumping activities within a 300m monitoring zone. Dredging and dumping activities would not commence until the Dugong is observed to leave the monitoring zone or alternatively the dredge will to move to another area of the dredge or disposal site (refer to Section 6.9.4.1 of the EIS). Cutter suction dredges (CSDs) are essentially stationary during dredging, and so do not pose a risk to Dugong; and
- A "soft-start" approach to pile driving and the monitoring of an exclusion zone (refer Section 10.5 of the EIS). "Soft-start" refers to the increasing of pile energy gradually over a period of time.

Any injury or death of Dugong as a result of boat strike from RTA's operations would be reported to DERM and investigated to determine appropriate mitigation measures.

6.3.2 Marine Turtles

DERM identified a number of required changes to the description of habitat used by marine turtles. **Table 6-35(sup.)** has been updated to reflect these comments.

A number of measures designed to mitigation impacts to marine turtles are identified in Section 6.9.4.3 of the EIS and the draft Dredge Management Plan for the Port (**Appendix 4** of this Supplementary report). These may be summarised as follows:

- 'soft start' approach, observation and response procedures for pile driving during construction;
- turtle exclusion device to be fitted to trailing suction hopper dredge;
- observation and response procedures for dredging, including the application of a 300m monitoring zone;
- water quality and coral health monitoring during capital dredging at the Port;
- lighting plan for the port with an adaptive approach as required in consultation with DERM;
- implement a feral pig control program in consultation with Traditional Owners and DERM;
- remove ghost nets in the vicinity of the port development;
- monitoring program to be developed with DERM and would include turtle nesting activities (number, type, predation, success), behaviour (hatchling activity) and incident reporting;
- work with DERM to evaluate whether relocating nests is appropriate;
- document and report any turtle injuries or deaths.

Section 6.6.5 of the EIS identifies that the primary factor currently impacting sea turtle nesting success on the Western Cape is predation by feral pigs. The intensity of nest disturbance by feral pigs is very high, particularly at Boyd Point immediately to the north of the proposed port area where there are no cliffs impeding beach access.

Hatchling turtles can be disoriented by altered light horizons such as those that would occur at the proposed Port: hatchlings may fail to disperse from the beach to the sea; in the water, they can be attracted to illuminated areas associated with vessels and structures where predation by fish can be expected to increase; and hatchlings may be slowed in their transit from the beach out to the open ocean and be vulnerable to inshore predators.

A lighting plan is provided in Table 6-50 of the EIS. The plan aims to minimise lighting whilst providing for safe operation of the Port and navigation as required by Maritime Safety Queensland. Low pressure sodium vapour (LPSV) lights are proposed, which are not effective for all species of marine turtle (including Flatback turtles). However, as LPSV lights have not been tested for Olive Ridley turtles, they are currently considered better than conventional lighting for mitigation of impacts to marine turtles.

Section 6.9.4.3 of the EIS identified that RTA would work with Traditional Owners and DERM to develop and implement a feral pig control program to reduce feral pig numbers in the area between Pera Head and Boyd Point. To improve the effectiveness of the proposed program and provide further mitigation against impacts of the proposed Port, RTA would extend the feral pig control program to areas of nesting north of Boyd Point and/or south of Pera Head beyond the direct zone of impact of the Port. This would increase hatchling survivorship in areas where hatchlings are less likely to be attracted to areas illuminated as a result of the Project.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Green Turtle *(Chelonia mydas)*	Endangered	Vulnerable Migratory species	Vulnerable	Coastal waters, in particular seagrass beds. The Wellesley Island area in the south-western corner of the Gulf of Carpentaria is a significant nesting site.	**Project Area** *Likely:* The species is likely to forage in the Project area. Surveys have found no nests in the Project area. No large rookeries are present in the region. **Proposed Port Site** *Likely:* This species is known to forage in shallow coastal areas, which would include the proposed port site footprint. Surveys have found no nests within the footprint of the proposed port site. **Proposed Spoil Ground** *Possible:* This species prefers to forage in shallow coastal areas or within seagrass beds. The proposed spoil ground would be too deep to provide preferred foraging habitat for this species and it contains no seagrass beds. While the proposed proposes spoil ground does not represent preferred habitat, it is possible they are transient in the area. **Albatross Bay Spoil Ground** *Possible:* For the same reasons as the proposed spoil ground, it is unlikely that this species would frequently occur at the Albatross Bay spoil ground; however, it is possible that they transit the area. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Likely:* As this species is known to forage within shallow coastal areas and seagrass beds. Foraging habitat for this species is present in the estuaries.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Hawksbill Turtle *(Eretmochelys imbricata)*	Critically endangered	Vulnerable Migratory species	Vulnerable	Hawksbill Turtle nesting sites occur on islands adjacent to Arnhem Land and north-eastern Cape York. The main feeding habitat for the species tends to be tidal and sub-tidal reefs. Hawksbill turtles also commonly inhabit seagrass flats and mangrove habitats.	**Project Area** *Known to Occur:* Although difficulties in identifying nest activity of this species exist, low density nesting is recorded from a number of locations from False Pera Head to Boyd Bay. Reef habitat in the area is also likely to provide significant foraging habitat for the species and they are also likely to inhabit seagrass flats and mangrove habitats. **Proposed Port Site** *Likely:* Near shore fringing reef communities occur within the vicinity of the proposed port area occur at Boyd Point, Pera Head and between Pera Head and Thud Point. This species may therefore traverse across the proposed port site to access preferred feeding habitat. This species is also known to nest on the beaches in the vicinity of the Project area. Therefore it may be assumed that the footprint of the proposed port site may also contain suitable nesting habitat for this species. **Proposed Spoil Ground** *Possible:* Drop camera surveys indicate that this area is largely vegetated, however Hawksbill turtles may feed on sea cucumbers or jellyfish in this area. As Nine Mile Reef which includes suitable foraging habitat for this species is located approximately 6km south-south-west of the proposed spoil ground, this species may traverse the proposed spoil ground to access Nine Mine Reef for foraging. **Albatross Bay Spoil Ground** *Possible:* The Albatross Bay Spoil ground does not contain or is not close to any reef communities. It is currently actively used for disposal of spoil dredged annually by North Queensland Bulk Ports. It is therefore unlikely this area would provide significant foraging habitat; however they may transit the site. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Possible:* The Hey and Embley Rivers contain seagrass and mangrove habitats which may be utilised by this species.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Flatback Turtle *(Natator depressus)*	—	Vulnerable Migratory species	Vulnerable	Soft-bottom, coastal waters including but not limited to shallow water habitats. Nesting is confined to Australia. The species forages over a wide depth range (6 – 40m)	**Project Area** *Known to Occur:* The Flatback Turtle is likely to forage in the Project Area and nesting has been regularly recorded and is best described as medium density nesting. The area is not a major location for breeding aggregations of the species. **Proposed Port Site** *Known to Occur:* Nesting has been regularly recorded within and surrounding the proposed port site footprint and is best described as medium density nesting. The area is not a major location for breeding aggregations of the species. The proposed footprint of the port would be considered foraging habitat for this species. **Proposed Spoil Ground** *Possible:* Drop camera surveys indicate that this area is largely vegetated, however Flatback turtles may feed on sea cucumbers or jellyfish in this area. **Albatross Bay Spoil Ground** *Possible:* The Albatross Bay Spoil ground is currently actively used for disposal of spoil dredged annually by North Queensland Bulk Ports. It is therefore unlikely this area would provide significant foraging habitat for this species , however it may transit the site. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Likely:* The proposed footprints of the ferry/barge terminals are within an estuarine environment which may be considered foraging habitat for this species.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Olive Ridley Turtle *(Lepidochelys olivacea)* (also known as the Pacific Ridley Turtle under the NC Act)	Vulnerable	Endangered Migratory species	Endangered	Coastal waters including but not limited to reefs. The species forages in benthic habitats over a range of depths from a few metres to hundreds of metres. Low density nesting has been historically recorded from a number of locations including the Gulf of Carpentaria.	**Project Area** *Known to Occur:* Low density nesting has previously been recorded from a number of locations from False Pera Head to Boyd Bay, and nesting has also been recorded further north between Weipa and Bamaga. **Proposed Port Site** *Known to Occur:* Sporadic nesting has been recorded surrounding the proposed port site footprint. This species forages in shallow unvegetated coastal habitats. The proposed footprint of the port would therefore be considered foraging habitat for this species. **Proposed Spoil Ground** *Possible:* The proposed spoil ground is too deep to provide foraging habitat for this species; however it is possible that it sporadically transits this area. **Albatross Bay Spoil Ground** *Possible:* For the same reasons as the proposed spoil ground, this species is unlikely to frequently occur within the Albatross Bay spoil ground due to lack of preferred habitat; however it may transit the site. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Likely:* This species forages in shallow unvegetated coastal habitats. The parts of the proposed footprints of the ferry/barge terminals that are not vegetated may therefore provide foraging habitat for this species.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Leatherback Turtle *(Dermochelys coriacea)*	Critically endangered	Endangered Migratory species	Endangered	Pelagic environment. The Albatross Bay area is identified as a potential foraging area for the species.	**Project Area** *Likely:* The species is likely to occur in the Project Area, using it for foraging. Leatherback turtles are rarely found in Queensland, however they have been reported on the Western Cape York peninsula coast (DERM pers com). **Proposed Port Site** *Likely:* The species is likely to occur sporadically in the vicinity of the proposed port site, using it for foraging. **Proposed Spoil Ground** *Likely:* The species is likely to occur sporadically in the vicinity of the proposed spoil ground, using it for foraging. **Albatross Bay Spoil Ground** *Likely:* The species is likely to occur sporadically in the vicinity of the Albatross Bay spoil ground, using it for foraging. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Unlikely:* This species prefers oceanic environments to estuarine environments, so it is unlikely to utilise the estuaries that contain the proposed footprints of the ferry/barge terminals as habitat.

Table 6-35(sup.) Threatened Marine Turtle Status

Species Name	IUCN Red List	EPBC Act	NC Act	Preferred Habitat in the Weipa/Cape York Region	Likelihood of Occurrence within the Project Area and Areas of Proposed Disturbance within the Project Area
Loggerhead Turtle *(Caretta caretta)*	Endangered	Endangered Migratory species	Endangered	Coastal waters including subtidal and intertidal coral and rocky reefs and seagrass meadows as well as soft-bottomed habitats.	**Project Area** *Likely:* The species is likely to be transient in the Project area and use it for foraging or resting. No rookeries are present in the Project Area. **Proposed Port Site** *Likely:* The species is likely to be transient in the vicinity of the proposed port and use it for foraging or resting. **Proposed Spoil Ground** *Likely:* This species is likely to occur within the proposed spoil ground for the same reasons that it is likely to occur in the vicinity of the proposed port. **Albatross Bay Spoil Ground** *Likely:* This species is likely to occur within the Albatross Bay spoil ground for the same reasons that it is likely to occur in the vicinity of the proposed port. **Proposed Ferry/Barge Terminals – Hey and Embley Rivers** *Likely:* This species is likely to occur in the vicinity of the ferry/barge terminals for the same reasons that it is likely to occur within the proposed port footprint.

EPBC Act = ***Environment Protection and Biodiversity Conservation Act 1999*** (Commonwealth)
NC Act = Queensland ***Nature Conservation Act 1992*** (Queensland)
IUCN = International Union for the Conservation of Nature
— = Species not listed

6.3.3 Sea Snakes

Sea snakes are addressed in Section 6.6.6 of the EIS. There are six species of sea snake that are listed under the NC Act and all are classed as 'Least Concern'. DERM has advised that sea snakes are being collected for research from rivers in the Weipa area.

Prawn trawling has been identified as the major threat sea snakes. Several of the sea snake species are potentially vulnerable to anthropogenic impacts within the Embley River and estuaries. The Project does not present any additional impacts to these species.

6.3.4 Recreational Impacts

DERM also sought clarification on the potential for impact on marine turtles resulting in recreational activities in the Project area. This was also a concern raised by Traditional Owners during the preparation of the EIS as described in Section 16.3.2 of the EIS. In response to issues raised by Traditional Owners in relation to damage currently being done in the area by recreational users, RTA has committed to working with Traditional Owners and other relevant stakeholders to develop an effective permit system to protect significant cultural heritage sites and environmental values and allow controlled access for recreational purposes. The administration of such a system by Traditional Owners would be subject to discussions between Traditional Owners, RTA and other stakeholders and would be implemented from the commencement of construction. This would effectively assist in managing the existing risks from recreational use to marine turtles.

6.4 Gulf of Carpentaria Fisheries

6.4.1 Northern Prawn Fishery

The area of the proposed spoil ground represents much less than 0.1% of the Northern Prawn Fishery (NPF) Weipa Statistical Area (20,990 km^2). Total prawn catch data (all species) for the whole Northern Prawn Fishery (NPF), the NPF Weipa Statistical Area and a local 6 x 6 nautical mile grid centred on the proposed spoil ground are presented in **Table 6-A**.

The area of the proposed spoil ground would represent about 5% of the 36nm^2 local grid and hence it is expected any reduction of catch due to disturbance to trawl habitat, were it to occur, would be of the order of 0.02% of the annual NPF catch. The Gross Value of Production of the NPF was $76.8 million in 2008 and $74.0 million in 2009 (ABARES 2010), hence the annual value of any reduction in catch, were it to occur, would be approximately $15,000.

Table 6-A Total Prawn Catch

Year	Total NPF Catch (t)	Weipa Statistical Area (t)	Weipa as % of Total NPF	Local Grid (36nm^2) (t)	Local Grid as % of Total NPF
2006	5563	399	7.2%	no data	no data
2007	4317	231	5.4%	no data	no data
2008	6962	883	12.7%	13	0.2%
2009	7479	560	7.5%	56	0.7%
2010	7596	349	4.6%	8	0.1%
Mean	**6383**	**484**	**7.6%**	**26**	**0.4%**

Source: Australian Fisheries Management Authority

6.4.2 Net, Line and Charter Operators

The net component of the Gulf of Carpentaria Inshore Fin Fish Fishery (GOCIFFF) includes the commercial inshore net fishery (N3, out to 7 nautical miles), commercial offshore net fishery (N9, 7 to 25 nautical miles) and commercial bait netting.

The Gulf of Carpentaria Line Fishery (GOCLF) line fishery (L4) covers the eastern half of the Gulf of Carpentaria and is a multi-species fishery which harvests a variety of pelagic and demersal fish. The charter (commercial tour operator) sector also uses this fishery.

DEEDI FQ provides catch data for 30 x 30 nautical mile grids where there are 5 or more boats working. Catch data for 6 x 6 nautical mile "sites" is also available where there are 5 or more boats working. However, there are often less than 5 boats working a "site" or a gird and without such data it is difficult to gain a full understanding of temporal and spatial variation in catches. The proposed jetty and berths are in AB8 (site 22), the channel is in AB8 (site 21), and the proposed spoil ground is in AC8 (site 25). AB9 and AC9 are adjacent grids. Catch data for the period 2005 to 2009 is presented in **Table 6-B**.

The footprint of dredging for the proposed port (berths and channel) is approximately 2km^2 and the footprint of the proposed new spoil ground is approximately 3km^2. If it were assumed that there was a long term impact on catch rate proportional to the area of seabed affected by the Project footprint then the average impact on annual Gross Value of Production would be less than $197 for the N3/N9 fishery and less than $206 for the L4 fishery. However, catch rates between "sites" within the AB8 and AC8 grids will vary considerably due to the presence or absence of varied benthic habitats, including inshore reefs. DEEDI FQ have provided data for AB8-21 (see **Table 6-B**), which includes the proposed channel and largely covers the area known as the "Three Mile", an important fishing area for charter operators and recreational anglers. Based on the above assumptions about impact and a channel footprint of 1km^2, the average impact on annual Gross Production Value for the L4 fishery within AB-21 would be $396. There would be variation in catches throughout the 6nm x 6nm AB8-21 "site" and the estimate of $396 per annum represents an average value only.

The Gross Production Value measure is not applicable to the charter operators as the catch is not sold. The gross revenue of the Weipa-based charter operators in 2006 was estimated to be $2,386,000, assuming 87.5% average hire rate over 30 weeks for 14 charter boats, 3 mother ships and 2 houseboats (Barradave Sportfishing Services 2011). Sites AB8-21 and AB8-22 contributed approximately 25% of the total charter catch in grid AB8. However, in the absence of data from AB7, AB9, AC8 and AC9, it is not possible for RTA to estimate what proportion of the overall charter catch comes from within sites where the Project has activities. If licence holders have reported catch data for "sites" or grids where there are 5 of more boats working, such data would be held by DEEDI FQ.

Table 6-B Gulf Commercial Net, Line and Charter Catch Data 2005-2009

Fishery	Grid*	Total Catch 2005-2009 (t)	Catch as % of Total	Gross Production Value 2005-2009 ($)	Gross Value as % of Total	Gross Value/ km²/year ($)
Net (N3/ N9)	All of Gulf	10,058	100%	$60,295,507	100%	
	AB8	87	0.9%	$541,325	0.9%	$33
	AB8-21	no data				
	AB8-22	no data				
	AB9	332	3.3%	$2,099,287	3.5%	$136
	AC8	146	1.5%	$652,781	1.1%	$42
	AC8-25	no data				
	AC9	295	2.9%	$1,606,945	2.7%	$104
Line (L4)	All of Gulf	2,110	100%	$11,635,036	100%	
	AB8	114.6	5.4%	$799,926	6.9%	$52
	AB8-21	35.0	1.7%	$244,788	2.1%	$396
	AB8-22	no data				
	AB9	8.6	0.4%	$60,380	0.5%	$4
	AC8	80.1	3.8%	$527,678	4.5%	$34
	AC8-25	no data				
	AC9	53.8	2.5%	$357,383	3.1%	$23
Commercial Charter	All of Gulf	729	100%	not applicable		
	AB8	72.7	9.9%			
	AB8-21	6.5	0.9%			
	AB8-22	11.2	1.5%			
	AB9	no data				
	AC8	no data				
	AC9	no data				

Source: DEEDI (FQ) database

* Individual grids are 30 x 30 nautical miles, proposed jetty and berths in AB8 (site 22), channel in AB8 (site 21), proposed spoil ground in AC8 (site 25).

6.4.3 DEEDI (Fisheries Queensland)

DEEDI FQ has indicated to RTA that they are developing a compensation model for commercial fishing operators for use in circumstances where there is a demonstrated economic impact attributable to a development project. DEEDI FQ has also indicated that such a model would be in a form that would enable advice to be provided to the Co-ordinator General in circumstances where the assessment of the development project required it. RTA will continue to consult with DEEDI FQ regarding their policies regarding threshold of impact for potential compensation and quantification of potential compensation. RTA has consulted with the Gulf of Carpentaria Commercial Fisherman's Association (GoCCFA) and the Queensland Seafood Industries Association (QSIA) after the publication of the EIS and is aware that there are different views concerning processes for determining potential compensation (if applicable) and different views concerning the nature of compensation (if applicable). RTA shall continue to consult with DEEDI FQ, QSIA and GoCCFA regarding these matters.

6.4.4 Recreational Fishing

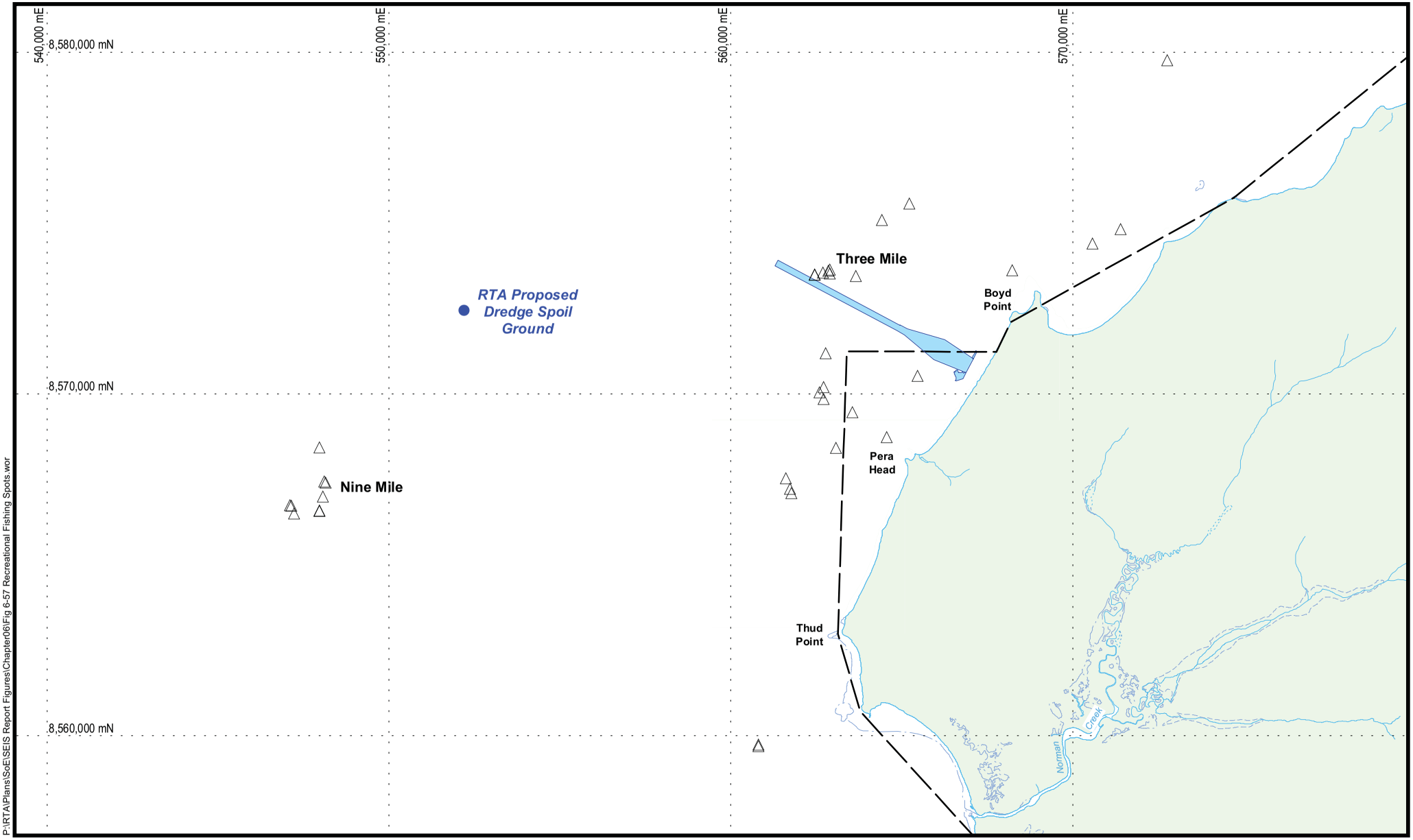
A number of submissions raised concerns regarding the potential for impact to the "Three Mile" area. RTA recognised that the "Three Mile" area was a popular fishing area (refer to Section 16.3.2 of the EIS). **Figure 6-57(sup.)** has been amended to show the "Three Mile" area. Targeted drop camera and towed sled surveys were carried out in the proposed dredge area where bathymetric survey indicated that there was potential for reefs to occur (refer Section 6.3.1.2 of the EIS). These surveys identified open benthic habitat in the berth and channel areas and included a survey point in the area identified as the "Three Mile" area. The EIS acknowledges that there would be a temporary impact on fish assemblages in the vicinity of the Port and spoil ground due to turbidity generated by dredging and disposal of sediment, however following dredging activities, the impacts are anticipated to be minor (Section 6.9.4.5 of the EIS). Since public exhibition of the EIS, a small two (2) degree alignment change to the south has been adopted (refer **Figure 2-6(sup.)** and **Section 2.6** of this Supplementary report. This realignment has the effect of reducing, but not eliminating, disturbance to the "Three Mile" fishing area

The last published estimate for recreational catch (non-charter operator catch) was 44 tonnes of reef fish for 2005, and this was for the whole of the Queensland portion of the Gulf of Carpentaria (DPI & F 2007).

6.4.5 Artificial Reefs

Charter fishing boat operators have suggested that the establishment of artificial reef structures, as an enhancement measure, would help mitigate loss of habitat due to dredging. Section 6.9.4.5 of the EIS notes that the jetty and wharf piles themselves will act as *de facto* artificial reefs and are, in effect, an enhancement measure. Fishing near the jetty will be possible and RTA would designate a safe passage underneath the proposed jetty for small recreational and charter boat users to prevent the need to travel around the jetty and wharf (which would have a safety exclusion zone of 50m) and in accordance with any Maritime Safety Queensland requirements (see Section 16.3.2 of the EIS). RTA recognises that the establishment of artificial reef structures, separate to the jetty, would be of benefit to charter operators and recreational fishers and would provide community fisheries benefits. A suggestion has been made to RTA that the spoil ground could be capped in part to form a reef structure. However, this is not considered feasible (the spoil ground will continue to receive maintenance dredging). It is considered more feasible to establish structures using steel or concrete for example, possibly using suitable surplus materials from Weipa. RTA proposes to support the establishment of a local recreational fishing reference group to provide a forum to develop and help implement the establishment of artificial reefs. The reference group would comprise representatives from charter operators and the Weipa Sportsfishing Club. RTA would cover the costs of materials, transport and placement at sea. The artificial reefs would also serve as an offset for fish habitat loss in the due to marine works in the Hey and Embley Rivers (see **Section 7.4.5**) The installation of artificial reef may be subject to obtaining approval for operational works in tidal areas under the *Sustainable Planning Act* and approval under the Commonwealth *Environment Protection (Sea Dumping) Act 1981*.

RTA also proposes that any SoE construction workers in the SoE camp seeking to go fishing by boat in their recreation time can only use local authorised charter fishing operators.



P:\RTA\Plans\SoE\SEIS Report Figures\Chapter06\Fig 6-57 Recreational Fishing Spots.wor

Mining lease boundary

Recreational reef fishing spot (provided by Weipa Sport Fishing Club)

Dredged area

N

0 5km

South of Embley Project

Fig. 6-57(sup.): Recreational Fishing Spots Near Port Area

Datum/Projection: GDA94/MGA Zone54

Date: 13/12/2011

6.5 Impact Assessment of Project Refinements

6.5.1 Temporary Seaborne Access

From the existing surveys, bathymetry and aerial survey, it is considered unlikely that there is significant coral or seagrass habitat in the footprint of the infrastructure. However, this will be confirmed via further field surveys prior to construction. There is no dredging proposed. Piling would create some direct disturbance to the seabed and bed levelling would be carried out, if required, by a barge-mounted excavator to remove any "lumps" and fill in any "holes" prior to the concrete matting being laid for the barge access. Bed levelling will ensure that the concrete matting lays flat on the seabed and reduces the potential for edge erosion and undercutting below the high tide mark. The concrete matting would be fixed in place by steel pins driven into the bed with an excavator. The concrete matting would be monitored for signs of erosion or deterioration and mitigation undertaken if required. The concrete matting will provide a defined pathway for vehicles and reduce potential for disturbance to the beach.

Reef habitat is shown in **Figure 6-19(sup.)**. However, as discussed in **Section 6.1** of this Supplementary Report, the area of coverage of live coral is very low. Section 6.4 of the EIS presents water quality data for the Port area and Section 6.9.2 of the EIS presents the results of modelling of water quality impacts associated with the proposed dredging. Baseline investigations found that water quality at the proposed port exhibits significant natural fluctuations in suspended sediment and turbidity. The extent of this natural variation buffers water quality impacts associated with dredging, disposal, construction and operation to some extent. Generally, these habitats may be described as being more resilient to short-term water quality changes. Movement of vessels in and out of the inshore area is likely to cause very short term, localised increases in turbidity. The proposed barge landing area would more than 100m from the mapped reef habitat near Pera Head and it is very unlikely that these minor, short term fluctuations would have any impact on coral health.

The length of the facilities is dependent on access to sufficient water depth. The barge access would be designed to operate at high tide to minimise the length of the infrastructure and associated disturbance of the sea bed. The passenger jetty will have a floating pontoon which allows it to operate at all tides. Scouring can occur as a result of propeller wash or current movements and the facility would be designed such that there is sufficient draft to minimise this potential.

The area where the facilities are proposed provides low to medium density Flatback Turtle nesting habitat and low density Olive Ridley and Hawksbill Turtle nesting habitat (refer Section 6.6.5 of the EIS for surveys undertaken in area). The primary factor currently impacting marine turtle nesting success at the proposed temporary seaborne access sites is predation by feral pigs (refer Section 6.9.4.3 of the EIS). The concrete matting for the barge access will provide a 7.5m wide access for vehicles directly up the beach. This pathway would remove a very small proportion of the available 5.8km turtle nesting habitat available between Boyd Point and Pera Head. The provision of the concrete pathway will provide a defined pathway to prevent vehicles from disturbing turtle nests. Once laid, vehicles and equipment will be restricted to the concrete pathway. The existing stairway in Boyd Bay would be improved for use by passengers or a scaffold stairway built depending on location.

Modified lighting regimes can alter marine turtle hatchling sea-finding behaviour and increase mortality of hatchlings. Navigational safety lights would be installed on any structures in accordance with MSQ requirements. Night time barge deliveries would only be required during high tide. Lighting would only be utilised when barges are loading or unloading for safe access. The passenger jetty would only be utilised in daylight hours except in the event of an emergency.

The area is known to be utilised by marine turtles for foraging and Dugongs may move through the proposed port area when periodically migrating between feeding areas (refer to Section 6.6 of the EIS). The risk of boat strike will be minimised by reducing speed of vessels in shallow water in the approach to the temporary seaborne access facilities.

The construction of these temporary facilities would be considerably lower impact than the construction of the Port infrastructure.

Mitigation measures for marine impacts associated with the temporary seaborne access include:

- No dredging would be required.
- Field surveys will be undertaken to confirm the absence of seagrass or coral in the vicinity of the proposed disturbance. If seagrass or coral is present, the location will be reviewed or mitigation measures will be discussed with relevant regulatory agencies.

- Mitigation measures for piling activities will include:
  - use of a vibratory hydraulic hammer for the temporary seaborne access facilities to reduce excessive noise levels;
  - a "soft start" approach to disperse animals in the vicinity prior to normal pile driving; and
  - An exclusion zone will be established around pile driving activities and monitored by an observer and normal pile driving will not be conducted while threatened marine fauna species are identified within the nominated exclusion zone.
- The following factors would be considered for lighting at the temporary seaborne facilities:
  - ensuring lighting is minimised overall to that which is essential for safe and efficient operation of the facility;
  - reducing lighting when there are no vessels at berth or being piloted in the area; and
  - shielding and/or recessing lights to minimise light spill.
- RTA will monitor for scouring of the sea bed and will implement mitigation measures if required, this may include extending the concrete matting under where the barge would enter and leave the facility or conducting localised repair work.
- A feral pig control program will be implemented between Pera Head and Boyd Point and other areas of nesting north of Boyd Point and / or south of Pera Head to reduce nest predation and enhance turtle population survivorship. It is considered that this measure would produce an overall increase in hatchling numbers and therefore there would not be an overall significant adverse impact on threatened marine turtles.
- The passenger ferry will be limited to 8 knots in water depths of up to 5m in the approach to the temporary seaborne access.
- RTA will document any injury or death of marine turtles (e.g. animals entangled in ghost nets), dugong or other threatened marine fauna and report these to DERM for inclusion in the Wildlife Stranding database. Any injury or death that may be attributable to RTA operations would be investigated to determine appropriate mitigation measures.
- Machinery and personnel associated with these landing points will be confined to the landing points to reduce disturbance of potential threatened species breeding habitat.
- RTA will monitor for scouring of the sea bed at the temporary barge landing area near Pera Head and will implement mitigation measures if required, this may include extending the concrete matting under where the barge would enter and leave the facility or conducting localised repair work.
- Once the temporary seaborne access is no longer required, all infrastructure would be removed and the area would be rehabilitated.

6.5.2 Port

As described in **Section 2.6**, discussion with marine contractors has determined the spans between the piles for the proposed port will be shorter than originally anticipated, resulting in additional piles. The spans between piles for the jetty over the beach would be a minimum of 16.8m. This means that there will be 6 piles installed on the beach above highest astronomical tide. However, the actual direct disturbance to turtle nesting habitat would only be 150m^2, which is a very minor proportion of the 5.8km beach between Boyd Point and Pera Head. Impacts would be more than offset by the proposed feral pig control program (described in Section 6.9.4.3 of the EIS).

The proposed realignment of the Port and associated dredged shipping channel by 2 degrees south (described in **Section 2.6**) would result in the furthest extent of the dredging works (7,640m seaward) moving to the south by approximately 267m (refer **Figure H**). The proposed realignment reduces, but does not eliminate, impact to the popular "Three Mile" recreational and charter fishing area.

Sediment samples of the material to be dredged at the Port were collected at 20 locations. Elutriate analysis results identified that zinc exceeded the ANZECC/ARMCANZ (2000) guideline levels for 95% species protection at the 95th percentile value. The elutriate analysis showed that only minimal dilution was required to achieve the ANZECC/ ARMCANZ water quality guideline criteria for zinc, which would be readily achieved by initial mixing. Dilute acid extraction analysis shows that all metal contaminants tested were below National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009) screening levels at each sampling location, indicating that contaminants are not readily bioavailable and are acceptable for unconfined disposal at sea.

The sediment sampling locations were randomly selected from a grid overlaying the original footprint and it is likely that if new sampling locations were randomly selected, there would be at least some overlap with the sampling already undertaken. The results of contaminant testing show good consistency amongst the offshore sampling locations with very low levels recorded. It is thus unlikely that the proposed realignment would encounter substantially different material.

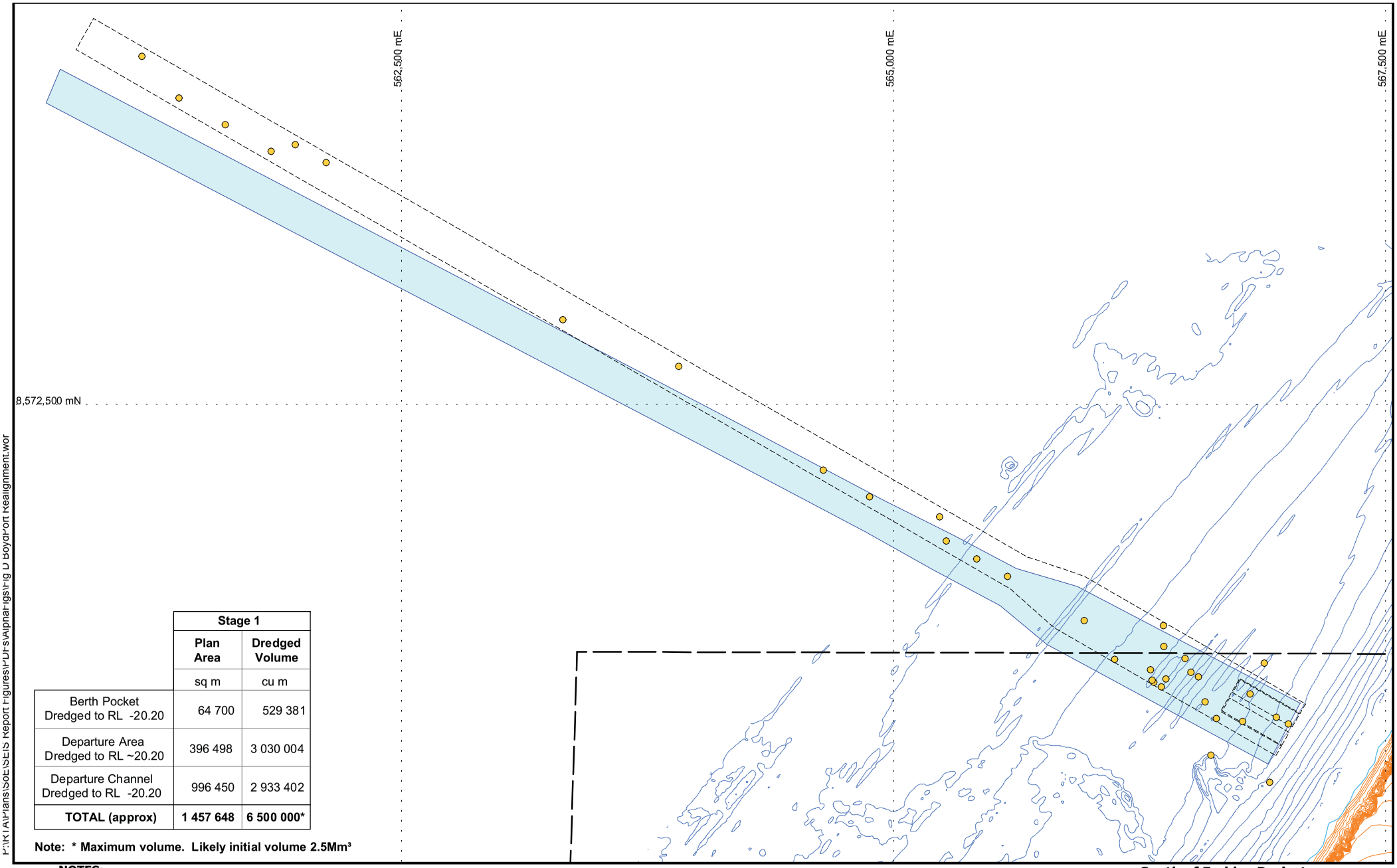
Given that the sampling demonstrates that the sediments are relatively clean and there have been no activities in the vicinity that may have changed sediment quality since the sampling was undertaken, the previous sampling is considered to be sufficient.

In terms of particle size distribution, the sediment sampling results presented in Figure 6-40 of EIS shows a clear distinction between the inshore locations (1 through 9, plus 18, 19 and 20) and the offshore locations (10 through 17), with the inshore locations having a larger percentage of finer material. The offshore locations all have a higher proportion of coarser material, and apart from some relatively minor variation between locations, show a consistent pattern. Therefore the material sampled is considered to be representative of the area within approximately 270m (at the furthest extent of dredging) and suitable for the characterisation of the material to be dredged.

In the vicinity of the berth pockets, the change in alignment would mean the channel would move approximately 45m to the south. At the furthest seaward extent of dredging, it is likely that the predicted turbid plumes would move approximately 270m to the south west (i.e. parallel to the shore). However, if this is compared against Figure 6-60c of the EIS (Period 4 - represents dredging point source occurring further offshore) and Figure 6-64 of the EIS (Period 4), it is apparent that this would make practically no difference to turbidity and sedimentation impacts upon sensitive receptors. It is therefore considered highly unlikely that changes to predicted turbidity and sedimentation impacts would be detectable in the inshore areas.

A draft Dredge Management Plan is provided in **Appendix 4** of this Supplementary report.

Anchor chains have the potential to structurally damage the benthos and associated communities at the anchorage areas. Utilising the existing Port of Weipa anchorage area (as described in **Section 2.6** and shown on **Figure 2-9(sup.)**) would reduce the area of potential impact caused by anchorage to benthic communities as well as reducing potential interactions with commercial, charter and recreational fishermen.



	Stage 1	
	Plan Area	Dredged Volume
	sq m	cu m
Berth Pocket Dredged to RL -20.20	64 700	529 381
Departure Area Dredged to RL ~20.20	396 498	3 030 004
Departure Channel Dredged to RL -20.20	996 450	2 933 402
TOTAL (approx)	**1 457 648**	**6 500 000***

Note: * Maximum volume. Likely initial volume 2.5Mm³

NOTES:

Vertical Datum:
Depths are in metres and are reduced to chart datum (CD) which is approximately the level of lowest astronomical tide (LAT).
CD (LAT) is 1.508m below AHD.

Mining lease boundary
Dredged area
Previous design
Sediment sample location

N

0 1km

South of Embley Project

Fig. H: Port Realignment and Sediment Sampling Sites

Datum/Projection: GDA94/MGA Zone 54 Date: 02/02/2012

Rio Tinto Alcan

P:\RTA\Plans\SoE\SEIS Report Figures\PDFs\AlphaHighStrip D BoydPort Realignment.wor

6.5.3 Humbug Barge Terminal

As described in the EIS, sediment samples were collected at six locations in the material to be dredged for the Humbug barge terminal (refer **Figure I**). All contaminant means and 95% UCL of the mean were below the relevant NAGD screening levels. Power analysis against the screening level detailed in the sediment characterisation report indicates that only five samples are required. The report concludes that the sediments are acceptable for unconfined disposal at sea.

The proposed change in depth results in a minor increase in both area and total volume of material to be dredged. Table 6 of the NAGD would normally require seven sampling locations for this total volume. However, when the volume of potentially contaminated material is considered, Table 6 would only require six sampling locations.

Given that the sampling demonstrates that the sediments are clean and there have been no changes in the catchment which may have altered sediment quality since the sampling was undertaken, the previous sampling is considered to be sufficient.

Visual inspection during early May 2010 (refer Section 6.3.4.2 of the EIS) revealed isolated patches of *E. acoroides* in good condition within and adjacent to the proposed dredge footprint at low tide. The presence of isolated patches of *E. acoroides* is consistent with recent survey data reported by McKenna and Rasheed (2010).

A draft Dredge Management Plan is provided in **Appendix 5** of this Supplementary report.

6.5.4 Hey River Barge/Ferry Terminal

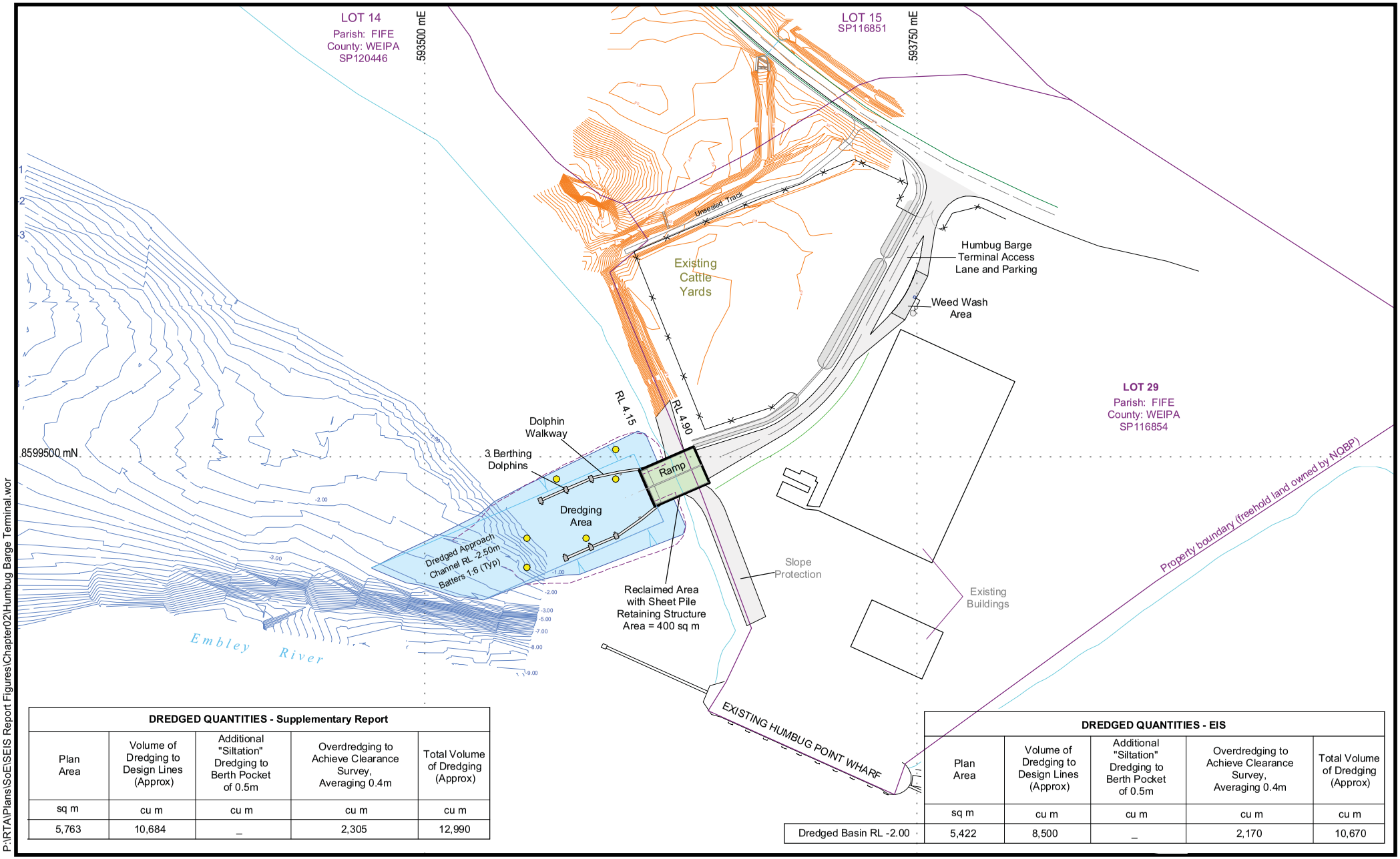
The layout of the Hey River terminal has been revised so that the barge berth is parallel to the bank, providing safer access. This design is similar to that originally proposed in the Sampling and Analysis Plan (SAP) which was approved by DSEWPaC on 16 June 2009.

As described in the EIS, sediment samples were collected at seven locations across the area proposed in the approved SAP of 2009, which is similar to the current proposed footprint (refer **Figure J**). All contaminant means and 95% UCLs were below relevant NAGD screening levels, except for arsenic. Results of elutriate analysis identified that arsenic required only minimal dilution to achieve concentrations less than the 'low reliability' ANZECC/ ARMCANZ (2000) water quality guideline values. Dilute Acid Extraction results were well below screening levels and indicated that arsenic is highly bound to sediments and therefore likely of geological origin. Power analysis against the screening level detailed in the sediment characterisation report indicates that only two samples were required for 17,300m^3. The report concludes that the sediments are suitable for disposal at sea.

The proposed change results in an increase in both area and total volume over that presented in the EIS, but similar to that presented in the approved SAP. Table 6 of the NAGD would normally require nine sampling locations for this total volume. However, when the volume of potentially contaminated material is considered, Table 6 would only require eight sampling locations.

Although this is one more sample than was collected in 2009, the sampling across the proposed dredged footprint demonstrates that the sediments are clean. Further, power analysis for the earlier volume required only two samples and there have been no changes in the catchment which may have altered sediment quality since the sampling was undertaken.

Seagrass monitoring between 2000 and 2009 (Chartrand and Rasheed 2009; McKenna and Rasheed 2010) in the vicinity of the Hey River Terminal location occasionally reports a very thin patch of isolated seagrass. Drop camera surveys undertaken over the Hey River Terminal dredge footprint in October 2007, November 2008 and June 2009 did not record any seagrass. However, it is possible that seasonally variable seagrasses were absent (*e.g. Halophila ovalis*).



DREDGED QUANTITIES - Supplementary Report				
Plan Area	Volume of Dredging to Design Lines (Approx)	Additional "Siltation" Dredging to Berth Pocket of 0.5m	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
sq m	cu m	cu m	cu m	cu m
5,763	10,684	_	2,305	12,990

DREDGED QUANTITIES - EIS				
Plan Area	Volume of Dredging to Design Lines (Approx)	Additional "Siltation" Dredging to Berth Pocket of 0.5m	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
sq m	cu m	cu m	cu m	cu m
Dredged Basin RL -2.00	5,422	8,500	_	2,170	10,670

NOTES

1. VERTICAL DATUM:
   Depths are in metres and are reduced to Chart Datum (CD).
   Which is approximately the level of lowest Astronomical Tide (LAT).
   CD (LAT) is 1.752m below AHD.
2. HORIZONTAL DATUM:
   Coordinates are to MGA/GDA94 Zone 54

Dredged area
Sediment sample locations
Previous design

Data Source: SKM Drawing S0-1610-00001.dxf

N
0 50m

South of Embley Project

Fig. I: Amended Humbug Terminal and Sediment Sampling Sites

Datum/Projection: GDA94/MGA Zone 54 Date: 02/02/2012

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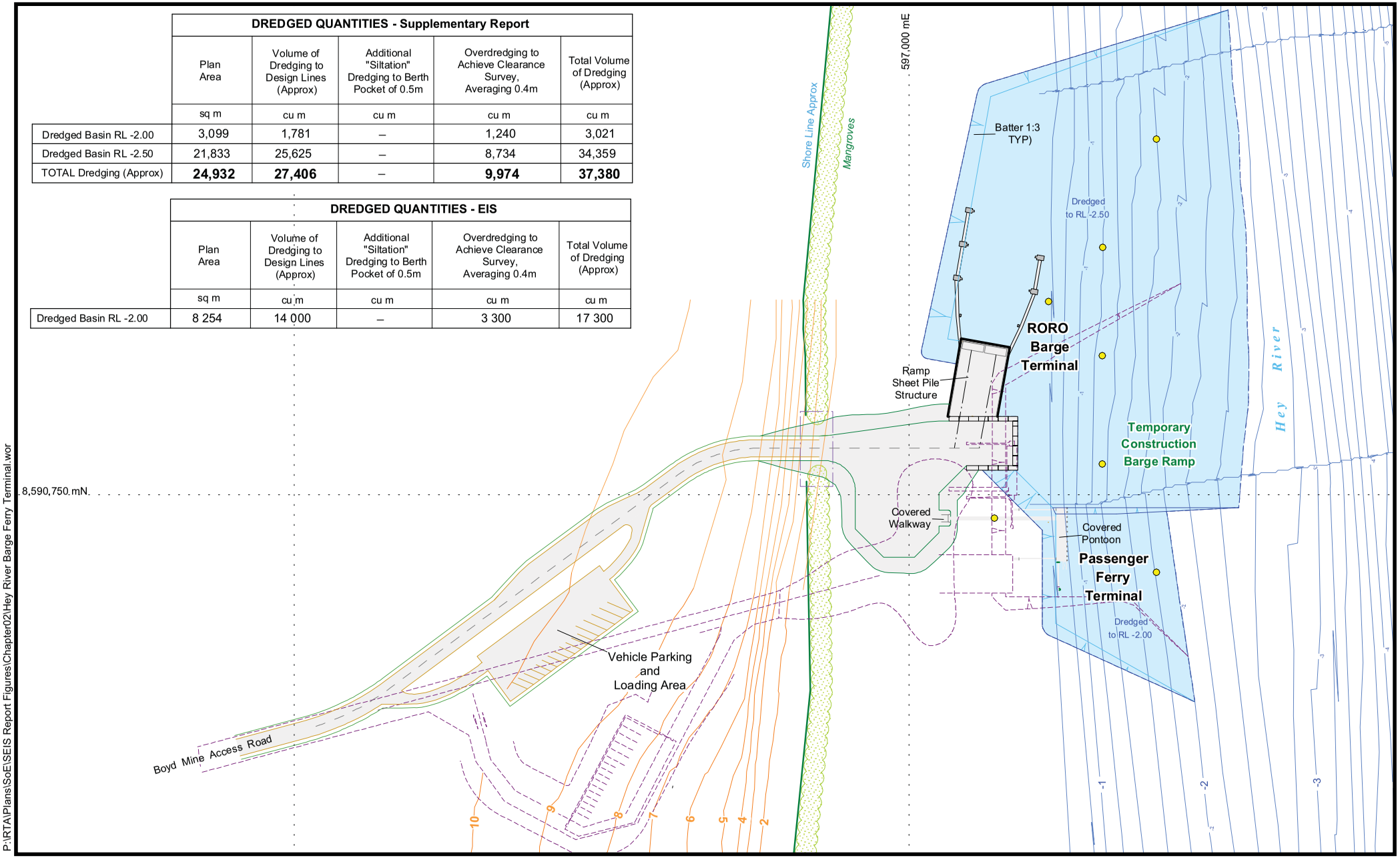
DREDGED QUANTITIES - Supplementary Report					
	Plan Area	Volume of Dredging to Design Lines (Approx)	Additional "Siltation" Dredging to Berth Pocket of 0.5m	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
	sq m	cu m	cu m	cu m	cu m
Dredged Basin RL -2.00	3,099	1,781	–	1,240	3,021
Dredged Basin RL -2.50	21,833	25,625	–	8,734	34,359
TOTAL Dredging (Approx)	**24,932**	**27,406**	–	**9,974**	**37,380**

DREDGED QUANTITIES - EIS					
	Plan Area	Volume of Dredging to Design Lines (Approx)	Additional "Siltation" Dredging to Berth Pocket of 0.5m	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
	sq m	cu m	cu m	cu m	cu m
Dredged Basin RL -2.00	8 254	14 000	–	3 300	17 300



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NOTES:

Vertical Datum:
Depths are in metres and are reduced to chart datum (CD) which is approximately the level of lowest astronomical tide (LAT).
CD (LAT) is 1.508m below AHD.

Data Source: SKM Drawing S0-1630-00001.dxf

Previous design
Dredged area
Sediment sample location

N
0 50m

South of Embley Project

Fig. J: Amended Hey River Terminal and Sediment Samplings Sites

Datum/Projection: GDA94/MGA Zone 54 Date: 13/12/2011

Overall though, it is considered that if any seagrasses do occur at the proposed terminal site from time to time, they are likely to contribute minimally to primary productivity in the area.

A draft Dredge Management Plan is provided in **Appendix 5** of this Supplementary report.

6.5.5 Lorim Point Tug Berths

The tugs for the Project would return to the Embley River during inclement weather and would utilise the existing tug berth adjacent to Lorim Point wharf. Up to 76,500m^3 dredging would be required in the tug berth pocket to provide sufficient draft for the additional berths and turning area (refer **Figure 2-4(sup.)**). Alternatively, and subject to further feasibility study, two berths may be constructed adjacent to the Hornibrook ferry facility for the tugs. Under this alternative, dredging would still be carried out within the footprint shown and the volume would not increase. Dredged material would be disposed of at the existing Albatross Spoil ground utilised by NQBP. The dredging is not required until operations commence and may be carried out at the same time as maintenance dredging is carried out by NQBP. The dredge footprint would partially overlap that which has previously been approved to be dredged by NQBP. NQBP currently dredge up to 10,000m^3 each year from the tug berth to a declared depth of 9.0m LAT (NQBP 2010). NQBP currently dredge approximately 1,000,000m^3 for maintenance of shipping berths and channels in the Embley River and dispose of the material in the Albatross Bay spoil ground.

A SAP was developed and implemented by SKM for NQBP as required under the *National Assessment Guidelines for Dredging* (NAGD). The SAP was approved by DSEWPaC (formerly DEWHA) on 25 November 2008 and implemented on 27-30 November 2008. The sediment sampling indicates that the material currently dredged contains more than 50% silt and approximately 25% sand, with the remainder being gravel. Polycyclic aromatic hydrocarbons (PAH) and Tributylin (TBT) were identified as potential contaminants of concern in the SAP. PAH and TBT were below the *National Ocean Disposal Guidelines for Dredged Materials* (NODGDM) and the NAGD screening levels at the 95% UCL of the mean contaminant concentration. The material was therefore deemed to be suitable for unconfined sea disposal and a 10-Year Sea Dumping Permit for Port of Weipa Maintenance Dredging was issued in June 2010.

The material proposed to be dredged for the Project is expected to be similar to that which has previously been sampled by NQBP. It is therefore anticipated that this material will also be suitable for unconfined sea disposal. If an additional Sea Dumping Permit is required for this dredging, a sediment sampling andanalysis plan would be developed and implemented in accordance with Commonwealth government requirements.

The most recent (2008) seagrass survey of the Port of Weipa (Chartrand and Rasheed 2009) shown in Figure 6-20 of the EIS indicates that aggregated patches of seagrass (*Enhalus acoroides*) may be present in the area between the tug berths and the shore. Survey for seagrass in the proposed dredge footprint would be undertaken prior to dredging and a permit for the removal of marine plants would be obtained in accordance with the *Fisheries Act 1994* (Qld) if required.

Given the minor scale and short duration of dredging, it is unlikely that sediment loads would be generated over the aggregated *E. acroides* patches adjacent to the proposed tug berths at a thickness that would approach critical levels. Further, any reduction in light levels would be short-term and the large-structured *E. acroides* would likely have sufficient stored reserves to provide resilience to the predicted low impact.

The locations of the proposed barge and ferry terminals are within the intensive seagrass monitoring area monitored at least annually by DEEDI. Any impacts from the initial dredging or ongoing vessel movements should be notable within the intensive monitoring undertaken.

Dredging would be carried out in accordance with an approved Dredge Management Plan (refer **Appendix 5** of this Supplementary EIS for the ferry and barge terminal draft Dredge Management Plan). Impacts associated with this dredging are anticipated to be minor.

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