Rio Tinto Alcan

Section 3

Description of the Proposed Action

3 Description of the Proposed Action

This section describes the location of the Project components and a description of each component from the construction phase through to operations and decommissioning.

3.1 Overview

The Project is situated on the western side of Cape York on the Gulf of Carpentaria (refer **Figure 2-1**).

RTA is currently mining the East Weipa and Andoom bauxite deposits located on ML7024 north of the Embley River (refer **Figure 2-2**). Exploration activities and Project investigation activities are carried out on ML7024, including the portion that lies to the south of the Embley River, and ML6024.

Significant bauxite reserves have been identified on the portion of ML7024 that lies to the south of the Embley River. Development of these reserves using existing Weipa infrastructure would pose logistical challenges due to the presence of the wide Embley River estuary. The proposed Project to develop these reserves therefore relies largely on new infrastructure located south of the Embley River. The key components of the Project are shown on **Figure 2-4**. The Project involves a staged increase in production up to 50Mdptpa. The initial production is likely to be approximately 22.5Mdptpa. Actual production rates and the timing and size of capacity expansions would depend on market conditions. The EIS assesses the impact of several different levels of production, including 22.5Mdptpa and a maximum rate of 50Mdptpa. The anticipated mine life is approximately 40 years, depending on production rate.

The Project involves the construction and operation of a bauxite mine and associated processing and Port facilities that would be located between Boyd Point and Pera Head on the western side of Cape York Peninsula as well as shipping activities related to the transport of bauxite, construction materials, cargo and fuel. Boyd Point is approximately 40 kilometres (km) south-west of Weipa and 40km north of Aurukun, with the closest mining areas being 4km from Napranum, 15km from Aurukun, and 50km from the nearest cattle station homesteads. The Project area would predominantly be located on a portion of ML7024 south of the Embley River and also on ML6024, certain Strategic Port Land (within the Port of Weipa), and offshore dredging and disposal areas.

The main infrastructure components are illustrated in **Figure 2-4** and the activities are described in detail in the following sections.

3.2 Location and Tenure

The Project area is predominantly located on the portion of ML7024 that is south of the Embley River and on ML6024. The land parcels and tenure within the Project area and adjacent properties are summarised in **Table 3-1** and shown in **Figure 2-6**.

The northern end of the main Project area is bounded by the Embley and Hey Rivers and the southern end lies north of the Watson River. The Gulf of Carpentaria abuts the western boundary of ML7024 which extends over submerged land between Thud and Boyd Points. The eastern side of ML7024 adjoins the former mineral development licence (MDL) 378, now designated a “restricted area” under the *Mineral Resources Regulation 2003* (RA315) which has been set aside by the State for the potential future development of the Aurukun bauxite resource. The area of the portions of ML7024 and ML6024 located south of the Embley River is approximately 106,000 hectares (ha).

Table 3-1 Land Parcels and Tenure

Table Aspect	Mining Tenement	Land Parcel	Background Tenure	Ownership
Mine, Port and Infrastructure	ML7024 (RTA)	Lot 7024 MP41159	State land	The State of Queensland
Hey River Barge/Ferry Terminal	ML6024 (RTA)	Lot 121 SP135863	State land	The State of Queensland
		Lot 67 WP50	State land	The State of Queensland
		Lot 68 WP50	State land	The State of Queensland
Humbug Barge Terminal	Not applicable. Located within Strategic Port Land.	Lot 29 SP116854	Freehold	NQBP (RTA has held lease since 23 July 1973)
		Lot 14 SP120446	Perpetual Lease	NQBP
Hornibrook Ferry and Tug Terminal	Not applicable. Located within Strategic Port Land.	Lot 17 SP116853	Freehold	NQBP (RTA has held lease since 23 July 1973)
		Lot 14 SP120446	Perpetual Lease	NQBP
Off-lease portion of dredged shipping channel	Not applicable	N/A	Unallocated State land	The State of Queensland

Mining activities would take place on ML7024. The location of areas proposed to be mined in years 1–13 and in years 14–40 are shown on **Figure 2-4**.

Two mine infrastructure areas would be established in stages. The first would be the Boyd infrastructure area which would be located near Boyd Point, approximately 40km south-west of Weipa and 40km north of Aurukun. Later, as mining moves to the south, the Norman Creek infrastructure area would be established approximately 15km south-east of the Boyd infrastructure area.

A combined ferry/tug terminal would be located at Hornibrook Point (Hornibrook terminal) and a barge terminal at Humbug Point (Humbug terminal). Both terminal locations are on Strategic Port Land administered by NQBP and both are within the Port of Weipa. A combined barge/ferry terminal would also be located on the Hey River on ML6024 (Hey River terminal).

A new Port facility would be constructed between Boyd Point and Pera Head for shipment of bauxite product. If dredged to maximum depth (-20.2m lowest astronomical tide (LAT)) a portion of the Port’s dredged departure channel would extend westward beyond the boundary of

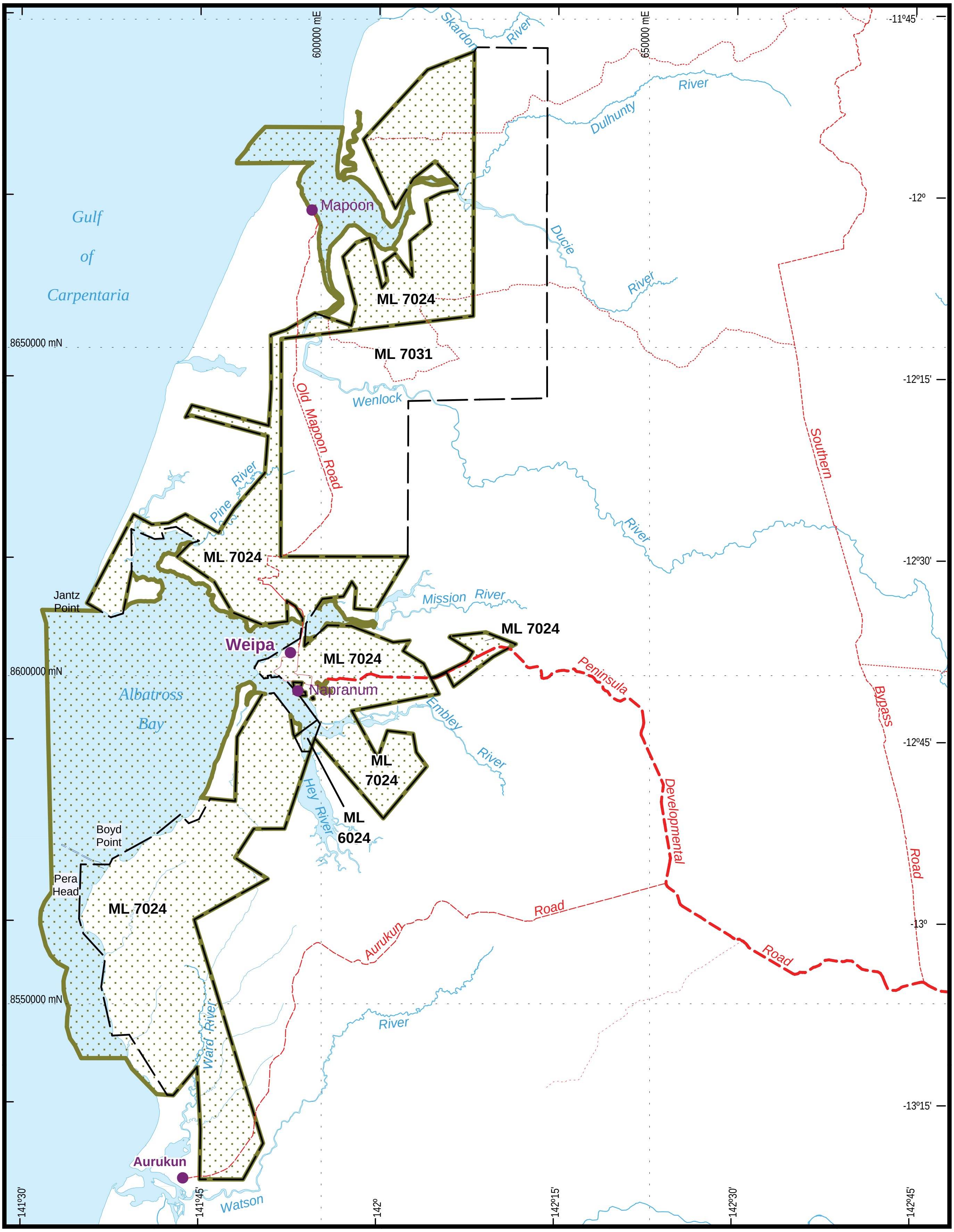
ML7024, but would remain within Queensland coastal waters. The proposed Port is located outside the Port of Weipa limits. Bauxite shipping activities would include the shipment of bauxite to both international and domestic markets. Details on proposed bauxite shipping activities and routes are provided in **Section 3.9**.

Current access to the Project is from the Peninsula Developmental Road (PDR) via the Aurukun Road, Beagle Camp Access Road, Pera Head Access Road, and/or Amban Access Road, which traverse the former MDL378. A temporary barge landing near Pera Head and a temporary passenger jetty near Boyd Bay would be utilised to provide access to the Port area during the initial stages of construction if required. Once the permanent barge/ferry terminals and mine access road are commissioned, access would be primarily via barge/ferry to the Hey River terminal and an “on-lease” mine access road to the Boyd infrastructure area.

There are no reserves, stock routes, easements or public road reserves within the Project area.

ML7024 and the northern portion of the Aurukun Road lies within the Cook Shire Local Government Area (refer to **Figure 2-6** for land tenure). ML6024 lies within the Napranum Aboriginal Shire. The southern portion of Aurukun Road, Beagle Camp Access Road, and Pera Head Access Road are in Aurukun Shire Council.

The Federal Court of Australia determined on 29 July 2009 (FCA 789) that the Wik and Wik Way people have Native Title over the land covered by the Project area. The Western Cape Communities Co-existence Agreement (WCCCA) is a registered Indigenous Land Use Agreement (ILUA) (QIA2001/002) under the *Native Title Act 1993* (Cth) between RTA, the State of Queensland and relevant Aboriginal parties including the Wik and Wik Way people. The area covered by the ILUA includes all of ML7024 and ML6024 and areas beyond the boundary of ML7024 including the Port’s dredged departure channel and is shown in **Figure 3-1**. Where any proposed activities are outside the ILUA area, to the extent that Native Title has not been extinguished in relation to those areas, RTA would comply with the applicable process under the *Native Title Act 1993*. RTA does not expect this to arise.



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RTA Mining Lease boundary

Indigenous Land Use Agreement QIA 2001/002 (also known as Western Cape Communities Co-existence Agreement) Area

Locality

Drainage

Road/track

South of Embley Project

Fig. 3-1: Indigenous Land Use Agreement Areas

N

10 0 10km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

3.3 Construction and Operational Phases

3.3.1 Construction Phase

The Project involves a staged increase in production up to 50Mdptpa from the likely initial production rate of approximately 22.5Mdptpa. The timing and size of capacity expansions would depend on market conditions. Similarly, the timing and extent of associated construction activities is subject to market conditions.

For the purposes of this EIS, the construction activities have been described for (a) an initial production rate 22.5Mdptpa and (b) a single expansion to maximum production of 50Mdptpa. While there is flexibility to undertake smaller production increments depending on circumstances, the EIS has assessed these construction scenarios for the Project:

1. Initial construction phase: Construction of mine, beneficiation plant, Port and associated infrastructure with a production capacity of 22.5Mdptpa; and,
2. Expansion: Construction of second beneficiation plant, expansion of Port capacity, expansion of associated infrastructure and increase in mine production to 50Mdptpa.

Key components of the initial construction phase for the 22.5Mdptpa capacity would include construction of:

- all-weather sealed 38km mine access road from the Hey River terminal to the Boyd infrastructure area (refer to **Figure 2-4** and **Section 3.6.1**);
- Boyd infrastructure area, including a beneficiation plant, tailings storage facility (TSF), and mine support facilities (e.g. diesel-fuelled power station, fuel storage, workshops, warehouse, administration facilities, and package sewage treatment plant) near the Port (**Section 3.5**);
- barge, ferry and tug facilities:
  - Humbug barge terminal (**Section 3.6.2.2** and **Section 3.8.2**);
  - Hornibrook ferry/tug terminal (**Section 3.6.2.3** and **Section 3.8.2**); and,
  - Hey River ferry/barge terminal (**Section 3.6.2.4** and **Section 3.8.2**).

  (commencing with temporary berthing facilities at the Humbug and Hey River terminal sites (**Sections 3.6.2.2** and **3.6.2.4**) followed by the permanent facilities).
- infrastructure corridor from the Boyd infrastructure area to the water supply dam (Dam C), including access track and high voltage power lines (**Section 3.6.3**);
- temporary construction accommodation (**Section 3.6.4**);
- temporary construction facilities (e.g. temporary barge landing area and passenger jetty near the Port (**Section 3.6.5**), concrete batch plant, power generation, water treatment, fuel storage, workshops, offices etc.);
- Dam C (on a tributary of Norman Creek), installation of six artesian bores and water management infrastructure (**Section 3.6.6**);
- Port facility including stockpile with stacker and reclaimer, conveyors, and ship loader (**Section 3.7**), including capital dredging (**Section 3.8**); and,
- mine development.

A site establishment phase would be undertaken initially and include activities to facilitate commencement of construction activities. Where required, the site establishment phase would build upon existing access developed for exploration and Project investigation activities to reduce overall impact and provide for both wet and dry season heavy vehicle access and construction workforce accommodation.

Construction of the Project would be anticipated to commence in or about 2013 subject to the grant of relevant environmental or other regulatory approvals and the determination of internal investment approvals for the project by Rio Tinto. The Project area lies within the Australian Monsoon Zone which has a tropical climate with distinctive dry and wet seasons. The mean annual rainfall at Weipa is 1,769mm, falling on an average of 109 days per year, with 95% of the region's rainfall occurring between November and April. Therefore, it would be expected that construction would take 30 to 36 months depending on weather conditions and timing of approvals within dry season windows. Wherever practicable and required, construction activities would be undertaken 24-hours a day. The high rainfall experienced in the wet season may restrict vehicle movements and thus curtail some construction activities in wetter months.

Cyclones, along with the associated storm surge and high winds, pose a risk to the safety construction workers and the community. These risks would be managed by a detailed Business Resilience and Recovery (BRR) Plan and specific Cyclone Emergency Procedures. All structures would be designed and constructed to the relevant cyclone and earthquake loading specified in Australian Standards *AS1170 Structural Design Actions Infrastructure*, *AS1170.2 Structural Design Actions – Wind Actions* and *AS1170.4 Structural Design Actions – Earthquake Actions in Australia*. The heights of the Port and barge/ferry terminals have been designed after taking into consideration maximum wave heights and storm surges resulting from cyclones.

Where suitable aggregate is not available on site, it is proposed that aggregate would be sourced from the existing Archer River Quarry, subject to a suitable commercial agreement. The quarry is located approximately 200km south-east of Weipa and 100km south of the Aurukun Road turn-off via the PDR. The operator has advised RTA that the supply of the material to the Project would not result in the need for any additional vegetation clearing at the quarry.

Shipping of construction materials from international and domestic locations would also occur. Shipping of construction materials is discussed in detail in **Section 3.7.2**.

Additional construction activities would be undertaken in a staged approach to increase capacity up to 50Mdptpa. The timing and extent of the expansion and associated construction activities would be subject to market conditions. The construction activities associated with increasing capacity to 50Mdptpa are expected to include:

- construction of the Norman Creek infrastructure area, including a beneficiation plant, TSF, and mine support facilities (e.g. possible diesel-fuelled power station, fuel storage, workshops, warehouse, administration facilities, and package sewage treatment plant) and/or expansion of Boyd and Norman Creek infrastructure (**Section 3.5**);
- a 24km sealed Norman Creek Mine Access Road (constructed as a spur from the Mine Access Road to the Boyd infrastructure area) (refer **Figure 2-4**);
- expansion of the Port facility and product stockpiles (**Section 3.5.3**);
- construction of the infrastructure corridor from Norman Creek infrastructure area to the product stockpiles at the Port, including conveyor, access road, water pipelines and extension of the high voltage power lines (**Section 3.6.3**);
- installation of a pump station on the Ward River and construction of the pipeline and powerline corridor between Ward River and the Norman Creek infrastructure area (**Section 3.6.6.3**);
- installation of an additional six artesian bores (**Section 16.4.2**);
- expansion of Dam C, if required (**Section 3.6.6.2**); and,
- temporary construction facilities as required.

For the purposes of assessment of impact on relevant matters on NES, the disturbance associated with later stages of construction has been included in the assessment of the operational phase.

3.3.2 Operational Phase

The Project involves a staged increase in production up to 50Mdptpa and for the purposes of the EIS, assessment has been carried out for the maximum rate of production. However, the actual rates and the timing of production increases would depend on market conditions.

Key components of the operational phase of the Project include:

- mining (**Section 3.4**);
- bauxite processing (beneficiation) (**Section 3.5**);
- Port operations (**Section 3.7.3**);
- maintenance dredging (**Section 3.8.1.2**);
- shipping activities (**Section 3.9**); and,
- progressive rehabilitation (**Section 3.10**).

Cyclones, along with the associated storm surge and high winds, pose a risk to the safety of employees and the community, and may potentially damage infrastructure and revegetated areas. The risks to the safety of employees and the community would be managed by a detailed BRR Plan and specific Cyclone Emergency Procedures.

3.4 Mining

The Project currently has bauxite reserves that could sustain a mine life of about 40 years, depending on annual production rate. Mine life also depends on the extent to which mineable reserves may change in the future subject to ongoing resource evaluation and economic factors.

The conceptual 40 year mine plan is shown in **Figure 2-4**. Mining would commence in the Boyd Point – Pera Head area, and would later be extended north towards Hey Point and south to the Norman Creek area. **Figure 2-4** shows the areas to be mined in years 1-13 and years 14-40. The areas to be mined comprise Darwin Stringybark woodlands on a bauxite plateau. Approximately 28,000ha of woodland would be progressively cleared for mining over the 40 year life of the mine. The disturbed area would be progressively rehabilitated to minimise the loss of vegetation at any one time (refer **Section 3.10**).

Vegetation would be cleared by bulldozers, following the wet season when the ground is sufficiently moist to allow tree roots to pull clear of the ground rather than breaking. Soil would be salvaged and returned by scraper or haul truck directly to mined-out areas undergoing rehabilitation where possible, or stockpiled for later respreading (refer to **Section 3.10** for a description of mine rehabilitation). The overburden above the bauxite would then be removed by front-end loader and returned to mined-out pits by trucks.

The top of the bauxite strata is generally less than 1m below the natural ground surface. The average ore thickness across the identified reserves in the Project area is approximately 3.4m. A shallow open pit would be developed whereby bauxite would be mined by front-end loader or excavator. Bauxite is relatively easy to dig and does not require blasting.

After overburden and soil are returned to mined-out pits, the final landform would be at a lower elevation than the original landform due to the removal of the bauxite, but the overall slope of the landform would be similar. Where mining leaves batters on the edges of the pit, these would be recontoured to a maximum slope of 20% (1 in 5). The final landform would not have any out-of-pit dumps of excavated waste material or soil. Rehabilitation is discussed further in **Section 3.10**.

Stormwater runoff generated in the mine areas would mostly be captured within the internally draining mine pits. The post-mining landscape would effectively provide internally draining sumps that would contain stormwater runoff that would then infiltrate through the pit floor and walls. For areas where the post-mining topography is not a fully internally draining pit, stormwater runoff would be directed via a sediment trap. Appropriate sediment control structures would also be included as part of the drainage design at points where haul roads cross watercourses (refer **Section 16.2**).

3.5 Processing, Tailings and Stockpiling

Product-grade bauxite is processed by beneficiation, a process where oversized particles are removed by screening and fine particles are removed by washing and screening. After beneficiation, product bauxite would be stockpiled prior to shipping from the proposed Port.

The beneficiation process generates tailings, which are pumped to a TSF where water is decanted and recycled back to the plant. Each stage of the process is discussed below.

The Mine Industrial Areas, which include the beneficiation plants, each cover an area of approximately 300ha. The Boyd infrastructure area (incorporating the industrial area, stockpiles and the TSFs) would be located approximately 40km south-west of Weipa and 40km north of Aurukun and would be constructed to meet the likely initial production capacity of 22.5Mdptpa. Bauxite would originally be processed in the Boyd beneficiation plant. Production capacity may be increased by expanding the Boyd beneficiation plant and/or by building a second beneficiation plant at the proposed Norman Creek infrastructure area located approximately 15km south-east of the Boyd infrastructure area. The Norman Creek beneficiation plant would also be designed such that it can be expanded if additional capacity is required.

The beneficiation plants and the administration and maintenance infrastructure would be erected on-site using conventional construction methods or prefabricated modules. The indicative layout of the Boyd and Norman Creek beneficiation plants is shown in **Figure 3-2** and **Figure 3-3** respectively.

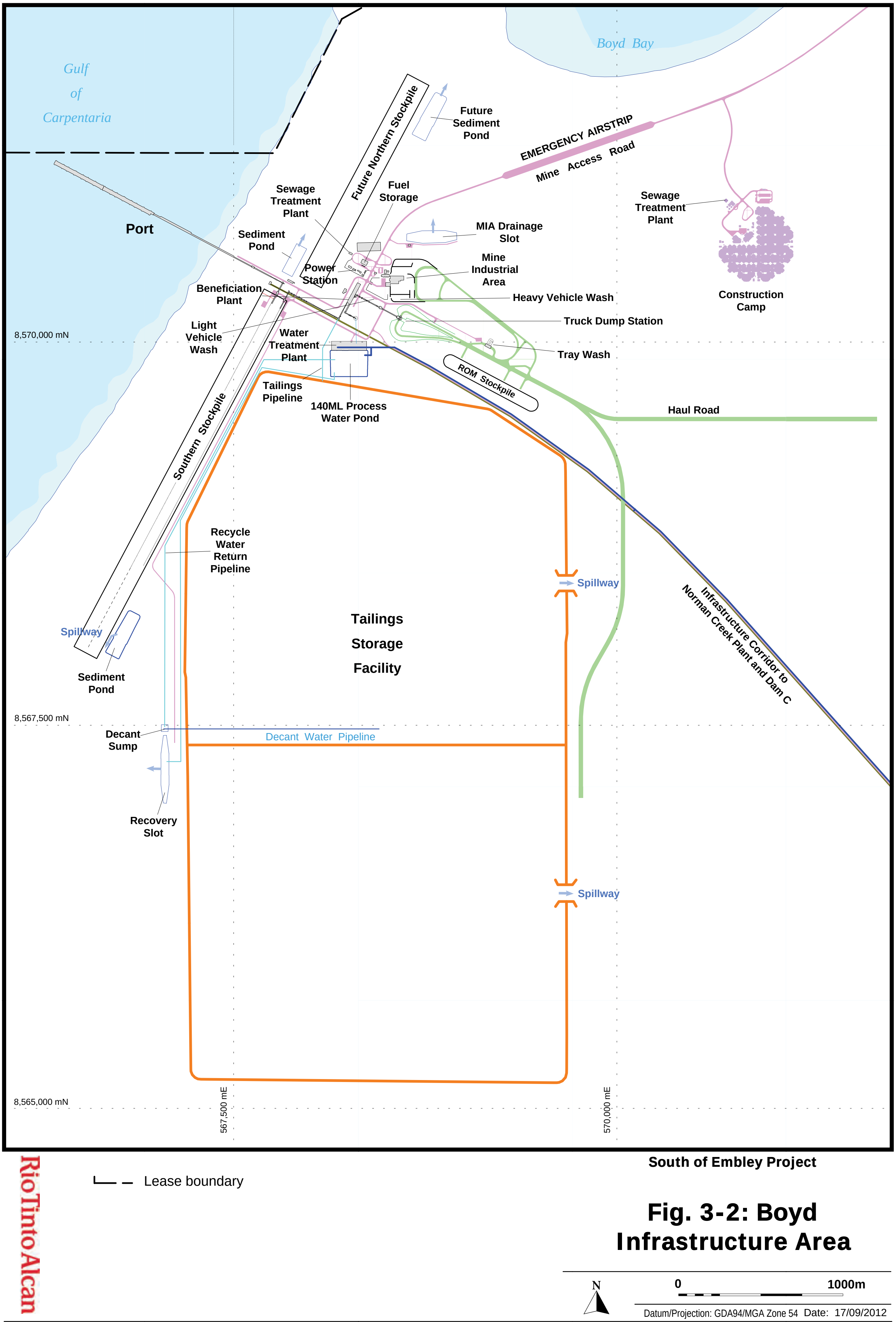
3.5.1 Beneficiation Plants

Crude ore would be transported to a truck dump station and dumped into a hopper. The ore would then be sized to <300mm in a primary sizer and then <90mm in a secondary sizer. Ore would then be conveyed to the beneficiation plant. The plant function is to disperse the sized crude bauxite by using water and separate oversize tramp and high-silica fines fractions from the product bauxite fractions, and then to dewater the product bauxite. No chemicals would be used in the beneficiation process. The high-silica fines fractions would report to a TSF via the tailings pumping system. The dewatered product bauxite would report to the product stockpiles.

In the plant, sized ore and dispersion water would be fed to single-deck scalping screens. Water sprays over the scalping screen decks would complete the dispersion of the crude ore. The decks of the scalping screens would classify and separate oversize rejects (+25mm) from the crude bauxite feed. The underflow slurry (–25mm) from each scalping screen would flow by gravity onto a dedicated product screen for final classification and dewatering of the product (+0.6mm). The product from all screens would collect on the product conveyor and the underflow from the product screens would flow by gravity to tailings sumps.

The oversized material from the scalping screens would be conveyed to a small stockpile adjacent to the plant. A larger oversize stockpile may be located between the plant and the TSF, if required. This material would either be reprocessed, used for construction (e.g. roads, TSF walls) or returned to mined-out pits.

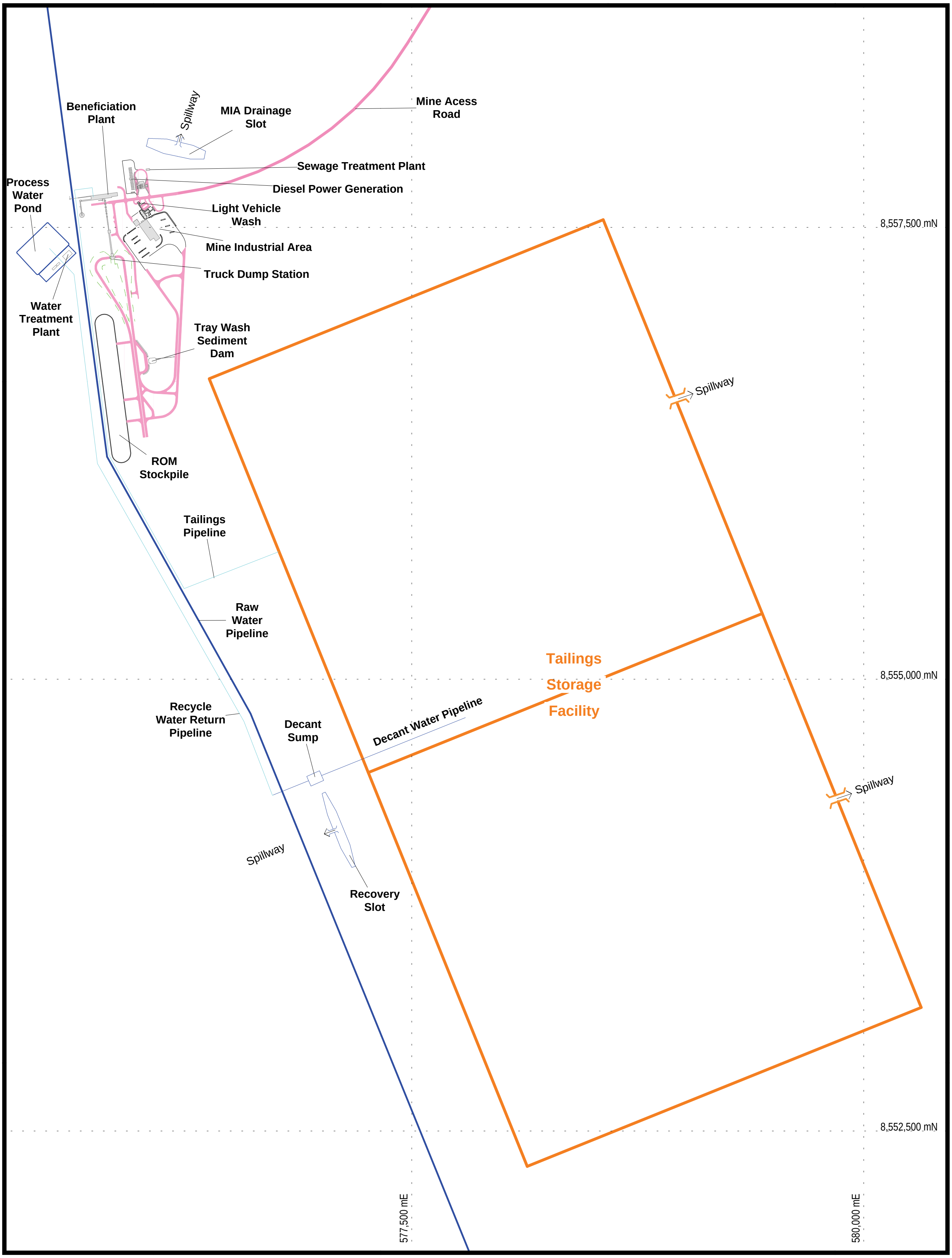
The beneficiation plant building structure would support the scalping and product screens, and outgoing conveyors. Elevated concrete frames would support the scalping screens. Ground level steel beams located over the below-grade screen-underflow sumps would support the scalping screens. Steelwork supports would provide all other supports and access-ways in the building structure. Stair towers would provide access at each end of the beneficiation plant to allow two points of egress. A concrete apron slab would drain area sumps.



South of Embley Project

Fig. 3-2: Boyd Infrastructure Area

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



South of Embley Project

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Fig. 3-3: Norman Creek Infrastructure Area

600 0 600

N

Data source: 25403-501-A0-4710-00001.dgn

Datum/Projection: GDA94/MGA Zone 54

Date: 17/09/2012

The initial Boyd and Norman Creek beneficiation plants would be similar “low dispersion energy” plants designed to process approximately 5,000 wet crude tonnes per hour and each plant would use approximately 1t of water to produce 1t of product bauxite. Approximately 40% of the crude ore in the Norman Creek mining area has elevated fines content that may require “high dispersion energy” beneficiation. This ore would be processed through a “high dispersion energy” module that would be added to the existing plant. This module would use approximately 1.9t of water to produce 1t of product bauxite.

After beneficiation, product bauxite would be stockpiled prior to shipping from the proposed Port.

Approximately 35% of the water used in the beneficiation plants would be recycled from the TSFs. Overall bauxite product recovery from crude ore would average approximately 70%.

Figure 3-2 and **Figure 3-3** show the layouts of the proposed infrastructure areas which include the beneficiation plants.

3.5.2 Tailings

The beneficiation process generates tailings which would consist of water, fine bauxite particles, sands and clays. Approximately 0.4 million tonnes (Mt) of tailings would be produced for every 1Mt of product bauxite. Bauxite tailings are benign, contain no added chemicals and are not classed as hazardous under the Queensland criteria for *Determining Dams Containing Hazardous Waste* (DERM 2011a) or *The Manual for Assessing Hazard Categories and Hydraulic Performance of Dams* (DERM 2012b).

The tailings would be pumped in slurry form (30% solids by weight) to a TSF. The TSFs would be “turkey’s nest” dams where tailings are discharged from the perimeter wall into cells within the dam. The tailings solids would beach and suspended solids would settle out and water would be decanted and pumped back to the beneficiation plant for reuse in processing. The TSFs would be divided into cells to facilitate the cycling of tailings perimeter deposition within a cell, and between cells, to enhance formation of a broad tailings beach adjacent to the perimeter walls that dries quickly to a consistent density over its full depth. TSF walls would be raised in lifts using an upstream raising technique.

The Boyd TSF would be up to 25m high upon completion and provide an ultimate capacity of approximately 216Mt and a footprint of 1,100ha. Alternatively the height may be increased to 30m and the area reduced to 800ha. The Norman Creek TSF would have a capacity of 234Mt and be a similar area and height. The layouts of the TSFs are shown on **Figure 3-2** and **Figure 3-3**.

Both TSFs would be located within an area of bauxite reserve which would be mined, used for dam construction, or a combination of the two.

3.5.3 Product Stockpiles

Product bauxite from the beneficiation plants would be conveyed to the product stockpiles to be located adjacent to the Port. The stockpile capacity would be expanded in stages as production increases. The initial product stockpile capacity would occupy approximately 21ha. The maximum stockpile footprint would be approximately 70ha with a capacity of 2.85 million wet product tonnes (Mwpt) to facilitate storage and shipping of bauxite products at maximum production. The stockpile facilities have been designed by RTA so as not to preclude a third party developer from the construction and operation of an additional stockpile, stacker, reclaimer, and conveyor. Expansion of the stockpile area could be carried out for a third party, if a suitable commercial agreement is reached with RTA and Port capacity is available.

A reclaiming system would reclaim the stockpiled product to convey it to the ship loading facilities at the wharf.

3.5.4 Ore and Tailings Characterisation

Crude bauxite ore is transformed into product by a process known as beneficiation. Beneficiation involves separation of the bauxite and waste materials through crushing, screening, washing and dewatering. No chemicals are added to the process. This process produces pea-sized pisolite product ore and tailings (consisting of water, fine bauxite pisolite, sands and clays). The particle size of tailings is less than 0.6mm.

Tailings solids, crude ore and bauxite product samples from East Weipa and Andoom, and crude ore samples from the Project area, were analysed for metals and evaluated in terms of enrichment (Rio Tinto 2009a). Tailings solids and liquid samples from East Weipa and Andoom were analysed (Rio Tinto 2009b) for the tailing constituents specified in the Information Sheet *Determining dams containing hazardous waste* (DERM 2011a). A summary of metal concentration results and the tailings solid and liquid results are presented in **Table 3-2** and **Table 3-3** respectively.

The data show that bauxite ore and tailings:

- do not trigger the environmental investigation limit (EIL) for contaminated land in Queensland (EPA 1998), except for chromium in ore;
- are not significantly enriched in any metal when compared to average crustal abundance using the Geochemical Abundance Index (GAI) (Bowen 1979). The DME/DEH (1995) guideline entitled *Assessment and Management of Acid Drainage* states "*a GAI of greater than three indicates significant enrichment to a level that warrants further examination*". None of the metals have a GAI greater than three; and,
- tailings and bauxite product are not enriched in any metal when compared to crude bauxite ore.

The chromium in the ore is present as Cr(III) in chromite. The Cr concentration in Weipa and Andoom ore is 155 and 175mg/kg respectively (see **Table 3-2**), which is at the lower end of the range in found bauxite ores (14 – 1,000mg/kg, Patterson *et al.* 1986). The Cr(III) concentrations found are the ambient background concentrations and do not pose a risk to the environment.

An earlier assessment of fine tailings from Andoom by the National Research Centre for Environmental Toxicology (Noller 2002) concluded:

> *"The chemical properties of Andoom ultrafine tailings, being essentially soil, suggest that there is unlikely to be any hazard associated with leaching by tropical rainwater as the material is already highly leached".*

The solids and liquid results indicate that the concentrations of all constituents are at least an order of magnitude less than the specified solids criteria (EHP 2012c) for hazardous waste and therefore the tailings are not hazardous. Based on the GAI of one for aluminium in tailings and the assessment by Noller (2002) aluminium in tailings is not expected to have an impact on the environment.

Table 3-2 Metal Concentrations in Bauxite Ore and Tailings

Material Type	Total Element Content (mg/kg or %)								EHP Criteria for Hazard Waste	EIL	Average Crustal Abundance	Geochemical Abundance Index (GAI)							
	Crude Ore*			Blended* (Andoom and East Weipa)			Tailings[##]					Crude Ore			Blended (Andoom and East Weipa)			Tailings	
Site / Parameter	South of Embley	Weipa	Andoom	Product Bauxite	Coarse Tailings	Fine Tailings	Andoom	Weipa	mg/kg	mg/kg	mg/kg or %	South of Embley	Weipa	Andoom	Product Bauxite	Coarse Tailings	Fine Tailings	Andoom	Weipa
Reference	1	2	2	2			3		4	5	6								
Aluminium	29.3%[#]	29.0%	28.9%	30.1%	23.5%	31.1%	ND	ND	na	na	8.2%	1	1	1	1	1	1	ND	ND
Arsenic	<5[##]	15	18	17	9	10	0.2	0.4	500	20	1.5	ND	3	3	3	2	3	0	0
Boron	ND	ND	ND	ND	ND	ND	<50	<50	15,000	na	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ND	<1	<1	<1	<1	<1	<0.1	<0.1	100	3	0.11	ND	ND	ND	ND	ND	ND	0	0
Chromium	ND	155	175	160	100	25	ND	ND	na	(50)^	100	ND	0	0	0	0	0	ND	ND
Cobalt	ND	12	16	9	11	15	6.1	1.1	500	na	ND	ND	ND	ND	ND	ND	ND	0	0
Copper	<5[##]	5	15	<5	<5	17	3	0.3	5,000	60	50	0	0	0	0	0	0	0	0
Iron	5.6%[#]	4.6%	9.5%	6.3%	3.6%	4.9%	ND	ND	na	na	4.1%	0	0	1	1	1	0	ND	ND
Lead	7[##]	31	24	36	24	33	12	6.4	1,500	300	14	0	1	0	1	0	1	0	0
Manganese	ND	185	160	160	180	240	ND	ND	na	500	950	ND	0	0	0	0	0	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	<0.1	<0.1	75	na	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	<2[##]	20	11	7	11	19	3.6	1.4	na	60	80	0	0	0	0	0	0	0	0
Selenium	ND	ND	ND	ND	ND	ND	<1	<1	na	na	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	<5[##]	30	20	10	15	20	0.8	0.6	na	200	75	0	0	0	0	0	0	0	0

Method: * XRF ** ICP-MS ^ Cr(III) only
EIL: Environmental Investigation Level; ND: No Data; na: not applicable
References:

1. Rio Tinto internal data. # Mean of 50 samples from drill cores taken in 2006 and
   ## Mean of two samples analysed in September 2009
2. Smith (1985)
3. Rio Tinto internal data. Mean of two whole *in situ* tailings samples taken in May and September 2009.
4. EHP (2012c)
5. EPA (1998)
6. Bowen (1979)

Table 3-3 Analysis of Weipa and Andoom Tailings Liquid

Analyte	Units	Andoom tailings liquid	East Weipa tailings liquid	EHP Criteria for hazardous waste	ANZECC (95%) Freshwater (receiving waters) trigger
pH	pH unit	8.1	6.1	5-9 inclusive	NA
EC	µS/cm	909	24	4000	NA
Aluminium	mg/L	0.302***	0.021***	NA	0.055*
Arsenic	mg/L	<0.001	<0.001	1.0	0.013**
Boron	mg/L	0.07	<0.05	5	0.370
Cadmium	mg/L	0.0001	<0.0001	0.01	0.0002
Cobalt	mg/L	<0.001	<0.001	1.0	NA
Copper	mg/L	<0.001	<0.001	1.0	0.0014
Lead	mg/L	<0.001	<0.001	0.5	0.0034
Mercury	mg/L	<0.0001	<0.0001	0.002	0.0006
Nickel	mg/L	<0.001	<0.001	1.0	0.011
Selenium	mg/L	<0.01	<0.01	0.05	0.011
Zinc	mg/L	<0.005	<0.005	20	0.008
Chloride	mg/L	0.185	25	2500	NA
Fluoride	mg/L	0.1	<0.1	2	NA
Sulphate	mg/L	57	<1	1000	NA

Notes: NA – not established
* pH>6.5
** assumes all arsenic as As(V)
***mean value from May and September 2009

The following metals were not detected in tailings liquid at concentrations greater than the reporting limit and were at least an order of magnitude lower than the Department of Environment and Heritage Protection (EHP) (2012c) criteria for hazardous waste; arsenic, boron, cobalt, copper, lead, nickel, selenium, zinc and mercury. This, combined with the lack of enrichment in the ore, indicates these elements are not considered potential contaminants of concern for the Project. Tailings liquid results have been compared with ANZECC/ARMCANZ (2000) freshwater guidelines; however, it should be noted this is a conservative screening approach as these guidelines are designed for receiving waters and not intended to be applicable to closed, managed waste systems. Nevertheless, when compared the concentration of all measured constituents in tailings water is less than the ANZECC guidelines, with the exception of aluminium at Andoom.

Leach analyses were also conducted on tailings solid and ore samples using two analytical methods. A de-ionised water bottle leach procedure was completed (AS4439.3) over a period of 18 hours and a 1:5 solid/water dilution leach test using deionised water over a 1 hour period. The bottle leach procedure presents a more conservative result. Results of both methods are presented in **Table 3-4** and **Table 3-5** respectively.

The concentration of aluminium in tailings leachate (10µg/L) and ore leachate (<10µg/L) was lower than the median of freshwater streams in the Project area (18µg/L). Based on these results, leaching from ore or tailings is not anticipated to have an adverse effect on surface freshwaters or groundwater.

Table 3-4 Tailings and Ore AS4493.3 Bottle Leach Procedure Results

			Location			
Analyte	**Units**	**LOR**	**East Weipa Tailings**	**Andoom Tailings**	**Lorim Point Stockpile (Ore)**	**SoE Ore**
Aluminium	mg/L	0.01	0.01	0.01	<0.01	<0.01
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	0.002	0.004	<0.001	<0.001
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.005	0.014	0.015	0.011	0.006
Zirconium	mg/L	0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	0.05	0.06	0.07	0.06	0.06
Iron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05

Table 3-5 Tailings and Ore 1:5 Solid / Water Leach Test Results

			Location			
Analyte	**Units**	**LOR**	**East Weipa Tailings**	**Andoom Tailings**	**Lorim Point Stockpile (Ore)**	**SoE Ore**
Final pH	pH Unit	0.1	6.2	6.9	7	7.2
Aluminium	mg/L	0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Chromium	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Copper	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Manganese	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Nickel	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Lead	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Zinc	mg/L	0.002	<0.002	<0.002	<0.002	<0.002

Notes:

LOR = Limit of reporting

1:5 leach test results reported in mg/kg, converted back to mg/L based on dilution factor of 5 not accounting for the moisture correction

A seawater elutriate test of bauxite product was also carried out using the US EPA's standard seawater elutriate test (US EPA 1991, Simpson *et al.* 2005) to assess the impact on seawater quality in the event that bauxite product entered the marine environment. The elutriate method chosen for the study was that recommended for the assessment of contaminant release during disposal of dredged sediment (NAGD 2009, US EPA 1991). The elutriate test uses a dilution of 1:4 wet sediment:added seawater and will greatly overestimate water quality impacts given that dilutions of the order of a hundred times or more (and often much more) would normally be expected in near shore and open coastal environments (NAGD 2009).

Therefore the initial elemental concentrations from bauxite in contact with seawater would be subject to relatively rapid and high dilution rates.

The potential impacts on water quality were assessed by comparing the elemental concentrations from the elutriate test, with due regard to initial dilution, to the relevant ANZECC/ARMCANZ (2000) marine water quality trigger values, where available, and to regional background concentrations. Results for elutriate tests on product bauxite from the East Weipa and Andoom mining areas (Rio Tinto 2012) are presented in **Table 3-6**.

Table 3-6 Seawater Elutriate Results for Bauxite Product

Analyte	Units	LOR	Elutriate Andoom Average (n=3)	Elutriate Weipa average (n=2)	Elutriate Blank	ANZECC (2000) 99%	ANZECC (2000) 95%	Weipa coastal average (n=5)***	Gladstone Harbour range#
pH	pH Unit	0.01	7.16	7.27	7.97	nd	7-8.5	8.2	7.73-8.24
Conductivity	µS/cm	1	48500	49800	50800	na	na	nd	nd
Aluminium	µg/L	10	5.3*	9.5*	18	ID	ID	35	<10
Iron	µg/L	5	9.3	18.5	<5	ID	ID	70	<5 - 18
Arsenic	µg/L	0.5	<0.5	<0.5	1.6	ID	ID	1.82	0.8 - 2.0
Cadmium	µg/L	0.2	<0.2	<0.2	0.3	0.7	5.5	<0.1	<0.2
Chromium	µg/L	0.5	0.6	3	<0.5	7.7/0.14 **	27.4/4.4 **	<1	<0.5
Copper	µg/L	1	5	2.5	7	0.3	1.3	<1	<1 -2
Lead	µg/L	0.2	0.7	0.25	0.4	2.2	4.4	<1	<0.2
Manganese	µg/L	0.5	3.4	1.75	1	ID	ID	3	<0.5 - 44.6
Mercury	µg/L	0.1	<0.1	<0.1	<0.1	0.1	0.4	<0.1	<0.1
Molybdenum	µg/L	0.1	3.4	4.95	11.3	ID	ID	nd	8.1 -12.4
Nickel	µg/L	0.5	1.1	1.15	0.9	7	70	<1	<0.5 - 0.8
Vanadium	µg/L	0.5	0.6	<0.5	1.9	50	100	nd	1.4 - 4.0
Zinc	µg/L	5	180*	170*	347	7	15	56.2	<5 - 10

na = not applicable; nd = no data; ID = insufficient data to derive a reliable trigger value
*Al and Zn were blank corrected due to the high blank concentrations
**Cr(III)/Cr(VI)

***RTA 2011

#EHP 2012f

A relatively small mass of bauxite product may potentially be spilled during loading at the proposed Port or unloading in Gladstone at the South Trees and Fisherman's Landing wharves. Gladstone harbour is defined as a slightly to moderately disturbed marine system and therefore the ANZECC/ARMCANZ (2000) 95% protection level is applied in assessing water quality. The area of the proposed Port is currently considered near pristine and therefore the assessment of water quality has also been made against the 99% protection level trigger values. **Table 3-6** shows that the elemental concentrations in the elutriates are all below the ANZECC/ARMCANZ (2000) 95% and 99% protection levels except for copper and zinc. The zinc concentration requires approximately 1:10 and 1:25 dilutions to meet the 95% and 99% protection levels, respectively. Hydrodynamic and water quality modelling in Gladstone harbour (RTA unpublished data) shows these dilutions would be readily achieved. The modelling shows a minimum dilution of 1:30 is achieved on neap slack tides at Fisherman's Landing wharf in Gladstone harbour, up to an approximate 1:400 dilution on spring ebb tides. Similar dilutions would be expected throughout the central Gladstone harbour area. Dilutions in excess of 1:25 would also be expected in the proposed Port area with similar tidal ranges and tidal currents.

The elemental concentrations in the bauxite product elutriates are within or below the range of concentrations for Gladstone harbour and at or below the average concentrations for the proposed Port except for zinc. Dilutions of 1:10 to 1:20, which would be readily achieved at the proposed Port and Gladstone harbour, would result in concentrations at or below the background concentrations.

The dissolved aluminium concentrations in Gladstone harbour seawater have been reported as <10µg/L at all sites (EHP 2012f). Angel *et al.* (2012) reported a range of dissolved aluminium concentrations of 1 to 6µg/L from 20 sites across Gladstone harbour. These concentrations are similar to the concentration in the elutriates prior to any further dilution.

Copper in the elutriates appears elevated compared to the ANZECC/ARMCANZ (2000) 95% and 99% protection level trigger values and Weipa and Gladstone harbour background levels, however the concentration is lower than the elutriate blank. This would indicate that the bauxite has actually adsorbed copper from the seawater and the concentrations would actually be below the trigger value and the background concentrations for the proposed Port and Gladstone harbour.

Similarly, arsenic, cadmium, molybdenum and vanadium concentrations in the bauxite product elutriates were less than the elutriate blank. This would indicate adsorption of these elements by the bauxite product.

In the extremely unlikely event that a fully loaded bauxite ship was to sink along the shipping route between the proposed Port and the Port of Gladstone the bauxite product would come in contact with seawater, but unless there was a catastrophic rupture of the hull, the majority of bauxite product would be retained within the ship and not dispersed through the water column. Therefore any dissolution of elements from the bauxite would be expected to be considerably less than in the elutriate tests which vigorously mixes the bauxite through the seawater.

As bauxite shipping would occur through the GBR the elutriate test results are compared to the ANZECC/ARMCANZ (2000) 99% protection level trigger values for pristine environments. **Table 3-6** shows that the element concentrations in the elutriates, before any further dilution, are at or below the ANZECC/ARMCANZ 99% trigger values except for zinc and copper. A 1:25 dilution would result in a zinc concentration at or below the ANZECC/ARMCANZ (2000) 99% trigger value and all element concentrations would be substantially lower than the trigger values. A 1:25 dilution would be very conservative given the water depths and tidal currents along the shipping route.

The dissolved aluminium concentration in the elutriates, prior to any further dilution, is within the range of dissolved aluminium recently reported in coastal waters of the GBR, from south of Hinchinbrook Island to Fitzroy Island in the north, 1.83 to 6.39µg/L (average 3.81µg/L) (Munksgaard *et al.* 2012).

While the copper concentration in the elutriates is higher than the ANZECC (2000) trigger values at 99% and 95% protection level the concentrations are lower than the elutriate blank which suggests that there is no dissolution of copper from the bauxite product. This result reflects the low concentration of copper in the bauxite ore and bauxite product (refer **Table 3-3**).

In conclusion, comparison of the elutriate elemental concentrations with the ANZECC/ARMCANZ (2000) 95% and 99% protection level trigger values and regional background concentrations shows that if bauxite product was to be spilled into seawater it would have an insignificant impact on water quality.

3.6 Associated Infrastructure

This section describes infrastructure that would be constructed as part of the Project to support mining, processing and Port operations.

3.6.1 Roads

The road network in the vicinity of the Project area is largely undeveloped, with vehicle access restricted to minor vehicular tracks. Current road access to the site is from the PDR via Aurukun Road, Beagle Camp Access Road, Pera Head Access Road, and/or Amban Access Road (refer **Figure 2-2**). However, the PDR and Aurukun Road are predominantly unsealed and prone to closure during the wet season and the Access Roads are also impassable during the wet season.

Prior to the construction of the barge and ferry terminals, construction workers would travel the Project area via the existing road network by bus or via boat (refer to temporary berthing at Humbug and Hey River terminals **Section 3.6.2** and temporary seaborne access **Section 3.6.5**).

A new 38km long “on-lease” mine access road would be constructed from the Hey River terminal to the Boyd infrastructure area. Once the permanent ferry terminals and the mine access road are constructed, they would be used to transport the construction workers to the site during construction and mine employees during mine operation. Buses would be used between the ferry terminal and the construction camp.

The mine access road alignment would follow elevated portions of the landscape wherever possible to enable all weather access; however, dry culvert causeways would be required at certain watercourse crossing points. The road alignment and creek crossings would be designed to provide all weather access up to a 1 in 10-year storm event. A section of the access road near the Boyd infrastructure area would be widened to meet the Royal Flying Doctor Service standards to provide for emergency aircraft evacuation of sick or injured people. As part of the subsequent development of the Norman Creek infrastructure area, a 24km long road would be constructed to connect it with the mine access road. Culvert causeways or low level crossings would also be required along this Norman Creek access road. Dry culvert cells would be installed at constructed access road crossings of Winda Winda Creek and the southern branch of Norman Creek to maintain habitat continuity along the riparian corridor apart from during periodic high flow events that may be utilised by the Northern Quoll.

The locations of the proposed drainage line crossings are shown on the vegetation maps presented in **Section 4.2** (refer **Figure 4-1**). Smaller culvert causeways or low level crossings would also be provided as necessary in lower parts of the landscape similar to those used in conventional roads of similar design standard.

Watercourse crossing points may also be required for certain internal mine haul roads that link mining blocks to the beneficiation plants. Haul road alignments would be planned during the mine development phase and would be subject to change to meet mining requirements.

Borrow pits would be utilised where necessary or material would be utilised from the existing Archer River Quarry (subject to a suitable commercial agreement) (refer **Section 3.3.1**) or another supplier to provide material for the construction of the roads. Aggregate would be transported from the Archer River Quarry to the Project site in a fleet of trucks via the PDR, Aurukun Road and Project access roads. Gazetted roads would be upgraded and/or maintained to manage Project-related impacts as required by the Queensland government and other access roads would be upgraded so that they are safe for heavy haulage where required.

3.6.2 Barge and Ferry Terminals

A combined ferry/tug terminal would be located at Hornibrook Point (Hornibrook terminal), a barge terminal at Humbug Point (Humbug terminal) and a combined barge/ferry terminal at Hey River (Hey River terminal).

Prior to the permanent barge and ferry facilities being established, most plant, materials and equipment would be delivered by ship or barge to Evans Landing, Humbug Wharf, or Lorim Point. It would then be transported via the existing road network to the Project site, via barge across the river to the Hey River terminal site (refer **Section 3.6.2.4**), or via barge to the temporary barge landing area near the proposed Port (refer **Section 3.6.5.1**). Some materials may be transported directly to these locations. Construction of the permanent barge terminals and mine access road would take approximately six to twelve months (depending on the timing of the construction period in relation to the wet season).

Once the permanent barge terminals and the Mine Access Road are operational, cargo and equipment may be delivered directly to the proposed Hey River terminal (if the draft of the barge allows). Deliveries to the Humbug Wharf, Evans Landing, or Lorim Point would be unloaded onto either:

- vehicles for a RORO transfer from the proposed Humbug terminal to the Hey River terminal; or,
- a barge with a shallower draft, suitable for berthing at the Hey River terminal, where it would be unloaded.

The RORO barge when loaded would have a displacement of approximately 700 tonnes (fully loaded) and a draft of 2.1m.

During construction, and prior to the on-site construction camp being established, the workforce may be transferred to the Project area via ferry or boat on a daily basis from accommodation in Weipa (refer **Section 3.6.2** for details on construction access at Hey River and **Section 3.6.5.2** for details on the temporary passenger jetty at Boyd Point/Boyd Bay). Once the on-site construction camp and the permanent transport infrastructure has been established the construction workforce would be transferred at the beginning and end of each roster primarily via the Hey River terminal.

The operational workforce would be housed in the existing Weipa community and commute to the Project area on a daily basis across the Embley River via ferry, barge or boat and the mine access road. The passenger vessel would be sized according to the number of people on each shift, would be sufficiently seaworthy to sail in all but severe weather events and would operate as needed; however, up to 4 to 6 return crossings per day are anticipated at the maximum production scenario of 50Mdptpa. The ferry would have a displacement of less than 30 tonnes and a draft of about 1.5m.

A description of the construction and operation of each barge and ferry terminal are provided in the following sections. The vessel movements and amount of materials moved through the terminals during construction and operations is detailed in **Section 3.9**.

3.6.2.1 Piling

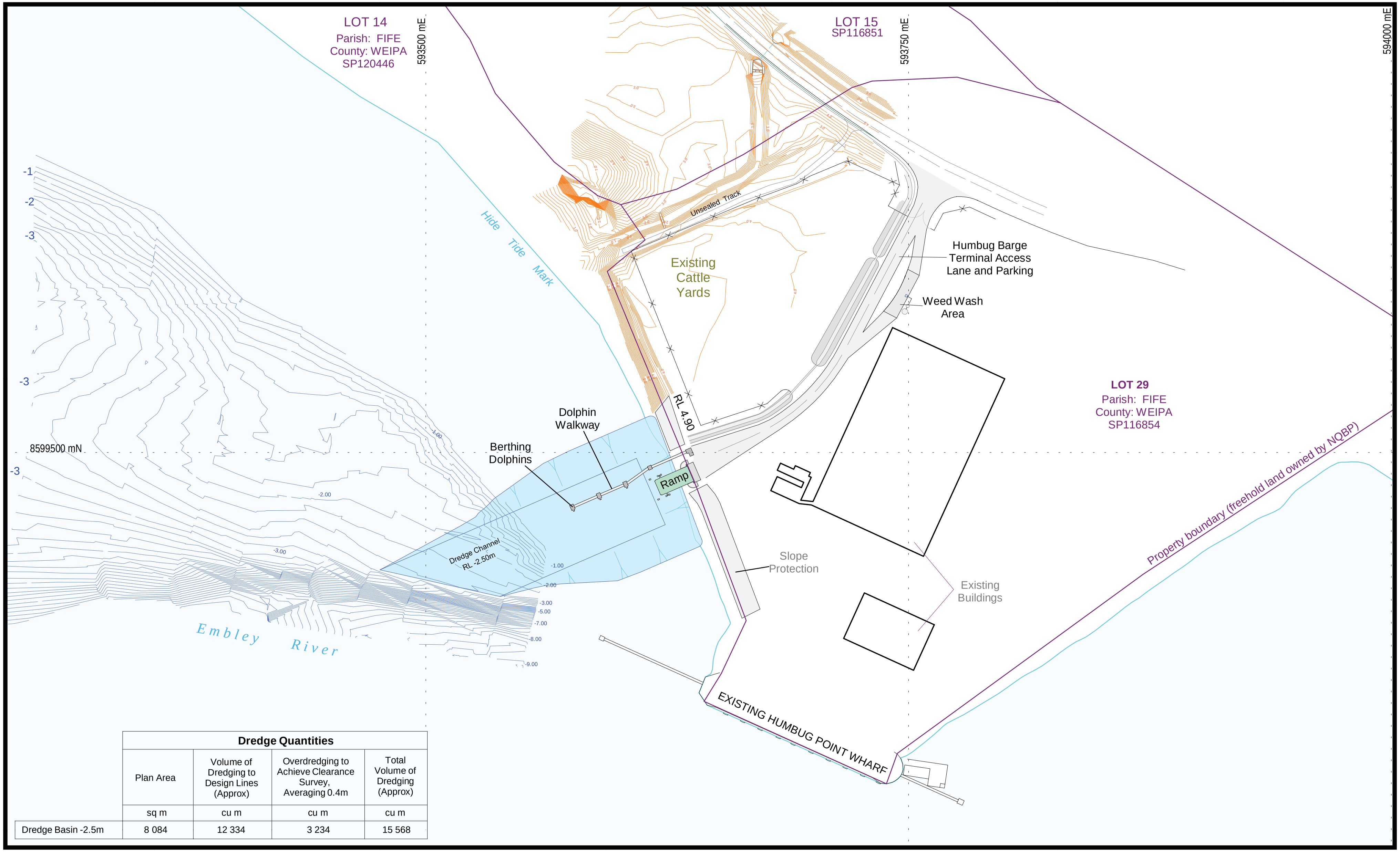
Piling activities associated with the construction of the barge and ferry terminals are summarised in **Table 3-7**. Piles may be driven by a piling rig mounted on a jack-up barge to improve access to inshore shallow areas.

Table 3-7 Piling Numbers and Details for Barge and Ferry Terminals & Temporary Construction Jetties at Hey River and Boyd Bay

Location	Pile Size (Outside Diameter)	Depth of Piling (m)	Length (m)	Number	Total
Humbug Barge Terminal	750	18	30	11	17
	900	18	30	6	
	Z Profile AZ28	6.0	12.5	110m side by side	160
Humbug Barge Terminal (temporary berthing facility)	600	6	15	4	4
Hornibrook Ferry/Tug Terminal	750	18	30	13	21
	1050	18	35	8	
Hey River Ferry/Barge Terminal	750	18	30	12	19
	900	18	30	6	
	1050	18	30	1	
	Z Profile AZ28	6.0	12.5	110m side by side	160
Hey River Ferry/Barge Terminal (temporary berthing facility)	600	6	15	16	16
Temporary Seaborne Access – Barge Landing (near Pera Head)	900		12	8	8
Temporary Seaborne Access – Passenger Jetty (Boyd Bay)	600	6	15	between 16 to 32	between 16 to 32
River Navigation Aids	1050	18	30	3	3
Planned Number of River Piles					**119**

3.6.2.2 Humbug Barge Terminal

Most plant, equipment and materials coming in by barge Australian and international ports would be offloaded at Humbug Wharf. The Humbug terminal would be located adjacent to Humbug Wharf to enable the efficient transfer of equipment, material, and the workforce bound for the Project area without the need to use public roads. The Humbug terminal would involve the construction and operation of a RORO barge facility, including floating ramp, mooring dolphins, access lane and vehicle parking. Approximately 15,600m^3 of material would be dredged and disposed of at the existing Albatross Bay spoil ground (refer to **Section 3.8** for further details on dredging). A small area (about 400m^2) would be reclaimed behind a sheet pile wall (refer to **Table 3-7** for piling information) or a concrete abutment would be constructed. The location and footprint of the Humbug terminal is shown in **Figure 3-4**.



Dredge Quantities

	Plan Area	Volume of Dredging to Design Lines (Approx)	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
	sq m	cu m	cu m	cu m
Dredge Basin -2.5m	8 084	12 334	3 234	15 568

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

Reclaimed area

N

0 50m

RioTintoAlcan

South of Embley Project

Fig. 3-4: Humbug Barge Terminal

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

An area within the footprint of the proposed Humbug terminal would be utilised during site establishment as a temporary berthing facility to allow all tide access for a vessel to transfer the construction workforce and cargo to and from the Project area. While operational, this area would primarily be utilised by vessels transiting from the temporary berthing facility at the Hey River terminal location (refer **Section 3.6.2.4**) and the temporary seaborne access near the Port (refer **Section 3.6.5**).

The temporary berthing facility at the Humbug terminal would extend approximately 40m from the shoreline to achieve the required draft of -1.5m LAT. It would consist of a temporary jetty with a precast concrete abutment, elevated walkway and a pontoon supported by piles. The precast concrete abutment, pontoon and piles would be removed when no longer required.

3.6.2.3 Hornibrook Ferry/Tug Terminal

The Hornibrook terminal would be constructed at Hornibrook Point, south-east of Lorim Point. This ferry terminal would be constructed to allow the transport of the workforce from Weipa to the Hey River terminal and back. The Hornibrook terminal would involve the construction and operation of a carpark area, covered waiting area and walkway, pontoon and floating ramp. The area of fill for the carpark area has been designed above the Highest Astronomical Tide (HAT) and therefore no reclaim for the construction of this facility is required. The footprint of the Hornibrook terminal also avoids impacts on mangroves.

Tug berths may be constructed adjacent to the Hornibrook terminal for either permanent use or use during inclement weather.

Approximately 57,600m^3 of material would be dredged for the combined ferry / tug facility and disposed of at the existing Albatross Bay spoil ground (refer to **Section 3.8.2** for further details on dredging). Details on piling are provided in **Table 3-7**. The location and footprint of the Hornibrook terminal is shown on **Figure 3-5**.

3.6.2.4 Hey River Ferry/Barge Terminal

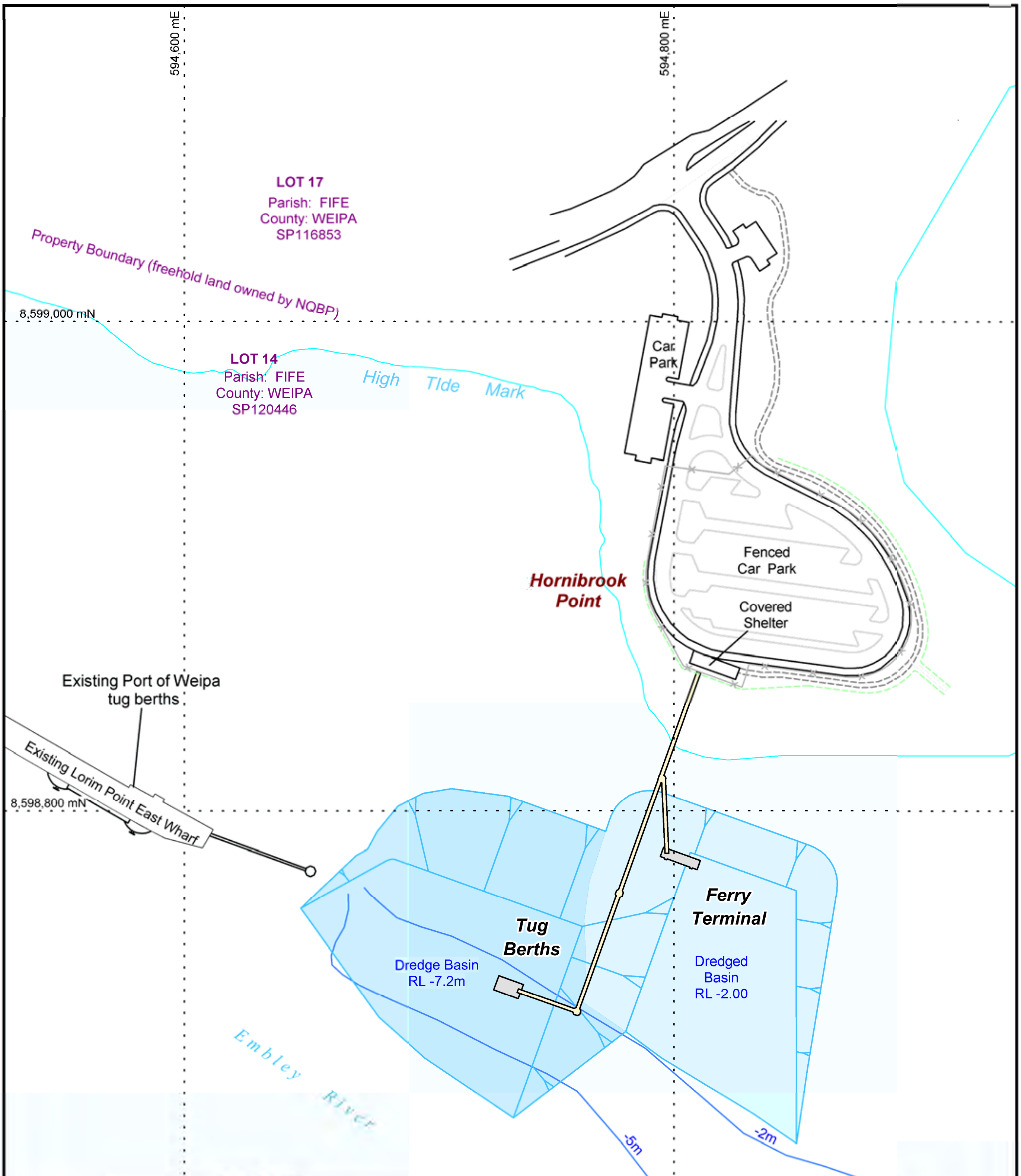
The Hey River terminal would be located on the southern bank of the Hey River on ML6024. It would operate as a joint RORO barge and ferry terminal. Construction and operation of the Hey River terminal would include a RORO facility, vehicle parking, covered waiting area and walkway, pontoon and floating ramp for the ferry terminal. Approximately 37,380m^3 of material would be dredged and disposed of at the existing Albatross Bay spoil ground (refer to **Section 3.8.2** for further details on dredging).

For the construction of the permanent terminal, a total area of about 4,400m^2 would be reclaimed and supported by rock revetment and/or sheet piles or, alternatively, a concrete abutment would be created (refer to **Table 3-7** for piling information). A small portion of these reclamation works would be undertaken for construction of the temporary barge landing to facilitate Project investigation activities.

As part of site establishment, prior to the construction of the Hey River terminal, a temporary barge landing area and/or berthing facility may be constructed within the footprint of the proposed Hey River terminal.

The temporary barge landing area would be a smaller reclaimed area within the footprint of the permanent reclaim area described above.

The temporary berthing facility would extend from the shoreline to approximately 130m from shore to achieve the required draft of -1.5m LAT. It would consist of a temporary jetty with a precast concrete abutment, elevated walkway spans and pontoons supported by piles. The precast concrete abutment, pontoons and piles would be removed when no longer required.



	Dredge Quantities			
	Plan Area	Volume of Dredging to Design Lines (Approx)	Overdredging to Achieve Clearance Survey, Averaging 0.4m	Total Volume of Dredging (Approx)
	sq m	cu m	cu m	cu m
Ferry Terminal	10 450	14 500	4 180	18 680
Tug Berths	12 850	33 780	5 140	38 920

Dredged area - Ferry Terminal

Dredged area - Tug Berths

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

South of Embley Project

Fig. 3-5: Hornibrook Ferry Terminal and Tug Berths

N

0 50m

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

Details on piling are provided in **Table 3-7**. A thin band of mangroves (approximately 40m in length of a single tree width) would also need to be cleared for the construction of the permanent terminal where the mangroves are not cleared as part of the earlier construction of the temporary facilities. The location and footprint of the Hey River terminal is shown on **Figure 3-6**.

3.6.3 Mine Infrastructure Corridors

The Boyd and Norman Creek infrastructure areas would be linked by a 15km long infrastructure corridor. The corridor would contain an overland conveyor, access road, transmission line and water supply pipeline. The corridor would traverse four tributaries of Norman Creek. A second 16km long corridor would link the Norman Creek infrastructure area with the Ward River pumping station and provide space for an access road, transmission line and water supply pipeline. The locations of the corridors are shown on **Figure 2-4**.

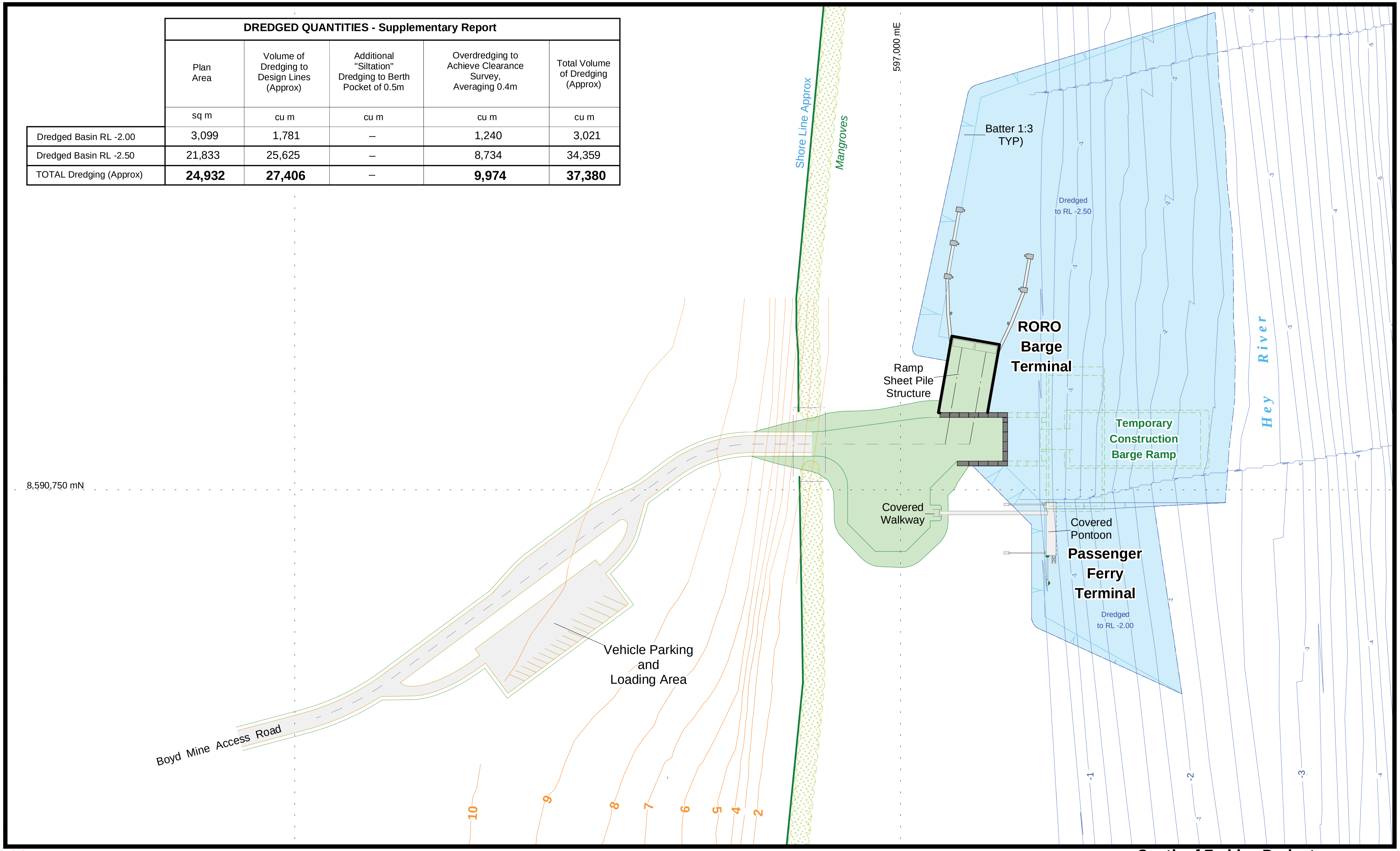
3.6.4 Construction Camps

A temporary construction camp would be established 2km northeast of the Boyd infrastructure area (refer **Figure 2-4**) for the construction period. The camp will be designed to provide up to 2,000 beds, with an expected average occupancy of approximately 740 in the first year of construction and 1,220 in the second year. Services and facilities will be designed to meet peak demand. This camp would be removed at the completion of the initial construction phase of the Project. The sewage sludge drying bed would be capped and rehabilitated, alternatively the sludge would be buried in pit or mixed with topsoil as a soil ameliorant (should trials prove successful). The construction camp would be located within an area that would later be mined. Therefore disturbance associated with this camp is included in the mining disturbance and would not increase the overall disturbance footprint for the Project. Workers would be transported to and from the camp at the beginning and end of their roster periods.

A recent external factor reducing accommodation in Weipa has been the introduction of about 200 Commonwealth government staff and contractors to support the operations and use of the Scherger Royal Australian Air Force (RAAF) Base as a detention centre for asylum seekers. This resulted in a shortage of accommodation and the existing Evans Landing camp is being used for contractors associated with the existing Weipa operations. Therefore it is proposed that a new camp, with up to 200 beds, be constructed if required, to help alleviate short term accommodation pressures associated with construction. The camp would be located on previously disturbed land adjacent to Nanum or other sites with existing development approval, or site(s) as agreed with relevant stakeholders. The camp at Nanum would use existing electricity, potable water and sewage services provided by RTA. The road into and out of the proposed site would be improved. The new camp would be utilised for the Project during the construction period and the infrastructure may be used following the construction phase, depending on the future of the Scherger RAAF base or to replace existing contractor accommodation at Rocky Point.

A mobile construction camp may be used during construction of the Hey River terminal and mine access road, and an accommodation barge may be used during construction of the Port.

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**



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 1.752m below AHD.

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

South of Embley Project

Fig. 3-6: Hey River Ferry / Barge Terminal

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

3.6.5 Temporary Seaborne Access

Temporary seaborne access to the mining lease may be established near the proposed Port.

The construction schedule for the Project would be highly influenced by the timing of relevant approvals in relation to the wet season. To mitigate impacts to the construction schedule associated with the wet season, temporary seaborne access infrastructure would be constructed and operated during site establishment and prior to commissioning of the permanent ferry and barge terminals and the all-weather mine access road (up to 12 months following commencement of construction, depending on the timing of approvals in relation to the wet season) including a temporary barge landing area north of Pera Head and a temporary passenger jetty in Boyd Bay or at Boyd Point (subject to further consultation with Traditional Owners).

Once the permanent transport infrastructure is established, primary access to the site would be via the barge/ferry terminals on the Embley and Hey Rivers and the mine access road.

3.6.5.1 Temporary Barge Landing Area near Pera Head

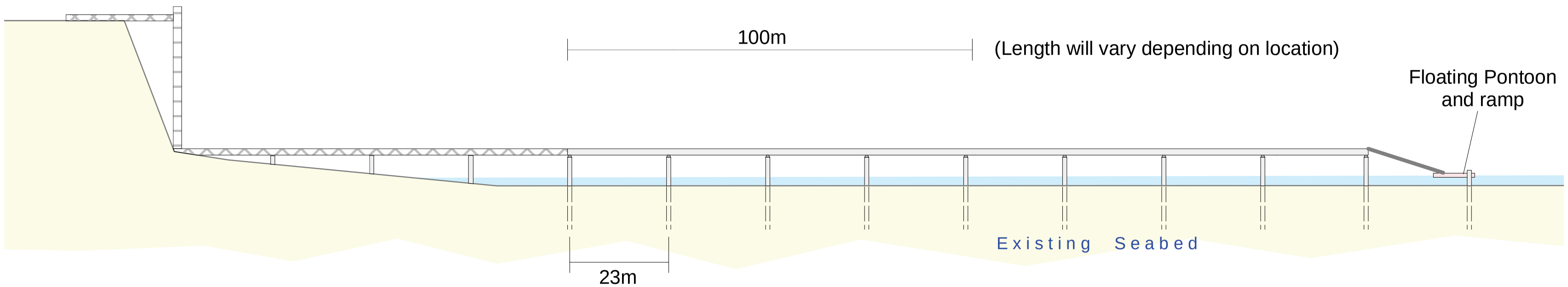
The preferred location for the temporary barge landing area would be approximately 200m to 400m north of Pera Head (refer **Figure 2-4**). The exact final location would be in consultation with Traditional Owners. This location was chosen as it avoided impacts to culturally sensitive areas and maximised distance from reef habitat at Pera Head, without requiring a significant cutting through the bauxite cliff.

The temporary barge landing area would consist of a pontoon (dumb barge) held in position with anchors (fore) and piles (aft). Piles would be installed using a vibratory hydraulic hammer from a barge. Semi flexible pre-cast concrete matting (approximately 7.5m wide laid) would be laid on the beach starting from the landward end and extend from the cutting in the bauxite plateau to the pontoon (**Figure 3-7**). The matting would be anchored in position by 1m steel pins. Approximately 2,000m^3 of geochemically-inert rock (+400mm) may need to be placed as loose fill on the concrete matting between high tide and pontoon to keep equipment out of salt water. The rock fill would be brought in from the land and progressively pushed out. No excavation of the sea bed would be required to construct the temporary barge landing area. The facility would be designed by a qualified marine engineer and have sufficient draft to minimise scouring. Eight 600mm diameter piles would also be installed for safe mooring and operation of the barge. A cutting through the plateau about 3-4m high, 7.5m wide at the base plus batters, and 50m long is required to establish suitable grades.

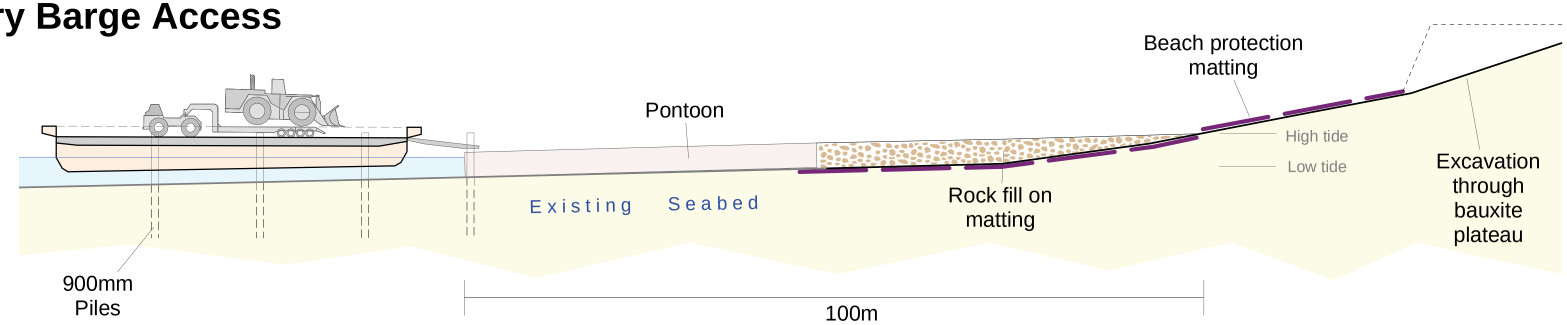
The temporary barge landing area would receive up to four deliveries a day with some night operation to suit the tides. Personnel may also be transferred here dependant on weather conditions.

All infrastructure from the temporary barge landing area would be removed when no longer required and the bauxite plateau would be reinstated from the original stockpiled excavated material as close as possible to original contours (refer to **Section 3.10** for further details on rehabilitation). The material would be compacted and stabilised as much as practicable. If piles cannot be removed they would be cut off below the surface.

Temporary Passenger Jetty



Temporary Barge Access



Not to scale.

South of Embley Project

Fig. 3-7: Temporary Seaborne Access (Conceptual Plan)

Date: 11/02/2013

3.6.5.2 Temporary Passenger Jetty

Two locations are being considered for the temporary passenger jetty – one near Boyd Point and one in Boyd Bay, dependent on the results of further consultation with Traditional Owners. Each option would require stairs to be installed from the top of the cliff. The jetty would be approximately 2m wide and consist of a precast concrete abutment, elevated walkway spans and pontoons secured by piles (refer **Figure 3-7**). There would be a floating pontoon at the end of the jetty for all tide operation. The length is dependent on the distance from the shore to -2m LAT water depth and the suitability of seabed for pile placement. The jetty length would range from 150m to 362m. Up to two transfers to the temporary passenger jetty per day would occur from Weipa, based on a 150 passenger ferry. This facility would not operate at night unless in an emergency. The temporary passenger jetty would be removed when no longer required (refer to **Section 3.10** for further details on rehabilitation); however, the stairs may be kept in place.

3.6.6 Water Infrastructure

3.6.6.1 Water Supply

The Project's main water requirements are for process water, haul road watering, vehicle wash-down, dust suppression and potable supplies. The Project's principal sources of supply are local surface waters (water storage dam and direct pumping from stream), deep artesian groundwater, and recycled water from the TSFs.

Typically, water would be drawn in order of preference from tailings recycle, recovery slots, surface water dam (Dam C), and artesian bores. Some supplementary surface water would be drawn directly from the Ward River to minimise the risk of inadequate supply from Dam C, once production increases above approximately 30Mdptpa. The artesian demand would therefore fluctuate depending on whether there is above or below average rainfall runoff into the dam. Refer to **Section 3.6.6.4** for details on groundwater infrastructure. The overall water balance for the Project is summarised in **Table 3-8**.

Table 3-8 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.

A reverse osmosis potable water treatment plant would be used to treat raw water to a standard that meets the *Australian Drinking Water Guidelines* (NHMRC 2004). The waste from the potable water treatment plant would be disposed of in the construction water pond or process water pond. Approximately 150 to 350kL/day of potable water would be produced during the construction phase but this would decline at the commencement of operations. Potable water use would then increase pro-rata with future production increases.

3.6.6.2 Water Supply Dam (Dam C)

Dam C would be a conventional earth-fill dam constructed on a freshwater tributary of Norman Creek. Dam C would have a maximum storage capacity of 29GL and could be constructed in either two stages or a single stage. If constructed in two stages, the first stage would provide 10.9GL storage capacity and, later, the wall would be raised to provide 29GL storage capacity. The dam would be constructed in a single stage (29GL capacity) should expansion of production be anticipated to occur quickly. This is the subject of ongoing feasibility studies. The proposed footprint of Dam C is shown in **Figure 2-4** and further detail on Dam C is provided in **Section 16.2.3**.

The dam would be fitted with a low level outlet pipe which would permit the controlled release of environmental flows when required. Sufficient water would be reserved for environmental flows to enable continued release in the driest months (August to October) of a volume equivalent to 25% of dam inflows. When natural inflows from Norman Creek to Dam C cease, environmental flow releases would cease. Once the dam is full following the onset of the wet season, the spillway would typically overflow on a regular basis.

Design of the fishway structure within the Dam C spillway would be undertaken in consultation with DAFF. The consultation would aim to:

- establish fish passage design principles, objectives and criteria specific to the Dam C site;
- assess suitability of fishway options; and,
- determine a suitable monitoring and management program for the fishway.

The fishway configuration currently being proposed would integrate the fishway into the Dam C low gradient spillway channel. The design would aim to facilitate fish passage over a naturally broad range of flow regimes under all development scenarios in most years.

3.6.6.3 Ward River

To supplement the Dam C supply when the mine's production rate exceeds 30Mdtpa, additional surface water supplies would be sourced from the lower reaches of the Ward River. Water would be pumped directly from the river. An in-stream weir or dam structure would not be required. The water would be pumped via a pipeline corridor to either the Boyd or Norman Creek beneficiation plants or to Dam C. The locations of the pump and pipeline corridor are shown on **Figure 2-4**.

The volume of water to be pumped annually from the Ward River would be capped at 1% of the mean annual river flow at the pump station (2.67GL). In addition, no pumping would occur when the river flow was less than 1,000L/s and the rate of pumping at all times would be less than 20% of the river flow rate.

3.6.6.4 Groundwater Supply

The groundwater bodies in the area have been differentiated as shallow aquifer and artesian aquifer resources. The artesian resources are hosted within the Gilbert River formation and Garraway Beds, and the shallow aquifer resources are those occurring within the formations above the Rolling Downs Group. The Gilbert River Formation is part of the Great Artesian Basin (GAB) aquifers and is the main artesian groundwater resource in the region. The Gilbert River Formation aquifer is present across the entire Western Cape region, west of the Great Dividing Range. It is capable of supporting a large rate of abstraction. The Garraway Beds underlie the Gilbert River Formation in the Project area. The Garraway Beds are similar to the Gilbert River Formation in lithology and artesian groundwater is also present in this unit. In relation to water resources management, the Gilbert River Formation and Garraway Beds are considered equivalents and are managed as one unit.

RTA proposes to install an artesian borefield that accesses the Gilbert River Formation artesian aquifer, to contribute to the water supply for the Project. The location of the borefield for the Project is shown on **Figure 2-4**. RTA has an existing artesian water licence for 9GL per annum which allows abstraction from bores located on ML7024. RTA has applied to increase the artesian allocation to cover the fluctuations in artesian demand. The overall artesian demand averages 12GL per annum, with a peak abstraction of 15GL in any one year. There are currently no other large users of artesian groundwater on Cape York. The impact of abstraction on the artesian aquifer has been modelled and is discussed in **Section 16.4.2**.

3.6.7 Power Supply

Electricity for the Project would be generated by diesel-fuelled power stations. It is likely that two power stations would be used, one at each of the Boyd and Norman Creek infrastructure areas. Alternatively one larger power station may be located at the Boyd infrastructure area with a transmission line running to the Norman Creek infrastructure area.

The power stations would be expanded in stages to meet growing demand by the installation of additional generating units. The total installed capacity would be approximately 20.8MW for a mine production of 22.5Mdptpa, and approximately 58.2MW for production of 50Mdptpa.

Transmission lines would be installed as required to reticulate electricity to the pumps for the artesian bores, Dam C, the Ward River pump and product conveyor drive station. The lines would comprise a single circuit with three active conductors and an overhead earth elevated on approximately 20m poles. The Project would not be connected to the existing Weipa electricity grid north of the Embley River.

3.7 Port Facility

3.7.1 Port Layout

RTA proposes to construct and operate a Port located between Boyd Point and Pera Head for shipment of processed bauxite to domestic and international destinations. The proposed Port is located outside the Port of Weipa limits. The proposed Port location is shown in **Figure 3-8** and Port layout is shown in **Figure 3-9**.

The Port would be constructed in a staged approach to provide capacity as required, depending on the market conditions. Additional capacity may be provided by:

- additional dredging of berth pockets and/or departure channel to allow for larger ships or allow ships to depart without waiting for a high enough tide (i.e. ships spend less time at berth allowing more ship movements); and/or,
- construction of additional berths and/or ship loader so that more ships can be brought into port and/or more than one ship can be loaded at any one time.

Stage 1 of the Port is likely to include one berth for a Dedicated Post-Panamax Vessel (DPPV) and one berth for a Cape size vessel (loading to 18.1m draft) and a shipping channel, providing capacity for the proposed startup capacity of 22.5Mdptpa. However, the actual configuration of berths may be altered based on ongoing feasibility studies. Stage 1 of the wharf would be designed and constructed by RTA to permit a future extension to provide additional berths (refer **Figure 3-9** which shows berths 3 and 4 which may be required for maximum production).

The proposed Port facility would not preclude expansion for a third party, if a suitable commercial agreement were reached between the third party and RTA and subject to the additional capacity not being required by RTA. The EIS has assessed the impact of Stage 1 and 2 of the wharf with a maximum RTA production capacity of 50Mdptpa and the cumulative impact of the operation of the Port up to 63Mdptpa.

Stage 1 of the Port facilities would likely include:

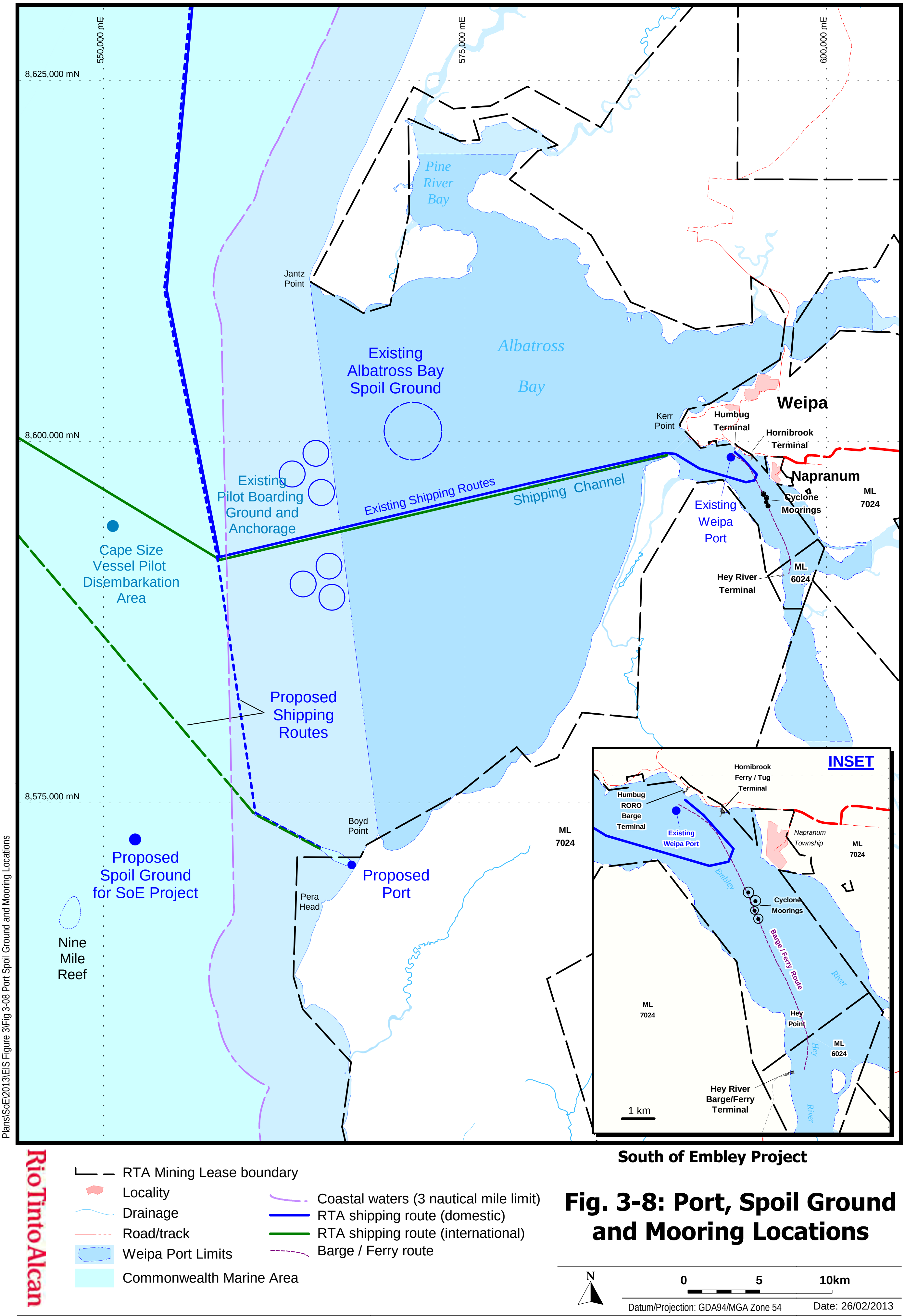
- jetty and wharf (approximately 1km in total length);
- shiploader;
- two berths, consisting of an "I" berth aligned perpendicular to the shoreline; and,
- moorings for tug berths and line boats alongside the approach jetty.

Separate berthing and mooring dolphins would be provided which isolate ship berthing loads from the main wharf structure.

The approach jetty would support the product load out conveyor and a vehicle access roadway from the Boyd infrastructure area. The wharf would support a rail-mounted travelling luffing and slewing ship loader. Bulk carriers would not be refuelled at the proposed port.

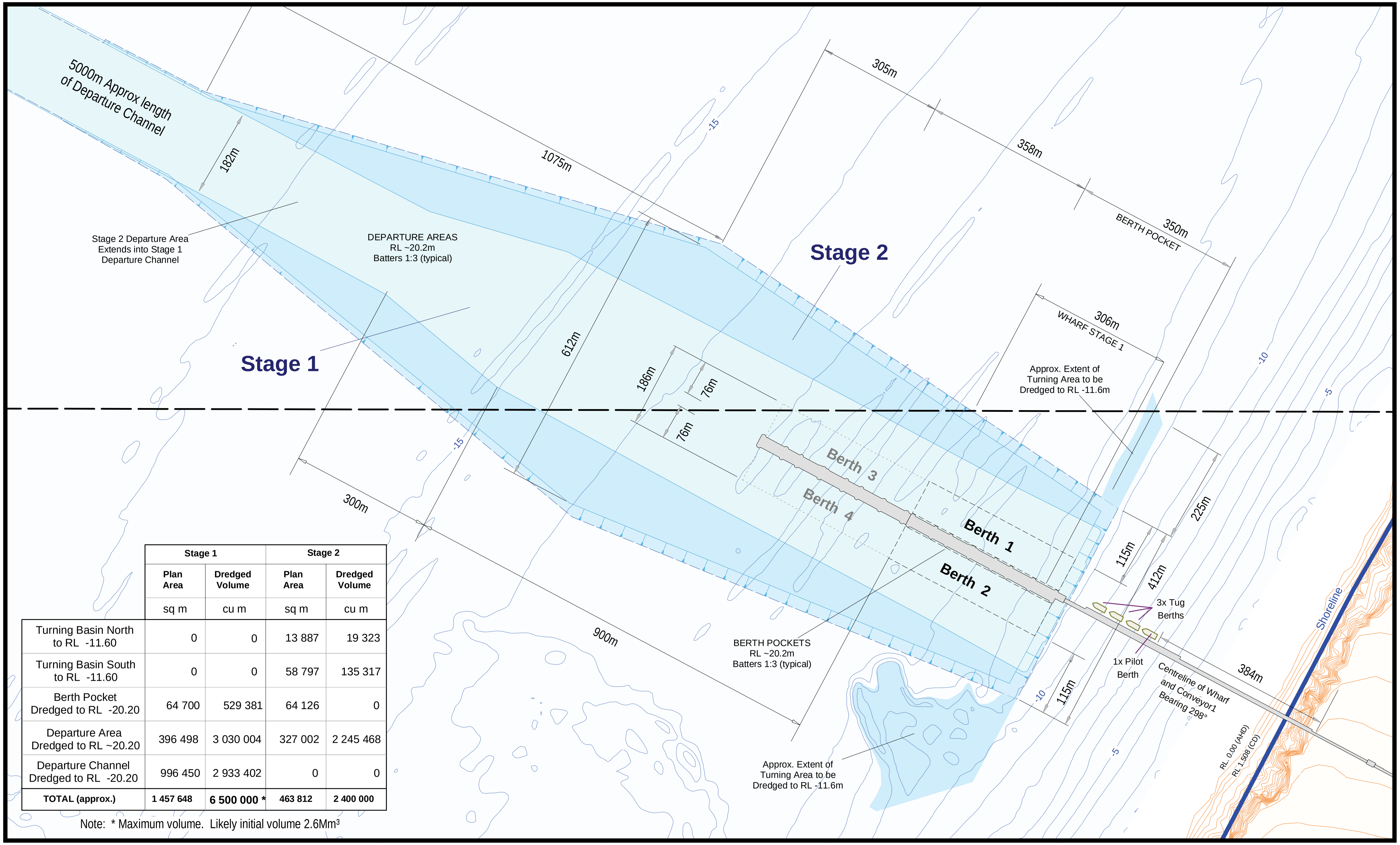
An Aids to Navigation Management Plan would be prepared in accordance with the *Maritime Safety Queensland guidelines for major development proposals*. The plan will be developed in consultation with Maritime Safety Queensland (MSQ) and the Regional Harbour Master and implemented prior to commissioning the proposed Port. It is likely that two marine navigational aids would be installed on the top of the cliffs – one near Boyd Point and one between Pera Head and the proposed Port.

A further two berths would be added to the wharf if required to increase capacity. The four-berth wharf combined with the jetty would then be approximately 1.3km long.



South of Embley Project

Fig. 3-8: Port, Spoil Ground and Mooring Locations



	Stage 1		Stage 2	
	Plan Area	Dredged Volume	Plan Area	Dredged Volume
	sq m	cu m	sq m	cu m
Turning Basin North to RL -11.60	0	0	13 887	19 323
Turning Basin South to RL -11.60	0	0	58 797	135 317
Berth Pocket Dredged to RL -20.20	64 700	529 381	64 126	0
Departure Area Dredged to RL ~20.20	396 498	3 030 004	327 002	2 245 468
Departure Channel Dredged to RL -20.20	996 450	2 933 402	0	0
TOTAL (approx.)	**1 457 648**	**6 500 000 ***	**463 812**	**2 400 000**

Note: * Maximum volume. Likely initial volume 2.6Mm³

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.

N

0 100 200 300m

Data Source: 1710-M-Wharf Dredging Stage 2.dgn

South of Embley Project

Fig. 3-9: Port Layout

Datum/Projection: GDA94/MGA Zone 54 Date: 12/10/2012

RioTintoAlcan

3.7.2 Port Construction

Construction of the Port is planned to start with dredging of the berth pocket and departure areas (dredging details provided in **Section 3.8**) followed by driving the piles supporting the wharf and jetty structures as well as the separate berthing and mooring structures. Piles may be installed using a drive-drill-drive method if required for more challenging ground conditions. Piles may be driven by a piling rig mounted on a jack-up barge to improve access to inshore shallow areas. Prefabricated headstocks would be lifted and welded in position to the piles. Placement of the prefabricated wharf and jetty decks is anticipated to be by heavy lift cranes mounted on barges or by a heavy lift vessel delivering the deck units. The jetty and wharf deck structures would have conveyor galleries and services pre-assembled to the extent practical to minimise work over water.

Spans between piles for the jetty over the beach for the Port would be a minimum of 16.8m. The piling numbers and details for Stage 1 of the Port facilities are provided in **Table 3-9**.

Table 3-9 Piling Details for Port Facilities (Stage 1)

Location	Pile Size (Outside Diameter)	Number	Total
Main Wharf	1200	20	84
	1050	64	
Dolphins	1500	36	96
	1200	60	
Approach Jetty	1050	38	38
Tug Berths	750	40	45
	600	2	
	355.6	3	
Navigation Aids	1050	5	11
	750	6	
		Planned Number of Piles for Port	**274**

Some deliveries of fuel to the Port area would be required for construction activities. The following mitigation measures would be used to minimise risks associated with fuel storage and transfer:

- storage, handling and use would be in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL), relevant Australian standards, and the Australian Maritime Safety Authrority (AMSA) guidelines;
- secondary containment would be used to reduce the risk of spills occurring as a result of accidental rupture of tanks or leaks from transfer points;
- relevant employees and contractors involved in the storage, handling, use and disposal of fuel and other hazardous substances would be trained to ensure that they are aware of their responsibilities;
- procedures would be developed for spill clean up and appropriate emergency response equipment provided at key locations to reduce the risk of harm from a spill; and,
- an oil spill response plan would be prepared for the barge carrying fuel tanks.

3.7.3 Ship Loading

The shipping of processed bauxite to domestic and international destinations is anticipated to commence in or about 2016 (or approximately three years after the commencement of construction) subject to the grant of relevant environmental or other regulatory approvals, the determination of internal investment approvals for the Project by Rio Tinto and the construction schedule). Details on bauxite shipping activities from the proposed Port are provided in **Section 3.9**.

Bauxite would be loaded into the ships via the rail-mounted travelling luffing and slewing ship loader. The speed and order of cargo hold loading would be determined by the master of the vessel to ensure that vessel stability is maintained and there is no undue strain on the hull structure.

The initial operation of the proposed Port would require the services of approximately three tugs, depending on their size and the size of the bulk carriers. The Project may use existing tugs used for the Port of Weipa which are moored at the existing Lorim Point wharf. However, if larger bulk carriers are used, larger tugs would be required which would have a displacement of less than 500t and a draft of 6.5m. These tugs would be moored at the proposed Port (refer **Figure 3-9**) when not in use and would return to the Hornibrook terminal (refer **Figure 3-5**) or cyclone (swing) moorings (refer **Figure 3-8**) in the Embley River in inclement weather. The tug fleet would be reviewed based on the bauxite shipping schedule as the Port is expanded to maximum production.

RTA operates the existing Lorim Point ship loader at the Port of Weipa and has implemented the MarineSafe system developed by Rio Tinto Marine. This system implements the requirements of AMSA, ISO14001 and other relevant international statutory authorities, relevant class rules, regulations and ship management contracts. The proposed Port would also operate under this system.

Several control measures would be adopted to minimise the risk of product spillage, including:

- in order to prevent bauxite spillage from the ship loader tripper, a catch tray would be positioned under the tripper to catch spillage from the inclined section of belt. The material collected from the tripper catch tray would be directed to the head-end sump and then pumped onshore to a sediment holding pond;
- three-stage belt scraping with water sprays would be positioned at the conveyor head pulley to clean the belt. The scrapings and the water used for belt cleaning would be directed into the head end sump for pumping onshore into sedimentation ponds;
- the wharf conveyor would be designed with variable speed drives to provide controlled belt starting, thereby minimising the potential for bauxite spillage;
- belt drift switches would be installed on the wharf and ship loading conveyor that shuts down the conveyor drives if a belt moves from the designed position. Training idlers that track the belts would also be installed;
- when loading ships, the product reclaimer would withdraw from the stockpile, and a section of the conveyor allowed to empty, before the ship loading boom travels between hatches to prevent bauxite spillage onto the deck of the ship, and,
- a sealed maintenance area would be provided at the end of the wharf so the ship loading boom can be serviced and cleaned within a bunded area. Runoff from this sealed maintenance area would be directed to the head end sump for pumping back to shore.

3.8 Dredging

3.8.1 Port

3.8.1.1 Capital Dredging

The Queensland EIS prepared in 2011 (Section 6.5 of RTA 2011) assessed an initial capital dredge volume of 6.5 million cubic metres for Stage 1 of the wharf (berths 1 and 2), a volume which would provide two berths for Cape size vessels and a shipping channel to a depth of -20.2m LAT (declared depth of -19.7m LAT), allowing sailing on all tides. This was a conservative scenario to ensure that the maximum possible impact of a single capital dredge campaign was assessed. However, further studies have indicated that RTA is likely to only dredge 2.6 million cubic metres in the initial construction stage, providing 1 berth for a DPPV vessel and 1 berth for a Cape Size vessel and a shipping channel to a depth of -17.8m LAT (declared depth of -17.3m LAT), providing capacity for the proposed startup capacity of 22.5Mdptpa. Additional feasibility studies may further optimise the Port design. The dimensions of the berth and shipping channel mean that Cape size vessels would typically carry about 185,000dwt of cargo, although this may vary somewhat depending on the departing tide. Following the initial construction, additional capital dredge campaigns would be undertaken as required up to a total of 6.5 million cubic metres for Stage 1 of the wharf, to increase the capacity of the Port as market conditions allow; however, the expansions would be undertaken in capital dredge campaigns of less than 2.6 million cubic metres. Furthermore, an additional maximum 2.4 million cubic metres would need to be dredged as part of the addition of berths 3 and 4 (Stage 2 of the wharf) to provide capacity for maximum production. Separate sea dumping permits would be sought as required for subsequent capital and maintenance dredge campaigns.

Dredging would be carried out by a cutter suction dredge (CSD). This would either be pumped to several split hopper barges (SHB) or re-deposited on the sea bottom and retrieved by a trailing suction hopper dredge (TSHD). Dredged spoil, which is suitable for sea disposal, would be transported by the TSHD or SHB to the proposed new spoil ground located approximately 17km west of Boyd Point (refer **Figure 3-9** for location). Dredging and spoil disposal would be conducted 24 hours a day, seven days a week. A barge would be used to transfer approximately 1ML of fuel oil for the operating dredgers.

Further details of dredging operations are provided in **Section 7** and in **Appendix 7-A**, **7-B**, **7-C** and **7-D** (Dredge Modelling Report, Sea Dumping Permit application and Port Dredge Management Plan (DMP)).

3.8.1.2 Maintenance Dredging

Subsequent capital and maintenance dredging would be undertaken as required under a separate Sea Dumping Permit. The initial capital dredge volume for the Port (2.6 million cubic metres) would require (on average) annual maintenance dredging of approximately 420,000m^3 to maintain under keel clearance for ships. Based on the maximum 6.5 million cubic metres of capital dredging for Stage 1 of the wharf, average annual maintenance dredging of approximately 890,000m^3 is expected to be required. Once the wharf is extended (Stage 2), an extra 2,400,000m^3 of capital dredging and 280,000m^3 of average annual maintenance dredging would be required.

Material dredged during the maintenance programs would also be disposed of at the proposed new spoil ground west of Boyd Point.

3.8.2 Barge, Ferry and Tug Facilities

The dredging required for the proposed ferry and barge terminals would be as follows:

- Hornibrook ferry terminal and tug berth: approximately 57,600m^3 to be dredged over an area of 23,300m^2 to a depth of -2.0m LAT (ferry berth) and -7.2m LAT (tug berths);
- Humbug barge terminal: approximately 15,600m^3 to be dredged over an area of 8,100m^2 to a depth of -2.5mLAT; and,
- Hey River barge/ferry terminal: approximately 37,380m^3 to be dredged over an area of 25,000m^2 to a depth of -2.5m LAT (barge berth) and -2.0m LAT (ferry berth).

Dredged material from these areas, which is suitable for sea disposal, would be disposed of at the existing Albatross Bay spoil ground which is used for the existing Port of Weipa dredging programs.

Dredging is anticipated to be undertaken using either a barge-mounted backhoe/dipper dredge, with a bucket up to approximately 13m^3 or a CSD. Dredge spoil would either be transferred to either a SHB or TSHD for transport to the Albatross Bay spoil ground. The method will be confirmed following engagement of the dredging contractor and included in the final DMP (refer **Appendix 7-D** for the draft DMP). A barge would be used to transfer approximately 1ML of fuel oil for the operating dredges.

Alternative options for disposal of dredged material from the barge/ferry terminals are presented in **Section 3.12**.

3.9 Shipping Activities

There are a number of different components to shipping activities for the Project. Cargo and fuel deliveries to the Project, as well as transfers of cargo, fuel and the workforce within the Project area, are discussed in **Section 3.9.1.** Bauxite shipping is discussed in **Section 3.9.2**.

3.9.1 Cargo, Fuel and Workforce

The existing Cairns-Weipa barge service caters for the cargo transport requirements of the existing Weipa community and mining operations, and involves approximately 104 shipments per year from the Port of Cairns to the Port of Weipa via the inner GBR Designated Shipping Area and the Torres Strait. Fuel supplies are currently transported by medium range fuel tankers, with 10 shipments a year servicing the existing community and Weipa operations. Fuel supplies currently travel to the Port of Weipa from the Port of Darwin. **Table 3-10** provides details on Project-related shipping activities.

The proposed Port area and the Hey and Embley Rivers are currently utilised by private recreational, charter fishing, and commercial fishing vessels.

Predicted vessel movements to deliver cargo and fuel and transfer the workforce for the Project area are summarised as follows (refer to **Table 3-10** for details):

- an increase in supply barge deliveries between Cairns and Weipa, which would traverse the inner GBR Designated Shipping Area from the Torres Strait to Cairns;
- barge traffic from international ports to Weipa, during construction only;
- an increase in fuel shipments to the Port of Weipa from Darwin;
- transfer of cargo, fuel, and people between the Port of Weipa and the Project area; and,
- vessel traffic associated with dredging operations.

The current and anticipated shipping and vessel movements under the construction and maximum production scenarios for the Project are summarised in **Table 3-10** and further detail is provided in the following sections.

3.9.1.1 Construction

It is currently estimated that 1,000,000 Revenue Tons of cargo would be required for construction. Of this, approximately 580,000 Revenue Tons of cargo would originate from domestic ports (most likely the Port of Cairns) to Weipa, with the remaining volume originating from international ports (predominantly in Asia). An estimated 30 international chartered ship voyages (annual average of 11 shipments) are currently planned to offload at the Port of Weipa or at the Boyd Port area during the construction period. The balance of international freight are predicted to be shipped as containers and/or break bulk to major domestic ports utilising the existing services, and have not been treated as additional ocean traffic. There are no Project chartered shipments planned to arrive at the Port of Cairns at this stage. Near the end of the construction phase it is anticipated that temporary buildings and offices would be sold to the local or other third parties and demobilised by the buyer. It is estimated about a third of this cargo would be moved by road to local and regional buyers, a third backloaded on incoming barges, and a third may require dedicated (additional) barges. Approximately 20 dedicated barges may be required, however, the destination would depend on the future buyer and it is not possible to identify the shipping route for these movements.

Table 3-10 Predicted Project-related Shipping Activities

	Route	Vessel type	Average Return Trips
Pre-SoE Project			
Bauxite shipping			
Weipa mining operations[1] (North of Embley River)	Port of Weipa to Gladstone (via Coastal waters, CMA, GBR)	Panamax/DPPV – RTM owned Panamax/DPPV – contract charter	270 annually
	Port of Weipa to international ports (via Coastal waters, CMA)	Panamax/DPPV – customer	150 - 180 annually
Cargo			
Cargo barge supplying Weipa and surrounding community and mining operations	Cairns to Port of Weipa (via GBR, CMA, Coastal waters)	Barge	104 annually
Fuel deliveries			
Fuel tanker supplying Weipa and surrounding community and mining operations	Darwin to Port of Weipa (via CMA, Coastal waters)	Medium range fuel tanker (30,000dwt)	10 annually
Other vessels			
Tugs and Line Boat (Port of Weipa Operations)	Lorim Point to anchorage area (via Coastal waters)	Small boat Weipa – 3 tugs	Linked to bauxite ship movements
Construction phase			
Bauxite shipping			
Weipa mining operations[1] (North of Embley River)	Port of Weipa to Gladstone (via GBR, CMA, Coastal waters)	Panamax/DPPV – RTM owned Panamax/DPPV – contract charter	270 annually
	Port of Weipa to international ports (via CMA, Coastal waters)	Panamax/DPPV – customer	150 - 180 annually
Cargo			
Domestic barges supplying Weipa and surrounding community, Weipa mining operations and SoE Project construction[2]	Domestic ports to Port of Weipa or direct to Project area (via GBR, CMA, Coastal waters)	Barge	147 annually (104 for existing operations, 43 for construction)
International barge supplying Project construction	International ports to Port of Weipa or direct to Project area (via CMA, Coastal waters)	Ocean Charter Barge	11 annually

	Route	Vessel type	Average Return Trips
Fuel deliveries			
Fuel supplying Weipa and surrounding community, Weipa mining operations and SoE Project construction[4]	Darwin to Port of Weipa (via CMA, Coastal waters)	Medium range fuel tanker (30,000dwt)	16 annually
Other vessels			
Tugs and Line Boat (Port of Weipa and SoE Construction)	Lorim Point to Boyd Point and Lorim Point to anchorage area (via Coastal waters, CMA)	Small boats Weipa – 3 tugs	Linked to bauxite ship movements
Dredge and dredge service vessels (SoE Construction and Operations)	(via Coastal waters, CMA)	To be confirmed	Mobilisation, demobilisation and servicing as required
Cargo and Diesel transfer to Project area (SoE Construction)	Humbug terminal to Project area. (Coastal waters)	Roll-on Roll-off Barge	75 per week
Passenger vessel (SoE Construction)	Hornibrook terminal to Project area (Coastal waters)	Ferry	11 per day
Operations phase (50Mdptpa)			
Bauxite shipping			
SoE Project mining operations	Boyd Port to Gladstone (via Coastal waters, CMA, GBR)	Panamax/DPPV – RTM owned	300 annually
		Panamax/DPPV – contract charter	
	Boyd Port to international ports (via Coastal waters, CMA)	Panamax/Post Panamax/Cape – customer	240 – 400 annually
Cargo			
Cargo supplying Weipa and surrounding community, and SoE Project operations[3]	Cairns to Port of Weipa or direct to Project area (via GBR, CMA, Coastal waters)	Barge	150 annually
Fuel deliveries			
Fuel supplying Weipa and surrounding community, and SoE Project operations[4]	Darwin to Port of Weipa (via CMA, Coastal waters)	Medium range fuel tanker (30,000dwt)	22 annually
Other vessels			
Passenger vessel	Humbug/Hornibrook terminal to Hey River	To be confirmed	8-10 per day

	Route	Vessel type	Average Return Trips
(SoE Project Operations)	(via Coastal waters)		
Tugs and Line Boat (SoE Project Operations)	Lorim Point to Boyd Point and Lorim Point to anchorage/departure area (via Coastal waters, CMA)	Small boat Weipa – 2 tugs South of Embley – 2 to 3 tugs	Linked to bauxite ship movements
Cargo and Diesel transfer (SoE Project Operations)	Humbug terminal to Project area. (via Coastal waters)	Roll-on Roll-off Barge	11 per day

[1] Based on projections at 2015 prior to commencement of shipping from the proposed Port. Actual numbers vary according to market conditions and size of ships. Bauxite shipping for the Project would be expected to commence in or about 2016 (or approximately 3 years after the commencement of construction) subject to the grant of relevant environmental or other regulatory approvals, the determination of internal investment approvals for the Project by Rio Tinto, and the construction schedule. The volume of bauxite shipping using the Port of Weipa will over time decrease as the reserves north of the Embley River are depleted and bauxite shipping from the proposed Port replaces much of this demand.

[2] These movements do not include those required for demobilisation (estimated to be 20 additional barges).

[3] Number of shipments includes shipments directly for the SoE operations (50Mdptpa) and indirectly for the Weipa community (including an estimate for the predicted increase for cargo at Weipa as a result of increased population).

[4] Fuel is currently sourced from Darwin; however this is subject to change at the discretion of the third party supplier.

Fuel supplies would continue to be transported by medium range fuel tankers, with an average additional five shipments a year to the Port of Weipa required during the construction phase for the Project. In addition, there is predicted to be one shipment per year during the dredging operations to service the dredging vessels. Fuel supplies are likely to continue being sourced from Darwin, but it is recognised that this could vary in the future at the discretion of the fuel supply company. A service vessel would be required during the dredging operations to transfer fuel from Lorim Point to the operating dredges during the construction period.

The Port of Weipa would receive most deliveries of fuel, cargo, and equipment for the Project at the Humbug, Evans Landing, and Lorim Point wharves. Materials would then be transferred either to laydown areas or to vehicles or smaller barges as required for transport to the Project area. Prior to the permanent barge and ferry facilities being established, it would then be transported via the existing road network to the Project site, across the river to the Hey River terminal site (refer **Section 3.6.2.4**, or to the temporary barge landing area near the proposed Port (refer **Section 3.6.5.1**). Some materials may be transported directly to these locations (if the draft of the barge allows).

Once the permanent facilities have been constructed, deliveries to the Humbug Wharf, Evans Landing, or Lorim Point would be unloaded onto either:

- vehicles for a RORO transfer from the proposed Humbug terminal to the Hey River terminal; or,
- a barge with a shallower draft, suitable for berthing at the Hey River terminal, where it would be unloaded.

The RORO barge when loaded would have a displacement of approximately 700 tonnes (fully loaded) and a draft of 2.1m. Cargo and equipment may also continue to be delivered directly to the proposed Hey River terminal.

Some deliveries, such as construction materials and equipment modules, may be made directly to the proposed Port site or the barge terminals if there is suitable access for the vessel. The volume and nature of deliveries to the Project area during the construction phase of the Project as well as the predicted trips are shown in **Table 3-10**.

During construction, and prior to the on-site construction camp being established, the workforce may be transferred to the Project area via ferry or boat on a daily basis from accommodation in Weipa (refer **Section 3.6.2.2** for Humbug temporary berthing facility and **Section 3.6.2.4** for Hey River temporary berthing facility, and **Section 3.6.5.2** for the temporary passenger jetty at Boyd Point/Boyd Bay). Once the on-site construction camp and the permanent transport infrastructure has been established the construction workforce would be transferred at the beginning and end of each roster primarily via the Hey River terminal. Waste from the Project area would be transported by back-haul on the barge to the Evans Landing Landfill or transfer stations.

3.9.1.2 Operational

Once operations commence, the Port of Weipa would continue to receive deliveries of cargo and equipment for the Project at the Humbug and Evans Landing wharves via the existing Cairns-Weipa barge service. Materials would then be transferred either to vehicles or smaller barges as required for transport to the Project area. Cargo and equipment may continue to be delivered directly to the proposed Hey River terminal (if the draft of the barge allows). The volume and nature of deliveries to the Port of Weipa under the maximum production scenario as well as the predicted trips are shown in **Table 3-10**.

An estimated annual average increase of 12 fuel shipments is also expected to be required by the Project at maximum production of 50Mdptpa. These additional shipments would be supplied from Darwin (subject to change at the discretion of the third party supplier). Fuel and other hazardous substances are expected to be delivered to the Project area via barge.

The operational workforce would be housed in the existing Weipa community and commute to the Project area on a daily basis across the Embley River via ferry, barge or boat and the mine access road. The ferry would be sized according to the number of people on each shift and would be sufficiently seaworthy to sail in all but severe weather events and would operate as needed; however, on average, eight to ten return trips per day are anticipated. The ferry would have a displacement of less than 30 tonnes and a draft of about 1.5m. A small boat may be used in place of the passenger vessel if there are only a few people to transport.

Tugs would move between the Port of Weipa and the proposed Port as required.

Waste from the Project area would continue to be transported by back-haul on the barge to the Evans Landing Landfill or transfer stations.

The barge and passenger vessel would run as required, and **Table 3-10** provides an estimate of the number of crossings required for the expected volume of fuel, cargo, and workforce.

3.9.2 Bauxite Shipping

RTA sets and maintains world-class standards in health, safety and environmental performance, and vessel assurance for freight transportation, and has an excellent record in managing its shipping operations internationally and through the GBR. During 2010, Rio Tinto Marine (a business unit of Rio Tinto) managed a total of 155Mt of seaborne cargo internationally.

The projected international and domestic bauxite shipping movements related to current and proposed bauxite mining operations are detailed below.

3.9.2.1 Fleet Characteristics

Vessels transporting bauxite from the existing Weipa operations include a mix of vessels owned and operated by Rio Tinto Marine (the Rio Tinto fleet) and chartered vessels. The Rio Tinto fleet consists of seven DPPVs (five existing vessels of approximately 90,000dwt and two new vessels of approximately 88,000dwt). The oldest vessel in the Rio Tinto fleet entered into service in 2007 with the newest vessel due for delivery in 2013.

The existing Rio Tinto fleet is 100% owned by Rio Tinto Shipping. The port of registry for all Rio Tinto ships is London and they are flagged in the United Kingdom. All vessels in the Rio Tinto fleet are classified by Lloyd's Register of Shipping. The vessels are all Japanese built bulk carriers with minor modifications to the cargo spaces, rudder and hull form to suit the specific requirements of the bauxite trade.

In addition to the Rio Tinto fleet, Rio Tinto charters Panamax vessels (typically 75,000–88,000dwt) as required. In future Rio Tinto would also charter Cape size vessels if required or use Rio Tinto Shipping Cape size vessels, for the transport of bauxite internationally. The dimensions of the berth and shipping channel mean that Cape size vessels using the proposed Port would typically carry about 185,000dwt of cargo, although this may vary somewhat depending on the departing tide. Chartered vessels are mostly less than five years old, and service both the domestic coastal (Panamax) and the international export trade (Cape size). Chartered vessels are required to develop their own environmental protection policy. Flag states for chartered vessels include Panama, Liberia, China and South Korea. Currently over 60% of the shipments between the Port of Weipa and the Port of Gladstone are made using the Rio Tinto fleet, with the remainder made by chartered vessels. Together, the Rio Tinto fleet and chartered vessels for the transport of bauxite are referred to as bauxite shipping throughout this report. All bauxite ships travelling between the Port of Weipa and the Port of Gladstone are Panamax or DPPV as larger ships cannot navigate the Torres Strait. Larger ships would be used for export. The most common ports of departure for export ships en route to Weipa are in Asia (from China to Singapore).

To ensure the highest standards of performance in terms of operation, safety and environmental performance, all chartered vessels are subject to vetting inspection under the independent Rightship system and must be rated to a minimum of three stars. The Rightship Ship Vetting Information System involves an in-depth assessment of a ship's quality and suitability for a task. In addition to the direct inspection of the vessel, this system takes account of a wide range of risk factors relating to the vessel's age, flag, class, vessel incidents and casualties, port state control and inspection history all of which are reviewed frequently.

The fuel currently used by the existing bauxite shipping from the Port of Weipa is heavy fuel oil (HFOs) with a kinematic viscosity of 380 Centistoke (cSt) or Intermediate Fuel Oil (IFO) with a kinematic viscosity of 180cSt. All fuel used has a sulphur content not exceeding 3.5%. Fuel oil is divided among separate tanks within the vessel. Indicative bunker capacities for typical DPPV (based on tanks being 96% full) are detailed in **Table 3-11**. The maximum amount of fuel is not usually carried because fuel loads are rationalised to maximise the amount of cargo transported.

Table 3-11 Typical Bunker Capacities for DPPV

Bunker	Capacity (m^3)
Fuel Oil Tank (Centre)	633
Fuel Oil Tank (Centre)	591
Fuel Oil Tank (Port)	534
Fuel Oil Tank (Starboard)	575
Marine Diesel Oil Tank (Port)	111

Bunker fuels are divided into a number of tanks located throughout the vessel including bottom tanks and wing tanks. As part of Rio Tinto's bunker management policy, bottom tanks on Rio-Tinto owned vessels are only used when undertaking longer international voyages where the full fuel bunker capacity is required for the distance. Bottom tanks are not used when travelling within the GBR in case of vessel grounding and damage to the hull. Cargo is also divided between separate holds within the vessel, with typical cargo hold volumes of a DPPV detailed in **Table 3-12**.

Table 3-12 Typical Cargo Hold Volumes for DPPV

Hold	Volume (m^3)*
No 1	15,666
No 2	16,752
No 3	18,009
No 4	16,772
No 5	16,200

* The hold capacities identified are provided in cubic meters, as weight would vary depending on characteristics of the cargo, such as moisture content.

3.9.2.2 Bauxite Shipping Movements

Bauxite is currently shipped from the Lorim Point terminal at the Port of Weipa. In 2015, prior to the commencement of shipments from the proposed Port, it is predicted that there would be approximately 430 bauxite shipments per annum from the Port of Weipa depending on international market demand and vessel size. Of these, on average 270 shipments per annum would be sailing from the Port of Weipa to the Port of Gladstone (i.e. 540 bauxite ship movements through the GBR per annum), with the remaining shipments likely to be to international ports.

Table 3-13 shows the estimated number of bulk carriers that would use the proposed Port including an assumption of the use of Cape Size vessels by some customers (generally international). Cape size vessels have a sailing draft too deep for passage of the Torres Strait and therefore would not travel via the GBR to any east coast Queensland Ports, including Gladstone (refer **Section 3.9.3.1** for a further description of the Torres Strait and GBR route). The actual number of Cape size vessels would depend on market conditions and actual sales of bauxite.

Table 3-13 Estimated Shipments from the Proposed Port

Production Scenario	Likely Mix of Vessels[1] (Shipments/Annum)	Maximum Number of Vessels[2] (Shipments/Annum)
22.5Mdptpa	260 Panamax, DPP, Cape size	320 Panamax and DPP
50Mdptpa	540 Panamax, DPP, Cape size	700 Panamax and DPP

Note: all figures approximate.
1. Number of ships will vary depending on market conditions, actual production and size of vessels.
2. Based on Panamax/DPP vessels only.

Bauxite shipping for the Project would be expected to commence in or about 2016 (or approximately three years after the commencement of construction) subject to the grant of relevant environmental or other regulatory approvals, the determination of internal investment approvals for the Project by Rio Tinto and the construction schedule. The volume of bauxite shipping using the Port of Weipa will over time decrease as the reserves north of the Embley River are depleted and bauxite shipping from the proposed Port replaces much of this demand.

Under the maximum production scenario (50Mdptpa) up to 700 ships per year would be loaded at the proposed Port and approximately 400 of these would be bound for export markets, not passing through the GBR. The remaining balance of a predicted average of 300 shipments per year (600 ship movements) are required to supply bauxite to two existing alumina refineries in Gladstone. The shipments through the GBR following commencement of production at SoE would continue to be the shipments required to meet the needs of the existing Gladstone refineries and would use the same inner GBR Designated Shipping Area as is used at present. Under the maximum production scenario (50Mdptpa), there could be a small potential increase of 30 shipments per annum on average through the GBR (60 movements), which includes possible fluctuations in the future of shipment numbers due to variation in bauxite grade quality and in alumina production at the Gladstone refineries, within the scope of the existing approvals for the refineries.

3.9.3 Shipping Routes

Cargo deliveries would continue to traverse the existing inner GBR Designated Shipping Area and Torres Strait from the Port of Cairns and other routes through the CMA. Other deliveries (particularly during the construction phase) would traverse established shipping routes from domestic and international (predominantly Asia) ports. International deliveries would not need to traverse the GBR.

Fuel supplies would continue to travel across the Gulf of Carpentaria via the CMA from the Port of Darwin and would not traverse the GBR, unless other arrangements are made by the third party supplier.

Loading and departure for bauxite shipping would be conducted at the proposed Port facilities to be constructed between Boyd Point and Pera Head to the south of Weipa (**Figure 3-8**).

When a ship arrives near the Port and has to wait to berth, it would generally anchor at the existing anchorage area for the Port of Weipa, subject to the direction of the Regional Harbour Master. The existing anchorage area is in Queensland coastal waters outside of the Port of Weipa limits.

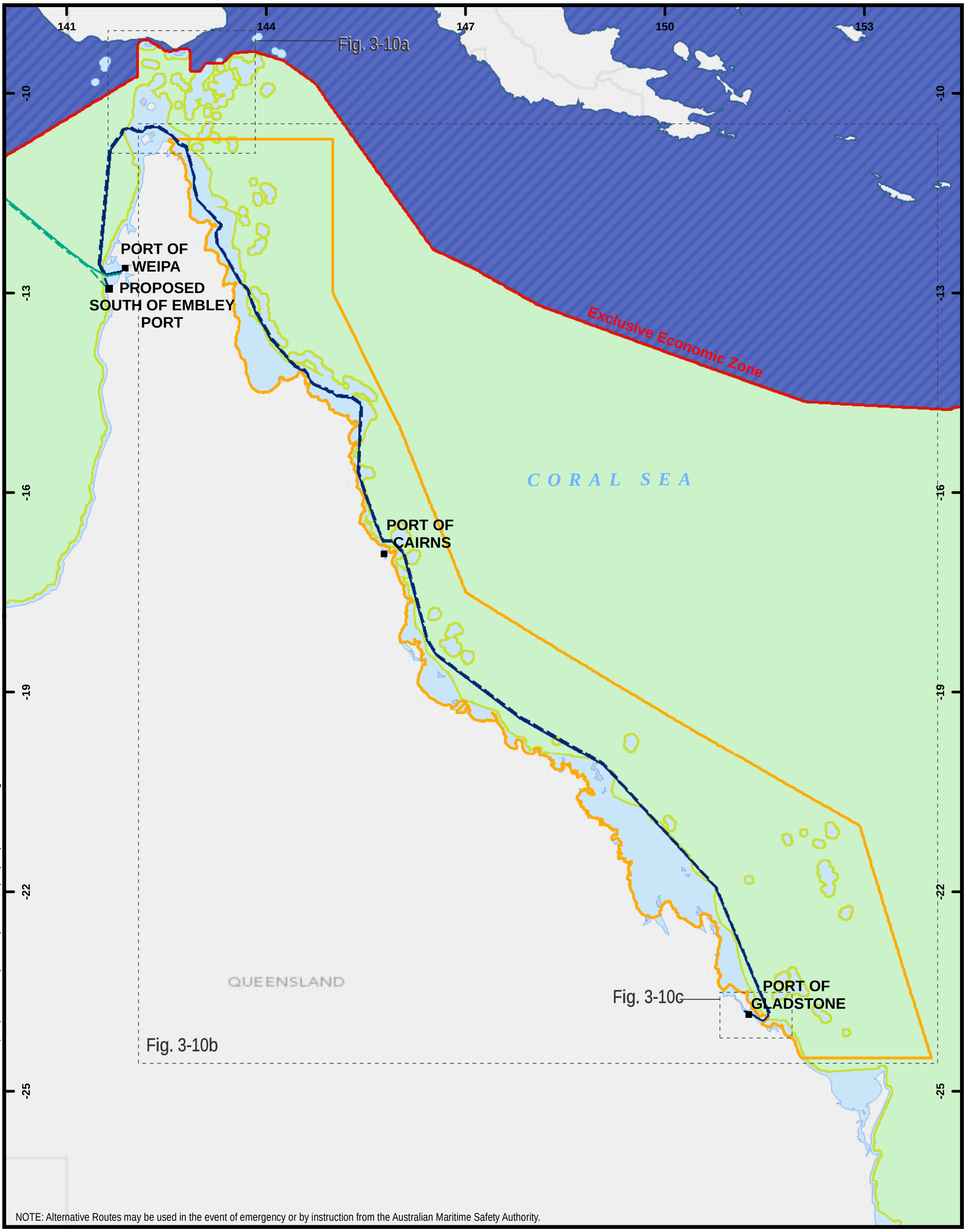
The proposed Port would be designed for continuous hours of operation. When the Port is ready to receive a ship, tug boats would assist to manoeuvre the ship to the berth. A new pilot disembarkation area for Cape size vessels would be established in deeper water west of the Port of Weipa (refer **Figure 3-8**). This area would be within the CMA. Anchorage is generally not required for pilot disembarkation; however, anchorage in the CMA may be required from time to time (e.g. if directed to do so by the Regional Harbour Master).

Bulk carriers leaving the Boyd Port would then travel north past the existing Port of Weipa and through the Gulf of Carpentaria. Vessels travelling to international ports (e.g. China) would typically pass to the west of West Papua then east of the Philippines and would not travel through the GBR (**Figure 3-10**). Vessels supplying the domestic market would travel to the Port of Gladstone via the Torres Strait shipping route and the inner GBR Designated Shipping Area (**Figure 3-10**). In both cases, once vessels have passed the Port of Weipa they would travel via the same shipping routes that have been used by bauxite shipping from Weipa to Gladstone and international ports for over 40 years.

3.9.3.1 SoE to Domestic Ports

Torres Strait Route

Vessels travelling between Asia and eastern Australia, Papua New Guinea or New Zealand may pass through Torres Strait. The numerous reefs and shoals in Torres Strait limit safe navigation by large vessels. Much of the navigable route through Torres Strait is confined in both width and depth. The recommended maximum draft for transiting ships is 12.2m with an under-keel clearance of 1.0m or 10% of the draft for vessels with a draft greater than 11.9m. The Torres Strait shipping channel is limited to Panamax / DPP vessels. All vessels over 70m in length must carry a pilot licensed by AMSA (AMSA 2012a).



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NOTE: Alternative Routes may be used in the event of emergency or by instruction from the Australian Maritime Safety Authority.

- Locality
- Exclusive Economic Zone
- RTA Proposed International Shipping Route
- RTA Existing International Shipping Route
- RTA Proposed Domestic Shipping Route
- RTA Existing Domestic Shipping Route
- Great Barrier Reef Marine Park (GBRMP)
- Commonwealth Marine Area (CMA)
- International Waters
- Coastal Waters

RioTintoAlcan

South of Embley Project

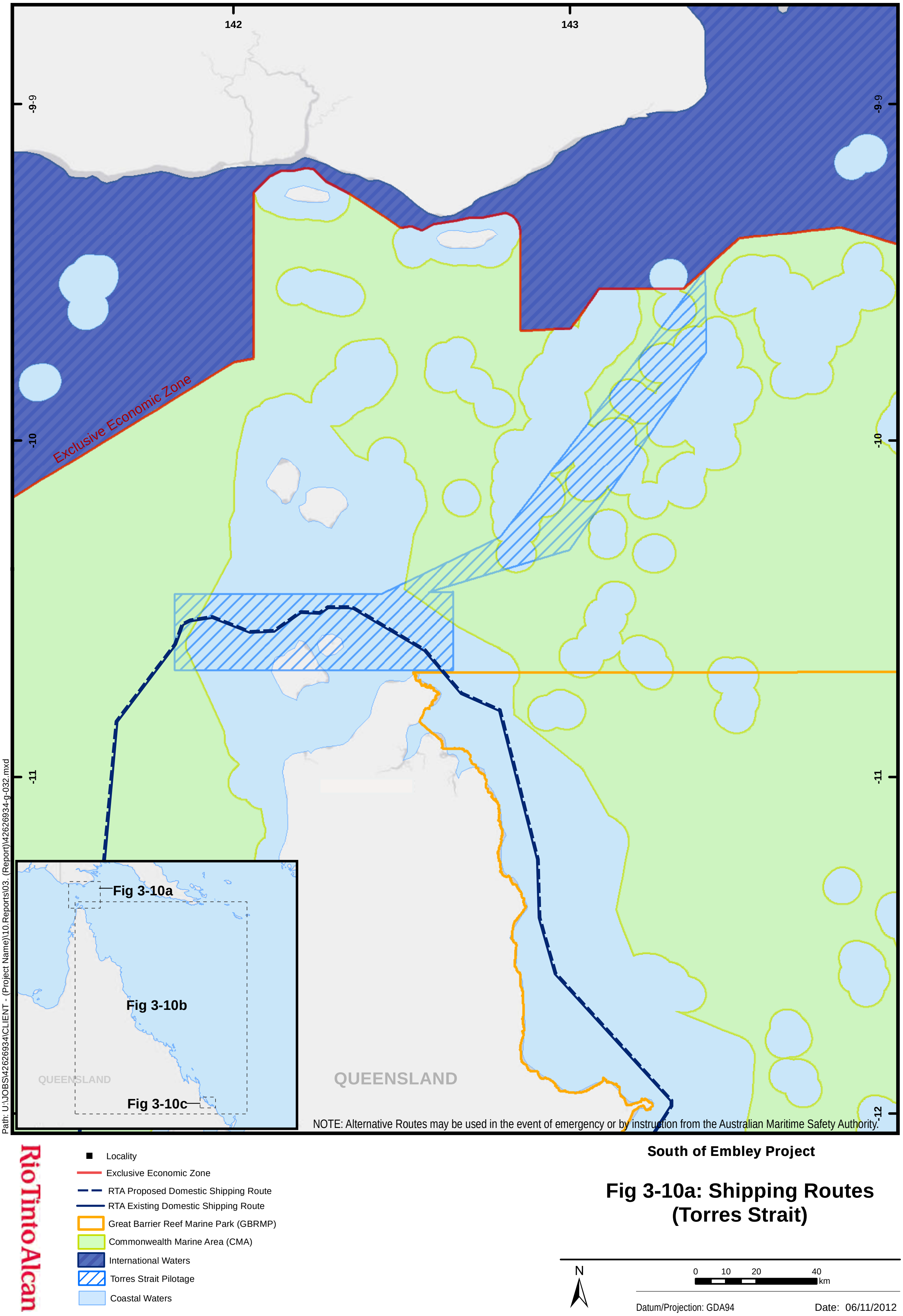
Fig. 3-10: Shipping Routes

N

0 55 110 220 km

Datum/Projection: GDA94

Date: 06/11/2012



RioTintoAlcan

South of Embley Project

Fig 3-10a: Shipping Routes (Torres Strait)

Datum/Projection: GDA94

Date: 06/11/2012

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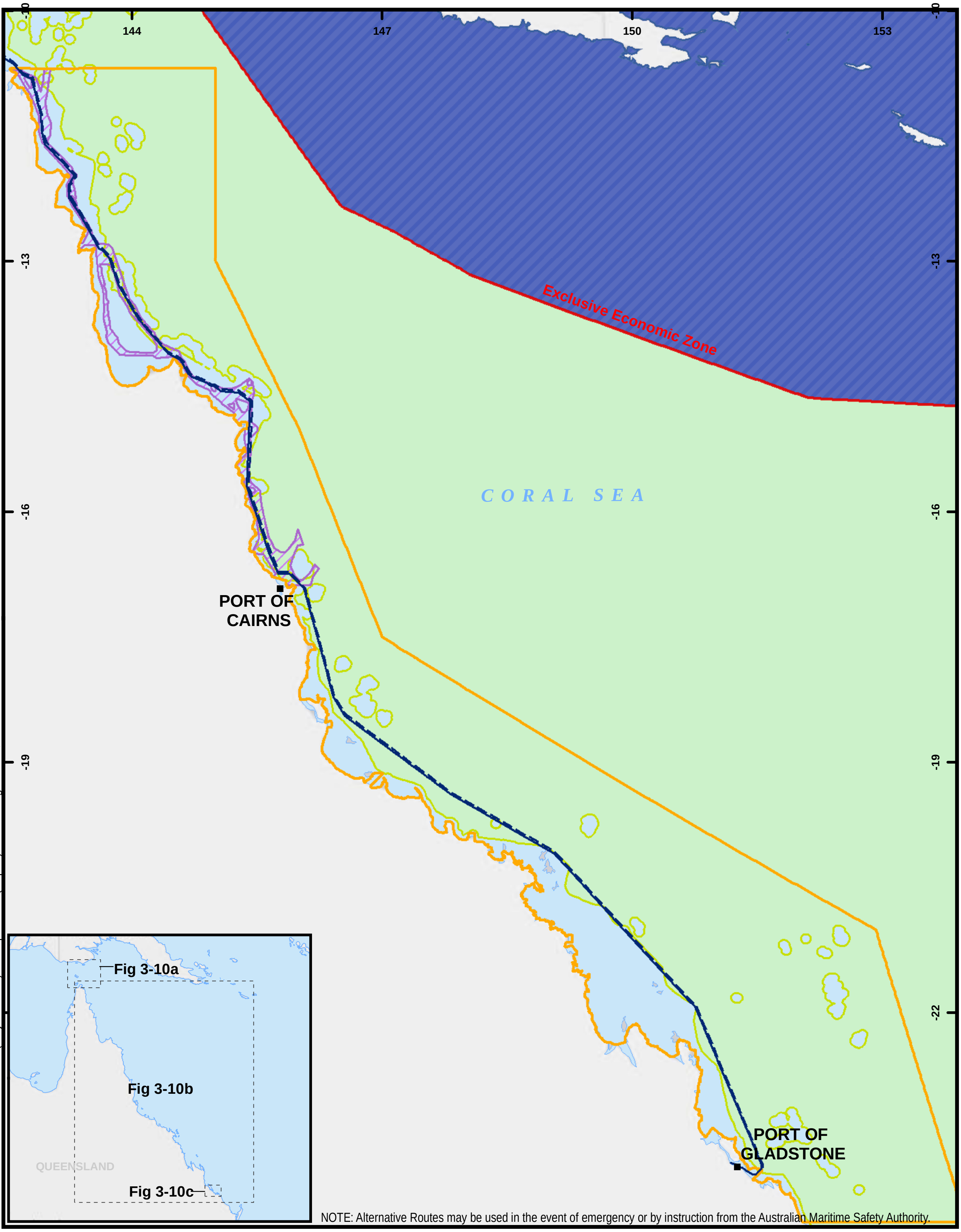


Rio Tinto Alcan

- Locality
- Exclusive Economic Zone
- RTA Proposed Domestic Shipping Route
- RTA Existing Domestic Shipping Route
- Great Barrier Reef Marine Park (GBRMP)
- Commonwealth Marine Area (CMA)
- International Waters
- GBR Inner Route Compulsory Pilotage Area
- Coastal Waters

South of Embley Project

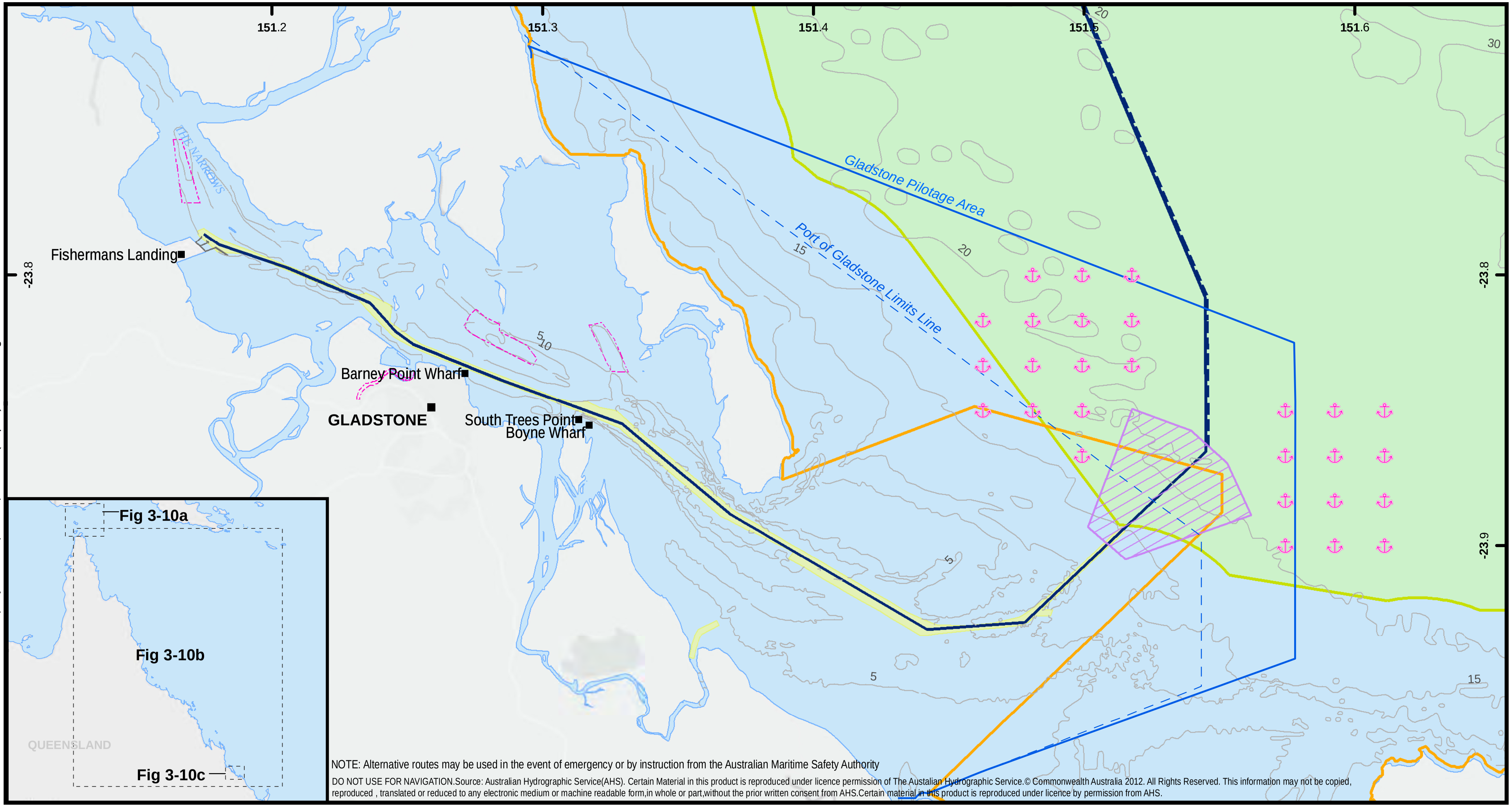
Fig. 3-10b: Shipping Routes (Great Barrier Reef Marine Park)

N

0 45 90 180 km

Datum/Projection: GDA94

Date: 06/11/2012



NOTE: Alternative routes may be used in the event of emergency or by instruction from the Australian Maritime Safety Authority

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RioTintoAlcan

- Locality
- Large Vessel Anchorage
- Gladstone Pilotage Area
- Port of Gladstone Limits Line
- RTA Proposed Domestic Shipping Route
- RTA Existing Domestic Shipping Route
- Small Vessel Anchorage Area
- Prohibited Anchorage Area
- Existing Dredged Channel
- Commonwealth Marine Area (CMA)
- Great Barrier Reef Marine Park (GBRMP)
- Coastal Waters

South of Embley Project

Fig. 3-10c: Shipping Routes (Port of Gladstone)

N

0 1.25 2.5 5 km

Datum/Projection: GDA94

Date: 06/11/2012

There are approximately 3,000 shipping movements through the Torres Strait per year by vessels longer than 50m. Bulk cargo carriers comprise approximately 38% of shipping movements Australia wide and this is reflected in the shipping traffic in the Torres Strait (AMSA 2012a). In recognition of the environmental sensitivity of the area and the difficulties associated with safe navigation, the International Maritime Organization (IMO) has designated Torres Strait as an extension of the GBR and classified it as a 'Particularly Sensitive Sea Area'. This designation allows Australian regulators to apply additional protective measures such as a ship reporting system, coastal vessel tracking services, compulsory pilotage, navigational aids, marine pollution response plans, and Designated Shipping Areas.

To cater for the navigational difficulty in the Torres Strait, AMSA maintains 31 major and minor navigational aids (lights and buoys), five transmitting tidal height gauges, one transmitting tidal stream meter, a Vessel Traffic System (VTS), and radar coverage. An emergency towing vessel is also on call (AMSA 2012a). In addition, the IMO has approved the requirements for compulsory pilotage in the region, whereby all vessels over 70m in length must carry a pilot licensed by AMSA (AMSA 2012a). All regulated ships with a draft of 8m or more must have a licensed pilot on board when they are transiting Torres Strait Compulsory Pilotage Area A (bounded by the longitudes 141°50'E and 142°05'E) and all regulated ships of any draft must have a licensed pilot on board when they are transiting Torres Strait Pilotage Area B (bounded by the longitudes 142°05'E and 143°24'E).

Great Barrier Reef Routes

Major shipping routes within the GBR can be divided into an outer and inner route, with a number of additional channels connecting these (**Figure 3-10**). These are described by Trainor and Hugget (2002) (AMSA) as follows:

> *"The outer route commences at the eastern limit of the Torres Strait (the Great North East Channel), continuing southwards through the Coral Sea and rejoining the Queensland coast near Sandy Cape, south of Gladstone. The outer route was surveyed and charted to international standards in 1997, encouraging a greater number of vessels, particularly oil tankers, to use the outer route.*
>
> *The inner route extends north-south between the GBR and the Queensland coast from Torres Strait to Gladstone in the south. The northern section from Torres Strait to Cairns is most restricted and passage through these waters involves navigation within confined waters for a long period, normally 40 hours. The inner route is well charted and marked with navigational aids."*

In addition to these two main north-south routes there are a number of east-west passages through the GBR that link the inner and outer routes. These passages include Curtis Channel and Capricorn Channel near Gladstone, Hydrographers Passage near Mackay, Palm Passage near Townsville, and Grafton Passage near Cairns. Most of the bulk carriers accessing Queensland's major coal ports use these e.g. Capricorn Channel for Gladstone, Hydrographers Passage for Hay Point, and Palm Passage for Abbott Point. Generally these ships do not transit all the way up the inner route.

In 2007 approximately 3,500 different ships transited the GBR, with some vessels making multiple voyages or return journeys through the reef, making a total of approximately 9,700 ship movements (GBRMPA 2009a).

Approximately 65-75% of all shipping in the GBR uses the inner route (GBRMPA 2009a). Pilotage has been compulsory within inner route of the GBR between Cape York and Cairns since 1991 for ships of over 70m (or for oil tankers, gas carriers and chemical tankers irrespective of length).

All bauxite shipping between Weipa and Gladstone associated with the Project would use the inner GBR Designated Shipping Area.

Under the *Great Barrier Reef Zoning Plan* (Zoning Plan), commercial ships do not require a permit to transit through General Use Zones and Designated Shipping Areas. By establishing Designated Shipping Areas the Zoning Plan also provides for certainty of access for shipping in the GBRMP and has facilitated the implementation of regulations governing safety, pollution prevention and response, as well as search and rescue. All Project-related shipping would remain within the Designated Shipping Areas.

In this regard, the effect of section 43 of the EPBC Act is that approval is not required under Part 9 of the EPBC Act to authorise the proposed shipping activities within the Designated Shipping Areas in the GBRMP.

It should be noted that there would be no changes to the existing shipping routes associated with bauxite mining operations in Weipa as a result of the Project other than the port from where bauxite ships depart. Bauxite shipping would depart from the proposed Port facilities to be located approximately 40km to the south of the existing Port of Weipa.

3.9.4 Port of Gladstone

3.9.4.1 Ship Movements

On arrival at the Port of Gladstone, Project vessels would travel along existing shipping channels from the outer harbour to the Targinie Channel. Small ships going in the opposite direction will pass the vessels in the parallel Golding Channel. The vessels' progress within the Port boundaries would be monitored by radar at all times. All vessels would have a minimum of one local pilot on board through the Port of Gladstone, with pilotage commencing at the Fairway Buoy.

The Gladstone Harbourmaster currently requires 30 minutes separation for Panamax size bulk carriers. Ship arrival and departure separation times and the width of safety zones around docked vessels are at the discretion of VTS and the Harbour Master.

Anchorage requirements for Project vessels awaiting transit through the Port of Gladstone would be determined by Vessel Traffic Information Service (VTIS) and the Harbour Master (Port of Gladstone) and are expected to occur within the existing anchorage and pilot boarding area for the Port of Gladstone. This area is located outside of the harbour as shown in **Figure 3-10**. Towage in the Port between the Fairway Buoy and Gatcombe Channel is provided by a commercial tug supplier, with five tugs servicing the Port of Gladstone. The tug service is a controlled activity as defined by Gladstone Port Corporation (GPC) (ref. Port Notice 03/06). Project vessels would at all times be attended by tugs during berthing operations and when manoeuvring in confined areas. RTA would continue to work with and enter into appropriate arrangements with the tug contractor to ensure that adequate tug capacity is provided.

3.9.4.2 Bunkering, Provisioning and Waste

Bunkering (refuelling) of vessels travelling between Weipa and Gladstone would be undertaken within the Port of Gladstone as part of normal operations. Bulk carriers would not be refuelled at the proposed SoE Port. Bunkering would be carried out by the Port of Gladstone refuelling contractor while vessels are at berth. Currently the Gladstone bunkering facilities are operated by International Bunker Supplies, and bunkering is undertaken via delivery direct to the ship while it is at berth either by direct pipeline at South Trees Wharf, by road tanker, or by the bunker barge MV *Larcom*.

Food and other consumables may be loaded onto vessels directly from barges while a vessel is alongside the berth. Solid wastes may also be discharged directly to a barge by crane off the vessel, with waste to be disposed of by an appropriately licensed waste management contractor. International and domestic legislation at the time of the commencement of the Project will limit the discharge of garbage to food wastes (subject to treatment and distance provisions), with no discharge of any garbage (including food waste) permitted within the GBRMP and parts of the Torres Strait. All Project vessels would have an on-board sewage treatment plant that is IMO approved and holding tanks and discharge connections. Ships will dispose of sewage at a licenced shore-based facility in Gladstone. All Project vessels will have IMO approved treatment and monitoring equipment for oily water from machinery space. Any discharges will occur in compliance with the MARPOL convention and the associated Australian legislation.

3.10 Rehabilitation

3.10.1 Post Mining Land Use

The overall objective of the rehabilitation program would be to return the land to a post-mining land use that will be stable, self-sustaining, requires minimal maintenance, and protects downstream water quality (**Table 3-14** provides the detailed objectives). Specifically, the objectives for the rehabilitation of areas disturbed by mining activities would be:

- to establish a self-sustaining vegetation community using appropriate local native tree, shrub and grass species, which provides habitat to support EPBC-listed threatened terrestrial flora and fauna that are likely to be impacted, and includes:
  - native dry woodland vegetation dominated by *Eucalypts*, *Corymbias*, *Erythrophleum* and other framework species; or,
  - native wetland community dominated by *Melaleuca* and/or *Lophostemon* species;
- depending on which native plant community is most appropriate for the post-mining landscape; 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.

At the request of the Western Cape Communities Co-ordinating Committee (WCCCC), RTA may establish post-mining land use options other than those required by regulation, subject to obtaining all necessary government approvals. RTA has commitments under the WCCCA to surrender parts of the mining lease after their rehabilitation. Such surrendering of parts of the mining lease would be undertaken where it is practical to do so, and would be subject to government approvals.

3.10.2 Post-Mining Landform

The dominant geological unit of the Project area is the Ferruginous Duricrust, which is derived from heavily laterised sandstones of the Bulimba Formation (refer to Section 3.2 of the Queensland EIS for further detail on the geology of the Project area) (RTA 2011). Ferruginous Duricrust is essentially the same as the Andoom land system as defined by Godwin (1985) and Gunness *et al*. (1987). Between the bauxite and sandstone there is a transitional zone consisting of kaolinite clay (refer **Figure 3-11** for an East-West cross section of the Project area), unlike the sharp ironstone-bauxite contact as in the East Weipa and Andoom mines. Note that **Figure 3-11** is vertically exaggerated, the overall slope in this cross section is <0.4%.

Figure 3-11 Geological Cross Section from East to West (Project Area)

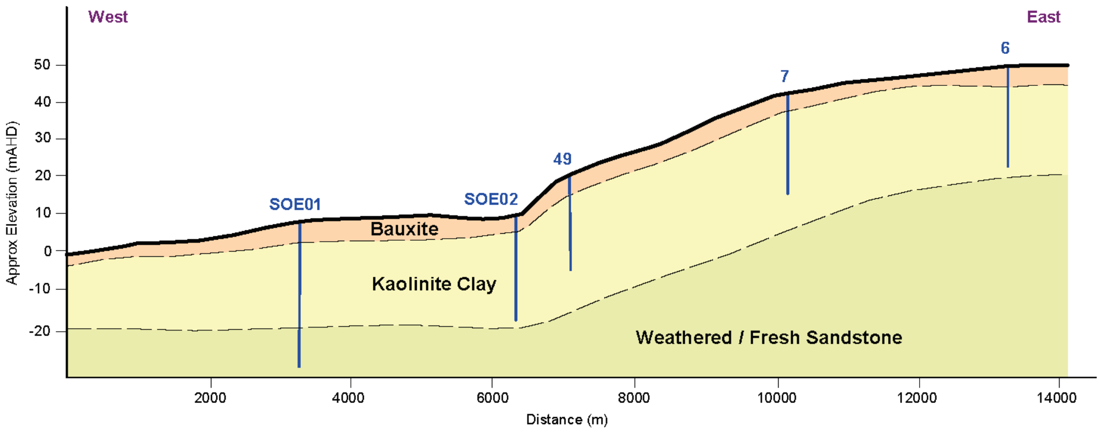


Table 3-14 Draft Rehabilitation Objectives, Indicators and Completion Criteria

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 (e.g. *Eucalypts, Corymbias, Erythrophleum and other framework spp.*) 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)
		Rehabilitated habitat suitable for a range of native fauna including threatened species	Vegetation structure provides suitable habitat for a wide range of fauna species	TBD: e.g. Structural elements present that provide suitable shelter for small mammals and birds, including prey for Red Goshawk and Masked Owl
			Native fauna species recolonising site	TBD: e.g. Fauna habitat development and/or evidence of fauna utilisation. Red Goshawk and Masked Owl prey species present
		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	Soil health – suitable growth medium established	Soil chemical, physical and/or biological properties	TBD

Mine Domain	Rehabilitation Goal*	Rehabilitation Objective/s*	Indicators*	Completion Criteria*
	derived from reference sites and trials) B. *Self-sustaining native wetland community dominated by Melaleuca and/or Lophostemon species*	Self-sustaining wetland vegetation and habitat established in seasonally inundated areas	Framework species (e.g. *Melaleuca and/or Lophostemon 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 FPC
		Rehabilitated habitat suitable for a range of native fauna including threatened species	Vegetation structure provides suitable habitat for a wide range of fauna species	TBD: e.g. Structural elements present that provide suitable shelter for small mammals and birds
			Native fauna species recolonising site	TBD: e.g. Fauna habitat development and/or evidence of fauna utilisation Red Goshawk prey species present
		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
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 FPC
			Health and resilience of vegetation	TBD: e.g. Evidence of growth and good health; Evidence of recovery following fire.

Mine Domain	Rehabilitation Goal*	Rehabilitation Objective/s*	Indicators*	Completion Criteria*
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. 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
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 EHP within three years of the commencement of mining.

Mining involves removing around 1m of soil and overburden above the bauxite and then excavating the bauxite (which has an average thickness of approximately 3.4m). The overburden would be returned to mined-out pits and then soil would be respread during rehabilitation.

Areas disturbed by mining activities and infrastructure would be rehabilitated to a stable landform with a self-sustaining vegetation cover. After overburden and soil are returned to mined-out pits, the final rehabilitated landform would be at a lower elevation than the original landform due to the removal of the bauxite, but the overall slope of the landform would be similar. Where mining leaves batters on the edges of the pit, these would be recontoured to a maximum slope of 20% (1 in 5, or approximately 11 degrees). The final landform would not have any out-of-pit dumps of excavated overburden or soil because it would be returned to the mined areas for use in rehabilitation.

Given the changes to topography due to mining and infrastructure at a local scale would be minor, and there would be no final out-of-pit dumps of overburden, there would be no significant changes to the broad scale topography of the Project area. Mining would involve clearing vegetation; however, vegetation would be retained within the proposed SoE environmental buffers along the coastline and beside waterways, with mining excluded within these buffer areas (refer **Section 6.3.4.5**).

Prior to mining, areas would be assessed to determine whether the post-mining landform would be seasonally inundated due to the final surface becoming close to the wet season watertable level. If this is the case, rehabilitation in these areas would be planned such that local species from *Melaleuca* and *Lophostemon* dominated vegetation communities would be used (refer to **Section 3.10.3.3** for information on revegetation).

The TSF embankments and surface would be revegetated after decommissioning and minor earthworks undertaken to install suitable water management features.

3.10.3 Rehabilitation Strategy

The rehabilitation strategy for the Project has been based on the *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Determination of Post-Mine Land Use* (DME/DEH 1995). The strategy consists of the following integrated measures:

- implementation of practical landform designs, to prevent erosion and establish final landform stability;
- revegetation trials, for selection of appropriate revegetation species and methodologies;
- progressive rehabilitation of disturbed areas, using rehabilitation procedures appropriate to the type of disturbance;
- appropriate management of the final bauxite processing waste, including construction of an earth cover; and,
- implementation of erosion control measures, consistent with the practices described in the *Technical Guidelines for Environmental Management for Exploration and Mining in Queensland – Erosion Control* (DME/DEH 1995).

Rehabilitation would commence progressively as areas become available and in accordance with the Plan of Operations, which is prepared in accordance with the Queensland EP Act. The Plan of Operations would be provided to the relevant WCCCC sub-committee in accordance with the requirements of the WCCCA. Rehabilitation of mining areas would generally be within one to two years of mining (refer **Section 3.10.4** for a typical rehabilitation scenario). Areas used for infrastructure would be rehabilitated at the end of the mine life unless they are decommissioned earlier or an agreement to leave the infrastructure in place is agreed with relevant regulatory authorities and Traditional Owners (refer **Section 3.11**).

RTA would jointly develop a rehabilitation process with the Traditional Owners and relevant WCCCC sub-committee prior to the commencement of mining. 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 **Section 3.14.15.1**.

A detailed rehabilitation management plan, including a quality assurance process, would be developed and implemented as described in **Section 3.10.3.6**.

3.10.3.1 History of Rehabilitation at Weipa

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 (such as a current research study of fauna colonisation of rehabilitated areas) 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 EA, which was issued in August 2011.

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 1,000 and 1,400 and between 43.5% and 73.4% of sites had more than 500 stems per hectare of the framework species. An average of 12 to 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 the maintenance (remediation) program; for example an area where weeds may have intruded are added to the 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.

3.10.3.2 Soil Management

The dominant soil type of the Project area is Red Kandosol, which has a topsoil depth of 10 to 20cm. These soils are weathered and very low in nutrients, and support vegetation adapted to such conditions. The majority of seed readily able to germinate is present in the upper 5cm of soil.

Prior to mining, all topsoil, subsoil and waste bauxite overlying the surface of the bauxite is stripped. Soil moisture levels would be assessed before soil stripping commences to ensure the soil is not so wet it would lose its structure when handled. Approximately 60cm of soil would be stripped and directly placed on mined-out areas in readiness for revegetation. This technique would help minimise the area of mined land exposed at any one time. If direct placement is not possible, soil would be stockpiled. If soil is stockpiled, it would be managed so as to maintain optimum growth media properties by maximising the stockpile surface area and minimising compaction. Stockpiled soil would be typically used within one year to maximise the benefits of the natural seed bank and conserve symbiotic micro-organisms. Any soil stockpiled for more than one year would be sown with a native local seed mix to control weeds and erosion. Areas receiving stockpiled material are sown with a special seed mix containing additional species to the standard seed mix, including seed of species that usually "volunteer" from natural seed store in freshly returned topsoil, such as grasses and Acacias.

Procedures for topsoil stripping, stockpiling and placement activities, including a quality assurance process, would be developed, implemented and included in the site rehabilitation procedure.

3.10.3.3 Revegetation

Revegetation is the component of the rehabilitation process that involves rebuilding the soil of disturbed land, seeding and/or planting plants. A similar revegetation methodology as that used at RTA's current operations north of the Embley River would be adopted and refined where required for the Project area. At RTA's current Weipa operations the following approach is taken to revegetation:

- respreading freshly stripped topsoil or stockpiled topsoil;
- ripping the mine floor to 50cm at three to four metre centres to break up the compacted floor and increase water infiltration (note, sometimes the mine floor is ripped before topsoil is replaced). Other compacted surfaces to be rehabilitated (such as haul roads) are repeatedly cross-ripped to ensure water infiltration and root penetration is achieved;
- scarifying along the contour prior to seeding;
- seeding with a seed mix of locally occurring native species at a density and richness to facilitate a self-sustaining local native ecosystem; and,
- applying fertiliser at an appropriate rate, if required.

The soil surface would be scarified prior to seeding, except where the topsoil has been ripped immediately prior to seeding and the soil surface forms an appropriate seedbed. Pre-seeding scarification assists in providing suitable growing media properties to optimise plant growth (e.g. porosity and water holding capacity). Scarifying also breaks up soil surface crusting and produces a soft soil bed for seeds, which maximises the chances of the seeded species germinating and establishing by increasing soil–seed surface contact. Scarification may be carried out using various means, such as a tractor-towed disc plough, a tractor-towed multi-tyne scarifier, a grader with a scarifier or a grader with a ripper beam attachment.

At current RTA operations north of the Embley River, direct seeding has been found to be the best method for establishing desired plant species. Direct seeding is generally undertaken using a belt spreader towed behind a tractor or via aerial seeding. The relatively small volumes of seed are bulked with a medium such as sand or sawdust to ensure a steady and adjustable delivery rate. Seeding would occur in November and December of each year to help ensure the soil moisture and follow-up rainfall is favourable to seedling establishment.

Native species seed mixes would be tailored to the anticipated post-mining conditions of the area to be rehabilitated. The proximity of the post-mined landscape to the wet season water table is the key factor determining which native plant community is most appropriate for the post-mining landscape.

Unlike the current East Weipa post-mining areas, only a small proportion (less than 5%) of the post-mining areas in the Project 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 Project area are expected to be suitable to support native dry woodland vegetation dominated by *Eucalypts*, *Corymbias*, *Erythrophleum* and other framework species.

Free draining areas would be seeded with a range of tree, shrub and groundcover species from *Eucalyptus* and *Corymbia* dominated woodlands. Free-draining areas are most suited to "Tall Darwin Stringybark woodland on lateritic red earths" and "Tall Darwin Stringybark woodland on yellow earths". Free-draining post-mining landscapes would be seeded with a range of tree, shrub and groundcover species from these communities. Suitable tree species are likely to include *Eucalyptus tetrodonta*, *Corymbia nesophila*, *Erythrophleum chlorostachys*, *Corymbia stockerii* and *Eucalyptus polycarpa*. Suitable mid-storey species may include *Acacia rothii*, *Alphitonia obtusifolia*, *Antidesma ghaesembilla*, *Breynia cernua*, *Exocarpus latifolius*, *Grevillea glauca*, *Grevillea parellala*, *Livistona muellerii*, *Parinari nonda*, *Petalostigma pubsecens*, *Planchonia careya* and *Xylomelum scottianum*. Suitable groundcover species may include *Heteropogon triticeus*, *Sorghum plumosum*, *Heteropogon contortus*, *Aristida macrantha*, *Eriachne triseta*, *Eriachne pallescens* and *Ectrosia leporina*.

In areas that are likely to be less free draining and seasonally inundated, species from *Melaleuca* and *Lophostemon* dominated vegetation communities would be used.

At current RTA operations north of the Embley River, fertiliser is applied at the time of seeding, with an aim to provide the best possible nutrition to maximise initial establishment and plant growth during the first wet season. The type and rate of fertiliser application is determined by the nature of the rehabilitated soils and plant species being re-established. Generally, superphosphate is applied at a rate of 200 kilograms per hectare (kg/ha) using a tractor-towed belt spreader. RTA is currently considering implementing a trial using biosolids for rehabilitation in the SoE Project area.

Traditional Owners have indicated during consultation that seed collection and rehabilitation are two potential business opportunities arising from the Project. RTA would continue to involve Traditional Owners in rehabilitation programs where practicable. The steps RTA would take to support the development of Indigenous businesses in the Western Cape region are detailed in **Section 3.14**.

3.10.3.4 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. Indicators currently proposed for the Project are summarised in **Table 3-14** along with proposed rehabilitation objectives and completion criteria. The rehabilitation indicators summarised in **Table 3-14** may be improved on in the future as site-specific research trials, the findings of on-going monitoring, and consultation outcomes become available.

The rehabilitation indicators prioritise matters relating to achieving the primary rehabilitation objective of self sustaining native woodlands, meeting criteria derived from reference sites and trials. While the completion criteria focus on this objective, they also reference matters of national environmental significance. It is important that the rehabilitation support suitable prey species for the Red Goshawk and the Masked Owl so that it is capable of supporting these threatened species (refer **Section 6.3.4.6** and **Section 6.4.4** for further data on how rehabilitation is expected to be able to support the Red Goshawk and Masked Owl respectively).

A vegetation structure capable of sheltering small mammals and birds is an important precursor to the colonisation of rehabilitation areas with suitable prey and this is reflected in the draft completion criteria.

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 would 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 under the continuous improvement cycle (Plan, Do, Check, Act) of RTA's certified environmental management system. The principle of adaptive management would be to undertake appropriate corrective action such that the rehabilitated areas ultimately meet the completion criteria.

3.10.3.5 Rehabilitated Land Completion Criteria

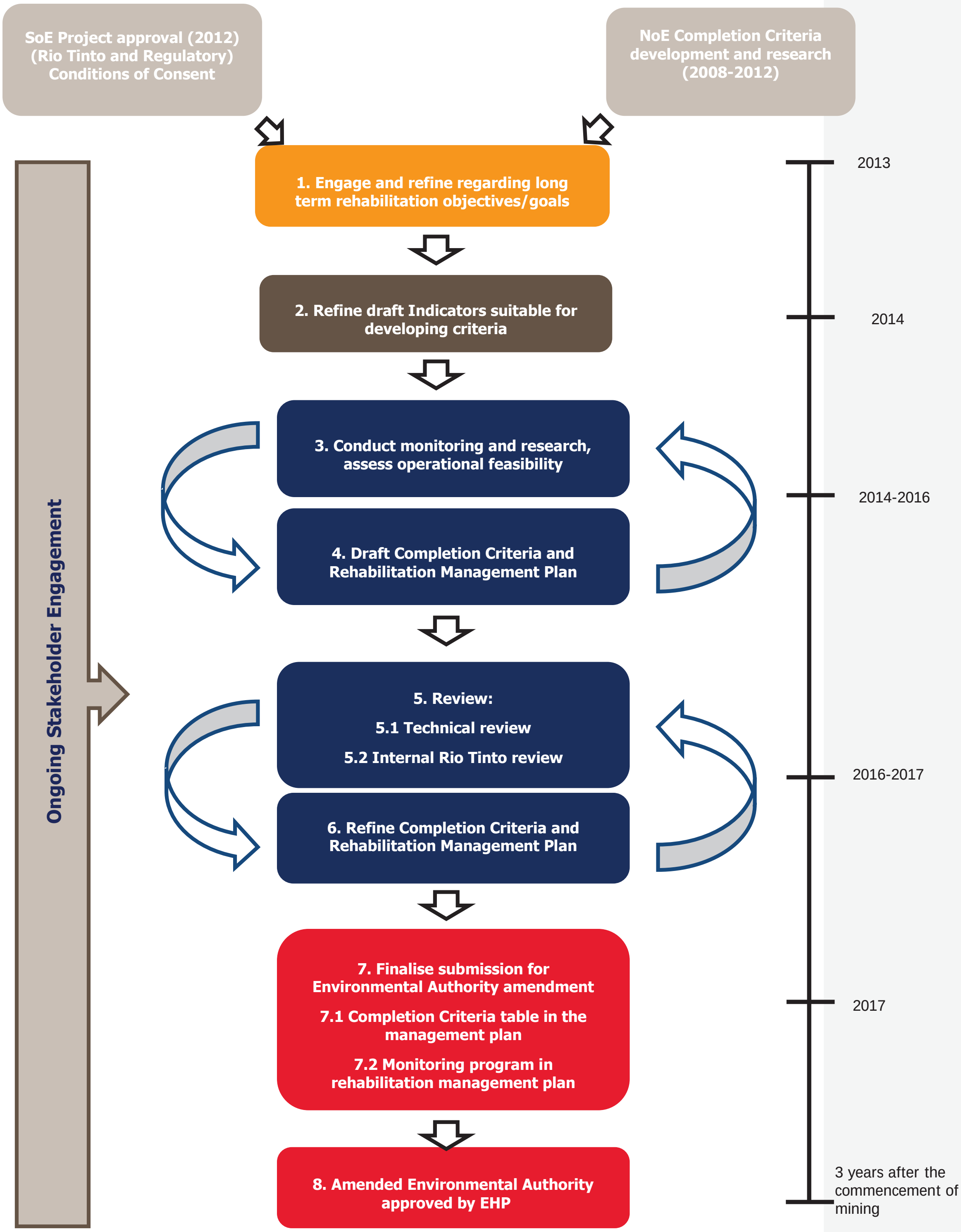
Proposed rehabilitation completion criteria are summarised in **Table 3-14**; however, these may change over the life of the Project. Under the WCCCA, RTA has commitments to consult Traditional Owner groups about rehabilitated land completion criteria.

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 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 in the Project area would be identical to those at existing operations north of the Embley River, or that reference sites are the same. RTA has committed to consulting with the Traditional Owners and the relevant 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.

Figure 3-12 indicates the steps for development of criteria, taking into account previous experience at Andoom and Weipa; outcomes from on-going monitoring, trials and research projects on the Project site; and stakeholder engagement. This feedback of information forms part of a continuous improvement loop which would 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 would be undertaken and remediation measures taken where necessary.

Figure 3-12 **Rehabilitation Completion Criteria Development Flowchart**



3.10.3.6 Rehabilitation Management Plan

The Queensland Coordinator General has determined that an interim Rehabilitation Management Plan must be prepared and submitted to EHP for approval before 30 August 2013 (Queensland Government 2012). Some elements of the Rehabilitation Management Plan for the existing north of Embley mining operations are directly adaptable for the Project, 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, survey of Project-specific reference sites and further research. The interim plan is required to be reviewed and updated annually until the final Rehabilitation Management Plan is approved by EHP.

The Queensland Coordinator General has determined that the final Rehabilitation Management Plan for the Project must be developed within three years of the commencement of bauxite mining, to allow the results of further consultation, survey of reference sites and some preliminary trials in the Project area.

The Queensland Coordinator General (Queensland Government 2012) requires the Rehabilitation Management Plan to include:

- schematic representation of final land form inclusive of drainage features;
- slope and cover designs;
- drainage design;
- erosion controls proposed on reformed land;
- revegetation methods inclusive of plant species selection, re-profiling, soil handling (including stockpiling), soil ameliorants/amendments, surface preparation and method of propagation;
- materials balance including available topsoil and low permeability capping material;
- geotechnical, geochemical and hydrological studies;
- chemical, physical and biological properties of soil and water;
- agreed post mining land and/or infrastructure use with the landowner/holder and the administering authority;
- 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;
- description of experimental design for monitoring of reference and rehabilitated areas inclusive of statistical design;
- a rehabilitation monitoring program based on a statistically sound, mutually agreed sampling design (i.e. a quality assurance process);
- research program and associated milestones; and,
- programs for maintenance of rehabilitation as required to achieve the nominated rehabilitation objective.

Under the ISO14001 Environmental Management System, the Rehabilitation Management Plan would be regularly reviewed and updated based on the results of research trials, the findings of on-going monitoring, and consultation.

3.10.3.7 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 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 SoE sub-committee prior to the commencement of mining. However, a draft flowchart has been provided in **Figure 3-12** 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 Governments (in particular EHP and DSEWPaC); and,
- 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) (RTA 2012). Further information on the proposed CHEMP is available in the Social Impact Management Plan (SIMP) (RTA 2012).

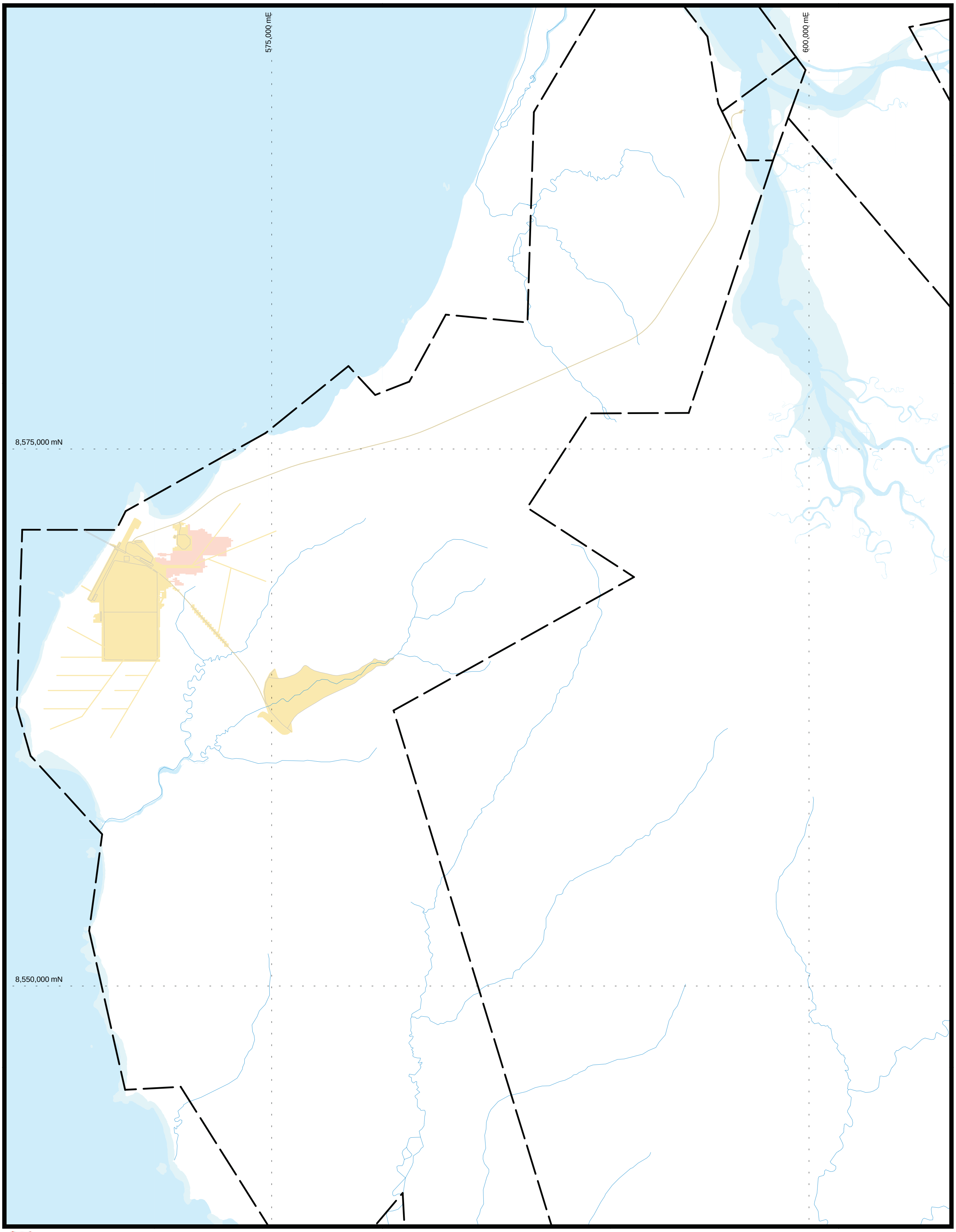
RTA would continue to report annually to the relevant WCCCC SoE sub-committee on rehabilitation programs, including an inventory of areas disturbed by mining, timeframes for rehabilitation, and supporting reports pertaining to the monitoring of rehabilitated areas. Ongoing community engagement, including engagement with Traditional Owners, is discussed in **Section 3.14.16**.

3.10.4 Typical Rehabilitation Scenario

Figure 3-13 outlines a typical mining and rehabilitation scenario for the Project. These figures show a typical production and rehabilitation scenario for every five years of the Project's life. It should be noted that this is just a typical scenario and the actual mining plan may differ in both the rate of production and/or the locations to be mined during any specific period.

Figure 3-14 shows graphically the progressive clearing for mining and rehabilitation cycles for a typical scenario. The largest area of un-rehabilitated land (approximately 9,000ha) would occur at about Year 30. The largest area of rehabilitated land less than 10 years old (approximately 9,000ha) would occur at about Year 45.

Additional details on relevant impacts from clearing on listed threatened terrestrial flora and fauna are included in **Sections 5** and **6**.



RioTintoAlcan

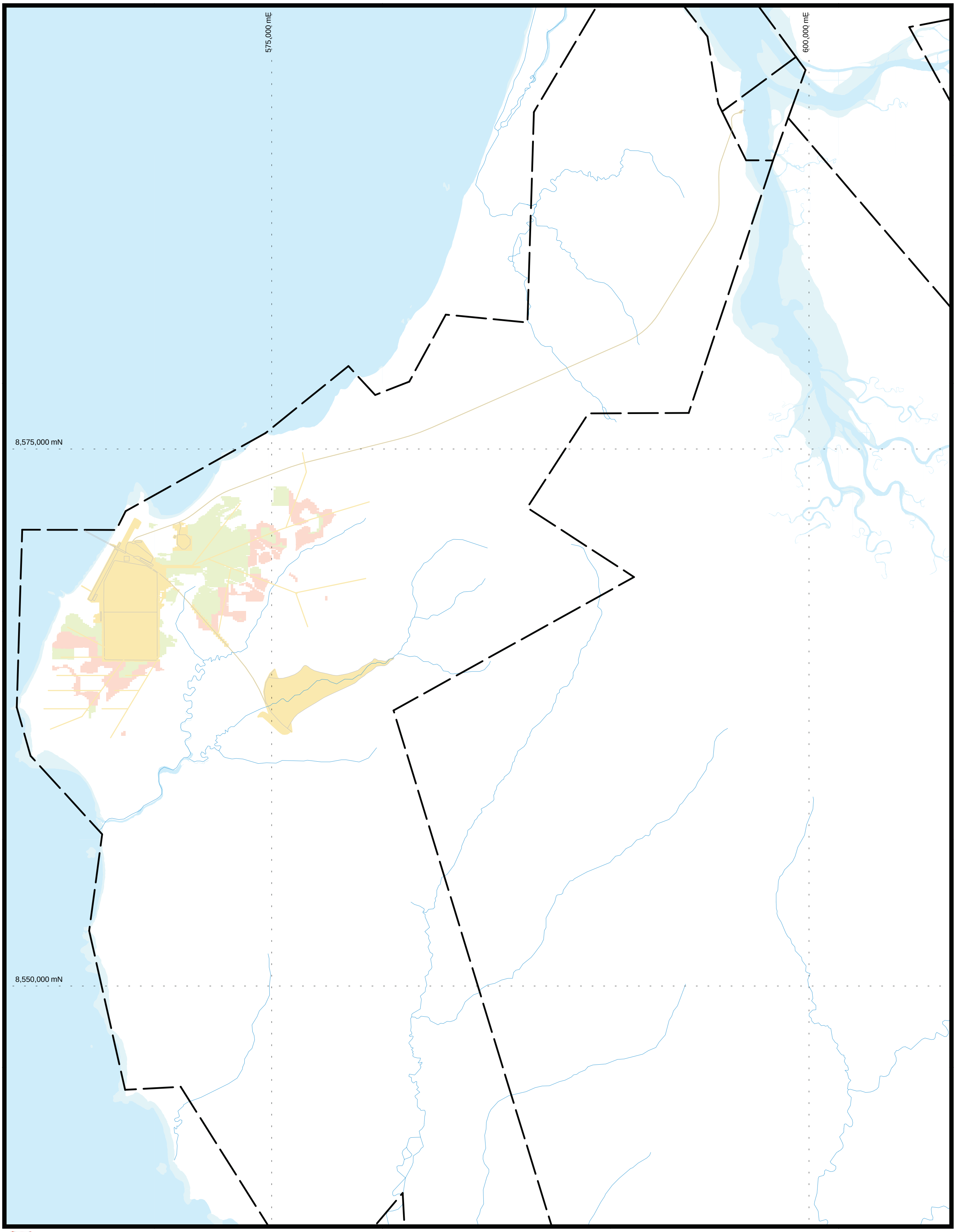
Lease boundary
Drainage
Infrastructure Disturbance
Mine Disturbance
Rehabilitated 0 - 5 years
Rehabilitated 5 - 10 years
Rehabilitated >10 years

NOTE
Assumes construction commences 2013

South of Embley Project

Fig. 3-13a: Typical Mining and Rehabilitation Scenario 2015

N
0 5km
Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



Rio Tinto Alcan

- Lease boundary
- Drainage
- Infrastructure Disturbance
- Mine Disturbance
- Rehabilitated 0 - 5 years
- Rehabilitated 5 - 10 years
- Rehabilitated >10 years

NOTE
Assumes construction commences 2013

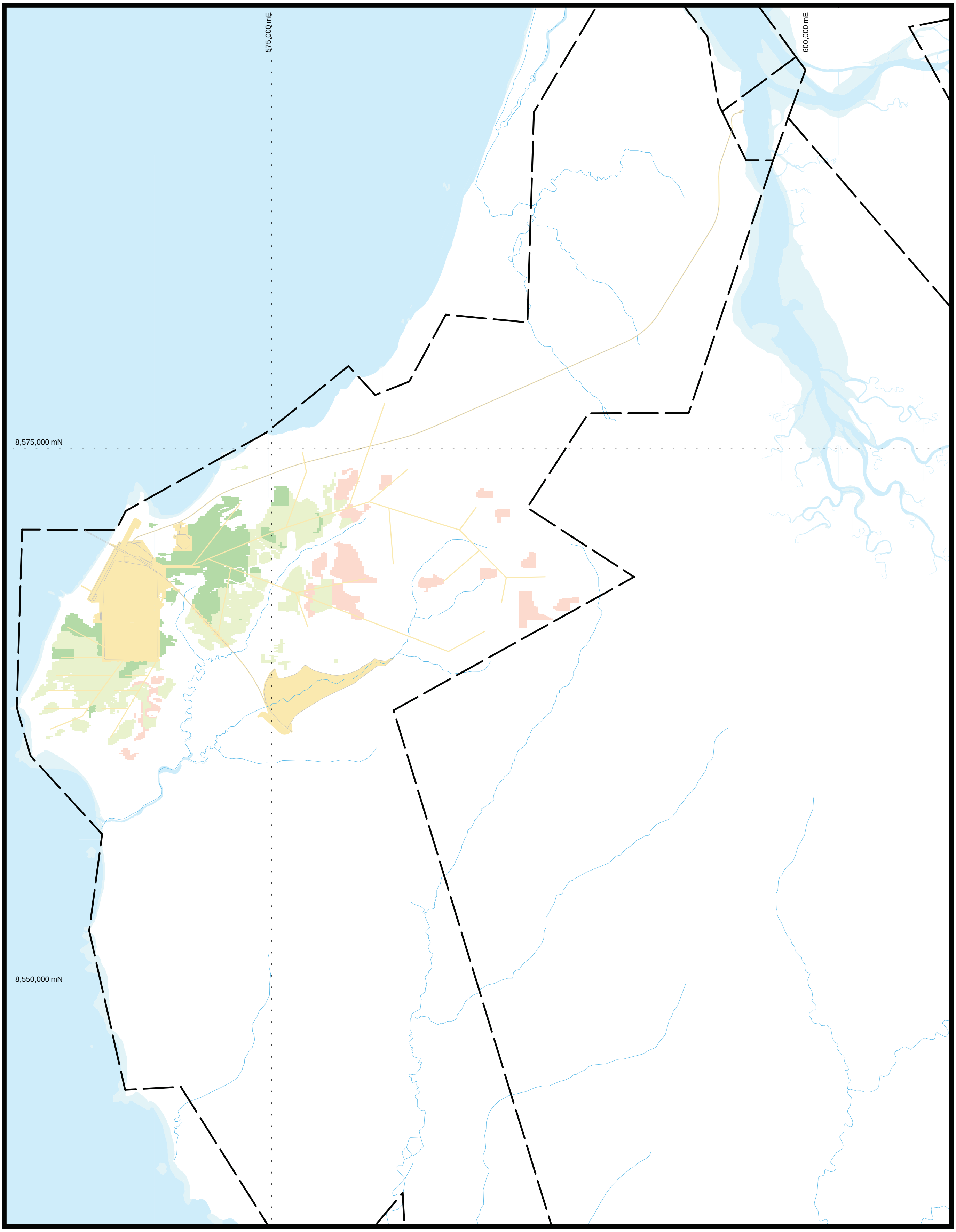
South of Embley Project

Fig. 3-13b: Typical Mining and Rehabilitation Scenario 2020

N

0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



Rio Tinto Alcan

Lease boundary
Drainage
Infrastructure Disturbance
Mine Disturbance
Rehabilitated 0 - 5 years
Rehabilitated 5 - 10 years
Rehabilitated >10 years

NOTE
Assumes construction commences 2013

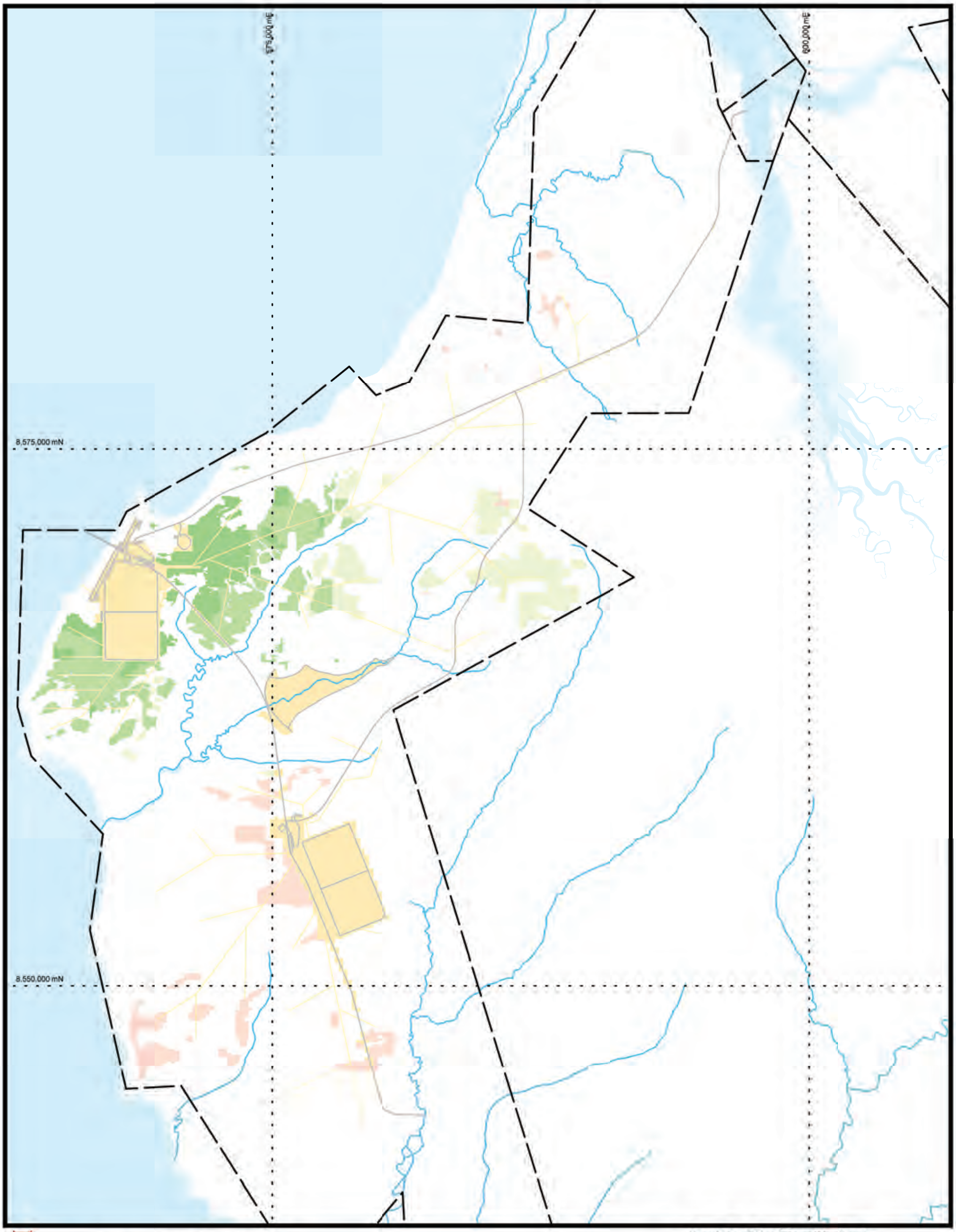
South of Embley Project

Fig. 3-13c: Typical Mining and Rehabilitation Scenario 2025

N

0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



RioTintoAlcan

- Lease boundary
- Drainage
- Infrastructure Disturbance
- Mine Disturbance
- Rehabilitated 0 - 5 years
- Rehabilitated 5 - 10 years
- Rehabilitated >10 years

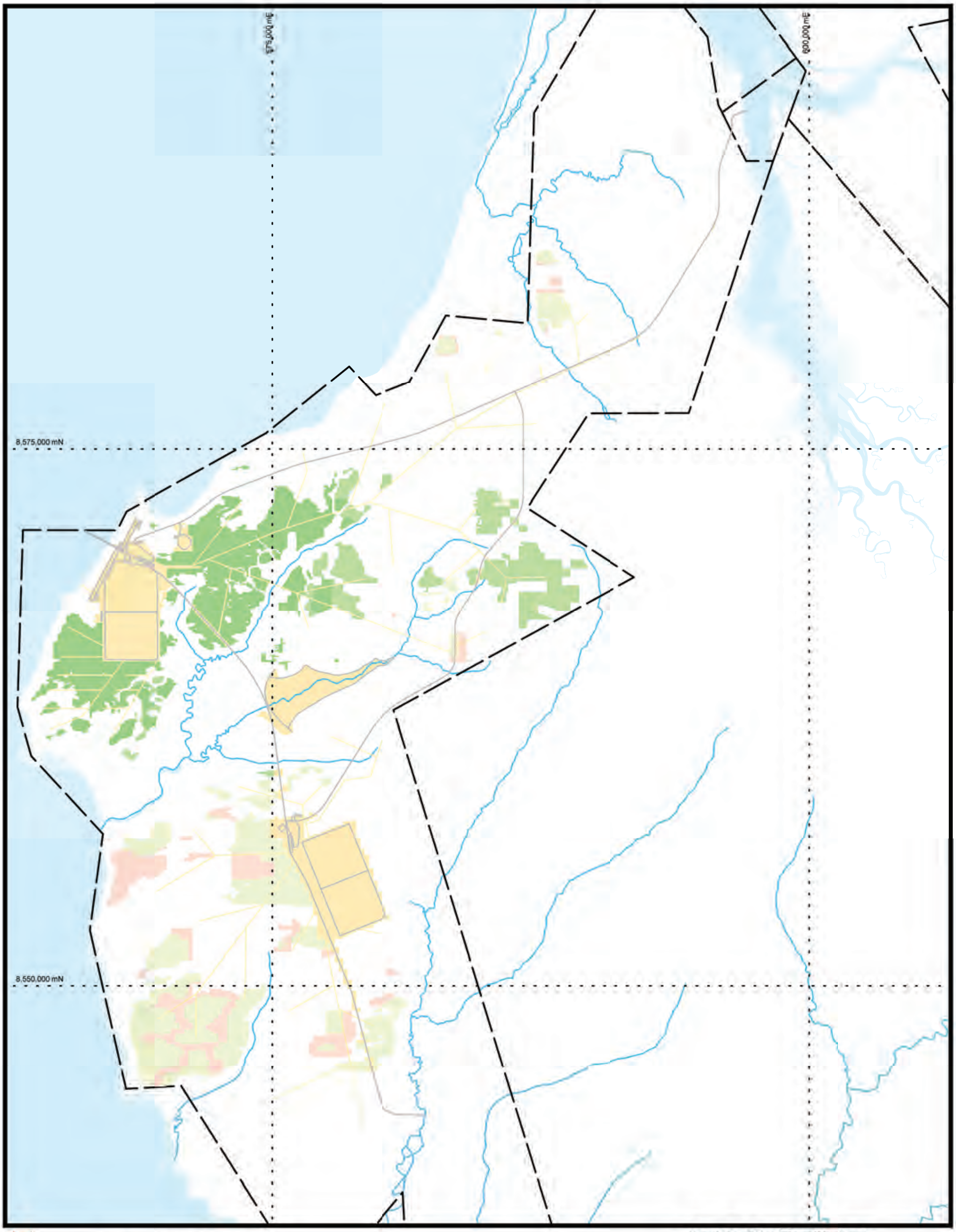
NOTE
Assumes construction commences 2013

South of Embley Project

Fig. 3-13d: Typical Mining and Rehabilitation Scenario 2030

N
0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



Rio Tinto Alcan

- Lease boundary
- Drainage
- Infrastructure Disturbance
- Mine Disturbance
- Rehabilitated 0 - 5 years
- Rehabilitated 5 - 10 years
- Rehabilitated >10 years

NOTE
Assumes construction commences 2013

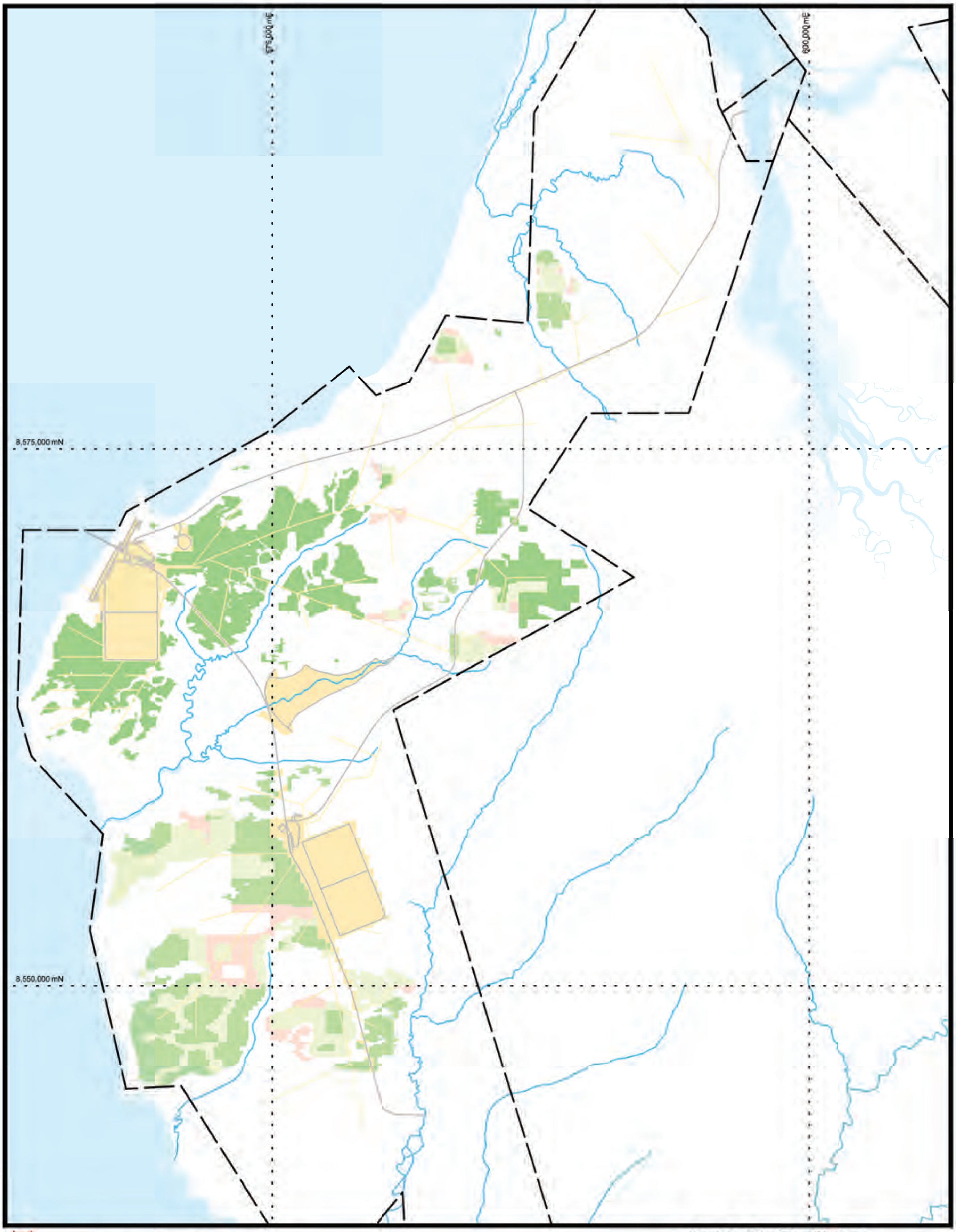
South of Embley Project

Fig. 3-13e: Typical Mining and Rehabilitation Scenario 2035

N

0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



Rio Tinto Alcan

- Lease boundary
- Drainage
- Infrastructure Disturbance
- Mine Disturbance
- Rehabilitated 0 - 5 years
- Rehabilitated 5 - 10 years
- Rehabilitated >10 years

NOTE
Assumes construction commences 2013

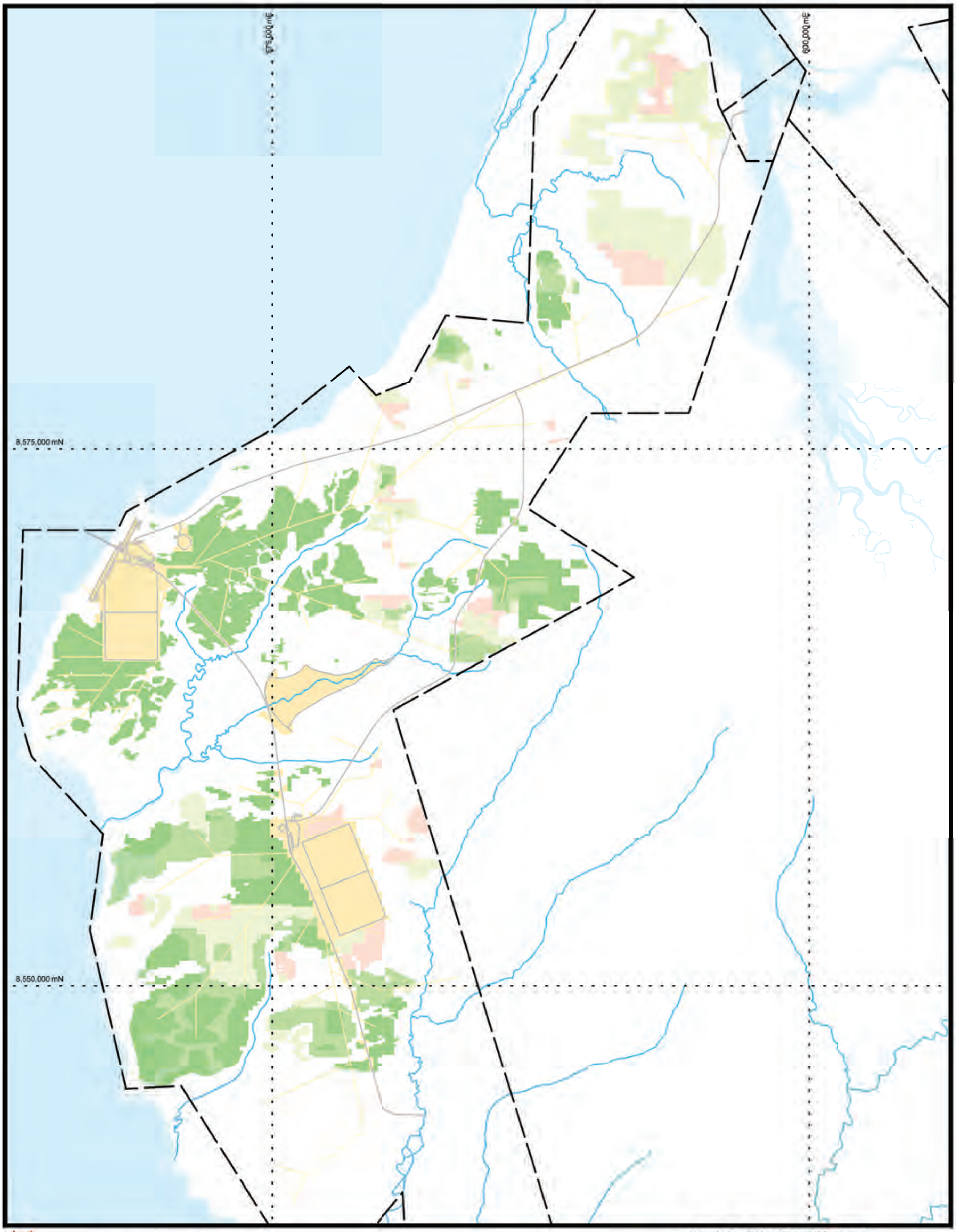
South of Embley Project

Fig. 3-13f: Typical Mining and Rehabilitation Scenario 2040

N

0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



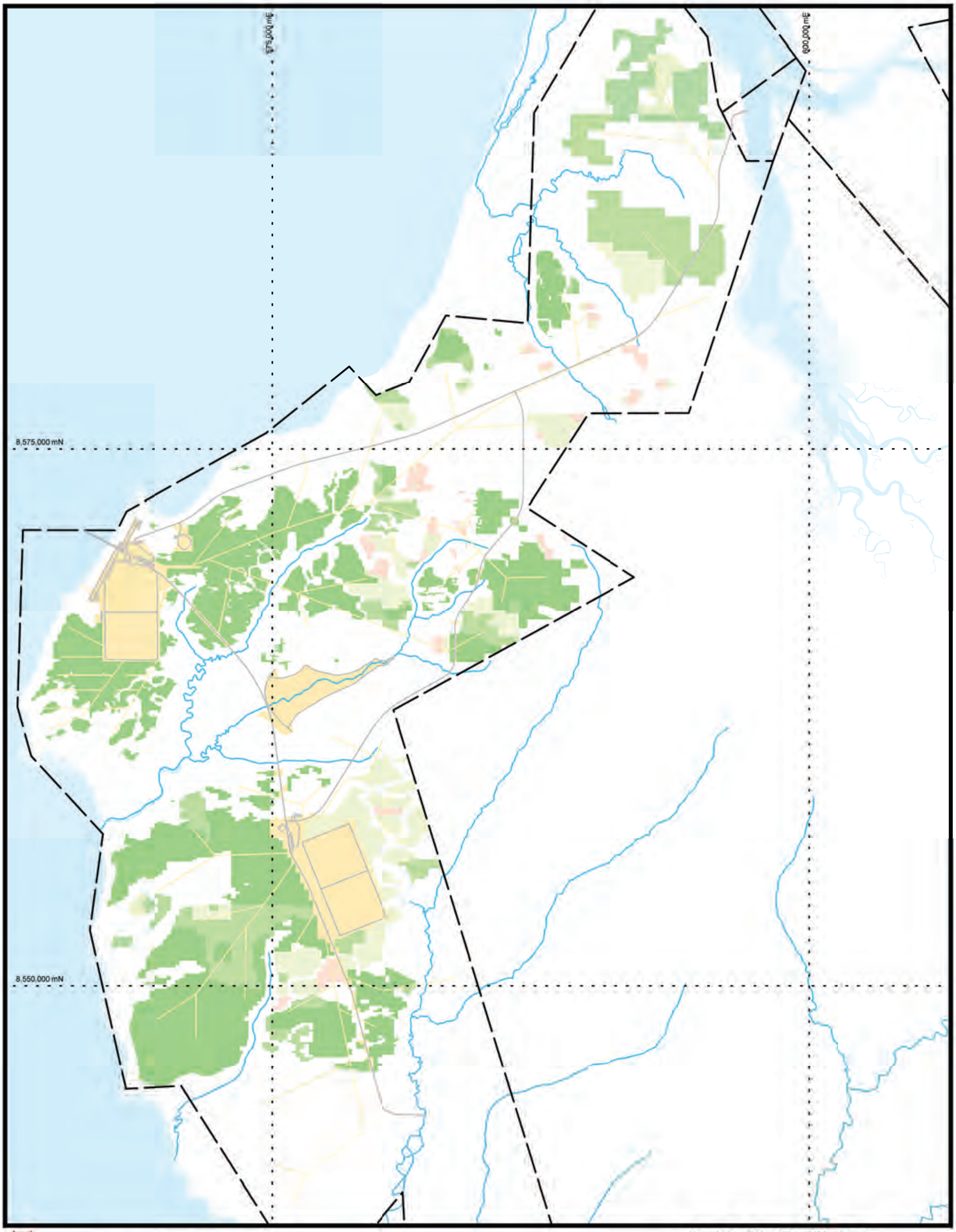
RioTintoAlcan

NOTE
Assumes construction commences 2013

South of Embley Project

Fig. 3-13g: Typical Mining and Rehabilitation Scenario 2045

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



Lease boundary
Drainage
Infrastructure Disturbance
Mine Disturbance
Rehabilitated 0 - 5 years
Rehabilitated 5 - 10 years
Rehabilitated >10 years

RioTintoAlcan

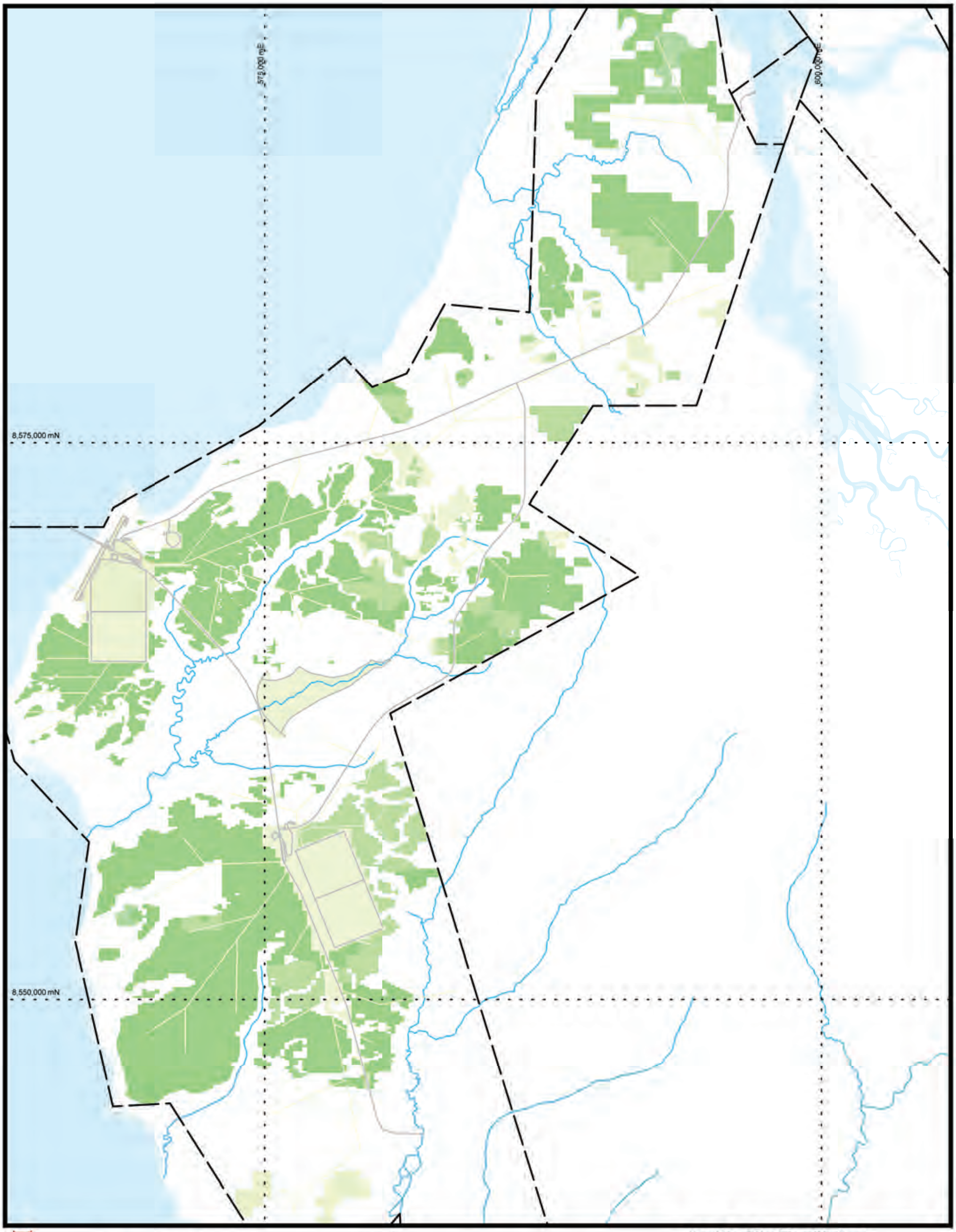
NOTE
Assumes construction commences 2013

South of Embley Project

Fig. 3-13h: Typical Mining and Rehabilitation Scenario 2050

N
0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012



- Lease boundary
- Drainage
- Infrastructure Disturbance
- Mine Disturbance
- Rehabilitated 0 - 5 years
- Rehabilitated 5 - 10 years
- Rehabilitated >10 years

NOTE
Assumes construction commences 2013
Assumes Dam C is not left as a water storage.

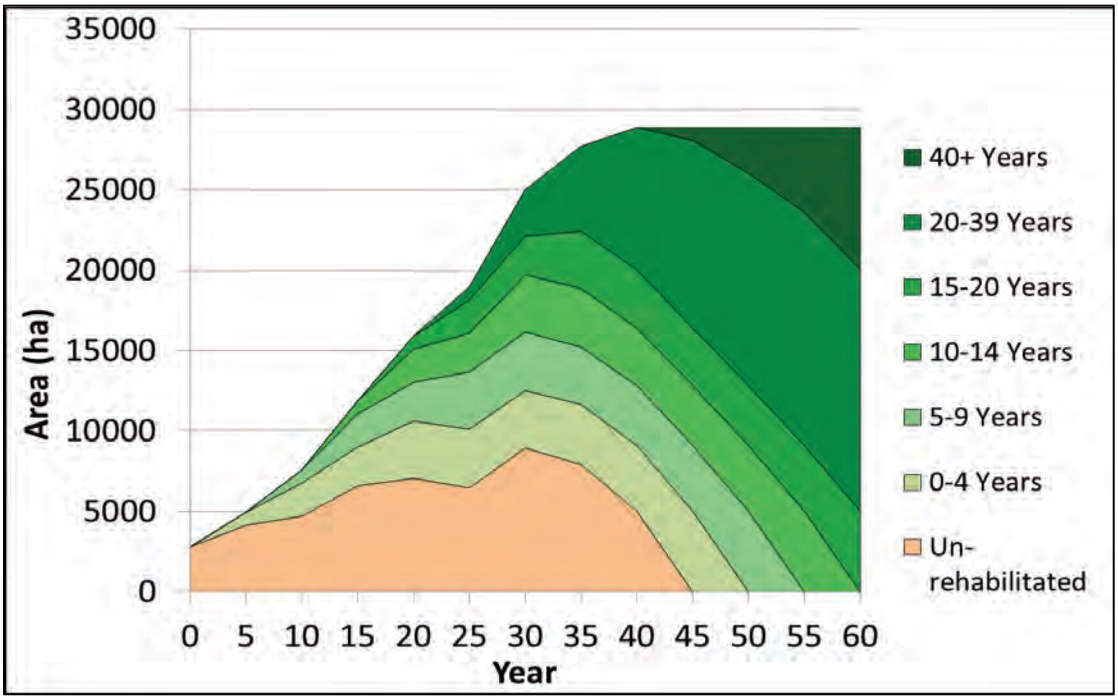
South of Embley Project

Fig. 3-13i: Typical Mining and Rehabilitation Scenario 2055

N
0 5km
Datum/Projection: GDA94/MGA Zone 54 Date: 17/09/2012

RioTintoAlcan

Figure 3-14 Typical Mining and Rehabilitation Scenario



3.10.5 Maintenance

Rehabilitated areas would be regularly monitored to identify any areas in need of maintenance at an early stage. Rehabilitation maintenance activities are likely to include:

- re-seeding of areas that have not reached a sufficient growth density of vegetation or have not achieved the desired species diversity;
- a fire management program aimed at excluding wildfires from rehabilitated land through construction and maintenance of fire access tracks and a prescribed burning program. The burning program would include areas adjacent to new rehabilitation. Prescribed burning is conducted early in the burning season, when fuel flammability is sufficient to carry a fire but low enough to maintain a relatively cool, low intensity burn;
- weed monitoring and management; and,
- erosion monitoring and control.

The early establishment monitoring of rehabilitation areas would be undertaken annually around August and September to provide an indication of the success of earthworks and seeding undertaken in the previous year. Re-seeding in the first or second year following establishment offers the most effective rehabilitation remedial response if remediation is required.

Where supported by knowledge of rehabilitation ecology and fire impacts, controlled burning of rehabilitation may be conducted to influence rehabilitation vegetation composition, structure and function. Controlled introduction of fire to developing sites can ensure fire-sensitive species do not dominate, and that desirable fire-resilient species and characteristics are encouraged.

Any controlled burning of rehabilitation would be accompanied by a monitoring program including a pre- and post-burn vegetation survey, fuel load estimations and fire intensity calculations, and spatial data of burnt areas and degree of vegetation removal, including canopy scorch.

3.11 Decommissioning and Closure

The decommissioning and final rehabilitation of the Project area would occur on a staged basis over several years. A Final Rehabilitation Report would be prepared under the EP Act prior to lease relinquishment. The Final Rehabilitation Report would address any on-going maintenance, management and funding requirements and would be approved by EHP.

A contaminated site register would be maintained for the operation and areas of soil contamination would be investigated prior to rehabilitation. Contaminated sites would be managed using methods developed on a case-by-case basis in accordance with EHP guidelines. A contaminated site assessment would be prepared prior to surrender of the mining lease.

RTA would jointly develop an initial mine closure plan with the Traditional Owners and relevant WCCCC sub-committee prior to the commencement of mining and update this plan every five years.

On the completion of mining, buildings, structures and other infrastructure would be treated as follows:

- The barge/ferry terminals, Port, Dam C and certain roads may have some ongoing beneficial use. Subject to agreement with relevant regulators and Traditional Owners, some of these facilities may be left in place. Otherwise, RTA would remove these facilities.
- Buildings, plant, equipment, tanks, conveyors, pipelines and transmission lines would be removed and the surface rehabilitated. Concrete pads would be broken up, buried, and then the area rehabilitated.
- RTA would provide Traditional Owners with the opportunity to purchase decommissioned construction camp accommodation on agreed commercial terms, once the construction phase is complete.

The area of land disturbance of those facilities identified above that may be left in place for use by Traditional Owners or others at the end of the Project life would be approximately 1,100ha (including 780ha for Dam C), with the remaining area of approximately 28,560ha rehabilitated in accordance with **Table 3-14** (note that actual areas are subject to change depending on the final agreement with relevant regulators and Traditional Owners). It should be noted that Dam C and narrow infrastructure corridors may provide foraging habitat for some terrestrial fauna species. Individual estimates of the areas of rehabilitated available to support those threatened fauna species that were considered as possibly occurring in the Project area (Red Goshawk, Masked Owl, and Northern Quoll) but which were not found during EIS surveys are provided in **Tables 6-11**, **6-25**, and **6-36** respectively.

3.12 Alternatives

RTA has been undertaking studies to optimise the Project design. A number of alternatives for different components of the Project have been considered including:

- location of the Boyd Port and stockpiles;
- construction of the Port jetty;
- Port capacity;
- location of anchorage area;
- locations of the barges and ferry terminals;
- location of the tug berths;
- disposal of dredged material;
- location of the temporary barge landing area;
- location of the temporary passenger jetty;
- construction workforce accommodation;
- shipping routes;
- water supply;
- beneficiation plant;
- tailings system;
- power supply;
- location of the beneficiation plants; and,
- access to the Project area.

Table 3-15 to **Table 3-32** describe the Project alternatives for each of the above components. The feasibility from a technical and operational perspective for each alternative is provided as well as a summary of the potential mitigated impacts of each feasible alternative on matters protected by each of the six controlling provisions relevant to each Project component. The magnitude of impact definitions are consistent with the definitions provided in **Sections 5.1.2**, **6.1.3**, **7.1.2**, **8.1.2**, and **9.1.2**. The impact shown for each of the preferred options shown in the tables is the highest potential mitigated impact identified for each controlling provision based on the assessments outlined in **Sections 5**, **6**, **7**, **8**, and **9**. Comparison of the impacts is then provided for each feasible alternative. Each table then presents a justification as to why an alternative has been chosen or why more than one alternative is under consideration.

The option of not proceeding with the Project is not financially feasible as the bauxite reserves will be depleted in RTA's current mining areas leading to the progressive closure of RTA's existing Weipa mining operations. Without an alternative source, the Gladstone alumina refineries would lose a viable, ongoing source of bauxite and the town of Weipa will lose a major financial contributor.

Table 3-15 Alternatives for the Location of Port and Stockpiles

	Proposed Port Location	Alternative - Use Existing Facilities at Lorim Point
Technical/ Operational Feasibility	Preferred: Less distance required to transport ore, thus reducing energy usage. Has the closest access to deep water along the coastline in the Project area and therefore minimises the required dredge volume.	Not Feasible: Requires a long distance to transport ore including the construction of a 3.5km bridge over the Embley River. Existing port facilities are limited to smaller ships. Is cost prohibitive and in the longer term the existing Lorim Point wharf facilities would not support 50Mdptpa production.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Dredging of berth pockets and departure areas and sea disposal of dredge material would be required.	Assessment not required as not feasible.
Listed Migratory Species	***Negligible Impact (Avian)*** ***Minor Impact (Non Avian)*** Dredging of berth pockets and departure areas and sea disposal of dredge material would be required.	Assessment not required as not feasible.
Commonwealth Marine Areas	***Negligible-Minor Impact***	Assessment not required as not feasible.

Justification for the preferred alternative:

- The preferred alternative would at most have a minor mitigated impact on applicable controlling provisions.
- The use of the existing Lorim Point stockpiles and ship-loader would require all crude ore or product bauxite to be transported on average more than 50km by conveyor or rail to the existing Lorim Point beneficiation plant, over a 3.5km bridge spanning the Embley River estuary. This proved to be cost prohibitive, would impact on riparian areas and require significant piling activities. In the longer term the existing Lorim Point wharf facilities would not support 50Mdptpa production.
- The proposed Port has been designed to accommodate Cape size vessels. Dredging of berth pockets and departure areas and sea disposal of dredge material would be required to accommodate these vessels at the proposed Port. The existing Port of Weipa facilities are limited to smaller ships up to 255m in length, 12.3m draft, and 85,000dwt (PCQ 2010). If the existing Port were to be upgraded to accommodate the larger vessels, then dredging in the Embley estuary and subsequent disposal of dredged material would also be required.
- The proposed Port would be much closer to the centroid of bauxite reserves and hence would reduce energy usage as it minimises the overall land transportation distance of crude ore and product.

Table 3-16 Alternatives for the Construction of the Port Jetty

	Construct Port Jetty as Designed	Construct a Longer Jetty and Reduce Dredging Volume
Technical / Operational Feasibility	Preferred: For Stage 1 of the wharf, the combined wharf and jetty length for this alternative would be 1km and require a dredge volume of up to 6.5 million cubic metres. For Stage 2 of the wharf, the combined wharf and jetty length would be 1.3km and require a dredge volume of up to 2.4 million cubic metres. Approximately 274 piles would be required to construct Stage 1 of the wharf and jetty.	Not preferred: The cost benefit of this alternative could not be realised.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** The length of the Port jetty and dredge channel has been optimised taking into consideration the trade-off between jetty length and dredging volumes.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** The same construction processes and mitigation measures would be adopted for this alternative. Constructing a longer jetty would not substantially reduce the dredging volumes as the depth increases rapidly over the first 500m from shore (between the shore and the berth pocket) and thereafter increases more gradually. A longer jetty would increase the number of piles and the energy requirements for conveying product bauxite.
Listed Migratory Species	***Negligible Impact*** The length of the Port jetty and dredge channel has been optimised taking into consideration the trade-off between jetty length and dredging volumes.	***Negligible Impact*** The same construction processes and mitigation measures would be adopted for this alternative. Constructing a longer jetty would not substantially reduce the dredging volumes as the depth increases rapidly over the first 500m from shore (between the shore and the berth pocket) and thereafter increases more gradually. A longer jetty would increase the number of piles and the energy requirements for conveying product bauxite.
Justification for the preferred alternative • The preferred alternative would have no greater impact on the applicable controlling provisions than the other alternative assessed. • The length of the Port jetty and dredge channel has been optimised taking into consideration the trade-off between jetty length and dredging volumes. In the case of the proposed Port, constructing a longer jetty would not substantially reduce the dredging volumes as the depth increases rapidly over the first 500m from shore (between the shore and the berth pocket) and thereafter increases more gradually. A longer jetty would increase the number of piles and the energy requirements for conveying product bauxite.		

Table 3-17 Alternatives for the Port

	Port for Capesize and Panamax/DPPV	Port for Panamax / DPPV Only
Technical/ Operational Feasibility	Under Consideration: Maximises access to markets. More efficient transport to export markets resulting in lower transport costs.	Under Consideration: Reduces capital cost associated with the initial construction of the Port, but increases transport costs for export during operations.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***No Impact (Terrestrial Species)*** Compared to the smaller vessel alternative, this alternative would require an increased dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for greater impact (although still minor) on threatened marine fauna, as a result of the increased dredging.	***Minor Impact (Estuarine and Marine Species)*** ***No Impact (Terrestrial Species)*** Compared to the large vessel option, would require a smaller dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for less impact (although still minor) on threatened marine fauna, as a result of reduced dredging; however, the use of smaller vessels means that there would be more vessel movements.
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** Compared to the smaller vessel alternative, this alternative would require an increased dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for greater impact (although still minor) on migratory marine fauna, as a result of the increased dredging.	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** Compared to the large vessel option, would require a smaller dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for less impact (although still minor) on migratory marine fauna, as a result of reduced dredging.
Commonwealth Marine Areas	***Negligible -Minor Impact*** Compared to the smaller vessel alternative, this alternative would require an increased dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for greater impact on the Commonwealth marine area, as a result of the increased dredging. However, the use of larger vessels means that there would be fewer vessel movements through Commonwealth marine areas during operations compared to the other alternative.	***Negligible-Minor Impact*** Compared to the large vessel option, would require a smaller dredge footprint, dredge depth, dredge volume and dredging duration. Would be likely to have the potential for less impact (although still negligible-minor) on the Commonwealth marine area, as a result of reduced dredging. However, the use of smaller vessels means that there would be more vessel movements through Commonwealth marine areas during operations compared to the other alternative and higher energy usage due to less efficient shipping.
Justification of alternatives for consideration: • Neither alternative under consideration would have a significant impact on the applicable matters of NES. Therefore whichever alternative is chosen would have a similar impact on matters of NES. • A larger vessel capacity would maximise access to markets and result in more efficient transport of ore.		

Table 3-18 Alternatives for Location of Anchorage Area

	Existing Anchorage Area for the Port of Weipa (refer Figure 3-8 for location)	**Alternative - Area close to proposed Port**
Technical/ Operational Feasibility	Preferred: This is the preferred arrival and anchorage area as indicated by the Regional Harbour Master. This location is closer to customs and quarantine services at the existing Port of Weipa. The emergency anchorage area is at the discretion of the Regional Harbour Master. It would be north of the port and in at least 20m of water.	Not Preferred: Not the preferred arrival and anchorage area as indicated by the Regional Harbour Master. Proposed anchorage area (in Figure 2-9 of RTA 2011) was within preferred recreational fishing grounds.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***No Impact***	***No Impact*** Changing the location of the anchorage area would not change the potential impact on threatened marine species.
Listed Migratory Species	***Negligible Impact***	***Negligible Impact*** Changing the location of the anchorage area would not change the potential impact on migratory marine species.
Commonwealth Marine Areas	***Negligible -Minor Impact*** Outside Commonwealth marine area.	***Negligible -Minor Impact*** Potentially inside Commonwealth marine area.

Justification for the preferred alternative:

- The preferred alternative would have no greater impact on the applicable controlling provisions than the other alternative assessed.
- It is the preferred arrival and anchorage area as indicated by the Regional Harbour Master.
- It minimises overall impact on commercial and recreational fishing activities.
- It is currently used for anchorage and therefore reduces overall seabed disturbance.

Table 3-19 Alternative Locations for Barge and Ferry Terminals

	Barge Terminal Adjacent Existing Humbug Wharf and Ferry Terminal at Hornibrook Point	Combined Barge/Ferry Terminal Adjacent to Existing Humbug Wharf	Combined Barge/Ferry Terminal Adjacent to Existing Evans Landing Wharf	Combined Barge/Ferry Terminal at Hornibrook Point
Technical/ Operational Feasibility	Under Consideration: the shortest route for the ferry and hence the shortest travel time to the Hey River barge/ferry terminal and the least amount of energy used. The Humbug terminal is close to the main areas of cargo arrival (Humbug Wharf and Evans Landing).	Under Consideration: Although this would be a longer route for a passenger vessel and greater travel time to the Hey River barge/ferry terminal, less dredging would be required which would be more cost effective. There is less area available for parking in the immediate area of the Humbug terminal than at the Hornibrook terminal.	Not Feasible: Unsuitable due to the potential for significant interference with existing commercial and recreational boating and also would increase ferry travel time.	Not Preferred: Additional use of public roads by heavy vehicles would be required if the barge terminal was located at Hornibrook Point. The area is much shallower and would require more dredging which would increase the cost.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**			
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** The potential impacts on threatened marine and estuarine fauna would be similar for all terminal locations.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Flora Species)*** ***Negligible Impact (Terrestrial Fauna Species)*** The potential impacts on threatened marine and estuarine fauna would be similar for all terminal locations. If the facilities were co-located at Humbug Wharf, a small amount of vegetation clearing may be required.	Assessment not required as not feasible	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** The potential impacts on threatened marine and estuarine fauna would be similar for all terminal locations.
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** The potential impacts on migratory marine fauna would be similar for all terminal locations.	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** The potential impacts on migratory marine fauna would be similar for all terminal locations. If the facilities were co-located at Humbug Wharf, a small amount of vegetation clearing may be required; however, the Frigatebird roost habitat would not be impacted.	Assessment not required as not feasible	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** The potential impacts on migratory marine fauna would be similar for all terminal locations.

Justification of alternatives for consideration:

- The location at Evans Landing was unsuitable due to the potential for significant interference with existing commercial and recreational boating and also would increase ferry travel time.
- The Humbug barge terminal would be located adjacent to the existing Humbug Wharf, which is where the regular barge service from Cairns docks. Large machinery and supplies arriving by barge from Cairns could be transported to the Project area without traversing public roads. Increased use of public roads would be required if the barge terminal was located at Hornibrook Point.
- Locating the ferry terminal at Hornibrook Point provides the shortest route and hence the shortest travel time to the Hey River barge/ferry terminal. This location also has the advantage of reducing interactions with vessels that support the existing operation.
- The potential impacts on threatened and migratory marine and estuarine fauna would be similar for all terminal locations. If the facilities were co-located at Humbug Wharf, a small amount of vegetation clearing may be required; however, the Frigatebird roost habitat would not be impacted. None of the options are likely to have a significant impact on threatened and migratory marine fauna.

Table 3-20 Alternative Locations for Tug Berths

	Tug Berths Co-Located at Hornibrook Terminal	Tug Berths located on jetty at Port during favourable weather and on swing moorings in Embley River during inclement weather	Tug Berths on the Jetty at the Port and a Breakwater Constructed	Tug Berths Constructed at Lorim Point
Technical / Operational Feasibility	Under consideration: Less dredging required than locating at Lorim Point.	Under consideration: No dredging required. Swing moorings would not be as accessible as permanent berths at the Hornibrook terminal.	Not Feasible: Significant capital cost required.	Not Preferred: More dredging required than for co-locating at Hornibrook terminal.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**			
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Less dredging is required if the tug berths are co-located at Hornibrook terminal rather than at Lorim Point.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** No dredging required. Swing moorings would be in the deepest part of the river near the passenger vessel transit route but the passenger vessel would be restricted in inclement weather. No seagrass would be impacted.	Assessment not required as not feasible	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** More dredging is required if the tug berths located at Lorim Point rather than co-located at Hornibrook terminal, although the residual impact on threatened marine species would still be minor.
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** Less dredging is required if the tug berths are co-located at Hornibrook terminal rather than at Lorim Point.	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** No dredging required. Swing moorings would be in the deepest part of river near the passenger vessel transit route but the passenger vessel would be restricted in inclement weather. No seagrass would be impacted.	Assessment not required as not feasible	***Negligible Impact (Avian)*** ***Negligible -Minor Impact (Non Avian)*** More dredging is required if the tug berths located at Lorim Point rather than co-located at Hornibrook terminal.

Justification for the preferred alternative:

- The preferred alternative would have no greater impact on the applicable controlling provisions than the other alternatives assessed.
- Less dredging is required if the tug berths are co-located at Hornibrook terminal rather than at Lorim Point.
- No dredging required if swing moorings are used; however swing moorings would not be as accessible as permanent berths at the Hornibrook terminal.
- Large capital cost if tugs are berthed at the proposed Port.

Table 3-21 Alternatives for Disposal of Dredged Material from the Port

	Disposal at Proposed New Spoil Ground	**Reuse for Beach Nourishment and Land Creation**	**Removal of Hazardous Constituents and off-Site Recycling**	**Disposal on Land**	**Disposal at the Existing Albatross Bay Spoil Ground**	**No Dredging**
Technical / Operational Feasibility	Preferred: Sediments have been assessed as suitable for sea disposal. The material would only be required to be barged half the distance than to the existing Albatross Bay spoil ground, which reduces costs.	Not Preferred: Poor environmental outcome.	Not Feasible: Although there are no hazardous materials to be removed, beneficial reuse opportunities do not exist. Material to be dredged is not suitable for recycling.	Not Preferred: Would require the construction of a large containment facility.	Not Preferred: Would require the material to be barged twice the distance than the proposed new spoil ground which is cost prohibitive.	Not Feasible: Due to the length of the structures for the Port, dredging is required to create sufficient depth in order to achieve the required draft.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**					
Listed Threatened Species and Ecological Communities	***Negligible Impact (Estuarine and Marine Species)*** ***No Impact (Terrestrial Species)*** Ocean disposal of marine sediments is likely to present a lower risk to the marine environment than land disposal would present to the terrestrial environment. Impacts on threatened marine and estuarine fauna would be the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.	***High Impact (Marine Turtles)*** ***No Impact (All other Threatened Species)*** Placement of dredged material on the beach would impact marine turtles' ability to nest and may reduce the viability of nests through constant inundation of water through dewatering.	Assessment not required as not feasible	***Moderate Impact (Terrestrial Flora)*** ***No Impact (All other Threatened Species)*** If the material was pumped ashore, the dewatering process could adversely affect a shallow, low-yield aquifer via infiltration of saline seepage through the porous coastal soils. The revegetation of a large elevated emplacement of marine sediments would pose difficulties and would be likely to require long-term maintenance. These impacts have not been fully assessed as this was not the preferred option.	***Negligible Impact (Estuarine and Marine Species)*** ***No Impact (Terrestrial Species)*** Ocean disposal of marine sediments provides a lower risk to the marine environment than land disposal. Impacts on threatened marine and estuarine fauna would be the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.	Assessment not required as not feasible
Listed Migratory Species	***Negligible (Avian)*** ***Negligible Impact (Non Avian)*** Ocean disposal of marine sediments is likely to present a	***High Impact (Marine Turtles)*** ***Negligible Impact (All other Threatened***	Assessment not required as not feasible	***Negligible Impact***	***Negligible Impact (Avian)*** ***Negligible Impact (Non Avian)*** Ocean disposal of marine sediments in a marine	Assessment not required as not feasible

	Disposal at Proposed New Spoil Ground	Reuse for Beach Nourishment and Land Creation	Removal of Hazardous Constituents and off-Site Recycling	Disposal on Land	Disposal at the Existing Albatross Bay Spoil Ground	No Dredging
	lower risk to the marine environment than land disposal would present to the terrestrial environment. Impacts on migratory marine fauna would be the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.	*Species)* Placement of dredged material on the beach would impact marine turtles' ability to nest and may reduce viability of nests through constant inundation of water through dewatering.			environment provides a lower environmental risk than land disposal. Impacts on migratory marine fauna would be the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.	
Commonwealth Marine Areas	*Negligible -Minor Impact*	*Negligible -Minor Impact* Not in Commonwealth marine areas.	Assessment not required as not feasible	*Negligible Impact* Not in Commonwealth marine areas.	*Negligible -Minor Impact* Not in Commonwealth marine areas.	Assessment not required as not feasible

Justification for the preferred alternative:

- The preferred alternative would have no greater impact on the applicable controlling provisions than the Albatross Bay spoil ground alternative and less impact than the other two alternatives assessed.
- The re-use of material for beach nourishment is not considered appropriate given that the beach area is a known nesting area for marine turtles. Placement of dredged material on the beach would impact marine turtles' ability to nest and may reduce viability of nests through constant inundation of water through dewatering. Peer-reviewed literature documents negative impacts on marine turtles from beach nourishment activities. Using the material for land creation is considered inconsistent with the use of the area by marine turtles for nesting.
- The material to be dredged is not suitable for construction material. The material from the Port area is comprised of a relatively thin layer of sandy silts on at the surface overlying stiff clays and underlying siltstone. Material beneficial for offsite recycling typically requires relatively clean sands. Beneficial re-use opportunities do not exist.
- If the material was pumped ashore, the dewatering process could adversely affect a shallow, low-yield aquifer via infiltration of saline seepage through the porous coastal soils. The shallow aquifer currently sustains baseflow in surface streams in the area. This water has very low salinity levels. Saline seepage from the marine sediment could adversely impact water quality. The disposal of dredged spoil to land would require construction of a suitable containment facility to store the material to minimise potential for impact on water quality. Awaiting construction of the containment facility would prevent commencement of dredging activities for some months, subsequently delaying the construction of the Port, which is on the critical path for construction of the Project. The revegetation of a large elevated emplacement of marine sediments would pose difficulties and would be likely to require long-term maintenance.
- Placement of the spoil from the Port area at the Albatross Bay spoil ground would require the material to be barged about twice the distance than to the proposed new spoil ground. This would require at least three hopper dump barges and contractors' dredging spreads do not typically extend to that number of barges, particularly in such a remote area. If a suitable contractor was found then the costs would be significantly greater. If three hopper dump barges could not be secured, the dredging and sea disposal timeline would increase, potentially extending persistence of turbid conditions.
- Ocean disposal of marine sediments is likely to present a lower risk to the marine environment than land disposal would present to the terrestrial environment, due to: using the material for beach nourishment or land disposal is inconsistent with the use of the area by marine turtles; disposal on land could adversely affect water quality in the shallow aquifer; and revegetation of marine sediments would pose difficulties.

Table 3-22 Alternatives for Disposal of Dredged Material from the Barge/Ferry Terminals and Tug Berths

	Disposal at the Existing Albatross Bay Spoil Ground	**Disposal on Land**	**Removal of Hazardous Constituents and Off-Site Recycling**	**No Dredging**
Technical/ Operational Feasibility	Preferred: Sediment has been deemed suitable for ocean disposal. Dredged sediment is currently transported from the Port of Weipa to the Albatross Bay spoil ground.	Not preferred: However if dredge volumes decrease following detailed design, improved relative cost of land disposal and potentially reduced environmental impact may improve the feasibility of this option. Due to small volumes, dredged sediment could be piped to an on land containment facility at a lower cost than barge transport. Would require additional impact assessment and regulatory approvals (impact to construction schedule) as well as the construction of a suitable containment facility.	Not Feasible: Although there are no hazardous materials to be removed, beneficial reuse opportunities do not exist. Material to be dredged is not suitable for recycling.	Not Feasible: A large volume of reclaim or additional piling would be required if dredging was not carried out in order to achieve the required draft.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**			
Listed Threatened Species and Ecological Communities	***Negligible Impact (Estuarine and Marine Species)*** ***No Impact (Terrestrial Species)*** Ocean disposal of marine sediments is likely to present a lower risk to the marine environment than land disposal would present to the terrestrial environment. Impacts on threatened marine and estuarine fauna would be the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.	***Moderate Impact (Terrestrial Flora)*** ***Negligible Impact*** ***(All other Threatened Species)*** If the material was pumped ashore, the dewatering process could adversely affect a shallow, low-yield aquifer via infiltration of saline seepage through the porous coastal soils. The revegetation of an elevated emplacement of marine sediments would pose difficulties and would be likely to require long-term maintenance. These impacts have not been fully assessed as this was not the preferred option.	Assessment not required as not feasible	Assessment not required as not feasible
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible Impact (Non Avian)*** Ocean disposal of marine sediments in a marine environment provides a lower environmental risk than land disposal. Impacts on migratory marine fauna would be	***Negligible Impact***	Assessment not required as not feasible	Assessment not required as not feasible

	Disposal at the Existing Albatross Bay Spoil Ground	Disposal on Land	Removal of Hazardous Constituents and Off-Site Recycling	No Dredging
	the same whether the material is disposed at the proposed new spoil ground or the Albatross Bay spoil ground, although disposal at the proposed new spoil ground would require disturbance of a new area.			

Justification of alternatives for consideration:

- Disposal at the existing Albatross Bay spoil ground would have less impact on applicable listed threatened species than disposal on land. However, disposal at the Albatross Bay spoil ground would have a slightly greater impact on marine and estuarine species and migratory marine species than disposal on land.
- The material to be dredged is not suitable for construction material. The material from the barge and ferry terminals is comprised primarily of silty-clays. Material beneficial for offsite recycling typically requires relatively clean sands. Beneficial re-use opportunities do not exist.
- If the material was pumped ashore, the dewatering process could adversely affect a shallow aquifer via infiltration of saline seepage through the porous coastal soils. The shallow aquifer currently provides potable water to the existing Weipa operations. Saline seepage from the marine sediment could adversely impact water quality. The disposal of dredged spoil to land would require construction of a suitable containment facility to store the material to minimise potential for impact on the aquifer. At the Hey River location, the construction of such a facility would require the removal of some vegetation. At Humbug Wharf and Hornibrook Point, the construction of a containment facility may sterilise the site for a prohibitive period prior to development of the onshore terminal infrastructure, further the silty-clay dominated sediments may not be suitable for engineered use, especially in supporting heavy machinery. Awaiting construction of the containment facility would prevent commencement of dredging activities for some months, subsequently delaying the construction of the barge and ferry facilities. These facilities are on the critical path for construction of the Project. The revegetation of a large elevated emplacement of marine sediments would pose difficulties and would be likely to require long-term maintenance. However, if dredge volumes decrease following detailed design, these potential environmental impacts may be reduced, which may improve the feasibility of this option.
- Placement of the spoil from the river facilities at the proposed new spoil ground would require the material to be barged about twice the distance than to the Albatross Bay spoil ground. This would require at least three hopper dump barges and contractors' dredging spreads do not typically extend to that number of barges, particularly in such a remote area. If a suitable contractor was found then the costs would be significantly greater. If three hopper dump barges could not be secured, the dredging and sea disposal timeline would increase, potentially extending persistence of turbid conditions. Ocean disposal of marine sediments is likely to present a lower risk to the marine environment than land disposal would present to the terrestrial environment, as disposal on land could adversely affect water quality in the shallow aquifer; and revegetation of marine sediments would pose difficulties.

Table 3-23 Alternatives for Location of the Temporary Barge Landing Area near the Port

	200m to 400m North of Pera Head and South of the Proposed Port	**An Elevated Platform Type Jetty that Abuts the Bauxite Cliff Closer to the Proposed Port**	**Extend Barge Landing Area with Gabions or Pontoons to allow use at Low Tide**
Technical/ Operational Feasibility	Preferred – provides for wet weather access during initial construction if this occurs in the wet season, thus avoiding significant delay to the Project schedule.	Not Preferred: Would require significantly more piling than the option chosen and is therefore cost prohibitive for short term use.	Not Preferred: Would require more disturbance to the seabed (gabion option). Barge access has been designed to operate at high tides.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**		
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Significantly less piling would be required for this alternative than the elevated platform jetty, thus reducing underwater noise impacts on threatened marine and estuarine fauna.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** The elevated jetty option would be further away from culturally sensitive sites near Pera Head and hard and soft coral reefs at Pera Head; however, it would be a significantly larger structure which would require significantly more piles.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Significantly less piling would be required for this alternative than the elevated platform jetty, thus reducing underwater noise impacts on threatened marine and estuarine fauna.
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** Significantly less piling would be required for this alternative than the elevated platform jetty, thus reducing underwater noise impacts on migratory marine fauna.	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** The elevated jetty option would be further away from culturally sensitive sites near Pera Head and hard and soft coral reefs at Pera Head; however, it is a significantly larger structure which would require significantly more piles.	***Negligible Impact (Avian)*** ***Negligible-Minor (Non Avian)*** Significantly less piling would be required for this alternative than the elevated platform jetty, thus reducing underwater noise impacts on migratory marine fauna.

Justification for the preferred alternative:

- The preferred alternative would have no greater impact on the applicable controlling provisions than any other alternative assessed.
- Allows for the option of wet weather access during the initial construction phase if required, thus avoiding a significant delay to the Project schedule.
- The elevated jetty option would be further away from culturally sensitive sites near Pera Head and hard and soft coral reefs at Pera Head; however, it would require significantly more piling.
- Extending the barge landing area using gabions would require more disturbance to the seabed.
- The Traditional Owners have agreed with the preferred location of the temporary barge landing area.

Table 3-24 Alternatives for Location of the Temporary Passenger Jetty near the Port

	Temporary Passenger Jetty at Boyd Point	Temporary Passenger Jetty at Boyd Bay
Technical/ Operational Feasibility	Under Consideration – Feasibility is still being assessed.	Under Consideration – Feasibility is still being assessed.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Residual impacts would be similar regardless of the location of the temporary passenger jetty.	***Minor Impact (Estuarine and Marine Species)*** ***Negligible Impact (Terrestrial Species)*** Residual impacts would be similar regardless of the location of the temporary passenger jetty.
Listed Migratory Species	***Negligible-Minor (Non Avian)*** ***Negligible Impact (Avian)*** Residual impacts would be similar regardless of the location of the temporary passenger jetty.	***Negligible-Minor (Non Avian)*** ***Negligible Impact (Avian)*** Residual impacts would be similar regardless of the location of the temporary passenger jetty.

Justification of alternatives for consideration:

- The preferred alternative would have no greater impact on the applicable controlling provisions than the other alternative assessed.
- Both alternatives are being assessed as the feasibility of each option is still being assessed and the location is to be agreed with in consultation with Traditional Owners.

Table 3-25 Alternatives for Construction Camp Location

	Temporary Construction Camp near Boyd Bay	**Utilise Existing Housing in Weipa/Napranum**
Technical/ Operational Feasibility	Preferred: Would minimise daily travel times and avoid locating a temporary construction workforce within an established township.	Not feasible: There is insufficient housing in Weipa/Napranum to accommodate the full construction workforce.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Terrestrial Fauna Species)*** ***Negligible Impact (Estuarine, Marine and Terrestrial Flora Species)*** The proposed temporary construction camp has been located in a mineralised area that would be later mined. However clearing of potential habitat for some threatened terrestrial fauna species would be required.	***Negligible Impact*** Assessment not required as not feasible
Listed Migratory Species	***Negligible Impact (Non Avian)*** ***Negligible Impact (Avian)*** Clearing of potential habitat for some migratory avian species would be required.	***Negligible Impact*** Assessment not required as not feasible

Justification for the preferred alternative:

Although the preferred alternative would have a slightly greater mitigated impact on the applicable controlling provisions, the following points provide a justification of why this option is preferred.

- The proposed temporary construction camp has been located in a mineralised area that would be later mined.
- There would be insufficient existing housing in Weipa/Napranum to accommodate the full construction workforce; therefore, additional temporary accommodation would need to be constructed in Weipa/Napranum which would result in disturbance of similar flora and fauna habitat.
- The provision of temporary worker-only accommodation on-site would minimise daily travel times and avoid locating a temporary construction workforce within an established township. Neither option would be likely to have a significant impact on threatened and migratory fauna and threatened flora.

Table 3-26 Alternative Shipping Routes

	To Gladstone via the Torres Strait Shipping Route and Great Barrier Reef Inner Shipping Route	To Gladstone via the Torres Strait Shipping Route and Great Barrier Reef Outer Shipping Route
Technical/ Operational Feasibility	Preferred: This would minimise travel times and maintain the shipping route utilised by the existing operations.	Not preferred: Although the outer route is outside GBRMP, GBRWHA, and GBRNHP except on final turn to Gladstone and may minimise impact on these features, the travel time and consumption of fuel is higher than that for the inner route.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
World Heritage Properties	*Negligible Impact*	*Negligible Impact*
National Heritage Places	*Negligible Impact*	*Negligible Impact*
Listed Threatened Species and Ecological Communities	*Negligible Impact*	*Negligible Impact*
Listed Migratory Species	*Negligible Impact*	*Negligible Impact*
Commonwealth Marine Areas	*Negligible Impact*	*Negligible Impact* The outer route requires an additional 30 hours travel time than the inner route and would require additional time within the CMA.
Great Barrier Reef Marine Park	*Negligible Impact*	*Negligible Impact*

Justification for the preferred alternative:

- The inner route is the shortest and therefore most efficient route for ships carrying out coastal trading (i.e. moving from one Queensland Port to another). The outer route would require an approximately 30 hours additional travel time compared to using the inner route. Using the inner route therefore, also minimises fuel consumption and reduces the number of ships that are under sail at any one time.
- This inner route is the route used by current RTA shipping.
- The potential impact on matters of NES associated with shipping activities in the inner route were determined to be negligible and, given the regulatory requirements for the inner route, is unlikely to be significantly different to the outer route.
- All shipping would remain within the Designated Shipping Areas under the Great Barrier Reef Zoning Plan (which is subject to strict regulation including safety and pollution prevention response).

Table 3-27 Water Supply Alternatives

	Dam C on Norman Creek	Dam C on Norman Creek and Dam on the Ward River	Pumping Water via a Pipeline from Weipa	Desalinisation of Seawater	Sole Reliance of Artesian Borefield
Technical / Operational Feasibility	Preferred: Most feasible in relation to cost, sustainability, reliability, addressing local community concerns and environmental impacts.	Not Preferred: Would require more disturbance than single, larger Dam C, more community / cultural heritage concerns, changed flow in the Ward River.	Not Preferred: Cost prohibitive. Supply constraints during the dry season.	Not Preferred: Cost prohibitive	Not Feasible: Bauxite cannot be washed with 100% artesian water.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**				
Listed Threatened Species and Ecological Communities	***Minor Impact (Terrestrial Species)*** ***Negligible Impact (Estuarine and Marine Species)*** Would require the disturbance of potential habitat for threatened terrestrial flora and fauna species, although disturbance would be less than also constructing a dam on the Ward River.	***Minor Impact (Terrestrial Species)*** ***Negligible Impact (Estuarine and Marine Species)*** This alternative would involve a greater total area of disturbance of potential habitat for threatened terrestrial flora and fauna species than the construction of Dam C only.	***Minor Impact (Terrestrial Species)*** ***Negligible Impact (Estuarine and Marine Species)*** Disturbance of potential habitat for threatened terrestrial flora and fauna species may be required for the >40km pipeline route.	***Minor Impact*** Potential minor impacts on threatened marine and estuarine fauna associated with brine disposal. These impacts have not been fully assessed as this was not the preferred option.	Assessment not required as not feasible
Listed Migratory Species	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** Would require the disturbance of potential habitat for avian migratory species, although disturbance would be less than also constructing a dam on the Ward River.	***Negligible Impact (Avian)*** ***Negligible-Minor Impact (Non Avian)*** This alternative would involve a greater total area of disturbance of potential habitat for avian migratory species than the construction of Dam C only.	***Negligible Impact (Avian)*** ***Negligible Impact (Non Avian)*** Disturbance of potential habitat for avian migratory species may be required for the >40km pipeline route.	***Minor Impact (Non Avian)*** ***Negligible Impact (Avian)*** Potential minor impacts on migratory marine fauna associated with brine disposal. These impacts have not been fully assessed as this was not the preferred option.	Assessment not required as not feasible

Justification for the preferred alternative:

- The preferred alternative would have no greater impact on the applicable controlling provisions than any other alternative assessed.
- Unlike the Weipa Peninsula, the Project area does not have a high-yielding shallow aquifer. The principal sources of supply are therefore restricted to recycled water from TSFs, surface water from

streams, and deep artesian groundwater. The wide range of supply combinations utilising various proportions of these sources was investigated. Surface water supply options encompassed both dams and direct pumping from flowing streams. Nine dam site options in the Norman Creek catchment were evaluated, along with two in the Ina Creek catchment and four in the Ward River catchment. Following consideration of cost, sustainability, reliability, cultural heritage impact, local community concerns and the environment, the following principal supply sources have been adopted: tailings water recycle, water supply dam (Dam C), and artesian; with a small volume of direct pumping from the Ward River to supplement supplies when production exceeds 30Mdtpa. • One water supply sub-option considered involved constructing a smaller single stage of Dam C only and constructing a second dam on the Ward River. This sub-option involved a greater total area of disturbance and was not the preferred approach of Traditional Owners. • The selected option of constructing one dam is likely to have less potential impact on threatened and migratory fauna and threatened flora, compared to the sub-option of constructing two dams, because one dam would require less vegetation clearing.

Table 3-28 Alternatives for Beneficiation Plant

	Use of a Wet Beneficiation Plant	**Use of a Dry Beneficiation Plant**
Technical/ Operational Feasibility	Preferred: Technology is proven.	Not Feasible: Previous trials identified technical problems that could not effectively be solved.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	*Negligible Impact* The type of beneficiation plant chosen would not impact on threatened species.	Assessment not required as not feasible
Listed Migratory Species	*Negligible Impact* The type of beneficiation plant chosen would not impact on migratory species.	Assessment not required as not feasible
Justification for the preferred alternative: • The preferred alternative would have negligible impact on applicable controlling provisions. • Crude bauxite in the ground is a mixture of bauxite bearing pisolites (pea-shaped particles) locked in a matrix of finer materials including fine bauxite and clay. Energy is needed to break up the crude ore into pisolites and fine matrix material. A dry screening process would break up some of the large lumps but would not remove fine material adhering to pisolites. A substantial quantity of pisolites would also remain trapped in the matrix material and be rejected as oversize material by a dry screening plant, further eroding the value of the ore body. Comalco (now RTA) has previously investigated mobile in-pit dry beneficiation but found the plant was burdened with many technical problems which could not be effectively solved. In a wet beneficiation plant the crude bauxite is soaked with water to break-up lumps and this "pre-conditioned" ore is then washed over a screen to remove the fines. The amount of water needed to wash the fines from the bauxite pisolites varies depending on the quantity and type of fines. A "high dispersion energy" high fines content plant uses more water than a "low dispersion energy" plant. The SoE deposit has been assessed as a "low dispersion energy" ore grade. • Wet beneficiation is an efficient and reliable technology that has been proven throughout the world.		

Table 3-29 Alternatives for Tailings System

	Use of Thickened Tailings System	Use of Unthickened Tailings System
Technical/ Operational Feasibility	Not Preferred: Difficult to recover additional water reliably. Also requires the use of chemical flocculants and greatly increases the energy needed to pump the thickened tailings to the disposal area.	Preferred: Recycled water can be recovered from the tailings disposal facility.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	*Negligible Impact* The type of tailings system chosen would not impact on threatened species.	*Negligible Impact* The type of tailings system chosen would not impact on threatened species.
Listed Migratory Species	*Negligible Impact* The type of tailings system chosen would not impact on migratory species.	*Negligible Impact* The type of tailings system chosen would not impact on migratory species.
Justification for the preferred alternative: • The preferred alternative would have no greater impact on the applicable controlling provisions than the other alternative assessed. • The use of thickened tailings was also evaluated but not adopted. The same amount of water is used within the bauxite processing circuit regardless of whether there is a thickened or an unthickened tailings system. With a thickened tailings system, water is removed from the tailings stream for recycling before tailings are pumped in paste form to the TSF; it is difficult to recover additional water reliably from a thickened TSF. With an unthickened tailings system, all the recycled water is recovered from the tailings disposal facility. Overall, the effective water recovery is similar for both types of tailings systems; however, a thickened tailings system also requires the use of chemical flocculants and greatly increases the energy needed to pump the thickened tailings to the disposal area.		

Table 3-30 Power Supply Alternatives

	Generate Power Onsite using Diesel Fired Generators	Connect via a High Voltage Transmission Line to Existing Weipa Power Supply	Alternative Energy Supplies
Technical / Operational Feasibility	Preferred: Lower capital cost than connecting to existing Weipa power supply and would result in a more efficient operating system. Less vegetation clearing required than connecting to the existing Weipa power supply.	Not Feasible: Higher capital cost than generating power onsite and would result in a less efficient operating system. More vegetation clearing required than generating power onsite.	Not Feasible: Wave power not technically viable, wind and solar sources were not able to guarantee supply at minimum base load power and biomass not technically viable for low base load demand situations.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**		
Listed Threatened Species and Ecological Communities	***Negligible Impact*** The option of installing a 50km overhead power line to Weipa is likely to have a greater potential impact on flora and fauna habitat, compared to generating power on site, because additional vegetation clearing would be required.	Assessment not required as not feasible	Assessment not required as not feasible
Listed Migratory Species	***Negligible Impact*** The option of installing a 50km overhead power line to Weipa is likely to have a greater potential impact on flora and fauna habitat, compared to generating power on site, because additional vegetation clearing would be required.	Assessment not required as not feasible	Assessment not required as not feasible

Justification for the preferred alternative:

- The preferred alternative would have negligible impact on applicable controlling provisions.
- Connecting the Project via a high voltage transmission line to the existing Weipa power supply is the least reliable and least feasible, in part because the 3.5km wide Embley River estuary would have to be traversed by a high voltage line. In addition to the higher capital cost, line losses along the length of the 50km overhead power line would result in a less efficient operating system.
- Alternative energy supplies such as biomass, wind, solar and wave were considered. Wave power was not technically viable. Wind and solar sources were not able to supply guaranteed minimum base load power. Biomass was not technically viable for low base load demand situations (e.g. beneficiation plant not running, ship loaders not running).
- The option of installing a 50km overhead power line is likely to have a greater potential impact on flora and fauna habitat, compared to generating power on site, because additional vegetation clearing would be required. Neither of the options would be likely to have a significant impact on threatened and migratory fauna and threatened flora.

Table 3-31 Alternatives for Beneficiation Plant Location

	Located South of the Embley River	**Continued use of the Lorim Point Beneficiation Plant**
Technical / Operational Feasibility	Preferred: Continued use of the Lorim Point beneficiation plant would be cost prohibitive.	Not Feasible: This option would be cost prohibitive. Would require a new TSF to be established and a bridge to be constructed over the Embley River.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**	
Listed Threatened Species and Ecological Communities	***Minor Impact (Terrestrial Fauna Species)*** ***Negligible Impact (Estuarine, Marine and Terrestrial Flora Species)*** Clearing of potential habitat for some threatened terrestrial fauna species would be required.	Assessment not required as not feasible
Listed Migratory Species	***Negligible Impact (Non Avian)*** ***Negligible Impact (Avian)*** Clearing of potential habitat for some migratory avian species would be required.	Assessment not required as not feasible
Justification for the preferred alternative: • The preferred alternative would have at the most a minor mitigated impact on applicable controlling provisions. • The continued use of the Lorim Point beneficiation plant to process ore mined from the SoE orebodies would require the crude ore to be transported on average more than 50km by conveyor or rail to the existing Lorim Point beneficiation plant, including over a 3.5km bridge spanning the Embley River estuary. Irrespective of the transport method selected, the cost of this system, including bridging the Embley River, proved to be cost prohibitive.		

Table 3-32 Alternatives for Access to the Project Area

	Passenger Vessel Transport Across the Hey/Embley Rivers	**Bridge Over the Embley River**	**Sealed road from Weipa to the Project site via the PDR and the Amban Access Road**	**Locating Operational Workforce South of the Embley River (on a Fly-in, fly out basis)**
Technical/ Operational Feasibility	Preferred: Travel times to the Project area are acceptable.	Not Feasible: Not economically feasible.	Not Feasible: Excessive daily commute travel times required.	Not Feasible: Not socially acceptable because RTA current provides significant support to the sustainability of the town of Weipa and this would not be maintained in a FIFO arrangement.
Applicable MNES Controlling Provisions	**Comparative Description of Mitigated Impacts**			
Listed Threatened Species and Ecological Communities	*Minor Impact (Estuarine and Marine Species)* *Negligible Impact (Terrestrial Flora Species)* *Negligible Impact (Terrestrial Fauna Species)*	Assessment not required as not feasible	Assessment not required as not feasible	Assessment not required as not feasible
Listed Migratory Species	*Negligible Impact (Avian)* *Negligible -Minor Impact (Non Avian)*	Assessment not required as not feasible	Assessment not required as not feasible	Assessment not required as not feasible

Justification for the preferred alternative:

- The SoE Project plans to use the existing workforce based in Weipa for operations. The workforce would transition from mining activities north of the Embley River to operations south of the Embley River.
- The sealed road was not feasible due to excessive daily commute travel times (2.5 hours each way)
- The bridge over the Embley River is the least economically feasible due to the high cost of bridging the 3.5km wide Embley River estuary.
- The barge and ferry terminals would be likely to have less potential impact on threatened and migratory fauna and threatened flora compared to the bridge, which would require additional vegetation clearing and piling.
- Locating the operational workforce in a camp south of the Embley river and transporting them on a fly-in, fly out basis is not socially acceptable as the existing town of Weipa would not be able to be sustained.

3.13 Project Avoidance Measures

3.13.1 Project Planning

The bauxite-bearing Weipa plateau supports *E. tetrodonta*, *Corymbia nesophila* tall woodland on deeply weathered plateaus (Regional Ecosystem (RE) 3.5.2). Of the vegetation that would be disturbed over the 40 year life of the Project, 99% is Darwin Stringybark woodland. The majority of listed threatened terrestrial flora and fauna species which possibly occur in the Project area occur in non-Darwin Stringybark vegetation communities, mainly the riparian gallery forest, and coastal and non-coastal vine thicket communities. All mining is proposed to occur within the Darwin Stringybark woodland and Project planning for infrastructure has aimed to minimise impact on non-Darwin Stringybark vegetation communities. These communities would only be cleared in the footprint of Dam C, watercourse crossings for access roads and conveyors, and at the Port.

3.13.2 SoE Environmental Buffers

The disturbance of sensitive environmental areas by mining would be avoided by the development of an environmental buffer system. The Queensland Government's *Regional Vegetation Management Code for Western Bioregions* provides recommended clearing set-back distances from watercourses and wetlands (DERM 2009b). In Cape York, the recommended minimum buffer distances from watercourses vary depending on stream order; from wetlands, they depend on the significance of the wetland. These buffer distances are:

- 50m buffer from each high bank of a watercourse with stream order one or two;
- 100m buffer from each high bank of a watercourse with stream order three or four;
- 200m buffer from each high bank of a watercourse with stream order five and above;
- 100m buffer from a natural wetland; and,
- 200m buffer from a natural significant wetland.

The above buffer distances have been included as a condition of approval by the Queensland Coordinator General (Queensland Government 2012). The proposed SoE environmental buffer system exceeds these regulatory requirements.

The SoE environmental buffer proposed system would comprise a methodology for determining set-back distances from sensitive vegetation types, rather than banks of watercourses and wetlands, and the preclusion of mining from within the designated buffers. The sensitive vegetation that would be buffered by Darwin Stringybark woodland would comprise the following vegetation types: riparian, wetland, estuarine, vine forest and coastal vegetation on sand (refer **Section 6.3.4.5**).

A variable environmental buffer system would be implemented that takes into account factors such as sensitive vegetation type, important locations of threatened flora and fauna, stream order and hydrology when determining buffer distances. In all cases the above Code requirements would be met or exceeded.

Typically, a buffer distance up to 200m would be adopted for vine forest, wetlands, estuaries, coastal vegetation on sand and riparian vegetation along watercourses of stream order three and above. Narrower buffer distances to a minimum of about 100m may be adopted for riparian vegetation along watercourses of stream order one and two, or where significant ecological attributes are absent and physical characteristics are such that a narrower buffer would still provide edge effect protection and filtering of surface runoff flows from disturbed areas.

A comparison of regulatory requirement and the proposed SoE environmental buffer system is presented in **Table 3-33**.

Table 3-33 Comparison of SoE environmental buffer system to regulatory requirements

Environmental feature	Regulatory Requirements*	SoE Buffer for Mining Areas
Stream order one of two	50m from high bank of watercourse	100m to 200m** from edge of riparian vegetation
Stream order three or four	100m from high bank of watercourse	100m to 200m** from edge of riparian vegetation
Stream order five an above	200m from high bank of watercourse	200m from edge of riparian vegetation
Natural wetland	100m from wetland	200m from edge of wetland vegetation
Natural significant wetland	200m from wetland	200m from edge of wetland vegetation
Tidal areas and marine plants***	200 metres of boundary of feature	200 metres of boundary of feature
Vine forest, coastal vegetation on sand, estuaries	Buffer not applicable	200m from edge of relevant vegetation type

* Specified in the Queensland Coordinator General's conditions for SoE Project and the Environmental Authority for ML7024.
** Set based on site specific factors following field survey.
*** Category B Environmentally Sensitive Area as defined by the *Environmental Protection Regulation 2008* (Qld).

Based on currently available information, the proposed SoE environmental buffer system would cover as a minimum approximately 17,346ha, which is 8,356ha more than that which would be required under regulatory requirements.

Surveys would be carried out to define the boundaries of mapped sensitive vegetation types in the field. The field surveys would be carried out prior to clearing for drill lines (which are typically established for detailed orebody definition) and prior to clearing ahead of mining. The surveys would also assess the location and stream order of any watercourses and the presence or absence of significant ecological features such as springs, aquatic refugia and threatened flora and fauna in and around the sensitive vegetation types.

Buffer distances would then be set and mapped based on the findings of the surveys and, where relevant, stream order. Establishment of the buffer distance and authorisation for clearing non-buffered areas would be managed through a ground disturbance approval process. RTA has committed to including the buffer system in the Land and Sea Management Program (LSMP) which is being developed in collaboration with Traditional Owners as part of the SIMP (RTA 2012).

The avoidance measures described above would effectively minimise the potential direct impacts of the Project on sensitive vegetation communities and waterways.

3.13.3 Water Supply Dam

One water supply sub-option considered involved constructing a smaller single stage of Dam C and constructing a second dam on the Ward River. This sub-option involved a greater total area of disturbance and was not the preferred approach of Traditional Owners.

3.13.4 Tailings Storage Facility Location

The Norman Creek TSF was moved from its original planned location onto an area that is predominantly within the 40 year mine plan. By locating some of the TSF footprints on mineralised areas rather than non-mineralised areas, the clearing of some vegetation has been avoided.

3.13.5 Offshore Anchorage Location

The location of the offshore anchorage location for the bulk carriers utilising the proposed Port was moved to the existing anchorage area for the Port of Weipa as it is the preferred anchorage area as indicated by the Regional Harbour Master. Moving the anchorage area to the existing anchorage area has reduced the area of commercial and recreational fishing grounds utilised by bulk carriers at anchor.

3.13.6 Construction Camp Location

The proposed temporary construction camp has been located in a mineralised area that would be later mined. This would result in the avoidance of clearing approximately 30ha of vegetation.

3.13.7 Temporary Barge Area Location

The temporary barge landing area near the Port was located to avoid culturally sensitive areas in the Pera Head area. The location chosen also avoids seagrass beds, live coral or and adjacent reefs.

3.13.8 Co-location of the Tug Berths adjacent to Hornibrook Terminal

The proposed relocation of the tug berths from Lorim Point to co-location at the Hornibrook Terminal would avoid dredging of approximately 37,580m^3 of material.

3.13.9 Power Supply

By generating power supply onsite, clearing of vegetation along a 50km power line easement to provide power from the existing Weipa power supply is avoided.

3.14 Consultation

3.14.1 Rio Tinto Approach

RTA's interaction with external stakeholders is guided by Rio Tinto's global code of business conduct, *The way we work*. The Rio Tinto Communities policy and Standards provide the framework (**Figure 3-15**), specific requirements and guidance in areas such as baseline communities assessment, consultation, social impact assessment, communities plans, partnerships and agreements.

Figure 3-15 Rio Tinto Community Framework

3.14.2 Current Weipa Operations

Mining and the transport of bauxite from Weipa to the Port of Gladstone has been occurring for over 40 years. In 2011, annual production at the current Weipa operations north of the Embley River was 20.6Mdpt. The current operation employs 1,024 Full Time Equivalent (FTE) employees.

Weipa has a long history as a mining town which is operated by RTA through the WTA, as there is a unique relationship between the mining operation and its activities imbedded in the Weipa community. The mining leases of the current operations are situated on Aboriginal land and neighbour the communities of Aurukun, Napranum, Mapoon and Weipa. RTA has strong relationships with surrounding Indigenous communities strengthened by the formal agreements that exist between the Traditional Owners and RTA that guide consultation and program development.

RTA Weipa has a dedicated Community Relations team that carry out regular consultation and oversee implementation of the following accountabilities:

- Indigenous agreement implementation;
- development and delivery of cultural awareness training programs;
- communications and external affairs;
- community investment programs;
- cultural heritage management;
- Indigenous business development;

- social risk analysis and management;
- communities, heritage and environmental impact assessment process; and,
- community and stakeholder engagement activities.

A number of roles within this team oversee consultation with communities and social impact related work for the Project. Upon confirmation of Project approvals, this team may be expanded.

3.14.3 SoE Consultation Approach

RTA has a long history of participation, communication and consultation on the Western Cape, with government and the broader community. Consistent with this, an extensive program of community consultation has been undertaken for the Project and would continue to be an important part of the approval process and throughout the life of the Project.

The following sections outline key communities and stakeholders, communication mechanisms, consultation phases undertaken and planned, issues and feedback received and the associated documentation available for the Project.

The following lists the objectives of the community consultation process for the Project:

- to identify stakeholders who have an interest in the Project;
- facilitate two-way engagement with stakeholders, providing accurate, timely and relevant information on the Project;
- identify any concerns or potential issues stakeholders may have with the Project;
- explore areas of the Project with the potential to have a positive impact on communities;
- develop appropriate strategies to mitigate any concerns; and,
- address stakeholder issues and concerns during the approvals process.

3.14.4 Communities

For the purpose of community consultation, the communities of interest were defined as the surrounding areas of the Western Cape region, including Aurukun, Napranum, Weipa and Mapoon. This region encompasses the members of the general public and the organisations (including Traditional Owners, government, industry, service providers, regional landholders and community groups) likely to be adversely or positively affected by the Project.

Traditional Owner families and individuals, whose traditional lands may be affected by the Project, were also identified. RTA's mining leases ML7024 and ML6024 (which includes the Project area), operate in accordance to the WCCCA. Land ownership and lease areas are highlighted in **Figure 3-16**.

3.14.5 Stakeholders

A scoping study was undertaken in 2008 to define the key stakeholders who would be potentially directly and/or indirectly affected by the Project or have a particular interest in an aspect of the Project. This list has been and will continue to be reviewed and expanded throughout the approval process and throughout the life of the Project.

The range of stakeholders and members of the general public provided with the opportunity to participate in the Project consultation process to date are summarised in **Table 3-34**

Figure 3-16 Western Cape York Peninsula Map of Indigenous Groups

Table 3-34 Stakeholder Groups

Category	Group
Government	State and Federal government-elected representatives State and Federal government agencies and service providers Cook, Aurukun, Napranum, Mapoon Aboriginal Shire Councils Northern Peninsula Area Aboriginal Council Great Barrier Reef Marine Park Authority Cape York Marine Authority Weipa Town Authority Regional Partnership Agreement Queensland Health – Cape York Health Services Queensland Police Department Department of Communities
Non-government organisations and local community groups	Cape York Land Council Community justice groups Cultural heritage bodies Cape York Sustainable Futures The Wilderness Society Other environment groups
Traditional Owners and Aboriginal groups	Wik and Wik-Way Traditional Owners whose traditional lands are directly impacted by the Project Other Traditional Owner groups across the Western Cape who are signatories to the Western Cape Communities Coexistence Agreement and Ely Bauxite Mining Project Agreement Western Cape Communities Trust and Coordinating Committee SoE Project Sub-Committee Ely Bauxite Mining Project Coordinating Committee
Industry, local business and service providers	Local businesses and service providers operating throughout the Western Cape region (Aurukun, Napranum, Weipa, Mapoon, Cairns) NQBP Weipa Chamber of Commerce Recreational and commercial fishing groups Tourism operators Cairns Chambers of Commerce Mareeba Chambers of Commerce Australia Zoo - Steve Irwin Wildlife Reserve Apunipima Cape York Health Services Western Cape Collage Aboriginal Australian Academy Koolkan Campus
General public and residents	Aurukun, Napranum, Weipa, Mapoon, New Mapoon (Northern Peninsula Area)
Regional landholders	Pastoral lease holders and managers, including: Merluna Station York Downs Station Watson River Station Batavia Downs Station Bertiehaugh Station – Steve Irwin Wildlife Reserve Bramwell Station Bramwell Junction Moreton Telegraph Station
Employees and contractors	RTA and local contractor employees based on the Western Cape

WCCCC

As a key stakeholder RTA has worked closely with the WCCCC throughout each Project consultation phase. In June 2009, RTA and the WCCCC agreed on a process whereby the Traditional Owners would obtain independent advice regarding the content of draft EIS chapters. This process involved RTA submitting draft chapters of the Queensland EIS (RTA 2011), WCCCC having these independently reviewed and providing recommendations back to RTA for response. RTA compiled responses to each of the recommendations and communicated these to the members of the SoE sub-committee (SoE-SC) and the WCCCC.

In late 2011 RTA compiled the responses and recommendations from this process into action plans contained in the draft SIMP that was released in February 2012 as part of the Queensland Supplementary EIS (SEIS) (RTA 2012). Since this time, RTA has continued to collaborate with the SoE sub-committee and WCCCC on refinement of the action plans in the SIMP, and on implementation of some of the key actions contained therein.

RTA has provided updates to the SoE sub-committee and WCCCC throughout the Commonwealth EIS process on its developments. RTA will continue to work collaboratively with the SoE sub-committee and WCCCC to ensure Traditional Owners are kept informed of the Commonwealth EIS process and can provide comment as necessary on the information provided by RTA to the Commonwealth.

3.14.6 Communication and Consultation Mechanisms

A number of communication and consultation mechanisms were utilised to meet the objectives of the consultation process for the Project. These include the following:

- existing forums;
- project DVD;
- project newsletters and feedback forms;
- fact sheets;
- freecall number;
- direct stakeholder contact, including telephone calls and face-to-face meetings;
- website;
- RTA employee communications;
- posters and banners;
- public information sessions;
- public displays;
- copies of the Queensland EIS and Executive Summary (RTA 2011);
- project email address;
- media releases; and,
- advertisements.

3.14.7 Publically Available Documentation

Many of the communication tools developed for the Project are publically available and can be accessed via the following links:

1. The South of the Embley page of Rio Tinto Alcan website which includes the final Commonwealth EIS and newsletters: http://www.riotintoalcan.com/ENG/ourproducts/1812_south_of_embley_project.asp
2. The Department of State Development Infrastructure and Planning (DSDIP) website which includes Initial Advice Statements, Coordinator General's report (Queensland Government 2012)

on the Queensland EIS (RTA 2011), SEIS (RTA 2012) including the draft SIMP: http://www.dsdip.qld.gov.au/assessments-and-approvals/south-of-the-embley.html

3. Department of Sustainability, Environment, Water, Population and Communities which includes the referral decision, the Tailored EIS Guidelines, the invitation to comment on the draft Commonwealth EIS and a link to the final EIS: http://www.environment.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referral_detail&proposal_id=5642

3.14.8 Public Consultation Summary

The proposed Project has been through an extensive public consultation process to identify the issues and discussion topics that have informed and shaped the development of mitigation measures. In addition to Project consultation that began in early 2008 and has continued throughout, formal opportunities for public comment commenced in January 2009 and have totalled 110 days.

During this period there have been a number of opportunities to publicly comment on the Project:

- invitation to comment on original Commonwealth EPBC referral (referral was withdrawn due to change to dredging in September 2010) (10 business bays – from 3 September to 17 September 2008);
- EIS draft Terms of Reference (20 business days – from 17 January to 16 February 2009)
- invitation to comment on current Commonwealth EPBC referral (10 business days – from 13 September – 27 September 2010);
- Queensland EIS public comment period (30 business days – from 1 August to 12 September 2011);
- Commonwealth reconsideration of controlled action decision (10 business days from 12 to 25 January 2012);
- Commonwealth EIS guidelines public comment (10 business days – from 6 June to 21 June 2012); and,
- Commonwealth public comment period (20 business days – from 22 November to 19 December 2012).

Consultation undertaken for the Project has been described in terms of Phase 1 – Initial Consultation and Phase 2 – Recent Consultation. The timing between the two is defined by the issuance of the reconsideration decision. These two phases of consultation are described in the following sections.

3.14.9 Phase 1 - Initial Consultation

Initial consultation, referred to as Phase 1, extended from 2008 to April 2012 and as per the earlier guidelines it included a period of public comment period from August to mid-September 2011 for the Queensland EIS (RTA 2011). A summary of the consultation in Phase 1 is outlined in **Table 3-35**. Further details of each consultation stage undertaken in Phase 1, has been presented in **Appendix 3-A**.

Table 3-35 Phase 1 – Initial Consultation

Stage	Period	Purpose	Key Activities
Pre Queensland EIS (RTA 2011) Public Comment Period (note: at this time, the EIS documentation was also being prepared for assessment under the EPBC Act)	Early 2008 to August 2011	• Stakeholder issue identification • Mitigation discussions • Development of a "tabular" SIMP within Queensland EIS (RTA 2011) • Regulatory consultation period on referral and Queensland EIS (RTA 2011) Terms of Reference	Some of the key activities of the stakeholder engagement programme are highlighted below: • Meetings, briefings and face to face (in excess of 70) • Workforce presentations (6) • Community forums (6) • Project site visits (2) • Workshops (2) • Scheduled and regular trips to Aurukun The public consultation period for the Project EPBC Act referral documentation was in September 2008 (original referral 2008/4435) and September 2010 (current referral 2010/5642). The public consultation period for the draft Terms of Reference for the EIS was January - February 2009 (note at that time the Project was to be assessed under a bilateral agreement). Comments on the adequacy of the draft EIS were provided by SDIP (against the Queensland Government Terms of Reference) and DSEWPaC (against the 2010 Tailored EIS Guidelines) and incorporated into the draft EIS prior to public exhibition.
Queensland EIS (RTA 2011) Public Comment Period	August 2011 to Mid Sept 2011	• Stakeholder review of the Queensland EIS (RTA 2011) • Public display of "tabular" the SIMP within the Queensland EIS (RTA 2011) • Receipt of 24 submissions	During the public comment period for the Queensland EIS (RTA 2011) published in 2011 RTA undertook a range of consultation activities as summarised below: • placed hardcopies at 12 locations for viewing (including Weipa (3 locations), Aurukun, Napranum, Mapoon, Bamaga, Cook, Brisbane, Canberra (2 locations)); • distributed 50 copies on CD ROM; • distributed Newsletter 4 to more than 2,000 stakeholders; • held public information sessions at Weipa (6), Napranum (4), Aurukun (4), Mapoon (1) and Bamaga (1); • held 2 community forums in Weipa and 1 each at Aurukun and Napranum; • held agency briefings in Canberra, Brisbane and Cairns and a site visit for regulatory agencies; and, • maintained the Project web site and 1800 free call number.
Post Queensland EIS (RTA 2011) Public Comment Period	Mid-September to Mid-March 2012	• Review of submissions • Follow up on technical matters • Development of the "stand-alone" SIMP and incorporation of feedback Queensland SEIS (RTA 2012) • Validation and further agency and local stakeholder engagement	Engagement post the public comment period included: • Meetings, briefings (35) • Presentations (1) • Workshops (1) • Correspondence (2) • Queensland SEIS (RTA 2012) distribution (~50) • Newsletter (1) The Queensland SEIS (RTA 2012), which responded to submissions, was provided to all those who had submitted comments during the public exhibition period. DSEWPaC provided comment on the Queensland EIS (RTA 2011) which has been addressed in this report.

3.14.10 Issues

The issues and opportunities of greatest significance identified and discussed with stakeholders during Phase 1 of consultation were:

- traffic/transport on the proposed new access road to the Project infrastructure;
- land and sea management;
- community consultation and engagement;
- employment, training and educational opportunities;
- breakdown in community cohesion associated with increases in alcohol and substance abuse, and escalating law and order problems;
- water supply dam construction, operational and closure impacts;
- opportunities for business development; and,
- workforce arrangements.

In addition, there were a number of other issues of importance raised by State and Commonwealth government departments and agencies in relation to the Project. These issues included:

- demographic changes;
- economic impacts on the local economy;
- housing and property values; and,
- cumulative impacts.

3.14.11 Stakeholder Submissions

During the Queensland EIS public comment period, 24 submissions were received from stakeholders (RTA 2012). RTA reviewed and responded to the submissions and refined the Project and plans where appropriate to address concerns raised.

The key issues and topics raised from the submissions received were:

- employment and training;
- land and sea management;
- transport between Aurukun and the Project site;
- local business;
- engagement;
- charter and commercial; and,
- broad social impacts.

3.14.12 Action Plans and SIMP

Issues and opportunities of high impact and interest raised by stakeholders during Phase 1- Initial Consultation were grouped into Action Plans to enable a focused and holistic approach to implementation. The Action Plans detail the impacts, performance goals, responsible parties, actions and performance indicators and implementation timeframes. The Action Plans are part of the SIMP which will be further refined from feedback received from Phase 2 – Current Consultation (refer **Appendix 3-B**). Many of the programs will be implemented via collaborative efforts and ongoing engagement with key stakeholders and utilise existing engagement groups and partnerships (refer **Appendix 3-D**).

3.14.13 Phase 2 - Recent Consultation

Phase 2 consultation extended from May 2012 to December 2012 and included the public comment period for the draft Commonwealth EIS. The stages and key activities during this phase are summarised in **Table 3-36**. Further details of the consultation undertaken to-date in Phase 2, has been presented in **Appendix 3-B**.

Table 3-36 Phase 2 – Recent Consultation

Stage	Period	Purpose	Key Activities
Pre Draft Commonwealth EIS Public Comment Period	Mid-March to October 2012	• Consultation on technical matters • Stakeholder Engagement Schedule included in the revised SIMP • Regulatory consultation period on Tailored EIS Guidelines	Consultation undertaken: • Meetings (44) • Informal meetings (9) • Workshops/Forums/Information sessions (10) • Site visits (6) • Display day (1) • Field camp (1) • Newsletter (1) • Fact sheet (1) • Correspondence (1) The revised Tailored EIS Guidelines were on public exhibition in June 2012.
Draft Commonwealth EIS Public Comment	22 November to 19 December 2012	• Identification and inclusion of any new interested parties • Stakeholder review of the draft Commonwealth EIS • Receipt of submissions	The approach for the public comment period was: • Community information sessions (one session in each Western Cape community, two for Weipa / Aurukun) (10) • Presentations to councils and community groups (5) • One on one meetings / briefings offered to~40 key stakeholders (~20+ accepted) • Public display of Commonwealth EIS hard copies 12) • Advertisements in The Australian, The Courier Mail, The Cairns Post, The Western Cape Bulletin (4) • Communication materials including newsletter, draft EIS summary document (provided at briefings, info sessions and available at Council offices in Western Cape) (~5 locations)
Post Draft Commonwealth EIS Public Comment Period	January 2013 throughout the life of the Project	• Review of submissions • Refine mitigations • Implementation of mitigations • Finalise management plans.	• Post public comment period Project engagement (refer **Appendix 3-B)** • Review On-going Stakeholder Engagement Schedule (refer **Appendix 3-C)** • Utilise existing forums (refer **Appendix 3-D)** • Establish Aurukun Office and new groups e.g. the SIMP steering committee and the Fishing Reference Group

3.14.14 Issues

The focus of Phase 2 consultation was to provide updates on the process and progress discussions on key issues and interest areas. The key issues raised in Phase 2 are summarised as follows:

- status of the Project and associated approvals;
- implications of shipping through the Great Barrier Reef;
- Cultural Heritage Protection and Management;

- Cultural Awareness Training;
- employment;
- Aurukun office;
- additional field survey work;
- fishing engagement and compensation;
- socio-economic study; and,
- SIMP status.

3.14.15 Draft Commonwealth EIS Public Comment Period

During the draft Commonwealth EIS public comment period, RTA undertook a comprehensive consultation program that included a range of activities such as community information sessions, presentations, briefings, public display of the draft EIS and invited written submissions (refer **Table 3-36**). Advertisements were placed in newspapers which provided an opportunity for any new stakeholders to become involved in the process.

3.14.15.1 Stakeholder Submissions

During the draft Commonwealth EIS public comment period, four submissions were received from stakeholders. The key issues and topics raised in these submissions were:

- access for commercial and recreational fishermen;
- economic impacts on commercial and recreational fishing businesses as well as compensation;
- potential impacts on fisheries habitats;
- potential economic impacts of closure;
- shipping through the GBR, including shipping numbers, cumulative impacts and spill modelling;
- assessment of potential underwater noise impacts;
- potential impacts on sea snakes in the Hey and Embley Rivers;
- clearing of *Eucalyptus tetradonta* woodland;
- potential impacts associated with water use;
- rationale for the proposed environmental buffers; and,
- potential impacts on the marine turtle nesting beach.

All submissions have been reviewed and where appropriate refined mitigation and management measures included in this document. A summary of the submissions and responses is provided in **Appendix 2-D**.

3.14.16 On-going Stakeholder Engagement Strategy

To ensure a high level of awareness, input, collaboration, participation and monitoring RTA would review and continue to implement a comprehensive Ongoing Stakeholder Engagement Schedule (refer **Appendix 3-C**) for the Project that would:

- include a range of communication mechanisms used throughout the Project to ensure accessibility of information and involvement to a wide audience;
- continue to utilise existing engagement forums to ensure a coordinated approach to programme development (refer **Appendix 3-D**); and,
- leverage new forums and key engagement mechanisms to support implementation and monitoring of mitigation measures and management plans.

Some of the new forums and key external engagement mechanisms specific to the Project include the Aurukun Office, the existing WCCCA processes, a local recreational fishing reference group and the SIMP Steering Committee.

RTA Community Office in Aurukun

RTA is working collaboratively with Aurukun Shire Council to establish a permanent office in Aurukun to coordinate Project activities and ensure an appropriate and accessible presence in Aurukun. The office would also facilitate improved communications and collaboration as well as timely updates on Project developments, progress on the implementation of mitigation measures and to ensure it keeps abreast of emerging issues. The Aurukun Office would provide the key interface that would support the CHEMP and LSMP Action Plans as well as local employment initiatives.

The WCCCC and SoE Sub-Committee

The WCCCC and SoE sub-committee will continue to provide a key mechanism for consultation between RTA and Traditional Owners and implementation of the SIMP. At the conclusion of the approvals process for the Project, the WCCCC will decide whether there is a need to continue the SoE sub-committee, in addition to the existing sub-committees that operate for the current Weipa operations. Progress reports and forward looking plans on all activities associated with the Project, including heritage surveys and development of management plans, Traditional Owner consultation and engagement activities, drilling programs and ongoing environmental work, will continue to be submitted for consideration at least quarterly to the SoE sub-committee until a decision is made. Formal recommendations are forwarded to the WCCCC for endorsement prior to implementation.

Local Recreational Fishing Reference Group

RTA will support the establishment of a local recreational fishing reference group to provide a forum to develop and help implement the establishment of a communities fisheries project (which may take the form of new or upgraded infrastructure or studies or management measure). The reference group will comprise representatives from charter operators and the Weipa Sportsfishing Club and will operate by consensus.

SIMP Steering Committee

To ensure an ongoing focus on SIMP implementation, a SIMP Steering Committee would be established in Weipa to monitor and guide progress of identified actions. Existing engagement forums would be utilised to support collaborative implementation and regular structured reporting. Further broader community engagement would also ensure RTA keeps abreast of emerging local issues, and is able to share and accumulate knowledge with members of the community not engaged in other formal mechanisms.