

# Section 8

## Aquatic Ecology



## 8. AQUATIC ECOLOGY

### 8.1 Undescribed Species

Section 8.7.2 of the EIS provided details of an undescribed species of freshwater crab *Austrothelphusa* sp. being first recorded in 2008 from Winda Winda Creek (Site 9A, Figure 8-2). The crab was found during surveys undertaken for the EIS and sent to the Queensland Museum for identification. Assessment by the Queensland Museum identified that this possibly represents a new undescribed species (P. Davie Pers. Comm.). Further survey work in 2009 extended the species recorded range beyond the original record in Winda Winda Creek (to Sites 33 and 34, Figure 8-2) but not beyond the Winda Winda Creek catchment.

Section 8.8.3 of the EIS provides details of the find of a Mysid (shrimp) Crustacean from a littoral grab sample in the upper Ward estuary which was tentatively identified by macro invertebrate taxonomists, including the senior curator of Crustacea at the Queensland Museum, as belonging to the family Lepidomysidae. This Family is also generally known to be stygofauna (groundwater/cave dwelling organisms), although they can occur in brackish water away from caves. Its appearance in a grab sample may suggest the upper estuary sample site was in a groundwater upwelling location, as upwellings are common in the upper estuary, and such an upwelling would be a likely habitat for a stygobiont able to survive in open water.

Specific assessment of potential impacts on instream habitats (including habitats utilised by *Austrothelphusa* sp.) and the shallow aquifer, along with mitigation measures, are presented in Section 8.14 of the EIS regarding potential alteration of catchment hydrology and Section 8.15 of the EIS regarding potential elevation of sediment loads in catchment runoff. Section 8.14.1 of the EIS assesses results of hydrological modelling and concludes that mining impacts to catchment surface and groundwater hydrology are unlikely to significantly alter catchment discharge volumes but may alter stream flow durations in either direction, depending on the partitioning of incident rainfall in each individual catchment or reach. Any such bias would be overlain on any natural patterns of variability in rainfall and flows. The net changes are anticipated to be relatively small and neutral in terms of ecological values at the catchment scale, although detectable changes may occur at the reach scale. While the changes may be directional over the life of the mine they are expected to occur at a rate within the range of the inter-decadal variability currently experienced by these systems and to largely rebound following the rehabilitation of mature vegetation cover post mining. Aquatic ecosystem impacts are expected to be neutral at a catchment scale.

Section 8.14.1 of the EIS discusses the shallow groundwater bore monitoring results which indicate the potential for mining-related alteration of catchment hydrology within the Project area is limited since fluctuations in groundwater levels, including rises through the wet season, only occasionally reach or exceed planned mine pit floor levels (refer Figure 5-26 to Figure 5-29, Table 5-23 of the EIS). Consequently, the removal of bauxite from the lateritic profile would have limited potential impact on the storage volume and residence time of the seasonal shallow groundwater aquifers that provide habitat for the shrimp species and contribute to stream base flow via discharge from the lateritic profile.

The impact mitigation measures proposed for the Project are expected to protect aquatic biota, including the unidentified species of freshwater crab and stygofauna.

The Queensland Museum and RTA have agreed to undertake additional surveys at the end of the 2012 wet season for these species. This will involve revisiting the original locations and surveying additional locations in the Western Cape with similar features. The proposed surveys will include:

1. Freshwater Crab:
  - a. Survey locations to be selected to confirm wider distribution of the species:
    - i. Winda Winda Creek; and
    - ii. Upper reaches of the Coconut and Norman Creek catchments which are adjacent to the upper reaches of the Winda Winda Creek catchment.
    - iii. Andoom area creeks.
  - b. Methods to include:
    - i. Box traps set overnight, and
    - ii. Back pack electroshocker.
2. Mysid Shrimp species:
  - a. Survey location to be selected to confirm wider distribution of the species:
    - i. In groundwater upwelling's within Ward River, Norman Creek, Winda Winda Creek and Andoom area creeks.
  - b. Methods:
    - i. Trawling, and
    - ii. Push dip netting.

Winda Winda Creek would be protected from mining by an environmental buffer. The sensitive vegetation to be buffered by Darwin Stringybark woodland would comprise the following vegetation types: riparian, wetland, estuarine, vine forest and coastal vegetation on sand. The relevant vegetation units and equivalent REs are listed in Table 7-11 of the EIS.

The buffer system would exceed the minimum requirements of the Queensland Government's *Regional Vegetation Management Code* as they relate to 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.

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.

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 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 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.

The management strategies proposed in the EIS to protect aquatic ecosystems would be sufficient to minimise impact to the unidentified species.

## 8.2 Fish Passage Requirements at Dam C

DEEDI noted in their EIS submission that fish will be attracted to environmental releases below the dam and will be vulnerable to entrapment, stranding, high levels of predation and harvest in this area. In consultation DEEDI FQ raised that the curtailment of the recessionary downstream flow was also a potential concern for the fish community at the Dam C catchment. Further assessment of the movement requirements for species recorded at the Dam C catchment to that presented in Section 8.16.2.1 of the EIS considered these concerns in regards to maintenance of the species populations.

**Section 5.3** identifies that Dam C will continuously spill during the wet season with potential to extend the duration of flow to some extent. An environmental release regime is proposed until October each year when the creek generally ceases flow (see Section 8.14.2.1 of the EIS). An extension of this spillway discharge would potentially reduce both the curtailment of the recessionary downstream flow and the requirement for a separate environmental release from the dam during non-spill periods.

Nine fish species were recorded within freshwater reaches of the proposed Dam C catchment area with an additional four fish species recorded from tidally influenced freshwater reaches downstream of the proposed Dam C (see **Table 8-A**). The majority (7 of 9) of species recorded from the freshwater reaches of the proposed Dam C catchment are potadromous (seasonally migrate but wholly within freshwater) or sedentary (breed and recruit within home reaches). Catadromous (estuarine/marine breeding freshwater residents) species were recorded in low densities and primarily in the lower reaches. A full discussion concerning the composition of freshwater fish communities recorded from drainages of the SoE area is presented in Section 8.7.1 of the EIS. A key point from a consideration of fish passage needs perspective is the generally depauperate nature of the communities from freshwater reaches in terms of overall species richness, the complete absence of species of otherwise ubiquitous families (i.e. *Gobiidae* and *Therapontidae*), and the low number and abundance of catadromous species.

**Table 8.A Dam C Catchment Fish Species**

<b>Fish Species</b>	<b>Movement Requirement/Classification</b>
Species recorded from freshwater reaches	
Mouth almighty <i>Glossamia aprion</i>	Sedentary
Poreless gudgeon <i>Oxyeleotris nullipora</i>	Sedentary
Empire gudgeon <i>Hypseleotris compressa</i>	Catadromous/Facultative amphidromous
Tarpon <i>Megalops cyprinoides</i>	Catadromous
Black-banded Rainbowfish <i>Melanotaenia nigrans</i> .	Potadromous
Chequered Rainbowfish <i>Melanotaenia splendida inornata</i>	Potadromous
Black catfish <i>Neosilurus ater</i>	Potadromous
Hyrtl's tandan <i>Neosilurus hyrtl</i>	Potadromous
Swamp eel <i>Ophisternon bengalense</i>	Unknown, possibly sedentary.
Species recorded from tidally influenced freshwater reaches	
Banded scat <i>Selenotoca multifasciata</i>	Marine vagrant
Sailfin glass perchlet <i>Ambassis agrammus</i>	Potadromous
Barramundi <i>Lates calcarifer</i>	Catadromous
Mangrove jack <i>Lutjanus argentimaculatus</i>	Catadromous

For many potadromous species from the seasonal tropics of Australia including those listed for Norman Creek, upstream movement is commonly associated with both flow initiation and subsequent flow pulses through the annual wet season (Pusey *et al.* 2004). Flow initiation in Norman Creek is seasonal and stream flow is maintained over the wet season and into the following dry season. Although onset of flows is delayed following construction of Dam C (refer to Section 5.2.3 of the EIS) the natural movement cue at initiation of flow would not be impacted. It is predicted that populations of potadromous species above and below Dam C will be maintained by:

- i. local reach habitat resources and breeding;
- ii. upstream migration past the proposed dam in the case of lower reach populations; and
- iii. downstream movement of adults and juvenile recruits from upper catchment populations.

Even a limited level of upstream movement of these species is likely to be sufficient to maintain the genetic viability of upstream populations (Vucetich and Waite 2000). Upstream migration through the spillway integrated fishway during the wet season spillway discharge is expected to be sufficient for lower reach populations however extension of the flow duration would be of further benefit.

Observations of environmental releases from recent monitoring programs at Ely Dam (in the Pine River catchment north of Weipa) show that some very small

schools (a maximum of hundreds of individuals) of potadromous rainbow fish, blue eyes and glass perch are present immediately around the outlet during environmental flow releases. However, breeding populations of these species are present in far greater numbers within the reservoir itself. The increased predation of these species during dry season recession of flows is a natural phenomenon within the seasonal streams of the project area and is considered to be inconsequential to the maintenance of populations of these species within the catchment.

Catadromous species which inhabit Norman Creek require substantive flows to facilitate migration. These species move primarily in the wet season when substantive flows are present. Substantive flows are not recorded in Norman Creek over the winter-dry season (see Figure 5-16 to 5-18 of the EIS). The spillway integrated fishway would therefore provide fish passage at the time when the system naturally experiences catadromous species migration. It is considered that this flow regime would meet the movement timing requirements for catadromous species recorded from reaches above the proposed dam site. Upstream movement opportunities for catadromous species currently only recorded from reaches below the dam site would also be provided including to the constructed lacustrine habitat that will be created by the proposed impoundment.

There is some likelihood that aggregations of one Catadromous species (Empire Gudgeon *Hypseleotris compressa*) may accumulate below the dam wall at the environmental release outlet prior to initiation of spillway flows. Such aggregations are

commonly observed for the species at natural and constructed fish passage barriers (Pusey *et al* 2004) and are unlikely to significantly affect population sustainability of this highly fecund species.

The three species identified as sedentary are by definition not recognised to have specific movement requirements or timing. However they have a widespread distribution through the seasonal drainage systems of the SoE area including upstream of reaches with higher gradient riffle run sequences e.g. upper Norman Creek and upper Ely Creek (Ecotone Environmental Services 2008).

The marine vagrant species (Banded Scat *Selenotoca multifasciata*) species recorded in tidally influenced lower freshwater reaches is considered unlikely to require fish passage at Dam C.

The ability of the freshwater species that occur in the Dam C catchment to move or spread within the environment is apparent from their distribution, published movement behaviours and observed utilisation of existing fishway designs. It is considered that all species would have the ability and opportunity to successfully utilise the fishway proposed for Dam C. The design process (see **Section 5.3**) would seek to minimise changes to the Norman Creek flow regime including limiting curtailment of the post wet season recessionary flow period and minimising environmental release during non-spill periods. The process will therefore aim to facilitate fish passage over a naturally broad range of flow regimes under all development scenarios in most years.

## Section 9

# Air Quality





## 9. AIR QUALITY

### 9.1 Ambient Air Quality

The DERM submission raised some queries regarding the ambient dust levels adopted for the assessment. Monitoring data from 2009 are summarised in **Table 9-1(sup.)**.

**Table 9-1(sup.) 24-Hour Average TSP and PM<sub>10</sub> Dataset Statistics (Nanum 2009)**

Statistic	TSP Concentration (µg/m <sup>3</sup> )	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> )	PM <sub>10</sub> to TSP Ratio
Mean	38.9	26.3	0.68
Standard Deviation	28.8	19.1	0.66
Median	34.4	22.1	0.64
Lower Quartile (25th Percentile)	22.0	14.8	0.68
Upper Quartile (75th Percentile)	46.6	33.3	0.71
90th Percentile (for entire year)	56.0	40.0	0.71
Minimum	6.0	6.0	1.0
Maximum	238.4	172.6	0.72

The predicted particulate concentrations at sensitive places close to the Project at the maximum production rate of 50Mdptpa have been revised based on an ambient level which is the 90<sup>th</sup> percentile of the 2009 monitoring data (refer **Table 9-7(sup.)**). Use of the 90<sup>th</sup> percentile is considered very conservative as it is anticipated that mining operations at East Weipa would scale back or cease once mining commences at the SoE site. The predicted levels are all within the adopted criteria.

**Table 9-7(sup.) Predicted Particulates at Sensitive Residential Receptors (50Mdptpa)**

Receptor	Predicted Particulate Levels for Sensitive Receptors (Including Ambient Levels)				
	Maximum PM <sub>10</sub> (24 hour) – Fifth Highest in a Year [µg/m <sup>3</sup> ]	Maximum PM <sub>2.5</sub> (24 Hour) [µg/m <sup>3</sup> ]	PM <sub>2.5</sub> (Annual Average) [µg/m <sup>3</sup> ]	TSP (Annual Average) [µg/m <sup>3</sup> ]	Dust Deposition (Highest Month) [mg/m <sup>2</sup> /day]
<b>Proposed Criteria</b>	<b>50</b>	<b>25</b>		<b>8</b>	<b>90</b>
<b>Existing Ambient</b>	<b>40</b>	<b>8<sup>1</sup></b>		<b>5<sup>2</sup></b>	<b>38</b>
Weipa	45	10		5	39
Napranum	45	9		5	39
Aurukun	45	10		5	39

<sup>1</sup> 20% of PM<sub>10</sub> 24-hour

<sup>2</sup> 20% of PM<sub>10</sub> annual average.

### 9.2 Change to Power Generation Location

The predicted NO<sub>2</sub> and SO<sub>2</sub> concentrations at all sensitive receptors (Weipa, Napranum and Aurukun) are much lower than the objectives to protect health and wellbeing. The predicted incremental increase to annual average NO<sub>2</sub> and SO<sub>2</sub> concentrations is zero at Weipa, Napranum or Aurukun as a result of the Project. In addition, the predicted annual increase does not exceed the *Environmental Protection (Air) Policy 2008* quality objectives for the protection of agriculture and natural ecosystems. If part of the power generating capacity were constructed at Norman Creek (refer **Section 2.7**), air quality impacts would be lower than the low impacts predicted through air modelling in the EIS due to increased dispersion.

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# Section 10

## Noise and Vibration



## 10. NOISE AND VIBRATION

No change to EIS.

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# Section 11

## Cultural Heritage





## 11. CULTURAL HERITAGE

RTA would engage Traditional Owners to assist with cultural heritage assessments in any areas that would be disturbed as part of the temporary construction areas or due to changes to the initial infrastructure that have not previously been assessed. Mitigation strategies will be developed where required in accordance with the WCCCA as outlined in Section 11.1.6 of the EIS.

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# Section 12

## Visual Amenity



## 12. VISUAL AMENITY

The temporary seaborne access facilities would be relatively minor infrastructure compared to the proposed Port and therefore considered to present low visual impact.

The temporary barge access (described in **Section 2.3**) would require some disturbance of the aesthetically prominent bauxite cliffs. A section of the embankment would need to be excavated to provide suitable grade onto the embankment, including batters on each side. The height of the cutting will be dependent on the location – the bauxite plateau is very low <1m near Pera Head and approximately 3m high 400m north of Pera Head. The cutting for the proposed barge landing would be 7.5m wide at the base plus batters for stability on each side.

The concrete matting would be anchored in the cutting to minimise disturbance to the beach. All piles, sleepers and concrete blocks would be removed and the embankment re-established as much as possible at the end of the construction period or prior to that if no longer required. Some stabilisation works are likely to be required to assist with rehabilitation (refer to further information about rehabilitation in **Section 3.1**). The area would be monitored in accordance with the erosion monitoring procedure described in Section 3.6.3 of the EIS until it stabilises.

Lighting for the temporary access is discussed in **Section 6.5.1**. The proposed lighting would be of short duration, temporary and have very low impact on visual amenity.

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# Section 13

## Waste





### 13. WASTE

No change to EIS.

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# Section 14

## Transport



## 14. TRANSPORT

### 14.1 Road

The traffic impact assessment for the Peninsula Development Road (PDR) and Aurukun Road has been revised to include the proposed increase in aggregate transportation during the construction phase. Traffic generation has been estimated and is presented in **Table 14-3(sup.)**.

**Table 14-3(sup.) Trip Generation – Construction Phase**

Purpose of Trip	Sections of Road Used	Peak Vehicles Per Day (vte¹)	Average Annual Vehicle Movements
Construction phase until barge facilities established (approx 6 months into the first dry season of the construction period)			
Fuel transport	Weipa to site (via PDR, Aurukun Road and the access roads)	2	364
Cargo transport		8	1,456
Heavy equipment/buildings transport		6	1,040
Employee shuttle bus from airport		4	728
Total Daily Vte for 90D PDR between Weipa and Aurukun Road Turnoff		20	1,812
Weekly delivery from Cairns	Cairns to site (via Kennedy Highway, PDR, Aurukun Road, the access roads)	0	52
Total Daily Vte for PDR between Cairns and Archer River Quarry		0.3	52
Aggregate delivery from Archer River Quarry	Archer River Quarry to site (via PDR, Aurukun Road and the access roads)	64	8,132
Dust suppression vehicles		6	1,008
Total Daily Vte for 90D PDR between Archer River Quarry and Aurukun Road Turnoff		70	9,192
Total Daily Vte for Aurukun Road and the Access Roads		90	11,004
Construction phase after barge/ferry facilities established			
Aggregate delivery from Archer River Quarry	Archer River Quarry to site (via PDR, Aurukun Road and the access roads)	64	8,132
Dust suppression vehicles		6	1,008
Total Daily Vte for 90D PDR between Archer River Quarry and Aurukun Road Turnoff		70	9,140
5% of shuttle bus trips from airport²	Weipa airport to site (via PDR, Aurukun Road and the access roads)	0	73
Total Daily Vte for 90D PDR between Weipa and Site		0	73
Total Daily Vte for Aurukun Road and the Access Roads		70	9,213

<sup>1</sup> Vehicle trip ends (vte).

<sup>2</sup> 5% contingency has been applied to employee related trips via the PDR and Aurukun Road, post ferry establishment.

Aurukun Road is owned by Aurukun Shire Council and Cook Shire Council. It connects the township of Aurukun with the Peninsular Development Road. The EIS conservatively assumed Aurukun Road carried 20 vehicles per day (vpd), based on the local population. However, consultation with Cook Shire Council indicated that, while they had no traffic data for Aurukun Road, the traffic volumes for Strathgordon Road between Pormpuraaw and the PDR which has similar characteristics to Aurukun Road are between 50vpd to 80vpd. On advice from

Cook Shire Council, these volumes were adopted as a range, and the heavy vehicle percentage of the PDR (27%) has been adopted for Aurukun Road.

Due to lack of roughness data for Aurukun Road, the roughness from the PDR has been adopted. This is considered a conservative approach, as anecdotal advice from Cook Shire Council was such that Aurukun Road had been upgraded more recently than the PDR and is expected to have a better average roughness coefficient.

The revised link impact of the proposed development on the PDR, the Kennedy Highway and Aurukun Road during the construction phase is presented in **Table 14-6(sup.)**. The link impact has been undertaken for using the volumes expected before the barge construction is complete as this is expected to be the peak period of construction traffic as demonstrated in **Table 14-3(sup.)**.

**Table 14-6(sup.) Average Daily Vehicle Movements**

Road	Section	Construction (Vte/Day)		
		Without Project	With Project	Change
32A Kennedy Highway	Cairns to Kuranda	8,560	8,560	0%
	Kuranda to Mareeba	5,256	5,256	0%
90A PDR	Mareeba to Mt Molloy	2,313	2,313	0%
90B PDR	Mt Molloy to 30km	531	531	0%
	30km to 145km	435	435	0%
	145km to Laura	149	149	0%
90C PDR	Laura to Coen	101	101	0%
90D PDR <sup>(1)</sup>	Coen to Archer River Quarry	96	96	0%
	Archer River Quarry to Aurukun Road Turnoff	96	186 <sup>(1)</sup>	94%
	Aurukun Road turnoff to Weipa	96	120 <sup>(1)</sup>	25%
	Kerr Point Road/John Evans Drive	520	529 <sup>(1)</sup>	2%
Aurukun Road	PDR turnoff to site (via the access roads)	50 <sup>(2)</sup>	158 <sup>(1)</sup>	216%
		80 <sup>(3)</sup>	188 <sup>(2)</sup>	135%

<sup>1</sup> First year of construction, including period prior to barge/ferry terminal construction.

<sup>2</sup> Based on lower estimate of Aurukun Road volumes from Cook Shire Council.

<sup>3</sup> Based on upper estimate of Aurukun Road volumes from Cook Shire Council.

The expected increase in daily traffic on the PDR from Archer River Quarry to Aurukun Road is 94% and from Aurukun Road to Weipa, 25% during the construction phase. The increase expected on Aurukun Road is between 135% and 216% for the construction phase. While this increase may seem significant in relative terms, the total daily traffic, inclusive of that generated by the proposed development, is considered to remain at very low levels. Therefore, the proposed development is not expected to have an adverse impact on daily operations of the PDR, the Kennedy Highway and Aurukun Road in future years.

The revised pavement impact of the proposed development on the PDR and Aurukun Road during the construction phase is detailed in **Table 14-7(sup.)**. This analysis has been undertaken using the

predicted peak period of construction delivery by road and includes deliveries of crushed rock and sand products by B-triples, B-doubles and semi-trailers.

As demonstrated in **Table 14-7(sup.)**, the proposed development is expected to increase Equivalent Standard Axles (ESAs) by up to 324% on the PDR and by up to 631% on Aurukun Road in the peak year of construction. Although this increase appears to be significant, taking into account that the daily traffic along each of these road sections are less than 100vpd without the development and less than 200vpd with the proposed development, the increase in absolute terms is quite minor. The total daily traffic (and hence ESAs), inclusive of that generated by the proposed development, is considered to remain at very low levels.

**Table 14-7(sup.) Pavement Impact Analysis**

Road Section	Existing Daily Volume (vpd)	Existing % HV	Existing HV Volume (vpd)	Existing Annual ESA	Max Annual Development ESAs	% Increase	Design Life ESAs without Project	Design Life ESAs* with Project
PDR (North of Aurukun Road turnoff)								
Northbound	48	27%	13	15,137	2,221	15%	3 x 10 <sup>5</sup>	3 x 10 <sup>5</sup>
Southbound	48	27%	13	15,137	2,849	19%	3 x 10 <sup>5</sup>	3 x 10 <sup>5</sup>
PDR (South of Aurukun Road turnoff)								
Northbound	48	27%	13	15,137	49,016	324%	3 x 10 <sup>5</sup>	4 x 10 <sup>5</sup>
Southbound	48	27%	13	15,137	2,435	16%	3 x 10 <sup>5</sup>	3 x 10 <sup>5</sup>
Aurukun Road (between PDR and Beagle Camp Access Road) – based on lower estimate of existing traffic volumes								
Northbound	25	27%	7	7,884	2,509	32%	2 x 10 <sup>5</sup>	2 x 10 <sup>5</sup>
Southbound	25	27%	7	7,884	49,718	631%	2 x 10 <sup>5</sup>	3 x 10 <sup>5</sup>
Aurukun Road (between PDR and Beagle Camp Access Road) – based on upper estimate of existing traffic volumes								
Northbound	40	27%	11	12,614	2,509	20%	3 x 10 <sup>5</sup>	3 x 10 <sup>5</sup>
Southbound	40	27%	11	12,614	49,718	394%	3 x 10 <sup>5</sup>	4 x 10 <sup>5</sup>

The design life of the pavement was assumed to be 20 years, calculated using 20 years of the existing annual ESA and three years of the maximum annual ESAs generated by the proposed development. This is considered a conservative approach due to the much lower ESAs generated by the project in the years before and after the peak period of construction. The project generated traffic makes up approximately 40% of the ESAs within the 20 year design life. Maintenance would be carried out to ensure the life of the pavement.

In Section 14.1.7 of the EIS, RTA committed to monitoring the road condition and repairing any damage to the PDR or Aurukun Road resulting from Project-related haulage. However, given the proposed increase in haulage and feedback received from the Department of Transport and Main Roads (DTMR), RTA will prepare a road impact assessment (RIA) and a road use management plan (RMP) in consultation with the DTMR.

## 14.2 Shipping

Following discussions with the Harbour Master, the proposed mooring area has been removed. The Harbour Master has indicated that the preferred arrival and anchorage area for bulk carriers to the SoE Port would be the existing anchorage area for the Port of Weipa (refer **Figure 2-9(sup.)**). The location of the anchorage areas is subject to the direction of the Harbour Master.

A new departure area for Cape size vessels (up to 185,000dwt) would be required in water with 20m draft directly seaward of the existing Port of Weipa arrival area. The departure area is required to allow the pilot to disembark and anchorage is generally not required. There are no impacts predicted at the departure area.

The EIS contained a conservative (high) number of ships based on the use of only Panamax and Dedicated Post-Panamax (DPP) bulk carriers. **Table 14-10(sup.)** shows the estimated number of bulk carriers using the proposed port based including the use of Cape size vessels by some customers. The actual number of cape size vessels will depend on market conditions and actual sales of bauxite.

The Port of Weipa loaded 313 Panamax/DPP bulk carriers in 2010. Additional anchorage points are unlikely to be required under the 22.5Mdtpa production scenario for the Project because the number of ships using the Port of Weipa will decrease. At maximum production, should market conditions allow, the number of bulk carriers arriving in this area would increase and additional anchorage may be required. The location of any new anchorage points would be identified by the Regional Harbour Master. Use of the Port of Weipa anchorage area minimises the environmental impact of the Project.

**Table 14-10(sup.) Estimated Shipments from Proposed Port**

<b>Production Scenario</b>	<b>Likely Mix of Vessels<sup>1</sup> (Ships/Annum)</b>	<b>Maximum Number of Vessels<sup>2</sup> (Ships/Annum)</b>
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

In 2014, immediately prior to the commencement of shipments from the proposed South of Embley Port, it is predicted that there will be approximately 270 ships per annum sailing from the Port of Weipa to the Port of Gladstone (i.e. 540 annual movements through the Great Barrier Reef Marine Park).

Shipping would occur from the proposed Port to the Port of Gladstone (via the existing shipping route through the Great Barrier Reef Marine Park) and, separately, to locations which do not pass through the Great Barrier Reef Marine Park. Under the maximum production scenario (50Mdptpa), it is predicted that an average of 300 ships per annum would travel to the Port of Gladstone (i.e. 600 annual movements through the Great Barrier Reef Marine Park).

The Great Barrier Reef Marine Park Authority's *Great Barrier Reef Outlook Report 2009* stated that there were 9,700 ship movements in the Great Barrier Reef Marine Park in 2007. The bauxite shipping in the Great Barrier Reef Marine Park associated with the Project would be very small in proportion to the total ship movements through the Great Barrier Reef Marine Park and would be similar to the bauxite shipping movements from the Port of Weipa through the Great Barrier Reef Marine Park prior to the commencement of the Project.

The Torres Strait shipping channel is limited to Panamax / DPP vessels and Cape size vessels from the proposed Port would not use the route through the Great Barrier Reef Marine Park.



# Section 15 Consultation



## 15. CONSULTATION

The extensive engagement continued after the publication of the EIS and included the six week EIS public comment period from 1 August 2011 to 12 September 2011. In this period over 500 external and more than 900 internal stakeholders were briefed on the Project.

The details of who was consulted during this period and a summary of the feedback they provided have been presented in the Section 3 and Appendix D of the Social Impact Management Plan (SIMP) (**Appendix 6**).

The feedback during the EIS public comment period was focused on four main areas:

- employment opportunities;
- contracting opportunities;
- impacts on commercial fishing and charter operators; and
- transport between Aurukun and the mine site.

### 15.1 Post EIS Public Comment Period

Engagement after the public comment period focused on key issues raised in submissions and greater Government agency awareness and involvement. The details of those consulted during this period and the issues raised are presented in Section 3 and Appendix E of the SIMP (**Appendix 6**).

The feedback after the EIS public comment period was focused on:

- Government agency requirements;
- impacts on commercial fishing and charter operators;
- implementation of commitments; and
- on-going engagement.

### 15.2 Feedback on the Social Impact Management Plan

A “tabular” SIMP was provided in 16.4 (Table 16-22) of the EIS. After assessing the EIS submissions and considering post public comment period engagement, the SIMP was revised into a “standalone” document with the “tabular” SIMP included as an Appendix (F) within the SIMP (**Appendix 6**).

Where there was increased interest from stakeholders and agencies key issues have been grouped into eight Action Plans, now a core component of the SIMP Section 7.2 (**Appendix 6**).

RTA will undertake additional consultation to seek stakeholder feedback on the revised “standalone” SIMP and Action Plans. This engagement will utilise existing engagement forums as set out in Section 6 of the SIMP (**Appendix 6**).

### 15.3 Ongoing Consultation

Ongoing engagement will be carried out, as outlined in the Stakeholder Engagement Strategy has been provided in Section 9 of the SIMP (**Appendix 6**). The Project refinements described in this Supplementary report will be discussed with relevant stakeholders. A newsletter will be distributed to local communities and this Supplementary report will be made available on the website. The suite of engagement tools developed and used throughout EIS development and public consultation period will continue to be utilised as part of the communication and engagement strategy.

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# Section 16

## Social Impact Assessment



## 16. SOCIAL IMPACT ASSESSMENT

### 16.1 Social Impact Management Plan

The “tabular” SIMP was provided in Section 16.4 (Table 16-22) of the EIS. The SIMP has been revised in consultation with the Social Impact Assessment Unit of DEEDI, incorporating feedback from WCCCA and other submissions. The revised “standalone” SIMP is provided in **Appendix 6**.

Where there was additional interest from stakeholders and agencies some issues were grouped into the following issue-specific Action Plans (see Section 4.2 of the SIMP):

- Community commute - Aurukun to the SoE mine site.
- Communities, Heritage and Environment Management Plan (CHEMP).
- Indigenous employment and training.
- Indigenous education.
- Local and Indigenous sourcing.
- Land and sea management.
- Housing and accommodation.
- Community health and well-being.

### 16.2 Governance

The SIMP provides a formal vehicle to ensure the implementation of the Project social commitments. RTA will establish an external Steering Committee to guide implementation, reporting obligations to DEEDI at regular intervals and external reviews (refer Section 5 of the SIMP, **Appendix 6**).

### 16.3 Land and Sea Access

#### 16.3.1 Temporary Seaborne Access

A concern raised by recreational and charter fishermen during the EIS consultation was the potential for limitations on access at Boyd Bay. While there are currently no physical moorings in Boyd Bay, it is a popular area for anchorage. The proposed temporary passenger jetty (described in **Section 2.3**) would have a minor impact on the available anchorage in this area. The passenger jetty would undertake approximately two transfers per day during the first 12 months of construction.

RTA would have limited need to use Boyd Bay during operations. During inclement weather, bulk carriers would remain at sea and the tugs would berth at Lorim Point.

#### 16.3.2 Access at Hornibrook Ferry Terminal

The Hornibrook ferry terminal area has been redesigned to incorporate public feedback received during the public consultation period, where concerns were raised regarding access for recreational fishing. The new design will incorporate a public car park area and provide access to the foreshore area east of the proposed ferry pontoon once the ferry terminal is commissioned. There will be some necessary restrictions during the construction period for safety reasons.

Section 16.3.1 of the EIS described the security measures for the employee carpark at the Hornibrook ferry terminal, which included a fenced compound with appropriate security systems. In response to a concern raised by the Queensland Police Service, RTA confirms that the security systems would include closed circuit television monitoring.

Due to the need to elevate the car park area for storm surge protection the mango trees within the footprint of the carpark would need to be removed. Some replacement trees will be incorporated into the final landscaping design.

#### 16.3.3 Safe Access under Jetty

A number of submissions from recreational, charter and commercial fishermen were interested in access under the jetty for the Port and also the opportunity for fishing near the jetty, which would provide artificial reef habitat.

In the EIS, RTA committed to designate a safe passage underneath the proposed jetty for the Port for small recreational and charter boat users to prevent the need to travel around the wharf and jetty subject to Maritime Safety Queensland requirements.

The wharf infrastructure (the area where bulk carriers berth) would have an exclusion zone for safety and security purposes. The jetty infrastructure (more than 500m in length) would not be subject to an exclusion zone, except in a small area where the tugs would berth. The jetty would be approximately 17.5m above LAT and the piles would be more than 20m apart. A safe passage under the jetty would be designated which would be sufficient for most commercial, charter and recreational fishing vessels to safely navigate. RTA has discussed provision of safe access under the jetty with MSQ and no concerns have been raised. Fishing vessels would not be able to tie up to the jetty, but would be able to anchor and fish near the jetty except in the safe passage area and the exclusion area around the tug berths and wharf.

During construction, some restrictions on access would apply in the construction area to ensure safety.

## 16.4 Strategic Plan for Recreational Sportfishing

One of the submissions received referred to the “Strategic Plan for Recreational Sportfishing Tourism Development in the Weipa/Western Cape Area”, which was prepared by Barradave Sportsfishing Services and released in March 2011 after the SoE Project EIS was submitted to government for approval to release publicly. Unfortunately, even though the Strategic Plan identifies RTA as a key stakeholder, no formal consultation was carried out with RTA during the development of this plan.

Key issues raised by the plan include availability of tourism accommodation, availability of recreational/charter fishing infrastructure, and proposed offsets for impacts caused by the SoE Project.

The Strategic Plan states: “While private ownership of freehold land in the area is rising steadily, RTA’s ownership of all surrounding land and its preoccupation with its core business – mining, means that there has been little thought given to long-term planning of the town’s future tourism requirements” and states that accommodation will be insufficient given the demands of rising tourism numbers, the South of Embley development and the Scherger Detention Centre.

RTA is working together with government and Weipa Town Authority in assessing future governance model. Weipa has a town area of 1,200ha and population of 3,500 people. Home ownership exceeds 80% of the total 1300 residential dwellings. While RTA is the major employer there are approximately 450 State and Federal Government employees in Weipa. RTA has facilitated release of land parcels for private purchase and currently provides all water, sewage and electricity services to the town of Weipa. RTA has proposed accommodation for contractors in a temporary camp in the SoE Project area during the construction period to minimise accommodation pressure in Weipa. RTA also proposed using the existing RTA Evans Landing camp north of the Embley River for accommodation of contractors involved in construction of the barge and ferry terminals. However, existing accommodation pressures in Weipa, which are largely related to the use of the Scherger RAAF base for accommodation of asylum seekers and the associated demand for motel accommodation by approximately 200 Commonwealth government support staff, mean that the existing Evans Landing camp is being used for contractors associated with the existing Weipa operations. Therefore, it is proposed that a new 200 bed camp be constructed on previously disturbed land adjacent to Nanum to help alleviate short term accommodation pressures associated with construction. The Commonwealth Government did not undertake any consultation with RTA with regard the provision of town services prior to

the use of the RAAF Scherger base to house asylum seekers. It is currently not clear whether Scherger will be used as a Detention Centre on a permanent basis.

The Strategic Plan states: “Given the increase in local workforce and tourist numbers during the past decade, a comprehensive review of all Weipa boating and fishing infrastructure is long overdue. In spite of the high level of boat ownership, the anomaly that prevails with RTA control of the town hinders any contributions by government to marine based improvements, a somewhat farcical situation.” It goes on to suggest: “RTA’s South of Embley project may provide an opportunity for new fishing/boating facilities to be established by their incorporation into the marine section of the development, particularly at the Embley River ferry departure site and seawards of the new port facilities to be established near Boyd Point/Pera Heads.”

Much of the land on the banks of the Embley River, including the Evans Landing jetty and the proposed Humbug barge terminal and Hornibrook ferry terminal, is Strategic Port Land which is owned or leased by North Queensland Bulk Ports, the Port Authority for the Port of Weipa. Therefore RTA does not have any control of development on this land. North Queensland Bulk Ports is responsible for safe operations of public facilities within the Port of Weipa. RTA does not propose to build a public marina facility.

The Strategic Plan states: “With the port and shiploader development between Boyd Point and False Pera Head set to impact on the offshore area most heavily fished by local boaters, including, of course, many RTA employees, an offset arrangement that saw the establishment of artificial reefs and fish attracting devices (FAD’s) outside of the established shipping lanes would seem a suitable outcome for all parties. If such an arrangement was able to include funding of a Weipa-based barramundi hatchery to stock local waters, this could provide an excellent cooperative opportunity for indigenous participation in a project that would benefit the entire population. Local fishers would, no doubt, be keen to become involved with such a hatchery on a voluntary basis.”

The Strategic Plan notes that “both estuarine and adjacent Gulf of Carpentaria waters in the Weipa area exhibited a marked decline in their fisheries during the past decade – commercial fishing tour operators recording a 76% fall in barramundi catches and more than 80% for queenfish and trevally from 2004-2009.”

Offsets for major projects apply where a project causes a long term or significant impact. In this case, RTA have acknowledged that there will be a temporary impact on fish assemblages in the vicinity of the Port and spoil ground due to turbidity generated by dredging and disposal of sediment,



however following dredging, the impacts are anticipated to be minor. The proposed departure channel is relatively narrow (182m wide). It should also be noted that the shipping channel at the mouth of the Embley River has been reported as an attractive fishing area (<http://www.fishingearth.com/fishing-articles-detail.asp?ArticleID=54&FishingTypeID=-1&btnID=-1&bgID=3>). RTA has realigned the port and shipping channel, which will reduce but not eliminate impacts to the “ThreeMile” fishing area. The EIS concludes that physical disturbance to the dredged site, deposition of spoil, and the re-suspension of disturbed and deposited sediment are anticipated to have minor impacts on the fish assemblages. During operations, the jetty and wharf piles themselves will act as de facto artificial reefs and are,

in effect, an enhancement project. RTA has discussed provision of access under the jetty with MSQ and no concerns have been raised. The jetty would be approximately 17.5m above LAT and the piles would be more than 20m apart. This would be sufficient for most commercial, charter and recreational fishing vessels to safely navigate. Fishing vessels would not be able to tie up to the jetty, but would be able to anchor and fish near the jetty except in the safe passage area and the exclusion area around the tug berths and wharf.

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# Section 17

## Economics



## 17. ECONOMICS

### 17.1 Economic Modelling

Since the economic modelling was undertaken for a 15Mdtpa production scenario in the EIS, RTA has undertaken further feasibility studies for the adopted 22.5Mdtpa initial production scenario. The predicted construction workforce has increased due to shortened construction period, change in work roster (requiring more workers), and an increase in the scale of works (mainly earthworks). Direct employment is now predicted to average 950 per annum over 30 months during Project construction (although peak numbers would exceed this), however this is subject to further feasibility studies.

The EIS provided economic modelling based on an average of 307 full-time equivalents over three years. Based on this conservative number, the construction phase would also induce an average of 179 jobs within the local economy over the period, supported by the indirect effect of the initial output stimulus. Thus, the Project would support an average of 1,129 jobs in the local economy over the construction period.

**Table 17-1(sup.) Employment During Construction Phase**

		Local	FNQ	QLD	AUST
Employment (Average Annual Full-Time Equivalent (FTE) Positions)	Workforce	950	950	950	950
	Flow-on*	179 (Minimum)	395 (Minimum)	632 (Minimum)	705 (Minimum)
	<b>Total</b>	<b>1,129</b>	<b>1,345</b>	<b>1,582</b>	<b>1,655</b>

\* Based on workforce in EIS

Most construction workers would be from the east coast of Australia and would be fly-in and fly-out of Weipa airport and be transported to site by RTA to stay in the on-site construction camp while on roster. If required, a camp of up to 200 beds would be constructed if required on previously disturbed land adjacent to Nanum (or another site as agreed with relevant stakeholders) to help alleviate any short term accommodation pressures associated with the construction phase (further information on housing and accommodation is provided in **Appendix 6**).

Economic modelling in the EIS predicted the economic output and value-add of the construction phase based on building 15Mdtpa production capacity. The capital cost estimate for the construction of 22.5Mdtpa production capacity has not yet been finalised. The economic output and value-add component of the construction period will be higher than that predicted in the EIS.

### 17.2 Local and Indigenous Employment and Sourcing

A number of submissions raised issues relating to the opportunity that the Project provided for local and Indigenous employment and local and Indigenous business opportunities, particularly for the community of Aurukun. RTA Weipa has a number of existing programs addressing these issues and plans to continue and expand these programs for the South of Embley Project. Further information is provided in the SIMP (**Appendix 6**) and, in particular, these issues will be addressed through the proposed *Indigenous employment and training Action Plan* and the *Local and Indigenous sourcing Action Plan*. RTA will work collaboratively with Aurukun Shire Council to establish a permanent office and accommodation in Aurukun to assist coordination of RTA activities, implementation of action Action Plans and ensure an appropriate and accessible presence in Aurukun.

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# Section 18

## Health and Safety





## 18. HEALTH AND SAFETY

No change to EIS.

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# Section 19

## Hazard and Risk



## 19. HAZARD AND RISK

### 19.1 Dangerous Goods

A barge would be used to store approximately 1ML of fuel oil for the operating dredges during the construction period. The EIS contained the following mitigation measures which would minimise risks associated with the fuel storage barge:

- Storage, handling and use in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL), relevant Australian Standards, and the Australian Maritime Safety Authority guidelines;
- Secondary containment will be utilised to reduce the risk of spills occurring as a result of accidental rupture of tanks or leaks from transfer points;
- The transfer of dangerous goods and hazardous substances by barge will be carried out in accordance with relevant regulatory requirements;
- Procedures will be developed for storage, handling, transfer and disposal of hazardous substances to minimise the risk of spills;
- Relevant employees and contractors involved in the storage, handling use and disposal of hazardous substances and materials will be trained to ensure that they are aware of their responsibilities in relation to hazardous substances; and
- Procedures will be developed for spill cleanup and appropriate emergency response equipment provided at key locations to reduce the risk of harm resulting from a spill.
- RTA will prepare an oil spill response plan for the barge carrying fuel tankers.

### 19.2 Emergency Management Plans

During EIS consultation, further information was requested in relation to flooding and bushfire.

Section 4.2 of the EIS provides information relating to the design of Project infrastructure to withstand extreme events such as cyclones and flooding. There are no community buildings or public roads in the Project area south of the Embley River. The Project would not have any impact on flooding

risk of community buildings or public roads in areas north of the Embley River. Section 5.2.3 and Section 5.2.4 address the risk of impact of Dam C and mining on flood events, buildings or public roads that are at downstream of Dam C or mining areas (refer Section 3.1.2 of the EIS for a description of the existing land uses in the Project area) and concludes that they would not increase the risk of flooding. The construction camp and bulk hazardous materials storage areas will be located above the Q100 line.

It is a requirement of the Environmental Authority (MIN100939109) for ML7024 and ML6024 that an emergency response/contingency plan must be developed and implemented in accordance with ISO14001 standard. The existing Weipa operations maintain a Business Resilience and Recovery (BRR) Plan (otherwise known as an Emergency Management Plan) which meets this requirement.

Section 19.3 of the EIS identifies the BRR would be updated to include the Project area and regularly updated prior to each stage of the Project. The BRR Plan would address the management and development of an appropriate response to emergency situations, including flood and bushfire in the Project area.

The BRR Plan would also address emergency evacuation of the Project area in the event of an emergency. The flood design criteria for the mine access road is a 1 in 10 year average recurrence interval (ARI) of greater than 300mm over the road with (refer Table 4-6 of the EIS). It should be noted that there are several methods of emergency evacuation available should the watercourse crossings on the mine access road become impassable, including by boat from the Port or via air from the emergency airstrip (refer **Figure 2-7(sup.)**).

Although the State Planning Policy 1/03 does not apply on the mining lease, fire breaks that are consistent with the requirements of the *State Planning Policy Guideline for Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* would be maintained for the construction camp and occupied permanent buildings.

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## Section 20

# Cumulative Impacts





## 20. CUMULATIVE IMPACTS

The agreement between Chalco and the Queensland government to develop the Aurukun Bauxite Project (on former MDL378) ended on 30 June 2011.

The Queensland government have designated the Aurukun bauxite resource a “restricted area” pursuant to part 188 of the *Mineral Resources Regulation 2003* and it is understood that a process to assess the viability of developing this resource may commence in due course. There is presently no proponent for the Aurukun Bauxite Project.

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# Section 21 Environmental Management Plan



## 21. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan, including the proposed conditions, has been reviewed in light of the Environmental Authority (EA) (MIN100939109) which was issued for ML7024 and ML6024 on 30 August 2011. The revised Environmental Management Plan is provided in its entirety in **Appendix 3**.

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# Section 22 EPBC Assessment Report





## 22. EPBC ASSESSMENT REPORT

The EPBC Assessment Report was a report provided in the EIS summarising impacts to matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*. In accordance with the Tailored EIS Guidelines, the EPBC Assessment Report contained cross referencing to other parts of the EIS to reduce overlap. However, feedback received after the EIS was published from the Commonwealth Department of Sustainability, Environment, Water and Communities indicated that the use of cross-referencing to the EIS was an imposition of assessment resources. This report will therefore be submitted to the Minister as a stand-alone document and separate to the Supplementary report.

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## Section 23

### References



## 23. REFERENCES

- ABARES (2010). Fisheries Status Reports 2010. Australian Bureau of Agricultural and Resource Economics and Science.
- ANZECC/ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. National Water Quality Strategy. Australian and New Zealand Environment Conservation Council and Agricultural Resource Management Council of Australia and New Zealand, Canberra.
- Barradave Sportsfishing Services (2011). Strategic Plan for Recreational Sportfishing Tourism Development in the Weipa/Western Cape Area.
- Commonwealth of Australia (2002). National Ocean Disposal Guidelines for Dredging. Commonwealth of Australia, Canberra.
- Commonwealth of Australia (2009). National Assessment Guidelines for Dredging. Commonwealth of Australia, Canberra, 2009.
- DPI & F (2007). Annual status report 2007. Gulf of Carpentaria Line Fishery. Queensland Department of Primary Industries and Fisheries.
- Ecotone Environmental Services (2008). Ely Dam Riparian and Aquatic Monitoring Study: Report on the first monitoring event conducted in March and June 2007 and recommendations for future Monitoring. Report prepared by Ecotone Environmental Consulting Pty Ltd for Rio Tinto Aluminium Weipa.
- Godwin M. (1985). Land Units of the Weipa Region, Cape York Peninsula. Queensland Parks and Wildlife Service.
- Great Barrier Reef Marine Park Authority (2009). Great Barrier Reef Outlook Report 2009. [http://www.gbrmpa.gov.au/\\_data/assets/pdf\\_file/0018/3843/OutlookReport\\_Full.pdf](http://www.gbrmpa.gov.au/_data/assets/pdf_file/0018/3843/OutlookReport_Full.pdf) (accessed online 25/1 2012).
- Gunness, A.G., Lawrie, J.W. and Foster, M.B. (1987). Land Units of the Weipa Environs – 1:24 000 Map and Explanatory Notes. Report to Comalco Aluminium Limited, Weipa.
- McKenna, S.A. and Rasheed, M.A. (2010). Port of Weipa Long Term Seagrass Monitoring, September 2009. DEEDI Publication. Fisheries Queensland. Cairns, 25 pp.
- NQBP (2010). Long term Environment Management Plan Addendum – Maintenance Dredging 2010-2019 – Port of Weipa.
- Pizzey, G., and Knight, F. (2003). The Field Guide to the Birds of Australia. Seventh Edition, Harper Collins, Sydney.
- Pusey, B.J., Kennard, M.J., Arthington, A.H., (2004). Freshwater Fishes of North-Eastern Australia. CSIRO, Collingwood, Victoria.
- RTA (2011). South of Embley Project Environmental Impact Statement.
- Vucetich & Waite 2000. Is one migrant per generation sufficient for the genetic management of fluctuating populations. *Animal Conservation* 3: 261–266.
- Winter, J. and Alford, R. (1999). Terrestrial Vertebrate Fauna in Regenerated Mine Areas at Weipa.

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