

## Section 5

### Threatened Species and Ecological Communities - Flora







## 5 Threatened Species and Ecological Communities - Flora

### 5.1 Introduction

#### 5.1.1 General Structure of Section

This section documents the results of the detailed profiling and impact assessment undertaken for the terrestrial flora species that have been assessed in detail because they are known, likely or could possibly occur based on the results of the review of matters of NES documented in **Section 4.4**.

The species are:

- *Calophyllum bicolor* – unlikely to occur in the mining area or infrastructure footprint, possibly occurs within the balance of the Project area not disturbed (listed as vulnerable under the EPBC Act);
- Cooktown Orchid (*Dendrobium bigibbum*) – unlikely to occur in the mining area, known to occur within the infrastructure footprint and balance of the Project area not disturbed (listed as vulnerable under the EPBC Act);
- Chocolate Tea Tree Orchid (*Dendrobium johannis* (*Cepobaculum johannis*)) – unlikely to occur in the mining area, known to occur within the infrastructure footprint and balance of the Project area not disturbed (listed as vulnerable under the EPBC Act);
- Ant Plant (*Myrmecodia beccarii*) – unlikely to occur in the mining area or infrastructure footprint, possibly occurs within the balance of the Project area not disturbed (listed as vulnerable under the EPBC Act);
- Beach Nightshade (*Solanum dunalianum*) – unlikely to occur in the mining area or infrastructure footprint, likely to occur within the balance of the Project area not disturbed (listed as vulnerable under the EPBC Act); and,
- *Spathoglottis plicata* – unlikely to occur within the mining area, possibly occurs within the infrastructure footprint and the balance of the Project area not disturbed (listed as vulnerable under the EPBC Act).

**Figure 5-1** illustrates the locations of known records of these threatened flora species in the Cape York Bioregion (locations of threatened flora species found in the Project area are identified on **Figure 5-3** in **Section 5.2**).

**Figures 4-1 (a-d)** illustrate the RE's located in the Project area.

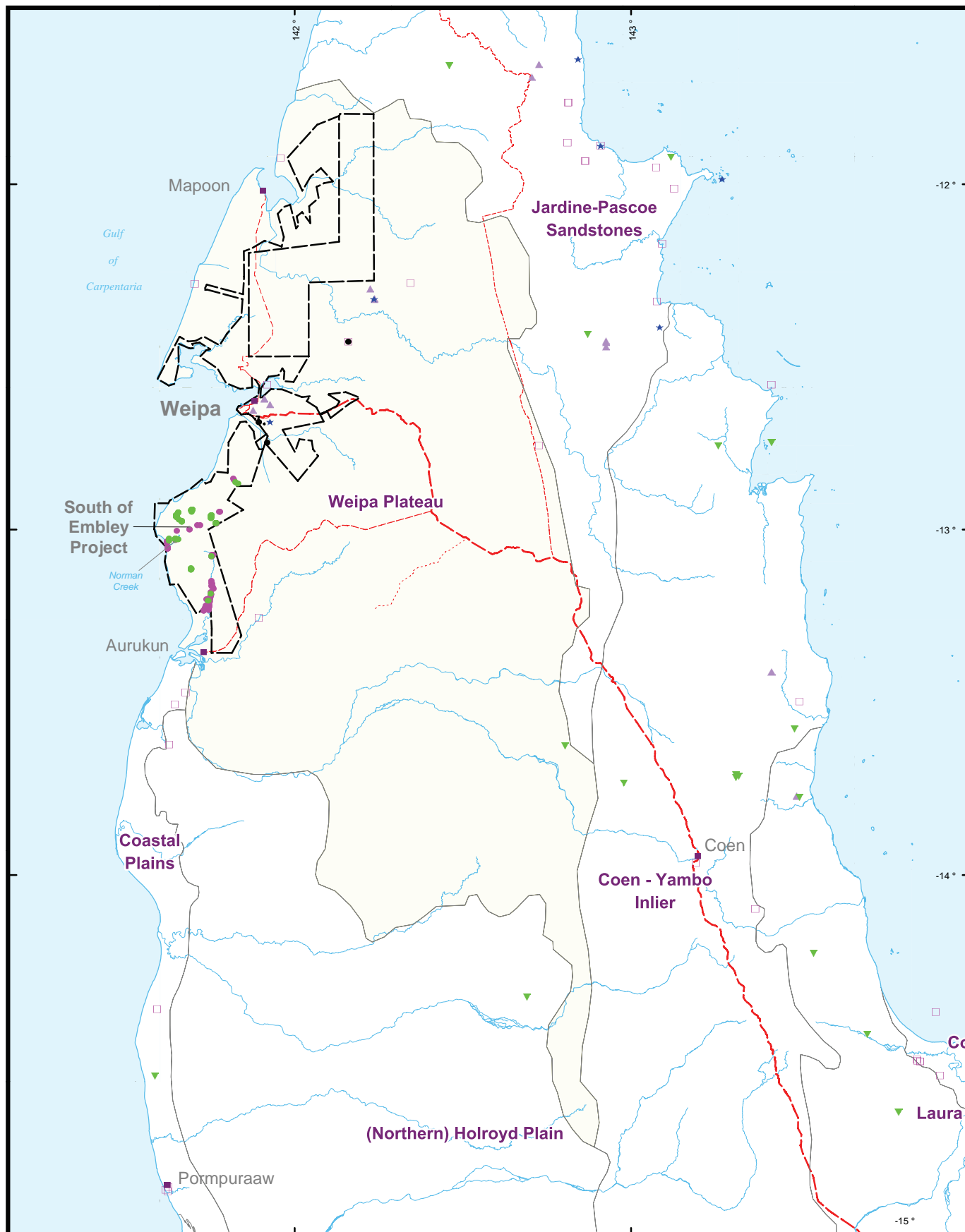
No threatened ecological communities are located in the Project area.

For the purposes of this section, the Project area refers to the proposed mine and Port area and the region comprises the Weipa Plateau Subregion as defined by Sattler and Williams (1999) and includes the extensive bauxite plateau landscape from the Wenlock River basin south to about Mungkan Kandju National Park and east to about 70km from the east coast.

The data collection efforts to assess these species in detail were designed to address the information requirements outlined in the Tailored EIS Guidelines.

In general, the Tailored EIS Guidelines require the following information to be provided about the listed species and communities that are considered likely or known to occur in the Project area.

- broader distribution, ecology and habitat preferences of each species on a regional perspective;
- distribution, ecology and habitat preference of each species on the Project area;
- information to explain the survey methodology used and any limitations;



Rio Tinto Alcan

- Lease Boundary
- Cape York Subregions Boundary
- Road
- Locality
- River

**Field Study (RTA)**

- Cooktown Orchid (*Dendrobium bigibbum*)
- Chocolate Tea Tree Orchid (*Dendrobium johannis*)

**Qld Herbarium Data**

- Cooktown Orchid (*Dendrobium bigibbum*)
- ▼ Chocolate Tea Tree Orchid (*Dendrobium johannis*)
- Beach Nightshade (*Solanum dunalianum*)
- ★ Spathoglottis plicata (*Spathoglottis plicata*)
- ▲ Calophyllum bicolor (*Calophyllum bicolor*)
- ◆ Ant Plant (*Myrmecodia beccarii*)

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**Fig. 5-1: Regional Records of Threatened Flora**



25 0 25km

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



- relevant impacts;
- proposed avoidance, mitigation and monitoring measures;
- residual impacts and their significance; and,
- proposed offset measures.

This section is structured to document the results of this assessment and present the information in a logical progression for each species and is structured as follows.

**Section 5.2** provides an overview of the general approach to survey for all species. This has been presented as a separate section to minimise repetition and duplication. Additional details on the species specific efforts are documented in the corresponding species specific sections.

**Sections 5.3 to 5.8** document the results of the data collection and impact assessment for each species.

In order to present the information required in the Tailored EIS Guidelines, each species specific section includes the following subsections:

- **Subsection 1 – Species Profile (5.3.1, 5.4.1, 5.5.1, 5.6.1, 5.7.1 and 5.8.1)**
  - describes the secondary source profiling work undertaken to better understand each species, outlines regional preferences and focuses of the survey effort.
- **Subsection 2 – Survey and Results (5.3.2, 5.4.2, 5.5.2, 5.6.2, 5.7.2 and 5.8.2)**
  - describes the specific survey efforts and the results that provided a better understanding of Project area habitat preferences.
- **Subsection 3 – Relevant Impacts (5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3 and 5.8.3)**
  - describes the relevant direct and indirect impacts of the Project.
- **Subsection 4 – Avoidance, Mitigation, Enhancement Measures and Residual Impacts (5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.4 and 5.8.4)**
  - describes the measures proposed to reduce the relevant impacts of the Project.
- **Subsection 5 – Offset Measures (5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.7.6 and 5.8.7)**
  - describes the measures proposed to offset any significant impacts of the Project, where required.

Cumulative and consequential impacts on these species are documented in **Section 18**. The cumulative and consequential impact assessment was undertaken at a higher/more strategic level of detail when compared to the Project-specific impact assessment because it is based on the potential activities that may or may not occur as a result of other projects.

### 5.1.2 General Approach to Impact Assessment

The Tailored EIS Guidelines require detailed impact assessments for each species identified as known or likely to occur within the Project area. A conservative approach was taken and species that could possibly occur were also selected for more detailed assessment. **Section 4.4** describes how the likelihood of occurrence was identified. The detailed impact assessment includes a focus on potential impacts on key habitat for each species associated with the construction and operational phases of the Project. In general, the impact assessment process for each species focussed on the following key steps:

1. determination of the potential environmental impacts of the Project on species;
2. identification of avoidance and mitigation measures to avoid and/or mitigate potential adverse impacts; and,
3. determination of the significance any residual impacts.

To document the results of the impact assessment process, the various subsections have been structured to provide an overview of the potential construction impacts and operational / maintenance impacts for each species. **Table 5-1** outlines the potential direct and indirect impacts on threatened flora species associated with the Project.

**Table 5-1 Potential Direct and Indirect Impacts Considered**

Potential Direct Impacts	Potential Indirect Impacts
Clearing and loss of habitat	Water quality
Edge effects	Altered hydrological regime
Fragmentation of habitat	Air quality
Effects on recruitment/movement of propagules	Introduction of weeds and pests
	Altered fire regime

The magnitude of potential impacts on each species assessed (both unmitigated and residual), are rated as either:

- None/negligible - unlikely to be any effect of consequence to the species.
- Minor impact - a small area of potential habitat or a small number of individuals would be directly or indirectly affected in no more than a few discrete locations but the overall important population would not be affected.
- Moderate impact - a large area of potential habitat would be directly disturbed and many individuals would be directly or indirectly affected. Impact would occur over numerous sites or an important population may experience some affect.
- High impact - impact would occur over a relatively large area of potential habitat and lead to the loss of a large proportion of the local habitat or local population. An important population would be permanently affected.

High and moderate residual impacts are considered to be significant, and none/negligible and minor residual impacts are not considered to be significant.

*E. tetradonta*, *Corymbia nesophila* tall woodland on deeply weathered plateaus (RE 3.5.2 (Darwin Stringybark woodland)) comprises 87% of the Project area and 99% of the disturbance area for the Project (refer **Figure 4-1**). This RE is correlated with the bauxite-bearing Weipa plateau. The threatened flora species that are likely to be encountered within the Project area occur in non-Darwin Stringybark vegetation communities, mainly the riparian gallery forest, and coastal and non-coastal vine thicket communities. Consequently, none of the threatened flora species are likely to occur in areas that would be directly affected by bauxite mining operations as all mining is proposed to occur within the Darwin Stringybark woodland. However, some threatened flora species may occur in riparian gallery forest along creeks in areas that would be disturbed for Project infrastructure (e.g. water supply dam (Dam C), water pipelines, conveyor, roads etc.).

**Table 5-2** summarises the habitat and potential occurrence within the Project area of the threatened terrestrial flora species assessed in this section.

**Table 5-2 Threatened Terrestrial Flora**

<i>Species</i> Common Name (if exists) [Family]	EPBC Status	Growth Form and Habitat	Occurrence within Project Area
<i>Calophyllum bicolor</i> [Clusiaceae]	V	A small fire sensitive tree known to be associated with permanent groundwater seepage zones, particularly in evergreen vine forest. Potential habitats comprise RE 3.3.5 (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Possible
<i>Dendrobium bigibbum</i> Cooktown Orchid [Orchidaceae]	V	An epiphyte that grows on trees and rocks in areas with moderate light intensity. Occurs in a range of fire sensitive habitats including coastal scrub, stream bank vegetation, monsoon thickets, and gullies in open forest and woodland where intense fire cannot penetrate. In the Weipa area it grows as an epiphyte on trees (rocks absent) and is commonly encountered in coastal vine forest and vine forest on bauxite. Potential habitats comprise REs 3.1.1a, 3.1.1c, 3.2.2, 3.3.5, and 3.5.4 (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Known to Occur
<i>Dendrobium johannis</i> Chocolate Tea Tree Orchid (also known as Johann's Orchid) [Orchidaceae]	V	An epiphyte that grows in open humid habitats, on slopes in open woodland, close to swamps and in pockets of monsoon forests. It has been recorded growing on Tea-tree in <i>Melaleuca</i> woodland and in coastal semi-evergreen vine thicket. In the Weipa area it is commonly encountered growing on <i>Melaleuca</i> and <i>Syzygium</i> on the margin of <i>Melaleuca</i> swamps and riparian gallery forest. Potential habitats comprise REs 3.1.1a, 3.1.1c, 3.1.3, 3.1.6, 3.2.3, 3.3.5, 3.3.9, 3.3.14a, 3.3.21, 3.3.50a, 3.3.63 and 3.3.65 (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Known to Occur
<i>Myrmecodia beccarii</i> Ant Plant [Rubiaceae]	V	A tuberous epiphyte known to grow in <i>Melaleuca</i> woodland and mangrove areas on Cape York. Recently recorded in the Weipa area in a small groundwater seepage forest. Potential habitats comprise REs 3.1.1a, 3.1.1c, and 3.1.3 and spring areas supporting closed forest or melaleuca swamp forest (potentially associated with REs 3.3.5 or 3.3.14a) (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Possible
<i>Solanum dunalianum</i> Beach Nightshade [Solanaceae]	V	An herbaceous shrub growing to 2–4m found in or at the edge of semi deciduous vine forest. Potential habitats comprise REs 3.2.2 and 3.5.2 (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Likely
<i>Spathoglottis plicata</i> [Orchidaceae]	V	A terrestrial orchid with flower stems to 1m that grows in or close to swamps, in seasonally inundated areas and in moist, grassy patches close to streams, in <i>Melaleuca</i> swamp forest and riparian gallery closed forest. Flowers during wet season, difficult to detect when not flowering. Potential habitats comprise REs 3.2.3, 3.3.5, 3.3.9, 3.3.14a, 3.3.21 and 3.3.50a (refer <b>Figure 4-1</b> for the locations of RE's within the Project area).	Possible

V = vulnerable

## 5.2 Flora Survey

### 5.2.1 General Approach

Surveys were undertaken of vegetation communities and flora within the Project area. The main objective of the flora survey program was to characterise the vegetation community of the Project area and determine the presence of threatened species listed under the EPBC Act that have the potential to be impacted by the Project. As noted in **Section 4.2**, no threatened ecological communities were identified in the Project area. The secondary survey methodology of the Queensland Herbarium (Neldner *et al.* 2005) was used to characterise main vegetation types, together with extensive targeted survey traverses in likely habitats for threatened species. There are currently no specific guidelines for conducting surveys for threatened flora listed under the EPBC Act or the *Nature Conservation Act 1992* (NC Act).

Flora surveys were undertaken in July 2006, May 2007, December 2007, May 2008, December 2008, May 2009 and June 2012. The distribution of survey events provided survey effort over the two key seasons for detecting vegetation and floristic variability within the Project area, namely the dry season and late wet season.

The flora surveys focussed initially (July 2006) on Darwin Stringybark woodland communities on the bauxite plateau which occur within the proposed mining areas. Following this initial survey, non-Darwin Stringybark communities became the focus of survey effort to describe vegetation types and overall floristics, and to determine the presence of threatened flora. The June 2012 survey addressed Darwin Stringybark woodland and riparian vegetation types occurring along the roads to be used for construction access and focussed on detection of threatened species.

The non-Darwin Stringybark communities within the Project area include riparian forest, vine forest, seasonally inundated areas and beach and estuary communities. These are most likely to support the threatened flora species that could potentially occur in the Project area.

The location of flora survey sites and traverses undertaken within the Project area is indicated in **Figure 5-2**. The known locations of threatened flora species in the Project area based on the surveys are illustrated on **Figure 5-3**.

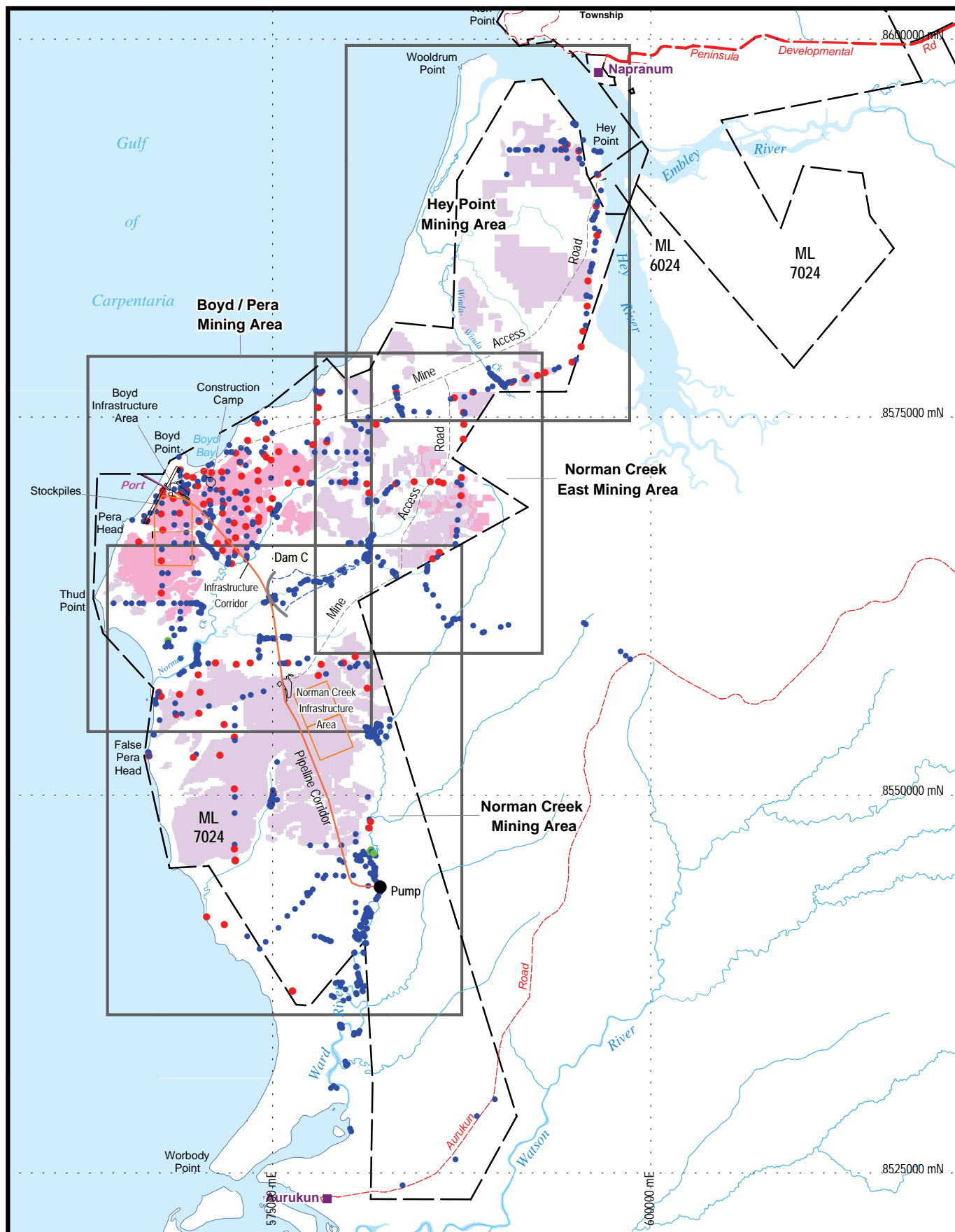
**Table 5-3** details the survey effort employed during all surveys in the Project area.

**Table 5-3 Flora Survey Effort**

Survey Effort	Survey/Level	Vegetation Community and Floristics	Targeted Threatened Flora Searches
No. of survey days		43	14
No. of EIS survey sites	Secondary	134	n/a*
	Tertiary	6	n/a*
	Quaternary	883	n/a*

\* Targeted threatened flora searches comprised traverses and broad searches for target species.





South of Embley Project

**Fig. 5-2:  
Flora Survey Sites**



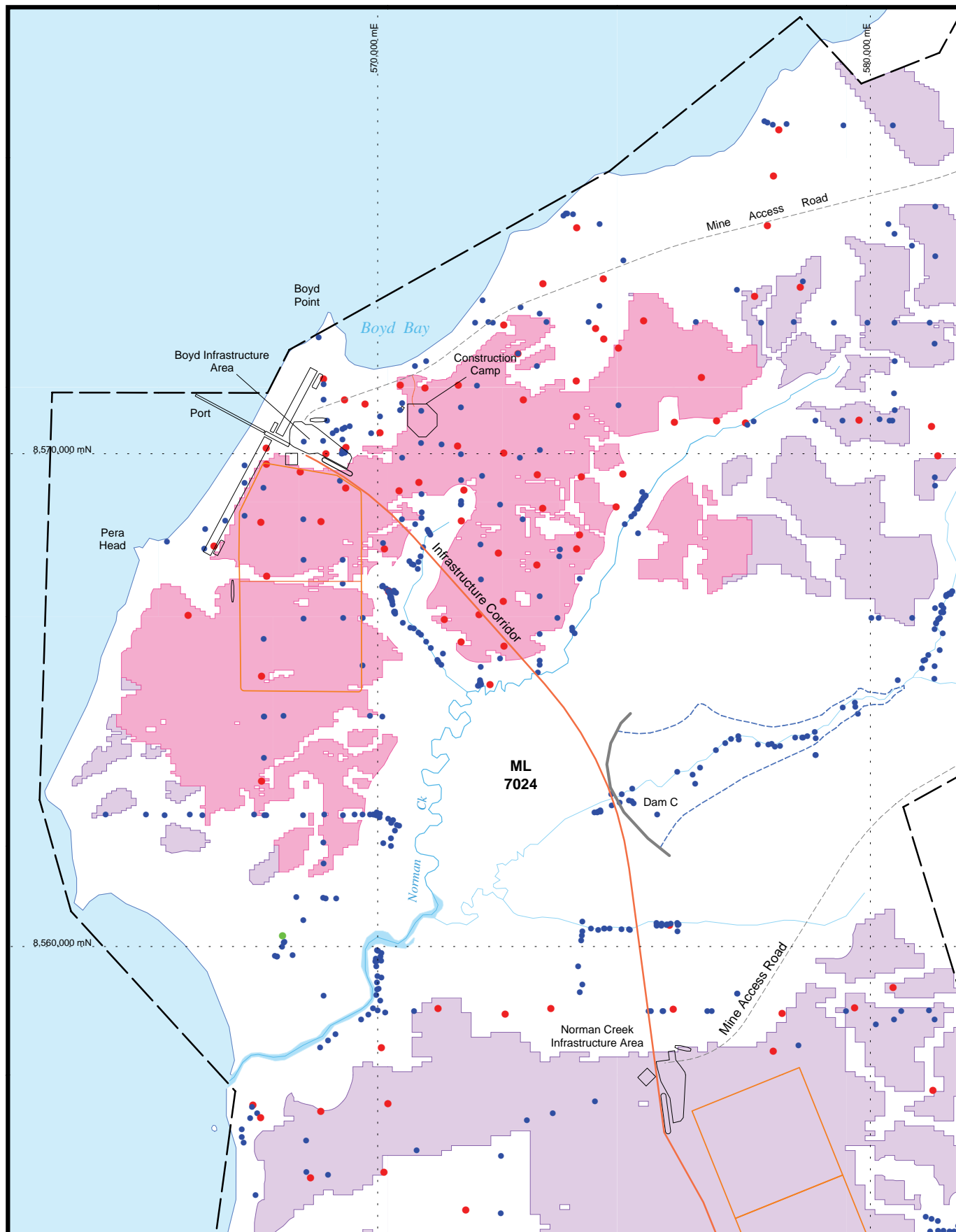
5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 02/10/2012

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40

**Vegetation Site Type**

- Secondary (134 locations)
- Tertiary (6 locations)
- Quaternary (883 locations)



RioTinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 - 13
- Mining Years 14 - 40

#### Vegetation Site Type

- Secondary
- Tertiary
- Quaternary

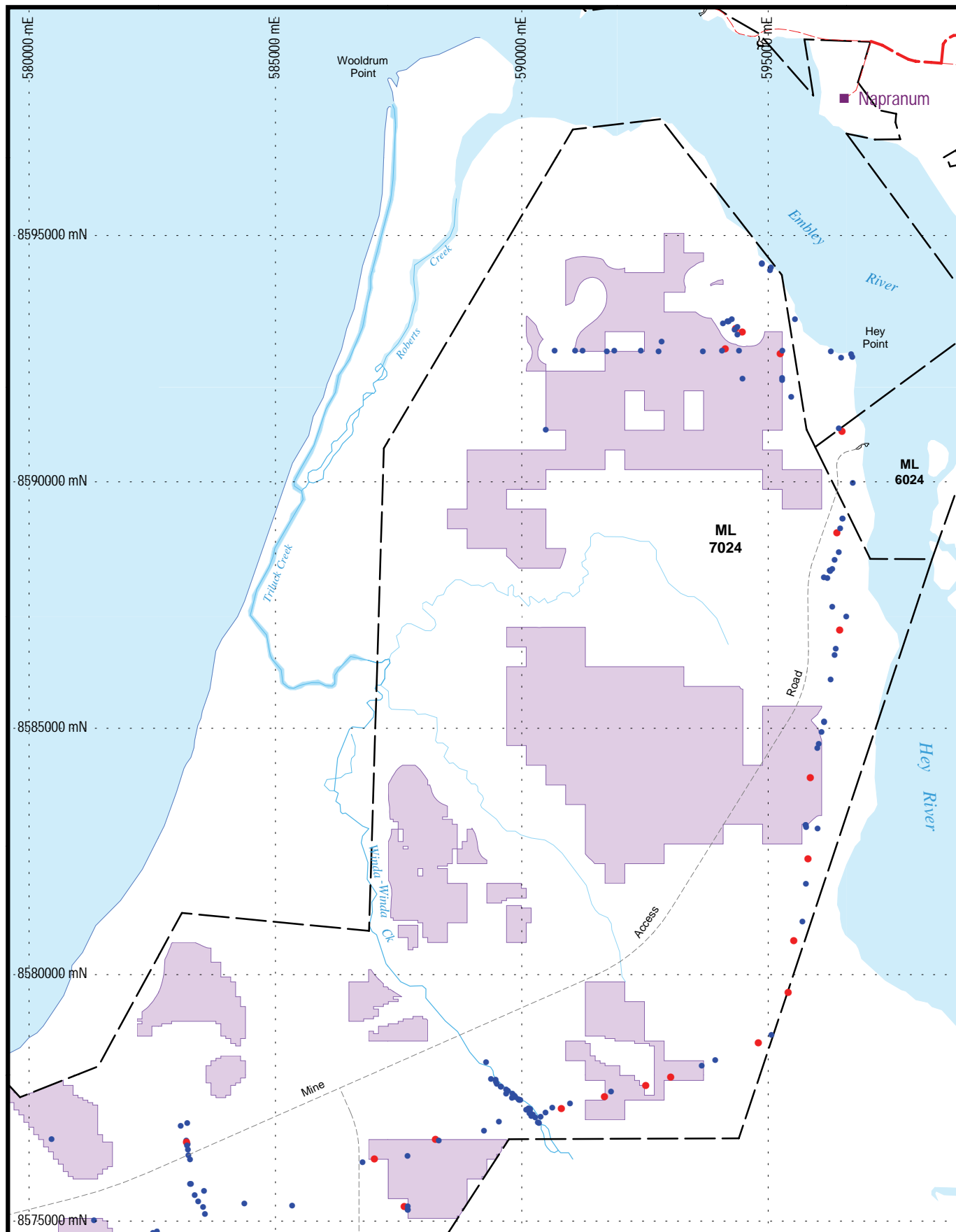
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**Fig. 5-2a:**  
**Flora Survey Sites**  
**(Boyd/Pera Mining Area)**



1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 02/10/2012



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- ▭ Freshwater dam
- ▭ Tailings storage facility
- ▭ Mining Years 1 - 13
- ▭ Mining Years 14 - 40

**Vegetation Site Type**

- Secondary
- Tertiary
- Quaternary

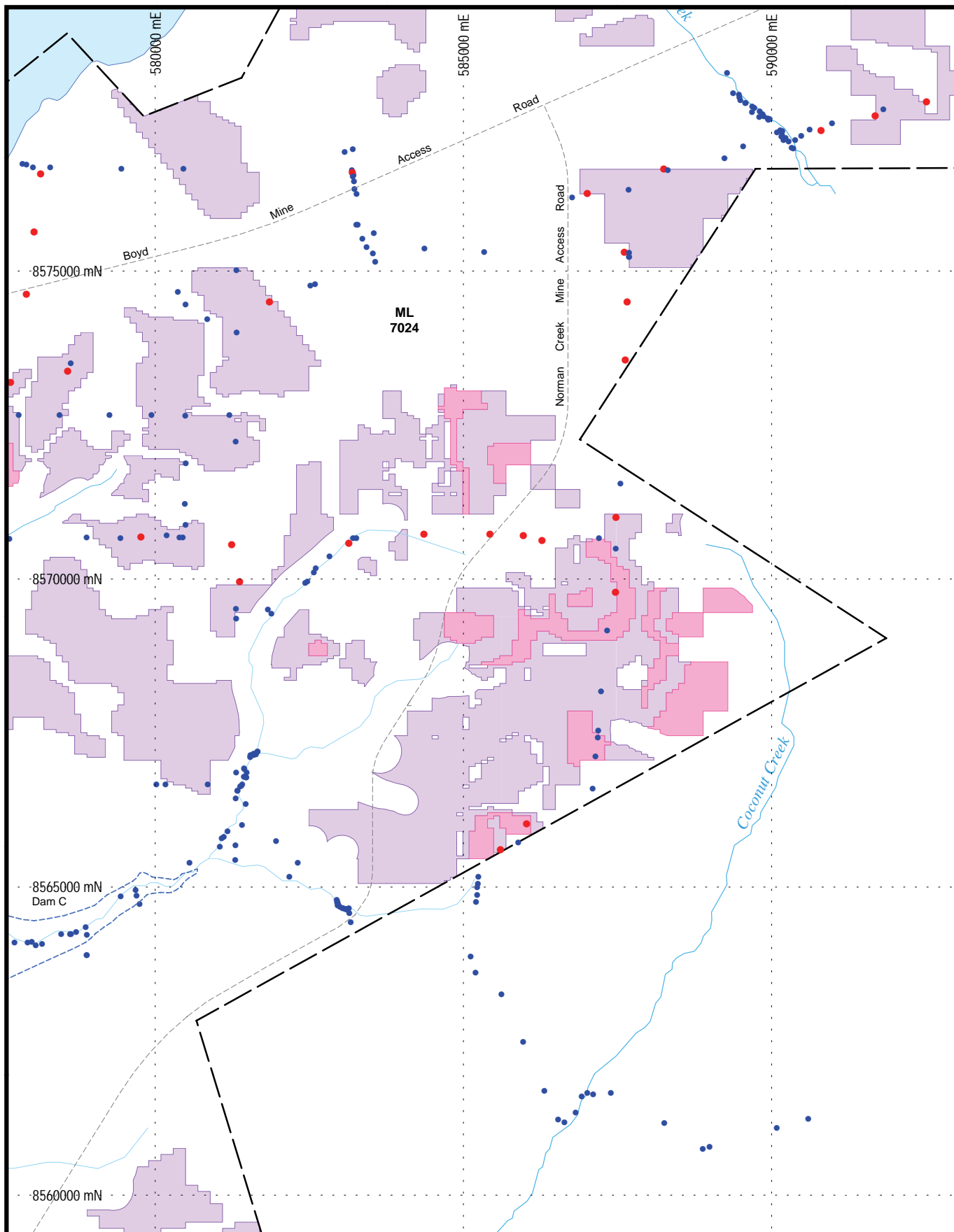
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**Fig. 5-2b:  
Flora Survey Sites  
(Hey Point Mining Area)**



1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 02/10/2012



RioTinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 - 13
- Mining Years 14 - 40

**Vegetation Site Type**

- Secondary
- Tertiary
- Quaternary

South of Embley Project

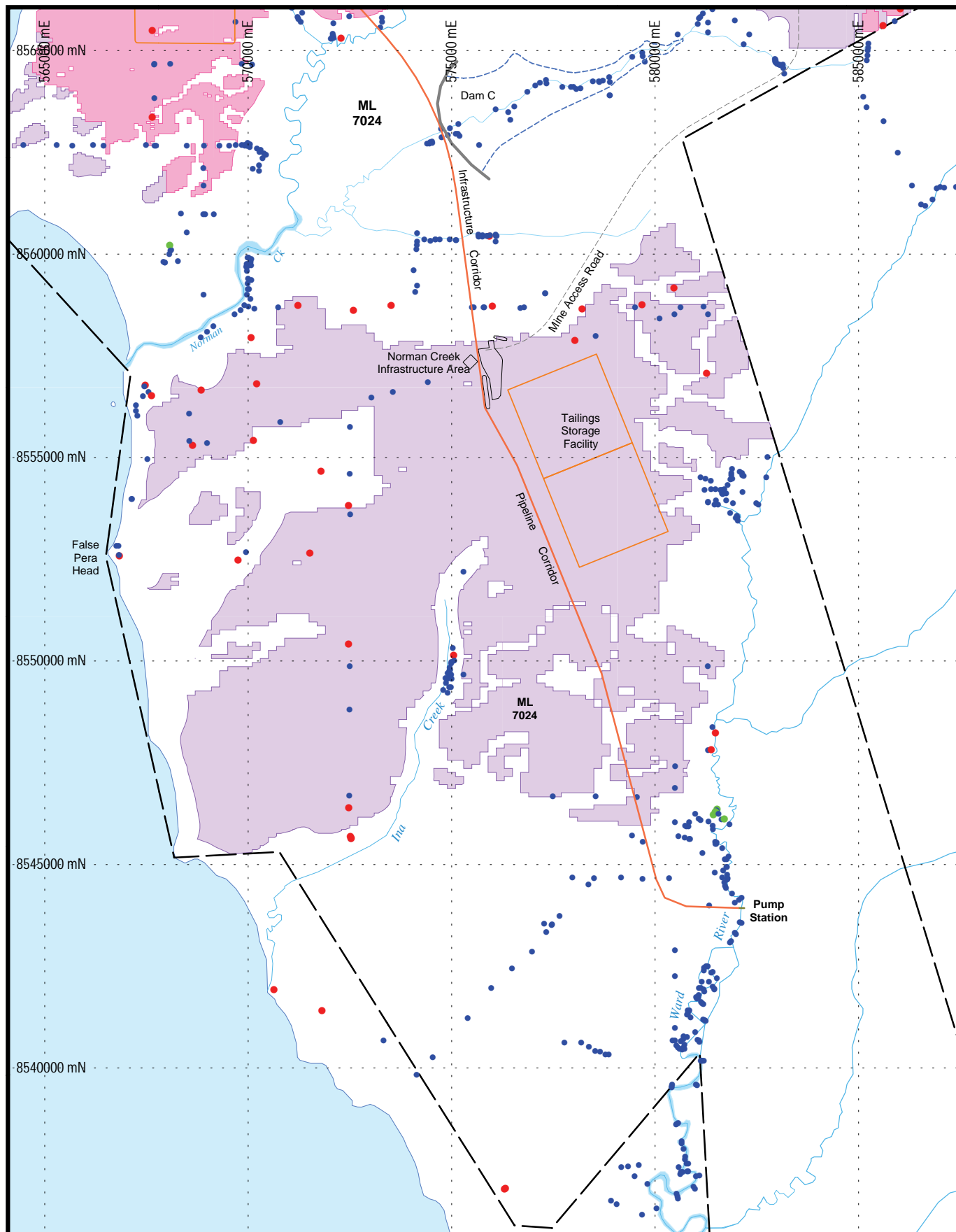
**Fig. 5-2c:**  
**Flora Survey Sites (Norman**  
**Creek East Mining Area)**



1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 02/10/2012





RioTinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- Freshwater dam
- Tailings storage facility
- Mining Years 1 - 13
- Mining Years 14 - 40

**Vegetation Site Type**

- Secondary
- Tertiary
- Quaternary

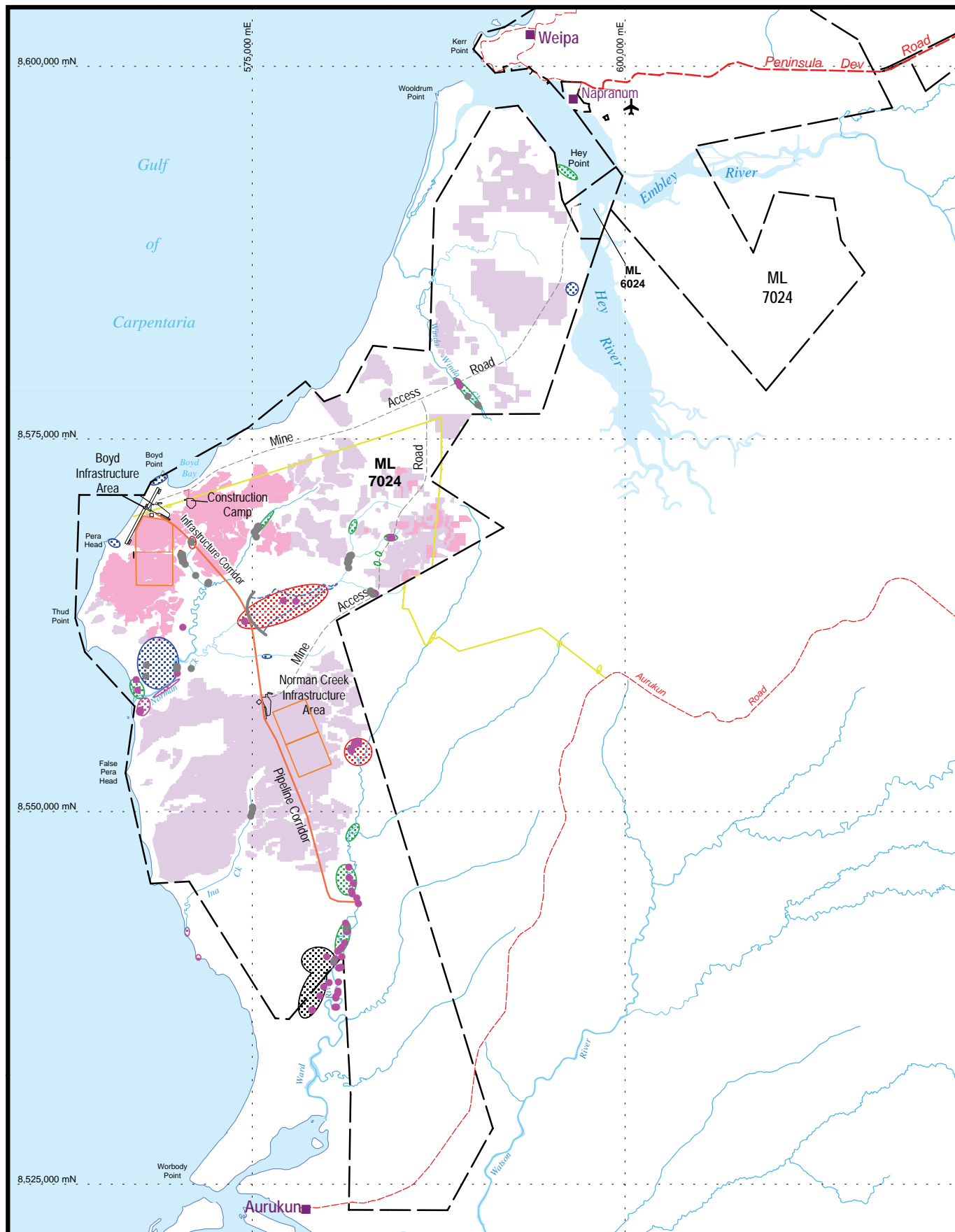
South of Embley Project

**Fig. 5-2d:  
Flora Survey Sites  
(Norman Creek Mining Area)**



1 0 1 2km

Datum/Projection: GDA94/MGA Zone 54 Date: 02/10/2012



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40

#### Threatened Flora

- Cooktown Orchid [*Dendrobium bigibbum*] (69 locations)
- Chocolate Tea Tree Orchid [*Dendrobium johannis*] (76 locations)

#### Targeted Threatened Flora survey

- December 2008
- December 2008 and May 2009
- May 2008
- May 2008 and December 2009
- May 2009
- June 2012

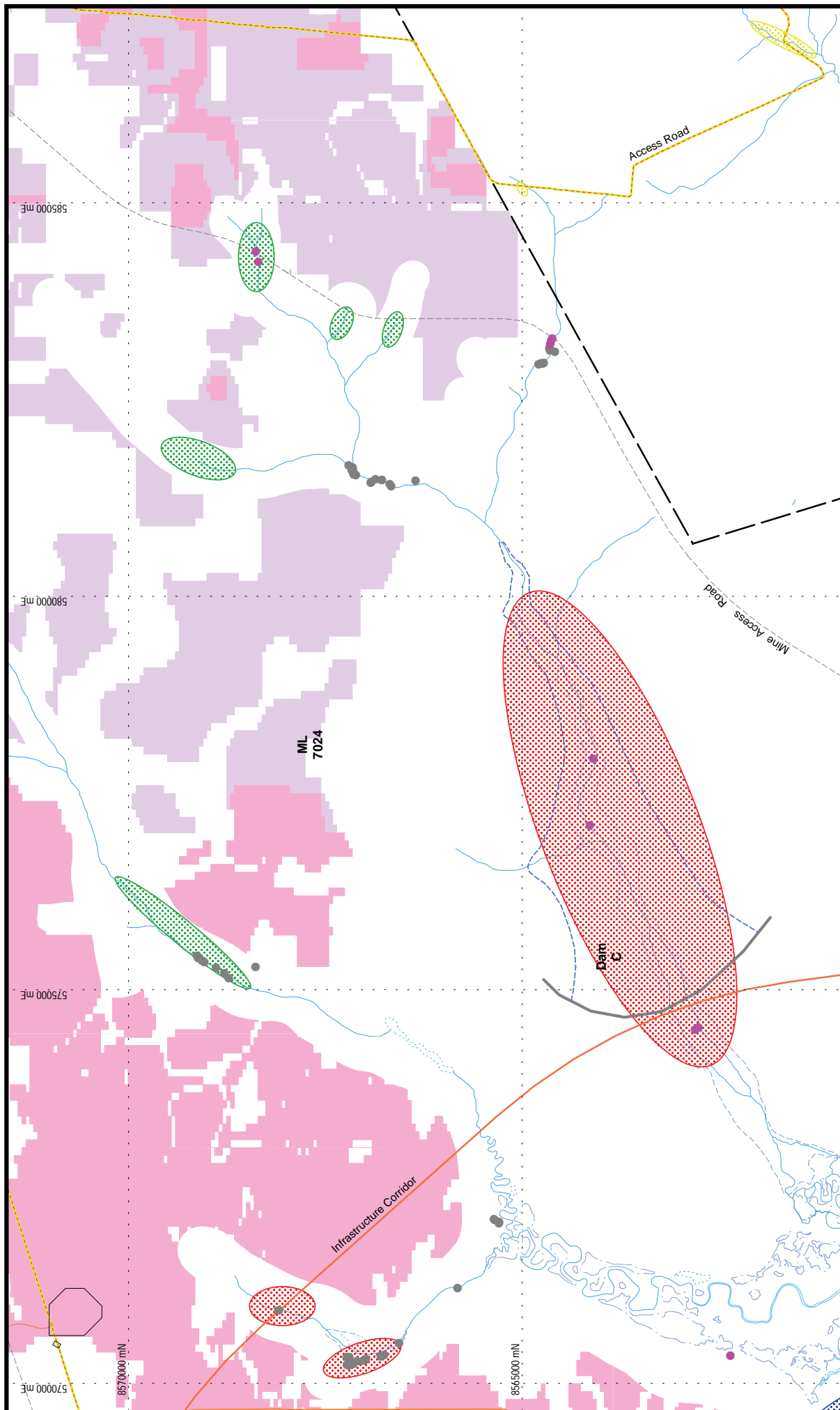
South of Embley Project

**Fig 5-3:  
Threatened Flora**



5 0 5km

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



**South of Embley Project**

**Fig. 5-3a: Threatened Flora (Dam C Area)**

**Targeted Threatened Flora survey**

- December 2008 and May 2009
- May 2009
- June 2012

**Threatened Flora**

- Cooktown Orchid (Dendrobium bigibbium)
- Chocolate Tea Tree Orchid (Dendrobium johannis)

**RTA Mining Lease boundary**

- Mining Years 1 - 13
- Mining Years 14 - 40

**Access Road**

**Mine Access Road**

**Dam C**

**Infrastructure Corridor**

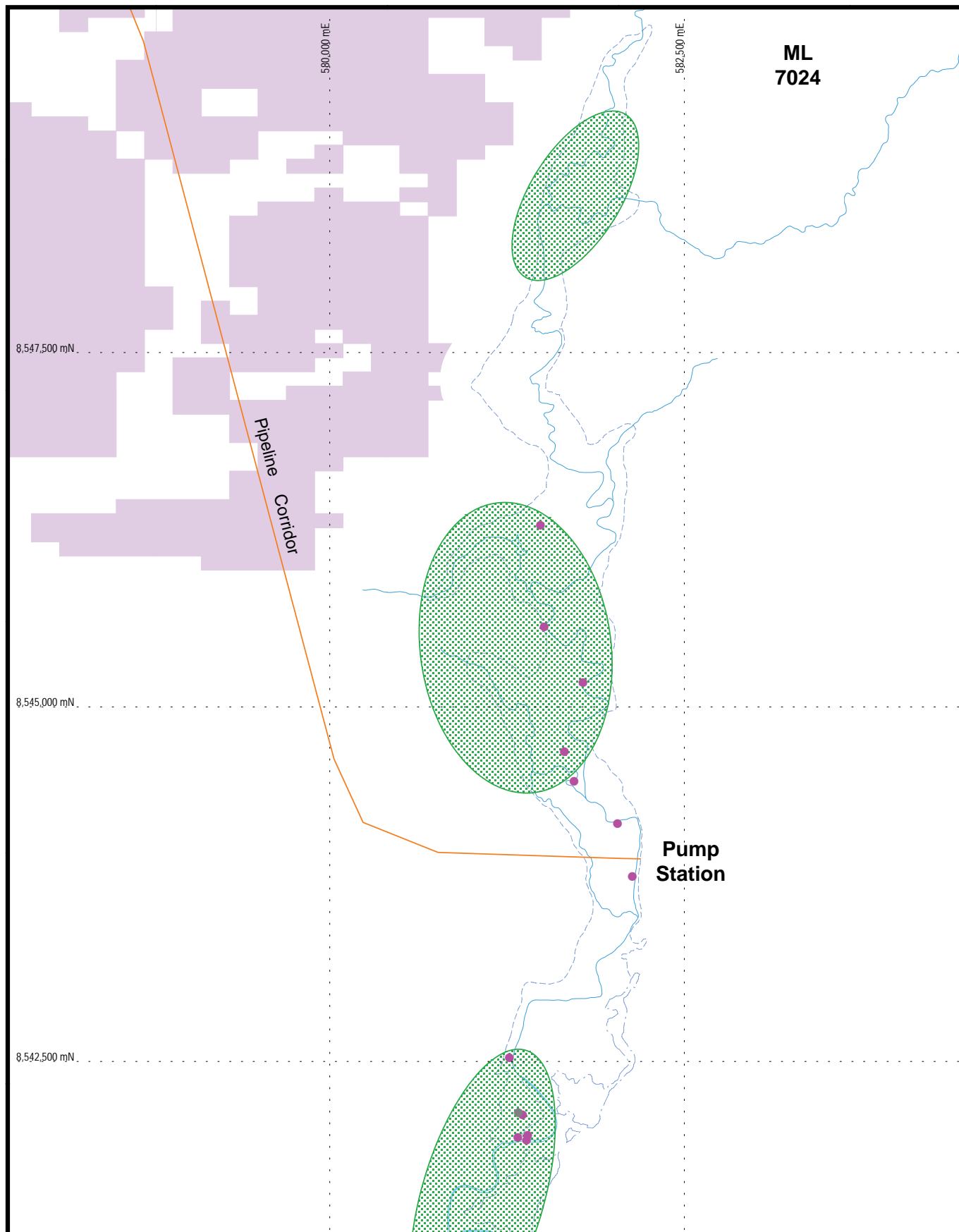
**ML 7024**

**Scale:** 0 1 km

**Date:** 17/09/2012

**Projection:** GDA94/MGA Zone 54

**RioTintoAlcan**



Rio Tinto Alcan

**Threatened Flora**

- Cooktown Orchid [*Dendrobium bigibbum*]
- Chocolate Tea Tree Orchid [*Dendrobium johannis*]

**Targeted Threatened Flora survey**

- ▨ May 2009

South of Embley Project

- RTA Mining Lease boundary
- Mining Years 14 - 40

**Fig. 5-3b: Threatened Flora  
(Pump Station)**



500 0 500m

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



## 5.2.2 Threatened Flora Surveys

With respect to threatened flora, an initial list of species potentially occurring in the Project area was developed based on database search results for the Project area and consideration of other species not recorded from the vicinity of the Project area but known to occur within the Cape York Peninsula region (refer **Section 4.4** for additional details). Species profiles were then developed to identify the known preferred habitat of each species based on existing records. Due to the paucity of records on Cape York for species such as the Ant Plant, Beach Nightshade and *Spathoglottis plicata* definitive habitat preferences were unable to be identified in the Project area and consequently a range of habitats similar to those reported for known locations of the species were included as potential habitat.

Aerial imagery of the Project area and local knowledge of the distribution of different habitats within the Project area were used to identify areas providing potential habitat for each species to be targeted during subsequent field inspections. As all of the threatened flora species that could occur within the Project area generally inhabit moist habitat types, many of the potential habitat areas identified for field inspection could possibly support multiple target species. Species identified as potentially occurring within the Project area are the *Calophyllum bicolor*, Cooktown Orchid, Chocolate Tea Tree Orchid, Ant Plant, Beach Nightshade and *Spathoglottis plicata*.

Survey areas targeted for threatened flora searches were generally traversed during at least one late wet season and one dry season survey event. During the construction access road survey (June 2012) the entire length of the access road was traversed with riparian areas searched extensively for threatened species.

**Table 5-4** summarises the detectability of the six target flora species, the suitability of survey timing, and species specific limitations of the survey approach.

All areas proposed for direct disturbance associated with infrastructure during the construction and operational phases of the Project were targeted for survey for threatened flora with a focus on riparian, wetland and vine forest habitats. These areas included the footprint of Dam C and immediate downstream area, the proposed Boyd infrastructure area and TSF; water infrastructure corridors between the Boyd infrastructure area, Norman Creek infrastructure area and the Ward River; and access road corridors including the Boyd Mine Access Road and Norman Creek Access Road.

Table 5-4 Survey Suitability and Limitations for Threatened Flora

Common Name (if exists) <i>Species</i>	Detectability	Suitability of Survey Timing*		Survey Limitations
		Post wet season (May/ July)	Late dry season (December)	
<i>Calophyllum bicolor</i>	Perennial shrub to small tree that is readily detected at any time of year.	good	good	No seasonal survey limitations as high detectability all year round. Identification of potential spring habitat on aerial imagery may have missed some spring areas associated with seasonal wetlands or mangrove areas on lower drainage systems. Such areas are located well away from proposed mining areas.
Cooktown Orchid <i>Dendrobium bigibbum</i>	High detectability when flowering due to visibility of purple flowers. Main flowering time reported to be January to July but can be as late as October (DSEWPac 2008a). Synchronous flowering of this species has been observed in the Weipa area during May. When not flowering the species is still detectable but could be overlooked.	good	moderate	No seasonal survey limitations as May surveys conducted during known flowering period.
Chocolate Tea Tree Orchid <i>Dendrobium johannis</i>	Greater detectability when flowering due to yellow/brown flowers. Main flowering time reported to be March to July but can be as late as October (DSEWPac 2008b). When not flowering the species is still detectable but could be overlooked.	good	moderate	No seasonal survey limitations as May surveys conducted during known flowering period. Some potential habitat areas associated with <i>Melaleuca</i> wetlands could not be fully inspected due to Crocodile hazard. These areas would not be impacted by the Project.
Ant Plant <i>Myrmecodia beccarii</i>	The Ant Plant is of low detectability during field survey due to the absence of obvious foliage or showy flowers, its diminutive size, and occurrence in the canopy of host trees.	moderate	moderate	No seasonal survey limitation as the species is of low detectability regardless of whether flowering or fruiting. Surveys in potential habitat areas employed slower traverses to compensate for low detectability. Access to some potential mangrove habitat areas was constrained by Crocodile hazard and inundation. Identification of potential spring habitat on aerial imagery may have missed some spring areas associated with seasonal wetlands or mangrove areas on lower drainage systems.

Common Name (if exists) <i>Species</i>	Detectability	Suitability of Survey Timing*		Survey Limitations
		Post wet season (May/ July)	Late dry season (December)	
Beach Nightshade <i>Solanum dunalianum</i>	A perennial shrub that is readily detectable when flowering and of good detectability when not flowering.  Flowering season not well known but flowers observed in July near Weipa.	good	good	No seasonal survey limitations as the species is of good detectability regardless of whether flowering or fruiting.
<i>Spathoglottis plicata</i>	Readily detectable when aerial shoots are present, particularly the brightly coloured flowers, but the plant may be difficult to detect if aerial shoots are absent such as immediately following fire or during extended dry periods.  Main flowering period is reported as November to January though flowering can occur from July to March.	good	good	No seasonal survey limitations as the species is readily detectable apart from after fire. Survey in May and December ensured the peak fire season was avoided.

\* Key to suitability of survey timing:

- poor - species with low or no detectability;
- moderate - species generally detectable at this time with appropriate survey approach; and,
- good - species with high detectability.

## 5.3 *Calophyllum bicolor*

### 5.3.1 Species Profile

*Calophyllum bicolor* is listed as 'vulnerable' under the EPBC Act.

*Calophyllum bicolor* grows as a small shrub to tall tree up to 50 centimetres (cm) in stem diameter and is a member of the *Clusiaceae* family. It is a perennial species that is fairly readily detected and identified in the field. *Calophyllum bicolor* is known to occur on mainland Australia in only 17 populations on Cape York Peninsula (EHP 2012g). The species also occurs in New Guinea and Indonesia (Queensland Herbarium 2012). There are a total of 19 specimens held by the Queensland Herbarium including four specimen records of the species from the Unigan Nature Reserve at Weipa (Queensland Herbarium 2012) with other regional records from Bamaga, Steve Irwin Wildlife Reserve, Macrossan Range, Lockerbie Scrub, Silver Plains and Bromley Station. Collection details for specimens on Cape York describe the species as uncommon to abundant at different locations. It occurs on spring-fed areas that form a distinct habitat with evergreen rainforest and permanently wet substrates, but does not occur on stream banks away from the spring-heads (EHP 2012g).

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPac's Register of Critical Habitat does not identify any critical habitat for *Calophyllum bicolor*.

There are no threats specifically listed for *Calophyllum bicolor* (DSEWPac 2012q); however the species is highly fire sensitive. Potential threats are associated with inappropriate fire regimes (frequent late season fires), and changes to groundwater characteristics that reduce flow volumes and/or periodicity at permanent springs occupied by the species.

### 5.3.2 Survey and Results

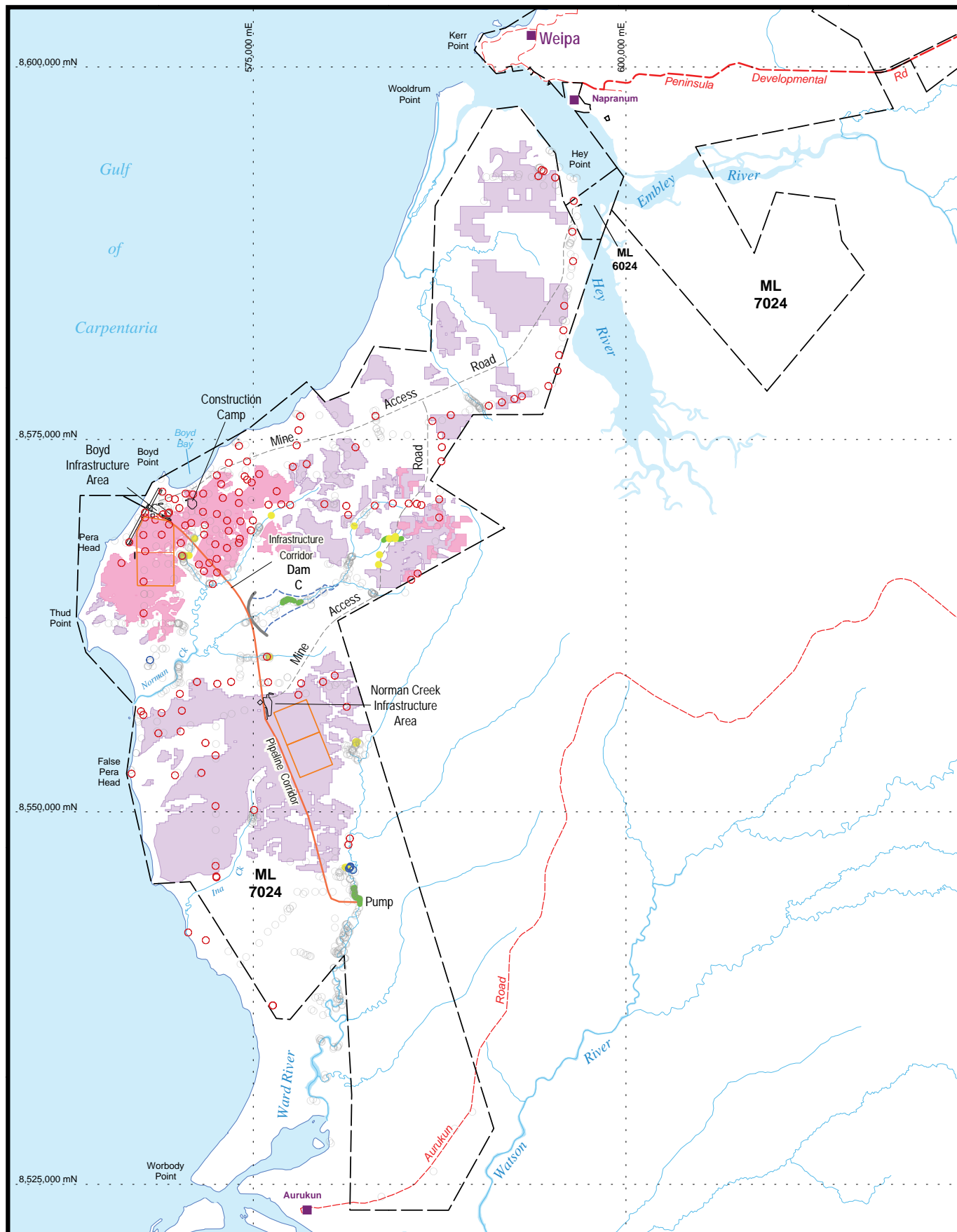
Permanently wet spring heads supporting vine forest have not been identified in the Project area.

However, potential habitat for *Calophyllum bicolor* within the Project area comprises closed forest associated with semi-permanent spring/seepage zones (potentially associated with RE 3.3.5). Potential habitat is shown on **Figure 5-4**. Aerial imagery and drainage patterns within the Project area were used to identify potential semi-permanent spring/seepage areas for targeted survey. These areas are identified on imagery as lush green areas with a dense canopy at the head of linear drainage systems or at the periphery of broader stream/wetland aggregations on the lower reaches of stream systems.

Potential semi-permanent spring/seepage areas identified from aerial imagery were traversed on foot to identify the presence of suitable habitat for the species. Riparian areas within Dam C footprint were also targeted. Of the 11 areas traversed, five semi-permanent springs/seepage zones close to proposed disturbance areas with potentially suitable habitat were identified. Survey of the five spring areas was conducted during the May/July and December field trips. These areas are of very limited extent (typically 20-50m in diameter). Six other seepage zones lacking suitable habitat for the species were also surveyed. The species was not located at any of the areas targeted during any of the surveys. However, it is possible that unidentified isolated patches of suitable habitat may occur at the margin of inaccessible wetlands in the lower freshwater sections of the main drainages (Norman Creek, Ward River, Winda Winda Creek) and may support the species.

**Table 5-5** summarises the profiling information for *Calophyllum bicolor*.





Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 - 13
- Mining Years 14 - 40
- Semi-permanent spring

***Calophyllum bicolor***  
 Potential Habitat

- Vegetation Survey type**
- Secondary
  - Tertiary
  - Quarternary

South of Embley Project

**Fig 5-4: Potential Habitat of *Calophyllum bicolor***



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Table 5-5 Profile Summary - *Calophyllum bicolor*

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Known/ Estimated Population in Project Area	Likelihood of Occurrence within Project Area
<i>Calophyllum bicolor</i>	A small fire sensitive tree growing as a dense shrub layer or in the canopy.	Spring/seepage areas supporting closed forest (potentially associated with RE 3.3.5).  Five semi-permanent groundwater seepage zones were located within the Project area and represent sub-optimal potential habitat. These areas are associated with the Norman Creek and Ward River drainage systems.  Additional semi-permanent seepage zones may occur in inaccessible areas of the lower Ward River and Norman Creek systems.	No known population.  Any population that may be present would be small.	<b><u>Mining Area</u></b> <b>Unlikely:</b> no suitable habitat exists in Darwin Stringybark woodland.  <b><u>Infrastructure footprint</u></b> <b>Unlikely:</b> Targeted surveys of the Dam C area and infrastructure crossings of riparian areas indicated with a high reliability that this species is not present in these locations.  <b><u>Balance of Project Area not disturbed</u></b> <b>Possible:</b> Only limited areas of potentially suitable fire retardant habitat occur within the Project area. The species was not detected during field surveys of five semi-permanent groundwater seepage rainforest patches that are close to proposed mining areas and provide suitable habitat for the species, but may occur in the Project area in groundwater-fed riparian gallery forest or seepage zones nearer the coast. Six other semi-permanent seepage areas that were surveyed (located outside the disturbance footprint) did not have suitable habitat present.

### 5.3.3 Relevant Impacts

#### 5.3.3.1 Construction Impacts Prior to Mitigation

The following provides an overview of the potential unmitigated direct and indirect impacts of the Project on *Calophyllum bicolor* during the construction phase of the Project. These are summarised in **Table 5-6**.

##### Direct Impacts

The results of the surveys determined that *Calophyllum bicolor* is unlikely to occur within or adjacent to proposed construction areas. Therefore there would be no direct disturbance of the species during construction and no edge effects on potential habitat. *Calophyllum bicolor* has a naturally patchy and restricted distribution associated with the isolated occurrence of permanent groundwater seepage zones. Populations of the species are therefore naturally fragmented and would not be affected if present by the small amount of habitat that would be disturbed during construction. Consequently, no direct relevant impacts to this species are expected.

##### Indirect Impacts

The groundwater seepage habitats on the lower sections of the main drainages where the species was determined to possibly occur (i.e. potential habitat areas that may have been missed during interpretation of aerial imagery or in areas unable to be accessed) are well removed from proposed construction areas and are beyond the area where indirect effects of construction activities on water quality, air quality and the groundwater regime may be experienced. However, these seepage areas could be susceptible to effects from weed infestations that may arise from construction activities. Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass, or smothering species, such as Rubber Vine. If left to proliferate in the vicinity of groundwater seepage zones these weeds could lead to an increase in fire intensity that could adversely affect the vegetation edge of these seepage areas (DEEDI 2011b, NTFRS 2003). The elevated moisture regime within these areas could also favour the proliferation of Rubber Vine which could smother and suppress spring vegetation. Resultant unmitigated indirect impacts on *Calophyllum bicolor* associated with uncontrolled weed infestations could therefore be moderate and, without control, result in a long-term impact.

#### 5.3.3.2 Operational Impacts Prior to Mitigation

##### Direct Impacts

The semi-permanent groundwater seepage habitats on the lower sections of the main drainages where the species possibly occurs are well removed from the proposed mining areas and would not be directly disturbed during mining operations or subject to edge effects from clearing.

The potential habitats of the species are naturally isolated and fragmented by non-favoured habitat and it is not anticipated that clearance of Darwin Stringybark woodland for mining would further fragment potential habitat areas of this species. Although the mechanism of dispersal of *Calophyllum bicolor* is not known, as the network of drainage line habitats that would remain and be unaffected by direct disturbance from operational activities are likely to maintain any processes related to the movement of plant propagules and genetic continuity between potential habitat areas.

**Table 5-6 Summary of Construction Impacts Prior to Mitigation for *Calophyllum bicolor***

Action/Issue	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed construction areas.
Edge effects	None Species not present in areas adjacent to proposed construction areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from construction phase habitat disturbance.
Effects on recruitment/movement of propagules	None <i>Calophyllum bicolor</i> does not occur in or adjacent to infrastructure areas and the extent and location of construction disturbance is unlikely to affect recruitment/movement of propagules of the species.
<b>Indirect Impacts</b>	
Water quality	None Species occurs in groundwater seepages. Groundwater quality would not be affected during construction (refer <b>Sections 16.2 and 16.4</b> ).
Altered hydrological regime	None Potential groundwater seepage zone habitat areas are located well beyond the proposed construction areas and potential effects of construction on groundwater are not expected (refer <b>Section 16.2 and 16.4</b> ).
Air quality	None Species is not present within the vicinity of proposed construction areas where localised air quality effects may be experienced (refer <b>Section 14.3</b> ).
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could over time affect groundwater seepage zones potentially occurring on the lower sections of the main drainages.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

### Indirect Impacts

The potential habitat areas for the species are located well away from proposed mining areas and beyond the area where effects on water quality and air quality may be experienced (refer **Sections 14.3, 16.2 and 16.4** for additional details). The groundwater seepage habitats that may support the species would be susceptible to significant changes to the groundwater regime, particularly reductions in groundwater discharge. Impacts could occur if adverse groundwater changes were experienced at locations that coincided with a groundwater seepage zone supporting the species. Modelling of catchment hydrology indicates that only minor localised effects on riparian and wetland ecosystems are likely as a result of Project development. Potential effects in downstream areas (such as those potentially inhabited by *Calophyllum bicolor*) may result in slightly extended groundwater discharge, but within the range experienced by the downstream ecosystems under natural inter-decadal variation (refer **Sections 16.2 and 16.4** for additional details). A minor extension of discharge periodicity is unlikely to adversely affect *Calophyllum bicolor* or the overall habitat condition and composition of groundwater seepage ecosystems.

Seepage areas would be susceptible to effects from weed infestations as described for the construction phase. Moderate impacts on this species could result over the long term if uncontrolled weed infestations occurred in these areas.

**Table 5-7** summarises the relevant unmitigated operational impacts on *Calophyllum bicolor*.

### **5.3.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts**

Disturbance to *Calophyllum bicolor* habitats would be avoided through implementation of the following:

- the proposed SoE environmental buffer system would exceed the requirement of the Queensland Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the *Calophyllum bicolor* would be protected from mining by the buffer system. RTA would work with Traditional Owners and the relevant WCCCC Sub-committee on establishment of environmental buffers as part of the CEMP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system are included in **Section 6.3.4.5**;
- the general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat. No plants were located in areas where infrastructure has been planned; and,
- removal of a dam on the Ward River from the proposal (refer **Section 3.13.3**).

**Table 5-7 Summary of Operational Impacts Prior to Mitigation for *Calophyllum bicolor***

Action/Issue	Summary of Potential Operational Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed mining areas.
Edge effects	None Species not present in areas adjacent to proposed mining areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None The network of undisturbed drainage line habitats is anticipated to maintain current dispersal mechanisms and levels of genetic continuity.
<b>Indirect Impacts</b>	
Water quality	None Species occurs in groundwater seepages. Groundwater quality would not be affected during operations.
Altered hydrological regime	Minor, long term The shallow aquifer feeding the semi-permanent groundwater seepage areas are typically hosted in the kaolinitic layer below the bauxite apart from at the peak of the wet season. The seepage areas are not fed from bauxite hosted groundwater in the dry season and bauxite removal would be very unlikely to affect groundwater supply to these areas (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species is not present within the vicinity of proposed mining areas where localised air quality effects may be experienced (refer <b>Section 14.3</b> ).
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect groundwater seepage zones.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.



Direct and indirect unmitigated impacts associated with the Project on *Calophyllum bicolor* are identified in **Table 5-6** and **Table 5-7**. The following mitigation and enhancement measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (refer **Section 6.3.4.3** for additional details); and,
- the proposed SoE environmental buffer system would be implemented to reduce impact from any alteration of the hydrological regime on areas that may provide habitat for *Calophyllum bicolor*.

The following general mitigation and enhancement measures would further reduce potential for negligible impacts or would provide positive outcomes for the *Calophyllum bicolor*:

- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed in cooperation with Traditional Owners and the relevant WCCCC Sub-committee as part of the CEMP (refer **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats such as groundwater seepage zones that potentially support *Calophyllum bicolor*; and,
- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (refer **Section 7.3.6.4**).

The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-8** summarises the relevant avoidance, mitigation and/or enhancement measures and residual impacts for *Calophyllum bicolor* compared to unmitigated impacts identified in **Table 5-6** and **Table 5-7** as greater than negligible.

**Table 5-9** summarises the relevant impacts on *Calophyllum bicolor* as a result of the Project after the proposed mitigation measures have been considered, compared to the significant impact criteria for matters of NES (DEWHA 2009c).

**Table 5-8 Potential Impacts, Mitigation and Enhancement Measures and Residual Impacts for *Calophyllum bicolor***

Potential Impact	Unmitigated Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds during the construction and operational phases that may intensify fire impacts or smother vegetation in <i>Calophyllum bicolor</i> habitats.	Moderate, long term	<ul style="list-style-type: none"> <li>• Weed management program</li> </ul>	Negligible, long term
Altered hydrological regime	Minor, long term	<ul style="list-style-type: none"> <li>• SoE environmental buffer around seepage zones</li> </ul>	Negligible, long term

Table 5-9 Impact Assessment Summary - *Calophyllum bicolor*

<b>Will the proposed works...</b>	<b><i>Calophyllum bicolor</i> : Vulnerable</b>
....lead to a long-term decrease in the size of an important population of a species?	<p><i>Calophyllum bicolor</i> is currently known only from 17 populations on Cape York Peninsula (EHP 2012g). It occurs on spring-fed areas that form a distinct habitat with evergreen rainforest and permanently wet substrates, but does not occur on stream banks away from the spring-heads. There are four specimen records of the species from the Weipa area, but the species has not been recorded in the Project area.</p> <p><i>Calophyllum bicolor</i> was not recorded within the Project area despite the presence and survey of five semi-permanent groundwater seepage zones that provided suitable habitat for the species. The species was absent from six other seepage zones surveyed where the habitat was unsuitable. These sites were located in close proximity to proposed mining areas and no other potential habitat areas appear to occur close to mining or infrastructure areas. However, unsurveyed isolated patches of suitable habitat may occur at the margins of wetlands in the lower freshwater sections of the main drainages (Norman Creek, Ward River, Winda Winda Creek) and may support the species.</p> <p>Any population of <i>Calophyllum bicolor</i> that may be present within the Project area would be regarded as an important population as the location would represent the southern distribution limit for the species.</p> <p>Any semi-permanent groundwater seepage habitats on the lower sections of the main drainages where the species may occur would be well removed from the proposed mining and infrastructure areas and would not be directly disturbed. These habitats would be susceptible to impacts from altered groundwater hydrology; however, their habitat location is well away from mining areas and the implementation of the proposed SoE environmental buffer system and post mining rehabilitation measures, which would aim to protect hydrological regimes are anticipated to minimise effects on semi-permanent groundwater seepage areas. As such it is unlikely that the species, if present, would be adversely affected. It is not anticipated that the Project would lead to a long-term decrease in any population of <i>Calophyllum bicolor</i> that may be present.</p>
....reduce the area of occupancy of an important population?	<p>If <i>Calophyllum bicolor</i> is present within the Project area, its habitat would not be directly affected by mining and it is not anticipated there would be sufficient hydrological impacts on the groundwater dependent habitats it occupies to lead to a reduction of the area of occupancy of an important population.</p>
....fragment an existing important population into two or more populations?	<p><i>Calophyllum bicolor</i> has a naturally patchy and restricted distribution associated with the isolated occurrence of permanent groundwater seepage zones. Populations of <i>Calophyllum bicolor</i> on Cape York are therefore naturally fragmented and not sensitive to disturbance of sub-optimal habitat between patches of preferred habitat. The Project would not lead to fragmentation of any potentially occurring <i>Calophyllum bicolor</i> populations.</p>
....adversely affect habitat critical to the survival of a species?	<p>The Project area does not include any critical habitat areas for <i>Calophyllum bicolor</i> that are listed under the EPBC Act or identified in Recovery Plans.</p>
....disrupt the breeding cycle of an important population?	<p>If <i>Calophyllum bicolor</i> is present within the Project area, it is not anticipated that its preferred habitat would be adversely affected by the Project and consequently the breeding cycle of the species would not be disrupted.</p>

<b><i>Will the proposed works...</i></b>	<b><i>Calophyllum bicolor</i> : Vulnerable</b>
<i>....modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?</i>	If <i>Calophyllum bicolor</i> is present within the Project area its habitat would not be directly affected by mining and it is not anticipated that there would be sufficient hydrological impacts on the groundwater dependent habitats it occupies to lead to a decline in the species.
<i>....result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</i>	Virtually all of the Project area is currently free of serious weeds and invasive species; however a number of significant environmental weeds occur in the surrounding region. The preferred habitat of <i>Calophyllum bicolor</i> is often favoured by invasive species due to the moist nature of the habitat. Should <i>Calophyllum bicolor</i> be present, the potential introduction of Rubber Vine ( <i>Cryptostegia grandiflora</i> ) would be of particular concern. Proposed mitigation measures for invasive species include a rigorous weed management program which would include preventative measures and control measures for weeds within the Project area. Riparian areas including groundwater discharge areas would be one of the habitats targeted by the program. These mitigation measures would be effective in managing the impacts of weeds on <i>Calophyllum bicolor</i> .  The Project is not anticipated to lead to the introduction or spread of invasive weeds within any potential habitat of <i>Calophyllum bicolor</i> .
<i>.....introduce disease that may cause the species to decline?</i>	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
<i>....interfere substantially with the recovery of the species?</i>	It is not anticipated that the Project would adversely affect <i>Calophyllum bicolor</i> (if present). The Project would not interfere with the recovery of <i>Calophyllum bicolor</i> .

#### ***5.3.4.1 National Recovery Plan and Threat Abatement Plans***

There is no national recovery plan or relevant threat abatement plans for *Calophyllum bicolor*.

#### **5.3.5 Offset Measures**

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012b), offsets are not required where the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c)).

**Sections 5.3.3 and 5.3.4** of this report documents the results of the impact assessment process and concludes that with the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the Project on *Calophyllum bicolor* would be negligible and therefore not significant (refer **Section 5.1.2**). As such, offsets relating to the *Calophyllum bicolor* are not required under the Commonwealth offsets policy.

## 5.4 Cooktown Orchid (*Dendrobium bigibbum* [*Vappodes bigibba*])

### 5.4.1 Species Profile

This species is listed under the EPBC Act as *Dendrobium bigibbum*, but is also known as *Vappodes bigibba*. The latter name is accepted as the correct name for *Dendrobium bigibbum* in the Australian Plant Census (CHAH 2008).

The Cooktown Orchid is listed as 'vulnerable' under the EPBC Act.

The Cooktown Orchid is a member of the Orchidaceae family and grows as an epiphyte on a variety of tree and rock hosts. It is a perennial plant that typically maintains permanent stems, and flowers annually. It is readily detected in the field when flowering due to the bold purple flowers but is diminutive and less apparent when not flowering. The Cooktown Orchid occurs on northern Cape York Peninsula south to about the Archer River (DSEWPaC 2008a). A closely related species, *Dendrobium phalaenopsis* (*Vappodes phalaenopsis*) also known as Cooktown Orchid, is listed as vulnerable and has a more restricted distribution centred on the Cooktown area.

The Cooktown Orchid (*Dendrobium bigibbum*) inhabits denser vegetation types with moderate light intensity including coastal and inland vine forest, moist gullies in open forest and woodland with protection from fire, and riparian vegetation. There are records of the species from throughout its range in the northern Cape York Peninsula and it may be locally common in suitable habitat. The Queensland Herbarium has 73 specimens of the species including numerous cultivated specimens and many wild specimens from the Project region including from near Aurukun and Weipa (Queensland Herbarium 2012).

The Cooktown Orchid has been recorded from several locations in the subregion, particularly in notophyll vine forest on coastal dunes and on lateritic red earths. The habitat preference of this species is well known and is restricted to closed forest, typically as an epiphyte in rainforest, vine thicket and mangrove habitats (DSEWPaC 2008a).

The species is sensitive to fire and therefore is found only in situations where frequent fires do not occur. Vine forest patches on bauxite provide the required fire protection but with respect to riparian gallery forest the species is more commonly encountered inside broad occurrences of the vegetation, or where lateral seepage zones and mesic ground vegetation suppress fire frequency and scorch height.

The current population size of the species in the subregion is unknown but likely to be in the order of tens of thousands based on the density of individuals observed in ideal habitat in the Weipa area (M. Thomas pers. comm.) and the abundance of potential habitat for the species throughout the subregion.

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPaC's Register of Critical Habitat does not identify any critical habitat for the Cooktown Orchid.

Known threats to the Cooktown Orchid include pressure from localised settlement and visitors, altered fire regimes and illegal collection. It has also been suggested that the Cooktown Orchid may also be detrimentally affected by an increase in the incidence of severe cyclones (DSEWPaC 2008a).

## 5.4.2 Survey and Results

Substantial survey effort was employed for the Cooktown Orchid during post wet season and late dry season targeted survey events. Potential habitat for the species was surveyed on each of the 14 targeted survey days. Surveys focussed on potential habitat including vine forest on bauxite (RE 3.5.4), alluvial vine forest (RE 3.3.5), vine forest on coastal dunes (RE 3.2.5), riparian gallery forest (RE 3.3.9 and 3.3.14a), and the landward margin of mangroves (RE 3.1.1a, 3.1.1c, and 3.1.3). Potential habitat is shown on **Figure 5-5**. In addition, secondary vegetation transects undertaken in potential habitat areas also provided survey data for the species.

Areas surveyed for the species included the large vine forest patch on bauxite at Hey Point, dunal vine forest on the northern and southern side of the Norman Creek mouth, dunal vine forest at Ina/Waterfall Creek, spring areas also searched for *Calophyllum bicolor*, the majority of riparian gallery forest on all branches of Norman Creek, on Coconut Creek and Winda Winda Creek, and the landward margin of mangroves along the western bank of the Ward River, the southern and northern shores of Norman Creek, and along the shoreline on the Embley River west of Hey Point (refer **Figure 5-3**).

The Cooktown Orchid was recorded in a number of locations throughout the Project area in coastal and Weipa plateau vine forest, mangrove communities, and in areas of riparian rainforest and riparian gallery forest (refer **Figure 5-3**). This species is expected to be widespread in suitable habitat within the Project area and adjoining areas.

**Table 5-10** summarises the profile information for the species.

## 5.4.3 Relevant Impacts

### 5.4.3.1 Construction Impacts Prior to Mitigation

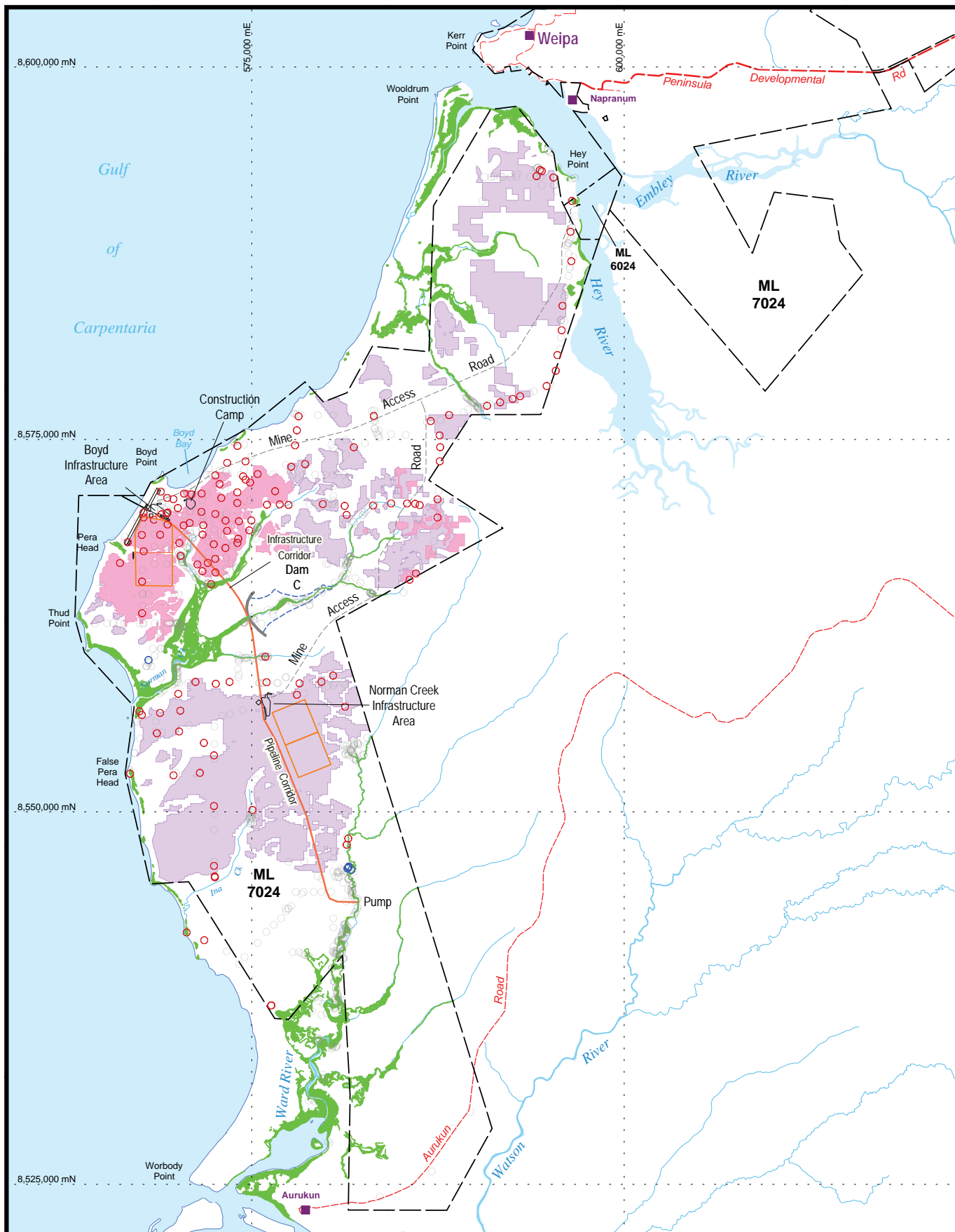
#### Direct Impacts

Two occurrences of the Cooktown Orchid within rainforest pockets in the proposed footprint of Dam C would be inundated (**Figure 5-3**). The species was also found in the vicinity of the proposed infrastructure corridor crossings on Norman Creek and the vicinity of road crossings at Norman Creek and Winda Winda Creek. These individuals may be disturbed, depending on the final required alignment of this linear infrastructure.

In total, approximately 7.34ha of potential habitat for this species would be cleared. This includes 7.3ha of RE 3.3.5 (which represents less than 0.04% and 0.01% of similar habitat in the Project area and subregion respectively) and 0.04ha of RE 3.1.1a (which represents less than 0.01% of similar habitat in the Project area and subregion).

Clearing in these areas may also produce edge effects at the boundary of adjoining uncleared riparian habitat, however the extent of the edge effect on the species would be negligible as individuals of the species are regularly observed at the natural edge of riparian and vine forest vegetation.

Construction of Dam C and infrastructure corridors would fragment habitat to a minor extent by creating a gap in the linear riparian gallery habitats occupied by the species. The gaps would not be of a sufficient magnitude to adversely affect dispersal of the species or genetic continuity.



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 - 13
- Mining Years 14 - 40

**Cooktown Orchid**  
(*Dendrobium bigibbum*)

■ Potential Habitat

**Vegetation Survey type**

- Secondary
- Tertiary
- Quarternary

South of Embley Project

**Fig 5-5: Potential Habitat of Cooktown Orchid**



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013



Table 5-10 Profile Summary - Cooktown Orchid

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Known/estimated population in Project area	Likelihood of Occurrence within Project Area
<i>Dendrobium bigibbum</i> Cooktown Orchid	An epiphyte that grows on trees and rocks in situations with moderate light intensity.	Within the Project area the Cooktown Orchid grows as an epiphyte on trees (as rocks are absent) and is commonly encountered in closed forest communities comprising coastal vine forest (RE 3.2.2), riparian rainforest (RE 3.3.5, 3.3.9), vine forest on bauxite (RE 3.5.4), and mangroves (REs 3.1.1a, 3.1.1c, 3.1.3). All areas of these habitat types within the Project area provide potential habitat.  (refer <b>Figure 5-5</b> for potential habitat).	Cannot be accurately estimated based on the targeted survey approach employed during field surveys, however, it is widespread and locally common within the Project area.	<p><b><u>Mining Area</u></b>  <b>Unlikely:</b> No suitable habitat exists in Darwin Stringybark woodland.</p> <p><b><u>Infrastructure footprint</u></b>  <b>Known to Occur:</b> Identified in two locations in pockets of riparian rainforest within the footprint of Dam C, in the vicinity of the infrastructure corridor crossings on Norman Creek, and in the vicinity of road crossings of Norman Creek and Winda Winda Creek.</p> <p><b><u>Balance of Project Area not disturbed</u></b>  <b>Known to Occur:</b> Located in coastal and non-coastal vine forest, and mangrove edges at several locations within the Project area that would not be affected by mining or infrastructure.</p>

### Indirect Impacts

Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass, or smothering species, such as Rubber Vine. If left to proliferate in the vicinity of riparian, mangrove and vine forest habitats these weeds could lead to an increase in fire intensity that could adversely affect Cooktown Orchids growing on the edge of these habitats over the long term (DEEDI 2011b, NTFRS 2003).

The Cooktown Orchid occurs in the Project area as an epiphyte on trees in riparian and non-riparian habitats and would not be susceptible to localised minor changes in water quality that may occur during the construction phase. Similarly, substantial changes to riparian and non-riparian ecosystems due to changes to groundwater hydrology are not anticipated and any effects are unlikely to impact on this epiphytic species (refer **Sections 16.2** and **16.4**).

Elevated dust levels from construction machinery, has the potential to adversely affect individuals by settling on foliage and suppressing respiratory processes. Any dust impact is likely to be relatively short term (i.e. restricted to the finite construction period in any one location), is not anticipated to lead to mortality of individuals, and would be attenuated within a short distance by the densely foliated vegetation favoured by the species. Additional details are included in **Section 14.3**.

**Table 5-11** summarises the relevant unmitigated construction impacts for the Cooktown Orchid.

### *5.4.3.2 Operational Impacts Prior to Mitigation*

#### Direct Impacts

No known or potential habitat for the Cooktown Orchid would be directly disturbed or fragmented during the operational phase of the Project. Similarly, mining would not occur close enough to habitat areas to create edge effects. Although the mechanism of dispersal of the Cooktown Orchid is not confidently known, as the network of undisturbed habitat that would remain after construction and be unaffected by direct disturbance during the operational phase of the Project would enable any processes related to the movement of plant propagules and genetic continuity to be maintained between potential habitat areas.

#### Indirect Impacts

The potential habitat areas for the species are located away from proposed mining areas and beyond the area where localised effects on air quality may be experienced (refer **Section 14.3**).

Although localised changes to surface water quality may occur adjacent to mining areas, the Cooktown Orchid is not regarded as susceptible to water quality effects given its epiphytic habit. Consideration of potential effects on riparian and non-riparian ecosystems from altered surface and groundwater regimes due to mining concluded that small localised changes may occur. However, it is not anticipated that these effects would be sufficient to substantially impact on individual plants or host trees (refer **Sections 16.2** and **16.4**).

Potential weed impacts on this species during operation would be the same as for the construction phase. Moderate impacts could occur over the long term if fire-promoting or smothering weed species become established in habitat of the species.

**Table 5-12** summaries the relevant unmitigated operational impacts for the Cooktown Orchid.

**Table 5-11 Summary of Construction Impacts Prior to Mitigation for Cooktown Orchid**

Action/Issues	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	Minor, long term Two occurrences of the Cooktown Orchid occur within the footprint of Dam C and several occur in the vicinity of linear infrastructure crossings of drainage lines.
Edge effects	Negligible, long term Species naturally occurs at the edge of riparian vegetation where infrastructure necessarily crosses drainage lines.
Fragmentation of habitat	Minor, long term Construction of infrastructure would produce small gaps in linear habitats occupied by the species.
Effects on recruitment/movement of propagules	Negligible, long term Construction of infrastructure would produce small gaps in linear habitats occupied by the species but not of a sufficient magnitude to affect local dispersal of propagules or genetic continuity.
<b>Indirect Impacts</b>	
Water quality	None Construction is unlikely to cause water quality changes which would affect this species.
Altered hydrological regime	Negligible, long term Substantial changes to riparian and non-riparian ecosystems due to potential changes to groundwater and surface water hydrology are not anticipated and any effects are unlikely to impact on epiphytic species (refer <b>Section 16.2</b> and <b>16.4</b> ).
Air quality	Minor, short term The vigour of a small number of individual plants could be adversely affected by dust settling on foliage in areas close to construction activities.
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect riparian and vine forest habitats occupied by the Cooktown Orchid.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

**Table 5-12 Summary of Operational Impacts Prior to Mitigation for Cooktown Orchid**

Action/Issue	Summary of Potential Operational Impact Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed mining areas.
Edge effects	None Species not present in areas adjacent to proposed mining areas.
Fragmentation of habitat	None Habitat of the species would not be affected by direct disturbance.
Effects on recruitment/movement of propagules	Negligible, long term No habitat would be disturbed during the operational phase of the Project. The network of undisturbed habitats that would remain in the Project area is anticipated to maintain current dispersal mechanisms and levels of genetic continuity.
<b>Indirect Impacts</b>	
Water Quality	None Construction is unlikely to cause water quality changes which would affect this species.
Altered hydrological regime	Negligible, long term Substantial changes to riparian and non-riparian ecosystems due to potential changes to groundwater and surface water hydrology are not anticipated and any effects are unlikely to impact on this epiphytic species (refer <b>Sections 16.2 and 16.4</b> ).
Air Quality	None Species not present in areas adjacent to proposed mining areas where air quality issues may occur.
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect riparian and vine forest habitats occupied by the Cooktown Orchid.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### 5.4.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts

Disturbance to Cooktown Orchid habitats would be avoided or minimised through implementation of the following:

- the proposed SoE environmental buffer system would exceed the requirement of the Queensland Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the Cooktown Orchid would be protected from mining by

the buffer system. RTA would work with Traditional Owners and the relevant WCCCC Sub-committee on establishment of environmental buffers as part of the CHEMEP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system is included in **Section 6.3.4.5**;

- the general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat; and,
- removal of a dam on the Ward River from the proposal (refer **Section 3.13.3**).

Direct and indirect unmitigated impacts associated with the Project on the Cooktown Orchid identified in **Table 5-11** and **Table 5-12**. The following mitigation and enhancement measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (refer **Section 6.3.4.3** for additional details); and,
- dust abatement measures proposed would minimise airborne dust and the potential effects of settled dust on individual plants during construction activities (refer **Section 14.4** for additional details).

The following general mitigation and enhancement measures would further reduce potential for negligible impacts or would provide positive outcomes for the Cooktown Orchid:

- the proposed SoE environmental buffer system that would be implemented would also reduce the impact from any alteration of the hydrological regime on areas that may provide habitat for the Cooktown Orchid;
- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed and implemented (refer **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats; and,
- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (refer **Section 7.3.6.4**).

An environmental management plan outline for the Cooktown Orchid which summarises these avoidance, mitigation and enhancement measures is provided in **Appendix 5-A**. The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-13** summarises the relevant mitigation measures and residual impacts for the Cooktown Orchid based on the unmitigated impacts identified in **Table 5-11** and **Table 5-12** as greater than negligible.

**Table 5-13 Potential Impacts, Avoidance, Mitigation and Enhancement Measures and Residual Impacts the Cooktown Orchid**

Potential Impact	Unmitigated Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds during the construction and operational phases that may intensify fire impacts or smother vegetation in Cooktown Orchid habitats.	Moderate, long term	Weed management program	Negligible, long term
Altered fire regime	Moderate, long term	Weed management program	Negligible, long term
Clearing and loss of known habitat during construction within the footprint of Dam C and at linear infrastructure crossings of some drainage lines.	Minor, long term	Vast majority of known and potential habitat areas of the species protected within the proposed SoE environmental buffers	Minor, long term
Fragmentation of habitat in construction areas.	Minor, long term	Network of undisturbed habitat protected within the proposed SoE environmental buffers	Minor, long term
Adverse effects on the vigour of individual plants affected by construction dust settling on foliage.	Minor, short term	Dust suppression during construction	Negligible, short term

**Table 5-14** summarises the potential impacts on the Cooktown Orchid as a result of the Project after proposed mitigation measures have been considered, compared to the significant impact criteria for matters of NES (DEWHA 2009c).

#### 5.4.4.1 National Recovery Plan and Threat Abatement Plans

There is no national recovery plan or relevant threat abatement plans for the Cooktown Orchid. However, the proposed feral pig program, which will reduce pig damage to riparian habitats, is consistent with the *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEH 2005) (refer **Table 5-30**).

#### 5.4.5 Offset Measures

Under the *EPBC Act Environmental Offsets Policy* (DSEWPac 2012b), offsets are not required here the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c)).

**Sections 5.4.3** and **5.4.4** of this report documents the results of the impact assessment process and concludes that with the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the Project on the Cooktown Orchid would be negligible to minor and therefore not significant (refer **Section 5.1.2**). As such, offsets relating to the Cooktown Orchid are not required under the Commonwealth offsets policy.

A recommendation in the *Queensland Coordinator General's Report on the EIS* (Queensland Government 2012) for the SoE Project is that RTA translocate and/or propagate 3.5 plants of Cooktown Orchid for each plant found within the footprint of disturbance and establish such plants within a 355.2ha offset area comprising riparian habitat (RE 3.3.5, RE 3.3.9, and RE 3.3.21).



Table 5-14 Impact Assessment Summary - Cooktown Orchid

<i>Will the proposed works...</i>	<b>Cooktown Orchid (<i>Dendrobium bigibbum</i>): Vulnerable</b>
<i>...lead to a long-term decrease in the size of an important population of a species?</i>	<p>The Cooktown Orchid occurs on Cape York Peninsula north from Princess Charlotte Bay and Kowanyama to the tip and into southern Asia, and has been recorded from several locations in the Weipa region, particularly in notophyll vine forest on coastal dunes and on lateritic red earths.</p> <p>The Cooktown Orchid was recorded from a number of locations throughout the Project area in coastal and Weipa plateau vine forest, mangrove communities and in areas of riparian rainforest and riparian gallery forest and is expected to be widespread within the entire Project area and adjoining areas in suitable habitat. The Cooktown Orchid was confirmed in two pockets of riparian rainforest within the proposed footprint of Dam C.</p> <p>The population of the Cooktown Orchid within the Project area is not considered an important population under the EPBC Act.</p>
<i>...reduce the area of occupancy of an important population?</i>	The population within the Project area is not regarded as an important population.
<i>...fragment an existing important population into two or more populations?</i>	The population within the Project area is not regarded as an important population.
<i>...adversely affect habitat critical to the survival of a species?</i>	The Project area does not include any critical habitat areas for the Cooktown Orchid that are listed under the EPBC Act or identified in Recovery Plans. The species is widespread through central and northern Cape York.
<i>...disrupt the breeding cycle of an important population?</i>	The population within the Project area is not regarded as an important population.
<i>...modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?</i>	Two pockets of rainforest with Cooktown Orchids, within the proposed footprint of Dam C, would be inundated. The Cooktown Orchid was also found in the vicinity of the proposed infrastructure corridor crossings on Norman Creek and vicinity of road crossings at Norman Creek and Winda Winda Creek. None of the vine forest or mangrove habitat types supporting the Cooktown Orchid within the Project area would be directly affected by clearing for mining. No significant modifications of these habitats due to changes in hydrology are anticipated. Overall, the reduction of habitats supporting the species would be very minor. The proposed fire management program would favour the species by reducing the impacts of the current fire regime on fire sensitive habitats such as vine forest.
<i>...result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</i>	<p>The Project area is currently predominantly free of serious weeds and invasive species; however a number of significant environmental weeds occur in the surrounding region. The vine forest habitat of the Cooktown Orchid is not considered at risk of weed invasion as most of the significant weeds in the region do not colonise closed forest. The mangrove habitat of the species is threatened by the introduction of Rubber Vine (<i>Cryptostegia grandiflora</i>). Proposed mitigation measures include a rigorous weed management program which would include preventative measures and control measures for weeds within the Project area. Riparian areas including mangroves would be one of the habitats targeted by the program. These mitigation measures would be effective in managing the impact of weeds on the Cooktown Orchid.</p> <p>The Project is not anticipated to lead to the establishment of invasive weeds within the habitat of the Cooktown Orchid.</p>
<i>....introduce disease that may cause the species to decline?</i>	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
<i>...interfere substantially with the recovery of the species?</i>	The Project would lead to a minor reduction in the extent of habitats supporting the species due to the inundation of riparian habitat by the proposed water supply dam and linear infrastructure. However, given the extensive occurrence of the species elsewhere within the Project area and surrounding areas it is not anticipated that the Project would interfere substantially with the recovery of the species.

## 5.5 Chocolate Tea Tree Orchid (*Dendrobium johannis* [*Cepobaculum johannis*])

### 5.5.1 Species Profile

This species is listed under the EPBC Act as *Dendrobium johannis*, but is also known as *Cepobaculum johannis*. The latter name is accepted as a synonym for *Dendrobium johannis* in the Australian Plant Census (CHAH 2008).

The Chocolate Tea Tree Orchid is listed as 'vulnerable' under the EPBC Act.

The Chocolate Tea Tree Orchid is an epiphytic orchid on tree hosts. It is a perennial plant that typically maintains permanent stems, and flowers annually. It is moderately detectable in the field when flowering but diminutive and less apparent when not flowering. The Chocolate Tea Tree Orchid occurs on the northern Cape York Peninsula from the tip south to Coen and Kowanyama (DSEWPaC 2008b). It also occurs on Torres Strait and GBR islands and may also occur in Papua New Guinea.

The Chocolate Tea Tree Orchid grows in open humid habitats such as close to swamps and in closed forest, and has been recorded from *Melaleuca* woodland and coastal semi-evergreen vine thicket. It inhabits areas that are subject to periodic fire and appears less fire sensitive than the Cooktown Orchid. It has been recorded throughout its range on the northern Cape York Peninsula with most records from the eastern side. The Queensland Herbarium holds 48 specimens of the species including several from the western side of Cape York Peninsula. The species has been recorded from several locations in the Weipa region, including the Andoom, Weipa and the Ely mining lease areas (M. Thomas pers. comm.). The habitat preferences of this species in the Weipa region are well known with the Chocolate Tea Tree Orchid being restricted to mesic habitats, typically as an epiphyte on mature *Syzygium* spp. and *Melaleuca* spp. trees in riparian gallery forest and on the margins of swamp habitats and their associated ecotones (M. Thomas pers. comm.).

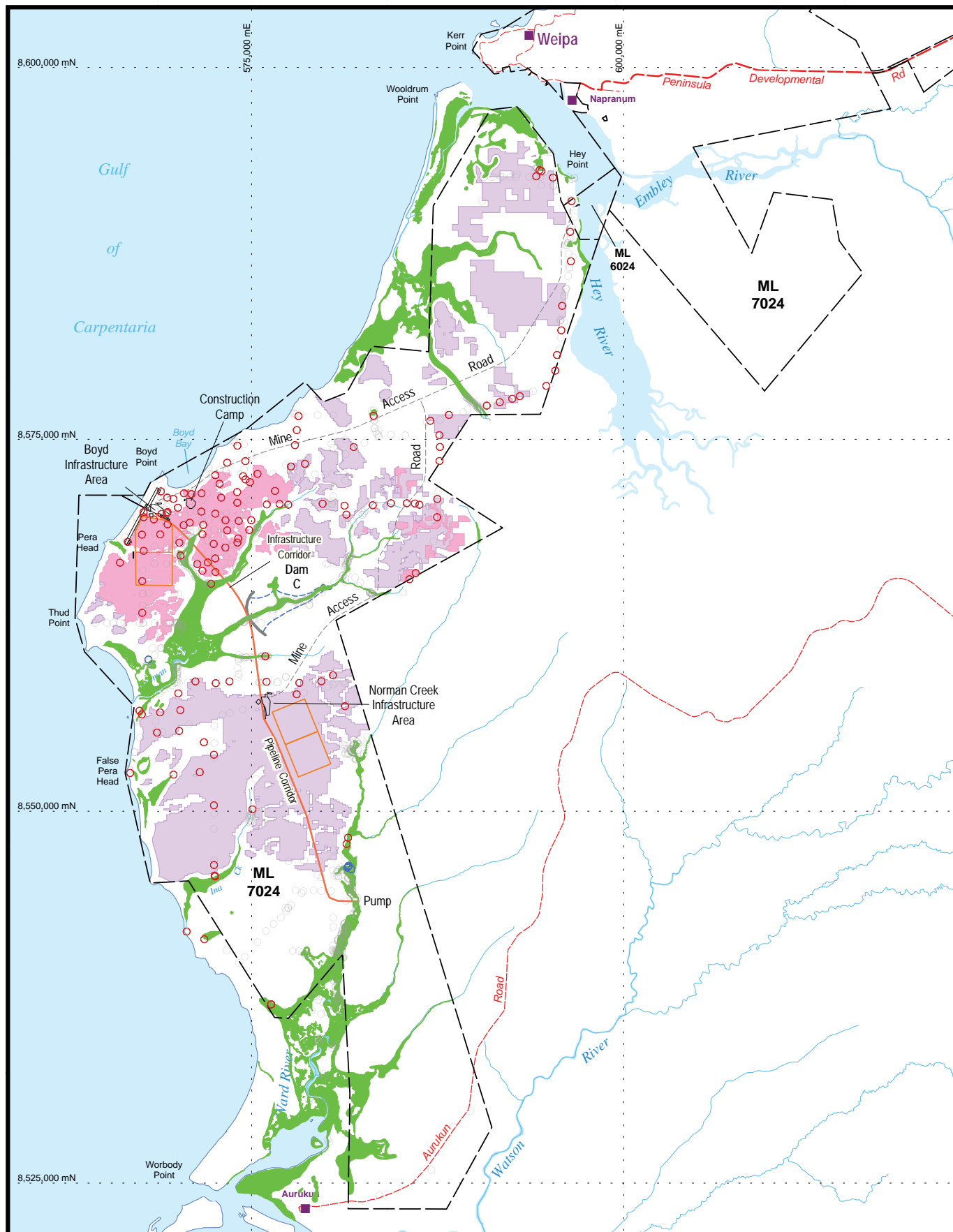
The current population size of the species in the subregion is unknown but likely to be in the order of tens of thousands based on the density of individuals observed in ideal habitat in the Weipa area (M. Thomas pers. comm.) and the abundance of potential habitat for the species throughout the subregion.

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPaC's Register of Critical Habitat does not identify any critical habitat for the Chocolate Tea Tree Orchid.

The key known potential threats to the Chocolate Tea Tree Orchid include over-collection by orchid enthusiasts and habitat degradation from settlement and visitor pressures (DSEWPaC 2008b). The species may also be adversely affected by an inappropriate fire regime.

### 5.5.2 Survey and Results

As with the Cooktown Orchid, substantial survey effort was employed for the Chocolate Tea Tree Orchid during the post wet season and early dry season targeted survey events. Potential habitat for the species was surveyed on each of the 12 targeted survey days dedicated to threatened flora. Surveys focussed on potential habitat including freshwater swamps (RE 3.3.14a and 3.3.50a), *Melaleuca* fringing vegetation on seasonal marine swamps and salt flats (RE 3.1.6, 3.3.63, and 3.3.65), riparian gallery forest (RE 3.3.9 and 3.3.14a), and the landward margin of mangroves (RE 3.1.1a, 3.1.1c and 3.1.3). Potential habitat is shown on **Figure 5-6**. In addition, secondary vegetation transects undertaken in potential habitat areas also provided survey data for the species.



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40

**Chocolate Tea Tree Orchid**  
(*Dendrobium johannis*)

Potential Habitat

- Vegetation Survey type**
- Secondary
  - Tertiary
  - Quarternary

South of Embley Project

**Fig 5-6: Potential Habitat of Chocolate Tea Tree Orchid**



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Areas surveyed for the species included the isolated tree swamp to the north east of Boyd Bay; spring areas searched for *Calophyllum bicolor*; the majority of riparian gallery forest and freshwater swamps on all branches of Norman Creek, on Coconut Creek and Winda Winda Creek; fringing *Melaleuca* vegetation on marine plains associated with the lower Ward River and Norman Creek systems; and the minor drainage lines to the west of Hey Point (refer **Figure 5-3**).

The Chocolate Tea Tree Orchid was recorded from a number of locations throughout the Project area within riparian gallery forest and *Melaleuca* dominated swamps along major drainage lines and associated tributaries. It is expected to be widespread in suitable habitat within the Project area and adjoining areas in these habitats. The Chocolate Tea Tree Orchid was found in areas of riparian gallery forest and fringing *Melaleuca* wetland where the proposed infrastructure corridor would cross Norman Creek (refer **Figure 5-4**) but not in other proposed areas of disturbance (including Dam C).

**Table 5-15** provides a profile summary of this species.

### 5.5.3 Relevant Impacts

#### 5.5.3.1 Construction Impacts Prior to Mitigation

##### Direct Impacts

The Chocolate Tea Tree Orchid was recorded within a small portion of the proposed construction disturbance area. The main impact on this species includes a minor reduction of the extent of wetland habitat supporting the species, due to the construction of linear infrastructure.

In total, approximately 58.04ha of potential habitat of this species would be cleared. This includes 0.04ha of RE 3.1.1a (which represents less than 0.01% of similar habitat in the Project area and subregion), 55.3ha of RE 3.3.9 (which represents less than 3.5% and 0.21% of similar habitat in the Project area and subregion respectively) and 2.7ha of RE 3.3.50a (which represents less than 0.2% and 0.11% of similar habitat in the Project area and subregion respectively).

Clearing in these areas may also produce edge effects at the boundary of adjoining uncleared wetland habitat, however the extent of the edge effect on the species would be negligible as individuals of the species are regularly observed at the natural edge of *Melaleuca* dominated wetland vegetation or in isolated trees in wetland areas.

##### Indirect Impacts

Construction of the infrastructure corridors would fragment habitat to a small extent by creating a gap in the wetland habitats occupied by the species. The Chocolate Tea Tree Orchid naturally occurs in both dense and open wetland habitats where gaps are common, and the gaps produced by clearing would not be of a sufficient magnitude to adversely affect dispersal of the species or genetic continuity.

Construction activities could lead to the introduction (via machinery and light vehicles) and spread of weeds such as Gamba Grass, Guinea Grass and Rubber Vine which could adversely affect epiphytic orchids via promotion of hot frequent fire or the smothering of host trees (DEEDI 2011b, NTFRS 2003). Establishment of these weeds could lead to moderate level, long term impacts on the Chocolate Tea Tree Orchid.

Table 5-15 Profile Summary - Chocolate Tea Tree Orchid

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Known/ estimated population in Project area	Likelihood of Occurrence within Project Area
<i>Dendrobium johannis</i> Chocolate Tea Tree Orchid	An epiphyte that grows in open humid habitats	Within the Project area the Chocolate Tea Tree Orchid grows as an epiphyte on trees (as rocks are absent) and is commonly encountered in freshwater swamps (RE 3.2.3, 3.3.14a, 3.3.21 and 3.3.50a); <i>Melaleuca</i> fringing vegetation on seasonal marine swamps and salt flats (RE 3.1.6, 3.3.63, and 3.3.65); riparian gallery forest (RE 3.3.5, 3.3.9, and 3.3.14a); and the landward margin of mangroves (RE 3.1.1a, 3.1.1c, and 3.1.3) (refer <b>Figure 5-7</b> ).	Cannot be accurately estimated based on the targeted survey approach employed during field surveys, however, it is widespread and locally common within the Project area.	<p><b><u>Mining Area</u></b>  <b>Unlikely:</b> No suitable habitat exists in Darwin Stringybark woodland.</p> <p><b><u>Infrastructure footprint</u></b>  <b>Known to Occur:</b> Occurs within the infrastructure corridor where it crosses Norman Creek. Not found within the footprint of Dam C.</p> <p><b><u>Balance of Project Area not disturbed</u></b>  <b>Known to Occur:</b> Located in riparian gallery forest and <i>Melaleuca</i> dominated swamps particularly along major drainage lines and associated tributaries throughout the Project area, in areas not to be disturbed.</p>

The Chocolate Tea Tree Orchid occurs in the Project area as an epiphyte on trees in riparian and wetland habitats and would not be susceptible to localised minor changes in water quality that may occur during the construction phase. Similarly, substantial changes to riparian and non-riparian ecosystems due to changes to groundwater hydrology are not anticipated and any effects are unlikely to impact on this epiphytic species (refer **Sections 16.2** and **16.4** for additional details).

Elevated dust levels from construction earthworks has the potential to adversely affect individual plant by settling on foliage and suppressing respiratory processes. Any dust impact is likely to be relatively short term (i.e. restricted to the finite construction period in any one location) and is not anticipated to lead to mortality of individuals (refer **Section 14.3** for additional details).

**Table 5-16** summarises the relevant unmitigated construction impacts for the Chocolate Tea Tree Orchid.

### *5.5.3.2 Operational Impacts Prior to Mitigation*

#### Direct Impacts

No known or potential habitat for the Chocolate Tea Tree Orchid would be directly disturbed or fragmented during the operational phase of the Project. Similarly, mining would not occur close enough to habitat areas to create edge effects. Although the mechanism of dispersal of Chocolate Tea Tree Orchid is not confidently known, as the network of undisturbed habitat that would remain and be unaffected by direct disturbance from the operational phase of the Project would likely ensure any processes related to the movement of plant propagules and genetic continuity to be maintained between potential habitat areas.

#### Indirect Impacts

With respect to indirect operational impacts the potential habitat areas for the species are located away from proposed mining areas and beyond the area where localised effects on air quality may be experienced (refer **Section 14.3** for additional details). Localised changes to surface water quality may occur adjacent to mining areas however the Chocolate Tea Tree Orchid is not regarded as susceptible to effects given its epiphytic habit.

Consideration of potential effects on riparian and non-riparian ecosystems from altered groundwater regimes due to mining concluded that small localised changes may occur. However, it is not anticipated that these effects would be sufficient to substantially impact on individual plants or host trees and lead to a substantial impact on the species (refer **Sections 16.2** and **16.4** for additional details).

Potential weed impacts during operation are the same as for the construction phase. Moderate impacts could occur over the long term if fire-promoting or smothering weed species become established in habitat of the species.

**Table 5-17** summarises the relevant unmitigated operational impacts for the Chocolate Tea Tree Orchid.

**Table 5-16 Summary Construction Impacts Prior to Mitigation for Chocolate Tea Tree Orchid**

Action/Issue	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	Minor, long term Small areas of known habitat occur within the footprint of infrastructure corridor crossings of some drainage lines.
Edge effects	Negligible, long term Species naturally occurs at the edge of wetland vegetation.
Fragmentation of habitat	Negligible, long term Construction of infrastructure corridors would produce only small gaps in habitats occupied by the species. Species naturally occurs in both dense and open wetland habitats where gaps are common.
Effects on recruitment/movement of propagules	Negligible, long term Construction of infrastructure would produce small gaps in linear habitats occupied by the species but not of a sufficient magnitude to affect local dispersal of propagules or genetic continuity.
<b>Indirect Impacts</b>	
Water quality	None Construction is unlikely to cause water quality changes which would affect this species.
Altered hydrological regime	Negligible, long term Substantial changes to riparian and non-riparian ecosystems due to changes to groundwater and surface hydrology are not anticipated and any effects are unlikely to impact on the epiphytic species (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	Minor, short term The vigour of a small number of individual plants could be adversely affected by dust settling on foliage.
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect riparian and <i>Melaleuca</i> wetland habitats occupied by the Chocolate Tea Tree Orchid.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.



**Table 5-17 Summary of Operational Impacts Prior to Mitigation for Chocolate Tea Tree Orchid**

Action/Issue	Summary of Potential Operational Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed mining areas.
Edge effects	None Species not present in areas adjacent to proposed mining areas.
Fragmentation of habitat	None Habitat of the species would not be affected by direct disturbance.
Effects on recruitment/movement of propagules	Negligible, long term The network of undisturbed habitats that would remain in the Project area is anticipated to maintain current dispersal mechanisms and levels of genetic continuity.
<b>Indirect Impacts</b>	
Water quality	None Operations are unlikely to cause water quality changes which would affect this species.
Altered hydrological regime	Negligible, long term Substantial changes to riparian ecosystems due to potential changes to groundwater and surface water hydrology are not anticipated and any effects are unlikely to impact on the epiphytic species (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species not present in areas adjacent to proposed mining areas where air quality issue may occur.
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect riparian and wetland habitats occupied by the Chocolate Tea Tree Orchid.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### 5.5.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts

Disturbance to Chocolate Tea Tree Orchid habitats would be avoided or minimised through implementation of the following:

- The proposed SoE environmental buffer system would exceed the requirement of the Queensland Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the Chocolate Tea Tree Orchid would be protected from mining by the buffer system. RTA would work with Traditional Owners and the relevant WCCC

Sub-committee on establishment of environmental buffers as part of the CHEMEP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system is included in **Section 6.3.4.5**.

- The general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat.

Direct and indirect unmitigated impacts associated with the Project on the Chocolate Tea Tree Orchid are identified in **Table 5-16** and **Table 5-17**. The following mitigation measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (refer **Section 6.3.4.3** for additional details); and,
- dust abatement measures proposed would minimise airborne dust and the potential effects of settled dust on individual plants (refer **Section 14.4** for additional details).

The following general mitigation and enhancement measures would further reduce the potential for negligible impacts on the Chocolate Tea Tree Orchid or would provide positive outcomes:

- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed and implemented (refer **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats; and,
- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (refer **Section 7.3.6.4**).

An environmental management plan outline for the Chocolate Tea Tree Orchid which summarises these avoidance, mitigation and enhancement measures is provided in **Appendix 5-A**. The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-18** summarises the relevant mitigation measures and residual impacts for the Chocolate Tea Tree Orchid based on unmitigated impacts identified in **Table 5-16** and **Table 5-17** as greater than negligible.

**Table 5-19** summarises the potential impacts on the Chocolate Tea Tree Orchid as a result of the Project after proposed mitigation measures have been considered, compared with the significant impact criteria for matters of NES (DEWHA 2009c).

**Table 5-18 Potential Impacts, Avoidance, Mitigation and Enhancement Measures and Residual Impacts for Chocolate Tea Tree Orchid**

Potential Impact	Unmitigated Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds during the construction and operational phases that may intensify fire impacts or smother vegetation in Chocolate Tea Tree Orchid habitats.	Moderate, long term	Weed management program	Negligible, long term
Altered fire regime.	Moderate, long term	Weed management program	Negligible, long term
Clearing and loss of known habitat during construction within the footprint of infrastructure corridor crossings of tributary of Norman Creek.	Minor, long term	Vast majority of known and potential habitat areas of the species protected within the proposed SoE environmental buffers	Minor, long term
Adverse effects on the vigour of individual plants affected by construction dust settling on foliage.	Minor, short term	Dust suppression during construction	Negligible, short term

**Table 5-19 Impact Assessment Summary - Chocolate Tea Tree Orchid**

<i>Will the proposed works...</i>	<b>Chocolate Tea Tree Orchid (<i>Dendrobium johannis</i>) : Vulnerable</b>
<i>....lead to a long-term decrease in the size of an important population of a species?</i>	<p>The Chocolate Tea Tree Orchid occurs from the Coen area north to the tip of Cape York and in Torres Strait and New Guinea, and has been recorded at several locations in the Weipa region, including the Andoom, Weipa and Ely mining lease areas. The habitat preferences of this species are well known: the Chocolate Tea Tree Orchid is restricted to mesic habitats, typically as an epiphyte on mature <i>Syzygium</i> spp. and <i>Melaleuca</i> spp. trees in riparian gallery forest and on the margins of swamp habitats and their associated ecotones.</p> <p>The Chocolate Tea Tree Orchid was recorded in a number of locations throughout the Project area in riparian gallery forest and <i>Melaleuca</i> dominated wetlands and is expected to be widespread within the entire Project area and adjoining areas in these habitats.</p> <p>The population of the Chocolate Tea Tree Orchid within the Project area is not considered an important population under the intent of the EPBC Act.</p> <p>The Chocolate Tea Tree Orchid occurs within riparian and wetland habitats throughout the Project area. The population within the Project area is not a discrete population, as the species occurs throughout the Weipa Plateau subregion and within the wider Cape York Bioregion.</p>
<i>....reduce the area of occupancy of an important population?</i>	The population within the Project area is not regarded as an important population.
<i>....fragment an existing important population into two or more populations?</i>	The population within the Project area is not regarded as an important population.
<i>....adversely affect habitat critical to the survival of a species?</i>	The Project area does not include any critical habitat areas for the Chocolate Tea Tree Orchid that are listed under the EPBC Act or identified in Recovery Plans. The species is widespread through central and northern Cape York.
<i>....disrupt the breeding cycle of an important population?</i>	The population within the Project area is not regarded as an important population.
<i>....modify, destroy, remove, isolate or</i>	Areas of riparian gallery forest and fringing <i>Melaleuca</i> wetland supporting the Chocolate Tea Tree Orchid would be disturbed by the infrastructure corridor crossing of Norman Creek. While the

<b>Will the proposed works...</b>	<b>Chocolate Tea Tree Orchid (<i>Dendrobium johannis</i>) : Vulnerable</b>
<i>decrease the availability or quality of habitat to the extent that the species is likely to decline?</i>	species was not found within the footprint of the water supply dam, there is suitable habitat present in this location. Elsewhere the habitats of the species will be avoided by the mine plan and buffered by the proposed SoE environmental buffer system. Significant modification of these habitats due to changes to hydrology is not anticipated. Overall there would be a minor reduction of the extent of habitats supporting the species but given the extensive occurrence of the species outside of these impact areas, it is not anticipated that the species would be caused to decline.  The proposed fire management program would favour the species by effectively reducing the impacts of the current fire regime on fire sensitive habitats such as riparian gallery forest and <i>Melaleuca</i> wetlands.
<i>....result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</i>	The Project area is currently predominantly free of serious weeds and invasive species; however a number of significant environmental weeds occur in the surrounding region. The habitats of the Chocolate Tea Tree Orchid are often favoured by weed invasion, as the moist nature of the habitats supports weed establishment. Of particular threat is the introduction of Rubber Vine ( <i>Cryptostegia grandiflora</i> ) which can thrive and displace native vegetation in riparian and wetland situations. Proposed mitigation measures include a weed management program which would involve preventative measures and control measures for weeds within the Project area. Riparian areas would be one of the habitats targeted by the program. These mitigation measures would be effective in managing the impacts of weeds on the Chocolate Tea Tree Orchid.  The Project is not anticipated to lead to the establishment of invasive weeds within the habitat of the Chocolate Tea Tree Orchid.
<i>.....introduce disease that may cause the species to decline?</i>	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
<i>....interfere substantially with the recovery of the species?</i>	The Project would lead to a minor reduction of the extent of habitats supporting the species due to the proposed infrastructure corridor crossing of Norman Creek. However, given the extensive occurrence of the species elsewhere within the Project area and surrounding areas it is not anticipated that the Project would interfere substantially with the recovery of the species.

#### 5.5.4.1 National Recovery Plan and Threat Abatement Plans

There is no national recovery plan or relevant threat abatement plans for the Chocolate Tea Tree Orchid. However, the proposed feral pig program, which will reduce pig damage to riparian habitats, is consistent with the *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEH 2005) (refer **Table 5-30**).

#### 5.5.5 Offset Measures

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012b), offsets are not required where the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c)).

**Sections 5.5.3** and **5.5.4** of this report documents the results of the impact assessment process and concludes that with the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the Project on the Chocolate Tea Tree Orchid would be negligible to minor and therefore not significant (refer **Section 5.1.2**). As such, offsets relating to the Chocolate Tea Tree Orchid are not required under the Commonwealth offsets policy.

A recommendation in the *Queensland Coordinator General's Report on the EIS* (Queensland Government 2012) for the SoE Project is that RTAW translocate and/or propagate 3.5 plants of Chocolate Tea Tree Orchid for each plant found within the footprint of disturbance and establish such plants within a 355.2ha offset area comprising riparian habitat (RE 3.3.5, RE 3.3.9, and RE 3.3.21).

## 5.6 Ant Plant (*Myrmecodia beccarii*)

### 5.6.1 Species Profile

The Ant Plant is listed as 'vulnerable' under the EPBC Act. The Ant Plant is a member of the *Rubiaceae* family and is of conservation interest due to the unusual stem morphology of the plant that hosts a symbiotic relationship between butterfly and ant species. The Ant Plant is of low detectability during field survey due to the absence of obvious foliage or showy flowers and its diminutive size. The current range of the species as indicated on the SPRAT database (DSEWPaC 2012q) is coastal areas between Cooktown and Ingham, although the tip of Cape York is also recognised by the Australian National Botanic Gardens (2004) as supporting a disjunct population of the species where it is known near Bamaga.

The Ant Plant is known from a variety of denser canopy habitats on Cape York including mangroves, *Melaleuca* dominated wetlands, coastal scrubs, and groundwater seepage zones with swamp vine forest. The Ant Plant was recently recorded in the Weipa area in a small groundwater seepage area supporting a palm swamp forest, and in riparian gallery forest but is apparently of very restricted distribution in the Weipa area (M. Thomas pers. comm.). The Queensland Herbarium holds specimens of the species from the wet tropics area only. There do not appear to be any other confirmed records of the species in the region.

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPaC's Register of Critical Habitat does not identify any critical habitat for the Ant Plant.

The current population size of the species in the subregion is unknown as little data exists on the presence of the species in the area. The Ant Plant appears to be naturally rare and of restricted distribution.

Known threats for the Ant Plant include clearing of lowland paperbark woodlands, localised settlement pressures and the removal or destruction of plants by plant and butterfly collectors (DSEWPaC 2008c). The species may also be threatened by an inappropriate fire regime, and changes to groundwater characteristics that reduce flow volumes and/or periodicity in spring areas occupied by the species.

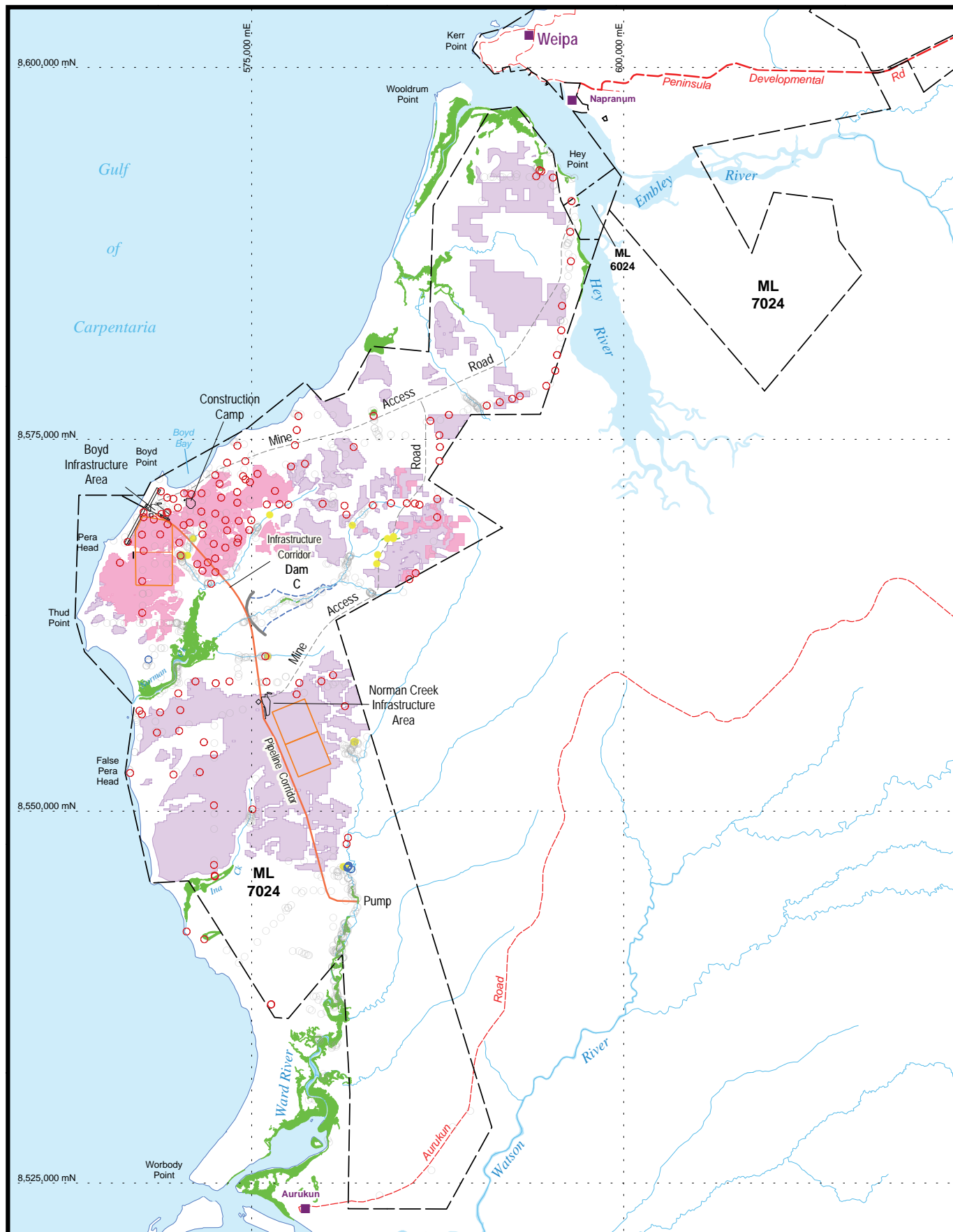
### 5.6.2 Survey and Results

Potential habitat for the Ant Plant includes spring areas supporting closed forest or *Melaleuca* swamp forest (potentially associated with RE 3.3.5 and 3.3.14a), and the landward margin of mangroves (REs 3.1.1a, 3.1.1c, and 3.1.3). Potential habitat is shown on **Figure 5-7**. The surveys for the Ant Plant focussed on these locations within the Project area. Spring areas targeted for *Calophyllum bicolor* were also targeted for the Ant Plant (refer **Section 5.3.2**).

The landward margins of mangroves were also searched on the western bank of the Ward River, the southern and northern shores of Norman Creek, and along the swampy shoreline of the Embley River west of Hey Point (refer **Figure 5-2**).

To accommodate the low detectability of this species, any areas within potential habitat that appeared especially favourable for the species were searched slowly and systematically. While most survey areas were searched during the post wet season and early dry season survey events, seasonal survey was not considered vital for the Ant Plant as detectability varies little throughout the year. The Ant Plant was not found during any surveys.

**Table 5-20** summaries the profiling information for this species.



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40
- Semi-permanent spring

**Ant Plant**  
*(Myrmecodia beccarii)*  
 Potential Habitat

- Vegetation Survey type**
- Secondary
  - Tertiary
  - Quaternary

South of Embley Project

**Fig 5-7: Potential Habitat of Ant Plant**



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Table 5-20 Profile Summary - Ant Plant

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Likelihood of Occurrence within Project Area
<i>Myrmecodia beccarii</i> Ant Plant	A tuberous epiphyte on trees.	<p>Spring areas supporting closed forest or <i>Melaleuca</i> swamp forest (potentially associated with RE 3.3.5 and 3.3.14a), and the landward margin of mangroves (REs 3.1.1a, 3.1.1c, and 3.1.3) see <b>Figure 5-7</b> for potential habitat.</p> <p>Five semi-permanent groundwater seepage zones associated with the Norman Creek and Ward River drainage systems did not support the species; however, additional semi-permanent seepage zones may occur in inaccessible areas of the lower Ward River and Norman Creek systems.</p>	<p><b><u>Mining Area</u></b> <b>Unlikely:</b> No suitable habitat exists in Darwin Stringybark woodland.</p> <p><b><u>Infrastructure footprint</u></b> <b>Unlikely:</b> Targeted surveys of the dam area and infrastructure crossings of riparian areas indicated with a high reliability that this species is not present in these locations.</p> <p><b><u>Balance of Project Area not disturbed</u></b> <b>Possible:</b> This species is of restricted distribution in the Weipa area. If a permanent groundwater seepage zone was identified within the Project area, this species may occur within this zone. At present only semi-permanent groundwater seepage zones have been identified within the Project area. The species may also occur within or on the landward margin of mangroves within the Project area.</p>

### 5.6.3 Relevant Impacts

#### 5.6.3.1 *Construction Impacts Prior to Mitigation*

##### Direct Impacts

The results of the surveys determined that the Ant Plant is unlikely to occur within or adjacent to proposed construction areas. A very small area (0.04ha) of fringing mangroves would be disturbed at the Hey Point ferry terminal but is not regarded as optimal habitat for the species, and the species was not located in this area during targeted surveys. Therefore, there would be no direct disturbance of the species during construction and no edge effects on potential habitat. The Ant Plant has a naturally patchy and restricted distribution associated with the isolated occurrence of suitable high moisture habitat. Populations of the species are therefore naturally fragmented and unlikely to be affected if present by the small amount of habitat that would be disturbed during construction.

##### Indirect Impacts

The potential habitat associated with any permanent groundwater seepage zones would be susceptible to effects from weed infestations that may arise from construction activities. Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass, or smothering species, such as Rubber Vine. If left to proliferate in the vicinity of groundwater seepage zones these weeds could lead to an increase in fire intensity that could adversely affect the vegetation edge of these areas over the long term (DEEDI 2011b, NTFRS 2003). The elevated moisture regime within these areas could also favour the proliferation of Rubber Vine which could smother and suppress spring vegetation. Similarly, the landward edge of mangrove communities (a position favoured by the Ant Plant in other areas) is susceptible to Rubber Vine infestation. Resultant impacts associated with uncontrolled weed infestations would be moderate given the likely restricted nature of the Ant Plant occurrences.

Construction activities are not expected to significantly alter the current fire regime.

The potential habitat for the species are located on the lower sections of the main drainages, well removed from proposed construction areas and beyond the area where indirect effects of construction activities on water quality, air quality and the groundwater regime may be experienced.

**Table 5-21** summarises the relevant unmitigated construction impacts for the Ant Plant.

#### 5.6.3.2 *Operational Impacts Prior to Mitigation*

##### Direct Impacts

The potential habitat areas for the Ant Plant on the lower sections of the main drainages are well removed from the proposed mining area and would not be directly disturbed during operations or subject to edge effects from clearing.

The potential habitats of the species are naturally isolated and fragmented by non-favoured habitat and it is not anticipated that disturbance of Darwin Stringybark woodland for mining would further fragment potential habitat areas located on the lower sections of the main drainages. Although the mechanism of dispersal of the Ant Plant are not confidently known, it is anticipated that the network of drainage line habitats that would be unaffected by direct disturbance from the operational phase of the Project are likely to maintain any processes related to the movement of plant propagules and genetic continuity between potential habitat areas (refer **Figure 2-4**).



**Table 5-21 Summary of Construction Impacts Prior to Mitigation for the Ant Plant**

Action/Issue	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	Negligible, long term Species is not present in proposed construction areas. There is a small area of potential habitat displaced during construction.
Edge effects	None Species not present in areas adjacent to proposed construction areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None The Ant Plant does not occur in or adjacent to infrastructure areas and the extent and location of construction disturbance is unlikely to affect recruitment/movement of propagules of the species.
<b>Indirect Impacts</b>	
Water quality	None Species potentially occurs in groundwater seepage areas and on the margin of estuaries well away from proposed construction areas. Water quality would not be affected in these areas during construction.
Altered hydrological regime	None Species potentially occurs in groundwater seepages and on the margin of estuaries well away from proposed construction areas. The hydrological regime in these areas would not be affected during construction (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species is not present within the vicinity of proposed construction areas where localised air quality effects may be experienced.
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect potential habitat of the species.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### Indirect Impacts

The potential habitat areas for the species are located well away from proposed mining areas and beyond the area where effects on water quality and air quality may occur.

Indirect impacts could occur if adverse groundwater changes were experienced at locations that coincided with a groundwater seepage zone supporting the species. Modelling of catchment hydrology indicates that only minor localised effects on riparian and wetland ecosystems are likely as a result of Project development. Potential effects in downstream areas (such as those potentially inhabited by the Ant Plant) may include slightly extended groundwater discharge but within the range experienced by the downstream ecosystems under natural inter-decadal variation (refer **Sections 16.2 and 16.4** for additional details). A minor extension of discharge periodicity is unlikely to

adversely affect the Ant Plant or the overall habitat condition and composition of groundwater seepage ecosystems.

Potential groundwater seepage areas would be susceptible to effects from weed infestations as described for the construction phase. Moderate impacts could result over the long term if uncontrolled weed infestations occurred in these areas.

**Table 5-22** summarises the relevant unmitigated operational impacts for the Ant Plant.

**Table 5-22 Summary of Operational Impacts Prior to Mitigation for the Ant Plant**

Action/Impact	Summary of Potential Operational Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed mining areas.
Edge effects	None Species not present in areas adjacent to proposed mining areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None The network of undisturbed drainage line habitats is anticipated to maintain current dispersal mechanisms and levels of genetic continuity for the species.
<b>Indirect Impacts</b>	
Water quality	None Species was not found in areas adjacent to proposed mining areas. Water quality would not be affected by operations.
Altered hydrological regime	Negligible, long term The shallow aquifer feeding the semi-permanent groundwater seepage areas are typically hosted in the kaolinitic layer below the bauxite apart from the peak of the wet season. The seepage areas are not fed from bauxite hosted groundwater in the dry season and bauxite removal would be very unlikely to affect groundwater supply to these areas (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species is not present within the vicinity of proposed mining areas where localised air quality effects may be experienced.
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate, these weeds could affect potential habitat areas.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### 5.6.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts

Disturbance to Ant Plant habitats would be avoided or minimised through implementation of the following:

- the proposed SoE environmental buffer system would exceed the requirement of the Queensland Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the Ant Plant would be protected from mining by the buffer system. RTA would work with Traditional Owners and the relevant WCCC Sub-committee on establishment of environmental buffers as part of the CEMP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system are included in **Section 6.3.4.5**;
- the general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat; and,
- removal of a dam on the Ward River from the proposal (refer **Section 3.13.3**).

Direct and indirect unmitigated impacts associated with the Project on the Ant Plant are identified in **Table 5-21** and **Table 5-22**. The following mitigation measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (refer **Section 6.3.4.3** for additional details).

The following general mitigation and enhancement measures would further reduce potential for negligible impacts or would provide positive outcomes for the Ant Plant:

- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed and implemented (refer **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats such as groundwater seepage zones that potentially support the Ant Plant; and,
- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (refer **Section 7.3.6.4**).

The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-23** summarises the relevant mitigation measures and residual impacts for the Ant Plant based on unmitigated impacts identified in **Table 5-21** and **Table 5-22** as greater than negligible.

**Table 5-23 Potential Impacts, Avoidance, Mitigation and Enhancement Measures and Residual Impacts for Ant Plant**

Potential Impact	Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds that may intensify fire impacts on groundwater seepage zones and smother vegetation	Moderate, long term	<ul style="list-style-type: none"> <li>Weed management program</li> <li>SoE environmental buffer areas</li> </ul>	Negligible, long term
Altered fire regime	Moderate, long term	<ul style="list-style-type: none"> <li>Weed management program</li> </ul>	Negligible, long term

**Table 5-24** summarises the potential impacts on the Ant Plant as a result of the Project after proposed mitigation measures have been considered, compared with the significant impact criteria for matters of NES (DEWHA 2009c).

**Table 5-24 Impact Assessment Summary - Ant Plant**

<i>Will the proposed works...</i>	<b>Ant Plant (<i>Myrmecodia beccarii</i>) : Vulnerable</b>
<i>....lead to a long-term decrease in the size of an important population of a species?</i>	<p>The Ant Plant is known from coastal woodlands between Cooktown and Ingham and the northern Cape York Peninsula between Weipa and the tip of Cape York. Ant Plant was not identified within the Project area and distribution within adjoining areas is not well known, although the species was recently located in a permanent groundwater seepage area near Weipa (M.Thomas pers. comm.). The Ant Plant is known from a variety of habitats on Cape York including <i>Melaleuca</i> wetlands, coastal closed forest, mangroves and swamp forest on permanent groundwater seepages.</p> <p>If a population of the Ant Plant occurs within the Project area it would be considered an important population under the intent of the EPBC Act since the species is little known with few specimen records from Western Cape York. The closest record for the species is from Weipa with no known records of the species south of the Project area. The Project area would represent a distributional limit for the species. Any isolated population in the Project area would be regarded as an important population as it would represent:</p> <ul style="list-style-type: none"> <li>key source populations either for breeding or dispersal;</li> <li>population that is necessary for maintaining genetic diversity; and/or,</li> <li>population that is near the limit of the species range. (i.e. there are no other records of the species on the west coast of Cape York south of Weipa).</li> </ul> <p>Significant areas of potential wetland, mangrove and coastal vine forest habitat occur within the Project area. Targeted threatened flora surveys were undertaken in a number of <i>Melaleuca</i> wetland, coastal vine forest, and semi-permanent groundwater seepage forest habitats within the Project area but the species was not located and it is not anticipated that the species occurs in these habitats within the Project area. Mangrove areas were less intensively surveyed and may provide habitat for the species.</p> <p>Only 0.04ha of mangrove habitats within the Project area would be directly affected by clearing associated with the Project and it is highly unlikely that the extensive remaining mangrove habitat areas would be significantly affected by changes to surface or groundwater hydrology as a result of the Project.</p> <p>It is not anticipated that a long-term decrease in the size of any important population of Ant Plant present within the Project area would occur.</p>
<i>....reduce the area of occupancy of an important population?</i>	It is not anticipated that any important population of the Ant Plant that may be present within the Project area would be reduced.
<i>....fragment an existing important population into two or more populations?</i>	The Ant Plant has a naturally patchy and restricted distribution associated with the restricted habitats it occupies. Populations of the Ant Plant on Cape York are therefore naturally fragmented and not sensitive to disturbance of sub optimal habitat between patches of preferred habitat. The Project would therefore not lead to fragmentation of important populations of the Ant Plant.

<b><i>Will the proposed works...</i></b>	<b>Ant Plant (<i>Myrmecodia beccarii</i>) : Vulnerable</b>
<i>....adversely affect habitat critical to the survival of a species?</i>	The Project area does not include any critical habitat areas for the Ant Plant that are listed under the EPBC Act or identified in Recovery Plans. The species is known to occur at a number of other locations on Cape York.
<i>....disrupt the breeding cycle of an important population?</i>	It is not anticipated that any important population of the Ant Plant that may be present would be adversely affected by the Project. Consequently, disruption of any important populations of the Ant Plant that may be present within the Project area is not expected to occur.
<i>....modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?</i>	Only 0.04ha of mangrove habitat for the Ant Plant would be directly disturbed within the Project area but the species is not present in this area and consequently the Ant Plant would not be adversely affected by the Project. The Project would not affect numerous other populations of the species reported from elsewhere on Cape York. Targeted surveys were undertaken in a number of <i>Melaleuca</i> wetland, coastal vine forest, and semi-permanent groundwater seepage forest habitats within the Project area but the species was not located and it is not anticipated that the species occurs in these habitats within the Project area. A decline in the species as a result of the Project is not expected.
<i>....result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</i>	The Project area is currently predominantly free of serious weeds and invasive species; however a number of significant environmental weeds occur in the surrounding region. The preferred habitat of the Ant Plant is susceptible to weed invasion due to the moist nature which is often favoured by invasive species. Of particular concern is the potential introduction of Rubber Vine ( <i>Cryptostegia grandiflora</i> ). Proposed mitigation measures include a weed management program which would include preventative measures and control measures for weeds within the Project area. Riparian areas including groundwater discharge areas would be one of the habitats targeted by the program. These mitigation measures would be effective in managing the impacts of weeds on the Ant Plant (if present).  The Project is not anticipated to lead to the spread of invasive weeds within the habitat of the Ant Plant.
<i>.....introduce disease that may cause the species to decline?</i>	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
<i>....interfere substantially with the recovery of the species?</i>	Potential mangrove habitat for the Ant Plant within the Project area would not be adversely affected by the Project. There are numerous other populations of the species reported from elsewhere on Cape York. It is not anticipated that the Project would interfere with the recovery of the species.

#### 5.6.4.1 National Recovery Plan and Threat Abatement Plans

There is no national recovery plan or relevant threat abatement plans for the Ant Plant.

#### 5.6.5 Offset Measures

Under the *EPBC Act Environmental Offsets Policy* (DSEWPac 2012b), offsets are not required where the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c)).

**Sections 5.3.3** and **5.3.4** of this report documents the results of the impact assessment process and concludes that with the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the Project on the Ant Plant would be negligible and therefore not significant (refer **Section 5.1.2**). As such, offsets relating to the Ant Plant are not required under the Commonwealth offsets policy.

## 5.7 Beach Nightshade (*Solanum dunalianum*)

### 5.7.1 Species Profile

The Beach Nightshade is listed as 'vulnerable' under the EPBC Act.

The Beach Nightshade is a member of the *Solanaceae* family and is a perennial shrub growing to 4m high with mauve flowers. The species appears to occur intermittently with known populations not always detected during subsequent surveys (Landsberg and Clarkson 2004, M. Thomas pers. comm.). The Beach Nightshade is highly detectable when flowering due to the presence of mauve flowers and has good detectability when not flowering. The Beach Nightshade is known from a few records near Weipa and on the Torres Strait islands, although more recent surveys for known populations in the Weipa area failed to relocate the species despite targeted searching (Landsberg and Clarkson 2004). The Queensland Herbarium holds 20 specimens of the species, mainly from New Guinea, with three of the four Australian specimens from the Weipa area and the fourth from Torres Strait.

The species has generally been recorded in semi-deciduous notophyll vine forest, and the edges of this community. In the Weipa area it has been recorded from vine thicket vegetation on coastal dunes between the Pennefather and Duyfken areas north of Weipa and vine forest on bauxite on the north shore of the Embley River near Napranum (J. Searle pers. comm.). The distribution of this species in the Project region is poorly known with only a few specimens collected, but it appears likely to be more prevalent in closed forest vegetation. Landsberg and Clarkson (2004) suggest that the species is likely to be much more widespread than just the Weipa area though this remains to be confirmed.

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPac's Register of Critical Habitat does not identify any critical habitat for the Beach Nightshade.

The current population size of the species in the subregion is unknown as little data exists on the presence of the species in the region. The Beach Nightshade appears to be naturally rare and restricted in the region.

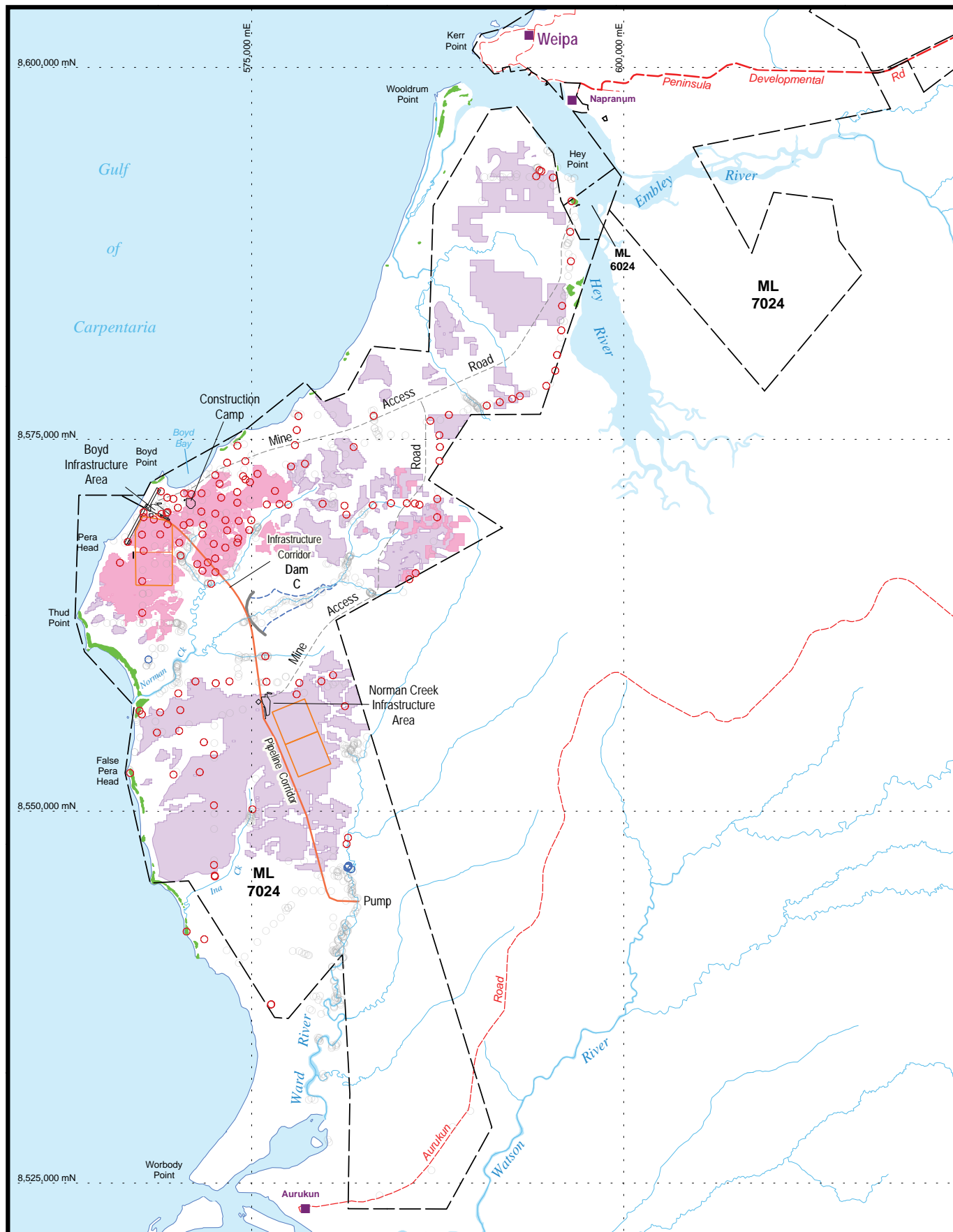
DSEWPac (2008d) identify the key known threats to some populations of the Beach Nightshade as localised settlement pressures including land clearing, exotic animals such as feral pigs, weeds and altered fire regimes. Landsberg and Clarkson (2004) note that a potential threat to the Beach Nightshade may be habitat destruction associated with mining activities. However, on close examination it is clear that mining has never impacted Beach Nightshade habitat and that the existing environmental buffer system enforced at the existing Weipa operations ensures the ongoing protection of this species.

### 5.7.2 Survey and Results

Substantial survey effort was employed for the Beach Nightshade during the post wet season and early dry season targeted survey events. Searches focussed on potential habitat including vine forest on bauxite (RE 3.5.4), alluvial vine forest (RE 3.3.5), and vine forest on coastal dunes (RE 3.2.5). The overall area of potential vine forest habitat within the Project area is relatively small and all potential habitat was comprehensively searched during the 12 targeted survey days dedicated to threatened flora. In addition, secondary vegetation transects undertaken in potential habitat areas also provided survey data for the species. Potential habitat is shown on **Figure 5-8**.

Areas surveyed for the species included two vine forest patches on bauxite at Hey Point, dunal vine forest on the northern and southern side of the Norman Creek mouth, and dunal vine forest at Ina/Waterfall Creek (refer **Figure 5-3**).

The species was not found during the surveys. **Table 5-25** provides a profile summary for the species.



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40

**Beach Nightshade**  
**(*Solanum dunalianum*)**

● Potential Habitat

**Vegetation Survey type**

- Secondary
- Tertiary
- Quarternary

South of Embley Project

**Fig 5-8: Potential Habitat of Beach Nightshade**



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Table 5-25 Profile Summary - Beach Nightshade

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Known/ estimated population in Project area	Likelihood of Occurrence within Project Area
<i>Solanum dunalianum</i> Beach Nightshade	An herbaceous shrub growing to 2–4m	Potential habitats within the Project area comprise all areas of coastal vine forest (RE 3.2.2) and all areas of vine forest on the bauxite plateau (RE 3.5.2) (refer <b>Figure 5-8</b> for potential habitat).	If present, population is likely to be small.	<p><b><u>Mining Area</u></b>  <b>Unlikely:</b> No suitable habitat exists in Darwin Stringybark woodland.</p> <p><b><u>Infrastructure footprint</u></b>  <b>Unlikely:</b> Within the Project area the species is expected to be restricted to coastal vine forest and vine forest on bauxite.</p> <p><b><u>Balance of Project Area not disturbed</u></b>  <b>Likely:</b> Not detected during field surveys but suitable coastal vine forest and vine forest on bauxite habitat occurs in the Project area in areas not to be disturbed.</p>



### 5.7.3 Relevant Impacts

#### 5.7.3.1 Construction Impacts Prior to Mitigation

##### Direct impacts

The results of the surveys determined that the Beach Nightshade is unlikely to occur within or immediately adjacent to proposed construction areas. Therefore, there would be no direct disturbance of the species during construction and no edge effects on potential habitat. The Beach Nightshade has a naturally patchy and restricted distribution associated with the patchy occurrence of vine forest habitat. Populations of the species are therefore naturally fragmented and unlikely to be affected by the small amount of potential habitat to be disturbed during construction.

##### Indirect impacts

Vine forest within the Project area occurs predominantly as a non-riparian habitat that is not susceptible to surface water quality issues. The majority of potential habitat areas for the species are well removed from proposed construction areas and beyond the area where indirect effects of construction activities on air quality and the groundwater regime may be experienced (refer **Sections 14.3, 16.2 and 16.4**). The vine forest patches at Boyd Point and Hey Point are closer to proposed construction areas but still at a distance where significant indirect impacts associated with air, water and the hydrological regime are unlikely to result in impacts on any Beach Nightshade specimens that may be present. Construction activities within the vicinity of these two vine forest patches are predominantly surface construction activities that are unlikely to have an effect on groundwater processes.

Potential habitat of the species would be susceptible to effects from weed infestations that may arise from construction activities. Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass, or smothering species, such as Rubber Vine. If left to proliferate in the vicinity of vine forest these weeds could lead to an increase in fire intensity that could adversely affect vegetation at the vine forest edge (DEEDI 2011b, NTFRS 2003). This is particularly relevant for the Beach Nightshade which is known to favour the edge and ecotone of vine forest/woodland interfaces. Resultant long term impacts associated with uncontrolled weed infestations could affect individuals growing at the edge of vine forest habitats. Individuals located deeper within the vine forest may not be affected.

**Table 5-26** summarises the relevant unmitigated construction impacts for the Beach Nightshade.

#### 5.7.3.2 Operational Impacts Prior to Mitigation

##### Direct Impacts

The vine forest areas that provide potential habitat for the Beach Nightshade are well removed from the proposed mining area and would not be cleared during operations or subject to edge effects from clearing.

The potential habitat of the species is naturally isolated and fragmented by non-favoured habitat and it is not anticipated that disturbance of Darwin Stringybark woodland for mining would further fragment potential habitat areas. Vine forest has a distinct coastal pattern of occurrence in the Project area and these areas would remain connected by undisturbed vegetation outside of the mining area. Although the mechanism of dispersal of the Beach Nightshade is not confidently known, it is anticipated that the network of undisturbed habitat would maintain any processes related to the dispersal of plant propagules and genetic continuity between potential habitat areas.

**Table 5-26 Summary of Construction Impacts Prior to Mitigation for the Beach Nightshade**

Action/Issue	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species does not occur in proposed construction areas.
Edge effects	None Species does not occur immediately adjacent to proposed construction areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None The Beach Nightshade does not occur in or adjacent to infrastructure areas and the extent and location of construction disturbance is unlikely to affect recruitment/movement of propagules of the species.
<b>Indirect Impacts</b>	
Water quality	None Construction is unlikely to cause water quality changes which would affect this species.
Altered hydrological regime	None Most potential habitat areas are located well away from proposed construction areas. Vine forest patches at Boyd Point and Hey Point are located closer to construction works but construction would not alter groundwater and surface water hydrology (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species is not present within the immediate vicinity of proposed construction areas where localised air quality effects may be experienced.
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction (via machinery and light vehicles) and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate, these weeds could affect potential habitat of the species.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

### Indirect Impacts

The potential habitat areas for the species are located at a sufficient distance from mining areas to be beyond the area where effects on air quality may be experienced (refer **Section 14.3** for additional details).

It is not anticipated that mining operations would have a significant impact on groundwater processes apart from minor localised effects on riparian or wetland ecosystems. Vine forest habitats on bauxite are not expected to experience groundwater related impacts given the proposed setback of mining from these areas. Coastal vine forest habitats occur on coastal sand deposits that are not associated with the bauxite aquifers and are therefore not susceptible to changes to groundwater regime (refer **Sections 16.2** and **16.4** for additional details).

Vine forest habitat areas would be susceptible to effects from weed infestations as described for the construction phase. Moderate, long term impacts could result if uncontrolled weed infestations occurred in these areas.

Operational activities are not expected to significantly alter the current fire regime or lead to the introduction of new feral fauna that could impact on potential habitat of the Beach Nightshade.

**Table 5-27** summarises the relevant unmitigated operational impacts for the Beach Nightshade.

### **5.7.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts**

Disturbance to Beach Nightshade habitats would be avoided through implementation of the following:

- the proposed SoE environmental buffer system would exceed the requirement of the Queensland `Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the Beach Nightshade would protected from mining by the buffer system. RTA would work with Traditional Owners and the relevant WCCCC Sub-committee on establishment of environmental buffers as part of the CHEMEP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system is included in **Section 6.3.4.5**; and,
- the general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat. No plants were located in areas where infrastructure has been planned.

Direct and indirect unmitigated impacts associated with the Project on the Beach Nightshade are identified in **Table 5-26** and **Table 5-27**. The following mitigation and enhancement measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (refer **Section 6.3.4.3** for additional details).

**Table 5-27 Summary of Operational Impacts Prior to Mitigation for the Beach Nightshade**

<b>Issues/Action</b>	<b>Summary of Potential Operational Impacts Prior to Mitigation</b>
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Potential habitat does not occur within proposed mining areas.
Edge effects	None Potential habitat does not occur immediately adjacent to proposed mining areas.
Fragmentation of habitat	None Potential habitat areas would remain connected by undisturbed coastal vegetation outside of the proposed mining area.
Effects on recruitment/movement of propagules	None The network of undisturbed habitats that would link vine forest patches is anticipated to maintain current dispersal mechanisms and levels of genetic continuity for the species.
<b>Indirect Impacts</b>	
Water quality	None Potential habitat comprises non-riparian habitats that are not susceptible to potential water quality changes associated with operations.
Altered hydrological regime	Negligible, long term Vine forest habitats on bauxite are not expected to experience groundwater or surface water related impacts given the proposed setback of mining from these areas. Coastal vine forest habitats occur on coastal sand deposits that are not susceptible to changes to groundwater and surface water regime (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Potential habitat is not present within the immediate vicinity of proposed mining areas where localised air quality effects may be experienced (refer <b>Section 14.2 and 16.4</b> ).
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass and smothering weeds, such as Rubber Vine. If left to proliferate these weeds could affect potential habitat of the species and affect individuals growing on the margin of vine forest habitat patches.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

The following general mitigation and enhancement measures would further reduce potential for negligible impacts or would provide positive outcomes for the Beach Nightshade:

- the proposed SoE environmental buffer system would be implemented to reduce impacts from any alteration of the hydrological regime on areas that may provide habitat for the Beach Nightshade;
- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed in cooperation with Traditional Owners and the relevant WCCCC Sub-committee as part of the CHEMEP (refer **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats; and,
- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (refer **Section 7.3.6.4**).

The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-28** summarises the relevant mitigation measures and residual impacts for the Beach Nightshade based on unmitigated impacts identified in **Table 5-26** and **Table 5-27** as greater than negligible.

**Table 5-28** Potential Impacts, Avoidance, Mitigation and Enhancement Measures and Residual Impacts for the Beach Nightshade

Potential Impact	Unmitigated Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds that may intensify fire impacts on vine forest edges and smother vegetation	Moderate, long term	<ul style="list-style-type: none"> <li>• Weed management program</li> <li>• SoE environmental buffer system</li> </ul>	Negligible, long term
Altered fire regime	Moderate, long term	<ul style="list-style-type: none"> <li>• Weed management program</li> </ul>	Negligible, long term

**Table 5-29** summarises the potential impacts on the Beach Nightshade as a result of the Project after proposed mitigation measures have been considered, compared with the significant impact criteria for matters of NES (DEWHA 2009c).

#### 5.7.4.1 National Recovery Plan and Threat Abatement Plans

There is no national recovery plan for the Beach Nightshade. One threat abatement plan is listed on the SPRAT database as being relevant to the Beach Nightshade, namely the *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEH 2005).

**Table 5-30** outlines the consistency of the Project with this threat abatement plan.

Table 5-29 Impact Assessment Summary - Beach Nightshade

<i>Will the proposed works...</i>	<b>Beach Nightshade (<i>Solanum dunalianum</i>): Vulnerable</b>
<i>....lead to a long-term decrease in the size of an important population of a species?</i>	<p>The Beach Nightshade is known from two Torres Strait islands and between Weipa and Mapoon on Western Cape York Peninsula, however it is expected to be more widespread on Cape York (Landsberg and Clarkson 2004). The species was not found in the Project area during targeted surveys; however, for the purposes of the impact assessment it is assumed that it could occur in the Project area in the vicinity of coastal vine forest and possibly vine forest on bauxite.</p> <p>Any occurrence of the species would be considered an important population under the intent of the EPBC Act since the species is little known with few existing records for the mainland, and any known occurrence of the species is regarded as:</p> <ul style="list-style-type: none"> <li>• key source populations either for breeding or dispersal;</li> <li>• populations that are necessary for maintaining genetic diversity; and/or,</li> <li>• populations that are near the limit of the species range.</li> </ul> <p>If present, the Beach Nightshade would be expected to be restricted to the margins of vine forest. These habitats would not be disturbed by mining or development of infrastructure. Furthermore, indirect effects from the Project due to changes to surface and sub-surface hydrology are not expected to lead to significant impacts as the proposed SoE environmental buffer system and measures to emulate pre disturbance drainage characteristics in the post-mining landscape would be implemented.</p> <p>The Project would not lead to a long-term decrease in the size of the Beach Nightshade population.</p>
<i>....reduce the area of occupancy of an important population?</i>	In line with the above, habitats supporting the Beach Nightshade would not be adversely affected by the Project and consequently, the area of occupancy of the Beach Nightshade within the Project area would not be reduced.
<i>....fragment an existing important population into two or more populations?</i>	Reduction in the area of the Beach Nightshade would not occur as a result of the Project and the population of this species would not be fragmented.
<i>....adversely affect habitat critical to the survival of a species?</i>	The Project area does not include any critical habitat areas for the Beach Nightshade that are listed under the EPBC Act or identified in Recovery Plans. The species is expected to be widespread on Cape York.
<i>....disrupt the breeding cycle of an important population?</i>	Vine forest habitat would not be affected by the Project and there would be no effect on the breeding cycle of the species.
<i>....modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?</i>	The vine forest habitat that supports the species would not be adversely affected by the Project thus a decline in the species is not anticipated. The proposed fire management plan would favour the species by effectively reducing the impacts of the current fire regime on the fire-sensitive vine forest habitats.
<i>....result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</i>	<p>The Project area is currently predominantly free of serious weeds and invasive species; however, a number of significant environmental weeds occur in the surrounding region. The peripheral vine forest habitats of the Beach Nightshade are favoured by weed invasion as the moist nature of the vine forest edge supports weed establishment. A number of smothering and ground cover weed species pose a threat, including Rubber Vine (<i>Cryptostegia grandiflora</i>) Hyptis (<i>Hyptis suaveolens</i>) and Stylo (<i>Stylosanthes</i> spp.). Proposed mitigation measures include a weed management program which would include preventative measures and control measures for weeds within the Project area. These mitigation measures would be effective in managing the impacts of weeds on the Beach Nightshade.</p> <p>The Project is not anticipated to lead to the establishment of invasive weeds within the habitat of the Beach Nightshade.</p>
<i>.....introduce disease that may cause the species to decline?</i>	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
<i>....interfere substantially with the recovery of the species?</i>	The Project would not lead to impacts on the Beach Nightshade and would consequently not interfere with the recovery of the species.

**Table 5-30 Consistency of SoE Project with the Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission with regard to the Beach Nightshade**

Objective	Action	Consistency of the SoE Project with the Threat Abatement Plan
Prevent feral pigs from establishing in areas where they currently do not occur or are in low eradicable numbers, and where they are likely to pose a threat on biodiversity; especially where they would impact on nationally listed threatened species and ecological communities	<ul style="list-style-type: none"> <li>Identify those areas currently free from feral pigs or in low eradicable numbers and where these areas overlay priority areas for nationally listed threatened species and ecological communities, and which are feasible to maintain free of feral pigs.</li> <li>Relevant agencies to verify as far as practicable, the presence or absence of feral pigs in priority areas.</li> <li>Relevant agencies to develop and implement strategies including surveillance monitoring and contingency plans to remove and pigs found in these priority areas. Where practicable, monitoring should be integrated into other programs where they exist.</li> <li>Awareness programs to be developed and implemented for key target groups (recreational hunters, bush walkers and land managers) to ensure that they understand the risk should feral pigs establish in these priority areas.</li> <li>Review the adequacy and effectiveness of existing legislation and its implementation that aims to control the release, transport and keeping of feral pigs. Relevant jurisdictions to make appropriate amendments to develop best practice strategies to implement it where the review identifies inadequacies.</li> </ul>	<p>Not applicable.</p> <ul style="list-style-type: none"> <li>Feral pigs are already established in the Project area, however the proposed feral pig control program aims to reduce feral pig numbers within the Project area including riparian areas which are habitat for the Beach Nightshade.</li> </ul>
Integrate feral pig management plans and their implementation into natural resource planning and investment at a regional, state and territory and national level through consultation and liaison with key stakeholders	<ul style="list-style-type: none"> <li>The Department and relevant state and territory agencies to: <ul style="list-style-type: none"> <li>Set out key concerns and issues to be included in Natural Resource Management planning/programs; and,</li> <li>Establish protocols and use funding and other relevant mechanisms to improve the consistency and coordination of actions across tenures and jurisdictions.</li> </ul> </li> </ul>	<p>Consistent:</p> <ul style="list-style-type: none"> <li>A feral pig control program is proposed for the Project.</li> </ul>
Increase the awareness and understanding of land managers and the general community about the damage that feral pig cause and management options.	<ul style="list-style-type: none"> <li>Relevant government agencies to assess the adequacy of available information and needs of key groups concerned about feral pigs and their management.</li> <li>Government agencies to arrange the preparation, packaging and dissemination of appropriate material to target groups to awareness and understanding of feral pig damage and how best to manage it.</li> <li>Support the dissemination and adoption of the pest management component of the Conservation and Land Management Training Package being developed by the National Training Authority.</li> </ul>	<p>Consistent:</p> <ul style="list-style-type: none"> <li>Through the feral pig control program that is proposed for the Project.</li> </ul>

Objective	Action	Consistency of the SoE Project with the Threat Abatement Plan
Quantify the impacts feral pigs have on biodiversity (especially nationally listed threatened species and communities) and determine the relationship between feral pig density and level of damage	<ul style="list-style-type: none"> <li>• Relevant government agencies to identify priority areas where nationally listed threatened species or ecological communities are known or perceived to be under threat from feral pigs.</li> <li>• Develop and implement appropriate studies that aim to determine the impact of feral pigs on national listed threatened species and the level of feral pig control required to reduce the impact to an acceptable level. This is best undertaken through and adaptive experimental approach to management.</li> </ul>	<p>Consistent:</p> <ul style="list-style-type: none"> <li>• Potential impacts from feral pigs on the Beach Nightshade have been identified.</li> </ul>
Improve the effectiveness, efficiency and humaneness of techniques and strategies used for managing the environmental damage due to feral pigs	<ul style="list-style-type: none"> <li>• In collaboration with private and government stakeholders, investigate and collate a list of current options for managing feral pigs, and assess the need for the development of effective and humane techniques and strategies with special emphasis on managing feral pigs in priority areas for the protection of nationally listed threatened species and ecological communities.</li> <li>• Relevant government agencies to assess techniques and strategies of feral pig control using these new approaches through an analysis of costs and benefits, safety, potential impact on no-target species and any other practical considerations, and formulate a regional best practice approach.</li> </ul>	<p>Consistent:</p> <ul style="list-style-type: none"> <li>• The proposed feral pig control program would use recognised methods for managing feral pigs within the Project area.</li> </ul>



### 5.7.5 Offset Measures

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012b), offsets are not required where the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c)).

**Section 5.7.3** and **Section 5.7.4** of this report documents the results of the impact assessment process and concludes that with the implementation of the proposed mitigation measures, the residual impacts associated with the construction and operation of the Project on the Beach Nightshade would be negligible and therefore not significant (refer **Section 5.1.2**). As such, offsets relating to the Beach Nightshade are not required under the Commonwealth offsets policy.

## 5.8 *Spathoglottis plicata*

### 5.8.1 Species Profile

*Spathoglottis plicata* is listed as 'vulnerable' under the EPBC Act.

*Spathoglottis plicata* is a member of the *Orchidaceae* family and is a terrestrial orchid with large leaves and purple flower spikes. *Spathoglottis plicata* is readily detectable when aerial shoots are present, particularly the brightly coloured flowers, but may be difficult to detect if aerial shoots are absent such as following fire or during extended dry periods.

*Spathoglottis plicata* is known to occur on Cape York between Cooktown and the Jardine River and has been recorded in the Weipa area (DSEWPaC 2008e). The Queensland Herbarium holds 25 specimens of the species including 18 specimens from Papua New Guinea and beyond, and two records from the Project region at Weipa and Bertihough Station.

*Spathoglottis plicata* typically occurs in or close to swamps; in seasonally inundated areas; in moist, grassy patches close to streams; and, in *Melaleuca* swamp forest and riparian gallery rainforest (Jones 1988, Dockrill 1992, Landsberg and Clarkson 2004). The Weipa specimen comes from a permanently swampy drainage line with dense low vegetation, and the Bertihough Station specimen is from a closed forest associated with a peaty spring area.

Critical habitat is habitat that the Minister has listed in the Register of Critical Habitat (prepared under Section 207A of the EPBC Act) in relation to an EPBC-listed species or ecological community. The DSEWPaC's Register of Critical Habitat does not identify any critical habitat for *Spathoglottis plicata*.

The current population size of the species in the subregion is unknown as little data exists on the presence of the species in the region. *Spathoglottis plicata* appears to be naturally rare and restricted in the region.

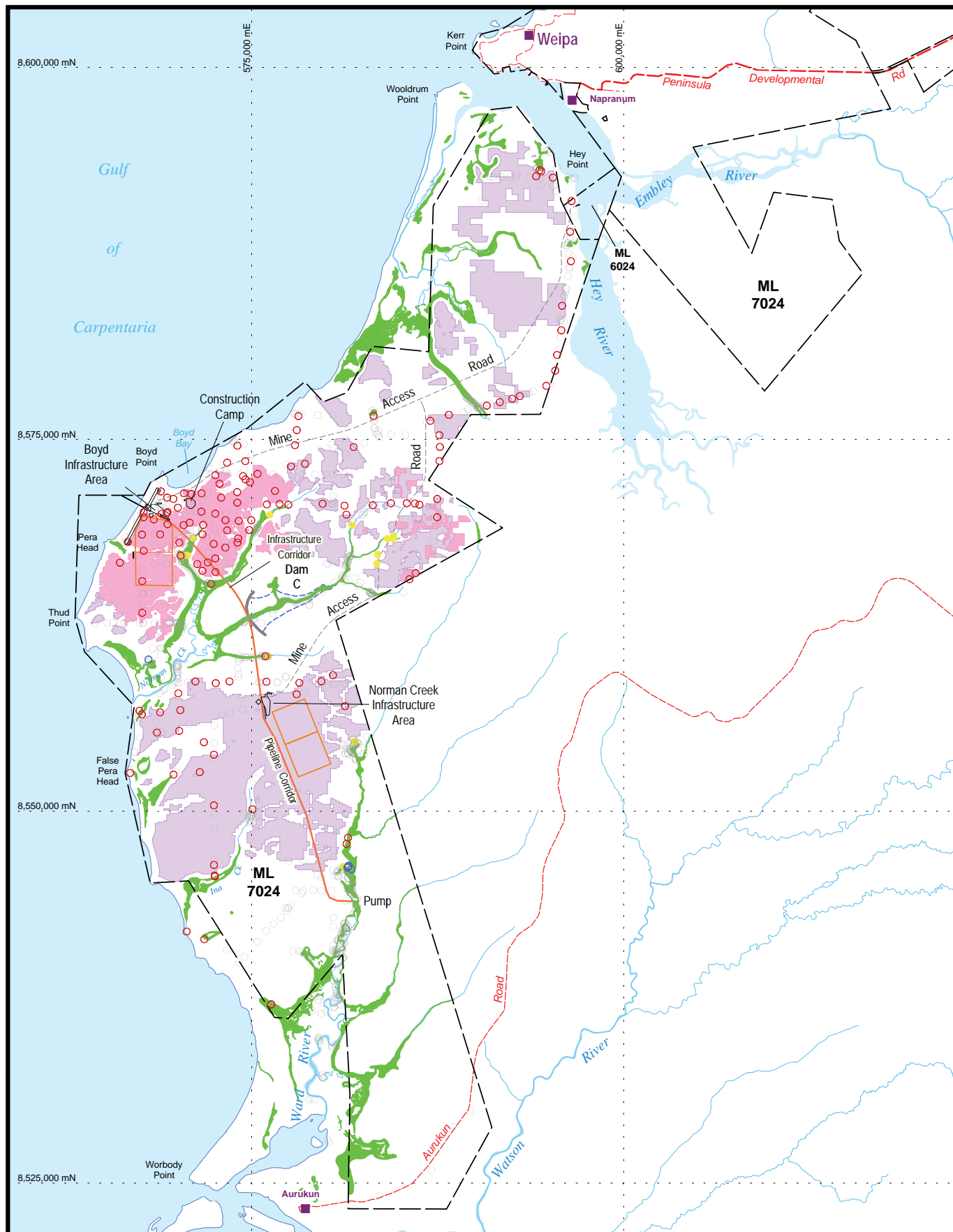
The key known potential threats to *Spathoglottis plicata* include over-collection and illegal collection by orchid enthusiasts, disturbance and foraging by feral pigs and altered hydrology (DSEWPaC 2008e). Additional potential threats are associated with inappropriate fire regimes (frequent late season fires), and changes to groundwater characteristics that reduce flow volumes and/or periodicity at permanent springs occupied by the species.

### 5.8.2 Survey and Results

Surveys for *Spathoglottis plicata* focussed on spring areas supporting a range of vegetation types, as both records of the species from the Project region were associated with permanent springs. Spring areas targeted for *Calophyllum bicolor* were also targeted for *Spathoglottis plicata* (refer **Section 5.3.2**).

The species was not located at any of the areas targeted during any of the surveys.

In addition to spring areas, surveys in spring influenced riparian / colluvial drainage lines and freshwater wetland areas (RE 3.3.9, 3.3.14a, and 3.3.21) also addressed the potential presence of the species (refer **Figure 4-1**). Riparian and freshwater wetland areas surveyed for the species included the majority of riparian gallery forest on all branches of Norman Creek, Coconut Creek, Winda Winda Creek, and along the swampy shoreline of the Embley River west of Hey Point (refer **Figure 5-9**).



Rio Tinto Alcan

- RTA Mining Lease boundary
- Locality
- Road/track
- - - Freshwater dam
- Tailings storage facility
- Mining Years 1 -13
- Mining Years 14 - 40
- Semi-permanent spring

### *Spathoglottis plicata*

● Potential Habitat

### **Vegetation Survey type**

- Secondary
- Tertiary
- Quarternary

### South of Embley Project

**Fig 5-9: Potential Habitat of *Spathoglottis plicata***



5 0 5km

Datum/Projection: GDA94/MGA Zone 54 Date: 05/02/2013

Potential habitat for *Spathoglottis plicata* within the Project area, shown on **Figure 5-9**, is very similar to *Calophyllum bicolor* given both species associate with permanently moist habitat such as springs and groundwater seepage areas. The species was not located in the semi-permanent groundwater seepage zones identified throughout the Project area but there is a possibility that unidentified isolated patches of suitable habitat may occur at the margin of inaccessible wetlands in the lower freshwater sections of the main drainages (Norman Creek, Ward River, Winda Winda Creek) and may support the species. Potential impacts on *Spathoglottis plicata* within the Project area are similar to those for *Calophyllum bicolor*.

**Table 5-31** provides a profile summary for the species.

### 5.8.3 Relevant Impacts

#### 5.8.3.1 Construction Impacts Prior to Mitigation

##### Direct Impacts

The results of the surveys determined that *Spathoglottis plicata* does not occur within or adjacent to proposed construction areas so there would be no direct disturbance of the species during construction and no edge effects on potential habitat. Populations of *Spathoglottis plicata* are naturally fragmented and unlikely to be affected by the small amount of habitat to be disturbed during construction.

##### Indirect Impacts

The possible groundwater seepage habitats on the lower sections of the main drainages where the species may occur are well removed from proposed construction areas and beyond the area where indirect effects of construction activities on water quality, air quality and groundwater regime may be experienced (refer **Section 14.3, 16.2 and 16.4**). These seepage areas would be susceptible to effects from weed infestations that may arise from construction activities. Construction activities could lead to the introduction and spread of fire promoting weeds such as Gamba Grass and Guinea Grass, which if left to proliferate in the vicinity of groundwater seepage zones could lead to an increase in fire intensity that could adversely affect the vegetation edge of these spring areas (DEEDI 2011b, NTFRS 2003). Resultant impacts associated with uncontrolled weed infestations could be moderate.

Construction activities are not expected to significantly alter the current fire regime.

**Table 5-32** summarises the relevant unmitigated construction impacts for *Spathoglottis plicata*.

#### 5.8.3.2 Operational Impacts Prior to Mitigation

##### Direct Impacts

The possible groundwater seepage habitats on the lower sections of the main drainages where the species may occur are well removed from the proposed mining area and would not be directly disturbed during operations or subject to edge effects from clearing.

The potential habitats of the species are naturally isolated and fragmented by non-favoured habitat and it is not anticipated that disturbance of Darwin Stringybark woodland for mining would further fragment potential habitat areas located on the lower sections of the main drainages. Although the mechanisms of dispersal of *Spathoglottis plicata* are not known, as the network of drainage line habitats that would be unaffected by direct disturbance from the Project are likely to maintain any processes related to the movement of plant propagules and genetic continuity between potential habitat areas.

Table 5-31 Profile Summary - *Spathoglottis plicata*

<i>Species</i> Common Name (if exists)	Growth Form	Potential Habitat within Project area	Known/ estimated population in Project area	Likelihood of Occurrence within Project Area
<i>Spathoglottis plicata</i>	A terrestrial orchid with flower stems to 1m	<p>Potential habitat within the Project area comprises spring areas supporting closed forest or <i>Melaleuca</i> swamp forest; spring influenced riparian / colluvial drainage lines (RE 3.3.9, 3.3.5, and 3.3.21); and freshwater wetland areas (REs 3.2.3, 3.3.9, 3.3.14a, and 3.3.50a). Based on survey results which did not find the species in these habitats, only isolated occurrences of the species in these potential habitats are possible.</p> <p>Five semi-permanent groundwater seepage zones associated with the Norman Creek and Ward River drainage systems did not support the species; however, additional semi-permanent seepage zones may occur in inaccessible areas of the lower Ward River and Norman Creek systems (refer <b>Figure 5-9</b> for potential habitat).</p>	If present, population is likely to be small.	<p><b><u>Mining Area</u></b>  <b>Unlikely:</b> No suitable habitat exists in Darwin Stringybark woodland.</p> <p><b><u>Infrastructure footprint</u></b>  <b>Possible:</b> Potential habitat for the species occurs within the proposed footprint of Dam C and the infrastructure corridor crossing of Norman Creek, although targeted surveys did not locate the species within these areas.</p> <p><b><u>Balance of Project area not disturbed</u></b>  <b>Possible:</b> Not detected during field surveys anywhere within the Project area but suitable stream, wetland and seepage habitat occurs extensively in the Project area in areas that would not be directly disturbed by the Project.</p>

**Table 5-32 Summary of Construction Impacts Prior to Mitigation for *Spathoglottis plicata***

Action/Issue	Summary of Potential Construction Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed construction areas.
Edge effects	None Species not present in areas adjacent to proposed construction areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None <i>Spathoglottis plicata</i> does not occur in or adjacent to infrastructure areas and the extent and location of construction disturbance is unlikely to affect recruitment/movement of propagules of the species.
<b>Indirect Impacts</b>	
Water Quality	None Species not found in groundwater seepage areas. Water quality would not be affected in these areas during construction.
Altered hydrological regime	None Potential groundwater seepage zone habitat areas are located well beyond the area where potential effects of construction on groundwater may occur (refer <b>Sections 16.2 and 16.4</b> ).
Air Quality	None Species is not present within the vicinity of proposed construction areas where localised air quality effects may be experienced.
Introduction of weeds and pests	Moderate, long term Construction activities could lead to the introduction and spread of fire promoting weeds which if left to proliferate could affect groundwater seepage zones.
Altered fire regime	Moderate, long term Construction activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### Indirect Impacts

The potential habitat areas for the species are located well away from proposed mining areas and beyond the area where effects on water quality and air quality may be experienced. The groundwater seepage habitats that may support the species would be susceptible to significant changes to groundwater regime, particularly reductions in groundwater discharge. The shallow aquifer feeding the semi-permanent groundwater seepage areas are typically hosted in the kaolinitic layer below the bauxite apart from at the peak of the wet season (refer **Sections 16.2 and 16.4**). The seepage areas are not fed from bauxite hosted groundwater in the dry season and bauxite removal would be very unlikely to affect groundwater supply to these areas. Modelling of catchment hydrology indicates that only minor localised effects on riparian and wetland ecosystems are likely as a result of Project development. Potential effects in downstream areas (such as those potentially inhabited by *Spathoglottis plicata*) may comprise slightly extended groundwater discharge but within the range experienced by the ecosystems under natural inter-decadal variation (refer **Sections 16.2 and 16.4**). A minor extension of discharge periodicity is unlikely to adversely affect *Spathoglottis plicata* or the overall habitat condition and composition of groundwater seepage ecosystems.

Seepage areas would be susceptible to effects from weed infestations as described for the construction phase. Moderate impacts could result if uncontrolled weed infestations occurred in these areas.

Operational activities are not expected to significantly alter the current fire regime or lead to the introduction of new feral fauna that could impact on potential habitat of *Spathoglottis plicata*.

**Table 5-33** summarises the unmitigated relevant impacts for *Spathoglottis plicata*.

**Table 5-33 Summary of Operational impacts Prior to Mitigation for *Spathoglottis plicata***

Action/Issue	Summary of Potential Operational Impacts Prior to Mitigation
<b>Direct Impacts</b>	
Clearing and loss of habitat	None Species is not present in proposed mining areas.
Edge effects	None Species is not present in areas adjacent to proposed mining areas.
Fragmentation of habitat	None Potential habitats are naturally isolated and located away from habitat disturbance.
Effects on recruitment/movement of propagules	None The network of undisturbed drainage line habitats is anticipated to maintain current dispersal mechanisms and levels of genetic continuity.
<b>Indirect Impacts</b>	
Water quality	None Species occurs in groundwater seepage areas. Groundwater quality will not be affected during operations.
Altered hydrological regime	None Substantial changes to wetland and riparian ecosystems are not anticipated given the minor localised changes to groundwater and surface water hydrology that would occur as a result of operations (refer <b>Sections 16.2 and 16.4</b> ).
Air quality	None Species is not present within the vicinity of proposed mining areas where localised air quality effects may be experienced (refer <b>Sections 14.3</b> ).
Introduction of weeds and pests	Moderate, long term Operational activities could lead to the introduction and spread of fire promoting weeds which if allowed to proliferate, could affect groundwater seepage zones.
Altered fire regime	Moderate, long term Operational activities could have moderate impacts on the fire regime if fire promoting weeds are introduced.

#### 5.8.4 Avoidance, Mitigation, Enhancement Measures and Residual Impacts

Disturbance to *Spathoglottis plicata* habitats would be avoided through implementation of the following:

- the proposed SoE environmental buffer system shall exceed the requirement of the Queensland Coordinator General's approval conditions and comprise a methodology for determining set-back distances for mining from sensitive vegetation, instead of from the banks of watercourses and wetlands. 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. All potential habitat for the *Spathoglottis plicata* would be protected from mining by the buffer system. RTA would work with Traditional Owners and the relevant WCCCC Sub-committee on establishment of environmental buffers as part of the CEMP. The proposed SoE environmental buffer system would maintain a network of undisturbed habitats and would be enhanced through the proposed fire management program (refer **Section 6.3.4.2** for additional details) which would conserve fire sensitive flora and promote overall vegetation diversity and the feral pig control program (refer **Section 7.3.6.4** for additional details) which would reduce pig damage to riparian and wetland areas. Additional details on the proposed SoE environmental buffer system is included in **Section 6.3.4.5**;
- the general avoidance measures discussed in **Section 3.13** further reduce impacts by siting facilities in areas with less sensitive habitat. No plants were located in areas where infrastructure has been planned; and,
- removal of a dam on the Ward River from the proposal (refer **Section 3.13.3**).

Direct and indirect unmitigated impacts associated with the Project on *Spathoglottis plicata* are identified in **Table 5-32** and **Table 5-33**. The following mitigation and enhancement measures would reduce these unmitigated impacts:

- a weed management program would be developed and implemented prior to commencement of construction, and would include weed surveys annually (post wet season) targeting operational areas and site routes (see **Section 6.3.4.3** for additional details).

The following general mitigation and enhancement measures would further reduce potential for negligible impacts or would provide positive outcomes for the *Spathoglottis plicata*:

- the proposed SoE environmental buffer system that would be implemented would reduce impact from any alteration of the hydrological regime on areas that may provide habitat for *Spathoglottis plicata*;
- stormwater runoff would be managed by constructing and maintaining appropriately sized stormwater management structures (refer **Section 16.2.2**);
- an erosion and sediment management plan would be developed prior to construction (refer **Section 16.2.2**);
- surface water monitoring would be conducted in accordance with the Queensland Coordinator General's approval conditions for the SoE Project (Queensland Government 2012) (refer **Section 16.5.1**);
- a fire management program would be developed in cooperation with Traditional Owners and the relevant WCCCC Sub-committee as part of the CEMP (see **Section 6.3.4.2** for additional details). A reduction in fire intensity and frequency would minimise fire impacts on fire sensitive habitats; and,



- the proposed feral pig control program aims to reduce pig populations in riparian areas where their foraging causes disturbance (see **Section 7.3.6.4**).

An environmental management plan outline for *Spathoglottis plicata* which summarises these avoidance, mitigation and enhancement measures is provided in **Appendix 5-A**. The cost of key avoidance, mitigation and enhancement measures are summarised in **Appendix 5-B**.

**Table 5-34** summarises the relevant mitigation measures and residual impacts for *Spathoglottis plicata* based on unmitigated impacts identified in **Table 5-32** and **Table 5-33** as greater than negligible.

**Table 5-35** summarises the potential impacts on *Spathoglottis plicata* as a result of the Project after the proposed mitigation measures have been considered, compared with the significant impact criteria for matters of NES (DEWHA 2009c).

**Table 5-34** Potential Impacts, Avoidance, Mitigation and Enhancement Measures and Residual Impacts for *Spathoglottis plicata*

Potential Impact	Impact Magnitude	Relevant Mitigation and Enhancement Measures	Residual Impact Magnitude
Introduction of weeds that may intensify fire impacts on groundwater seepage zones and smother vegetation	Moderate, long term	<ul style="list-style-type: none"> <li>Weed management program</li> <li>SoE environmental buffer system</li> </ul>	Negligible, long term
Altered fire regime	Moderate, long term	<ul style="list-style-type: none"> <li>Weed management program</li> </ul>	Negligible, long term

**Table 5-35** Impact Assessment Summary - *Spathoglottis plicata*

Will the proposed works...	<i>Spathoglottis plicata</i> : Vulnerable
....lead to a long-term decrease in the size of an important population of a species?	<p><i>Spathoglottis plicata</i> is known from the Cape York peninsula between Cooktown and the Jardine River and in the Asia Pacific region. <i>Spathoglottis plicata</i> has not been recorded from surveys within the Project area but suitable habitat occurs in the Project area, including riparian gallery forest, <i>Melaleuca</i> wetlands, and seasonally inundated grassy areas.</p> <p>If a population of <i>Spathoglottis plicata</i> occurs within the Project area it would be considered an important population under the intent of the EPBC Act since the species is little known, with only one record from western Cape York (near Weipa). Any additional known occurrence of the species would be regarded as significant because it would represent:</p> <ul style="list-style-type: none"> <li>key source populations either for breeding or dispersal;</li> <li>populations that are necessary for maintaining genetic diversity; and/or,</li> <li>populations that are near the limit of the species range.</li> </ul> <p><i>Spathoglottis plicata</i> may occur within the footprint of the proposed water supply dam (Dam C), although targeted surveys within the dam footprint did not locate the species. Suitable habitat for the species also occurs elsewhere within the Project area in areas that would not be disturbed by mining and infrastructure.</p> <p>Habitat areas adjacent to proposed mining areas may be subject to isolated localised minor effects due to changes in hydrology associated with the removal of bauxite. However, these effects would be limited by proposed mitigation measures including spatial buffering of riparian and wetland areas and the use of reconstructed surface drainage and detention areas in mine pits to recharge shallow groundwater aquifers. Significant indirect impacts on the species as a result of hydrological changes are not anticipated.</p> <p>Should <i>Spathoglottis plicata</i> occur within the footprint of the water supply dam, a long term decrease in the size of the local population may occur; however, there is no current evidence to suggest the species is present in this area.</p>

<b>Will the proposed works...</b>	<b><i>Spathoglottis plicata</i>: Vulnerable</b>
....reduce the area of occupancy of an important population?	Should <i>Spathoglottis plicata</i> occur within the proposed footprint of the water supply dam then the area of occupancy of the species within the Project area would be reduced; however, there is no current evidence to suggest the species is present in this area.
....fragment an existing important population into two or more populations?	It is not anticipated that <i>Spathoglottis plicata</i> would occur as discrete populations within the Project area. However, the disturbance of any <i>Spathoglottis plicata</i> would not be expected to fragment any other population that may be present within the Project area.
....adversely affect habitat critical to the survival of a species?	The Project area does not include any critical habitat areas for <i>Spathoglottis plicata</i> that are listed under the EPBC Act or identified in Recovery Plans.
....disrupt the breeding cycle of an important population?	Should any <i>Spathoglottis plicata</i> be disturbed then the breeding cycle of the species would be disrupted within that area; however, there is no current evidence to suggest the species is present in the Project area.
....modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Project would disturb potential habitat for this species within the proposed water supply dam footprint; however, more extensive areas of similar suitable habitat occur elsewhere throughout the Project area. The proposed feral animal control program would reduce feral pig numbers in the Project area and would most likely reduce damage levels to potentially occurring populations of <i>Spathoglottis plicata</i> during the dry season. Furthermore, the fire management program would effectively reduce the impacts of fire to potential habitat areas. If the species occurrence is restricted to the proposed Dam C footprint then the species would experience a decline; however, if present in the dam area it is unlikely that the species would be restricted to this area given the availability of more extensive areas of similar suitable habitat associated with the main drainage systems of Norman Creek, Ward River and Winda Winda Creek which would remain undisturbed by the Project.
....result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	The Project area is currently predominantly free of significant weeds and invasive species; however a number of significant environmental weeds occur in the surrounding region. The moist nature of wetland and seasonally inundated habitats favoured by <i>Spathoglottis plicata</i> puts them at risk of invasion by weed species. Of particular concern is Rubber Vine ( <i>Cryptostegia grandiflora</i> ). Proposed mitigation measures include a rigorous weed management program which would include preventative measures and control measures for weeds within the Project area. These mitigation measures would be effective in managing the impacts of weeds on <i>Spathoglottis plicata</i> .  The Project is not anticipated to lead to the establishment of invasive weeds within any potential habitat of <i>Spathoglottis plicata</i> .
.....introduce disease that may cause the species to decline?	Disease is not known as a threat to this species. It is not anticipated that the Project would represent a threat with respect to the introduction of disease.
....interfere substantially with the recovery of the species?	It is not anticipated that the species, if present in the Project area, would be restricted to the proposed Dam C footprint given the occurrence of more extensive areas of similar suitable habitat throughout the Project area that would not be disturbed, and consequently it is unlikely the Project would interfere substantially with the recovery of the species.

#### 5.8.4.1 National Recovery Plan and Threat Abatement Plan

There is no national recovery plan or relevant threat abatement plans for *Spathoglottis plicata*. However, the proposed feral pig program, which will reduce pig damage to riparian habitats, is consistent with the *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs* (DEH 2005)(refer **Table 5-30**).

### 5.8.5 Offset Measures

Under the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012b), offsets are not required where the residual impact is not likely to be significant (when assessed against the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DEWHA 2009c).

**Section 5.3.3** and **Section 5.3.5** of this report documents the results of the impact assessment process and concluded that with the implementation of the proposed mitigation and enhancement measures there would be negligible impacts on *Spathoglottis plicata* and therefore not significant (refer **Section 5.1.2**). Therefore, no formal offsets are required for *Spathoglottis plicata*.