Cairns Shipping Development Project

Ports North

VOLUME 2

Draft : Environmental Impact Statement

Chapter B6 Water Resources

B6.1 Introduction

This chapter describes the existing surface water and ground water values that may potentially be affected by the Cairns Shipping Development Project (the project), the possible impacts on these values and proposed management and mitigation measures.

For the purposes of this chapter, the study area is defined as the area where landside infrastructure upgrades will occur, as shown in **Figure B6.1a**. The project area terminates at the coastline with the coastal and tidal environments addressed separately in **Chapter B3, Coastal Processes, Chapter B4, Marine Sediment Quality** and **Chapter B5, Marine Water Quality**.

B6.2 Methodology and Assumptions

B6.2.1 Methodology

This assessment is based on a desktop study and entailed the following tasks:

- A review of the relevant legislation and policy
- A review of environmental values and water quality objectives for Trinity Inlet
- A review of available Geographical Information System (GIS) datasets including topographical information, watercourses, geology, vegetation and land use
- A review of background information for the project including weather information from the Bureau of Meteorology, local government websites and other publications, as detailed below in **Section B6.2.1.1**.

A desktop study is considered a reasonable approach for this study, as most project works are marine-based, and there is limited potential for the disturbance of surface waters or groundwater as part of the project.

B6.2.1.1 Data Sources

The following reports were reviewed to understand the existing environment of the study area relating to surface water and groundwater:

- CSD Project EIS, BMT WBM Water Quality Monitoring Program (July 2013 to July 2014) – water quality data collected in support of the project including 12 months of turbidity and physico-chemical measurements along with grab samples of total and dissolved metal, nutrients and TSS at selected locations
- Water Resources (Wet Tropics) Plan 2013: Consultation Draft published in 2013 by the Department of Environment and Heritage Protection (DEHP)
- Cairns CBD and Environs Drainage Management Plan: Phase 2 Report published in 2001 by Cairns Regional Council (CRC)
- Cairns Port Long Term Management Plan - Dredging and Dredge Spoil Management published in 2010 by Worley Parsons
- The Trinity Inlet Management Study Context Report, published in 1980 by Environmental Science and Services
- Environmental Protection (Water) Policy 2009: Trinity Inlet environmental values and water quality objectives Basin No.111, published in July 2010 by the DEHP.

B6.2.2 Significance Criteria

Environmental Values (EVs) and Water Quality Objectives (WQOs) have been stipulated for these waters as discussed in **Section B6.2.3**. These EVs and WQOs form a key component to the significance criteria used to assess the significance of potential impacts for the project, as presented in **Table B6.2.2a**.

Figure B6.1a Project Area and Neighbouring Surface Waterways

Table B6.2.2a Significance of Potential Impacts

Impact Significance/ Consequence	Description of Significance
Very High	Impacts are considered critical to the decision making process. They tend to be permanent or irreversible, long term and are of national significance, e.g, the surface waters of the Great Barrier Reef World Heritage Area (GBRWHA) and Marine Park catchments. Long-term irreversible change to surface waters or groundwater quality (i.e. greater than 20 years) that are considered critical to water quality of the GBRWHA. Long term or irreversible change to surface water or groundwater hydrodynamics that support ecosystems critical to the GBRWHA and Marine Park, e.g change to groundwater levels or surface water flows that support a critical habitat.
High	Impacts are considered important to the decision making process. They tend to be medium term and are of national or state significance. A medium term loss of environmental values ascribed to surface waters or groundwater that supports the GBRWHA and Trinity Inlet that can be mitigated only over the medium-term (i.e. within seven to 20 years). Medium term, but reversible, change to surface water or groundwater hydrodynamics that support ecosystems critical to the GBRWHA and Marine Park or Trinity Inlet, e.g change to groundwater levels or surface water flows that support a critical habitat. Regular breaches of relevant water quality guidelines (refer to **Section B6.2.3**).
Moderate	These impacts are considered relevant to the decision making process (but not likely to be key decision making issues) and tend to range from short to medium (i.e. one to seven years) and are of regional or local significance. Deterioration of water quality conditions of surface waterways and groundwater for a short to medium term that can be mitigated. Some occasional breaches of relevant water quality guidelines (refer to **Section B6.2.3**).
Minor	Impacts are recognisable or detectable, but deemed acceptable. These impacts are not considered key to decision making but are relevant when considering mitigation measures. A temporary change to existing surface water or groundwater quality or hydrological processes that is limited to local scale or easily mitigated.
Negligible	Negligible impact to the existing situation. No change to existing surface water or ground water quality/hydrology or changes that are beneath levels of detection.
Positive	The quality and quantity of water is improved beyond existing background levels that support EVs.

Table B6.2.2b Likelihood of Impact

Category	Definition
Almost Certain	Very likely to occur during construction or the operational phases.
Likely	Likely to occur during construction or operational phases.
Possible	Less than likely to occur but still appreciable with the probability of occurrence rated above 50 percent.
Unlikely	May occur during construction or the during the life of the project with the probability of occurrence being below 50 percent, but not negligible.
Highly Unlikely/Rare	Highly unlikely to occur but theoretically possible.

B6.2.2c Risk Matrix

Likelihood	Significance				
	Negligible	Minor	Moderate	High	Very High
Highly Unlikely/ Rare	Negligible	Negligible	Low	Medium	High
Unlikely	Negligible	Low	Low	Medium	High
Possible	Negligible	Low	Medium	Medium	High
Likely	Negligible	Medium	Medium	High	Extreme
Almost Certain	Low	Medium	High	Extreme	Extreme

B6.2.2d Risk Rating Legend

Extreme Risk	An issue requiring change in project scope; almost certain to result in a 'significant' impact on a Matter of National or State Environmental Significance
High Risk	An issue requiring further detailed investigation and planning to manage and reduce risk; likely to result in a 'significant' impact on a Matter of National or State Environmental Significance
Medium Risk	An issue requiring project specific controls and procedures to manage
Low Risk	Manageable by standard mitigation and similar operating procedures
Negligible Risk	No additional management required

B6.2.3 Policy, Context and Legislative Framework

The following legislation, policies and guidelines were identified as relevant to water resources and have been referenced in this chapter. The guidelines represent the national, regional and the most locally accredited documents applicable to the project area. As a general rule, where local guidelines relevant to the protection of water quality are available, they take priority over the regional and national guidelines.

- National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC Guidelines)
- *Water Act 2000* and the Water Resources (Wet Tropics) Plan 2013
- Queensland Water Quality Guidelines (QWQG) 2009
- Water Quality Guidelines for the Great Barrier Reef Marine Park 2010
- *Environmental Protection Act 1994* and *Environmental Protection (Water) Policy 2009*.

B6.2.3.1 National Water Quality Management Strategy

The National Water Quality Management Strategy (NWQMS) is a joint initiative developed by the Australian and New Zealand governments in conjunction with the state and territory governments that aims to improve water quality.

The NWQMS has been available since 1992 and its main objective is to achieve sustainable use of the nation's water resources by protecting and enhancing their quality whilst simultaneously maintaining social and economic development.

The Australia and New Zealand Guidelines for Fresh and Marine Water Quality (also known as Australian Water Quality Guidelines - AWQG) were developed as a result of this strategy in 2000 (ANZECC & ARMCANZ, 2000). They remain the default guideline for water quality objectives where locally or regionally more appropriate guidelines have not been developed. In this instance, local water quality guidelines for the project area do exist.

B6.2.3.2 Water Act 2000 and Water Resource Plan 2013

The water resource planning process is designed to plan for the allocation and sustainable management of water to meet Queensland's future water requirements. Water Resource Plans (WRPs) are structured under the ***Water Act 2000*** to deliver new levels of sustainability for riverine ecosystems. A WRP details what government aims to achieve for a catchment's social, economic and environmental needs, and applies to a catchment's rivers, lakes, dams, springs and if necessary, underground water and overland flow.

There is one WRP affecting the project area which was released in 2013 as a draft consultation plan by the DEHP covering the Wet Tropics Area.

The purposes of this plan are as follows:

- To define the availability of water in the plan area
- To provide a framework for sustainably managing water and the taking of water
- To identify priorities and mechanisms for dealing with future water requirements
- To provide a framework for establishing water allocations
- To provide a framework for reversing, where practicable, degradation in natural ecosystems
- To regulate the taking of groundwater.

B6.2.3.3 Queensland Water Quality Guidelines 2009

The Queensland Water Quality Guidelines (QWQG), developed by the DEHP, provides guideline EVs and WQOs tailored to the various water types found across Queensland. In the absence of a more locally applicable guideline, the values specified in the QWQG become the default values.

B6.2.3.4 Water Quality Guidelines for the Great Barrier Reef Marine Park 2010

For waters in or entering the GBRMP, specific environment values and water quality objectives apply. These EVs and WQOs have been developed by the Great Barrier Reef Marine Park Authority (GBRMPA) to halt or reverse the decline in the quality of waters entering the marine park.

This document provides the concentrations and trigger values for sediment, nutrients and pesticides based on the protection of marine species and ecosystem health of the reef. These values were derived to be used as triggers for management actions, such as initiating investigation of causes, not as specific condition/limits. These guidelines are applicable to five distinct water bodies defined below:

- Enclosed coastal
- Open Coastal
- Midshelf
- Offshore
- The Coral Sea.

Based on the above classification it is noted that the surface waterways that lie within the study area do not fall under the water bodies specified by GBRMPA, as the water types defined above are consistent with the definitions for marine and estuarine waters (as outlined in the QWQG 2009 and EPP 2009). Relevant trigger values from these guidelines specified for the adjacent marine waterways are described separately in **Chapter B5, Marine Water Quality**.

B6.2.3.5 Environmental Protection Act 1994

In Queensland the *Environmental Protection Act 1994* and subordinate legislation the *Environmental Protection (Water) Policy 2009* (EPP) form the legislative framework which regulates the activities likely to affect both surface water and ground water.

Within this framework, the key focus is to establish the EVs attached to water courses and subsequently determine the WQOs required for protecting the EVs.

For the Trinity Inlet, local EVs and WQOs have been established, covering the inlet region that includes the port and parts of the outer channel under the EPP's *Trinity Inlet Environmental Values and Water Quality Objectives – Basin No.111* report (DEHP, 2010). Under the process outlined in the EPP, these guideline values take precedence over the broader guidelines such as the ANZECC and the QWQG.

B6.2.3.6 Environmental Values

The protected EVs for Trinity Inlet as contained in the *Trinity Inlet Environmental Values and Water Quality Objectives – Basin No.111* report are specified in **Table B6.2.3.6a**. These values have been derived with the overarching aim of maintaining the viability and sustainability of the Trinity Inlet ecosystem. **Figure B6.2.3.6a** shows Trinity Inlet Basin as defined in Plan WQ1111.

Figure B6.2.3.6a Trinity Inlet Water Quality Plan

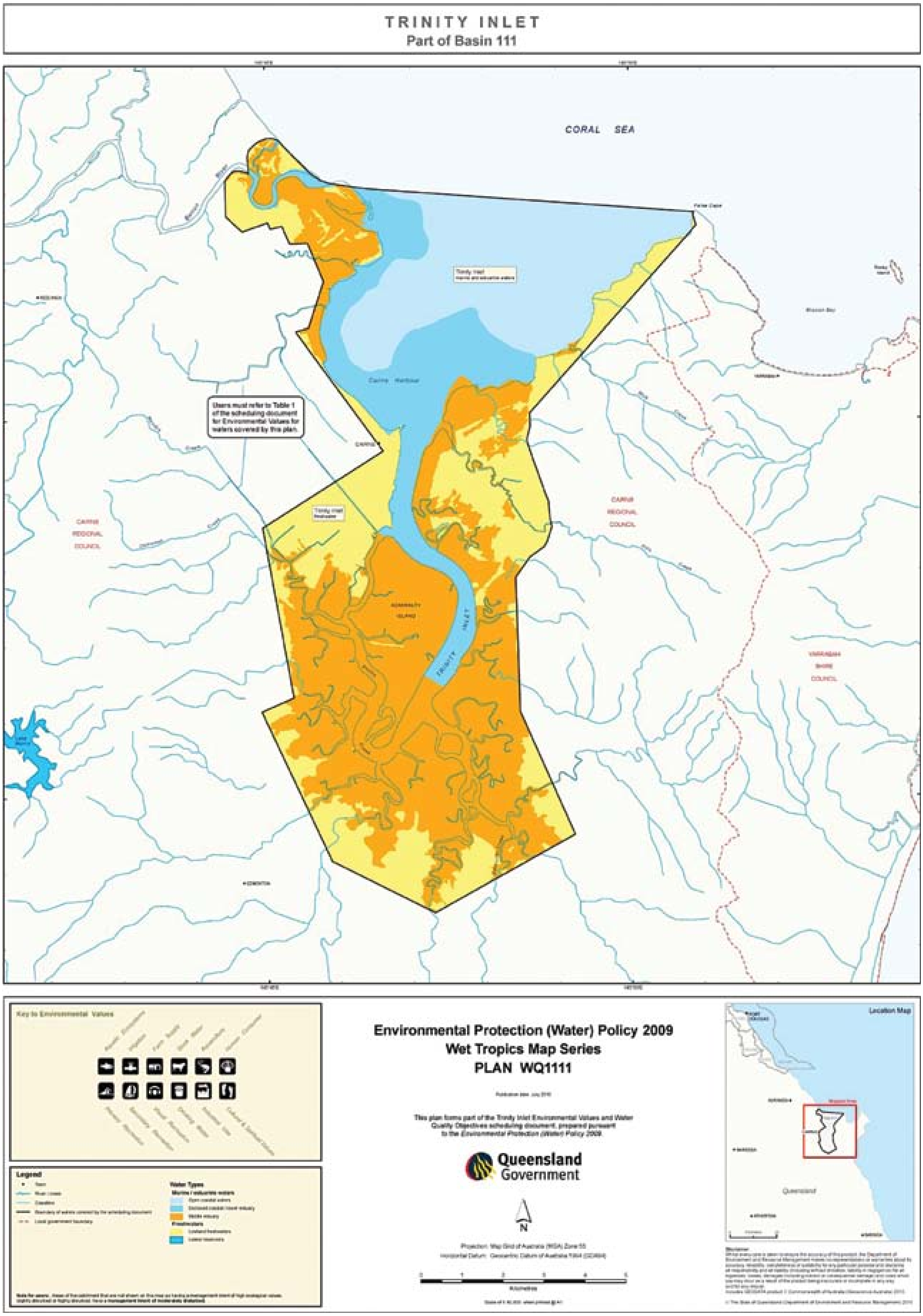


Table B6.2.3.6a Trinity Inlet Environmental Values

Environmental Values	Potentially Applicable To	
	Ground Water	Fresh (Non-Tidal) Waters
Protection of Aquatic Ecosystems (Aquatic Ecosystem EV)		
Protection or enhancement of aquatic ecosystem values, under four possible levels of ecosystem conditions: • High ecological value (effectively unmodified) waters • Slightly disturbed waters • Highly disturbed waters.	✓	✓
EVs other than Aquatic Ecosystem EV (Human Use EVs)		
Educational and scientific use	✓	✓
Human consumer	✓	✓
Primary contact recreation (e.g swimming)		✓
Secondary contact recreation (e.g boating)		✓
Visual recreation (no contact)		✓
Aquaculture		✓
Cultural and spiritual values		✓

The EVs specified for the Trinity Inlet catchment waters include aquatic ecosystem EVs as well as other specific 'human use' related EVs such as drinking water use, recreational water use, crop irrigation and aquaculture. In instances where more than one EV applies to the waters identified, the most stringent water quality objective is adopted. For this project, the guideline trigger values specified for the protection of aquatic ecosystems represent the most stringent values and will therefore be adopted for the purposes of this assessment.

The applicable environmental values for the waters within the project area are:

- Protection of aquatic ecosystem (moderately disturbed) – freshwater
- Protection of aquatic ecosystem (high ecological value) – groundwater.

WQOs for the applicable EVs are provided in **Section B6.2.3.7**.

B6.2.3.7 Water Quality Objectives

Surface Waters

Separate water quality objectives have been developed for different water types of Trinity Inlet. The project area as defined in Section B6.1 lies within the lowland freshwater classification. The EPP guideline values for the protection of the aquatic ecosystem are provided in **Table B6.2.3.7a**.

Table B6.2.3.7a Trinity Inlet Water Quality Objectives – Lowland Freshwater Streams

Parameter	Lowland Freshwater (comprising of lowland streams and coastal streams)
Suspended Solids (background < 15 mg/L)	< 10 mg/L increase for extended periods of time
Suspended Solids (background >15 mg/L)	< 25 mg/L increase for extended periods of time
Chlorophyll-a	< 1.5 µg/L
Total nitrogen (TN)	< 240 µg/L
Oxidised N	< 30 µg/L
Ammonia N	< 10 µg/L
Organic N	< 200 µg/L
Total phosphorous (TP)	< 50 µg/L
Filterable reactive phosphorous (FRP)	< 4 µg/L
Dissolved Oxygen (DO) (minimum diurnal DO > 6 mg/L)	< 5.5 mg/L
Dissolved Oxygen (DO) (minimum diurnal DO < 6 mg/L)	5.5 mg/L
pH	6.5 – 9.0
Temperature	< 2° C increase
Toxicants	Toxicants in water and sediments as per AWQG (2000) • Toxicants in water, refer to AWQG Section 3.4 – 'water quality guidelines for toxicants' (including Table 3.4.1, 3.4.2 and Figure 3.4.1) • Toxicants in sediments, refer to AWQG Section 3.5 – 'sediment quality guidelines' (including Table 3.5.1 and Figure 3.5.1 Comply with Code of Practice for Antifouling and in-water Hull Cleaning and Maintenance, ANZECC.

Groundwater

The WQ Plan 1111 for the Trinity Inlet catchment does not provide WQOs relating to groundwater protection. It recommends that where ground waters interact with surface waters, groundwater quality should not compromise identified EVs and WQOs for those waters. Where ground waters are in good condition, the intent is to maintain existing water quality (20th, 50th and 80th percentiles).

B6.3 Existing Conditions

Trinity Inlet and Trinity Bay have been identified to be of high environmental value in a number of water quality planning documents (Refer to **Section B6.2.3**).The Trinity Inlet Management study (1980) and the Trinity Inlet Environment Values and Water Quality Plan (2011) identify environmentally sensitive receptors within this catchment. The proximity of the Inlet to the GBRMP and its designation as a Fish Habitat Area (FHA) under the *Fisheries Act 1994* further increases the sensitivity of this area. Water quality within Trinity Inlet is a key factor in maintaining the ecological characteristics of the inlet.

B6.3.1 Catchment Description and Land Use

The project lies in the Trinity Inlet catchment which is approximately 33, 956ha in size (Barron and Haynes, 2009). The catchment comprises the southern portion of the Cairns Central Business District (CBD); the towns of Gordonvale and Edmonton to the south west of the Inlet, cane lands to the south of the inlet and mangrove swamps to the east (Environmental Sciences, 1980), as shown in **Figure B6.1a**.

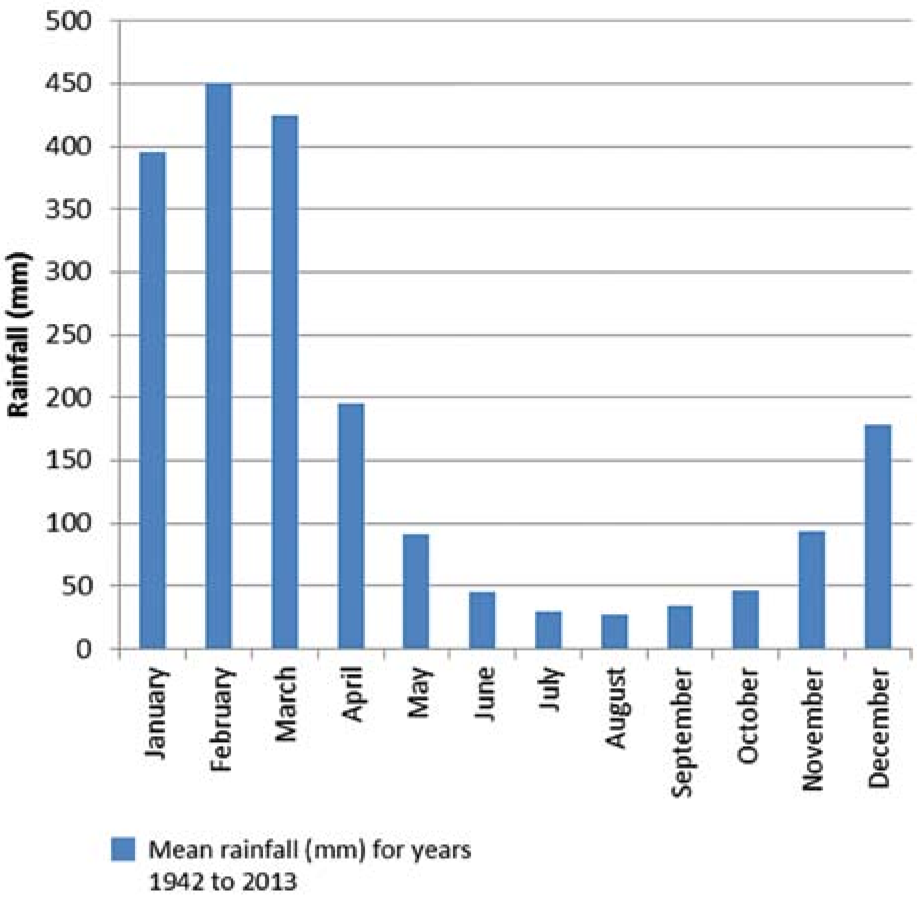
The Great Barrier Reef is located approximately 25-30 km offshore to the north east of the inlet. The Barron River Catchment is located to the north of the Trinity Inlet catchment and the Barron River feeds into the north western region of the Trinity Bay. The Trinity Inlet has a number of freshwater creeks including Smiths Creek, Skeleton Creek, Lily Creek, etc. The predominant land use within the Barron and Trinity catchments is natural forests (46 percent) with 29 percent of the land used for grazing and 13 percent for crops and only seven percent of the area bearing the urban footprint (Barron and Haynes, 2009).

With the exception of the eastern mangrove areas, the other parts of the Trinity Inlet catchment are largely developed. The study area which forms a minor part of the Trinity Inlet catchment is bounded by a mixture of industrial, commercial and recreational land uses to the north, south and westerly directions (Worley Parsons, 2010). There are two wastewater treatment plants located in the catchment; the Southern Wastewater Treatment Plant and the Edmonton Wastewater Treatment Plant. The treated effluent from the Southern Plant is discharged to Smiths Creek which drains to Trinity Inlet. The effluent from the Edmonton Plant discharges to Smiths Creek via Skeleton Creek. The wastewater treatment plants were upgraded to a tertiary treatment plant in 2010-12 to reduce the nutrient input into the Inlet.

B6.3.2 Climate

The Cairns region experiences a distinct dry and wet season with most rainfall occurring during the wet season. The annual average rainfall measured at the Cairns Aero station is 2013mm. The wet season typically extends from November to March with the highest rainfall occurring between January and March. The region is also prone to tropical cyclones and storms during the wet season and as a result, periods of intense rainfall leading to rapid runoff are common (BoM, 2013). Monthly rainfall statistics are detailed in **Figure B6.3.2a below**.

Figure B6.3.2a Monthly Rainfall Statistics



B6.3.3 Surface Waterways

The Trinity Inlet catchment contains no major rivers (Environmental Sciences, 1980). It comprises minor creeks and natural drainage lines, although there are none within the immediate study area (refer to **Figure B6.3.4a**). Lily Creek is a minor creek located to the north of the study area. A minor open channel runs alongside Fearnley Street to the south west of the study area, draining to Smiths Creek. It is noted that the existing drainage lines, particularly the Fearnley St and Chainman's Creek drain have been heavily modified due to the urban development in the catchment. These drains were modified to reduce the volume of existing wetlands to reduce the risk of mosquitoes and tropical diseases.

There is no recorded surface water extraction within the study area.

For most of the year, the minor creeks and drainages within the study area experience low flows. During the wet season, however, a substantial amount of run-off can occur over short periods.

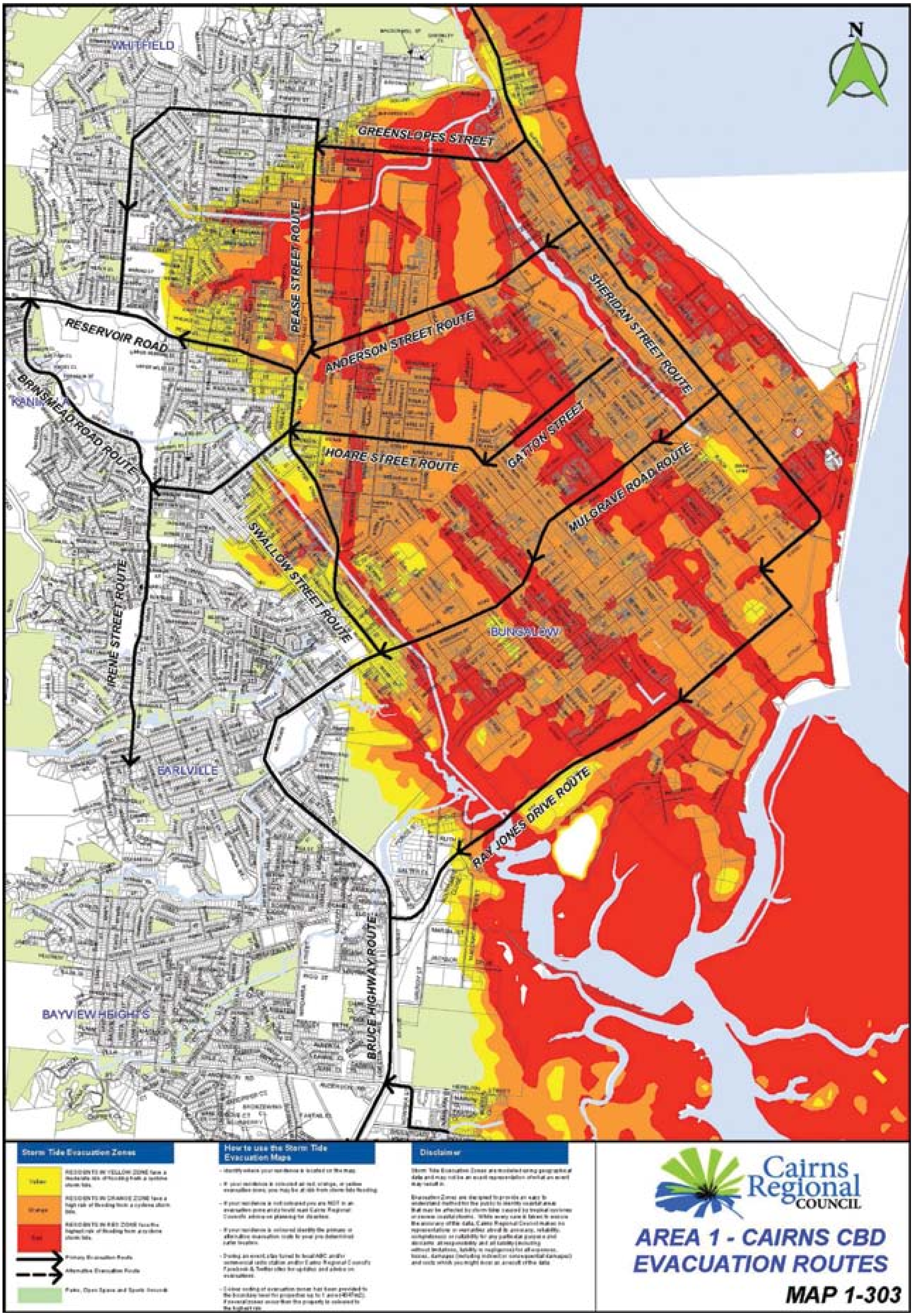
In terms of other major water courses outside the study area, the Barron River, located to the north of the Trinity Inlet catchment, discharges to Trinity Bay. The Russell and Mulgrave Rivers lie to the south of the Trinity Inlet catchment.

B6.3.4 Flooding Regime

The Cairns CBD and environs are low-lying lands that were previously swamps and sand ridges (SKM, 2001). The CBD and North Cairns areas are drained by a system of stormwater pipes and overland flow, draining to Trinity Bay and Trinity Inlet. The land lies between 2m and 4m Australian Height Datum (AHD). The Highest Astronomical Tide (HAT) level is 1.78m AHD. The Cairns CBD is susceptible to short-term flooding in any substantial rainfall event and is vulnerable to high tides and/or storm surges.

The storm tide evacuation route maps developed by the CRC for the CBD area show most of the CBD to be under highest flooding risk from cyclone storm tides (CRC, 2010). The study area falls under the category marked as highest to high flooding risk from cyclonic storm tides. The Cairns CBD and Environs Drainage Management Plan (SKM, 2001) was developed to address the effect of stormwater flooding in the area and develop options for future stormwater management. The intent of this plan is to ensure that new developments do not result in adverse flooding impacts within the CBD.

Figure B6.3.4a Storm Tide Evacuation Map for Cairns CBD

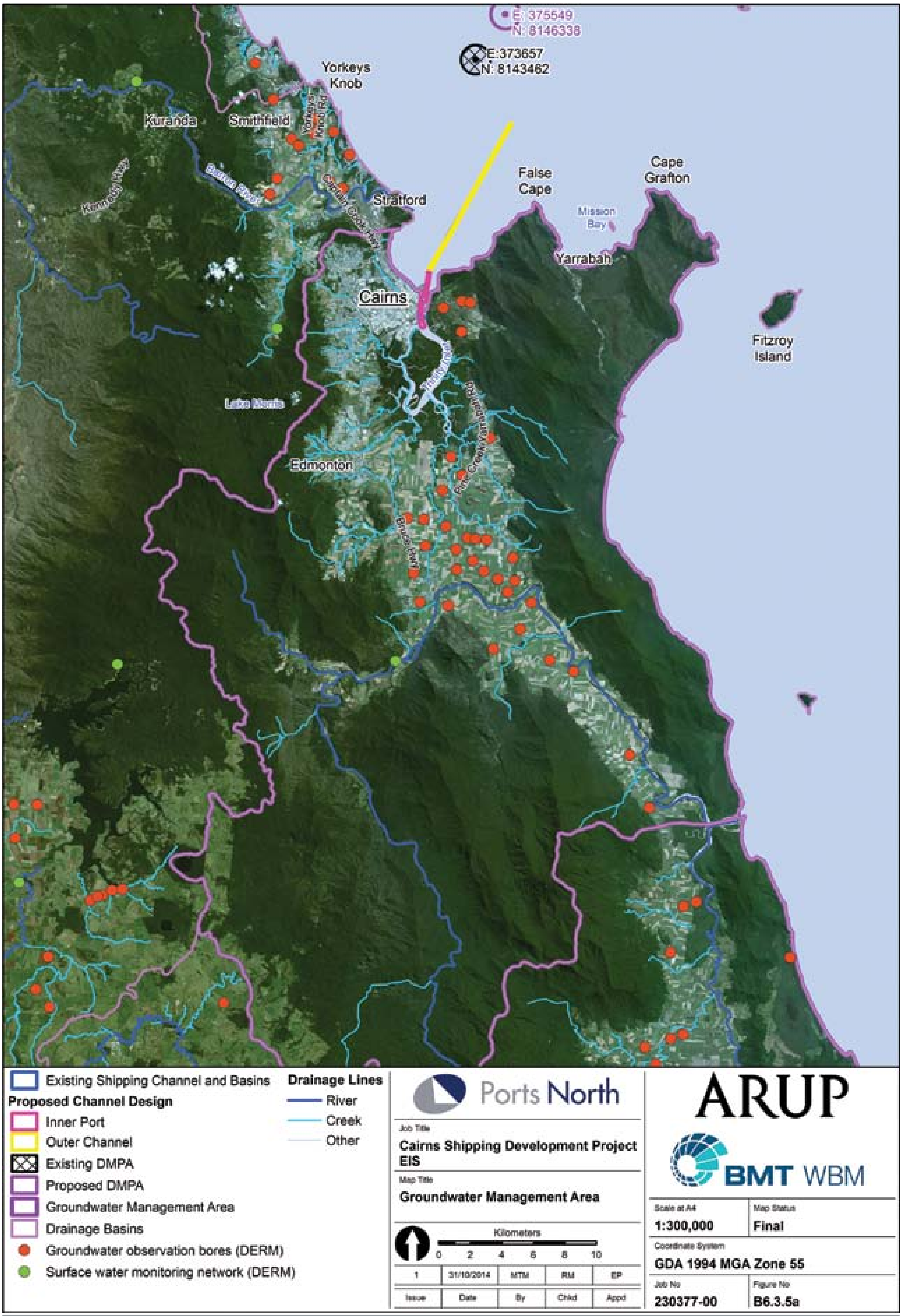


B6.3.5 Groundwater

Under Schedule 4 of the draft ***Water Resource (Wet Tropics) Plan 2013*** (DEHP, 2013), Trinity Inlet forms part of the Mulgrave-Russell groundwater catchment area, as shown in **Figure B6.3.5a**. Groundwater in Trinity Inlet is a part of the former Cairns Coast sub-artesian areas (now known as Mulgrave-Russell catchment area) which is a designated Groundwater Management Area under this plan. The major objectives under the resource plan are to maintain access to groundwater for irrigation purposes, and groundwater-surface water connectivity.

Groundwater usage within the Wet Tropics region is generally observed to be in areas where there is no access to surface water for agriculture. The number of ground water licences in the region is significantly less than the surface water entitlements. No records of groundwater usage/licences are observed within the study area or the broader Cairns Coast sub-artesian area. Given the predominantly industrial and commercial nature of the study area, it is unlikely that there is any significant use of groundwater.

Figure B6.3.5a Groundwater Management Area



B6.3.6 Existing Water Quality

B6.3.6.1 General Description

Information on water quality of the surface waterways is not available as there are no major rivers or streams within the study area and therefore no monitoring of water quality or quantity. However, the water quality within the inlet has been the subject of numerous investigations.

Water quality monitoring was established throughout the inlet by the former Cairns Port Authority through the Trinity Inlet Management Program (TIMP). This monitoring has continued since 1995. Monitoring has included over 15 sites around the inlet. Although not continuous, the monitoring program contains 17 years of data that captures the seasonal and long-term trends apparent in the water quality in the inlet. More recently, the project's EIS Coastal Data Collection and Water Quality and Monitoring Programs (February 2013 to July 2014) have been established with the aim of providing data to assist in defining the baseline conditions for marine water quality and establishing the trigger values for compliance monitoring during the dredging works (BMT WBM, 2013).

As the Trinity Inlet forms the receiving water body for the drainage network, it can be inferred that the water quality observed at the inlet generally reflects the water quality from the upstream catchment but not necessarily the study area specifically. The waters of the inlet are classed as moderately disturbed in the ***Trinity Inlet Environmental Values and Water Quality Objectives – Basin No.111*** report (DEHP, 2010). The receiving waters of the inlet are strongly influenced by inputs from the upstream catchment made up of a combination of rural, urban and industrialised areas discharging via a series of natural waterways and heavily modified drainage lines.

The Cairns Port Long Term Management Plan - Dredging and Dredge Spoil Management (LTMPDDSM) (Worley Parsons, 2010) was developed to support Ports North applications for marine dredging and spoil disposal permits, and provides the most comprehensive discussion of water quality in Trinity Bay. At the time of baseline reporting, the Worley Parsons (2010) report was used as the primary reference in establishing baseline water quality conditions. This information has now been supplemented with the results of the water quality monitoring undertaken specifically for this EIS.

Section B6.3.6.2 presents a summary of the outcomes of previous water quality monitoring within the inlet.

B6.3.6.2 Water Quality Conditions

The key surface water quality parameters investigated included turbidity, suspended solids, nutrients, dissolved oxygen, chlorophyll-a and toxicants. The following is a summary of the water quality conditions described in the Worley Parsons (2010) report:

- Trinity Inlet catchment's physical characteristics and hydrodynamic processes tend to result in naturally high levels of turbidity and suspended solids. Background concentrations of Total Suspended Solids (TSS) were noted to be in the range of 20-200mg/L
- Documented monitoring results indicate high TSS levels of 1000-2000mg/L near the Cairns Esplanade, 400 mg/L at the port entrance and 30 -50mg/L at Marlin Jetty
- Turbidity levels varied from 18 Nephelometric Turbidity Units (NTU) at the surface within the inner port, increasing up to 30 NTU with depth. Typical maximum values of 200-300 NTU were observed with a peak value of 700 NTU
- Levels of dissolved oxygen were found to be at a lower end, indicating excessive organic loads
- Total nitrogen and chlorophyll-a were found to be within acceptable limits, while ammonia and phosphorous levels were in excess of the WQOs specified for the inlet
- Nutrient and sediment levels were also found to increase following rainfall and during the wet season. This is likely to be caused by the nutrient transport from diffuse point sources in the upstream catchment
- Toxicant monitoring indicated that the port area generally contained levels of metals and hydrocarbons within acceptable limits. Dredge material placement sites (located in open waters) recorded some elevated levels of zinc and hydrocarbons.

Additional water quality monitoring was undertaken as part of the EIS for the project and a summary of the water quality characteristics noted in the Trinity Inlet is described below. Physico-chemical parameters including Salinity, pH, Temperature and Dissolved Oxygen were monitored in the inlet.

- Salinity values indicated seasonal variation with lower salinity readings observed in the wet season caused by freshwater inflows. Typical median salinity value averaged around 28-32ppt
- Water temperature remained relatively constant. Dry season temperatures were noted to be 4-5°C less than the wet season where median temperatures were in the range of 29°C
- pH levels remained constant during the wet and dry seasons and well within the limits specified. The median values observed in the inlet indicate slightly acidic conditions owing to the catchment flows and acid sulphate soils (ASS) resulting from anthropogenic influences
- Dissolved Oxygen levels were found to be generally less than the minimum DO level specified, indicating organic loads from the catchment and limited flushing within the tidal channel
- Turbidity values observed in the inlet remained within the WQO, the median value being 10 NTU. However, anecdotal evidence suggests that background concentrations are high, with higher turbidity during the wet season. The turbidity levels vary with maximum values noted to be 200-300 NTU with a peak value of 1200 NTU, caused as a result of upstream catchment flows and re-suspension of material in the inlet. Turbidity is observed to increase from the inlet with depth
- Suspended Solids monitoring indicate TSS concentrations to exceed the WQO. Median TSS concentration monitored (mid-estuary) shows high TSS levels to 100 mg/L
- Total Metals/metalloids are routinely monitored by Ports North. The 95th ile values were assessed against the Toxicity Trigger Levels and exceedances were observed for aluminium, copper and zinc
- Trinity Inlet experiences high levels of phosphorus and ammonia, exceeding the specified WQO. Elevated nutrient levels are thought to be the result of agricultural land use in upstream catchments as well as effluent discharge from sewerage treatment works. The water quality monitoring data shows acceptable median levels for nutrients including total nitrogen, ammonia, oxides of nitrogen and total phosphorus.

B6.3.6.3 Sediment and Nutrients

The major influences for the water quality include the upstream catchments that drain into the inlet. Sources of contamination include urban pollutants, trade wastes and other diffuse sources, as well as point source discharges from the wastewater treatment plants and licenced discharges located in the catchment.

Sediment and nutrient ingress occurs through catchment-related runoff from the upstream catchments, discharging to the existing waterways. The upstream Barron River deposits sediments in the order of 44,000 tonnes to the inlet annually. The Trinity catchment deposits 19,000 tonnes of sediment per year (Hateley et al 2009). Nutrients from the upstream rural and grazing lands as well as the urban areas contribute to approximately 1,700 tonnes per year. Additional sources of nutrients include the two wastewater treatment plants, the Southern Wastewater treatment plant and the Edmonton wastewater treatment plant, respectively. These plants were upgraded to tertiary treatment plants in 2010-12 to reduce the nutrient input to Trinity Inlet (CRC, 2013).

B6.3.6.4 Spills

Spills or incidents are a regular occurrence for most industrial and commercial operations, including activities at the Port of Cairns. On average, 25 environmental incidents that involve discharge to the environment are recorded each year predominantly due to accidental operational spills or discharges due to tenants, contractors or customers using the port facilities, rather than malicious pollution events (Ports North, Annual Report 2013).

The most common events are minor volume marine refuelling, hydraulic line failures or bilge oil discharge spills where standard hydrocarbon spill response measures can be enacted.

Bulk mineral concentrate handling does not occur at the Port of Cairns; hence issues of product spillage leading to water or sediment contamination are notthe issue they may be at other locations.

Spill events in the vast commercial and urban catchments, as well as chronic pollution to storm water that drains into the inlet, are the main sources of contaminants to the Trinity Inlet waterway.

Large spill events are extremely rare and most historical events have involved oil or fuel products where standard spill response equipment is very effective. Non-oil spill events are similarly quiet rare, however, one significant event was recorded at Cairns in January 2013 due to the accidental release of fire fighting foam from a commercial facility. The product included constituents that were bio accumulating and biologically persistent. This event was subject to an extensive investigation by DEHP to ensure environmental harm from the event was evaluated and appropriately managed. Additional sediment quality testing was subsequently undertaken by Ports North, with results indicating that the spill presented a low risk (**Chapter B4, Marine Sediment Quality**) to sediments in the study area.

B6.3.6.5 Summary of Existing Conditions

The water quality conditions within Trinity Inlet indicate that elevated levels of contaminants are primarily the result of activities within the upstream catchment. The Barron River to the north, contributes significant amount of sediment and nutrient loads from upstream agricultural and urban catchments. The two wastewater treatment plants located in the upstream catchments are likely to increase the nutrient loads entering the inlet. The heavily urbanised catchment of the Cairns CBD and surrounds, including the study area, is also likely to contribute to a range of nutrients and minor toxicants (Worley Parsons, 2010).

Whilst there is no recorded water quality data available for the specific study area, i.e. for the land-based works component of the project itself, the results of surface water quality monitoring for Trinity Inlet indicate the presence of elevated pollutant loads generated from the surrounding catchments and transported to the receiving waters of the Trinity Bay.

Based on an assessment of the current land uses within the study area, key pollutants of concern likely to be generated include sediments and nutrients from the surrounding urban (industrial and commercial) areas. Previous monitoring within the area indicates an increase in concentration of sediments and nutrients following rainfall. Other pollutants of concern include hydrocarbons and toxicants generated from vessel maintenance and operational activities.

B6.4 Impact Assessment

This section assesses the potential impacts of the project on water resources within the study area and associated environmental values, as described in **Section B6.2.3.6**.

Construction activities are described in detail in Chapter A4, Project Description. Activities that have the potential to impact on surface or groundwater conditions within the study area are limited to the installation of upgraded services, including fuel supply, potable water supply, fire fighting services and sewerage. Works will occur largely within the confines of the port, in areas that are already heavily developed, restricting potential impacts. There are no proposed changes to existing stormwater drainage systems. Any water sourced for construction purposes will be drawn from either potable sources or delivered to site via water trucks. There will be no extraction of surface water or groundwater.

Operational activities are also described in **Chapter A4, Project Description**. Potential operational activities of relevance include:

- The provision of fuel to cruise ships
- Spills or leakages from other services
- Spills or leakages from maintenance equipment, including vehicles.

The sections below only apply to fresh surface waters and groundwater. Potential impacts on marine water quality are described in **Chapter B5, Marine Water Quality**.

B6.4.1 Potential Impacts

Potential impacts to surface water and groundwater identified during the construction and operational phases of the project are discussed in the following sections.

B6.4.1.1 Construction Phase Impacts

Surface Water

The potential impacts to surface waters include:

- Release of water polluting substances (e.g oil, fuel, litter, chemicals, etc.) resulting in spillages and leaks from construction equipment or supply delivery vehicles entering the stormwater system, and ultimately the marine environment
- Release of dust and sediment from surface disturbance to the drainage system
- Release of acidic runoff to drainage channels from disturbance of soil during the installation of services
- Increased flows through existing drainages due to flooding in the upstream areas.

During wet weather, spills and sediments generated on site, if not managed properly, could enter into the local drainages resulting in altered water quality. Wastewater generated from vehicle and plant wash down could also be mobilised into surface water flows by significant rainfall events.

Because works will largely occur on a hardstand area that is heavily disturbed and the flat nature of the study area, the potential for water polluting substances to enter existing drainage lines or the groundwater is limited. Construction vehicles will access the site via existing covered roads or hardstand areas, limiting potential erosion of surface soils and subsequent sediment runoff. There are no anticipated construction activities occurring within existing waterways or stormwater drainage lines.

The study area is mapped by CRC as having the potential to contain ASS (refer to Chapter B1, Land). As the study area is heavily disturbed and excavations are likely to occur in areas of fill material that would not contain ASS, it is unlikely there will be significant disturbance of ASS. Any such disturbance can be managed using established methods under a standard Construction Environmental Management Plan (CEMP) by the appointed contractor. The operational procedures are included in the **Chapter C1, Environmental Management Plan (Construction and Operation)**.

Works are not expected to alter the existing hydrological regime by impeding or changing existing water flows across the study area. The potential impacts to surface water quality from construction activities are considered to be minor.

Groundwater

The potential impacts to groundwater arising from the project are related to the risk of groundwater contamination as well as some minor acidification due to disturbance ASS materials at the construction site during services installation. The construction activities are not likely to use groundwater and therefore no extraction of groundwater is anticipated.

The project will include shallow below-ground structures (underground sewerage storage tank and replacement of existing sewer and potable water pipelines). Construction and replacement of underground infrastructure is likely to include small volumes of de-watering, the extent of which will be determined during the detail design. Earthworks activities will occur in areas of fill materials and therefore risk of encountering ASS is likely to be very low.

There is a risk that materials or substances brought to the site and stored or used during the construction process could be released into the groundwater environment. Liquids such as fuels, lubricants and herbicides spilled or leaked on to the ground could percolate through the unsaturated zone and reach the water table. Solid materials such as cement and concrete additives could be transported in rainfall runoff or in water used for dust suppression and subsequently might enter the groundwater system through infiltration below the ground surface.

In the unlikely event of an impact to groundwater, this is likely to be localised and temporary if management strategies are adopted. It should be noted that the project is not located in the vicinity of any known bores within the project area and there is no groundwater extraction. The overall impact to groundwater due to the construction activities is considered minor.

B6.4.1.2 Operational Phase Impacts

Surface Water

The operational phase activities will be characterised by the berthing of cruise ships. No significant change to the volume of operational plant and vehicles is expected (refer to **Chapter B14, Transport**). Run off from building roofs at the wharves and other hard-stand areas will be high during the wet season, discharging via the natural/artificial drainage ways into the coastal environment.

Potential operations may impact on surface water via the stormwater runoff from impervious areas. The biggest potential impact of the project relate to potential spills from storage and distribution of IFO through leaks from failed infrastructure. This is the most likely significant potential impact, however, consistent with other major fuel storage and distribution, there is a low likelihood of occurrence due to the stringent industry maintenance inspection regimes. Potential runoff is also possible from handling and storage of hazardous goods including IFO, chemicals, etc. containing substances impacting water quality if released to the drainage lines.

The following management procedures will need to be set in place to reduce the risk of contamination arising from spill events, including:

- Transfer of IFO from fuel ships to storage tank covered by procedures in place by operators of the existing fuel facilities
- Storage will be in a purpose-built tank located within the existing fuel farm and will be covered by existing procedures
- Transfer of IFO from storage tank to cruise ships will be via a new pump station and pipeline to a new refuelling point at the cruise shipping waves. Procedures will be developed by the commercial operator who will install and operate this facility
- Inspection and maintenance regimes for the storage facility and pipeline to be established and implemented by the IFO facility operator to ensure detection of potential infrastructure issues and prevent incident releases to storm or ground waters.

The resulting impact to the surface water environment is considered as moderate.

Groundwater

During the operations phase of the project a risk is a potential impact on groundwater quality due to spills or leaks of liquids during storage, handling or transport. The management measures described above will apply to mitigate any impact of groundwater quality in the event of a potential spillage.

In the context of groundwater, the likelihood of spills or leaks of IFO are noted to be possible and the resulting impact is considered to be moderate.

B6.4.2 Mitigation Measures

B6.4.2.1 Construction Phase

A Construction Environmental Management Plan (CEMP) will be developed to monitor and mitigate the impacts generated by the construction activities. Litter, mud and sediment generated by equipment and plants will be controlled by appropriate erosion and sediment control measures. Sediments generated by vehicle movements will be controlled by implementing appropriate vehicle wash-down activities. Small discharges from vehicles on site will be managed by using vehicle spill kits. Chemicals will be stored in designated storage areas in sealed enclosures and managed by strict procedures. Management measures are documented in subsequent sections and will form part of the CEMP.

Surface Water and Groundwater

Mitigation of the surface water flow and quality and groundwater risks during construction will be through the establishment of appropriate procedures in the Construction EMP (refer to **Chapter C1, Construction and Operational Environmental Management Plan**). Construction phase mitigation measures will include:

- Development and implementation of an Erosion and Sediment Control Plan (ESCP) as a part of the CEMP. This shall detail construction controls, dimensions, materials, expected outcomes and implementation
- Provision of washdown bays in key areas to reduce transport of sediment off-site
- Correct procedures for handling, transporting and using potentially contaminating substances including diesel, petrol, oils, greases, cement, construction chemicals, etc
- Development and maintenance of an up-to-date hazardous materials register on site
- Provision of designated storage areas for potential pollutants, which are appropriately sealed and bunded
- Construction of storage areas to relevant Australian Standards to prevent contamination and infiltration by stormwater
- Locating washdown bays and storage areas away from waterways and drainage channels

- Preparation of an Emergency Spill Containment Plan identifying the sensitive receptors within the project area
- Appropriate procedures for recovery of spills and leaks, including provision of spill control materials such as booms and absorbent materials
- Spill kits and other spill containment materials will be stored on site and construction staff trained in their correct use
- Implementation of an Acid Sulphate Soil Management Plan (where necessary) devised by the contractor.

The construction activities will be staged with the aim of managing and reducing the risks associated with significant wet weather or flooding. Significant earthworks will be avoided during wet weather.

For construction works, measures will be undertaken to protect stormwater drainage. Erosion control will likely include, but not be limited to, the use of silt fences, rock protection, temporary covering of exposed surfaces and stockpiles, sediment traps and stormwater inlet controls.

Fuel and chemical storage areas will be designed to the relevant Australian Standards for storage and bulk handling. Where required, these areas will be fitted with interceptors and first flush systems. Equipment maintenance areas will be fitted with oil and grit separators.

Consistent with contemporary construction site environmental management practices and site checking, water leaving the work sites shall be checked regularly and efforts shall be made to ensure contaminants do not enter the marine environment. Reactive water quality monitoring shall be undertaken in the event of sediment/contaminant release due to wet weather events or failure of control procedures. Water quality monitoring will include assessment of turbidity, pH, salinity, temperature, dissolved oxygen, suspended solids and nutrients.

With the implementation of a Construction EMP, the project is likely to result in low impact to the surface water and groundwater environments from erosion and sedimentation and spills.

B6.4.2.2 Operation Phase

Surface Water and Groundwater

Fuel handling and storage procedures are currently part of the port's environmental management and port operations procedures for existing activities (ship fuel bunkering facilities are currently provided for marine diesel fuels). These procedures will need to be revised based on the change in shipping and Intermediate Fuel Oil (IFO) refueling activity resulting from the project. Implementation of these procedures is expected to reduce the risk of significant loads of contaminants entering the marine environment. Mitigation measures to deal with the risk of surface water/groundwater contamination during the operational phase are similar to those which should be adopted during the construction phase; namely the use of proper procedures for storage and handling of contaminating materials and substances, and the incorporation of these procedures into the Operations EMP (refer to **Chapter C1 - Environmental Management Plan, Construction and Operation**).

In addition to the above procedures documented in the Operations EMP, the respective IFO storage and facility operator will include an update to their Site Based Stormwater Management Plan (SBMP). The plan shall take into account the environmental licence conditions applicable and shall detail appropriate stormwater management measures required to meet the licence conditions. This plan shall contain measures for managing stormwater on site, such as installation of interceptors, first flush devices, gross pollutant traps to avoid and mitigate potential impacts from surface or groundwater discharge systems where possible.

Ongoing monitoring of the quality of water exiting the stormwater system and groundwater levels shall also be implemented as applicable under the respective licence held by the IFO storage and facility operator. Where poor water quality is observed, corrective actions will be undertaken.

B6.4.3 Residual Impact

B6.4.3.1 Surface Water

The residual impact to existing local drainage following the implementation of stormwater drainage design is expected to be low. To reduce the potential risk to surface water quality, mitigation measures will include re-instatement of local drainage patterns post construction to existing stormwater infrastructure, and appropriate rehabilitation of any unsealed surfaces following the works to help control erosion and excessive sediment transport.

The risk to surface water quality resulting from spills/leaks from the IFO storage will be managed by the provision of fuel handling and spill response procedures incorporated into the respective OEMP implemented by the operator. Mitigation measures will also involve provision of training to relevant staff in spill management.

It is therefore considered that the residual impact to surface waters resulting from the project works is low.

B6.4.3.2 Groundwater

The residual impact of the construction phase on the local groundwater resource will be localised and confined to the immediate area of modification. The residual impacts during the operations phase resulting from spills/ leaks will be a localised reduction in quality. The potential risk to groundwater quality from spills/ leaks from the IFO storage will be managed through the provision of fuel handling and spill response procedures included in the IFO storage and facility operator's OEMP. Mitigation measures will also involve provision of training to relevant staff. The reduction in groundwater throughput due to increased impervious area is considered to be negligible.

The overall risk to groundwater is considered to be low.

B6.5 Conclusion

This chapter outlines the regulatory framework associated with the water resources and its management. The construction and operational phases of the project will have limited impacts on the surface water and groundwater environments. The main potential risks include the impacts associated with:

The handling and storage of chemicals and materials associated with construction activities as well as IFO storage and handling, wastewater, etc, that may accidentally release contaminants into the waterways through spills or leaks

The management of on-site infrastructure services (sewer, IFO services) and other trade products that may release contaminants into the waterways during rain events during operations.

With the implementation of the management measures outlined in **Section B6.4.2**, the impacts to surface waters and groundwater generated during the construction and operational phases are expected to result in negligible residual impacts.

A summary of the impact of the project on surface waters and groundwater is provided in the Tables below.

Table B6.5a Surface Water Impact Assessment

Impact Assessment – Surface Water								
Activity	Initial risk assessment				Residual risk assessment with mitigation measures in place			
	Potential Impact	Significance of impact	Likelihood of impact	Risk Rating	Additional Mitigation	Significance of impact	Likelihood of impact	Residual Risk rating
Construction Phase								
Location of development works.	Risk of flooding and impact to local drainage.	Minor	Possible	Low	Appropriate erosion and sediment control measures during construction phase. Use of silt fences, rock protection, temporary covering of exposed surfaces and stockpiles, sediment traps, stormwater inlet controls.	Minor	Unlikely	Low
Release of oils, chemicals, construction materials to surface water.	Visual impact. Contaminated substance entry into surface water. Deterioration of water quality parameters.	Moderate	Possible	Medium	Implement CEMP. Store chemicals in bunded and roofed areas. Regular inspections of storage areas. No direct discharge of contaminated water to surface waterways.	Moderate	Unlikely	Low
Generation of litter.	Visual impact	Minor	Likely	Medium	Implement CEMP. Use of litter traps and pollution control devices.	Minor	Possible	Low
Release of sediment laden water to adjacent waters.	Visual impact. Worsening of water quality.	Moderate	Likely	Medium	Implement appropriate erosion and sediment control measures.	Minor	Unlikely	Low

Operation Phase								
Activity	Initial risk assessment				Residual risk assessment with mitigation measures in place			
	Potential Impact	Significance of impact	Likelihood of impact	Risk Rating	Additional Mitigation	Significance of impact	Likelihood of impact	Residual Risk rating
Location of development works.	Risk of upstream flooding and impact to local drainage.	Minor	Possible	Low	Siting of infrastructure above flood levels. Re-instate local drainage patterns post construction.	Minor	Unlikely	Negligible
Storage and use of fuels, oils etc. results in release of substances to the receiving environment.	Surface water contamination due to spills, leaks, improper practices. Deterioration of water quality. Visual amenity.	Minor	Possible	Low	Storage of hazardous substances in bunded and roofed areas. Install interceptors, first flush devices. Existing Refuelling Permits and Procedures under the Port Rules. Regular inspections of storage areas. Regular water quality monitoring.	Minor	Unlikely	Negligible
Spills and leaks from IFO storage areas resulting in release of contaminants to the receiving environment.	Deterioration of water quality, visual amenity.	Moderate	Possible	Medium	Implement emergency spill management response procedures. Ensure relevant staff are trained in above procedures.	Minor	Possible	Low
Stormwater discharge and release of sediment laden waters.	Contaminated substance entry into waterways.	Minor	Possible	Low	Storage of hazardous substances in bunded and roofed areas. Install interceptors, first flush devices. Regular water quality monitoring at discharge point.	Minor	Unlikely	Low

Table B6.5b Groundwater Impact Assessment

Impact Assessment – Groundwater								
Activity	Initial risk assessment				Residual risk assessment with mitigation measures in place			
	Potential Impact	Significance of impact	Likelihood of impact	Risk Rating	Additional Mitigation	Significance of impact	Likelihood of impact	Residual Risk rating
Construction Phase								
Storage and use of construction materials, plant, processes etc. results in release of substances to the groundwater environment.	Groundwater contamination due to spills, leaks, improper practices.	Minor	Possible	Low	Construction EMP. Bunds, sealing.	Minor	Unlikely	Low
Operation Phase								
Increased hard surfacing reduces incident rainfall hence reduced recharge to groundwater.	Increase in salinity of groundwater due to reduction of fresh water input.	Negligible	Unlikely	Negligible	Sustainable drainage systems which replicate natural application of rainfall to the subsurface.	Negligible	Unlikely	Negligible
Storage and use of fuels, oils, etc. results in release of substances to the groundwater environment.	Groundwater contamination due to spills, leaks, improper practices.	Minor	Possible	Low	Operational EMP's. Bunds, sealing.	Minor	Unlikely	Low
Spills and leaks from IFO storage areas resulting in release of contaminants to the receiving environment.	Deterioration of water quality.	Moderate	Possible	Medium	Implement emergency spill management response procedures. Ensure relevant staff are trained in above procedures.	Minor	Possible	Low

B6.6 References

ANZECC & ARMCANZ, 2000, ***Australian and New Zealand Guidelines for Fresh and Marine Water Quality***, Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

Barron, F. and Haynes, D., 2009, ***Water Quality Improvement Plan for the catchments of the Barron River and Trinity Inlet,*** Terrain NRM

Cairns Regional Council, 2013, Storm tide surge evacuation maps, http://www.cairns.qld.gov.au/community-information/cyclone-emergency-information/evacuation, Accessed 11/02/2014

Department of Environment and Resource Management, 1994, ***Environmental Protection Act***, Queensland Government

Department of Environment and Resource Management, 2009, ***Environmental Protection (Water) Policy 2009***, Queensland Government

Department of Environment and Resource Management, 2010, Environmental Protection (Water) ***Policy 2009: Trinity Inlet environmental values and water quality objectives, Basin No. 111(part)***, Queensland Government

Department of Environment and Resource Management, 2000, ***Water Act***, Queensland Government

Department of Environment and Heritage Protection, 2013, ***Water Resource (Wet Tropics) Plan 2013 –Consultation Draft***, Queensland Government

Department of Environment and Resource Management, 2009, ***Queensland Water Quality Guidelines Version3 September 2009***, Queensland Government

Department of Environment and Heritage Protection, 2013, ***Water Resource (Wet Tropics) Plan 2013: Consultation Draft***, Queensland Government

Environment Science and Services, 1980 ***Trinity Inlet Management Study: Context Report***, prepared for Cairns Port Authority and Cairns City Council, Queensland.

Great Barrier Reef Marine Park Authority, 2010, ***Water quality guidelines for the Great Barrier Reef Marine Park 2010***, Commonwealth of Australia

Hateley, L., Pitt, G., Armour, J. and Waters, D. 2009, ***Modelling Water Quality with E2 in the Barron Catchment A Report for the Barron Water Quality Improvement Plan***, Department of Environment and Resource Management

Sinclair Knight Merz, 2001, ***Cairns CBD & Environs Drainage Management Plan: Phase 2 Report***, prepared for Cairns City Council, Cairns

Worley Parsons, 2010, ***Cairns Port Long Term Management Plan Dredging and Dredge Spoil Management***, prepared for the Far North Queensland Port Corporation, Queensland Government