City Pacific Limited

Townsville Ocean Terminal Supplementary EIS

Draft Water Quality Monitoring Program

Tuesday, 8 July 2008

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Hyder Consulting

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Contents

1 Executive summary

Water Quality Monitoring Program

This report is an interim report, outlining a proposed water quality monitoring program for the Townsville Ocean Terminal (TOT) project. Details of appropriate local guidelines, discharge criteria, construction and post-construction monitoring programs will be formulated following collection of adequate baseline data (in consultation with relevant government agencies) and presented in a full *Supplementary Water Quality Report*.

Review of historical data

A review of historical data to date has identified that extensive, good quality background water and sediment quality data for the future development area (FDA) is not readily available. In consultation with the Queensland Government Environmental Protection Agency (EPA) it was decided that existing background data is insufficient to develop relevant local guidelines, and that a more comprehensive water quality monitoring program is required.

Methodology

Methodology and quality control measures for sample collection, storage and transport are outlined in Section 5.

Baseline (pre-construction) monitoring program

Discussions with the EPA have resulted in the formulation of an extensive 6-month pre-construction monitoring program to be undertaken (commencing dry season 2008) in order to obtain baseline data. This baseline data set will then inform the development of locally relevant guidelines for application in the construction and post-construction phases of the project.

Details of the proposed pre-construction marine water, groundwater and sediment quality monitoring programs are contained in Section 6.

Construction monitoring program

A brief outline of the currently expected construction water quality monitoring program is presented in Section 7, and will be revised following collection of baseline data.

Post-construction monitoring program

A brief outline of the currently expected post-construction water quality monitoring program is presented in Section 8, and will be revised following collection of baseline and construction-period water quality monitoring data.

2 Glossary

ACTFR	Australian Centre for Tropical Freshwater Research
AIMS	Australian Institute of Marine Science
APHA	American Public Health Association (see also reference APHA 2005)
CEMP	Construction Environmental Management Plan
DPI&F	Queensland Government Department of Primary Industries and Fisheries
EIS	environmental impact statement
EPA	Queensland Government Environmental Protection Agency
FCG	Flanagan Consulting Group
FDA	future development area
TRP	total reactive phosphorus
GBRMPA	Great Barrier Reef Marine Park Authority
JCU	James Cook University
NATA	National Association of Testing Authorities
NODGDM	National Ocean Disposal Guidelines for Dredged Material
NO_x	oxidisable nitrogen
OEMP	Operations Environmental Management Plan
ORP	oxidation reduction potential
PoT	Port of Townsville
QWQG	*Queensland Water Quality Guidelines* (see also reference EPA 2007)
TKN	Total Kjeldahl Nitrogen
TN	total nitrogen
TOT	Townsville Ocean Terminal
TP	total phosphorus
TPA	Townsville Port Authority

3 Introduction

Hyder Consulting has been commissioned by City Pacific Limited to respond to the submissions received in response to the water quality aspects of the Environmental Impact Statement for the proposed Townsville Ocean Terminal project.

A number of comments were received from individuals, organisations, community groups and government agencies in response to the selection and use of appropriate water quality guidelines for the TOT project, and details of the proposed water and sediment quality monitoring programs. This draft *Water Quality Monitoring Program* has been developed in order to address concerns raised by respondents relating to these issues, and supersedes earlier TOT EIS documents in any case of apparent contradiction.

Following completion of an extensive baseline survey of marine water, groundwater and sediment quality over six months, data collected will be used to inform the development of locally relevant guidelines for application in the construction and post-construction phases of the project. Details of appropriate local guidelines, discharge criteria, construction and post-construction monitoring programs will be discussed with relevant government agencies following collection of baseline data, and presented in a full *Supplementary Water Quality Report* to the TOT EIS (expected date of completion currently February 2009).

Management and response measures to maintain water quality in the environment surrounding the TOT FDA, together with appropriate investigation and intervention trigger levels, will be presented in the revised CEMP and OEMP.

Other documents relating to water quality are in the process of being developed by the Flanagan Consulting Group (FCG), Townsville. At time of writing, these included:

- "*R-PF3946 – Review of Construction Issues*";
- "*R-KO0131 – Water Quality Management During Construction*"; and
- "*R-KO0123 – Potential Operational Dredging Impacts on Water Quality*".

The FCG report "*R-KO0131 – Water Quality Management During Construction*" outlines the expected quantity of water discharges due to construction activities, and subsequent treatment and disposal procedures. The report demonstrates that the proposed treatment mechanisms and processes are of adequate capacity to meet discharge criteria and ensure regulatory compliance.

4 Review of historical data

A thorough review of historical water quality data in the region is currently being undertaken. Sources and potential sources of data have been identified, including, but not limited to:

- the Queensland Government Environmental Protection Agency (EPA);
- the Australian Institute of Marine Science (AIMS);
- the Great Barrier Reef Marine Park Authority (GBRMPA);
- James Cook University (JCU);
- the Australian Centre for Tropical Freshwater Research (ACTFR);
- the Townsville Port Authority (TPA); and
- published, peer-reviewed journal articles.

While it appears that extensive, long-term, good quality data is not readily available, any reliable background data obtained for local marine water, groundwater and sediment quality will be presented in the full *Supplementary Water Quality Report*.

One further source of historical data was that collected for the original water quality report of the Townsville Ocean Terminal Project Environmental Impact Statement ("*Impact of the Proposed Townsville Ocean Terminal Development on the Water Quality of Cleveland Bay*" (C&R Consulting, June 2007), Appendix 12 of the original EIS) by C&R Consulting, Townsville. Following consultation with the EPA it was determined that this data is not appropriate for use as a baseline data set.

Given the limited spatial and temporal extent of available historical data, a comprehensive baseline survey of pre-construction water and sediment quality conditions is now proposed, as outlined in Section 6. Details of the proposed monitoring program have been discussed and agreed upon with the Water Quality division of the EPA.

5 Sampling methodology

Details of methodologies and quality control measures relating to all stages of the marine water, groundwater and sediment sampling program are outlined below.

5.1 Marine water samples

Marine water samples for all stages of the water quality monitoring program are proposed to be collected using the methodology described in the Queensland Government EPA's *Water Quality Sampling Manual* (EPA 1999). During each round, one sample will be collected slightly below the water surface and one slightly above the sediment layer at each sampling site, on the outgoing tide.

5.2 Groundwater samples

Groundwater samples for all stages of the water quality monitoring program are proposed to be collected using, where appropriate, methodologies described by the Victorian Government EPA (EPA 2000), U.S. EPA (USEPA 1996), and U.S. Geological Survey (USGS 1999).

5.3 Sediment samples

Sediment samples for all stages of the sediment quality monitoring program are proposed to be collected with the sampling methodology described in the *National Ocean Disposal Guidelines for Dredged Material* (DEH 2002).

5.4 Quality control

The following measures will be taken to ensure a high level of quality control is achieved and maintained during sample collection and laboratory testing for all stages of the water and sediment quality monitoring program:

- Staff with training in trace metal sampling techniques will be used to collect samples;
- Container preparation, collection, preservation, handling and holding times for samples will follow the *Water Quality Sampling Manual* (EPA 1999) and other standard methods including those outlined in *Standard Methods for the Collection of Water and Wastewater* (APHA 2005) and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000, hereafter referred to as ANZECC/ARMCANZ 2000);
- Duplicate samples will be taken for 10% of samples and sent to the same laboratory;

- Triplicate samples will be taken for 5% of samples and sent to a different laboratory;
- Field and trip blanks (one of each, for each round of sampling) will be collected and analysed;
- Samples, blanks, duplicates and triplicates will be labelled using a coded system so that laboratories do not have information indicating sample location information, blanks or duplicate samples;
- Analytical laboratories will be NATA accredited;
- Detection limits achieved by laboratories will, as a minimum, meet *Queensland Water Quality Guidelines* (EPA 2007, hereafter referred to as QWQG) values for nutrients and ANZECC/ARMCANZ 2000 'moderately disturbed ecosystems' values for metals; and
- Total metal analysis will be undertaken on 20% of samples (in addition to undertaking dissolved metal analysis on all samples) in order to check the validity of dissolved metal analysis results.

6 Pre-construction monitoring program

Extensive pre-construction water quality monitoring is proposed to be undertaken in order to obtain adequate baseline data. This baseline data set will then inform the development of locally relevant guidelines for application in the construction and post-construction phases of the project. These guidelines will be developed in conjunction with the EPA, DPI&F and, where necessary, other relevant government agencies, and published as part of the full *Supplementary Water Quality Report.*

Quality control measures relevant to all stages of the water and sediment quality monitoring program are described in Section 5.4.

Details of the proposed pre-construction monitoring programs are contained in Sections 6.1, 6.2 and 6.3. The proposed analytes, number of samples and frequency of sampling were established following a process of consultation with the EPA, on the understanding that these parameters will be reviewed by the EPA and, if necessary, amended, following the collection and analysis of the first month's data. The analytes selected reflect potential pollutants associated with pre-existing infrastructure in Cleveland Bay, port activities and potential impacts of the proposed development.

Marine water and sediment samples are proposed to be collected at nine sites. The locations of the nine marine water and sediment quality monitoring sites for the baseline investigation will be influenced by the currents in the bay, which predominantly flow to the north-west (P. Ridd of James Cook University, pers. comm.). It is envisaged that the sites selected will include:

- Two sites within the FDA;
- Three sites "downstream" along a transect north-west of the development area, ranging from the FDA to the nearest seagrass site in this direction (as illustrated in Figure 1 below);
- Two control sites "upstream" (i.e. to the south-east) of the FDA;
- One seagrass control site; and
- One site at Middle Reef or Virago Shoal (Cleveland Bay).

Figure 1: Drawing showing nearest downstream seagrass beds to the FDA, as at May-June 2008 (Source: *Marine habitat mapping report* (C&R Consulting, June 2008), Appendix A of the *Interim Supplementary Nature Conservation Report* (Hyder Consulting, June 2008)).

Baseline turbidity data is proposed to be collected using three continuous data loggers for six months, with data downloaded monthly. Proposed sites for the location of the three turbidity data loggers are:

- One within the FDA;
- One at the seagrass bed near Kissing Point; and
- One at Middle Reef or Virago Shoal (Cleveland Bay).

The precise location of the marine water and sediment quality monitoring sites will be developed in consultation with the EPA once details of the construction methodology have been finalised. Their location will also take into account the results of the biological distribution mapping within the FDA and surrounding areas. This mapping was completed in June 2008 by C&R Consulting, and the results presented in the *Interim Supplementary Nature Conservation Report* (Hyder Consulting, July 2008). A revised version of the *Water Quality Monitoring Program* will be issued (following consultation with the EPA and relevant contractors) showing the exact location of marine water and sediment quality monitoring sites, prior to the commencement of data collection.

Groundwater samples are proposed to be collected from three sites. The three groundwater quality monitoring sites are located at the northern and southern edges of the FDA, as indicated by points TOT1, TOT2 and TOT3 in Figure 2.

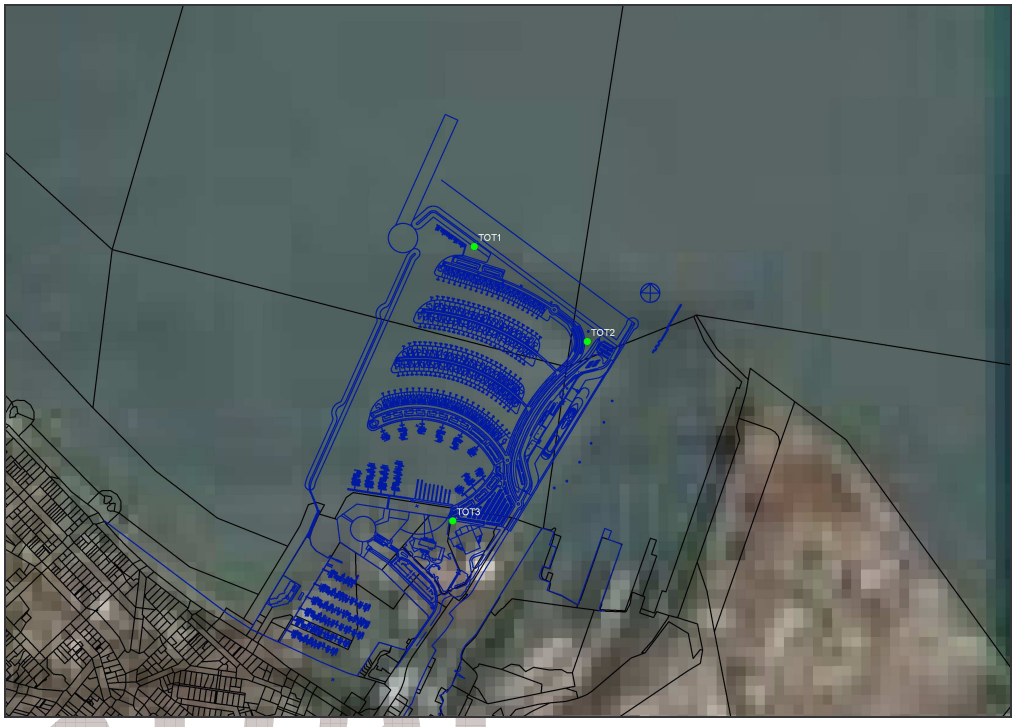

Figure 2: Location of groundwater bores TOT1, TOT2 and TOT3 within the FDA (Source: C&R Consulting).

The monitoring programs proposed below are based on the assumption that no further significant sources of background data will be obtained prior to the commencement of monitoring. In the event that new material becomes available, the EPA will be consulted to review the requirements outlined below.

Results of the pre-construction monitoring program will be included in the full *Supplementary Water Quality Report* upon completion of analysis of the final samples. Appropriate local guidelines, discharge criteria and construction and post-construction monitoring programs will be discussed at this point with the EPA, DPI&F and other relevant stakeholders.

6.1 Marine water

Table 1 outlines the marine water analytes proposed to be monitored, as well as the timing and frequency of the proposed pre-construction sampling program for marine water. As noted above, these parameters will be reviewed by the EPA and, if necessary, amended, following the collection and analysis of the first month's data.

Data is proposed to be obtained over six months, in order to develop a baseline data profile for both the wet and dry seasons. Quality control measures will be taken as outlined in Section 5.4.

Wind data (direction and speed) will also be obtained for the duration of the period of turbidity monitoring.

Table 1: Parameters for marine water pre-construction monitoring program

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
PHYSICO-CHEMICAL PARAMETERS			
Dissolved oxygen (DO)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
pH	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Electrical conductivity (EC)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Salinity	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Turbidity	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Temperature	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
NUTRIENTS			
Total phosphorus (TP)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Filterable reactive phosphorus (FRP)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Total nitrogen (TN)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Total Kjeldahl nitrogen (TKN)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Oxidisable nitrogen (NO_x)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Ammonia	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
DISSOLVED METALS			
Copper (Cu)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Zinc (Zn)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
Cadmium (Cd)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Chromium (Cr)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Lead (Pb)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Nickel (Ni)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Mercury (Hg)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Arsenic (As)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Cobalt (Co)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Manganese (Mn)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Aluminium (Al)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
Iron (Fe)	9	2 per site	One round, monthly for 6 months, commencing dry season 2008
TURBIDITY (via continuous data loggers)			
Turbidity	3	1 data logger per site	Data to be collected continuously for six months, commencing dry season 2008, with data to be downloaded monthly
PESTICIDES (via passive samplers) – suggested analytes, to be confirmed following consultation with GBRMPA			
Chlorpyrifos	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Diuron	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Atrazine	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Hexazinone	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Endosulphan	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Simazine	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008
Ametryn	5	1 passive sampler per site	One round, monthly for 6 months, commencing dry season 2008

6.2 Groundwater

Three permanent groundwater bores have been established within the FDA, and their locations are indicated in Figure 2.

Table 2 outlines the groundwater analytes proposed to be monitored, as well as the timing and frequency of the proposed pre-construction sampling program for groundwater.

Data is proposed to be obtained over two months. At this point, the data will be reviewed and discussed with the EPA. If data does not vary significantly between the two data sets, further monitoring is not expected to be required. Quality control measures will be taken as outlined in Section 5.4.

Table 2: Parameters for groundwater pre-construction monitoring program

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
PHYSICO-CHEMICAL PARAMETERS			
Oxidation reduction potential (ORP)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
pH	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Electrical conductivity (EC)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Salinity	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Turbidity	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
NUTRIENTS			
Total phosphorus (TP)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Filterable reactive phosphorus (FRP)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Total nitrogen (TN)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Total Kjeldahl nitrogen (TKN)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Oxidisable nitrogen (NO_x)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Ammonia	3	1 per site	One round, monthly for 2 months, commencing dry season 2008

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
METALS			
Copper (Cu)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Zinc (Zn)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Cadmium (Cd)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Chromium (Cr)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Lead (Pb)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Nickel (Ni)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Mercury (Hg)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Arsenic (As)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Cobalt (Co)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Manganese (Mn)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Aluminium (Al)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008
Iron (Fe)	3	1 per site	One round, monthly for 2 months, commencing dry season 2008

6.3 Sediment

A number of sediment studies have been undertaken in the area, and a concerted effort is currently being made to obtain adequate baseline data from the results of these previous studies. If this does not prove to be possible, two rounds of monitoring are proposed (once during the local dry season, and once during the local wet season) in order to collect adequate baseline sediment quality data.

The sediment analytes proposed to be monitored (if necessary), as well as the timing and frequency of the potential pre-construction sampling program for sediments, are presented in Table 3 below. Particle size distribution (PSD) is important in describing the sediment type and putting dissolved metal data into context. Quality control measures will be taken as outlined in Section 5.4.

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Table 3: Parameters for sediment pre-construction monitoring program

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
NUTRIENTS			
Total phosphorus (TP)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Filterable reactive phosphorus (FRP)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Total nitrogen (TN)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Total Kjeldahl nitrogen (TKN)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Oxidisable nitrogen (NO_x)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Ammonia	9	1 per site	One round during dry season 2008, one round during wet season 08-09
METALS			
Copper (Cu)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Zinc (Zn)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Cadmium (Cd)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Chromium (Cr)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Lead (Pb)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Nickel (Ni)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Mercury (Hg)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Arsenic (As)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Cobalt (Co)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
Manganese (Mn)	9	1 per site	One round during dry season 2008, one round during wet season 08-09
ORGANO-METAL COMPOUNDS			
Tributyltin (TBT)	9	1 per site	One round during dry season 2008, one round during wet season 08-09

ANALYTE	NO. OF SITES	NO. OF SAMPLES PER ROUND	TIMING OF SAMPLING
PARTICLE SIZE DISTRIBUTION			
Particle size distribution (PSD)	9	1 per site	One round during dry season 2008, one round during wet season 08-09

7 Construction monitoring program

The final programs for monitoring during construction will be developed in consultation with the EPA and other relevant government agencies, and will be informed by the results of the baseline data collected prior to construction. Details of the final construction monitoring programs will be presented in the full *Supplementary Water Quality Report*.

During construction the most significant potential impacts to the local environment are likely to be associated with increased turbidity from the construction site, particularly in association with the release of wastewater from settlement ponds, and the placing of rock to form breakwater walls.

As a minimum, the monitoring programs during construction are currently proposed to include:

- Monitoring of the dewatering stream for physico-chemical parameters (DO, pH, EC, salinity, turbidity, and temperature) using a portable water quality probe;
- Ongoing turbidity measurements with permanent data loggers, with data downloaded every two weeks during the construction period; and
- Visual monitoring for turbidity plumes (details of the visual monitoring program to be established following consultation with EPA, DPI&F and other relevant government agencies).

Details of the way the monitoring results will feed back into the construction process (i.e. responses to exceedence of investigation and intervention levels) will be contained in the revised CEMP for the project.

8 Post-construction monitoring program

The final programs for post-construction monitoring will be developed in consultation with the EPA and other relevant government agencies. This process will be informed by the results of the baseline data collected prior to construction, as well as the monitoring data obtained during the construction phase. Details of the proposed post-construction monitoring programs, together with a confirmation of arrangements for responsibility for any ongoing monitoring, will be presented in the final *Supplementary Water Quality Report*.

As a minimum, post-construction monitoring is proposed to include quarterly and significant rainfall event-based monitoring of:

- hydrocarbons;
- pesticides;
- nutrients (TP, FRP, TN, TKN, NO_x and ammonia);
- chlorophyll a; and
- metals typically associated with marina activities (namely copper, lead and zinc).

A minimum of three sites will be monitoring on the outgoing tide, including:

- one in the access channel to the development; and
- two reference sites.

Quality control measures will be taken as outlined in Section 5.4.

During periods of maintenance dredging the construction monitoring programs will be reverted to.

Details of the management initiatives that will be implemented in response to the results of ongoing monitoring (i.e. responses to exceedence of investigation and intervention levels) will be contained in the revised OEMP for the project.

9 Conclusion

The conclusions drawn by this report are, in summary:

- Respondents to the original TOT project EIS identified concerns with the selection of guidelines, the proposed monitoring programs and the data presented in the water quality report submitted with the original EIS. A comprehensive baseline water quality monitoring program has subsequently been developed to address these concerns and, where necessary, supersedes relevant sections of the original water quality report (Appendix 12 to the EIS);
- Based on a preliminary review and assessment of historic water and sediment quality data for the region, it appears that inadequate data exists to compile a comprehensive baseline data set;
- Accordingly, a comprehensive pre-construction baseline marine water, groundwater and sediment quality monitoring program has been developed in conjunction with the EPA, and is now proposed to be implemented, commencing in the local 2008 dry season. Data is proposed to be collected over six months, in order to develop a baseline data profile for both the wet and dry seasons, with the EPA to review the parameters listed in Section 5 following analysis of the first month's data;
- Monitoring programs for the construction and post-construction periods will be finalised following collection of adequate baseline data (as outlined in Section 5), and will be presented in the full *Supplementary Water Quality Report*; and
- Management and response measures to maintain water quality in the environment surrounding the TOT FDA, together with appropriate trigger levels, will be presented in the revised CEMP and OEMP.

10 References

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