Gold Coast International
marine precinct

GOLD COAST INTERNATIONAL MARINE PRECINCT ENVIRONMENTAL IMPACT STATEMENT

AUGUST 2012

Volume 01

Gold Coast International
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ENVIRONMENTAL IMPACT STATEMENT PART I

Gold Coast International
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ENVIRONMENTAL IMPACT STATEMENT

Gold Coast International Marine Precinct
Shipper Drive, Coomera

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EIS GUIDE

Gold Coast International Marine Precinct

Environmental Impact Statement - Guide

This EIS document relates to the Gold Coast International Marine Precinct (GCIMP) Project. The EIS has been compiled by the Project Team and is structured in accordance with the Terms of Reference (ToR) document released by the Queensland Government in December 2011.

Sections and headings of the EIS document generally correspond with the ToR document for ease of reference and assessment. Within the EIS Report, the relevant ToR is provided in a grey text box which is subsequently addressed below, with references provided to the appropriately appended technical reports.

Details pertaining to the location of all technical reports, and the contents of each EIS Volume is provided as follows.

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EXECUTIVE SUMMARY

Gold Coast International Marine Precinct

Environmental Impact Statement

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Executive Summary

The function of the executive summary is to convey the most important aspects and key findings of the EIS in a concise and readable form. It should use plain English and avoid the use of jargon. The executive summary should be written as a comprehensive stand alone document, able to be reproduced on request and distributed to interested parties who may not wish to read or purchase the EIS as a whole.

The executive summary must include:

- the title of the project
- name, ACN and contact details of the proponent and a discussion of previous projects undertaken by the proponent and their commitment to effective environmental management
- a concise statement of the aims and objectives of the project
- the legal framework, decision-making authorities and advisory agencies
- an outline of the background to and need for the project, including the consequences of not proceeding with the project
- an outline of the alternative options considered and reasons for the selection of the proposed development option
- a brief description of the project (pre-construction, construction and operational activities) and the existing environment, utilising visual aids where appropriate
- an outline of the principal environmental impacts predicted and the proposed environmental management and monitoring strategies (including waste minimisation and management) and commitments to avoid, or where avoidance is not possible, minimise and mitigate the significance of these impacts.

Background

The Gold Coast Marine Precinct is the major marine industrial area within the Gold Coast dedicated to manufacture, servicing, repairs and refits of recreational boats.

Encompassing an area of approximately 250 hectares (taking in planning Stages One and Two) the Precinct is located on the Coomera River, approximately 15 kilometres from Surfers Paradise with direct water access to Moreton Bay and the Pacific Ocean.

The existing Gold Coast Marine Precinct has developed over a 6 year period. The critical mass achieved by its planning designation and the industries which have established within the precinct has resulted in a rapidly growing industry for the Gold Coast. The precinct and the associated marine industries contribute significantly to the local economy and the generation of employment opportunities.

The Gold Coast International Marine Precinct project seeks to develop the remaining 63.5 hectares of the designated Marine Industry Precinct to deliver a high quality, integrated industrial marina of international standard.

The Proposal

The proposed project, referred to as the Gold Coast International Marine Precinct (GCIMP) project (or "The Project), consists of the construction and operation of a world class industrial marina. Specifically, the project involves developing the remainder of the existing Gold Coast Marine Precinct located on the Coomera River, to incorporate best practice design for a working industrial marina.

The GCIMP concept has been developed through the combined expertise of Maritimo Offshore Pty Ltd and Property Solutions Group Australia. In the development of the GCIMP project, these companies have merged to create a joint venture initiative under the company Harbour Island Pty Ltd (ACN 122 548 467).

Both companies bring high levels of expertise to the project, and are committed to developing a high quality, state of the art industrial marina. Enquiries pertaining to this project are managed via the GCIMP project website www.gcintmarineprecinct.com.au or by mail:

Gold Coast International Marine Precinct
C/ - Planit Consulting Pty Ltd
PO Box 206
Nobby Beach QLD 4218

Maritimo Offshore Pty Ltd is a large internationally renowned cruiser boat manufacturer, currently operating from two established sites on the Gold Coast, one in the existing Gold Coast Marine Precinct and the other at Hope Island. The company has staff of approximately 90 and in the 2010-2011 financial year produced 30 vessels attracting sales of $25 million. Maritimo Offshore Pty Ltd has high levels of expertise in boat manufacture and in working industrial marinas and is committed to ensuring the GCIMP project achieves economic, social and environmental objectives.

Property Solutions Group Australia is a Brisbane based company with a mix of industrial, commercial, retail and marina development, ownership and management experience. The company has developed retail and commercial projects including the Centro on James in Brisbane and the Yatala Enterprise Area. Property Solutions Group Australia are experts in marina owner-operations and development of industrial subdivisions and mixed use urban precincts and are committed to ensuring best practice principles are applied in the conceptual, construction and operational phases of the GCIMP.

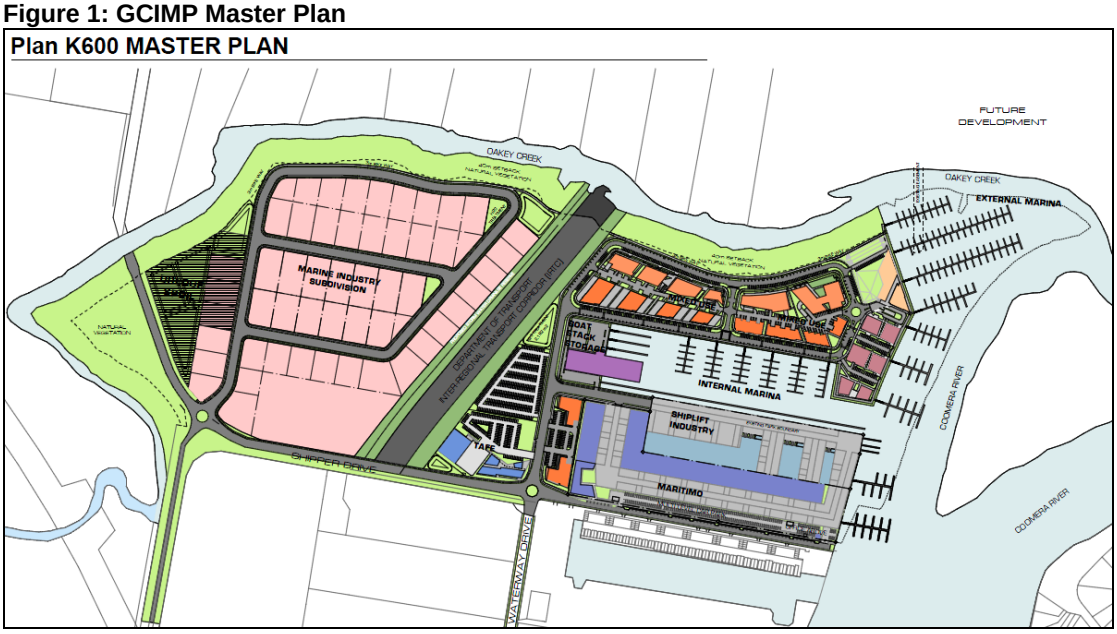
The GCIMP project is considered to be essential in providing a world-class integrated, industrial marina. Unlike the existing Marine Precinct located on the Coomera River, the GCIMP proposes a range of complementary uses to the marine industry. Current Planning Scheme provisions strictly regulate the nature of land uses contemplated within Marine Precinct. As such, the GCIMP proposal has been developed in response to the needs key industrial stakeholders to ensure the precinct is expanded to incorporate a variety of uses.

Key elements of the project include:

- Developing 28.9 hectares of industrial uses inclusive of Marine industry, Ship lift industry and the new Maritimo facility;
- Creating a mixed use precinct of 9.3 hectares comprising sales, showrooms, display of marine parts, fittings and fixtures, corporate office space, small scale light industry and services such as a yacht club, restaurants and retail outlets;
- A stacked dry boat storage facility with gantry crane access for approximately 290 vessels;
- Development of a 4.5 hectare internal marina of approximately 110 berths, providing a calm water environment for the launch and retrieval of vessels and for on water display of vessels by manufacturers and retailers on site;
- A 7 hectare widening to the Coomera River to allow for an external marina incorporating 280 multiple sized berths; and
- A TAFE college site of 1.57 hectares comprising a 3000 square metre Centre of Excellence and a 1500 square metre workshop devoted to marine industry training.

An excerpt of the GCIMP Master Plan prepared by Push Architects is provided below.

Figure 1: GCIMP Master Plan



A three dimension model of the overall GCIMP has been developed by Push Architects to illustrate the development in the context of the existing environment. An excerpt of the 3D model is provided below.

Image 1: Aerial View from South-East

Planit Consulting has prepared 3D modelling of key elements of the GCIMP development. Provided below are a selection of still perspectives from the three dimension modelling.

Image 2: View from North-East towards the Internal Marina, Boat Stack Storage and Mixed Use Precinct

Image 3: Street View along Internal Marina

Image 4: Internal Street View - Educational Establishment Site to the Left and Boatstack to the Right

Image 5: View from External Marina towards Hotel

Image 6: View of Maritimo Building from the West

Image 7: Natural Vegetation Buffer to Oakey Creek - Showrooms to the Left

Image 8: Showroom Buildings in Northern Precinct

Image 9: Tavern Deck

Image 10: Tavern Deck

Aims and Objectives

The GCIMP aims to establish a world class industrial marina which combines a desired mix of uses to facilitate the creation of an integrated and self sufficient precinct. Key project objectives include:

- Develop the remainder of the Gold Coast Marine Precinct located on the Coomera River;
- To allow the development of marina berths;
- To create a desired mix of supporting uses within the precinct to facilitate self sufficiency and operational efficiency within the GCIMP;
- Operate the marina in a manner that has an acceptable impact on surrounding communities and the environment;
- Develop and operate the GCIMP Project in compliance with all relevant statutory requirements; and
- Continue to maintain an open and honest relationship with stakeholders.

The aim of the EIS process is to identify and assess potential environmental, social and economic impacts of the GCIMP project and, where possible, identify how adverse impacts would be avoided or mitigated. The EIS examines and addresses any direct, indirect and cumulative impacts of the GCIMP, where practical. The EIS contains sufficient technical information for an informed assessment of the potential impacts, both negative and positive, of the project. The EIS document includes:

- a description of the relevant aspects of the existing social, economic, natural and built environment;
- a description of the GCIMP proposal and means of achieving the development objectives;
- definition and analysis of the likely impacts of the development on the environment, society and the economy, including comprehensive description of the data used for providing baseline information to predict impacts of the development and associated activities;
- a framework against which government decision-makers can consider the various aspects of the proposal and set conditions of approval to ensure environmentally sound development;
- a consolidated list of measures proposed to mitigate adverse effects;
- consideration of offset options where direct impacts cannot be mitigated or avoided; and
- recommendations on the need for and contents of any environmental management plans (EMPs) and/or operational plans to mitigate adverse effects.

The EIS provides a whole of project assessment through a Multi Criteria Analysis (MCA) framework. This MCA has provided a three tiered assessment of the project against social, environmental and economic criteria.

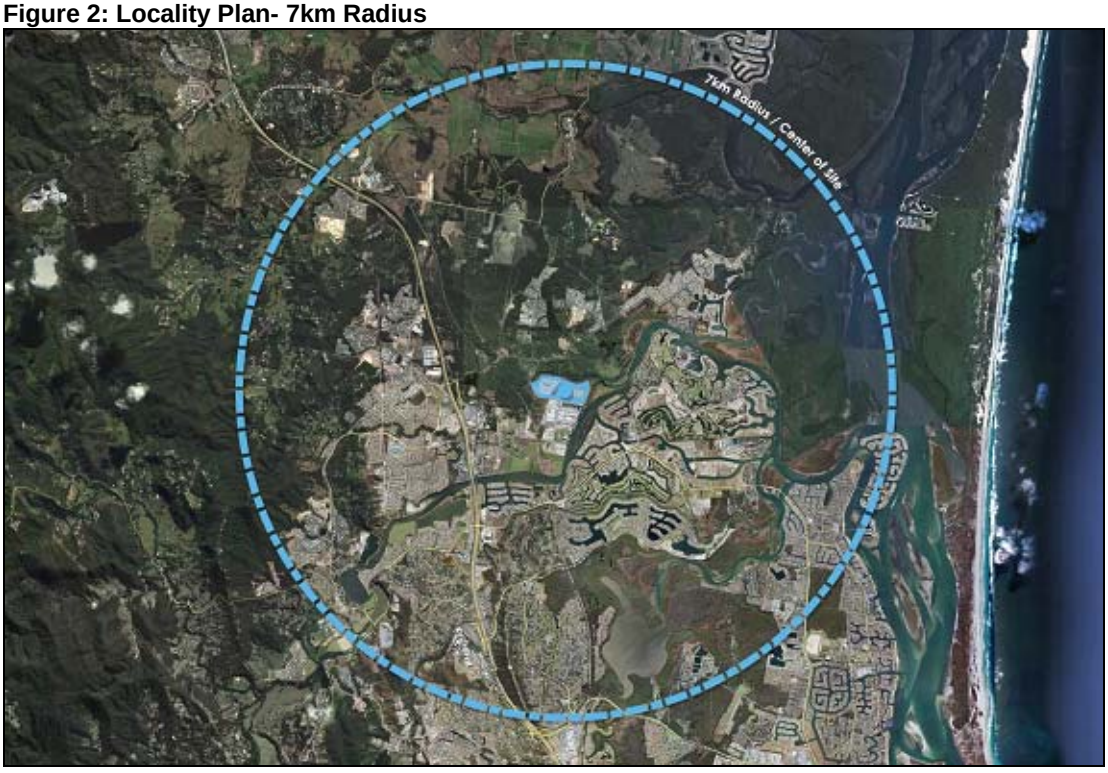
Site and Surrounds

From a regional perspective, the GCIMP site is located with South East Queensland and can be identified within the Gold Coast Local Government area. The Site is situated within the suburb of Coomera, which is a major new urban area in the northern Gold Coast and within the Gold Coast – Brisbane growth corridor.

Coomera is identified in the South East Queensland Regional Plan 2009-2031 (SEQRP) as a 'Major Regional Activity Centre', and in the Gold Coast Planning Scheme as a 'Regional Centre'.

The site is located on the Coomera River and is approximately three (3) kilometres upstream from the Moreton Bay Marine Park, seven (7) from the Southern Broadwater and a further nine (9) kilometres to the Pacific Ocean. Proximity Plans have been provided as follows.

Figure 2: Locality Plan- 7km Radius



This site is in close proximity to the future Coomera Town Centre, approximately two (2) kilometres and key transport routes. The site is bound to the north and west by Oakey Creek, which is tidally influenced adjacent to the site.

Figure 3: Locality Plan - 2km Radius

To the north and west of Oakey Creek a variety of landuses such as residential, commercial and open space are planned for or have already been developed. The Coomera area is identified in the Gold Coast Planning Scheme as accommodating a future community in excess of 60,000 people. The allotments adjoining the northern bank of Oakey Creek, incorporate undeveloped land or land with a rural character typically improved through dwellings and clearing.

Immediately to the east of the site is Foxwell Island a freehold island in the Coomera River. Beyond this is Hope Island. Hope Island incorporates a number resort/residential facilities, international hotels, new developing residential communities, small villages, marine industries, marinas retail and tourist uses. A series of canal and golf courses define the settlement pattern of Hope Island.

South of the site occurs the existing Marine Precinct. This southern interface is illustrated in Image 11 below.

Image 11: View west on Shipper Drive

Encompassing a total area of 250 hectares, the precinct has direct access to Moreton Bay and the Pacific Ocean via the Coomera River. Image 12 provides an aerial, viewing north, of the existing precinct with the subject site in the background.

Image 12: Gold Coast Marine Precinct

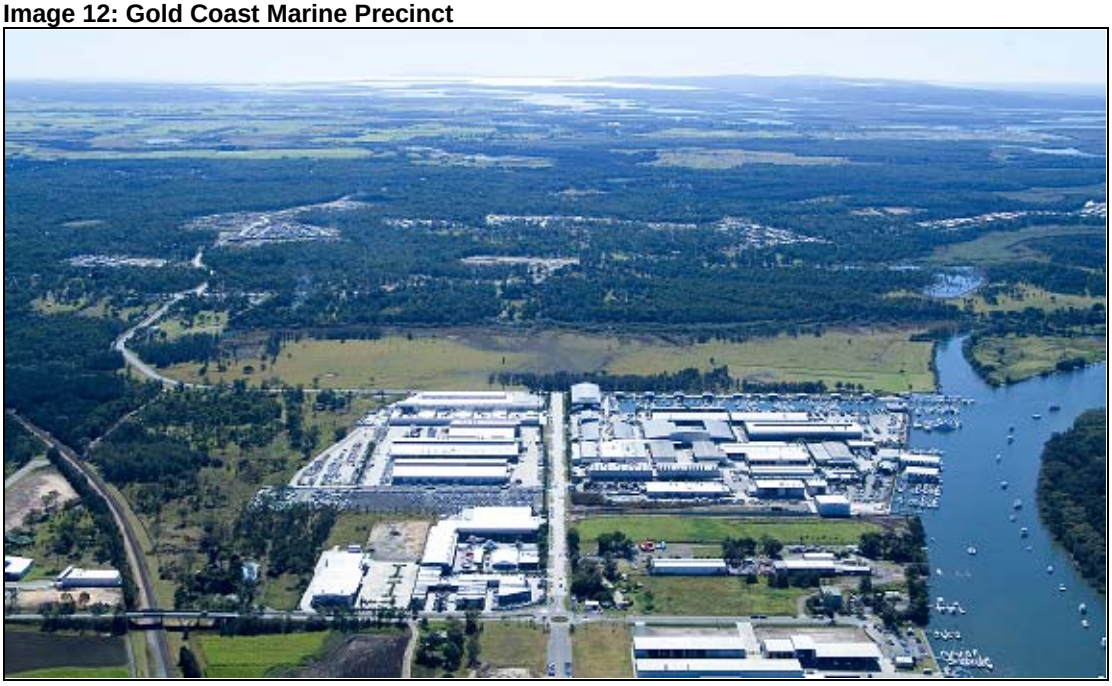
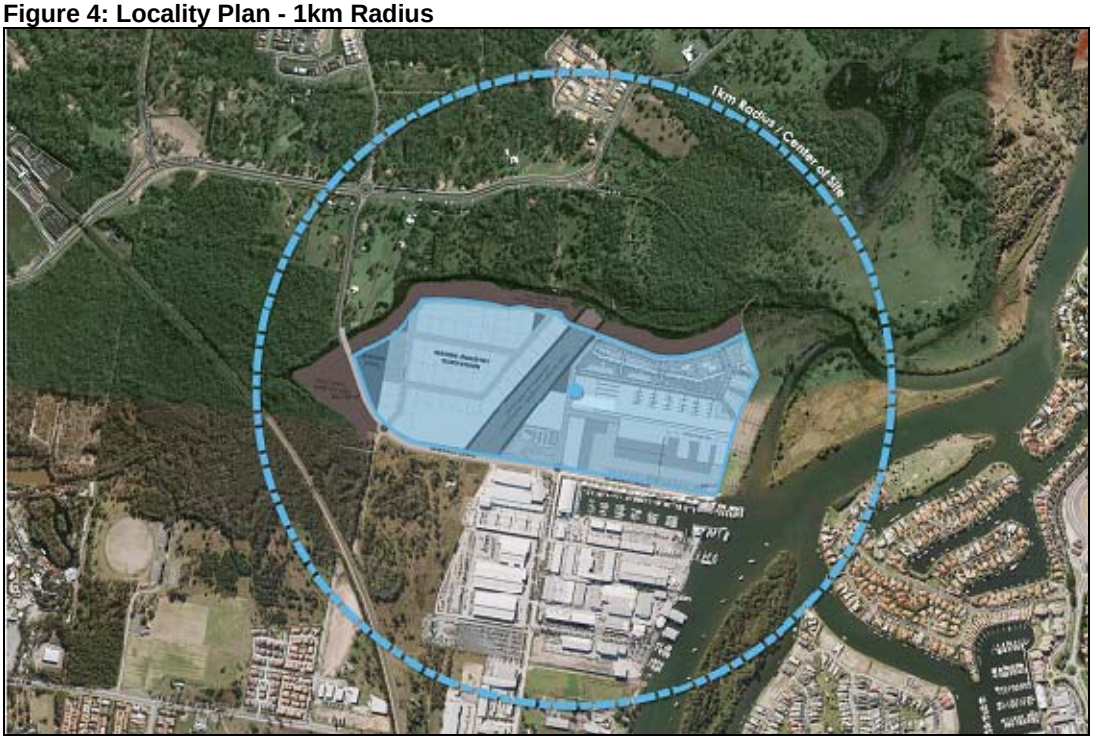


Figure 4: Locality Plan - 1km Radius



As evident from Figures 2 - 4, the site's location on the Coomera River has been a key determinant to the establishment of the Gold Coast Marine Precinct. The figures also illustrate the river has been extensively modified through urban development. This development has seen the establishment of extensive series of canals.

Legal Framework

The GCIMP was originally declared to be a "significant project" on 18 April 2008 and subsequently re-declared on the 7 July 2011. The "significant project" declaration requires the preparation and submission of an Environmental Impact Statement (EIS) as per section 26(1)(a) of the *State Development and Public Works Organisation Act 1971* (SDPWO Act), by the Queensland Coordinator General. Matters considered in making the "significant project declaration" included:

- Information provided within the Initial Advice Statement;
- The level of investment necessary for the project;
- Employment opportunities provided by the project;
- Potential impact on the environment;
- Potential effects on relevant infrastructure; and
- The significance of the project to the region and State.

The Project was referred to the Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA), now known as the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DEWHA decided that the proposal constitutes a "controlled action" under section 75 of the EPBC Act. The controlling provisions for this project are wetlands of international significance, listed threatened species and communities and listed migratory species.

The statutory impact assessment process under the SDPWO Act is the subject of a bilateral agreement between the Queensland and Australian Governments in relation to environmental assessment under the EPBC Act. On 6 May 2008, the Queensland Government decided that the assessment of the project would be undertaken under the terms of the bilateral agreement.

Since the project's inception, detailed surveying and site monitoring has occurred. The initial detailed site surveying occurred between July – August 2008. Subsequent site inspections have been undertaken to update and validate these initial surveys on a regular basis, up to July of this year.

Various Government departments are involved in the assessment of the EIS inclusive of:

- Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC);
- Department of State Development, Infrastructure and Planning (SDIP);
- Department of Natural Resources and Mines (DNRM);
- Department of Energy and Water Supply (DEWS);
- Department of National Parks, Recreation, Sport and Racing;
- Department of Agriculture, Fisheries and Forestry (DAFF);
- Department of Communities, Child Safety and Disability Services (DCCSDS);
- Department of Community Safety (DCS);
- Department of Education, Training and Employment (DETE);
- Department of Housing and Public Works (DHPW);
- Department of Transport and Main Roads (DTMR); and
- Gold Coast City Council (GCCC).

Project Alternatives

The abovementioned proposal is the desired development concept for the site. However, four alternatives for the site have also been identified. Project alternatives considered as part of the EIS process are summarised as follows:

1. The preferred development concept. This includes the development the above stated concept which includes a 40m setback to Oakey Creek and assumes acquisition of the Gold Coast City Council Park located on Shipper Drive.
2. Alternative 1. This concept also includes a 40m setback to Oakey Creek and assumes the Park land, but proposes a significant portion (9ha) of the site to be dedicated to the storage of dredge spoil.
3. Alternative 2. This plan maintains a 40m setback to Oakey Creek, but does not include involve the acquisition of the Council Park and a public boat ramp facility is accessed at the end of Shipper Drive.
4. Alternative 3. This plan involves increasing the setback from Oakey Creek to 100m. The public park is acquired through this alternative.
5. Alternative 4. This is a status quo concept which involves leaving the site in the current state of degraded rural land.

The preferred development concept has been selected as it maximises the use and efficiency of the site and effectively balances economic, environmental and social considerations as detailed within Norling Consulting's Multi-Criteria Analysis contained within the Social and Economic Impact Assessment contained in Appendix 10 to the EIS.

Pre-Construction Activities

As detailed in the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13 to the EIS, pre-construction activities include the establishment of a temporary construction compound within the project site. This will provide office, lunch room, first aid area and toilet facilities and will provide a location for stockpiles and storage of construction materials and equipment. Temporary offices will be provided by use of mobile demountable buildings which will be connected to water, sewer, electricity and telecommunications services. At the completion of site construction works, these building will be demobilised off site. The site compound will contain back-up generators. It is envisaged that the construction works phase of the project will not have an excessive demand on the existing infrastructure.

The pre-construction phase will include the construction of temporary fencing to secure the construction site and prevent unauthorised access. This fencing will be

located across the site land access points and will be constructed of chain wire fencing panels. At the completion of site construction works and once the site is secure for safe public access, fencing material will be demobilised off site.

The site will be bunded to provide a dry site for undertaking excavation and for the formation of fill platforms and to prevent dispersion of pollutants to surrounding waterways. The majority of the site will be contained by temporary construction bunds. These bunds are required to isolate the site from adjacent waterways. These bunds will be constructed of engineering fill material incorporating a water barrier membrane. The bunds will be removed at the completion of the filling / excavation works to allow water to flow into the internal marina area. Fill material removed from the temporary bunds will be reused within the site.

Removal of the bunds will be undertaken in stages or controlled in piped water fill to allow stabilisation of the enclosed waterway prior to total removal of the bund.

Construction Activities

The GCIMP will be constructed using 'wet' and 'dry' excavation techniques. The 'wet excavation' will be associated with the widening of the Coomera River and the creation of the External Marina. This will be undertaken in stages to better monitor and control sediment disturbed in the river by excavation works. As detailed by Hyder Consulting, the 'wet excavation' works will be the most suitable construction method and will be undertaken by long reach excavator or dragline set up on a temporary construction bund wall or via barge.

The 'dry excavation' will allow the creation of the internal Marina. A temporary bund will allow the creation of the Internal Marina in dry conditions and will require excavators, trucks and other land-based machinery.

Excavated material will be placed in constructed treatment beds to allow for treatment of acid sulfates and conditioned by drying back for optimal use as construction fill as either compacted fill or for preload purposes.

Monitoring will be undertaken during the construction phase for water quality, noise and site management of fuel / oil storage, litter, silt curtains and other structures.

The recommendations of the Construction Methodology Report and subsequent reports have been incorporated into the Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14 and will be implemented during construction.

Operational Activities

Hyder Consulting has prepared a Site Based Management Plan (SBMP) which is contained in Appendix 15 of the EIS. The SBMP is a working document which details policies, performance criteria and procedures to minimise the impact of activities at the Gold Coast International Marine Precinct (GCIMP) on the physical and social environment of that precinct on the Gold Coast. In particular, the SBMP includes monitoring and reporting mechanisms whereby the performance of the system can be measured, and agreed corrective actions can be implemented in a timely manner in the event of an incident occurring.

The SBMP has been prepared in accordance with Queensland Environmental Protection Agency (EPA/DERM) Guidelines, Gold Coast City Council (GCCC) and sound engineering and environmental practice.

Principle Impacts and Proposed Mitigation and Management

The following presents the principal impacts predicted for the proposal, the proposed environmental management and monitoring strategies and commitments to avoid, minimise and mitigate the significance of these impacts. These are further detailed within the EIS document.

Climate and Natural Disasters

The Queensland Government developed a methodology for assessing potential impacts entitled *Guidelines for preparing a Climate Change Impact Statement (CCIS) (2008)*. The CICS guidelines have been applied to analyse the physical risks of climate change to the Gold Coast International Marine Precinct, where adaptation measures are identified for priority risks. The methods utilised for the GCIMP are also consistent with the Australian and New Zealand Standard for Risk management AS/NZS 31000-2009.

Prioritised risks and the recommended adaption measures have been summarised in the table below. Further detail is contained in the Climate Risk Assessment prepared by Hyder Consulting contained in Appendix 25.

Table 1: Priority Risks and Adaption Measures

Climate impact	Risk Statement	Adaptation option
Higher wind speeds from increased cyclone/ECL intensity	Structural damage to buildings and infrastructure creating higher maintenance costs and reduced	Buildings and infrastructure to be designed with consideration of high emissions scenario climate change

	asset lifespan	projections to 2070
Flooding from more intense rainfall events, storm surge etc	Flooding of buildings and infrastructure causing higher maintenance and reduced asset lifespan	Structural and storm water drainage design to consider high emissions scenario climate change projections to 2070.
	Rising groundwater level impacts on foundations/infrastructure leading to asset deterioration	Use of appropriate materials and engineering design capable of withstanding wetting and drying and prolonged periods of inundation
	Overtopping and runoff from slipways (e.g. antifouling chemicals) resulting in water quality impacts	Design to ensure work and chemical storage areas are contained and include adequate drainage to prevent fugitive discharge events
	Breach of fuel storage facilities resulting in water quality impacts	Ensure that fuel storage areas and tanks are designed with consideration of high emissions scenario climate change projections to 2070. Design adequate secondary containment around all fuel/dangerous goods storage tanks
Increase in sea level causing change in soil moisture content and soil swelling	Structural damage to buildings and infrastructure associated with ground and foundation movement, shrinkage and changes in groundwater creating higher maintenance costs and reduced asset lifespan	Use of appropriate materials and engineering techniques
Increase in sea level causing inundation associated with increase in high tide level	Flooding of buildings and infrastructure causing higher maintenance costs	Consideration for design of 0.8m sea level rise above mean high tide level as per the DRAFT Queensland Coastal Plan
	Reduced serviceability of buildings and infrastructure causing reduced income from marina / retail services	Consideration for design of 0.8m sea level rise above mean high tide level as per the DRAFT Queensland Coastal Plan
Increase in sea level causing an increase in the salt water table	Accelerated deterioration of materials causing higher maintenance costs	Use of appropriate materials and engineering design techniques
	Structural damage to buildings and infrastructure creating higher	Use of appropriate materials and engineering design techniques

	maintenance costs and reduced lifespan	

Hydraulics

BMT WBM have prepared a Floodplain Report (Appendix 26) addressing the Gold Coast City Council's Planning Scheme Constraint Code for Flood Affected Areas and any relevant studies undertaken by the Gold Coast City Council in relation to flooding and storm vulnerability.

Relevant studies include the use of Council's current MIKE21 model of the Coomera River, and Council's committee recommendation C99.0326.003. These provisions are based on the recommendations in PPK (1999), Coomera Marine Precinct Hydraulic Plan Report No 2A. PPK (1999), a planning study that considered, at a concept detail, the development of the entire Marine Precinct.

Flood Level Impacts

The flood level increases caused by the existing Precinct when assessed using the Mike 21 model generally complied with Council recommendations (C99.0326.003). An exception was the river reach from Beattie Road south to Saltwater Creek where the impacts were up to 0.09 m. The impacts that would be caused by the proposed development of the Site only were small by comparison to the existing Precinct, typically being an additional 1/3 to 1/10 of those caused by the existing Precinct. An exception is upstream of the Site on Oakey Creek where there the proposed development would cause increases of up to 0.044 m in the 100 year ARI event, whereas the existing Precinct did not increase flood levels in this area. In the Council Planning Scheme the floodplain in this area is classified as Open Space – Oakey Creek Environmental Park, and hence the increases in flood level in this area are in the main not impacting on private property. There are a small number of private properties in this area, but the land is steeply sloping and the houses are positioned well above the flood level. The assessment of real damages associated with flood level increases is summarised below.

Flood Velocity Impacts

The proposed development does not impact on flood velocities, other than some localised effects. There are velocity increases in the range 0.1 to 0.3 m/s in Oakey Creek adjacent to the northwestern corner of the Site in the 20, 50 and 100 year ARI events, and increases in the range 0.1 to 0.2 m/s in the 5 and 10 year ARI

events. The increases in the more regular 5 and 10 year ARI events are unlikely to cause any scouring. In the rare floods such as the 20 to 50 year ARI events, the increases of up to about 0.3 m/s may cause minor localised scouring of the creek bed and of the banks if bare soil is exposed. If it is determined during the detailed design stage that there is a risk of erosion at this location, then minor reshaping and/or adjustment to the fill extent at this location would minimise the impacts.

Flow Rate Impacts

The proposed development of the Site would not significantly impact on flow rates.

Hazard Impacts

The proposed development would not increase hazard across the floodplain. The development would increase the depth of flooding and velocities at the Shipper Drive Crossing of Oakey Creek in 50 year ARI and above floods, but this is not an evacuation route for the proposed development or existing developments and so this change would not impact on emergency management response during floods.

Real Damages

The hydraulic analysis presented in this report found that 11 properties would likely be subjected to material damage in very specific flood events as a result of flood level increases causing inundation of habitable floors that would otherwise not occur. All of the 11 properties are currently subject to inundation in events up to the 100 year ARI and the increase in flood level is small (10 to 20 mm). Therefore for each property there is a very narrow band of floods that would result in material damage, e.g., the band for one property is the 13.9 to 14.4 year ARI events – this means that material damage would not occur in floods smaller than or larger than this band. Because of these narrow bands, the probability of material damages occurring is rare, ranging from about 1 in 300 to 1 in 4000 in any given year.

The analysis also found that the development would not significantly alter the duration of inundation of ay properties.

Based on these findings Minter Ellison Lawyers determined that the 11 properties may experience over floor flooding in a specific event that they otherwise would not, which may result in a claim for actionable nuisance, i.e., real damage.

Climate Change

An assessment of the likely impacts of sea level rise and increased rainfall intensity on the flood level at the site was undertaken. The analysis identified conservative assumptions in the current flood model relating to the combined probabilities of storm tide and flood event, and the storm tide levels themselves. It is beyond the scope of this study to resolve these matters, and it is assumed that Council will provide a position in this regard over the coming years. However a range of analyses were undertaken to provide an indication of the sensitivities of these various assumptions. From these analyses it is concluded that 100 year ARI designated flood level at the site may increase by up to 0.35 m at the site, but there is also a reasonably likelihood that it may remain unchanged once the current conservative assumptions are removed and allowances are made for climate change influences.

Geology and Soils

Key geotechnical issues of the proposed development include:

- Potential consolidation settlement as a result of the proposed filling and structural loads.
- Excavation conditions in the proposed Coomera River widening and the suitability of the excavated material for use as engineered fill.
- Stability of excavation batters and revetments for the Coomera River widening and the proposed internal and external marinas.
- Settlement, stability and bearing capacity of the foundation materials beneath the proposed perimeter retaining wall.
- The impact of construction within the IRTC on the adjacent land.

Acid Sulphate Soils

Gilbert and Sutherland undertook an Acid Sulfate Soil Assessment of Stage 1 of the GCIMP site. This included the drilling and sampling of 35 boreholes in areas to be disturbed below 5m AHD (including the adjacent waterway) and the subsequent testing of samples for acid sulfate potential. The laboratory results indicated acid sulfate materials would be disturbed as part of the construction process. Consequently, an Acid Sulfate Soils Management Plan (ASSMP) is required to manage excavated acid sulfate soils during the stage 1 construction phase, and to meet the requirements of State Planning Policy 202 (SPP2/02) and GCCC Planning Scheme Policy for Acid Sulfate Soils (ASS). An ASSMP for the proposed marina development is included.

The ASSMP is designed to ensure that ASS encountered at the GCIMP site are appropriately identified and treated in accordance with proven management techniques. The ASSMP provides a clear management protocol based on operational policies, performance criteria, implementation strategies and corrective actions should they be necessary. The ASSMP also identifies the responsible entities for each specific aspect of ASS management. Effective management will allow for the protection of the surrounding environment.

Land Use

The impacts on surrounding land uses, and strategies for minimisation have been summarised as follows:

- Good Quality Agricultural Land / Cropping Land - the site is not located on Good Quality Agricultural Land (GQAL) as per the Gold Coast Planning Scheme Overlay Maps, and is not utilised as cropping land.
- Key Resource Areas - the site is not located within or near a Key Resource Area.
- Competing Land Uses - The GCIMP is not located considered to be located in proximity to competing land uses. Small residential an acreage allotments exist in the vicinity surrounding the proposed site to the south west, and to the north across Oakey Creek. The project site is not located in close proximity to any significant sensitive receptors.
- Recreational Uses - the project involves the resumption of the William Guise Foxwell Park which is currently utilised by the Hinterland Model Flying Club. This will involve the removal of an existing recreational use. However, given the nature of the proposal, additional park area will be provided in the development. This would fundamentally service the recreational, leisure and sporting needs of the wider community.
- Residential, commercial, retail and industrial uses - the site is a designated marine industry area, located adjoining the existing Marine Precinct. The project is not anticipated to impact on commercial areas given that the retail component of the site is of proposed to be of a scale suitable to service the GCIMP workers / uses internally, and will not impact upon surrounding existing and planned retail catchments.

The GCIMP is appropriately located within an area designated for Marine Industry. Due to the limited availability of land suitable to be developed for Marine Industry purposes, it is considered that there is very low possibility of the adjoining areas being re-zoned within future Planning Schemes. The GCIMP is not considered to constrain potential future development given that the site has been set aside for this scale and nature of development.

Detailed investigations and reporting has been undertaken as part of the GCIMP EIS to ensure impacts of the development on surrounding uses are minimised and mitigated.

Contaminated Land

Activities/materials identified as having the potential to have contaminated the site include:

- Storage of chemicals i.e. Glyphosate (triggering the need to investigate the presence of organochlorines and organophosphorus pesticides in particular).
- Former livestock dip.
- Historical cropping activities.
- Livestock yards.
- Use of anti-biofoulants in marine industry upstream.

The DEH has previously provided a Statement of Suitability (April 17, 1996 DEH ref 901614) that the subject site (Lot 146 on WD6470) is suitable for any use and no other notifiable activity was identified, a notification in accordance with the *Environmental Protection Act 1994* is not warranted.

The site does not require any mitigation measures given that the site is not contaminated. With regards to future contamination, an Operational Site Based Management Plan (SBMP) has been prepared by Hyder Consulting and is contained in Appendix 15. The SBMP will be required to be amended and updated in future if necessary to ensure suitable measures are in place to prevent any future contamination as a result of the GCIMP.

Nature Conservation

Aquatic Ecology

Description of Existing Environment/Values

The value of the different areas of marine plant communities on the proposed GCIMP development site to aquatic ecology and fisheries was classified from poor to very good. The majority of marine plant communities on the proposed development site are of poor value to fisheries, as they are grazed by cattle and infrequently inundated. However there are marine plant communities of fair and good value to aquatic ecology and fisheries on the tidally inundated area of the proposed GCIMP development site as well as on the western edge of Foxwell Island. To the north of the proposed development site there is a relatively small area of marine plants with a very good value to aquatic ecology and fisheries.

No seagrass communities were recorded along the foreshore of the development in either Oakey Creek or the Coomera River. However, there are patches of seagrass on the western shore of nearby Foxwell Island, dominated by a sparse band of *Halophila ovalis*.

Benthic macroinvertebrate communities in the vicinity of the site were relatively abundant and diverse and did not show signs of significant pollution, eutrophication or high turbidity and sedimentation rates.

Bare mud, mostly covered with detritus and/or unattached filamentous algae, was the dominant habitat type in the benthos area surveyed in the Coomera River. There were also some areas of bare sand, particularly on the upstream side of islands, and some very small and isolated areas of clay and rock.

There were also several isolated patches of seagrass, consisting of sparse *Halophila ovalis*.

Most of the shoreline in the area surveyed in the Coomera River consisted of artificial walls and artificial walls with jetties. Vegetation, including grass and mangroves, also covered a large proportion of the foreshore.

Common fish of the region that are harvested include bream, whiting, flathead, tailor, sand crabs, mullet, snapper mackerel, cod, parrotfish, sweetlip, trevally, jewfish, dart, catfish, perch, luderick, coral trout, sole, emperor, squire, flounder, yellow tail and penaeid prawns.

Potential Impacts and Mitigation Measures

The proposed GCIMP development may impact marine and estuarine habitats both directly and indirectly. The most notable direct impacts will be the loss of marine plants and soft-sediment benthic habitats. All marine plants and soft-sediment benthic habitats directly within the footprint of each development option proposed for GCIMP will be permanently lost. Some soft- sediment benthic habitat, and hard substrate habitats will also be gained as a result of the proposed GCIMP development. The ecosystem services values of marine habitats to fisheries provide indicative guidelines for compensation for unavoidable habitat loss. Building fish friendly structures will also attract fish to the new habitat created by the marina.

Increased human activity and noise during construction may influence fauna, particularly marine mammals in the vicinity of the proposed development. A management plan for marine vertebrates should be developed to minimise this impact.

During marina operation there may be direct impacts of increased boat traffic, including increasing the number of boat strikes in the areas. Speed restrictions within the marina and entrance channels would reduce the incidence of boat strike within the vicinity of the proposed development site.

Terrestrial Flora and Fauna

Description of Existing Environment/Values

Botanical assessments identified five vegetative communities on the site including 'of concern' RE12.1.1 which consists of *Casuarina glauca* and *Sprorobolus virginicus* on tidal mudflats. Other communities in the saltmarsh contain *Melaleuca quinquenervia*, *Avicennia marina* and *Sarcocornia quinqueflora* (Samphire). Saltmarshes play an important role in ecosystem services, nutrient cycling of estuaries, providing a nursery area for fish as well as buffering water bodies from excess nutrients from the land.

Fauna surveys revealed a variety of habitats including tidal and intertidal estuarine wetlands associated with Oaky Creek and the Coomera River, mudflats, creek channels, saltmarsh, sedgelands, mangrove forest, open wetlands/dams and soft-sediment benthic habitats.

The sites wetland communities and its context within expansive estuarine and riverine environment influence the diversity of fauna on site. Wetland and wader species were commonly observed on site with the sites semi permanent wetland providing a roost and forage resource for scheduled and non scheduled aves.

This significant habitat feature of the site is located across the sites boundary with the future IRTC motorway. We note from preliminary design of this motorway that significant filling is proposed and removal of this wetland in part is contemplated.

Investigations reveal a high presence of waterbirds inhabiting the site including the Black-necked stork. An absence of scheduled species was found in areas mapped as essential habitat of the Wallum sedgefrog (*Litoria olongburensis*) and Wallum froglet (*Crinia tinnula)*.

Potential Impacts and Mitigation Measures

Although no critical habitat for scheduled species exists on the site, the development is likely to impose a variety of impacts on flora and fauna on site and in its surrounds at multiple spatial and temporal scales including habitat loss and fragmentation. Potential vibration, noise and pollutants during construction and operation are likely to disrupt the daily behaviour of species on and adjacent to the site.

Whilst the proposal removes available habitat to fauna it is considered the habitat types / vegetation communities removed are common in the locality and no significant impacts would arise. The impacts which have been identified are largely able to be minimized or mitigated through management plans, best practice processes and offsetting.

Downstream impacts from the proposal and broader affects to the estuarine and riverine environment have been demonstrated not to be significantly affected with the development noted as not translating into increased bank erosion. It has also been demonstrated that the proposed development would have little effect on the tidal water levels in the Coomera River system.

Oakey Creek is preserved in a minimum 40m wide open space reserve. This area totals 4.9ha of the site. The open space incorporates a range of mapped estuarine communities.

This minimum dimension was derived from the former the State Coastal Management Plan—Queensland's Coastal Policy which was recently repealed and replaced by the Coastal Plan 2012.

The former Queensland Coastal Management Plan mapping required setback is noted as segment 2700 which identifies Mean High Water Springs (MHWS) +40m as the required setback. MHWS generally reflects top of bank along Oakey Creek and thus a 40m setback from top of bank was adopted.

The layout of the preferred design has been chosen to meet the most practical and efficient provision for Engineering Services and therefore ecological values are unavoidably impacted upon because of these processes. 11.5 ha of land will be removed to create the external marina, 4.5ha removed for the internal marina and 7 ha to widen the Coomera River. This will cause a change to the diversity and abundance of species inhabiting the tidal communities on site. We note other estuarine and fisheries impacts also occur through filling. Smaller quantities of terrestrial vegetation are also impacted on and retention is not feasible.

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Direct impacts and areas of non compliance (AS S.2 – S.4 and AS S.6 – S.10) will be formally offset under an agreed set of offset works. The ongoing secondary / indirect impacts on the retained remnant habitats will be managed / mitigated in

accordance with the various management plans outlined in the Environmental Management Plan (EMP).

Matters of National Environmental Significance

Description of Existing Environment/Values

The controlling provisions that occur within and adjacent to the land and water to be affected by the proposed GCIMP are outlined below:

1. Moreton Bay Ramsar Wetland;

2. Known and potential habitat for listed threatened species; and

3. Known and potential habitat for migratory species listed under international agreements including;

    - The Bonn Convention (Convention on the conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
    - The agreement between the Government of Australia and the Government for the Peoples Republic of China for the Protection of Migratory Birds and their environment (CAMBA); and
    - The agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds and Birds in danger of extinction and their environment (JAMBA).

Potential Impacts and Mitigation Measures

Assessments of the likelihood of the proposed GCIMP development impacting upon Matters of NES have been carried out. These significant impact assessments are generally based on the findings of detailed technical assessments carried out as part of the GCIMP EIS process. The significant impact criteria considered in these assessments have been derived from the EPBC Act Significant Impact Guidelines Version 1.1 (2009)

This assessment is based on the anticipated effectiveness of a number of environmental mitigation and management measures that are proposed as part of the GCIMP development.

At the forefront of the assessments is recognition that the EPBC Act aims to balance the protection of Matters of NES with overarching economic and social needs, derived from the established principles of ecologically sustainable

development. It is therefore appropriate to consider the social and economic benefits that would be derived from the proposed GCIMP development.

Given the anticipated low likelihood of any significant impacts occurring on Matters of NES and the environmental, social and economic benefits expected to be derived as a result of the project; it is considered that the GCIMP development is consistent with the principal objective of the EPBC Act. Furthermore, it is the conclusion of this assessment that the GCIMP development is not, when consideration is given to existing site conditions and the overall effect of the proposed impact mitigation and management strategies, likely to have a significant adverse impact on any Matters of NES.

Water Courses and Drainage

During both the construction and operational phases of the project, stormwater runoff from the project site may potentially impact upon the water quality. If stormwater is not managed appropriately, there is the potential for stormwater to transport pollutants (such as sediment, nutrients and hydrocarbons) from ground surfaces into adjacent waterways during rainfall events.

Water quality release criteria for the construction phase have been sourced from the State Government's *—Draft Urban Stormwater - Queensland Best Practice Environmental Management Guidelines 2009"* and a monitoring program proposed.

Load-based release criteria were recommended for the operational phase in accordance with the load reduction targets included in guidelines specifically for the Gold Coast and the SEQ region. A Stormwater Management Plan was prepared by Hyder Consulting on this basis and is contained in Appendix 16.

The EHMP monitoring data for Coomera River, while temporally extensive, does not include a number of key water quality parameters, specifically suspended solids and heavy metals. The EIS Terms of Reference includes the requirement to assess water quality in terms of suspended solids, total and dissolved aluminum, and total and dissolved iron, along with other parameters already included in the EHMP data. Therefore, in order to fill the gaps in the existing data, it is necessary to commence a baseline water quality monitoring program for at least 18 months and preferably two years.

Dredging during the construction phase of the proposed development has the potential to impact on the marine environment – particularly from increased turbidity. The extent of these impacts can be evaluated through implementation of a construction phase water quality monitoring program. It will be a requirement of

the implementation of the monitoring program to evaluate that the actual impacts are consistent with the modeled impacts as this will ensure that the required offset program to mitigate those impacts is sufficient.

Groundwater

The analysis and field investigations by Gilbert & Sutherland support the following conclusions:

- Given the nature of the site soils and the groundwater characteristics recorded to date, the most likely potential impacts on groundwater as a result of the development are associated with potential impacts from disturbance of acid sulfate soils during the marina construction phase.
- The marina excavation is to be located within the estuarine alluvial aquifer, which generally flows in a south to north direction, towards Oakey Creek and the Coomera River.
- It is unlikely that the proposed development marina will substantively affect the water quality of the alluvial aquifer.
- Unmitigated dry excavation of the marina is likely to result in groundwater drawdown extending a maximum horizontal distance of 190 metres from the edge of the excavation.
- Upon completion of dry excavations the marina would be connected to the Coomera River and allowed to fill. Groundwater levels surrounding the marina would recover to closely reflect the pre-development groundwater regime. Therefore, the operational groundwater levels will not decrease (i.e. drawdown) beyond the range of current natural fluctuations. Post-developed water level within the marina would be influenced by the tidal cycle of the Coomera River.
- The anticipated groundwater impacts associated with the construction phase of the proposed marina can be managed using proven techniques and specific measures to mitigate drawdown. These techniques and measures are described in the Groundwater Management Plan.

Groundwater levels and quality will require careful management during the construction and operational phases of the development. This will require at least eight rounds of groundwater height and quality data to be collected (ideally including seasonal variation) prior to the start of construction.

Coastal Processes

<u>Sedimentation</u>

Overall sedimentation rates in the river system are a mixture of sediment transport processes under day-to-day (i.e. primarily tidal) conditions plus occasional flood event-driven sediment transport. Tidal currents are responsible for the majority of the sediment transport in the study area.

Hydrodynamic and cohesive sediment transport modelling of the Coomera River has been performed in order to identify the processes leading to sedimentation at the proposed development under day-to-day conditions. The major findings of the modelling are:

- Under day-to-day conditions, the proposed dredged areas will be subject to sedimentation of fine materials. The modelled annual rate of sedimentation under tidal flow conditions is about 5,000 m_3 of in-situ fine sediment;
- The greatest sedimentation within the dredged areas is predicted to occur around the confluence of Oakey Creek with the secondary channel of the Coomera River, where annual deposition depths in the order of 100mm are predicted;
- In addition to sedimentation due to day-to-day conditions, sedimentation may also be experienced during occasional flood events. Although the sedimentation volumes due to flood events are difficult to predict, the in-situ volume of fine material to be dredged from the development site due to flood events is estimated to be in the order of 16,000m_3 over a 20 year period.

Bank Erosion

It is not expected that the minor impacts on current velocities in the Coomera River due to the construction of the marina will have any appreciable impact on bank erosion. The increase in vessel movements may result in a minor increase in bank erosion due to boat wakes. However, it is noted that there are a broad range of processes that impact on bank erosion in this section of the Coomera River and that vessel movement is only one of these and its contribution to bank erosion is not able to be quantified.

Capital and Maintenance Dredging

Construction Dredging techniques have been chosen as a result of environmental considerations. Techniques are listed as follows:

- Wet Excavation via long reach excavator and barge from the perimeter bund will create less turbidity.
- Construction will be undertaken in stages to confine smaller areas that are able to be monitored closely for water quality and treated more effectively
- Works able to be completed quicker due to less stoppages due to machine down time due to pipe blockages on the dredges

- Settling ponds required will be smaller due to lower water content in the excavated material.
- Less impact on the water quality of the Coomera River due to confined areas
- Treatment of excavated material for ASS to occur sooner than dredged material
- Excavation of the bank to be undertaken more accurately increasing geotechnical stability therefore creating a safer working platform

Maintenance dredging will occur using a cutter suction dredge. The methods used will ensure that the Water Quality Objectives (WQO's) will be met. This will mainly involve monitoring the discharge of tailwaters into the Coomera River and ensuring that the pollutant / contaminant levels conform to a set of previously agreed upon criteria. This will ensure that environmental harm will be minimised.

Waste

The GCIMP requires appropriate water management to ensure litter and sewage disposal/refuelling activities from vessels is managed appropriately.

Possible impacts upon environmental values include possible waste spills and loss of containment of waste resulting in impacts to water, terrestrial and marine fauna, and human health. The GCIMP will offer appropriate vessel management and waste disposal facilities to ensure impacts are minimised and mitigated.

A Waste Management Plan has been prepared to inform appropriate waste management strategies for both the construction and operation of the GCIMP which will, as far as practicable, mitigate potential impacts on environmental values from waste contamination.

Air Quality

Predicted concentrations, from the development, of PM_{10}, carbon monoxide, nitrogen dioxide are still within the criteria. The likelihood of any impacts arising from these emissions is very low.

Predicted existing styrene concentrations exceed the amenity criterion at the nearest sensitive receptor reaching 134 $\mu g/m^3$ compared to the amenity criterion of 75$\mu g/m^3$. There is low likelihood of this being detected in ambient air by the average person, and it is not likely to cause nuisance, unless there is an especially sensitive individual living nearby. Worst case predicted styrene concentrations are well within the one week health criterion of 280 $\mu g/m^3$.

There is low likelihood of odour being detected. Given the prevailing marine industry land use of the area, odour, at these low levels, reaching commercial properties should not give rise to nuisance complaints.

Construction Measures

Throughout construction, a water cart will be used to damp haul routes, and during windy conditions, other exposed dry surfaces. Fabric wind-break / catch nets should be used at the edge of exposed areas.

Operational Measures

If odour complaints are received, an assessment should be undertaken to determine the major source(s) of odorous emissions, including fugitive sources. Where necessary, appropriate extraction and filter systems should be installed to reduce emissions.

Greenhouse Gas Emissions

The total emissions estimated for the development is 23,138 tCO_2e. Regular monitoring of emissions is recommended throughout the project to assess the effectiveness of emissions mitigation actions. The following actions are recommended for mitigation of GHG emissions for construction and embodied emissions:

- Where possible, use locally sourced materials to reduce emissions associated with transport;
- Ensure that waste is recycled/composted wherever possible;
- When importing fill source from nearby construction sites wherever possible to reduce transport related emissions;
- Plan construction works to avoid double handling of materials;
- Make use of recycled materials to reduce emissions associated with embodied energy
- Develop construction/transport plans to minimise the use of fuel during each construction stage. For example throttling down and switching off construction equipment when not in use;
- Assess the fuel efficiency of the construction plant/equipment prior to selection, and where practical, use equipment with the highest fuel efficiency which use lower GHG intensive fuel (e.g. gas, ethanol); and
- Regular maintenance of equipment to ensure optimum operations and fuel efficiency.

Noise and Vibration

The construction stages have been assessed and whilst there is no noise criteria for construction activities in Queensland, the Gold Coast Planning Scheme (GCPS, Part 7, Div 2, Ch 11) provides time limits for construction activities. The Noise and Vibration Report prepared by Hyder Consulting contained in Appendix 34 has incorporated construction activities being undertaken during these times.

It is recommended that noise and vibration monitoring be carried out at representative receiver locations on a periodic basis, but particularly during periods of intense or generally noisy construction activities that are near to residences. It is also recommended to undertake noise audits during non-standard construction hours, should the construction schedule be required to operate at these times, to confirm the actual impacts.

The noise impact assessment establishes that the operation of the development is likely to exceed the EPP Noise 2008 acoustic criteria and also the EcoAccess acoustic criteria for this project and has identified that noise control measures are required. These common noise control measures include:

- Selection of low noise emission plant and equipment;
- Design of floor plans for manufacture and maintenance sheds that provide an area inside for noisy works;
- Orientation of external doors so that they do not direct noise to noise sensitive receivers;
- Design and construction of proprietary acoustic enclosures and attenuators for significant mechanical plant.

The design of such noise attenuation treatment may reduce noise emission levels of specific plant items by approximately 5-10dB(A), which may be satisfactory to control noise emission to comply with the acoustic criteria for daytime and potentially evening time periods.

This report has recommended that industrial activities on the site should be limited to less noise sensitive periods, for example daytime and early evening as the level of noise mitigation for buildings and plant may not be practical.

Visual Amenity and Landscape Character

As detailed in the Visual Impact Assessment prepared by Planit Consulting contained in Appendix 36, the site is not significantly visible due to the existing

topography and vegetation of the area. As such, the GCIMP is unlikely to create any adverse impacts on visual amenity and landscape character.

Whilst the GCIMP will involve on site vegetation clearing in order to facilitate the delivery of the development, the lack of direct views into the site from various vantage points and the retention of a 40 metre natural vegetation buffer to Oakey Creek has meant that visual amenity impacts will be relatively minor to surrounding residences.

The landscape character of the GCIMP Masterplan presents a strong design character and sense of place. The proposed streetscaping has been designed for appropriate usage, and encourages pedestrian movement throughout the development. The plant selection proposed incorporates suitable form, scale, colour and species type to create a strong character and design which highlights key nodes to strengthen visual legibility. Hardscape elements such as bollards and balustrades have been utilised to draw design inspiration from traditional boat building techniques to further reinforce the marine character of the development.

It is considered that the high quality landscape design envisaged for the GCIMP masterplan creates an improved visual outcome than what currently exists on site.

Indigenous Cultural Heritage

While this area was undoubtedly significant as a source of food, medicine, tools etc. most of these activities do not survive to provide any archaeological trace.

The exception to this stricture is shell middens – the discarded food remains piled up in rubbish heaps. None have so far been found but as there is a trace of evidence that middens may once have existed in the study area. A monitoring brief will be recommended to follow up this possibility.

The possibility of deeply buried ACH evidence, in the form of middens and camp sites buried beneath the alluvium, further suggests that all construction workers should be clearly inducted about Aboriginal cultural heritage and thus enabled to call on relevant Traditional Owners for advice.

The Aboriginal Cultural Heritage Management Report prepared by Turnix, contained in Appendix 37, recommends that the Traditional Owners undertake monitoring of some of the earthmoving activities associated with the site.

Non-Indigenous Cultural Heritage

The site is not contained on the Cultural Heritage Register, and the development is not considered to have a negative impact upon Non-Indigenous Cultural Heritage.

Infrastructure

Traffic and Transport

As detailed in the Traffic and Transport Impact Assessment prepared by CRG contained in Appenix 21, the GCIMP is estimated to generate approximately 10,132 daily trips and up to 1,099 peak hour trips on the surrounding road network.

With regard to the State controlled road network, the Pacific Motorway, Foxwell Road and Days Road interchange as well as the Beattie Road / Service Road intersections will be at or near capacity by 2021 regardless of the proposed development and will require upgrading within the next 10 years. It is noted that the proposed development traffic will marginally increase the degree of saturation at each of the above intersections only marginally and will have a relatively minor impact upon their performance. It has been recommended that the Applicant be required to pay a contribution to this required upgrade work.

With regard to the Local Road Network, the Shipper Drive / Foxwell Road intersection, Waterway Drive / Beattie Road intersection, as well as the proposed access intersections in Shipper Drive, will operate satisfactorily for the foreseeable future with the proposed development traffic.

Sufficient car parking is able to be accommodated on site. Indented bus bays and bus shelters are recommended to be constructed on both sides of Shipper Drive adjacent to the subject site to accommodate additional passenger demands in this area resulting from the proposed development.

Electricity and Telecommunications

Energex has advised that the feeder CMA10A and CMA11A does not have enough capacity for the entire proposed development. Construction timing, staging and required load will be given to Energex to enable a new zone substation to be planned.

An advantage for the client is that the 11kV feeders CMA10A/CMA11A are located in close proximity to the proposed location. There are existing spare conduits available and the development site is not far from the two new zone substations. This being the case we believe that Energex would provide supply to the site from one of two new zone substations.

With regards to telecommunications, there are existing optical fibre cable and connection point in Shipper Drive. The usage of optical fibre or copper wire will be dependent on the federal government's new rule.

Water Supply

The Water Supply Capacity Assessment prepared by Hyder Consulting has shown that the GCIMP can meet the Allconnex Water Desired Standards of Service of potable water supply. Modelling has shown the DSS are generally met in the existing scenario for all planning horizons, with the exception of areas to the west of the Pacific Highway, around Runway Drive, to the south, along River Links Boulevard East, and to the north, along Cunningham Drive South and Jones Street which fail to meet the minimum 22m standard flow pressure in all planning horizons.

When the demands of the GCIMP are imposed on the system no detrimental effects are incurred in the surrounding water network. The GCIMP can connect to the existing 225mm diameter water main in Waterway Drive while continuing to meet Allconnex Water's DSS.

Wastewater

The proposed sewage from the project site is to be collected internally via a series of gravity sewer mains and pump stations with discharge rising mains. These are to then connect to the existing infrastructure associated with the alternative options for sewerage discharge.

The preferred option for the development is to utilize an onsite pump station and rising main along Shipper Drive to connect to the proposed alignment under the allotments to the north of the GCIMP which in turn connect to the Amity Way Gravity Line. All services will be aligned with existing roads and no easements will be required.

The construction of a rising main and pumping station will be required through the allotments to the north of Oakey Creek. It is anticipated that developers of these sites will be responsible for the construction of this rising main and pumping station. A connection to this proposed rising main will be made from the rising main that follows Shipper Drive that the developer will be responsible for.

Hazard and Risk

The Gold Coast Planning Scheme identifies natural hazard management areas for the project area. Other than flood, identified areas of, bushfire and landslide risk do not affect the project area and therefore require little or no consideration under SPP 1/03 Mitigating the Adverse Effects of Bushfire, Flood and Landslide.

Human activity and technological issues can also present hazards. A Hazard and Risk Assessment (HRA) has been undertaken for the project in accordance with the principles set out in AS / NZS / ISO 31000 2009 and AS / IEC 61508. The risks identified in the HRA are considered to be at most a medium risk level, which in the context of the HRA, means that these risks are considered to be adequately managed through existing and/or proposed management measures.

A Disaster Management Plan for the management of natural hazards and site specific emergencies will also be developed at the detailed design stage. Emergency Management Plans will also be in place to will determine day-to-day procedures and responsibilities for health and safety and emergency planning.

Social and Economic Considerations

It is estimated that the proposed GCIMP would generate approximately 2,250 annual full-time equivalent position (FTE) years during construction. The flow-on benefits of this employment would generate about 4,950 FTE postition years in Queensland, with 4,160 FTE position years generated within the Gold Coast Region.

The annual operating revenue of the proposed GCIMP is projected to be in the order of $754.4 million upon completion and is projected to provide approximately 2,700 FTE operational jobs on site. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 FTE positions in Queensland, of which 4,800 FTE positions would be generated within the Gold Coast Region, representing about 2% of current Gold Coast jobs.

It is considered that the development of the GCIMP would assist in the rebuilding of the marine industry on the Gold Coast, particularly given the high economic value of the marine industry to the Gold Coast through the training of skilled employees and export of products both domestically and internationally.

Significantly, the Gold Coast has demonstrated strong growth of population and resident workers within the area, which has outpaced the supply of local jobs. The proposed TAFE, which forms a key component of the GCIMP, would assist in assuring that the community has ready access to an appropriate skills-based

training facility, which would contribute to the commmunity's ability to access the proposed jobs to be generated.

The proposed retail and commercial services and facilities to be developed as part of the GCIMP are considered to be sufficient in servicing the needs of the marine industry.

Multi Criteria Analysis

Norling Consulting has utilised a Mutli-Criteria Analysis (MCA) to evaluate the benefits/disbenefits of the proposed GCIMP. MCA is a means of simplifying complex decision making tasks which involve numerous stakeholders, diverse problems and intangible outcomes (Proctor, 2001). The ability to place a monetary value on certain environmental and social matters remains extremely difficult, thus MCA is being utilised in this project as a suitable alternative which does not require specific dollar value inputs. Importantly, MCA is seen as a means to maintaining a well structured and transparent decision making process (Proctor, 2001).

Application of the MCA methodology results in the Status Quo option delivering the highest environmental score and the lowest social and economic scores, resulting in the lowest overall score by a significant margin. In contrast, Options 1 (Preferred Option) to Option 4 scored very highly in the economic criteria and well on the social criteria. With these options scoring only slightly less than the Status Quo on the environmental criteria, they achieved overall scores of more than double the Status Quo option.

Option 1, the Preferred Option achieved the highest social and economic scores to also achieve the highest overall score.

Recommendations

The principal objective of the GCIMP EIS has been the identification of environmental and related impacts that could occur as a result of the construction and operation of the GCIMP and the assessment of such impacts against relevant policies and legislative requirements. Environmental, social and economic impacts have been considered, and where appropriate, mitigation measures to avoid or minimise potential impacts have been recommended.

Environmentally Sustainable Development (ESD) principles have been integral to the Proponent's decision making processes in respect to the design and planning for the GCIMP. The Proponent is committed to implementing principles of ESD and enforcing the relevant Environmental Management Plans (EMPs) and Site

Based Management Plan (SBMP) during the construction and operational phases of the Project.

A summary of the Project's overall impacts, mitigation measures and key considerations has been presented as follows. This is further detailed in Section 7.0 of the EIS.

- Mitigation measure if implemented appropriately, could remove numerous project impacts, with the exception of various impacts associated with the construction of the marina. However, various mitigation measures are proposed to minimise disturbance to the Coomera River. These measures include undertaking excavation in small stages to confine turbidity in smaller areas for easier control and by utilising a long reach excavator and barge from the perimeter bund to create less turbidity;
- Loss of vegetation communities as a result of the development are proposed to be offset as detailed in the Offset Option Report prepared by Herron Todd White Earthtrade contained in Appendix 9.
- Through discussions with Department of Agriculture, Fisheries and Forestry (DAFF) and the Department of National Parks, Recreation, Sport and Racing (DNPRSR), on the proposed offsets it was identified that additional areas/options also be considered. The offset areas should be suitably tenured, possessing all or substantial areas of tidal fish habitats which shared a common boundary with a declared Fish Habitat Area (FHA). Appropriate tidal lands would then be formally added to the adjoining declared FHA. In these discussions the Baffle Creek declared FHA was identified as a priority location for expansion of the Queensland declared FHA Network. Options are to be further investigated and offset requirements will be resolved through the EIS process.
- Where direct offsets are not able to be obtained (e.g. seagrass communities), monetary contributions to research programs, boardwalks and educational signage can be provided through an agreement between Fisheries and the Proponent;
- The majority of environmental impacts will be short-term impacts associated with the construction phase of the GCIMP;
- The GCIMP presents an overall social benefit, through improved construction and operational employment opportunities and educational facilities provided by the project; and
- The GCIMP will present a vast economic improvement through employment opportunities and improved economic conditions for the locality and for the Marine Industry as a whole.

Having regard to the potential benefits and impacts of the Project, it is a recommendation of the EIS that the GCIMP project be approved subject to conditions pursuant to Section 39(1) of the *State Development and Public Works Organisation Act 1971* and Section 134 of the *Environmental Protection and Biodiversity Conservation Act 1999.*

Gold Coast International
marine precinct

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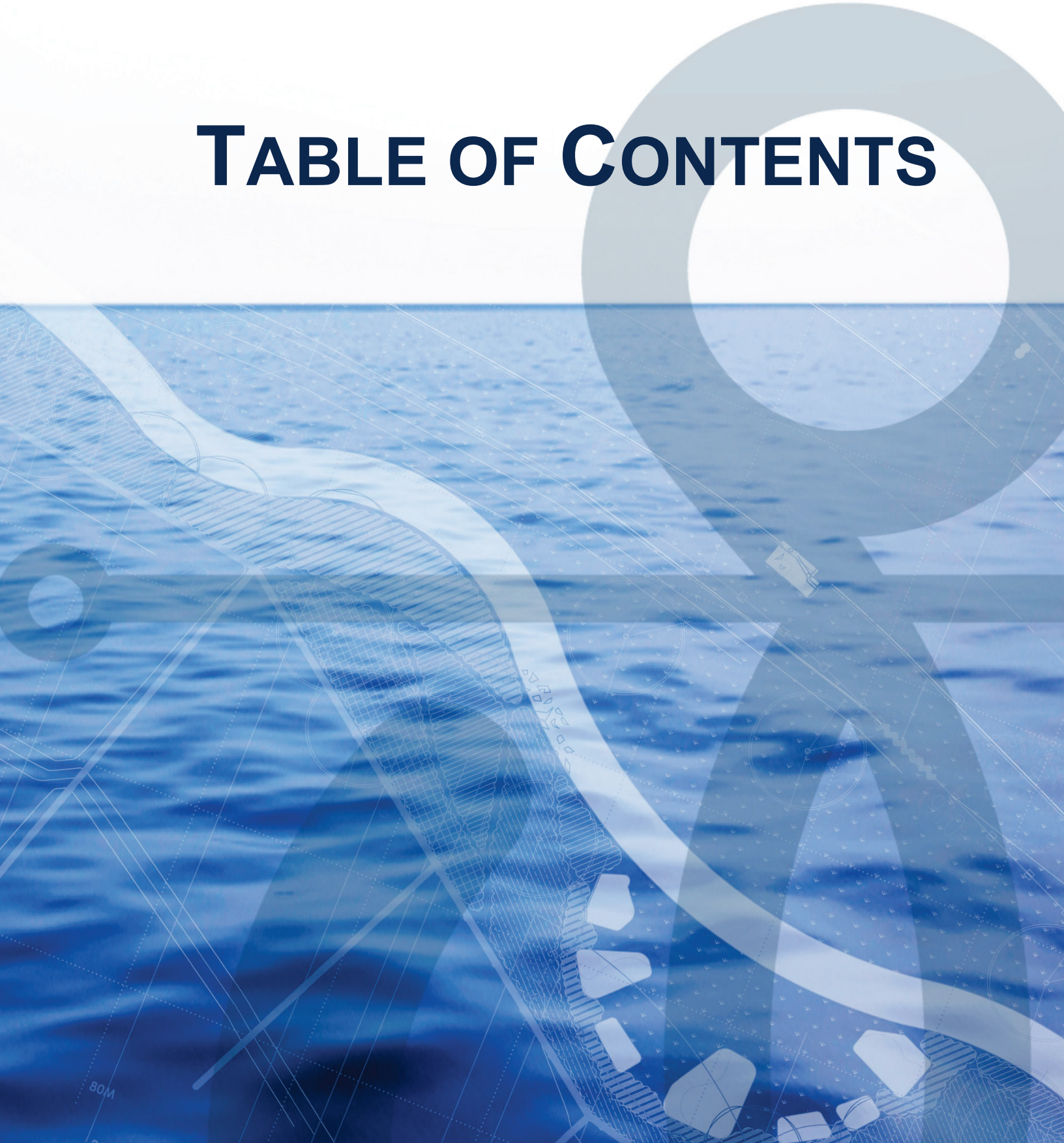

Gold Coast International Marine Precinct

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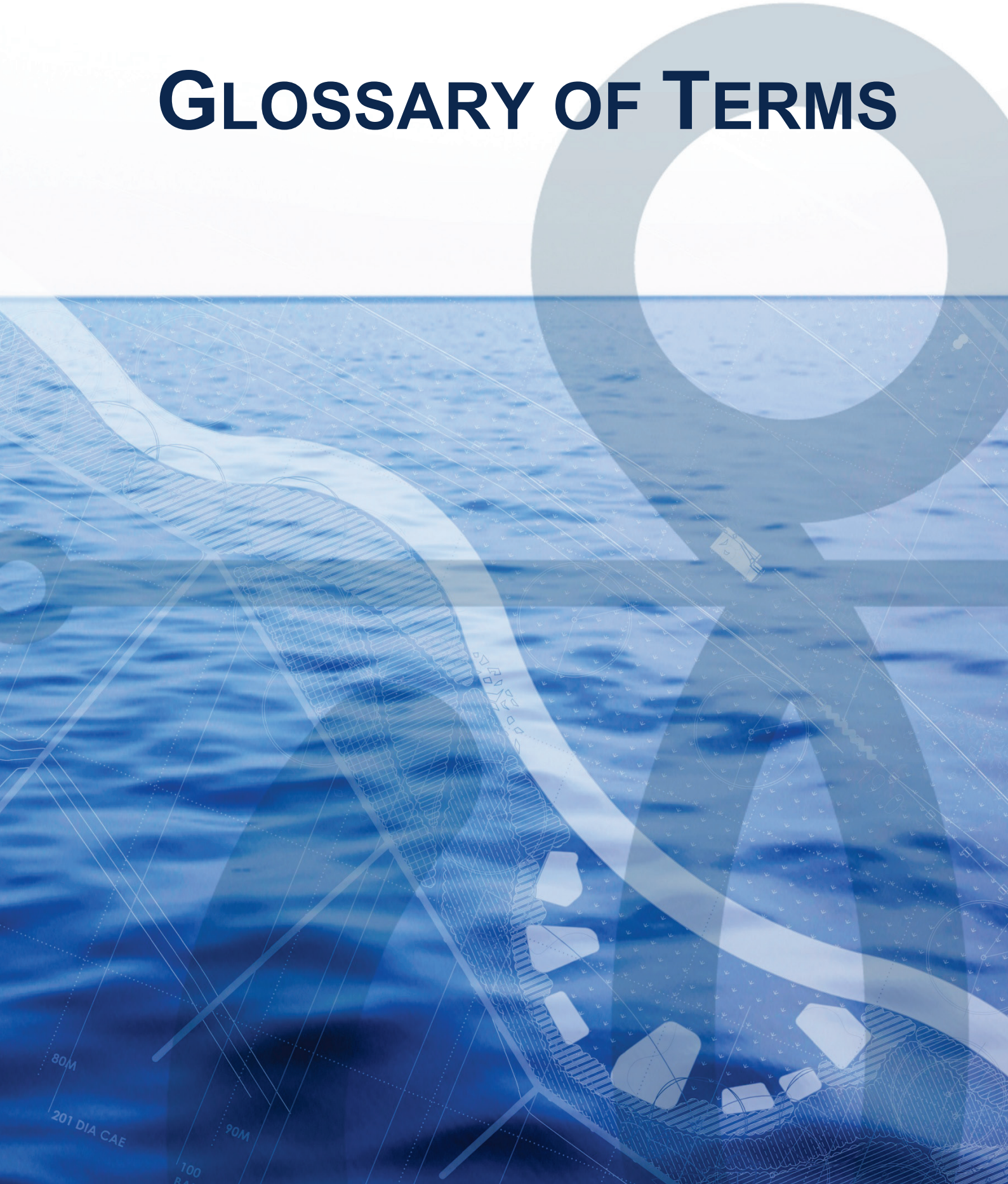
GLOSSARY OF TERMS



Glossary of Terms

A glossary or technical terms, acronyms and references should be provided.

Government Bodies

ANZECC	Australian and New Zealand Environment Conservation Council
BOM	Bureau of Meteorology
DSDIP	Department of State Development Infrastructure and Planning
DETE	Department of Education, Training and Employment
DAFF	Department of Agriculture, Fisheries and Forestry
DNRM	Department of Natural Resources and Mines
DEWS	Department of Energy and Water Supply
DSITIA	Department of Science, Information Technology, Innovation and the Arts
DNPRSR	Department of National Parks, Recreation, Sport and Racing
DTMR	Department of Transport and Main Roads
DEHP	Department of Environment and Heritage Protection
DEED	Department of Employment and Economic Development
GCCC	Gold Coast City Council
IPCC	Intergovernmental Panel on Climate Change
MSQ	Maritime Safety Queensland
QFRS	Queensland Fire and Rescue Service
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities

Acts, Legislation and Policy Documents

AWQG	*Australian Water Quality Guidelines 2000*
Building Act	*Building Act 1975*
CPM Act	*Coastal Protection and Management Act 1995*
DGSM Act	*Dangerous Goods Safety Management Act 2001*
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EPP	Environmental Protection Policy
EPP Noise	*Environmental Protection (Noise) Policy 2008*
EPP Waste	*Environmental Protection (Waste Management) Policy 2000*
EPP Water	*Environmental Protection (Water) Policy 2009*
EPR	*Environmental Protection Regulation 2008*
Fisheries Act	*Fisheries Act 1994*
FRS Act	*Fire and Rescue Service Act 1990*
IPA	*Integrated Planning Act 1997*
IPR	*Integrated Planning Regulation 1998*
Land Act	*Land Act 1994*
Marine Safety Act	*Transport Operations (Marine Safety) Act 1994*
MP Act	*Marine Parks Act 2004*
NC Act	*Nature Conservation Act 1992*
NCWR	*Nature Conservation Wildlife Regulation 1994*
QFA	*Queensland Fisheries Act 1994*
QFRSA	*Queensland Fire and Rescue Service Act 1990*
QGEOP	Queensland Government Environmental Offsets Policy
SDPWOA	*State Development and Public Works Organisation Act 1971*
SEQRP	*South East Queensland Regional Plan 2009-2031*
SPA	*Sustainable Planning Act 2009*
SPP2/02	State Planning Policy 2/02 – Planning and managing development involving Acid Sulfate Soils
SPP4/10	State Planning Policy 4/10 - Healthy Waterways
SPR	*Sustainable Planning Regulation 2009*
Supply Act	*Water Supply (Safety and Reliability) Act 2008*
TIA	*Transport Infrastructure Act 1994*
VMA	*Vegetation Management Act 1999*
Water Act	*Water Act 2000*

Other

AHD	Australian Height Datum
AMTD	Adopted Middle Thread Distance
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate Soils
ASSA	Acid Sulfate Soils Assessment
ASSMP	Acid Sulfate Soils Management Plan
CCIS	Climate Change Impact Statement
CFL	Courant-Friedrich-Levy
CG	Coordinator General
CG Report	report prepared by the CG evaluating the EIS, pursuant to section 35 of the SDPWOA
CLR	Contaminated Land Register
COPC	Contaminants of Potential Concern
CPI	Consumer Price Index
CPTED	Crime Prevention through Environmental Design
CRS	Chromium Reducible Sulfur
CSWMP	Conceptual Stormwater Management Plan
DEM	Digital Elevation Model
DEO	Desired Environmental Outcome
EC	Electrical Conductivity
ECL	East Coast Lows
EHMP	Healthy Waterway's Ecosystem Health Monitoring Program
EIA	Environmental Impact Assessment
EIL	Environmental Investigation Levels
EIS	Environmental Impact Statement
EHMP	Ecosystem Health Monitoring Program
EMP	Environmental Management Plan
EMR	Environmental Management Register
ENSO	El Nino - Southern Oscillation
ERA	Environmentally Relevant Activity
ESCP	Erosion Sediment Control Plan
ESD	Ecologically Sustainable Development
EV	Environmental Values
FADs	Fish Attracting Devices
FHA	Fish Habitat Area
GCIMP	Gold Coast International Marine Precinct
GFA	Gross Floor Area
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GPT	Gross Pollutant Trap

GWA	Ground Water Assessment
GWMP	Ground Water Management Plan
HAT	Highest Astronomical Tide
HIL	Health Investigation Levels
HRA	Hazard and Risk Assessment
HWP	South East Queensland Healthy Waterways Partnership
IAS	Initial Advice Statement
IDAS	Integrated Development Assessment System
IEQ	Indoor Environment Quality
IFD	Intensity Frequency Distribution
IPWEA	Institute of Public Works Engineering Australia
IRTC	Inter-Regional Transport Corridor
IUCN	International Union for the Conservation of Nature
LAP	Local Area Plan
LAT	Lowest Astronomical Tide
LUT	Land Use Theme
MBMP	Moreton Bay Marine Park
MCU	Material Change of Use
MHWS	Mean High Water Springs
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NAGD	National Assessment Guidelines for Dredging 2009
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NGER	National Greenhouse and Energy Reporting
NLSWE	Non-Linear Shallow Water Equations
NSL	Near Surface Level
OPW	Operational Works
OSMS	Open Space Management Statement
PASS	Potential Acid Sulphate Soils
PIA	Priority Infrastructure Area
PIC	Pacific Innovation Corridor
PIP	Priority Infrastructure Plan
PMAV	Property Map of Assessable Vegetation
QASSIT	Queensland Acid Sulfate Soils Investigation Team
QUDM	Queensland Urban Design Manual 2007
RMP	Risk Management Plan
ROL	Reconfiguration of a Lot
SBMP	Site Based Management Plan
SEQ	South East Queensland
SRES	Special Report on Emission Scenarios
SMP	Stormwater Management Plan
SMOF	Single Mode Optical Fibre
SQIDs	Stormwater Quality Improvement Devices
TAA	Titratable Actual Acidity
The Project	Gold Coast International Marine Precinct

The Proponent	Harbour Island Pty Ltd
TOD	Transit Oriented Development
TOR	Terms of Reference
TPA	Titratable Potential Acidity
TSA	Titratable Sulfidic Acidity
TSS	Total Suspended Solids
TVD	Total Variation Diminishing
USGS	United States Geological Survey
VMP	Vegetation Management Plan
WELS	Water Efficient Labelling and Standards
WQOs	Water Quality Objectives
WSAA	Water Services Association of Australia
WSUD	Water Sensitive Urban Design

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SECTION 1
INTRODUCTION

Gold Coast International Marine Precinct

Environmental Impact Statement - Section 1

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1.0 Introduction

The introduction should clearly explain the background and purpose of the EIS, to whom it is directed and should contain an overview of the structure of the document.

This Environmental Impact Statement (EIS) has been prepared for the Gold Coast International Marine Precinct (GCIMP) by Planit Consulting Pty Ltd, in accordance with the projects Terms of Reference (ToR).

The ToR were initially prepared by the Department of Infrastructure and Planning (DIP) on behalf of the Coordinator General (CG) in March 2009. The original ToR were superseded by a new ToR in December 2011 which was produced as the original "significant project" declaration of the GCIMP lapsed on 29 March 2011. The revised ToR contains various modifications in response to legislative changes and minor modifications to the original development proposal. A revised copy of the ToR is provided in Appendix 1 of the EIS.

The proposed project involves the development of an integrated industrial marina on the Coomera River on land located at 2, 54 and 110 Shipper Drive, Coomera. The suburb of Coomera is located on the Gold Coast within South East Queensland. Further detail pertaining to the site's location is provided in Section 1.3 below.

The site contains the following allotments:

- Lot 108 WD6404 (4.047ha)
- Lot 98 SP150731 (54.6608ha)
- Lot 146 SP150731 (4.8467ha)
- Part of Shipper Drive adjacent to Lot 98 on SP150731

This project addresses Queensland's demand pressures upon Marine Industry. As at July 2010, Queensland has approximately 240,179 registered recreational boats with continual growth rates contributing to the State being Australia's leading recreational boating centre. Furthermore, the Gold Coast is experiencing high growth and demand for facilities for the refit, manufacture and maintenance of recreational and commercial vessels inclusive of super yachts.

The existing Gold Coast Marine Precinct (GCMP) is a major marine industrial centre dedicated to manufacture, servicing/repairs and refits of recreational boats. Encompassing a total area of approximately 250 hectares (inclusive of the undeveloped GCIMP site), it is located on the Coomera River with direct water access to Moreton Bay and the Pacific Ocean. At present, approximately 60

hectares of this precinct has been developed and an estimated $120 million invested by the private sector.

This proposal for the Gold Coast International Marine Precinct, was declared by the Coordinator-General to be a “significant project” under Section 26 of the *Queensland State Development and Public Works Organisation Act 1971* (SDPWO Act) on the 18 April 2008. The “significant project” declaration thereby initiated the statutory Environmental Impact Assessment (EIA) process as per Part 4 of the SDPWO Act which requires the preparation of this Environmental Impact Statement (EIS).

The project was re-declared as a "significant project" under Section 26 of the SDPWO Act on 7 July 2011 as the EIS was not completed within the two year statutory timeframe.

This submission is made to the Department of Employment, Economic Development and Innovation, the responsible authority for the Environmental Impact Assessment Process, acting on behalf of the Coordinator General.

This EIS document has been compiled by the project team and is structured in accordance with the Terms of Reference (ToR) document released by the Queensland Government in December 2011. Please note that sections and headings of the EIS document generally correspond with the ToR document for ease of reference and assessment. Details pertaining to the location of all technical reports appended to the EIS is contained within the EIS Guide.

1.1 Proponent

This section should include details of the proponent, including information regarding joint venture partners, business structure, record of and expertise in similar projects it has carried out elsewhere.

The Gold Coast International Marine Precinct Project is to be developed by Harbour Island Pty Ltd (Harbour Island), that being a joint venture partnership between Maritimo Offshore Pty Ltd (Maritimo) and Property Solutions Group.

Maritimo Offshore Pty Ltd (Maritimo)

Maritimo is a well recognised brand and company that manufactures large cruise boats and contributes significantly to the local marine industry within the Gold Coast. Maritimo currently operates from two sites, one at the existing GCMP, and another site within Hope Island. The owner of Maritimo is locally renowned Bill Barry-Cotter.

Although being a relatively new company, Maritimo has achieved many successes. Maritimo currently has 90 directly employed staff and the 2010-2011 financial year saw the production of 30 vessels attracting sales of approximately $25 million. These figures do not take into account suppliers and contractors.

In 2009, Maritimo acquired the business 'Mustang Cruisers' after it went into receivership. As such, Maritimo now manufactures these to extend its range of products.

Maritimo in response to current expansion and demand, forecasts continual strong growth in future, and thereby requires further facilities and site area to meet such consumer demands. As the project site owner, Maritimo has been involved throughout the concept design process of the project to ensure production facilities will meet the needs of the manufacturing process, and service industries integrate with the production process.

Maritimo is an award winning Queensland Company that has won acclaim both nationally and overseas. Maritimo has established a comprehensive national and international dealer network boasting authorised dealers in Queensland, New South Wales, Western Australia, Tasmania, Victoria, Kuwait, Italy, France, Puerto Rico, New Zealand, South Africa and the United States, where it has appointed nine (9) authorised dealers.

Expansion of the award- winning Maritimo production unit will occupy approximately five hectares of the proposed development. The remainder of the site is to include a range of facilities and factory units. The marina will be a full working facility complete with travel lift, slipways, marine mechanics/engineers and shipwrights to service marina tenants and cruising vessels. Further detail pertaining to the proposed project is contained in section 1.2 below.

Property Solutions Group

Property Solutions Group specialises in Property Development and Investment and brings expertise in industrial property development and marina ownership and design to the GCIMP Project.

Property Solutions Group is renowned for its intense development activity within Fortitude Valley and inner northside sections of Brisbane. Its projects include industrial, commercial, retail and marina developments.

Specifically, Property Solutions Group have been a key player in the development of industrial estates in the Yatala Enterprise Area through land subdivisions and both freehold and community title 'Design and Construct' projects within new estates.

With regards to marine development, Property Solutions Group collaboratively own and operate Tin Can Bay, Coffs Harbour and Pacific Harbour Marinas. The company aims to own and operate these marinas and to expand to 500-1000 berths in its control in the next couple of years.

All the company's marinas have managers and staff in place to run autonomously and efficiently.

The partnership between Maritimo and Property Solutions Group was formed specifically to develop the GCIMP at Coomera. This collaboration will ensure the delivery of an integrated industrial marine precinct of an international standard as a result of the companies' respective expertise within the joint venture partnership.

1.2 Project Description

A brief description of the key elements of the Project should be provided and illustrated. Detailed descriptions of the Project should follow in Section 3.

The GCIMP seeks to extend the existing GCMP and show case through design, a purpose built marine industry complex of international standard.

The GCIMP Master Plan prepared by Push Architects contained in Appendix 2, embodies best practice designs for a working industrial marina, supply chain management, management and control of manufacturing processes. Furthermore, the master plan will open new opportunities for research and design, workforce training and continual education within the Coomera Area.

Specific details pertaining to the project have been summarised as follows.

- a 28.9 hectare marine industrial zone, inclusive of ship-life facilities, boat and yacht manufacturers, repairers and associated businesses;
- a dry boat stacked storage facility with gantry crane access for approximately 290 vessels;
- a 4.5 hectare internal marina incorporating approximately 110 berths, providing a calm water environment for the launch and retrieval of vessels and for the on-water display of vessels by manufacturers and retailers onsite;
- an external marina within the Coomera River incorporating 280 multiple sized berths constructed through a 7 hectare widening of the Coomera River;
- a 9.3 hectare mixed use precinct comprising sales, showrooms, display of marine parts, fittings and fixtures, corporate office space, small scale light industry and services such as a yacht club, restaurants and retail outlets; and
- an educational establishment (i.e. TAFE college) comprising a 3,000m^2 Centre of Excellence and a 1,500m^2 workshop for marine industry training;

Approximately 42 hectares of the site will be developed for marine industry. The remaining area includes a 40 metre naturally vegetated setback along Oakey Creek and other public access facilities. A public access pedestrian zone will be constructed along the riverfront, providing a landscaped promenade alongside the marina.

The proposed development is generally reflective of the site's Marine Industry designation within the Gold Coast City Council Planning Scheme

A more detailed description of the proposed project is provided in Section 3 of this EIS report.

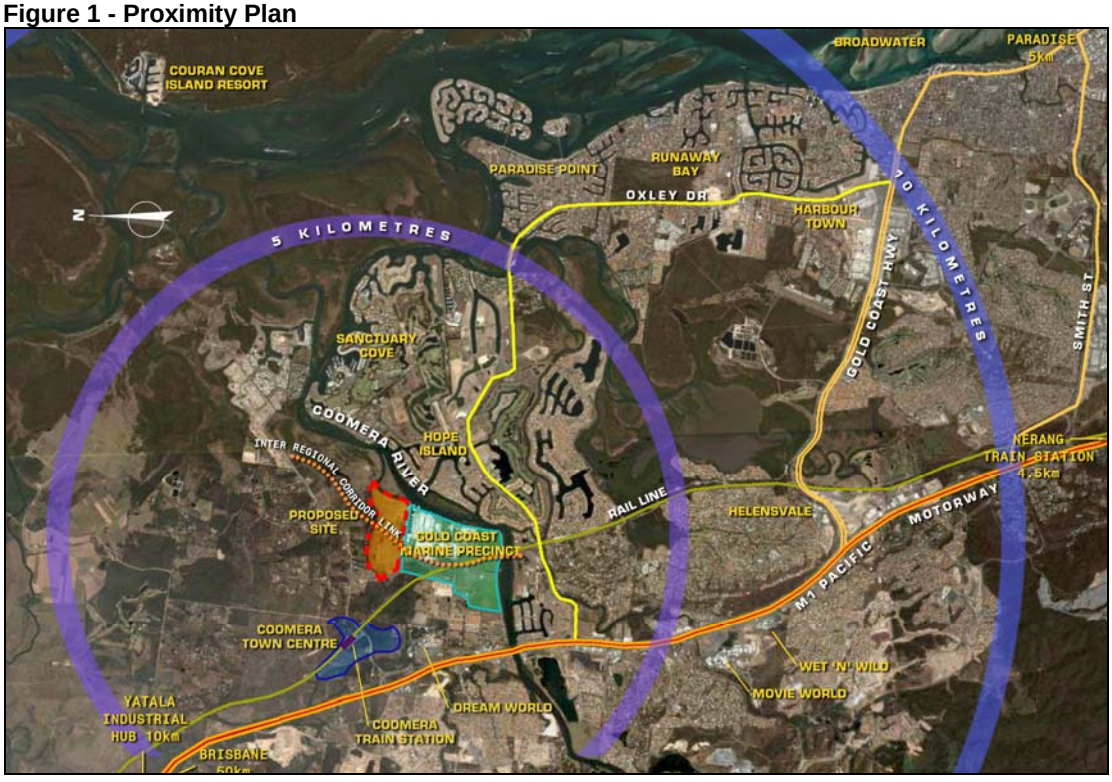
1.3 Project Context

The EIS should discuss the Project in a local and regional context, including providing a summary of marine industry developments within the Project region and discuss the strategic directions of the marine industry.

The GCIMP site is located on the Gold Coast within South East Queensland. The Site is situated within the suburb of Coomera, which is a major new urban area in the northern Gold Coast and within the Gold Coast – Brisbane growth corridor.

The site is located on the Coomera River and is approximately 3km upstream from the Moreton Bay Marine Park, 7km from the Southern Broadwater and a further 9km to the Pacific Ocean. The site is approximately 20km north of Surfers Paradise. A proximity plan prepared by Push Architects has been provided below.

Figure 1 - Proximity Plan



As previously discussed, the subject site comprises the following allotments:

- Lot 108 WD6404 (4.047ha)
- Lot 98 SP150731 (54.6608ha)
- Lot 146 SP150731 (4.8467ha)
- Part of Shipper Drive adjacent to Lot 98 on SP150731

Historically, Lot 108 on WD6404 formed part of original Portion 71 on W3150, Parish of Coomera. Portion 71 covered an area of 60.7 ha. The original Deed of Grant (10250065), issued in June 1875 to Angus Bell over Portion 71 under clause 71 of the *Crown Land Alienation Act 1868*, was a grant of an exclusive interest. Therefore the extinguishing effect of the deed of grant can be relied upon and Native Title has been extinguished over the whole of original portion 71.

Since this time, two (2) applications have been lodged with DNRM to acquire:

1. Reserve for Park and Recreation – R 1843 (Lot 108 on WD6404)
2. Part of Shipper Drive adjacent to Lot 98 on SP150731

The proponent requests that the issue of ownership of this Crown land be resolved as part of the EIS process.

Surrounding Marine Industry Development

The development of marine precincts within Queensland is becoming more prevalent as the State's climatic conditions encourage outdoor activities inclusive of boating and yachting. The largest marine precincts in Queensland are located at the Gold Coast, Brisbane, Mackay/Whitsundays and Cairns.

Within the South East Queensland Region, the capital city of Brisbane boasts a vibrant marine industry sector. Marine industry in Brisbane is highly clustered at the Brisbane Marine Industry Park in Hemmant and the Rivergate Marine and Shipyard in Murrarie, all located within the bounds of the Australia Trade Coast. Such facilities provide a variety of services to the marine industries inclusive of maintenance, refit, manufacture and berthing of ships, boats and superyachts (DTRDI, 2009).

Strategically, the Queensland Government through its Smart Industry Policy, supports the marine industry sector to provide services necessary to retain its globally competitive status and to facilitate marine development strategies in Cairns and Mackay. Furthermore, the Queensland Government seeks to facilitate the following:

- Improved marine infrastructure;
- Transparent regulatory processes;
- Improved industry capability;

- Domestic and export market development;
- Emerging technologies;
- Cluster development;
- Skills development and training; and
- Implementation of the Queensland Superyacht Strategy 2008-2013.

(DTRDI, 2009)

In this regard, this project is considered to facilitate the achievement of these Queensland Government strategic goals.

Further discussion regarding the contextual location of the GCIMP is presented is Section 3.3 of this EIS report.

1.4 The Environmental Impact Assessment Process

EIS Methodology

This section should provide a description of the EIS process steps, timing and decisions to be made for relevant stages of the project. This section should also indicate how the consultation process would integrate with the other components of the impact assessment, including the stages, timing and mechanisms for public input and participation. The information in this section is required to ensure:

- that relevant legislation is addressed;
- readers are informed of the process to be followed; and
- that stakeholders are aware of any opportunities for input and participation.

The GCIMP project requires approvals from the Australian Government and the Queensland State Government. As previously mentioned, the proposal was referred to the Australian Government Minister for the Environment, Heritage and the Arts in accordance with the *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Subsequently the project was declared to be a 'controlled action' under Section 75 of the *EPBC Act* on 27 April 2008. The controlling provisions for this proposal are Wetlands of international significance; Listed threatened species and communities; and Listed migratory species.

On the 18 April 2008 the project was declared a 'significant project' under Section 26 of the *Queensland State Development and Public Works Organisation Act 1971* (*SDPWO Act*).

The initial 'significant project' declaration for the GCIMP lapsed on 29 March 2011 as the EIS was not submitted within the two year period. As such, the project was re-declared as a 'significant project' on 7 July 2011 and a new Terms of Reference was released in December 2011.

The Department of Employment, Economic Development and Innovation (DEEDI) is responsible for managing the Environmental Impact Assessment process on behalf of the Coordinator-General.

The impact assessment process under the SDPWO Act is subject of a bilateral agreement between the Queensland and the Australian Governments in relation to environmental assessment under the EPBC Act. It was decided by the Australian Government that the assessment of the Project would be undertaken under the terms of the bilateral agreement.

The assessment was to be undertaken in accordance with Schedule 1 of the bilateral agreement. This involves, amongst other things, the provision of enough information about the proposal and its impacts to allow the relevant authority to make an informed decision regarding the approval of the action under the EPBC Act. This also includes the provision of sufficient information regarding the direct and indirect impacts of the action. The following approvals and legislation were required:

- Controlled Action under the EPBC Act;
- Significant project under the SDPWO Act;
- Development Permits and Preliminary Approvals (including s242 Varying the Affect of the Planning Scheme) under the *Sustainable Planning Act 2009;*
- Damage to Marine Plants under the *Queensland Fisheries Act 1994;*
- Works within a Coastal Management District under the *Queensland Coastal Protection and Management Act 1995;*
- Activities involving assessment against the Queensland Coastal Plan;
- Marine Vegetation and Development in or near declared Fish Habitat Areas under the *Fisheries Act 1994* and *Fisheries Regulation 1995;*
- Operation of a Marina and Industrial Development classed as Environmentally Relevant Activities (ERA's) under the *Environmental Protection Act 1994;*
- Provision of protection of native animals, plants and ecosystems which have been classified as threatened under the *Nature Conservation Act 1992;*
- Matters of Cultural Significance under the *Aboriginal Cultural Heritage Act 2003;*
- Matters of State Significant Vegetation under the *Vegetation Management Act 1999*; and
- Taking or Interfering with Water under the *Water Act 2000.*

Use of the Bilateral Agreement between the Australian Government and the Queensland State Government and the accredited process for the SDPWO Act, allows for the use a single assessment (EIS) to inform the numerous approval agencies of the proposed works and associated environmental impact.

Opportunities for consultation and public input have been provided within the Community Consultation Report prepared by Planit Consulting contained in Appendix 4. This report details that the consultation / public input phase will be delivered through three stages. The first stage was undertaken up until the lodgement of the EIS. This represented the most sizable portion of consultation, beginning in 2008 and continuing whilst studies and technical reports were being undertaken for the EIS.

The second consultation / public input phase will occur when the EIS is publicly notified. The third and final phase will include consultation during the construction and operational phases of the GCIMP.

It is considered that through this community consultation process, the community and relevant stakeholders will be given numerous opportunities to participate and provide input into the project. Please refer to the Community Consultation Report contained in Appendix 4 for more detail.

Objectives of the EIS

This section should provide a statement of the objectives of the EIS process. The structure of the EIS can then be outlined as an explanation of how the EIS will meet its objectives.

The role of the EIS in providing information for the formulation of EMPs should be discussed.

The purpose of this EIS is to identify and assess potential environmental, social and economic impacts of the GCIMP project and, where possible, to identify how adverse impacts would be avoided or mitigated. Direct, indirect and cumulative impacts of the GCIMP have been fully examined and addressed, where practical. The GCIMP EIS contains sufficient technical information for an informed decision on the potential impacts of the project. This EIS document has included:

- a description of the relevant aspects of the existing social, economic, natural and built environment;
- a description of the GCIMP proposal and means of achieving the development objectives;
- definition and analysis of the likely impacts of the development on the environment, including comprehensive description of the data used for providing baseline information to predict impacts of the development and associated activities;
- a framework against which government decision-makers can consider the environmental aspects of the proposal and set conditions for approval to ensure environmentally sound development;
- a consolidated list of measures proposed to mitigate adverse effects
- recommendations on the need for and contents of any environmental management plans (EMPs) and/or operational plans to mitigate adverse effects.

This main EIS report is supported by appendices containing relevant data, technical reports, assessments and management plans and other sources relevant to the EIS analysis. In preparing the EIS, predictions of environmental impacts have been based on scientifically supported studies and technical data. These have been detailed in the relevant technical report documents contained in the Appendices to the EIS. The methodology for technical reports and assessments have also been described within the relevant Appendices.

Each technical report has provided detail pertaining to the scientific reliability and statistical validity of predictions where relevant. Furthermore, impacts that cannot be quantified have been qualified and described.

Where relevant, each technical report has specified compliance with legislation, policies, standards, community acceptance and risk minimisation techniques adopted. Various alternatives have been discussed in detail where relevant, and reasons have been provided as to the preference of the GCIMP Master Plan option.

Based on the above information the objectives of this EIS are summarized as follows:

- to provide information on the GCIMP proposal and the development process to the community and decision makers;
- to comprehensively identify, describe and evaluate all relevant issues and aspects associated with the proposal
- to evaluate the proposal with respect to appropriate policies, such as the South East Queensland Regional Plan and relevant State Planning Policies
- to provide a detailed description of the relevant aspects of the existing social, economic, natural and built environment;
- to identify all potential environmental, social and economic impacts of the proposal, and recommend design and operational measures required to minimise and manage adverse impacts and enhance benefits;
- to describe the development proposal and detail the way in which development objectives will be achieved;
- to consult with the community and relevant stakeholders in the process of indentifying, assessing and responding to the impacts of the proposed development;
- to identify all necessary licences, planning and environmental approvals including approval requirements pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), *Sustainable Planning Act 2009*, *Environmental Protection Act 1994*, *Fisheries Act 1994*, *Nature Conservation Act 1992, Coastal Management and Protection Act 1995, Aboriginal and Cultural Heritage Act 2003* and other legislation and the Gold Coast Planning Scheme 2003;
- To provide an input to the decision-making process, assisting with the determination of whether to accept or modify the proposal, approve it with conditions or carry out further studies.

In assessing the GCIMP project as a whole, a Multi Criteria Analysis (MCA) has been undertaken by Norling Consulting in their Social and Economic Impact Assessment contained in Appendix 10. This MCA has provided a three tiered assessment of the project against social, environmental and economic criteria.

Public Consultation Process

An appropriate public consultation program is an important component of the EIS process. This section should outline the methodology that will be adopted to:

- Identify Stakeholders and how their involvement in the EIS process will be facilitated;
- Identify the process conducted to date and future consultation strategies and programs, including during the operational phase of the Project;
- Indicate how consultation involvement and outcomes will be integrated into the EIS process and future site activities, including opportunities for engagement and provision for feedback and action if necessary.

The public consultation program should provide opportunities for community involvement and education. It may include interviews with individuals, public communication activities, interest group meetings, production of regular summary information and updates, and other consultation mechanisms to encourage and facilitate active public consultation.

The public consultation process should address issues from project planning through commissioning and project operations. A Consultation Plan should be prepared during the initial phase of the EIS process. This should identify:

- types of consultation activities to be undertaken;
- consultation timing;
- target stakeholders and community representatives;
- integration with other EIS activities and project development processes;
- communication protocols; and
- reporting and feedback arrangements.

A list of the Stakeholders consulted during the program should be provided, as well as any meetings held, presentations made and any other consultation undertaken for the EIS process.

An extensive and appropriate public consultation process has been undertaken as part of the GCIMP project. Numerous opportunities were provided for community involvement and awareness of the proposed project through the use of numerous consultation methods. It is put forward that the optimum timing of community consultation for the proposed project should continue from the beginning of projects planning stages and be maintained until the operational phase of the GCIMP.

Planit Consulting Pty Ltd has undertaken the first stage of the community consultation process and have prepared a Community Consultation Report contained in Appendix 4. In this regard, Planit Consulting Pty Ltd have acted as an independent consultant of the project's proponent during the consultation process.

As previously discussed, the consultation program is delivered through three stages. The first phase has already been undertaken, and involves consultation which took place up until the lodgement of the EIS. This is considered to be the most sizable proportion of consultation which will be undertaken in relation to the proposed development. This consultation period began in 2008 and has continued while studies have been undertaken in relation to the preparation of the EIS.

The second phase of the consultation will involve the formal public notification of the EIS. The final phase of consultation will occur during the construction and operational phases of the project.

In determining the community consultation process to be undertaken, it was important to provide definitions of key terms relevant to the consultation program. The notion of 'the community' as a social construct is a tern relatively difficult to define. In this regard, the following definitions are presented as being widely accepted viewpoints when considering the defining of the social construct of the community.

In the first instance Wendy Sarkissian puts forward the following in explaining the meaning of community:

> *"Community is a practical expression of our commonly owned goods, including the infrastructure in our streets, the services we depend on, our communications and exchanges and the ways we actively build the world around us. A community is any group that shares a location, interests or practices, defined by patterns of interaction among individuals, perceptions of commonality or common interest and/or geography."*
>
> (Sarkissian W., N. Hofer, Y. Shore, S. Vajda & C. Wilkinson 2009)

An alternative understanding of the social construct of the community is held by Patsy Healey in noting:

> *"Sometimes the word 'community' is used merely as a synonym for 'the people who live in an area'. But the metaphor carries more meaning than this. It brings with if firstly the image of an integrated place-based social world…Secondly, it carries connotations of community in opposition to business, or government."*
>
> (Healey, P. 2006)

The approach which has been adopted to guide the community consultation program of this project reflects a combination of both abovementioned definitions.

The project's community consultation has been developed to gain feedback not only from specific identified stakeholders, but also to give the general resident and business community opportunities to have input into the project.

Community Consultation Process

Following the release of the draft Terms of Reference, Planit Consulting liaised with the proponent and the Queensland Government Department of Employment, Economic Development and Innovation (DEEDI), previously the Department of Tourism, Regional Development and Industry (DTRDI).

An initial Community Consultation Plan was developed with the intention that the document would guide the consultation program for the GCIMP project. At this point in time, Planit Consulting Pty Ltd distributed the draft consultation plan to Jacquie Edwards of DTRDI for comment and feedback. Comment was provided in relation to two key aspects of the community consultation plan, first relating to consistency of contact information being given to stakeholders and second relating to the development of a project website. These two outcomes were both taken into account and are reflected in the consultation which has occurred for the project.

This Community Consultation Plan was the basis of consultation objectives, tasks and timelines of the implemented consultation strategy.

Community Consultation Objectives

The objectives of the community consultation were to:

- Facilitate a high level of public awareness and understanding of the proposal;
- Identify relevant stakeholders to obtain varying needs and values;
- Incorporate public involvement into the proposed development;
- Deliver a meaningful, fair and equitable consultation process;
- Provide numerous opportunities for all members of the community to provide input;
- Gain public input regarding issues and concerns to establish mitigation methods;
- Build significant relationships with the community and stakeholders through the facilitation of the EIS process;
- Establish a preferred concept plan;
- Inform of project study outcomes; and
- Establish how key community issues will be identified and considered during the EIS process.

In relation to the abovementioned consultation objectives, it is presented that the objectives should continue to guide the project's consultation program through the operational phase of the project's development.

Consultation Phases

As previously mentioned, the consultation program will be delivered through three stages. The first phase started in 2008, and has already been completed. This represents the most sizable portion of the consultation process. The second consultation phase involves the formal public notification period of the EIS once the document is officially submitted for assessment. The final consultation phase includes consultation undertaken during construction and operational phases of the GCIMP project.

From an information processing and delivery perspective, it is expected that the level of detail being provided to stakeholders will continue to grow as studies and technical investigations relating to the project are completed. The longevity of the community consultation program has ensured that project updates have been continually provided to interested parties.

Background to the Community

A definition and discussion pertaining to the meaning of 'community' has been previously provided. In doing so, two key elements were identified as being central in establishing relevant project stakeholders. The first being identification of stakeholders by the project team, and the second being providing the general public with opportunities to be informed and provide feedback on the project.

In addressing the first avenue, the following methods were used by the project's community consultation team to identify and classify stakeholders:

- A qualitative assessment of potential social, economic and environmental impacts associated with the proposal;
- Development of stakeholder segmentation via location and interest; and
- Allocation of stakeholders into groups according to location, values and opinions.

While the above means were used to identify possible interested parties, the consultation plan included activities which would insure parties not specifically defined as stakeholder would have opportunities to provide feedback in relation to the proposed project. The following subsections will attempt to detail the stakeholders and groups consulted for the GCIMP project.

Local/Adjoining Community

The GCIMP is proposed to be developed on a large land holding located in the suburb of Coomera. The immediate surrounding suburbs including Upper Coomera, Oxenford, Santa Barbara are located with close proximity to the subject site and are all located on the Coomera River. Local residents within Coomera and the abovementioned surrounding suburbs are likely to have an interest in the

proposed project from an employment, recreation, amenity and construction impact perspective. It is likely that residents within the broader context of the Gold Coast will have an interest in the commercial and employment value of the proposed development and the longevity of marine industries on the Gold Coast.

Business Community

There are a number of business which operate from the existing developed GCMP, as well as business in the Coomera locality which may be interested in or affected by the proposed development. In this regard, business stakeholders have been identified as being those that use the Marine Precinct and surrounds for business activities inclusive of (but not limited to):

- Marine industry;
- Supporting businesses (cafés, restaurants etc);
- Coomera Chamber of Commerce;
- Marine GC;
- Marine Queensland;
- Marina Industries Associate of Australia;
- Developers; and
- Businesses located within Coomera.

Community Interest Groups

Inclusive of the local residents listed in the earlier section of this report, a number of community interest groups are likely to have an interest in the GCIMP project mainly from an environmental and social viewpoint. These groups include:

- Fishing clubs;
- Watersports clubs;
- Hinterland Model Flying Club;
- Coomera Scout group;
- Lions Club of Helensvale;
- Rotary Club of Coomera;
- Yachting Queensland;
- Boat owners & boating groups;
- Recreational groups;
- Oxenford Coomera Community Youth Centre;
- Coomera River Catchment Group;
- Gold Coast Hinterland Environmental Council Association Inc;
- South East Queensland Water Catchment Group; and
- Sunfish QLD Inc.

Other Community Stakeholders

In addition to local residents, business and interest groups identified above, there were also a number of additional key stakeholders with an expected interest in the project. These include:

- Coomera Anglican College;
- Coomera Primary School;
- Saint Stephen's College;
- Upper Coomera State School;
- Kombumerri Aboriginal Corporation for Culture/ Yugambeh Museum, Language & Heritage Research Centre.

Project Partners and Government Agencies

There were a number of other government agencies and authorities, at a local, state and federal level, who have an interest in the GCIMP proposed development.

The project partners and government agencies listed below have an interest in the project either directly through the statutory approval process or from a more general perspective in relation to the representation of constitutes or specific department interests. The project partners and government agency stakeholders include:

- Gold Coast City Council;
- Councillor Grant Pforr – Division 3 Gold Coast City Council;
- Queensland Government – Department of Transport and Main Roads (DTMR);
- TAFE Queensland (TAFE);
- Queensland Government – Department of Education, Training and Employment (DETE);
- Queensland Government – Department of State Development, Infrastructure and Planning (DSDIP);
- Queensland Government – Department of Employment, Economic Development and Innovation (DEEDI);
- Queensland Government – Department of Communities, Child Safety and Disability Services (DCCSDS);
- Queensland Government – Department of Community Safety (DCS);
- Queensland Government – Department of Environment and Resource Management (DERM);
- Queensland Police Service (QPS);
- Queensland Government – Department of Housing and Public Works (DHPW);
- Margaret Keech MP – Queensland State Member for Albert;
- Michael Crandon MP – Queensland State Member for Coomera;
- Commonwealth Government - Department of Infrastructure and Transport (DIT);

- Commonwealth Government - Department of Sustainability, Environment, Water, Population and Communities (SEWPAC); and
- Stuart Robert MP – Federal Member for Fadden.

Traditional Owners

Consultation with traditional owners was not undertaken through this project consultation program. Rather, a specialist firm was engaged to undertake both indigenous and non-indigenous cultural heritage assessment for the project. The Indigenous and Non-Indigenous Cultural Heritage Assessments and Management Plan are included in Appendix 37.

Consultation Report Summary

An extensive community consultation program was undertaken between June 2008 and the lodgement of the Environmental Impact Statement with the Coordinator General, which has been detailed throughout this report. A variety of communication activities and tools were utilised to seek broad community input regarding the proposed Gold Coast International Marine Precinct.

Specific communication activities undertaken include onsite information sessions, and one-on-one consultation at Boat Shows and local railway stations. While these specific activities were being undertaken informal consultation techniques were employed by developing and distributing surveys, project fact sheets and the development of a detailed project website.

In this regard, stakeholders had the ability to provide project feedback through a number of means including by phone, the project mailing address, the project email address or through the project website's online contract form.

While it is envisaged that the community consultation program will continue beyond the submission of the EIS into operational phases of the project, at the close of this stage of the consultation program a number of outcomes and issues have been highlighted by varying stakeholders. All issues and outcomes, positive and adverse, which have been brought forward by project stakeholders have been addressed in the relevant technical sections of the EIS.

In order to ensure the community consultation program was delivered effectively and in line with the predetermined consultation objectives, the consultation program was continually monitored and refined, where necessary.

The Community Consultation Report prepared by Planit Consulting is presented as Appendix 4 to the EIS.

Submissions

Readers should be informed when submissions will be taken into account in the decision-making process. The EIS should inform the reader how to make submissions and what form the submissions should take.

The EIS will be advertised in relevant national, state and local newspapers. Over a 45 day public consultation period the public and private sector may make written comments to the Coordinator General (CG).

The EIS will be forwarded to relevant Government agencies and made available to the wider community by:

- placement of paper and CD version of the EIS in publicly accessible locations; and
- access to electronic copies of the EIS on the project website.

Written submissions must be forwarded to the CG within the 45 day allocated timeframe. The CG will review the submissions, and if requested by the CG the proponent is required to address any specific issues which are not identified in the EIS but which are identified during the EIS process in the format of a Supplementary EIS.

1.5 Project Approvals

Relevant Legislation and Policy Requirements

This section should explain the legislation and policies controlling the approvals process.

Reference should be made to the *Sustainable Planning Act 2009* and other relevant Queensland laws particularly the *Environmental Protection Act 1994*, *Coastal Protection and Management Act 1995*, *Fisheries Act 1994* (and *Fisheries Regulation 1995*), *Vegetation Management Act 1999*, *Nature Conservation Act 1994*, *Marine Parks Act 2004*, *Land Act 1994*, *Water Supply (safety and reliability) Act 2008* and the *Transport Infrastructure Act 1994*. Any requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* should also be included.

Local government planning controls, local laws and policies applying to the development should be described including the Gold Coast City Council Planning Scheme and relevant local plans, policies and codes.

This information is required to assess how the legislation applies to the proposal, which agencies have jurisdiction and whether the proposed impact assessment process is appropriate. A list of the approvals required for the project and the expected program for applications should be included.

A number of items of State and Commonwealth legislation apply to the project. These may impose certain restrictions and requirements on the development and are discussed below. A Project Approvals Report prepared by Minter Ellison Lawyers is presented as Appendix 3 of the EIS. This report details all relevant information relating to required project approvals.

Program and Process

On 18 April 2008 the Coordinator-General ('CG') declared the Gold Coast International Marine Precinct project ('GCIMP') a 'significant project' for which an environmental impact statement ('EIS') must be prepared under Part 4 of the *State Development and Public Works Organisation Act 1971* ('SDPWO Act'). Part 4 establishes the framework for environmental assessment of declared significant projects, facilitated and coordinated by the CG. The function of the Part 4 EIS process is to coordinate State Government departments and local government towards ensuring that proper account is taken of the environment.

The GCIMP was re-declared as a 'significant project' on 7 July 2011 as the EIS document was not submitted within the required 2 year period.

In December 2011, the final TOR for the EIS were issued. The TOR identify the framework for the EIS and the scope and range of issues to be considered in the preparation of the EIS.

The SDPWO Act EIS process involves the following sequence of steps after the issuing of the TOR:

1. The proponent prepares a draft EIS addressing the terms of reference to the satisfaction of the CG.

2. After the CG confirms the draft EIS has been prepared to the CG's satisfaction, the proponent publicly notifies the draft EIS inviting public submissions during the specified submission period. The CG also invites advisory agencies (collectively, State Government departments/agencies and the relevant local government) to consider the draft EIS and provide their submissions to the CG.

3. Any properly made submissions must be accepted by the CG.

4. After the close of the submission period, the proponent prepares a revised version of the draft EIS or a supplement to the draft EIS and provides it to the CG as the final EIS. This step is not one stipulated by the SDPWO Act; it is a requirement of the bilateral agreement for satisfying requirements under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

5. The CG considers the EIS, all properly made submissions (and other submissions accepted) about the EIS and any other material the CG considers relevant to the project and then prepares a report evaluating the EIS. The report may make recommendations (including recommendation as to whether the project should be approved), and state conditions of approval that *must* be imposed under certain approval processes. The ability for the CG's report to impose conditions is not limited to Impact Assessable Material Change of Use Development Applications. Section 54B of the SDPWO Act enables the CG's report to impose conditions for the undertaking of the project. If an imposed condition for the undertaking of the project is inconsistent with a condition of an approval that applies to the undertaking of the project (for example, a development approval), the imposed condition prevails to the extent of the inconsistency.

6. After completing the evaluation report, the CG gives a copy of the report to the proponent and publicly notifies the report (not for comment but for information purposes only). The CG also gives a copy to the Gold Coast City Council (as assessment manager for the development application). A copy of the evaluation report is also to be provided to the Commonwealth Environment Minister.

The SDPWO Act EIS process does not of itself result in an operative approval or refusal decision or avoid the need for the proponent to secure necessary approvals, such as:

- The Commonwealth Environment Minister's approval for the taking of controlled actions under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; and
- Development approvals required from the assessment manager (Gold Coast City Council) and other State agencies (as alternative assessment managers or concurrence agencies) under the *Sustainable Planning Act 2009* (Qld).

The following sections describe the legislation and policies relevant to the assessment of approvals required for the GCIMP from the Commonwealth, from State agencies and at a local level from the Gold Coast City Council. Each is briefly described in overview, followed by an identification of its relevance/application (or otherwise) to the GCIMP.

Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 ('EPBC Act')

Overview

The EPBC Act requires that approval must be obtained from the Commonwealth Environment Minister for actions which have, may have or are like to have, a significant impact on a matter of national environmental significance. These are known as 'controlled actions'.

Relevance to the GCIMP

Following referral to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) by the proponent in accordance with the EPBC Act, the project was determined to be a controlled action on the basis of the following controlling provisions:

- Wetlands of international importance (sections 16 and 17B);
- Listed threatened species and ecological communities (sections 18 and 18A); and

- Listed migratory species (sections 20 and 20A).

For the purposes of informing the Environment Minister's decision under the EPBC Act as to whether or not to grant approval for the proposed action and, if so, on what conditions, the proposal is being assessed in accordance with the bilateral agreement between the Commonwealth and the State of Queensland ('bilateral agreement'). The bilateral agreement accredits the SDPWOA Act Part 4 EIS process, with the purpose of avoiding duplication in assessment but facilitating the provision of sufficient information to inform the Environment Minister's decision-making under the EPBC Act.

Following completion of the SDPWOA EIS process and the Commonwealth Environment Minister's receipt of the CG's evaluation report (described as the (final) 'assessment report' under the EPBC Act/bilateral agreement), the Minister must, within 30 business days, make a decision under Part 9 of the EPBC Act as to whether or not to approve, for the purpose of each controlling provision for a controlled action, the taking of the action. In deciding whether to refuse, approve or approve subject to conditions, the Minister must consider:

- matters relevant to the protected matters of national environmental significance; and
- economic and social matters.

In considering these matters, the Environment Minister must take into account the principles of ecologically sustainable development and the assessment report, and cannot act inconsistently with obligations under relevant international conventions.

An EPBCA – Matters of National Environmental Significance (NES) Report prepared by Planit Consulting is presented as Appendix 6 of the EIS, as required by the TOR to address potential impact on matters of national environmental significance.

State legislation – approval requirements integrated under the *Sustainable Planning Act 2009*

Sustainable Planning Act 2009 ('SPA')

The *Sustainable Planning Act 2009* (SPA) and the *Sustainable Planning Regulation 2009* (SPR) replaced the *Integrated Planning Act 1997* (IPA) and the *Integrated Planning Regulation 1998* (IPR) on the 18 December 2009.

Overview

The SPA is Queensland's principal planning legislation. The purpose of the SPA is to seek to achieve ecological sustainability by:

- managing the process by which development takes place;
- managing the effects of development on the environment, including managing the use of premises; and
- continuing the coordination and integration of planning at the local, regional and State levels.

The SPA sets the framework for assessment and approval of development in Queensland. There are five aspects of 'development' under the SPA:

- material change of use;
- reconfiguring a lot;
- operational work;
- building work; and
- plumbing and drainage work.

Under the SPA framework, the need for development approvals for each aspect of development which may be involved in a proposal is determined by:

- Schedule 3 of the *Sustainable Planning Regulation 2009* ('SPR'); and
- the relevant local planning instrument (planning scheme). For the GCIMP, this is the Gold Coast Planning Scheme.

The SPA provides a system of integrated development approvals, applications for which are assessed and decided using the Integrated Development Assessment System (IDAS) process in the SPA. Schedule 3 of the SPR identifies development approvals required under various pieces of Queensland legislation.

The level of assessment for a proposed development may be:

- Exempt – no development approval required
- Self-assessable – does not require a development application to be made, but must comply with relevant acceptable solutions
- Code assessable – requires an IDAS development application, which is assessed, among other things, against applicable codes
- Impact assessable – requires an IDAS development application which must be publicly notified and which is assessed, among other things, against the planning scheme.

The development applications for development made assessable under the SPR and the Gold Coast Planning Scheme are made and assessed using IDAS. The IDAS process involves four stages (but not all stages or all parts of stages apply to all development applications):

- application stage;
- information and referral stage;
- notification stage; and
- decision stage.

For certain development application to be properly made under the SPA so as to be able to be processed under IDAS, owner's consent or a resource entitlement is required. The need for a resource entitlement and the entity that provides that entitlement is identified in Schedule 14 of the SPR.

For the GCIMP, evidence of resource entitlement to the following tenure and allocations is required:

- To construct the marina berths on land that is currently unallocated State land – seabed lease under the *Land Act 1994* and quarry material allocation notice under the *Water Act 2000*.

- To do capital and maintenance dredging –quarry material allocation notice under the *Coastal Protection and Management Act 1995.*

These requirements are further discussed in relation to the GCIMP under the *Land Act 1994, Water Act 2000* and *Coastal Protection and Management Act 1995* discussion below.

Relevant stakeholders in respect of the tenure/allocations for the GCIMP are:

- Gold Coast City Council
- The Department of Environment and Heritage Protection (Environmental Services)
- Maritime Safety Queensland (Department of Transport and Main Roads)
- Department of Transport and Main Roads (as the Regional Harbour Master)

The proponent will consult with each stakeholder, address their requirements and secure their support for the tenure/allocations before meeting with the Department of Natural Resources and Mines (DNRM) for a pre-lodgment meeting. The purpose of the pre-lodgment meeting is to streamline the statutory process for securing the tenure/allocations.

The statutory process for the seabed lease under the *Land Act 1994* is:

- Lodge the application and supporting documentation, including stakeholder support from the Gold Coast City Council and other relevant stakeholders.
- DNRM assesses the application and makes an offer.

The statutory process for the quarry material allocation notice under the *Water Act 2000* is:

- Lodge the application and supporting documentation.
- DNRM assesses the application and issue the quarry material allocation notice subject to any conditions it considers appropriate.

The statutory process for the quarry material allocation notice under the *Coastal Protection and Management Act 1995* is:

- Lodge the application for quarry material allocation, and supporting documentation.
- The Department of Environment and Heritage Protection will assess the application and issue the quarry material allocation notice subject to any conditions it considers appropriate.

Schedule 7 of the SPR identifies when and how State agencies have a role in IDAS. The jurisdiction of the State agencies is also identified in the SPR. Where a development application involves development assessable under the local government planning scheme as well as other aspects of development assessable under Schedule 3 SPR, the local government is the Assessment Manager, and State agencies are Referral Agencies, fulfilling either a 'concurrence' or 'advice' function. Concurrence agencies can direct the Assessment Manager to take certain action with which the Assessment Manager must comply in making the decision. This can include requiring that the development application be refused or that specified conditions be imposed if the Assessment Manager approves the development application.

Development applications for the development approvals required by the SPA can be made at any time – before, during or after the SDPWO Act Part 4 EIS process. For the GCIMP, the proponent intends on making the development applications after the conclusion of the EIS process.

Completion of the SDPWO Act Part 4 EIS process modifies the IDAS process under the SPA so that to the extent the proponent makes a development

application under the SPA for a material change of use or requiring impact assessment or both (which will be the case for this proposal):

(a) There are no referral agencies under the SPA for the development application.

(b) The information and referral stages of IDAS do not apply. This means that the development application does not have to be referred to State referral agencies for their referral agency response, no information requests are issued by either the Assessment Manager (Gold Coast City Council) or Referral Agencies, and the application does not have to be publicly advertised for submissions. These stages of IDAS are removed because during the course of the EIS process State agencies and the Gold Coast City Council will have had the opportunity to provide input in the preparation of the TOR (described collectively in the TOR as 'advisory agencies') and, together with members of the public, will have had the opportunity to make submissions/comments on the EIS. This would be duplicated if the IDAS information and referral stages applied to the development application.

(c) The notification stage of IDAS does not apply. This is because the public will have had the opportunity to make submissions/comments on the EIS. This otherwise would be duplicated if the IDAS notification stage applied to the development application.

(d) A properly made submission about the EIS is taken to be a properly made submission about the development application. Appeal rights under the SPA, for either submitters or the applicant, are not modified by the SDPWOA Part 4 EIS provisions.

(e) The CG's evaluation report on the EIS is taken to be a concurrence agency's response for the development application. This means that the CG may (among other things) tell the Gold Coast City Council (and the Gold Coast City Council must then follow the direction) that if the Gold Coast City Council decides to approve the application, particular conditions must be imposed. This is further discussed in Floodplain Management Report in Appendix 26 of this EIS.

(f) The decision stage of IDAS does not start until the CG gives the Gold Coast City Council a copy of the CG'S report.

Relevance to the GCIMP

The GCIMP involves all five aspect of development discussed above, and requires various development approvals under the SPA.

The proponent intends on making the development applications following the issuing of the CG's report.

Among the first development applications to be made will be an application for a preliminary approval that varies the effect of the Gold Coast Planning Scheme, under section 242 of the SPA. The application will seek to have approved the proposed Gold Coast International Marine Precinct Place Code, which will vary the levels of assessment for future development on the GCIMP land and identify/include codes for the development. This is discussed in more detail in the Project Approvals Report prepared by Minter Ellison contained in Appendix 3.

The Gold Coast City Council will be the Assessment Manager for the section 242 application. Because the application is for a preliminary approval which seeks to vary the effect of the Gold Coast Planning Scheme, the Department of State Development, Infrastructure and Planning (DSDIP) would ordinarily be a concurrence agency for this application under the SPR Schedule 7 Table 3 Item 24, with its jurisdiction being the purposes of the SPA. However, because of the manner in which the SDPWO Act EIS process modifies the IDAS process, DSDIP will instead undertake this assessment as an advisory agency during the EIS process. The application would ordinarily require public notification.

The SPA and the SPR provide for the integrated assessment of applications for various development approvals or referral requirements under the following State legislation which apply to the GCIMP project and/or which the TOR asked to be addressed in the EIS:

- *Coastal Protection and Management Act 1995*
- *Environmental Protection Act 1994*
- *Fire and Rescue Service Act 1990*
- *Fisheries Act 1994*
- *Marine Parks Act 2004*
- *Nature Conservation Act 1992*
- *State Planning Policy 2/02 Planning and Managing Development Involving Acid Sulfate Soils*
- *State Planning Policy 4/10 Healthy Waters*
- *Transport Infrastructure 1994*
- *Transport Operations (Marine Safety) Act 1994*
- *Vegetation Management Act 1999*
- *Water Act 2000*
- *Building Act 1975*

A project approvals report prepared by Minter Ellison is presented as Appendix 3 of the EIS, which details the application of the above legislation in relation to the proposed project.

The relevance of the *South East Queensland Regional Plan 2009 - 2031*, as instrument relevant to the assessment of development applications under the SPA, is separately discussed in the Planning processes and standards section of this EIS.

A Project Approvals report prepared by Minter Ellison is presented as Appendix 3 of the EIS, further discussion regarding relevance of state legislation to the proposed project is contained within this report.

Local planning instruments and local laws

Gold Coast Planning Scheme

The applicable planning scheme is the Our Living City – Gold Coast Planning Scheme ('Planning Scheme'). As at the date of preparation of this EIS, the current version is Version 1.2 Amended November 2011.

Following the conclusion of the SDPWO Act EIS process, a development application will be made to the Gold Coast City Council, under section 242 of the SPA for a preliminary approval that varies the affect of the Planning Scheme by the approval of the proposed 'Gold Coast International Marine Precinct Place Code'. The Gold Coast City Council is the Assessment Manager for this application. The Department of State Development, Infrastructure and Planning (DSDIP) would ordinarily be a concurrence agency for this application under the SPR Schedule 7 Table 3 Item 24, with its jurisdiction being the purposes of the SPA. However, because of the manner in which the SDPWO Act EIS process modifies the IDAS process, DSDIP will instead undertake this assessment as an advisory agency during the EIS process.

The preliminary approval (if given) will vary the levels of assessment for future development on the GCIMP land and will identify/include codes for the development. The future development of the GCIMP site involves a wide variety of proposed and contemplated potential uses. The range of uses is identified, on a precinct-by-precinct basis in the proponent's proposed 'Gold Coast International Marine Precinct Place Code' contained within the Town Planning Package in Appendix 5.

One of the proposed future uses on the GCIMP site is the TAFE College which is proposed to be developed by the State. This proposed use falls within the Planning Scheme's definition of an 'Educational Establishment'.

Currently under the Planning Scheme, a material change of use for an Educational Establishment on the land is not identified in the relevant table of development for

the Coomera Local Area Plan and is therefore deemed to be impact assessable. However it is contemplated that, as is the typical course of action to facilitate State-developed educational facilities of this kind, a community infrastructure designation over the land will be made by the Minister for Education, Training and Employment under Chapter 5 of the SPA. The consequence of such a designation under section 203 of the SPA is that the proposed MCU under the Planning Scheme and any reconfiguring of lot for development under the designation becomes exempt development for IDAS.

In addition to MCU approval, related development approvals required under the Planning Scheme for the GCIMP will include:

- Reconfiguring a lot (code assessable if no lot less than 1,000m^2)
- Operational work – change to ground level (code assessable)
- Operational work – works for infrastructure (code assessable)
- Operational work – vegetation clearing (self assessable if carried out in accordance with the relevant Acceptable Solutions of the Planning Scheme's Vegetation Management Specific Development Code).

A Project Approvals report prepared by Minter Ellison is presented as Appendix 3 of the EIS, this report provides a more detailed discussion regarding the proposed project and the Gold Coast Planning Scheme.

Approvals and referrals required for the GCIMP

A summary of all project approvals required and relevant approval referrals is summarised in Table 1- Project Approvals and Referrals.

Table 1- Project Approvals and Referrals

LEGISLATION	RELEVANCE	SPECIFIC TRIGGER	ENTITY
COMMONWEALTH			
Environment Protection and Biodiversity Conservation Act 1999	The GCIMP is a 'controlled action'	EPBC Act sections 16 and 17B, 18 and 18A, 20 and 20A (controlling provisions); 67A	Commonwealth Environment Minister / Commonwealth Department of Sustainability, Environment, Water, Population and Communities
STATE / LOCAL			
Resource allocation / entitlement			
Land Act 1994	Resource entitlement	Land Act 1994; SPR Schedule 14	DNRM

LEGISLATION	RELEVANCE	SPECIFIC TRIGGER	ENTITY
Coastal Protection and Management Act 1995	Quarry material allocation required for dredging	CPM Act Part 5 Division 1; SPR Schedule 14	DEHP
Water Act 2000	Resource entitlement	Water Act 2000 Part 9; SPR Schedule 14	DNRM
Material change of use			
Gold Coast Planning Scheme	Material changes of use assessable under the Gold Coast Planning Scheme – application for a section 242 preliminary approval under the *Sustainable Planning Act 2009*	Coomera LAP and Coomera Town Centre Structure Plan SPR Schedule 7 Table 3 Item 24	GCCC – assessment manager DSDIP – concurrence agency under SPR
Environmental Protection Act 1994	Material change of use for the commencement of environmentally relevant activities – dredging (ERA 16), boat maintenance or repair (ERA 49), and chemical (petroleum) storage (ERA 8) Registration certificate to be held by the operator of each activity.	SPR Schedule 3 Part 1 Table 2 Item 1	DNRM and GCCC – as the administering authority
Environmental Protection Act 1994	Material change of use on land within 100m of a wetland	SPR Schedule 7 Table 2 Item 43	DNRM – advice agency
Coastal Protection and Management Act 1995	Material change of use involving operational work in a coastal management district	SPR Schedule 7 Table 3 Item 5	DNRM – concurrence agency under SPR
Fisheries Act 1994	Material change of use involving operational works involving potential disturbance to marine plants	SPR Schedule 7 Table 2 Item 32 and Table 3 Item 25	DAFF – concurrence agency under SPR

LEGISLATION	RELEVANCE	SPECIFIC TRIGGER	ENTITY
Transport Infrastructure Act 1994	MCU on land relating to a State-controlled road (assumes the existence of the proposed future IRTC)	SPR Schedule 7 Table 3 Item 1(a)	DTMR – concurrence agency under SPR
Reconfiguring a lot			
Gold Coast Planning Scheme	Reconfiguring a lot assessable under the Gold Coast Planning Scheme	Coomera LAP and Coomera Town Centre LAP	GCCC – assessment manager
Coastal Protection and Management Act 1995	Reconfiguring a lot in a coastal management district	SPR Schedule 7 Table 2 Item 14(a)	DNRM –concurrence agency under SPR
Vegetation Management Act 1999	Reconfiguring on land involving vegetation clearing	SPR Schedule 7 Table 3 Item 10(a)(i)	DNRM – concurrence agency under SPR
Operational work			
Gold Coast Planning Scheme	Operational works – change to ground level, vegetation clearing and works for infrastructure assessable under the Gold Coast Planning Scheme	Coomera LAP and Coomera Town Centre LAP	GCCC – assessment manager
State Planning Policy 2/02 Planning and Managing Development Involving Acid Sulfate Soils	Excavation/filling meeting the specified thresholds; operational work (change to ground level) assessable under the Gold Coast Planning Scheme	SPR Schedule 7 Table 3 Item 3	DNRM – advice agency
Coastal Protection and Management Act 1995	Operational work that is tidal works (including prescribed tidal works)	SPR Schedule 3 Part 1 Table 4 Item 5	GCCC
Coastal Protection and Management Act 1995	Operational work that is creating an artificial waterway	SPR Schedule 3 Part 1 Table 4 Item 5	DEHP – concurrence agency under SPR
Transport Operations (Marine Safety) Act 1994	Operational work that is tidal works	SPR Schedule 7 Table 2 Item 14	DTMR (Maritime Safety Queensland) – concurrence agency

LEGISLATION	RELEVANCE	SPECIFIC TRIGGER	ENTITY
Water Act 2000	Operational works that is the removal of quarry material from a lake that requires an allocation notice	SPR Schedule 3 Part 1 Table 5 Item 1	DNRM – concurrence agency under SPR
Water Act 2000	Operational work that is taking or interfering with water	SPR Schedule 3 Table 4 Item 3	DNRM – concurrence agency under SPR
Fire and Rescue Service Act 1990	Operational work that is tidal work and involves a marina with more than six berths	SPR Schedule 7 Table 2 Item 18	Department of Community Safety (Queensland Fire and Rescue Service)
Building work			
Building Act 1975	Assessable building work	SPR Schedule 3 Part 1 Table 1 Item 1	Building certifier

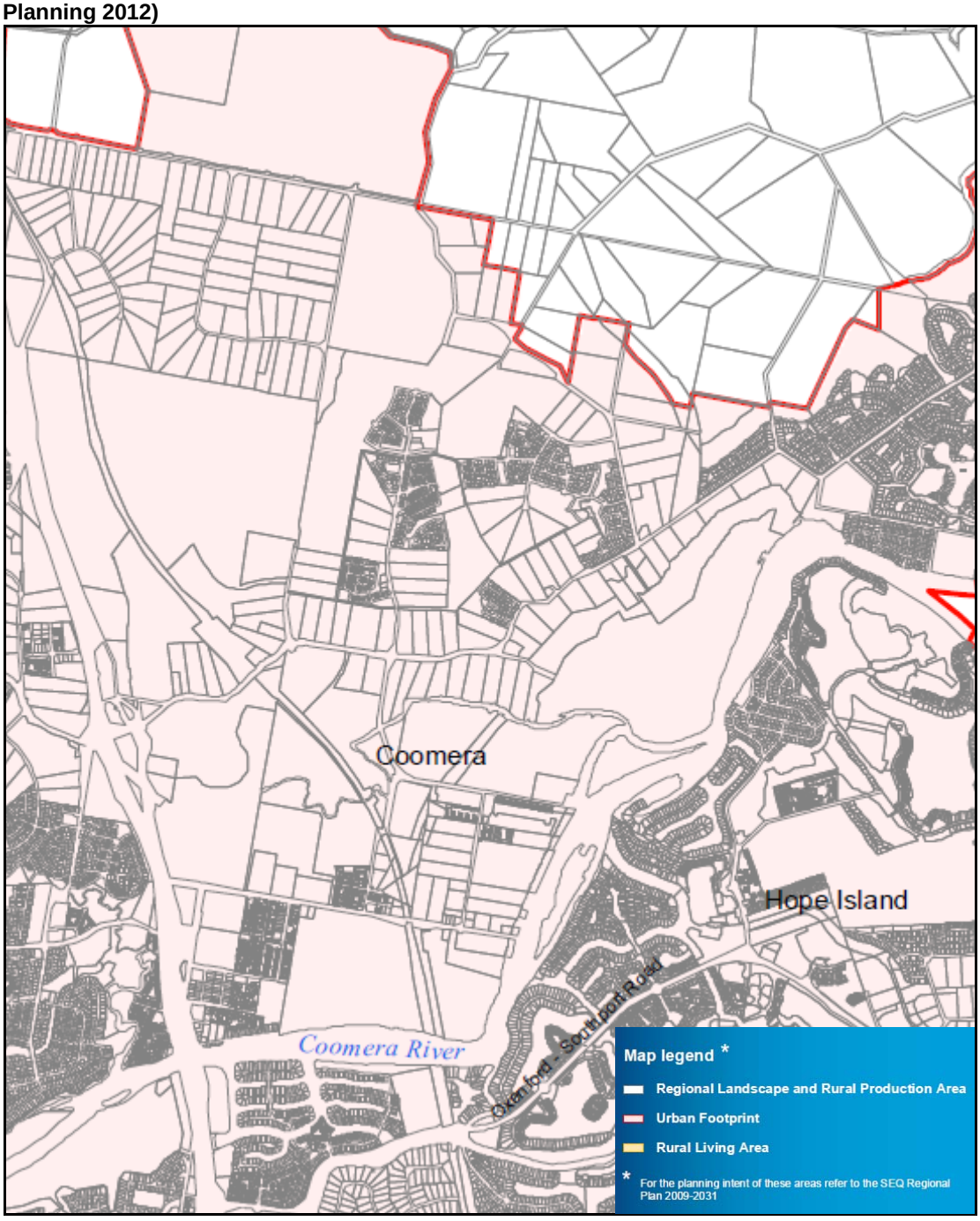
Planning Processes and Standards

This section should discuss the project's consistency with existing land uses or long-term policy framework for the area (e.g. as reflected in local and regional plans), and with legislation, standards, codes or guidelines available to monitor and control operations on site. This section should refer to all relevant State and regional planning policies. This information is required to demonstrate how the proposal conforms with State, regional and local plans for the area.

South East Queensland Regional Plan 2009-2031

The subject land is identified within the Urban Footprint land use category as per the *South East Queensland Regional Plan 2009-2031*. It is noted that the Urban Footprint identifies land predominately allocated to provide for the region's urban development needs to 2031. A copy of the relevant extract from the Regional Plan is provided in the Figure below.

Figure 2 - SEQ Regional Land Use Plan (Department of State Development, Infrastructure & Planning 2012)



The Urban Footprint includes existing urban areas as well as Greenfield areas potentially suitable to support future development needs and population growth.

The site is contained wholly within the Urban Footprint with a small portion of the site's South-West within a "Development Area". The SEQ Regional Plan states that Development Areas *"…in addition to regional activity centres and other suitable established urban areas, are the focus for accommodating regional dwelling and employment targets, and require comprehensive planning to coordinate future development with infrastructure delivery."*

Whilst the site is only partially located in the Development Area, the development does seek to accommodate employment targets through comprehensive planning inclusive of infrastructure delivery.

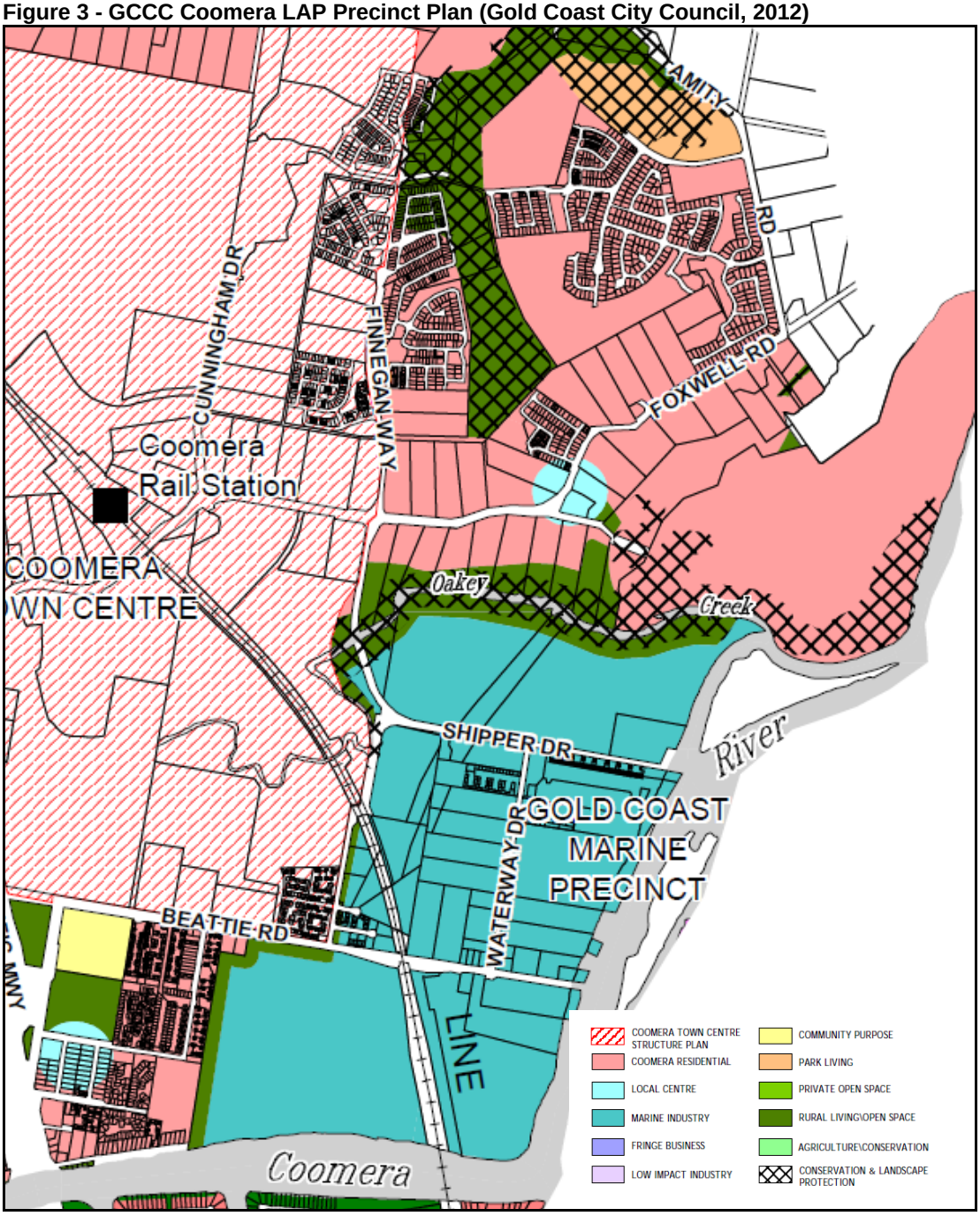
It is important to note that Coomera is designated as a 'Major Regional Activity Centre' under the SEQ Activity Centres Network under the SEQ Regional Plan.

Gold Coast 'Our Living City' Planning Scheme 2003

The site is described as Lots 98 and 146 on SP150731 and Lot 108 on WD6404. The site is mostly contained within Precinct 3: 'Marine Industry' of the Coomera Local Area Plan (LAP) as per the Gold Coast Planning Scheme 2003. Portions of the site are contained within Precinct 9: 'Rural Living/Open Space and Precinct 10: 'Conservation and Landscape Protection' . The Precinct 9 and 10 designations are limited to along the northern and western boundaries of the site along Oakey Creek. The GCIMP Master Plan has been designed with consideration of the Precinct 9 and 10 designations as this area incorporates a 40 metre natural vegetation buffer to Oakey Creek.

An excerpt of the Coomera Local Area Plan Precinct Plan is provided in the figure below.

Figure 3 - GCCC Coomera LAP Precinct Plan (Gold Coast City Council, 2012)



The site is mostly included within the Marine Industry Precinct which is the preferred designation for a Marina and associated Marine Industries. The Planning Scheme Preferred Character for this precinct is provided below.

Precinct 3: Marine Industry – Preferred Character

The Marine Industry is identified as an economic sector which has future prospects for local economic growth for the City. A Marine Industry Precinct at Beattie Road, Coomera is proposed to include approximately 250 hectares of land. A range of marine industry companies is to be accommodated, including boat building, boat refit, mechanical service and marine component manufacture. It is intended to develop this precinct as a world class waterfront industry development. A high standard of architectural and landscape form is expected.

Development within this precinct is subject to Council's approval for fill, and will be determined on the basis of detailed hydraulic analysis. Storm water treatment is to be of the highest standard, to ensure that acceptable water quality is maintained in the Coomera River. Development within the Marine Precinct will be subject to a number of Environmental Protection Policies.

The Beattie Road area is intended for business and industry associated with the manufacture of sports fishing boats, motor cruisers, fibreglass and reinforced plastic boats, outboard motor boats, aluminium fishing dinghies and commercial and recreational boats. Ancillary business and industry is also encouraged. Preferred activities include marine lighting, boat fittings, steering controls, propeller inspection systems and marine instrumentation manufacture.

To meet the need of the boat building industry, the LAP incorporates sufficient land for the industry's needs for the next 30 years. The precinct is promoted locally, nationally and internationally, and will provide opportunities for major boat building and maintenance for craft from ten foot to the super yacht.

It is essential that businesses in this precinct have access to the Coomera River. Consequently, there will not be a continuous open space corridor between the Marine Precinct and the river. In any development, appropriate steps are to be taken for the provision of landscaping, to promote an attractive environment on the river.

To ensure the establishment and continued operation of this precinct at Coomera, the following planning objectives will be used to assess development applications:

- *the precinct is to be sufficiently large to allow appropriate buffering from residential developments;*
- *the release of land is to be planned, to allow for progressive development;*

- *provision is made for large (50 metre) boat maintenance and refit facilities which require water access; and*
- *to preserve the manufacturing integrity, no residential development should be allowed within the precinct.*

The proposed configuration of the development has been formulated having regard to the Preferred Character of this Precinct and has been further informed by the opportunities and constraints presented by the site. Detail pertaining the GCIMP's consistency with the Marine Industry Precinct of the Coomera Local Area Plan is contained in the Town Planning Report prepared by Planit Consulting contained in Appendix 5.

The Preferred Character of the Rural Living/Open Space Precinct is provided below.

Precinct 9: Rural Living/Open Space

'To provide for rural style residential development and also to provide for the effective servicing of current and future needs for recreational land within the Coomera LAP area. Further, to contribute to the open space network within the Coomera area for landscape and habitat protection purposes'.

The area of the site identified within this precinct is located across and along the northern and western fringes of the site. This area is further characterised by the Conservation and Landscape Protection Overlay. It is understood that the intent of the precinct over this site is to protect and maintain the existing waterways and vegetation communities applicable to the site.

The intent of this planning for the site has been reflected in the layout and design of the proposed development, however has been refined and shaped to reflect the most important natural features of this area as informed by a detailed ecological assessment. Oakey Creek which is located to the site's northern and western boundaries is proposed to be protected and maintained within a 40 metre wide natural buffer.

The site's open space and natural buffer comprises a total of 4.9 hectares. This is to aid in the protection for natural areas surrounding Oakey Creek. We note that this open space area does not precisely reflect the boundary of this precinct as identified in the Coomera LAP; however detailed ecological, hydraulic and open space investigations have informed the specific location of this area of open space and therefore the development is considered to be compliant in this regard.

A Town Planning report prepared by Planit Consulting is presented as Appendix 5 to the EIS, and provides a thorough assessment of the proposed against all relevant planning instruments.

Accredited Process for Controlled Actions under Commonwealth Legislation

This project has been determined to be a controlled action under the EPBC Act. In this regard, the Australian Government has accredited the State's EIS process for the purposes of the Australian Government assessment under Part 8 of the EPBC Act.

It is necessary for the EIS to address potential impacts on the matters of national environmental significance that have been identified in the 'controlling provisions for the project. In this case the matters of national environmental significance are as follows:

- sections 16 and 17B (Wetlands of international importance);
- sections 18 and 18A (Listed threatened species and communities); and
- sections 20 and 20A (Listed migratory species)

A stand-alone report addressing the matters of National Environmental Significance must be provided as an appendix to the EIS that exclusively and fully addresses the issues relevant to the controlling provisions. This stand alone section should include:

A Description of the Affected Environment Relevant to the Matters Protected

It is important that the current status of the matters protected under the EPBC Act be described in sufficient detail, to inform the analysis of the proposal's impact on these matters.

For wetlands of international importance, the description of the environment should set out the relevant ecological character of the Ramsar wetland that are potentially affected by the proposal within the wider context of the values of the wetland as a whole.

For listed threatened and migratory species, the description of the environment should include:

- the current species distribution;
- relevant information about the ecology of the species (habitat, feeding and breeding behaviour etc);
- information about any populations of the species or habitat for the species in the area affected by the proposed proposal;
- current pressures on the species, especially those in the area to be affected by the proposal; and
- relevant controls or planning regimes already in place.

Assessment of Relevant Impacts and Mitigation Measures

The EIS must include a description of all the relevant impacts of the action. Relevant impacts are impacts that the action will have or is likely to have on a matter protected by the controlling provision (as listed in the preamble of this document). Impacts during both the construction and operation phases of the project should be addressed and the following information provided:

- a detailed assessment of the nature and extent of the likely short-term and long-term relevant impacts;
- a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;
- analysis of the significance of the relevant impacts;
- any technical data and other information used or needed to make a detailed assessment of the relevant impacts.

The possible mitigation measures for each impact need to be analysed. If alternative ways of taking action have been identified, the relative impacts of these alternatives should also be considered.

Offsets

When effective mitigation measures are not available, the discussion should be broadened to include compensatory measures to offset unavoidable residual impacts.

The discussion of impacts to the relevant matters protected should address all relevant impacts and provide sufficient justification for all conclusions reached on specific impacts.

In some cases impacts may be relevant to more than one protected matter, for example when the species is listed as both a migratory and threatened species under the EPBC Act. In such cases the impacts may be addressed together, clearly stating the relevance of the impact to the different matters protected.

The following potential impacts may need to be addressed in the EIS. The impacts are provided as a guide for specific matters of national environmental significance.

Impact on the values of wetlands of international importance:

An action is likely to have a significant effect on wetlands of international importance if one or more of the following occur:

- areas of the wetland being destroyed or substantially modified;
- a substantial and measurable change in the hydrological regime of the wetland.
- substantial change to the volume, timing, duration and frequency of ground and surface water or flows to and within the wetland;
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;
- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health;
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

Impact on listed threatened species and communities

Potential impacts vary depending on whether the species is extinct in the wild, endangered or vulnerable but generally if one or more of the following occur:

- long term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of the species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to the species becoming established;
- interfere with the recovery of the species;
- consistency with recovery plans.

Impact on a listed migratory species

Potential impacts would include direct impact on the species if one or more of the following occur:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles) habitat for migratory species;
- destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established;
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The GCIMP was referred to the Australian Government Department of the Environment, Water Heritage and the Arts (now the Department of Sustainability, Environment, Water, Population and Communities) (SEWPaC) on 8 February 2008 to determine whether Commonwealth approval is required for the action. A decision notice as issued on 27 April 2008 notifying that the proposal is a controlled action and requires approval under the EPBC Act before it can proceed.

The SEWPaC determined that the controlling provisions applying to the project to be:

- Sections 16 and 17D – Wetlands of International Importance;
- Sections 18 and 18A – Listed threatened species and communities; and
- Sections 20 and 20A – Listed migratory species.

A Matters of National Environmental Significance (NES) Report has been prepared by Planit Consulting and is presented as Appendix 6 of the EIS. This report addresses the abovementioned ToR requirements in detail, this has been summarised as follows.

Description of the Environment

Terrestrial Flora

As a result of flora surveying five (5) vegetation communities/associations were identified on site as outlined below.

- Community 1A: Mid-High Open Forest/Forest (*Casuarina Glauca*) [T6D/M] on tidal mudflats
- Community 1B: Mid-High Forest (*Casuarina Glauca*) [T6M] on Alluvial Deposits

- Community 2: Saltmarsh Communities
- Community 3: Low-Tall open forest/woodland *(Avicennia Marina + Aegiceras Corniculatum)* [T4M/S]
- Community 4: Very tall closed grassland (*Setaria Sphacelata*) [G4D/M]
- Community 5: Low closed pasture with scattered Trees/Paddock mosaic [G1D/M]

One species of flora scheduled as vulnerable under the *Nature Conservation Act* was observed on site. This species (*Macadamia tetraphylla*) was encountered in the SW corner of the site and will be retained in association with the proposed development.

Whilst it is acknowledged that the EPBC Act identifies that the GCIMP development site has potential to support several species of threatened terrestrial flora, none were located onsite as a result of the field surveys undertaken.

Terrestrial Fauna

Aves

One Hundred (100) species of bird were recorded during surveys of the subject site and surrounding areas.

Two species, recorded on site are listed as Migratory Marine Birds under the EPBC Act, these being the Ardea alba (Great Egret) and the Ardea ibis(Cattle Egret), resident populations of each species can be found on the Gold Coast and within the Moreton Bay Marine Park.

Two species listed as a Migratory Terrestrial Species under the EPBC Act, being *Merops ornatus*, the Rainbow Honeyeater and *Haliateetus leucogaster*, White-bellied Sea Eagle were also observed. Again both these specie have a resident population on the Gold Coast and within the Moreton Bay Marine Park. In the case of the White-bellied Sea Eagle an active nest site for the species is opposite the site, north of Oakey Creek.

Four species, identified on site, are listed as Migratory Wetland Species under the EPBC Act, including the previous identified Great and Cattel Egret. The other two (2) species being the Sharp-tailed Sandpiper (*Calidris acuminate*) and Red-necked Stint (*Calidris ruficollis*).

Including those six (6) species identified above a further two species recorded on site are listed in the EPBC Act as a 'Listed Marine Species'. These additional species are the Red Capped Plover (*Charadrius ruficapillus*) and Black-winged Stilt (*Himantopus himantopus*).

The EPBC Act protected matters search has identified a total of 43 Threatened Species, 49 Migratory Species and 83 marine Species as potentially occurring or suitable habitat for the species occurs. Of these ten (10) are threatened avifauna, and forty one (41) are Migratory species. Of the Marine Species forty seven (47) are avifauna.

Amphibia
A total of six (6) native frog and one (1) introduced toad species were recorded on the subject site. No amphibians listed as rare, vulnerable or endangered within the NC Act or the EPBC Act were recorded on site.

Reptilia
The diversity of habitats for reptile species is considered reasonably low across the site due to limited diversification (i.e. relatively uniform relief, soil type, dominance of saltmarsh and pasture).

Typically reptile species require a large diversity of microhabitats (including vegetation

Within the site reptile recordings were most common in this western area with three species of skink, water dragon, lace monitor and two tree snakes recorded. The grass skink, wall skink and red-bellied black snake were also recorded from the pasture and swamp oak zone. All of the recorded reptiles are considered to be of 'least concern' (NC Act) and common within the local area.

A total of eight (8) reptile species were recorded on the subject site. No reptiles listed as rare, vulnerable or endangered within the NC Act were observed on site.

Mammalia
A total of twenty-three (23) mammal species, including seven (7) introduced species, were recorded on the subject site. One threatened species listed under the EPBC Act was recorded on site, this being the Grey-headed Flying fox.

Coastal Processes

The area is characterised by a low wave energy environment with tidal hydraulics, flood hydraulics and the associated sediment transport being the major physical processes that determine the shape of the Coomera River and the potential bank erosion mechanisms. The bed of the Coomera River is predominantly made up of fine sediments (fine silt and clay material) with some sands.

The Coomera River discharges into the Lower Moreton Bay and Broadwater area, which experiences a predominantly semidiurnal tide (i.e. two high tides and two low tides in a little over 24 hours).

Aquatic Flora and Fauna

Mangrove communities dominated by *Avicennia marina* line the foreshore of Oakey Creek, with an extensive community of marine couch (*Sporobolus virginicus*) to landward. In the middle of the site there is a brackish pond surrounded by marine couch that extends almost to the southern border. These communities are predominantly below the measured Highest Astronomical Tide. There are also scattered patches of *Casuarina glauca* on the site, and a small area of *Melaleuca quinquenervia*. There is a narrow band of mangroves dominated by *A. marina* along the foreshore of the Coomera River, and mangrove communities also line the northern foreshore of Oakey Creek, and the western and northern foreshore of nearby Foxwell Island.

No seagrass communities were recorded along the foreshore of the development in either Oakey Creek or the Coomera River.

Benthic macroinvertebrate communities in the vicinity of the site were relatively abundant and diverse and did not show signs of significant pollution, eutrophication or high turbidity and sedimentation rates.

Common fish of the region that are harvested include bream, whiting, flathead, tailor, sand crabs, mullet, snapper mackerel, cod, parrotfish, sweetlip, trevally, jewfish, dart, catfish, perch, luderick, coral trout, sole, emperor, squire, flounder, yellow tail and penaeid prawns.

Whilst a variety of marine mammals and reptiles of conservation significance may use the waterways adjacent to the site, the area is unlikely to provide significant habitat to them. Dolphins may enter the Coomera River to feed, however their presence is likely to be transient, reflective of the distribution of prey fishes. Dugongs are likely to be infrequent visitors to the area, as there are no nearby food sources of significance. Turtles may swim through the area, but again there are no significant food sources for them in this area, so they are unlikely to be common.

The proposed development is approximately 3.3 km Australian middle thread distance (AMTD) upstream of the Moreton Bay Marine Park, and approximately 1.1 km AMTD from the Coomera River Fish Habitat Area (FHA) and 9.1 km AMTD from the Jumpinpin-Broadwater FHA. Coastal and tidal wetlands on, and in the vicinity of, the proposed development site are protected under a number of policies, codes and legislation.

Relevant Impact and Mitigation – Matters of National Environmental Significance

The controlling provisions that occur within and adjacent to the land and water to be affected by the proposed GCIMP are outlined below:

- Moreton Bay Ramsar Wetland;
- Known and potential habitat for listed threatened species; and
- Known and potential habitat for migratory species listed under international agreements including:
  - The Bonn Convention (Convention on the conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
  - The agreement between the Government of Australia and the Government for the Peoples Republic of China for the Protection of Migratory Birds and their environment (CAMBA); and
  - The agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds and Birds in danger of extinction and their environment (JAMBA).

The subsequent sections of this report provide a detailed description of each of the above Matters of NES, including an assessment of the acceptability of potential impacts of the GCIMP on the relevant matters of NES. This discussion will be based on the avoidance, mitigation and management strategies that form part of the GCIMP development proposal. Where unavoidable significant impacts are identified as being likely to occur, an analysis of the magnitude, duration and scale of such impacts will be provided.

Moreton Bay Ramsar Wetland Site

The GCIMP development is not likely to have any significant impacts of the values associated with the Moreton Bay Ramsar site. It is considered that the localised extent of any direct and indirect impacts will be limited to the part of Coomera River adjacent to the site and will not result in any downstream impacts to the Moreton Bay Ramsar site. Moreover, the proposed environmental management and monitoring programs that form part of the overall GCIMP proposal will ensure that any potential indirect impacts which have been identified as effectively managed to ensure the GCIMP development will not notably degrade, damage or diminish the recognised values of the Moreton Bay Ramsar wetland site.

Threatened Terrestrial Species

Based on the detailed assessment undertaken in relation to the recognised values associated the threatened terrestrial species, it is considered that the GCIMP development is unlikely to adversely affect the identified species.

Although possible habitat for key threatened species is identified within a five (5) radius from the subject site, based on desktop assessment and field surveying is can be concluded that the actual development site itself provides limited habitat for the identified terrestrial threatened species.

Given the permitted development of the site, the development proposal is considered to be sufficiently responsive through the retention of low-lying systems (estuarine environs etc) within conservation areas. The minimum 40m buffer to Oakey Creek enables protection of areas of terrestrial habitats.

Threatened Aquatic Species

Whales (minke whale, Byde's whale, humpback whale and killer whale), oceanic dolphins (common dolphin, Risso's dolphin, dusky dolphin and spotted dolphin) and large marine fish (grey nurse sharks, great white sharks and whale sharks) have significant conservation status, however, these species are oceanic and unlikely to occur in waters adjacent to the proposed development. Similarly, due to the historic records (not sighted in Moreton Bay since 1960s), green sawfish are unlikely to inhabit waters adjacent to the proposed development. Some turtles (hawksbill turtle, olive ridley turtle, flatback turtle and leatherback turtle) are also unlikely to occur in the vicinity of the project as they are rare in Moreton Bay and there is no significant habitat or food in the area.

Several listed threatened and migratory species such as dolphins (Irrawaddy River dolphin, Australian snub-nosed dolphin, Indo-Pacific humpback dolphin and inshore spotted dolphin) and marine turtles (green turtles) have been recorded in southern Moreton Bay may occasionally use the waters adjacent to the proposed development site. Whilst dolphins and dugongs may enter the Coomera River to feed, their presence is likely to be transient, and they are unlikely to use the waters adjacent to the proposed development site. There is little significant habitat or food sources for turtles and dugongs in the vicinity of the proposed development site. Nevertheless turtles have been sighted in the area.

Based on the detailed discussion provided in relation to the recognised values associated the threatened aquatic species, it is considered that the GCIMP development is unlikely to adversely affect the identified species.

Threatened Migratory Species

Potential impacts of the GCIMP development upon the identified migratory species could include:

- Direct physical loss or modification of habitat associated with the establishment of the GCIMP; and
- Indirect degradation of the habitat values of adjacent area associated with the construction and operation of the GCIMP development.

In respect to these issues it is noted that there would be no significant loss of habitat for the identified migratory species as a consequence of the GCIMP development. It is acknowledged that habitat cleared or disturbed for the development includes tidal and intertidal estuarine wetlands associated with Oaky Creek and the Coomera River, mudflats, creek channels, saltmarsh, sedgelands, mangrove forest, open wetlands/dams and Swamp Oak areas. However, it is considered that the direct loss of habitat as a result of the GCIMP development will not result in any significant impacts to the identified migratory species.

As noted the central wetland areas of the site does provide a roost function for a diversity of wetland / waterfowl species. This habitat is however affected by the future IRTC motorway which bisects the central wetland. The central wetland areas are also affected by existing anthropocentric activities which reduces the value of these wetlands for more sensitive and migratory species.

Given the permitted development of the site, the development proposal for is considered to be sufficiently responsive to avifauna habitat through the retention of low-lying systems (estuarine environs etc) within conservation areas. The minimum 40m buffer to Oakey Creek and provides in part protection of terrestrial habitats areas.

Removal of weed species dominated and rehabilitation of this area to a freshwater wetland will in part offset removal of the central wetland and the affect to wetland and waterfowl species.

Indirect impacts upon the identified migratory species could be anticipated from the increased level of human activity which will occur as a result of the GCIMP development. In this regard, it is noted that the GCIMP development will generate a range of activities that will have the potential to alter the environmental conditions of the locality. However, it is relevant to note that the locality of the GCIMP development is not a pristine environment and is subject to various forms of human induced disturbance associated with the existing industrial GCMP development, the use of the site by the Model Aeroplane Club, use of the open space, mostly associated with either fishing and or dog of leash walking and existing grazing and agistment activities undertaken on the site.

Based on the detailed discussion provided in relation to the recognised values associated to migratory species, it is considered that the GCIMP development is unlikely to have a significant impact on the identified migratory species.

Overall Discussion regarding Relevant Impacts and Mitigation

Assessments of the likelihood of impacts of the proposed GCIMP development upon Matters of NES have been carried out. These significant impact assessments are generally based on the findings of detailed technical assessments carried out as part of the GCIMP EIS process. The significant impact criteria considered in these assessments have been derived from the EPBC Act Significant Impact Guidelines Version 1.1 (2009)

This assessment involved the establishment of environmental mitigation and management measures and ensuring their effectiveness in preventing or minimising the negative environmental impacts of development.

A consolidated list of the various mitigation and management measures proposed to minimise, and where possible, prevent the direct, indirect and cumulative impacts of the GCIMP development has been included within the Matters of NES report prepared by Planit Consulting contained in Appendix 6. Where the impacts result in an unavoidable loss, offset measures have been proposed and are included within the Matters of NES report.

The technical reports and assessments prepared by the GCIMP project team have been reviewed to compile the abovementioned list of mitigation and management techniques. These reports include:

- Aquatic Ecology - Appendix 7;
- Terrestrial Flora and Fauna Assessment - Appendix 8;
- Offset Options Report - Appendix 9;
- Waste Management Plan - Appendix 12;
- Construction Methodology Report - Appendix 13;
- Stormwater Management Plan - Appendix 16;
- Maintenance Dredging Report - Appendix 18;
- Coastal Processes Report - Appendix 27;
- Water Quality Report - Appendix 28;
- Geotechnical Report - Appendix 29;
- Preliminary Contamination and Baseline Soil Assessment - Appendix 30;
- Groundwater Assessment and Management Plan - Appendix 31;
- Acid Sulfate Soils Assessment and Management Plan - Appendix 32;
- Hazard and Risk Assessment - Appendix 38;
- Open Space Management Statement - Appendix 40.

In addition to the above, various mitigation, management and monitoring techniques have been summarised in the construction phase Environmental Management Plan (EMP) and the operational phase Site Based Management Plan (SBMP) prepared by Hyder Consulting contained in Appendix 14 and 15 respectively. These documents incorporate best practice techniques for the avoidance and minimisation of environmental harm. Together, these working documents seek to ensure the negative impacts of the project are avoided and minimised where possible during construction and ongoing operations.

Furthermore, the GCIMP development incorporates a range of mitigation and monitoring measures for water quality including:

- A baseline water quality monitoring program;
- An Acid Sulfate Soil Management Plan to protect groundwater aquifers;
- A Groundwater Management Plan;
- A Stormwater Management Plan including rainwater collection;
- Waste Management Plan to minimise litter in waterways;
- Oil Spill response strategies.

These have been summarised in the Matters of NES Report prepared by Planit Consulting contained in Appendix 6.

In addition to the mitigation strategies outlined above, it is noted that the Terrestrial Flora and Fauna Report and the Aquatic Ecology Report recommended a number of strategies which will also assist in minimising the impact to fauna and fauna values during construction and operation activities. These procedures include but are not limited to:

- Capture and translocation by qualified wildlife spotters during the construction period;
- A Noise Management Plan for marine mammals should be developed to minimise vibration and noise impacts caused from construction;
- Noise generating activities during operation and construction shall be “ramped up” to alert fauna and provide the opportunity for them to move away;
- Daily inspections for presence of marine mammals in waterways surrounding the site prior to commencement of noise and wet excavation;
- Spotter/catcher present during dredging;
- Dredging to avoid marine species nesting periods;
- Pile driving to cease if turtles, dolphins and dugongs are observed within 500m of work site;
- Shielded lighting to be installed in marina berth areas to minimise impact on marine species;
- All construction personnel, staff and sub-contractors educated about ecological values of site, instructed not to feed fauna and report sightings of significant fauna species;

- To offset the loss of hollow bearing trees, it is recommended that five fauna boxes be installed within the retained environmental parkland in the western corner of the site; and
- Restrict vessel speed.

Summary and Conclusions

Based on the assessments presented within the Matters of NES Report, it can be concluded that any anticipated impacted to Matters of NES associated with the construction and operation of the GCIMP development will be relatively minor. In this regard, it is put forward that potential impacts to Matters of NES associated with the contemplated development will be of a limited magnitude, localised extent and/or appropriately mitigated through the implementation of relevant management plans proposed as part of the GCIMP development.

At the forefront of the assessments presented within thin report is recognition that the EPBC Act aims to balance the protection of Matters of NES with overarching economic and social needs, derived from the established principles of ecologically sustainable development. It is therefore appropriate to consider the social and economic benefits that would be derived from the proposed GCIMP development. As part of the EIS process, Norling Consulting, have undertaken a Multi Criteria Analysis to assess the economic, social and environmental elements of the project, a copy of the Economic and Social report is presented as Attachment 10.

Based upon the Multi Criteria Analysis undertaken and the detailed economic and social investigations carried out, it has been determined that the GCIMP development would:

- Generate approximately 2,250 annual full-time equivalent position (FTE) years during construction. The flow-on benefits of this employment would generate about 4,950 FTE position years in Queensland, with 4,160 FTE position years generated within the Gold Coast Region;
- The annual operating revenue of the proposed GCIMP is projected to be in the order of $754.4 million upon completion and is projected to provide approximately 2,700 FTE operational jobs on site. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 FTE positions in Queensland, of which 4,800 FTE positions would be generated within the Gold Coast Region, representing about 2% of current Gold Coast jobs;
- It is considered that the development of the GCIMP would assist in the rebuilding of the marine industry on the Gold Coast, particularly given the high economic value of the marine industry to the Gold Coast through the training of skilled employees and export of products both domestically and internationally;

- The proposed TAFE, which forms a key component of the GCIMP, would assist in assuring that the community has ready access to an appropriate skills-based training facility, which would contribute to the community's ability to access the proposed jobs to be generated; and
- The proposed tavern and hospitality uses would offer a meeting point for community and business groups.

Given the anticipated low likelihood of any significant impacts occurring on Matters of NES and the environmental, social and economic benefits expected to be derived as a result of the project, it is considered that the GCIMP development is consistent with the principal objective of the EPBC Act. Furthermore, it is the conclusion of this assessment that the GCIMP development is not, when consideration is given to existing site conditions and the overall effect of the proposed impact mitigation and management strategies, likely to have a significant adverse impact on any Matters of NES. Further detail has been provided in the Matters of National Environmental Significance Report prepared by Planit Consulting contained in Appendix 6.

Gold Coast International marine precinct

SECTION 2
PROJECT NEED AND ALTERNATIVES

Gold Coast International Marine Precinct

Environmental Impact Statement - Section 2

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2.0 Project Need and Alternatives

2.1 Project Justification

The justification for the project should be described, with particular reference made to the economic and social benefits, including employment and spin-off business development which the project may provide. The status of the project should be discussed in a local, regional, state and national context. An overall assessment of the need for the various elements of the project is required with regard to the following matters:

- the implications of the project for the Queensland Government's commitment to expanding and supporting Queensland's recreational boat building and service industry and its implementation of the Queensland Super Yacht Strategy and Marine Industry Training and Skills Forum plan and other relevant policies or plans
- potential benefits for the regional tourism industry
- need for the project against existing and proposed marina facilities in the region
- potential benefits for the regional marine industry
- need for commercial and retail facilities as part of the project
- need for the proposed marine industry training facility
- expected community, regional, state or national economic benefits (including anticipated capital expenditure, peak construction and operational jobs on a FTE (full time equivalent) basis)
- identify the anticipated social benefits for the project in a 'balance sheet' against any perceived social detriments
- other expected benefits.

The objective in the master planning of the site is to secure the best overall outcome for extending the existing GCMP to create an integrated industrial marina of international standard. There has been an emphasis on providing substantial area and excellent amenity for the growth of Marine Industry in the plan. The site is well positioned to fulfil the requirements of large scale Marine Industry uses. In particular, the excellent river frontage and a capacity for significant marine berthing jetties are key for the functional operation and success of the overall plan.

Numerous design alternatives have been tested and considered throughout the process. The Preferred Option Master Plan represents the culmination of a rigorous consultative process utilising the expertise of an experienced project team. Key elements of the Master Plan have been detailed as followed.

Public Park to be Acquired

The existing public parkland, William Guise Foxwell Park, alongside Shipper Drive is considered a key portion of land to be incorporated into the site. The requirement for adequate access to the Coomera River is of primary importance to the functionality of the Marine Industry. Without the parkland and the available river frontage, the development is severely compromised in both scale and access to the river.

The parkland represents over 35,000m^2 of constructed marine industry facilities as well as 170 metres of river frontage. The significant feature of the internal marina facility will not be possible without the parkland. The internal marina is a significant feature for the functionality of the overall precinct. Many marine businesses rely on the facility which is effective in increasing the overall direct river access.

The External Marina (Coomera River)

The external marina comprises 280 berths. 34 of these berths are dedicated to the Marina ship lift industry for the temporary docking and testing of new boats and the berthing of boats to be repaired. The resultant berths service the combined requirements for work, dormitory and temporary docking facilities. Reasoning pertaining to the number of berths included in the Master Plan is provided as follows.

- The marina extends and consolidates the existing Gold Coast Marina facility providing a single well managed location which will reduce environmental impact elsewhere on the river.
- Marina berths provide sewer connection and oil separating facility to prevent the dumping of boat waste into the river.
- The capacity also provides berths for boats, including overseas (and interstate), requiring access to service/repair facilities and ship lift.
- Sufficient berths are required to cater for everyday working and dormitory uses.
- The total berth numbers cater for the demonstrable increase in demand forecast by the Boat Industry Association Queensland.
- Economical viability of the marina requires that a minimum of 225 berths are available. The popularity of Coomera and the Gold Coast as a destination ensures that demand will be high.

The Internal Marina

The internal marina facility is primarily important for providing a significant increase in access directly into the Coomera River. The internal location provides many benefits including:

- 110 calm water berths with jetty access
- Siting for a large boat stack storage facility which will add up to 120 dry berths
- The marina provides an attractive visual separation and physical barrier to the industrial uses and the mixed commercial uses on the northern precincts of the site.
- The length of the internal marina provides a sufficient functional queuing distance for the boats using the Stack Storage facility.

The Boat Stack Storage Facility

The boat stack storage facility provides for approximately 120 dry berths and fulfils a variety of essential functions that contribute to the overall efficiency of the Marina:

- Dry berths provide storage for new vessels manufactured within the Marina.
- Dry berths provide storage for vessels which have been repaired or await repair within the Marina.
- The facility can provide for long term berthing or short term berthing.
- On site sales and brokering facilities attached to store enable the commerce of new and used craft to transact on site.
- A centralised wash down facility and cleaning service is incorporated ensuring best environmental standards for waste removal.

The boat stack storage facility is not possible in a functional sense using the 30 metre set back requirement of the external marina and hence the internal marina provides the optimum location.

The Boat Ramp

A public boat ramp was considered in concept design phases, although it has been rejected in the preferred Master Plan option. A public boat ramp is detrimental to the working functionality of the Marine industries (and vice versa). This is primarily because of the basic incompatibility of the two uses in neighbouring locations. A better location for a public boat ramp would be a significant distance away from the workings of a busy marine industry precinct.

Mixed Use Precinct

A mixed use precinct based around the principles of pedestrian friendly activated streetscapes caters for a variety of related activities. A mix of buildings types of two and three level construction will house uses including the sales and display of marine parts; fittings and fixtures; corporate office space; small scale light industry;

and service/recreational uses such as yacht club, restaurants, tavern and retail outlets to be located on the Marina river frontage. A hotel also is incorporated into the precinct to provide short term accommodation to travellers and marine industry workers. Streets typically have built frontages and are tree-lined with parking provided. Large car parking areas are hidden behind the built street front.

As detailed in the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10, the retail uses are intended to predominantly cater to the Marine Precinct workforce and the day tripper market. The proposed tavern would offer a meeting point for community and business groups. As such, the retail and showroom components are not anticipated to significantly impact upon the existing, approved or designated centres network within the local Coomera area, including the Coomera Town Centre. The retail and commercial services incorporated within the GCIMP are considered to be essential and appropriate in servicing the needs of the marine industry.

Summary

The master planned concept as presented represents a current 'state of play' rather than a finalised definitive solution. Whilst the concept represents many months of considered decision making, it is acknowledged that many factors will continue to cause and effect variations to the plan. The rationale and consultation that has created the current concept will continue throughout the approval process. An increased level of detail will be incorporated into the concept and evolve the master plan into an exceptional extension to the GCMP.

Project Implications

The GCIMP project is considered to meet and uphold the Queensland Government's commitment to expanding and supporting Queensland's boat building and service industry. It is acknowledged that the marine industry, and the boatbuilding sector in particular, represents one of the largest sophisticated manufacturing and high value added sectors in the State. As such the proposal is supportive of increasing and improving the marine industry and boatbuilding sector through the development of this marine industry facility of international standards.

Furthermore, the marine industry sector has a substantial regional presence and has been assessed as having significant potential for increased growth.

The project further reinforces the Marine Industry Training and Skills Forum Plan by incorporating an educational establishment (i.e. TAFE) inclusive of a 3000m^2 Centre for Excellence and a 1500m^2 Workshop devoted to Marine Industry training.

With regards to the regional tourism industry, many visitors are attracted to the Gold Coast due to water based activities (e.g. boating, whale watching, fishing, going to the beach). The Gold Coast Seaway, between The Spit and South Stradbroke Island, allow vessels direct access to the Pacific Ocean from The Broadwater and many of the city's canal estates, allowing for a broad range of water activities such as deep sea fishing and whale watching. Consequently, the Gold Coast's tourism industry sustains a large number of commercial vessels, each of which must be maintained, berthed and provisional on the Gold Coast. The GCIMP project will assist in these activities.

Employment and Income

As detailed in the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10, the GCIMP is anticipated to generate significant employment opportunities for the local community and wider Gold Coast region during construction and operation. It is estimated that the total construction cost of the proposed development would be approximately $390M (including all civil works and construction of buildings). Multipliers were utilised to determine the additional value generated from every dollar spent or invested during the construction phase. Thus, the indirect flow-on or multiplier effects to the Gold Coast Region and Queensland economy are projected to be in the order of $407M and $446M, respectively. The scale of this economic stimulus to the Gold Coast is equivalent to between 2% and 3% of its annual Gross Regional Product (although the benefit would be distributed over several years).

Furthermore, the construction of the proposal is projected to provide approximately 2,250 annual full-time equivalent position (FTE) years. The flow-on benefits of this employment would generate about 4,950 full-time equivalent position years in Queensland and 4,160 full-time equivalent position years within the Gold Coast Region.

The operating revenue of the proposal is projected to be in the order of $754.4 million upon completion and is projected to provide approximately 2,700 FTE operational employment position years. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 full-time equivalent positions in Queensland, of which 4,800 full-time equivalent positions would be generated within the Gold Coast Region. This represents about 2% of the current Gold Coast jobs.

Furthermore, the proposed GCIMP is estimated to generate approximately $250 million of the annual export income of the region. This revenue contribution would contribute to positioning Queensland as the nation's leading recreational boat exporter, therefore adding to the Region's appeal for visitors, events and business investments.

Net Benefit Test

A net benefit assessment takes into account all economic, social and environmental impacts of a project and establishes whether such a project produces a net benefit to the State, region, or distinct sectoral, commercial or private venture (Department of Environment and Resource Management 2009). In addition, net benefit assessment is noted as a tool for summative evaluation, seen as a critical instrument in explaining the logic and benefits of proposals to project stakeholders (Heywood, 2008). Net benefit assessment can be undertaken through a Cost-Benefit Analysis or a Multi Criteria Analysis.

A Multi-Criteria Analysis Framework has been adopted for this project to assess all net benefits of the project. This method is supported by the:

- Environmental Economic Valuation – An Introductory Guide for Policy-makers and Practitioners prepared by the Inter-Departmental Committee on Environmental Economic Valuation for the Queensland Environmental Protection Agency in August 2003; and
- Net Benefit Analysis Framework by the Queensland Department of Tourism, Regional Development and Industry in June 2008.

The Multi-Criteria Analysis Framework is superior to more quantitative methods when evaluating criteria that are difficult to quantify, such as social and environmental issues. The EIS has placed dollar estimates on those impacts able to be quantified, but applies the Multi-Criteria Analysis Framework to assess the net benefit of all criteria. It is also a transparent process, with the reader readily able to overlay different values (if in disagreement with the values selected) to identify the extent to which the Analysis is sensitive to changes in values for some criteria.

Social Criteria and Values

The selected criteria/values to be assessed have been derived from the Terms of Reference issued with regards to the development of the GCIMP. The table below provides a summary of the social, economic and environmental criteria (values) that are assessed as part of the Multi-Criteria Analysis.

Table 1 - Social, Economic and Environmental Criteria

Social Criteria (Value)	Economic Criteria (Value)	Environmental Criteria (Value)
Traffic & Transport - Impact on existing State and Local Government Roads	**Labour Market** - Construction - Operation	**Land Values** - Topography and Landscape Character - Geology and Soils – erosion and sedimentation - Minimise disturbance of Acid Sulphate Soils - Containment of Contaminated Land - Terrestrial Ecology o Fauna/Flora Values
Land Use - Amenity impacts on surrounding land use - Compatibility with planning intent for the site - Local Community Values	**Housing Market** - Construction - Operation	**Water Values** - Groundwater Values - Surface Water Quality o Construction o Operation
Health and Safety - Use of public safety emergency and medical facilities - Vulnerability to natural disasters	**Gross Regional Product** - Construction - Operation	**Surface Water Flooding**
Telecommunication Infrastructure	**Employment Generation** - Construction - Operation	**Aquatic Ecology** - Marine - Freshwater - Wetlands
Cultural Heritage Values - Indigenous values - Non-indigenous values	**Regional Tourism Industry**	**Energy Footprint**
Local Community Values & Lifestyles	**Activity Centres Network**	**Water Supply**
Community Service Needs	**Council Rate Base**	**Vulnerability to Change**
Educational Needs	**Property Market**	**Waste Generation** - Solid Waste o Construction/Operation - Sewerage o Construction/Operation - Marine o Construction/Operation
Recreational, Leisure and Sporting Needs	**Region's Competitive Advantage**	**Air Quality** - Construction/Operation
Urban Character - Built Form - Visual Amenity	**Export Dollars**	**Noise and Vibration** - Construction/Operation
	QLD Boat Building & Service Industry	

Multi-Criteria Analysis Matrix

The Multi-Criteria Analysis (MCA) is designed to measure the relativity between the status quo (do nothing option) and the four possible development options. Therefore, it is the relativities across these various options that will produce the net result.

A score out of 10 has been attributed for each criteria (value) for each of the development options, whereby 10 is the highest and 0 is the lowest. The table below provides a guide for these scores, where standards/expectations include quantified standards adopted by relevant government organisation or the reasonable standards by the community in the absence of a standard.

Table 2 - Multi-Criteria Ranking Scores

SCORE	OUTCOMES
10	World best practice
9	Australian best practice
8	Queensland best practice
7	Exceeds standards/expectations
6	Slightly exceeds standards/expectations
5	Satisfies minimum standards/expectations
4	Slightly fails standards/expectations
3	Fails standards/expectations
2	Significantly fails standards/expectations
1	Major disaster
0	Catastrophic disaster

A summary of the assigned scores for each of the social, economic and environmental elements is contained within the Social and Economic Impact Assessment Report prepared by Norling Consulting is presented as Appendix 10 of the EIS.

Alternatives

This section should:

- provide a general explanation of the option of not taking the action.
- provide general information on any alternative locations or design options that were considered, including the option of not proceeding with the development. Feasible alternative uses of the site should also be outlined including existing use (considering its value as a coastal habitat resource). This section should consider alternative buffers to Oakey Creek and describe reasons for the chosen buffer and why others were rejected, and address the feasibility of altering the design of the external marina such that erosion impacts to surrounding areas are prevented or minimised.
- discuss the options for dredge material disposal and reasons for choosing the preferred material disposal site. Indicate any constraints to the different options for disposal.
- describe the social, economic, ecological and technical criteria for selection of the preferred project option
- provide sufficient detail to enable understanding of the reasons for selection of the preferred option and for rejection of alternatives.

The EIS should describe any prudent and feasible alternatives to the project or specific elements of the project. These alternatives should be discussed in sufficient detail to make clear the reasons for preferring certain options and rejecting others. The reasons for choice of the preferred option should be explained, with reference to the adverse and beneficial effects used as the basis for selection as well as compliance with government policy and with the principles and objectives of ecologically sustainable development.

Preferred Concept and Alternative Development Options

In preparing the GCIMP Master Plan, three alternative development options were considered, along with the option of leaving the site as is in its undeveloped state. These alternatives are summarised as follows.

Preferred Option

The GCIMP Master Plan prepared by Push Architects contained in Appendix 2 is the preferred development option for the site. This Masterplan embodies best practice designs for a working industrial marina, supply chain management, management and control of manufacturing processes. Furthermore, the master plan will open new opportunities for research and design, workforce training and continual education within the Coomera Area.

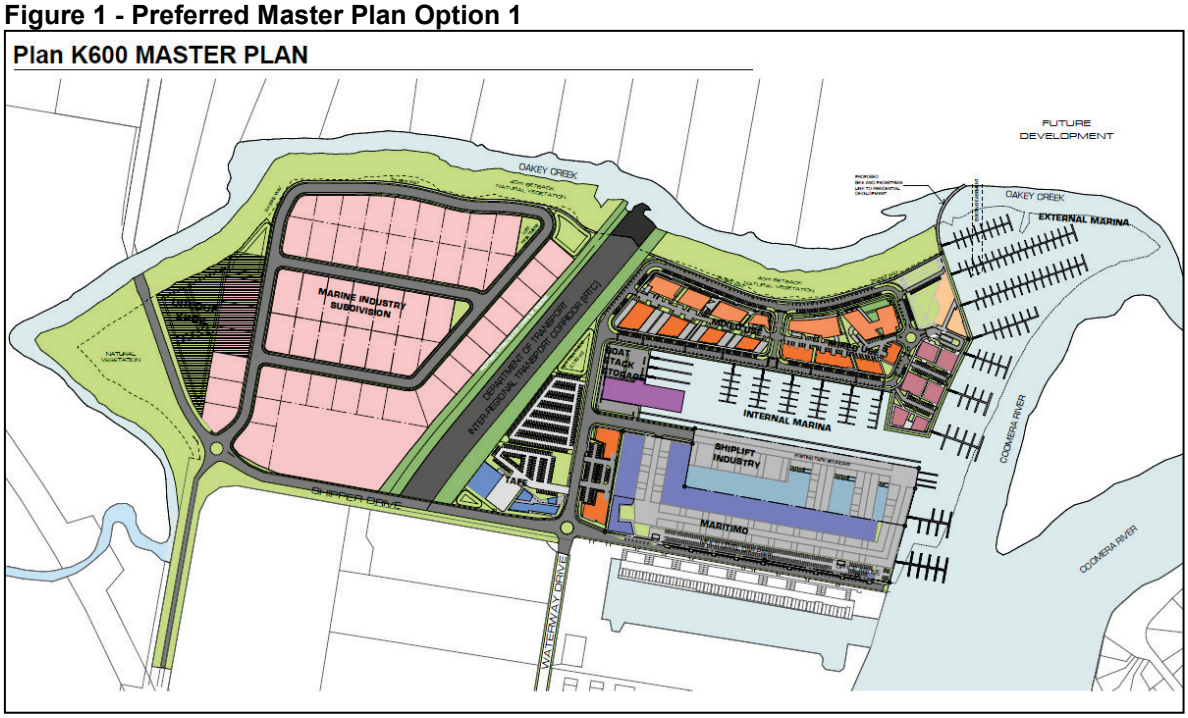
Specific details pertaining to the project are summarised as follows.

- a 28.9 hectare marine industrial zone, inclusive of ship-life facilities, boat and yacht manufacturers, repairers and associated businesses;
- a dry boat stacked storage facility with gantry crane access for approximately 290 vessels;
- a 4.5 hectare internal marina incorporating approximately 110 berths, providing a calm water environment for the launch and retrieval of vessels and for the on-water display of vessels by manufacturers and retailers onsite;
- an external marina within the Coomera River incorporating 280 multiple sized berths constructed through a 7 hectare widening of the Coomera River;
- a 9.3 hectare mixed use precinct comprising sales, showrooms, display of marine parts, fittings and fixtures, corporate office space, small scale light industry and services such as a yacht club, restaurants and retail outlets; and
- an educational establishment (i.e. TAFE college) comprising a 3,000m^2 Centre of Excellence and a 1,500m^2 workshop for marine industry training;

Approximately 42 hectares of the site will be developed for marine industry. The remaining area includes a 40 metre naturally vegetated setback along Oakey Creek and other public access facilities. A public access pedestrian zone will be constructed along the riverfront, providing a landscaped promenade alongside the marina.

The Masterplan is provided in the Figure below. This is seen as the optimum spatial arrangement of landuses when all social, economic and environmental constraints and opportunities are considered.

Figure 1 - Preferred Master Plan Option 1



Option 2

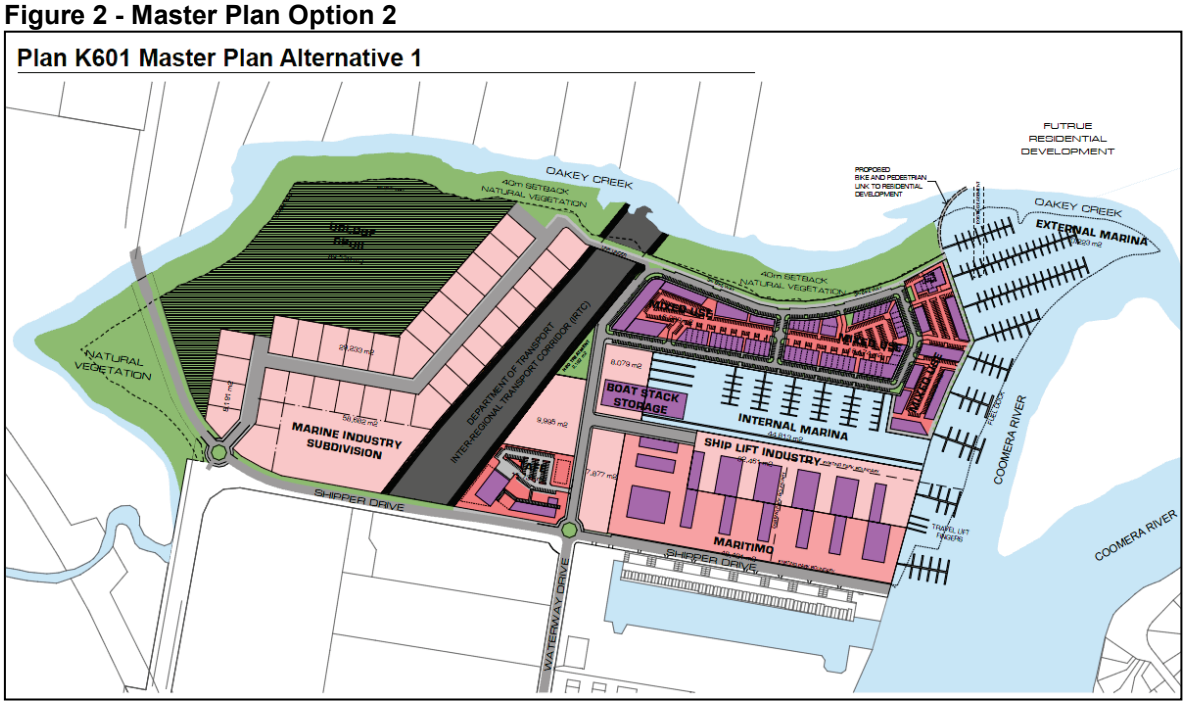
This alternative has been designed to incorporate a Coomera River and Southern Broadwater dredge spoil facility. This facility has been identified as being required as necessary in the maintenance the navigation channels of the Coomera River and Southern Broadwater.

Studies undertaken by Department of Transport and Main Roads and GCCC have identified the site as a potential location for this facility. A site of approximately 9ha is indentified as required for the facility.

The EIS provides a report on this issue and a identifies an alternative site to met the long term dredging requirements. It cannot be assumed however that this will be adopted and thus an alternative which includes the dredge facility is considered a necessary option to evaluate. In evaluating this option economic aspects of the facility are able to be considered.

In comparison to the preferred Master Plan a significant area of the western precinct is removed to accommodate the dredge facility. An image of Option 2 is provided below.

Figure 2 - Master Plan Option 2



Option 3

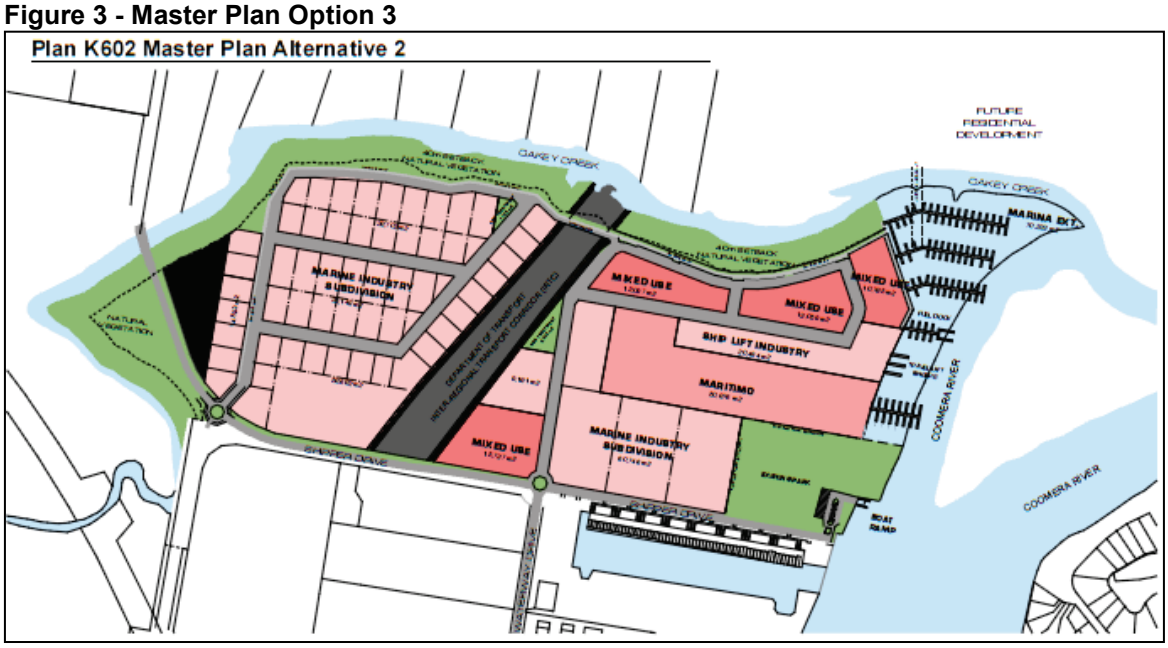
In the case of open space, an alternate concept which did not rely upon or incorporate the existing park reserve (Lot 108 WD6404) was considered a valid alternative to consider.

This option would evaluate the ability to deliver the desired integrated marine industrial complex and also gauge community support and or comments on preserving protecting the park.

This alternate plan also sought to embellish the open space with a boat ramp and parking to increase the accessibility of and use of the park for boat users.

The affect of retaining the open space is deletion of the internal marina, dry boat stack facility. A reduced mixed use area and external marina use also occurs in this alternative. An image of the Option 3 is provided below.

Figure 3 - Master Plan Option 3

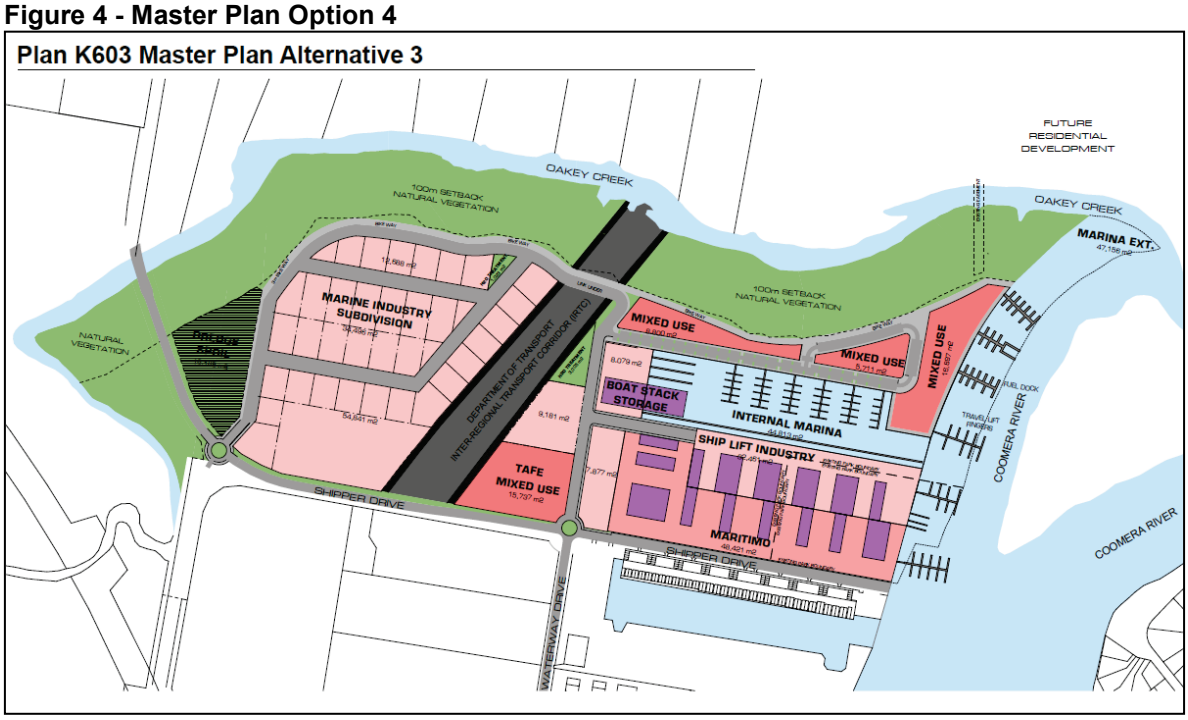


Option 4

The alternative option based upon a more responsive environmental design, incorporates greater setbacks to Oakey Creek, thus preserving additional marine habitats. A 100m setback was selected in this alternative based upon the maximum nominated buffer in the GCCC Natural Wetland and Waterways Code.

The affect of this requirement is a reduced external marina, mixed use precinct and industrial subdivision component, when compared to the preferred Master Plan. An image of this option is presented below.

Figure 4 - Master Plan Option 4



Option 5 - Status Quo

The status quo refers to the site in the current state of degraded rural land. There is no built form and the site exhibits a poor visual amenity outcome. Refer to the figure below.

Figure 5 - Project Alternative Status Quo site as degraded rural land

The following Land Use Comparison Table sets out the breakdown of various uses on each master plan alternative.

Table 3 - Land Use Comparison

Land Use	Option 1 (Preferred Option)	Option 2	Option 3	Option 4	Option 5 (Status Quo)
TAFE	1.6 ha	1.6 ha	-	1.6 ha	-
Mixed Use	9.3 ha	5.3 ha	6.9 ha	3.1 ha	-
Maritimo	5.0 ha	4.8 ha	5.1 ha	4.8 ha	-
Boat Stack Storage	8.0 ha	8.0 ha	-	8.0 ha	-
Ship Lift Industry	5.2 ha	3.2 ha	2.0 ha	3.2 ha	-
Marine Industry	18.7 ha	11.4 ha	21.2 ha	11.9 ha	-
Marina Berths - External - Internal	 280 berths 110 berths	 280 berths 110 berths	 168 berths	 78 berths 110 berths	-
Dredge Spoil Area	2.2 ha	9.0 ha	1.4 ha	1.8 ha	-
River Frontage	548m	548m	383m	512m	
Development Area Total	42ha	27.1ha	35.2ha	27.9ha	-

The preferred option master plan has significant benefits in the area of land which can be developed. This is particularly relevant compared to Option 3 and 4 which are compromised on the eastern river frontage part of the site. Option 2 maintains the eastern portion of the site however loses significant land in creating a dredge spoil store on the western portion.

The preferred option masterplan also presents better in terms of urban character when considering Built Form and Visual Amenity criteria. This is particularly evident on the eastern portion of the site whereby the greater land area and river frontage enable more successful urban design to be integrated with the ship lift industry and internal marina. Option 3 has no internal marina and requires a greater proportion of the site remaining (and river frontage) to be dedicated to industrial use.

The preferred option and Option 2 have similar qualities on the eastern portion of the site whereby the internal marina creates a visually appealing barrier between the industrial and mixed use areas of the site. A clear distinction in planning zones is evident whereby heavy industrial use is set on the south boundary alongside Shipper Drive and closer to the existing marina facility. The more pedestrian friendly Mixed Use and Entertainment use planning is on the northern portion of the site abutting the natural vegetation buffer to Oakey Creek.

The mixed use area in Option 4 is significantly smaller and therefore allows less opportunity for a critical mass of development sufficient to create a destination for the wider community.

The table below gives a comparison of the options in terms of urban character using the multi-criteria analysis guidelines.

Table 4 - Urban Character Comparison

	Preferred Option	Option 2	Option 3	Option 4	Status Quo
Built Form	9	8	6	7	0
Visual Amenity	8	6.5	5	6	6

The status quo refers to the site in the current state of degraded rural land. There is no built form and the visual amenity is not a maintained natural environment nor a maintained farm land.

The preferred option offers the best opportunity for creating an integrated designed master plan with the best character.

Option 2 is particularly let down on visual amenity due to the incorporation of a large dredge spoil store.

Option 3 has no opportunity for the integration of the internal marina and therefore lacks the design benefits and functional benefits of such an important feature.

Option 4 is compromised on the area available for mixed use development. The mixed use area available in the preferred option enables more facilities to be created which can be accessed by the public. Facilities such as retail, entertainment and short term accommodation are vital in terms of creating a destination and a vibrant urban character for the marina.

The detailed Architectural and Alternative Master Plans prepared by Push Architecture is presented as Appendix 2 of the EIS, which illustrates specific details in relation to the projects preferred and alternative scenarios discussed above.

A Social and Economic Impact Assessment report prepared by Norling Consulting is presented as Appendix 10 of the EIS, which undertakes a Multi-Criteria Analysis (MCA) of each scenario development option as sought by the ToR to evaluate all development options considered over the subject site. As previously discussed, the MCA takes into account applicable social, economic and environmental criteria to determine the overall net benefits and impacts of each development option.

Values were assigned to each social, economic and environmental criteria by relevant experts in their respective fields. Further detail relating to the MCA, and reasoning pertaining to the preferred GCIMP Master Plan is contained in the Social and Economic Impact Assessment Report contained in Appendix 10 of the EIS.

Dredge Disposal Alternatives

In addition to the alternative development options, alternate dredge disposal sites have been considered. This has been detailed in the Coomera River Dredge Disposal Options Report prepared by Hyder Consulting contained in Appendix 17.

The Coomera River Dredge Disposal Options Report provides a summary of three different reports covering possible options and analysis of dredging both the proposed Marina and the Coomera River and the disposal of the associated spoil.

The first report covered is the Pipeline Route and Onsite Facility Evaluation Report, prepared by Hyder, which covers the various methods of dredge spoil deposition from the dredging of the marina sections of the Gold Coast International Marine Precinct (GCIMP). The report mainly covers the analysis of five different pipeline routes to dispose of dredged spoil, with additional options including onsite disposal and the use of geo-textile materials. Benefits and constraints for each option are identified for each option, considering the social impacts and amenity,

environmental, economical and constructability issues. The report also outlines the preliminary details of a potential land swap in which land required for a permanent dredge spoil solution can potentially be exchanged with the park and recreation area on Lot 108.

The second report is the Coomera River Stage Pumping System, prepared by R.J Robbins & Associates, which covers the analysis and preliminary design of a pumping system to transport and responsibly dispose of the dredged spoil which arises from the regular maintenance dredging of the Coomera River. A dredge strategy is outlined within the report along with the design of a pipeline to transport the spoil to a disposal area. Although one pipeline option is presented, three disposal options are investigated. Capital cost and operating cost budget estimates have also been provided with the design of the pumping system.

The third report is an assessment of costs associated with the engagement of Neumann's Dredging to undertake maintenance dredging of the marina and dispose of the dredge spoil through a pipeline to their sand washing facility at Hart Street. This option is similar to the Coomera River Disposal option investigated by Hyder, however this option is temporary with the dredge engaged at regular intervals to undertake maintenance dredging and to establish and dismantle the required temporary pipeline.

Detail pertaining to each dredge disposal option and recommendations regarding the preferred methods of dredge disposal is contained within the Coomera River Dredge Disposal Options Report prepared by Hyder Consulting contained in Appendix 17.

Gold Coast International marine precinct

SECTION 2
PROJECT NEED AND ALTERNATIVES

Gold Coast International Marine Precinct

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The justification for the project should be described, with particular reference made to the economic and social benefits, including employment and spin-off business development which the project may provide. The status of the project should be discussed in a local, regional, state and national context. An overall assessment of the need for the various elements of the project is required with regard to the following matters:

- the implications of the project for the Queensland Government's commitment to expanding and supporting Queensland's recreational boat building and service industry and its implementation of the Queensland Super Yacht Strategy and Marine Industry Training and Skills Forum plan and other relevant policies or plans
- potential benefits for the regional tourism industry
- need for the project against existing and proposed marina facilities in the region
- potential benefits for the regional marine industry
- need for commercial and retail facilities as part of the project
- need for the proposed marine industry training facility
- expected community, regional, state or national economic benefits (including anticipated capital expenditure, peak construction and operational jobs on a FTE (full time equivalent) basis)
- identify the anticipated social benefits for the project in a 'balance sheet' against any perceived social detriments
- other expected benefits.

The objective in the master planning of the site is to secure the best overall outcome for extending the existing GCMP to create an integrated industrial marina of international standard. There has been an emphasis on providing substantial area and excellent amenity for the growth of Marine Industry in the plan. The site is well positioned to fulfil the requirements of large scale Marine Industry uses. In particular, the excellent river frontage and a capacity for significant marine berthing jetties are key for the functional operation and success of the overall plan.

Numerous design alternatives have been tested and considered throughout the process. The Preferred Option Master Plan represents the culmination of a rigorous consultative process utilising the expertise of an experienced project team. Key elements of the Master Plan have been detailed as followed.

Public Park to be Acquired

The existing public parkland, William Guise Foxwell Park, alongside Shipper Drive is considered a key portion of land to be incorporated into the site. The requirement for adequate access to the Coomera River is of primary importance to the functionality of the Marine Industry. Without the parkland and the available river frontage, the development is severely compromised in both scale and access to the river.

The parkland represents over 35,000m^2 of constructed marine industry facilities as well as 170 metres of river frontage. The significant feature of the internal marina facility will not be possible without the parkland. The internal marina is a significant feature for the functionality of the overall precinct. Many marine businesses rely on the facility which is effective in increasing the overall direct river access.

The External Marina (Coomera River)

The external marina comprises 280 berths. 34 of these berths are dedicated to the Marina ship lift industry for the temporary docking and testing of new boats and the berthing of boats to be repaired. The resultant berths service the combined requirements for work, dormitory and temporary docking facilities. Reasoning pertaining to the number of berths included in the Master Plan is provided as follows.

- The marina extends and consolidates the existing Gold Coast Marina facility providing a single well managed location which will reduce environmental impact elsewhere on the river.
- Marina berths provide sewer connection and oil separating facility to prevent the dumping of boat waste into the river.
- The capacity also provides berths for boats, including overseas (and interstate), requiring access to service/repair facilities and ship lift.
- Sufficient berths are required to cater for everyday working and dormitory uses.
- The total berth numbers cater for the demonstrable increase in demand forecast by the Boat Industry Association Queensland.
- Economical viability of the marina requires that a minimum of 225 berths are available. The popularity of Coomera and the Gold Coast as a destination ensures that demand will be high.

The Internal Marina

The internal marina facility is primarily important for providing a significant increase in access directly into the Coomera River. The internal location provides many benefits including:

- 110 calm water berths with jetty access
- Siting for a large boat stack storage facility which will add up to 120 dry berths
- The marina provides an attractive visual separation and physical barrier to the industrial uses and the mixed commercial uses on the northern precincts of the site.
- The length of the internal marina provides a sufficient functional queuing distance for the boats using the Stack Storage facility.

The Boat Stack Storage Facility

The boat stack storage facility provides for approximately 120 dry berths and fulfils a variety of essential functions that contribute to the overall efficiency of the Marina:

- Dry berths provide storage for new vessels manufactured within the Marina.
- Dry berths provide storage for vessels which have been repaired or await repair within the Marina.
- The facility can provide for long term berthing or short term berthing.
- On site sales and brokering facilities attached to store enable the commerce of new and used craft to transact on site.
- A centralised wash down facility and cleaning service is incorporated ensuring best environmental standards for waste removal.

The boat stack storage facility is not possible in a functional sense using the 30 metre set back requirement of the external marina and hence the internal marina provides the optimum location.

The Boat Ramp

A public boat ramp was considered in concept design phases, although it has been rejected in the preferred Master Plan option. A public boat ramp is detrimental to the working functionality of the Marine industries (and vice versa). This is primarily because of the basic incompatibility of the two uses in neighbouring locations. A better location for a public boat ramp would be a significant distance away from the workings of a busy marine industry precinct.

Mixed Use Precinct

A mixed use precinct based around the principles of pedestrian friendly activated streetscapes caters for a variety of related activities. A mix of buildings types of two and three level construction will house uses including the sales and display of marine parts; fittings and fixtures; corporate office space; small scale light industry;

and service/recreational uses such as yacht club, restaurants, tavern and retail outlets to be located on the Marina river frontage. A hotel also is incorporated into the precinct to provide short term accommodation to travellers and marine industry workers. Streets typically have built frontages and are tree-lined with parking provided. Large car parking areas are hidden behind the built street front.

As detailed in the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10, the retail uses are intended to predominantly cater to the Marine Precinct workforce and the day tripper market. The proposed tavern would offer a meeting point for community and business groups. As such, the retail and showroom components are not anticipated to significantly impact upon the existing, approved or designated centres network within the local Coomera area, including the Coomera Town Centre. The retail and commercial services incorporated within the GCIMP are considered to be essential and appropriate in servicing the needs of the marine industry.

Summary

The master planned concept as presented represents a current 'state of play' rather than a finalised definitive solution. Whilst the concept represents many months of considered decision making, it is acknowledged that many factors will continue to cause and effect variations to the plan. The rationale and consultation that has created the current concept will continue throughout the approval process. An increased level of detail will be incorporated into the concept and evolve the master plan into an exceptional extension to the GCMP.

Project Implications

The GCIMP project is considered to meet and uphold the Queensland Government's commitment to expanding and supporting Queensland's boat building and service industry. It is acknowledged that the marine industry, and the boatbuilding sector in particular, represents one of the largest sophisticated manufacturing and high value added sectors in the State. As such the proposal is supportive of increasing and improving the marine industry and boatbuilding sector through the development of this marine industry facility of international standards.

Furthermore, the marine industry sector has a substantial regional presence and has been assessed as having significant potential for increased growth.

The project further reinforces the Marine Industry Training and Skills Forum Plan by incorporating an educational establishment (i.e. TAFE) inclusive of a 3000m^2 Centre for Excellence and a 1500m^2 Workshop devoted to Marine Industry training.

With regards to the regional tourism industry, many visitors are attracted to the Gold Coast due to water based activities (e.g. boating, whale watching, fishing, going to the beach). The Gold Coast Seaway, between The Spit and South Stradbroke Island, allow vessels direct access to the Pacific Ocean from The Broadwater and many of the city's canal estates, allowing for a broad range of water activities such as deep sea fishing and whale watching. Consequently, the Gold Coast's tourism industry sustains a large number of commercial vessels, each of which must be maintained, berthed and provisional on the Gold Coast. The GCIMP project will assist in these activities.

Employment and Income

As detailed in the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10, the GCIMP is anticipated to generate significant employment opportunities for the local community and wider Gold Coast region during construction and operation. It is estimated that the total construction cost of the proposed development would be approximately $390M (including all civil works and construction of buildings). Multipliers were utilised to determine the additional value generated from every dollar spent or invested during the construction phase. Thus, the indirect flow-on or multiplier effects to the Gold Coast Region and Queensland economy are projected to be in the order of $407M and $446M, respectively. The scale of this economic stimulus to the Gold Coast is equivalent to between 2% and 3% of its annual Gross Regional Product (although the benefit would be distributed over several years).

Furthermore, the construction of the proposal is projected to provide approximately 2,250 annual full-time equivalent position (FTE) years. The flow-on benefits of this employment would generate about 4,950 full-time equivalent position years in Queensland and 4,160 full-time equivalent position years within the Gold Coast Region.

The operating revenue of the proposal is projected to be in the order of $754.4 million upon completion and is projected to provide approximately 2,700 FTE operational employment position years. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 full-time equivalent positions in Queensland, of which 4,800 full-time equivalent positions would be generated within the Gold Coast Region. This represents about 2% of the current Gold Coast jobs.

Furthermore, the proposed GCIMP is estimated to generate approximately $250 million of the annual export income of the region. This revenue contribution would contribute to positioning Queensland as the nation's leading recreational boat exporter, therefore adding to the Region's appeal for visitors, events and business investments.

Net Benefit Test

A net benefit assessment takes into account all economic, social and environmental impacts of a project and establishes whether such a project produces a net benefit to the State, region, or distinct sectoral, commercial or private venture (Department of Environment and Resource Management 2009). In addition, net benefit assessment is noted as a tool for summative evaluation, seen as a critical instrument in explaining the logic and benefits of proposals to project stakeholders (Heywood, 2008). Net benefit assessment can be undertaken through a Cost-Benefit Analysis or a Multi Criteria Analysis.

A Multi-Criteria Analysis Framework has been adopted for this project to assess all net benefits of the project. This method is supported by the:

- Environmental Economic Valuation – An Introductory Guide for Policy-makers and Practitioners prepared by the Inter-Departmental Committee on Environmental Economic Valuation for the Queensland Environmental Protection Agency in August 2003; and
- Net Benefit Analysis Framework by the Queensland Department of Tourism, Regional Development and Industry in June 2008.

The Multi-Criteria Analysis Framework is superior to more quantitative methods when evaluating criteria that are difficult to quantify, such as social and environmental issues. The EIS has placed dollar estimates on those impacts able to be quantified, but applies the Multi-Criteria Analysis Framework to assess the net benefit of all criteria. It is also a transparent process, with the reader readily able to overlay different values (if in disagreement with the values selected) to identify the extent to which the Analysis is sensitive to changes in values for some criteria.

Social Criteria and Values

The selected criteria/values to be assessed have been derived from the Terms of Reference issued with regards to the development of the GCIMP. The table below provides a summary of the social, economic and environmental criteria (values) that are assessed as part of the Multi-Criteria Analysis.

Table 1 - Social, Economic and Environmental Criteria

Social Criteria (Value)	Economic Criteria (Value)	Environmental Criteria (Value)
Traffic & Transport - Impact on existing State and Local Government Roads	**Labour Market** - Construction - Operation	**Land Values** - Topography and Landscape Character - Geology and Soils – erosion and sedimentation - Minimise disturbance of Acid Sulphate Soils - Containment of Contaminated Land - Terrestrial Ecology o Fauna/Flora Values
Land Use - Amenity impacts on surrounding land use - Compatibility with planning intent for the site - Local Community Values	**Housing Market** - Construction - Operation	**Water Values** - Groundwater Values - Surface Water Quality o Construction o Operation
Health and Safety - Use of public safety emergency and medical facilities - Vulnerability to natural disasters	**Gross Regional Product** - Construction - Operation	**Surface Water Flooding**
Telecommunication Infrastructure	**Employment Generation** - Construction - Operation	**Aquatic Ecology** - Marine - Freshwater - Wetlands
Cultural Heritage Values - Indigenous values - Non-indigenous values	**Regional Tourism Industry**	**Energy Footprint**
Local Community Values & Lifestyles	**Activity Centres Network**	**Water Supply**
Community Service Needs	**Council Rate Base**	**Vulnerability to Change**
Educational Needs	**Property Market**	**Waste Generation** - Solid Waste o Construction/Operation - Sewerage o Construction/Operation - Marine o Construction/Operation
Recreational, Leisure and Sporting Needs	**Region's Competitive Advantage**	**Air Quality** - Construction/Operation
Urban Character - Built Form - Visual Amenity	**Export Dollars**	**Noise and Vibration** - Construction/Operation
	QLD Boat Building & Service Industry	

Multi-Criteria Analysis Matrix

The Multi-Criteria Analysis (MCA) is designed to measure the relativity between the status quo (do nothing option) and the four possible development options. Therefore, it is the relativities across these various options that will produce the net result.

A score out of 10 has been attributed for each criteria (value) for each of the development options, whereby 10 is the highest and 0 is the lowest. The table below provides a guide for these scores, where standards/expectations include quantified standards adopted by relevant government organisation or the reasonable standards by the community in the absence of a standard.

Table 2 - Multi-Criteria Ranking Scores

SCORE	OUTCOMES
10	World best practice
9	Australian best practice
8	Queensland best practice
7	Exceeds standards/expectations
6	Slightly exceeds standards/expectations
5	Satisfies minimum standards/expectations
4	Slightly fails standards/expectations
3	Fails standards/expectations
2	Significantly fails standards/expectations
1	Major disaster
0	Catastrophic disaster

A summary of the assigned scores for each of the social, economic and environmental elements is contained within the Social and Economic Impact Assessment Report prepared by Norling Consulting is presented as Appendix 10 of the EIS.

Alternatives

This section should:

- provide a general explanation of the option of not taking the action.
- provide general information on any alternative locations or design options that were considered, including the option of not proceeding with the development. Feasible alternative uses of the site should also be outlined including existing use (considering its value as a coastal habitat resource). This section should consider alternative buffers to Oakey Creek and describe reasons for the chosen buffer and why others were rejected, and address the feasibility of altering the design of the external marina such that erosion impacts to surrounding areas are prevented or minimised.
- discuss the options for dredge material disposal and reasons for choosing the preferred material disposal site. Indicate any constraints to the different options for disposal.
- describe the social, economic, ecological and technical criteria for selection of the preferred project option
- provide sufficient detail to enable understanding of the reasons for selection of the preferred option and for rejection of alternatives.

The EIS should describe any prudent and feasible alternatives to the project or specific elements of the project. These alternatives should be discussed in sufficient detail to make clear the reasons for preferring certain options and rejecting others. The reasons for choice of the preferred option should be explained, with reference to the adverse and beneficial effects used as the basis for selection as well as compliance with government policy and with the principles and objectives of ecologically sustainable development.

Preferred Concept and Alternative Development Options

In preparing the GCIMP Master Plan, three alternative development options were considered, along with the option of leaving the site as is in its undeveloped state. These alternatives are summarised as follows.

Preferred Option

The GCIMP Master Plan prepared by Push Architects contained in Appendix 2 is the preferred development option for the site. This Masterplan embodies best practice designs for a working industrial marina, supply chain management, management and control of manufacturing processes. Furthermore, the master plan will open new opportunities for research and design, workforce training and continual education within the Coomera Area.

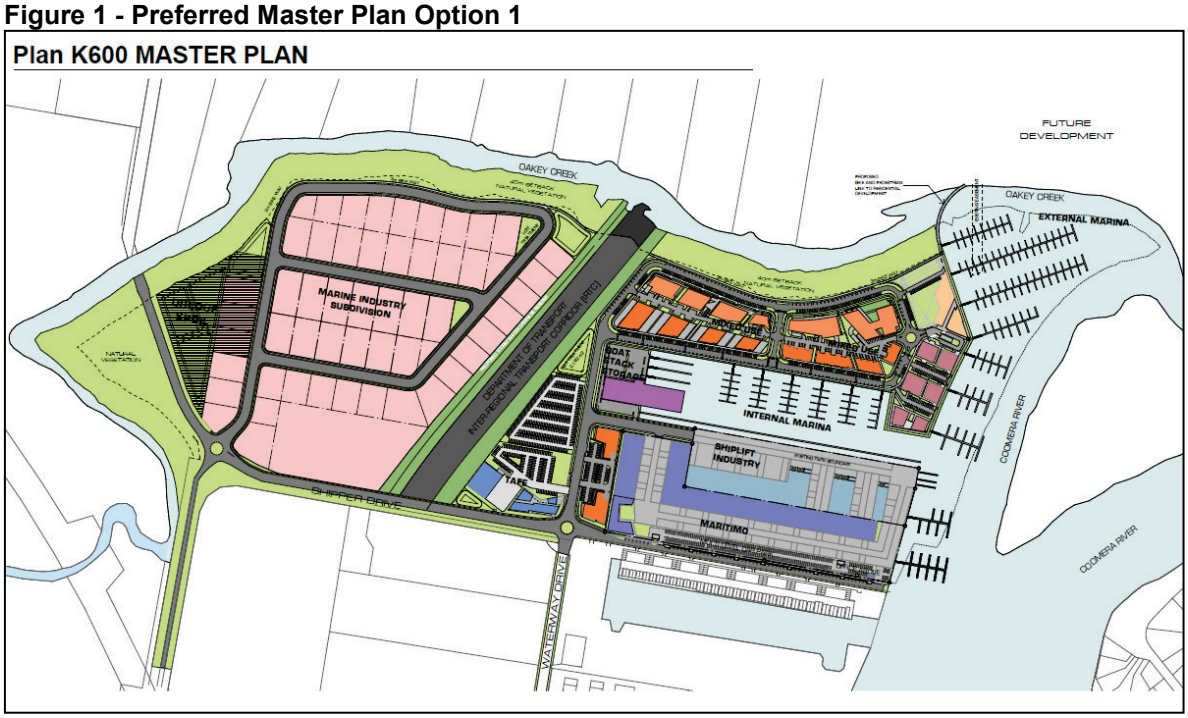
Specific details pertaining to the project are summarised as follows.

- a 28.9 hectare marine industrial zone, inclusive of ship-life facilities, boat and yacht manufacturers, repairers and associated businesses;
- a dry boat stacked storage facility with gantry crane access for approximately 290 vessels;
- a 4.5 hectare internal marina incorporating approximately 110 berths, providing a calm water environment for the launch and retrieval of vessels and for the on-water display of vessels by manufacturers and retailers onsite;
- an external marina within the Coomera River incorporating 280 multiple sized berths constructed through a 7 hectare widening of the Coomera River;
- a 9.3 hectare mixed use precinct comprising sales, showrooms, display of marine parts, fittings and fixtures, corporate office space, small scale light industry and services such as a yacht club, restaurants and retail outlets; and
- an educational establishment (i.e. TAFE college) comprising a 3,000m^2 Centre of Excellence and a 1,500m^2 workshop for marine industry training;

Approximately 42 hectares of the site will be developed for marine industry. The remaining area includes a 40 metre naturally vegetated setback along Oakey Creek and other public access facilities. A public access pedestrian zone will be constructed along the riverfront, providing a landscaped promenade alongside the marina.

The Masterplan is provided in the Figure below. This is seen as the optimum spatial arrangement of landuses when all social, economic and environmental constraints and opportunities are considered.

Figure 1 - Preferred Master Plan Option 1



Option 2

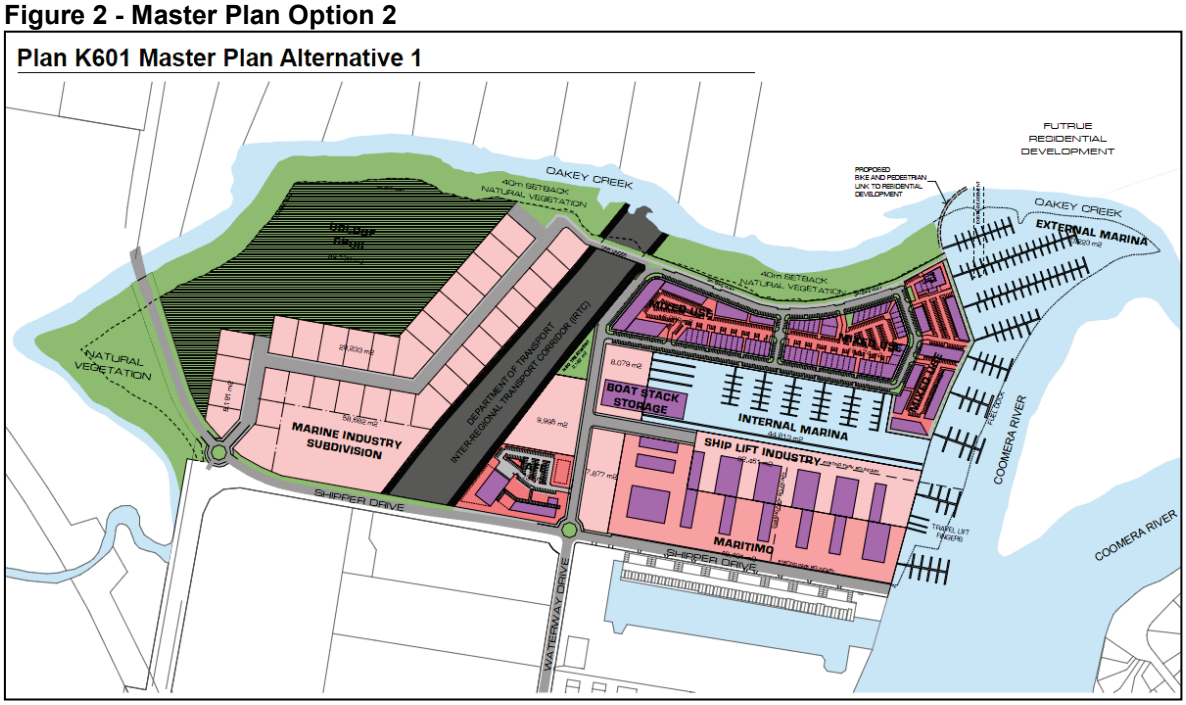
This alternative has been designed to incorporate a Coomera River and Southern Broadwater dredge spoil facility. This facility has been identified as being required as necessary in the maintenance the navigation channels of the Coomera River and Southern Broadwater.

Studies undertaken by Department of Transport and Main Roads and GCCC have identified the site as a potential location for this facility. A site of approximately 9ha is indentified as required for the facility.

The EIS provides a report on this issue and a identifies an alternative site to met the long term dredging requirements. It cannot be assumed however that this will be adopted and thus an alternative which includes the dredge facility is considered a necessary option to evaluate. In evaluating this option economic aspects of the facility are able to be considered.

In comparison to the preferred Master Plan a significant area of the western precinct is removed to accommodate the dredge facility. An image of Option 2 is provided below.

Figure 2 - Master Plan Option 2



Option 3

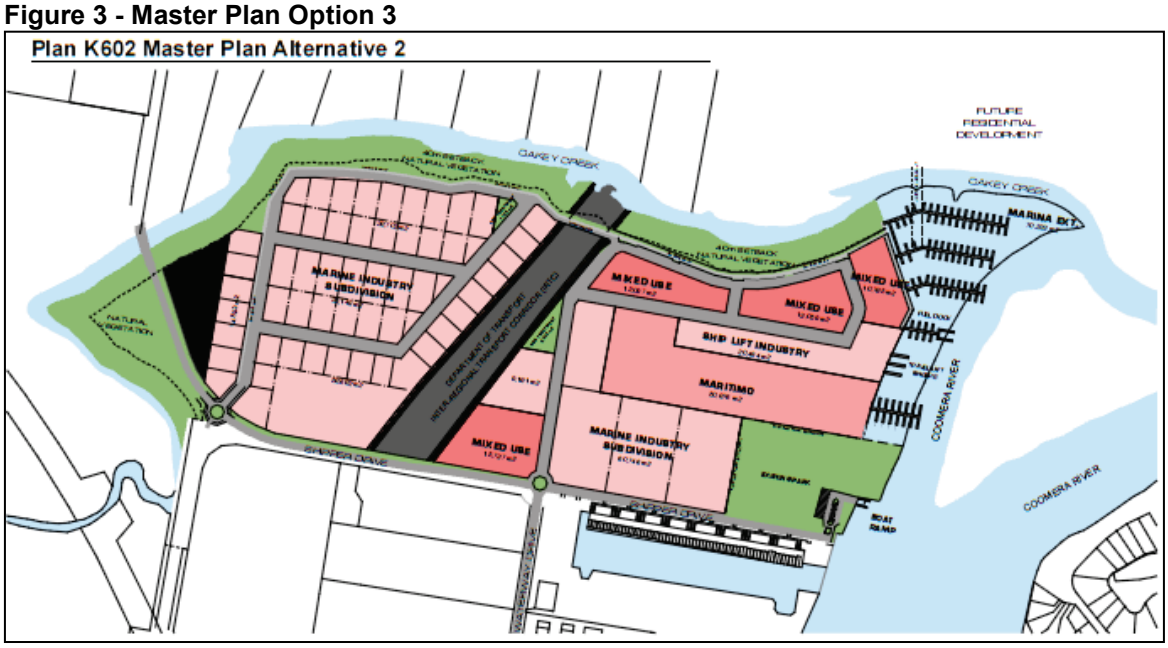
In the case of open space, an alternate concept which did not rely upon or incorporate the existing park reserve (Lot 108 WD6404) was considered a valid alternative to consider.

This option would evaluate the ability to deliver the desired integrated marine industrial complex and also gauge community support and or comments on preserving protecting the park.

This alternate plan also sought to embellish the open space with a boat ramp and parking to increase the accessibility of and use of the park for boat users.

The affect of retaining the open space is deletion of the internal marina, dry boat stack facility. A reduced mixed use area and external marina use also occurs in this alternative. An image of the Option 3 is provided below.

Figure 3 - Master Plan Option 3

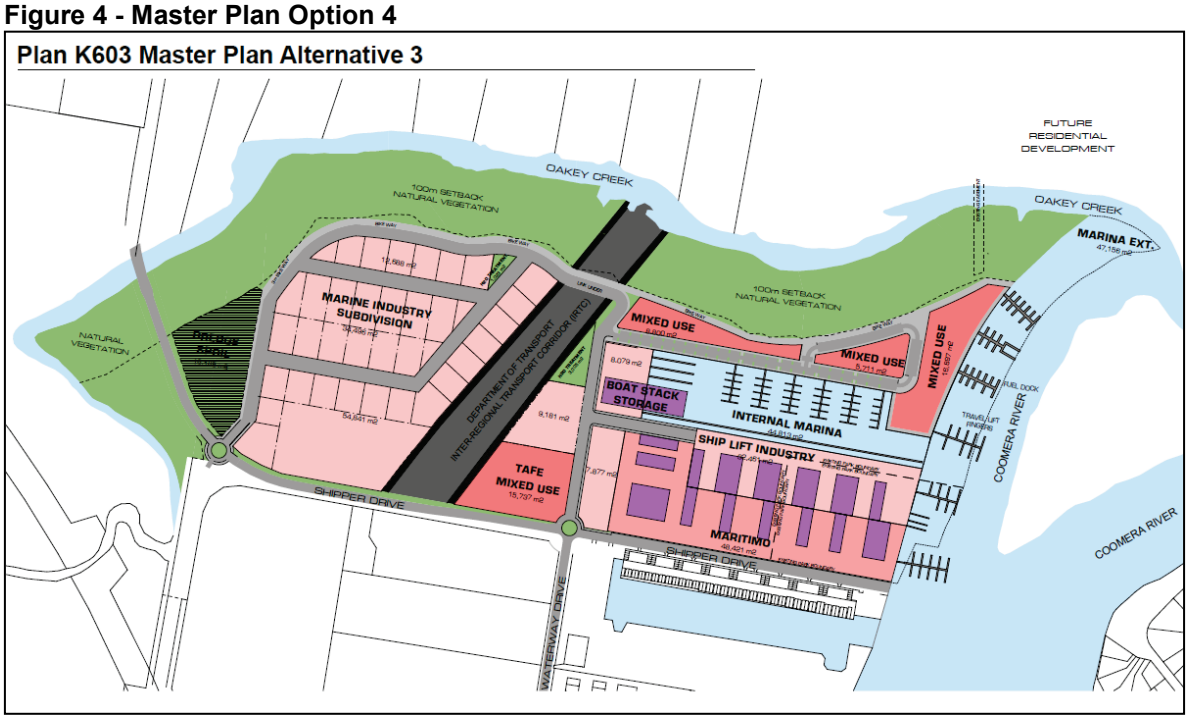


Option 4

The alternative option based upon a more responsive environmental design, incorporates greater setbacks to Oakey Creek, thus preserving additional marine habitats. A 100m setback was selected in this alternative based upon the maximum nominated buffer in the GCCC Natural Wetland and Waterways Code.

The affect of this requirement is a reduced external marina, mixed use precinct and industrial subdivision component, when compared to the preferred Master Plan. An image of this option is presented below.

Figure 4 - Master Plan Option 4



Option 5 - Status Quo

The status quo refers to the site in the current state of degraded rural land. There is no built form and the site exhibits a poor visual amenity outcome. Refer to the figure below.

Figure 5 - Project Alternative Status Quo site as degraded rural land

The following Land Use Comparison Table sets out the breakdown of various uses on each master plan alternative.

Table 3 - Land Use Comparison

Land Use	Option 1 (Preferred Option)	Option 2	Option 3	Option 4	Option 5 (Status Quo)
TAFE	1.6 ha	1.6 ha	-	1.6 ha	-
Mixed Use	9.3 ha	5.3 ha	6.9 ha	3.1 ha	-
Maritimo	5.0 ha	4.8 ha	5.1 ha	4.8 ha	-
Boat Stack Storage	8.0 ha	8.0 ha	-	8.0 ha	-
Ship Lift Industry	5.2 ha	3.2 ha	2.0 ha	3.2 ha	-
Marine Industry	18.7 ha	11.4 ha	21.2 ha	11.9 ha	-
Marina Berths - External - Internal	 280 berths 110 berths	 280 berths 110 berths	 168 berths	 78 berths 110 berths	-
Dredge Spoil Area	2.2 ha	9.0 ha	1.4 ha	1.8 ha	-
River Frontage	548m	548m	383m	512m	
Development Area Total	42ha	27.1ha	35.2ha	27.9ha	-

The preferred option master plan has significant benefits in the area of land which can be developed. This is particularly relevant compared to Option 3 and 4 which are compromised on the eastern river frontage part of the site. Option 2 maintains the eastern portion of the site however loses significant land in creating a dredge spoil store on the western portion.

The preferred option masterplan also presents better in terms of urban character when considering Built Form and Visual Amenity criteria. This is particularly evident on the eastern portion of the site whereby the greater land area and river frontage enable more successful urban design to be integrated with the ship lift industry and internal marina. Option 3 has no internal marina and requires a greater proportion of the site remaining (and river frontage) to be dedicated to industrial use.

The preferred option and Option 2 have similar qualities on the eastern portion of the site whereby the internal marina creates a visually appealing barrier between the industrial and mixed use areas of the site. A clear distinction in planning zones is evident whereby heavy industrial use is set on the south boundary alongside Shipper Drive and closer to the existing marina facility. The more pedestrian friendly Mixed Use and Entertainment use planning is on the northern portion of the site abutting the natural vegetation buffer to Oakey Creek.

The mixed use area in Option 4 is significantly smaller and therefore allows less opportunity for a critical mass of development sufficient to create a destination for the wider community.

The table below gives a comparison of the options in terms of urban character using the multi-criteria analysis guidelines.

Table 4 - Urban Character Comparison

	Preferred Option	Option 2	Option 3	Option 4	Status Quo
Built Form	9	8	6	7	0
Visual Amenity	8	6.5	5	6	6

The status quo refers to the site in the current state of degraded rural land. There is no built form and the visual amenity is not a maintained natural environment nor a maintained farm land.

The preferred option offers the best opportunity for creating an integrated designed master plan with the best character.

Option 2 is particularly let down on visual amenity due to the incorporation of a large dredge spoil store.

Option 3 has no opportunity for the integration of the internal marina and therefore lacks the design benefits and functional benefits of such an important feature.

Option 4 is compromised on the area available for mixed use development. The mixed use area available in the preferred option enables more facilities to be created which can be accessed by the public. Facilities such as retail, entertainment and short term accommodation are vital in terms of creating a destination and a vibrant urban character for the marina.

The detailed Architectural and Alternative Master Plans prepared by Push Architecture is presented as Appendix 2 of the EIS, which illustrates specific details in relation to the projects preferred and alternative scenarios discussed above.

A Social and Economic Impact Assessment report prepared by Norling Consulting is presented as Appendix 10 of the EIS, which undertakes a Multi-Criteria Analysis (MCA) of each scenario development option as sought by the ToR to evaluate all development options considered over the subject site. As previously discussed, the MCA takes into account applicable social, economic and environmental criteria to determine the overall net benefits and impacts of each development option.

Values were assigned to each social, economic and environmental criteria by relevant experts in their respective fields. Further detail relating to the MCA, and reasoning pertaining to the preferred GCIMP Master Plan is contained in the Social and Economic Impact Assessment Report contained in Appendix 10 of the EIS.

Dredge Disposal Alternatives

In addition to the alternative development options, alternate dredge disposal sites have been considered. This has been detailed in the Coomera River Dredge Disposal Options Report prepared by Hyder Consulting contained in Appendix 17.

The Coomera River Dredge Disposal Options Report provides a summary of three different reports covering possible options and analysis of dredging both the proposed Marina and the Coomera River and the disposal of the associated spoil.

The first report covered is the Pipeline Route and Onsite Facility Evaluation Report, prepared by Hyder, which covers the various methods of dredge spoil deposition from the dredging of the marina sections of the Gold Coast International Marine Precinct (GCIMP). The report mainly covers the analysis of five different pipeline routes to dispose of dredged spoil, with additional options including onsite disposal and the use of geo-textile materials. Benefits and constraints for each option are identified for each option, considering the social impacts and amenity,

environmental, economical and constructability issues. The report also outlines the preliminary details of a potential land swap in which land required for a permanent dredge spoil solution can potentially be exchanged with the park and recreation area on Lot 108.

The second report is the Coomera River Stage Pumping System, prepared by R.J Robbins & Associates, which covers the analysis and preliminary design of a pumping system to transport and responsibly dispose of the dredged spoil which arises from the regular maintenance dredging of the Coomera River. A dredge strategy is outlined within the report along with the design of a pipeline to transport the spoil to a disposal area. Although one pipeline option is presented, three disposal options are investigated. Capital cost and operating cost budget estimates have also been provided with the design of the pumping system.

The third report is an assessment of costs associated with the engagement of Neumann's Dredging to undertake maintenance dredging of the marina and dispose of the dredge spoil through a pipeline to their sand washing facility at Hart Street. This option is similar to the Coomera River Disposal option investigated by Hyder, however this option is temporary with the dredge engaged at regular intervals to undertake maintenance dredging and to establish and dismantle the required temporary pipeline.

Detail pertaining to each dredge disposal option and recommendations regarding the preferred methods of dredge disposal is contained within the Coomera River Dredge Disposal Options Report prepared by Hyder Consulting contained in Appendix 17.

Gold Coast International
marine precinct

SECTION 3
PROJECT DESCRIPTION

Gold Coast International Marine Precinct

Environmental Impact Statement - Section 3

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3 Project Description

The objective of this section is to describe all components of the total project in detail from construction activities to long term operations. The project description allows further assessment of approvals which may be required and how they may be managed through the life of the project.

3.1 Ecologically Sustainable Development

A brief summary of the proposal's compatibility with the concepts of ecologically sustainable development and other relevant policy instruments such as the standard criteria defined in the *Environmental Protection Act 1994* and the Guidelines for Fish-Friendly Structures (Department of Primary Industries and Fisheries Policy FHG006) (Derbyshire 2006) should be presented. Consideration should focus on The National Strategy for Ecologically Sustainable Development, (Ecologically Sustainable Development Steering Committee 1992). A life-of-project perspective should be shown.

The GCIMP project has been designed and developed to ensure that economic goals have been balanced with social equity and protection of environmental quality. Social, economic and environmental values have been considered in a comprehensive integrated assessment to maintain intergenerational equity and ensure that project activities do not compromise the quality of life for future generations. The project will contribute significant social and economic benefits to the Gold Coast region providing a valuable resource for use by present and future generations.

As detailed within the Ecologically Sustainable Development (ESD) Report prepared by Hyder Consulting contained in Appendix 11, the Queensland *Environment Protection Act 1994* (EP Act) aims to protect ecological processes and the quality of life for current and future generations in Queensland through development of environmental protection policies that address specific factors such as air, noise, water and waste. The standard criteria defined by Schedule 3 of the EP Act require consideration of the principles of ESD as set out in the National Strategy for ESD (NSESD) in assessment of development in Queensland.

The principles set out by the NSESD are:

- *'decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations;*
- *where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*
- *the global dimension of environmental impacts of actions and policies should be recognised and considered;*
- *the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised;*
- *the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;*

- *cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms; and*
- *decisions and actions should provide for broad community involvement on issues which affect them.'*

The standard criteria as defined by the EP Act also include addressing a number of instruments described under Schedule 3. All applicable Local, State and Commonwealth legislation including the Queensland Environmental Protection Policies (EPPs) have been considered in each of the elements under assessment for the EIS.

Environmental values identified under the EPPs are protected during the construction phase by implementation of the Environmental Management Plan (EMP) prepared by Hyder Consulting contained in Appendix 14, and during the operational phase by implementation of the Site Based Management Plan (SBMP) prepared by Hyder Consulting contained in Appendix 15. All recommendations arising from specialist site investigations are also included in the EMP and SBMP where relevant. The character, resilience and values of receiving environments are assessed in specialist reports contained in the Appendices to the EIS.

Best practice environmental management measures are proposed for protection of receiving environments that may be affected by construction and operational activities associated with the GCIMP project.

In preparing the EIS, consideration have been given to social, economic and environmental aspects of the development. Implementation of the principles of ESD has been achieved for the project through:

- review and modification of construction methodologies and operational activities where required;
- identification of social, economic and environmental values through detailed studies and site investigations;
- identification of potential adverse or beneficial impacts of the development on receiving environments;
- assessment of the level of risk associated with potential impacts;
- determining impact mitigation measures required to protect social, economic and environmental values;
- development of objectives, performance indicators and standard criteria to be achieved; and
- preparation of monitoring programs to evaluate the effectiveness of impact mitigation measures and determine the requirement for corrective actions.

As detailed below, the project will contribute significant social and economic benefits to the Gold Coast region providing a valuable resource for use by present and future generations.

Social Factors

A program of community consultation has been undertaken to identify and engage potential stakeholders and to ensure that those affected by the project are given the opportunity to participate in project planning and the EIS process. During this program, social values and expectations were identified and community concerns and issues were addressed as part of the social impact assessment.

The project will provide uninterrupted access from local residential areas for pedestrian and cycling pathways to the proposed GCIMP promoting integration of the development with existing public open spaces. Landscaped parkland within the development will provide opportunities for public use of the site and will maintain foreshore access for the local community and visitors to the site.

The GCIMP will provide important tourism infrastructure for use by public members and visitors to Gold Coast. The building design and strategic location of key activities allows spaces for onsite workers and visitors to gather and provides equitable opportunities for community interaction.

The close proximity of the residential precinct to existing public transport networks will facilitate use of alternative transport options and reduce the need for private vehicle use. Transport nodes will be provided within the GCIMP for connection to existing transport networks and access to the Gold Coast and the wider region.

Environmental Factors

Baseline monitoring of existing environments has been conducted and modelling was undertaken to predict likely changes in these environments as a result of the project. Where required, the project design was modified and the construction methodology was altered to prevent unacceptable impacts on environmental values.

Mixed use lot layout and the layout of the GCIMP precinct was designed to minimise air and noise impacts by separation of ocean terminal activities from sensitive receptors in the Coomera Marine precinct area. Internal waterway design was modified to ensure adequate tidal flushing and to protect water quality and aquatic habitats.

Detailed site investigations were carried out to identify environmental values associated with adjacent aquatic and terrestrial habitats and to set objectives and targets for environmental protection. The EMP and SBMP will ensure that recommendations arising from these investigations are considered during construction and operation and that the use of non-renewable resources is minimised and materials reuse and recycling is considered during all phases of

development. Opportunities for conservation of resources such as energy, water and materials have been identified and measures will be implemented during all phases of development.

Economic Factors

The GCIMP project is expected to generate substantial economic benefits to the regional economy. The project will provide important marine manufacturing, educational facilities, tourism and marina infrastructure attracting increased visitation in these sectors. It will provide increased opportunities for local businesses and for the level of business investment in the Gold Coast. The project will generate opportunities for additional marine manufacturing-related businesses and flow-on benefits for existing local businesses and service providers through increased operator and passenger-related expenditure.

The proposed GCIMP is anticipated to generate significant employment opportunities for the local community and wider Gold Coast region during construction and operation. It is estimated that the total construction cost of the proposed development would be approximately $390Million. Multipliers were utilised to determine the additional value generated from every dollar spent or invested during the construction phase. Thus, the indirect flow-on or multiplier effects to the Gold Coast Region and Queensland economy are projected to be in the order of $407 Million and $446 Million, respectively.

The construction of the proposal is projected to provide approximately 2,250 annual full-time, part-time and casual employment position (FTE) years. The flow-on benefits of this employment would generate about 4,950 full-time equivalent position years in Queensland and 4,160 full-time equivalent position years within the Gold Coast Region.

The operating revenue of the proposal is projected to be in the order of $754.4 million upon completion and is projected to provide approximately 2,700 FTE operational employment position years. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 full-time equivalent positions in Queensland, of which 4,800 full-time equivalent positions would be generated within the Gold Coast Region. This represents about 2% of the current Gold Coast jobs.

An Ecologically Sustainable Development Assessment report prepared by Hyder Consulting is presented as Appendix 11 of the EIS, and provides a detailed assessment of ecologically sustainable development merits of the proposed development from both a short and long term perspective.

Fish-Friendly Structures

As detailed in the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7, fish-friendly structures should be incorporated into the marina design where possible. Fisheries Queensland outlines several general and specific fish-friendly design features intended for developments that require aquatic infrastructure (Derbyshire 2006).

For marinas, consideration of the flushing of waters is important to maintain water quality. This includes a wide and deep opening, avoiding dead ends of no flow and a flow through design (e.g. open piles, floating breakwaters).

The use of fish friendly designs in the construction of revetment walls will increase the available habitat for fish and invertebrates. Revetments constructed from different sized pieces of rock, or geotextile fabrics will offer more habitat rather than walls made out of concrete. Fish friendly design suggests that materials such as polystyrene, tyres, treated wood and uncured cement should not be used, and gently sloping revetments should be used in place of vertical revetments. The use of horizontal cross piece structures or stacked rip-rap adhered to supporting pylons will increase fish habitat.

Sloping revetments will also act to dampen wave energy, and reduce wave reflection onto Foxwell Island and the northern bank of Oakey Creek. Please refer to the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7.

Design Principles

The design principles adopted for the marine precinct should be considered in the context of both the *Australian Building Greenhouse Rating* and the Green Building Council's *Green Star Environmental Rating System for Buildings* in the design, construction and operation of the proposed development. The Gold Coast City Council Planning Scheme Policy 5 – *Energy Conservation [Design for Climate]* should be considered. Design principles could include:

- water sensitive use and design such as rainwater tanks and/or re-use of water opportunities, where appropriate
- public spaces designed to promote social interaction and to be safe and accessible for users of all ability levels (as per the *Disability Discrimination Act 1992* and the *Queensland Anti-discrimination Act 1991*)
- subtropical design principles to minimise energy demand associated with heating and cooling as well as enhanced amenity
- best practice environmental management
- waste management and minimisation strategies
- industry best practice standards for the design of marinas
- innovative construction methods and materials.

Design principles should also incorporate the *Principles of Crime Prevention through Environmental Design.* The principles are outlined in the draft *Crime Prevention through Environmental Design Guidelines for Queensland*, which includes information on appropriate responses to design, ownership, management, access control, individuality and natural surveillance.

The Ecologically Sustainable Development (ESD) Report prepared by Hyder Consulting contained in Appendix 11, conducted a detailed assessment GCIMP project's compatibility with the principles of ESD as outlined in the NSESD and in compliance with State policy relating to ESD including the standard criteria defined by the EP Act and the regional planning policies of the South East Queensland (SEQ) Regional Plan that focus on ESD.

The ESD Report provides a thorough discussion relating to ESD design principles in relation to the project.

Future landowners within the GCIMP will be provided within information on Gold Coast City Council's initiative of Sustainable Building and Renovation which aims to encourage good design and construction of new buildings, and reduce greenhouse gas emissions.

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Significant improvements in the environmental performance of a building can be achieved through application of sustainable development measures including

careful selection of construction materials, specification of efficient fittings and passive building design measures to ensure efficient use of energy and water resources. Passive design elements should include orientation of the building to reduce heat gain in summer and natural ventilation and daylighting to minimise the need for artificial cooling and electric lighting for daytime use.

An ESD element has been included in the EMP prepared by Hyder Consulting contained in Appendix 14, and in the SBMP prepared by Hyder Consulting contained in Appendix 15. Provisions pertaining to ESD are to be provided to the GCIMP Body Corporate for future landowners within the GCIMP to encourage adoption of sustainability principles.

With regards to the Marine Precinct design and operation, the following provisions have been identified for inclusion in the ESD report prepared by Hyder Consulting in Appendix 11.

Rainwater Harvesting

Collection of rainwater for toilet flushing, boat wash down and landscape irrigation can assist in the sustainability of the site and will reduce demand on high quality potable water supplies and related infrastructure. Reuse of rainwater within the site also contributes to the stormwater management of the site, diverting runoff that would otherwise have entered the stormwater system. Rainwater collection will be undertaken for toilet flushing and irrigation purposes in accordance with the Stormwater Management Report prepared by Hyder Consulting contained in Appendix 16.

Rainwater storage tanks will be installed and collection from the building roofs. These tanks will provide a sustainable supply of non-potable water for onsite toilet flushing, boat wash down and irrigation of all landscaped areas within the site. A water balance model will be conducted for the site to further determine the actual size of the tanks for reuse. Preliminary calculations demonstrate that the rainwater harvesting will provide approximately 3 mega litres for toilet flushing per year as a minimum.

Water Efficient Fittings

In order to reduce potable water consumption by building occupants, the building design will specify installation of water efficient fittings and appliances using the Water Efficiency Labelling and Standards (WELS) Scheme.

Toilets installed into the buildings will have a minimum 4 Star WELS Rating and shower, basin, laundry tub and sink tap ware will have a minimum 3 Star WELS Rating.

Passive Design Elements

Passive building design can significantly improve thermal comfort levels and reduce the requirement for mechanical heating and cooling by minimising heat gain in summer and heat loss in winter. North and south facing windows boat shed doors are preferable for optimal building performance during winter and summer and should be openable to assist in cross-ventilation.

The GCIMP buildings have been designed to take advantage of natural energy flows through building orientation and suitable building envelope. The western and eastern aspects of the buildings are minimised to reduce solar gain in summer particularly in the afternoon when building temperature will be at a maximum. Large roof eaves outside the main building areas will provide further shading of west and east facing windows.

Controlled admission of natural light is facilitated by external glazing allowing lighting of internal spaces during the day, reducing the need for artificial lighting. The north facing windows will receive more direct sunlight in winter than in summer allowing natural heating during cooler months. Tinted glazing as well as eaves on the northern building aspect will assist in reducing the intensity of direct sunlight in summer. Louvered screens on windows on the south-eastern aspect will assist in reducing solar gain in summer.

Energy Efficient Electrical Lighting

The lighting specification for the building requires installation of low ballast and high efficiency light fittings.

Energy efficient refrigerators between 450L and 500L capacity can range from 557KWh/year for a 3.5 Star model to 473KWh/year for a 4.5 Star model. Other high-energy household appliances include clothes dryers, dishwashers and hot water heaters. Careful specification of these appliances as well as energy efficient light fittings will be undertaken to ensure reductions in overall building energy consumption during occupancy.

Energy reduction can be achieved with a strategic combination of new generation compact fluorescent lighting, Low E Tinted performance glass and R2 rated wall insulation. By replacing light fittings such as halogen lights with compact fluorescent lights, great energy savings can be achieved. For example replacing 5 halogen lights of 50 watts each with a single 20 watt light, total energy used in lighting the area will be reduced by 92%. In addition, the use of overhanging eaves, cross flow ventilation, the use of custom sized drapes with pelmets, and concrete walls with a large thermal mass all contribute to the reduction in energy

use required for heating, cooling and lighting and therefore reducing the buildings carbon footprint.

Gas Hot Water Systems

Greenhouse gas emissions can be significantly reduced by use of gas hot water systems than by use of a traditional electrical system. In addition, the energy lost in generation and distribution of coal-fired electricity is avoided. The GCIMP development will incorporate gas hot water systems.

Construction Materials

Construction materials may contain embodied energy and water consumed during manufacture of products. Careful selection of construction materials with a high recycled content can minimise resource consumption, reduce embodied energy and water usage and reduce the amount of waste requiring disposal to landfill.

In order to minimise environmental impacts associated with construction materials, materials used in construction of the GCIMP project will be selected for:

- high recycled content;
- low toxicity; and
- sourced from renewable resources.

The project will utilise recycled construction materials including recycled plastics in landscape irrigation systems and recycled steel in reinforced concrete structures. Low emission products such as carpets, paints and adhesives/sealants are selected to ensure low toxicity in indoor environments. In addition, the project is committed to the use of approved and recognised plantation timbers to minimise the consumption of non-renewable resources. The use of construction materials will be controlled by the Construction EMP prepared by Hyder Consulting contained in Appendix 14.

Plantation timbers and other renewable materials will be specified in building construction to minimise the use of non-renewable resources. Reinforcing steel with a minimum recycled content of 60% will also be specified in building construction and concrete used will have a fly ash content of 25%. Construction materials with recycled content will be selected for buildings to maximise waste reuse. The selection of recycled materials will minimise the amount of water and energy utilised in product manufacture.

The quality, durability and longevity of materials and finishes within buildings will also be considered to minimise the need for refurbishment or replacement. Recycled materials will be used where they are fit-for-purpose. Recycled plastics

can be used in irrigation systems and recycled steel products can be used in reinforced concrete.

Material Pollution, Waste and Recycling

The *Environment Protection (Waste Management) Policy 2000* (EPP Waste) provides for the preparation of waste management plans to minimise waste generation, promote the efficient use of resources and promote the use of waste as a resource in order to achieve the waste objectives of the *Environment Protection Act 1994.*

Construction activities will generate a range of wastes requiring various disposal methods. It is proposed that a Construction Waste Management Plan (Construction WMP) will be prepared prior to the commencement of construction, once construction material types and volumes have been determined. The major waste types likely to be generated during construction include:

- Demolition materials (bricks, glass, roofing etc.);
- Concrete, timber and steel/metals;
- Cardboard, plastics and packaging materials; and
- Landscaping materials.

The construction contractor for the GCIMP project will adopt strategies for waste avoidance, reuse and recycling ensuring that disposal of wastes to landfill is the last option after all other options have been considered.

Waste avoidance involves reducing the volume of waste generated by an activity. This will be achieved during construction by avoiding over-estimation of material supplies or by using alternative materials and processes to minimise the amount of material requiring disposal. Re-use or recycling of waste materials will be undertaken within the project site or by removal of demolition and construction waste to an approved waste recycling facility. Waste requiring disposal will be stored within a designated area within the construction site compound for collection by a licensed contractor and disposal at an approved landfill facility.

All waste materials generated during construction will be assessed for the ability to be reused on-site or recycled to minimise the component of waste requiring disposal. The construction contractor will ensure that separate waste receptacles are provided within the construction site for reuse of waste materials. Construction waste materials requiring disposal will be collected for disposal at a landfill facility licensed to accept demolition and construction waste. Waste separation and collection facilities will be located in a designated bunded area within the construction site with suitable access for collection vehicles.

Waste recycling facilities are provided within the grounds facilities for separation of recyclable materials during operation by building occupants. Access is provided via internal roads for collection of recyclables. The building manager will be responsible for arranging regular collection of recycled materials by an approved waste recycling service.

Toxicity of Materials

Indoor Environment Quality (IEQ) is important to occupant well-being and amenity. Naturally or mechanically ventilated buildings are designed to improve outside air exchange rates to prevent accumulation of airborne contaminants. Natural ventilation will be provided in the buildings through windows, louvers and doors, allowing distribution of air through occupied areas. Ventilation rates will be controlled by building managers.

Wall, floor and window coverings may produce toxic emissions to internal environments increasing exposure of building occupants to air pollutants. Such pollutants may include volatile organic compounds and formaldehyde used in manufacture of building materials. While good ventilation rates will assist in removing air pollutants, the building design will also specify the use of low emission paints, carpets, adhesives, sealants and the specification of no vinyl floor coverings, to ensure a healthy indoor environment for building occupants.

Environmental & Building Management

The Environmental Management Plan (EMP) prepared by Hyder Consulting contained in Appendix 14 addresses the project's construction phase, and details how it will incorporate the ESD initiatives outlined in this report and will include measures for reducing volumes of waste generated and for maximising reuse and recycling of construction materials within the site.

In addition, a Building User's Guide will be prepared for the operational phase to inform occupants of the ESD measures incorporated into the building, the environmental benefits provided by these measures and the procedures that should be adopted to achieve sustainability during building operation.

In addition to the above comments relating to ESD design principles; design principles have been incorporated into the GCIMP Development Code prepared by Planit Consulting as part of the Town Planning Report contained in Appendix 5. These principles include:

- Public spaces designed to promote social interaction and to be safe and accessible for users of all ability levels (as per the *Disability Discrimination Act 1992* and the *Queensland Anti-discrimination Act 1991*)

- *Principles of Crime Prevention through Environmental Design.*

As detailed within the Community Consultation Report prepared by Planit Consulting contained in Appendix 4, consultation has occurred with the Queensland Police regarding Crime Prevention through Environmental Design (CPTED) principles. Suggestions were made as to the incorporation of surveillance and the provision of security guards within the GCIMP. Security will be implemented as part of the body corporate arrangement for the portion of the site to the east of the IRTC. Such information will be provided during subsequent development applications and during detailed design stages.

The Queensland Government published document, Crime Prevention through Environmental Design Guidelines for Queensland has also been reviewed as part of this EIS. The GCIMP Master Plan prepared by Push contained in Appendix 2, and the Landscape Master Plan prepared by Planit Consulting contained in Appendix 35 were established having regard to essential features of safer places.

The preliminary design has incorporated passive surveillance and legibility throughout the GCIMP. Furthermore, place making design techniques have been used to create a sense of place, and public ownership of the GCIMP as detailed within the Landscape Master Plan.

CPTED principles have also been reinforced in the GCIMP Development Code contained as an attachment to the Town Planning Report prepared by Planit Consulting, in Appendix 5.

3.2 Project Overview

The various elements of the project should be described and illustrated with maps and diagrams (at a suitable scale) as required. Details should be provided of the project's components, including:

- the indicative location and layout of the industrial, retail and commercial facilities, including any environmental buffer zones and open space and landscaping
- training facilities such as the proposed TAFE and Centre of Excellence including consideration of student transport and accommodation for international students
- layout of marina berths
- dredged areas and dredge disposal ponds
- waterways and overland drainage pathways
- vehicular access, car parking and traffic flows
- proposed construction sequencing and methodology.

The concept for the GCIMP is to extend the existing Gold Coast Marine Precinct and provide best practice design for a working industrial marina. The design has evolved under the guidance of the combined expertise of Maritimo in relation to working industrial marinas and yacht construction facilities; and Property Solutions expertise in marina owner operating, and development of quality industrial land sub-division and built mixed use urban precincts.

The resultant masterplan displays the best outcome balancing environmental issues with the functional requirements of a growing Marine Industry Precinct. Important issues of flood mitigation, stormwater quality, economic stimulation and public access benefits have been considered and incorporated.

The key features of the Masterplan are:

- The concept covers a site of approximately 63.57 hectares and develops approximately 42 hectares of this land.
- The land development consists of: Industrial use of 28.9 hectares including Marine industry, Ship lift industry and the new Maritimo facility; Mixed use precinct of 9.3 hectares; a TAFE college site of 1.6 hectares.
- Land removed to create marina areas is approximately 11.5 hectares, consisting of a 7 hectare widening to the Coomera River and an internal calm water marina of 4.5 hectares.
- The integration of the existing river front public park into this site is seen as a major benefit to the overall masterplan efficiency. The park offers 170

metres of river frontage and 3.7 hectares of developable Marine industry land.

- A new 5 hectare boat building facility for Maritimo which will comprise a 12,500sqm built state of the art manufacturing facility.
- A further 5.2 hectares of waterfront site dedicated to Ship Lift industry development located in close proximity to the large scale Travel lift. This enables the removal and launching of very large boats direct into the river.
- A large internal marina enables the water borne display of marine craft and provides for the launching and retrieval of boats housed in the stacked Boat Storage facility. The internal Marina is a vital feature of the development providing a calm water environment necessary for the launch and retrieval of vessels.
- The stacked boat storage facility is state of the art with gantry crane access direct to the internal marina. This facility offers a secure dry store for approximately 120 boats and has associated facilities of showroom sales and brokering.
- A mixed use precinct based around the principles of pedestrian friendly activated streetscapes caters for a variety of related activities. A mix of buildings types of two and three level construction will house uses including the sales and display of marine parts; fittings and fixtures; corporate office space; small scale light industry; and service/recreational uses such as yacht club, restaurants and retail outlets to be located on the Marina river frontage. Streets typically have built frontages and are tree-lined with parking provided. Large car parking areas are hidden behind the built street front.
- A 1.6 hectare TAFE college acts as a gateway building to the site and comprises a 3000sqm Centre of Excellence and a 1500sqm Workshop devoted to the training of skilled workers for the Marine Industry. The site area allows for future facilities to be integrated.
- An extensive external marina to the Coomera River. The setback of the bank revetment to the Coomera River and Oakey Creek enables the creation of a sizeable marina accommodating over 280 berths. This marina is a complimentary adjunct to the industry and ensures boat owners and sailors are in constant contact with the services provided within the precinct.

Masterplan Considerations

The key drivers of the masterplan layout are:

- Two major traffic entries onto the site have been carefully placed to provide the best amenity for heavy vehicle movement and the vehicular trafficking of large vessels throughout the entire precinct.
- The division of the masterplan into the Eastern Marina related industry and Western Marine industrial subdivision is a consequence of the Transport Corridor bisecting the site. A 15m naturally landscaped stormwater corridor

borders either side of the corridor and links to landscaped water treatment reserves. This 15 metre setback provides a functional barrier to the edge of the development on either side of the future Motorway.

- A 40 metre setback to Oakey Creek provides for a sizeable naturally vegetated bank to the creek. This natural vegetation zone has a perimeter 'corso' road alongside providing continuous public amenity access to the creek bank.
- A bikeway and walking track also follows the corso perimeter road providing a landscaped edge to the natural vegetation.
- A public access pedestrian zone borders the riverfront of the Mixed Use development providing a landscaped promenade alongside the marina. It is intended that the service related uses attached to the marina would directly front this public promenade.
- The Western Marine Industry subdivision has been generally orientated north-south to facilitate energy efficiency of the built facilities. Lot subdivisions of approximately 2000m^2 can be amalgamated in a variety of arrangements to suit a maximum number of potential users.

The mixed use precinct is located to the north of the site with the smaller, less industrial uses bordering the creek and closer proximity to the future residential development proposed on the northern bank.

In formulating the Master Plan, consideration has been given to provision of sufficient on site car parking to meet demands generated by the various uses. Furthermore, consideration has been given to provision of cycleways and footpaths to allow for various forms of connectivity.

The projects architectural and alternative master plans, including indicative built form images prepared by Push Architecture are presented as Appendix 2 of the EIS.

Furthermore, the Landscape Master Plan documentation prepared by Planit Consulting is presented as Appendix 35, providing further drawings and design information about the project from a landscape architectural and place perspective.

Construction Considerations

Construction related considerations and methods have been included in the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13. This report details how the works will be constructed with consideration given to minimising any detrimental environmental impacts.

The construction of the Gold Coast International Marine Precinct will be constructed using 'wet' and 'dry' excavation techniques. The 'wet excavation' will

be associated with the widening of the Coomera River and the creation of the External Marina. This activity will be undertaken in stages which will enable better monitoring and control of the sediment disturbed in the river by the excavation works. It is proposed that the most suitable method for the 'wet excavation' works will be undertaken by long reach excavator or dragline set up on a temporary construction bund wall or via barge.

The 'dry excavation' will be associated with the creation of the Internal Marina. The temporary bund will allow the creation of the Internal Marina in dry conditions and undertaken by using excavators, trucks and other land-based machinery.

The material from both the 'wet' and 'dry' excavation works will then be placed in constructed treatment beds. The material then be treated in the beds for acid sulfates and conditioned by drying back for optimal use as construction fill either as compacted fill or for preload purposes. Routine monitoring will be undertaken during the construction phase on significant areas including water quality, noise and will include daily and weekly reviews of general site management issues such as storage of fuels and oils, litter, silt curtains and other structures.

The Construction Methodology Report draws specific reference to several other consultants' reports including but not limited to geotechnical, acid sulfate, stormwater management, marine ecology and flooding. As such, major environmental constraints have been considered, and mitigation and avoidance methods have been development accordingly for the construction phase. For further detail, please refer to the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13.

3.3 Description of the Environment

This section must provide a detailed description of the environment of the proposed site and the surrounding areas that may be affected by the construction and long term operation of the master planned development. The description should focus on the matters of NES protected under Part 3 of the EPBC Act including listed threatened species, Ramsar wetlands and listed migratory species. The description should also identify ecologically significant features / areas on the subject site including threatened species listed under the *Nature Conservation Act 1992*, and 'Of Concern / Endangered' remnant vegetation communities listed under the *Vegetation Management Act 1999.*

As previously discussed, the GCIMP was originally declared to be a 'Significant Project' on 18 April 2008, and was subsequently re-declared on 7 July 2011. Throughout this period detailed flora and fauna surveying and site monitoring has been undertaken by Planit Consulting.

As detailed in the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8, five (5) vegetation communities / associations were identified on site as a result of flora surveying. Of these, Community 1 and 2 are further classified into an additional 2 sub communities. This sub description is based upon underlying geology in the case of Community 1 and species composition in regard to Community 2.

A flora species list is contained within the Terrestrial Flora and Fauna Assessment to supplement the following descriptions. From the surveying a total of 115 species were recorded.

Flora - Scheduled Species

One species of flora scheduled as vulnerable under the Qld Nature Conservation Act was observed on site. This species (*Macadamia tetraphylla*) was encountered in the SW corner of the site and will be retained in association with the proposed development.

Two (2) additional specie listed under QLD *Nature Conservation Act 1992* are identified as being recorded within 5km of the site. These were not observed.

The EPBC Act protected matters search listed fourteen (14) specie as potentially occurring on site these were not recorded.

Vegetation Communities and Regional Ecosystems

The communities identified on site are described below and are illustrated in Figure 1.

Community 1: Mid-High Open Forest/Forest (*Casuarina Glauca*),T6D/M

This community is identified as occurring from within four (4) locations on site. Of the mapped locations two (2) are noted as occurring on tidal substrates whilst the other two (2) are identified as occurring on alluvial.

The communities whilst displaying similarities are able to be distinguished as two differing types of the same vegetation type by the underlying geology.

Community 1A: Mid-High Open Forest/Forest (*Casuarina Glauca*),T6D/M On Tidal Mudflats

This community occurs in two discernible locations in the north western portions of the site on areas mapped as containing tidal mudflats (i.e. land zone 1). This community was recorded principally from Lot 146 SP150731 and a small area of Lot 98 SP15073.

Approximately 2.1 ha of this community has been mapped on site.

Community 1B: Mid-High Forest (*Casuarina Glauca*),T6DM On Alluvial Deposits

The mapped Casuarina Forests on Alluvium occur in two disjunct locations on site but principally occurring on Lot 98 SP150731. The larger of these is located along Shipper drive and grazing activities structurally affect floristic diversity in the community. The community is almost mono specific Casuarina glauca.

Community 2: Saltmarsh Communities

This community, of approximately 23ha, dominate the northern portions of the site and are located on tidal mud flats which are regularly inundated and are comprised of grasses, sedges and herbs which are tolerant to hypersaline conditions.

Community 2A: Very Tall Rushland (*Juncus Krausii*),V4M

This community is restricted to a small area of ~2000sqm in the NW corner of Lot 146 SP SP150731 adjacent to the recent Oaky Creek bridging work.

Vegetation consists of primarily tussocking Salt Rush (*Juncus kraussii*) to 1.2m in height. Associated species present in low abundance include Saltcouch (*Sporobolus virginicus*) and Samphire (*Sarcocornia quinqueflora*).

Community 2A: Very Tall Rushland (*Juncus Krausii*),V4M

This community is restricted to a small area of ~2000sqm in the NW corner of Lot 146 SP SP150731 adjacent to the recent Oaky Creek bridging work.

Vegetation consists of primarily tussocking Salt Rush (*Juncus kraussii*) to 1.2m in height. Associated species present in low abundance include Saltcouch (*Sporobolus virginicus*) and Samphire (*Sarcocornia quinqueflora*).

Community 2B: Low Closed Tussock (*Sporobolus Virginicus*) Grassland,G1D

This is the dominant of the two Saltmarsh Communities. Saltmarsh is the dominant species and is also the dominant ground-layer element within two remnant patches of Swamp oak Forest (refer Community 1 above). This community was recorded from all allotments including the future IRTC(Lot 35 SP150730.

This community is mapped as approximately 22ha.

Community 3: Low-Tall Open Forest/Woodland (*Avicennia Marina + Aegiceras Corniculatum*),T4M/S

This community is restricted to the northern and western boundaries of the site in association with the riverbanks of Oaky Creek. For the most part the association occurs as a thin remnant (3-10m in width) of shrubs and small trees lining the bank of Oaky Creek with numerous canopy gaps as a result of previous clearing. As indicated, detailed discussion on this community is provided in the FRC Aquatic Ecology Report.

Community 4: Very Tall Closed Grassland (*Setaria Sphacelata*), G4D/M

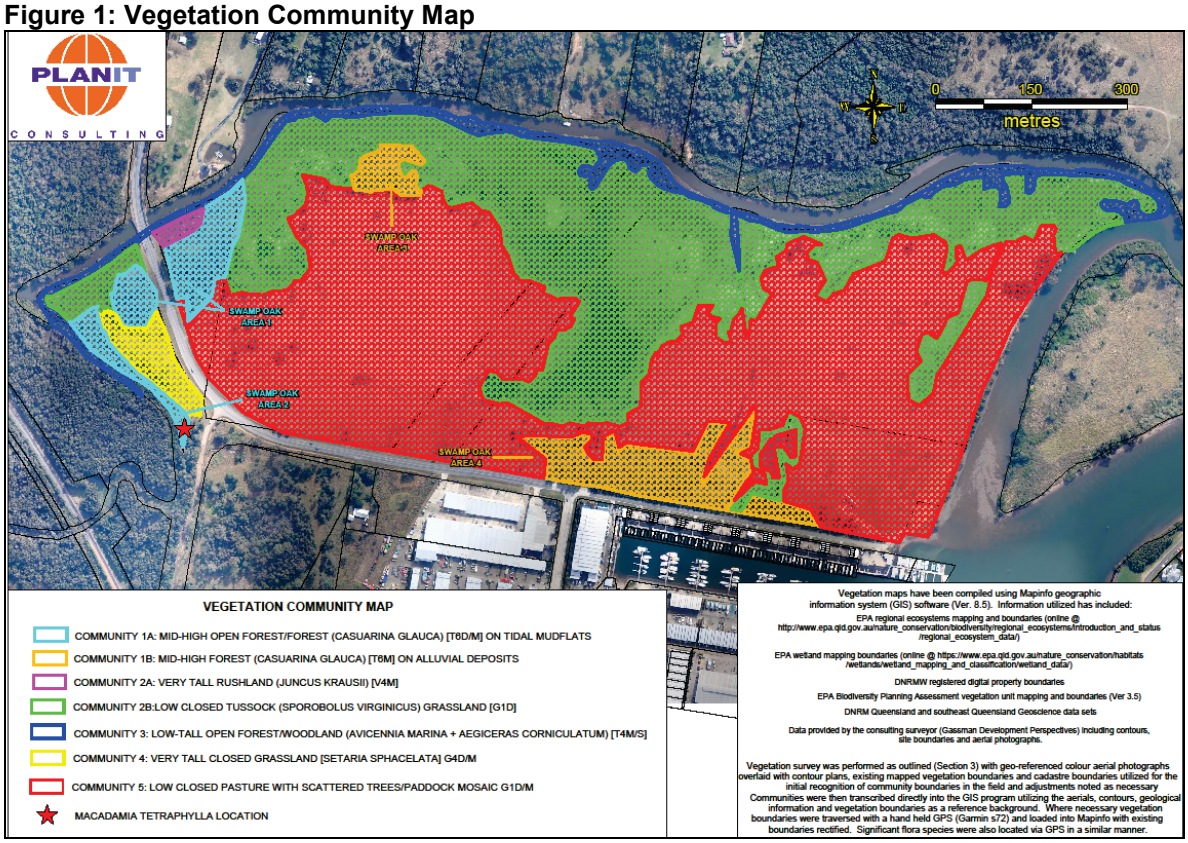
This modified community occurs in Lot 146 SP150731within a previously grazed paddock which is no longer utilized for agistment following the severing of the site to facilitate the Shipper Drive extension and Oaky Creek bridge upgrade.

Community 5: Low Closer Pasture with Scattered Trees/Paddock Mosaic, G1D/M

This community is the most abundant community recorded on site, occurring in all allotments including the future IRTC allotment. The community, of approximately

36ha in area, dominates the southern portions of the site where previously occurring woodland/forest communities have been cleared for pastoral lands. Whilst scattered remnant and juvenile trees remain, all areas are dominated by pasture grasses and weeds which are grazed by resident cattle and horses.

Figure 1: Vegetation Community Map



Regional ecosystem mapping identifies 4 distinct ecosystem types as occurring on site. A significant portion of the site is not covered by a regional ecosystem reflective of its predominately cleared nature. A fifth ecosystem type is also identified from the onsite surveying.

Of the various regional ecosystem types four are noted to be ‘of least concern’ and one is identified as ‘of Concern’. This ‘of concern’ RE is 12.1.1, Casuarina glauca open forest on margins of marine clay and mapped as Community 1A.

A review of the GCCC Nature Conservation Strategy documents indicates the following:

- RE 12.1.1 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The Pimpama River Conservation Reserves Management Plan, dated January 2010 (PRCRMP) noting 51% of the remnant remaining.

The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 934ha of the remnant was remaining.

- RE 12.1.2 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 66% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 559ha of the remnant was remaining.

- RE12.1.3 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 89% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 2,803ha of the remnant was remaining.

- RE 12.2.15 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 98% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 57ha of the remnant was remaining.

- 12.3.5 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as Very Low. The PRCRMP estimates 5% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 341ha of the remnant is remaining.

We note these estuarine and palustrine habitat types are well represented and conserved in the network of marine and national parks within the immediate and broader coastal environment.

Fauna

Fauna surveys undertaken by Planit Consulting revealed a variety of habitats including tidal and intertidal estuarine wetlands associated with Oaky Creek and the Coomera River, mudflats, creek channels, saltmarsh, sedgelands, mangrove forest, open wetlands/dams and soft-sediment benthic habitats.

The sites location on the Coomera River and approximately 3km from the Moreton Bay Marine Park and the extensive network of Marina and National Parks provide a regional habitat complex for multiple species. The coastal setting / context of the site is reflected in the recorded wetland/waterfowl and wader specie recorded on site.

Aves - Scheduled Species

Eight (8) avifauna, are listed within the Qld Nature Conservation Act as Endangered, Vulnerable or Near Threatened, are listed as being recorded within 5km of the site. Of these one (1) species listed as 'near threatened' pursuant to the QLD *Nature Conservation Act 1992* was recorded during survey works. These are discussed in the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8.

Two species, recorded on site are listed as Migratory Marine Birds under the EPBC Act, these being the Ardea alba (Great Egret) and the Ardea ibis (Cattle Egret), resident populations of each species can be found on the Gold Coast and Moreton Bay Marine Park.

Two species listed as a Migratory Terrestrial Species under the EPBC Act, being Merops ornatus, the Rainbow Honeyeater and Haliateetus leucogaster, Whit-bellied Sea Eagle were also observed. Again both these specie have a resident population on the Gold Coast and Moreton Bay Marine Park. In the case of the Whit-bellied Sea Eagle an active nest site for the species is opposite the site, north of Oakey Creek.

Four species, identified on site, are listed as Migratory Wetland Species under the EPBC Act, including the previous identified Great and Cattel Egret. The other two (2) species being the Sharp-tailed Sandpiper (Calidris acuminate) and Red-necked Stint (Calidris ruficollis).

Including those six (6) species identified above a further two species recorded on site are listed in the EPBC Act as a 'Listed Marine Species'. These additional specie are the Red Capped Plover (Charadrius ruficapillus) and Black-winged Stilt (Himantopus himantopus).

The EPBC Act protected matters search has identified a total of 43 Threatened Species, 49 Migratory Species and 83 marine Species as potentially occurring or suitable habitat for the species occurs. Of these ten (10) are threatened avifauna, and forty one (41) are Migratory species. Of the Marine Species forty seven (47) are avifauna.

Amphibia - Scheduled Species

A total of six (6) native frog and one (1) introduced toad species were recorded on the subject site. No amphibians listed as rare, vulnerable or endangered within the Nature Conservation Act 1992 or EPBC Act were recorded on site.

Amphibian habitat within the site is mostly limited to the western dam (and adjacent grassland/casuarinas) with the balance areas occupied by heavily grazed pasture or areas subject to tidal influence (i.e. the amphibian permeable skin provides no protection against water loss via osmosis to a surrounding medium of saline water [Barker, Grigg & Tyles, 1995]).

One species listed under the Qld Nature Conservation Act and one species listed within the EPBC Act are listed as potentially occurring these species are unlikely to occur or be significantly impacted upon.

Repitilia - Scheduled Species

The diversity of habitats for reptile species is considered reasonably low across the site due to limited diversification (i.e. relatively uniform relief, soil type, dominance of saltmarsh and pasture).

Within the site reptile recordings were most common in this western area with three species of skink, water dragon, lace monitor and two tree snakes recorded. The grass skink, wall skink and red-bellied black snake were also recorded from the pasture and swamp oak zone. All of the recorded reptiles are considered to be of 'least concern' (Nature Conservation Act 1992) and common within the local area.

A total of eight (8) reptile species were recorded on the subject site. No reptiles listed as rare, vulnerable or endangered within the *Nature Conservation Act 1992* or EPBC Act were observed on site.

The EPBC Act Protected Matters Search Report indicates the presence of eight (8) federally listed rare and threatened reptile species within the sub-region (5-kilometre radius). Six (6) of these are marine turtles which have been addressed within the Aquatic Ecology Report prepared by FRC Environmental contained in

Appendix 7. Of the remaining two these are unlikely on site due to the absence of preferred habitat.

Mammalia - Scheduled Species

A total of twenty-three (23) mammal species, including seven (7) introduced specie, were recorded on the subject site. One threatened species listed under the EPBC Act was recorded on site, this being the Grey headed Flying fox.

During site survey works the Grey-headed Flying Fox was recorded foraging on flowering Blue Gums and is noted to be common within the local area as a result of large tracts of eucalypt and melaleuca forests providing favoured foraging resources. A thorough search of the Mangrove Forest/Woodlands areas did not reveal any roosting/camping sites.

The EPBC Act lists an additional seven (7) federally listed threatened species within the sub-region (5-kilometre radius). It is acknowledged that the Koala has been listed under the EPBC Act subsequent to the generation of the Protected Matters Search and has also been assessed against the relevant Table 9 criteria.

No species listed under the Qld Nature Conservation Act were observed. Two (2) species listed as Vulnerable are identified as having been recorded within 5km of the site. These species are the Koala and the False Water Rat. The Koala is unlikely to occur on site or be significantly affected by the proposal as the preferred habitat for the species is largely absent.

Wetlands

The site is contextually within a riverine /estuarine environment. The site is bound by two (2) tidally influenced waterways which are connected to the southern Broadwater. The site is approximately 3km from the Moreton Bay Marine Park.

The former DERM state in relation to shorebirds and the Moreton Bay Marine Park that Moreton Bay is an important habitat in the East Asian – Australasian Flyway, which is one of eight flyways in the world. The East Asian – Australasian Shorebird Reserve Network is an international chain of wetlands recognised for their importance to shorebirds.

Moreton Bay's extensive intertidal areas are essential for shorebirds as they provide roosting, feeding and, in some cases, breeding habitat. Moreton Bay is Queensland's third, and one of Australia's top 12, shorebird habitats (Thompson 1990).

The Bay provides habitat for over 3500 resident (Driscoll 1997), and over 40,000 migratory shorebirds, during the summer months (Driscoll 1993; Watkins 1993). Moreton Bay supports the third highest concentration of migratory waders in Queensland at approximately 10 percent of the state's population (Driscoll 1993)'.

The site is mapped as containing 'referrable wetlands'. These wetlands correlate with the Regional Ecosystem mapping. Communities 1 – 3 are identified as either estuarine or palustrine wetlands. The detailed vegetation assessment as outlined generally reflects the extent of the mapped wetland areas.

Approximately 17.5ha of the site constitutes an estuarine wetland whilst 3.47ha are classified as palustrine. Of the tidally inundated ate only 9.72 ha of the *Sporobolus virginicus* grassland (Community 2B) is located below HAT.

The wetlands are recognised as of significant at a state level with the VMA and Coastal Plan two (2) of the more relevant government instruments identify the estuarine and palustrine wetlands as significant. The local government also recognises wetlands as significant within the 'Planning Scheme' and other Council documents.

The Coastal Plan identifies areas of 'High Ecological Significance'(HES) are located one site, the mapped area reflects the extent of Communities 1 – 3 on site and generally the sites estuarine and palustrine wetlands.

The Coastal plan also recognises the value of HES areas for conservation and the habitat these areas provide to various species including waders. The local planning controls also seek to preserve and protect wetlands.

The VMA identifies RE 12.3.5 as a palustrine wetland which is also essential habitat for two amphibians. The mapped area, 3.47ha occurs in two separate locations on site. Surveying did not record the identified species and the areas were noted as not providing key habitat requirements for the frogs.

Matters of National Environmental Significance (NES)

The GCIMP was referred to the Australian Government Department of the Environment, Water Heritage and the Arts (now the Department of Sustainability, Environment, Water, Population and Communities) (SEWPaC) on 8 February 2008 to determine whether Commonwealth approval is required for the action. A decision notice as issued on 27 April 2008 notifying that the proposal is a controlled action and requires approval under the EPBC Act before it can proceed.

The SEWPaC determined that the controlling provisions under the EPBC Act applying to the project to be:

- Sections 16 and 17D – Wetlands of International Importance;
- Sections 18 and 18A – Listed threatened species and communities; and
- Sections 20 and 20A – Listed migratory species.

Further details regarding the aforementioned controlling provisions that occur within and adjacent to the land and water to be affected by the proposed GCIMP are outlined below:

1. Moreton Bay Ramsar Wetland;
2. Known and potential habitat for listed threatened species; and
3. Known and potential habitat for migratory species listed under international agreements including.
   - The Bonn Convention (Convention on the conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
   - The agreement between the Government of Australia and the Government for the Peoples Republic of China for the Protection of Migratory Birds and their environment (CAMBA); and
   - The agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds and Birds in danger of extinction and their environment (JAMBA).

A detailed description of each of the above Matters of NES, including an assessment of the likelihood that the GCIMP will have a significant impact on the relevant matters of NES is contained within the Report on Matters of NES prepared by Planit Consulting contained in Appendix 6.

3.4 Location

This section should describe the regional and local context of the project and associated infrastructure, illustrated on maps at suitable scales. Real property descriptions of the project site should be provided. Maps should show the precise location of the project area, and in particular:

- the location and boundaries of land tenures, in place or proposed, to which the project area is or will be subject
- the location and boundaries of the project footprint, including easement widths and access requirements
- the location of the project in relation to any sensitive receptors including residences, approved developments, remnant vegetation, vegetation that is on state land, on waterways, fish habitats, declared fish habitat areas, marine plants and marine parks
- the location of any proposed buffers to sensitive receptors
- the location of any proposed buffers surrounding the working areas (for construction).

The GCIMP involves the development of an integrated industrial marina on the Coomera River at 2, 54 and 110 Shipper Drive, Coomera located on the Gold Coast in South East Queensland. This land contains the following allotments:

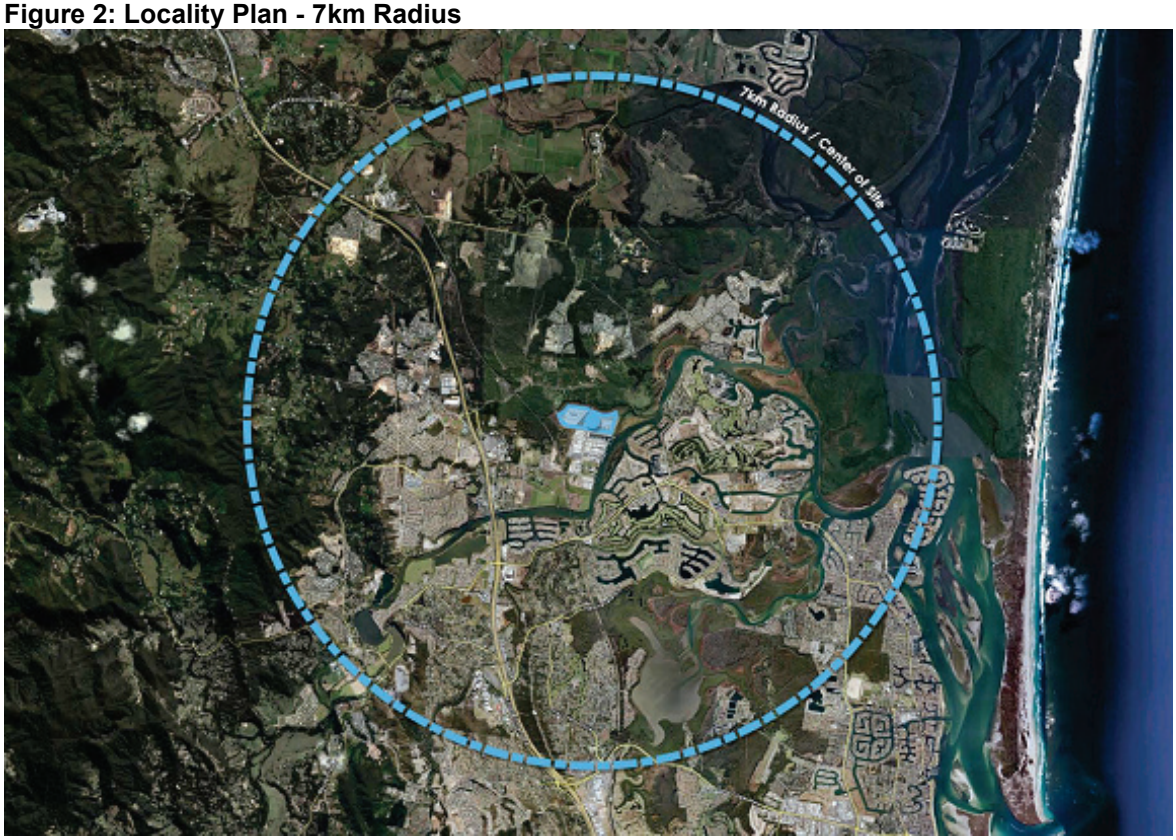
- Lot 108 WD6404 (4.047ha)
- Lot 98 SP150731 (54.6608ha)
- Lot 146 SP150731 (4.8467ha)
- Part of Shipper Drive adjacent to Lot 98 on SP150731

The allotment sizes and boundaries are shown on the Survey Plan prepared by Gassman Development Perspectives contained in Appendix 2.

The suburb of Coomera is a major new urban area in the northern Gold Coast and within the Gold Coast – Brisbane growth corridor. Coomera is identified in the South East Queensland Regional Plan 2009-2031 (SEQRP) as a 'Major Regional Activity Centre', and in the Gold Coast '*Our Living City*' Planning Scheme 2003 as a 'Regional Centre'.

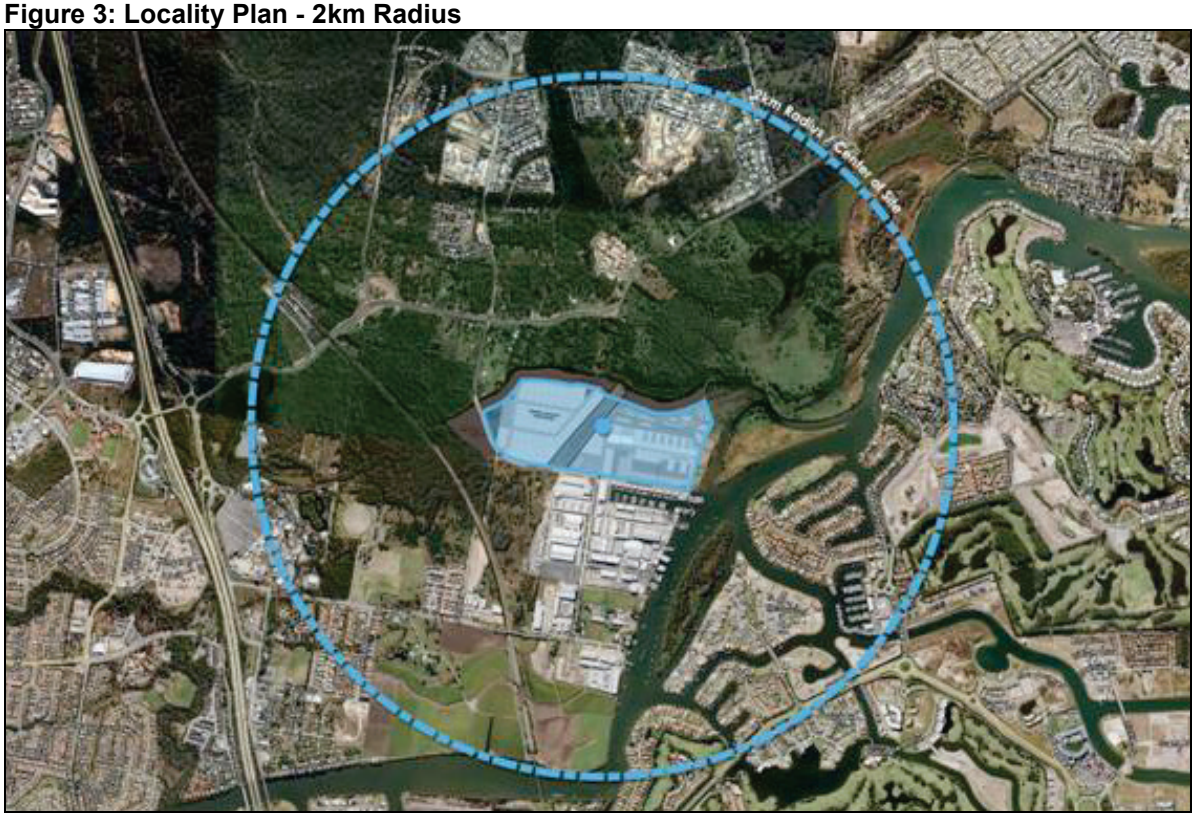
The site is located on the Coomera River and is approximately 3km upstream from the southern extent of the Moreton Bay Marine Park, 7km from the Broadwater and a further 9km to the Pacific Ocean. The site is approximately 20km north of Surfers Paradise.

Figure 2: Locality Plan - 7km Radius



This site is in close proximity (approximately 2km) to the future Coomera Town Centre, and key transport routes including the Pacific Motorway (2km). The site is bound to the north and west by Oakey Creek, which is tidally influenced adjacent to the site. The development concept incorporates a 40 metre naturally vegetated buffer to Oakey Creek.

Figure 3: Locality Plan - 2km Radius



To the north and west of Oakey Creek a variety of landuses inclusive of residential commercial and open space are planned for, and / or have been developed. The Coomera area is identified in the Gold Coast Planning Scheme as accommodating a future community in excess of 60,000 people. The allotments adjoining the northern bank of Oakey Creek, incorporate undeveloped land or land with a rural character typically improved through dwellings and clearing.

Immediately to the east of the site is Foxwell Island a freehold island in the Coomera River. Beyond this is Hope Island. Hope Island incorporates a number resort/residential facilities, international hotels, new developing residential communities, small villages, marine industries, marinas retail and tourist uses. A series of canal and golf courses define the settlement pattern of the island.

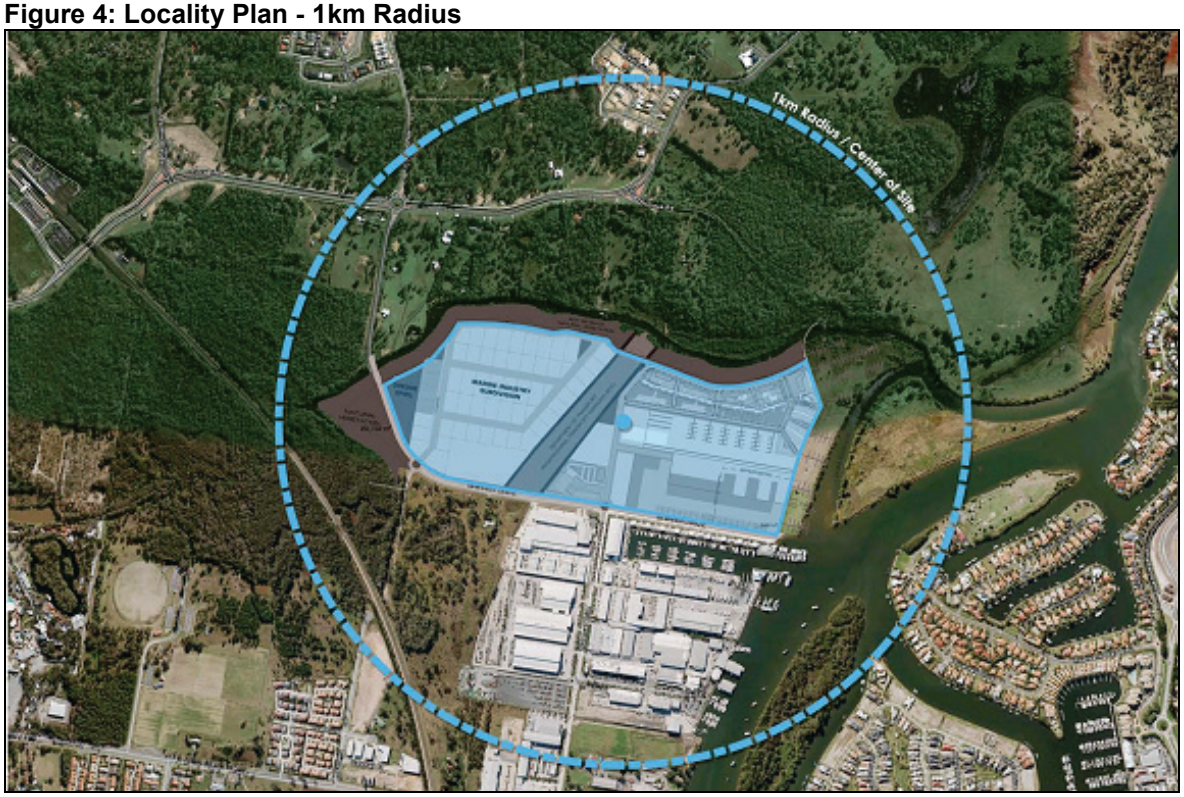
South of the site occurs the existing Marine Precinct. The Gold Coast Marine Precinct (GCMP) in Coomera, is a world class marine industrial area within Gold Coast City dedicated to manufacture, servicing/repairs and refits of recreational boats. This southern interface is illustrated in Image 1 below.

Image 1: View West on Shipper Drive - 22.09.09

Encompassing a total area of 250 hectares (inclusive of the GCIMP site), the precinct has direct access to Moreton Bay and the Pacific Ocean via the Coomera River. To date 90 hectares has been developed. Image 2 below provides an aerial, viewing north, of the existing precinct with the subject site in the background.

Image 2: Gold Coast Marine Precinct

Figure 4: Locality Plan - 1km Radius



As evident from Figures 2-4, the site's location on the Coomera River has been a key determinant to the establishment of the Gold Coast Marine Precinct. The figures also illustrate the river has been extensively modified through urban development. This development has seen the establishment of extensive series of canals.

This canal development and modifications to the Coomera River and tidal prism have occurred over a 40year period. This typology of development derives its basis from the Queensland Government, Policy on Coomera River Developments, ratified by a Cabinet on 15 February 1988. This in part stated *"the interim limit of the waterway area available for canal development in the Coomera River"* of 231 hectares. To date approximately 200ha of the tidal prism has been utilized. The Master Plan for the site would utilize 11.5ha of the residual allocation.

3.5 Construction

Pre-construction Activities

This section should briefly describe pre-construction activities, including:

- any land acquisitions required, be it in full or as easements, leases, etc.
- the land acquisition process
- site establishment requirements for construction facilities.

With regards to Pre-Construction, we note that the GCIMP is located within the following allotments:

- Lot 108 on WD6404;
- Lot 98 on SP150731;
- Lot 146 on SP150731; and
- Part of Shipper Drive adjacent to Lot 98 on SP150731.

The allotments are shown on the Survey Plan prepared by Gassman Development Perspectives contained in Appendix 2.

As detailed within the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13, no land acquisitions are required in full or as easements or leases.

A temporary construction compound will be established within the project site to provide office, lunch room, first aid and toilet facilities and to provide a location for stockpiles and storage of construction materials and equipment. Temporary offices will be established in the form of mobile demountable buildings which will be connected to water, sewer, electricity and telecommunications services. These offices are to be demobilised off site at completion of the construction phase.

The site will require back-up generators in case of power loss to the compound and for emergency situations. It is considered that the construction phase will not have a significant demand on existing infrastructure.

The preconstruction phase will involve the installation of temporary fencing to secure the construction site and prevent any unauthorised access. This fencing will be located across the site land access points and will be constructed using chain wire fencing panels. When the site is secure for safe public access and construction works are completed, the fencing will be demobilised off site.

In order to provide a dry site for undertaking excavation and the formation of fill platforms and to prevent dispersion of pollutants in waterways, the site will be adequately bunded generally by temporary construction bunds. These bunds will be constructed of engineering fill material incorporating a water barrier membrane.

The bunds will be removed at the completion of the filling / excavation works to enable water to flow into the internal marina area. Fill material removed from the temporary bunds will be used within the site where possible.

Bund removal will be undertaken in stages or controlled into piped water fill to allow stabilisation of the enclosed waterway prior to the total removal of the bund.

For further information pertaining to the Pre-Construction Phase, please refer to the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13.

Construction

The extent and nature of the Project's construction phase should be described, including any staging of the proposal, with illustrations showing site boundaries, development sequencing and timeframes. The general description should include:

- the layout, development, sequencing and timeframes for construction of the various precincts within the project site including the marina, marine industry and public open space areas;
- the design, construction standards, construction methods and site management associated with the Project;
- works needed off-site (e.g. erosion protection);
- the number and type of vehicles, machinery and equipment used for construction activities;
- general construction requirements including types, sources, quantity and method of transport of construction material, including the nature, extent and scheduling of proposed earthworks including requirements for import of fill;
- layout, staging and construction methodology of all infrastructure necessary for development and operation of the project, including any roads, pipelines, power, telecommunications and any other services;
- details of the construction of the marina are to be provided including:
  - sequencing of activities undertaken to construct the marina basin and external marina;
  - how the excavation of the marina basin will be undertaken, in particular the measures that would be used to avoid or minimise impacts to adjacent waterways;
  - the proposed use or disposal of excavated material including treatment and handling of acid sulfate soils; and
  - layout, staging and construction methodology of proposed structures including revetments, piling, pontoons and hardstand areas.
- estimated numbers and roles of persons to be employed;
- a description of any chemicals and hazardous goods to be utilized (if any) during construction;
- allowance for provision of power back-up in emergency and potential impact on local supplies in the area
- site security, including public safety and emergency aid/medical facilities to be provided on site.

The development and sequencing of the GCIMP is detailed within the Construction Methodology Report and Construction Sequence Plans prepared by Hyder Consulting contained within Appendix 13.

The GCIMP is anticipated to be constructed over a 30 month period. The proposed construction activities associated with the development and anticipated corresponding timeframes are outlined in the table below..

Table 1 Construction Programme

Development Phase	Timeframe
Construction of Bunds / Widening of River / Marina Works	8 months
Excavation, Compaction, Liming, Drying	10 months
Pre-cast / Engineering Fill and Rip Rap	6 months
Roadworks and Services	12 months
Landscaping works	6 months
First settlements	--
Handover and Commissioning	--

Construction Methodology

The construction of the GCIMP will be informed by a construction methodology. This methodology was developed to ensure environmental values are protected during the construction phase. The methodology is based on the following primary objectives as detailed in Hyder Consulting's Construction Methodology Report:

- To ensure protection of environmental values identified during site investigations and as a result of this Environmental Impact Statement.
- To comply with all Commonwealth, State and Local Government environmental standards in the approval, construction and operation of the GCIMP.
- To work with Local Government and other relevant authorities to ensure minimisation of social and economic impacts and for the respective management of any such impacts as the precinct develops.
- To implement best practice environmental management procedures during design construction and operational phases of the precinct.
- To implement ESD principles into all aspects of the development.
- To adopt construction techniques that will minimise the potential impact of the construction works on the environment
- To limit the amount of construction works required
- To effectively manage the works through all phases of the development with a continual focus on the performance in meeting objectives
- To provide a protected deep-water marina for the safe navigation of large powerboats and yachts.
- To provide a high quality marine industry and commercial development.

- To generate employment within the marine industries as well as create capital investment.
- To deliver high quality dedicated berthing facilities on the Coomera River for the mooring of vessels.

With regards to works required off site (e.g. erosion protection), the Construction Methodology Report details that all stormwater runoff from areas disturbed and exposed by construction, will be designed to pass through a sediment and erosion control device prior to discharging to the existing waterways. Temporary sediment control bunds are to be implemented around the extent of construction works.

Construction Equipment and Machinery

The Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13 to the EIS has provided details regarding the type of equipment and machinery anticipated to be used within each construction phase. These have been provided in the table below. Please note that only equipment for the construction of Stage 1 has been provided, as Stage 2 replicates several phases in Stage 1.

Table 2 Construction Plant and Machinery

Activity	Plant and Machinery
Phase 1	D6 Dozer (Swampy) Boat/barge for silt curtain installation Walking Floors to remove mulch from site Water truck Boat/barge for silt curtain installation Tub grinder 2 x 30t excavator 4 x Cat 740 articulated dump truck
Phase 2	D6 Dozer Cat 740 articulated dump truck 30t excavator Water truck Cat 815 Compactor 12t Smooth Drum Roller Piling Rig
Phase 3	Barge (sheet piling rig) 30t excavator Cat 740 articulated dump truck D6 Dozer Dewatering pumps 65t excavator Water truck Super long reach excavator

Activity	Plant and Machinery
Phase 4	Cat 740 40t articulated trucks Rigid Truck and Dog / Semi tipper for importation of fill Dewatering pumps Self-propelled roller Compactor Water truck
Phase 5	Semi Tipper Cat 740 40t articulated trucks Dewatering pumps 30t excavator D6 Dozer Water truck Lime spreader
Phase 6	Franna Crane Cat 740 40t articulated trucks Dewatering pumps D6 Dozer Compactor Water truck Lime spreader
Phase 7	Cat 740 40t articulated trucks Truck and dog / semi tipper Dewatering pumps D6 Dozer Compactor Water truck
Phase 8	Long Reach Excavator Boat/barge Cat 740 40t articulated trucks Dewatering pumps D6 Dozer Compactor Water truck
Phase 9	100t digger Cat 740 40t articulated trucks Truck and dog Dewatering pumps D6 Dozer Water truck
Phase 10	Excavator Cat 740 40t articulated trucks
Phase 11	Excavators Cat 740 40t articulated trucks Truck and dog D6 Dozer Water truck
Phase 12	Excavators 12G grader Cat 740 40t articulated trucks Truck and dog Steel drum roller

Activity	Plant and Machinery
Additional Civil Works Equipment	Graders Various Sized Excavators Backhoe Ditch Witch Trencher Kerb Machine Water Truck Steel Drum Roller Double Drum Roller CC10 Roller Truck and Dogs AC Placing Plant Bitumen Sprayer Rubber-Tyred Roller Impact Roller

Construction Requirements

The construction requirements of the GCIMP will involve the use of various materials including quality fill for earthworks, lime for Acid Sulfate Soils (ASS) treatment, concrete, revetment rock and drainage and pavement aggregate.

As detailed in the Construction Methodology Report prepared by Hyder Consulting, approximately 655,000m^3 of material is expected to be generated from both wet and dry excavations. It is anticipated that the majority of this material will be suitable for use as Construction Fill or as Preload material. Some excavated material may be suitable for engineered fill.

The fill volume required is approximately 1,100,000m^3. Approximately 515,000m^3 of fill will be required to be imported from external sources.

Fill to be imported will be sourced locally and transported to the site by truck and trailers with 22m^3 capacities. Each load will be covered to reduce loss of material. Access to the site will be designed to effectively capture any material stuck to vehicles exiting the site.

A Traffic Management Plan will be submitted for approval with local authorities within the detailed design phase with a route chosen to minimise effects on surrounding road networks.

Onsite material will be reused and incorporated in the works as much as possible (e.g. topsoil for bunding and preload material).

Additional materials for pavement and drainage aggregates would be sourced from local suppliers / quarries where possible. Manufactured items such as the precast

revetment walls and drainage pipes and pits, sewerage pipes and pits and water pipes and fittings will all be sourced locally wherever possible.

Storage and Stockpiling

During the bulk earthworks phase, it is anticipated that the necessity to provide areas for stockpiling material is minimal. The topsoil will be stripped and placed in bunds, the excavated material will be treated and placed as fill and the imported material will be placed in applicable areas ready for compaction. The majority of material stockpiled will be the lime for treating the ASS material which will be placed in a controlled stockpiled area.

In the latter phases after the preload has been removed, additional areas would be readily available for the storing of pipes, structures and construction and quarry materials. The location of the stockpiles and storage areas will be effectively managed and planned to minimise environmental impact and disruptions to construction.

Infrastructure Construction

As detailed within Hyder Consulting's Engineering Services Report contained in Appendix 19, the development can be adequately be supplied with services. This has been summarised as follows.

Energy

The proposed development will require a load of 6.78MVA which is made up from 1.65MVA (55 lots Standard URD Subdivision) plus 5.13MVA (Mixed Commercial / Industrial Development)

The existing network infrastructure will require upgrades to cater for the proposed development. Energex have advised that upgrades will occur via either of the two (2) future zone substations proposed for the area and construction of a new 111CV feeder to the site:

- Foxwell Road and Cemetery Road
- Beattie Road

Timing of the construction of these substations could not be confirmed by Energex at the time of preparing this EIS, and the construction timing / staging shall be communicated with Energex to program in the upgrade works to ensure sufficient supply is available at the development commissioning.

Telecommunications

An existing optical fibre cable is located within Shipper Drive adjacent to the development site. This fibre cable is a suitable connection point for the site. An internal optical fibre or copper cable telecommunications network will be installed within the development with direct connection to the service within Shipper Drive.

Gas Service

An existing gas service is not currently available to the proposed project site. An existing 160mm PE high pressure natural gas pipeline is located within Foxwell Road to the north of the site which is the proposed site connection point.

To connect the service in Foxwell Road a 110 PE pipe will be constructed along Shipper Drive to provide adequate service of 19,200M/j to the development.

Potable and Recycled Water Supply and Storage

Potable water supply for the proposed development will be supplied via the use of the existing 225mm diameter Council water main located at the intersection of Shipper Drive and Waterway Drive. A new 150mm diameter Potable water main will be constructed along Shipper Drive from the existing 225mm diameter potable water main at Waterway Drive to the existing 450mm diameter water main at Foxwell Road. This main will be constructed to provide dual connection points for water service and to also comply with Council's plans for water supply connections in the Priority Infrastructure Plan. Internal reticulation services have been designed through Water Network Modelling to ensure adequate standards of service are available via these connections.

Recycled water shall be supplied to the development via a recycled water main within the development. Service shall be provided via a future 200mm diameter main constructed along the alignment of the Intra Regional Transport Corridor (IRTC). The future main will provide a connection between Shipper Drive and Foxwell Road. As the IRTC construction date has not yet been determined, the proposed development will provide a cross connection to potable water service at the property boundary with recycled water service provided as soon as the trunk main is constructed and commissioned. The construction of the recycled water main will be under taken by others.

The proposed development will incorporate significant water saving measures through the use of water sensitive urban design principles along with rainwater harvesting and re-use tanks. Full details of rainwater harvesting tanks are provided in the Hyder Consulting Stormwater Management Plan, however it is anticipated that approximately 3,311,000L of rainwater will be harvested over the site each year and re-used for the purposes of toilet flushing and irrigation.

Sewerage

It is proposed to service the site with wastewater via an internal low pressure sewerage system. The low pressure sewer system shall incorporate a collection chamber within each allotment which will be gravity fed by the internal users. A low pressure pump will transfer sewerage from the allotments, via a sewerage rising main to a common sewerage pump station within the development.

This pump station shall collect sewerage from the entire development prior to discharging via a sewerage rising main to the existing service in Foxwell Road. The service in Foxwell Road shall be the connection point until such time as Allconnex Water, in consultation with adjoining land owners construct a regional pump station on the northern side of Oakey Creek which will collect sewage from allotments fronting Foxwell Road and discharge into the Finnegan Way Sewer.

Marina Construction

Construction sequencing of the development will be undertaken within two stages. The IRTC corridor that traverses the site has been used to determine staging due to site conditions and the required times for preloading the insitu material. Construction staging is as follows:

- Stage 1 - Portion of the Site to the East of the IRTC Corridor;
- Stage 2 - Portion of the Site to the West of the IRTC Corridor.

Construction of the Marina forms part of Stage 1. The intention is to construct Stage 1 before Stage 2, however the timing for the commencement of Stage 2 is yet to be decided (i.e. on completion of Stage 1 or mid-construction).

Construction details pertaining to the marina have been provided within the Construction Methodology Report and Construction Sequence Plans prepared by Hyder Consulting contained in Appendix 13 of the EIS.

The first phase of construction works will involve the building of the bund walls and the installation of the silt curtain to the extent of the external marina works to protect the marine environment during construction. Indicative Construction Phasing for Stage 1 (inclusive of the marina) has been provided below.

Table 2: Indicative Construction Phasing for Stage 1

Construction Phase 1	
Install ESC devices	Install silt fence to extents of Work

Clear and grub the site	EPA approved spotter and catcher on site to supervise clearing works Trees cut down will be cut up and loaded offsite for reuse Off cuts from vegetation will be ground on site and loaded off site Site will be grubbed and stickraked to 300mm below existing surface with roots and stumps ground and removed off site
Strip Topsoil	Remove topsoil to a depth of 150mm Stockpile on site or reuse where required for the construction of the proposed temporary non-trafficable and trafficable construction bunds (Phase 2)
Construction Phase 2	
Construct bunds	Complete Construction of temporary non trafficable and trafficable earth bunds to the extent of stage 1. Place and compact pavement layer on trafficable construction bunds.
Retaining wall	Remove layer of soft clays with imported quality fill down to RL -4.0m Replace with imported quality fill up to RL -1.78m Construct Retaining wall along 40m natural setback buffer zone of Oakey Creek Backfill wall with quality imported fill (CBR15)

Construction Phase 3	
ESC Devices and Environmental monitoring	Install Erosion and Sediment Control devices, silt curtains Undertake water quality testing external to silt curtains Construct temp sediment ponds undertake water quality monitoring of water Sediment ponds to outlet within controlled excavation zones
Earthworks	Construct temp earth bund for increased excavation reach by drag line/super long reach excavator where required Any unsuitable material from river excavation to be stockpiled for future preload Spread, dry treat acid sulphate soils and compact excavated river material Repeat for staged manner for wet excavation of river via long reach excavator and barge with long reach excavator
Construction Phase 4	
Earthworks	Dry excavate early works area under revetment wall locations removing soft clays and unsuitable material to RL -4.0m Refer to construction sequence revetment walls phase 1 for details
Acid Sulphate Treatment	Spread excavated early works material in treatment zone for drying, treatment of acid sulphate soils and compacting. The treatment and verification testing of Acid Sulphate Soils shall be in accordance with ASS Management Plan
Construction Phase 5	
Revetment Wall	Place and compact imported quality fill (CBR 15 or equivalent) to required levels in the Internal and External Marinas. (Refer to construction sequence revetment walls phase 2 for details)
Acid Sulphate Treatment	Continue treatment process of excavated material until suitable for re-use as fill material.

Construction Phase 6	
Revetment Wall	Prepare foundation for revetment walls Place precast revetment wall panels on foundation Precast panels to be manufactured offsite and delivered via approved route in accordance with a traffic management plan
Earthworks	Place and compact back fill to revetment wall with imported quality fill (CBR 15 min) Place and compact the conditioned excavated material to the required level (RL 2.4m approx.). (Refer to construction sequence revetment walls phase 3 and phase 4 for details)
Acid Sulphate Treatment	Continue treatment process of excavated material until suitable for re-use as fill material.
Construction Phase 7	
Earthworks	Dry excavate internal marina area to RL -4.0m with 1(v) in 3(h) batters and over excavate to RL -8.0m where required as shown on the drawings Construct temporary trafficable bund to entrance of Marina Place revetment rock to toe of revetment wall for batter stability
Acid Sulphate Treatment	Spread excavated material in treatment zone for drying, treatment of acid sulphate soils for reuse as construction fill. Construct temporary trafficable bund to entrance of Marina
Construction Phase 8	
ESC Devices and Environmental monitoring	Install silt curtain to river adjacent to excavation areas
Earthworks	Excavate in dry zone between revetment wall and temp bund. Excavate temporary earth bund to final external marina profile. Topsoil removed from temporary bunds to be stockpiled for preload Repeat excavation method for remainder of zones between river and revetment walls A to F Refer to drawing K119 Excavate Coomera River using long reach excavator on barge
Acid Sulphate Treatment	Spread excavated material in treatment zone for drying, treatment of acid sulphate soils for reuse as construction fill.
Construction Phase 9	
ESC Devices and Environmental monitoring	Install silt curtain to entrance of internal marina monitor and treat water quality in internal marina
Earthworks	Breach temporary bund across the entry to the internal marina and allow water to fill internal marina Place and compact final remainder of construction fill to treatment zone
Construction Phase 10	
Earthworks	Remove final link bund and silt curtain at entrance once water quality in internal marina is achieved Import place and compact construction fill to final profile allowing for 450mm of settlement in prep for preloading
Construction Phase 11	
Preload	Place and compact preload material to depths specified in the Geotechnical report. Refer to Figure 9

Construction Phase 12	
Earthworks	Final profile for stage 1

The excavation of the marina basin will be undertaken using a combination of wet and dry excavation techniques as detailed within the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13.

The difference between 'wet' and 'dry' excavation is the diversion of water and dewatering for the area targeted for 'dry' excavation. Wet excavation involves the removal of underwater sediments by using conventional excavation equipment (e.g. backhoe positioned on a barge or on shore).

The wet excavation pertains to the external marina which will be excavated using a dragline or long reach excavator set up on a perimeter bund or via barge. The wet excavation will be undertaken in stages to minimise the disturbance to the river. This will ensure that the resulting turbidity can be confined in smaller areas for easier control.

The widening of the Coomera River and the external marina formation will be undertaken using long arm excavators from on shore and on barge. Wet excavation techniques require suitable access and stable manoeuvrability to the construction area. It is proposed that a trafficable vehicular access road and earth bund be constructed for sediment control and water barrier purposes.

A recharge trench is proposed to be constructed around earthworks areas to control groundwater and to minimise soil oxidation and acid sulphate soils disturbance. Temporary pump units shall dewater the excavation areas and irrigate the recharge trenches during excavation.

The internal marina is proposed to be constructed using 'dry excavation' techniques by constructing a temporary bund along the eastern boundary fronting the Coomera River. The bund will hold back the river water and allow the creation of the internal marina using excavators, trucks and land based machinery.

The process for constructing the internal marina involves the stripping of the topsoil to the eastern precinct with the stripped material used to form the temporary bund. The material from the internal marina will then be treated in the beds for acid sulfates and conditioned by drying back for optimal use as construction fill.

The method of construction will reduce the construction period for this phase of the works as the mechanical drying back of the excavated material will allow it to be reused as fill a lot quicker in the required areas.

The temporary bund wall will allow for the majority of the works to be undertaken in dry conditions:

- Placement of structural fill to the foundation of the internal revetment walls;
- Placement of pre cast revetment walls;
- Detailed excavation of the bed profile of the Internal Marina;
- Placement of armour rock to the revetment banks.

If poor material is found in the foundation of the internal marina, the material will be removed and replaced by select fill. Upon completion of the revetment walls bulk earthworks shall proceed with the excavation of material from the internal marina.

Placement of rock armouring will occur as excavation of the internal marina profile is undertaken. Upon completion of each individual block of earthworks, the internal marina section will be flooded and water treated for acid sulfate soils in accordance with the Acid Sulfate Soils Assessment and Management Plan prepared by Gilbert and Sutherland contained in Appendix No.32.

The final marina entrance shall be breached using either a long arm excavator or dragline upon completion of the internal marina and stabilisation of water acidity and testing requirements. Silt curtains will be provided within the Coomera River to prevent release of silt during excavation.

A staged excavation shall be considered in this respect to ensure partial water balancing internal and external to the temporary construction bunds.

Dredging the internal marina base and entrance may be required to be undertaken to achieve the final internal marina profile depth.

The initial sources of fill material were identified as being taken from waterways adjacent to the site (by over-excavation) and the remote importation from external sources. Preliminary discussions regarding material sourcing within the internal and external marina areas of the proposed development were positive. The Geotechnical Assessment of underlying materials suggests that excavation below approximately RL 4.0m will be a likely source of good quality material which could be re-used for construction filling. Over excavation of the proposed internal and external marina will allow sediment deposition and an adequate dredge spoil location whilst negating the requirement to treat the potential Acid Sulphate Soils.

Construction Employment

The construction workforce would vary in structure during the project due to the differing phases of construction required. The workforce is likely to be minimal during initial phases and is expected to ramp up towards the end of the works in the latter phases.

Labour crews will be sought including project management staff, site supervisors, foreman, labourers, plant and equipment operators, truck drivers, pipe layers, riggers and dogmen, scaffolders, concreters, form workers and environmental monitors.

Chemicals and Hazardous Materials

It is anticipated that hazardous materials will be used during the Construction Phase inclusive of concrete, diesel, oils, grease and lubricants, paint, solvents, silicones/mastic, grouts and contact cement. Appropriate management techniques for these materials has been detailed within the Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14.

Construction Power Back-Up

The site compound will contain back-up generators in case of power loss to the compound and for emergency situations. The construction works phase of the project will not have an excessive demand on the existing infrastructure.

Security and Safety

As previously mentioned, a construction compound will be established and will include various facilities inclusive of a first aid area. This compound will contain back-up generators in case of power loss to the compound and for emergency situations.

Construction Dredging

This section should describe the proposed dredging and spoil disposal activities which have been developed in accordance with the National Assessment Guidelines for Dredging (NADG) (Department of Environment, Water, Heritage and the Arts 2009). It should include:

- the amount of dredged material to be relocated and the planned relocation site
- the type and method of dredging proposed and the expected length and timing of the dredging activities
- the equipment and methodology used to dispose of the dredged material including sediment testing when transferring spoil from the dredge site to the disposal area
- contingency plans in the event of dredging equipment failure or flooding
- dredge sediment plume modelling which takes tidal, estuarine and seasonal processes into account
- a discussion of any potential impacts from mobilised sediments
- size, location and flood resistance of the dredge material disposal site
- information on the management of acid sulphate soils. Criteria used to assess the results of acid sulphate soils (ASS) screening tests to identify actual ASS (AASS) or potential ASS (PASS) should also be addressed.
- potential impacts on EPBC Act listed threatened species and the Ramsar wetland within the proposed dredging area and mitigation measures proposed
- historical dredging requirements within the Coomera River with particular emphasis on dredging intervals and depth. Any changes that capital dredging may have on future maintenance dredging requirements in the Coomera River should also be included as part of a geomorphological study. Please note requirements for a geomorphological study have also been referenced at section 4.5.

Construction dredging and dredge disposal options have been discussed within the Construction Methodology Plan prepared by Hyder Consulting contained in Appendix 13 to the EIS.

Dredge Material, Methods and Equipment

With regards to dredge material during the construction phase, approximately 655,000m^3 of material is expected to be generated from the works including both wet and dry excavations. It is anticipated that the majority of this material will be

suitable to be utilised in the works as "Construction Fill" or as "Preload" material. Some of the excavated material may be suitable for engineered fill.

Specifically, the material from the Internal Marina will be excavated and placed in constructed treatment beds. The material will then be treated in the beds for acid sulfates and conditioned by drying back for the optimal use as construction fill. If poor material is found in the foundation of the internal marina, this material will be removed and replaced with a select fill.

As the excavated material will be treated and placed as fill, the need to provide stockpiling areas is minimal.

As detailed above, the method for dredging will involve wet excavation techniques which involve the removal of underwater sediments by using conventional excavation equipment (e.g. backhoe positioned on a barge or on shore). The excavation of the external marina will be via dragline or long reach excavator set up on the created perimeter bund or via barge. Wet excavation will be undertaken in stages so as to minimise the disturbance to the river with the resulting turbidity being able to be confined in smaller areas for easier control.

The anticipated length and timing of the dredging activities are approximately 8 months for the Construction of Bunds / Widening of the River / Marina works, and 10 months for the excavation, compaction, liming and drying phase. This is detailed in the Construction Methodology Plan prepared by Hyder Consulting contained in Appendix 13 of the EIS.

As the dredged material is anticipated to be treated and used on site, as such transportation options are not required.

Contingency Plans

In order to maintain safe navigation of the Coomera River and surrounding waterways, a navigational channel will be maintained during construction activities. In the event of excessive rainfall or cyclone occurring during the construction works, all works on site will cease and standard damage mitigation measures will be undertaken to secure vehicles, property and material in accordance with an emergency response plan. A level of protection will be provided by the proposed temporary construction bunds which are to be constructed during the first phase of construction.

Specific contingency plans have been included within CEMP 16 within the Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14 to mitigate the environmental impacts of any unforeseen emergency circumstances. Control measures have been summarised below:

- In the event of heavy / long-lasting rainfall a preliminary assessment is conducted to determine if that rainfall event will result in increased risk of stormwater contamination, which will require that works stop immediately.
- Actions shall be taken to ensure erosion and sediment control measures are performing adequately so as to adhere to stormwater discharge release criteria.
- Repairs, alterations and additions are to be made to sediment and erosion control devices;

In the event that material is accidentally released at the excavation and / or spoil disposal areas, all measures will be taken to contain the released material, an assessment of the release will be conducted and DERM shall be notified.

If unforeseen circumstances contribute to halting construction works, sediment and erosion control devices will be checked to ensure their function is not impaired.

Dredge Sediments

The outcomes of the dredge sediment plume modeling undertaken by BMT WBM is contained in their Water Quality Report contained in Appendix 28 of the EIS.

The wet excavation will generate a sediment plume (sediment in suspension) that will move through the Coomera River system by advection and dispersion. A calibrated two-dimensional hydrodynamic and advection-dispersion model of the Coomera River system was developed to assess the dispersion of sediment plumes generated by dredging activities associated with the Precinct.

The model was used to simulate the likely concentrations and plume behaviour of total suspended solids (TSS) under a number of construction dredging scenarios, maintenance dredge scenarios and sediment pond discharge during maintenance dredging.

The construction methods have been chosen due to various environmental considerations inclusive of minimising any potential impacts of mobilised sediments. These methods include:

- Wet Excavation via long reach excavator and barge from the perimeter bund will create less turbidity.
- Construction will be undertaken in stages to confine smaller areas that are able to be monitored closely for water quality and treated more effectively
- Works able to be completed quicker due to less stoppages due to machine down time due to pipe blockages on the dredges
- Settling ponds required will be smaller due to lower water content in the excavated material.

- Less impact on the water quality of the Coomera River due to confined areas
- Treatment of excavated material for ASS to occur sooner than dredged material
- Excavation of the bank to be undertaken more accurately increasing geotechnical stability therefore creating a safer working platform

The dredge spoil is located to the west portion of the site as shown in the Master Plan prepared by Push contained in Appendix 2. The dredge spoil is 2.2 hectares in size.

Acid Sulphate Soil Management

An Acid Sulfate Soils Assessment (ASSA) was undertaken by Gilbert and Sutherland and is contained in Appendix 32. The ASSA found acid sulfate materials would be disturbed as part of the construction process. Accordingly, an Acid Sulfate Soils Management Plan (ASSMP) is required to manage excavated acid sulfate soils during the stage 1 construction phase. This has been prepared by Gilbert and Sutherland and is contained in Appendix 32.

This provides the framework to ensure the potential impacts on construction for the development are managed, treated, monitored, reported and if necessary, mitigated.

Matters of National Environmental Significance

Assessments of the likelihood of the proposed GCIMP development impacting upon Matters of National Environmental Significance (NES) have been carried out. The results of these assessments are discussed in detail within the Report of Matters of National Environmental Significance, refer to Appendix 6 of the EIS.

These significant impact assessments are generally based on the findings of detailed technical assessments carried out as part of the GCIMP EIS process. The significant impact criteria considered in these assessments have been derived from the EPBC Act Significant Impact Guidelines Version 1.1 (2009)

Based on the assessments presented within this report, it can be concluded that any anticipated impacted to Matters of NES associated with the construction and operation of the GCIMP development will be relatively minor. In this regard, it is put forward that potential impacts to Matters of NES associated with the contemplated development will be of a limited magnitude, localised extent and/or appropriately mitigated through the implementation of relevant management plans proposed as part of the GCIMP development.

Historical Dredging

As per the Construction Methodology Report prepared by Hyder Consulting, we note that the Queensland Government has invested $12 million on dredging projects which will maintain the Gold Coast waterways channel network, which includes the Coomera River. Recently completed dredging projects include the South Channel of the Gold Coast Broadwater, which was completed in early March 2011, the North Channel of the Gold Coast Broadwater, which was completed in February 2011, and the Gold Coast Seaway entrance which was completed in April 2011.

Previous dredging of the Coomera River which was undertaken for the Gold Coast City Marina and Riviera Developments dredged approximately 140,000m^3 of sand and clay along a 12km stretch of the Coomera River. Dredging depths were up to 3.5m, but were shallower in upstream areas.

Impacts of Dredging

A preliminary baseline sediment quality assessment has been carried out in the area to be disturbed by dredging or vessel movements in the Coomera River and this will be supplemented by further work at operational works stage.
Studies to date have included:-

- The drilling of twelve (12) land based boreholes by Shaw Urquhart Pty Ltd. Five (5) of these were within the proposed internal marina excavation and seven (7) were in the proposed external marina excavation area. The boreholes were drilled to depths of between about 12m and 21m below the existing ground surface.
- The drilling of twelve (12) water based boreholes by Gilbert & Sutherland within the proposed external marina excavation in the Coomera River. The boreholes were drilled to depths of between about 4.5m and 5m below the bed of the river.
- Particle size distributions were carried out by Shaw Urquhart Pty Ltd on thirteen (13) samples of the sediment types encountered in the external marina excavation area. The samples were measured to a minimum particle size of 0.0013m.
- Gilbert & Sutherland carried out an acid sulphate soils assessment of the sediments recovered from the proposed external marina excavation area.
- Gilbert & Sutherland has also carried out a Stage 1 contamination assessment of the site and this included the recovery of benthic sediment samples from the base of the Coomera River within the proposed external marina excavation area at eight (8) locations. These samples were tested for Organotin Compounds. No Tri, Di or Mono–butyltin concentrations were

recorded above the LOR during the investigation of recovered benthic sediment samples recovered from the Coomera River.

It is not planned that dredge material be disposed of in tidal waters and an assessment of sediment quality as per the National Assessment Guidelines for Dredging 2009 is therefore not required.

BMT WBM has carried out dredge plume modelling to simulate likely concentrations and plume behaviour of total suspended solids (TSD) under a number of construction dredging scenarios, maintenance dredge scenarios and sediment pond discharge during maintenance dredging. Please refer to the Water Quality Report contained in Appendix 28.

3.6 Operation

Site Operations

This section should describe the proposed operation of the project. A detailed description is required of all operations that would be environmentally relevant activities as prescribed in the *Environmental Protection Act 1994*. Operational issues to be addressed include (but are not limited to):

- a description of the buildings, structures, plant and equipment to be employed during site operations
- a brief description of ongoing programs to monitor impacts of the project and maintenance dredging on the receiving waters and marine and estuarine environment. EMPs required to be implemented should be described
- the location and nature of shipyard operations including any abrasive blasting and painting
- the nature, sources, location and approximate quantities of all chemicals to be handled on site
- the use of bunds, dry-break couplings and containment for fuels, oils, gases and other environmentally hazardous substances during transfer, use and storage should be identified together with the development of appropriate contingency plans for containing and cleaning up spills
- water use and the approximate amount and characteristics of solid and liquid wastes produced and method of disposal
- water use and equipment required for fire fighting and emergency situations
- details of sewage disposal for vessels utilising the marina
- details of predicted vessel movements in the Coomera River as a consequence of the project, including the maximum displacement and draft of vessels intended to be catered for by the proposed marina
- maintenance provisions for all structures within the marina precinct, including responsibility for maintenance works and monitoring requirements.

Site Based Management Plan

The Site Based Management Plan (SBMP) prepared by Hyder Consulting contained in Appendix 15 addresses ongoing programs to monitor impacts of the project and maintenance dredging on the receiving waters and marine and

estuarine environment. Specifically, these programs are in place to ensure that the following environmental values are upheld:

- Maintaining the water quality of the Coomera River and Oakey Creek to prevent impacts on environmental values within the adjacent ecosystems including seagrass communities, benthic communities, wetland communities, migratory and threatened species and recreational and visual amenity.
- The water quality values of the Coomera River and Oakey Creek are protected from sediments mobilised in stormwater runoff from the site.

Programs / Environmental Management Plan Elements include those specific to Water and Sediment Quality; Stormwater, Erosion and Sediment Control; and Flora and Fauna (Marine).

Shipyard Operation Locations

The GCIMP will involve shipyard operations inclusive of abrasive blasting and painting. We advise that the Masterplan is conceptual in nature, and various uses can be applied for within the site as per the GCIMP Development Code prepared by Planit Consulting contained in Appendix 5. However, it is envisaged that blasting and painting will occur within the Maritimo site as shown on the GCIMP Masterplan prepared by Push contained in Appendix 2. Other specific locations for this type of activity may be within the Marine Industry Subdivision component of the GCIMP. This level of information will be provided within the detailed design phase or within subsequent Development Applications.

The specific nature, location, sources and quantities of chemicals to be handled on site is an uncertain detail at this stage of the project. We note that Maritimo operations require chemical handling in boat production, similar to that of the existing Marine Precinct. Chemicals to be handled during the construction phase have been addressed within the Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14.

Specifics relating to chemical handling within the operational phase are considered to be an issue to be addressed within the detailed design phase inclusive of subsequent Development Applications.

Dangerous Goods Containment

The Site Based Management Plan (SBMP) prepared by Hyder Consulting contained in Appendix 15. This SBMP includes measures for containing fuels, oils, gases and other environmentally hazardous substances during transfer, use and storage along with appropriate contingency plans for spills.

Various measures for containment of fuels / hazardous substances have been provided in the SBMP, and are summarised as follows:

- A secured, bunded containment area shall be provided within the site for storage and handling of dangerous and hazardous substances (including oil, fuel grease and hydraulic fluids) in accordance with AS 1940(2004).
- Material Safety Data Sheets (MSDS) of all hazardous materials on site shall be stored in a central location and in a designated area close to hazardous materials storage areas(s).
- Hazardous materials will be stored in accordance with the requirements of the Australian Dangerous Goods Code and in an appropriate impervious area which has sufficient capacity to prevent release of substances to the environment in the event of spills or leakages, therefore allowing recovery of any materials being contained within the bund. Bunds should be fitted with an isolation system to protect the waterways and surrounding land from spills.
- In order to prevent the entry of stormwater, the bunded containment area shall be located away from overland flow paths.
- Hazardous material required to be transported to or from the site shall be appropriately handled to prevent release to receiving environments.
- Vehicles to transport these materials shall be appropriately licensed for hazardous material removal and shall be appropriately signed in accordance with Australian Standards.
- All hazardous materials shall be transported in accordance with the Australian Dangerous Goods Code with a copy of the MSDS provided by the product manufacturer and shall be appropriately labelled and accompanied by handling instructions.
- Where possible, all hazardous materials shall be transported in their original containers. Where transportation requires alternative containers, these shall be compatible with the producer's requirements, the product being transported and shall be appropriately labelled.
- Persons handling / transporting materials shall be appropriately trained in handling such products and shall be aware of spill clean-up procedures.
- All persons in contact with hazardous materials shall be provided with appropriate protective clothing, protective eye wear, respiratory protection as required and be made aware of the hazards associated with handling the hazardous material.
- Maintenance and neutralisation of equipment shall be undertaken within a designated bunded area designed to contain spillage and waste water.

- A register shall be maintained of all dangerous and hazardous substances to be kept on-site including the MSDS for each substance.
- All dangerous and hazardous substances shall be stored and handled in accordance with the requirements of the MSDS for the substance.
- Incompatible substances shall not be stored together (for example flammables cannot be stored with oxidizers).
- All staff shall be trained in the safe storage and handling requirements of dangerous and hazardous substances.
- Emergency procedures associated with spillage events and containment measures shall be displayed in a prominent position within the site working area.
- A spill response kit (including appropriate absorbents and neutralising substances) shall be kept on site in a clearly marked location with clear instructions for spill clean-up procedures.

Waste Production and Disposal

Please refer to the Waste Management Plan prepared by Hyder Consulting contained in Appendix 12 of the EIS. The major waste types anticipated to be produced by the GCIMP has been summarised as follows along with proposed measures for reuse, recycling, storage, handling and disposal.

Table 3: Waste Management and Disposal

Waste Type	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Dewatered dredge spoil unsuitable for reclamation	To be disposed to appropriately licensed landfill.
Water from dewatering activities of dredge spoil	To be stored in collection ponds and tested and treated to meet discharge criteria prior to reuse on site or disposal to Coomera River.
Geo technically unsuitable fill	To be disposed in the deep excavations of the marina canal.
Vegetation	Cleared timber will be mulched for landscaping or disposed as green wastes.
Topsoil	Top soil will be stockpiled and reused on site.
Other soil	To be reused in various fill locations subject to geological characteristics.
Acid sulphate soils	To be reused onsite or collected in a dedicated collection pond/s and tested and treated to meet discharge criteria prior to reuse on site or disposal to Coomera River. Acid sulphate soil stockpiles to be clearly marked and protected from the elements. Run off from acid sulphate soil stockpiles to be collected and disposed in accordance with

Waste Type	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
	regulatory requirements. Alternatively to be collected and disposed by a licensed contractor to an appropriate licensed landfill.
Waste rock	To be reused on site where practicable.
Waste concrete	To be collected in skips and sent to the recycling area of the landfill.
Timber pallets and off-cuts from site shed and other construction works	Timber formwork will be salvaged for re use in future constructions. Timber pallets to be returned to the material suppliers. Timber which cannot be reused or returned will be disposed to landfill.
Office paper, newspapers, and cardboard	To be segregated and recycled.
Computers, Printers, Photocopier and other electronic wastes	To be segregated and sent to appropriately licensed waste recycler.
Waste Packaging	Thermacol, bubble wrap. Shrink wrap and non recyclable packaging to be minimised by appropriate procurement. If unavoidable, these materials to be reused where practicable or disposed appropriately. Cardboard, plastics and other recyclable packaging to be segregated and recycled.
Steel/metal off –cuts used machinery parts.	Metal wastes to be reused where practicable or collected in designated skips for recycling.
Timber, fibreglass, plastics and other construction wastes	Construction wastes to be recycled where practicable or disposed as solid inert waste.
Plastics	To be reused on site or collected in separate skips for recycling.
Grease, waste oils, oily rags, Contaminated soils, spill kit materials, waste oil filters	To be collected and disposed by a licensed contractor. Contaminated soil stockpiles to be clearly marked and protected from the elements. Run off from contaminated soil stockpiles to be collected and disposed in accordance with regulatory requirements.
Domestic rubbish recyclable	Skips to be set up to segregate and collect domestic packaging wastes, aluminium drink cans, glass bottles, plastic milk bottles etc. which can be recycled.
Domestic rubbish putrescibles and non recyclable	To be collected and disposed to landfill.
Waste drums and containers	Waste drums with hazardous residue to be returned to supplier if possible or to be disposed by an appropriately licensed

Waste Type	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
	contractor. Waste drums free of residue to be managed by sent to appropriately licensed waste drum recycler.
Waste tyres	Waste tyres will be removed off site by a licensed contractor for re use and disposal to a licensed facility.
Waste batteries	Waste batteries will be collected by an approved battery recycler for recycling.
Waste water	Dispose to sewer under trade waste agreement.
Oily water; bilge wastes, slop tank wastes, oily water, waste coolant	Waste tyres will be removed off site by a licensed contractor for re use and disposal to a licensed facility.
Paint stripper, paints, other chemicals and hazardous wastes	To be collected and disposed by a licensed contractor.
Galley and accommodation refuse, organic wastes and other wastes subject to quarantine	To be disposed in accordance with AQIS requirements , which is deep burial under AQIS supervision.
Soot and exhaust wastes	To be appropriately packaged to ensure these wastes do not become airborne and to be collected for disposal by appropriate licensed contractor.

The quantities of such waste have been detailed in the Waste Management Plan prepared by Hyder Consulting where practicable.

Water Use / Equipment Required for Emergency Situations

As detailed in the Water Network Capacity Assessment prepared by Hyder Consulting, the water infrastructure proposed will be of sufficient pressure in the event of a fire. Furthermore, specific detail pertaining to emergency situations is contained within the Site Based Management Plan prepared by Hyder Consulting contained in Appendix 15.

Vessel Sewage Disposal

The Engineering Services Report prepared by Hyder Consulting contained in Appendix 19 details requirements and methods of vessel sewage disposal. This report details that sewage pumpout systems will be employed to service the marine vessels while they are docked at the marina.

The pumpout system will either be at a fixed point, commonly located at a fuel dock, dock-end or other dedicated area that is easily accessible by boat or they will be located slip side so that two or four boats may be serviced from the same pumpout station. The pump unit includes a connector hose to provide access to the boats sewage holding tank and a pump that connects into the existing sewage network of the development site.

Vessel Movements

The predicted vessel movements and volumes in the Coomera River as a consequence of this project have been discussed in the Marine Vessel Activity Survey and Estimated Marine Traffic Report prepared by CRG Traffic and Acoustic Consultants contained in Appendix 22 to the EIS.

The marine traffic generation of the proposed development was estimated through a comparison and survey of the existing Gold Coast City Marina development located immediately to the south.

A survey of all marine vessel movements associated with the existing development was carried out over four days in June 2010 including a typical weekend. The results for the peak weekday and weekend day are summarised in the Marine Traffic Report.

These rates were then applied to the equivalent area for the proposed development. It was concluded that the GCIMP development would generate an average of 69 trips per day. This is considered to be minor given the existing number of boats present within the Gold Coast and Coomera River.

Specifically, as of March 2012 the Gold Coast has a total of 40,771 registered boats, most of which utilise the Broadwater and its connected systems of canals and rivers. Limited launch facilities and boat ramps exit within the Gold Coast's other waterway systems (i.e. Tallebudgera and Currumbin Creeks). As such, the majority of registered boats on the Gold Coast utilise the Broadwater and its canals and rivers. Furthermore, this waterway system is home to all existing marinas in the Gold Coast.

Boat wash from the development will have a minimal / immeasurable affect on bank stability and erosion, given the high amount of boat use in the existing waterway system.

Maintenance

Maintenance provisions for all structures within the marina precinct, including responsibility for maintenance works and monitoring requirements will be provided at the detailed design phase and through subsequent development applications. However, Hyder Consulting has prepared a Site Based Management Plan (SBMP) contained in Appendix 15 which establishes maintenance and monitoring provisions for GCIMP operations. This SBMP is a working document which will be updated and modified as required, to ensure the best maintenance and management practices are in force through the life of the GCIMP.

Maintenance Dredging

Details of the potential maintenance dredging of the artificial water (internal marina) and the navigation channels, in accordance with the *National Assessment Guidelines for Dredging* (NADG) (Department of Environment, Water, Heritage and the Arts 2009), are to be provided. This should include:

- the expected amount and frequency of maintenance dredging required to maintain the marina and associated waterways;
- details of the dredging methods to be employed including a description of the typical dredging plant, timing of maintenance dredging and dredge material disposal;
- measures for minimizing turbidity plumes and release of contaminants including water quality objectives to be maintained during dredging and details of the proposed water quality monitoring program;
- a description of the locations and dimensions of dredge spoil disposal areas on land or in water, including information on alternative methods of dredge spoil disposal and any beneficial use of dredged materials;
- identification of any potential impediments on dredging delivery (i.e. access constraints)
- responsibility for dredging areas within the internal marina (i.e. body corporate exclusions)
- potential impacts on EPBC Act listed threatened species and the Ramsar wetland, threatened species listed under the *Nature Conservation Act 1992*, within the proposed dredging area, and mitigation measures proposed.

A Maintenance Dredging Report prepared by Hyder Consulting is presented as Appendix 18 of the EIS, which responds in detail to the TOR relating to maintenance dredging.

Dredging Amount and Frequency

The dredge spoil resulting from maintenance dredging will be disposed of via the use of settlement ponds. It is anticipated that dredge spoil will be pumped along Shipper Drive to the settlement ponds in the designated dredge spoil area. The settlement pond design will allow the sediment to accumulate to a height that is half of the total pond height.

The area put aside for dredge spoil is 2.2 hectares. Given a dredging interval of 10 years, the total volume of sediment to be dredged is approximately 50,000m^3.

The timing of the dredging is dependent on the size of the dredge disposal area. The larger the disposal site, the larger volume of dredge material is able to be treated, increasing the time required between dredging intervals. It is estimated that the GCIMP will require 34 days for maintenance dredging, based on a dredge production rate of 300m^3 / hour, with the dredge working 10 hours per day, with actual dredging occurring for five hours.

Dredging Methods

It is recommended that a small cutter suction dredge be used to carry out the dredging. Given the nature of the material located adjacent to the GCIMP site it has been determined that a cutter suction dredge would be most applicable for maintenance dredging over the other types of dredger available. Although much of the material is quite fine, a lot it is very clayey and compacted, and therefore quite hard to remove. In order to remove it from the bed surface some physical manipulation will be required. It the material was predominately sand then a trailer suction hopper dredge would be ideal as it can simply 'trawl' the areas that need dredging and suck the sand up into the hopper. This cannot be done for this particular case as it will not be able to suck up the material in question.

Although mechanical dredgers will be able to remove the sediment, they are very slow and are more suited to capital dredging rather than maintenance dredging. A cutter suction dredge is the only hydraulic dredge that is suited to removing this type of sediment from the bed during maintenance dredging. Only a small dredge is required, given the relatively small amount of material that needs to be removed. A small dredge will also be better suited to removing sediment within the small internal marina.

Dredgers that have been investigated include one of the dredgers from the Neumann dredging fleet, Neumann Series 250-12L 'Nu Compact'. It has a production rate of 250m^3/hr in sand and a pipeline diameter of 305mm. Another dredge that would also be appropriate for the project would be the 'Saibai' cutter suction dredge; part of Hall Contracting's dredging fleet. It is roughly the same size as 'Nu Compact' and has a pipeline diameter of 300mm. These are examples of dredges that have been investigated but any small cutter section dredge; with a production rate of around 300m^3/hr will be the most applicable.

Dredge Impacts and Monitoring

In order to alleviate the stresses placed on the receiving waters of the Coomera River measures will be put into place in order to minimize and/or prevent environmental harm. Of particular importance are turbidity levels and the potential release of contaminants. As tailwaters from treated dredge spoil are discharged

back into the same environment as where the material was initially dredged the release of contaminants is not a pertinent issue. However there are conditions that need to be met in order to ensure that the release of contaminants does not occur. They are as follows:

1. Contaminants must not be released to any waters or the bed and banks of any waters, except for those contaminants released in compliance with Release Limits specified in the Maintenance Dredging Report.
2. Where water quality is impacted by an aspect of the activity and found to be in non-compliance with the Release Limits specified in the Maintenance Dredging Report, that aspect of the activity must cease immediately until effective mitigation strategies can be implemented.
3. Where the water quality of acid sulfate soil treatment ponds is found to be in non-compliance with the Release Limits, no release of tailwaters is permitted.
4. Written notification of the date when dredging will commence must be provided to the administering authority prior to starting the approved activity
5. Tailwater must only be released to Oakey Creek/Coomera River from an as yet specified release point. Tailwater must only be released in accordance with the Release Limits.
6. Monitoring must be undertaken and records kept of contaminant releases to waters from the monitoring locations, quality characteristics and frequencies specified in the Release Criteria. All determinations of the quality of contaminants released must be:
   a) made in accordance with methods prescribed in the Water Quality Sampling Manual (Department of Environment and Resource Management);
   b) carried out on samples that are representative of the discharge.

Dredge Spoil Disposal Areas

As previously mentioned, the area put aside for dredge spoil in is approximately 2.2 hectares. Given a dredging interval of 10 years, the total volume of sediment to be dredged is approximately 50,000m^3. Two settlement ponds have been designed, one primary pond, used to treat mainly sand and a secondary pond, used to treat mainly silt. The primary pond has an area of approximately 5,000m^2 and is 3m high, giving it a total volume of around 15,000m^3. It can accommodate around 7,500m^3 of dredged material at one time and will have to be emptied 4 times during the dredging campaign.

The secondary pond is roughly 4,900m^2 and 1m high, giving it a total volume of 4,900m^3. It can accommodate approximately 2,450m^3 of material and can accommodate the entire volume of material that it has been designed to settle. Detailed dimensions of the settlement ponds can be seen in drawing, K172-

AA001578 attached to the Maintenance Dredging Report prepared by Hyder Consulting contained in Appendix 18.

It is anticipated that the ponds will settle around 31,210m^3 of sand and 2,236m^3 of silt out of the total 50,000m^3 of material dredged which equates to 67%. It is assumed that dredge slurry is 15% solids and 85% water, which indicates that there will be 150g of sediment per litre of water. Given the effectiveness of the settlement ponds approximately 100.34g will settle leaving 49.66g/L or 49,660mg/L.

Alternative Dredge Disposal Methods

Some alternative methods of dredge spoil disposal include disposal at sea. When dredged material is disposed of at sea it is commonly placed at a designated disposal site or an area where the material may be used for coast of flood protection purposes. Where possible the characteristics of the dredged material should be of a similar type to the characteristics of the deposition zone, to minimise any adverse effects on the environment. However some parts of the marine environment are particularly sensitive to the deposition of sedimentary material. In the case of this project estuary and harbour areas are being dredged, offering up fine grained material. Depositing this type of material in areas where turbidity can cause adverse effects would not be advisable, even if the material is 'clean' and uncontaminated. Side effects of this type of action may give rise to blanketing effects on marine biota among other issues.

Other land based alternatives for disposal of dredged material are to dispose of it to land areas normally used for industrial or domestic water disposal. However these options are often unacceptable due to the high water content and difficulties in transporting it to the site. Given the constraints of this project, such as the fine nature of the material to be dredged and the method of dredging, any option implemented will have significant issues when handling the dredged material. Settlement ponds are one option that may be utilised that will have an ongoing use associated with them and they may also contribute to options of beneficial reuse.

Due to the fine nature of the material being dredged there are limited options for beneficial reuse. However because the settlement ponds have been designed to settle material according to particle size, which will therefore segregate the different materials, there are some options. The main beneficial reuse option is to reuse the sand that will settle in the primary settlement pond. There are many engineering applications for this type of material, such as use in bulk earthworks at other construction sites that it is possible that it will not be disposed of at a land fill site but reused in this manner. If this is this case it may be possible to recoup some of the costs associated with maintenance dredging.

There are significantly less options for beneficial reuse for the silt/clay material that will accumulate in the secondary pond. It is possible that it can be used for landscaping purposes, but it is more likely that it will be taken to a landfill site and be disposed of.

Potential Impediments

Potential impediments to dredging include potential access constraints in the internal marina as well as undertaking dredging around boat slips, especially if they are occupied at the time of dredging. It is anticipated that the type of dredge selected will be able to access all required areas while not causing excessive detrimental effects to the surrounding areas and user of the marina.

Dredging Responsibility

The body corporate of the site shall be responsible for the maintenance dredging of the internal channels that service commercial areas. i.e those areas within their water leases. The Gold Coast City Council and Queensland Government/Marine Safety Queensland shall be responsible for maintaining the entrance and internal navigation channels of the Coomera River.

Potential Significant Environmental Impacts

A range of construction and operational activities were identified which may potentially impact upon water quality and ecological receptors.

A key activity identified is the dredging activities. The impact of dredging on water quality objectives, and ecological communities outside of the construction footprint were identified by BMT WBM within their Water Quality Report contained in Appendix 28, and by FRC Environmental within their Aquatic Ecology Report contained in Appendix 7.

With regards to Sensitive Ecological Receptors, seagrass patches proximate to the site (e.g. Foxwell Island) will be lost as a result of the capital dredging campaign, and will again be lost as a result of turbid plumes generated by maintenance dredging. Assuming that these beds recover between the capital and maintenance dredging campaigns (which would be separated by approximately 10 years), it is expected that vessel traffic would also adversely affect these beds. Recovery of these seagrass patches is therefore not expected.

In terms of seagrass patches in the Coomera River, it is not expected that turbid plumes generated by maintenance dredging will have major adverse impacts.

Assessments of the likelihood of the proposed GCIMP development impacting upon Matters of NES have been carried out and the results of these assessments are discussed in detail within the Report of Matters of National Environmental Significance, refer to Appendix 6 of the EIS. These significant impact assessments are generally based on the findings of detailed technical assessments carried out as part of the GCIMP EIS process. The significant impact criteria considered in these assessments have been derived from the EPBC Act Significant Impact Guidelines Version 1.1 (2009)

Based on the assessments presented within this report, it can be concluded that any anticipated impacted to Matters of NES associated with the construction and operation of the GCIMP development will be relatively minor. In this regard, it is put forward that potential impacts to Matters of NES associated with the contemplated development will be of a limited magnitude, localised extent and/or appropriately mitigated through the implementation of relevant management plans proposed as part of the GCIMP development.

Workforce and Accommodation

This section should provide details on the employment requirements and skills base of the required workforce for both the construction and operational phases of the Project, including:

- Size and source of construction and operational workforce;
- Information regarding the occupational groupings required for the workforce; and
- New skills and training required in relation to the Project.

Size and Source of Workforce

As detailed within the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10, the proposed GCIMP is anticipated to generate significant employment opportunities for the local community and wider Gold Coast region during construction and operation.

The construction of the proposal is projected to provide approximately 2,250 annual full-time equivalent position (FTE) years. The flow-on benefits of this employment would generate about 4,950 full-time equivalent position years in Queensland and 4,160 full-time equivalent position years within the Gold Coast Region.

The operations of the proposal is projected to provide approximately 2,700 FTE operational employment position years. The flow-on benefits of this employment would generate further employment opportunities, resulting in approximately 5,400 full-time equivalent positions in Queensland, of which 4,800 full-time equivalent positions would be generated within the Gold Coast Region. This represents about 2% of the current Gold Coast jobs.

The existing Gold Coast Marine Precinct employs a skilled workforce, many of whom live in the northern part of the Gold Coast. This provides a core labour market upon which the proposed development would leverage from.

The Gold Coast's labour market is large in size, containing wide industry sectors and a shortage of jobs on the Gold Coast. This has meant many Gold Coast residents travel to Logan and Brisbane for employment. Continuing strong population growth, together with higher unemployment levels indicates an economy that is seeking to attract new employment opportunities rather than one that is unable to supply a workforce.

Occupational Groupings

Various land uses have been contemplated within the GCIMP as shown in the Table of Development included within Town Planning Report prepared by Planit Consulting contained in Appendix 5. As such, the GCIMP is anticipated to generate employment from a vast array of occupational sectors. These sectors include, but are not limited to:

- Construction;
- Electricity, gas, water and waste services;
- Manufacturing;
- Wholesale trade;
- Retail trade;
- Accommodation and food services;
- Transport and postal;
- Warehousing;
- Telecommunications;
- Hiring and recreation services;
- Professional and technical services (e.g. Naval engineers / architects);
- Administrative and support services; and
- Education and training.

Skills and Training

As previously stated, the existing Gold Coast Marine Precinct employs a skilled workforce, many of whom live in the northern part of the Gold Coast. The proposed development would leverage from this existing core labour market. It is noted that the proposal includes a TAFE teaching facility to improve the skills of existing workforce and train new workers attracted to the Precinct.
The GCIMP seeks to provide a fully integrated development, whereby students can be trained at the TAFE facility and then enter the workforce on site.
Further detail is contained within the Social and Economic Impact Assessment Report prepared by Norling Consulting contained in Appendix 10.

With regards to the construction phase, highly skilled labour crews will be sought including project management staff, site supervisors, foreman, labourers, plant and equipment operators, truck drivers, pipe layers, riggers and dogmen, scaffolders, concreters, form workers and environmental monitors.

3.7 Infrastructure Requirements

This section should provide a description of the requirements for constructing upgrading or relocating any infrastructure in the vicinity of the Project. This section should include layout plans showing the location of any infrastructure elements in relation to the Project site.

The infrastructure requirements of the GCIMP have been detailing in the following section. The Engineering Services Report prepared by Hyder Consulting contained in Appendix 19, details the engineering services and engineering planning issues of the development associated with the provision of infrastructure. The general scope of the Engineering Services Report is potable and recycled water and sewerage.

A separate report has been prepared by MDA Consulting in relation to the provision of electrical, telecommunications and gas services to the development. This report is contained in Appendix 23.

The Traffic and Transport Impact Assessment prepared by CRG is contained in Appendix 21 and details the provision of traffic and transport infrastructure.

Furthermore, a Stormwater Management Plan has been prepared by Hyder Consulting and is contained in Appendix 16 which details the stormwater drainage issues.

The above stated reports demonstrate that the proposed development can be adequately supplied with services satisfactory for the construction and operational phases of the GCIMP.

Traffic and Transport

The assessment of traffic and transport impacts should be presented in a separate report for each project affected mode (e.g. road, rail, air and sea). For this project "sea" is taken by the Department of Transport and Main Roads to include the Coomera River South Branch and interconnecting corridors. These reports must provide sufficient information to allow an independent assessment to be made of how existing transport infrastructure will be affected by project transport at the local and regional level.

Proposed new alterations to transport related infrastructure required by the project should be described. This includes modification to roads for access works and realignments, and rail lines, including level crossings and services, air and sea port facilities, if relevant. The EIS must also include details on the construction of any project related plant and utilities, within or impacting on the jurisdiction of any transport authority.

This section should also include:

- an assessment of any impacts to the Gold Coast railway including an analysis of any changes to the drainage and flooding characteristics of the upstream areas of Oakey Creek and how the impacts will be mitigated
- Expected volumes of project inputs and outputs of transported raw materials, wastes, hazardous goods, finished products and so on for all phases of the project
- How identified project inputs and outputs will be moved through the transport network (volume, composition, trip timing and routes);
- Traffic generated by workforce personnel including visitors (volume composition, timing and routes, plus on site car parking management for construction workforce);
- Likely heavy and oversize loads (volume, composition, timing and routes) highlighting any vulnerable bridges and structures along proposed routes plus haul route pavement evaluation and dilapidation surveys.

The EIS should also consider requirements for public transport, pedestrian and cycling networks to the subject site, should outline proposed linkages to the Project site and their alignment with the *Coomera Local Area Plan, Coomera Town Centre Structure Plan*, and adjacent development approvals.

The site is currently undeveloped and located within the Marine Industry Precinct of the Coomera Local Area Plan. The following comments are provided as a summary of the outcomes of the Traffic and Transport Impact Assessment that was undertaken by CRG contained in Appendix 21.

Whilst several alternative options have been prepared for the site, this assessment focuses on the Masterplan option given that this is the most intensive development option of the site and will therefore have a greater impact upon the surrounding road network.

Transport Network

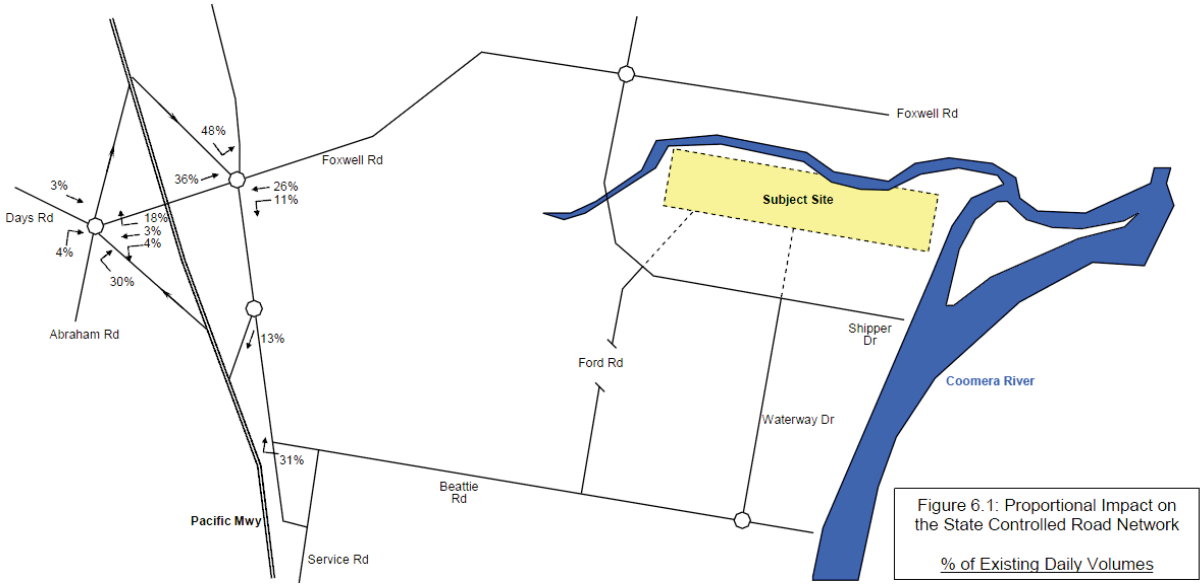
The volume, composition, trips, timing and routes to be moved through the transport network as a result of the proposal, have been detailed within the Traffic Impact Assessment prepared by CRG Traffic and Acoustics contained in Appendix 21 to the EIS. This is summarised as follows and further detail is provided in Section 4.12 of the EIS report.

State Controlled Network

A summary of the daily development traffic volumes using the State controlled road network (expressed also as a percentage of existing daily volumes) for each individual turning movement is shown in the Figure below. As shown, the percentage impact is greater than 5% on some turning movements at the Foxwell Road interchange as well as the Beattie Road / Service Road intersection. A detailed capacity analysis was therefore required at these intersections.

This analysis showed that the existing Pacific Motorway interchange at Days Road and Foxwell Road will reach capacity by 2021 and require upgrading regardless of the proposed development and will require upgrading within the next 10 years.

Figure 11 - Impact on the State Controlled Road Network



It is noted that the proposed development traffic will increase the degree of saturation at each of the above intersections only marginally and therefore have a relatively minor impact upon their performance. It is considered reasonable, however, that the Applicant be required to contribute towards the development of the surrounding State controlled road network. Such contributions should only be required at the completion of each stage and be consistent with those required under the Gold Coast Priority Infrastructure Plan (State component).

Local Network

With regard to the Local Road Network, the Traffic Impact Assessment has conducted a capacity analysis of the following intersections:

- Shipper Drive / Ford Road / Proposed Access
- Shipper Drive / Waterway Drive / Proposed Access
- Foxwell Road / Shipper Drive
- Waterway Drive / Beattie Road

This assessment has revealed that intersections will operate satisfactorily for the foreseeable future with the proposed development traffic. Thus the proposed development will not have any adverse impact upon the performance of the local road network.

Traffic Generation

The proposed Industry Subdivision will incorporate a mix of warehouse and light industry uses. Based on the standard DTMR trip generation rates for Industry development, it is considered that a rate of 7 daily trips per 100m^2 of GFA and 0.7 peak hour trips per 100m^2 GFA is appropriate to apply to this component of the development. The GFA of the Industry Subdivision is approximately 45% of the site area, thereby equating to 81,000m^2.

The traffic generation rates for the Retail, Hotel, Tavern and TAFE components of the development have been calculated at a different rate. It is considered reasonable to assume that a large proportion of the retail, hotel and tavern patrons will be associated with other uses in the development. This will therefore involve significantly less vehicle trips on the external road network when compared to stand-alone development. The following rates have been applied.

Table 4: Traffic Generation Rates

Land Use	Peak Hour	Daily
Retail	AM 1.5 trips / 100m^2 PM 3 trips / 100m^2	30 trips / 100m^2
Hotel	0.2 trips per room	2 trips / room
Tavern	AM - Closed PM 3.0 trips /100m^2	30 trips / 100m^2

Furthermore, a large proportion of TAFE students are anticipated to reside within the Coomera Town Centre, many of whom will cycle, walk or catch a bus to the campus. The TAFE incorporates 147 car parking spaces, half of which will turn over once each peak hour resulting in 75 vehicle trips each peak hour. The proposed TAFE is therefore considered to generate 300 daily trips.

Application of the above rates to the proposed development yields the following traffic generation potential:

Table 5: Total Traffic Generation Rates

Traffic Generation Rate	Daily Trips	AM Peak Hour		PM Peak Hour	
	TOTAL	IN	OUT	IN	OUT
Marina Berths, Showroom, Factory, Boat, Storage & Warehouse Uses (Approximately 24.3 ha)	1,752	102	56	34	182
Industry Subdivision (81,000m^2)	5,670	454	113	113	454
Retail (5,800m^2)	1,740	70	17	87	87
Hotel (110 rooms)	220	18	4	13	9
Tavern (1,500m^2)	450	-	-	22	23
TAFE	300	60	15	30	45
TOTAL	**10,132**	**704**	**205**	**299**	**800**

As such, it is estimated that the proposed development will generate in the order of 10,132 daily trips and up to 1,099 peak hour trips on the surrounding road network.

Car Parking

Application of the recommended car parking rates to the proposed development yields a total car parking requirement of 2537 car parking spaces for the Eastern Precinct.

A total of 2720 spaces are proposed (including on-street car parking) which exceeds this minimum requirement. The inclusion of on-street car parking is considered to be acceptable in this instance given that the proposed development will act as an isolated 'closed' catchment. Car parking demands will only be generated by those uses on the site and there will be no external uses generating demands for on-street car parking within the eastern precinct. It is therefore considered that the proposed car parking supply is satisfactory and will not result in any adverse car parking conditions.

Public Transport, Cycling and Pedestrian Linkage

Various public transport nodes are located in proximity to the GCIMP development site. The Coomera Rail Station is located on Foxwell Road and is a key element of the Town Centre and local planning in the area. The rail line connects to Brisbane and to Robina / Varsity Lakes. North and south-bound trains depart approximately every 30 minutes.

Bus services also operate within Coomera, with Route 725 operating along Shipper Drive directly past the development site. This bus route provides connectivity to the Coomera Town Centre and Rail Station as well as the Helensvale Town Centre and Rail Station. Services operate every 30-60 minutes through the Marine Precinct and are coordinated with Queensland Rail services.

The development proposal recommends the inclusion of bus stops along both sides of Shipper Drive in proximity of the proposed TAFE. These are shown in the Traffic Impact Assessment prepared by CRG contained in Appendix 21.

Pedestrian refuges should also be installed in Shipper Drive to facilitate safe pedestrian movement between bus stops and the proposed development.

With regards to pedestrian and cycle networks, we note that the regional cycleway corridor runs adjacent to the rail line through Coomera and is located in close proximity to the site. On-road bicycle lanes are also located along Beattie Road and Foxwell Road, east of the Coomera Rail Station. This allows good

connectivity for cyclists between the Marine Precinct and the Coomera Town Centre and Coomera Rail Station.

Connectivity may be improved through the implementation of bicycle lanes along Shipper Drive to line the Marine Precinct to Foxwell Road. It is considered that this should be provided regardless of the proposed development. Sufficient pavement width currently exists to allow this.

It is recommended that Bicycle parking be supplied in accordance with the requirements set out in Table 10-1 of the Austroads publication 'Guide to Traffic Engineering Practice - Part 14: Bicycles'. End of trip facilities (lockers, showers) should also be provided where appropriate to encourage cycling trips.

Railway

With regards to the existing Queensland Rail network, the development is not considered to impact significantly on its efficiency. The majority of users and workers of the GCIMP is anticipated to be in the local catchment, and the trips generated will be largely internalised within the precinct.

With regards to flooding, the existing Precinct analysis shows compliance with Council's Flood Level Increase Criteria, please refer to the Floodplain Management Report prepared by BMT WBM contained in Appendix 26. The Site analysis indicates impacts of up to 0.044 m in the 100 year ARI event and up to 0.058 m in the 10 year ARI event. These increases do not result in overtopping of the railway. This is predominantly Environmental Park and on private properties the houses are elevated well above the flood extent.

Transported Materials and Oversized Loads

Most truck movements will occur through delivery of materials to the construction site. There will be some additional traffic transporting waste and recycling materials in the opposite direction. Over the construction period of the Gold Coast International Marine Precinct it is estimated an average of 4 to 15 truck movements per day[1]. Some of these movements will be through trucks 'back loading' however, the extent of this is considered to be small as the majority of material delivered to the site will be used on site for the construction works. These figures are the approximate maximum daily movements.

During the operational phase of the TAFE, Marina and Mixed Use precinct, traffic generation will be in the order of between 1 to 3 truck movements per day for waste collection and recycling from the terminal- based on the same truck capacity assumed above.

It is not considered that transported materials will create a significant impact upon the existing road network.

Energy and Telecommunications

The energy and telecommunication requirements of the Project should be identified and described. A description of electricity, natural gas, and other solid and liquid fuel requirements for the construction and operation of the Project should be provided.

Existing electrical networks, proposed upgrades and the locations of any easements should be shown on appropriately scaled maps.

The capacity of existing energy and telecommunications networks to service the Project must be determined in consultation with service providers.

Any energy efficiency measures proposed should be briefly described in the context of any Commonwealth, State and local government policies.

This section should also include information on:

- estimates of commercial and marine industrial Gross Floor Areas
- precise staging and timing of the development
- estimates of the electricity requirements for the development.

An assessment of the existing electrical infrastructure and telecommunications services has been undertaken by MDA Consulting Engineers Pty Ltd in their Electricity and Telecommunication Services Report contained in Appendix 23 to the EIS. This report also details if any upgrades are required to the existing electrical and telecommunications services.

Electrical

As Energex has advised that the feeder CMA10A and CMA11A does not have enough capacity for the entire proposed development. Furthermore, it was recommended that the developer advise the exact required load, the staging plan and scheduled construction time so Energex will plan a new zone substation.

It is estimated that the development site based on air conditioned retail / commercial premises would require 6.78MVA. As such, the development would require to share a new 11kV feeder.

An Advantage for the client is that the 11kV feeders CMA10A/CMA11A are located in close proximity to the proposed location. There are existing spare conduits available and the development site is not far from the two new zone substations.

This being the case we believe that Energex would provide supply to the site from one of two new zone substations.

Telecommunication

From the current Telstra service, there are SMOF cable running past the opposite side of the development and several pits.

Telstra officers have advised that the government may introduce a new rule pertaining to optical fibre. This involves the compulsory installation of optical fibre as opposed to copper wire.

We note there are existing optical fibre cable and connection points in Shipper Drive. As such, the only issue pertaining to telecommunication services is the use of optical fibre or copper wire, depending on the federal government's new rule.

Energy Efficiency

As detailed in Section 3.1 of the EIS, and as per the Environmentally Sustainable Development Report prepared by Hyder Consulting contained in Appendix 11, the GCIMP will include various energy efficiency measures.

This includes passive building design, which can significantly improve thermal comfort levels and reduce the requirement for mechanical heating and cooling by minimising heat gain in summer and heat loss in winter.

North and south facing windows boat shed doors are preferable for optimal building performance during winter and summer and should be openable to assist in cross-ventilation. The western and eastern aspects of the buildings are minimised to reduce solar gain in summer particularly in the afternoon when building temperature will be at a maximum. Large roof eaves outside the main building areas will provide further shading of west and east facing windows.

Controlled admission of natural light is facilitated by external glazing allowing lighting of internal spaces during the day, reducing the need for artificial lighting.

Furthermore, energy efficient electrical lighting can be incorporated. The lighting specification for buildings require installation of low ballast and high efficiency light fittings. Careful specification of appliances as well as energy efficient light fittings will be undertaken to ensure reductions in overall building energy consumption during occupancy.

Energy reduction can be achieved with a strategic combination of new generation compact fluorescent lighting, Low E Tinted performance glass and R2 rated wall insulation. By replacing light fittings such as halogen lights with compact fluorescent lights, great energy savings can be achieved. In addition, the use of overhanging eaves, cross flow ventilation, the use of custom sized drapes with pelmets, and concrete walls with a large thermal mass all contribute to the reduction in energy use required for heating, cooling and lighting and therefore reducing the buildings carbon footprint.

Energy Efficiency Policies

Applicable Government Policies addressed within the Environmentally Sustainable Development report includes the Queensland *Environment Protection Act 1994* (EP Act) which aims to protect ecological processes and the quality of life for current and future generations in Queensland through development of environmental protection policies that address specific factors such as air, noise, water and waste. The standard criteria defined by Schedule 3 of the EP Act require consideration of the principles of ESD as set out in the National Strategy for ESD (NSESD) in assessment of development in Queensland.

The standard criteria as defined by the EP Act also includes addressing a number of instruments described under Schedule 3. All applicable Local, State and Commonwealth legislation including the Queensland Environmental Protection Policies (EPPs) have been considered in each of the elements under assessment for the EIS.

Gold Coast City Council's (GCCC) *Our Living City Report 2004-05* identifies water and energy as the key resources consumed within the City and recognises that reduction in demand and the potential for reuse is critical to the long term sustainability of these non-renewable resources.

GCCC's *Energy Conservation (Design for Climate) Policy No. 5* states that new buildings must minimise the need for artificial cooling or heating through energy efficient design.

Construction Timing

As the construction timing of the project is unknown at present, the likely size of the workforce is provided in the Table below. The details for the construction of Stage 1 and Stage 2 have been provided separately assuming independent construction of each stage.

Table 6: Construction Workforce

Stage	Period	Workforce
Stage 1	Phases 1 - 10	40 persons 18 month construction period 172,800 man hours
	Phase 11	Minimal due to preload
	Phase 12	60 persons 12 month construction period 172,800 man hours
Stage 2	Phases 1 -4	40 persons 12 month construction period 115,200 man hours
	Phase 5	Minimal due to preload
	Phase 6	60 persons 12 month construction period 172,800 man hours

Details pertaining to each construction stage and phase is contained within the Construction Methodology Report and Plans prepared by Hyder Consulting contained in Appendix 13.

Water Supply

The EIS should provide information on expected water usage by the project, including the quality and quantity of all water supplied to the site. In particular, the proposed and optional sources of water supply and estimated rates of supply from each source should be described (eg. bores, any surface storages such as dams and weirs, municipal water supply pipelines).

Appropriate water conservation and management measures should be outlined and any opportunities for recycled water use should be detailed.

Determination of potable water demand should be made for the project, including the temporary demands during the construction period, demand from visiting marine vessel and ongoing demand from commercial and industrial properties within the marine precinct. Details should be provided of any existing town water supply to meet such requirements. If water storage and treatment is proposed on site, for use by the site workforce, then this should be described.

The water supply report should be generally in accordance with Council / Allconnex Water with regard to:

- Desired Standards of Service - Planning Scheme Policy 11
- Land Development Guidelines - Planning Scheme Policy 11
- Priority Infrastructure Plan
- Temporary Local Planning Instrument Water Supply and Wastewater Land Use Category Demand Table for Priority Infrastructure Plan for calculation of Equivalent Tenement (ET) for the development site
- Capacity assessment of existing infrastructure system using Base Model established by Allconnex Water
- Servicing and Land Titling arrangements in line with the *Water Act 2005.*

A Water Supply Report prepared by Hyder Consulting is contained within Appendix 24 of the EIS and specifically addresses the water supply requirements for the project.

The former Gold Coast Water Infrastructure upgrades within the Coomera region formed the Pimpama Coomera Water Futures Alliance. This group is currently delivering a large portion of trunk water infrastructure within the region and have plans for future connections which are relevant to the GCIMP. A future potable water main of 150mm diameter is proposed to be constructed from Foxwell Road to the north of the project site, along Shipper Drive to the intersection with Waterway Drive. The proposed water main will connect to the existing 225mm diameter main in Waterway Drive.

With regards to calculating the demand on surrounding water infrastructure, the increase in development loading is applied through the projected increase in Equivalent Tenements (ET). The ETs for each planning horizon are included in the Table below.

Table 7: Equivalent Tenement Calculations for Project Icon

Planning Horizons / Year	Total ET of Proposed Development	Assigned ET for Development in Council IDM	Additional Demand ET
2011	0	590	0
2016	1317.76	590	727.76
2021	1317.76	590	727.76
PSD (2056)	1317.76	5083.85	-3766.09

The above equivalent tenements result in the following water demands:

Table 8: GCIMP Water Demands

Equivalent Tenements	AD (L/s)	MDMM (1 x AD) (L/s)	MD (1 x AD) (L/s)	MH (1.37 x AD) (L/s)
1317.76	14.28	14.28	14.28	19.56

The above water demands have been calculated as per Policy 11: Land Development Guidelines Section 4 - Water Reticulation - Design Requirements of the GCCC Planning Scheme. These demands are input into the water model to estimate the impacts on existing infrastructure.

In order to promote water conservation and management, where possible stormwater harvesting and reuse has been implemented on site through the use of stormwater harvesting tanks, as per the Queensland Development Code. Further reuse is to be through irrigation of landscaped areas, toilet flushing and other non-potable uses. Please refer to the Stormwater Management Plan prepared by Hyder Consulting contained in Appendix 16.

The site is also located in the Pimpama Coomera Water Futures Master Plan which encourages recycled water usage. A 450mm diameter recycled water main is located adjacent to the site and is proposed to connect the GCIMP site to the existing recycled water network. It is assumed that sufficient capacity exists in the current infrastructure network to cater for the GCIMP.

The impact of the proposed development on surrounding infrastructure was modelled using the H2OMAP water model. The site's demands were applied to the model at the designated connection point for the given planning horizon.

The impact on the existing water supply network was assessed by verifying and

comparing the standard flow pressure, fire flow pressure and velocity against Allconnex Water's Desired Standards of Service (DSS) in the vicinity of the subject site.

The DSS are identified as a minimum 22m and a maximum of 80m pressure head under proposed demands, fire flow pressure of12m with 30L/s fire flow demand applied and a maximum velocity of 2.5m/s in mains.

Potable water supply network was modelled using the H2OMAP Water modelling software using the Southern Multi-Use Final v26 model provided by Gold Coast City Council with the additional demands imposed by the development applied in 2016, 2026 and Planning Scheme Demand (PSD – 2056) horizons.

The proposed development was incorporated into the H2OMAP water model for each of the planning horizons. The impact on the existing water supply network was assessed by verifying and comparing the standard flow pressure, fire flow pressure and pipe velocity against Allconnex Water's (Southern District) Desired Standards of Service (DSS) in the vicinity of the development site. The DSS are:

- Minimum Standard Flow Pressure = 22m
- Maximum Standard Flow Pressure = 80m
- Minimum Fire Flow Pressure = 12m
- Maximum Pipe Velocity = 2.5m/s.

Infrastructure surrounding the development has been assessed to determine if the above DSS are met while catering for the increased loadings due GCIMP. Please refer to the Water Network Capacity Assessment prepared by Hyder Consulting contained in Appendix 24 to the EIS.

Stormwater Drainage

This section should provide a description and concept plan for the proposed stormwater drainage system and the proposed treatment and disposal arrangements including proposed discharge points. A stormwater management plan should be prepared for the site that addresses stormwater quantity and quality and incorporates the principals of water sensitive urban design together with *State Planning Policy 4/10 Healthy Waters.*

Water quality objectives for discharge of stormwater should be specified and stormwater quality improvement devices should be proposed to achieve the stated objectives.

If storm water drainage systems are proposed to discharge to tidal waters, details of any development permit required to undertake operational work within the coastal management district and/or tidal work should be provided. If a development permit is required information will need to be provided in accordance with the Guideline for *Operational Work On State Coastal Land* (Department of Environment and Resource Management 2010b) and/or *Guideline: Constructing Tidal Works* (Department of Environment and Resource Management 2010a).

Scope

Hyder Consulting has prepared a Stormwater Management Plan addressing the proposed stormwater drainage system, treatment and disposal arrangements including proposed discharge points. This Stormwater Management Plan addresses stormwater quantity and incorporates principals of water sensitive urban design and is contained in Appendix 16 to the EIS.

BMT WBM has prepared a Water Quality Report which addresses stormwater quality and incorporates the provisions of State Planning Policy 4/10 Healthy Waterways. The Water Quality Report is contained in Appendix 28 to the EIS.

The Stormwater Management Plan prepared by Hyder Consulting demonstrates that the proposed development has incorporated Water Sensitive Urban Design (WSUD) principles and via the adoption of design and planning best practices, ensures that discharging stormwater runoff from the site will not adversely impact on the surrounding environment as a direct and preventable result of the development.

A major component of the hydrologic assessment is to develop an understanding of the flow rates of discharging stormwater from the development, via the use of

hydrograph analysis. By calculating an analysing hydrograph profiles before and after the proposed development, the design of stormwater detention structures will be undertaken through an educated approach. Further hydrograph analysis of the developed catchment areas with the inclusion of proposed detention structures additionally allows for assessment of the detention structure's performance.

The ultimate scope of the hydrologic assessment is to provide engineering solutions to the environmental threats incurred by the inevitable increase in peak stormwater runoff which results from any development causing an increase in impervious areas.

A summary of the methodology employed to undertake the hydrologic assessment is as follows:

1. Identify existing discharge locations, the contributing catchment areas and the runoff parameters of all internal catchments.
2. Quantify the stormwater runoff at each discharge location in the existing condition for a standard range of storm events and durations using manual methods.
3. Create, calibrate and verify existing case WBNM hydrologic models for the standard range of storm events and durations.
4. Determine the critical storm events for the existing condition and produce event hydrographs.
5. Examine the proposed development and identify the discharge locations, the contributing catchment areas and the runoff parameters of all internal catchments.
6. Quantify the stormwater runoff at each discharge location in the developed condition for a standard range of storm events and durations using manual methods.
7. Create, calibrate and verify developed case WBNM hydrologic models for the standard range of storm events and durations.
8. Determine the critical storm events for the developed condition and produce event hydrographs.
9. Using the existing and developed critical storm event hydrographs, determine approximate detention structure requirements.
10. Iteratively optimise the design of stormwater detention structures using the hydrologic modelling results.
11. Present results.

All methods of calculation and equations used throughout the hydrologic analysis are performed in accordance with the relevant and referenced Queensland Urban Design Manual (QUDM 2007) recommendations and Gold Coast City Council Land Development Guidelines (2007).

From undertaking the above hydrologic assessment, Hyder Consulting has examined the effects that the proposed development will place on the immediate points of discharge from each internal catchment within the proposed development site.

The impacts of increasing peak stormwater discharge from the catchments which outlet to Oakey Creek, a comparatively small subsidiary branch of the Coomera River is considered to be unacceptable practice due to the likelihood of affecting regional storm events. As the Oakey Creek catchment area is small, an increase in peak flow discharge to Oakey Creek is likely to incur increased water levels within the creek and upstream properties. It is anticipated that all proposed stormwater detention structures within catchments discharging to Oakey Creek will be required.

The Coomera River has a larger regional catchment covering 489km^2 of area with 928km of stream network. It is not expected that an increase in peak discharging flow rates from internal catchments within the proposed development will have a substantial impact on the regional hydrology.

Impervious area increases causes an increase to flow rates discharging to the Coomera River, however no downstream properties are to be affected by this increase and the possibility of an adverse impact on the regional Coomera River hydrology is expected to be negligible.

It is considered that the construction of two (2) 900m^3 and one (1) 1800m^3 tanks to provide stormwater detention to internal catchments is unnecessary given the little or no benefit it will have to the development or the Coomera River as a whole.

Water Quality Objectives

The *Environmental Protection (Water) Policy 2009* (EPP Water), which embodies the principles of the National Water Quality Management Strategy, forms the legislative basis for water quality management in Queensland. The EPP Water includes a process of determining environmental values of waterways and corresponding water quality objectives (WQOs), also known as targets, for differing indicators including pH, nutrients and toxicants.

WQOs are sought to be achieved and protected for a waterway to ensure environmental values and users of the waterway are protected.

The *Environmental Protection (Water) Policy 2009 - Coomera River Environmental Values and Water Quality Objectives July 2010* addresses the WQOs of the receiving environment that is downstream of the GCIMP (i.e. the Coomera River). This document identifies the Urban Stormwater Planning

Guidelines 2010 (DERM) as the document from which both construction and operation phase WQOs should be specified for stormwater drainage design.

Hyder Consulting's Stormwater Management Plan contained within Appendix 16 to the EIS seeks to ensure that all parameters identified in Table 2.1 of the *Urban Stormwater Quality Planning Guidelines 2010 (DERM)* are maintained during construction phase and all parameters identified in Table 2.2 of the *Urban Stormwater Quality Planning Guidelines 2010 (DERM)* are maintained during operational phase.

In complying with these objectives, Hyder Consulting's Stormwater Mangement Plan reflects the provisions of:

- GCCC (2006) Stormwater Management and Water Quality Guidelines. Gold Coast City Council Planning Scheme Policy.
- Environmental Protection (Water) Policy 2009
- Environmental Protection (Water) Policy 2009 – Coomera River Environmental Values and Water Quality Objectives July 2010
- State Planning Policy 4/10 Healthy Waters

The following summarises the performance objectives for the construction phase:

Table 9: Construction Phase Performance Objectives

Pollutant	Criteria
Drainage Control	Design life and design storm of temporary drainage works: 1. Disturbed area open for <12 months—1 in 2 ARI 2. Disturbed area open for 12-24 months—1 in 5 ARI 3. Disturbed area open for > 24 months—1 in 10 ARI
Erosion Control	1. Minimise exposure of disturbed soils at any time 2. Avoid or minimise large construction activities in the wet season 3. Divert water run-off from undisturbed areas around disturbed areas 4. Use erosion risk ratings to determine appropriate erosion control measures
Sediment Control	Use soil loss rates to determine appropriate sediment control measures Design storm for sediment control basins should be based on retaining the maximum sediment quantity for the maximum volume of water run-off Site discharge during sediment basin dewatering should not exceed 50 mg/L TSS and pH between 6.5–8.5
Water Quality Outcomes	**Stormwater flows from undisturbed and disturbed areas**—manage to help protect environmental values **Coarse sediment**—coarse sediment is retained on site **Fine sediment**—Site discharge during sediment basin dewatering has a TSS concentration less than 50 mg/L **Turbidity**—Site discharge during sediment basin dewatering has a turbidity

	(NTU) less than 10% above receiving waters turbidity— measured immediately upstream of the site **Nutrients (N & P)—**Nitrogen and phosphorus are managed through sediment control. **pH**—Site discharge during sediment basin dewatering has a pH range 6.5–8.5 **Litter and other waste**—Prevent litter/waste entering the site, the stormwater system or watercourses that discharge from the site. Also minimise or sufficiently contain on-site litter and waste production and regularly clear waste bins **Hydrocarbons and other contaminants**—Hydrocarbons and other contaminants are prevented from entering the stormwater system or internal watercourses that discharge from the site **Wash down water**—Wash down water is prevented from entering the stormwater system or internal watercourses that discharge from the site **Cations and anions**—Cations and anions including aluminium, iron and sulfate are managed as required under an approved acid sulphate soil management plan
Stormwater Drainage / Flow Management	Hydraulics and hydrology—Take all reasonable and practicable measures to minimise significant changes to the natural waterway hydraulics and hydrology from: • peak flow for the one-year and 100-year ARI event (respectively for aquatic ecosystems and flood protection) • run-off frequency and volumes entering receiving waters • uncontrolled release of contaminated stormwater

The following summarises the performance objectives for the operational phase. It is also noted that the criteria identified in this table, complies with the reduction targets specified in Section 13 of the GCCC Land Development Guidelines.

Table 10: Operational Phase Performance Objectives

Pollutant	Minimum reductions in mean annual loads from unmitigated development (%)
Total Suspended Solids (TSS)	80
Total Phosphorus (TP)	60
Total Nitrogen (TN)	45
Gross Pollutants >5mm	90

Stormwater Quality Improvement Devices

The treatment of stormwater will occur using environmental best management practices. Various Stormwater Quality Improvement Devices (SQIDs) will be implemented to reduce pollutant release to external catchments to form a 'stormwater treatment train'. The utilisation of various devices will ensure sediment, pollutants and nutrients in the stormwater are treated to meet environmental guidelines. These devices are listed as follows:

- **Turf buffer strip** - usually located between the road pavement / allotment and the swales and bio-retention systems to remove suspended solids, litter, gross pollutants, oils and greases. These will be incorporated in the project at the detailed design stage.
- **Bio-retention basin** - vegetated area where runoff is filtered through a filter media layer, then percolated downwards to perforated drains which flow downstream. These systems act to remove suspended solids, total phosphorus and total nitrogen. These are proposed to be incorporated into the landscape design of the development.
- **Trash rack** - recommended to be provided to downstream outlets to pipes entering any bio-filtration or detention basins to capture gross pollutants.
- **Oil and grit separators** - contain chambers which remove sediment, screen debris and separate oil from stormwater. The capture particulates and hydrocarbons from small, highly impervious areas. This device is to be sized to treat a Q_{3month} flow, and will meet the discharge guidelines.
- **Rainwater Tanks -** Rainwater tanks are assumed to be provided for each lot within the proposed development as per Council requirements. The size of such tanks will be determined at detailed design stages.

Further detail is provided within the Stormwater Management Plan prepared by Hyder Consulting contained in Appendix 16.

Wastewater Service

This section of the EIS should describe the wastewater infrastructure required to service the project including the location and capacity of wastewater reception and handling facilities associated with the marine vessels. An assessment should be undertaken of potential impacts on existing and planned wastewater infrastructure to determine the requirement for infrastructure upgrades as a result of the project, including estimated costs of required upgrades.

The wastewater report should be generally in accordance with Council/Allconnex Water with regard to:

- Desired Standards of Service – Planning Scheme Policy 11
- Land Development Guidelines 2008 – Planning Scheme Policy 11
- *Priority Infrastructure Plan*
- Temporary Local Planning Instrument Water Supply and Wastewater Land Use Category Demand Table for Priority Infrastructure Plan for calculation of Equivalent Tenement (ET) for the development site
- capacity assessment of existing infrastructure system using Base Model established by Allconnex Water
- Servicing and Land Titling arrangements in line with the *Water Act 2005*.

An Engineering Services Report prepared by Hyder Consulting is presented as Appendix19 of the EIS, detailing information regarding engineering services required for the proposed project including sewerage.

Existing Sewerage Network

The proposed development site forms part of the Pimpama-Coomera catchment area which has been identified by Gold Coast City Council for adoption of an integrated water management approach to the provision of wastewater infrastructure. Council's provisions for sewerage reticulation incorporate Reduced Infiltration Gravity Sewer Systems. As of writing this report no sewerage connection is currently proposed for the site.

An existing sewerage system is located adjacent to the development site area and is a vacuum pump station and rising main located within Waterway Drive which currently services the existing Coomera Marine Industry and ultimately pumps sewerage west to Beattie Road and north to the Pimpama Coomera Wastewater Treatment plant.

Gold Coast Water (now Allconnex) have advised that the existing vacuum pump station located within Waterway Drive is at its peak capacity and discharge into the existing vacuum pump station and/or rising main would result in failure of the system.

Internal Sewerage Reticulation System

The internal sewer reticulation system for the subject development will incorporate a low pressure sewer system, with reduced infiltration gravity sewer principles for the gravity component of the sewer system. The developer shall, as part of the development works, construct the internal pressure sewer reticulation service for the proposed development in accordance with Gold Coast City Council's Land Development Guidelines.

Project Sewerage Demand

To determine the impacts of the proposed development onto the existing sewerage infrastructure, Hyder has undertaken a sewerage network assessment analysis over the proposed development site. Development information relating to land use has been obtained from Push Architects, Gold Coast City Council Policy 3b – Policy for Infrastructure (Sewerage Network Developer Contributions) and the Temporary Local Planning Instrument (TLPI) Water Supply and Sewerage Land Use Category Demand Table for Policies 3A and 3B.

Details pertaining to demand are contained within the Engineering Services Report prepared by Hyder Consulting contained in Appendix 19.

Project Sewerage Requirements

All sewer supply systems shall be designed to meet Gold Coast City Council Land Development Guidelines. The gravity and pressure components of the domestic sewer supply system shall be designed in accordance with the specifications for reduced infiltration gravity systems.

All the proposed lots in the development are to be sewered. To facilitate the Council planning strategy density for the site, the sewer mains have been placed external to the individual lots where possible. This has been provided intentionally to maximise the usable built form area on the allotments and to enable effective access for future maintenance.

Internal to the development site a pressure sewerage system is to be constructed that utilises small, low powered grinder pumps in each property which are then

connected to a centralised discharge network within the road verge where available or within the allotments for community title land designations. These pumps are capable of storing sewage from the individual allotment to which they are connected and are drained of sewerage via an electronic activation system when full via pressure and transported to the connecting sewer system. From the development collection point the sewerage is then pumped into the Council trunk main situated in Shipper Drive.

The Pressure Sewerage Code of Australia WSA07 identifies the pressure system philosophy generally as follows: *"The pressure sewer system uses the combined flows under pressure from individual collection/pump units to transport sewage. In most instances the system will discharge to a sewage pumping station or a gravity sewer for further transport to a treatment plant. Compared to a traditional gravity system, pressure sewer systems have negligible inflow/infiltration issues and are not limited by the same strict grade controls. As a result the pipes are smaller and can be laid shallower, allowing reduced depths of excavation or other construction options, which lowers construction costs".*

The use of a pressure sewerage system is proposed on this site due to the low lying development platform and the existing subsoil conditions. A pressure sewerage system can be constructed within a depth range of approximately 2m for the gravity and pressure lines allowing construction to proceed above the water table and limit the disturbance of acid sulphate soils. Construction methods allow for a faster construction method than for a traditional full gravity system as groundwater pumping, trench stability and acid sulphate treatment requirements can be reduced with a pressure system.

In addition should a traditional gravity trunk system be constructed, the length of pipe work to construct the system would result in the trunk lines being very deep at the location of the pump station and considerable detail would be required in relation to buoyancy effects of the pump station and manholes. On-going maintenance of the system in the future would also be more difficult than the proposed pressure sewerage system.

The design of pressure sewer systems and pump station components shall comply with the Water Services Association of Australia's publication "Pressure Sewerage Code of Australia" unless specified otherwise by Gold Coast City Council.

Impacts on Existing and Planned Infrastructure

The proposed sewage from the project site is to be collected internally via a series of gravity sewer mains and pump stations with discharge rising mains. These are to then connect to the existing infrastructure associated with the alternative options for sewerage discharge that have been identified by the developer.

The preferred option is to utilise an onsite pump station and rising main along Shipper Drive to connect to the proposed alignment under the allotments to the north of the GCIMP which in turn connect to the Amity Way Gravity Line. All services will be aligned with existing roads and no easements will be required.

It is proposed that the low pressure sewer reticulation and pump station system within the project site will be owned, operated and maintained by the body corporate. The sewer facilities external to the project site will become assets of Gold Coast City Council. The gravity mains up to the low pressure pods will be owned by the individual tenants, while the rising mains and pump station will be owned by the Water Authority. These facilities will ultimately be operated and maintained by Gold Coast City Council. Please refer to Engineering Drawing K232-AA001578-01 attached to the Engineering Services Report prepared by Hyder Consulting contained in Appendix 19.

Required Infrastructure Upgrades

Some of the options for sewage disposal will require infrastructure upgrades in order for them to be considered as a viable option. The preferred option will require the construction of a rising main and pumping station will be required through the allotments to the north of Oakey Creek. It is anticipated that developers of these sites will be responsible for the construction of this rising main and pumping station. A connection to this proposed rising main will be made from the rising main that follows Shipper Drive that the developer will be responsible for.

3.8 Rehabilitation

This section should present general strategies and methods for rehabilitation and should seek to re-establish Pre-Clearing Regional Ecosystems, including coastal resources and values. For guidance on preferred rehabilitation strategies and expected outcomes reference should be made to Gold Coast City Council's *Open Space Management Guideline: Guideline for the preparation of Reports and Plans associated with dedication of Public Open Space November 2007:Ver. 1.0*.

As detailed in the Open Space Management Statement (OSMS) prepared by Planit Consulting contained in Appendix 40 of the EIS, rehabilitation is to occur onsite inclusive of reconstruction and assisted regeneration of natural vegetation as well as the 40 metre vegetation buffer. Ass reconstruction plantings are to be in accordance with the Swamp Sclerophyll Module [RE 12.3.5]. Assisted regeneration shall consist of the continuously rehabilitation/protection via management of weeds and removal of threatening processes (inappropriate access, recreational vehicle exclusion etc).

Whilst few areas are evident (at the time of most recent site inspections) any disturbed areas which become evident throughout the 'establishment' and 'on-maintenance' period (i.e. as a result of recreational vehicle damage, construction impact etc) are to be revegetated in accordance with the Swamp Sclerophyll Module [RE 12.3.5].

Formal plantings will be restricted to the streetscapes, stormwater retention devices and general landscaping amongst open space areas. A Landscape Masterplan has been prepared in this regard and is contained in Appendix 35.

Please note that implementation of added reconstruction plantings will only be necessary if 'assisted natural regeneration' efforts are unsuccessful in the medium term.

Three planting zones are provided for the open space within the Gold Coast International Marine Precinct described below (refer to Landscape Masterplan - Appendix 35):

- Public open space interfaces
  - Mixed use precinct species list
  - Streetscape Module

- Rehabilitation zones (assisted regeneration/reconstruction):
  - Swamp Sclerophyll Module [RE 12.3.5]

- Stormwater treatment devices planting including (basins)
  - Stormwater Treatment Device Planting Module.

Figure 4 below shows the location of these abovementioned zones.

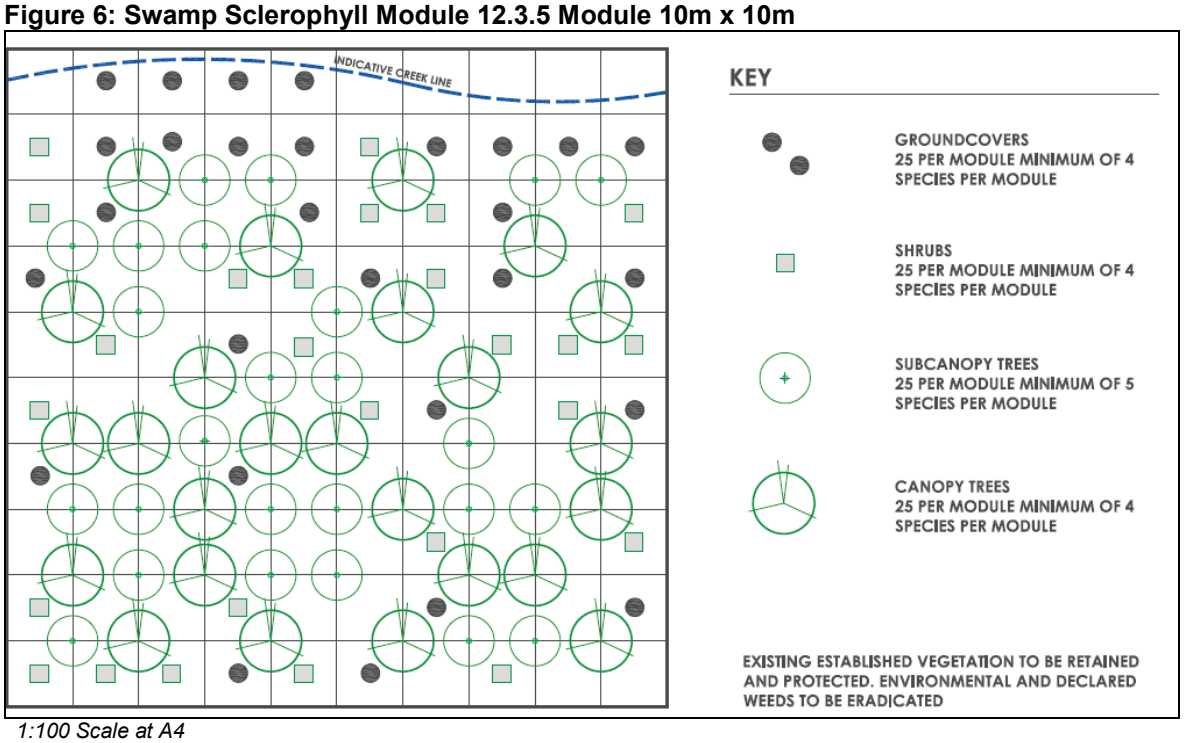
Figure 5: Planting Management Zones - Including Assisted Regeneration and Reconstruction Management Zones

The following summarises the provisions for the Rehabilitation Zones, further detail pertaining to other planting zones is discussed in the OSMS contained in Appendix 40.

<u>Rehabilitation Zones - Assisted Regeneration & Reconstruction</u>

This zone incorporates the reconstruction and assisted regeneration of the retained vegetation located to the north and west within the development site. Assisted regeneration is to be implemented within retained saltmarsh communities and copses of swamp oak forest. Pasture areas to the west are to be reconstructed in accordance with the Swamp Sclerophyll Module [RE 12.3.5], shown in Figure 5 below.

Figure 6: Swamp Sclerophyll Module 12.3.5 Module 10m x 10m



1:100 Scale at A4

Table 11: Swamp Sclerophyll Module: RE 12.3.5*

SWAMP SCLEROPHYLL MODULE: RE 12.3.5*			
Species	**Size**	**Minimum Diversity**	**No. per module 100m^2**
Canopy Tree			
Eucalyptus robusta	75mm TUBE	4 per module	25 80% to be comprised of *Casuarina glauca* and *Melaleuca quinquenervia*
Casuarina glauca			
Callistemon salignus			
Meleleuca quinquenervia			
Eucalyptus tereticornis			
Eucalyptus robusta			
Small Trees			
Cupaniopsis anacardioides	75mm TUBE	5 per module	25
Allocasuarina littoralis/torulosa			
Ficus coronata			
Glochidion ferdinandi			
Lophostemon suaveolens			
Banksia integrifolia			
Dubosia myoporoides			
Syzygium oleosum			
Trococarpa laurina			
Shrubs			

Hovea acutifolia	75mm TUBE	5 per module	25
Notolaea longifolia			
Pittosporum revolutum			
Austromyrtus dulcis			
Groundcovers			
Blechnum indicum	75mm TUBE	5 per module	25
Crinum pedunculatum			
Cyperus polystachyos			
Dianella caerulea			
Gahnia aspera			
Gymnostachys anceps			
Lomandra hystrix			
Schoenoplectus validus			
Xyris complanata			

**Planting schedule species selected from REDD (EPA 2007), Supplementary Descriptions (Bean et al, 1998), GCCC VT Lists (2007) and native species recorded on site (Planit, 2008). Additional species considered suitable for use are those native plants endemic to the Coomera River Floodplain area. Canopy trees must however be dominated by those specifically listed within the above module (i.e. RE 12.3.5).*

Long-term canopy cover is to achieve a minimum crown cover of 40-50% of which 50% is to be dominated by the pre-clearing ecosystem species (i.e. canopy trees listed above).

Rehabilitation/protection is to be applied to the 40m vegetation buffer and the natural vegetation area (saltmarsh and copses of swamp oak forest) on coastal deposits which exhibits minor areas of pasture weed infestation that need to be monitored. Please note that for the 40m buffer zone and the natural vegetation areas 'assisted natural regeneration' will apply. Planting in accordance with the Swamp Sclerophyll Module [RE 12.3.5] will be required in the instance that 'assisted natural regeneration' efforts are unsuccessful in restoring native vegetation cover in the medium term.

Rehabilitation Strategy - Oakey Creek Buffer Zone

Management of the retained vegetation will be largely focused upon the rehabilitation of minor weed infested and bare areas within the saltmarsh communities as well as the swamp oak forest. Reconstruction plantings are to occur throughout the retained pasture.

The below rehabilitation strategy is recommended and aimed initially at the protection of existing vegetation to be retained and secondly at providing a level of enhancement (where required).

It often takes a period of several years before the achievement of such aims are realised and as such it is of paramount importance that an appropriate strategy is derived and implemented in the initial phases of rehabilitation. The primary objectives recommended for the 40m vegetation buffer and natural vegetation area to be rehabilitated include:

- Retain existing vegetation and associated fauna habitat;
- Retain and enhance fauna habitat values;
- Remove and manage processes potentially threatening the viability of existing habitats.
- Reconstruct habitat that has been altered by previous land uses

As the rehabilitation zone (40m vegetation buffer zone and natural vegetation area) is partly occupied by intact remnant vegetation, the 'assisted natural regeneration' management approach will be necessary. Reconstruction will occur where pre-existing native vegetation has been modified to accommodated cattle.

The applicable circumstances of these types of rehabilitation per GCCC are provided below:

<u>Assisted Natural Regeneration applies:</u>

- To natural areas where the native plant community is largely healthy and functioning.
- When native plant seed is still stored in the soil or will be able to reach the site from nearby natural areas, by birds or other animals, wind or water.
- Where the natural regeneration processes (seedling germination, rootsuckering, *etc*.) are being inhibited by external factors, such as weed invasion, soil compaction, cattle grazing, mechanical slashing, etc
- When limited human intervention, such as weed removal, minor amelioration of soil conditions, erection of fencing, cessation of slashing, etc. will be enough to trigger the recovery processes through natural regeneration.
- When the major component is weed control.

<u>Reconstruction applies:</u>

- Where the site is highly degraded or altered
- When the degree of disturbance has been so great and long-standing that the pre-existing native plant community cannot recover by natural means.
- To sites such as areas of fill, sites affected by stormwater flow, and areas that have been drastically cleared, either mechanically or by stock even though there may be a few remaining native trees or shrubs.
- When a greater degree of human intervention is required, such as weed removal, cessation of grazing and/or slashing, amelioration of soil conditions such as importation of soils, drainage works or reshaping of the landscape.

- When a major component is the importation of native species through planting.

A weed management strategy has been prepared for the site and is contained within the OSMS prepared by Planit Consulting contained in Appendix 40. This weed management strategy has been prepared for the management zones, and is intended to progressively remove weed species from the area.

In association with the progressive removal of the nominated weed species from the 40m vegetation buffer and natural vegetation area, a revegetation/regeneration strategy should be selected to ensure that the newly weeded areas become established with native species. The regeneration strategies to be utilised on site are discussed below.

Revegetation Strategy

It is recommended that revegetation of disturbed areas to be undertaken on site for the following reasons:

- To maintain the existing level of integrity of vegetation communities contained within the 40m vegetation buffer zone and natural vegetation area
- To maintain and potentially increase the floristic diversity currently exhibited within the 40m vegetation buffer zone and natural vegetation area
- To ensure that degraded and managed areas regenerate with native endemic flora species
- To stabilise areas subjected to weed management
- To restore cover and habitat diversity for the faunal assemblage following weed removal
- To progressively offset the loss of vegetation from the overall development
- To increase crown cover in open areas such that with the ongoing regrowth succession of the site there is potential for the existing communities to reach remnant status in the future.

In addition to the above, revegetation of disturbed areas and areas of sparse vegetative cover is required to provide long-term protection to the 40m vegetation buffer zone and natural vegetation area from potential edge effects including:

- Abiotic effects: those changes in light, temperature, humidity and wind that occur when a remnant edge is formed by the creation of new surrounding land uses, such as clearing land for grazing, agriculture or urban development.
- Direct biological effects: include changes in the number and abundance of species brought about by changed environmental conditions (e.g. the spread of species that adapt well to the altered climatic conditions and the reduction in recruitment of species that do not prosper).

- Indirect biological effects: are changes in the way species interact, particularly modified patterns of competition, pollination, and the dispersal of seeds (Greening Australia, 2000).

Revegetation Types

It is suggested that the saltmarsh communities and copses of swamp oak forest are to be rehabilitated according to strategies of assisted natural regeneration which would prove feasible and effective. Locations for these types of revegetation strategies are outlined below.

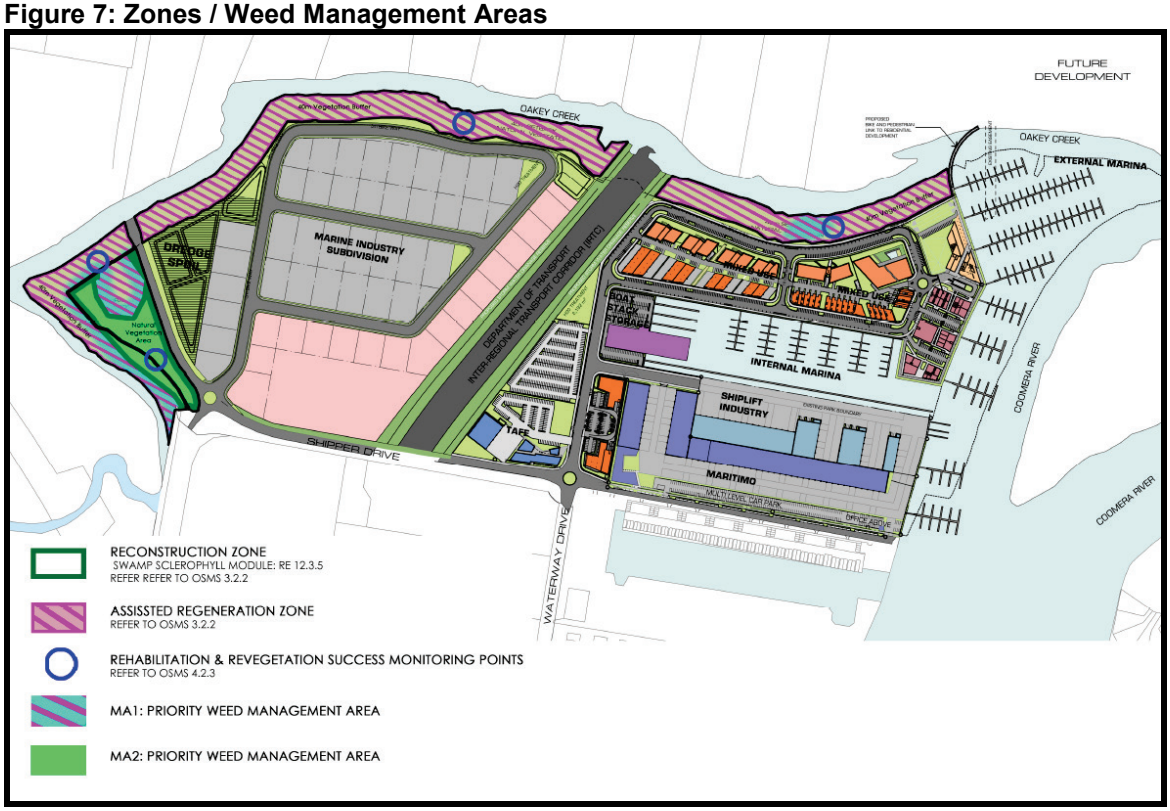
Assisted Natural Regeneration (with follow up landscaping only where necessary)

Assisted natural regeneration will occur within the following areas:

- Within the saltmarsh communities and copses of swamp oak forest which have generally an intact canopy and/or closed lower strata dominated by native species.

The area to be managed for assisted natural regeneration is highlighted in Figure 6 figure below.

Figure 7: Zones / Weed Management Areas



These areas shall be managed as 'assisted regeneration' areas whereby weed re-establishment will be routinely monitored (and control applied as necessary) and regeneration of native vegetation cover also monitored. This shall be undertaken from the 'pre-start' meeting until three months prior to the 'on-maintenance' period. At this stage a meeting shall be held between the site contractors and council officers to determine the success of the natural regeneration areas. This shall be determined via the cover of the natural regeneration zones with native species.

During the aforementioned site meeting (three months prior to 'on maintenance') to determine the success of the natural regeneration project, areas which are bare or denuded (shall be addressed via reconstructive management (i.e. landscaping). This landscaping will be implemented and monitored accordingly for the remaining three months of the 'establishment period' and the 12 months of the 'on-maintenance' period. The landscaping modules to be planted within bare areas (if deemed necessary following the site meeting) shall be in accordance with the Swamp Sclerophyll Module [RE 12.3.5].

Ground preparation and ongoing monitoring/maintenance for landscaping of any bare areas (6 months prior to 'off-maintenance') shall occur in accordance with the revegetation, maintenance and monitoring details provided below.

Large-scale Planting (Reconstruction)

This type of revegetation will occur to the pasture area (Community 4) located to the west of the development site (refer Figure 6 above). Revegetation within this area will be reflective of the following:

Pasture Areas (resulting from frequent grazing)

- Planting of the Swamp Sclerophyll Module [RE 12.3.5]

Ground preparation and ongoing monitoring/maintenance shall occur in accordance with the revegetation, maintenance and monitoring details provided below.

Revegetation Techniques

Direct Planting (Reconstruction)

This technique is suitable for small-scale sequential revegetation of disturbed areas, and within currently open locations to increase crown cover. Landscaping is the most common method of revegetation, however, it does require establishment, maintenance watering, mulching and weeding and also has the highest cost. The landscaping process should occur as follows:

- Identify areas on site which require direct planting

- Ensure areas identified are appropriately prepared (refer below) including mulching with forest mulch;
- Select plant species to be utilised from Rehabilitation Zone details provided above;
- Maintain and monitor area in accordance with section entitled 'Monitoring and Maintenance'.

Prior to the planting within designated areas, the following ground preparation works are to be undertaken:

- Remove all rubbish including any previously dumped vegetative material, building slabs etc. Any existing hollow logs and regenerated native plants are to be retained in-situ;
- Erect temporary signage to inform that the relevant location is now a rehabilitation area. This will assist in reducing accidental damage to plant stock, introduction of additional weeds and dumping of rubbish;
- Undertake weed removal
- Undertake follow-up weed treatment following a period of two weeks to remove individuals which have germinated from soil bank resources;
- Provide forest mulch (100mm depth min.) to revegetation area;
- Plant species in accordance with Rehabilitation Zone details provided above. It is considered that the revegetation palettes have been designed to achieve canopy closure in the shortest possible time (i.e. by utilization of fast growing and pioneer canopy trees) in order to minimize weed growth and associated competition with planting works.

Maintenance

- Planting areas ('reconstruction') are to be regularly watered for a period of twelve weeks. Required planting within the 'assisted regeneration' areas shall be determined six months prior to 'off-maintenance' and also be regularly watered for a period of 12 weeks;
- Recurrent weeds within planting/regeneration areas are to be removed as they occur monthly during winter and autumn and fortnightly during spring and summer for the extent of the 'establishment' (12 months) and 'on-maintenance' (12 months) periods;
- The boundaries of assisted natural regeneration and reconstruction rehabilitation areas are to be fenced with safety mesh (CEP-FENCING-100 Safety Fence Orange or similar) during the 'establishment' period to reduce risk of machinery damage. Following acceptance of the park areas 'on maintenance', temporary signage is to remain informing open space users that the relevant areas are regeneration zones (below signage or similar [sign sourced from Hornsby Shire Council]). These signs shall be removed at the end of the off-maintenance period.

- Replacement planting of stock loss shall occur as required to achieve the performance criteria listed in subsequent section of this report.

Monitoring

The success of a regeneration project can be assessed by systematic visual monitoring of rehabilitation areas. This need not be an overly time-consuming process and the data generated can then be used to compare the success of various treatments. The measurements to be visually monitored are:

- Average height of plant within rehabilitation areas (height in metres for tree, shrub and groundcover species);
- Dominant species (qualitative description of dominant species within tree, shrub and ground layer);
- Health of vegetation within rehabilitation areas (per Performance Criteria provided in the OSMS);
- Area of ground cover covered by weed species (area in square metres);
- Percentage of planted specimens survived (number of survived specimens as a % of total planted);
- Incidence of recruitment, both exotic and native (description and quantity estimates of new species noted).

The simplest of all methods of monitoring a site is to establish permanent photo points and take photographs at regular intervals during the establishment period, and to regularly (i.e. monthly) traverse the rehabilitation areas. In this regard, three selected points within the 40m vegetation buffer and one selected point within the natural vegetation area shall be photographed on a monthly basis and results recorded for the six variables to be monitored above. Photographs shall be taken at the SW, SE, NW, NE corners of the rehabilitation zones.

The monitoring quadrats shall be selected prior to the commencement of the 12 month 'establishment period' and be marked with star pickets (10m x 10m). The monthly monitoring results and photographs shall be maintained by the contractor for the length of the 'establishment' and 'on-maintenance' periods (24 months total) and provided to Council at 'off maintenance.'

Rehabilitation Performance Criteria

The following performance criteria are to be achieved within rehabilitation areas:

- The contractor undertaking regeneration works is to be a suitably qualified professional.
- Existing native vegetation to be retained
- All rubbish/vegetation dumping etc is removed from rehabilitation areas
- No declared weeds are present on site
- A significant reduction in the presence of other weed species within the site is evident. In practice it is noted that the removal of all individuals of all weed species is unachievable. Therefore it is considered appropriate that the following performance criteria be adopted:
  - All large weed trees are treated;
  - No weed shrubs/trees older than three months of age are present. Densities of such shrubs/trees is not to exceed 1 per $20m^2$
  - Scattered groundcover weed species may occur but not covering an area greater than $5m^2$ in any one location.

- A survival rate of at least ninety percent of revegetated plants is to occur within the first 18 months ('establishment' and 'on-maintenance' period). Stock to exhibit fair or healthy conditions:

Condition	Descriptor
Healthy	Leaves green, no abnormal leaf loss
Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected
Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement
Dead	Leaves brown or absent, little of the canopy remaining

Further Performance Criteria provisions have been detailed in the OSMS prepared by Planit Consulting contained in Appendix 40.

Fauna Habitat Enhancement

Enhancement of retained fauna habitat values within the 40m vegetation buffer and the natural vegetation area is proposed to increase the potential for native fauna to continue to utilise the area. This will be achieved through the implementation of the following mechanisms:

- Foraging resources: Identified food resources for various species will be incorporated within revegetated/rehabilitated areas (i.e. *Allocasuarina* species for glossy black cockatoos, eucalypts for koalas and elbow-winged-gliders, nectar producing flora species for birds, bats, possums and wrist-winged gliders etc). The list of species to be utilised on site has been prepared and is contained in the OSMS; in particular the following species are recommended:
  - Koala Foraging Resources
    Eucalyptus propinqua
    Eucalyptus resinifera
    Eucalyptus robusta
    Eucalyptus tereticornis
  - Glossy Black Cockatoo Foraging Resources
    Allocasuarina littoralis
    Allocasuarina torulosa

- Cover: Native understorey regeneration and additional supplementary plantings will provide cover for small native species from predators whilst moving throughout the 40m vegetation buffer and natural vegetation area;
- Salvage: Hollow logs contained within the development envelope in areas to be cleared should be stockpiled on a staged basis and placed randomly within the ground layer of the 40m vegetation buffer and the natural vegetation area.

Further detail pertaining to Fauna Habitat Enhancement is detailed in the OSMS prepared by Planit Consulting contained in Appendix 40. The OSMS has been prepared in accordance with Council's *Open Space Management Guideline: Guideline for the preparation of Reports and Plans associated with dedication of Public Open Space November 2007:Ver. 1.0* and contains suitable strategies for site rehabilitation.

Gold Coast International
marine precinct

SECTION 4
ENVIRONMENT

Gold Coast International Marine Precinct

Environmental Impact Statement - Section 4

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4 Environmental Values and Management of Impacts

This section should address all elements of the environment, such as land, water, air, noise, nature conservation, cultural heritage, social and community, economy, waste, health and safety, hazards and risk, in a way that is comprehensive and clear. The functions of this section are to:

- describe the existing environmental values of the area which may be affected by the project. Environmental values should be described by reference to background information and studies, which should be included as appendices to the EIS
- describe the potential adverse and beneficial impacts of the project on the identified environmental values
- describe measures taken to avoid, or where avoidance is not possible, measures to minimise and mitigate impacts on environmental values
- describe any direct, indirect or cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned developments
- present environmental protection objectives and the standards and measurable indicators to be achieved by the project
- examine viable alternative strategies for managing impacts. These alternatives should be presented and compared in view of the stated objectives and standards to be achieved. Available techniques, including best practice, to control and manage impacts should be discussed. The *Queensland Government Environmental Offsets Policy* should be considered for remaining impacts after all viable mitigation measures.

The EIS should assess the impacts of pre-construction, construction and operation of the project. The EIS should consider project specific impacts, such as any proposed increase in size and number of vessels accessing the Coomera River as a result of the development and subsequent environmental impacts. The impacts associated with potential ongoing maintenance, access and servicing resulting from the development and any other facilities required for the project should also be assessed.

The EIS should detail the environmental protection measures incorporated in the planning, construction, commissioning, operations, decommissioning, rehabilitation and associated works for the project. Preferred measures should be identified and described in more detail than other alternatives.

It is recommended that the EIS follows the heading structure shown below. The mitigation measures, monitoring programs, etc., identified in this section of the EIS should be used to develop the environmental management plan (EMP) for the project.

Aspects of the environment inclusive of land, water, air, noise, nature conservation, cultural heritage, social and community, economy, waste, health and safety, hazard and risk have been addressed within various technical reports which have been included as Appendices to the EIS.

The following table has been provided to identify various consultant reports which address differing Environmental Values (EVs). These reports consider the project's impact upon EVs, and provide various mitigation and management measures where necessary.

Table 1: Environmental Values and Corresponding Reports

Environmental Values	Consultant Report	Appendix No.
Climate & Natural Disasters		
Flood Plain Management	Floodplain Management	26
Climate Change Adaptation	Climate Risk Assessment	25
Land		
Geology & Soils	Geotechnical Report	29
Acid Sulfate Soils	Acid Sulfate Soils Assessment and Management Plan	32
Land Use	Town Planning Report	3
Contaminated Land	Contamination and Baseline Soils Assessment	30
Nature Conservation		
Terrestrial & Aquatic Ecology	Flora and Fauna Assessment; and Aquatic Ecology Report	8 7
Water Resources		
Watercourses & Drainage	Coastal Processes; Water Quality; and Stormwater Management Plan	27 28 16
Groundwater	Groundwater Assessment and Management Plan	31
Coastal Environment		
Coastal Processes	Coastal Processes; and Aquatic Ecology Report	27 7
Waste		
Waste Generation	Waste Assessment and Management Plan	12
Waste Management	Waste Assessment and	12

Environmental Values	Consultant Report	Appendix No.
	Management Plan	
Air Quality		
Existing Air Quality	Air Quality Assessment	33
Greenhouse Gas Emissions	Greenhouse Gas Assessment	39
Noise & Vibration		
Acoustics	Noise and Vibration Report	34
Visual Amenity and Landscape Character		
Existing Visual Amenity and Landscape Character	Landscape Masterplan	35
Native Title and Indigenous Cultural Heritage		
Existing Native Title and Indigenous Cultural Heritage	Indigenous Cultural Heritage Assessment and Management Plan	37
Non Indigenous Cultural Heritage		
Existing Non Indigenous Cultural Heritage	Cultural Heritage Assessment and Management Plan	37
Social Environment		
Existing Social Environment	Community Consultation Report; and Social and Economic Impact Assessment	4 10
Economic Environment		
Existing Economic Environment	Social and Economic Impact Report	10

Environmental Values	Consultant Report	Appendix No.
Infrastructure impacts		
Traffic & Transport	Traffic and Transport Impact Assessment	21
Power & Telecommunications	Engineering Services Report Electricity and Telecommunication Services Report	19 23
Water Supply & Sewerage	Water Supply Network Capacity Assessment; and Engineering Services Report	24 19
Hazard & Risk		
Health & Safety	Environmental Management Plan	14
Hazard & Risk Assessment	Hazard and Risk Report	38
Emergency Management Plan	Environmental Management Plan; Site Based Management Plan	14 15
Cumulative Impacts		
Existing Cumulative Impacts	Social and Economic Impact Assessment and Multi Criteria Analysis	10

4.1 Climate and Natural Disasters

This section should describe the local and regional meteorological environment and climate, including any seasonal and diurnal variations. Ambient conditions should be described in sufficient detail to allow identification of elements that may influence the project. Climatic factors should include rainfall patterns (including magnitude and seasonal variability of rainfall), air temperatures, humidity, wind (direction and speed) and any other special factors (e.g. temperature inversions) that may affect management of the project.

Historic weather patterns in the project area and seasonal conditions (e.g. cyclones, thunderstorms, floods and storms) that may influence timing and/or construction methods should be discussed, including how this would be managed. Extremes of climate (e.g. droughts, floods, etc.) should be discussed with particular reference to water management at the project site.

The vulnerability of the area to natural or induced hazards, such as flood, cyclone and bushfire should be addressed, including increased risk of extreme events due to climate change. The relative frequency and magnitude of these events should be considered together with the risk they pose to the construction and operation of the project.

Hyder Consulting has addressed the impacts of climate and natural disasters within their Climate Risk Assessment Report which is presented as Appendix 25 of the EIS.

Local and Regional Meteorological Environment and Climate

The area has a sub-tropical climate, heavily influenced by coastal weather patterns. South East Queensland is a high rainfall zone with its wettest seasons in summer and autumn. Intense summer rain events are generally associated with the influence of tropical cyclone and east coast low systems.

Climatic Factors

Weather data has been obtained from the Bureau of Meteorology (BOM) and from the Gold Coast Seaway weather station (Station ID 040764). This data is summarised as follows:

- Highest average rainfall was recorded in February both historically and in 2009/2010.

- The highest daily rainfall event in 2009/2010 was in May 2010 at 115.2mm, historically the highest rainfall event was in June 2005 at 350.8mm.
- The average maximum temperature in the region ranged between 21.4°C to 30.4°C for 2009/2010. Historically, the average maximum temperature ranges between 21.1°C and 28.6°C.
- The highest maximum temperature recorded in 2009/2010 in the region was 37.9°C in January 2010. Historically, the highest recorded maximum in the region was 40.5°C recorded in February 2004.
- January 2010 had 17 days above 30°C which is 8 days greater than the historical average. November 2009 and February 2010 both had 8 days where maximum temperatures went over 30°C. Historically, the months between October and March had the most number of days where maximum temperatures exceeded 30°C.
- Mean wind speeds generally do not exceed 30 km/h at 9am or 3pm.
- Relative humidity in the region typically ranges between 55% and 72%.
- On average, South East Queensland experiences 0.8 tropical cyclones a year. Twenty five tropical cyclones have come within 200km of the Gold Coast since 1906.

Historic and Seasonal Conditions

Data was analysed for monthly average rainfall and maximum rainfall from June 2009 to May 2010. This was compared to historic data which was available from 1992 onward. This data showed:

- Average monthly rainfall is higher during summer months between November and February. The 2009/2010 rainfall in February, March and May was significantly above the historic average;
- Driest months are between July and October. The 2009/2010 rainfall in winter months from July to November was significantly below the historical average;
- Highest daily rainfall between 1994 and 2010 was recorded. The highest daily rainfall was in June 2005 with 350.8mm. The 2009-2010 highest daily rainfall event was in May 2010 at 115.2mm.

With regards to temperature, historical BOM data was analysed and compared to recent data from 2009/2010. This data showed:

- The average maximum temperature in 2009/2010 was greater than the historical averages for every month.
- In January 2010, the average maximum temperature exceeded 30°C.
- August 2009 had the highest recorded temperature since 1992 records.
- The highest January 2010 maximum temperature of 37.9°C was close to the historical highest maximum temperature of 38.5°C recorded on the 12th of January 2002.

- months in 2009/2010 had a greater than the historical average number of days over 30°C. January had the most number of days with 17 days above 30°C while November and February both had 8 days over 30°C.

Wind speeds were also recorded at the Gold Coast Seaway weather station at 9am and 3pm. This data showed:

- Mean wind speeds in 2009/2010 were equal to or higher than historical averages for both times for all months with the exception of January and September.
- Mean wind speeds were generally lower in the morning and during winter months, between May and September.
- Generally mean wind speeds did not exceed 30 km/h, however gust speeds of 52-89km/h were recorded throughout 2009/2010.

Relative Humidity was also examined using information from the Gold Coast Seaway weather station. Results showed that:

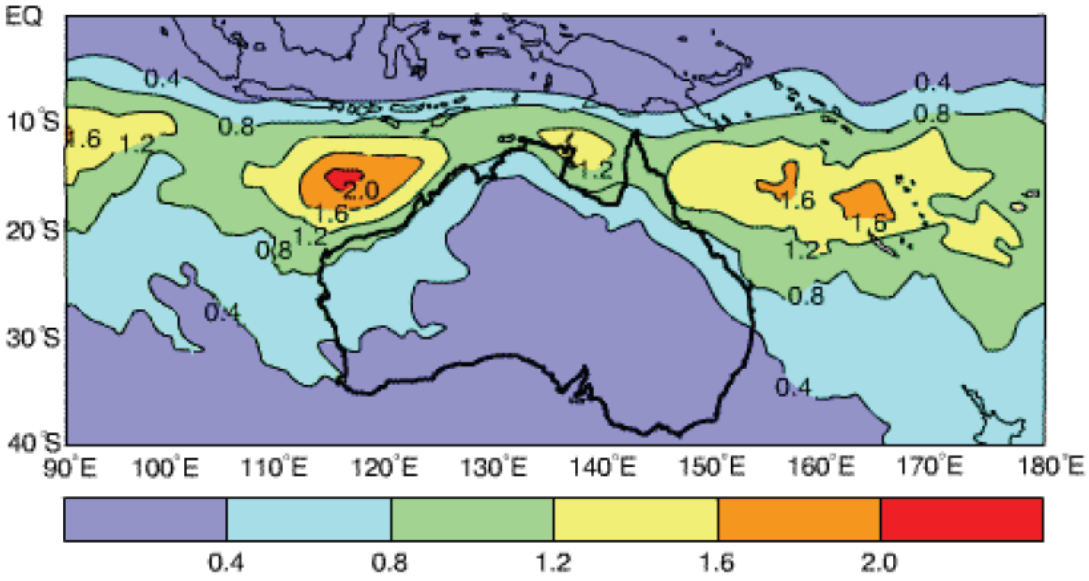
- Relative humidity historically ranges between 55% and 72%
- Minimum humidity recorded during 2009/2010 was 49.5%, and maximum was 72.5%
- Months between July and October tend to be slightly drier, however humidity generally tends to remain stable throughout the year.

Historic Weather Patterns

As per the Climate Risk Assessment prepared by Hyder Consulting contained in Appendix 25, tropical cyclones are characterised by sustained hurricane force winds of over 120 km/h. Strong winds, intense rainfall and ocean effects such as extreme waves combine to make the total cyclone hazard.

This hazard is greatest in Queensland between January and March, but tropical cyclones in Queensland can occur anytime over the period from November to April (QOCC 2009). On average, six cyclones hit the Australian coast every year. However this number is highly variable from year to year. Sixteen Cyclones were reported to have made landfall in 1963 while many years have recorded none or only one (Baum *et al.* 2009). The figure below illustrates the spatial occurrence of cyclones in Australia.

Figure 1: Annual Average Frequency of Cyclones (BOM 2008)



South East Queensland is located within the 0.8 cyclone per year zone. Twenty five tropical cyclones have been within 200km of the Gold Coast from 1906 to 2006. Despite the relatively low occurrence of cyclones, the region is still impacted by tropical cyclones, either from those that do track further southwards, or the weather patterns that accompany cyclones to the north (e.g. heavy rain, storm surge and strong easterly winds).

In addition to tropical cyclones, east coast lows (ECLs) can spin off the coast of South East Queensland and are considered a significant source of severe weather. Severe ECLs can also match the destructive power of many tropical cyclones.

Risks to the Project and Recommendations

The current climate of the Gold Coast area presents a number of risks and impacts. It is important to ensure that these are considered during construction of the development and appropriate actions are implemented to mitigate risks to an appropriate level.

Specific risks have been detailed in the Climate Risk Assessment prepared by Hyder Consulting contained in Appendix 25 and are summarised as follows.

The Australian Geological Survey Organisation undertook a review of natural hazard risks in South East Queensland in 2000. This review estimated risk based on the average recurrence interval (ARI) of a given hazard. It must be appreciated

that an ARI does not give an indication of when a hazard may occur next. The review found that the region is subject to the following natural hazards caused by the current climatic regime:

- Flooding (greatest risk)
- Storm tide (moderate to high risk)
- Severe winds associated with tropical cyclones (low to moderate risk)
- Landslide (localised risk)
- Bushfire (low risk in urban areas)
- Hail, lightning and wind from severe thunderstorms (significant but un-quantified risk)
- Heat waves (significant but un-quantified fatality risk)

With regards to the project, prolonged rainfall in the Coomera River is the most significant risk relative to other natural hazards. Further, there is a moderate to high level risk from storm tide inundation. Potential flooding and storm tide impacts to the development during construction and operation phase include:

- Erosion and sedimentation issues into Oakey Creek and Coomera River
- Water quality impacts associated with runoff into Oakey Creek and Coomera River
- Inundation of areas
- Asset damage
- Loss of construction materials.

The risk posed by tropical cyclone severe wind is considered low to moderate across South East Queensland. The impact of severe winds on the project will largely depend on the infrastructure constructed at the project site. Assuming that the planned infrastructure complies with the cyclone standards then the impacts of severe winds on the completed project are likely to be low. During the construction phase, the following impacts should be considered:

- Erosion and loss of sediment due to wind
- Dust generated by wind erosion
- Loss and destruction of machinery and construction materials

Landslide risk is a localised phenomenon in the Gold Coast area. It is considered that landslip will not pose a significant risk to the project as the site has a very low risk of instability as shown on the Unstable Soils and Potential Landslip Hazard Overlay Map contained in the Gold Coast Planning Scheme 2003.

Bushfire risk is considered to be relatively low for the project. The site is located within a low risk of bushfire damage area as shown on the Potential Bushfire Hazard Area Overlay Map contained within the Gold Coast Planning Scheme 2003.

The SEQ Region is associated with having an overall risk from hail, lightning and wind associated with severe thunderstorms. This risk however is localised and difficult to quantify. Potential impacts to the development during construction and operation phase due to hail, lightning and wind are:

- Damage to machinery and construction materials
- Dust generated by wind erosion
- Damage to electrical equipment on site
- OH&S issues for site workers and employees

There is a significant risk of fatalities from heat waves in the region (AGSO 2000). Although this risk is not quantified, potential impacts to the development during construction and operation phase could include:

- Project delays due to occupational health and safety issues
- Increased incidence of heat related illness on site
- Overheating of machinery and equipment
- Degradation of building materials

Further detail pertaining to climatic risks on the construction and operational phases of the project is contained within the Climate Risk Assessment prepared by Hyder Consulting, contained in Appendix 25 of the EIS.

Floodplain Management

A comprehensive flood study for a range of flood events up to ARI 100 years should be included in the EIS, and which considers:

- quantification of flood impacts on surrounding properties and external to the project site from redirection or concentration of flows
- identification of likely increased flood levels, increased flow velocities or increased time of flood inundation as a result of the development
- any potential for loss of flood plain storage, including detailed calculations and triangulated surface meshes produced in computer terrain modeling software.

The comprehensive flood study will assume that existence of the proposed future intra-regional transport corridor taking into consideration its stormwater drainage and landfill requirements.

The flood report should address the Gold Coast City Council's *Planning Scheme Constraint Code for Flood Affected Areas*. The Gold Coast City Council's two-dimensional hydraulic model should be utilised for flood impact studies.

Should there be any adverse impacts as a result of this proposal, the study report should include a full discussion of proposed mitigation measures of any potential impacts external to the subject site.

Reference must be made to any relevant studies undertaken by the Gold Coast City Council in relation to flooding and storm vulnerability. Hazard and risk assessment and management should be addressed in Section 4.13.

Floodplain Management is discussed within the Floodplain Management Report prepared by BMT WBM, contained within Appendix 26.

The report has addressed the requirements of the Gold Coast Planning Scheme's Constraint Code for Flood Affected Areas, and various relevant studies undertaken by Gold Coast City Council relating to flooding and storm vulnerability. These studies include the MIKE21 model of the Coomera River System, ensuring that the provisions of Council's committee recommendation C99.0326.003 are included, as advised by Gold Coast City Council. These provisions are based on the recommendations in PPK (1999), Coomera Marine Precinct Hydraulic Plan Report No 2A, a planning study that considered the development of the entire precinct (i.e. the site and the remainder of the Marine Precinct to the south).

As such, the hydraulic impacts of the site have been assessed against the provisions of the Code and C99.0326.003, with reference back to the PPK(1999) to understand the intent of the recommendations.

Two key principles are present in the Code and C99.0326.003 are fundamental to the assessment undertaken by BMT WBM. The first being 'real damage', and the second being 'floodplain storage'. Real damage is defined as *"whether the development is likely to cause damage that would adversely affect land and / or premises to an extent likely to be actionable".* C99.0326.003 states that *"there shall be no increase in real damage anywhere in the Coomera River system".*

Minter Ellison Lawyers advised that '*actionable damage means damage that would result in a successful claim for flooding nuisance*' and that for a claim to be successful '*the interference must be both substantial and unreasonable'*. Various factors would be considered in establishing whether the interference is substantial and unreasonable including but not limited to '*the location and character of the property, the duration of the flooding and effect of the flooding'*. With regards to the effect of the flooding, Minter Ellison Lawyers advised that real damages would likely exist where the flooding causes material damage, e.g., *'the base case hydraulic modelling shows no above floor flooding of an existing house, but the hydraulic modelling of the developed case shows above floor flooding*.' If this situation was to occur then consideration of the location and character of the property would be required to properly establish whether there is real damage.

To assess whether the proposed development may cause material damage, habitable floor levels were surveyed for those houses that fell within the areas identified by the hydraulic model as having increased flood level as a result of the development. Each property was then assessed to establish whether the proposed development would cause above floor flooding where there currently is no above floor flooding. This assessment was done for all floods from the y to 100 year ARI flood events.

With regards to floodplain storage, the Code and C99.0326.003 are in conflict. The Code has as an objective 'protecting the flood storage function of the City's flood plains'. C99.0326.003 recognises, based on the findings in PPK (1999), that the development of the Precinct (not just the Site), could not occur without loss of floodplain storage and so allows a concession in this regard. There are a number of criterion written around this concession, but in essence it allows for filling of up to 65% of the site (by gross plan area) to the Q100 level.

C99.0326.003 has a number of other assessment criterion detailed within the Floodplain Management Report prepared by BMT WBM in Appendix 26, along with the original recommendation in PPK (1999). Some of Council recommendations differ slightly from those in PPK (1999). If the Council recommendations are taken

literally then the impacts shown in PPK (1999), on which the recommendations are based, would not comply with the criteria. For example the requirement that afflux be attenuated to 'no afflux before any other properties are affected', could be literally interpreted to mean zero afflux (less than 0.005 m) within any property boundaries. The increases in flood level (afflux) calculated by PPK are in the range 0.01 m to 0.04 m. However, the Council recommendation has as a fundamental principal that the development does not cause real damage. In the context of this principal and considering the report from which the criteria were derived, it is reasonable to assume 'properties are affected' refers to properties that suffer real damages, rather than the simpler test of an increase in flood level.

Flood Level Impacts

The flood level increases that were caused by the existing Marine Precinct when assessed using the Mike 21 model, were generally compliant with Recommendation C99.0326.003. An exception was the river reach from Beattie Road South to Saltwater Creek where impacts were up to 0.09m.

The impacts that would be caused by the proposed development of the Site only were small by comparison to the existing Precinct, typically being an additional 1/3 to 1/10 of those caused by the existing Precinct. An exception is upstream of the Site on Oakey Creek where there the proposed development would cause increases of up to 0.044 m in the 100 year ARI event, whereas the existing Precinct did not increase flood levels in this area. In the Council Planning Scheme the floodplain in this area is classified as Open Space – Oakey Creek Environmental Park. The increases in flood level in this area are in the main, not impacting on private properties. There are a small number of private properties in this area, but the land is steep sloping and the houses are positioned well above the flood level. The assessment of real damages associated with flood level increases is summarised below.

Flood Velocity Impacts

The proposed development does not impact on flood velocities, other than some localised effects. There are velocity increases in the range 0.1 to 0.3 m/s in Oakey Creek adjacent to the northwestern corner of the Site in the 20, 50 and 100 year ARI events, and increases in the range 0.1 to 0.2 m/s in the 5 and 10 year ARI events. The increases in the more regular 5 and 10 year ARI events are unlikely to cause any scouring. In the rare floods such as the 20 to 50 year ARI events, the increases of up to about 0.3 m/s may cause minor localised scouring of the creek bed and of the banks if bare soil is exposed. If it is determined during the detailed

design stage that there is a risk of erosion at this location, then minor reshaping and/or adjustment to the fill extent at this location would minimise the impacts.

The flow rates would not significantly be altered by the development.

Hazard Impacts

The proposed development would not increase hazard across the floodplain. The development would increase the depth of flooding and velocities at the Shipper Drive Crossing of Oakey Creek in 50 year ARI and above floods, but this is not an evacuation route for the proposed development or existing developments and so this change would not impact on emergency management response during floods.

Real Damages

The hydraulic analysis presented in the Floodplain Management Report prepared by BMT WBM contained in Appendix 26, found that 11 properties would likely be subjected to material damage in very specific flood events as a result of flood level increases causing inundation of habitable floors that would otherwise not occur. All of the 11 properties are currently subject to inundation in events up to the 100 year ARI and the increase in flood level is small (10 to 20 mm). Therefore for each property there is a very narrow band of floods that would result in material damage, e.g. the band for one property is the 13.9 to 14.4 year ARI events – this means that material damage world not occur in floods smaller than or larger than this band. Because of these narrow bands, the probability of material damages occurring is rare, ranging from about 1 in 300 to 1 in 4000 in any given year.

The analysis also found that the development would not significantly alter the duration of inundation of ay properties. Based on these findings Minter Ellison Lawyers determined that the 11 properties may experience over floor flooding in a specific event that they otherwise would not, which may result in a claim for actionable nuisance, i.e. real damage.

Further detail has been provided in the Floodplain Management Report prepared by BMT WBM contained in Appendix 26.

Climate Change Adaptation

Climate change, through alterations to weather patterns and rising sea levels, has the potential to significantly impact on coastal developments. Therefore, it is important that the EIS specifies how the project design is adaptive to climate change. Consequently, the EIS should provide an assessment of the project's vulnerability to climate change and describe possible adaptation strategies.

There is now unequivocal scientific evidence that climate change is happening and that these changes are associated with release of greenhouse gas emissions from human activities. Future changes in climate have the potential to impact significantly on human and natural systems (IPCC 2007). Queensland will experience various challenges as a result of climate change:

- Variable rainfall events characterised by an overall reduction in rainfall, but an increase in more severe and intense rainfall events.
- In general, weather events such as cyclones, bushfires, droughts and floods will be more severe in their force and impacts.
- Coastal infrastructure and ecosystems will increasingly be at risk from the impacts of storm surges and flooding.

In recognition of the potential impacts posed by climate change, the Queensland Government developed a methodology for assessing potential impacts entitled *Guidelines for preparing a Climate Change Impact Statement (CCIS) (2008)*. Application of these guidelines is a mandatory requirement for all "significant projects" designated under Section 26 of the Queensland *State Development and Public Works Organisation Act 1971 (SDPWO Act).* The CICS guidelines have been applied to analyse the physical risks of climate change to the Gold Coast International Marine Precinct, where adaptation measures are identified for priority risks. The methods used within this assessment are also consistent with the Australian and New Zealand Standard for Risk management AS/NZS 31000-2009. The main objectives for this assessment are to:

- Identify risks from climate change impacts
- Assess the risks
- Identify adaptation options to mitigate the priority risks

Flood Considerations

The Climate Risk Assessment prepared by Hyder Consulting contained in Appendix 25 details responses to climate change risks and adaptation strategies for the site. As detailed in the Floodplain Management Report prepared by BMT WBM contained in Appendix 26, flood levels on the site are influenced by a combination of river flows and storm tide level (tide level plus storm surge). As

such, the Climate Risk Assessment identifies that increases to sea level and rainfall intensity may pose a risk to the site across its life. The Floodplain Management Report provides further supporting information pertaining to flooding.

The Draft Queensland Coastal Plan requires consideration of a sea level rise of 0.8 m for coastal infrastructure to the year 2100, but does not provide guidance in relation to climate change influences on storm surge: storm surge could potentially be affected by altered wind patterns and barometric pressure.

Therefore for the purposes of the Floodplain Management Assessment it was assumed that there would be no change in the storm surge and so the storm tide level was increased by 0.8 m and the 100 year ARI flood level reassessed.

With regards to potential increased rainfall intensity associated with climate change, DERM (2010) provides the following guidance to assist in this assessment:

- a 5% increase in rainfall intensity per degree of global warming can be incorporated into the 100, 200 and 500 year ARI event;
- temperature increases and planning horizons: 2 degrees by 2050, 3 degrees by 2070 and 4 degrees by 2100.

Assuming a 100 year planning horizon, consideration of a 20 % increase in rainfall intensity is required. The flood model is provided by Council. At the time of writing Council had not prepared climate changes scenarios for the model. However, DERM (2010) also states that '*local governments may be able to use their existing flood maps to approximate future flood levels that incorporate the recommended climate change factors..'* and as a footnote the report also says that '*this is a general approach only and local governments need to check with flood hydrologists whether this is a valid approach for their existing flood studies and particular catchments.'* This approach is adopted within the Floodplain Management Report.

An assessment of the likely impacts of sea level rise and increased rainfall intensity on the flood level has identified conservative assumptions in the current flood model relating to the combined probabilities of storm tide and flood event, and the storm tide levels themselves. We advise that it is beyond the project scope to resolve these matters, and it is assumed that Council will provide a position in this regard over the coming years. However a range of analyses were undertaken to provide an indication of the sensitivities of these various assumptions. These analyses concluded that the 100 year ARI designated flood level at the site may increase by up to 0.35metres at the site, but there is also a reasonable likelihood that it may remain unchanged once the current conservative assumptions are removed and allowances are made for climate change influences.

Further detail is contained in the Floodplain Management Report prepared by BMT WBM contained in Appendix 26.

Prioritised risks

The initial suite of analysed risks was evaluated relative to one another to gain general consensus on the final risks ratings. Particular attention was paid to the high and moderate risks to ensure any inconsistency had not inadvertently promoted or relegated a priority risk (high and extreme).

Overall, a total of 10 priority (high or extreme risks) were identified across the climate impacts identified. These are documented in and were considered to be most significant and require adaptation measures to reduce risk level.

Table 2: Priority Risks

Climate variable	Primary impact	Secondary impact	Risk Statement	Risk rating
Increased cyclone intensity/East Coast low intensity	Higher wind speeds	N/A	Structural damage to buildings and infrastructure creating higher maintenance costs and reduced asset lifespan	High
	Extreme rainfall events	Flooding	Flooding of buildings and infrastructure causing higher maintenance and reduced asset lifespan	High
			Rising groundwater level impacts on foundations/infrastructure leading to asset deterioration	High
			Overtopping and runoff from slipways (e.g. antifouling chemicals) resulting in water quality impacts	High
			Breach of fuel storage facilities resulting in water quality impacts	High
Increase in sea level	Change in soil moisture content	Soil swelling	Structural damage to buildings and infrastructure associated with ground and foundation movement, shrinkage and changes in groundwater creating higher maintenance costs and reduced asset lifespan	High
	Increase in high tide level	Inundation	Flooding of buildings and infrastructure causing higher maintenance costs and reduced asset lifespan	High
			Reduced serviceability of buildings and	High

Climate variable	Primary impact	Secondary impact	Risk Statement	Risk rating
			infrastructure causing reduced income from marina / retail services	
	Increase in salt water table	N/A	Accelerated deterioration of materials causing higher maintenance costs and reduced asset lifespan	High
			Structural damage to buildings and infrastructure creating higher maintenance costs and reduced asset lifespan	High

Recommended adaptation actions

Priority risks, including those rated as 'extreme' and 'high' were subject to a detailed review of applicable adaptation measures which could reduce the potential risk level over the life of the project. Adaptation measures considered for application included existing and potential controls.

Recommended adaptation measures for control and mitigation of priority risks are shown in the Table below. The design for the marine precinct will account for these adaptation measures to mitigate potential risks posed by climate change.

Table 3: Priority Adaptation Measures for the Project

Climate Impact	Risk Statement	Adaptation Option
Higher wind speeds from increased cyclone/ECL intensity	Structural damage to buildings and infrastructure creating higher maintenance costs and reduced asset lifespan	Buildings and infrastructure to be designed with consideration of high emissions scenario climate change projections to 2070
Flooding from more intense rainfall events, storm surge etc	Flooding of buildings and infrastructure causing higher maintenance and reduced asset lifespan	Structural and storm water drainage design to consider high emissions scenario climate change projections to 2070.
	Rising groundwater level impacts on foundations/infrastructure leading to asset deterioration	Use of appropriate materials and engineering design capable of withstanding wetting and drying and prolonged periods of inundation
	Overtopping and runoff from slipways (e.g. antifouling chemicals) resulting in water quality impacts	Design to ensure work and chemical storage areas are contained and include adequate drainage to prevent fugitive discharge events

Climate Impact	Risk Statement	Adaptation Option
	Breach of fuel storage facilities resulting in water quality impacts	Ensure that fuel storage areas and tanks are designed with consideration of high emissions scenario climate change projections to 2070. Design adequate secondary containment around all fuel/dangerous goods storage tanks
Increase in sea level causing change in soil moisture content and soil swelling	Structural damage to buildings and infrastructure associated with ground and foundation movement, shrinkage and changes in groundwater creating higher maintenance costs and reduced asset lifespan	Use of appropriate materials and engineering techniques
Increase in sea level causing inundation associated with increase in high tide level	Flooding of buildings and infrastructure causing higher maintenance costs	Consideration for design of 0.8m sea level rise above mean high tide level as per the DRAFT Queensland Coastal Plan
	Reduced serviceability of buildings and infrastructure causing reduced income from marina / retail services	Consideration for design of 0.8m sea level rise above mean high tide level as per the DRAFT Queensland Coastal Plan
Increase in sea level causing an increase in the salt water table	Accelerated deterioration of materials causing higher maintenance costs	Use of appropriate materials and engineering design techniques
	Structural damage to buildings and infrastructure creating higher maintenance costs and reduced lifespan	Use of appropriate materials and engineering design techniques

A Climate Risk Assessment Report prepared by Hyder Consulting is presented as Appendix 25 of the EIS; the report details all aspects of climate risk associated with the proposed project in addition to the summary provided above.

4.2 Land

This section should detail the existing environment for all land areas associated with the project. This section should also describe the potential for the construction and operation of the project to change existing and potential land uses of the project sites and adjacent areas.

The majority of the site is currently used for rural activities such as cattle grazing. Part of the site is the current Gold Coast City Council Park located on Shipper Drive, utilised by the Hinterland Model Flying Club. The site also contains an area set aside for the Department of Transport and Main Roads (DTMR) Inter Regional Transport Corridor (IRTC).

In contrast, the proposed GCIMP is anticipated to generate significant employment opportunities for the local community and wider Gold Coast region during construction and operation, as discussed in detail in the Social and Economic Impact Report prepared by Norling Consulting contained in Appendix 10.

The proposed GCIMP is a more consistent land use for the site, given the site's location within the Marine Industry Precinct of the Gold Coast Planning Scheme 2003. Furthermore, the proposal forms a strategic and logical extension to the existing Gold Coast Marine Precinct. The Gold Coast Marine Precinct is a world-class waterfront industry cluster located on the Coomera River dedicated to the manufacture, servicing/repairs and refits of recreational vessels. A number of boat building, storage, and marine service facilities are provided within this precinct.

Given the nature of uses within this location, it is considered that the proposal further consolidates the intended role and function of the Marine Precinct as a world-class waterfront industry cluster.

Topography and Land Form

This EIS should provide a detailed description of the nature and characteristics of the terrain, within and adjacent to the project area, including soil types and major land units. Coastal and shoreline geomorphology should be characterised and supported by mapping including quantification of sediment movements for the current (base case) and the proposed development case.

Significant features of the landscape should be included on the maps. Commentary on the maps should be provided highlighting any significant topographical features.

Maps should show contours at suitable increments in relation to Australian Height Datum (AHD). The location of key tidal planes should be shown.

The site is approximately rectangular in shape and is bounded to the south by Shipper Drive, to the east by the Coomera River and to the north and west by Oakey Creek. Some cattle yards are located at the western end of the site and there is an existing park in the south east corner adjacent to the Coomera River.

The investigation area is described as generally flat with poor drainage. Ponded water was observed in the centre of the site coinciding with the area of lowest elevation and boggy areas adjacent to Oakey Creek were also noted.

The site is extensively grassed with occasional stands of trees in the central south and west of the site. Narrow bands of riparian vegetation consisting of grasses, sedges and Melaleuca. were also observed adjacent to the Coomera River and Oakey Creek.

The development site maintains a relatively flat surface level across the whole site that ranges from approximately RL1.0m AHD to RL1.5m AHD. No general slope of the site is observed and a total of seven (7) natural drainage outlets are noted which result from very minor gradients in the range of 0% to 1%.

The groundwater table was present from within 1.5 metres of the surface based on livestock watering dams as detailed in the Preliminary Contamination Assessment and Baseline Soil Assessment prepared by Gilbert and Sutherland contained in Appendix 30.

The location of the site adjacent to the Coomera River and Oakey Creek and the relatively, flat, low-lying features of the site, indicates the area may be classified as low energy river terrace system. The Geological Survey of the Moreton Region Map was reviewed, which confirms this classification. The western and northern portions of the site appear to drain towards the intertidal zone of Oakey Creek.

Agricultural drains discharging to the north assist the drainage of the eastern portion of the site within Lot 98 on SP15731. The remaining portion of the site is naturally negatively graded to a low-lying area located in the centre of the site within Lot 35 on SP150730 and Lot 98 on SP150731. This low-lying area eventually drains to the intertidal zone of Oakey Creek to the north.

With regards to sub-surface conditions, the site is underlain by an undulating and deeply incised residual / weathered rock profile which has been eroded by the action of flood waters in the past and progressively infilled by alluvial soils associated with the Oakey Creek and Coomera River.

A site soil investigation was undertaken by Gilbert & Sutherland and is discussed in the Acid Sulfate Soil Assessment and Management Plan (ASSAMP) contained in Appendix 32, and the Preliminary Contamination and Baseline Soil Assessment contained in Appendix 30. The site soils were highly variable and were classified (after Isbell, 1996) as Grey and Brown Kurosols, Kandosols and Tenosols and Sulfidic Hydrosols. These were generally comprised of loams to sandy clays overlying clay loams to light clays, in turn overlying light to heavy clays and sandy clays.

A Detailed Site Contour Plan prepared by Gassman Development Perspectives is contained within Appendix 2 of the EIS, which illustrates the site's existing topographical features. .

Geology and Soils

Description of Existing Geology and Soils

The EIS should provide a description, including maps, of the geology of the project area, with particular reference to the physical and chemical properties of surface and sub-surface materials and geological structures within the proposed areas of disturbance. Particular reference should be made to those properties of the soils that would influence erosion potential, stormwater run-off quality and compaction and settlement. Information should also be provided on soil stability and suitability for construction of all project facilities. Soils should be mapped at a suitable scale and described according to the *Australian Soil and Land Survey Field Handbook* (Gunn et al 1988 and McDonald et al, 1990) using the *Australian Soil Classification* (Isbell, 1996) and the relevant Gold Coast City development assessment guidelines and specifications.

Surface Conditions

The site is approximately rectangular in shape and is bounded to the south by Shipper Drive, to the east by the Coomera River and to the north and west by Oakey Creek.

The development site maintains a relatively flat surface level across the whole site that ranges from approximately RL1.0m AHD to RL1.5m AHD. No general slope of the site is observed and a total of seven (7) natural drainage outlets are noted which result from very minor gradients in the range of 0% to 1%.

The site is characterised by open grassed paddock with some clumps of trees. There is a shallow expanse of ponded water in the central portion of the site. Some cattle yards are located at the western end of the site and there is an existing park in the south east corner adjacent to the Coomera River.

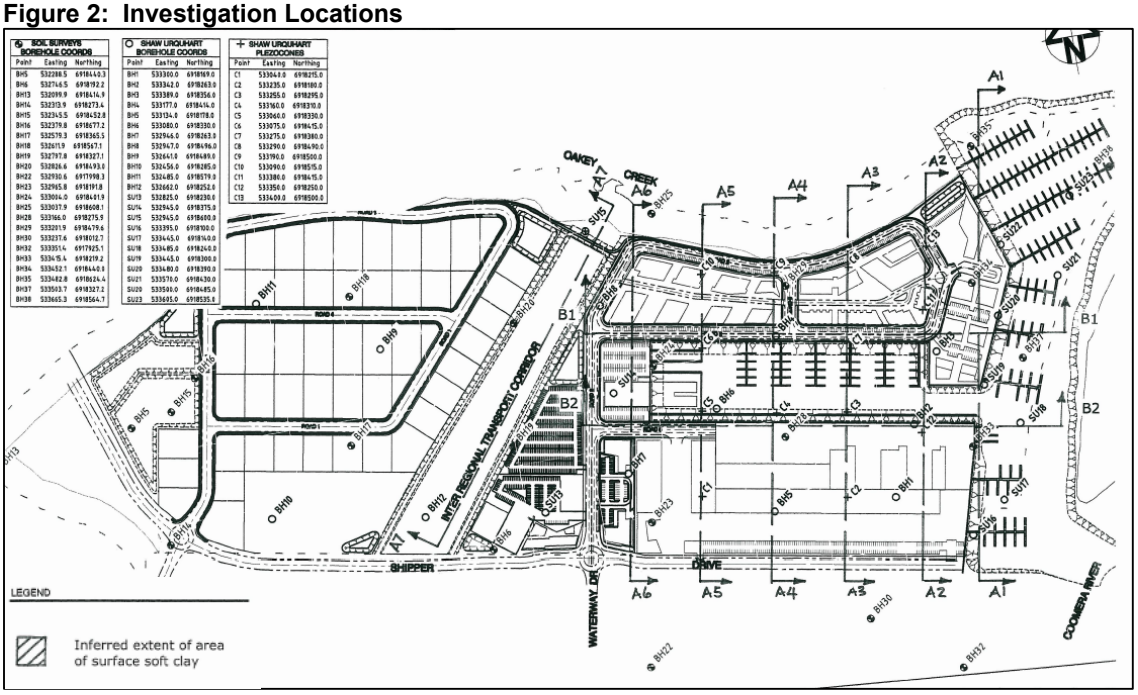
Subsurface Conditions

The site is generally underlain by an undulating and deeply incised residual / weathered rock profile which has been eroded by the action of flood waters in the distant past and progressively infilled by alluvial soils associated with the Oakey Creek and Coomera River.

The western portion of the site (to the west of the Inter Regional Transport Corridor) is generally underlain by stiff to very stiff alluvial clays ranging from 4.5m (BH8) in thickness to more than 12m in thickness (BH12). Please refer to

Geotechnical Assessment prepared by Shaw Urquhart contained in Appendix 29 and excerpt of Investigation Locations shown in the figure below.

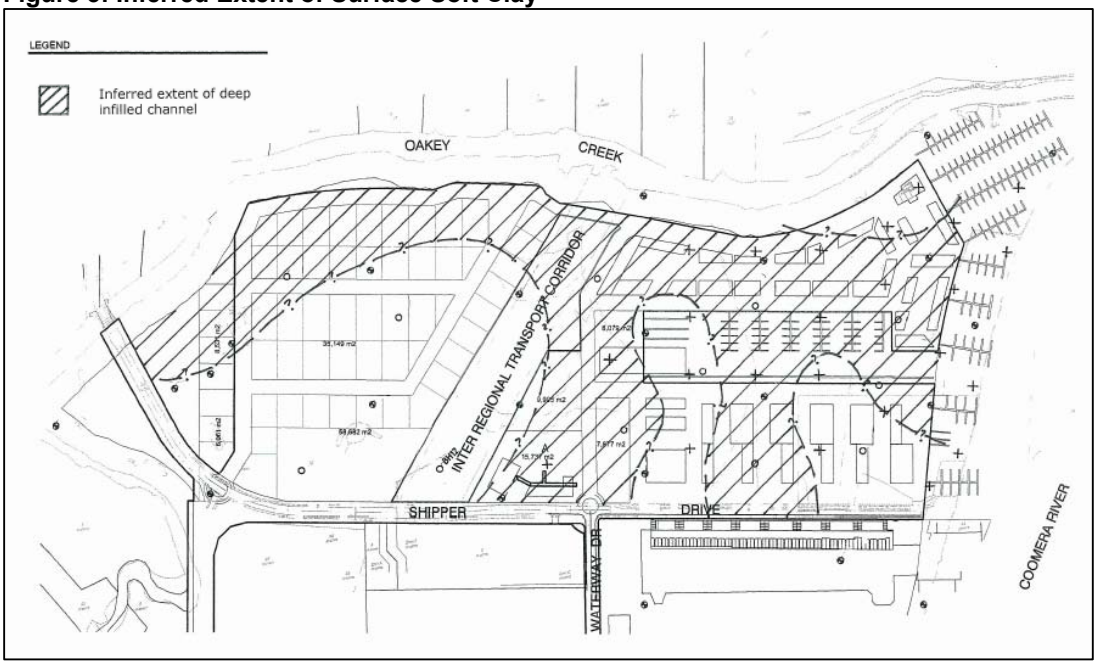
Figure 2: Investigation Locations



A surface layer of soft clay of 1.2m in thickness was encountered in borehole BH11 and it is likely that this layer extends across a portion of the north-west corner of the site.

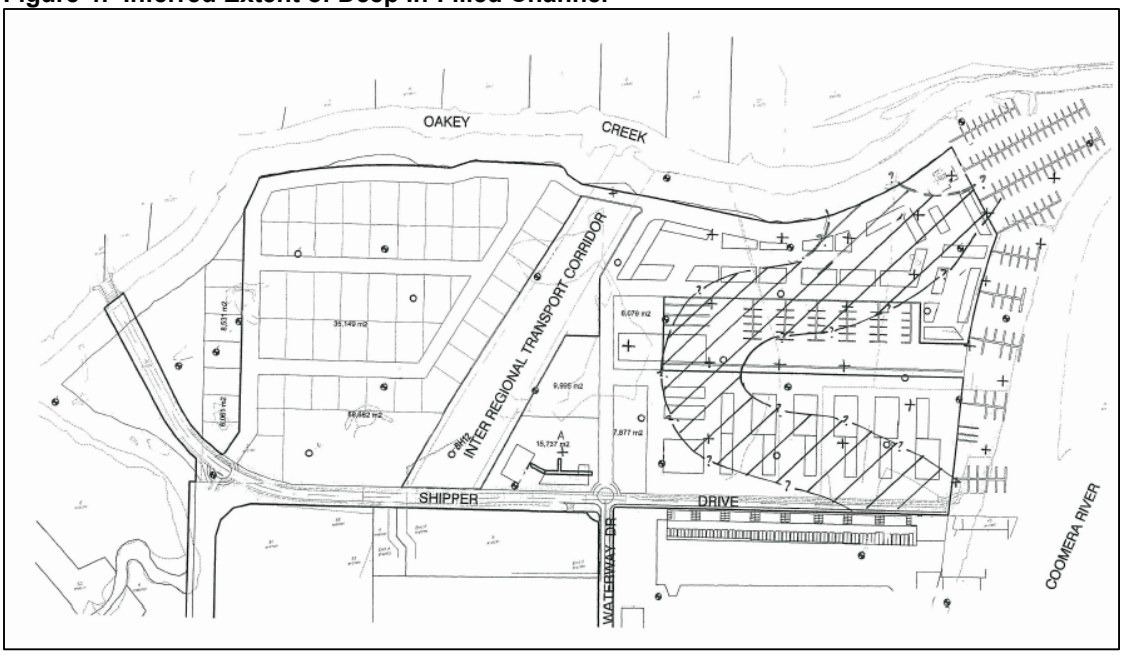
The eastern portion of the site is underlain by highly variable soil conditions. In general, most of the area is underlain by a near surface layer of soft clay which increases in thickness towards the Coomera River. The inferred extent of the surface clays and their thickness is shown in the Figure below.

Figure 3: Inferred Extent of Surface Soft Clay



Two of the 2007 boreholes (BH4 and BH5) encountered a clay layer at depth which was assessed, on the basis of the drilling resistance, to be potentially soft to very soft and therefore compressible under the proposed development loads. It was speculated that the boreholes had potentially encountered a deeply incised, infilled, narrow creek channel that meandered across the site in a north south direction. Soft peaty clay, peat , wood and organic material were also encountered between about 11.2m and 13.5m depth in borehole BH5 and between about 12.5m depth and 16.5m depth in borehole BH4. This area was subsequently investigated in detail using piezocone probes in June 2008. It was confirmed that there was a deeper, lower strength, clay layer which was found to be of significantly greater lateral extent than originally envisaged. The inferred extent of the layer is shown on the figure below.

Figure 4: Inferred Extent of Deep In-Filled Channel



The piezocone probes found that the layer was stronger than implied by the boreholes logs and these deeper clays are not expected to settle significantly under the proposed development loads.

Five boreholes were drilled in the vicinity of the Inter Regional Transport Corridor (IRTC). With the exception of the northern end of the corridor, near Oakey Creek, the corridor is expected to be underlain by stiff alluvial clay. A near-surface layer of soft clay of about 1.5m thickness was encountered in borehole BH8 at the northern end of the corridor. Further detail pertaining to the subsurface conditions encountered by Shaw Urquhart is included within the Geotechnical Assessment contained in Appendix 29.

Groundwater

Groundwater seepages and inflows were recorded during drilling and the standing groundwater levels were recorded in a number of selected boreholes as summarised in the table below. The time and date at which standing groundwater levels were recorded is shown on the borehole logs presented within the Geotechnical Assessment prepared by Shaw Urquhart contained in Appendix 29.

Table 4: Summary of Groundwater Table Records

Location	Depth (m)	
	Groundwater seepage or inflow	Standing groundwater depth
BH1	1.7	-
BH2	2.8	-
BH3	1.2	-
BH4	1.0	-
BH5	1.0	0.4
BH6	1.5	-
BH7	1.5	-
BH8	0.5	0.1
BH9	-	2.0
BH10	2.5	2.4
BH11	1.05	1.05
BH12	2.1	-
SU13	0.6	0.6
SU14	0.6	-
SU15	0.7	0.7
SU16	1.2	1.2
SU17	-	1.6
SU19	0.4	0.4
SU20	1.4	1.4
SU21	-	0.6
SU22	0.6	0.6
SU23	-	0.6

The proposed development contains the following components of geotechnical significance:

- The western portion of the site (approximately 8ha) is to be filled to approximately RL3.4 metres and developed as a marine services industry area;
- The eastern portion of the site (approximately 30ha) is to be filled to approximately RL3.4 metres and developed as waterfront industry;
- The Coomera River is to be widened by approximately 30 metres, and a marina is constructed to the eastern end of the site;
- An internal marina is to be constructed in the central, eastern portion of the site;
- A retaining wall is proposed around the northern and western perimetre of the development areas to facilitate placement of fill up to the boundary of the proposed Oakey Creek buffer zone;
- As part of the GCIMP construction, the area within the IRTC will be filled to a similar elevation as the eastern and western development platforms. At a future time, the road embankment within the corridor will be raised to an approximate elevation between RL8 metres and RL10 metres.

Detail pertaining to the impacts of the project on geology and soils is provided below.

Potential Impacts on Geology and Soils and Mitigation Measures

This section should provide details of any potential impacts and proposed mitigation measures to prevent or control soil erosion and sedimentation as a result of the construction and operation of the project. This may be addressed in accordance with measures detailed in *Best Practice Erosion & Sediment Control for Building and Construction Sites (International Erosion Control Association (Australasia) November 2008) and Guideline: EPA Best Practice Urban Stormwater Management – Erosion and Sediment Control* (Environmental Protection Agency 2008). The soils erosion and sediment control plan should be included in the EMP, which should address the management of nutrients of concern for coastal algal blooms (N, P, Fe, C) to prevent / minimise release of these nutrients into estuarine and marine waters.

Analysis of the proposed change in the river width, channel location, tidal flows and impact of this on the long-term geomorphology of the river outside of the project area, particularly any bank stability issues on the neighbouring properties, should be described. Quantification of the sediment movements for the current (base case) and the proposed development case should be provided.

It is recommended that a suitable treatment for the settlement and compaction of the soils be addressed.

The assessment of impacts and mitigation measures should also conform to the Gold Coast City Council *Constraint Code for Sediment and Erosion Control* (Chapter 14) and should include a sediment and erosion control layout plan overlain on the proposed plan of development.

Key geotechnical issues of the proposed development include:

- Potential consolidation settlement as a result of the proposed filling and structural loads.
- Excavation conditions in the proposed Coomera River widening and the suitability of the excavated material for use as engineered fill.
- Stability of excavation batters and revetments for the Coomera River widening and the proposed internal and external marinas.
- Settlement, stability and bearing capacity of the foundation materials beneath the proposed perimeter retaining wall.
- The impact of construction within the IRTC on the adjacent land.

Settlement

<u>General Background Information</u>

When soft clays are loaded by development platforms such as are proposed on this site, the stresses in the clays are increased due to the weight of the fill and consolidation settlement occurs. This settlement is usually considered in three components:-

- **Initial or elastic compression**: This occurs rapidly as a result of total stress changes in the soil mass. Analysis of settlement due to total stress considers the response of the soil particles and the water contained in the voids between the soil particles (pore water) to the increase in stress. Elastic compression is usually completed during placement of the fill load and is small in comparison with primary consolidation settlement.
- **Primary consolidation**: This occurs as water is expelled from the voids between the soil particles and the total stress changes are transferred to effective interparticle stresses. Analysis of settlement due to effective stress considers only the response of the soil particles to the increase in stress. As the component of the increase in stress that was initially taken by the water reduces due to pore water pressure drainage, the stress is transferred to the soil particles causing an increase in the effective interparticle stresses. As the interparticle stresses increase, there is volume decrease in the soil skeleton and this volume change results in consolidation which manifests itself as settlement at the surface. The time for primary consolidation to occur is proportional to the square of the path length along which the pore water is required to travel to the drainage boundary. Primary consolidation is completed in a finite period of time.
- **Secondary consolidation (long term creep):** This is believed to be related to the rearrangement of soil particles under constant effective stress. It occurs very gradually and is usually only noticed once primary consolidation is completed. Secondary consolidation will occur for the life of the development but at a decreasing rate with respect to time.

The magnitude of consolidation settlement and in particular, the magnitude of differential settlement, may exceed that which can be accommodated by conventional structures and it is necessary to carry out some form of foundation treatment to reduce the settlement likely to occur during the operational life of the structures.

Consolidation Parameters

Four (4) oedometer tests were carried out on selected undisturbed samples of the alluvial clays to assess the likely consolidation parameters for the range of strengths encountered during the subsurface investigation.

The consolidation parameters have been averaged over the pressure range of 25kPa to 100kPa which represents the likely applied loading due to the proposed fill and structural loads.

It is generally assessed that where firm clays are encountered on this site, they are sufficiently over-consolidated to not undergo primary consolidation as a result of filling to about RL3.4m plus structural loads.

Actual field performance, with respect to magnitude and rate of settlement, can often differ greatly from predictions based on laboratory test results, particularly where there is significant variation in the subsurface profile. Depending on the period of time available before development commences, it is recommended that consideration be given to constructing one or more monitored trial embankments to obtain field consolidation parameters for final design. If this is not carried out, the construction programme for the development should have sufficient flexibility to accommodate variations that may occur from predicted rates of settlement.

Predicted Settlement

The inferred thickness of soft to firm clay at each investigation location, likely to experience consolidation as a result of the proposed development. It has been assumed that the site will be filled to about RL3.4m and that structural loads will be an average of 20kPa. This equates to a two storey building. It is expected that buildings applying average loads of greater than 20kPa will be supported on piled footings.

Long-term secondary creep has been estimated for a 50 year design life. The estimates do not include recompression settlements of over-consolidated soils which are expected to occur predominantly during construction.

A significant portion of the site, mostly within the western development platform and the Queensland Department of Transport corridor is expected to experience negligible consolidation settlement due to the proposed development loads.

Recommended Foundation Treatment Strategy

Where surcharging is recommended, the surcharge has been designed to remove most of the settlement expected as a result of filling the area to RL4m and allows for a uniformly distributed load of 20kPa for structures and the theoretical secondary creep over a 50 year period. The surcharge has been designed to theoretically leave not more than 40mm of in-service settlement for the life of the development.

Western Development Platform

With the exception of the north-west corner, the western development platform is not underlain by sediments that are likely to consolidate as a result of the proposed development.

It is recommended, at final design stage, that a number of additional test pits or boreholes be drilled to accurately delineate the area of the north western corner requiring foundation treatment.

Preliminary calculations based on the profile of borehole BH11 indicate that 2m of surcharge above the final proposed fill platform level for a period of 3 to 6 months will remove most of the expected primary and secondary consolidation due to the proposed development. Alternatively the surface layer could be excavated and replaced with engineered fill.

Eastern Development Platform

The subsurface conditions beneath the eastern development platform are complex. It is recommended that the eastern development platform area be surcharged to remove most of the expected primary and secondary consolidation due to the proposed development loads. Depending on the underlying subsurface profile, 2m or 3m of surcharge is required. No treatment is required in the south-eastern corner of the site. Theoretical surcharge duration varies between about 3 months and up to 2 years.

In areas of thicker clays, consideration could be given to installing wick drains to accelerate settlement. If wick drains are installed at a triangular spacing of 1.5m, the surcharge period can be reduced to about 6 to 9 months. Generally, wick drains are only an advantage where the soft clay thickness exceeds about 3m. There is a possibility that wick drains may not be required and it is recommended, during the early surcharging of the revetment alignment, that a trial embankment be incorporated into the early surcharging to allow intensive monitoring in the area of deeper clays. It is recommended that this be take place in the vicinity of borehole BH3. The trial section should be not less than 50m by 50m in plan dimension and should have at least five (5) settlement plates installed in the central portion of the trail section. Further advice should be obtained on the settlement plate layout within the early surcharge area and the trial embankment prior to construction commencing.

Department of Transport and Main Roads Corridor

With the exception of the northern end of the corridor next to Oakey Creek, the transport corridor is not underlain by sediments that are likely to consolidate as a result of the proposed development.

At some time in the future the road embankment within the corridor will be raised to an elevation of between about RL8m and RL10m. It is recommended, at final design stage, that a number of additional test pits and/or boreholes be drilled to accurately delineate the extent of soft clay in the northern area.

Preliminary calculations based on the profile of borehole BH8 indicate that 2m of surcharge above the final proposed fill platform level for a period of 3 to 4 months will take out most of the expected primary and secondary consolidation due to the proposed embankment filling. Alternatively, the surface layer of soft clay could be excavated and replaced with engineered fill.

Due to the presence of predominantly stiff to very stiff clays in the natural profile along most of the transport corridor, construction within the transport corridor is not expected to have a significant impact on the adjacent land. A potential exception is the northern end where there is a surface layer of soft clay that extends beneath the transport corridor and adjacent land.

The potential impact of construction within the transport corridor in this area will depend on the final design adopted. Notwithstanding this, it is considered that it will be possible to implement relatively simple engineering solutions to mitigate any potential effects.

Construction Settlement Monitoring

Where surcharging is to be carried out, it is recommended that a granular drainage layer be placed on the prepared natural ground surface between the fill material and the natural alluvial soils to allow water generated by the consolidation process to rapidly drain away. If the fill material is sand the drainage layer will not be required. Provided a suitable geotextile is placed above and below the drainage layer, the thickness of the drainage layer can be limited to about 0.3m. Due to the potential need for a bridging layer to improve traffickability on portions of the site the drainage layer may actually end up being thicker than 0.3m.

It is essential that any foundation treatment is adequately monitored to ensure that the design settlements are achieved. A grid of settlement plates should be installed on the natural ground before filling commences at, say, 100m intervals and at other targeted locations. Settlement plates typically consist of 400mm to 500mm square x 12mm thick steel base plates with a 50mm diameter steel water pipe welded to the base plate. The pipe may be extended in length as required during the filling process by progressively screwing on additional lengths. The

pipe is often braced with flanges at the base to prevent bending at the connection to the base plate. A thin bed of sand may be placed on the natural ground surface to form a uniform surface for the base plate to contact with the natural ground.

An initial reading should be taken prior to fill placement commencing and settlement should then be monitored at regular intervals throughout the foundation treatment period.

To assist with interpretation of the settlement data, it is recommended that the fill level adjacent to each plate is also recorded during the settlement monitoring.

Stability

Batter stability has been assessed for a number of key areas of the site.

- The external revetment along the Coomera River.
- The northern and southern revetments of the internal marina.
- The stability of Foxwell Island in the area of proposed dredging.
- Temporary bunds at various locations to facilitate construction in the dry.
- The proposed road embankment within the Queensland Department of Transport corridor.

Short Term (Construction) Stability

The proposed construction sequence involves:-

- Excavation of a strip along the alignment of the proposed revetment to a nominal elevation of RL-4m or to the depth at which a suitable foundation material is encountered.
- The removal of any soft foundation materials and their replacement with imported selected engineered fill to the proposed founding level of the revetment wall.
- Construction of the revetment wall and backfilling to the wall.
- Excavation of the internal marina basin to RL-8.0m and backfilling with river dredge spoil.
- Placement of engineered fill and preload on the area behind the revetment wall.
- Monitoring of preload performance and subsequent removal of preload.

To ensure stability of the revetment during preloading it will be necessary for the excavation and replacement zone beneath the revetment wall to extend behind the wall to the minimum dimensions. It is also critical that the preload does not encroach beyond the setback distance.

A layer of medium dense clayey silt was encountered at about 9m depth in borehole SU19 and has the potential to result in lower than acceptable factors of safety for excavations to RL-8m. At the time of writing, excavations in the area of borehole SU19 will be limited to RL-4m but it recommended that care is taken in this area and inspections are carried out during construction to ensure that the material is not exposed in deeper excavations in the vicinity.

Long Term Stability

To achieve acceptable long-term factors of safety, the following is required:-

Internal and External Marina (20kPa surcharge):
Precast Concrete Revetment: The excavation and replacement zone should be constructed of compacted, selected imported fill with a soaked CBR of not less than 15, a fully softened effective cohesion of not less than 5kPa and an effective friction angle of not less than 34°. Depending on the nature of the fill material, it may be necessary to place a geofabric between the fill and the adjacent natural soils to prevent loss of fines into the fill.

Entrance to Internal Marina (20kPa surcharge):
Pre-Cast Concrete Revetment: The excavation and replacement zone should be constructed of compacted, well-graded rock fill with an effective friction angle of not less than 55°. It will be necessary to place a geofabric between the rock fill and the adjacent natural soils to prevent loss of fines into the rock fill.

Area of Boat Crane Loading:
A 500 tonne boat crane will operate on the southern side of the internal marina and the adjacent southern section of the Coomera River revetment. Stability analyses incorporating the additional load from the crane obtained factors of safety for global stability that were less than 1.3 for some conditions. This is not considered acceptable. Local stability also needs to consider the potential loads which could be applied to the revetment walls as a result of the crane loading. It is therefore recommended that the boat crane operating area be designed as a reinforced concrete slab supported on piled footings. The piles will need to be founded below the base of the adjacent water way to ensure that load is not transferred to the revetment walls or batter slopes. The boat crane loading and its effect on revetment stability can be further addressed at the final design stage when the actual operating conditions of the crane are better understood. It may be possible to use a high quality fill material to increase the factor of safety.

Potential for Differential Settlement

It needs to be accepted that the proposed excavation and replacement zone will result in the construction of an abrupt change in foundation conditions some distance behind the revetment at the boundary of the soft clay and the engineered fill. Even with successful preloading, long term differential settlement due to secondary consolidation will occur at this boundary. This needs to be taken into account in the layout of the roads and buildings and footing design.

General Embankment Stability

Areas underlain by soft clay will require batter slopes of not steeper than 1V:4.5H around the perimeter of the fill areas to achieve acceptable short term factors of safety for general filling to RL3.4m and preloading to RL6.3m. This is based on a typical subsurface profile where the upper 4m of the profile consists of soft clay.

Where stiff clays are encountered from the existing ground surface, batter slopes of 1V:2H will achieve acceptable factors of safety.

In the area of general embankment filling and preloading adjacent to the Queensland Transport corridor most of the corridor is underlain by stiff clay with the exception of the northern end in the vicinity of borehole BH8 where there is 1.5m of soft clay. In this area, batter slopes of the adjacent fill areas should not exceed 1V:4H to achieve acceptable short term factors of safety. Alternatively, the upper 1.5m of soft clay could be excavated and replaced. This is likely to be required beneath the northern end of the embankment in the transport corridor to ensure stability of the proposed road embankment.

Foxwell Island

No filling is proposed along the Foxwell Island revetment and it is understood that a 1V:3H slope be excavated from natural ground level to RL-4m with the crest of the excavation commencing at a distance of not less than 5m from the intersection of lowest astronomical tide (LAT) within the existing channel profile.

The proposed revetment geometry (incorporating slopes of 1V:3H) has been analysed for both sandy soils and soft clays and has an estimated factor of safety against instability of not less than 1.5 for the long term “operating” condition where the batter is submerged.

If the batter is not submerged, as would be the situation when excavation and shaping of the batter is being carried out in the dry, the factor of safety for the proposed geometry is sensitive to the cohesion for clayey soils and also to ground water levels and seepage within the batter for both sandy and clayey soils. Batter

slopes of 1V:3H are considered to have a high likelihood of small scale instability which could involve much of the batter face.

It is therefore recommended that, for excavations in the dry, the batter be no steeper than 1V:4H. This may still involve some minor sloughing in areas of ground water seepage and some localized dewatering may be required to ensure stability during construction. The batter may be steepened to 1V:3H after the area is flooded and the batter is submerged. This may require the use of a long reach excavator or a dredge.

Temporary Bunds

Temporary bunds are proposed at the northern and southern ends of the section of waterway between the site and Foxwell Island. The purpose of the bunds is to facilitate dewatering and allow excavation of the internal marina and deepening of the Coomera River to take place in “the dry”.

It is understood that the crest of the bunds will be at RL2.5m. The current river bed in the vicinity of the bund locations is understood to vary between about RL-0.5m and RL-1m.

The available subsurface information suggests that the subsurface profiles along the bund alignments are likely to be highly variable and will include significant sand layers and layers of soft to firm alluvial clay. The sand layers will permit the flow of water beneath the embankment with significant seepage forces expected in the face of the excavated slopes below the current river bed level.

The bund construction sequence will involve placing fill on the river bed and constructing an embankment to RL2.5m. It is recommended that the embankment be constructed with a batter slope of 1V:3H. The enclosed area will then be dewatered and excavations to RL-4m will commence. The factor of safety of the excavated batter depends on the material type but is significantly influenced by ground water levels and seepage through the batters for both sandy and clayey soils. Batter slopes of 1V:4H have been analysed for a number of seepage conditions and have obtained factors of safety typically about 1.3. The stability of the excavations will be largely controlled by groundwater conditions.

It is recommended that, for excavations in the dry, the batter be no steeper than 1V:4H. Where significant groundwater seepage is occurring through sand layers and emerging on the batter face, instability is inevitable and will only be stabilized by controlling the seepage. At this stage, on the basis of the available subsurface information, it is not possible to accurately delineate the areas where this is likely to happen. It may therefore be appropriate during construction to start with a

significantly flatter slope initially and then steepen the batters or install seepage control measures as required for the soil types encountered..

Alternatively, consideration could be given to installing a sheet pile cut-off wall through the crest of the embankment and extending into the clayey soils below the base of the proposed excavation. From the available subsurface data, likely depths of sheet piling are expected to be in the range of RL-6m to RL-9m at the northern end of the site (boreholes SU24, SU25 and Soil Surveys BH35) and RL -9m at the southern end of the site (Borehole SU16).

Perimeter Retaining Wall

Earthworks are not permitted to encroach on the proposed buffer zone between the development and Oakey Creek. Consequently, to optimize the area of land available for development, it is proposed to construct a retaining wall around the northern and western perimeter of the site to enable filling to extend to the edge of the buffer.

Subsurface conditions around the northern perimeter between the Coomera River and the Queensland Transport corridor, as inferred from the available data. To the west of the transport corridor founding conditions are expected to be better but further investigations are required to assess the lateral extent of the surface clay layer in this area.

Conditions are highly variable in the area of the proposed wall with soft clays ranging in thickness from zero to greater than 5.0m. Geotechnical issues that need to be addressed include:-

- Bearing Capacity
- Settlement
- Stability

Bearing Capacity

It is proposed that the bearing capacity of the surface soils be improved by excavating and replacing the surface soft clays to a depth of 2m. The zone should extend across the width of the footing and for a further 1m on each side to allow for the distribution of stresses with depth in the zone beneath the footing. The replacement material should consist of good quality rockfill. Assuming an average undrained shear strength of 10kPa in the underlying soft clay the excavation and replacement zone is estimated to increase the allowable bearing capacity from about 20kPa to 100kPa.

Settlement

The area immediately adjacent to the retaining wall will be preloaded to reduce the in-service settlement. Due to potential for instability it will not be possible to preload to the edge of the retaining wall and there will be a zone between the wall and the crest of the preload which does not receive full treatment. Long term differential settlement will occur in this area. In addition, since it will be necessary to construct the wall in advance of site filling, the wall will settle as a result of the additional loads imposed by the preloading.

It is understood that the area immediately adjacent to the wall will be a road easement and the owners will need to make allowance for future maintenance in this area as differential settlement occurs with time.

The magnitude of differential settlement along the wall alignment and in the area not receiving full foundation treatment can be reduced by constructing stone columns beneath the wall footing and in the adjacent area. The stone columns will also assist in maintaining the stability of fill and preload.

A configuration of 1.0m diameter stone columns in a triangular spacing of 2.0m for a width of not less than say 4.5m has been assumed. At this stage detailed analyses of the effect of the stone columns on settlement has not been carried out but preliminary estimates suggest that the proposed configuration could result in a 60% reduction in settlement. In addition, the presence of the stone columns will assist in draining excess pore water pressures which will reduce the time to achieve consolidation and will assist in maintaining stability.

Total settlement (primary and secondary consolidation) in the area under consideration has been assessed to vary from negligible amounts to about 250mm. The stone columns are therefore expected to reduce the differential settlement along the wall alignment to about 100mm. It would be preferable if the wall was constructed of individual units such as concrete blocks or gabion baskets, as it may be necessary, from a visual perspective, to make allowance for realignment of some portions of the wall depending on the actual in-service settlement.

General Earthworks

Site Preparation

With the exception of some areas in the northern section of the site along Oakey Creek, traffickability during the site investigation was suitable for a truck-mounted

drilling rig. It is expected that traffickability was being assisted by the existing grass cover and the presence of a thin upper desiccated layer of firm to stiff clay.

Prior to placement of fill, it will be necessary to remove the vegetation and strip any organic rich materials from the site. Unfortunately, at some locations this has the potential to expose the underlying soft alluvial clays and it is recommended that site preparation is carried out using light-weight construction equipment in an attempt to avoid pumping of the subgrade.

The requirement, in areas of proposed surcharging, for a granular drainage layer to be placed between the fill and the natural soils will also aid construction equipment traffickability.

Fill Placement Procedures

It is recommended that, after site preparation, fill is placed in layers not exceeding 200mm in thickness and compacted in the moisture range optimum ± 2% to a dry density ratio of not less than 98% of Standard maximum dry density.

Generally filling should be in accordance with the requirements of AS3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”.

In the area of the proposed marina, depending on the revetment option adopted, it may be necessary to adopt a staged construction procedure to maintain acceptable factors of safety against instability of the revetment.

Suitability of Excavated Material for Use as Engineered Fill

A number of disturbed samples were selected from the boreholes in the vicinity of the proposed marina excavation from the potential depth range to be excavated. The samples were subjected to particle size distribution tests and Atterberg limits tests. The test result certificates are presented in Appendix D.

The materials to be excavated are a mixture of sandy, silty and clayey soils, predominantly very loose and soft to firm above about RL-4m. Below RL-4m the clays are generally stiff to very stiff with lower moisture contents.

The materials occur in a layered sequence and the excavation process, whether by dredge or dragline, will result in the layers being mixed such that it is not considered feasible to selectively borrow the various material types.

Generally the materials are not considered suitable for dredging and hydraulic placement as engineered fill due to the high fines content and the potential time required to effectively drain the materials.

It may be feasible to recover the materials by dragline, but it needs to be recognised that significant moisture conditioning will be required to render the materials suitable for compaction. It will be necessary to dry back the soils to a moisture content that is close to the optimum for compaction. This can be achieved by spreading the soils in thin layers and turning and mixing them on a regular basis. The action of the sunshine and wind will naturally result in a loss of moisture. This process may be aided by the addition of lime if it is necessary to neutralise the acid sulphate generating capacity of the soils. The mixing of lime with the clay soils will assist in reducing the moisture content and will also make the clays less moisture sensitive and easier to work with.

This drying process can result in significant loss of volume. Insufficient data has been obtained to quantify the potential losses for the wide range of materials encountered in the boreholes but experience elsewhere suggests that losses of between about 35% and 45% can be expected in soft alluvial clays. Losses in the sandy and silty soils could be between 10% and 20% depending on the initial in-situ density.

Geotechnical Assessment During Construction

It is important that a program of geotechnical inspections be carried out during construction to ensure that the actual conditions exposed are consistent with the design assumptions. This is particularly important in relation to excavation stability.

Key areas of inspection include but are not limited to:-

- The marina excavations to RL-4m and the assessment of the extent of excavation and replacement along the revetment alignment.
- Selection of suitable replacement material.
- The marina excavations to RL-8m and construction of adjacent filling and preloading.
- Construction of temporary bunds and adjacent excavations.
- Installation of settlement plates and preload monitoring.
- Foundation treatment in the northern end of the Queensland Transport corridor.
- Assessment of the extent of surface clay in the north western corner of the western development platform.
- Monitoring of staged construction along the perimeter retaining wall alignment.

It is recommended that, prior to construction commencing, a suitable program of inspections is developed in conjunction with the project geotechnical engineers to ensure these important issues are addressed.

A Geotechnical Report prepared by Shaw Urquhart is presented as Appendix 29 of the EIS, the report provides detailed information relating to the potential impacts on geology and soils and proposed mitigation measures.

Sedimentation

A study into the erosion and sedimentation processes within a section of the Coomera River was undertaken by BMT WBM to assess the impacts of the proposed dredging associated with the Gold Coast International Marine Precinct development and estimate the sedimentation rates at the proposed dredged areas. Please refer to the Coastal Processes Study prepared by BMT WBM contained in Appendix 27.

Sediment processes around the development site are driven by materials being transported into the system from the Broadwater (tidally driven) or from runoff from the surrounding land catchments (fluvially driven). These materials are predominantly moved around within the system by the prevailing currents.

Overall sedimentation rates in the river system are a mixture of sediment transport processes under day-to-day (i.e. primarily tidal) conditions plus occasional flood event-driven sediment transport. Tidal currents are responsible for the majority of the sediment transport in the study area.

Hydrodynamic and cohesive sediment transport modelling of the Coomera River has been performed in order to identify the processes leading to sedimentation at the proposed development under day-to-day conditions. The major findings of the modelling are:

- Under day-to-day conditions, the proposed dredged areas will be subject to sedimentation of fine materials. The modelled annual rate of sedimentation under tidal flow conditions is about 5,000m^3 of in-situ fine sediment;
- The greatest sedimentation within the dredged areas is predicted to occur around the confluence of Oakey Creek with the secondary channel of the Coomera River, where annual deposition depths in the order of 100mm are predicted;
- In addition to sedimentation due to day-to-day conditions, sedimentation may also be experienced during occasional flood events. Although the sedimentation volumes due to flood events are difficult to predict, the in-situ volume of fine material to be dredged from the development site due to

flood events is estimated to be in the order of 16,000m^3 over a 20 year period.

Erosion

This section presents the findings of investigations undertaken to determine the susceptibility of the banks of the Coomera River adjacent to the site to increased erosion. As detailed in the Coastal Processes Study prepared by BMT WBM contained in Appendix27, the banks of the Coomera River currently show significant erosion in most tidal sections of the river and this can be contributed to the many changes that have occurred in the lower Coomera River over the last 30 years.

There are numerous natural and man-induced causes of bank erosion and the changes that have occurred in the Coomera River estuary make it difficult to separate the influences of these changes on bank erosion.

The recently completed Coomera River Estuary Processes Study – Technical Assessment and Foreshore Management Plan (Riparian Engineering, 2011) describes in detail the existing condition of the banks in the study area.

Bank Erosion Measures

As well as natural mechanisms for sediment transport, there are also changes introduced by human activities, including sand and gravel extraction, navigation channel dredging, canal development and boat wash. These have the potential to influence bank stability either directly or indirectly through changes to the sediment transport processes. The full range of mechanisms potentially affecting the Coomera River estuary is detailed below.

- Natural meandering often exacerbated by floods: A river has a natural tendency to meander by scouring the outside bank and allowing a build up of sediment on the inside bank. These natural tendencies may result from tidal flows or freshwater (flood) flows.
- Natural slumping after flood events: Rapid drawdown as floodwater recede can lead to high groundwater pressures behind the banks with subsequent instability and slumping.
- Natural wind waves: Wind blowing across an open water body will generate waves. In the case of a river, these will be of limited height and period, but may still be responsible for bank erosion.
- More persistent freshwater runoff because of development and catchment clearing: Development/clearing of the catchment may contribute to more persistent and more frequent freshwater runoff and increased flood flows for

a given rainfall event. This would intensify normal meandering processes by increasing the power of the river to remove scoured sediment.

- Increased tidal compartment: Enlargement of the tidal waterway, resulting from the construction of canals, marinas, flood-control channels or other enlargement of the tidal volume, will result in increased tidal flows and potential channel readjustment.
- Sand and gravel extraction: Dredging for sand or gravel extraction for navigation or other purposes, may contribute to lessening the stability of the adjacent bank, that can then slump or fail during flood drawdown or surcharge loading conditions. It may also generate a major 'sink' for fluvial sediment, starving downstream areas of sediment supply, leading to progressive bed and bank erosion. Armouring of the bed with coarser material after finer material had been carried away may limit such impacts.
- Dredging for navigation: Dredging of river channels, while not directly enlarging the tidal waterway area, can make the river channel more efficient at carrying tidal or flood flows; therefore, more tidal water flows in and out of the river during each tidal cycle. The increased cross sectional area within the dredged channel may be sufficient to accommodate the extra flow without increasing the velocities there. However, velocities and scour potential could increase outside the dredged areas as a result of the additional flow, which may intensify normal erosion processes or create separate problem areas.
- Natural shoreline vegetation cleared: Rural and urban development often involves clearing a large percentage of the natural vegetation at or near the shoreline. In particular, mangroves are often not valued because of the silts they trap and as they are seen to 'obscure' water views. However, they are effective at slowing shoreline recession due to the high level of energy dissipation in their exposed root system. Also, clearing of larger timbers near the shoreline exposes the water body to higher winds and hence higher waves, which can cause shoreline erosion.
- Boat wash: Boat generated waves are a significant problem in most rivers where population/boating density has increased. However, the physical causes are still being understood and not all boats contribute to erosion. Almost all soil types are affected to some degree by boat wash, with clays being undercut and sandy materials transported away from the banks.

Coomera River Erosion Discussion

Previous reports clearly indicate that the Coomera River was at or near its limit to absorb change at the time of their preparation (1991/1992). Since then, there have been significant additional developments, including canal and urban development and a marine precinct. Some of this development has required the navigation

channel to be dredged and there has been a dramatic increase in boat traffic. These activities are likely to have contributed to exacerbated bank erosion.

The river has been extensively dredged previously for navigation, flood mitigation and sand and gravel extraction. Various reports have indicated that navigation channels have been dredged and maintained as far upstream as Beattie Road. The channel from the South Arm entrance to Sanctuary Cove is 40m wide to a bottom level of –3.5mLAT and from Sanctuary Cove to Beattie Road 40m wide to a bottom level of –3mLAT. This channel was last dredged in 1999/2000 when 170,000m3 of material was relocated to land at Sanctuary Cove and Hope Island. About 78,000m3 of sand was also extracted from the navigation channel downstream of Coombabah Creek in 1997/2000. These large amounts of extraction may impact on sediment transport along the river. However, the lack of floods and the revetment of much of the southern shoreline may have masked significant impacts to date.

The previous studies also indicated that proposed (in 1991) canal developments, which have now been realised, would most likely exacerbate bank erosion problems. The reports stated that it was not possible to accurately assess the reaction of the river to the increased tidal flows, but predicted that this would manifest itself as erosion in selected areas i.e. outside of bends. In this regard the outside bend between Paradise Point and Jabiru Island has shown severe erosion stress in the past and has now been largely revetted.

A factor, which was noted but not assessed in the previous studies, was the impact of the dramatic rise in vessel movement on the Coomera River, particularly below the Highway Bridge. This is related to urbanisation and associated recreational use of watercraft and the development of the boat building precinct at Coomera. There is often confusion regarding the additional impact of boat induced waves in excess of the natural wind induced waves which occur on any waterbody and impacts from channel dredging.

Recent studies (AMC 2002) have indicated that boat wake is different to natural wind waves and the impact of boat traffic is complex, with different boat types having varying degrees of impact.

It is quite likely that more than one mechanism is contributing to the current bank erosion problems in the Coomera River, with the dominant factors possibly related to:

- Changes in the tidal prism as a result of increased waterways and channel dredging (in the reaches downstream of the Pacific Motorway);
- Increased boating traffic and associated boat wake (in the reaches downstream of the Pacific Motorway); and

- Sand and gravel extraction (in the reaches upstream of the Pacific Motorway).

If it is desired to further quantify any particular component of the overall erosive pressure (i.e. dredging, boat wash or other) it will be necessary to carry out further detailed studies focussed on the process of interest. These studies will require a significant level of data collection and numerical model development and are beyond the scope of this study.

Considering the conclusions of the technical studies reviewed and field inspections, it is considered that the area between Sanctuary Cove and the Marine Precinct is likely to show ongoing erosion at a higher rate than other areas and efforts to protect infrastructure and buildings need to be concentrated in this area.

Erosion Impacts

It is not expected that the minor impacts on current velocities in the Coomera River due to the construction of the marina will have any appreciable impact on bank erosion. The increase in vessel movements may result in a minor increase in bank erosion due to boat wakes. However, it is noted that there are a broad range of processes that impact on bank erosion in this section of the Coomera River and that vessel movement is only one of these and its contribution to bank erosion is not able to be quantified.

Acid Sulfate Soils

Description of Potential Acid Sulfate Soils

An assessment of acid sulphate soils in accordance with the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998* (Ahern et al. 1998) (Revision 4.0 or any updates as they become available) should be carried out for all areas subject to excavation or filling below the level of five metres AHD (Australian height datum) and for wetland areas where the natural hydrology (surface or groundwater) may be affected by the proposal such that oxidation of potential ASS may occur. Additional technical information is available from:

- *Acid Sulfate Soils Laboratory Methods Guidelines in the Queensland Acid Sulfate Soils Technical Manual*, Ahern et al (2004)
- *Soil Management Guidelines in the Queensland Acid Sulfate Soils Technical Manual*, Dear, S.E. et al (2002)
- *Legislation and Policy Guide in the Queensland Acid Sulfate Soils Technical Manual*, Dear, S.E. et al (2004).

Acid Sulfate Assessment

An Acid Sulfate Soil Assessment has undertaken in accordance with:

- Gold Coast City Council's Policy for the Management of Activities to be Located in Areas of Acid Sulfate Soils in the City of the Gold Coast,
- the State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils (SPP2/02), and
- the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland (1998).

Reference was also made to the Australian Soil and Land Survey Handbook – Guidelines for Conducting Surveys The Australian Soil and Land Survey Handbook and The Australian Soil Classification.

Section 6.4 of the State Planning Policy (SPP 2/02), and the Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines advocate avoidance as the preferred management method for acid sulfate soils. This is because avoidance carries the least environmental risk. However, earthworks to depths of between 2.0m and 10.0m below NSL would be necessary to facilitate construction of the proposed development. A detailed Acid Sulphate Soil Assessment and

Management Plan has been prepared by Gilbert and Sutherland and is contained in Appendix 32.

The findings of this acid sulfate soil assessment within the proposed marina complex site on Lot 108 on WD6404 and Lot 98 on SP150731 has been summarised as follows:

- The site soils were highly variable and were classified according to the Australian Soil Classification (Isbell, 1996) as Grey and Brown Kurosols, Kandosols and Tenosols and Sulfidic Hydrosols. These were generally comprised of loams to sandy clays overlying clay loams to light clays, in turn overlying light to heavy clays and sandy clays.
- Initial field pH's ranged from 4.1 to 9.1, indicating the material analysed contained no significant actual acidity.
- Many of the samples screened exhibited a pH_{FOX} of <3 with a medium to very high peroxide reaction indicating Potential Acid Sulfate Soil (PASS).
- The CRS laboratory results confirmed that material of low to high PASS risk was present on-site. Out of the 465 samples analysed, 136 contained PASS material. This was represented in 24 of the 35 constructed boreholes across all proposed development areas.
- The TAA laboratory results indicated actual acidity above the actionable criteria in 38 of the 465 samples analysed.
- Based on the TAA results, this material will also require lime treatment upon disturbance and placement as engineered fill.
- Indicative required maximum liming rates range from 88.3 to 160.6kg/dry tonne.

This acid sulfate soil investigation undertaken by Gilbert and Sutherland has identified the presence of potential acid sulfate soils (PASS) within the investigation area. Consequently, an Acid Sulfate Soils Management Plan (ASSMP) is necessary to meet the requirements of the State Planning Policy 2/02 (SPP2/02) and GCCC Planning Scheme Policy for Acid Sulfate Soils. An ASSMP for the proposed marina development is included.

The aim of the ASSMP was to ensure effective management of PASS during the marina complex construction. Effective management will allow for the protection of the surrounding environment. An Acid Sulfate Soil Assessment and Management Plan, prepared by Gilbert and Sutherland, is presented as Appendix 32 of the EIS, the report provides further information regarding the description of potential Acid Sulfate Soils.

Potential Impacts of Acid Sulfate Soils and Mitigation Measures

The potential for acid generation by disturbance of acid sulfate soils during earthworks and construction should be discussed. Measures to avoid, or where avoidance is not possible, minimise and mitigate impacts should be proposed for all site earthworks and construction activities.

Where required, management measures should be outlined in an acid sulfate soils management plan prepared in accordance with the *Queensland Acid Sulfate Soils Investigation Team (QASSIT) Soil Management Guidelines* and the requirements of State Planning Policy 2/02 *Planning and Managing Development Involving Acid Sulfate Soils 1.0 (Queensland Government, 2002)* and its accompanying *Guideline for State Planning Policies 2/02: Planning and Managing Development Involving Acid Sulfate Soils 2.0* (Queensland Government, 2002). The acid sulfate soils management plan should be prepared in consultation with DERM and should consider management of trace metals (e.g. Fe, Al) in association with acid sulfate soils to avoid, and where avoidance is not possible, minimise discharge into waterways.

The ASSMP prepared by Gilbert and Sutherland contained in Appendix No.32 acknowledges the potential environmental impacts associated with the future disturbance of acid sulfate soils during Stage 1 works at the Gold Coast International Marine Precinct site and details strategies to mitigate them.

Each control strategy is based upon proven environmental management methods and is presented as a commitment. The commitments made within this document will form the basis of future assessments, which will be made available for review.

General commitments

Commitment 1
The Developer undertakes to comply with the environmental implementation strategy as contained within the approved Acid Sulfate Soil Management Plan (ASSMP).

Commitment 2
The Developer undertakes to fulfil all commitments made in this ASSMP and to carry out their activities on the project site in accordance with relevant current statutory requirements and approved amendments.

Commitment 3

The Developer will undertake all necessary investigation to identify the occurrence and severity of PASS, AASS and acidic soil during the Stage 1 construction phase.

Commitment 4
The Developer will appropriately treat acid sulfate soil excavated in the course of construction, in accordance with the recommended liming rate determined from Phase 2 testing

Commitment 5
The Developer will ensure that appropriate and adequate erosion and sediment control measures are installed and maintained for the duration of the construction works.

Commitment 6
Management will ensure through inspection and insitu analysis that no adverse impact on surface water quality as a result of development of the site has occurred.

Commitment 7
Dewatering of groundwater shall be managed to minimise the potential oxidation of PASS.

Commitment 8
A proactive program of contractor management will be implemented.

The Developer and any person appointed by the Developer as having responsibility for a control strategy set out in the ASSMP prepared by Gilbert and Sutherland contained in Appendix 32 has clearly defined responsibilities under the *Environmental Protection Act 1994* to report any incidents likely to cause material or serious environmental harm.

Further information pertaining to Acid Sulfate Soil Management is contained in the ASSMP prepared by Gilbert and Sutherland, contained in Appendix 32.

Land Use

Description of Existing Land Use

The EIS should provide a description of current and proposed land tenures and land uses in the project area, with particular mention of land with special purposes.

Maps at suitable scales showing existing land uses and tenures, and the project location, should be provided for the entire area and surrounding land that could be affected by the development including accesses. The maps should identify areas of conservation value and marine areas in any locality that may be impacted by the project.

The land tenure has been summarised as follows:

- Lot 98 on SP150731 - Maritime Quays Pty Ltd;
- Lot 146 on SP150731 - Maritime Quays Pty Ltd;
- Lot 108 on WD6404 - Reserve for Park and Recreation (Department of Environment and Resource Management);
- Lot 35 on SP150730 - Reserve for Road (Department of Transport and Main Roads)

Lot 98 and 146 on SP150731 and Lot 35 on SP150730 is currently used for rural purposes, such as cattle grazing. Lot 108 on WD6404 is currently William Guise Foxwell Park, which is utilised by the Hinterland Model Flying Club.

A plan showing the existing land tenures of the site, and the immediate area has been prepared by Gassman Development Perspectives and is contained in Appendix 2. This plan also shows the site adjoining the existing Marine Precinct Area.

The project site is located amongst areas with environmental value. This is addressed within the Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8 and the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7.

Matters of National Environmental Significance have been discussed in the EPBCA Report prepared by Planit Consulting contained in Appendix 6.

Potential impacts on land use and mitigation measures

The potential for the construction and operation of the project to change existing and potential land uses of adjacent areas should be detailed. A description of the following should be included:

- impacts on existing terrestrial land uses should be discussed with regard to existing function and planning intent and strategies for addressing any individual properties affected, either during the construction or ongoing operation of the project, should be identified
- direct and indirect impacts on any areas of high conservation value, including national parks, Ramsar sites, or other areas designated to be of high conservation value (including impacts on accessibility)
- impacts on surrounding land uses and human activities and strategies for minimisation, including:
  - good quality agricultural land—refer to *State Planning Policy 1/92: Development and the Conservation of Agricultural Land* (Department of Housing, Local Government and Planning & Department of Primary Industries 1992) and *Planning guidelines: The Identification of good quality agricultural land* (Department of Primary Industries & Department of Housing, Local Government and Planning 1993)
  - cropping land—highlight any strategic cropping land and describe the crops commonly grown on the land, including any rotations
  - key resource areas—refer to *State Planning Policy 2/07: Protection of Extractive Resources* (Department of Mines and Energy 2007a) and *State Planning Policy 2/07 Guideline: Protection of Extractive Resources* (Department of Mines and Energy 2007b)
  - competing land uses—refer to *State Planning Policy 5/10: Air Noise and Hazardous Materials* (Department of Environment and Resource Management 2010)
  - recreational uses (existing and future)
  - residential, commercial, retail and industrial uses
- possible effect on town planning objectives and controls, including local government zoning, the *Coomera Local Area Plan*, *Coomera Town Centre Structure Plan*, and other strategic plans
- constraints to potential future developments and possibilities of rezoning adjacent to the development area
- potential impacts on state controlled roads
- incompatible land uses, whether existing or potential, adjacent to all aspects of the project, including essential and proposed ancillary developments or activities and areas directly or indirectly affected by the construction and operation of these activities should be identified and measures to avoid unacceptable impacts defined
- incompatible land uses within the development itself.

As previously discussed, the site is currently used for cattle grazing purposes, and Lot 108 on WD6404 is used as William Guise Foxwell Park. The development of the site for the proposed GCIMP will ensure that the planning intent for the site is achieved. The majority of the site is located within the Marine Industry Precinct of the Coomera Local Area Plan, and is intended to be developed as a world class marine industry area. The GCIMP seeks to achieve the strategic planning intent set forth for the site. This is further detailed within the Town Planning Report prepared by Planit Consulting contained in Appendix 5.

With regards to areas of high conservation value, detail is contained in the Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8 and the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7. We advise that the project site is located approximately 3.3 kilometres from the Ramsar Site at Moreton Bay, and the proposal will therefore have no impact upon the Ramsar site's conservation values.

Land Use Impacts

The impacts on surrounding land uses, and strategies for minimisation have been summarised as follows:

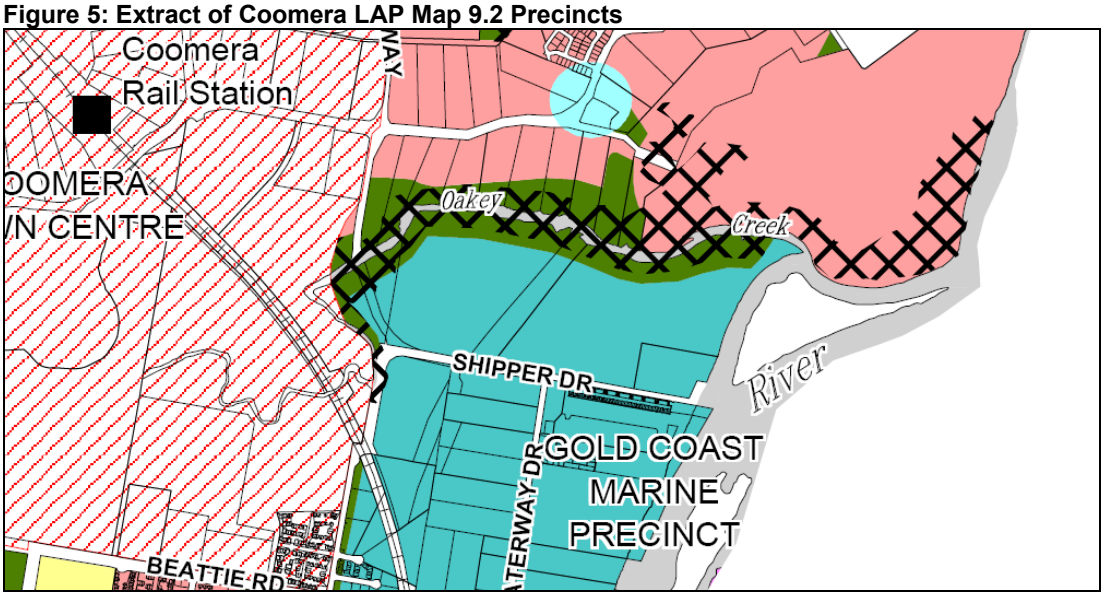
- Good Quality Agricultural Land - the site is not located on Good Quality Agricultural Land (GQAL) as per the Gold Coast Planning Scheme Overlay Maps. As such the proposal will not impact upon GQAL.
- Cropping land - the site is not utilised for cropping land, and the project will not have impacts upon cropping land.
- Key Resource Areas - the site is not located within or near a Key Resource Area. The project will not have any impact upon Key Resource Areas.
- Competing Land Uses - the GCIMP has taken into account the provisions of State Planning Policy 5/10: Air Noise and Hazardous Materials. Detail pertaining to SPP 5/10 is contained within the Air Quality Assessment prepared by ASK Consulting Engineers contained in Appendix 33. The GCIMP is not located considered to be located in proximity to competing land uses. Small residential an acreage allotments exist in the vicinity surrounding the proposed site to the south west, and to the north across Oakey Creek. The project site is not located in close proximity to any significant sensitive receptors. Please refer to the Air Quality Assessment contained in Appendix 33.
- Recreational Uses - the project involves the resumption of the William Guise Foxwell Park which is currently utilised by the Hinterland Model Flying Club. This will involve the removal of an existing recreational use. This is further discussed in detail within the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10.
- Residential, commercial, retail and industrial uses - the project is not considered to impact upon these uses. The site is a designated marine

industry area, located adjoining the existing Marine Precinct. The project is not anticipated to impact on commercial areas given that the retail component of the site is of proposed to be of a scale suitable to service the GCIMP workers / uses internally, and will not impact upon surrounding existing and planned retail catchments. Please refer to the Social and Economic Impact Assessment prepared by Norling Consulting contained in Appendix 10.

Consistency with Town Planning Objectives

As previously discussed, the development of the site for the proposed GCIMP will ensure that the planning intent for the site is achieved. Within the Coomera LAP, the site has been identified as being contained within two (2) precincts, that being the Marine Industry Precinct and the Rural Living / Open Space Precinct. Over the areas of Rural Living / Open Space, a Conservation and Landscape Protection Overlay is identified as shown in an excerpt of the Coomera LAP Map below:

Figure 5: Extract of Coomera LAP Map 9.2 Precincts



Precinct 3: Marine Industry

As evidenced above, the majority of the site is located within the Marine Industry Precinct of the Coomera Local Area Plan. The Planning Scheme Intent of this Precinct is provided below:

'Marine Industry is identified as an economic sector which has future prospects for local economic growth for the City. A Marine Industry Precinct at Beattie Road, Coomera is proposed to include approximately 250

hectares of land. A range of marine industry companies is to be accommodated, including boat building, boat refit, mechanical service and marine component manufacture. It is intended to develop this precinct as a world class waterfront industry development. A high standard of architectural and landscape form is expected.

Development within this precinct is subject to Council's approval for fill, and will be determined on the basis of detailed hydraulic analysis. Storm water treatment is to be of the highest standard, to ensure that acceptable water quality is maintained in the Coomera River. Development within the Marine Precinct will be subject to a number of Environmental Protection Policies.

The Beattie Road area is intended for business and industry associated with the manufacture of sports fishing boats, motor cruisers, fibreglass and reinforced plastic boats, outboard motor boats, aluminium fishing dinghies and commercial and recreational boats. Ancillary business and industry is also encouraged. Preferred activities include marine lighting, boat fittings, steering controls, propeller inspection systems and marine instrumentation manufacture.

To meet the need of the boat building industry, the LAP incorporates sufficient land for the industry's needs for the next 30 years. The precinct is promoted locally, nationally and internationally, and will provide opportunities for major boat building and maintenance for craft from ten foot to the super yacht.

It is essential that businesses in this precinct have access to the Coomera River. Consequently, there will not be a continuous open space corridor between the Marine Precinct and the river. In any development, appropriate steps are to be taken for the provision of landscaping, to promote an attractive environment on the river.

To ensure the establishment and continued operation of this precinct at Coomera, the following planning objectives will be used to assess development applications:

- *the precinct is to be sufficiently large to allow appropriate buffering from residential developments;*
- *the release of land is to be planned, to allow for progressive development;*
- *provision is made for large (50 metre) boat maintenance and refit facilities which require water access; and*
- *to preserve the manufacturing integrity, no residential development should be allowed within the precinct.'*

It is understood that the intent of this precinct is to provide a 250 hectare world class Marine Industry area accommodating a range of marine industry and associated uses.

The Development Application involves a Preliminary Approval to Vary the Affect of the Planning Scheme pursuant to Section 242 of the *Sustainable Planning Act 2009*. As part of this Application a GCIMP Development Code and associated Planning Maps have been proposed. These involve the establishment of various Precincts over the site, and Tables of Development for each Precinct to ensure appropriate uses are able to be developed on site in future in appropriate locations. This method contemplates an array of suitable uses which are able to be developed to ensure flexibility can occur. Further detail is contained within the Town Planning Application prepared by Planit Consulting contained in Appendix 5.

Despite the s242 Preliminary Approval, the proposal still seeks to uphold the general intent of the Marine Industry Precinct of the Coomera LAP. The proposal seeks to establish an integrated industrial marina on the Coomera River consistent with the intent of the Marine Industry Precinct. The proposal seeks to establish a world class, purpose built marina which incorporates marine industry and waterfront uses and various other land uses which support the function and integrated operation of the marine precinct.

The proposal involves contemplating a variety of land uses, all of which facilitate the delivery of a functional marine precinct. Uses envisaged range from fittings and fixture manufacturers for vessels, a marine industry education establishment, restaurants and retail uses along the waterfront to support workers and visitors of the precinct, boat stack storage facilities and various manufacturers and showrooms. As such, all the land uses envisaged will be supportive of the marine industry precinct to ensure its viable operation and functionality.

This proposal essentially involves an expansion and enhancement to the existing Gold Coast Marine Precinct incorporating a high quality design to deliver a marine industry complex of international standard. The proposal is considered to retain consistency with the general intent of the Marine Industry Precinct.

Precinct 9: Rural Living / Open Space Precinct

The Intent of the Rural Living / Open Space Precinct has been provided below.

> *'To provide for rural style residential development and also to provide for the effective servicing of current and future needs for recreational land within the Coomera LAP area. Further, to contribute to the open space network within the Coomera area for landscape and habitat protection purposes'.*

The area of the site identified within this precinct is located across and along the northern and western fringes of the site.

The GCIMP retains consistency with the intent of the Rural Living / Open Space Precinct as this area is set aside for natural conservation purposes. The area of land located within this Precinct is generally located within the 40 metre natural conservation buffer to Oakey Creek to protect and maintain the existing waterway and vegetation communities.

The buffer to Oakey Creek proposed, will aid in the protection of landscape and habitat values.

Precinct 10: Agriculture / Conservation

As previously stated, portions of the site are also contained within the Agriculture / Conservation Precinct. The intent of this Precinct is provided below.

> *'The Agriculture / Conservation allocation is intended to protect rural economic activities, while providing opportunities for the protection of valuable natural areas and recreation and landscape interest values.*
>
> *This precinct applies to land included in areas shown on Coomera LAP Map 9.2 – Precincts as either Agriculture or Open Space Buffer. Some of this land is also affected by the Conservation and Landscape Protection overlay, shown on the same map.*
>
> *The land contained within the Agriculture/Conservation Precinct is generally to remain for the use of low intensity agricultural pursuits, in accordance with the provisions in the Planning Scheme for the Rural Domain. Areas of conservation significance are to be managed in accordance with the Nature Conservation Strategy. A minimum lot size of 20 hectares is identified for this precinct.'*

It is understood that the intent of Precinct 10 is to protect and maintain the existing waterways and vegetation communities present as identified within the overlay provisions applicable to the site.

The intent of this planning for the site has been reflected in the layout and design of the proposed development. Furthermore, the GCIMP Development Plan has included the designation of Precinct 4 Nature Conservation which adopts a refined boundary which is shaped to reflect the most important natural features of this area as informed by a detailed ecological assessment. Oakey Creek which is located to

the site's northern and western boundaries is proposed to be protected and maintained within a 40 metre wide natural buffer.
A small portion of the site is also located within Precinct 9e Conservation of the Coomera Town Centre Structure Plan. The intent of this precinct is provided as follows:

> *"... accommodate a portion of the Ring Road connecting Beattie Road to Foxwell Road. The sub-precinct contains areas of State and regional biodiversity significance and serves as important fauna habitat. This sub-precinct will be highly protected to facilitate connectivity with the Oakey Creek corridor east of the Coomera Town Centre, eventually connecting with the Coomera River to the east and Pimpama River Conservation Area to the north east. It is intended that the sub-precinct remains undeveloped with limited human encroachment to protect biodiversity and environmental values and preserve ecological function."*

No development will occur on this portion of site as this area is to remain as a natural conservation buffer to Oakey Creek. This is entirely consistent with the Intent of Precinct 9e of the Coomera Town Centre Structure Plan.

Further detail pertaining to the Development's consistency with site's Planning designation is contained within the Town Planning Report prepared by Planit Consulting contained in Appendix 10.

Compatibility with the Surrounding Environment

The GCIMP is appropriately located within an area designated for Marine Industry. The site forms a part of the total Gold Coast Marine Precinct designated area, which cumulatively consists of a total of 250 hectares. Due to the limited availability of land suitable to be developed for Marine Industry purposes, it is considered that there is very low possibility of the adjoining areas being re-zoned within future Planning Schemes. The GCIMP is not considered to constrain potential future development given that the site has been set aside for this scale and nature of development.

With regards to State Controlled Roads, the site contains a reserve for the future DTMR IRTC. As detailed within the Construction Methodology Plan prepared by Hyder Consulting contained within Appendix 13, this corridor will be subject to earthworks and fill concurrently with the development of the GCIMP so as to minimise differential settlement where possible. The development concept and design has been undertaken in response with numerous discussions and advice received from DTMR so as to ensure that the development will not impact upon the future State Controlled Road.

Detailed investigations and reporting has been undertaken as part of the GCIMP EIS to ensure impacts of the development on surrounding uses are minimised and mitigated. Detail pertaining to this aspect is contained in various technical reports included by not limited to the Traffic and Transport Impact Assessment in Appendix 21, the Air Quality Assessment in Appendix 33, the Noise and Vibration Assessment in Appendix 34, the Social and Economic Impact Assessment in Appendix 10 and the Site Based Management Plan in Appendix 15. In this way, impacts of the development on surrounding uses have been considered and minimised wherever possible.

Through the s242 Preliminary Approval Application to Vary the Effect of the Planning Scheme, a GCIMP Precinct Plan has been adopted to ensure most appropriate development outcome and to separate any incompatible uses. Furthermore, landscaping, design outcomes and setback provisions have been adequately incorporated within the GCIMP Development Code. Please refer to the Town Planning Report prepared by Planit Consulting contained in Appendix 5

Contaminated Land

Description of Existing Contaminated Land

A review of the project site, to determine if all or part of the site is on the *Environmental Management Register* or *Contaminated Land Register* is to be undertaken. Maps of any areas listed on the *Environmental Management Register* or *Contaminated Land Register* should be provided and a schedule of further investigations and remediation activities recommended for those land parcels where soil contamination may have an impact on construction activities.

A preliminary site investigation in accordance with the Environmental Protection Agency *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland, 1998* and *The National Environmental Protection (Assessment of Site Contamination) Measures, 1999* should be prepared where evidence of existing or past contamination is encountered and where it may be impacted by the project.

If construction proceeds, the results of site investigations, remediation and validation will need to be certified by a third party reviewer before being submitted to DERM.

A investigation of contaminated land was undertaken by Gilbert and Sutherland. Please refer to the Preliminary Contamination Assessment and Baseline Soil Survey contained in Appendix 30.

In undertaking a Contamination Assessment, the investigation area consisted of the site in its entirety, however sampling was conducted judgementally based on the locations of former sheds / dwellings, existing livestock yards and a groundwater well.

A summary of the allotments and their current use and improvements has been provided below.

- Lot 98 on SP150731 is currently utilised for livestock grazing, and contains livestock yards. The nearest surface water body is Oakey Creek which flows along the northern boundary and the Coomera River which flows along the eastern boundary.
- Lot 35 on SP150730 is currently utilised for livestock grazing, and contains no structures. The closest water receptor is Oakey Creek which flows along the northern boundary of the site.
- Lot 146 on SP150731 is currently utilised for livestock grazing and contains remains of livestock yards. The closest surface water receptor is Oakey Creek which flows along the south-western and north-western boundary of the site.

- Lot 108 on WD6404 is currently a reserve for park, and is utilised by the Hinterland Model Flying Club. The site contains launch and service areas a tin shed and runways. The closest surface water receptor is the Coomera River which flows along to the eastern boundary of the site.

The site assessment was divided into three (3) stages:

1. Review of historical data, including findings from previous site investigations (if any) and a review of historical aerial photographs.
2. Review of relevant Queensland Government records (EMR/CLR databases and title records).
3. A site inspection including baseline soil and sediment sampling events.

Historical Data

AGC Woodward-Clyde Pty Ltd (Woodward Clyde) was commissioned by Morton and Associates to undertake a site contamination assessment of a parcel of land featuring a former livestock dip within the former Lot 146 on WD6470 (currently Lot 146 on SP150731) in July, 1995. The results of this investigation were published in a report titled *'Stage I and II Site Assessment Waterway Downs, Coomera, August 1995 (DEH Document No.R001-A)'* by Woodward Clyde in August 1995.

The 1995 investigation identified arsenic and organochlorine pesticides (OCPs) that exceeded the 1995 Department of Environment and Heritage (DEH) health based investigation levels within Lot 146 on WD6470, specifically in the vicinity of the former livestock dip.

DEH subsequently requested a Remediation and Validation Report be submitted for review. The subject lot was appropriately remediated by removal and disposal of the contaminated material to Suntown Landfill, Labrador, and validated by Woodward Clyde to the satisfaction of the DEH and Gold Coast City Council (GCCC). The results are reported in Woodward Clyde's *Remediation and Validation, Waterway Downs, Coomera, Queensland*, April 1996 (DEH Document No. R001-A.DOC).

DEH issued a Statement of Suitability dated April 17, 1996, stating '*the subject property is suitable for any use'* based on information provided by Woodward Clyde in the aforementioned reports. The DEH Suitability Statement is attached to the Preliminary Contamination and Baseline Soil Assessment prepared by Gilbert and Sutherland contained in Appendix 10.

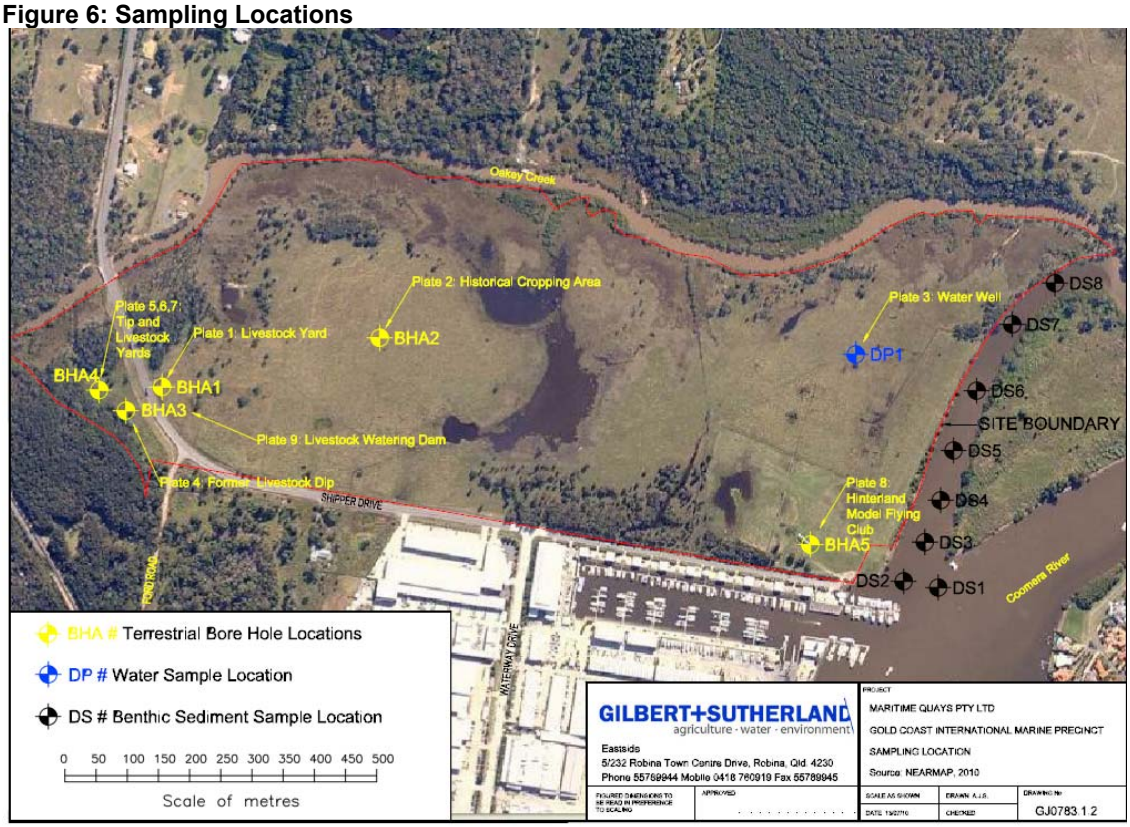
Queensland Government Registers / Databases

Gilbert and Sutherland undertook a search of the Environmental Management Register (EMR) and Contaminated Land Register (CLR). These searches indicated that the site was not registered on either database for notifiable activities.

Site Inspection

The site inspection including baseline soil and contamination investigations involved various boreholes as shown on the Figure below.

Figure 6: Sampling Locations



As previously stated, the boreholes were located based on the location of existing and previous structures. The following photographic images show the existing structures and specific ground conditions at the time of the Stage 1 investigation. An explanation of each borehole location has been provided below.

Image 1: Borehole BHA1

Borehole BHA1 was located within the yard farthest from the photographer on Lot 146 SP150731 near existing livestock yards. This borehole showed no evidence of tickicide spraying or pesticide treatment of the area.

Image 2: Borehole BHA2

BHA2 was constructed in the foreground of the image above, within the historical cropping area in Lot 98 on SP150731.

Image 3: Water Sample DP1

Water sample DP1 was collected on Lot 98 on SP150731 within the existing water well, which is shown shored by timber palings.

Image 4: Borehole BHA3

Borehole BHA3 was located on Lot 146 on SP150731 in proximity to 20L drums of Glyphosate (450g/L) found at the approximate location of the former livestock dip.

Image 5: Borehole BHA4

Borehole BHA4 was constructed on Lot 146 on SP150731 in the remains of a small livestock yard (approximately 7 x 8 metres)

Image 6: Borehole BHA5

Borehole BHA5 was constructed on Lot 108 on WD6404 near the Hinterland Model Flying Club service area.

The borehole and water samples were analysed. Results of this analysis has been provided as follows:

- **Metals** - all metals results were below HIL and EIL levels in all samples analysed.
- **Organochlorine and Organophosphorus pesticides (OC & OP)** - no OC/OP pesticides results exceeded the laboratory's limit(s) of reporting (LOR) or documented HIL thresholds for any of the soil samples tested. No OC/OP pesticides results exceeded the LOR or documented EIL thresholds for the water sample (DP1) tested. ALS's LOR for OC/OP pesticides were greater than the EIL thresholds for marine waters samples tested. As all of the OC/OP pesticide concentrations were identified below the LOR in soil samples and cropping appears to have ceased as late as 1983, analysis of OC/OP pesticides with a reduced LOR is not warranted.
- **Benzene, Toluene, Ethyl-benzene and Xylene (BTEX)** - no benzene, toluene, ethyl-benzene and total xylene results were recorded above the LOR and the adopted investigation criteria for the soil samples recovered from within Lot 108 WD6404 (Hinterland Flying Model Club.
- **Total petroleum hydrocarbons (TPH)** - no total petroleum hydrocarbons were recorded above the LOR or the adopted investigation criteria during the investigation of recovered soils samples from within Lot 108 WD6404 (Hinterland Flying Model Club).
- **Organotin Compounds** - no Tri, Di or Mono –butyltin concentrations were recorded above the LOR during the investigation of recovered benthic sediment samples recovered from the Coomera River, adjacent to Lot 98 on SP150731.

Further detail pertaining to results analysis is contained within the Preliminary Contamination Assessment and Baseline Soil Survey prepared by Gilbert and Sutherland contained in Appendix 30.

Summary of Results

The samples recovered from across the site were analysed for the occurrence and concentration of arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, organochlorine and organophosphorus pesticides, BTEXs and TPH. Samples were recovered for the adjacent river bed were analysed for organotin compounds.

The results of this assessment demonstrate that no COPCs were present within the bounds of the site at concentrations greater than the relevant NEPM Health-Based Investigation Levels (HIL), the Environmental Investigation Levels (EIL) and the QLD and NSW EPA guidelines for assessing service station sites.

Whilst the site has historically identified potentially contaminating activities, laboratory results recorded for soil samples extracted from the site indicate that

there is no contamination present associated with current or historical agricultural activities. DEH recognised the remediation of the dip on Lot 146 WD6470 by issuing a Statement of Suitability dated April 17, 1996 stating '*the subject property is suitable for any use'.*

Based on the result of this Stage 1 Preliminary Site Contamination Assessment, no further site-specific investigations are required in relation to the identified potentially contaminating activities. Gilbert & Sutherland therefore considers the contamination does not constitute a constraint to the development of the site for its intended use as a commercial / industrial marine precinct.

Potential Impacts of Contaminated Land and Mitigation Measures

This section should provide details of any potential impacts from land contamination and proposed mitigation measures in accordance with all relevant guidelines, including:

- a description of the nature and extent of existing or potential contamination at each site and remediation and validation sampling
- the means of preventing land contamination, site management measures to ensure that land contamination does not cause human health impacts or environmental harm.

The means of preventing land contamination (within the meaning of the *Environmental Protection Act 1994*) should be addressed. Methods proposed for preventing, recording, containing and remediation of any contaminated land should be outlined.

Activities/materials identified as having the potential to have contaminated the site include:

- Storage of chemicals i.e. Glyphosate (triggering the need to investigate the presence of organochlorines and organophosphorus pesticides in particular).
- Former livestock dip.
- Historical cropping activities.
- Livestock yards.
- Use of anti-biofoulants in marine industry upstream.

Given the DEH has previously provided a Statement of Suitability (April 17, 1996 DEH ref 901614) that the subject site (nee Lot 146 on WD6470) is suitable for any use and no other notifiable activity was identified, a notification in accordance with the *Environmental Protection Act, 1994* is not warranted.

The site does not require any mitigation measures given that the site is not contaminated.

With regards to future contamination, an Operational Site Based Management Plan (SBMP) has been prepared by Hyder Consulting and is contained in Appendix 15. The SBMP will be required to be amended and updated in future if necessary to ensure suitable measures are in place to prevent any future contamination as a result of the GCIMP.

4.3 Nature Conservation

This section of the EIS should provide a comprehensive description of the environmental values of the affected area. Any areas impacted by the project within or adjacent to a sensitive ecological community, including impact footprint, should be discussed. Where the project would impact upon a threatened species or community, the discussion should include reasons why an alternative site layout cannot be adopted and the viability of alternatives considered. The EIS should demonstrate how the project (including all associated infrastructure requirements such as navigation channels) would comply with the following hierarchy:

- avoiding impact on areas of conservation value, rare and threatened species, and coastal wetlands, water quality, biodiversity values, connectivity and supporting ecological processes
- where avoidance is not possible, mechanisms to minimise impacts
- mitigation of impacts through rehabilitation and restoration
- measures to be taken to replace or offset the loss of conservation values where avoidance and mitigation of impacts cannot be achieved, including locally within the Gold Coast City Local Government Area
- explanation of why measures above would not apply in areas where loss would occur.

Where relevant, this section should discuss environmental offset requirements in accordance with the *Queensland Government Environmental Offsets Policy (QGEOP)* and taking into account the applicable specific-issue offset policies, as follows:

- *Policy for Vegetation Management Offsets (DNRW September 2007)*
- *Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss* (Department of Primary Industries and Fisheries 2002) (FHMOP005)
- *Offsets for Net Benefit to Koalas and Koala Habitat* (EPA 2006)
- *Policy for Biodiversity Offsets* (consultation draft, EPA 2008).

The following components address the project's potential impacts on areas of ecological value. Where relevant, mitigation and management measures are proposed. Furthermore, environmental offsets are proposed where necessary.

Sensitive Environmental Areas

The EIS should identify all areas that are environmentally sensitive in proximity to the project. Particular consideration should be given to koala habitat, saltmarsh wetlands, freshwater/palustrine wetlands, essential habitat listed under the *Vegetation Management Act 1999*, shorebird habitat, important habitats of species listed under the NCA and or EPBC Act and presumed extinct, endangered, vulnerable or rare, nature refuges, national parks, conservation parks, declared fish habitat areas, wilderness areas, aquatic reserves, heritage/historic areas or items, national estates, world heritage listings and sites covered by international treaties or agreements (e.g. Ramsar), areas of cultural significance and scientific reserves. The proximity of the project to environmentally sensitive areas should be shown on a map of suitable scale.

Action plans for protecting rare or threatened species and vegetation types, where identified, should be described, and any obligations imposed by Queensland or Australian Government biodiversity protection legislation or policy should be discussed.

This section should also identify any areas of significant coastal wetlands, areas of state significance (natural resources) or areas of High Ecological Significance (HES) or General Ecological Significance (GES) as detailed in the draft *Queensland Coastal Plan*.

Following a review of the flora and fauna assessments undertaken by Planit Consulting and FRC Environmental (Appendix 6 - 8), the following further discussions/review of ecological significance have been prepared. This discussion addresses alterative concepts and also wider ecology aspects such as corridors and core habitat:

Vegetation Communities and Wetland Classification

The following vegetation communities have been mapped as a result of field survey and are tabulated below. The community's wetland status is also identified.

Table 5: Mapped Vegetation Communities & Clearance Rates

Mapped Community	RE Nos.	VMA Status	Approx. extent within site	Approx. extent to be disturbed /cleared via development	Approx. extent to be disturbed /cleared via main roads reserve	Approx % remaining
COMMUNITY 1A: MID-HIGH OPEN FOREST/FOREST (*CASUARINA GLAUCA*) [T6D/M] ON TIDAL MUDFLATS	12.1.1	'Of concern' Estuarine Wetland	2.156ha	0.815ha	0	62%
COMMUNITY 1B: MID-HIGH FOREST (*CASUARINA GLAUCA*) [T6M] ON ALLUVIAL DEPOSITS	12.3.5	''Least Concern' Palustrine Wetland	3.4788ha	3.4788ha	0	0%
COMMUNITY 2A: VERY TALL RUSHLAND (*JUNCUS KRAUSII*) [V4M]	12.1.2	'Least Concern' Estuarine Wetland	0.1ha	0	0	100%
COMMUNITY 2B:LOW CLOSED TUSSOCK (*SPOROBOLUS VIRGINICUS*) GRASSLAND [G1D]	12.1.2	'Least Concern' Estuarine Wetland	21.945ha	15.45ha	1.650	22%
COMMUNITY 3: LOW-TALL OPEN FOREST/WOODLAND (*AVICENNIA MARINA* + *AEGICERAS CORNICULATUM*) [T4M/S]	12.1.3	'Least Concern' Estuarine Wetland	2.735ha	0.74	0.18	66%
COMMUNITY 4: VERY TALL CLOSED GRASSLAND	N/A	Non-remnant community	1ha	0	0	100%

Mapped Community	RE Nos.	VMA Status	Approx. extent within site	Approx. extent to be disturbed /cleared via development	Approx. extent to be disturbed /cleared via main roads reserve	Approx % remaining
[*SETARIA SPHACELATA*] G4D/M						
COMMUNITY 5: LOW CLOSED PASTURE WITH SCATTERED TREES/PADDOCK MOSAIC G1D/M	N/A	Non-remnant community	38ha	35.6	2.4	0%
		TOTALS	**67.86**	**54.52ha**	**4.11**	**86%**

As is identified a number of this communities (1 – 3) are listed as either estuarine or palustrine wetlands which are subject to varying direct impacts from the proposal. These communities are a significant site feature.

Significant to note from the site investigations is that approximately twenty-two hectares of the 63.6 hectare site is tidally inundated. However of that, only 9.72 ha of the *Sporobolus virginicus* grassland (Community 2B) is located below HAT.

The balance area is made up principally of the area occupied by the semi permanent wetland. Images of the subject area, which is mapped on the regional ecosystem map as RE12.2.15, but as described within this report has been included within the mapping for RE12.1.2.Community 12.2.15 is approximately 2.27ha in area. Images 7 and 8 below illustrate the changing character of this area.

Image 7: Central wetland view east from centre of Lot 98 SP150731

Image 8: Central wetland view north from centre of Lot 98 SP150731

Salt marshes in the intertidal zone provide ecosystem services, contribute to the nutrient cycling of estuaries, provide a nursery area for fish as well as buffer water bodies from excess nutrients from the land (Adam 1990).

Mapped Vegetation Communities Local Significance

A review of the GCCC Nature Conservation Strategy documents indicates the following:

- RE 12.1.1 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The Pimpama River Conservation Reserves Management Plan, dated January 2010 (PRCRMP) noting 51% of the remnant remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 934ha of the remnant was remaining.

- RE 12.1.2 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 66% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 559ha of the remnant was remaining.

- RE12.1.3 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 89% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 2,803ha of the remnant was remaining.

- RE 12.2.15 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 98% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium,

Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 57ha of the remnant was remaining.

- 12.3.5 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as Very Low. The PRCRMP estimates 5% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 341ha of the remnant is remaining.

We note these estuarine and palustrine habitat types are well represented and conserved in the network of marine and national parks within the immediate and broader coastal environment. Of these Lake Coombabah Marine National Park is approximately 4 kms south of the site.

Significant Flora Species

One flora species listed as rare, vulnerable or endangered pursuant to the Qld Nature Conservation Act was recorded within the SW corner of the site. This species (*Macadamia tetraphylla*) will be retained in association with site development.

Two (2) species listed under the Qld Nature Conservation Act 1999 are listed as recorded within 5km of the site. An additional 13 species are also listed within the protected matters search EPBC Act protected matters search as potentially occurring but these were not recorded or likely to be on site due to site features and absence of associated habitat.

Hollow-Bearing Trees

Within the site there exists a general paucity of hollow bearing trees (HBT) with only two such individuals noted (one within the paddock area and one adjacent Oaky creek) (it is acknowledged that additional trees with hollows that are not readily visible at ground level may occur).

One of these trees (within the paddock) will be removed in association with development of the site.

Wetlands and Waterways

International / National Wetlands

As outlined earlier, the site is contextually within a riverine /estuarine environment. The site is bound by two (2) tidally influenced waterways which are connected to the southern Broadwater. The site is approximately 3km from the Moreton Bay Marine Park

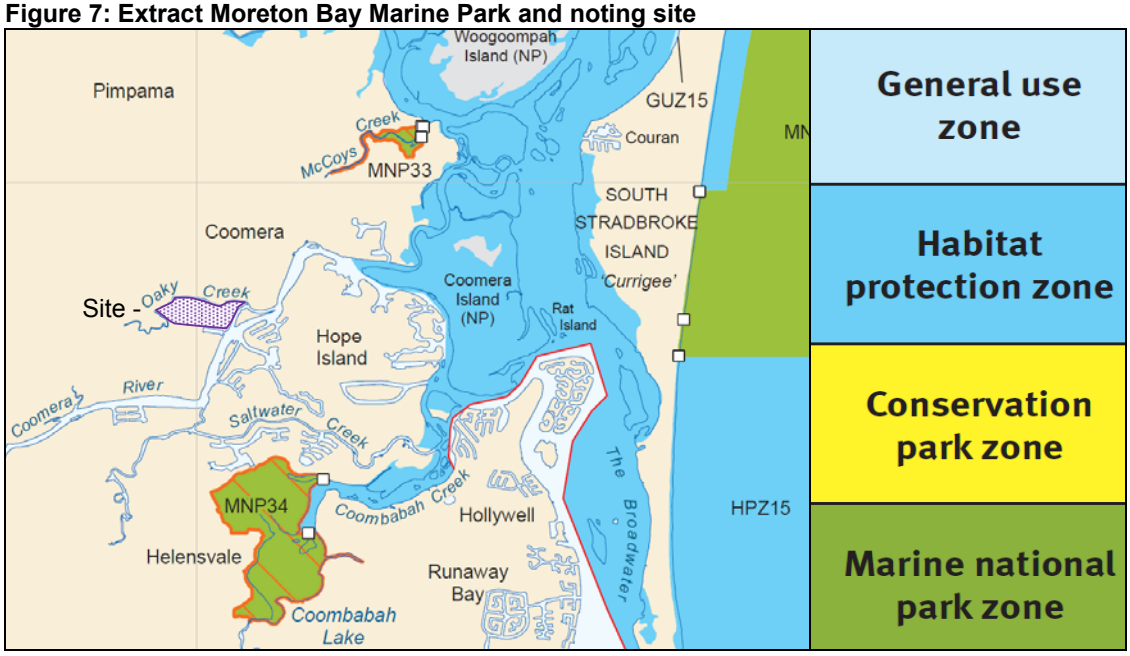
Moreton Bay Marine Park was first declared in 1993 to protect its unique values and high biodiversity while still allowing people to use it. The marine park covers 3400sq.km and stretches 125km from Caloundra to the Gold Coast.

It takes in most of the bay's tidal waters, including many river estuaries and extends seawards to the limit of Queensland waters. The landward boundary is generally the line of highest astronomical tide.

Moreton Bay Marine Park protects a range of marine and coastal environments including rocky shores, internationally significant wetlands, coral reefs, mangroves, seagrass meadows and sandy beaches. These habitats provide important seasonal resources for migratory wading birds, humpback whales and marine turtles. Permanent resident species include dolphins, dugong, shorebirds, grey nurse sharks and various fish species''.

An extract of the Moreton Bay Marine Park showing the location of the site is provided below in Figure 22.

Figure 7: Extract Moreton Bay Marine Park and noting site



DERM further state in relation to shorebirds and Moreton Bay Marine Park that ‘’Moreton Bay is an important habitat in the East Asian – Australasian Flyway, which is one of eight flyways in the world. The East Asian – Australasian Shorebird Reserve Network is an international chain of wetlands recognised for their importance to shorebirds.

Moreton Bay’s extensive intertidal areas are essential for shorebirds as they provide roosting, feeding and, in some cases, breeding habitat. Moreton Bay is Queensland’s third, and one of Australia’s top 12, shorebird habitats (Thompson 1990).

The Bay provides habitat for over 3500 resident (Driscoll 1997), and over 40,000 migratory shorebirds, during the summer months (Driscoll 1993; Watkins 1993). Moreton Bay supports the third highest concentration of migratory waders in Queensland at approximately 10 percent of the state’s population (Driscoll 1993)’.

Moreton Bay is noted as being a semi-enclosed basin bounded on its eastern side by two of the largest sand islands in the world. It is one of only three extensive intertidal areas of seagrass, mangroves and salt marsh on the eastern coast of Australia that provide habitat for a number of water birds.

Information obtained from Wetlands International (2012) identified that the Moreton Bay sites meets the following Ramsar criteria:

- *1b Moreton Bay is one of the largest estuarine bays in Australia which are enclosed by a barrier island of vegetated sand dunes.*

- *1c Moreton Bay plays a substantial role in the natural functioning of a major coastal system through its protection from oceanic swells providing habitat for wetland development, receiving and channelling the flow of all rivers and creeks east of the Great Dividing Range from the McPherson Range in the south to the north of the D'Aguilar Range.*
- *2a Moreton Bay supports appreciable numbers of the vulnerable green and hawksbill turtles, the endangered loggerhead turtle and is ranked among the top ten dugong habitats in Queensland.*
- *2b Moreton Bay supports over 355 species of marine invertebrates, at least 43 species of shorebirds, 55 species of algae associated with mangroves, seven species of mangrove and seven species of seagrass.*
- *2c It is a significant feeding ground for green turtles and is a feeding and breeding ground for dugong. The Bay also has the most significant concentration of young and mature loggerhead turtles in Australia.*
- *3a Moreton Bay supports more than 50,000 wintering and staging shorebirds during the non-breeding season.*
- *3b At least 43 species of shorebirds use intertidal habitats in the Bay, including 30 migratory species listed by JAMBA and CAMBA.*
- *3c The Bay is particularly significant for the population of wintering Eastern curlews (3,000 to 5,000) and the Grey-tailed tattler (more than 10,000), both substantially more than 1% of the known Flyway population.*

(Wetlands International, 1999)

Queensland Wetlands

In addition to the downstream Moreton Bay Marine Park being recognised as significant within various Acts the State also recognises wetlands as significant and within a number of Acts.

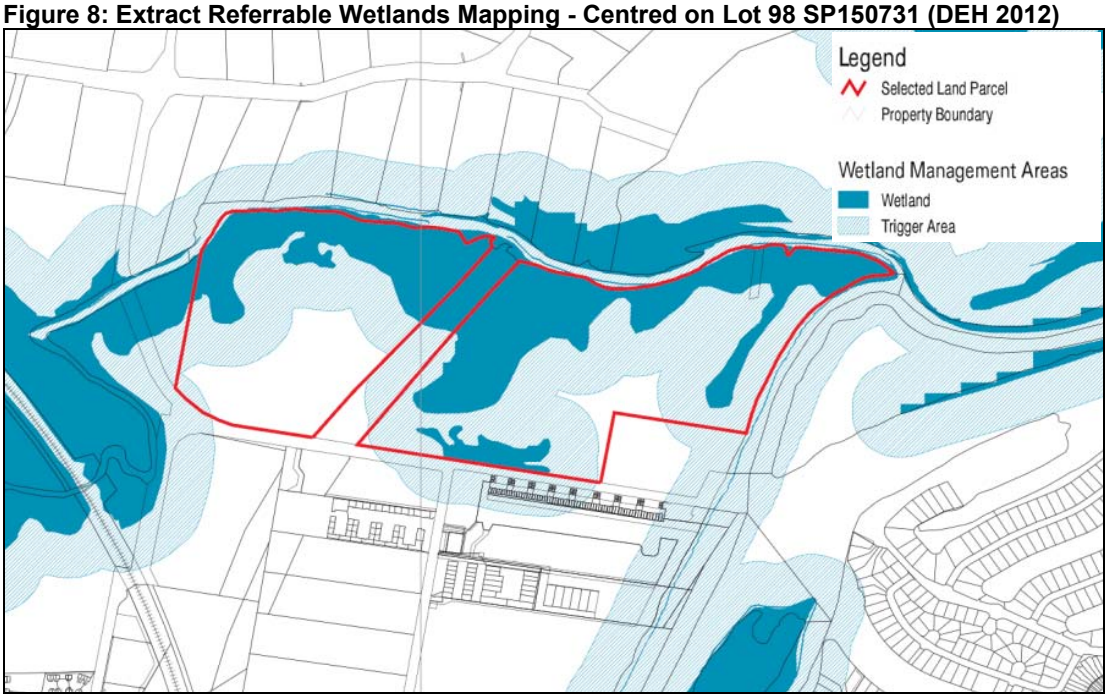
The first of these is under the Vegetation Management Act and 'referable wetlands'. This is an area identified as a wetland on the Map of Referable Wetlands. The current Map of Referable Wetlands is a tool used to trigger the former Department of Environment Resources and Mines (DERM's) concurrence and advice role under the Sustainable Planning Act 2009 (Qld).

The site is mapped as containing referrable wetlands. These wetlands correlate with the Regional Ecosystem mapping identified in the vegetation communities section of this document. As identified Communities 1 – 3 are identified as either estuarine or palustrine wetlands. The detailed vegetation assessment as outlined generally reflects the extent of the mapped wetland areas.

An approximately 17.5 ha are mapped as estuarine wetland, whilst 3.4 are palustrine. Of this 17.5 ha 2.27ha is the semi permanent wetland.

An extract from the Department of Environment and Heritage Protection (DEH) Referrable Wetlands mapping is provided in Figure 23 below.

Figure 8: Extract Referrable Wetlands Mapping - Centred on Lot 98 SP150731 (DEH 2012)



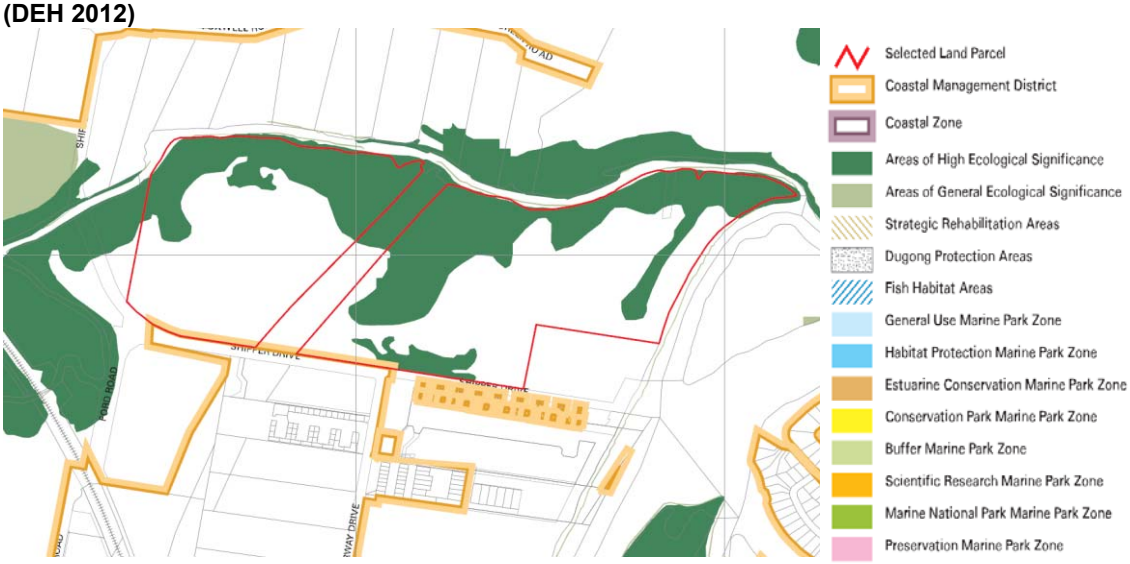
Wetlands are also recognised as significant features in the Queensland Coast Plan. The Coastal Plan it is noted from the DEH website 'replaces the State Coastal Management Plan (2001) (http://www.ehp.qld.gov.au/coastalplan/management-plan/index.html) and associated regional coastal management plans. (http://www.ehp.qld.gov.au/coastalplan/managementplan/#repealed_regional_coastal_management_plans). The Queensland Coastal Plan has been prepared under the *Coastal Protection and Management Act 1995.* It includes a state planning policy under the *Sustainable Planning Act 2009*.'

The Queensland Coastal Plan has two parts: State Policy for Coastal Management and the State Planning Policy 3/11: Coastal Protection (SPP). The Policy states that 'The management policy applies to coastal land and its resources within the coastal zone. Coastal land includes land under tidal waters, erosion prone areas, land at risk from storm tide inundation or permanent inundation due to sea level rise (collectively called coastal hazard areas), coastal roads and esplanades, reserves and unallocated State land, and other parcels of land adjacent to the foreshore. Coastal resources are the natural and physical features, processes, places or objects of the coastal zone that have ecological, economic or social value.

This includes areas of high ecological significance (HES). The policy identifies that ‘Areas of high ecological significance are the protected area estate, 'endangered' and 'of concern' regional ecosystems, essential habitat for threatened species, wetlands, and coastal dunes.

Figure 9 provides an extract of the HES mapping for the site, cantered on Lot 98 SP 150731. As can be seen the areas of HES reflect the extent of the mapped RE 12.1.1, 12.1.2, 12.1.3 and 12.3.5 areas on site and correlate with Communities 1 – 3.

Figure 9: Extract Queensland Coastal Plan (HES) mapping – Centred on Lot 98 SP 150731 (DEH 2012)



Local Wetland Significance

The Gold Coast City Council Planning Scheme 2003 Gold Coast City also recognises wetlands as of significant. The site is mapped within the ‘Natural Wetland Areas and Natural Waterway Constraint Code and other relevant documents such as the Nature Conservation Strategy.

Natural Wetland Areas and Natural Waterway Constraint Code

The ‘Scheme states ‘ This code seeks to ensure the long term protection, enhancement and management of natural waterways and wetlands for their ecological, fishery, shore line and bank stabilisation, hydro geological, open space, recreational, environmental, scientific and cultural value.

This code supports and implements, at the local level, state and national policies (in particular, the Moreton Bay Marine Park Strategic and Zoning Plans and the

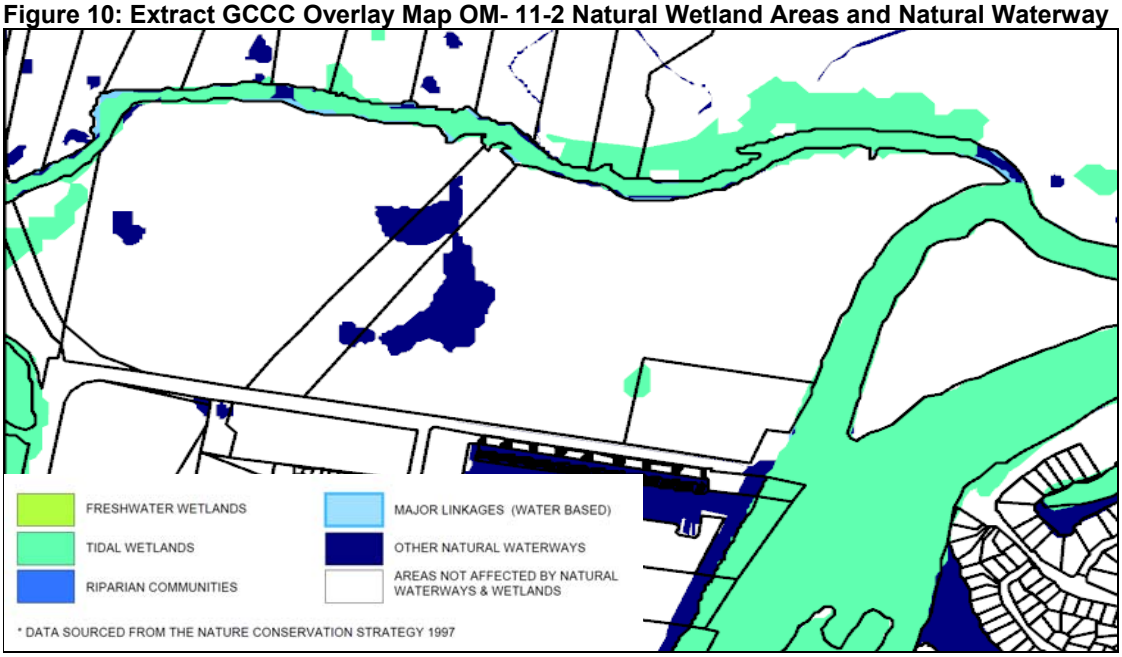
Draft State Coastal Management Plan), legislation and strategies (e.g. the Wetlands Policy of the Commonwealth Government of Australia and Declared Fish Habitat Areas of Queensland) and international agreements including:

- Convention of Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR, 1971);
- Agreement for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment, between the Government of Australia and the Government of Japan, 1974, (JAMBA);
- Agreement for the Protection of Migratory Birds and their Environment between the governments of Australia and the People's Republic of China, 1976, (CAMBA).

This code provides for the maintenance of effective and functional buffers between development and natural waterways and wetland areas to ensure that ecological and hydrological conditions can be continued and protected and natural processes can occur, without impacting on the residential amenity of those areas.

The application of the Scheme and the site is discussed in more detail in the follow section. Overlay mapping as relevant to the site is shown below.

Figure 10: Extract GCCC Overlay Map OM- 11-2 Natural Wetland Areas and Natural Waterway



As can be seen from the mapping the scheme identifies the tidal waterways adjacent to the site and other natural waterways and tidal wetlands occurring within the site.

Site vegetation mapping indicates a wider distribution of wetlands on site.

Significant Fauna Species

The site supports a diversity of fauna, with habitat features, such as wetlands supporting a range of wetland/waterfowl and wader specie.

Aves

Eight (8) avifauna, are listed within the Qld Nature Conservation Act as Endangered, Vulnerable or Near Threatened, are listed as being recorded within 5km of the site. Of these one (1) the Black Necked Stork listed as 'near threatened' was recorded during survey works.

Two species, recorded on site are listed as Migratory Marine Birds under the EPBC Act, these being the Ardea alba (Great Egret) and the Ardea ibis (Cattle Egret), resident populations of each species can be found on the Gold Coast and Moreton Bay Marine Park.

Two species listed as a Migratory Terrestrial Species under the EPBC Act, being Merops ornatus, the Rainbow Honeyeater and Haliateetus leucogaster, Whit-bellied Sea Eagle were also observed. Again both these specie have a resident population on the Gold Coast and Moreton Bay Marine Park. In the case of the Whit-bellied Sea Eagle an active nest site for the species is opposite the site, north of Oakey Creek.

Four species, identified on site, are listed as Migratory Wetland Species under the EPBC Act, including the previous identified Great and Cattle Egret. The other two (2) species being the Sharp-tailed Sandpiper (Calidris acuminate) and Red-necked Stint (Calidris ruficollis).

Including those six (6) species identified above a further two species recorded on site are listed in the EPBC Act as a 'Listed Marine Species'. These additional specie are the Red Capped Plover (Charadrius ruficapillus) and Black-winged Stilt (Himantopus himantopus).

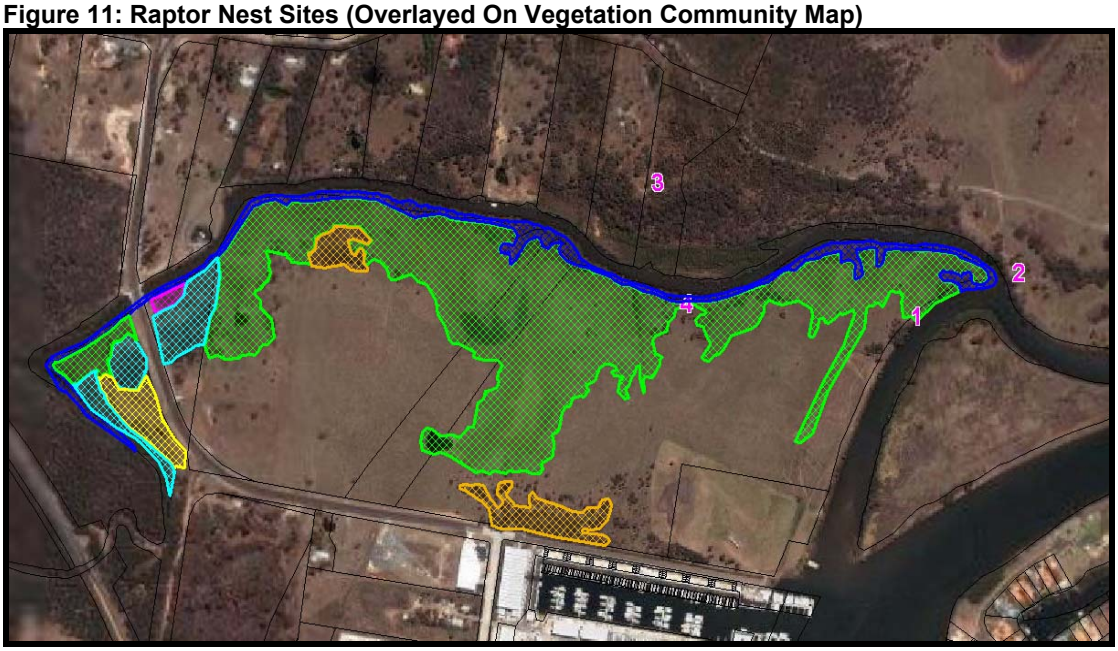
The EPBC Act protected matters search has identified a total of 43 Threatened Species, 49 Migratory Species and 83 marine Species as potentially occurring or suitable habitat for the species occurs. Of these ten (10) are threatened avifauna, and forty one (41) are Migratory aves species. Of the Marine Species forty seven (47) are avifauna.

Raptor nests

Four trees containing five typical raptor nests (stick platforms) were recorded proximate to the site although many more are known to occur within the local area (per. obs.). The location of these trees is displayed in Figure 26 below:

1. One nest noted in a Blue Gum on the west bank of the Coomera River [not recorded being utilized during the survey period. Brahminy Kite noted being perched in the tree during survey]
2. Two nests noted in a Blue Gum north of the Oaky Creek/Coomera River confluence [both nests utilized by Whistling Kites]
3. One major platform nest noted in a stag north of Oaky Creek [nest utilized by White-bellied Sea-eagle]
4. One small nest noted in a Blue Gum on the south bank of Oaky Creek [not recorded being utilized during the survey period]

Figure 11: Raptor Nest Sites (Overlayed On Vegetation Community Map)



Amphibia

No amphibians listed as rare, vulnerable or endangered within the Qld Nature Conservation Act 1992 or EPBC Act were recorded on site.

One species listed under the Qld Nature Conservation Act and one species listed within the EPBC Act are listed as potentially occurring these species are unlikely to occur or be significantly impacted upon.

Repitilia

A total of eight (8) reptile species were recorded on the subject site.

No reptiles listed as rare, vulnerable or endangered within the Nature Conservation Act 1992 or EPBC Act were observed on site.

The EPBC Act Protected Matters Search Report indicates the presence of eight (8) federally listed rare and threatened reptile species within the sub-region (5-kilometre radius). Six (6) of these are marine turtles and addressed separately within the FRC Aquatic ecology Report prepared by FRC. Of the remaining two these are unlikely on site due to the absence of preferred habitat.

Mammalia

A total of twenty-three (23) mammal species, including seven (7) introduced specie, were recorded on the subject site. One threatened species listed under the EPBC Act was recorded on site, this being the Grey headed Flying fox. A discussion on the recorded and or listed scheduled threatened species is provided below:

No mammals listed as rare, vulnerable or endangered within the Qld Nature Conservation Act 1992 were recorded on site.

The Qld Nature Conservation Act 1992 lists two specie as being recorded within 5km of the site these were not recorded and unlikely to be affected.

The EPBC Act protected matters search lists and additional seven (7) terrestrial mammals as potentially occurring a review of the habitat and specie requirements has concluded they are unlikely to be significantly affected.

Environmental Corridors and Core Habitats

Areas of State Significance

Wildlife corridors can be defined as ‘retained and/or restored systems of (linear) habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation’ (Wilson & Lindenmayer, 1995). Corridors can assist ecological functioning at a variety of spatial and temporal scales from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographically regions (Parsons Brinkerhoff, 2005).

Corridors serve a number of different functions in terms of biodiversity conservation including:

- providing increased foraging area for wide-ranging species
- providing cover for movement between habitat patches, particularly for cover dependent species and species with poor dispersal ability and enhancing the movement of animals through sub-optimal habitats
- reducing genetic isolation by maintaining continuity between sub-populations in a metapopulation and thereby preventing and /or reversing localised extinction
- facilitating access to a mix of habitats and successional stages to those species which require them for different activities (for example, foraging or breeding)
- providing refuge from disturbances such as fire
- providing habitat in itself (Wilson, A. & Lindenmayer 1995; Lindenmayer, 1994; Bennett, 1999).

How species use the corridor network will depend largely on the home and activity ranges of the species, their habitat requirements and the ecological characteristics of the corridor. For example, some large or mobile species may make direct movements through the corridor network, moving from one patch of habitat to another. These direct movements may be on the scale of a foraging expedition or a migration (Bennett 1990b).

Other species may have movements by single individuals punctuated by pauses in the corridor, which can last anything from a small foraging or resting bout to weeks and even months. If the corridor contains sufficient resources to maintain a population, then continuity through the corridor may be through gene flow through the resident population (Bennett 1990b; Wilson, A. & Lindenmayer 1995).

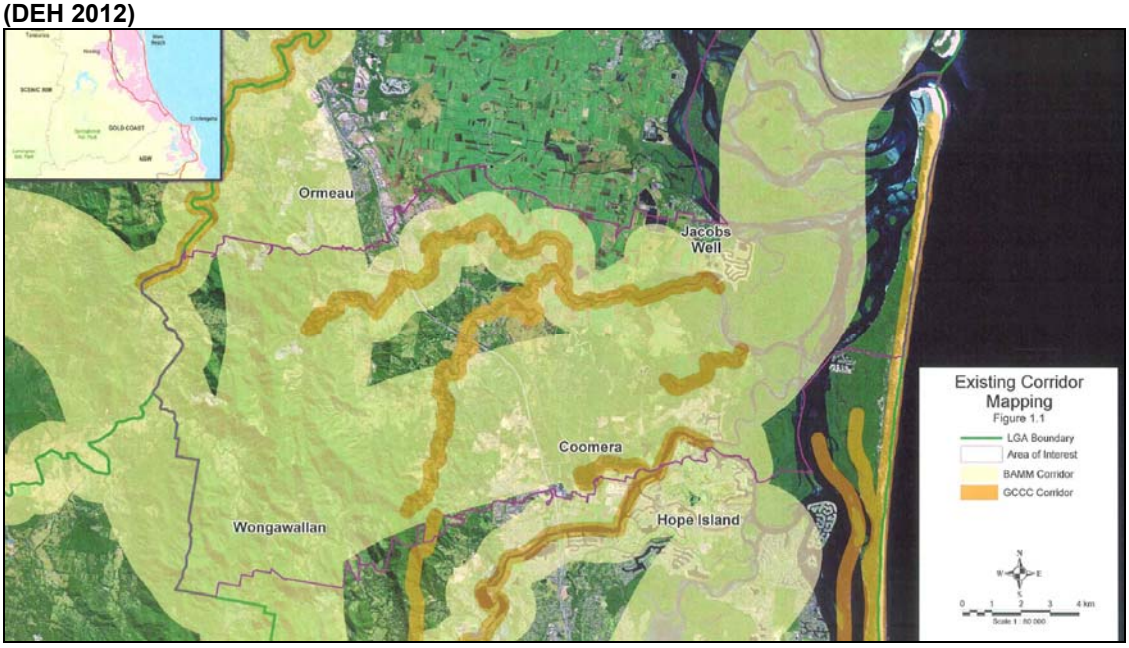
For example a mobile species with a large home range (i.e. koala) may regularly traverse a corridor to move between favoured feeding grounds or in attempt to access mates, whereas a species with a comparably minor home range (i.e. antechinus) may spend its entire life within a portion of the same corridor.

Within Queensland, the State Biodiversity Assessment and Mapping Methodology (BAMM) has been prepared to provide a consistent approach for assessing biodiversity values at the landscape scale using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis.

The existing BAMM corridor mapping is presented within Figure 12 and sourced from the ‘Southern Moreton Bay to Wongawallan – Bioregional Corridor Study’ prepared for GCCC.

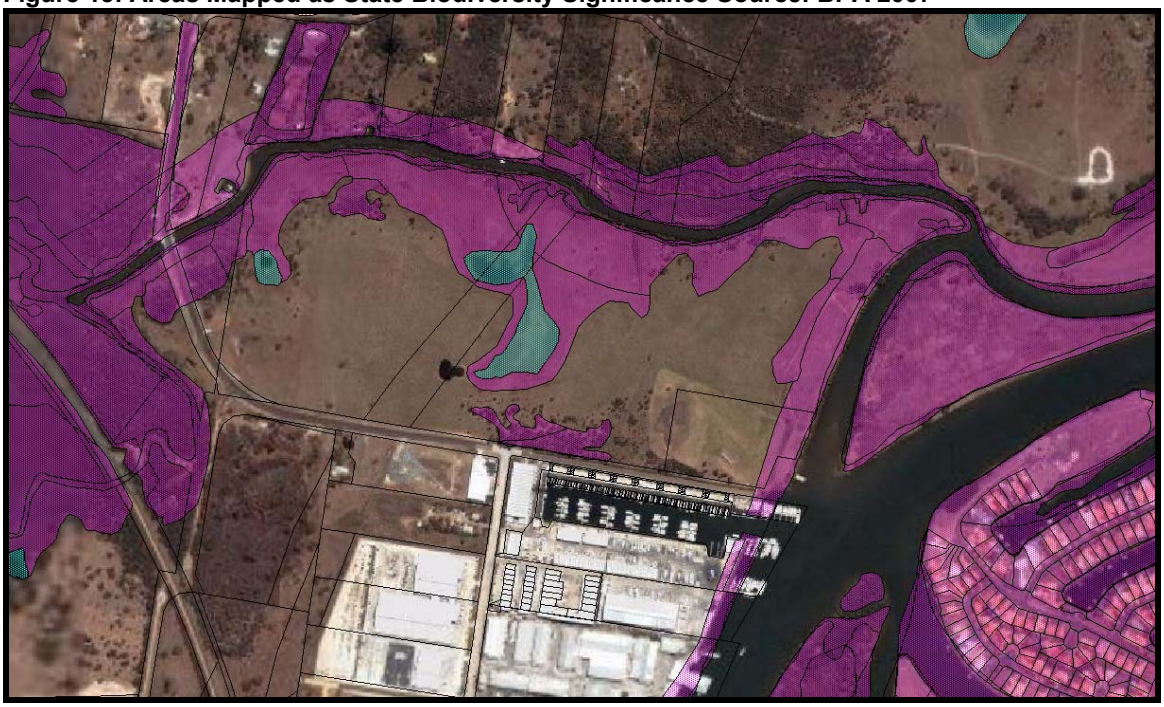
This study which examined the corridors route identifies that the presence of the Coomera Town Centre prohibited the corridor from traversing this area. The study realigns the east west bioregional corridor to the interurban break area north of the designated urban footprint and Coomera.

Figure 12: Extract Queensland Coastal Plan (HES) mapping – Centred on Lot 98 SP 150731 (DEH 2012)



The Assessments identify three levels of Biodiversity Significance – State, Regional and Local – based on a number of data queries that simultaneously integrate an array of information for a bioregion. It is noted that the native vegetation communities of the site are mapped as 'state significant habitats' located within a bioregional corridor aligned with the major (Oakey Creek, Coomera River) waterway systems (Figure 28).

Figure 13: Areas Mapped as State Biodiversity Significance Source: BPA 2007



As can been seen this correlates with the mapped estuarine and palustrine wetlands, represented by RE 12.1.1, 12.1.2, 12.1.3 and 12.3.5 occurring on site and mapped as Communities 1 – 3.

As mentioned above the Coastal Plan also correlates with this area in its HES mapping.

Gold Coast City Council Local Areas of Significance

The Planning Strategy is the broad citywide strategy adopted by the Planning Scheme to achieve ecological sustainability. The Planning Strategy is therefore be used to assist in assessing applications for impact assessment by providing the assessment manager with a broad context within which to determine whether there are sufficient planning grounds to justify a decision.

The Scheme states the 'Planning Strategy will be particularly useful for impact assessable applications that conflict with the detailed assessment codes. In many other cases, it is envisaged that compliance with the detailed assessment codes will reflect compliance with the broader strategies upon which they have been based.'

The Planning Strategy contains two major components:

- 15 Key Strategies that apply across the entire City; and

- 18 Land Use Themes that apply to particular parts of the City.

The Key Strategies are the major citywide policy initiatives necessary to advance ecological sustainability within the City.

The Land Use Themes indicate, for major areas of the city, the generalized mix of land uses that is considered to be desirable to implement the DEOs and Key Strategies.'

Key Strategies

The Planning states 'The basic elements of the natural environment, the economy and the community are developed in the Planning Strategy through 15 key strategies. These strategies individually consider the most important aspects of life of Gold Coast City, from a land use perspective.' These principal strategies apply to the whole City. They are used to inform the selection and arrangement of Land Use Themes.

The Gold Coast Planning Scheme states 'The basic elements of the natural environment, the economy and the community are developed in the Planning Strategy through 15 key strategies. These strategies individually consider the most important aspects of life of Gold Coast City, from a land use perspective.'

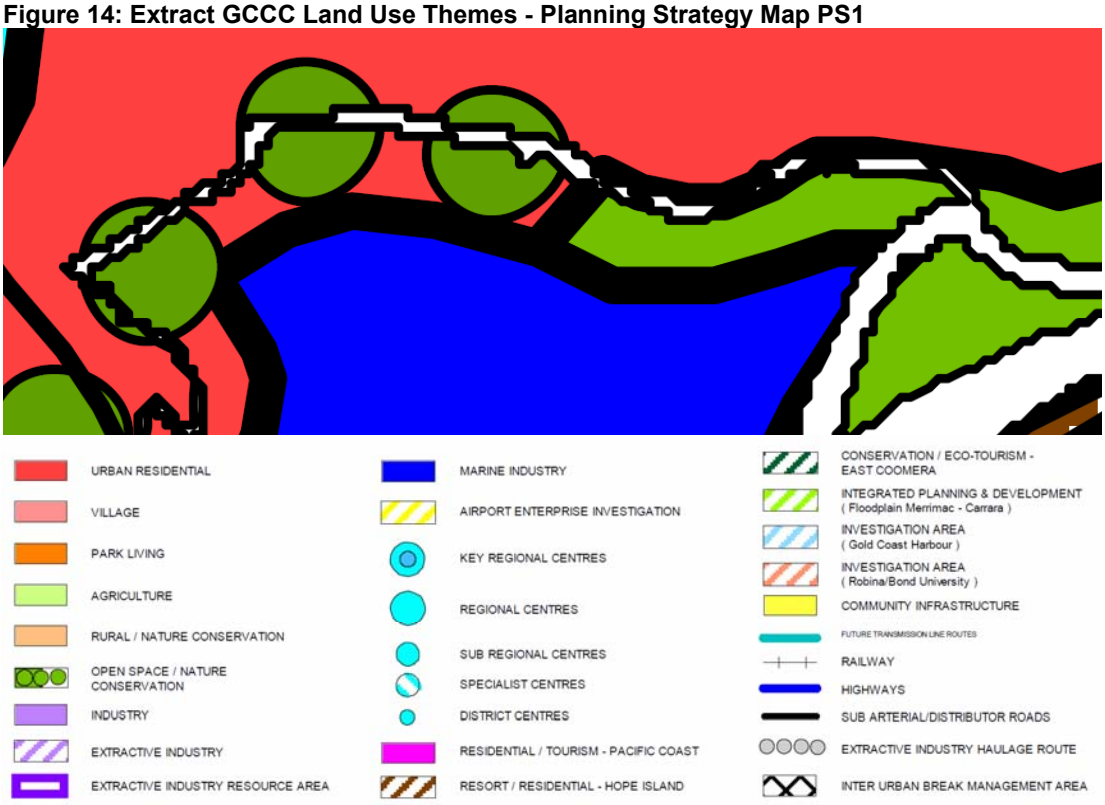
These principal strategies apply to the whole City. They are used to inform the selection and arrangement of Land Use Themes.

The Land Use theme mapping relevant to the site is presented below in Figure 15;

As can be seen the site is generally in definable by the defining waterways to the north east and west. The site is principally identified for Marine Industry. We note the site does not have an Open Space / Nature Conservation designation to the Coomera River. We note the eastern section of Oakey Creek is nominated as Open Space Nature Conservation whilst the balance area is shown as a linkage with an Urban Residential underlay.

Based on the above discussion, it can be summarized that the site is not identified primarily for any conservation/open space uses.

Figure 14: Extract GCCC Land Use Themes - Planning Strategy Map PS1



Of particular relevance to the proposal is the Nature Conservation Strategy which provides a wide range of measures to assist both Council and the community to protect and manage the City's most valued natural assets.

These measures range from the use of statutory instruments, such as Local Laws and Planning Scheme provisions, through to voluntary arrangements between Council and landholders.

The Planning Strategy reflects those elements of the Nature Conservation Strategy that identify Planning Scheme measures as the appropriate mechanism, to protect the City's valuable natural assets.

Figure 15 below provides an extract from Planning Strategy Map 3 – the Nature Conservation Strategy. As can be seen from this the site is affected by the Major Linkages (Water Based) designation to the Coomera River. Minor existing 1994 remnant vegetation (and other Natural Systems) within the City are also evident.

Figure 15: Extract GCCC Nature Conservation Strategy - Planning Strategy Map PS3

From a review of these two guiding documents some conflict is evident with the conservation strategy focused to the Coomera River linkage, whilst the land use theme mapping identifies open space designations to Oakey Creek.

The Scheme states in regard to Major Linkages (Water Based) that 'These areas have been identified as a functioning ecological network which provide linkages and corridors between the large habitat systems and key isolated remnants, and between coastal and inland areas.

They play an essential role in maintaining connectivity between different ecosystems and landscapes, and provide corridors for fauna movement. Major Linkage (Water Based) areas also contribute to the protection and maintenance of water quality.

It is of critical importance that these ecological connections be sustained in the long term. During Development, emphasis will therefore be placed on retaining

existing vegetation, rehabilitating degraded areas, and avoiding the construction of barriers to fauna movement.'

GCCC Bio Regional Corridor

A revision document to the Nature Conservation Strategy, the Nature Conservation Strategy 2009 – 2019 (NCS) has recently been released.

This document identifies the need to develop and implement corridor plans for the Southern Moreton Bay - Pimpama - Wongawallan which is also noted as being a critical corridor. This bioregional 'Hinterland – Coast' corridor is identified as including the subject site.

The Southern Moreton Bay - Pimpama - Wongawallan Bio Regional Corridor Study October 2009 identifies that the bioregional corridor through Coomera is not achievable. It notes committed development precludes establishing a bioregional corridor in this location and a more northerly regional corridor will be pursued.

Fish Habitat Areas

Fish Habitat Areas (FHAs) are declared under the *Fisheries Act 1994* (Fisheries Act) to enhance existing and future fishing activities and to protect the habitat upon which fish and other fauna depend. They predominantly cover inshore and estuarine habitats, as these are recognised as being highly valuable habitats for commercially and recreationally important fish and crustaceans. While normal community use and activities (including legal fishing activities) are not restricted in FHAs, any works or activities requiring the disturbance of habitats within an FHA require a specific permit under the provisions of the Fisheries Act.

Each declared FHA is classified as Management level A or B. Management level A is designed to protect critical fish habitat for the purpose of productive and sustainable fishing, short and long term, maintain the ecological character and integrity of undisturbed fisheries habitat and maintain the biodiversity of fisheries resources. Management level B is designed to protect important fish habitat for the purpose of productive and sustainable fishing, short and long term, minimise the impacts of non-fisheries related disturbance to important fisheries habitat, maintain biodiversity of fisheries resources, and provide a management buffer to Fish Habitat Areas A.

There are two FHAs in the vicinity of the proposed GCIMP development: the Coomera FHA (Management level B) and the Jumpinpin-Broadwater FHA (Management level A). The proposed development site is approximately 1.09 km

AMTD from the Coomera FHA and 9.14 km AMTD from the Jumpinpin-Broadwater FHA.

The Coomera FHA was originally declared in 1983. The area (607 ha) contains *Avicennia* and *Rhizophora* zones along the estuary and tidal creeks as well as scattered seagrass beds and saltmarsh, and supports populations of bream, estuary cod, flathead, garfish, luderick, mangrove jack, sea mullet, tailor, whiting, banana prawns, eastern king prawns and bay prawns.

The Jumpinpin-Broadwater FHA contains a unique system of islands and complex estuarine deposits that has valuable mangrove (*Avicennia* and *Rhizophora*) dominated estuaries, dense to sparse seagrass beds (*Zostera* and *Halophila*), channels, an extensive delta, and sandy shoals (Beumer et al 1997). The Jumpinpin-Broadwater FHA was gazetted to protect seagrass meadows and shallow estuarine areas supporting local valuable commercial and recreational fish and crab fisheries. The region is also known to support an important bream spawning area. Estuary cod, flathead, jewfish, mangrove jack, school mackerel, sea mullet, snapper, tailor, whiting, eastern king prawns, bay prawns, oysters, mud and sand crabs are also known to inhabit the area.

Further Detail

Detail pertaining to development impacts upon Sensitive Environmental Areas and any proposed avoidance, mitigation, management and offset measures are contained in the Matters of National Environmental Significance Report prepared by Planit Consulting, the Aquatic Ecology Report prepared by FRC Environmental, the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting and the Offset Options Report prepared Herron Todd White Earthtrade contained in Appendix 6, 7, 8 and 9 respectively.

Terrestrial and Aquatic Ecology

Description of Existing Ecological Values

An ecological assessment of the area affected by the project should be undertaken. The level of assessment should be consistent with contemporary best practice standards for ecological assessment (e.g. the Gold Coast City Council Planning Scheme Policy 8 – *Guidelines for Ecological Assessments,* the EPA's *Biodiversity Planning Assessment Version 3.5*), including consideration of seasonality, potential for occurrence of significant species, rarity of species and the sensitivity of the species to disturbance.

Vegetation communities within the affected area should be described at an appropriate scale with mapping produced from aerial photographs and ground-truthing. A discussion of the significance of any native vegetation (including re-growth and restored areas in addition to remnant vegetation and vegetation that is on State Land) from a local, regional, state and national perspective should be included. Special landscape values of natural vegetation communities should be described including Regional Ecosystem descriptions of tidal and coastal wetland communities with a clearly mapped Highest Astronomical Tide line.

Existing information on plant species may be used instead of new survey work provided that the data are derived from surveys consistent with the above methodology and describe existing conditions.

- location and extent of vegetation types using the regional ecosystem type descriptions in accordance with the REDD.
- location of vegetation types of conservation significance based on regional ecosystem types and occurrence of species listed as protected plants under the *Nature Conservation (Wildlife) Regulation 1994* (Qld) and subsequent amendments, as well as areas subject to the *Vegetation Management Act 1999*.
- the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected area estate (national parks, conservation parks, resource reserves, nature refuges and conservation reserves under the *Land Act 1994* (Qld).
- any plant communities of cultural, commercial or recreational significance
- the location of any horticultural crops in the vicinity of the project area
- location and abundance of any exotic or weed species.

The occurrence of pest plants (weeds), particularly significant populations of declared plants under the *Land Protection (Pest and Stock Route Management) Act 2002* should be shown on a map at an appropriate scale. A weed management strategy will be required where pest plants are present.

The survey of terrestrial fauna occurring in areas affected by the project should describe broad distribution patterns in relation to vegetation, topography and substrate. Wildlife corridors and refugia on or adjacent to the project site should be identified and mapped. The existence of feral or exotic animals should be discussed.

A description of habitat requirements and the sensitivity of aquatic flora and fauna species to changes in flow regime, water levels and water quality in areas affected by the project should be described. This should include detailed mapping of the occurrence, health and density of aquatic flora and fauna within and adjacent to, the project site.

Where marine plants are proposed to be disturbed, a development approval under the *Sustainable Planning Act 2009* will be required. Marine plants in the vicinity of the project should be shown on a map of a suitable scale and the nature of the impacts should be discussed in detail. Description of marine plants should be undertaken in accordance with the relevant Department of Employment, Economic Development and Innovation operational policies.

Methodology used for flora and fauna surveys should be specified in the appendices to the report. Any existing information should be revised and comments provided on whether vegetation areas are degraded, cleared or affected in ways that would affect their environmental value. The EIS should indicate how well any affected communities are represented and protected elsewhere in the sub-region where the project occurs.

The following description of existing ecological values includes information pertaining to three separate ecological assessments. These include

- Aquatic Ecology Report prepared by FRC Environmental (Appendix 7);
- Terrestrial Flora and Fauna Assessment prepared by Planit Consulting (Appendix 8); and
- Matters of National Environmental Significance (NES) Report prepared by Planit Consulting (Appendix 6).

Aquatic Ecology

Vegetation Communities - Marine Plants

Under the *Fisheries Act 1994*, marine plants are defined as:

- plants that usually grow on or adjacent to tidal land, whether living, dead, standing or fallen
- the material of a tidal plant, or other plant material on tidal land, and
- a plant, or material of a plant, prescribed under a regulation or management plan to be a marine plant.

Tidal land is defined as all land below the theoretical level of highest astronomical tide (HAT). Plants of high significance to fisheries are plants that usually grow on or adjacent to tidal land, including mangroves, seagrasses, marine algae, saltcouch and samphires. These are protected as marine plants, whether or not they are on tidal land (Couchman & Beumer 2007).

Plants that usually grow adjacent to tidal lands include some *Melaleuca* and *Casuarina* species. These plants are of value to fisheries productivity. In particular, *Melaleuca* communities adjacent to tidal areas that are either permanently or periodically tidally connected, and *Casuarina* stands that have salt couch or samphires in the understory, are protected under the *Fisheries Act 1994* (Couchman & Beumer 2007).

Consequently, to map marine plant communities on the proposed development site, the position of HAT was determined, and plant communities adjacent to and below this were mapped.

Estimation of Highest Astronomical Tide

The extent of tidal inundation over the proposed development site was mapped following methods adapted from Paul (2004) and the Surveyors Board of Queensland (2002). Tidal inundation was mapped on 12 January 2009, a fine day, with no rain the night before, and on a spring high tide, close to HAT. This tide was predicted to be 2 cm below HAT, however, it exceeded HAT by 5 cm.

Prior to the high tide, stakes were placed into the ground at the extent of tidal inundation, at approximately 10 m intervals. Stakes were continuously checked and repositioned as the tide came in, until the tide began to ebb at approximately 11:20 am. The positions of the stakes were recorded using a GPS (accurate to ± 4 m), and subsequently geo-referenced by Gassman Surveyors , and the data plotted using GIS software (*MapInfo*).

Approximately 2 ha within the transport corridor, and a further 24 ha of the

development site outside the transport corridor are tidally inundated. The footprint of the preferred development option (option 1) as well as options 2 and 3 cover approximately 16 ha of land that is tidally inundated.

Marine Plant Communities

The community structure and composition of marine plant communities were assessed on the proposed development site in September 2008 and December 2009, and on Foxwell Island in July 2010. The distribution and cover of seagrass and macroalgae were assessed along transects adjacent to the proposed development site, in Oakey Creek and the Coomera River on 16 October 2008, and in November 2010. Where seagrass was encountered, transects were continued along depth contours parallel to the shore to determine the extent of the patch. Presence and absence of seagrass, water depth and time were recorded at each point.

Marine plant communities were classified according to their Regional Ecosystem (RE), with sub-classifications following the coastal wetlands of southeast Queensland mapping and survey program (Dowling and Stephens 1999, 2001), and the definition of marine plants under the *Fisheries Act 1994*. The categories used are summarised in the table below.

Table 6: Marine Plant Communities, Equivalent RE Categories, and Coastal Wetland of South East Queensland Categories

Marine Plant Community	Coastal Wetland Category	RE
Avicennia marina and open and closed scrub of *Aegiceras corniculatum*, occasional *Bruguiera gymnorrhiza* and *Rhizophora stylosa*	1F(i) & 1F(ii)	12.1.3
Avicennia marina dominated communities	1B(i)	12.1.3
Saltmarsh dominated by *Sporobolus virginicus* – closed grassland	4A(i)	12.1.2
Samphire (saltmarsh dominated by *Sarcocornia* sp., *Suaeda* spp. dwarf open to closed shrublands)	3A(i)	12.1.2
Casuarina glauca with *Sporobolus virginicus*	5A(i)a, 5A(i)b, 5A(ii)a & 5A(ii)b	12.1.1
Casuarina glauca without *Sporobolus virginicus*	5A(i)a, 5A(i)b, 5A(ii)a & 5A(ii)b	12.1.1
Melaleuca quinquenervia with *Sporobolus virginicus*	N/A	12.3.5
Sedgeland dominated by *Schoenoplectus littoralis* and *Juncus kraussii*[1]	6A(ii)	12.1.2
Seagrass and macroalgae	NA	NA

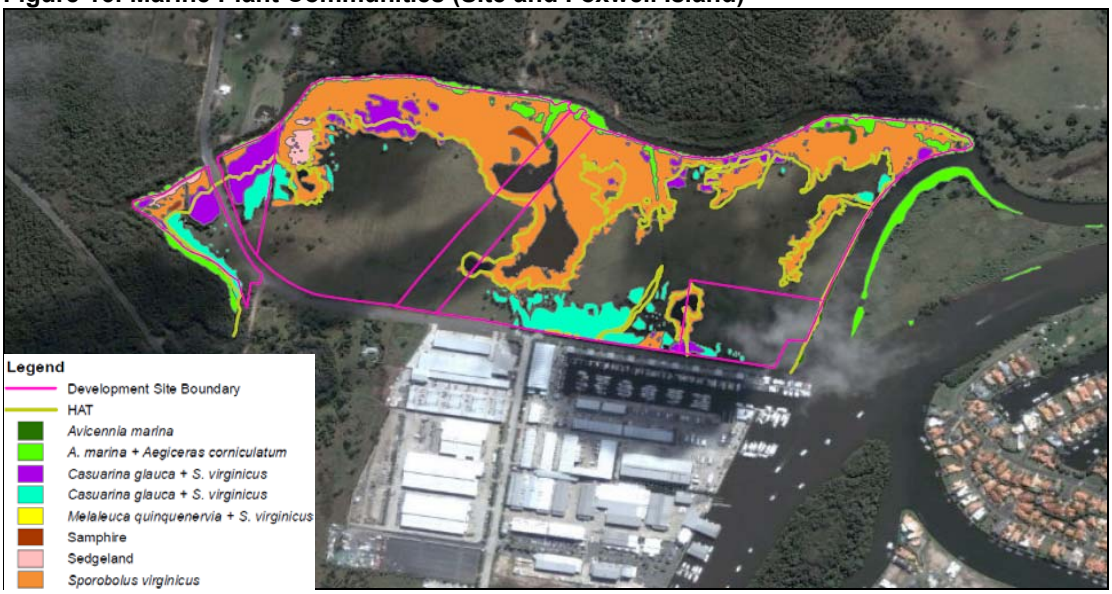
[1] Note, these communities above HAT are not considered to be marine plant communities.

The boundaries of marine couch (*Sporobolus virginicus*), coastal swamp oak (*Casuarina glauca*), and paper barked tea-tree (*Melaleuca quinquenervia*) were marked using a GPS (accurate to ± 4 m). In addition, vegetation type was marked at regular intervals along transects perpendicular to the shore, and when changes in community structure or health were noted.

Data points and field survey data were overlain onto rectified aerial photographs using GIS software (*MapInfo*). Maps of the vegetation communities were created from this data, and from the interpretation of aerial photography. Please refer to the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7.

Marine plant communities cover approximately 40% of the site as shown in Figure 7 below.

Figure 16: Marine Plant Communities (Site and Foxwell Island)



Mangrove communities dominated by *Avicennia marina* line the foreshore of Oakey Creek, with an extensive community of marine couch (*S. virginicus*) landward. There is also a narrow band of mangroves, dominated by *A. marina* along the foreshore of the Coomera River and along the western and northern foreshore of Foxwell Island.

In the middle of the site there is a brackish pond surrounded by marine couch that extends almost to the southern border. These communities are predominantly below HAT. There are also scattered patches of *C. glauca* on the site, and a small area of *M. quinquenervia*. Further detail is provided in the Table below.

Table 7: Area (hectares) of marine plant communities within the site and within each development footprint (above and below HAT)

Marine Plant Community	Total Area	Option 1	Option 2	Option 3	Option 4	Option 5	Transport corridor
Below HAT							
Avicennia marina	0.45	0.38	0.38	0.35	0.21	–	–
Avicennia marina with *Aegiceras corniculatum*	2.96	0.86	0.86	0.86	0.39	–	0.10
Samphire	0.14	0.11	0.11	0.11	–	–	–
Sporobolus virginicus	16.09	10.71	10.71	10.33	5.63	–	0.68
Sedgeland	0.52	0.34	0.34	0.34	0.01	–	–
Casuarina glauca with *Sporobolus virginicus*	1.80	0.87	0.87	0.85	0.13	–	–
Casuarina glauca without *Sporobolus virginicus*	0.13	0.07	0.07	0.07	0.06	–	–
Melaleuca quinquenervia with *Sporobolus virginicus*	0.01	–	–	–	–	–	–
Total Below HAT	**22.10**	**13.34**	**13.34**	**12.91**	**6.43**	**0.00**	**0.78**
Above HAT							
Sporobolus virginicus	2.95	2.77	2.77	2.63	2.10	–	0.08
Casuarina glauca with *Sporobolus virginicus*	1.51	0.97	0.97	0.85	0.39	–	–
Melaleuca quinquenervia with *Sporobolus virginicus*	0.03	–	–	–	–	–	–
Total Above HAT	**4.49**	**3.74**	**3.74**	**3.48**	**2.49**	**0.00**	**0.08**

Value of Marine Plant Communities

At each survey point assessed in September 2008, December 2009 and July 2010, the marine plant communities were also qualitatively assessed for their relative value to aquatic ecology and fisheries. The abundance of crabs or crab burrows was used as an indicator of the ability of the site to support marine fauna.

The availability of physical habitat for fauna, the amount of human or cattle disturbance, the ponding of water, and the relative proximity of each point to permanent water at low tide (to assess the likely frequency of tidal inundation) were also assessed. Categories used to describe the habitat value of marine plants to aquatic ecology and fisheries are described in the tables below.

Table 8: Qualitative Assessment Categories for Marine Plant Values to Aquatic Ecology and Fisheries (Excluding Seagrass and Macroalgae)

Value	Criteria
Excellent	High abundance of fauna / crab burrows present, very complex structural habitat for fauna, likely to be regularly inundated
Very Good	High abundance of fauna / crab burrows present, complex structural habitat for fauna, likely to be regularly inundated, but some disturbance
Good	Some fauna / crab burrows present, periodical tidal inundation, some structural habitat for fauna provided, little anthropogenic disturbance
Fair	Low abundance of fauna / crab burrows, habitat is disturbed, little structural habitat provided to fauna, infrequent tidal inundation
Poor	Little to no fauna present, poorly flushed, little / no structural habitat provided to fauna, habitat is heavily disturbed, infrequent or no tidal inundation, only opportunistic species present

Table 9: Qualitative Assessment Categories for Seagrass and Macroalgae Values to Aquatic Ecology and Fisheries

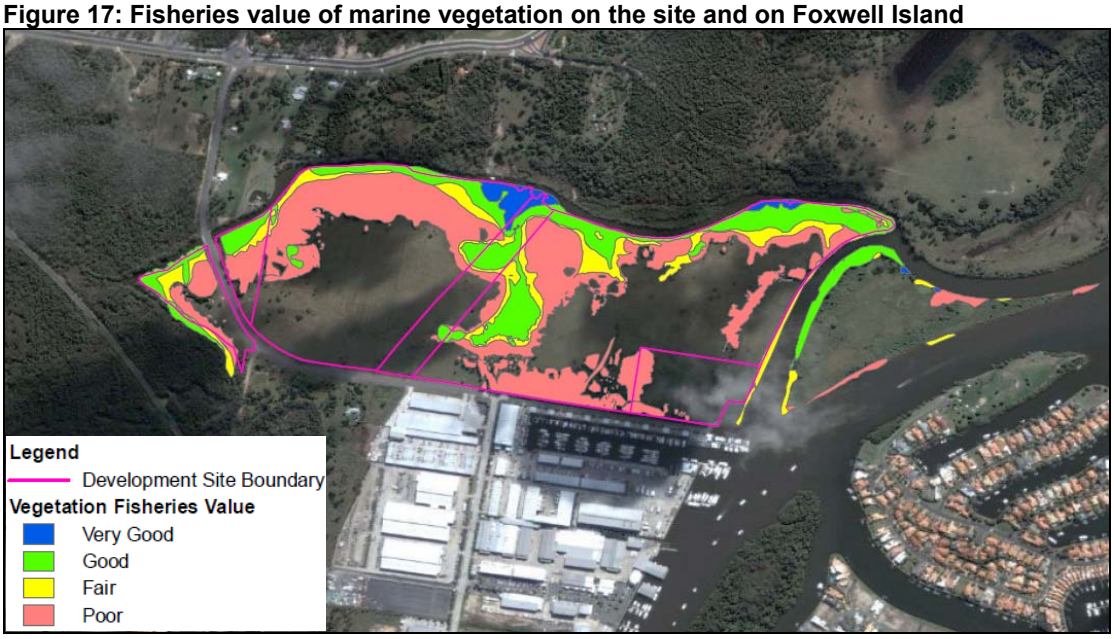
Value	Criteria
Very good	High percent cover and biomass of seagrass, offering complex structural habitat for fauna, proximal to mangroves, high densities of fauna / crab burrows and no damage such as burning or discolouration
Good	Moderate percent cover and biomass of seagrass, offering good structural habitat, proximal to mangroves, moderate densities of fauna / crab burrows and little damage evident
Fair	Moderate percent cover and biomass of seagrass, offering some structural habitat, proximal to limited mangroves, some fauna / crab burrows and some damage evident
Poor	Low percent cover and biomass of seagrass, offering little structural habitat, distal to mangroves, few fauna / crab burrows and damage evident
Very poor	Very low percent cover and biomass of seagrass, offering very little structural habitat, distal to mangroves or mangroves absent, very few fauna / crab burrows with only opportunistic species present and extensive damage evident

Most of the marine plant communities on the proposed development site are of relatively poor value to fisheries, as they are rarely inundated, support few crab burrows, have a low, sparse canopy (providing little shelter), and are grazed by cattle, which damages the vegetation and results in 'pug holes' or hoof depressions in the substrate (altering the inundation regime). Marine plant

communities above HAT, such as *S. virginicus* and *C. glauca* with *S. virginicus,* are also of poor value to fisheries as they are very rarely inundated, however, these areas provide detritus (leaf litter) to nearby marine systems.

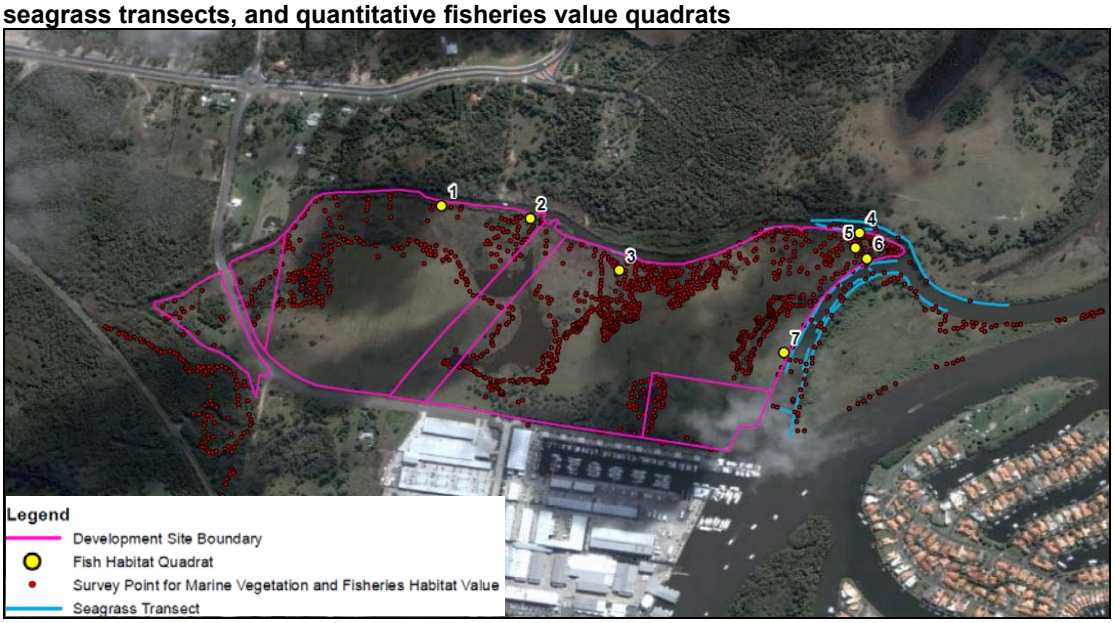
Marine plant communities of fair and good value to aquatic ecology and fisheries cover much of the tidally inundated area of the site, and the western edge of Foxwell Island. Marine plant communities with a very good value to aquatic ecology and fisheries cover a relatively small area along the Oakey Creek foreshore. Please see Figure 17 below.

Figure 17: Fisheries value of marine vegetation on the site and on Foxwell Island



To support the qualitative assessment, and to provide a baseline for further assessments, the value of marine plant communities to aquatic ecology and fisheries were assessed quantitatively at seven randomly selected sites dominated by saltmarsh in September 2008. These are shown in Figure 18 below.

Figure 18: Location of sites surveyed for marine vegetation and qualitative fisheries value, seagrass transects, and quantitative fisheries value quadrats



At each site, the following variables were recorded in five 0.25 m^2 quadrats:

- the height of pneumatophores and saltmarsh
- % coverage of leaf litter
- % coverage of large debris (e.g. fallen branches)
- the number of active large (> 25 mm), medium (11 – 25 mm)
- and small (< 10 mm) burrows
- abundance and diversity of visible molluscs, and
- abundance and diversity of visible crabs.

The average and standard error (s.e.) for each indicator were calculated for each site. The relevance of each indicator is discussed in further detail below.

Sites 1, 5 and 6 were in areas of *S. virginicus* that were qualitatively assessed as having good value to aquatic ecology and fisheries. Sites 1 and 5 had a relatively high canopy height of 25 – 38 cm, a relatively high abundance and taxonomic richness of either crabs or molluscs, a moderate number of burrows, a low cover of leaf litter (0 – 12%) and a low to moderate cover of large debris (0 – 6%). Site 6 had a moderate canopy cover (15 cm), no crabs, a low abundance but a high diversity of molluscs, a moderate number of large burrows, cover of leaf litter (14%) and cover of large debris (2%).

Sites 3 and 7 were in areas that were qualitatively mapped as fair value to aquatic ecology and fisheries. These sites had a moderate canopy height of 6 – 14 cm. Site 3 had a relatively moderate abundance and taxonomic richness of crabs and molluscs, a low number of burrows, a relatively high cover of leaf litter (26%) and

low cover of large debris (3%). While site 7 had no molluscs or large debris, it had a moderate abundance and taxonomic richness of crabs, a relatively high number of burrows and a moderate cover of leaf litter (2%).

Site 4 was in areas that were qualitatively mapped as poor fisheries value to aquatic ecology and fisheries. This site had the lowest canopy height of 2 cm, no crabs or molluscs present, but the highest number of burrows. There was also a low to moderate cover of leaf litter (5%) and large debris (2%).

Site 2 was in an area that was qualitatively mapped as very good to aquatic ecology and fisheries. This site had relatively high canopy height of 28 cm, a moderate abundance and taxonomic richness of crabs and molluscs, a moderate number of burrows, a high cover of leaf litter (23%) and moderate cover of large debris (3%).

In summary of the above, the value of the different areas of marine plant communities on the proposed GCIMP development site to aquatic ecology and fisheries was classified from poor to very good. The majority of marine plant communities on the proposed development site are of poor value to fisheries, as they are grazed by cattle and infrequently inundated. However there are marine plant communities of fair and good value to aquatic ecology and fisheries on the tidally inundated area of the proposed GCIMP development site as well as on the western edge of Foxwell Island.

Seagrass Communities near the Development Site

No seagrass communities were recorded along the foreshore of the development in either Oakey Creek or the Coomera River. However, there are patches of seagrass on the western shore of nearby Foxwell Island, dominated by a sparse band of *Halophila ovalis*. There are also some sparse patches of the wide morphotype of *Halodule uninervis* in this area. These beds are likely to be ephemeral, with area, density and depth distribution dependent largely on turbidity.

Benthic Macroinvertebrate Communities near the Proposed Development Site

Benthic macroinvertebrate communities in the vicinity of the site were relatively abundant and diverse and did not show signs of significant pollution, eutrophication or high turbidity and sedimentation rates.

Aquatic Habitats of the Benthos and Shoreline

Bare mud, mostly covered with detritus and/or unattached filamentous algae, was the dominant habitat type in the benthos area surveyed in the Coomera River. There were also some areas of bare sand, particularly on the upstream side of islands, and some very small and isolated areas of clay and rock.

There were also several isolated patches of seagrass, consisting of sparse *Halophila ovalis*. Most of the shoreline in the area surveyed in the Coomera River consisted of artificial walls and artificial walls with jetties. Vegetation, including grass and mangroves, also covered a large proportion of the foreshore.

Fish and Fisheries near the Proposed Development Site

Common fish of the region that are harvested include bream, whiting, flathead, tailor, sand crabs, mullet, snapper mackerel, cod, parrotfish, sweetlip, trevally, jewfish, dart, catfish, perch, luderick, coral trout, sole, emperor, squire, flounder, yellow tail and penaeid prawns. Although within Moreton Bay commercial fisheries contribute significantly to the local economy, less than five boats operate within the vicinity of the proposed development.

Species and Environments of Conservation Significance

Whilst a variety of marine mammals and reptiles of conservation significance may use the waterways adjacent to the site, the area is unlikely to provide significant habitat to them. Dolphins may enter the Coomera River to feed, however their presence is likely to be transient, reflective of the distribution of prey fishes. Dugongs are likely to be infrequent visitors to the area, as there are no nearby food sources of significance. Turtles may swim through the area, but again there are no significant food sources for them in this area, so they are unlikely to be common.

The proposed development is approximately 3.3 km Australian middle thread distance (AMTD) upstream of the Moreton Bay Marine Park, and approximately 1.1 km AMTD from the Coomera River Fish Habitat Area (FHA) and 9.1 km AMTD from the Jumpinpin-Broadwater FHA. Coastal and tidal wetlands on, and in the vicinity of, the proposed development site are protected under a number of policies, codes and legislation.

Terrestrial Flora and Fauna

Planit Consulting conducted initial detailed site flora surveying between July and August 2008. Subsequent site inspections have been undertaken to update and validate these initial surveys on a regular basis, up to July 2012. As detailed in the Terrestrial Flora and Fauna Assessment contained in Appendix 8, there has been no discernible change in species diversity and distribution or community structure.

Detailed fauna surveying and site monitoring has also occurred initially between July and August 2008. Subsequent site inspections have been undertaken to update and validate these initial surveys on a regular basis, up to July 2012.

Repeat fauna surveying to that undertaken in 2008 was performed in September to October 2011. The site contains a semi permanent wetland community located centrally within the site and straddling the future IRTC site boundaries. As such, additional, periodic opportunistic surveying has occurred. This has been focused to recording avifauna and use of the central wetland and adjacent intertidal areas.

Specific surveying effort and techniques were also adopted in response to scheduled species potentially occurring. Results of flora and fauna surveys are summarised below and are detailed in the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8.

Flora

As a result of flora surveying five (5) vegetation communities/associations were identified on site and are described separately below. Of these Community 1 and 2 are further classified into an additional 2 sub communities. This sub description is based upon underlying geology in the case of Community 1 and species composition in regard to Community 2.

A flora species list and map to supplement the descriptions provided below, is contained within an attachment to the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8. From the surveying a total of 115 species were recorded.

Scheduled Species

One species of flora scheduled as vulnerable under the Qld Nature Conservation Act was observed on site. This species (*Macadamia tetraphylla*) was encountered in the SW corner of the site and will be retained in association with the proposed development.

Two (2) additional specie listed under QLD Nature Conservation Act *1992* are identified as being recorded within 5km of the site. These were not observed.

The EPBCA protected matters search listed fourteen (14) specie as potentially occurring on site these were not recorded.

Vegetation Communities and Regional Ecosystems

The communities identified from site are described below and are illustrated in Figure 10 below.

Community 1: Mid-High Open Forest/Forest (*Casuarina Glauca*),T6D/M

This community is identified as occurring from within four (4) locations on site. Of the mapped locations two (2) are noted as occurring on tidal substrates whilst the other two (2) are identified as occurring on alluvial.

The communities whilst displaying similarities are able to be distinguished as two differing types of the same vegetation type by the underlying geology.

Community 1A: Mid-High Open Forest/Forest (*Casuarina Glauca*),T6D/M On Tidal Mudflats

This community occurs in two discernible locations in the north-western portions of the site on areas mapped as containing tidal mudflats (i.e. land zone 1). This community was recorded principally from Lot 146 SP150731 and a small area of Lot 98 SP15073.

Approximately 2.1 ha of this community has been mapped on site

Community 1B: Community 1b: Mid-High Forest (*Casuarina Glauca*),T6DM On Alluvial Deposits

The mapped Casuarina Forests on Alluvium occur in two disjuct locations on site but principally occurring on Lot 98 SP150731. The larger of these is located along Shipper drive and grazing activities structurally affect floristic diversity in the community. The community is almost mono specific Casuarina glauca.

Community 2: Saltmarsh Communities

This community, of approximately 23ha, dominate the northern portions of the site and are located on tidal mud flats which are regularly inundated and are comprised of grasses, sedges and herbs which are tolerant to hypersaline

conditions.

During inspection most areas were noted to be wet underfoot with ponding up to 400mm noted proximate to Oaky Creek and associated mangrove lined channels. As the communities are contained within a grazing/fodder area, heavy trampling of the soil surface is evident.

A number of shallow dams and larger shallow water bodies are present within the Saltmarsh, as are numerous areas of exposed mud. Further detailed discussion on this community is contained within the FRC Aquatic Ecology report.

Community 2A: Very Tall Rushland (*Juncus Krausii*),V4M

This community is restricted to a small area of ~2000sqm in the NW corner of Lot 146 SP SP150731 adjacent to the recent Oaky Creek bridging work.
Vegetation consists of primarily tussocking Salt Rush (*Juncus kraussii*) to 1.2m in height. Associated species present in low abundance include Saltcouch (*Sporobolus virginicus*) and Samphire (*Sarcocornia quinqueflora*).

Community 2B: Low Closed Tussock (*Sporobolus Virginicus*) Grassland,G1D

This is the dominant of the two Saltmarsh Communities. Saltmarsh is the dominant species and is also the dominant ground-layer element within two remnant patches of Swamp oak Forest (refer Community 1 above). This community was recorded from all allotments including the future IRTC(Lot 35 SP150730.
This community is mapped as approximately 22ha.

Community 3: Low-Tall Open Forest/Woodland (*Avicennia Marina* + *Aegiceras Corniculatum*),T4M/S

This community is restricted to the northern and western boundaries of the site in association with the riverbanks of Oaky Creek. For the most part the association occurs as a thin remnant (3-10m in width) of shrubs and small trees lining the bank of Oaky Creek with numerous canopy gaps as a result of previous clearing. As indicated, detailed discussion on this community is provided in the FRC Aquatic Ecology report

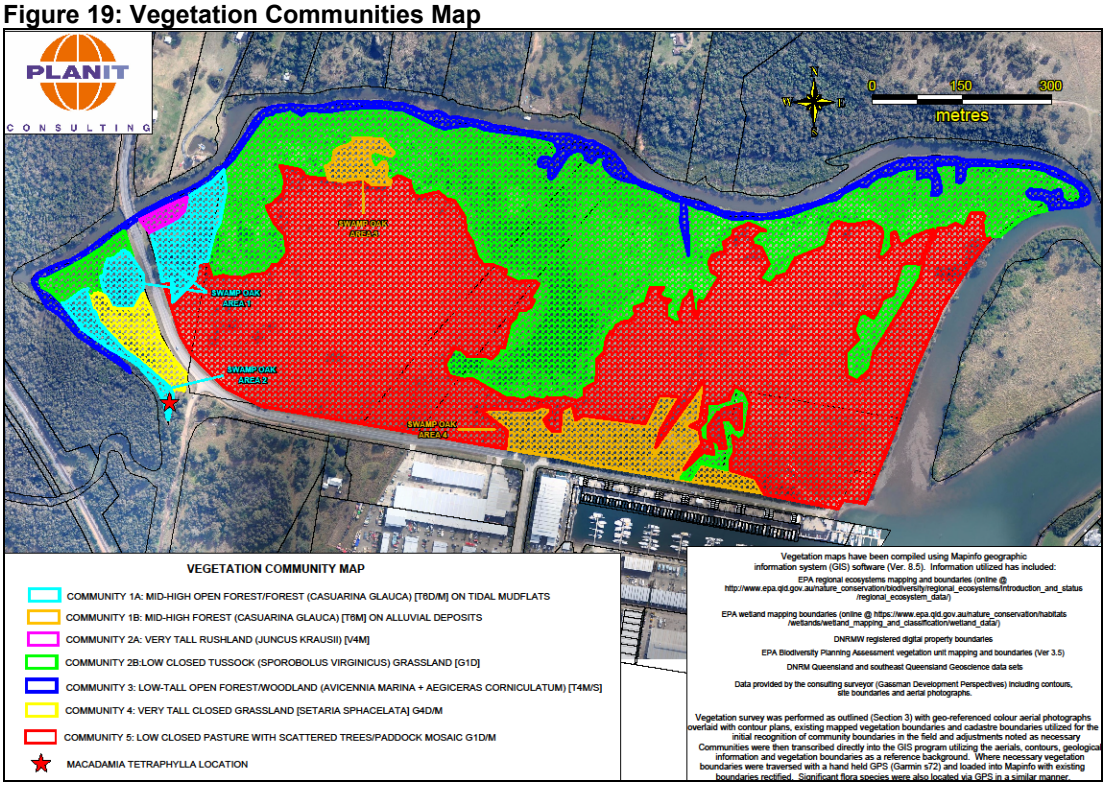
Community 4: Very Tall Closed Grassland (*Setaria Sphacelata*), G4D/M

This modified community occurs in Lot 146 SP150731within a previously grazed paddock which is no longer utilized for agistment following the severing of the site to facilitate the Shipper Drive extension and Oaky Creek bridge upgrade.

Community 5: Low Closed Pasture With Scattered Trees/Paddock Mosaic,G1D/M

This community is the most abundant community recorded on site, occurring in all allotments including the future IRTC allotment. The community, of approximately 36ha in area, dominates the southern portions of the site where previously occurring woodland/forest communities have been cleared for pastoral lands. Whilst scattered remnant and juvenile trees remain, all areas are dominated by pasture grasses and weeds which are grazed by resident cattle and horses.

Figure 19: Vegetation Communities Map



Regional ecosystem mapping identifies 4 distinct ecosystem types as occurring on site. A significant portion of the site is not covered by a regional ecosystem reflective of its predominately cleared nature. A fifth ecosystem type is also identified from the onsite surveying.

Of the various regional ecosystem types four are noted to be ‘of least concern’ and one is identified as ‘of Concern’. This ‘of concern’ RE is 12.1.1, Casuarina glauca open forest on margins of marine clay and mapped as Community 1A. A review of the GCCC Nature Conservation Strategy documents indicates the following:

- RE 12.1.1 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The Pimpama River Conservation Reserves Management Plan, dated January 2010 (PRCRMP) noting 51% of the remnant remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 934ha of the remnant was remaining.

- RE 12.1.2 – is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 66% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 559ha of the remnant was remaining.

- RE12.1.3 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 89% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 2,803ha of the remnant was remaining.

- RE 12.2.15 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as high. The PRCRMP estimates 98% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium, Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 57ha of the remnant was remaining.

- 12.3.5 - is represented in a series conservation reserve with the overall extent of the remnant in the city regarded as Very Low. The PRCRMP estimates 5% of the community remaining.

  The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003, prepared by Queensland Herbarium,

Queensland Government Environmental Protection Agency for Gold Coast City Council estimates that at 2001 341ha of the remnant is remaining.

We note these estuarine and palustrine habitat types are well represented and conserved in the network of marine and national parks within the immediate and broader coastal environment.

A summary of the various communities, the respective areas for each community, the mapping classifications of each community and status is provided in the table below.

Table 10: Mapped Vegetation Communities

Mapped Vegetation Communities			
Mapped Community	**RE Nos.**	**VMA Status**	**Approx. extent within site and DTMR allotment (hectares)**
COMMUNITY 1A: MID-HIGH OPEN FOREST/FOREST (*CASUARINA GLAUCA*) [T6D/M] ON TIDAL MUDFLATS	12.1.1	'Of concern' Estuarine Wetland	2.1564
COMMUNITY 1B: MID-HIGH FOREST (*CASUARINA GLAUCA*) [T6M] ON ALLUVIAL DEPOSITS	12.3.5	''Least Concern' Palustrine wetland	3.4788
COMMUNITY 2A: VERY TALL RUSHLAND (*JUNCUS KRAUSII*) [V4M]	12.1.2	'Least Concern' Estuarine Wetland	0.1946
COMMUNITY 2B:LOW CLOSED TUSSOCK (*SPOROBOLUS VIRGINICUS*) GRASSLAND [G1D]	12.1.2	'Least Concern' Estuarine Wetland	22.3774
COMMUNITY 3: LOW-TALL OPEN FOREST/WOODLAND (*AVICENNIA MARINA* + *AEGICERAS CORNICULATUM*) [T4M/S]	12.1.3	'Least Concern' Estuarine Wetland	2.801
COMMUNITY 4: VERY TALL CLOSED GRASSLAND [*SETARIA SPHACELATA*] G4D/M	N/A	Non-remnant community	1.00
COMMUNITY 5: LOW CLOSED PASTURE WITH SCATTERED TREES/PADDOCK MOSAIC G1D/M	N/A	Non-remnant community	35.8518
		TOTALS	**67.86**

Fauna

Fauna surveys revealed a variety of habitats including tidal and intertidal estuarine wetlands associated with Oakey Creek and the Coomera River, mudflats, creek channels, salt marsh, sedgelands, mangrove forest, open wetlands/dams and soft-sediment benthic habitats.

The site's location on the Coomera River and approximately 3.3km from the Moreton Bay Marine Park and the extensive network of Marina and National Parks provide a regional habitat complex for multiple species. The coastal setting / context of the site is reflected in the recorded wetland/waterfowl and wader specie recorded on site.

Aves

One Hundred (100) species of bird were recorded during surveys of the subject site and surrounding areas.

A review of the bird groupings, habitat condition of the study area and surrounds and the resultant species list has provided the following perspectives.

The avifauna assemblage occurring in the study area and surrounding areas is diverse and considered to be due largely to its position in the landscape between a major river (Coomera River) and creek system (Oakey Creek) and large habitat system centred on Coomera.

The sites relatively close proximity, 3 – 6km of two major estuarine habitats i.e. Moreton Bay Marine Park, McCoy's Creek and Lake Coombabah further influences the assemblage. These large conservation reserves provide habitat complexes similar to those occurring on site and a wider range of species have been recorded from these. The Bay provides habitat for over 3500 resident (Driscoll 1997), and over 40,000 migratory shorebirds, during the summer months (Driscoll 1993; Watkins 1993). Moreton Bay supports the third highest concentration of migratory waders in Queensland at approximately 10 percent of the state’s population (Driscoll 1993)’.

It was evident during survey that a significant proportion of the species recorded (including migratory waders, water birds, raptors, herons and flycatchers) were present mainly within the estuarine and palustrine areas of the Oakey Creek riparian zone and central wetland area.

Transient birds as a group (i.e. present due to seasonal movement and/or to utilize forage resources as part of daily movements through larger ranges [including

honeyeaters, cuckoos, whistlers, large raptors]) account for approximately twenty percentage of the assemblage.

Seasonal transient to migratory species (i.e. Spangled Drongo, Dollar Bird, Rainbow Bee-eater, Flycatchers, Cuckoos) are significant due to breeding in the local area as part of their life-cycle.

Parrot and cockatoo species are present as breeding populations in the local area.

Assessments of diet preferences of avifauna confirm that the study area and surrounds contains high feed value levels with the majority of birds recorded from the insectarivorous and nectarivorous guilds. Predatory birds are prevalent due to the overall diversity of habitat and foraging sources available.

In summary, the study area and general locality generated a diverse species list with the extended survey aimed to observe peak seasonal usage by migratory/transient species. The study area's geographical location appears to be situated at the confluence of broader movement corridors including estuarine, freshwater and topographical systems. This accounts for the large total bird counts comparative to the size of the study area and habitat present when considering the impact of prior land uses.

As noted the central wetland areas of the site does provide a roost function for a diversity of wetland / waterfowl species. This habitat is however affected by the future IRTC motorway which bisects the central wetlands. The central wetland areas are also affected by existing anthropocentric activities which reduces the value of these wetlands for more sensitive and migratory species.

Scheduled Species

Eight (8) avifauna, are listed within the Qld Nature Conservation Act as Endangered, Vulnerable or Near Threatened, are listed as being recorded within 5km of the site. Of these one (1) species listed as 'near threatened' pursuant to the QLD Nature Conservation Act 1992 was recorded during survey works. These are discussed further within the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8.

Two species, recorded on site are listed as Migratory Marine Birds under the EPBCA, these being the Ardea alba (Great Egret) and the Ardea ibis(Cattle Egret), resident populations of each specie can be found on the Gold Coast and Moreton Bay Marine Park.

Two species listed as a Migratory Terrestrial Species under the EPBCA, being Merops ornatus, the Rainbow Honeyeater and Haliateetus leucogaster, Whit-

bellied Sea Eagle were also observed. Again both these specie have a resident population on the Gold Coast and Moreton Bay Marine Park. In the case of the Whit-bellied Sea Eagle an active nest site for the species is opposite the site, north of Oakey Creek.

Four species, identified on site, are listed as Migratory Wetland Species under the EPBCA, including the previous identified Great and Cattel Egret. The other two (2) species being the Sharp-tailed Sandpiper (Calidris acuminate) and Red-necked Stint (Calidris ruficollis).

Including those six (6) species identified above a further two species recorded on site are listed in the EPBCA as a 'Listed Marine Species'. These additional specie are the Red Capped Plover (Charadrius ruficapillus) and Black-winged Stilt (Himantopus himantopus).

The EPBCA protected matters search has identified a total of 43 Threatened Species, 49 Migratory Species and 83 Marine Species as potentially occurring or suitable habitat for the species occurs. Of these ten (10) are threatened avifauna, and forty one (41) are Migratory species. Of the Marine Species forty seven (47) are avifauna.

Amphibia

A total of six (6) native frog and one (1) introduced toad species were recorded on the subject site. No amphibians listed as rare, vulnerable or endangered within the Nature Conservation Act 1992 or Environment Protection and Biodiversity Conservation Act 1999 were recorded on site.

Amphibian habitat within the site is mostly limited to the western dam (and adjacent grassland/casuarinas) with the balance areas occupied by heavily grazed pasture or areas subject to tidal influence (i.e. the amphibian permeable skin provides no protection against water loss via osmosis to a surrounding medium of saline water [Barker, Grigg & Tyles, 1995]).

Scheduled Species

One species listed under the Qld Nature Conservation Act and one species listed within the EPBCA are listed as potentially occurring these species are unlikely to occur or be significantly impacted upon.

Repitilia

The diversity of habitats for reptile species is considered reasonably low across the site due to limited diversification (i.e. relatively uniform relief, soil type, dominance of saltmarsh and pasture).

Typically reptile species require a large diversity of microhabitats (including vegetation structure, ground substrates, basking sites etc) and suitable shelter sites to regulate body heat.

Such components are crucial as reptiles require differing levels of microhabitat to regulate body heat which controls essential functions such as movement, digestion, respiration and breeding activity (Kaplan, 1996). Areas with higher structural diversity were limited to the western Swamp Oak Forest and Tall Closed Grassland.

Within the site reptile recordings were most common in this western area with three species of skink, water dragon, lace monitor and two tree snakes recorded. The grass skink, wall skink and red-bellied black snake were also recorded from the pasture and swamp oak zone. All of the recorded reptiles are considered to be of 'least concern' (Nature Conservation Act 1992) and common within the local area.

A total of eight (8) reptile species were recorded on the subject site. No reptiles listed as rare, vulnerable or endangered within the *Nature Conservation Act 1992* or EPBCA were observed on site.

Scheduled Species

The EPBC Act Protected Matters Search Report indicates the presence of eight (8) federally listed rare and threatened reptile species within the sub-region (5-kilometre radius). Six (6) of these are marine turtles and addressed separately within the FRC Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7. Of the remaining two these are unlikely on site due to the absence of preferred habitat.

Mammalia

A total of twenty-three (23) mammal species, including seven (7) introduced specie, were recorded on the subject site. One threatened specie listed under the EPBCA was recorded on site, this being the Grey headed Flying fox. A discussion on the recorded and or listed scheduled threatened species is provided below.

Ground-dwelling Mammals

All terrestrial mammals require vegetated cover for shelter and to facilitate movement. Small terrestrial mammals prefer areas within a complex vegetation structure which is dense within the lower strata and subsequently provides shelter/nesting sites and refuge from predators. Larger terrestrial mammals (larger wallabies, kangaroos) also generally require dense cover for refuge but tend to favour more open areas for grazing/feeding.

Suitable structural forest variation and/or dense understorey components were absent over the majority of the site due to the dominance of grazed grassland areas. The western Swamp Oak Forest and adjacent rank grasslands whilst dominated by weed growth and somewhat uniform in structure, provides potential refuge for small mammals.

Large Ground-dwelling Mammals (Macropods)

Two species of wallaby and one species of kangaroo were noted within the study area across all habitat types but in particular association with denser growth/pasture ecotones. Observation of the Grey Kangaroo noted a small mob of 9 animals, within the site and surrounds which utilize disturbed paddock areas of the site.

Small-medium Ground-dwelling Mammals

Small to medium sized ground dwelling mammals were common particularly within the area west of Shipper Drive which has, despite its areas of disturbance, greater structural diversity in the understorey and ground layers. A low diversity of small – medium ground-dwelling mammals was observed.

Arboreal Mammals

Arboreal mammals previously noted to occur within the vicinity of the site are all noted to be hollow dependent with the exception of the Koala and the Ringtail Possum (which does utilize hollows but will also construct leaf dreys) (Strahan eds, 2002; Gibbons and Lindenmayer, 2002). It is widely accepted that a reduction in senescent trees is a limiting factor in hollow dependent arboreal mammal populations (Smith and Lindenmayer, 1998; Gibbons and Lindenmayer, 2002; Lindenmayer, 2002; Lunney, 1987).

Within the site there exists a general paucity of hollow bearing trees (HBT) with associated Eucalypt Woodland/Open Forest also absent. The habitat value for hollow-dependent arboreal mammals is accordingly considered to be low.

Spotlighting, call playback/detection and trace analysis efforts over the site resulted only in the recording of the Brushtail Possum in the SW corner.

Flying Mammals

While suitable foraging resources for nectivorous bat species were located on the subject site, no evidence of roosting or breeding areas were recorded. The paucity of flowering species during the survey period (isolated blue gum only) resulted in minimal foraging resources for the mega-bats with only the Black and Grey-headed Flying Foxes noted. No roosting or flying fox camps were noted with the riparian zone with specific searches undertaken.

The Black and Grey-headed Flying-foxes were the only members of the megachiropteran bats recorded on the subject site feeding on Eucalypt and Melaleuca blossoms. The mega-bats require a continual source of blossom nectar and/or fruits for foraging throughout the year. In this regard the site provides limited food sources in the form of various flowering Eucalypt, Lophostemon and Melaleuca species.

Anabat Detection survey also recorded 4 micro-bat species within the study area.

Scheduled Species

One threatened species listed under the EPBCA was recorded on site, this being the Grey headed Flying fox.

During site survey works the Grey-headed Flying Fox was recorded foraging on flowering Blue Gums and is noted to be common within the local area as a result of large tracts of eucalypt and melaleuca forests providing favoured foraging resources. A thorough search of the Mangrove Forest/Woodlands areas did not reveal any roosting/camping sites.

The EPBCA lists an additional seven (7) federally listed threatened species within the sub-region (5-kilometre radius). It is acknowledged that the Koala has been listed under the EPBCA subsequent to the generation of the Protected Matters Search.

No species listed under the Qld Nature Conservation Act were observed. Two (2) species listed as Vulnerable are identified as having been recorded within 5km of the site. These species are the Koala and the False Water Rat. The Koala is unlikely to occur on site or be significantly affected by the proposal as the preferred habitat for the species is largely absent.

Potential Impacts on Ecological Values and Mitigation Measures

If the EIS is completed before the commencement of the draft *Queensland Coastal Plan*, this section must address mitigation measures as per policies 2.8.1 and 2.8.2 of the *State and SEQ Regional Coastal Plans*.

The EIS should address any actions of the project or likely impacts that require an authority under the *Fisheries Act 1994*, *Marine Parks Act 1994*, *Nature Conservation Act 1992* and/or would be assessable development for the purposes of the *Vegetation Management Act 1999*. The description should include all direct and indirect impacts on terrestrial and aquatic communities affected by the project. Objective and practical methods to minimise impacts on ecological communities should be identified. In particular, the EIS should describe:

- direct and indirect impact on regional vegetation ecosystems at the project site, including an evaluation of type and amount of vegetation clearing required for the project
- consideration for protecting vegetation communities on-site
- impacts the project may have on terrestrial fauna, wildlife habitat and other fauna conservation values, including direct and indirect impacts due to loss of habitat, food supply, nest sites, breeding/recruiting potential or movement corridors with reference to the current extent of protected vegetation of conservation significant within protected area estates as represented in the *Gold Coast City Vegetation Community Representation Report 2009: An action of the Nature Conservation Strategy 2009-2019 prepared by Chenoweth EPLA.*
- Reference should be made to the Vegetation Management Status and Biodiversity Status under the *Vegetation Management Act 1999*, including the status of remnant vegetation communities within the Local Government Area with reference to the *Gold Coast City Vegetation Community Representation Report 2009: An action of the Nature Conservation Strategy 2009-2019 prepared by Chenoweth EPLA*
- how the development will not adversely impact on the habitat of threatened species where the habitat supports a critical life stage ecological process, such as feeding, breeding or roosting
- details of the proposed methodologies to be used to avoid capture or injury to native fauna as a result of the project's construction and operational works, and if accidental capture or injury should occur the procedures to assess and handle injuries

- assessment and report on the adjacent natural biota, including surface elevation modelling, for measuring the relative elevation change of wetland sediments particularly for any higher impacted sites near the proposal
- consideration of impacts from increased sediment deposition resulting from construction activities and potential impacts on marine biodiversity or ecological processes
- disturbance of marine flora and fauna associated with increased marine vessel traffic and/or changes in water quality or hydrology
- an assessment of the likely effects of the project on the integrity and functioning of adjacent aquatic environments, including wetlands within and adjacent to the site.

Identify any species listed by the EPBC Act and the NC Act occurring in the project area. Identify any species listed by the DERM *'Back on Track'* species prioritisation methodology (refer to http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/back_on_track_species_prioritisation_framework/back_on_track_species_prioritisation_framework_criteria.html).

Indicate how well any affected communities are represented and protected elsewhere in the bio-region where the project occurs. Specify methodology used for fauna surveys. Provide relevant site data to DERM in a format compatible with the *Wildlife Online* database for listed threatened species (formerly the Wildnet database - refer to http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife-ecosystems/wildlife/wildlife_online/index.html).

The EIS should include a discussion of the significance of identified impacts on ecological communities at a local, catchment, bioregional, state or national level. Any strategies to mitigate identified adverse impacts from the project on flora and fauna, for incorporation into an EMP, should be identified and discussed.

The EMP should include a weed management plan, where required, and control measures to prevent increases in local populations and spread of biting insect species of pest and health significance. These sections of the EMP should be prepared in consultation with local government environmental officers.

The existence of rare or threatened species and communities should be specifically addressed under the EIS section dealing with sensitive environmental areas.

The sites wetland communities (both tidal and coastal) should be mapped in regard to the following:

- areas of retention
- areas of buffer
- areas of wetland loss.

Mitigation measures to protect and rehabilitate wetlands and buffers are to be described. Reference should be made to local planning provisions in relation to buffer dimensions from ecologically significant areas and as determined in accordance with DERM 2011 Queensland Wetland Buffer Planning Guideline Queensland Wetlands Program, Brisbane.

Reference should be made to DERM mapping for Referrable Wetlands when reviewing site wetlands.

Aquatic Ecology Impacts

FRC Environmental has prepared an Aquatic Ecology Report contained in Appendix 7 of the EIS which addresses the impacts of the development upon aquatic ecology values, and any proposed mitigation, management and offset measures. These impacts and relevant mitigation measures are summarised as follows.

Direct Impacts during Construction

Direct impacts that may result from the construction of the proposed GCIMP development are the physical removal of and damage to aquatic flora, fauna and habitat. Some soft-sediment benthic habitat may also be gained as a result of the proposed development.

Marine Plants

The proposed GCIMP, and alternative development options, will result in the direct loss of marine plants on the proposed development site. Areas of marine plants that would be directly lost by the proposed development options, and by construction of the Transport Corridor are listed in Table 6 above.

Some mangroves will be protected in the buffer to Oakey Creek and these communities will not be impacted. The preferred development option will result in 1.24 ha of mangroves being directly impacted, these are mostly of good and

very good value to fisheries. 11.58 ha of communities dominated by *S. virginicus* below HAT, and 4.49 ha above HAT would be directly impacted. Much of the *S. virginicus* is of poor value to fisheries as it is infrequently inundated however it also includes some areas of good value to fisheries and represents a relatively large intertidal area.

Seagrass was only recorded on the western shore of Foxwell Island, with no seagrass found along the eastern border of the proposed development site or in Oakey Creek. That is, there is no seagrass in the footprint of any of the proposed development options, and the proposed development will have no direct impact on seagrass communities.

All marine plants directly within the footprint of the proposed development will be permanently lost.

Construction of the Transport Corridor will result in the direct loss of 0.1 ha of mangroves, 0.68 ha of *S. virginicus* below HAT and 0.08 ha of *S. virginicus* above HAT. The Transport Corridor also cuts across the major inlet that allows tidal inundation of the central brackish wetlands. Stopping tidal inundation of this area will significantly negatively impact the fisheries value marine plants remaining in this area.

Soft Sediment Benthic Habitat

Soft sediment benthic communities will be directly impacted during the wet excavation of the channel to the east of the proposed development site and to the south of Foxwell Island. A total of 51,975 m_2 of soft-sediment benthic habitat will be impacted in Oakey Creek and the Coomera River .

Direct loss of benthic communities is likely to be temporary (recovering in a few months), however the changes to the community structure of benthic invertebrates may be permanent. Where the freshly exposed substrate is physically or chemically different from the sediment to be removed, a benthic community of different species may become established. Communities will likely change considering the increases in depth, decreases in light penetration associated with a deeper environment and changes in velocity of the water column. Soft sediment communities within the marinas will be deeper and will receive shade from the marina structures, leading to reduced benthic microalgal (BMA) biomass. Due to the relatively small area that will be disturbed, any shifts in benthic community structure are unlikely to significantly impact fisheries productivity on a local or regional scale.

In contrast, the dry excavation of the land for the marina will provide new marine habitat. For the preferred development option (Option 1), this will provide an additional 11.5 ha of subtidal marina habitat (a 7.0 ha external marina and 4.5 ha internal marina).

Any structures within the new habitat will contribute to the range of habitat available in the Coomera River. Each habitat provides a characteristic combination of hard surfaces, voids and shading, and may alter both the water quality and sediment characteristics in its immediate vicinity.

The characteristics of an artificial habitat influence the species (type) of finfish and other taxa that it is likely to support. Studies of natural and artificial habitat indicate that each may support a fish fauna of similar species richness, yet of different, but often overlapping, assemblages (Fujita et al. 1996; Clark & Edwards 1999). Increases in the total abundance of fishes have been positively correlated with both an increase in rugosity (structural complexity) and degree of fouling (Rooker et al. 1997). Whilst a larger artificial structure is likely to attract not only a greater abundance of organisms but also a greater diversity; small structures support a disproportionately high diversity of biota.

Natural and artificial habitat can provide a synergistic benefit to fishes. For example, in Botany Bay (NSW) a seagrass meadow within a small, constructed harbour supported abundances of post-larval and juvenile bream, tarwhine and blackfish up to 73 times that of other nearby seagrass meadows (McNeill et al. 1992).

Little attention has been given to the habitat value provided by moored vessels, although the concept of floating, moored fish-attracting devices (FADs) is well appreciated by fishers and fisheries managers worldwide. Pontoons and moored boats will be common in the proposed marina, and are capable of producing novel communities, different to those attached to rocky reefs, pylons and concrete revetments (Holloway & Connell 2002).

The proposed development will provide new habitat and add to the physical complexity of the subtidal habitat in the Coomera River. Habitats that provide structural and topographical relief such as woody debris, rock and oyster reefs and rubble play an important role in the recruitment and survival of commercially important species (Skilleter & Loneragan 2003, see references therein).

Construction of the marina will result in a mosaic of habitats associated with pontoons, piles and other intertidal and subtidal structures. The characteristic hard surfaces of these structures may provide substrate for many species of algae, hard and soft corals, and a variety of other invertebrate fauna such as sponges and ascidians. In turn, this hard-substrate benthic community may provide shelter and

food for a variety of fish and other fauna. The structures associated with the proposed development will also provide a high degree of shade, important in attracting many fish species (de la Moriniere et al. 2004; Verweij et al. 2006). Fish-friendly structures should be incorporated into the marina design where possible. The Fisheries Queensland outlines several general and specific fish-friendly design features intended for developments that require aquatic infrastructure (Section 4.2 in Derbyshire 2006).

For marinas, consideration of the flushing of waters is important to maintain water quality. This includes a wide and deep opening, avoiding dead ends of no flow and a flow through design (e.g. open piles, floating breakwaters).

The use of fish friendly designs in the construction of revetment walls will increase the available habitat for fish and invertebrates. Revetments constructed from different sized pieces of rock, or geotextile fabrics will offer more habitat rather than walls made out of concrete. Fish friendly design suggests that materials such as polystyrene, tyres, treated wood and uncured cement should not be used, and gently sloping revetments should be used in place of vertical revetments. The use of horizontal cross piece structures or stacked rip-rap adhered to supporting pylons will increase fish habitat.

Sloping revetments will also act to dampen wave energy, and reduce wave reflection onto Foxwell Island and the northern bank of Oakey Creek.

Fish and Fisheries

Fish are likely to be trapped in the wet excavation areas by the silt curtains. The impact to these fish will depend on the time taken to excavate each cell and the turbidity of the water during excavation, with higher turbidities and longer periods more likely to negatively impact fish.

In order to minimise risks of the project on fish, a management plan should be formulated prior to in- or on-water construction activities. Mitigation options to be considered include:

- installing the silt curtains at low tide to minimise the number of marine vertebrates caught in the area; and
- capturing fish within the area confined by the silt curtains and release outside the silt curtains.

Recreational fishers occasionally use the existing Council Park. In the proposed development this use of the area will be removed.

Marine Mammals and Reptiles

Dolphins and turtles may be trapped in the wet excavation areas by the silt curtains. This would negatively impact these individuals, with the severity of the impact depending on the length of time they were trapped. There is also the potential that these animals, particularly turtles, may be damaged by the excavation operations.

However, this area is not a significant habitat for these species, while they may occur here on occasion, they are unlikely to frequent the area.

In order to minimise risks of the project on marine vertibrates, a management plan should be formulated prior to in- or on-water construction activities. Mitigation options to be considered include:

- visual observations by marine mammal and reptile spotter prior to commencement of excavation activities;
- cessation of wet excavation if a dolphin, dugong or turtle is observed within the silt curtains, until the animal can be removed from the area being excavated, and
- dolphins can be driven away from an area prior to completion of the installation of silt curtains by mechanical noise, such as banging an iron pipe underwater (Mciwem 2006).

Indirect Impacts during Construction

Activities including wet excavation, dry excavation and construction activities have the potential to result in:

- increased turbidity, suspended sediments, sediment deposition and subsequent release of nutrients and contaminants from the disturbed sediments
- disturbance of acid sulfate soils or potential acid sulfate soil (ASS / PASS)
- spills of hydrocarbons, and
- increase in human activity and noise.

The impacts of increases in suspended solids, sediment deposition and the subsequent depletion of oxygen and releases of nutrients and contaminants associated with the proposed development on marine plants, soft-sediment communities, fish and other marine vertebrates (such as mammals and turtles) have been assessed by BMT WBM in the Water Quality Report contained in Appendix 28.

Turbidity plumes may result in partial or complete loss of some seagrass beds, however given the small size and low density of these beds, it is unlikely that

marine turtles and dugong would be affected by the loss of these food resources. Further detail is contained in the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7.

Disturbance of Acid Sulfate or Potential Acid Sulfate Sediments

Disturbance of intertidal and marine sediments may expose acid sulfate soils to oxidising (acidifying) conditions. Acid sulfate materials are formed when pyrite in sediments is exposed to oxidation. Pyrite (FeS2) is unstable in the presence of specialised bacteria and atmospheric oxygen, decomposing to the form ferrous iron and sulfuric acid.

The effects of acidification can be chronic or acute. The effects of chronic acidification on Australian estuarine biota, including fishes, is poorly understood, however sudden acidification has been responsible for fish-kills, disease and other disturbances (Sammut et al. 1993). Chronic low-level acidity may reduce vigour and predispose marine biota to other diseases. Historical fluctuations in commercial finfish and prawn catches may be partially attributable to periods of increased acidity in estuarine waters (Leadbitter 1993).

Other environmental effects of oxidation of pyrite include: the dissolution of clay minerals and the release of soluble aluminium, which is highly toxic to gilled animals (including fish, molluscs and crustacea) and aquatic plants; the release of soluble iron, also toxic to aquatic life in high concentration; and the oxidation of ferrous iron causing large decreases in dissolved oxygen.

Screening of soils throughout the proposed development site showed that there were some mildly acidic soils present and much of the material encountered is likely to be PASS (Gilbert and Sutherland 2010). An Acid Sulfate Soil Management Plan (ASSMP) has therefore been developed to ensure that ASS encountered at GCIMP are appropriately identified and treated (Gilbert and Sutherland 2010). Please refer to Appendix 32.

The ASSMP provides clear management protocol based on operational policies, performance criterion, implementation strategies and corrective actions (if required). The impacts of disturbing acid sulfate soils on aquatic ecology can be substantially managed and minimised through the ASSMP.

Hydrocarbon Contamination

Hydrocarbon spills from machinery during construction activities can negatively affect aquatic flora and fauna. It is possible that hydrocarbon spills could occur

during the transportation of fuel or during equipment refueling in the construction phase of the GCIMP. Concentrations of dissolved oil fractions below 0.01 ppm have not been shown to have adverse effects on any aquatic organism either in the short or long term, at any stage of development or at a cellular or sub-cellular level. Between 0.01 ppm and 0.1 ppm, some adult animals show sub-lethal behaviour and physiological disturbance, while developmental stages may show retarded growth or increased abnormalities. In general, the developmental stages of a species are far more susceptible than are adults, frequently by one or two orders of magnitude (Brown 1985).

Whilst acute (or at least a one off) contamination may result in severe ecological consequences, recovery is in most cases inevitable. In contrast, chronic contamination can result in the permanent (or at least for the duration of contamination) morbidity or localised extinction of flora and fauna. Chronic small spills, though probably influencing a lesser area, effectively prevent recovery and lead to cumulative impacts. Frequent spills from diffuse locations within a waterway can result in an enduring impact over a very wide area.

Refueling and storage within bunded areas, the provision of spill kits and a spill management plan or response strategy will significantly reduce the likelihood and impact of any potential spill. Where fuel storage and handling activities are undertaken in accordance with AS1940 (Storage and Handling of Flammable and Combustible Liquids – encompassing spill containment and response protocols), the risk of acute spills during construction is considered to be minor. Measures for management of hazardous substances within the project site are provided in the Environmental Management Plan contained in Appendix 14.

Increase in Human Activity and Noise

Increased human activity during construction, including changes in underwater noise levels, may affect the behavior of fauna, particularly marine mammals. The River in the vicinity of the proposed development is not likely to be significant habitat for any marine mammals or reptiles. Further, the seagrass beds adjacent to the dredge area are relatively sparse, isolated, very small in area, and are consequently unlikely to be a significant foraging habitat for either dugongs or turtles. Nevertheless dolphins, turtles and to a lesser extent dugongs may occasionally be found in the area.

Underwater noise and other loud sounds may affect marine mammals by interfering with their use of sounds in communication, especially in relation to navigation and reproduction (Weilgart 2007; Wright et al. 2007). Marine mammals cease feeding, resting or social interaction at the onset of acoustic disturbance and to initiate alertness or avoidance behaviours (Richardson et al. 1995). Marine

mammals in the vicinity of frequent, high intensity noise are likely to be highly stressed or even physically harmed and consequently, are likely to stay well away from continuously operating acoustic disturbance (Smith 1997). Therefore, any Indo-Pacific humpback dolphins, bottlenose dolphins or dugongs in the vicinity of the proposed marina may vacate the area on commencement of the proposed in water works such as wet excavation. Noise from on-land works is unlikely to disturb marine mammals. Any avoidance behaviour is likely to cease following completion of the work.

Turtles have relatively poor hearing and are far less likely to be impacted by underwater acoustic disturbance. In the unlikely event that in- and under-water construction does audibly disturb turtles, they may temporarily leave the area. Similarly, underwater construction noise may disturb some local fish, which may vacate the area for a short time.

A management plan for marine mammals should be developed to mitigate any potential impacts associated with increased human activity and noise.

FRC Environmental has recommended that monitoring during construction of the development incorporates the following:

- assessment of sediments to be dredged in accordance with NADG 2009
- reactive monitoring of up and downstream water quality during wet excavation operations, including monitoring of control locations, and including pH and turbidity, with predetermined actions should water quality not meet specific criteria
- monitoring the presence of marine mammals and reptiles in the vicinity of any works on the water, and the development of control actions should they be sighted within 100 m of operations
- monitoring the health of remnant marine plant communities following upstream disturbance, including monitoring before and after potential impacts, and monitoring of control sites, and
- monitoring of benthic invertebrate communities including those sampled in this survey, to demonstrate whether or not the development has had an impact on community diversity and abundance.

Direct Impacts during Operation

Increased Boat Traffic

Increased boat traffic associated with the proposed GCIMP development may increase the chance of collisions between boats and marine vertebrates, particularly turtles, both in the immediate vicinity of the proposed development and in the broader environs of the Marine Park.

Boat strikes are responsible for the largest proportion of all human-related turtle strandings or mortalities (Greenland et al. 2004). In general, the shallower the area and the larger the boat, the greater the risk of a boat strike to turtles. Turtles feed on the intertidal flats at high and mid tides, and drop into deeper waters (which can include the waters of navigation channels) at low tide, where they can be struck by passing traffic. This habit of moving into navigation channels increases the risk of boat strike. However, given the paucity of seagrass in the area, the risk of boat strike due to increased boating activity in the Coomera River from this marina is low.

Dolphins are likely to be able to avoid approaching boats, however, at least nine dolphins were killed in Queensland by boat strike in a period of 8 years (Greenland & Limpus 2007a). Dugong will also avoid approaching boats, however they are slower than dolphins and more vulnerable to vessel strike. Since dugongs were included in the Marine Wildlife Stranding and Mortality Database in 1996, between 2 and 7 individuals have died each year due to boat strike (Greenland & Limpus 2007b). The majority of these boat strikes occurred in Moreton Bay due to the high amount of boat traffic. The vulnerability of dugongs (with slow breeding rates and slow maturity) means that any dugong deaths may contribute to a population decline. Dugongs are not common within the upper reaches of the Coomera River, therefore increased boat traffic in the River is unlikely to pose a significant risk.

Go slow areas in Moreton Bay Marine Park limit speed in areas that are recognised as particularly significant for dugongs and turtles. This risk of boat collisions with marine mammals and reptiles can be minimized if speed restrictions near the entrance of the proposed GCIMP development are implemented and enforced.

Indirect Impacts during Operation

Potential indirect impacts to aquatic habitats and fisheries associated with the operation of the marina are:

- altered hydrodynamics and consequently altered patterns of sediment deposition and erosion
- increased turbidity, suspended sediments, sediment deposition and subsequent release of nutrients and contaminants from the disturbed sediments during maintenance dredging (see BMT WBM report)
- increased release of hydrocarbon contaminants
- increased risk of introduced marine pests
- increased litter in the marine environment, and
- increased boat traffic and access.

Altered Hydrodynamics

Model simulations of have predicted tidal peak flow velocities in the proposed marina will decrease due to profile enlargement; from approximately 0.25 m/s to 0.04 m/s for peak ebb flow velocities. In contrast through the section of Oakey Creek adjacent to Foxwell Island, peak ebb flow velocities are predicted to increase from approximately 0.30 m/s to 0.47 m/s during spring tides and peak flow flood velocities from approximately 0.22 m/s to 0.34 m/s. These increases would only occur at peak velocities during spring tides and therefore have a short duration and cause local redistribution of sediments (e.g. minor bed changes and slight movement of shoals in the area of highest velocity changes). No increase in bank erosion is predicted (BMT WBM 2010).

Changes in water velocity around the proposed GCIMP development site are likely to change (increase or decrease) the suitability of habitat for marine plants as well as change the composition of benthic macroinvertebrates. Marine plants may be influenced by changes in velocity resulting in removal of sediment, changes in sediment composition and chemistry, as well as changes in turbidity levels. Benthic macroinvertebrate communities are also likely to change with any changes to water velocity: in low flow environments predators exert more influence on benthic community structure than in high flow environments (Leonard et al. 1998). Any changes to sediment grain size would also alter the composition of benthic macroinvertebrate communities.

Reduced velocities may result in an accumulation of fine sediment and may also result in changes to sediment chemistry and water turbidity. Marine plants are unlikely to be negatively impacted by reduced flows and may even show a positive response. The composition of benthic macroinvertebrates is likely to change due to lower water velocities in this area.

The eastern foreshore of the proposed development site is currently eroding into the Coomera River. This foreshore will be removed and stabilised by the proposed GCIMP development, due to the construction of the marina. However, the construction of marina walls along the eastern side of the site may increase wave reflection onto the western shore of Foxwell Island and northern shore of Oakey Creek. Increased wave energy along the western shore of Foxwell Island is likely to increase erosion and disrupt seagrass and mangrove communities by increasing turbidity and current velocities. This type of damage is evident approximately 750 m downstream of the GCIMP site, where there is an area of active erosion on the western shore of the Coomera River, which is likely to have been exacerbated by the revetment wall on the opposite bank.

Erosion and sediment control devices on the site have been designed in accordance with the *Soil Erosion and Sediment Control Engineering Guidelines for*

Queensland Construction Sites 1996. All stormwater runoff from areas disturbed and exposed by construction are designed to pass through a sediment and erosion control device prior to discharging to the existing waterways. Sediment and erosion control devices include silt fences, sag gulley treatment, grade gulley treatment, field inlet treatment, sand bag check dams, rock check dams, vehicle shake-downs and sedimentation ponds (Hyder 2010).

Chronic Hydrocarbon Contamination

Chronic hydrocarbon pollution can result from the synergistic effects of small, frequent spills, these small scale spills are frequently associated with the refueling of smaller crafts at marinas, other purpose built and ad hoc refueling facilities and boat ramps (GBRMPA 1998; Cullen Grummitt and Roe 2000). Marinas that support considerable activity, including pleasure boat marinas, boat repair facilities and commercial fishing operations have significantly higher levels of both aromatic and aliphatic hydrocarbons than estuaries seldom used by boats (Voudrias & Smith 1986). The small-scale spills commonly associated with small-scale refueling operations are rarely reported or treated: the petrol, diesel or oils are left to disperse under natural conditions.

Floral communities and sessile faunal communities are most at risk from chronic hydrocarbon pollution. As these communities often form a critical component of habitat (providing structural complexity, shelter and often food), a permanent impact to these communities may have a consequentially widespread impact on the mobile components of the faunal community including fishes and crustacea. Both petroleum and petroleum by-products are harmful to mangroves (Odum & Johaness 1975) causing mechanical damage by blocking the pores in the pneumatophores and effecting respiration, photosynthesis and translocation (Mackey & Smail 1995). Hydrocarbons are also known to cause reproductive disorders, immune deficiencies, tumours and cyst development in marine mammals and reptiles, especially when they are stressed (Schaffelke et al. 2001).

Low levels of petroleum hydrocarbons in the aquatic environment are adsorbed onto, or incorporated into, the sediments, where they may persist for years (Voudrias & Smith 1986; Pelletier et al. 1991). A large number of small-scale oil spills may lead to a significant increase in hydrocarbons over time, in effect resulting in a permanent impact. Mangrove sediments in particular may serve as long-term reservoirs for chronic contamination holding hydrocarbons for periods in excess of 5 years (Burns et al. 1994).

Where fuel storage and handling activities are undertaken in accordance with AS1940 (Storage and Handling of Flammable and Combustible Liquids –

encompassing spill containment and response protocols), the risk of impacts to aquatic flora and fauna due to chronic and acute fuel spills is considered minor.

Contamination by Heavy Metals

The absorption of heavy metals from solution occurs in plants and animals by passive diffusion across gradients created by adsorption at the surface, and by binding by constituents of the surface cells, body fluids, etc. An alternative pathway for animals is when metals are adsorbed onto or are present in food, and by the collection of particulate or colloidal metal by food gathering mechanisms.

Depending upon the types and concentrations of heavy metals release, impacts could range from the reduction of reproductive capacity of some species to the mortality of aquatic flora and fauna. Considering the land within the proposed GCIMP site has previously been used for agriculture, it is unlikely to be contaminated with industrial contaminants or heavy metals. However, it is possible that agricultural contaminants may be present. The effect of chronic heavy metal pollution is still largely unresolved, and effects depend on the interrelationships of many physical and chemical factors. Threshold concentrations of toxicants to ensure the protection of aquatic ecosystems have been developed by the Australian and New Zealand Environment and Conservation Council (ANZECC & ARMCANZ 2000).

Antifouling paints used on the exterior of boats often contain heavy metals, particularly copper, that can build up in marine organisms. In south-east Queensland, many anchorages have exceeded of the ANZECC/ARMCANZ trigger values for copper, with copper concentrations in the water column correlated with vessel numbers (Warnken et al. 2004). The proposed GCIMP development may increase the concentration of heavy metals, particularly copper in the water. This risk is reduced where International and Australian standards relating to antifouling paints are followed (National Heritage Trust 2007).

Contaminants may also enter the aquatic environment from stormwater runoff from the proposed development site. The release of toxicants to the marina and surrounding waters will be minimised by treating stormwater (with water sensitive urban design techniques) to comply with local water quality criteria (Hyder 2010). Further, the sediment and erosion control plan is developed to minimise the release of sediment-bound toxicants to the water (Hyder 2010). With these in place, it is unlikely that suspended sediments and toxins become critically elevated in the waters of, and adjoining, the marina, and are therefore unlikely to cause an adverse ecological impact.

Increased Litter in the Marine Environment

An increase in human activity associated with the proposed GCIMP development may eventuate in an increase in the amount of litter entering the Coomera River and pose a threat to marine life.

At least 35 cetaceans (whales and dolphins) have been killed since 1998 due to entanglement in debris, and one dolphin has died within that period due to ingesting foreign material (Greenland & Limpus 2007a). Seven turtles in Moreton Bay were found to have ingested synthetic materials in 2001, and nine turtles in 2002 (Greenland et al. 2004). Of these, most had ingested fishing line, and only two animals were released alive (Greenland et al. 2004). In 2001 and 2002, entanglement in fishing ropes / lines, bags and ghost nets accounted for 21-35% of the annual human-induced turtle strandings or deaths (Greenland et al. 2004).

Dugongs have also been stranded / killed by ingesting fishing line or hooks (2 individuals in Moreton Bay in 2003), or becoming entangled in ropes, fishing line and crab pots etc. (0-2 individual each year) (Greenland & Limpus 2005).

During site visits in September 2008, the drain running parallel to Shipper Drive was filled with litter, including fishing line, empty beverage containers and industrial wastes such as packing tape and outboard engines containers. This litter, and litter produced by the proposed development could enter Coomera River and Broadwater, and poses a threat to marine vertebrates.

This risk will be minimised by the installation of gross pollutant traps as a part of the Stormwater Management Plan for the development (Hyder 2010), and can also be minimised by educational signage, explicitly stating the risk to wildlife of disposing rubbish in the water.

Introduction of Pest Species

Marine pest species can be introduced via ballast water and hull fouling. While this risk is predominantly from vessels that have been in international waters, there is also a risk of boats spreading pests established in other ports. The introduction and spread of marine pest species can be minimised by following protocols of the National System for the Prevention and Management of Marine Pest Incursions, which aims to prevent new marine pests from arriving in Australia, and minimise the spread of pests within Australian waters. To reduce the risk of inadvertently spreading marine biofouling pests, vessel operators need to minimise the amount of biofouling on their vessels (Australian Government 2010). These measures are included in the SBMP prepared by Hyder Consulting contained in Appendix 15.

Increased industrial density near the wetland areas may lead to an increase in weed cover in mangrove and saltmarshes. This may be a result of dumping of garden refuse in the wetland areas, by seeds and propagules being inadvertently spread along access tracks and paths by vehicles or on foot, and by the air and water borne spread of seeds and propagules from gardens and landscaped areas.

A weed management strategy, and a strategy for the maintenance of wetland and native plant areas on the proposed GCIMP site would reduce this risk of introduced plant pests.

Increased Boat Traffic and Access

Increases in boat traffic can alter behaviour patterns in marine mammals and turtles. Changes in behaviour as a result of noise and other activity may include cessation of feeding, resting, and social interactions; or avoidance (Richardson & Würsig 1995). In dolphins, few behavioural changes in response to passing vessels have been documented (Acevedo 1991 and Janik & Thompson 1996, cited in Neil 1998).

However, boat traffic may be detrimental to marine turtles when avoidance behaviour leads to injury or stress. This has been observed in bays or around islands where turtles can be trapped against land or a reef crest (Dobbs 2001). High vessel use in an area may also displace turtles from their habitats, and has the potential to deter turtles from entering their foraging habitat or nesting beaches (Dobbs 2001).

Dugongs move approximately 100 m away when boats approach, and within 5 minutes they normally return and resume feeding. However, if vessels are too frequent, the dugongs leave the area and go elsewhere to feed. The longer the boat stays in the area (e.g. maneuvering or ‘hanging around’) the more strongly the dugongs react, and more likely they are to leave (A. Hodgson, pers. comm. 2001). Waterways that are subject to high levels of human use (such as major boat channels) are likely to be avoided by dugongs (Preen 1993). Therefore, after a point, increase in frequency of passage may actually reduce the likelihood of a boat strike incident because the animals are no longer using this habitat.

Indo-pacific humpbacked dolphins are extremely shy, difficult to observe and easily disrupted. If present within the study area, they would likely be deterred from this reach of the Coomera River and Oakey Creek due to increased human activity and boating traffic.

Turtles, dugongs and dolphins in the area are already likely to avoid the busier reaches of the Coomera River. Slow speeds within the proposed marina area will

reduce the risks of behavioural changes associated with boats for most species. Slow moving species such as turtles and dugongs are unlikely to frequent the area because foraging habitat (seagrass) surrounding the proposed development is sparse.

From a mitigation and management perspective, it is recommended that slow speed limits within the proposed marinas will greatly reduce the risk of boat strike. From a regional perspective, the project will increase the number of boats and the probability of boat strikes in the broader area (CRG 2010). The increased risk of boat strike associated within an increase in boat traffic from the new marina can be minimised by:

- concentration of traffic in existing channels (i.e. not introducing any new routes);
- ensuring that the 6 knot speed limit in the area is well advertised and enforced;
- public education to increase awareness of risk to and value of these fauna – this could include informative signage at public boat ramps, explicitly stating risk to wildlife of speeding over shallow areas, and that penalties apply if caught driving boats 'on the plane' in go slow areas within the marine park; and
- support of research into the behaviour of dolphins, turtles and dugong with respect to boat traffic.

Fisheries Offset

The Queensland Government Environmental Offset Policy (QGEOP) is based on seven principles (EPA 2008b):

- Principle 1: Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy
- Principle 2: Environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact
- Principle 3: Offsets must achieve an equivalent or better environmental outcome
- Principle 4: Offsets must provide environmental values as similar as possible to those being lost
- Principle 5: Offset provision should minimise the time-lag between the impact and delivery of the offset
- Principle 6: Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values, and
- Principle 7: Offsets must be legally secured for the duration of the offset requirement.

The QGEOP identifies two types of environmental offsets: direct and indirect. Direct offsets are those actions that provide environmental values, while indirect offsets complement the intended environmental outcome in other ways, e.g. funding for targeted research linked directly to the environmental values, providing infrastructure that will help protect the environmental values being impacted (EPA 2008b).

Offset measures for marine fish habitat loss balance the residual impact of proposed approved losses triggered by fisheries development approvals assessed under the provisions of the *Fisheries Act 1994* and the *Sustainable Planning Act 2009*.

Offset measures for marine fish habitats seek to (QPIF 2010):

- maintain fisheries values, including fish habitat values
- match ecosystem costs associated with the fish habitat losses with offsets appropriate to the loss
- promote the importance of fish habitats during implementation
- recognise the natural capital of fish habitats, and
- create public awareness of the value of fish habitats

Marine fish habitat offsets are applicable when impacts cannot be avoided, minimised or mitigated, and only after the proposed marine fish habitat loss is determined as justifiable, unavoidable and acceptable under departmental legislation and policy.

Offset measures to balance the loss of, or change to fish habitat relating to a fisheries development approval may include one or more of the following:

- fish habitat enhancement
- fish habitat restoration, rehabilitation or creation
- fish habitat secured exchange, where the lands proposed for exchange contribute to similar fish habitat, and
- contribution of an 'offset amount' constituting financial support for one or more of the following where associated with fish habitats
    - applied research
    - enhancement, restoration, rehabilitation or creation
    - education, training or extension, or
    - fish habitat acquisition or exchange.

Offset measures involving a financial contribution as funding toward fish habitat research may be agreed between Fisheries Queensland and the proponent as an offset requirement, for example under the Urban Fish Habitat Management Research Program. A third party would then be enlisted to deliver the research

project under a separate agreement with Fisheries Queensland for research funding (Dixon et al. 2009).

Fisheries Queensland provide indicative guidelines for monetary compensation for unavoidable habitat loss (Queensland Fisheries 2010). These guidelines are based on the ecosystem service value estimates provided by Costanza et al. (2007), and allow for an economic evaluation of the contribution that these habitats would make to local and regional fisheries and environmental services over a 20 year production cycle, if left undisturbed. These guidelines are only indicative and are designed to form the basis for initial discussion.

Through discussions with Department of Agriculture, Fisheries and Forestry (DAFF) and the Department of National Parks, Recreation, Sport and Racing (DNPRSR), on the proposed offsets it was identified that additional areas/options also be considered. The offset areas should be suitably tenured, possessing all or substantial areas of tidal fish habitats which shared a common boundary with a declared Fish Habitat Area (FHA). Appropriate tidal lands would then be formally added to the adjoining declared FHA.

In these discussions the Baffle Creek declared FHA was identified as a priority location for expansion of the Queensland declared FHA Network. Options are to be further investigated and offset requirements will be resolved through the EIS process.

Terrestrial Flora and Fauna

Impacts arising from the development can be direct i.e. removal of vegetation and habitat or indirect. These have been discussed above through the Terrestrial Flora and Fauna Assessment prepared by Planit Consulting contained in Appendix 8 as it relates to specific species or category of fauna. A summary of impacts is presented as follows.

Vegetation Communities and Wetlands

As identified in Table 11 the proposed Master Plan affects the mapped vegetation communities on site through removal and or filling activities. These direct impacts are quantified in the table. As noted approximately 54ha of remnant and non remnant mapped communities are removed.

Of these communities 1 – 3 represent either estuarine or palustrine wetlands. Palustrine wetland removal equates to 1.915ha. This impacted area is located in the southern section of the site adjacent to Shipper Drive. A portion of this community is found within the existing open space allotment Lot 108 WD6404.

Estuarine wetlands affected by the proposal are made up of three (3) separate regional ecosystem types. These being, RE 12.1.1, 12.1.2.and 12.1.3 and total 17 ha.

Salt marsh communities constitute the largest contributor to the total area of estuarine wetlands with approximately 15.45ha to be removed. A separate report by FRC discusses the relative value of these estuarine communities. Of this 15.45 we note a significant area of this constitutes the semi permanent wetland.

Wetland communities are significant for the multiple functions they perform. These wetlands hold and facilitate various functions and values.

These include but are not limited to : value of aquatic ecosystems for plant, animals and ecological interactions; value of riparian wildlife and their habitat; primary recreation; secondary recreation; visual recreation, support river based ecosystems; maintain water quality – prevent excessive nutrients & pollutants and cultural heritage.

Wetland impacts are discussed separately, however it is noted that of the communities to be removed these are widely conserved in conservation reserves in the immediate area. This includes national parks, marine national parks, and conservation reserves as well as outside the reserve system. We note outside the conservation reserve system wetlands are protected through various mechanisms.

Table 11: Mapped Vegetation Communities and Clearance Rates

Mapped Community	RE Nos.	VMA Status	Approx. extent within site	Approx. extent to be disturbed /cleared via development	Approx. extent to be disturbed /cleared via main roads reserve	Approx % remaining
COMMUNITY 1A: MID-HIGH OPEN FOREST/FOREST (*CASUARINA GLAUCA*) [T6D/M] ON TIDAL MUDFLATS	12.1.1	'Of concern' Estuarine Wetland	2.156ha	0.815ha	0	62%
COMMUNITY 1B: MID-HIGH FOREST (*CASUARINA GLAUCA*) [T6M] ON ALLUVIAL DEPOSITS	12.3.5	"Least Concern' Palustrine Wetland	3.4788ha	3.4788ha	0	0%
COMMUNITY 2A: VERY TALL RUSHLAND (*JUNCUS KRAUSII*) [V4M]	12.1.2	'Least Concern' Estuarine Wetland	0.1ha	0	0	100%
COMMUNITY 2B:LOW CLOSED TUSSOCK (*SPOROBOLUS VIRGINICUS*) GRASSLAND [G1D]	12.1.2	'Least Concern' Estuarine Wetland	21.945ha	15.45ha	1.650	22%
COMMUNITY 3: LOW-TALL OPEN FOREST/WOODLAND (*AVICENNIA MARINA + AEGICERAS CORNICULATUM*) [T4M/S]	12.1.3	'Least Concern' Estuarine Wetland	2.735ha	0.74	0.18	66%
COMMUNITY 4: VERY TALL CLOSED GRASSLAND [*SETARIA SPHACELATA*] G4D/M	N/A	Non-remnant community	1ha	0	0	100%
COMMUNITY 5: LOW CLOSED PASTURE WITH SCATTERED TREES/PADDOCK MOSAIC G1D/M	N/A	Non-remnant community	38ha	35.6	2.4	0%
		TOTALS	**67.86**	**54.52ha**	**4.11**	**86%**

Dealing specifically with the local distribution of palustrine and estuarine wetlands, approximately 3km from the site is Coomera Island. Coomera Island forms part of the Southern Moreton Bay Islands National Park consists of five islands which support over half of the mangroves in Moreton Bay.

These mangrove and tidal flats support extensive habitat for fish, birds, shellfish, dugongs and turtles.

Coomera Island contains extensive estuarine wetland areas and includes a shallow, brackish lagoon system in the centre, comparable to the central wetland areas of the site.

Approximately 4km to the south the Coombabah Lakelands Conservation Area protects more than 1200 hectares of wetland, Eucalypt forest, salt marsh and mangrove swamp habitat. Lake Coombabah and its Riverine/estuarine habitat system are important coastal wetlands and migratory water bird habitats.

GCCC has recently acquired an additional 61 hectare site at Arundel, adjoining Coombabah Creek and Coombabah Conservation Area. The site contains significant areas of estuarine and palustrine wetlands, adjoins declared fish habitat areas and provides habitat for species such as the near threatened Black-necked Stork.

Approximately 6km to the north of the site is McCoys Creek Marine National Park and the Pimpama Rivers Conservation Cluster.

Gold Coast City Council notes that ‘The Pimpama River Conservation Reserves Cluster (approximately 447.58 hectares) protects a large portion of the lower reaches of the Pimpama River at its confluence with Moreton Bay.

It contains the largest coastal mainland conservation reserve of the northern Gold Coast (Pimpama River Conservation Area) and is part of a series of protected estates conserving the natural landscape of the southern Moreton Bay area.

The planning area is internationally important for the protection of coastal wetlands and complements the adjacent Southern Moreton Bay Island National Parks, Moreton Bay Marine Park, an internationally listed Ramsar wetland site and a Fish Habitat Area. It protects a diversity of coastal lowland vegetation types typical of South East Queensland but otherwise poorly represented in protected areas on the Gold Coast’.

The proposal results in reductions in the abundance of least concern regional ecosystems and wetlands. A small reduction in one ‘Of Concern’ regional ecosystem type also occurs.

Based on these levels of disturbance the follow approximate reductions in each remnant within the Gold Coast would arise. Please note each number is rounded to two decimal places;

- RE 12.1.1 – 0.815 removed, proportional 0.00% reduction in the 2001 remnant mapped area based on The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003
- RE 12.1.2 – 15.9525 removed, proportional 0.03% reduction in the 2001 remnant mapped area based on The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003
- RE12.1.3 – 2.801 removed, proportional 0.00% reduction in the 2001 remnant mapped area based on The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003
- RE 12.2.15 – community addressed within RE 12.1.2
- 12.3.5 -.3.4788 removed, proportional 0.01% reduction in the 2001 remnant mapped area based on The Gold Coast City Nature Conservation Mapping Review Stage 1' - Vegetation Mapping November 2003

As demonstrated the quantum of each community to be removed is not significant at a local level with the communities being well represented in various conservation reserves.

We note that properties downstream of the site and adjoining the Coomera River have planning approvals in place and or are already developed. This minimises additional cumulative impacts to estuarine and riverine communities. We note a range of restrictions and approvals processes regulate future clearing of these communities.

Significant Flora Species

The proposal does not impact upon the recorded 'Vulnerable' *Macadamia integrifolia* which is listed under the Qld Nature Conservation Act.

As identified the additional scheduled specie recorded or potentially recorded in the locality are unlikely to occur on site due to its coastal and estuarine influences.

Hollow-Bearing Trees

The loss of hollow bearing trees has been identified as the most significant cause of biodiversity reduction in timber production forests of eastern Australia (Smith *et al*, 1994) with the subsequent adequate management of the hollow tree resource

being critical to achieving Commonwealth and State conservation objectives (National Forest Policy Statement, 1992; Nature Conservation Act, 1992).

Gibbons and Lindenmayer (2002) estimate that 303 native vertebrate species utilize tree hollows of which approximately 100 are listed as rare or threatened within State or Commonwealth Legislation. Research conducted by the Department of Natural Resources (1998) estimates that 134 of these species potentially utilize tree hollows in SE Queensland. Given that hollow bearing potential is low for Eucalypts below 120-180 years of age (with older trees required for larger fauna) and the fact that many species require a variety of different hollows within their home range (particularly arboreal mammals), hollow bearing trees represent a limited ecological resource (Gibbons & Lindenmayer, 2002; DNR, 1998-1999; Strahan, 2002; Ball, Lindenmayer & Possingham, 1999).

Within the site there exists a general paucity of hollow bearing trees (HBT) with only two such individuals noted (one within the paddock area and one adjacent Oaky creek) (it is acknowledged that additional trees with hollows that are not readily visible at ground level may occur).

One of these trees (within the paddock) will be removed in association with development of the site.

Wetlands and Waterways

Impacts to wetlands on site will occur during construction and potentially during operational procedures. Impacts may also occur over time up and downstream of the site.

Under the VMA, portions of 'of concern' and 'least concern' wetlands will be cleared for development; this amounts to approximately 2ha of the palustrine wetland and 17ha of estuarine wetland communities.

Sixty-two percent (0.815ha) of the 'of concern' wetland will be preserved through the development. This community is retained in minimum 40m wide corridor along Oakey Creek. We note the areas west of Shipper Drive in Lot 146 SP SP150731 are retained in the open space buffer.

The association between marine industries and access to waterways is also reflected in the Queensland Coastal Plan.

Assessment in relation to QLD Coastal Plan

The Coastal Plan whilst preserving and protecting the natural environment and coastal processes also recognises within the policy document use of the coastal zone for certain forms of development. These are referred to as Coastal Dependant development.

The Coastal Plan defines Coastal – dependent development as follows;

Coastal-dependent development: *development that requires access to tidal waters to function. Coastal-dependent development may include but is not limited to ports, harbors and navigation channels and facilities, aquaculture involving marine species, desalinization plants, tidal generators, erosion control structures and beach nourishment. To remove any doubt, residential development in any form is not coastal-dependent development.*

The proposal constitutes a coastal dependent development.

The Coastal Plan, Policy document states that the objective relative to coastal dependent development is to "protect and maintain opportunities for sustainable coastal-dependent development in a manner that minimizes impacts on coastal resources.'

The DERM fact Sheet for Coastal – dependent development states, *'The coastal plan describes a planning process for specifying areas of land and/or coastal waters that are most suitable for maritime development, and for protecting these areas from other types of development that are not dependent on tidal waters to function.*

Maps accompanying the coastal plan show maritime development areas. Maritime development areas are sites containing existing marine infrastructure, areas over which specific development approvals or zoning provide for maritime infrastructure. Proactively designating appropriate areas for marinas and larger-scale marine infrastructure serves two purposes. It provides greater certainty for proponents and government on potential locations for maritime development and also provides opportunities for streamlining development assessment processes for maritime development at these sites in the future'.

Coastal dependent development areas are defined and an extract for the site is presented below in Figure 20. As can be seen the site and the Gold Coast Marine Precinct is identified as being within a maritime development area.

We note under the Coastal Plan the site is primarily a defined 'coastal dependent use' area and identified within the Gold Coast Marine Industry Precinct'.

This designation affects the Coomera River frontage of the site and a portion of Oakey Creek. The balance area is within a Coastal Management Control district. The designation also applies to the future IRTC development and the central wetland areas of the site. The designation also covers the HES palustrine wetlands Community 1B, RE 12.3.5.

Figure 20: Extract Coastal Plan Coastal Dependent Development Mapping (DEH 2012

Oakey Creek

As identified above part of Oakey Creek is within the coastal dependent landuses designated Gold Coast Marine Industrial Development area.

We note a proportion of the external marina is also outside this designated area and within a coastal management area as well as other mapping designations such as HES.

The preferred Master Plan design has been developed to facilitate a functional layout which maximises the potential for berths and creates a viable development outcome. Excluding the external marina, the development includes ancillary access roads, access paths and dredge spoil facilities outside the 40m setback but within the Coastal management district. These constitute coastal dependent public access facilities. All proposed buildings are able to be constructed outside the Coastal Plan erosion prone areas.

It is noted that that this outcome does not fully achieve the overall policy outcome of the QLD Coastal plan, however overriding need in the public interested demonstrated within the Norling 'Social and Economic Impact Assessment. It is also important to establish that the proposal cannot be located elsewhere to avoid the conflict with the policy outcome of the State Planning Policy 3/11: Coastal Protection (SPP).

Oakey Creek Setback

The balance area of Oakey Creek is identified within a coastal management area and is also covered by other mapping layers such as HES.

The balance section of Oakey Creek is preserved in a minimum 40m wide open space reserve. This area totals 4.9ha. The open space incorporates a range of mapped estuarine communities.

This minimum dimension was derived from the former the State Coastal Management Plan—Queensland's Coastal Policy which was recently repealed and replaced by the Coastal Plan 2012.

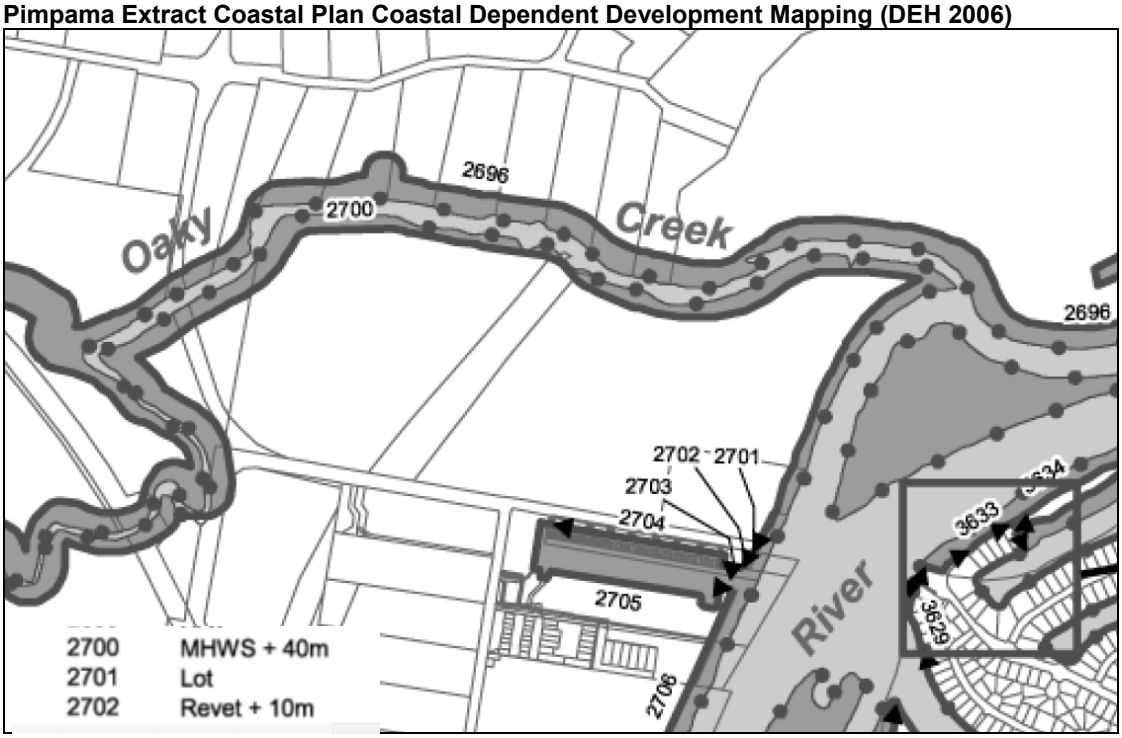
The repealed document identified as part of the policy response to physical coastal processes the mapping of erosion prone areas. The repealed document states *'Erosion prone areas are areas that are vulnerable to erosion or encroachment from tidal waters within a 50 year planning cycle. These areas provide a buffer between land uses and the coast to allow the natural fluctuations of the coast to occur without the need for intervention to protect human life and property.'*

Fluctuations in the position of the coastline and periodic inundation of some coastal areas are part of the natural processes of the coast. In the past, development has occurred within areas vulnerable to erosion and in many cases this development amounts to substantial private and public investment. Protection works for the built environment in these areas can result in adverse impacts on coastal resources and their values.

The erosion prone area mapping for the site is presented below, refer to Figure 21. As noted in the mapping the required setback is segment 2700 which is Mean High Water Springs (MHWS) +40m. MHWS generally reflects top of bank along Oakey Creek and thus a 40m setback from top of bank applies.

This setback was also selected as it correlated with the extent of filling being contemplated in the preliminary design for the IRTC bridge structure over Oakey Creek. We note the earthworks for the site include filling of the IRTC land and the DTMR has conditionally accepted the proposed earthworks and hydraulic modelling proposed by the development.

Figure 21: Extract South East Queensland Coastal Management District Sheet 13.28 Pimpama Extract Coastal Plan Coastal Dependent Development Mapping (DEH 2006)



Significant Fauna Species

The proposal will involve the clearing of areas of pasture and remnant vegetation to facilitate future infrastructure and development in accordance with the proposed master plan.

These areas currently support a variety of flora and fauna assemblages associated with pastoral lands and estuarine river environments. Potential impacts associated with vegetation clearing on fauna include:

- Overall loss of standing biomass and reduction in flora species abundance/diversity
- Mortality as a result of construction activities (removal/disturbance of nests, hollows, burrows and general habitat)
- Loss of habitat complexity from the clearance zones including loss of potential foraging and nesting/roosting resources
- Increased potential from 'edge effects' to retained remnants
- Disturbance of species behaviour (i.e. some species are less tolerant to human presence or a higher level of human activity and may abandon currently utilized habitats)

Scheduled Species - Aves

The sites proximity to the extensive coastal and intertidal habitats of Moreton Bay, its contextual setting i.e. waterways to two boundaries and the onsite wetland communities does strongly influence the presence and recording of marine and wetland species on site.

The site exhibits habitat generally suitable for estuarine wetland waterfowl, grassland/pasture birds and open forest/woodland birds. Due to extensive available areas of adjacent and in close proximity to the site (Coomera River and Moreton Bay to the east) and on site intertidal areas and wetlands a large number of water-birds were consequently recorded.

The proposal will remove wetland areas of the site utilised by wetland birds. All recorded scheduled avifauna, excluding the two species listed as a Migratory Terrestrial Species under the EPBC Act, being *Merops ornatus*, the Rainbow Honeyeater and *Haliateetus leucogaster*, Whit-bellied Sea Eagle were associated with the semi permanent central wetlands of the site.

As outlined the habitat provided by the central wetland areas also occurs in a number of conservation reserves and other freehold allotments within the immediate vicinity. These conservation reserves are contained within the broader Moreton Bay Marine Park which contains critical roost and feeding areas for the recorded species.

As identified the sites wetland habitats and use by wetland/wader species is affected by human disturbance. This includes direct disturbance from use of the site and adjacent waterway by the public boating activities. This impact significantly also includes the activities of the model aeroplane flying club which operate from the existing open space reserve (lot 108 WD 6404). The plane's flight paths occur over the site and directly over the central wetland areas and foreshore of the Coomera River.

We note the central wetland areas of the site occur across the future IRTC allotment and the site. Delivery of the future IRTC motorway will have a direct and indirect affect on the central wetland areas and potential use by waders.

Eight (8) avifauna, are listed within the Qld Nature Conservation Act as Endangered, Vulnerable or Near Threatened, are listed as being recorded within 5km of the site. Of these one (1) species listed as 'near threatened' pursuant to the QLD Nature Conservation Act 1992 was recorded during survey works.

In regard to the recorded species, the Jabiru, the removal of the habitat from which it was recorded is likely to decrease and or preclude continued use of the site for this specie.

Two species, recorded on site are listed as Migratory Marine Birds under the EPBC Act, these being the *Ardea Alba* (Great Egret) and the *Ardea ibis* (Cattle Egret); resident populations of each species can be found on the Gold Coast and Moreton Bay Marine Park.

This species was recorded across the site in a variety of habitats and is likely to continue to utilise the retained habitat areas of the developed site.

Two species listed as a Migratory Terrestrial Species under the EPBC Act, being *Merops ornatus*, the Rainbow Honeyeater and *Haliateetus leucogaster*, White-bellied Sea Eagle were also observed. Again both these species have a resident population on the Gold Coast and Moreton Bay Marine Park. In the case of the Whit-bellied Sea Eagle an active nest site for the species is opposite the site, north of Oakey Creek.

These species are unlikely to be significantly affected by the proposal.

Four species, identified on site, are listed as Migratory Wetland Species under the EPBC Act, including the previous identified Great and Cattle Egret. The other two (2) species being the Sharp-tailed Sandpiper (*Calidris acuminate*) and Red-necked Stint (*Calidris ruficollis*).

It is considered that the site does provide a roost for a variety of wader species. The habitat for the scheduled migratory species is widely distributed in the immediate area. Critical roost and low tide feeding sites for waders as being recorded from a number of marine and national parks within 6km of the site. The removal of the sites central wetland and the 15ha of associated habitat it provides, whilst reducing the potential for continued use of the site by waders does not affect their distribution in the immediate or local area. Further the wider regional distribution is also unlikely to be impacted upon.

It is considered the proposal is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Including those six (6) species identified above a further two species recorded on site are listed in the EPBC Act as a ‘Listed Marine Species’. This additional species are the Red Capped Plover (*Charadrius ruficapillus*) and Black-winged Stilt (*Himantopus himantopus*).

The EPBC Act protected matters search has identified a total of 43 Threatened Species, 49 Migratory Species and 83 marine Species as potentially occurring or suitable habitat for the species occurs. Of these ten (10) are threatened avifauna, and forty one (41) are Migratory species. Of the Marine Species forty seven (47) are avifauna.

From a review of the proposal, survey data and information available on these species it is considered based upon the significant impact criteria in the EPBC Act Guidelines, it is unlikely the scheduled specie would be significantly affected.

Scheduled Species – Amphibia

The proposal will result in the removal minor areas of disturbed pasture non remnant areas and approximately 3.4ha of remnant regional ecosystem type 12.3.5. This regional ecosystem type is noted as a palustrine wetland and essential habitat for the Wallum froglet and the Wallum Sedgefrog.

The proposal is unlikely to result in the impact to these scheduled species which were not recorded on site.

It is unlikely that the proposal will significantly impact on the current diversity of fauna occurring on site with all species being recorded from areas proposed to be retained as open space

Scheduled Species – Mammalia

A total of twenty-three (23) mammal species, including seven (7) introduced specie, were recorded on the subject site. One threatened species listed under the EPBC Act was recorded on site; this being the Grey headed Flying fox.

During site survey works the Grey-headed Flying Fox was occasionally recorded foraging on flowering Blue Gums and is noted to be common within the local area as a result of large tracts of eucalypt and melaleuca forests providing favoured foraging resources. A thorough search of the Mangrove Forest/Woodlands areas did not reveal any roosting/camping sites.

It is noted the site vegetation provides limited habitat for terrestrial fauna, with general paucity of hollow bearing trees and low abundance of fruiting and flowering specie. It is acknowledged that the modified pasture areas do provide general forage/habitat for macropods.

Areas of highest structural habitat diversity and species recordings for fauna and scheduled fauna are generally conserved within the proposed minimum 40 buffer to Oakey Creek.

The corridor of open space also serves to preserve continued movement along the riparian zone for potentially occurring scheduled flying and terrestrial/aquatic mammals.

It is considered the proposal would not significantly affect continued native fauna use of the site.

Scheduled Species – Reptilia

The diversity of habitats for reptile species is considered reasonably low across the site due to limited diversification (i.e. relatively uniform relief, soil type, dominance of salt marsh and pasture).

Typically reptile species require a large diversity of microhabitats (including vegetation structure, ground substrates, basking sites etc) and suitable shelter sites to regulate body heat.

Such components are crucial as reptiles require differing levels of microhabitat to regulate body heat which controls essential functions such as movement, digestion, respiration and breeding activity (Kaplan, 1996). Areas with higher structural diversity were limited to the western Swamp Oak Forest and Tall Closed Grassland.

Within the site reptile recordings were most common in this western area with three species of skink, water dragon, lace monitor and two tree snakes recorded. The grass skink, wall skink and red-bellied black snake were also recorded from the pasture and swamp oak zone. All of the recorded reptiles are considered to be of 'least concern' (Nature Conservation Act 1992) and common within the local area.

A total of eight (8) reptile species were recorded on the subject site. No reptiles listed as rare, vulnerable or endangered within the *Nature Conservation Act 1992* or EPBC Act were observed on site.

The EPBC Act Protected Matters Search Report indicates the presence of eight (8) federally listed rare and threatened reptile species within the sub-region (5-kilometre radius).

From a review of the proposal, survey data and information available on these species it is considered based upon the significant impact criteria in the EPBC Act, it is unlikely the specie would be significantly affected.

Terrestrial Flora and Fauna - Design and Mitigation Measures

The general principle of environmental management and sustainability is to (in order of preference):

- Avoid environmental impact
- Reduce impact
- Mitigate the impacts
- Following investigation of the above, compensate for the residual impact.

Design

The layout of the preferred design has been chosen to meet the most practical and efficient provision for Engineering Services and therefore ecological values are unavoidably impacted upon because of these processes. 11.5 ha of land will be removed to create the external marina, 4.5ha removed for the internal marina and 7 ha to widen the Coomera River. This will cause a change to the diversity and abundance of species inhabiting the tidal communities on site. We note other estuarine and fisheries impacts also occur through filling. Smaller quantities of terrestrial vegetation are also impacted on and retention is not feasible.

Nonetheless, the project design was modified and the construction methodology was altered to prevent unacceptable impacts on environmental values and the principles of Ecologically Sustainable Development applied to protect these values. For example, 'the layout of the GCIMP precinct was designed to minimise air and noise impacts by separation of ocean terminal activities from sensitive receptors in the Coomera Marine precinct area. Internal waterway design was modified to ensure adequate tidal flushing and to protect water quality and aquatic habitats' (Hyder 2010f:6).

Also a setback consisting of native vegetation of at least 40 metres is proposed along Oakey Creek. Riparian habitat serves as a source and sink for biotic and abiotic effects. The efficacy of this riparian buffer for protecting aquatic organisms and aquatic ecosystem function in Oakey Creek will be known when the desired environmental goals (wildlife corridor, bank stabilization, water quality protection) have been demonstrated.

Summary of Mitigation Measures

A range of proposed mitigation strategies are necessary to minimise the impact to ecological values during construction and operation activities.

A hazard and risk assessment was undertaken and an Environmental Management Plan (EMP) has been prepared to mitigate potential adverse impacts

that may occur to tidal communities, fauna and fauna habitat. Monitoring programs should provide an early warning of adverse changes to limit the risk of irreversible damage to the environment.

A Site Based Management Plan should outline routine monitoring to be undertaken during the construction phase on significant areas including air emissions, water quality and noise and will include daily and weekly reviews of general site management issues such as storage of fuels and oils, litter and silt curtains. A Construction Waste Management Plan will also minimise impacts to water quality and habitat due to litter and toxic substances.

A range of mitigation strategies will assist in minimising the impact to fauna and fauna values during construction and operation activities. These procedures include but are not limited to:

- Capture and translocation by qualified wildlife spotters during the construction period;
- A Noise Management Plan for marine mammals should be developed to minimise vibration and noise impacts caused from construction;
- Noise generating activities during operation and construction shall be “ramped up” to alert fauna and provide the opportunity for them to move away.
- Daily inspections for presence of marine mammals in waterways surrounding the site prior to commencement of noise and wet excavation.
- Spotter/catcher present during dredging.
- Dredging to avoid marine species nesting periods.
- Pile driving to cease if turtles, dolphins and dugongs are observed within 500m of work site.
- Shielded lighting to be installed in marina berth areas to minimise impact on marine species.
- All construction personnel, staff and sub-contractors educated about ecological values of site, instructed not to feed fauna and report sightings of significant fauna species.
- To offset the loss of hollow bearing trees, it is recommended that five fauna boxes be installed within the retained environmental parkland in the western corner of the site.
- Restrict vessel speed.

Hollows

It is recommended that ten fauna boxes be installed within the retained environmental parkland in the western corner of the site to offset this loss. To potentially allow for a wide range of avifauna species to utilize the fauna boxes to be provided it is recommended that boxes be designed in accordance with a

variety of specifications (i.e. varying internal sizes, configurations and entrance diameters).

The fauna boxes should be randomly placed within the retention zone and regularly inspected/ observed to determine usage and species type for occupation. In the event of occupation by introduced species (i.e. bees, mynah) the box should be taken down and cleaned.

Offsets

Offsets will need to be provided for the terrestrial and marine communities lost. Environmental offset requirements in accordance with the Queensland Government Environmental Offsets Policy (QGEOP) applicable to the development include:

- Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss (Department of Primary Industries and Fisheries 2007)
- Policy for Vegetation Management Offsets v3 2011
- Offsets for Net Benefit to Koalas and Koala Habitat (EPA 2006)
- Policy for Biodiversity Offsets (consultation draft, EPA 2008).

The Queensland Government Environmental Offset Policy (QGEOP) is based on seven principles (EPA 2008b):

- Principle 1: Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy
- Principle 2: Environmental impacts must first be avoided, then minimized, before considering the use of offsets for any remaining impact
- Principle 3: Offsets must achieve an equivalent or better environmental outcome
- Principle 4: Offsets must provide environmental values as similar as possible to those being lost
- Principle 5: Offset provision should minimize the time-lag between the impact and delivery of the offset
- Principle 6: Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values, and
- Principle 7: Offsets must be legally secured for the duration of the offset requirement.

The QGEOP identifies two types of environmental offsets: direct and indirect. Direct offsets are those actions that provide environmental values, while indirect offsets complement the intended environmental outcome in other ways, e.g.

funding for targeted research linked directly to the environmental values, providing infrastructure that will help protect the environmental values being impacted (EPA 2008b).

To arrive at acceptable offsets multiple meetings were held with various departments including the current Qld Department of National Parks, Recreation, Sport and Racing (DNPRSR) and Department of Agriculture, Fisheries and Forestry (DAFF).

From this process it was agreed that;

- Offsets could be provided outside the catchment from where the impact was occurring;
- Offsets could be provided outside GCCC local Government area
- Offsets were to be provided within QLD

These criteria acknowledged the restricted ability to source offsets in the catchment, local government area and the general provisions of the relevant fisheries policies.

As such, a number of Queensland localities were identified where offsetting or active rehabilitative measures to improve fisheries values could occur. This enabled targeted searches for suitable sites for potential offsetting to be undertaken, with properties in Bustard Bay identified. These are detailed in the Offset Option Report prepared by Herron Todd White Earthtrade.

Through discussions with Department of Agriculture, Fisheries and Forestry (DAFF) and the Department of National Parks, Recreation, Sport and Racing (DNPRSR), on the proposed offsets it was identified that additional areas/options also be considered. The offset areas should be suitably tenured, possessing all or substantial areas of tidal fish habitats which shared a common boundary with a declared Fish Habitat Area (FHA). Appropriate tidal lands would then be formally added to the adjoining declared FHA.

In these discussions the Baffle Creek declared FHA was identified as a priority location for expansion of the Queensland declared FHA Network. Options are to be further investigated and offset requirements will be resolved through the EIS process.

It was further noted that offset measures involving a financial contribution as funding toward fish habitat research may be agreed between Fisheries Queensland and the proponent as an offset requirement, for example under the Urban Fish Habitat Management Research Program. A third party would then be enlisted to deliver the research project under a separate agreement with Fisheries Queensland for research funding (Dixon et al. 2009).

It was also noted from the discussion that local offset options for GCIMP include signage for salt marshes, signage for marine fish habitat education, or repairs or extension of public boardwalks at either Currumbin on Tallebudgera.

Offsets for Net Benefit to Koalas and Koala Habitat

The development proposal has been declared to be a significant project under the *State Development and Public Works Organisation Act 1971*, section 26(1) (a). The site is located within an identified 'koala broad hectare area' and 'koala assessable development area' which would typically trigger the provisions of the SPRP. However since the development is a significant project the provisions of the SPRP are not applicable.

Local Government Area Offsets

As identified through the offset process area which is available to provide offsets is limited. It was identified that educational signage actions could be considered as part of the overall mitigation works.

As outlined educational signage is proposed within the development to address of site and downstream impacts to fauna i.e. waders.

Opportunities for new expanded boardwalks and educational initiatives in the local creek systems of the coast may also exist. The extent of offset requirements will be determined through the EIS process.

Matters of National Environmental Significance

Based on field surveying and a review of the EPBC Act Protected Matters Report for a five (5) kilometre search radius from the centre of the subject site, the GCIMP project has the potential to support the following species of threatened fauna and flora, as listed in Table 12 below.

Table 12: Species of Threatened Fauna and Flora

Common Name	*Scientific Name*	*EPBC Status*
THREATENED TERRESTRIAL FAUNA AND FLORA		
Birds		
Regent Honeyeater	*Anthochaera phrygia*	Endangered
Australasian Bittern	*Botaurus poiciloptilus*	Endangered
Coxen's Fig-Parrot	*Cyclopsitta diophthalma coxeni*	Endangered
Eastern Bristlebird	*Dasyornis brachypterus*	Endangered
Red Goshawk	*Erythrotriorchis radiates*	Vulnerable
Southern Squatter Pigeon	*Geophaps Scripta*	Vulnerable
Swift Parrot	*Lathamus discolor*	Endangered
Southern Black-throated Finch	*Peophila cincta*	Endangered
Australian Painted Snipe	*Rostratula australis*	Vulnerable
Black-breasted Button-quail	*Turnix melanogaster*	Vulnerable
Frogs		
Giant Barred Frog	*Mixophyes iteratus*	Endangered
Mammals		
Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable
Northern Quoll	*Dasyurus hallucatus*	Endangered
Spotted-tail Quoll	*Dasyurus maculatus*	Endangered
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Vulnerable
Long-nosed Potoroo	*Potorous tridactylus*	Vulnerable
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable
Water Mouse	*Xeromys myoides*	Vulnerable
Koala (southeast Queensland bioregion)	*Phascolarctos cinereus*	Vulnerable
Plants		
Dwarf Heath Casuarina	*Allocasuarina defungens*	Endangered
Hairy-joint Grass	*Arthraxon hispidus*	Vulnerable
Marbled Balogia	*Baloghia marmorata*	Vulnerable
Heart-leaved Bosistoa	*Bosistoa selwynii*	Vulnerable
Three-leaved Bosistoa	*Bosistoa transversa*	Vulnerable
Native Jute	*Corchorus cunninghamii*	Endangered
Stinking Cryptocarya	*Cryptocarya Foetida*	Vulnerable
Leafless Tongue-orchid	*Cryptostylis hunteriana*	Vulnerable
Floyd's Walnut	*Endiandra floydii*	Endangered
Wandering Pepper-cress	*Lepidium peregrinum*	Endangered
Macadamia Nut	*Macadamia integrifolia*	Vulnerable
Lesser Swamp-orchid	*Phaius australis*	Endangered
Mt Berryman Phebalium	*Phebalium distans*	Critically Endangered
Minute Orchid	*Taeniophyllum muelleri*	Culnerable

Common Name	*Scientific Name*	*EPBC Status*
Reptiles		
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	Vulnerable
Collared Delma	*Delma torquata*	Vulnerable
THREATENED AQUATIC FLORA AND FAUNA		
Mammals		
Southern Right Whale*	*Eubalaena australis*	Endangered
Reptiles		
Loggerhead Turtle*	*Caretta caretta*	Endangered
Green Turtle*	*Chelonia mydas*	Vulnerable
Leatherback Turtle*	*Dermochelys coriacea*	Endangered
Hawksbill Turtle*	*Eretmochelys imbricata*	Vulnerable
Olive Ridley Turtle*	*Lepidocheys olicacea*	Endangered
Flatback Turtle*	*Natator depressus*	Vulnerable
Sharks		
Grey nurse Shark	*Carcharias taurus*	Critically Endangered
Green Sawfish	*Pristis zijsron*	Vulnerable
Porbeagle*	*Lamna nasus*	Listed Migratory
THREATENED MIGRATORY SPECIES		
Terrestrial Species		
Coxen's Fig-Parrot	*Cyclopsitta diophthalma coxeni*	Endangered
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Listed Migratory
White-throated Needletail	*Hirundapus caudacutus*	Listed Migratory
Rainbow Bee-eater	*Merops ornatus*	Listed Migratory
Black-faced Monarch	*Monarcha melanopsis*	Listed Migratory
Spectacled Monarch	*Monarcha trivirgatus*	Listed Migratory
Satin Flycatcher	*Myiagra cyanoleuca*	Listed Migratory
Rufous Fantail	*Rhipidura rufifrons*	Listed Migratory
Regent Honeyeater	*Anthochaera phrygia*	Endangered
Wetland Species		
Common Sandpiper	*Actitis hypoleucos*	Listed Migratory
Great Egret	*Ardea alba*	Listed Migratory
Cattle Egret	*Ardea ibis*	Listed Migratory
Ruddy Turnstone	*Arenaria interpres*	Listed Migratory
Sharp-tailed Sandpiper	*Calidris acuminata*	Listed Migratory
Sanderling	*Calidris alba*	Listed Migratory
Red Knot	*Calidris canutus*	Listed Migratory
Curlew Sandpiper	*Calidris ferruginea*	Listed Migratory
Red-necked Stint	*Calidris ruficollis*	Listed Migratory
Great Knot	*Calidris tenuirostris*	Listed Migratory
Double-banded Plover	*Charadrius bicinctus*	Listed Migratory
Greater Sand Plover	*Charadrius leschenaultii*	Listed Migratory
Lesser Sand Plover	*Charadrius mongolus*	Listed Migratory
Oriental Plover	*Charadrius veredus*	Listed Migratory
Latham's Snipe	*Gallinago hardwickii*	Listed Migratory
Grey-tailed Tattler	*Heteroscelus brevipes*	Listed Migratory
Broad-belled Sandpiper	*Limicola falcinellus*	Listed Migratory
Bar-tailed Godwit	*Limosa lapponica*	Listed Migratory
Black-tailed Godwit	*Limosa limosa*	Listed Migratory
Australian Cotton Pygmy-	*Nattapus coromandelianus*	Listed Migratory

Common Name	*Scientific Name*	*EPBC Status*
goose	*albipennis*	
Eastern Curlew	*Numenius madagascariensis*	Listed Migratory
Little Curlew	*Numenius minutus*	Listed Migratory
Whimbrel	*Nemenius phaeopus*	Listed Migratory
Pacific Golden Plover	*Pluvialis fulva*	Listed Migratory
Grey Plover	*Pluvialis squatarola*	Listed Migratory
Painted Snipe	*Rostratula benghalsnsis*	Vulnerable
Wood Sandpiper	*Tringa glareola*	Listed Migratory
Marsh Sandpiper	*Tringa stagnatilis*	Listed Migratory
Terek Sandpiper	*Xenus Stagnatilis*	Listed Migratory
Migratory Marine Birds		
Fork-tailed Swift	*Apus pacificus*	Listed Migratory
Great Egret	*Ardea alba*	Listed Migratory
Cattle Egret	*Ardea ibis*	Listed Migratory

The potential for the GCIMP development to have significant impacts on the identified threatened species listed above has been subject to detailed assessments during the preparation of detailed development plans and the compilation of the EIS, Matters of NES are discussed in detail in Section 1.5 of the EIS and within the Report on Matters of NES prepared by Planit Consulting contained in Appendix 6 to the EIS.

4.4 Water Resources

This section should describe the existing environment for water resources, including surface and groundwater resources that may be affected by the project. All environmental values, as defined under the EP Act, *Environmental Protection (Water) Policy 2009* and the *National Water Quality Management Strategy (Australian and New Zealand Environment and Conservation Council) 2000*, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand 2000) and *Queensland Water Quality Guidelines 2009* (DERM) and *Environmental Protection (Water) Policy 2009 – Coomera River Environmental Values and Water Quality Objectives July 2010* should be described.

Given the lack of overall gradient across the development site, there is no main watercourse traversing the site or general direction of flow.

A number of existing natural and constructed watercourses are observed on the development site. In total, seven (7) points of discharge have been identified with reciprocal local catchment areas. Five (5) of the existing catchments discharge to the north of the site toward Oakey Creek, and two (2) of the catchments discharge to the east toward Coomera River.

Within the western portion of the site there are two (2) existing constructed dams. Central to the development site and covering the land dedicated to the IRTC a large natural, unmaintained wetland exists with three (3) semi-perennial ponds connected by temporally adjusting natural channels. On the eastern portion of the site a series of excavated earth channels exist which provide two (2) discharge locations to Oakey Creek, one (1) discharge location to the Coomera River and one (1) discharge to the open channel drainage to the North of Shipper Drive which ultimately discharges to Coomera River. The excavated earth channels provide low efficiency drainage to the site and are generally ponded with low to no velocity flow. To the far north-east of the site a low laying catchment exists which is predominantly submerged wetland and is assumed to discharge naturally via surcharging sheet flow to Oakey Creek and the Coomera River.

Each of the seven (7) existing internal catchments is independent and each have a unique point of discharge. The table below provides a summary of the existing catchment areas and the parameters which influence stormwater runoff behaviour.

Table 13: Existing Catchment Summary

Name	Area (ha)	% Impervious	Length of Sheet Flow (m)	Length of Channel Flow (m)	Average Slope (%)
A	10.90	5	100	180	0.6
B	22.45	5	120	400	0.9
C	3.02	5	60	180	0.75
D	2.67	5	90	70	1
E	3.60	5	130	30	1
F	10.47	5	200	280	0.5
G	5.94	5	100	130	0.5

The hydrologic assessment of the current site includes the Identification of existing discharge locations, the contributing catchment areas and the runoff parameters of all the internal catchments in the existing condition.

A Stormwater Management Plan prepared by Hyder Consulting is presented as Appendix 16 of the EIS; which presents detailed information regarding water resources relating to the management of stormwater.

Details pertaining to existing Water Quality of the Coomera River, and the impacts of the GCIMP on water quality is contained in the Water Quality Report prepared by BMT WBM contained in Appendix 28 to the EIS. This information is also summarised in the EIS sections below.

Watercourses and Drainage

Description of the Existing Watercourses and Drainage

A detailed description of regional catchments, sub-catchments and overland flow paths and watercourses within the project site should be provided. Run-off characteristics including water quantity and quality should be described.
A detailed description of the upstream values of Oakey Creek showing an analysis of pre-development drainage and flooding characteristics should be provided.

A detailed description of the receiving environment should be provided including description of existing sources of contamination, water quality, environmental values and water quality objectives. The description of the receiving environment should consider water quality characteristics in both a seasonal and episodic (e.g. flooding) context. Water quality description should include:

- physical, chemical and biological characteristics (e.g. pH, dissolved oxygen, suspended solids, turbidity, total nitrogen, total phosphorous, total and dissolved aluminium, total and dissolved iron, faecal coliforms and chlorophyll (a)
- current sources and nature of any pollutants
- physical processes that may influence water quality including currents, tides, storm surge, freshwater flows and their interactions in relation to pollutant transport.

Existing water quality data (if available) should be supplemented by water quality monitoring to establish baseline water quality in the area against which potential impacts of the project can be considered.

This section should define and describe the water quality objectives (WQO) required to protect the environmental values identified, including discussion of why they are suitable indicators for the environmental values. Impacts on water quality as a result of climate change should be considered. The description of surface water run-off characteristics and the receiving environment should be undertaken in accordance with relevant state and local government requirements, including the *Environmental Protection (Water) Policy 2009 – Coomera River environmental values and water quality objectives July 2010* and the relevant Gold Coast City development assessment guidelines and specifications. The stormwater quality objectives should consider the targets of relevant action plans within the *South East Queensland Healthy Waterways strategy 2007–2012*. The assessment of existing water quality and potential water quality impacts should specifically address impacts on retained wetland (tidal and coastal) communities.

The Water Quality Report prepared by BMT WBM contained in Appendix 28 of the EIS identifies the environmental values (EVs) and water quality objectives (WQOs) for the Coomera River, based on a review of available literature and existing water quality data for the Coomera River. EVs and initial WQOs are sourced from Schedule 1 of the *Environmental Protection (Water) Policy 2009* (EPP Water), with further site specific 20th/80th percentiles derived from an analysis of existing water quality data.

Environmental Values

As per ANZECC/ARMCANZ 2000, water quality objectives for a waterway can be determined by first identifying the EVs for a particular catchment area. EVs have previously been established for the Coomera River catchment under Schedule 1 of the EPP Water.

Areas within the Coomera River catchment which are relevant to the GCIMP Project include:

- Coomera River downstream of the weir to the junction of the north and south arm;
- Oakey Creek.

EVs for this area are summarised in Table 14 below.

Table 14: Environmental Values for the Coomera River and Oakey Creek

Environmental Values	Coomera River – 3km downstream of weir to junction of north and south arm	Oaky Creek
Aquatic Ecosystems	M	M
Seagrass	M	-
Irrigation	-	L
Aquaculture	M	-
Human Consumer	M	M
Primary Recreation	H	M
Secondary Recreation	M	L
Visual Recreation	M	H
Industrial Use	L	L
Cultural and Spiritual Values	M	L

Note: H = high, M = medium, L = low priorities sourced from GCCC Report "Environmental Inventory of the Coomera River Catchment and its Tributaries"

The EVs listed in the above table can be broadly defined as follows:

- **Aquatic ecosystems** - The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas;
- **Seagrass** – this is part of the aquatic ecosystem EV, and relates to maintenance or rehabilitation of seagrass habitat;
- **Human consumer of aquatic foods** - health of humans consuming aquatic foods — such as fish, crustaceans and shellfish (other than oysters) from natural waterways;
- **Oystering** – this is part of the human consumer EV, and relates to health of humans consuming oysters from natural waterways and commercial ventures;
- **Primary recreation** - health of humans during recreation which involves direct contact and a high probability of water being swallowed - e.g. swimming, surfing, windsurfing, diving and water-skiing;
- **Secondary recreation** - health of humans during recreation which involves indirect contact and a low probability of water being swallowed — e.g. wading, boating, rowing and fishing;
- **Visual recreation** - amenity of waterways for recreation which does not involve any contact with water – e.g. walking and picnicking adjacent to a waterway;
- **Cultural and spiritual values** - indigenous and non-indigenous cultural heritage – e.g. custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities; symbols, landmarks and icons (such as waterways, turtles and frogs); and lifestyles (such as agriculture and fishing); and
- **Aquaculture** - health of aquaculture species and humans consuming aquatic foods (such as fish, molluscs and crustaceans) from commercial ventures.

Water Quality Objectives

Schedule 1 of the Environmental Protection (Water) Policy (EPP Water) sets out the previously defined Environmental Values and the necessary WQOs to maintain those Environmental Values.

An important step in determining appropriate WQOs is to define the water type and level of protection required. According to the water type classification system included in the EPP Water, the Coomera River in the vicinity of the project site is defined as —*marine/estuarine waters - middle estuaryll.*

In regard to the protection of the aquatic ecosystem EVs, there are three possible levels of protection required depending on the current state of the waterway. As per ANZECC/ARMCANZ 2000, these three levels include:

- **Level 1 (high ecological/conservation value ecosystems)** - effectively unmodified or other highly valued systems, typically (but not always) occurring in national parks, conservation reserves or in remote and/or inaccessible locations
- **Level 2 (slightly-moderately disturbed ecosystems)** - ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained
- **Level 3 (highly disturbed ecosystems)** - measurably degraded ecosystems of lower ecological value. Examples of highly disturbed systems would be some shipping ports and sections of harbours serving coastal cities, urban streams receiving road and stormwater runoff, or rural streams receiving runoff from intensive horticulture.

As per Schedule 1 of the EPP Water, the Coomera River falls into the slightly-moderately disturbed level of protection (Level 2), for which corresponding WQOs have been derived. The following table outlines the WQOs for the protection of identified EVs.

Table 15: WQOs for Protection of Identified EVs

EV	WQO to protect the EV
Aquatic Ecosystem (Level 2)	▪ turbidity: <8 NTU ▪ suspended solids: <20 mg/L ▪ chlorophyll a: <4 µg/L ▪ total nitrogen: <300 µg/L ▪ oxidised N: <10 µg/L ▪ ammonia N: <10 µg/L ▪ organic N: <280 µg/L ▪ total phosphorus: <25 µg/L ▪ filterable reactive phosphorus (FRP): <6 µg/L ▪ dissolved oxygen: (20th - 80th percentile): 85 – 105% saturation ▪ pH: 7.0 – 8.4 ▪ secchi depth: (20th percentile) >1.0m
Seagrass	The minimum WQOs needed to restore seagrass to areas where it has been lost are: ▪ median total suspended solids: <10 mg/L; ▪ median secchi depth: >1.7 m; and ▪ light attenuation coefficient: >0.9.

	However, in areas where seagrass is intact, it is more important to maintain existing water quality. Therefore the WQOs are: ▪ local total suspended solids, turbidity, secchi and light attenuation is maintained; and ▪ local seagrass distribution and composition is maintained, as measured by: – extent of seagrass; – species diversity; and – seagrass depth limit.
Irrigation	▪ ANZECC objectives for pathogens and metals are provided in Tables 9 and 10 of EPP Water. For other indicators, such as salinity, sodicity and herbicides, see AWQG (2000).
Human Consumer of Aquatic Foods	▪ Objectives as per AWQG (2000) and Australia New Zealand Food Standards Code8, Food Standards Australia New Zealand, 2007 and updates. ▪ Fish and Crab Health: – Health of individuals - absence of pollutant induced disease or deformity – Tissue—no evidence of pollutant accumulation.
Primary Recreation	▪ median faecal coliforms <150 organisms per 100 mL or median enterococci organisms <35 organisms per 100 mL; and ▪ Secchi depth >1.2 m.
Secondary Recreation	▪ median faecal coliforms <1,000 organisms per 100 mL or median enterococci organisms <230 organisms per 100 mL.
Visual Recreation	Water being free from: ▪ floating debris, oil, grease and other objectionable matter; ▪ substances that produce undesirable colour, odour, taste or foaming; and ▪ undesirable aquatic life, such as algal blooms, or dense growths of attached plants or insects.

Cultural and Spiritual Values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.
Aquaculture	For tropical aquaculture in marine waters: ▪ Dissolved oxygen: >4mg/L ▪ Temperature (0C): 24-33 ▪ pH: 7-9 ▪ Ammonia (TAN, total ammonia-nitrogen): <1.0mg/L ▪ Ammonia (NH3, un-ionised form): <0.1mg/L ▪ Nitrate (NO3): 1-100mg/L ▪ Nitrite (NO2): <1.0mg/L ▪ Salinity: 15-35 ppt ▪ Alkalinity: >100mg/L ▪ Arsenic: <0.05mg/L ▪ Cadmium: <0.003mg/L ▪ Chromium: <0.1mg/L ▪ Copper: <0.006mg/L in soft water ▪ Cyanide: <0.005mg/L ▪ Iron: <0.5mg/L ▪ Lead: <0.03mg/L ▪ Manganese: <0.01mg/L ▪ Calcium/Magnesium: 10–160mg/L ▪ Mercury: <0.00005mg/L ▪ Nickel: <0.01mg/L in soft water, <0.04mg/L in hard water ▪ Tin: <0.001mg/L ▪ Zinc: 0.03–0.06 mg/L in soft water, 1–2 mg/L in hard water

A baseline study of existing water quality in the Coomera River has been conducted which provides an assessment of the existing water quality of Coomera River, identifying Environmental Values (EVs) and Water Quality Objectives (WQOs). This is detailed within the Water Quality Report prepared by BMT WBM contained in Appendix 28 and is summarised as follows.

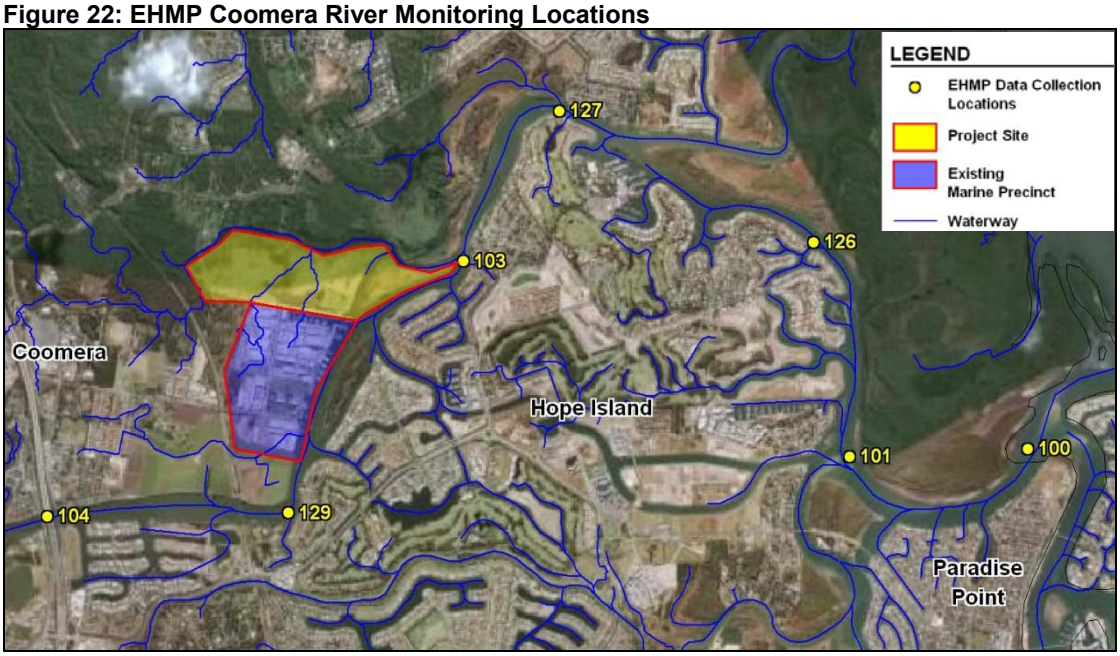
Existing Water Quality Data

Existing water quality data for Coomera River was sourced from the Healthy Waterways' Ecosystem Health Monitoring Program (EHMP). The EHMP is one of the most comprehensive marine, estuarine and freshwater monitoring programs in

Australia. It delivers a regional assessment of the ambient ecosystem health for each of South East Queensland's (SEQ) 19 major catchments, 18 river estuaries, and Moreton Bay, highlighting where the health of our waterways is getting better or worse. The EHMP is managed by the South East Queensland Healthy Waterways Partnership on behalf of its various partners and is implemented by a large team of experts from the Queensland Government, universities and CSIRO (HWP, 2010).

As part of our assessment of the Coomera River, seven sample sites located along the length of Coomera River were utilised from the EHMP dataset. These include sites 100, 101, 103, 104, 126, 127 and 129. The location of these monitoring sites are show in the figure below.

Figure 22: EHMP Coomera River Monitoring Locations



Data for these monitoring locations on Coomera River include monitoring results for a period between February 2000 and January 2009, monitored on a monthly basis. Water quality parameters include dissolved oxygen, turbidity, temperature, pH, conductivity, light penetration (secchi depth), chlorophyll-a, total nutrients and nutrient species. No analysis for suspended solids or heavy metals is included.

Data analysis was performed on these sites separately and also as a combined dataset to provide an indication of overall water quality of the Coomera River.

The table below presents the median values for each of the Coomera River monitoring locations, along with the median values from the combined dataset.

These medians can be compared to the literature-based WQOs for Coomera River, with highlighted cells indicating an exceedance of the relevant WQO. As can be seen from these results, while there are some minor exceedances, in the main the existing water quality in Coomera River meets the stated WQOs.

Table 16: Median Values from EHMP Ambient Monitoring Data

Parameter	Units	Coomera River Sample Sites								WQO
		100	101	103	104	126	127	129	Combined	
Temperature	oC	22.9	23.3	24.1	24.5	23.8	24.2	24.4	23.8	N/A
pH	-	8.06	7.97	7.86	7.79	7.92	7.88	7.81	7.90	7-8.4
Dissolved oxygen	% sat	94.3	94.5	94.2	94.1	93.2	93.3	92.9	93.9	85 - 105
Conductivity	mS/cm	52.4	52.0	48.7	43.9	50.7	49.2	45.0	49.6	N/A
Turbidity	NTU	5	5	6	8	6	6	8	6	<8
Total nitrogen	mg/L	0.16	0.17	0.24	0.31	0.19	0.22	0.27	0.22	<0.3
oxidised N	mg/L	0.001	0.002	0.001	0.004	0.002	0.001	0.002	0.002	<0.01
ammonia N	mg/L	0.002	0.003	0.003	0.009	0.003	0.003	0.004	0.003	<0.01
organic N	mg/L	0.156	0.164	0.224	0.282	0.179	0.206	0.264	0.210	<0.28
Total phosphorus	mg/L	0.019	0.02	0.027	0.04	0.023	0.024	0.033	0.025	<0.025
Filterable reactive phosphorus (FRP)	mg/L	0.006	0.006	0.009	0.014	0.007	0.008	0.009	0.008	<0.006
Secchi depth	metres	1.8	1.7	1.3	1.0	1.5	1.4	1.1	1.4	>1.2
Chlorophyll-a	µg/L	2.0	2.8	3.9	5.1	3.2	3.8	5.2	3.3	<4

The following comments can be made regarding existing water quality at or around the project site:

- pH and DO median values for all sites in Coomera River comply with the WQOs. Also, the majority of monitoring data lies within the WQO range, as indicated by the 20th and 80th percentiles of the datasets being between the upper and lower WQO limits;
- In terms of turbidity, all median values are either at or below the WQO;
- Median values for total nitrogen, ammonia, organic nitrogen, and oxidised nitrogen for most sites are at or below the WQO, except for sites 104 and 129 which exceed the WQO in terms of their median values;
- Median values for total phosphorus slightly exceed the WQO at sites 103, 104 and 129, and remain below the WQO at other sites. The results for Filterable Reactive Phosphorus (FRP) are similar, with the medians at all sites exceeding the WQO;
- Light penetration results indicate that median values for most sites are within the WQO (i.e. deeper than 1.2m), except 104 and 129 which are only in slight exceedance of the WQO; and
- Results for chlorophyll-a indicate that median values for most sites are within the WQO, except 104 and 129 which slightly exceed it.

As per the above, long-term water quality monitoring data from the EHMP was analysed to determine the trends in water quality over an eight year period. This data were used to examine natural fluctuations around the WQOs, to produce site-specific thresholds, and to examine the effects of season and weather on water quality. pH and DO median values for all sites in Coomera River over this period complied with the WQOs, and the majority of monitoring data for other parameters fell within the WQO range, as indicated by the 20th and 80th percentiles of the datasets. In terms of turbidity, all median values were either at or below the WQO.

A Water Quality Report prepared by BMT WBM is presented as Appendix 28 of the EIS which presents detailed information regarding the existing water quality within the Coomera River.

Furthermore, this report provides suitable water quality release criteria for both construction and operational phases. In addition this report assesses the extent and concentration of turbid plumes during dredging, and whether these plumes will result in exceedances of water quality objectives, and their impact on sensitive environmental receptors and predicted model outlets. This report assesses the release of sediment associated contaminants during dredging and provides a framework for baseline and construction phase management plans.

Potential Impacts on Watercourses and Drainage and Mitigation Measures

A detailed assessment of the potential direct and indirect impacts of the Project on runoff quantity and quality and the water quality of the receiving environment should be undertaken. The assessment should consider both construction and operation stages.

Potential impacts of changes in runoff quantity should be identified including environmental flows, erosion and scour and any potential impacts on physical integrity, fluvial processes and morphology of water courses, including riparian zone vegetation and form. In addition this will include an analysis of post development drainage and flood levels on the Oakey Creek upstream locality to determine any changes to existing values and the need to mitigate impacts if necessary.

The assessment of water quality should consider as a minimum:

- dredging and dredge material disposal with particular attention to suspended solids, pH, dissolved oxygen, phosphorus, and nitrogen;
- potential accidental discharge of contaminants during construction and operation of the project;
- release of contaminants from marine structures and vessels, including antifouling coatings;
- stormwater run-off from developed areas;
- consideration of water circulation and flushing to the "dead end" located within the internal marina.

The assessment of potential water quality impacts should include an analysis based on both historical climatic regimes and predicted climatic regimes (changes to the frequency and intensity of rainfall, and extreme events such as flood, storm surge).

The assessment should propose measures to mitigate, manage and monitor any impacts including the preparation of a stormwater management plan in accordance with relevant state and local government requirements, including the *Environmental Protection (Water) Policy 1997* and the relevant Gold Coast City development assessment guidelines and specifications.

Existing Water Quality

A baseline study of existing water quality in the Coomera River is contained in the Water Quality Report prepared by BMT WBM contained in Appendix 28. This

report provides an assessment of the existing water quality of Coomera River, identifying Environmental Values (EVs) and Water Quality Objectives (WQOs).

Construction Impacts

The table below presents an indicative list of proposed construction activities which may have the potential to discharge waters containing a variety of pollutants to surrounding areas. The various water quality indicators which may be impacted by these activities are also listed.

Table 17: Construction Activity and Pollutant Sources

Construction Activity	Potential Effects
Land Clearing	Tubidity, suspended solids, debris, temperature
Mulching of trees and cleared vegetation and stockpiling of mulched materials	Dissolved oxygen, nutrients, pH, algae, chlorophyll-a, debris
Earthworks including cutting and filling	Turbidity, suspended solids, pH, nutrients, heavy metals, debris
Dredge works and associated tailwater discharge	Turbidity, suspended solids, pH, dissolved oxygen, nutrients, temperature, chlorophyll-a, heavy metals.

The operational use of the marine precinct has the potential to discharge waters containing a variety of pollutants to surrounding areas, although the types of pollutants are likely to be significantly different to the construction phase. The table below presents an indicative list of operational activities and the various water quality indicators which may be impacted by these activities.

In addition to the above mentioned water quality indicators, the EIS Terms of Reference includes specific water quality indicators which are required to be assessed to determine baseline water quality conditions. These indicators include:

- pH;
- total phosphorous;
- dissolved oxygen;
- total and dissolved aluminium;
- suspended solids;
- total and dissolved iron;
- turbidity;

- faecal coliforms;
- total nitrogen; and
- chlorophyll a.

Table 18: Operational Activity and Pollutant Sources

Operational Activity	Potential Effects
Road use	Turbidity, suspended solids, heavy metals, hydrocarbons and debris
Boat building activities	Chemical contaminants and debris
Boat refuelling and mooring	Hydrocarbons, faecal coliforms and debris
Spillages	Variety of water quality indicators, depending on what may be spilt
Maintenance dredging	Turbidity, suspended solids, pH, dissolved oxygen, nutrients, temperature, chlorophyll-a, heavy metals

A range of construction and operational activities were identified in the tables above which have the potential to impact on water quality and ecological receptors.

Key sensitive ecological receptors within the study area are:

- Invertebrates and fish - particularly with respect to potential changes in dissolved oxygen concentrations, pH or the release of toxins as a result of mobilisation of riverbed sediments during dredging;
- Seagrass - particularly in the context of light reductions and smothering caused by suspension of bed sediments by dredging;
- Aquatic species with significant conservation status including dolphins, turtles, dugong and pipefish;
- Protected areas including Ramsar and nationally significant wetlands, marine parks and Fish Habitat Areas.

Dredging activities are identified as having the potential to have an impact upon water quality and ecological receptors. The GCIMP will be constructed using a combination of staged wet and dry excavation techniques. The wet techniques will produce turbid plumes that vary in intensity according to construction location. The impact of these activities on water quality objectives and ecological communities outside the construction footprint were identified as per the Water Quality Report prepared by BMT WBM contained in Appendix 28, and the Aquatic Ecology report prepared by FRC Environmental contained in Appendix 7.

Dry Excavation

Water released from the first flushing and dewatering of the dry excavated marina has the potential to affect water quality through the release of deoxygenated, turbid and/or acidic waters. The impacts of turbid and acidic water releases will be mitigated by adhering to the Water Release Program detailed in the construction Acid Sulfate Soil Management Plan contained in Appendix 32.

Nutrient and ammonia release is considered a very low risk because of the clay nature of soils, which bind to ammonia. The risk of releasing other contaminants of concern, such as metals and pesticides is considered low because these have not been present above screening levels elsewhere in the project site. Potential impacts of hydrocarbon spills during construction are listed in Section 7.4.2 of the Aquatic Ecology Report prepared by FRC Environmental contained in Appendix 7.

Wet Excavation

The impacts of the release of sediment-associated containments and of turbid plumes were considered. The risk of sediment-associated containments is considered low as the concentrations of trace metals, organotins, pesticides, and petroleum hydrocarbons were all below NAGD screening levels, and in most cases, below laboratory detection limits.

The sandier sediments in the southern section of this passage are not expected to pose a risk in terms of the release of nutrients or other oxygen consuming substances. Furthermore, any release of nutrients associated with dredging of finer (organically enriched) sediments is not expected to result in major changes to water quality or ecosystem health given that:

- the sediments were not highly eutrophic;
- the environment is considered to be sufficiently well flushed such that it would rapidly disperse, advect and dilute nutrients to low levels;
- any ammonia or nitrate released during dredging is expected to be rapidly oxidised.

The modelling of the turbid plume indicated that water quality objectives would be exceeded and so impacts on ecological sensitive receptors were assessed.

It is difficult to predict the response of seagrass to the intermittent nature of plumes at these locations. Taking a highly conservative approach and assuming that the conditions at a seagrass bed approximately 800 m downstream on the Coomera River could result in complete loss, it is estimated that 1.23 ha of seagrass will be lost in total as a result of the dredge plumes. The beds to be affected are generally small in extent, relatively sparse, and not located in significant areas such as the

Moreton Bay Marine Park or declared fish habitat areas. Therefore, areas of conservation significance and local fisheries are not likely to be affected by changes in water quality associated with dredging.

The seagrass bed downstream of the project site on the Coomera River is expected to recover to its former extent within 1- 3 years, in the absence of major rainfall or flood events. Such natural events can dramatically reduce the extent of seagrass and it is possible that the mapped distribution of seagrasses has changed significantly since the January 2011 floods.

Water Quality Release Program - Land Activities

During both the construction and operational phases of the project, stormwater runoff from the project site may potentially impact upon the water quality. If stormwater is not managed appropriately, there is the potential for stormwater to transport pollutants (such as sediment, nutrients and hydrocarbons) from ground surfaces into adjacent waterways during rainfall events.

Water quality release criteria for the construction phase have been sourced from the State Government's —*Draft Urban Stormwater - Queensland Best Practice Environmental Management Guidelines 2009"* and a monitoring program proposed.

Load-based release criteria were recommended for the operational phase in accordance with the load reduction targets included in guidelines specifically for the Gold Coast and the SEQ region. A Stormwater Management Plan was prepared by Hyder Consulting on this basis and is contained in Appendix 16 of the EIS.

Water Quality Monitoring

The EHMP monitoring data for Coomera River, while temporally extensive, does not include a number of key water quality parameters, specifically suspended solids and heavy metals. The Terms of Reference (ToR) contained in Appendix 1 includes the requirement to assess water quality in terms of suspended solids, total and dissolved aluminium, and total and dissolved iron, along with other parameters already included in the EHMP data. Therefore, in order to fill the gaps in the existing data, it is necessary to commence a baseline water quality monitoring program for at least 18 months and preferably two years.

Dredging during the construction and operational phase of the proposed development has the potential to impact on the marine environment – particularly from increased turbidity. The extent of these impacts can be monitored through

implementation of a water quality monitoring program. It will be a requirement of the implementation of the monitoring program that the specified threshold values are not exceeded as this will ensure that the impacts to the marine environment are no greater than estimated.

Groundwater

Description of the Existing Groundwater Environment

A groundwater survey should be undertaken to review the quality and quantity of groundwater in the project area, including groundwater use in neighbouring areas. This section should identify groundwater characteristics, recharge sources, direction of flow and existing levels across the project area.

Data obtained from the groundwater survey should be sufficient to enable specification of the major ionic species present in the groundwater, pH, electrical conductivity and total dissolved solids. The groundwater assessment should also be consistent with relevant guidelines for the assessment of acid sulfate soils, including sufficient spatial and temporal monitoring to accurately characterise baseline groundwater characteristics.

In order to review the quality and quantity of groundwater in the project area, Gilbert and Sutherland installed five (5) boreholes, to supplement the two (2) existing boreholes on site. The purpose of the boreholes was to:

- Increase reliability of groundwater calculations and modelling;
- Assess influence of site stratigraphy on groundwater quality;
- Estimate soil permeability;
- Enable the collection of an additional data set upon which to base an inital groundwater model.

The bore locations are shown in the Gilbert and Sutherland Groundwater Assessment and Management Plan contained in Appendix 31.

The boreholes were drilled into the alluvial stratigraphy to various depths. Piezometers were constructed and installed in accordance with the Minimum Construction Requirements for Water Bores in Australia. The piezometer boreholes (100mm in diameter) were constructed to various depths.

Permeability

The results of the rising head tests conducted within groundwater bores are summarised in the table below.

Table 19: Rising head test results

MW1	1.63×10^{-6}
MW4	6.48×10^{-6}
MW5	2.53×10^{-5}

MW7	1.16×10^{-6}
GW3	1.25×10^{-5}
GW7	5.0×10^{-6}

Groundwater quality

The analytical results for samples recovered from the bores for the entire data set recorded from May 12 to September 14, 2010 are discussed in this section. Complete results tables for each parameter and copies of the laboratory certificates and in situ sheets are included in the Groundwater Assessment and Management Plan, Appendix 31 of this EIS.

At the time of reporting six (6) rounds of monitoring data had been recovered (with monitoring continuing). Although the data recovered thus far provides a good representation of background water quality characteristics, to have 'statistical confidence' in the establishment of water quality objectives (WQO's), a minimum of eight rounds (8) is required. Data collection is ongoing and WQO's would be established prior to the commencement of the construction phase.

To understand the distribution characteristics of the data and to check the integrity of the data collected so far, an assessment of its distribution was undertaken, and is reported below (e.g. normal, log normal or non parametric).

<u>pH</u>
The analysis of the pH data recovered from MW1, MW2 and GW7 so far indicates a normal distribution. MW4, MW7 and GW3 require log transformation for assessment using parametric methods. The data set for MW5 is non-parametric. No outliers were removed.

	MW1	MW2	MW4	MW5	MW7	GW3	GW7
Normal distribution	Y	Y	--	--	--	--	Y
Non parametric	--	--	--	Y	--	--	--
Log normal	--	--	Y	--	Y	Y	--

Results for pH ranged from strongly acidic (3.04) to neutral (7.00), with mean results ranging from 4.47 to 6.47.

Throughout the monitoring period, the results for pH represented characteristics expected of an alluvial stratigraphy in this setting.

Electrical conductivity

The analysis of the EC data recovered from MW1 and MW5 so far indicates a normal distribution. MW7 and GW7 require log transformation for assessment using parametric methods. Interestingly, the non-parametric distributions are associated with the upgradient bores MW2 and GW3. MW4 also requires assessment using nonparametric methods. The analysis identified an outlier within the data set for GW7, which was removed from the analysis.

	MW1	MW2	MW4	MW5	MW7	GW3	GW7
Normal distribution	Y	--	--	Y	--	--	--
Non parametric	--	Y	Y	--	--	Y	--
Log normal	--	--	--	--	Y	--	Y

Mean results for EC were 1.62mS/cm to 58.7mS/cm, with a range of 0.9mS/cm to 91.8mS/cm. All bores were brackish to saline. The results for EC within the bores adjacent to Oakey Creek, Coomera River and the centre of the site had an EC of greater than 40mS/cm. MW2 reported the lowest EC's (<3.33mS/cm).

Total metals

The concentration of total metals was generally consistent throughout the monitoring period. The means ranged from 17.24mg/L to 118.5mg/L for total aluminium and 39.75mg/L to 298mg/L for total iron. It is also noted that results for both aluminium and iron on May 12 were considerably below their respective means.

Dissolved metals

The concentration of dissolved metals was generally consistent throughout the monitoring period. No spikes in the data set were noted, with the exception of MW5, which recorded the largest range in iron concentration (<0.25mg/L to 146mg/L).

Major cations and anions

Major cations (calcium, magnesium, sodium and potassium) and major anions (chloride, sulfate and alkalinity) are measured to allow for statistical analysis of the data set, and to allow for an ion balance to be undertaken to check quality assurance of laboratory results.

Piper and Durov diagrams were generated from the groundwater quality data and are included in Appendix 2. These diagrams map the proportions of cations and anions at each monitoring location.

The ion balance for these bores was approximately equal on the majority of occasions. The cations are dominated by sodium and potassium, whilst the anionic balance is maintained by the water's chloride concentration.

Results at MW2 appeared to differ slightly in ion dominance to the other bores. This bore is located in the south-western extremity of the site and is located the furthest away from Oakey Creek and the Coomera River. Generally, HCO_3 and CO_3 dominate the water's chemistry.

Groundwater Flow

Groundwater level monitoring was conducted by Gilbert and Sutherland across the bore network on six occasions. The resultant groundwater contours for the monitoring are shown in drawings contained in the Groundwater Assessment and Management Plan contained in Appendix 31.

The groundwater contours indicate that groundwater generally flows in a northerly direction, towards Oakey Creek, as such there are no downstream users of the alluvial aquifer.

A Ground Water Assessment and Management Plan prepared by Gilbert and Sutherland is presented as Appendix 31 of the EIS; containing further information regarding existing groundwater conditions.

Potential Impacts on Groundwater and Mitigation Measures

The Groundwater Management Plan must address the requirements of Policy 2.4.5 of the *State Coastal Plan* or the *draft Queensland Coastal Plan* (whichever is relevant at the time). This section should assess potential impacts on the environmental values of groundwater. It should also define and describe the objectives and practical measures for protecting or enhancing water resource environmental values, to describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

Matters to be addressed should include clear descriptions of the following.

- assessment of the impact of the Project on the local groundwater regime caused by altered porosity and permeability from land disturbance,
- an assessment of the potential to contaminate groundwater resources and measures to prevent, mitigate and remediate any potential contamination should be identified;
- the extent of the area within which groundwater resources are likely to be affected by the construction and operation of the Project including potential impacts from the disturbance of Acid Sulfate Soils;
- an assessment of the likely impact on groundwater depletion or recharge regimes.

A groundwater monitoring program should be developed for monitoring of groundwater quality both prior to commencement of construction and during operation of the Project.

Drawdown Calculations

Initially, empirical modelling using Houghoudt's Equation was undertaken to give an estimate of likely groundwater drawdown during the construction phase.

The proposed marina would be excavated over a number of phases. The marina would be over-excavated to a depth of RL-8.0m AHD to accommodate disposal of acid sulfate soil spoil from other areas of the site. In its final form, the excavation would be at a depth of RL-4.0m AHD.

The construction of the marina would primarily be achieved using dry excavation techniques. As such an estimate of groundwater drawdown associated with the construction phase was undertaken.

Construction phase drawdown

Based on a maximum excavation depth of RL -8m AHD and a final depth of -4m (following placement of acid sulfate soil spoil) the following table gives the predicted lateral extent of groundwater drawdown during the construction phase of the development. The extent of drawdown is shown for a dry, median and wet climatic sequence.

Table 20: Predicted groundwater drawdown using Houghoudt's Equation

Climatic sequence	Inflow rate (mm/day)	Drawdown (excavation at RL-4m AHD)	Drawdown (excavation at RL-8m AHD)
Dry	0.53	97	186
Median	0.816	78	150
Wet	1.29	62	119

These results are based on a hydraulic conductivity of $1x10E^{-6}$ and daily recharge rates equivalent to 30% of rainfall and represent groundwater drawdown without mitigation measures.

The anticipated groundwater impacts associated with construction of the proposed marina can be managed using proven techniques and specific measures to mitigate drawdown.

Operational phase drawdown

The operational phase impact of the proposed development on groundwater levels was estimated using a mean tide level of 0.5m for the marina. The monitored groundwater levels in the vicinity of the proposed marina have ranged from approximately 0.00 to 0.25m AHD. Therefore the introduction of the marina with an average groundwater level of 0.5m AHD will not result in drawdown of the groundwater table.

Conclusions

The analysis and field investigations by Gilbert & Sutherland support the following conclusions:

- Four development scenarios have been reviewed. Given the nature of the site soils and the groundwater characteristics recorded to date, the most likely potential impacts on groundwater as a result of the four development scenarios are associated with potential impacts from disturbance of acid sulfate soils during the marina construction phase.

- The marina excavation is to be located within the estuarine alluvial aquifer, which generally flows in a south to north direction, towards Oakey Creek and the Coomera River.
- It is unlikely that the proposed development marina will substantively affect the water quality of the alluvial aquifer.
- Unmitigated dry excavation of the marina is likely to result in groundwater drawdown extending a maximum horizontal distance of 190 metres from the edge of the excavation.
- Upon completion of dry excavations the marina would be connected to the Coomera River and allowed to fill. Groundwater levels surrounding the marina would recover to closely reflect the pre-development groundwater regime. Therefore, the operational groundwater levels will not decrease (i.e. drawdown) beyond the range of current natural fluctuations. Post-developed water level within the marina would be influenced by the tidal cycle of the Coomera River.
- The anticipated groundwater impacts associated with the construction phase of the proposed marina can be managed using proven techniques and specific measures to mitigate drawdown. These techniques and measures are described in the Groundwater Management Plan.

General Recommendations

In terms of the estimated groundwater impacts associated with the construction and operational phases of the proposed development and the near surface groundwaters, these can be readily managed by proven techniques. As such, additional detailed groundwater investigations and modelling are not necessary.

Nonetheless, groundwater levels and quality will require careful management during the construction and operational phases of the development. This will require at least eight rounds of groundwater height and quality data to be collected (ideally including seasonal variation) prior to the start of construction.

Management of Potential Impacts – Construction Phase

To minimise the potential extent and magnitude of drawdown within the modelled cone of depression, it is recommended that recharge trenches be established along the boundaries of the marina excavation.

It is recommended that each trench be positioned approximately 10m from the excavation area. The base of each trench should be flat, with a minimum width of 1.0m. The sides of the trenches should be graded at approximately 1V:3H and appropriate fencing and signage should be placed around the perimeter of each individual trench.

To limit the extent of the cone of depression, dewatered seepage from the main excavation area should be pumped from a sump into the recharge trenches. This would effectively limit the areal extent of the cone of depression to between the excavation area and each recharge trench.

If the recharge trenches are unable to drain sufficient water back into the profile, or monitoring of groundwater indicates impacts to groundwater depth or quality, additional re-injection of groundwater via a spear system will be undertaken. Alternatively, stone-filled drainage columns will be placed beneath the recharge trenches as required.

If any sand lenses appear to be preferential flow paths, these discrete areas can be over excavated and 'plugged' with the heavy clays available on site. This method has been used successfully and would generally involve dewatering of the immediate area by use of spears, removal of the highly permeable materials and replacement of the void with low permeability materials.

Monitoring of Drawdown and Potential Oxidation

Groundwater quality sampling and ongoing monitoring of groundwater levels (to evaluate any potential adverse impacts) should be undertaken during the construction phase of works.

It is proposed that groundwater level monitoring would be undertaken for all piezometers on a weekly basis during the construction phase of works to evaluate the extent of any influence from site activities. Groundwater quality monitoring would also be undertaken on a monthly basis.

Management protocols for potential impacts on groundwater during the construction and operational phases of development are included in the Groundwater Management Plan.

Groundwater Management Plan

The principal objective of the Groundwater Management Plan prepared by Gilbert and Sutherland contained in Appendix 31, is to provide mitigation measures to minimise the potential impacts of the development.

Additionally, the management plan provides information on specific site management issues relating to potential environmental impacts from the development during the construction and operational phases.

The control measures detailed in this management plan have been developed to minimise impacts on the environment and achieve the following objectives:

- Appropriate stewardship of natural resources,
- Protection of downstream flora and fauna habitats,
- Confirmation of the success of impact control measures by the means of monitoring during the construction of each stage,
- Compliance with statutory requirements, and
- Preservation of the existing groundwater conditions.

Detail pertaining to Groundwater Management is contained in the Groundwater Assessment and Management Plan prepared by Gilbert and Sutherland contained in Appendix 31.

4.5 Coastal Environment

Describe the existing coastal environment that may be affected by the project in the context of coastal values identified in the Queensland State of the Environment reports and environmental values as defined by the EP Act and environmental protection policies.

Identify actions associated with the project that are assessable development within the coastal zone and will require assessment under the provisions of the *Coastal Protection and Management Act 1995*.

Assess the project's consistency with the relevant policies of the draft *Queensland Coastal Plan*, including the Draft State Planning Policy: Coastal Protection (Department of Environment and Resource Management 2009a) and the Draft State Policy: Coastal Management (Department of Environment and Resource Management 2009b).

The *Coastal Protection and Management Act 1995* (CMP Act) is administered by the Department of Environment and Heritage Protection (DEHP). The objectives of the CMP Act includes:

- the protection, conservation, rehabilitation and management of the coast, including its resources and biological diversity; and
- in conjunction with other legislation, a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone.

As detailed in the Project Approvals Report prepared by Minter Ellison contained in Appendix 3 of the EIS, the desired coordination and integration in coastal management is achieved through the making of coastal management plans and the identification of coastal management districts under the CPM Act. Development that is operational work in a coastal management district is assessed by DEHP using IDAS under the SPA, with the SPR containing various triggers for development approvals and referral assessment against the CPM Act. The assessment by the local government of 'prescribed tidal works' against the *IDAS code for development applications for prescribed tidal works* (Schedule 4A of the Coastal Protection and Management Regulation 2003) is also regulated by the CPM Act.

Relevance to the GCIMP

The GCIMP site is located within a coastal management district. The GCIMP development involves a number of activities that trigger assessment against the Queensland Coastal Plan.

Material change of use

As both the proposed reconfiguring a lot and material change of use will be carried out in a coastal management district, DEHP is usually triggered as a concurrence agency for IDAS, with its jurisdiction being coastal management under the CPM Act. However, because of the manner in which the SDPWO Act EIS process modifies the IDAS process, DEHP will instead undertake this assessment as an advisory agency.

Dredging and removal of quarry material

The capital dredging to form the marina basin and access channel/s and maintenance dredging for the GCIMP involves the removal of quarry material from tidal water. The removal of the quarry material will require a quarry material allocation notice (a resource allocation) from DEHP under the CPM Act.

As it is intended that the dredge spoil will be stored on-site at a designated dredge spoil area, the requirement for operational work development approval of dredge spoil or solid waste material in tidal water does not apply.

Queensland Coastal Plan Maps

The proposed development is located in an area which is mapped by DEHP (Plan 9542-242 Coomera) as a high hazard area with expected storm tide inundation of more than 1m by 2100. There is no erosion threat mapped. Therefore compliance with the QCP will require that components of State Planning Policy will apply. The preferred development must achieve the overall policy outcome of the SPP, through compliance with the policy outcomes, policies and code of the SPP.

The specific SPP for Coastal Protection outcome requires that:

"*Communities and development are protected from adverse coastal hazard impacts, taking into account the projected effects of climate change, the protective function of the natural environment and the preference for allowing the natural fluctuation of the foreshore and foreshore ecosystems to continue, including, in response to rising sea levels*".

The proposed development has been considered with regard to the SPP for Coastal Protection and potential for compliance of the proposed works within the policy outcomes are below:

- Policy 2.2.1 a) – Development can occur in a coastal hazard area because it is a coastal-dependent development. *The proposed development is a coastal-dependent development.*

- Policy 2.3 – *Development can occur as the site is not a mapped coastal erosion zone*;

- Policy 2.5.5 b) – Development in a high coastal hazard area can occur if the design takes into account the hazard. *For the proposed development land levels will be increased to above the projected 2100 inundation levels*.

- Policy 2.5.7 b) - Development in the coastal hazard area will maintain or enhance coastal ecosystems and natural features between development and tidal waters where they protect or buffer communities and infrastructure from sea-level rise and coastal inundation impacts, or where changes to these features cannot be avoided, mitigate risks to development from coastal hazards. *The design for the proposed development has included the risks associated with elevated water levels and land levels have been increased to mitigate this risk.*

- Policy 2.5.7 c) - Development in the coastal hazard area will ensure structures can sustain flooding from a defined stormtide event. *The design for the proposed development has included the risks associated with elevated water levels and structures have been designed to mitigate this risk*.

- Policy 2.5.7 d) - Development in the coastal hazard area will maintain the safety of people living and working on the premises from a defined storm-tide event. *The design for the proposed development has included the risks associated with elevated water levels and public safety has been taken into account by the elevation of land areas to above the projected inundation levels.*

Further detail is contained in the Coastal Processes Report prepared by BMT WBM contained in Appendix 27.

Description of Existing Coastal Processes

Describe the environmental values of the coastal processes of the affected area in terms of the physical integrity and morphology of landforms created or modified by coastal processes, including sediment transport processes and tidal hydraulics, and the dependence of estuarine and marine ecosystems on the existing physical environment.

Provide baseline information on marine sediments and sediment quality in the area likely to be disturbed by dredging or vessel movements including contaminants (such as heavy metals, nutrients, pesticides), the presence of fines and/or indurated layers and acid sulfate potential. This information should be presented as a map of sediment types based on their physical and chemical properties and include depth profiles.

Description of coastal processes

The area is characterised by a low wave energy environment and the major physical processes that determine the shape of the Coomera River and the potential bank erosion mechanisms include tidal hydraulics, flood hydraulics and sediment transport. The bed of the Coomera River is predominantly made up of fine sediments (fine silt and clay material) with some sands.

The Coomera River discharges into the Lower Moreton Bay and Broadwater area, which experiences a predominantly semidiurnal tide (i.e. two high tides and two low tides in a little over 24 hours). The tidal range near the Site is typically about 1 metre during springs and about 0.6m during neaps. These tides propagate into the connected rivers (including the Coomera River) and their tidal tributaries.

Fluvial flows are generated by runoff from the Coomera River and Oakey Creek catchments and from time-to-time flood events occur in the river. Floods result in the sediment bed load becoming dynamic for a short period of time (a matter of days or hours), producing a markedly different distribution of sediment depending on the size of the flood.

Sedimentation processes around the development site are driven by materials being transported into the system from the Broadwater (tidally driven) or from runoff from the surrounding land catchments (fluvially driven). These materials are predominantly moved around within the system by the prevailing currents. Overall sedimentation rates in the river system are a mixture of sediment transport processes under day-to-day (primarily tidal) conditions plus occasional flood event-driven sediment transport. Tidal currents are considered to be responsible for the majority of the sediment transport in the study area. However, large flood events

will lead to substantial sediment transport rates and could also result to significant sedimentation (and scour) in the river.

Sediment Transport

The sediment (sand, gravel, silt etc) present in the river is a product of transport from the eroding catchment and incision of the river into alluvial plains deposited during prehistoric times of higher sea level. The transport of this sediment along the estuary is a complex process, with major influences from tidal and flood hydraulics.

Floods result in the sediment bed load becoming dynamic for a short period of time (a matter of days or hours), producing a markedly different distribution of sediment depending on the size of the flood. Generally, floods tend to scour out beds and banks on the outside of bends where flow velocities are highest and severe turbulence and lateral flow components occur. These scoured materials are then deposited downstream in straight sections and more often on the inside of bends where velocities are lower. The sediment transport during a flood can overwhelm the day-to-day transport and have an impact which equates to years or decades of tidal transport.

Tides also result in a redistribution of sediment but, due to the typically lower velocities involved, the rate of change is much more gradual, with the time frame being in the order of months to years. In a similar mechanism to that for floods, sediment is transported when velocities reach a critical value and are deposited when velocities drop below a lower critical value. This process will continue until an equilibrium is obtained or other external forces interfere (floods, dredging etc). In the absence of these external forces, there is a tendency for a sediment balance to be established. That is, the sediment supply from the upstream catchment is matched by the discharge of sediment through the river's mouth.

In a localised area of a river, a deeper section of the river can cause disturbance to this equilibrium by starving downstream areas of sediment supply (as the deeper section fills). This may lead to adjacent and downstream bed and bank areas suffering progressive erosion.

A Coastal Processes Report prepared by BMT WBM is presented as Appendix 27 of the EIS; which provides a more detailed discussion on existing coastal processes.

Potential Impacts on Coastal Processes and Mitigation Measures

A geomorphological study should be included in the EIS addressing the following issues:

- quantification of the sediment movement for the base case (current condition) and the proposed developed case
- analysis of the proposed change in the river width and impact of this to the long term geomorphological change of the river outside the project area, particularly any bank stability issues on surrounding property (e.g. Waterway Downs and Foxwell Island)
- impacts on tidal flows and water levels. The assessment should consider the effects of the proposed marina basin and external marina, and the proposed channel dredging both separately and in combination
- the potential of the proposed works to impact on bank erosion within the Coomera River and adjacent waterways
- impacts of the proposed works on the fluvial geomorphic processes, including the potential for increased sediment and nutrient export
- an assessment of the erosive effects of vessel wash associated with boat traffic generated by the proposed marina. This would be supported by a vessel traffic impact assessment to determine the increase of vessels (size and number) that can be expected as a result of the project relative to the existing situation considering the Coomera Marine Precinct and development further upstream
- a survey of the existing condition of the potentially affected banks in the Coomera River and identification of the erosion potential of those banks and likely need for bank protection works, and who is responsible for identified bank protection works
- identification of mitigation measures, for any adverse impacts as a result of the proposal, that demonstrates potential impacts (short and long term) are fully mitigated. The geomorphological study report should use the 'Gold Coast Planning Scheme Policy 11: Land Development Guidelines Section 8.3.4 Report Submission - Waterways' as a guide.
- identification of measures to be taken to replace or offset areas of significant impact, where avoidance and mitigation of impacts cannot be achieved, in consultation with Gold Coast City Council.
- an assessment and report on the maintenance costings and life cycle program for all mitigation measures, suggested for the potential impacts identified, is to be prepared. The report should use the '*Gold Coast Planning Scheme Policy 11: Land Development Guidelines Section 8.3.4 Report Submission - Waterways'* as a guide

- should significant impacts to foreshore areas be identified, the geomorphic assessment should include a detailed geotechnical investigation to allow the confirmation of ground conditions identified in the Coomera River Estuary Foreshore Management Plan (2011) Part 1 and 2. The proponent should suggest alternative foreshore protection should ground conditions vary significantly to those suggested, for areas that are affected.

This assessment should also provide a discussion of the potential impacts associated with extreme events such as storm tide flooding. This must include an assessment of the vulnerability of the project to storm tide flooding and the potential of the project to affect vulnerability to storm tide flooding on adjacent properties.

The following studies (available from Gold Coast City Council) are relevant for these assessments:

- *Environmental Inventory for the Coomera River and its Tributaries 2005*
- *Oakey Creek Catchment, Stormwater Drainage Management Plan 2004*
- *Saltwater Creek Foreshore Master Plan 2008*
- *Saltwater Creek Environmental Inventory 2006*
- *Coomera River Estuary Foreshore Processes Study (2011) Part 1 and 2, prepared by Riparian Engineering.*

Sedimentation

A study into the erosion and sedimentation processes within a section of the Coomera River was undertaken to assess the impacts of the proposed dredging associated with the GCIMP development and estimate the sedimentation rates at the proposed dredged areas. Please refer to the Coastal Processes Report prepared by BMT WBM contained in Appendix 27.

Sediment processes around the development site are driven by materials being transported into the system from the Broadwater (tidally driven) or from runoff from the surrounding land catchments (fluvially driven). These materials are predominantly moved around within the system by the prevailing currents.

Overall sedimentation rates in the river system are a mixture of sediment transport processes under day-to-day (i.e. primarily tidal) conditions plus occasional flood event-driven sediment transport. Tidal currents are responsible for the majority of the sediment transport in the study area.

Hydrodynamic and cohesive sediment transport modelling of the Coomera River has been performed in order to identify the processes leading to sedimentation at the proposed development under day-to-day conditions. The major findings of the modelling are:

- Under day-to-day conditions, the proposed dredged areas will be subject to sedimentation of fine materials. The modelled annual rate of sedimentation under tidal flow conditions is about 5,000 m^3 of in-situ fine sediment;
- The greatest sedimentation within the dredged areas is predicted to occur around the confluence of Oakey Creek with the secondary channel of the Coomera River, where annual deposition depths in the order of 100mm are predicted;
- In addition to sedimentation due to day-to-day conditions, sedimentation may also be experienced during occasional flood events. Although the sedimentation volumes due to flood events are difficult to predict, the in-situ volume of fine material to be dredged from the development site due to flood events is estimated to be in the order of 16,000m^3 over a 20 year period.

River Width and Geomorphologic Change

The Coomera River discharges into the Broadwater area, which experiences a predominantly semidiurnal tide (i.e. two high tides and two low tides in a 25.5 hours). These tides propagate into the Coomera River and its tidal tributaries. The speed of propagation of the tide up the estuary is primarily dependent on:

- Depth of the river; and
- Friction losses due to the roughness of the bed and banks and the non-uniformity of the river cross-section.

The tidal prism at a particular location is the volume of water that passes this location during the rise or fall of a tide. Therefore the tidal prism decreases from a maximum at the mouth of the river to zero at the limit of tidal propagation.

Most rivers which flow through alluvial coastal plains develop a tidal regime equilibrium in the lower estuary areas, in which:

- There is a balance between tidal flow (expressed in terms of the tidal prism) and the cross-section area at each part of the river; and
- There is a balance between the width and depth of the river.

The cross-section of the lower Coomera River is therefore governed predominantly by tidal processes. Clearly, bedrock and/or stiff cohesive clays may restrict the ability of a river to achieve this equilibrium in certain areas, sometimes affecting other adjacent areas. Furthermore, if dredging or reclamation works are undertaken which change 'natural' tidal hydraulics, this equilibrium can be upset with scour and/or deposition occurring until a new equilibrium is reached.

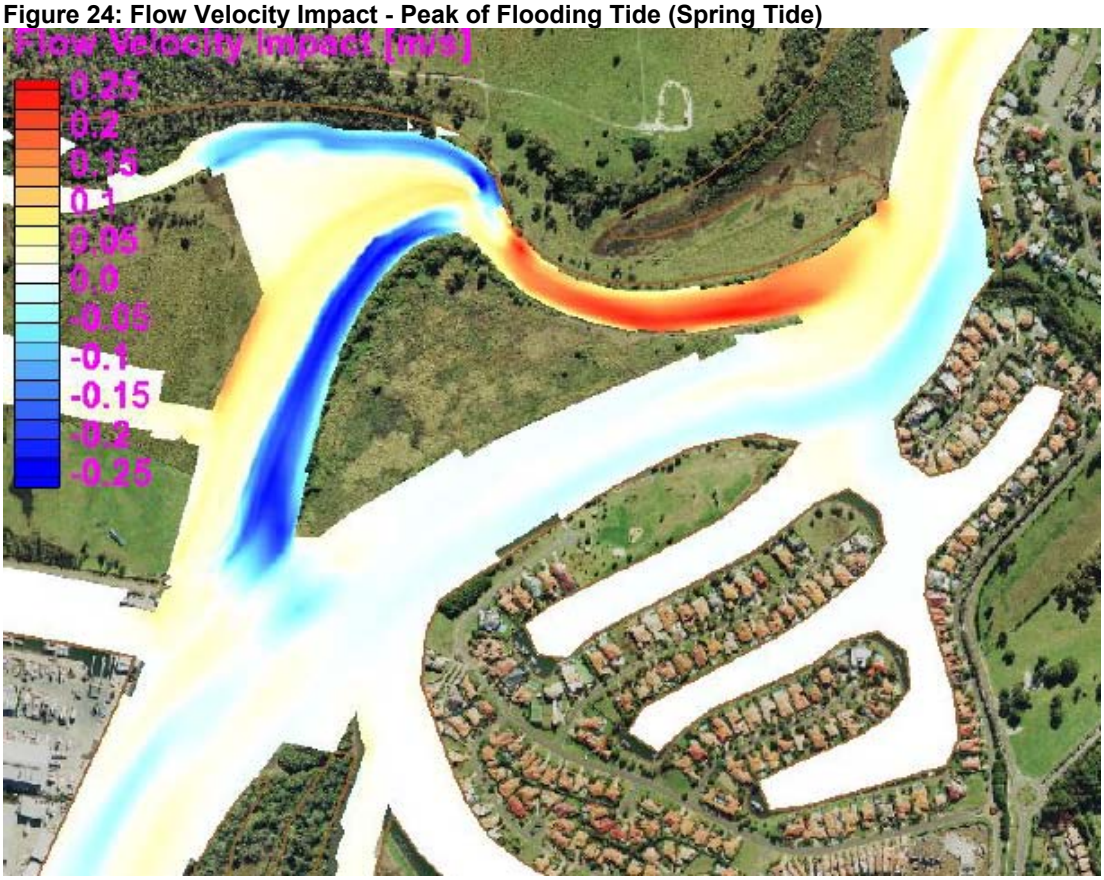
Tidal Flows and Water Levels

The proposed dredging has the potential to impact on the tidal hydrodynamics of the Coomera River system by improving the hydraulic conveyance through the dredged areas. This could result in changes in the tidal flow distribution between the main and secondary channel around Foxwell Island and associated morphological changes (shoaling and erosion of channels).

To assess the potential impacts of the proposed dredging on tidal hydrodynamics in the river, numerical modelling of the predevelopment (Base Case) and post development configuration was undertaken. The Base Case TUFLOW-FV model was then modified to represent the features of the proposed development and a full (2 week) spring-neap tidal cycle was simulated using both configurations. The impact to velocity and flow magnitude was calculated for both ebb and flood tides. The figures below show maps of the velocity magnitude impacts during the peak of ebbing and flooding respectively.

Figure 23: Flow Velocity Impact - Peak of Ebbing Tide (Spring Tide)

Figure 24: Flow Velocity Impact - Peak of Flooding Tide (Spring Tide)



Time series of the velocity magnitude for the Base Case and the Developed Case are compared in the Coastal Processes Report prepared by BMT WBM contained in Appendix 27.

The impacts in terms of flow discharge through the main channels and the secondary channel indicates that the dredging increases the peak ebb and flood discharge through the section of Oakey Creek adjacent to Foxwell Island during spring tides by up to approximately 11.0 m^3/s and approximately 6.5 m^3/s respectively (This equates to a increase of approximately 50% and 36% respectively).

In addition, the modelled peak ebb and flood discharge through the main channel increase by about 1.4 m^3/s and 2.0 m^3/s respectively (This is equivalent to a relative increase of approximately 0.7% and 1.7% respectively).

Although the tidal flows increase, the modelled peak flow velocities within the dredged areas decrease significantly due to the profile enlargement (peak ebb flow

velocities are predicted to reduce from approximately 0.25m/s to approximately 0.04m/s). Between the dredged area and the downstream edge of the secondary channel, peak flow velocities are predicted to increase due to the dredging. The peak ebb flow velocity through the section of Oakey Creek adjacent to Foxwell Island (during spring tides) is predicted to increase from approximately 0.30m/s to approximately 0.47m/s and the peak flood flow velocity from approximately 0.22m/s to approximately 0.34m/s.

These increases would only occur at peak velocities during spring tides and as such are of short duration. Of initial concern were the increased flows and velocities in the section of Oakey Creek adjacent to Foxwell Island. The modelling indicated that the increase in conveyance in the secondary channel of the Coomera River (due to the dredging) caused the peak velocities in Oakey Creek to increase to levels which may result in local redistribution of sediments. This is likely to be in the form of bed changes and slight movement of shoals in the area of highest velocity changes. It is expected that this would not translate into increased bank erosion.

Various options to reduce these peak velocities back to predevelopment levels were investigated.

Mitigation options that involved dredging within the section of Oakey Creek adjacent to Foxwell Island or implementation of constriction within the marina area were found to be ineffective as measures to reduce the flow velocity impacts.

The modelling of the option with a constriction in the section of Oakey Creek adjacent to Foxwell Island showed that the increased flow discharges through the northern channel can be mitigated by implementing a lateral constriction within this section. However, the implementation of such constriction would result in a further increase in peak flow velocities in the vicinity of the constriction. In addition, the construction works required for the implementation of such constriction is likely to cause environmental disturbance. The increased velocities in the vicinity of the constriction could be mitigated through bed protection works. The exact extent would need further investigation and would require further assessment of ecological impacts. The disturbances associated with these works are considered to be greater than the effects they are intending to mitigate. At this stage, implementation of any mitigation option is not recommended.

Based on the assessment of a range of potential mitigation options, it is recommended that the increased velocities, including the local minor redistribution of sediments in the bed of Oakey Creek, be tolerated and no immediate structural mitigation works be undertaken to reduce these impacts. It is recommended that a monitoring program be implemented to establish the baseline conditions and

monitor the effects of the development on erosion within the section of Oakey Creek adjacent to Foxwell Island.

Should this monitoring program indicate that unacceptable bank erosion has occurred due to the development, implementation of the constriction mentioned above or bank stabilisation measures could be investigated further.

Please refer to the Coastal Processes Report prepared by BMT WBM contained in Appendix 27.

Existing Bank Condition

The recently completed Coomera River Estuary Processes Study – Technical Assessment and Foreshore Management Plan (Riparian Engineering, 2011) describes in detail the existing condition of the banks in the study area. The information below is largely taken from that report and site inspections during 2010 and 2011.

Currently, erosion appears to occur in most areas downstream of the railway bridge in the South Arm and in the upper section of the North Arm. It also appears that erosion is greater in the areas where no boat speed restrictions apply and boat wash is uncontrolled. Of particular note was the amount of boat traffic on the river, particularly during week days, and the amount of boat wash generated.

The erosion is evident in the intertidal zone as a receding beach and an erosion escarpment behind the beach on non-cohesive soils, and bank undercutting in cohesive soils. No hydrographic surveys have been provided or undertaken to indicate changes below water level. Even in areas where mangroves exist at the shoreline, there is evidence of bank erosion behind the leading mangroves. There also appear to be areas where a loss of natural vegetation may be contributing to increased erosion. In some areas (i.e. between Sanctuary Cove and Santa Barbara), there has been a significant loss of shoreline vegetation due to erosion. In particular, the following locations show severe active erosion:

- Foxwell Island;
- South bank of Coomera River (upstream of Santa Barbara boat ramp near private residences;
- South bank of Coomera River downstream of Santa Barbara near parkland (area of GCCC trials;
- North bank of Coomera River opposite Santa Barbara boat ramp.

Discussion

Previous reports clearly indicate that the Coomera River was at or near its limit to absorb change at the time of their preparation (1991/1992). Since then, there have been significant additional developments, including canal and urban development and a marine precinct. Some of this development has required the navigation channel to be dredged and there has been a dramatic increase in boat traffic. These activities are likely to have contributed to exacerbated bank erosion.

The river has been extensively dredged previously for navigation, flood mitigation and sand and gravel extraction. Various reports have indicated that navigation channels have been dredged and maintained as far upstream as Beattie Road. The channel from the South Arm entrance to Sanctuary Cove is 40m wide to a bottom level of –3.5mLAT and from Sanctuary Cove to Beattie Road 40m wide to a bottom level of –3mLAT. This channel was last dredged in 1999/2000 when 170,000m3 of material was relocated to land at Sanctuary Cove and Hope Island. About 78,000m3 of sand was also extracted from the navigation channel downstream of Coombabah Creek in 1997/2000. These large amounts of extraction may impact on sediment transport along the river. However, the lack of floods and the revetment of much of the southern shoreline may have masked significant impacts to date.

The previous studies also indicated that proposed (in 1991) canal developments, which have now been realised, would most likely exacerbate bank erosion problems. The reports stated that it was not possible to accurately assess the reaction of the river to the increased tidal flows, but predicted that this would manifest itself as erosion in selected areas i.e. outside of bends.

In this regard the outside bend between Paradise Point and Jabiru Island has shown severe erosion stress in the past and has now been largely revetted.
A factor, which was noted but not assessed in the previous studies, was the impact of the dramatic rise in vessel movement on the Coomera River, particularly below the Highway Bridge. This is related to urbanisation and associated recreational use of watercraft and the development of the boat building precinct at Coomera. There is often confusion regarding the additional impact of boat induced waves in excess of the natural wind induced waves which occur on any waterbody and impacts from channel dredging.

Recent studies (AMC 2002) have indicated that boat wake is different to natural wind waves and the impact of boat traffic is complex, with different boat types having varying degrees of impact.

It is quite likely that more than one mechanism is contributing to the current bank erosion problems in the Coomera River, with the dominant factors possibly related to:

- Changes in the tidal prism as a result of increased waterways and channel dredging (in the reaches downstream of the Pacific Motorway);
- Increased boating traffic and associated boat wake (in the reaches downstream of the Pacific Motorway); and
- Sand and gravel extraction (in the reaches upstream of the Pacific Motorway).

If it is desired to further quantify any particular component of the overall erosive pressure (i.e. dredging, boat wash or other) it will be necessary to carry out further detailed studies focussed on the process of interest. These studies will require a significant level of data collection and numerical model development and are beyond the scope of this study.

Considering the conclusions of the technical studies reviewed and field inspections, it is considered that the area between Sanctuary Cove and the Marine Precinct is likely to show ongoing erosion at a higher rate than other areas and efforts to protect infrastructure and buildings need to be concentrated in this area.

Boat Traffic Survey Results

The above discussions indicate that boat traffic and the resulting wake is one of many possible influences on bank erosion. An report on the existing boat traffic and an estimate of the possible increase of boat traffic as a result of the Gold Coast International Marina Project has been produced.

This report indicates that the project is likely to generate and extra 69 trips per day in excess of the current average of 149 trips per day adjacent to Shipper Drive i.e. a 46% increase (refer CRG Marine Vessel Activity Survey). While this is a significant increase in vessel movements it locally it is likely that this will not translate to similar increases further from the site. For example the average vessel movements recorded at Paradise Point were 255 indicating that vessel activity increases towards to Broadwater.

Boat wash from vessel movement is only one of many contributors to bank erosion. However, it is expected that the vessel generated by the proposed development will exacerbate bank erosion.

The recently completed Coomera River Estuary Processes Study – Technical Assessment and Foreshore Management Plan (Riparian Engineering, 2011) also indicates that many sections of the river have adapted to bot wash and that the

level of impact associated with increased boat movements is expected to decrease.

Summary of Bank Erosion

It is not expected that the minor impacts on current velocities in the Coomera River due to the construction of the marina will have any appreciable impact on bank erosion. The increase in vessel movements may result in a minor increase in bank erosion due to boat wakes. However, it is noted that there are a broad range of processes that impact on bank erosion in this section of the Coomera River and that vessel movement is only one of these and its contribution to bank erosion is not able to be quantified.

A Coastal Processes Report prepared by BMT WBM is contained in Appendix 27. This report further discusses impacts on coastal process and mitigation measures.

Storm Tide Flooding

This assessment should also provide a discussion of the potential impacts associated with extreme events such as storm tide flooding. This must include an assessment of the vulnerability of the project to storm tide flooding and the potential of the project to affect vulnerability to storm tide flooding on adjacent properties.

A detailed analysis of a storm tide alone at the site has not been undertaken because flood at the site is dominated by fluvial flows in combination with a storm tide. Council's model currently combines the 100 year ARI fluvial flow with the 100 year ARI storm tide to give a flood level at the Site in the range 3.20 to 3.23m AHD, please refer to Table 20 below.

Table 21: Existing Peak Flood Level Range Across Site

ARI (years)	Precinct Flood Level (m AHD)
5	1.74 to 1.80
10	2.19 to 2.25
20	2.66 to 2.70
50	2.95 to 2.99
100	3.20 to 3.23
200	3.45 to 3.46
500	3.67 to 3.68

The 100year ARI storm tide level adopted by Council in the model is 2.05m AHD, which is substantially lower than the flood level. Please refer to the Floodplain Management Report prepared by BMT WBM contained in Appendix 26.

Capital and Maintenance Dredging

The assessment of impacts on coastal processes should specifically consider capital and maintenance dredging requirements of the project. Information should be provided on the predicted impacts on tidal flows and water levels, siltation that may affect marine flora and fauna and /or biological processes. An assessment of the nature and extent of turbidity plumes from dredging should be undertaken. The assessment of dredging should be consistent with contemporary best practice standards (e.g. Australian and New Zealand Environment and Conservation Council *National Ocean Disposal Guidelines for Dredged Material*, DERM Guideline - *Approval of a Dredge Management Plan (2011)* and in accordance with the NAGD (Department of Environment, Water, Heritage and the Arts 2009).

Water quality controls during dredging should be discussed in detail. This section should address how the dredging will meet policy 2.4.1 of the *State Coastal Plan,* which stipulates that the dredging must be planned and undertaken in such a manner that achieves the general environmental values and water quality objectives outlined in the *Environmental Protection (Water) Policy 2009*. This section should address the potential impacts of the dredging (capital and maintenance) on surrounding ecological values. A calculation should be included which addresses when/how often maintenance dredging is expected to be required. The impacts of the dredging on coastal resources and values must be addressed, including the long-term impacts associated with the maintenance dredging. This section should address the impact on tidal and current patterns in the area.

The dredge material disposal site/s should be discussed in detail and address the following:

- the release location/s for discharge waters
- wastewater release quality
- sediment and erosion controls at the disposal site
- design and construction of the disposal site
- a description of the receiving environment
- information on the end use of the dredge spoil.

If the dredge material disposal location is planned to be in tidal waters for either the capital or maintenance dredging campaigns, an assessment of the sediment quality as per section 4.2 of the *National Assessment Guidelines for Dredging 2009* with be required.

Measures for minimizing turbidity plumes and release of contaminants should be identified which include water quality objectives to be maintained during dredging activities. The potential rate of sedimentation within adjacent navigation channels as a consequence of the proposed dredging should be discussed.

A strategy for dealing with capital and maintenance dredge spoil should be developed in the context of local and regional dredging requirements, particularly any maintenance dredging requirements of navigation channels necessary to facilitate vessel access to the project.

When considering a strategy for capital and maintenance dredge spoil management due regard should be given to social, environmental and economic issues as part of a net benefit assessment. A net present value assessment of options should also be provided which highlights the expected operational and capital cost of alternatives with all assumptions clearly referenced.

Detail pertaining to capital and maintenance dredging is contained within the Construction Methodology Report prepared by Hyder Consulting contained in Appendix 13 and the Maintenance Dredging Report prepared by Hyder Consulting contained in Appendix 18.

Construction Dredging

The proposed earthworks for the marinas and revetment walls shall be undertaken in accordance with Hyder Consulting Construction Methodology Plans contained in Appendix 13. The preferred construction method for the GCIMP is the combination of wet and dry excavation techniques. As previously discussed, wet excavation involves removal of underwater sediments by using conventional excavation equipment (e.g. backhoe positioned on a barge or on shore). The difference between 'wet' excavation and 'dry' excavation is the diversion of water (and dewatering) for the area targeted for 'dry' excavation.

The excavation of the external marina will be excavated via dragline or long reach excavator set up on the created perimeter bund or via barge. The wet excavation will be undertaken in stages to minimise the disturbance to the river with the resulting turbidity being able to be confined in smaller areas for easier control.

The construction sequencing of this method will be undertaken in stages as shown in the Construction Methodology Plans contained in Appendix 13. To undertake the widening of the Coomera River and the external marina formation, long arm excavators will be utilised from on shore and on barge.

Wet excavation techniques require suitable access and stable manoeuvrability to the construction area. It is proposed that a trafficable vehicular access road and earth bund be constructed for sediment control and water barrier purposes.

A recharge trench shall be constructed around earthworks areas to control ground water and to minimise soil oxidation and acid sulphate soils disturbance. Temporary pump units shall dewater the excavation areas and irrigate the recharge trenches during excavation.

Dry excavation techniques will be used for the construction of the internal marina by constructing a temporary bund along the eastern boundary fronting the Coomera River. The bund will hold back the river water and allow the creation of the Internal Marina using excavators, trucks and other land-based machinery.

These construction techniques have been chosen as a result of the following environmental considerations:

- Wet Excavation via long reach excavator and barge from the perimeter bund will create less turbidity.
- Construction will be undertaken in stages to confine smaller areas that are able to be monitored closely for water quality and treated more effectively
- Works able to be completed quicker due to less stoppages due to machine down time due to pipe blockages on the dredges
- Settling ponds required will be smaller due to lower water content in the excavated material.
- Less impact on the water quality of the Coomera River due to confined areas
- Treatment of excavated material for ASS to occur sooner than dredged material
- Excavation of the bank to be undertaken more accurately increasing geotechnical stability therefore creating a safer working platform

An assessment of the impacts of Construction Dredging against Water Quality Objectives, and an assessment of sediment quality against the *National Assessment Guidelines for Dredging 2009* (NAGD) has been undertaken by BMT WBM in the Water Quality Report contained in Appendix 28.

The following measures have been proposed to ensure that the potential impact of turbid plumes released by dredging works are no greater than that estimated in the Water Quality Report prepared by BMT WBM contained in Appendix 28. They also apply to sensitive receptors such as seagrasses, mangroves, benthic fauna, fisheries and conservation areas:

- Use of silt curtains during dredging works, as assumed in the modelling, should be adopted. Silt curtains could assist in preventing the migration of

contaminants towards sensitive receptors. Silt curtains would need to be maintained frequently to ensure tidal currents and river flow do not alter their position and to keep curtains free of debris.

- Water quality monitoring should be undertaken before and during all dredging works to assess any impacts of turbid plumes and contaminants associated with these plumes. This monitoring should be in accordance with the Construction Management Plan prepared by Hyder Consulting contained in Appendix 13, and the Water Quality Monitoring Program contained in the Water Quality Report prepared by BMT WBM contained in Appendix 28.

Trigger levels for the dredge monitoring program are based around existing turbidity (NTU) water quality data collected during the EHMP. The Water Quality Report prepared by BMT WBM contained in Appendix 28 contains information regarding the appropriate WQOs and the likely outcomes from the dredging program show that there is likely to be significant exceedance of the WQO for some dredging scenarios with the potential to impact on the marine environment – particularly from increased turbidity.

The extent of these impacts can be monitored through implementation of a water quality monitoring program as mentioned above. It will be a requirement of the implementation of the monitoring program that the specified threshold values are not exceeded as this will ensure that the impacts to the marine environment are no greater than estimated. A construction phase dredge monitoring program has been drafted to assess this and is detailed in the Water Quality Report prepared by BMT WBM contained in Appendix 28.

Maintenance Dredging

It is recommended that a small cutter suction dredge be used to carry out the dredging. Given the nature of the material located adjacent to the GCIMP site it has been determined that a cutter suction dredge would be most applicable for maintenance dredging over the other types of dredger available. Although much of the material is quite fine, a lot it is very clayey and compacted, and therefore quite hard to remove. In order to remove it from the bed surface some physical manipulation will be required. It the material was predominately sand then a trailer suction hopper dredge would be ideal as it can simply ‘trawl’ the areas that need dredging and suck the sand up into the hopper. This cannot be done for this particular case as it will not be able to suck up the material in question.

Although mechanical dredgers will be able to remove the sediment, they are very slow and are more suited to capital dredging rather than maintenance dredging. A cutter suction dredge is the only hydraulic dredge that is suited to removing this type of sediment from the bed during maintenance dredging. Only a small dredge

is required, given the relatively small amount of material that needs to be removed. A small dredge will also be better suited to removing sediment within the small internal marina.

Dredgers that have been investigated include one of the dredgers from the Neumann dredging fleet, Neumann Series 250-12L 'Nu Compact'. It has a production rate of 250m3/hr in sand and a pipeline diameter of 305mm. Another dredge that would also be appropriate for the project would be the 'Saibai' cutter suction dredge; part of Hall Contracting's dredging fleet. It is roughly the same size as 'Nu Compact' and has a pipeline diameter of 300mm. These are examples of dredges that have been investigated but any small cutter section dredge; with a production rate of around 300m3/hr will be the most applicable. The timing of the maintenance dredging for the GCIMP Masterplan is 34 days, when using a dredge production rate of 300m^3 / hour with the dredge working for 10 hours per day, with actual dredging occurring for 5 hours.

With regards to environmental considerations, in order to alleviate the stresses placed on the receiving waters of the Coomera River measures will be put into place in order to minimize and/or prevent environmental harm. Of particular importance are turbidity levels and the potential release of contaminants. As tailwaters from treated dredge spoil are discharged back into the same environment as where the material was initially dredged the release of contaminants is not a pertinent issue. However there are conditions that need to be met in order to ensure that the release of contaminants does not occur. They are as follows:

1. Contaminants must not be released to any waters or the bed and banks of any waters, except for those contaminants released in compliance with the Release Limits specified in the Table below.
2. Where water quality is impacted by an aspect of the activity and found to be in non-compliance with the Release Limits specified in the table below, that aspect of the activity must cease immediately until effective mitigation strategies can be implemented
3. Where the water quality of acid sulfate soil treatment ponds is found to be in non-compliance with the Release Limits for the table below, no release of tailwaters is permitted
4. Written notification of the date when dredging will commence must be provided to the administering authority prior to starting the approved activity
5. Tailwater must only be released to Oakey Creek/Coomera River from an as yet specified release point
6. The release of tailwater as permitted by condition 5 must only be released in accordance with the Release Limits specified in the table below.
7. Monitoring must be undertaken and records kept of contaminant releases to waters from the monitoring locations, quality characteristics and frequencies

specified in the table below. All determinations of the quality of contaminants released must be:

a. made in accordance with methods prescribed in the Water Quality Sampling Manual (Department of Environment and Resource Management);
b. carried out on samples that are representative of the discharge.

The following Water Quality Objectives shown in the table below relate to the discharge waters to the Coomera River from the proposed project site. They have been determined by BMT WBM from Schedule 1 of the EPP water along with the site specific WQOs determined from the Ecosystem Health Monitoring Program (EHMP).

Table 22: Water Quality Release Criteria

Parameter	Units	Water Quality Release Criteria
Temperature	ºC	19 - 27
pH	-	7.77 - 8.03
Dissolved Oxygen	% sat	88.5 - 98.5
Conductivity	mS/cm	42 - 53
Turbidity	NTU	<8
Suspended Solids	Mg/L	<20
Total Nitrogen	Mg/L	<0.3
Oxidised N	Mg/L	<0.009
Ammonia N	Mg/L	<0.01
Organic N	Mg/L	<0.28
Total Phosphorus	Mg/L	<0.038
Filterable Reactive Phosphorus (FRP)	Mg/L	<0.006
Secchi Depth	Metres	>1.2
Chlorophyll-a	µg/L	<4

BMT WBM have undertaken a modeling assessment of the likely changes in TSS concentrations during the maintenance dredging program which have been assessed against the WQO. These assessments have shown that the WQO are exceeded, as such the significance of these changes to the marine environment has been assessed. Detailed assessments, implications and mitigation/ management techniques have been discussed within the Water Quality Report prepared by BMT WBM contained in Appendix 28.

Flocculation Assessment

The Total Suspended Solids (TSS) ratio for each option is much higher than the prescribed <20mg/L. Even though it is predicted that the settlement ponds will be successful in settling around 60 – 70% of the total material dredged, the Water Quality Objectives are so stringent and the material being dredged is so fine that it is very difficult to meet the prescribed WQO's without designing settlement ponds that have massive areas and very long settlement times to compensate for this fine material.

In order to compensate, an investigation into the use of flocculants/coagulants has been undertaken to determine their effectiveness in aiding in the settlement of small colloidal particles. The settlement aid that will be used in the investigation is Aluminium Sulfate, more commonly known as Alum. In some cases it has been shown that if alum is used it is possible to settle around 92% of the suspended sediment. If a flocculent were to be used then it would be utilised solely in the secondary pond, where the finer materials are to be settled.

Alum works by neutralising the negative charge on suspended and colloidal matter and by chemically reacting with elements present in the water to form a precipitate, which further traps suspended matter. Through this process it is possible to have major reductions in not just suspended solids and overall turbidity but also phosphorus, nitrogen, biochemical demanding substances and chlorophyll-a.

However because the chemical reaction that takes place results in the formation of sulphuric acid, the pH of the water in the ponds will be lowered. Because of the high dosage rates that will be needed for alum to be effective, typically 100 – 150mg/L, the pH of the water can be lowered to such a degree that it may not meet the water quality release criteria. It should be noted that these dosage rates and the percentage of suspended sediment settled are based on figures used in similar projects, rates specific to this project will need to be based upon tests performed on the water in the settlement ponds.

For the purposes of this report it will be assumed that a dosage rate of 100mg/L will result in 90% of sediment being settled. It is assumed that the 10% that doesn't settle will be the finest portion of the materials in that pond, which in the case of the secondary ponds in which the flocculants are used are clay materials.
The area of the secondary pond is 4,900m^2 with a total depth of 1m. If sediment is allowed to settle to a depth of half the pond height, .5m, then the total volume for the secondary pond is 2,450m^3.

If a flocculent such as alum is used in the secondary pond and it has an effectiveness of 90% then the total amount of material that will settle is approximately 16,911m^3, 10,165m^3 of silts and 6,746m^3 of clays. This is roughly 7

times the amount that the secondary pond can accommodate. This amount only takes into account the volume of actual dredged material that has settled and not the volume of aluminium precipitate, which is unknown at this time and will depend on the dosage rates used.

There are four (4) main options to account for the increase in material settled in the secondary pond. The first is to periodically empty the pond as it fills. If it can be implemented this option will not affect either the production cycle of the dredge or the size of the pond. However, this may be unfeasible as this will disturb settled sediment and sediment that is in the process of settling.

The second option addresses this issue and entails halting dredging, clearing out the accumulated sediment and then resuming dredging once the pond has been emptied. This is a more practical option than the previous option as it will not interfere with the actual flocculation process. However, it is not an economically viable option to have the dredge on standby waiting for the ponds to be cleared until it can resume dredging. While this may be an applicable option it may prove to be costly.

The third option is to enlarge the secondary pond to such a size that will enable it to accommodate the total volume of dredged material at one time. The area required for this is approximately 33,822m_2. The area put aside for dredge spoil for the preferred option is approximately 22,000m_2 and it is obvious that implementing this option will involve the resumption of surrounding lots into the dredge spoil deposition area. This should be avoided if possible in order to maximise the usability of the site.

The final option involves splitting the secondary settlement pond into two separate ponds that will be used in an alternating manner. This will enable the removal of material without disturbing the flocculation process and without halting the production cycle of the dredge. This is the most desirable option as it has fewer impacts on the cost of the maintenance dredging and will not require the resumption of surrounding lots. It is advised that should flocculation be required that this option is explored in more detail.

Further detail is contained in the Maintenance Dredging Report prepared by Hyder Consulting contained in Appendix 18.

Monitoring

Operational phase monitoring for any maintenance dredging activities will follow the same program as the construction dredging phase given that the likely impacts would be similar. The only likely significant difference would be the duration of dredging operations. As such, the operational phase monitoring program for

maintenance dredging should follow the same program as the construction phase monitoring, with responsible persons being those acting in the operational phase equivalent roles. Further detail is contained in the Water Quality Report prepared by BMT WBM contained in Appendix 28.

4.6 Waste

This section should provide comprehensive description of the waste generated by the Project and the strategies to be employed to avoid, or where avoidance is not possible, minimise and manage waste in accordance with best practice waste management and the requirements of the *Environmental Protection (Waste Management) Policy 2000* and Gold Coast City Council's Draft *Solid Waste Management Guideline for New Developments - July 2011 - Version 1* or updated version.

Hyder Consulting has prepared a Waste Management Plan contained in Appendix 12 to the EIS. The Waste Management Plan incorporates the waste management hierarchy which prioritises from the most preferred to least preferred method of waste management:

- Waste avoidance;
- Waste re-use;
- Waste recycling;
- Energy recovery from waste; and
- Waste disposal in accordance with regulatory requirements as a last option.

The objective of the plan is to ensure compliance with the regulatory requirements governing waste management contained within the Queensland *Environmental Protection Act 1994 (EP Act)*, the *Environmental Protection Regulation 1998* and associated *Environmental Protection (Waste Management) Regulation 2000*. The Gold Coast City Council's Draft *Solid Waste Management Guideline for New Developments – July 2011 – Version 1* has also been referenced for preparation of this plan.

Waste Generation

The EIS should identify and describe all sources of waste associated with construction and operation of all aspects of the project, using schematic diagrams and flowcharts as required for each distinct phase. This section should describe all activities including:

- chemical and mechanical processes conducted on the construction sites (e.g. chemical storage, sewage treatment, power generation, fuel burning, mechanical workshop, fuel storage)
- the amount and characteristics of solid and liquid waste (including run-off from roads, plant areas, chemical storage areas and workshops) produced on-site by the project
- any waste treatment process
- hazardous materials to be stored and/or used on-site, including environmental toxicity data and biodegradability.

Descriptions should also include (using maps and plans as appropriate) showing:

- waste generation points
- storage methods and facilities
- quantities
- disposal arrangements
- recycling/reuse arrangements.

Waste Generation - Construction Phase

Construction activities at the Gold Coast International Marine Precinct Project will generate a range of wastes requiring various methods of disposal.

The construction phase will include:

- Site Reclamation Works; and
- Building Works.

Site Reclamation Works

The site reclamation design and construction methodology has been optimised to reduce the volume of fill material required for site reclamation works. Materials excavated from within the site will be reused as fill to form building platforms to the required levels. This methodology has reduced the requirement for rock and sand fill and has prevented the need for disposal of excavated material.

Civil infrastructure works to be undertaken once land platforms are constructed will be monitored to ensure that accurate material quantities are ordered to prevent

excess material requiring disposal. Material that cannot be recycled or reused within the site will be either returned to the supplier or delivered to a recycling facility.

It is expected that waste materials generated during site reclamation works will be minimal and that materials requiring disposal can be accommodated by existing landfill and recycling facilities.

The major waste types likely to be generated during the site reclamation works include:

Dewatered dredge spoil unsuitable for reclamation works;
- Water from dewatering activities of dredge spoil;
- Fill and excavated material which is geotechnically unsuitable for reuse;
- Cleared vegetation;
- Acid sulphate soils; and
- Food wastes from lunch rooms for construction workers.

Building Works

It is estimated that construction personnel for all works is 4800 annual full time, part time and casual employment position (FTE) years. The building works will generate a number of wastes from the site sheds including domestic rubbish, packaging wastes, office wastes, waste oils, machinery parts and other waste building materials.

The provision of waste bins for general wastes such as putrescibles, and recycling bins for aluminium cans, bottles, plastics and office paper will be provided in appropriate locations.

Construction wastes will also be collected separately and recycled wherever practicable.

The major waste types likely to be generated during the building works include:
- Concrete, timber, steel/metals, asphalt;
- Cardboard, plastics and packaging materials;
- Plasterboard;
- Landscaping materials;
- Food wastes from lunch rooms for construction workers;
- Paper and other office wastes from on site offices.

Decommissioning

At the completion of site construction works, temporary buildings used as offices and other facilities will be demobilised off site. At the completion of site construction works and once the site is secure for public access, fencing material will be demobilised off site. It is expected that these materials can be reused and will not require disposal.

Material removed from temporary bund sites will be reused within the site in final site profiling.

The major waste elements likely to be generated during decommissioning include:

- food waste;
- domestic garbage;
- plastics and packaging materials;
- paper and cardboard;
- aluminium, glass and plastic drink containers;
- newspapers, office paper; and
- miscellaneous hard rubbish such as old furniture; used cleaning equipment; rags etc.

Waste Generation - Operational Phase

Operational activities at the Gold Coast International Marine Precinct Project will generate a range of wastes requiring various methods of disposal.

The operational phase will include:

- Gold Coast International Marina Visitors and Cafeterias;
- Marine Industry TAFE Building;
- Marine Operations;
- Mixed Use Precinct;
- Maintenance Dredging.

Gold Coast International Marina Visitors and Cafeterias

The number of visitors to the Marina each year has been assumed to be around 200,000 – this figure includes the number of persons visiting the marina to access their vessels as well as persons visiting the precinct for tourist purposes or day trips. It is expected that a number of the visitors and workers will visit the cafeteria and generate food wastes.

The major waste elements likely to be generated by the visitors and the cafeteria during operations include:

- food waste;
- plastics and packaging materials;
- paper and cardboard;
- aluminium,. glass and plastic drink containers;
- waste oils;
- waste cleaning chemicals for the cafeteria;
- newspapers, office paper;
- used containers;
- miscellaneous hard rubbish such as old furniture; used cleaning equipment; rags etc.

Marine Industry Educational Establishment Building

The Gold Coast International Marine Precinct will consist of a Marine Industry Educational Establishment (i.e. TAFE) building comprising a 3000 square meter Centre of Excellence and a 1500 square meter workshop devoted to marine industry training. The TAFE will incorporate classrooms, laboratories, offices, caféteria and a security room. It is noted that the TAFE building will operate during semesters and operate with reduced personnel during semester breaks.

The major waste elements likely to be generated by the TAFE during operations include:

- food waste;
- plastics and packaging materials;
- paper and cardboard;
- aluminium, glass and plastic drink containers;
- waste cleaning chemicals for the cafeteria;
- newspapers, paper;
- used containers;
- miscellaneous hard rubbish such as old furniture; used cleaning equipment; rags, stationery etc.

Marina Operations

The operations of a ship building and maintenance industry will generate a number of wastes which will vary in quantity depending on the works to be conducted.

These works will include cutting, sanding, paint stripping, painting, washing, oil changes, filter changes, replacement of parts, decarburising and engine overhauls, change of coolants, antifouling.

The operator of the Marina will have limited control over ship-board waste generation. The segregation and waste avoidance will be the responsibility of vessel operators. Collection facilities for bilge wastes, sewage, waste oils; waste chemicals and general wastes (putrescibles and recyclable wastes) will be provided. The type of solid waste a typical cruise ship generates comprises of glass, paper, steel, food scraps, aluminium, cardboard etc. Waste types found on military vessels are similar. It should also be noted that small amounts of hazardous materials are generated on ships such as chlorinated hydrocarbons and solvents from on-board activities and processes that include photo processing, dry-cleaning, and equipment cleaning.

The Marina has facilities for receiving larger yachts which have sailed in international waters and accordingly all waste on board will be subject to inspection by the Australian Quarantine and Inspection Service (AQIS). Plastics and metal which have been appropriately segregated may be suitable for recycling. In cases where contamination has occurred (e.g. contact with foodstuffs) the waste must be treated in accordance with AQIS requirements, which is either deep burial or incineration. All quarantine waste collected at the Gold Coast International Marine Precinct is to be buried under AQIS supervision.

Accordingly the waste streams generated will include:

- Waste water; oily water; waste coolant;
- waste oils, grease; bilge wastes; slop tank waste water and oily water;
- waste filters and oily rags;
- metal, timber, fibreglass, plastics and other wastes from refurbishing operations;
- parts from maintenance operations;
- paint stripper; paints; other chemicals and hazardous waste;
- used drums and containers;
- non-quarantine garbage from vessels (food, paper, glass, metals, plastics and packaging);
- quarantine waste from vessels (galley and accommodation refuse; floor sweepings; organic wastes that constitute a health risk; and food subject to quarantine); and
- Soot and exhaust wastes.

Mixed Use Precinct

The Gold Coast International Marine Precinct will provide landform for construction of approximately 9.3 hectares for offices, light industry and service recreational. This is expected to cater to 1326 persons work.ing in the showrooms/ offices and 905 persons working in light industry and service recreational.

The major waste elements likely to be generated by the mixed use precinct during operations include:

- food waste;
- domestic garbage;
- plastics and packaging materials;
- paper and cardboard;
- aluminium, glass and plastic drink containers;
- newspapers, office paper;
- used containers;
- miscellaneous hard rubbish such as old furniture; used cleaning equipment; rags etc.

Maintenance Dredging

Maintenance dredging will be required to maintain the dimensions of access channels and waterways within The Project site for navigational purposes. Material dredged from the access channels will be disposed of at an approved disposal site at the western portion of the GCIMP.

Volumes of material to be dredged and frequency of maintenance dredging is has been previously discussed. The disposal of excess dredge spoil will be established during the construction phase. Dewatering and reuse of this material will be investigated. If reuse is not feasible, approvals will be obtained for disposal of this material to appropriately licensed facilities in accordance with regulatory requirements.

The major waste types likely to be generated during the maintenance dredging works include:

- Dewatered dredge spoil unsuitable for reclamation works;
- Water from dewatering activities of dredge spoil;
- Acid sulphate soils; and
- Food wastes from lunch rooms for construction workers.

Waste Related Traffic

Estimates of the volume of waste related traffic generated during construction and operation of the Marine Industry TAFE, the Marina and the Mixed Use Precinct are based on the following assumptions:

- Construction of the TAFE, Marina and Mixed Use area would be undertaken over a staged 10 year period;
- The maximum sustained construction workforce would be approximately 2248 workers (staged over 10 years); and
- Construction would take place six days per week over a 12 hour period.

Most truck movements will occur through delivery of materials to the construction site. There will be some additional traffic transporting waste and recycling materials in the opposite direction. Over the construction period of the Gold Coast International Marine Precinct it is estimated an average of 4 to 15 truck movements per day (based on 2-7 tonne per truck). Some of these movements will be through trucks 'back loading' however, the extent of this is considered to be small as the majority of material delivered to the site will be used on site for the construction works. These figures are the approximate maximum daily movements.

During the operational phase of the TAFE, Marina and Mixed Use precinct, traffic generation will be in the order of between 1 to 3 truck movements per day for waste collection and recycling from the terminal- based on the same truck capacity assumed above.

Liquid Waste

Quality and quantity of stormwater, site drainage and runoff from roads and hardstand areas within the site is detailed in the Stormwater Management Plan. A site stormwater analysis, usage of water and water supply for The Project is detailed in the Infrastructure Report. The collection, treatment and disposal of wastewater origination from The Project is described in the Engineering Services Report prepared by Hyder Consulting contained in Appendix 19.

Management of groundwater during site excavations is described in the Water Quality Report. An erosion and sediment control plan will be prepared during the detailed design phase to be implemented during construction in accordance with the *Engineering Guidelines for Queensland Construction Sites (Institute of Engineers Australia)* to prevent mobilisation of pollutants in runoff from the site and to protect the water quality of surrounding waterways during construction. Management measures for handling of hazardous substances including liquid waste products are outlined in Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14.

Sewage and Trade Waste

Sewage will be disposed via connections to the sewer main system.

A trade waste approval will be obtained from Gold Coast City Council to allow discharge of waste water from the proposed oil and grit separators within the Gold Coast International Marina precinct to the sewer. The Gold Coast International Marina operator will ensure that all conditions of the approval are met including:

- maximum discharge quantity;

- maximum rate of discharge;
- waste water quality limits; and
- treatment and management requirements.

Discharge of trade waste to the sewer will be separated from the domestic waste discharge line. The discharge location will incorporate an inspection chamber located at ground level to allow for monitoring and sampling as required by Council.

Regular cleaning and removal of accumulated oil and grease from the oil and grit separator will be undertaken by an EPA-licensed contractor who will be responsible for waste tracking requirements. All trade waste will be transported, treated and disposed of in accordance with the *Environmental Protection Regulation 1998* and the *Environmental Protection (Waste Management) Regulation 2000.*

A Waste Management Plan prepared by Hyder Consulting is presented as Appendix 12 of the EIS; this report will further discuss waste generation related to the proposed project.

Waste Management

Having regard for best practice waste management strategies, the *Environmental Protection (Waste Management) Policy 2000* and the *Environmental Protection (Waste Management) Regulation 2000*, the proposals for waste avoidance, reuse, recycling, treatment and disposal should be described.

This section should discuss waste management strategies, including reduction, reuse, recycling, storage, transport and disposal of waste, and measures to minimize attraction of vermin, insects and pests. Market demand for recycled waste should be quantified. The potential impact of all wastes to be generated during construction and operation should be considered.

Details should be provided of each waste in terms of:

- Operational handling and fate of all wastes including storage;
- On-site treatment methods proposed for any wastes;
- Methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes;
- The potential level of impact on environmental values;
- Measures to ensure stability of the waste storage areas and impoundments;
- Methods to prevent, seepage and contamination of groundwater from stockpiles and/or storage areas and impoundments;
- Market demand for recyclable waste (where appropriate); and
- Decommissioning of the construction site.

Waste Minimisation and Management

The objectives for waste minimisation and management at The Project site during construction and operation are:

- To minimise waste generated at the site to reduce the volume of waste requiring disposal to landfill.
- To encourage residents and operators within the GCIMP project site to implement waste reduction management measures.
- To prevent dispersal of waste from the site to receiving environments.
- To ensure compliance with the *Environmental Protection Act 1994* and the *Environmental Protection (Waste Management) Policy 2000 (EPP Waste)*.
- To ensure compliance with the Gold Coast City Council's *Solid Waste Management Policy for New Developments September 2011,* and associated guideline.

The Waste Management Plan incorporates all of the above and accordingly includes the following:

- Relevant legislation
- Waste stream characterisation
- Segregation and separation of wastes;
- Operational handling and fate of all wastes including storage;
- On-site treatment methods proposed for any wastes;
- Assessment of waste reduction opportunities for identified waste; and
- Management of waste in accordance with the waste management hierarchy
- Methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes;
- The potential level of impact on environmental values;
- Measures to ensure stability of the waste storage areas and impoundments;
- Methods to prevent, seepage and contamination of groundwater from stockpiles and/or storage areas and impoundments;
- Market demand for recyclable waste (where appropriate); and
- Decommissioning of the construction site.

Waste Regulations

The regulatory requirements governing waste management in Queensland are contained within the Queensland Environmental Protection Act 1994 (EP Act), the Environmental Protection Regulation 1998 and associated Environmental Protection (Waste Management) Regulation 2000, clarifying waste management practices in Queensland and providing for improved environmental safeguards.

i. Environmental Protection Act 1994 - aims to reduce waste and ensure all waste is managed so that it doesn't cause health or environmental problems.
ii. Environmental Protection (Waste Management) Policy 2000 - provides a strategic framework for managing waste in Queensland.
iii. Environmental Protection (Waste Management) Regulation 2000 - provides the requirements for handling specific waste streams.

This Policy is administered by the Department of Environment and Heritage Protection and deals with:

- the ways local governments make decisions on waste and environmental management
- what should be in a local government's waste management program
- local government strategic plans to reduce waste over the long term
- the agreements that businesses can make to cut down their waste (Voluntary Industry Waste Reduction Agreements).

The Project will generate a large variety of waste types throughout the construction and operational phases of development. Implementable waste management measures will need to accommodate for the full range of waste types, including, domestic, commercial and industrial. The majority of construction waste will be general, however it is likely that some waste types produced through the operational phase of The Project will be considered as regulated waste.

The Policy states “regulated waste” means waste that:

- Contains a significant quantity and concentration of a hazardous contaminant; or
- The hazardous contaminant exhibits hazardous characteristics because of its toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, corrosivity, reactivity, ignitability or infectiousness, through its physical, chemical or biological characteristics; or
- The waste may cause environmental harm if improperly transported, treated, stored, disposed or otherwise managed.

All “regulated wastes” are listed in Schedule 7 of the *Environmental Protection Regulation 1998 (Qld)*

i. *Waste Reduction and Recycling Act 2011* - aims to establish a new framework to modernise waste management and resource recovery practices in Queensland. The purpose of the new legislation is to promote waste avoidance and reduction and to encourage resource recovery and efficiency.

The key provisions of the Waste Reduction and Recycling Act 2011 include:

- a waste disposal levy on industry waste sent to landfill
- a requirement for Queensland Government agencies and local governments to prepare waste management plans
- introduction of product stewardship arrangements for any waste products that are identified as a growing problem for landfill in the future
- strengthened litter and illegal dumping offences, including public reporting of vehicle-related littering offences.

This new legislation will require local governments to revisit their waste management practices and policies.

i. *Solid Waste Management Policy for New Development (2011)* - Local governments have legal responsibilities under the *EP Act* to manage waste within their boundaries.

Gold Coast City Council has prepared a *Solid Waste Management Policy for New Developments (2011)*. The objectives of the policy are to ensure that:

- the storage and disposal of solid waste in both domestic and commercial development is undertaken in a manner to ensure minimal risk to public health and the environment.
- new developments within the city incorporates suitable provisions for the collection and storage of solid waste and recyclable materials which are appropriate and adequate for the type and amount of waste generated.
- on-site waste storage of development within the city does not create nuisance to either residential or commercial occupants of the development and adjoining properties.
- solid waste and recyclables can be safely collected with minimum disruption to traffic.
- to improve development outcomes via consistent waste management conditioning with an expectation of fewer post development waste design related issues.

The objectives of the Solid Waste Management Policy for New Developments are met by complying with the intent and provisions of the *Solid Waste Management Guideline for New Developments*. Sufficient support information is provided in the Guideline for development proposals to adequately address issues necessary to demonstrate compliance with the objectives of this policy. The policy relates to requirements for solid waste management for any new development in Gold Coast City and will serve as an interim measure to assist both developers and Council officers in the submission and assessment of relevant development applications, until such time that such provisions are incorporated into the Gold Coast Planning Scheme.

ii. *Solid Waste Management Guideline for New Developments July 2011* - guideline addresses the management of solid waste from domestic and commercial premises, including general and recyclable waste.

It applies to all new developments on the Gold Coast. For developments that are required to submit a development application to Council, waste management provisions will be assessed against this guideline.

The guideline is to be used by everyone involved in the design and construction of new development in the city, including architects, developers, engineers, consultants and builders.

The objectives of this guideline are to:

- clearly outline the requirements for solid waste management for new developments within the city
- detail development application requirements with regard to solid waste management to streamline the application process
- ensure the storage and service of solid waste in the city is undertaken in a manner to minimise risk to public health and the environment

- ensure new developments incorporate suitable provisions for the storage and service of solid waste appropriate and adequate to the type and volume generated
- ensure on-site storage of solid waste does not create a nuisance to occupants of the development or adjoining properties
- ensure solid waste can be safely collected with minimum disruption to traffic
- ensure recycling is provided in all new developments and encourage consideration of other waste minimisation strategies
- encourage developments to incorporate best practice technologies and install waste infrastructure that is beyond the minimum requirement

The guideline outlines information requirements with regards to development applications for new developments, based on the type of development. The Gold Coast International Marine Precinct overall falls under a Mixed Use Development, which requires a Waste Management Plan to be prepared in accordance with Section 2.3 of the guideline. A detailed WMP, and individual WMPs (for varying components of the development) may be required by Gold Coast City Council as a condition of development approval.

Waste Management

The proposed measures for reduction, reuse, recycling, storage, handling and disposal are listed in the following table.

Table 23: Waste Types and Disposal / Management

Waste Type	Characteristic of Waste	Source of Waste	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Dewatered dredge spoil unsuitable for reclamation	Inert	Site reclamation works and maintenance dredging. Excavation of marina shipping channel	To be disposed to appropriately licensed landfill.
Water from dewatering activities of dredge spoil	Require testing and treatment prior to disposal	Site reclamation works and maintenance dredging. From the dredge spoil dewatering	To be stored in collection ponds and tested and treated to meet discharge criteria prior to reuse on site or disposal to Coomera River.
Geo technically unsuitable fill		Site reclamation works. Various excavations on site.	To be disposed in the deep excavations of the marina canal.

Waste Type	Characteristic of Waste	Source of Waste	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Vegetation	Inert	Site reclamation works. Clearing in construction and inundation areas	Cleared timber will be mulched for landscaping or disposed as green wastes.
Topsoil	Inert	Site reclamation works. Scraped before excavation works	Top soil will be stockpiled and reused on site.
Other soil	Inert	Site reclamation works. From cut locations on site for the marina channel and building foundations	To be reused in various fill locations subject to geological characteristics.
Acid sulphate soils	Regulated	Site reclamation works and maintenance dredging. From cut locations on site.	To be reused onsite or collected in a dedicated collection pond/s and tested and treated to meet discharge criteria prior to reuse on site or disposal to Coomera River. Acid sulphate soil stockpiles to be clearly marked and protected from the elements. Run off from acid sulphate soil stockpiles to be collected and disposed in accordance with regulatory requirements. Alternatively to be collected and disposed by a licensed contractor to an appropriate licensed landfill.
Waste rock	Inert	Site reclamation works. From excavations on site for the marina channel and building foundations	To be reused on site where practicable.
Waste concrete	Inert	Site reclamation works. The quantities are estimated to be minimal as there are no building structures on site. From pathways existing on site.	To be collected in skips and sent to the recycling area of the landfill.

Waste Type	Characteristic of Waste	Source of Waste	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Timber pallets and off- cuts from site shed and other construction works	Inert	Building works. Packaging and wastes from site building works, site shed building works.	Timber formwork will be salvaged for re use in future constructions. Timber pallets to be returned to the material suppliers. Timber which cannot be reused or returned will be disposed to landfill.
Office paper, newspapers, and cardboard	Inert	Construction, TAFE and Marina Operations	To be segregated and recycled.
Computers, Printers, Photocopier and other electronic wastes	Regulated	Construction and Marine Operations From TAFE and on site offices.	To be segregated and sent to appropriately licensed waste recycler.
Waste Packaging	Inert	Building works. Packaging and wastes from site building works, site shed building works.	Thermacol, bubble wrap. Shrink wrap and non recyclable packaging to be minimised by appropriate procurement. If unavoidable, these materials to be reused where practicable or disposed appropriately. Cardboard, plastics and other recyclable packaging to be segregated and recycled.
Steel/ metal off –cuts used machinery parts.	Inert	Building works. Wastes from various metal works on site such as pipe works, roofing etc. Machinery parts from maintenance operations.	Metal wastes to be reused where practicable or collected in designated skips for recycling.
Timber, fibreglass, plastics and other construction wastes	Inert	From construction and refurbishing operations	Construction wastes to be recycled where practicable or disposed as solid inert waste.
Plastics	Inert	Building works. Wastes from various piping works.	To be reused on site or collected in separate skips for recycling.

Waste Type	Characteristic of Waste	Source of Waste	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Grease, waste oils, oily rags, contaminated soils, spill kit materials, waste oil filters	Regulated	Building works. Wastes from machinery maintenance and oil spills.	To be collected and disposed by a licensed contractor. Contaminated soil stockpiles to be clearly marked and protected from the elements. Run off from contaminated soil stockpiles to be collected and disposed in accordance with regulatory requirements.
Domestic rubbish recyclable	General	Construction and Marina Operations From the site lunch rooms, TAFE, Marina Operations, Mixed Use Precinct..	Skips to be set up to segregate and collect domestic packaging wastes, aluminium drink cans, glass bottles, plastic milk bottles etc. which can be recycled.
Domestic rubbish putrescibles and non recyclable	General	Construction and Operations From the site lunch rooms, cafeterias. General wastes from site. Used furniture, broken equipment, broken fittings, etc. Non quarantine garbage from vessels.	To be collected and disposed to landfill.
Waste drums and containers	Regulated	Construction and Marina Operations. Supply of materials	Waste drums with hazardous residue to be returned to supplier if possible or to be disposed by an appropriately licensed contractor. Waste drums free of residue to be managed and sent to appropriately licensed waste drum recycler.
Waste tyres	Regulated	Construction and Marina Operations Plant, equipment and vehicle maintenance	Waste tyres will be removed off site by a licensed contractor for re use and disposal to a licensed facility.
Waste batteries	Regulated	Construction and Marina Operations Plant, equipment and vehicle maintenance	Waste batteries will be collected by an approved battery recycler for recycling.

Waste Type	Characteristic of Waste	Source of Waste	Proposed measures for reduction, reuse, recycling, storage, handling and disposal
Waste water	Licensed	Marina Operations	Dispose to sewer under trade waste agreement.
Oily water; bilge wastes, slop tank wastes, oily water, waste coolant	Regulated	Marina Operations	Waste tyres will be removed off site by a licensed contractor for re use and disposal to a licensed facility.
Paint stripper, paints, other chemicals and hazardous wastes	Regulated	Building Operations and Marina Operations	To be collected and disposed by a licensed contractor.
Galley and accommodation refuse, organic wastes and other wastes subject to quarantine	Regulated	Quarantine waste from vessels (galley and accommodation refuse, organic wastes and food subject to quarantine.	To be disposed in accordance with AQIS requirements , which is deep burial under AQIS supervision.
Soot and exhaust wastes	Regulated	From Marine Operations From exhaust manifold and scavenge manifold cleaning.	To be appropriately packaged to ensure these wastes do not become airborne and to be collected for disposal by appropriate licensed contractor.

All waste generated at the site during construction and operation will be stored for collection by approved waste contractors and transported for treatment or disposal off-site. There is no proposal for treatment and disposal of wastes on site. Where practicable waste materials will be reused within the site and arrangements will be made for collection of recyclable waste by a licensed waste recycling facility.

There will be no waste dumps or impoundments within the site. Any stockpiles required for temporary storage of materials during construction will be appropriately located away from overland flow paths and stormwater runoff from the stockpile area will be treated by filtration and or sedimentation prior to discharge from the site.

Waste Avoidance, Waste Minimisation and Cleaner Production

Waste minimisation principles will be applied to the construction and operational phases of The Project to ensure reduction of energy and water consumption and to

ensure efficient use of material resources. Waste management measures to be implemented in order to minimise generation of waste from the site are detailed in the Waste Management Plan prepared by Hyder Consulting contained in Appendix 12 and in the Environmental Management Plan prepared by Hyder Consulting contained in Appendix 14.

Contracts with construction and earth works companies will be prepared to encourage contractors to adopt best practice waste minimisation procedures including the purchase of materials cut to standard sizes, reuse of concrete formwork where practicable and source separation and segregation of all recoverable materials.

The design has incorporated the best cut to fill ratios to ensure minimisation of waste generation and to maximum reuse of onsite fill. Vegetation clearance will be limited to the level necessary for construction and building material wastage is to be reduced through efficient procurement and staging supply of construction materials.

Contractors and sub contractors will be encouraged to recycle and reuse wastes by setting up separate skips to maintain segregation and maximise economic reuse and recycling, in preference to disposal to landfill.

Site activities will incorporate the following techniques:

- Minimisation of packaging wastes through specifying recyclable and low volume packaging from suppliers
- Minimisation of liquid wastes from vehicle washes and introduction of low water consumption devices where feasible
- Minimisation of oily wastes by ensuring all machinery is routinely checked and leaks are promptly attended to

Cleaner production technology is applied to production processes to reduce generation of industrial waste, greenhouse gas emissions and consumption of raw materials. Strategies are developed for modification of production processes, use of new technologies and reuse of process by-products.

Generally, methods for achieving cleaner production include substitution of input used in production processes with less hazardous substances; product reformulation to provide a less hazardous end-product; production process modification; improved operation and maintenance of production equipment and methods; and closed-loop recycling to ensure extended use of substances within the production process.

There are no production processes proposed during operation of this project site that will result in generation of by-products or require input of raw materials.

Additionally there is no proposal for integrated process design, cogeneration of power or by-product re-use.

Gaseous wastes were discussed as part of the Air Quality Assessment prepared by ASK Consulting contained in Appendix 33.

Waste Reuse and Recycling

After waste minimisation, waste reuse and recycling are the next priority for waste management and include the following measures:

- Scrapers will be used to segregate top soil for reuse prior to commencing deeper excavation works.
- The site is currently used for grazing and accordingly the amount of concrete and building rubble to be generated is expected to be minimal.
- Mulching of cleared vegetation and reuse shall be implemented where feasible.
- In summary, the major construction wastes such as waste rock, cleared vegetation, top soil and concrete will be reused or recycled on site.
- Reuse of timber pallets and timber skids where practicable;
- Separate skips will be set up as required to ensure the recycling of packaging wastes, office paper, timber, scrap metals, plastics, glass etc.
- Recycling of waste oils and batteries will also be implemented.
- Stormwater collected from designated stockpile areas shall be reused for dust suppression.

Waste Storage, Handling and Disposal

Major construction wastes will be stockpiled on site in designated areas with an appropriate collection system for stormwater runoff. The soil stockpile areas will be adequately protected from wind to minimise dust generation.

Storage of domestic rubbish and packaging wastes will be in covered bins or skips located near the site office, toilets, crib rooms and workshop areas. Storage of construction wastes to be recycled such as bricks, concrete, metals, timber etc will be in skips located at a designated area.

Storage of hazardous wastes such as waste oils, batteries, chemicals etc will be stored in a designated hazardous waste area which is appropriately bunded and with an appropriately designed stormwater collection system to ensure that any runoff or leaks are captured. Appropriate handling and spill response procedures will be implemented to ensure that spills and leaks are prevented and managed. Appropriate personal protection equipment, spill response kits, materials safety data sheets (MSDS) shall all be maintained at the storage areas as well as in the site office.

Containers for waste collection and recycling in the Gold Coast International Marina Precinct will be suitably covered or will be contained by a lid if putrescible waste is the main component, thereby minimising emissions. Additionally, all 'receptacles' will also be in good working order so that no leakage will occur during storage and transport. There will be no necessity to have any dedicated waste processing facilities on site as everything will be transported to existing Council managed or contracted facilities.

It is expected that some wastes will require to be disposed to landfill. These wastes include:

- Domestic rubbish (eg food, rags etc.);
- Non recyclable packaging (e.g. foam, shrink wrap);
- Contaminated soils;
- Used spill response materials;
- Waste tyres; and
- Waste oils and chemicals. (to a hazardous waste contractor for treatment and disposal).

Disposal Facilities

General Wastes: It is anticipated that much of the solid waste to be landfilled (including domestic rubbish and mixed building wastes will be taken to the landfill at Rossman's Road, Stapylton.

Recyclable wastes: The Stapylton landfill offers recycling for the following wastes motor oil, scrap metal, glass, green waste, batteries, car tyres, car bodies, concrete, demolition waste. It is expected that the recycling bins will also be sent to the recycling area of the landfill.

Quarantine and other specialist Port Waste: The Existing Gold Coast Marine Precinct provides shore-based facilities for receiving ship-generated waste to ensure compliance with MARPOL 73/78 (Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978). These waste products include:

- Oils and oily mixtures including chemicals;
- Noxious Liquid Substances (NLS);
- Sewage;
- Non-quarantine garbage from Australian vessels (food, paper, glass, metals, plastics and packaging); and
- Quarantine waste.

Existing waste facilities are expected to be of sufficient capacity to receive the volumes of waste expected to be produced by The Project through construction

and operation. It is therefore not proposed to construct additional landfill for The Project.

A Waste Management Plan prepared by Hyder Consulting is contained in Appendix 12 of the EIS; this report further discusses the proposed project in relation waste management and mitigation measures.

4.7 Air Quality

Description of Existing Air Quality

This section of the EIS should describe the existing air quality that may be affected by the project in the context of environmental values as defined by the *Environmental Protection Act 1994* and *Environmental Protection (Air) Policy 2008*. These descriptions should include any baseline monitoring results. Emissions sources (quantity and characteristics) in the vicinity of the project site and nearby sensitive receptors should be identified and presented with the aid of maps at a suitable scale.

Existing Air Quality

ASK Acoustics and Air Quality has prepared an Air Quality Assessment which is contained within Appendix 33. The purpose of the Air Quality Assessment is to describe the existing air quality that may be affected by the Precinct in the context of environmental values as defined by the Environmental Protection Act 1994 and Environmental Protection (Air) Policy 2008. These descriptions include any baseline monitoring results. Emissions sources (quantity and characteristics) in the vicinity of the Project site and nearby sensitive receptors are identified and presented with the aid of an appropriately scaled map.

The tasks undertaken include:

1. identifying environmental values (referring to the Environmental Protection (Air) Policy 2008 and the Environmental Protection Act 1994) that may be affected by the Project;
2. describing any relevant baseline monitoring results;
3. describing sources of relevant emissions in the vicinity and their annual emission quantities based on the NPI and SEQ inventory;
4. locating nearby sensitive receptors using Google Earth Pro;
5. inspect the site and surrounds to identify receptors and minor emission points, appreciate land uses; and
6. illustrate these sources and receptors along with the Project site on a Google Earth Pro overlay.

Environmental Values

Queensland Environmental Protection (Air) Policy: The Environmental Protection (Air) Policy of 2008, referred to as the EPP (Air) sets out ambient air quality goals by which pollutant levels can be assessed for their potential to cause harm to human health and wellbeing in Queensland.

Table 24: Ambient air criteria from the EPP (Air)

Indicator	Value	Objective (µg/m^3)	Period
TSP	health & wellbeing	90	1 year
PM_{10}	health & wellbeing	50 [1]	24 hours
$PM_{2.5}$	health & wellbeing “	25 8	24 hours 1 year
carbon monoxide	health & wellbeing	11,000 [2]	8 hours
nitrogen dioxide	health & wellbeing “	250 [2] 62	1 hr 1 year
sulfur dioxide	health & wellbeing “ “ ecosystems	570 [2] 230 [2] 57 22	1 hour 1 day 1 year 1 year
benzene	health & wellbeing	10	1 year
styrene	aesthetic environment health & wellbeing	75 [3] 280	30 minutes 1 week
toluene	health & wellbeing “ aesthetic environment	4100 410 1100	24 hours 1 year 30 minutes
xylenes	health & wellbeing “	1200 950	24 hours 1 year

Notes: 1. Allowance is made to exclude 5 days but these should only be during identified bushfires or dust storms.
2. Allowance is made to exclude 1 day but this should only be during identified bushfires.
3. The odour threshold for styrene is approximately 800 µg/m3, being the geometric mean of those thresholds published by AIHA (1989), Amoore and Hautala (1983), and Devos et al (1990). Thus the criteria has built in an order of magnitude allowance for the uncertainties of assessments and the short-term peak fluctuations of concentrations

National Air Quality: The Environment Protection and Heritage Council (EPHC) specifics goals for Australian ambient air within the National Environment Protection (Ambient Air Quality) Measure, also known as the Air NEPM. These goals are included in the EPP (Air).

Baseline Monitoring

The nearest ambient air monitoring station is the DERM station at Springwood. This is not in the same catchment as Coomera, but has a similar mixture of light

industry and residential land uses. Hence it can be used to provide an indication of likely regional air quality at Coomera.

Average and hourly maximum concentrations are provided in Table 25 below. With the exception of styrene and carbon monoxide, the results are for the year 2005 from Springwood. Carbon monoxide was obtained from Woolloongabba. Styrene monitoring was undertaken by Simtars at Coomera in November 2007.

Table 25: Ambient Air Monitoring Data

Indicator	Concentration ($\mu g/m^3$)	Averaging Time	Site
PM_{10}	63.6 [1]	24 hours	Springwood [2]
$PM_{2.5}$	17.7 6.6	24 hours 1 year	Springwood [2]
carbon monoxide	4600 (4ppm)	8 hours	Woolloongabba [2]
nitrogen dioxide	77 (0.041 ppm) 11 (0.006 ppm)	1 hour 1 year	Springwood [2]
sulfur dioxide	39 (0.015 ppm) 5 3	1 hour 1 day 1 year	Springwood [2]
styrene	14	1 hour	Coomera [3]
benzene	3 (0.8 ppb)	1 year	Springwood [2]
toluene	18 (4.9 ppb) 6	24 hours 1 year	Springwood [2]
p-xylene	7 (1.6 ppb) 4	24 hours 1 year	Springwood [2]

Notes: There were three days identified as due to dust storms. The fourth highest PM_{10} was 40.6 $\mu g/m^3$. DERM (2005); Simtars (2007)

Table 26: Existing Sources of Air Emissions

Source	Pollutants	Emission rate (g/s)	Source of data
Maritimo Offshore 6 bays	styrene	0.0056 0.57 0.17 0.16 0.11 0.11	Simtars reports
Riviera Marine	styrene	6.3	NPI
Smaller boat builders in Gold Coast Marine Centre & Gold Coast City Marina	styrene	0.46	NPI
Motor vehicles and boating	NO_x CO PM_{10}	20 45 79	SEQ Inventory

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Sensitive Receptors

Small residential and acreage allotments exist in the vicinity surrounding the proposed site to the south west and to the north across Oakey Creek. New residential estates are currently being developed off Foxwell Road to the north. To the south-west a gated community exists along Ford Road and to the east across the Coomera River lies residential suburbs' including Santa Barbara and Hope Island. Approximately 2km to the east-north-east lies the residential suburb of Upper Coomera. Dreamworld amusement park is approximately 1km to the east-north-east.

The nearest sensitive receptors are summarised in the Table below including the approximate distance from the proposed marine precinct.

Table 27: Nearest Sensitive Receptors

Site	Address	Distance from Proposed Marine Precinct (km)	Direction from Proposed Marine Precinct
A	87 Shipper Drive	0.1	S
B	190 Shipper Drive	0.2	NW
C	East side of Shipper Drive, last house before Foxwell Rd	0.3	NW
D	220 Foxwell Road	0.5	NW
E	240 Foxwell Road	0.4	NNW
F	266 Foxwell Road	0.2	N
G	274 Foxwell Road	0.2	N
H	308 Foxwell Road	0.2	N
I	Lot 4 Foxwell Road	0.3	N
J	20 Foxwell Road	0.3	N
K	158 Beattie Road	1	S
L	19 Mcphail Road	0.8	S
M	Gated Community, Ford Road	0.7	SSW
N	Hansen Court	0.7	SSW
O	Rosebank Way West	0.3	ESE
P	Proposed tavern dining	internal	NE corner
Q	Proposed hotel 7th floor	internal	NE corner
R	Proposed hotel 7th floor	internal	NE corner

An Air Quality Assessment Report prepared by ASK Acoustics and Air Quality is presented as Appendix 33 of the EIS; this report provides further information to describe the existing air quality.

Potential Impacts on Air Quality and Mitigation Measures

This section of the EIS should describe in detail the expected quantity and quality of all air emissions (including particulates, gaseous, and odorous compounds) from the Project during construction and operation. The proposed level of emissions of dust, fumes and odours should include emissions during both typical and worse case conditions. The assessment of air emissions should consider at least the following matters:

- construction activities likely to cause air emissions including excavation and filling, site compounds and stockpiles;
- a review of operational impacts associated with increased road and river traffic emissions and air quality issues associated with servicing the Project;
- the human health risk associated with emissions from all hazardous or toxic pollutants; and
- the potential for nuisance and amenity impacts associated with the Project.

The emissions from the Project should be modelled using a recognized atmospheric dispersion model to identify changes in existing conditions. A comparison with air quality goals contained in the *National Environmental Protection (Ambient Air Quality) Measures 2003* (available from: www.ephc.gov.au/airquality/aaq_nepm), the *National Guidelines for Control of Emissions from Stationary Sources* (National Health and Medical Research Council of 1985) and the *Environmental Protection (Air) Policy 2008* should be included in the discussion.

Features of the Project designed to suppress or minimize emissions including dusts and odours, should be detailed in this section. Objectives for protecting and or enhancing environmental values for air quality should be identified, including a discussion on how nominated quantitative standards and indicators may be achieved.

Impact of Proposed Development

The following presents an outline of the expected quantity and quality of all air emissions (including particulates, gaseous, and odorous compounds) from the Project during construction and operation. Further detail is contained within the Air Quality Assessment prepared by ASK Acoustics and Air Quality contained in Appendix 33.

The proposed level of emissions of dust, fumes and odours includes emissions during both typical and worse case conditions. The assessment of air emissions considers the following matters:

- construction activities likely to cause air emissions including excavation and filling, site compounds and stockpiles;
- a review of operational impacts associated with increased road and river traffic emissions and air quality issues associated with servicing the Project;
- the human health risk associated with emissions from all hazardous or toxic pollutants; and
- the potential for nuisance and amenity impacts associated with the Project.

Discussion

Predicted concentrations, from the development, of PM_{10}, carbon monoxide, nitrogen dioxide are an order of magnitude or more within the criteria. Including background listed in Table 8 above, they are still within the criteria. The likelihood of any impacts arising from these emissions is very low.

Predicted existing styrene concentrations exceed the amenity criterion at the nearest sensitive receptor reaching 134 $\mu g/m^3$ compared to the amenity criterion of 75 $\mu g/m^3$. Thus the predicted concentration is almost double the criterion. The criterion is based on a published odour threshold of styrene, so this prediction is effectively 2 odour units. There is low likelihood of this being detected in ambient air by the average person, and it is not likely to cause nuisance, unless there is an especially sensitive individual living nearby.

Worst case predicted styrene concentrations are well within the one week health criterion of 280 $\mu g/m^3$. The highest predicted 30 minute styrene concentration is 62 $\mu g/m^3$ which is close to the amenity criterion of 75 $\mu g/m^3$. Figure 3 shows that the 75 $\mu g/m^3$ contour marginally enters the residential area to the east. Hence the worst case prediction represents a concentration of approximately1 odour unit. Predictions for the worst case, with the Maritimo shed emissions diverted through a filter and up a stack are less than for the existing scenario, but also reach 62$\mu g/m^3$.

There is low likelihood of odour being detected, and so nuisance is unlikely, depending on the uptake of boat building activities, and the subjective sensitivity of the neighbouring residents. Given the prevailing marine industry land use of the area, odour, at these low levels, reaching commercial properties should not give rise to nuisance complaints.

Mitigation Measures

Scope

Features of the Project designed to suppress or minimize emissions including dusts and odours, are detailed in this section. Objectives for protecting and or enhancing environmental values for air quality should be identified, including a discussion on how nominated quantitative standards and indicators may be achieved.

Construction Measures

Throughout construction, a water cart will be used to damp haul routes, and during windy conditions, other exposed dry surfaces.

Fabric wind-break / catch nets should be used at the edge of exposed areas:

- on the southern boundary adjacent to receptor A and the existing marine precinct;
- on the western boundary adjacent to receptor B; and
- if nuisance dust complaints are received on the northern boundary.

Operational Measures

If odour complaints are received, an assessment should be undertaken to determine the major source(s) of odorous emissions, including fugitive sources. Where necessary, appropriate extraction and filter systems should be installed to reduce emissions.

An Air Quality Assessment Report prepared by ASK Acoustics and Air Quality is presented as Appendix 33 of the EIS; this report provides further information regarding impacts to air quality and mitigation measures in relation to the proposed project.

Greenhouse Gas Emissions

The EIS should provide an inventory of projected annual greenhouse gas emissions from construction equipment and plant, with total emissions expressed in 'CO_2 equivalent' terms.

The Australian Greenhouse Office Factors and Methods Workbook (Australian Greenhouse Office 2004) can be used as a reference source for emission estimates and supplemented by other sources where practicable and appropriate.

A description of the proposed measures (alternatives and preferred) to implement energy efficiency measures should be described. This section should consider actions to achieve energy efficiency measures either through design principles or technology and how these measures compare with current national best practice standards.

The Environmental Management Plan in the EIS should include a specific module to address energy efficiency.

Assessment of GHG Impact of Proposal

The total emissions estimated for the development is 23,138 tCO_2e. A breakdown from construction and embodied emissions of materials is shown below, and a summary of total emissions for this development is also presented in the table below.

Figure 25: Emissions breakdown from construction and embodied emissions of materials

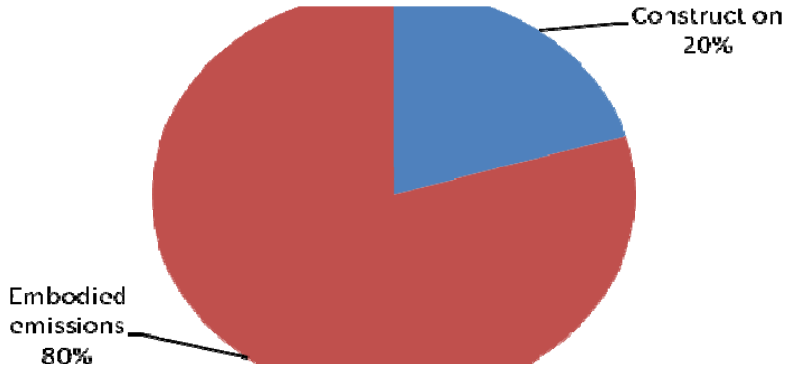


Table 28: Summary of total emissions

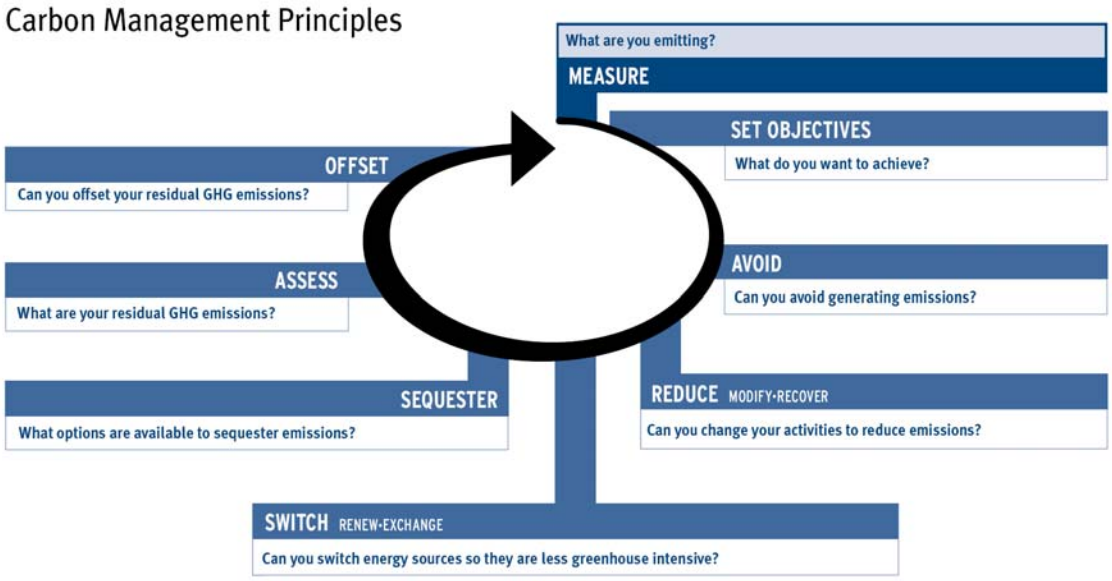
Emissions source	Emissions (tCO_2e)
Construction	4721
Embodied emissions	18417
TOTAL	**23138**

The construction emissions of tCO_2e represents approximately 0.01% of emissions produced by the manufacturing and construction sector in Queensland in 2008. The embodied emissions represent 79% of the overall emissions associated with construction. Embodied emissions are considered Scope 3 emissions and can be managed through material selection.

GHG management and mitigation options

The carbon management principles shown in the Figure below, provide a robust framework for the management and reduction of GHG emissions.

Figure 26: Carbon management principles for emissions reduction (Victorian EPA)



The Greenhouse Gas Assessment prepared by Hyder Consulting contained in Appendix 39 shows the emissions measurement and setting objectives components of the carbon management principles. GHG emissions reduction actions should ideally be prioritised according the carbon management principles.

- **Avoid**: Actions which avoid emissions, in the first instance, should be considered as a priority;

- **Reduce**: Actions which result in a reduction of emissions should be considered next;
- **Switch**: Actions which switch energy sources to reduce emissions should be the next considered;
- **Sequester**: Actions which sequester GHG emissions do not reduce emissions but store them; and
- **Offset**: Offsetting of emissions through the purchase of offsets. This should be considered as a last resort.

Regular monitoring of emissions is recommended throughout the project to assess the effectiveness of emissions mitigation actions. The following actions are recommended for mitigation of GHG emissions for construction and embodied emissions:

- Where possible, use locally sourced materials to reduce emissions associated with transport;
- Ensure that waste is recycled/composted wherever possible;
- When importing fill source from nearby construction sites wherever possible to reduce transport related emissions;
- Plan construction works to avoid double handling of materials;
- Make use of recycled materials to reduce emissions associated with embodied energy
- Develop construction/transport plans to minimise the use of fuel during each construction stage. For example throttling down and switching off construction equipment when not in use;
- Assess the fuel efficiency of the construction plant/equipment prior to selection, and where practical, use equipment with the highest fuel efficiency which use lower GHG intensive fuel (e.g. gas, ethanol); and
- Regular maintenance of equipment to ensure optimum operations and fuel efficiency.

A Greenhouse Gas Assessment Report prepared by Hyder Consulting is contained in Appendix 39 of the EIS; this report provides further information regarding greenhouse gas emissions relative to the proposed project.

4.8 Noise and Vibration

Description of Acoustical Environmental Values

This section should describe the existing noise and vibration environment that may be affected by the Project in the context of environmental values as defined by the Environmental Protection (Noise) Policy 2008. The EIS investigation should refer to the *Noise Measurement Manual* (Environmental Protection Agency 2000) and to *Guideline: Planning for Noise Control* (Environmental Protection Agency 2004).

All existing and future sensitive receptors as defined by the Environmental Protection (Noise) Policy 2008 should be identified within the vicinity of the project and located on a map at a suitable scale. Background noise levels, including daytime and night time measurements, should be monitored at sensitive receptors likely to be impacted by the project.

A Noise and Vibration Report has been prepared by Hyder Consulting and is contained in Appendix 34 of the EIS; this report provides a detailed description of acoustical environmental values.

Existing Acoustic Environment

The development site is currently unoccupied and there are no buildings on the site, with the exception of a model aeroplane club which consists of one small building and a landing strip. This model aeroplane club is located on the south east corner of the site, adjacent to the Coomera River and Shipper Drive. At the time of our site inspections, this facility was not in operation.

There are existing noise and vibration sources within the existing Gold Coast Marina on the southern side of Shipper Drive. Based on findings of a site inspection within the marina, existing noise sources observed include:

- Boating movements on the Coomera River;
- Forklift movements around the site;
- Ship lift operational noise – raising boats out of the water and manoeuvring around the site;
- Reversing alarms on forklifts;
- Mechanical plant such as air conditioners and exhaust fans and air intakes;
- Maintenance and boat construction sources such as grinders, air/ water compressors and manual hammering;
- Vehicle movements in and out of the marina site.

Receiving Environment

The Coomera Marine Precinct development has the potential to impact on the following receivers:

- Existing residences to the north of the development site;
- Existing residences to the north west of the development site;
- Existing residences to the south west of the development site;
- Existing residences to the east of the development site on Santa Barbara;
- Existing residences to the south east of the development site on Hope Island;
- Existing residences along the material delivery haulage route on Shipper Drive and Foxwell Drive;
- The existing Marina Industry on the southern side of Shipper Drive;
- Marine life within the Coomera River (this will be assessed by a specialist consultant and does not form part of this assessment).

Residences

North and North-West

The nearest existing residences are approximately 127 metres to the north-west of the marine industry subdivision and these residences are the closest to the project. These receivers are located on Shipper Drive. Based on available information on these properties, the dwellings are scattered over a large land area with access from Foxwell Road and private access to the Coomera River.

Additional residences north west of the site are located between approximately 185 metres to 240 metres from the north site boundary along Oakey Creek, with further residences currently being constructed on Foxwell Road at a distance of 390 metres.

South-west:
The residential area to the south-west of the site is approximately 645 metres from the site. This residential area is adjacent to Beattie Road and Ford Road and some areas are currently being constructed.

East:
The nearest residential receivers to the east of the development site are located at Santa Barbara. These residences are approximately 290 metres distance and we have assumed for the purposes of this acoustic assessment that the majority of these dwellings are 2 storeys in height. Each dwelling has direct access to the Coomera River via a private jetty.

South-east:

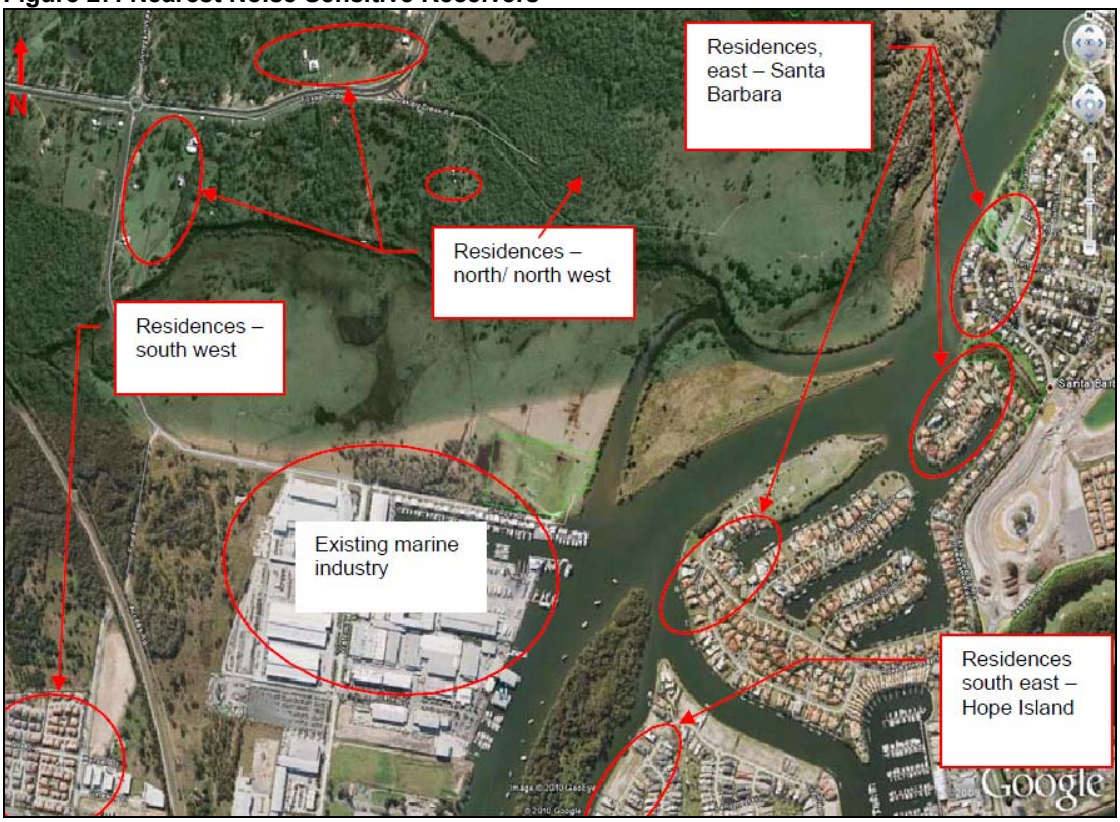
The nearest residential receivers to the south east of the development site are located on Hope Island. These residences are approximately 430 metres distance and we have assumed for the purposes of this acoustic assessment that the majority of these dwellings are 2 storeys in height. Each dwelling has direct access to the Coomera River via a private jetty.

Existing Marina Industry

The existing marina industry located along Shipper Drive is approximately 30 metres from the southern site boundary of the Coomera Marine Precinct. Based on the industrial nature of this area, potential noise impacts from the proposed Coomera Marine Precinct are unlikely to be significant.

The existing identified noise receivers are shown in the Figure below.

Figure 27: Nearest Noise Sensitive Receivers



Potential Impacts on Acoustical Environmental Values and Mitigation Measures

The EIS should describe the modelled impacts of noise and vibration generated during the construction and operational phases of the project. In particular any places of work, residence, recreation, education or worship should be considered. Potential noise contours should be prepared and mapped using a suitable acoustic model based on the proposed generation of noise associated with the operation of the project.

An analysis of noise and vibration impacts should include:

- the levels of noise and vibration generated during construction of the project and ancillary activities (e.g. access roads) and operations, assessed against current typical background levels
- potential emission of low-frequency noise (noise with components below 200Hz) where it may impact sensitive receivers, should be described
- information on the magnitude, duration and frequency of any vibration from construction and operation of the project should be provided, including schedules
- information should be supplied on blasting which might cause ground vibration or fly rock on or adjacent to the site
- a comparison with objectives, standards to be achieved and measurable indicators, including environmental impact on terrestrial and aquatic animals and avifauna should be provided.

A Noise and Vibration Report has been prepared by Hyder Consulting and is contained in Appendix 34. This report details acoustical impacts and mitigation measures in relation to the proposed project.

Construction Noise

The following is a list of each modelled construction stage scenario that has been used in the acoustic assessment and a brief description of what the model represents. The construction stage noise contour maps are contained within the Noise and Vibration Report prepared by Hyder Consulting contained in Appendix 34.

The construction of this development is separated into two stages and these are:

- Construction Stage 1 – defined as the area of the development, east of the proposed future IRTC alignment.
- Construction Stage 2 – defined as the area of the development, west of the proposed future IRTC alignment.

The following table is a list of each modelled construction stage scenario that has been used in the acoustic assessment and a brief description of what the model represents.

Table 29: Outline of Construction Stage models used in the Acoustic Assessment

Construction Stage Models		Description of Models
1	Piling – Internal Marina:	This model represents piling activities within the internal marina area. Although some piling will likely be required in some of the main bulk earthworks phases of each construction Stage, piling has been assessed separately due to the high noise levels typical of this type of activity.
2	Piling – Oakey Creek:	This model represents piling activities at Oakey Creek, in the vicinity of the proposed IRTC. Although some piling will likely be required in some of the main bulk earthworks phases of each construction Stage, piling has been assessed separately due to the high noise levels typical of this type of activity.
3	Construction Stage 1 – Phase 1 to Phase 9:	This model represents bulk earthworks associated with construction Stage 1.
4	Construction Stage 1 – Phase 10 and 11:	This model represents civil works associated with construction Stage 1.
5	Construction Stage 2 – Phase 1 to Phase 4:	This model represents bulk earthworks associated with the construction of Stage 2.
6	Construction Stage 2 – Phase 5:	This model represents civil works associated with the construction of Stage 2.

Construction Noise

With reference to the Gold Coast Planning Scheme (GCPS, Part 7, Div 2, Ch 11), construction activities shall be carried out during the following time periods:

- 6am to 6pm Monday to Friday
- 7am to 6pm on Saturdays
- No work is to be undertaken on Sundays

Construction Vibration

Vibration criteria that are proposed for this project are summarised below.

Table 30: Summary of Vibration Criteria

Criteria	Vibration Velocity (mm/s-1)	Standard
Human Comfort		
Disturbance to Persons (Day)	0.3 – 0.6 peak	BS6472
Disturbance to Persons (Night)	0.2 peak	BS6472
Structural Damage		
Commercial Buildings	20 – 50 r.m.s	DIN 4150 Part 3
Damage to Dwellings (residences)	5 – 20 r.m.s	DIN 4150 Part 3
Damage to Heritage Buildings	3 – 10 r.m.s	DIN 4150 Part 3

For the purposes of this assessment, it is assumed that the construction would be completed in approximately 2.5 to 3 years.

Construction Noise Sources

Construction noise sources will include equipment and plant used for the construction of the project including, dredging and haulage route traffic noise. Noise and vibration impacts associated with the construction of the proposed development may be generalised as follows:

- Noise from the various construction phases of the project including bulk earthworks and civil works;
- Excavation activities;
- Piling noise impact;
- Dredging noise impact;
- Haulage traffic noise during construction.

Haulage Route

It is proposed that the materials haulage route to the site will be from the Pacific Motorway onto Foxwell Road, then onto Shipper Drive and into the site. It is estimated that there may be up to approximately 25,000 heavy vehicle movements entering / exiting to deliver fill for the site, over a 12 month period. This is approximately 85 trucks over a period of 20 days along this route.

Potential Vibration Sources

The main potential vibration generating construction activities are estimated to include the following, in order of precedence:

- Piling – sheet piling
- Compacting earth
- Materials delivery
- Spoil / fill haulage

Construction Stage Noise Emission

The construction stages have been assessed and whilst there is no noise criteria for construction activities in Queensland, the Gold Coast Planning Scheme (GCPS, Part 7, Div 2, Ch 11) provides time limits for construction activities. The Noise and Vibration Report prepared by Hyder Consulting has been based on construction activities being undertaken during these times.

The acoustic assessment has identified that, based on the construction plan, several stages of construction are likely to significantly impact on the nearest affected residences and noise control measures are required to minimise the impact as far as practicable. These activities include:

- Bulk Earthworks; and
- Piling.

Construction equipment and quantities have been estimated based on previous project experience with source noise levels being referenced from the Australian Standard AS2436. It is expected that the construction Contractor would undertake an acoustic assessment when details of plant and equipment are known, specific to each phase of work. Pending a detailed assessment, this report provides an outline of best practice mitigation measures for control of construction noise for consideration. These have been based on the Australian Standard AS2436 Some recommended best practice measures outlined in the Noise and Vibration report include the following:

- Prepare a Construction Noise and Vibration Management Plan. This should be undertaken by the Contractor;
- Select construction plant based on acoustic performance, where practical;

- As piling is a significantly noisy construction activity, it is preferable if bored piles are used in lieu of driven piles in order to reduce noise impact to noise sensitive receivers.
- Incorporating noise attenuating controls at the source, such as mufflers, acoustic screens and maintaining plant and equipment.
- Community consultation to provide affected receivers with details of the construction plan and any planned activities that may exceed noise and vibration targets.
- Carry out construction noise and vibration monitoring, where criteria has been identified to be potentially exceeded.
- Use of temporary noise barriers.
- Provision of respite periods for noisy activities.
- Use of broadband reversing alarms on mobile equipment in accordance with the relevant health and safety regulations.
- Where noise or vibration is found to cause unacceptable impact, modify work activities where practical.

As outlined, the noise levels and activities that have been used in the Noise and Vibration assessment have been based on previous project experience and our understanding of the general function of the proposed development. A detailed acoustic assessment of each of the buildings is expected to be undertaken during further design stages of this project to confirm specific detailed requirements of noise control measures.

It is important to note that based on the current design, blasting is not required.

Noise and Vibration Audits During Construction

It is recommended that noise and vibration monitoring be carried out at representative receiver locations on a periodic basis, but particularly during periods of intense or generally noisy construction activities that are near to residences. It is also recommended to undertake noise audits during non-standard construction hours, should the construction schedule be required to operate at these times, to confirm the actual impacts.

If necessary and where feasible and practical, the construction methodology would be reviewed to identify reasonable and feasible mitigation measures that could be employed to minimise the noise impacts. Some additional considerations for monitoring construction noise may include a combination of the following:

- Carrying out long-term noise and vibration logging at the closest residences to the works. This information would be downloaded and analysed by an acoustic consultant with the findings presented to the contractor and potentially can be presented at community consultation meetings to discuss

findings and provide a basis for improving noise mitigation methods or re-scheduling of construction activities for example; and
- Carry out short-term noise and vibration measurements of particularly intense construction activities on a trial basis to provide a basis for the most practical noise and vibration mitigation treatment/ methods that can be installed on site, prior to the works commencing.

Operational Noise

Based on discussions with the Queensland Government Department of Environment, it is understood that the operational stage of the development shall be assessed to both the EcoAccess noise guideline and also the Environment Protection (Noise) Policy 2008. Computer noise modelling using Soundplan proprietary software has been carried out to assist with the acoustic assessment of both operational noise and construction stage noise emission. Several operational stage noise models have been used to assess the potential noise impact from the development to the nearest noise affected residential receivers and these models include:

- Ship lift noise emission;
- General industry noise emission (boat manufacturing and maintenance);
- Mechanical plant noise emission;
- Boating movements noise emission;
- TAFE noise emission.

The noise impact assessment establishes that the operation of the development is likely to exceed the EPP Noise 2008 acoustic criteria and also the EcoAccess acoustic criteria for this project and has identified that noise control measures are required. Some of the noise control measures that are discussed in this assessment report can be commonly applied to most of the generalised models listed above. These common noise control measures include:

- Selection of low noise emission plant and equipment;
- Design of floor plans for manufacture and maintenance sheds that provide an area inside for noisy works. This approach utilises the noise attenuation provided by the building envelope to minimise noise impact to the nearest affected residential receivers;
- Orientation of external doors so that they do not direct noise to noise sensitive receivers;
- Design and construction of proprietary acoustic enclosures and attenuators for significant mechanical plant.

The design of such noise attenuation treatment may reduce noise emission levels of specific plant items by approximately 5-10dB(A), which may be satisfactory to

control noise emission to comply with the acoustic criteria for daytime and potentially evening time periods.

The assessment has been based on descriptions for potentially 24 hour operation of the site, however the noise modelling has indicated that night time operation of noise intensive activities such as hammering and grinding and the use of mechanical plant will not comply with the night time noise emission criteria. It is unlikely that noise attenuation measures such as attenuators, silencers and acoustic enclosures would provide satisfactory noise attenuation of noise sources and activities on the site to control noise emission so that there are no noise exceedences during the night time period.

The Noise and Vibration Report contained in Appendix 34 has recommended that industrial activities on the site should be limited to less noise sensitive periods, for example daytime and early evening as the level of noise mitigation for buildings and plant may not be practical.

Night-time surface works

Provide details of any night time surface work that may be undertaken. Specifically include:

- the reasons why night time work may be undertaken (e.g. to avoid peak traffic periods, or to undertake work on a rail corridor)
- the likely duration of work (if known)
- the proposed hours of work
- the nature of work to be undertaken
- the likely impact on residents and the associated mitigation measures to be undertaken by the proponent
- the methods that will be used to communicate with affected residents.

The Noise and Vibration Assessment prepared by Hyder Consulting is contained in Appendix 34 of the EIS, details any night time work that may be undertaken. The outcomes of this assessment has been provided as follows.

Night Time Works

The assessment has been based on descriptions for potentially 24 hour operation of the site, however the noise modelling has indicated that night time operation of noise intensive activities such as hammering and grinding and the use of mechanical plant will not comply with the night time noise emission criteria. It is unlikely that noise attenuation measures such as attenuators, silencers and acoustic enclosures would provide satisfactory noise attenuation of noise sources and activities on the site to control noise emission so that there are no noise exceedences during the night time period.

Recommendations

This report has recommended that industrial activities on the site should be limited to less noise sensitive periods, for example daytime and early evening as the level of noise mitigation for buildings and plant may not be practical. Should night time operation of the site be required, a detailed assessment of the activities, plant sound power levels, equipment sound power levels and duration of such activities are undertaken to determine if it is possible for this to occur. At the time of this report, there is insufficient information to carry out a detailed acoustic assessment however best practice measures would be expected to be assessed which may include for example:

- Variable speed drives on mechanical plant to enable operation of plant such as air conditioners and exhaust fans at reduced loads during the night time period;

- Increased sound isolation design of the building envelope for manufacturing and maintenance sheds which may include provision for high acoustic performance proprietary acoustic doors, double-skin external masonry walls and built-up roof/ ceiling constructions;
- Implementation of multiple-stage attenuation for intake air and extraction fans;
- Provision to close all external doors during the night time period.

4.9 Visual Amenity and Landscape Character

Description of the existing visual amenity and landscape

This section should describe in general terms the existing landscape character and visual amenity of the project site and surrounding areas. Information in the form of maps, sections, elevations and photographs is to be provided in this section. The discussion should include:

- a description of the character of the built environment in terms of scale, form, materials and colours
- a description of existing landscape features, panoramas and views that have, or could be expected to have, value to the community whether of local, regional, state or national significance
- identification of elements within the project and surrounding area that contribute to their image of the town/city as discussed in the local government planning scheme
- a review of existing short and long distance views of the project area and visibility of the project from existing view sheds, including assessment from private residences in the affected area
- significant visual landmarks within the locality including natural features, ridgelines and water views to determine existing visual amenity of the area
- a description of the general impression of the landscape that would be obtained while travelling through and around the project site
- comment on any changes that have already been made to the natural landscape since European settlement.

Site and Surrounds

The current site is located on the Gold Coast, within the suburb of Coomera. The site has a combined area of 63.6 hectares and is to the north and west by Oakey, to the east by the Coomera River and to the south by Shipper Drive. The site is located alongside the existing Gold Coast Marine Precinct, and as such the immediate area contains various marine industry development with a relatively low amenity and landscape character due to the industrial nature of such development.

The site is inclusive of a park reserve, that being William Guise Foxwell Park, which is flat, turfed area with small shed structures. This area is currently used by the Hinterland Model Flying Club. The remainder of the site is generally flat, with ponded water. The site is used for cattle grazing, and is of relatively low aesthetic value. With the exception of the park, the site in its current state is considered to be of low community value, without local, regional, state or national significance.

A Visual Impact Assessment has been prepared by Planit Consulting and is contained in Appendix 36. This assessment outlines the existing character of the location with detailed analysis of existing views in and out of the subject site from various vantage points. The assessment recognises that the Coomera region is one of the most dynamic and quickest growing regions within South East Queensland, and character changes external to the site may well affect viewing catchments in future.

Foxwell Road

The existing vegetation to Foxwell Road screens any potential views to the subject site. Most screening vegetation to Foxwell Road is substantial in height ranging from 6 ft to 20 ft, providing more than suitable screening buffers.

Shipper Drive

Screening of the subject site from Shipper Drive is limited however this s not recognised as an issue given that Shipper Drive is one of two main access roads to both the subject site and the existing Marine Precinct. Shipper Drive provides access to 2 existing residential lots, however these lots are suitably screened from the subject site due to existing vegetation lining Oakey Creek.

The areas developed directly to the north and east of the subject site have views into the site. These views however are not direct site lines due to existing vegetation present to most lots the direct north of the site and vegetation existing on the island helping to screen the subject site.

The majority of the developed Coomera residential areas north of Foxwell Road do not have views of the site. Foxwell Road has high points of 25 metres creating a ridgeline which blocks most to all of the view of the subject site. The areas around Coomera Sports Park are also significantly screened from the site by dense vegetation which exists through the site lines of these areas and the site.

Vantage Points and Visual Assessment

Eight vantage points were utilised in conducting the Visual Impact Assessment. These were identified based on their RL level relative to the site, and immediate surrounds, as well as their existing / potential view corridors to the subject site.

Given the necessity to provide image based assessment for this item, please refer to the Visual Impact Assessment prepared by Planit Consulting contained in Appendix 36 for further detail relating to the existing landscape and visual amenity.

Potential impacts on visual amenity and landscape and mitigation measures

This section should describe the potential impacts of the landscape character of the site and the surrounding area. Particular mention should be made of any changes to the broad-scale topography and vegetation character of the area, such as broad-scale clearing. Details should be provided of measures to be undertaken to mitigate or avoid the identified impacts including impacts on existing land uses that contribute to the character of the local area. An assessment should be made of the impacts of the project on the existing visual quality of the site and the surrounding area. This assessment should describe:

- impacts on existing short and long distance views of the project area
- changes in the visibility of the project from existing view sheds
- impacts on significant visual landmarks within the locality, including natural features, ridgelines and water views
- changes in the character of the built environment in terms of scale, form, materials and colours.

The visual sensitivity or the capacity of the project area to absorb visual changes should be assessed to determine likely impacts on existing visual quality. An assessment of the obtrusive effects of installation of project lighting should be undertaken. This assessment should:

- provide details on the level and types of lighting required for safety and security requirements
- identify potential impacts of lighting of the project site including potential for light spill/intrusion, light glare on road users, changes to night viewing conditions due to sky glow, etc
- provide an assessment of the sensitivity of the receiving environment (e.g. fauna, residents, road users) to project lighting
- applicable limits or maximum lighting levels to control the obtrusive effects of lighting.

This section should propose options for avoidance, or where avoidance is not possible, mitigation of visual impacts and provide details of measures adopted in the design of the project including the use of colours and forms to ensure integration with existing environments and the use of landscaping vegetation as a visual screen.

As detailed in the Visual Impact Assessment prepared by Planit Consulting contained in Appendix 36, the site is not significantly visible due to the existing topography and vegetation of the area. As such, the GCIMP is unlikely to create any adverse impacts on visual amenity and landscape character.

Whilst the GCIMP will involve on site vegetation clearing in order to facilitate the delivery of the development, the lack of direct views into the site from various vantage points and the retention of a 40 metre natural vegetation buffer to Oakey Creek has meant that visual amenity impacts will be relatively minor to surrounding residences.

With regards to the impacts of the project on the existing visual quality, detail has been included within the Visual Impact Assessment prepared by Planit Consulting. As previously mentioned, due to the topography and vegetation of the surrounding area changes to views generally will not occur as a result of the development. Only two vantage points were found to have their existing views impacted on by the GCIMP, these two locations are discussed as follows.

Vantage Point 7

Location:	Chindrina, Sanctuary Cove
Elevation:	10 metres
Distance from Site Centre Point:	1.5km

Vantage Point 7 has a significant view into the site and has a RL level 9 metres higher than that of the GCIMP site. From this vantage point, there is minimal vegetation blocking the visibility of the site. The most prominent part of the GCIMP which will be visible from this location is the proposed Mixed-Use area, and more specifically, the area that the Hotel and Tavern is conceptually proposed. The remaining visible part of the site is the Marine Industry subdivision.

Whilst this location will be visibly impacted upon by the GCIMP, it is important to note that the existing Marine Precinct is also highly visible from this location, with approximately 90% of the existing Marine Precinct within this sight line. As such, the development of the GCIMP will have minimal visual amenity impacts upon this location, given the quality of current visual amenity is quite poor with views directly to the industrial nature of the existing Marine Precinct.

Vantage Point 8

Location:	Rosebank Way West, Sanctuary Cove
Elevation:	3 metres
Distance from Site Centre Point:	0.9km

Vantage Point 8 has significant views into the subject site. This vantage point is located directly to the east of the GCIMP site, and is therefore the most affected viewpoint.

This location is within the parkland associated with the gated community, directly across the river from the site. This location does not have any features to provide a visual barrier from the site. Foxwell Island however, does provide a minimal visual barrier. Similarly to Vantage Point 7, this location already is dominated by views to the existing Marine Precinct. As such, the GCIMP will be continuing the existing visual character that exists, and offering improved design and landscape outcomes to that of the existing Marine Precinct. It is not considered that the development will contribute negatively to the visual amenity of this location.

As previously mentioned, only two vantage points were determined to be impacted upon by the GCIMP. These locations will not have changed visibility, will not impact on significant visual landmarks, and will not contribute to a high level of character change given that the current view for these locations is impeded by the existing Marine Precinct.

Visual Sensitivity

The issue of visual sensitivity has been addressed within the Visual Impact Assessment prepared by Planit Consulting contained in Appendix 36. The project area is considered to be capably of absorbing visual changes, given that the visibility to the site is relatively low, with the exception of the two vantage points discussed above.

With regards to project lighting, these issues will be considered at the detailed design stage. However, it is not considered that lighting will be a significant issue given that the majority of the GCIMP will not be subject to night operations.

The sensitivity of the receiving environment is considered to be relatively low. The majority of the surrounding area and residents will have no direct views into the site. Road users will not be significantly impacted given there are only two main access roads to the site and existing marine precinct.

Various techniques have been employed to ensure that any negative visual impacts are minimised where possible. Please refer to the Landscape Master Plan prepared by Planit Consulting contained in Appendix 35. This document outlines landscape and design principles envisaged for the GCIMP. The overall character of the development seeks to create a visually appealing outcome.

The landscape character of the GCIMP Masterplan presents a strong design character and sense of place. The proposed streetscaping has been designed for appropriate usage, and encourages pedestrian movement throughout the development. The plant selection proposed incorporates suitable form, scale, colour and species type to create a strong character and design which highlights key nodes to strengthen visual legibility.

Hardscape elements such as bollards and balustrades have been utilised to draw design inspiration from traditional boat building techniques to further reinforce the marine character of the development.

It is considered that the high quality landscape design envisaged for the GCIMP masterplan creates an improved visual outcome than what currently exists on site.

4.10 Native Title and Indigenous Cultural Heritage

Description of Native Title and Indigenous Cultural Heritage

The EIS should provide a description of the location and owner/custodians of native title in the area and details of the status of any native title claims. The EIS should describe the Indigenous cultural heritage values that may be affected by the project. A systematic field survey of the site should be undertaken by a suitably qualified specialist to locate and record places and objects of cultural heritage significance. The Indigenous cultural heritage survey should refer to:

- the DERM Indigenous site database
- any existing literature relating to the affected areas.
- Refer to the consultation and negotiation with traditional owners and the outcomes about:
- significant Aboriginal objects and significant Aboriginal areas and their involvement in field surveys
- requirements relating to the selection of consultants and confidentiality of culturally sensitive information.

The EIS should:

- include locations of significant Aboriginal objects and significant Aboriginal areas likely to be impacted by the project
- provide a constraints analysis of the proposed development area to identify and record Indigenous cultural heritage places
- provide a report of work done which includes background research, relevant environmental data and methodology, as well as results of field surveys, significance assessment and conclusions and management recommendations (having due regard for any confidentiality requirements specified by community representatives).

Study Area Native Title and Indigenous Cultural Heritage

The coastal strip between the Nerang River mouth and the Albert and Logan River mouths has a complex geomorphological history, and the history of Aboriginal occupation in the area is probably equally complex.

Complex landscapes make for complex vegetation patterns. However, the Shipper Marine Precinct is mainly a low swampy or sandy area dominated by mangroves and salt marsh and bordered on the south by the Coomera River and on the east by Oaky Creek.

The poor drainage has resulted in some good fresh water sources in swampy areas. Proximity to fresh water is also an essential factor in the location of Aboriginal occupation and exploitation sites. It is sources such as these which would have supported the Aboriginal occupation on such hill tops as those recorded in 1995 (see amended report TNX 193B) just across Oaky Creek.

The very name Oaky Creek implies that the flats were largely covered with water tolerant *Casuarina* woods. The river banks would have supported mangroves, while any levee banks would have allowed larger eucalypts to grow.

Aborigines traditionally used plants and animals:

As foods;
As medicines;
As fish poisons;
For the production of tools and other implements;
As lures for animal prey (birds, kangaroos); and.
As seasonal indicators.

Thus, any fresh-water swamps would have supported considerable stands of useful plants such as Mat Rushes (*Lomandra*), as well as tortoises, goannas, birds and other game.

The indigenous cultural heritage comprises not just occupation sites (e.g. midden heaps), but also a variety of plant, animal and marine resources known to have been traditionally important.

Ironically, the very landscape diversity that rendered the area marginal for European exploitation may have worked to preserve much of the evidence of indigenous occupation.

Unfortunately, the vicissitudes of history have meant that relatively little information about the size and nature of the resident indigenous groups has been transmitted. It seems fairly certain that that the people resident in the area when contacted by Europeans spoke a Yugambeh language.

The Traditional Owners of this area have been identified in part from the testimony of a Wangerriburra man, Bullum (Lane 1914). Bullum, from the Tamborine area, named a number of groups in the lands east of the mountain. Between the Nerang River and the Logan & Albert River mouth he named (from south – north) the Kombumerri (Tweed – Coomera Rivers), the Bullongin (Coomera & Pimpama area) and the Gugingin (Gugugin) (Logan/Albert confluence) as identifiable social and territorial groups (clans or tribes). It must be noted, however, that there exist interpretations of the existing historical literature, as well as contemporary

identifications that do not support the interpretation given to John Lane by Bullum in 1913 of the traditional boundaries and affiliations of the area (e.g. Hanlon 1934).

It is recognised that some of the indigenous inhabitants of the area may have assisted with the early clearing (as for example was the case on the dam and night paddock at the junction of White's Pimpama and Coombabah Runs at Yawalpah, see Turnix *et al.* 2003).

Despite the existence of conflicting contemporary interpretations regarding the precise details of pre-European boundaries and affiliations it is clear that descendants of the traditional inhabitants exist. However, the Shipper Marine location apparently does not figure directly in the traditional knowledge that has been passed down. This may be emphasised by an apparent lack of knowledge about or stories relating to places in the area having great sacred or spiritual significance.

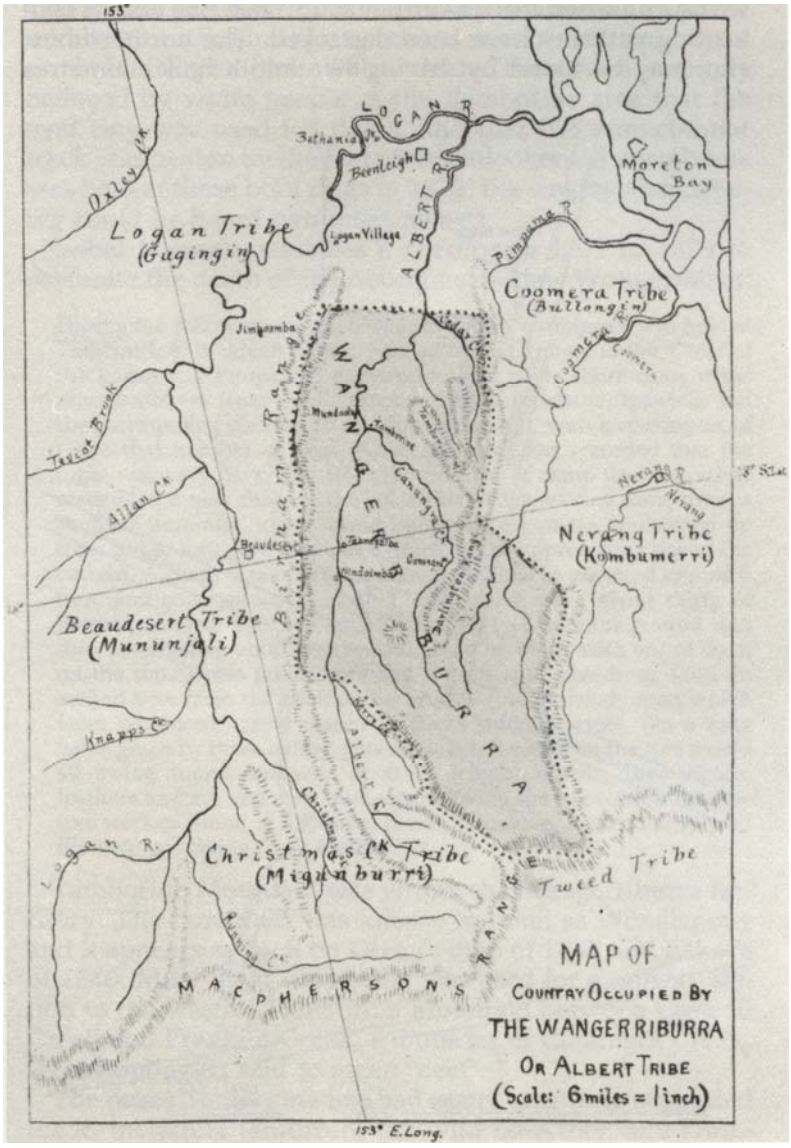
Nevertheless, the remaining indigenous cultural heritage evidence is testimony to the long and fruitful relationship of Aborigines with the land and in applying the CHMP prepared by Turnix, contained in Appendix 37 will recognise that Aboriginal people have spiritual and cultural associations with the land.

Ecological landscape

The continually varied landscapes north of the Nerang River, where low hills alternate with flats and swamps in a seemingly never-ending pattern of small parcels, provided ideal conditions for Aborigines prior to the arrival of Europeans. Most economic needs could be satisfied within the radius of a few kilometres. This perhaps fostered the known ethnographic pattern of small clan group areas. If each clan had approximately the same number of members then a corresponding population density may be inferred.

The figure below (Lane 1914) shows how a member of the Wangerriburra perceived that these clans were distributed. It will be noted that Lane describes the groups by district and tribe, inserting the clan name in brackets.

Figure 28: Bullumm's map from Lane 1914



The Shipper Marine Precinct falls within the Bullongin Clan area. Bullongin from balun = river/swamp; and gin = a pluraliser, thus translates as 'People of the Swamp & River Country'. Unfortunately, this appears to have been a nickname (along the lines of Pom for Englishman), and thus not the name the people would have known themselves by.

Methodology

The site was visited in 1995 by a party consisting of Tony Dillon, Traditional Owner, Dr Eleanor Crosby, archaeologist.

Ground visibility was virtually nil following recent rain, and no Aboriginal cultural heritage evidence was found in the area under consideration.

Results

Traditional ACH knowledge

Probably because of the lack of any historical ethnographic record there is no record of any significant traditional association (e.g. in stories and legends) with this block of land.

Post 1850 ACH associations

Similarly, there appear to be no historical records of particular Aboriginal Traditional Owners associated with this particular block of land soon after the arrival of Europeans in the area.

Pre-1850 ACH associations

Prior to the arrival of Europeans, the river flats would have provided fresh water in the swamps, together with a range of useful plants & animals. It is likely that the area was largely used for periodical visits but was not used for longer-term camping.

One site on the hill across Oaky Creek is likely to have been the focus of such activity.

However, the river banks almost certainly were thick with oysters which would have been regularly harvested. A locally made pipe near the mouth of Oaky Creek was recorded to have been made using shell & charcoal instead of shingle and it is possible that the shell and charcoal was gathered from near the mouth of the creek.

It is therefore possible that small midden heaps of shell may be located along the banks of the creek and the adjacent banks of the Coomera River and Foxwell Island.

Significance

While this area was undoubtedly significant as a source of food, medicine, tools etc. most of these activities do not survive to provide any archaeological trace.

The exception to this stricture is shell middens – the discarded food remains piled up in rubbish heaps.

None have so far been found but as there is a trace of evidence that middens may once have existed in the study area a monitoring brief will be recommended to follow up this possibility.

The possibility of deeply buried ACH evidence, in the form of middens and camp sites buried beneath the alluvium, further suggests that all construction workers should be clearly inducted about Aboriginal cultural heritage and thus enabled to call on relevant Traditional Owners for advice.

Please refer to the Aboriginal Cultural Heritage Assessment and the Cultural Heritage Assessment and Management Plan prepared by Turnix contained in Appendix 37.

Potential Impacts and Mitigation Measures

The Proponent should provide an assessment of any likely impacts on Native Title and effects on sites of Indigenous cultural heritage values, including but not limited to the following:

- a description of the significance of artefacts or places of Indigenous cultural heritage value likely to be affected by the project and their values at a local, regional and national level
- recommended means of mitigating any negative impacts on Indigenous cultural heritage values and enhancing any positive impacts.

The *Aboriginal Cultural Heritage Act 2003* requires (in most cases) the preparation of a Cultural Heritage Management Plan in conjunction with the EIS. A Cultural Heritage Management Plan should be prepared for the project site in a form that complies with the provisions of Part 7 of the *Aboriginal Cultural Heritage Act 2003*, thereby meeting the cultural heritage duty of care. The plan must provide a process for the conduct of comprehensive cultural heritage investigations and the identification and management of significant Aboriginal objects and significant Aboriginal areas in the proposed project area.

The agreement or plan should include the following:

- a process for including Aboriginal communities or Aboriginal parties in the identification, management and protection of Aboriginal cultural heritage in the project area
- a process for undertaking a comprehensive and systematic cultural heritage assessment
- processes for the mitigation, management and protection of identified cultural heritage objects and areas in the project area, and in any areas to be affected by development of any associated infrastructure, both during construction and operational phases of the project
- provision for the management of the accidental discovery of cultural material, including burials, in the project area
- processes for determining any requirements for monitoring of the project during construction, and measures by which any monitoring program is to be implemented
- Indigenous cultural heritage induction and awareness programs for project staff, subcontractors and staff, consultants and agents of the project
- a conflict resolution process.

The development of the agreement or plan should be negotiated with all relevant stakeholder representatives, subject to any confidentiality specified by the Aboriginal community, registered native title applicants, and/or Aboriginal parties as appropriate.

As a minimum, impact assessment, management and protection strategies should satisfy statutory responsibilities and duties of care under the *Aboriginal Cultural Heritage Act 2003* and the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cwlth).

As detailed in the Aboriginal Cultural Heritage Assessment prepared by Turnix contained in Appendix 37, the site's Aboriginal Cultural Heritage was likely to be significant as a source of food, medicine, tools etc. However, most of these activities do not survive to provide any archaeological trace.

No shell middens, the discarded food remains piled up in rubbish heaps have so far been found. However there is a trace of evidence that middens may once have existed in the study area a monitoring brief will be recommended to follow up this possibility.

The possibility of deeply buried ACH evidence, in the form of middens and camp sites buried beneath the alluvium, further suggests that all construction workers should be clearly inducted about Aboriginal cultural heritage and thus enabled to call on relevant Traditional Owners for advice.

Recommendations and Management

The Aboriginal Cultural Heritage Management Report prepared by Turnix, contained in Appendix 37, recommends that the Traditional Owners undertake monitoring of some of the earthmoving activities associated with the site.

Recommendation 1

That a plan for further work be adopted involving monitoring of

1 all earthwork affecting the river and creek banks; and,
2 all earthwork affecting the upper 50cm of excavation in all other parts of the site (with a proviso that monitoring may also cover deeper parts of such trenches if ACH evidence is encountered).

Recommendation 2

That, in view of the potential for deeply buried ACH evidence to be revealed all construction personnel receive an onsite induction, and instruction in procedures in

the event of ACH evidence being uncovered in the absence of an appointed monitor.

Commencement

Prior to any earthworks being initiated a meeting between the sponsor, the contractor and the Traditional Owner representatives should be convened. This meeting should take place on site so that all parties understand what is involved, (e.g. how many days the work will cover and on what dates, where any finds are to be stored, and the requirements for the analysis of such finds).

A pre-commencement examination of all potential area of monitoring should be carried out by the sponsor, the contractor the Traditional Owner representative and the archaeologist/Technical Adviser. It is at this meeting that the details of the monitoring will be arranged.

Inductions

Indigenous Cultural Heritage Awareness Inductions

a) Company staff, contractors and sub-contractors working on the Shipper Marine Precinct project will attend a Cultural Heritage Induction Program provided by the Traditional Owners (included as part of the monitoring program).
b) At least 75% of staff working within the project area at any one time will have completed either the Cultural Heritage Induction program or the Intensive Cultural Heritage Induction Program.
c) The sponsor is to maintain a register of the sponsor's Inducted employees, contractors and sub-contractors.
d) The sponsor will fund participation of its staff in the Cultural Heritage Training.

Project staff induction

a) All monitors and Traditional Owner employees or consultants must possess a relevant industry 'blue card'
b) All Traditional Owners working on this project must undergo the sponsor's site induction.

Supply of equipment and information to Traditional Owners

a) The technical adviser will supply Traditional Owner representatives with monitoring kits.
b) The sponsor will supply any required personal protective equipment (PPE) to Traditional Owner representatives.

c) The sponsor will supply all aerial photographs, maps and relevant plans, any pertinent EIS information that is requested and any other documents that are relevant to the successful outcome of this ACH process.

Confidentiality

The sponsor agrees to keep confidential any material, outside the public domain, provided to them by the Traditional Owners and agrees that they will not use that material in any way without the express permission of the Traditional Owners.

The Traditional Owners agree to keep confidential any material, outside the public domain, which is provided to them concerning the project without the express permission of the sponsor.

Responsibilities of staff and contractors

a) All staff and contractors will be instructed in what to look for and who to call if any finds are made.
b) A temporary halt may be called if any ACH evidence is observed. This is not intended to stop work. The evidence should be drawn to the attention of the monitor, or the foreman, either of whom may decide how to proceed. The foreman will be provided with appropriate contact details for the Traditional Owners and the technical adviser.
c) The monitor should use his discretion about what should happen to the ACH evidence. It may be either collected on the spot according to the procedure outlined below, or it may be roped off and further advice sought from the technical adviser.

Monitoring procedures

The following monitoring procedures will be operative.

Isolated finds only

- Photograph item with scale
- Write label (date, location, any other useful information)
- Pick up item and bag with label
- Replace item with strip of coloured tape held down by a nail (if spot likely to be left untouched until GPS location can be recorded)
- Keep all bags in suitable container until passed on the archaeologist.

Artefact Scatters (>5 artefacts in 10m x10m area), shell middens

- Rope off area around evidence
- Call on technical advice
- Photograph

Human Skeletal Remains

- If human skeletal remains or burials are found during any stage of the Project, work in that area will stop immediately.
- The monitor will alert the contractors and contact the Queensland Police and the Traditional Owners immediately.
- The human remains may not be disturbed until all legal formalities have been observed.
- The Human Remains Guidelines published by the Department of Natural Resources and Mines entitled *The Discovery, Handling and Management of Human Remains under the Provisions of the Aboriginal Cultural Heritage Act 2003 and Torres Strait Islander Cultural Heritage Act 2003* will be implemented.

Fulfilment of the Cultural Heritage Duty of Care

The Traditional Owners will provide a statement that the DoC has been fulfilled when the agreed mitigation procedures have been completed to their satisfaction.

Discovery of all other surface or buried cultural material

Part of the study area has been subject to cultural heritage surveys (Ponosov 1966, Hall 1982, Wallin 1996, King & Crosby in press). During those surveys several midden sites were located along the Coombabah Creek shore line. Turnix report 58 details the presently understood distribution of indigenous cultural heritage at Shipper Marine.

It is felt that while the potential for further large sites to be discovered is relatively low, there remains the possibility that smaller midden deposits, or scatters of stone tool materials may be encountered.

Should further deposits of shell, or scatters of stone material (i.e. sites that are considered relatively more significant than a single shell or stone artefact) be uncovered then the following procedures shall apply:

1. All work in the immediate vicinity must cease and reasonable efforts to secure the discovery should be made. Note that material should not be removed or further disturbed and that barriers or temporary fences may be erected as a buffer if required;
2. The cultural heritage monitor and appropriate staff of Shipper Marine Precinct should be notified;
3. The designated archaeologist should be notified and if necessary the Cultural Heritage Coordination Unit of DNR should be contacted and advised of the situation;
4. The designated archaeologist will make an *in situ* evaluation of the resources, or may create accurate records including map references (or GPS location) and photographs of the material;
5. The cultural heritage monitor or archaeologist shall make a written report and the findings shall be provided to the Traditional Owners for their consideration. Their response will be required within 7 working days of their receipt of such written report;
6. Based on the recommendations, decisions regarding the treatment of finds shall be made in consultation with the Traditional Owners, the archaeologist and appropriate government officers and shall be incorporated into the CHMP;

If the resources cannot be protected *in situ*, and require further archaeological work then the following procedure should be undertaken:

1. A data recovery program planned in consultation with the Traditional Owners, a qualified archaeologist and appropriate government officers should be developed and implemented;
2. Representatives of the Traditional Owners should be present during the data recovery phase;
3. The results of the data recovery program should be evaluated in consultation with the Traditional Owners, archaeologist and DNR representative;
4. Should a burial be located, refer to burials policy procedure, detailed above.

Remedial activities

The cultural heritage monitors and Traditional Owners will oversee repairs to any sites damaged during construction. Shipper Marine Precinct. will undertake such repairs in consultation with Traditional Owners. Appropriate government representatives and the designated archaeologist should also approve such plans. Repairs in accordance with these instructions will include only those measures approved by the designated Traditional Owners in writing beforehand.

Such consent will not be unreasonably withheld, and will be provided by the Traditional Owners within fourteen days to minimise delays to work schedules, without compromising cultural values or sensitivities.

Continuing protection

Shipper Marine Precinct undertakes to protect the sites already identified on the shores of Lake Coombabah until such time as it concludes the Shipper Marine development project.

If other cultural material is discovered, and is recovered as part of a mitigation plan, it should be held in a safe keeping place in perpetuity. Shipper Marine Precinct will negotiate with the Traditional Owners about creating a suitable keeping place. The keeping place may be:

1. A permanent facility established by Shipper Marine Precinct;
2. A keeping place agreed between the Traditional Owners; or
3. A permanent facility established by Gold Coast City Council.

It should be noted that following the demise of the *Cultural Record Act*, the Queensland Museum no longer remains the statutory depository for recovered material.

Further detail pertaining to Aboriginal Cultural Heritage Management is contained within the Cultural Heritage Management Plan prepared by Turnix contained in Appendix 37.

4.11 Non Indigenous Cultural Heritage

Description of existing Non-Indigenous Cultural Heritage

The EIS should describe the existing environmental values for non-Indigenous cultural heritage that may be affected by the project. Reference should be made to:

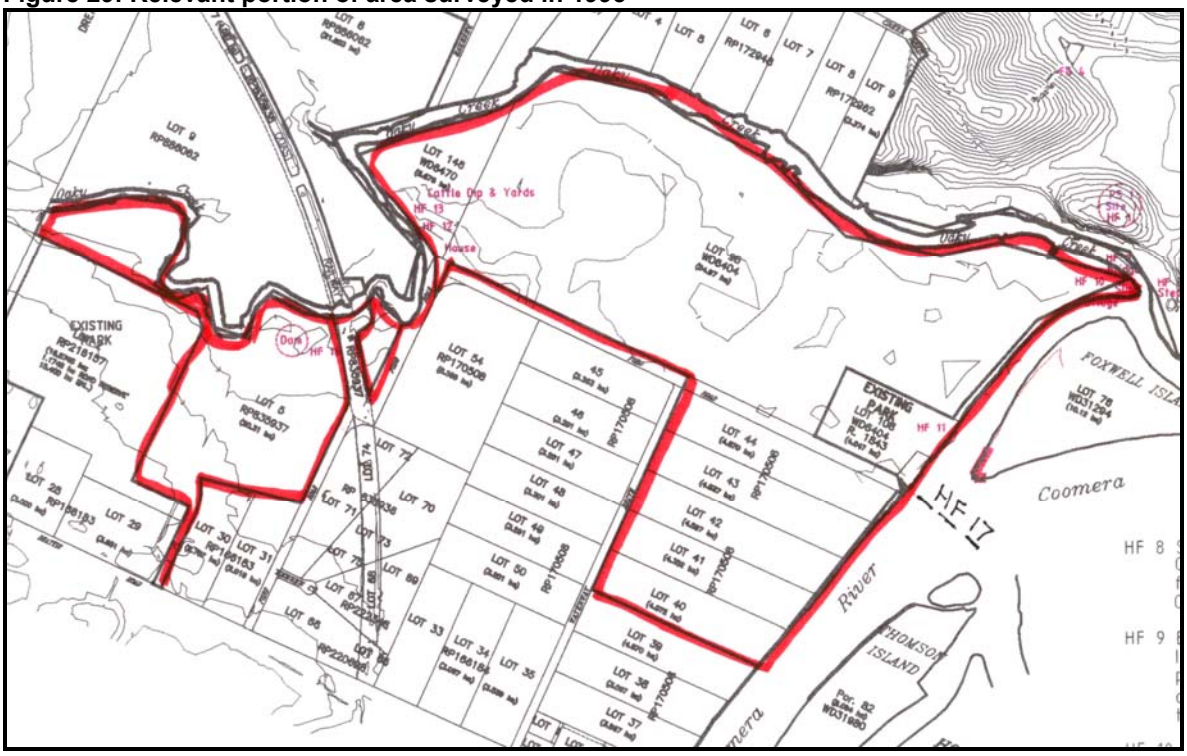
- the Australian Heritage Places Inventory
- the Queensland Heritage Register
- local government heritage register
- Gold Coast City Council
- any existing literature relating to the affected areas.

A survey report which includes background research, relevant data and methodology, as well as results of field surveys, significance assessment and conclusions and management recommendations (having due regard for any confidentiality requirements specified by community representatives) should be prepared.

As a minimum, investigations and consultation should be undertaken in such manner and detail to satisfy statutory responsibilities and duties of care, under the EPBC Act and *Queensland Heritage Act 1992*.

As detailed in the Historical Summary survey was undertaken in 1995 to identify a number of historical cultural finds. This survey area is shown on the Figure below.

Figure 29: Relevant portion of area surveyed in 1995



The relevant finds from the 1995 survey area:

HF 10	Remains of a bridge across the mouth of Oaky Creek
HF 11	Remains of a 'corduroy' bridge between the northern bank of Oaky Creek and Foxwell Island, together with power poles and piping.
HF 12	Remains of a house on the river bank just downstream from the end of Ford Road.
HF 13	Remains of a house on Lot 148.
HF 14	Remains of a cattle dip and yards on Lot 148.
HF 17	Remains at the end of Ford Road of the stumps marking a former low-tide ford across the river.

No recommendations for preservation of further investigation were made concerning any of these historical finds.

Historic occupation

History is generally taken to refer to people who have writing. Hence the distinction between prehistory (before history, or referring to the study of peoples without writing) and history.

The lower reaches of the Broadwater were explored rather later than Brisbane and its hinterland, and the first Europeans officially into the area were timber getters under the direction of Thomas Caffrey. His men were on the Logan and Coomera (then called the Arrowsmith) Rivers in February and March 1843, "squaring a cargo of 100,000 feet" for shipment to Sydney on the Wanderer (Longhurst 1994:10-11). A whale boat was built on the Coomera in 1844 (*ibid*:12).

The south coast was generally uninviting to the grazing interest, and as Longhurst notes:

> Mostly ticket of leave men and some fugitives from the law, the timber cutters employed by such entrepreneurs [as Caffrey] had followed the course of the north coast cedar boom, generally at an arms length distance from the authorities. The Tweed and South Coast rivers were to be their last refuge, protected for at least ten years by their isolation and lack of squatters' interests and permanent settlements (*ibid*:12)

The land was taken up for grazing from 1852 when A W Compigné of Nindooinbah Station on the Albert leased two properties south of the Nerang River, called Dungogie and Murry Jerry. These were transferred later that year to W. D. White, who later took up Pimpama and Coombabah, which included the Coomera area. By 1860 White "leased a series of stations from the Logan to the New South Wales border" (*ibid*:19). No evidence exists that the land in the study area was much affected by the raising of cattle or horses.

Owing to the American Civil War of the 1860's, cotton manufacturers in Britain began a worldwide search for replacement fibre. Cotton requires wet and fertile conditions, and it seemed to the authorities that parts of the south coast might be suitable. In a flurry of applications for large plantation blocks, the Manchester Cotton Company was granted a large lease at Carrara south of the Nerang River, other plantations were made at Hotham and Pimpama, and the Bolton and Queensland Cotton Growing and Selling Company "hoped to develop a plantation on the Coomera" (*ibid*:31). None of these enterprises was very successful as the vagaries of the local climate (either flooded or in drought) had not been sufficiently appreciated.

However, in 1866, the Leasing Areas Act, and more importantly in 1868, the Crown Lands Alienation Act really began to open up the south coast to smaller farmers. Sugar was to be the main cash crop. Once again, climatic vagaries proved

difficult, and sugar was ultimately to be generally limited to the Pimpama area and south of the Tweed River, that is, to areas where larger areas of suitable flat land were available.

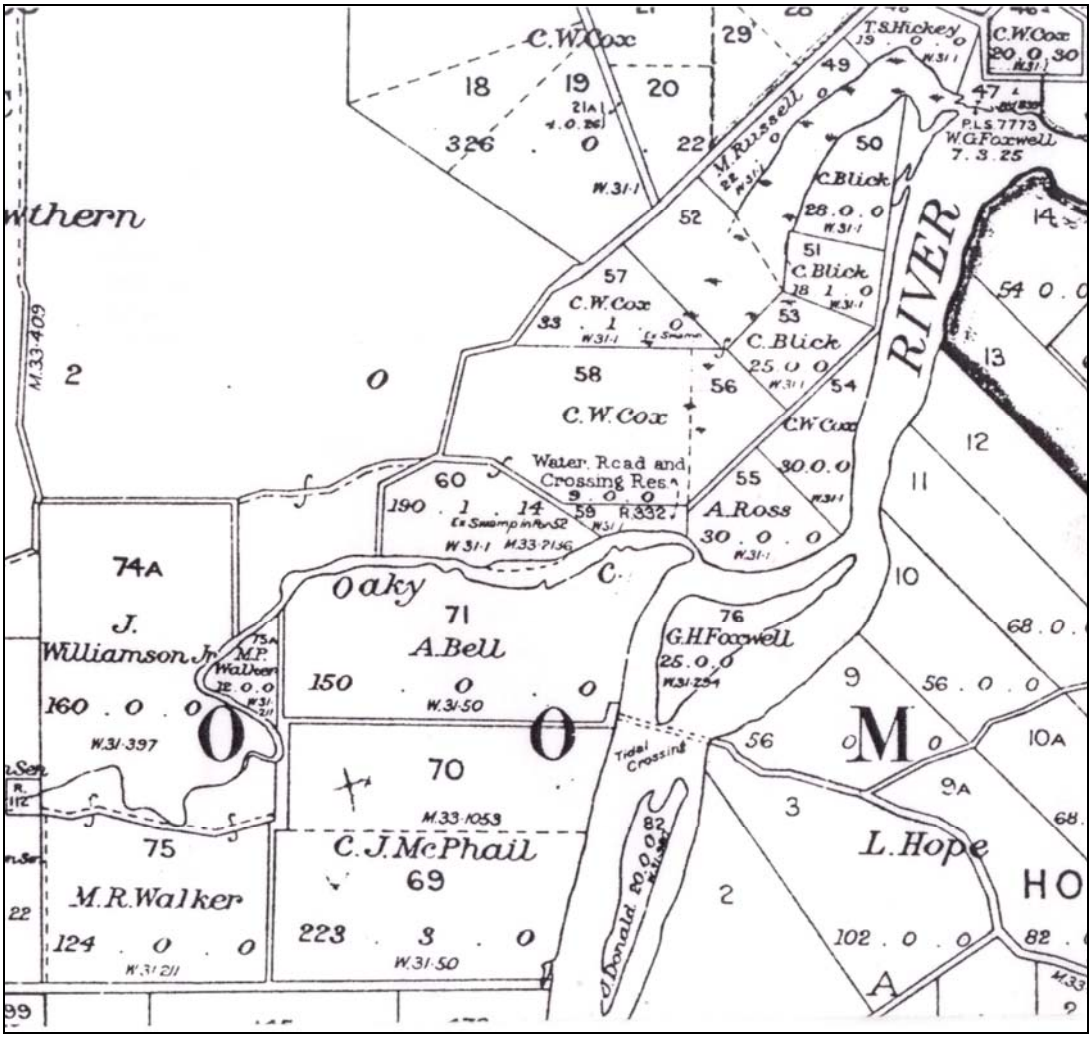
The following table shows the land holdings given on the 1931 Coomera Parish Map (QSA 1/2A5/10) even though it is most unlikely that this represents the land ownership at that time. No searches have been made to determine how the present system of land units has evolved.

Table 31: Portions, acreages and former owners.

PORTION	AREA (ACRES)	LESSEE
50	28.0.0	C BLICK
51	18.1.0	"
53	25.0.0	"
54	30.0.0	C. W. COX
55	30.0.0	A. ROSS
56	25.0.14	C. W. COX
57	33.1.0	C. W. COX
58	97.2.0	C. W. COX
59	9.0.0	RESERVE R232
60	190.1.14	C. W. Cox
69, 70	223.3.0	C. JOHN McPHAIL
71	150.0.0	ANGUS BELL
74A	159.1.31	JOHN WILLIAMSON jnr
75	124.0.0	R. WALKER
70	25.0.0	G. H. FOXWELL
83	20.0.0	JAMES DONALD

The following extract from the Coomera Parish map, 1931 below, also shows the former ford across the Coomera River, linking both ends of Ford Road. Stumps from this structure were still visible in 1995.

Figure 30: Extract from Coomera Parish map, 1931 showing portions and ford across Coomera River



Historic occupation places

No attempt has been made to itemise each single historic period structure or landscape feature. A variety of interesting historical features (HF) are summarised as follows:

HF 1 House site on western knoll

Little remains except a concrete pad, 2 water tanks, various sheets of iron, abandoned household fixtures (bath, washing machine, stove,) and exotic plants including Brazilian cherry, cassia, camphor laurel. Although some old brown ceramic insulators were noted, the stove and washing machine indicates that the

house was demolished fairly recently. Across the current track four posts forming a gate with strainers on either side, probably a former entrance. Site close to PS 1. This house was owned by the last of the Foxwell's until sold to the father of the present owner in the 1960's.

HF 2 House site on eastern knoll
This site has very little evidence left. It was near some recently burnt palm and bunya pine trees on the angle of the knoll above creek and river confluence. This burning also resulted from a fire which became too brisk which was lit as part of the movie Storm Fighter.

HF 3 House site
North of HF 3 on western edge of slope overlooking large swamp. Traces of several sheds, house site, tanks, Torana wagon, etc.

HF 4 Moreton Bay fig near HF
A comparison of the relative sizes of this tree in the 1944 and 1993 aerial photographs suggests that it may have been planted in the 1920's, or even the 1930's.

HF 5 Farm structures near HF 3
Remains of dairy, shed, water tank, concrete-edged structure, possible pigsty or spray dip.

HF 6 Large posts
Three, on edge of steep slope northeast of HF 4. These are remains of a fence along the cliff edge.

HF 7 Dams northeast of HF 6
Three, fresh water dams, catching run-off from the small gully. It is possible that this area was a naturally swampy or former spring area converted into dams, as the find spot FS 6 is on the west side of the lowest dam. Upper two contain water, lowest is dry.

HF 9
Steps into the River at the junction of Oaky Creek and the Coomera River. A handsome flight of steps leading down into the river. Constructed in 1994 for movie Storm Fighter.

HF 10 Bridge
This bridge was still standing in 1944 as shown in the image below. It was a log structure, probably with corduroy planks, and appears to have been part of the connection from the north side of Oakey Creek to Foxwell Island.

Figure 31: 1944 Aerial

HF 11

Other structures on the bank of Coomera River. These include remains of a bridge to Foxwell Is., a slipway formed from old railway lines, a pole with ceramic insulators carrying a telephone line, and a concrete pipe, using charcoal and shell for filler (i.e. perhaps remains of an Aboriginal midden).

HF 12

House site on the south bank of Oaky Creek near where Ford Road formerly crossed the Creek. This site is now marked largely by a patch of rambling roses.

HF 13, HF 14
Farm structures, including dip and house, situated near Oaky Creek on Lot 148.

HF 15
Weir at mouth of big swamp. Long disused, this weir or floodgates were built in 1974 in an attempt to convert the swamp into a fresh water swamp (figure 22). According to Ross Franklin (pers. comm.) the lack of any barriers to prevent debris jamming the valves led to the failure of the project within a few weeks.

HF 16
Posts and strainers of a gate. This gate appears to mark the boundary between portions 50 and 51. It may be considered representative of various former fence lines across the property.

HF 17
Dams to the west of the rail line.

HF 18
Ford across Coomera River. Early survey maps indicate that the Coomera River was fordable between Foxwell and Thompson Islands. This crossing is situated, naturally enough, at the eastern end of Ford Road.

The now deferred South Coast Tollway cuts through the north western part of the study area.

Potential impacts on non-Indigenous Cultural Heritage and Mitigation Measures

The proponent should provide an assessment of any likely effects on sites of non-Indigenous cultural heritage values, including but not limited to the following:

- description of the significance of artefacts, items or places of conservation or non-Indigenous cultural heritage value likely to be affected by the project and their values at a local, regional and national level
- recommended means of mitigating any negative impacts on non-Indigenous cultural heritage values and enhancing any positive impacts
- negotiations with Queensland Heritage Council, Gold Coast City Council and the DERM regarding management of places of historic heritage significance, taking account also of community interests and concerns
- documented management strategies in accordance with the outcomes of negotiations with Queensland Heritage Commission, DERM, Gold Coast City Council and the community.

As a minimum, impact assessment, management and protection strategies should satisfy statutory responsibilities and duties of care, including those under the EPBC Act and *Queensland Heritage Act 1992*.

Whist the site is not contained on the Cultural Heritage Register and it is considered that the development will not impact upon Non-Indigenous Cultural Heritage, the following detail is provided relating to the area's cultural heritage and any appropriate considerations for the GCIMP.

Prehistoric archaeology

A number of prehistoric sites and find spots was recorded. Various recommendations concerning their future may be put forward on the following basis.

If the material is determined to be in situ, then it could be:

1. Destroyed. That is, it may be determined to be sufficiently insignificant that its destruction without further study is accepted;
2. Salvaged through excavation with limited objectives of dating and artefactual analysis;
3. Subjected to a broader archaeological study through a larger excavation with more extensive aims, such as the full extent of the site, the probable

economic resources exploited, the possibility that different areas represent different episodes of occupation, whether it was a family, or perhaps a male/female oriented site, and many other questions; or

4. Preserved intact, its location recorded and no further work undertaken.

Site 1

Although one camp site was located during the survey very little evidence was associated. A largely unquantifiable possibility exists that this was a very ancient site, but the balance of probability suggests that it was neither very large, nor very ancient. However, because of this possibility it is not possible to recommend that the site be allowed to be destroyed without some further work. Option 4, that it be preserved intact, as for instance as part of a park, would be a viable option. However, should the site not be so preserved then an archaeologist should be given a watching brief over the relevant period of earthworks. This archaeologist should conduct any salvage excavations considered necessary

The opinion of the regional archaeologist should be sought as to the extent of these excavations. At least one radio carbon date should be obtained if possible.

None of the artefact find spots is indicative of either any great antiquity or economic importance. It is apparent that the whole of the study area would have been exploited, and its productivity looked after and enhanced so far as the "firestick farming" methods of Aboriginal land use made possible, but it would seem that it was never very highly important in the prehistoric life cycle. These sites may be destroyed.

The possibility that part of the wave cut cliff edge where Oakey Creek and the Coomera River join to flow out to sea was occupied during the 6,000 © 3,000 higher water level period has been examined. No sites were located along the top edge of the cliff.

Accordingly, one recommendation concerning the future of the camp site is made. This proposes that if the site cannot be left intact, then some salvage excavation will be warranted.

Historic archaeology

The area has been subject to considerable changes in land ownership since the 1870's.

Substantial houses do not appear to have been built until dairying became economically feasible. This suggests that the land was most intensively occupied by farming families between 1900 and 1970.

A historical feature which deserves to be preserved is the magnificent Moreton Bay fig on the ridge line.

Management Considerations and Recommendations

The major swamp was at one time controlled by a weir and floodgates where it joins the river. This has been derelict for many years. However, a decision should be made on whether this swamp should be controlled by way of a weir, or whether the weir should be demolished and the former natural water flow allowed to re-develop. Among general considerations are the questions of mosquito control, and the effect of altering the water regime on any acid sulphate soils which may be present.

All creek and river banks appear to have formerly been more cleared of trees than at present. In particular the 1944 and 1993 aerial photographs seem to show considerable recent re-development of the mangroves.

Comments on cultural heritage

The area might be characterised as marginal in both Aboriginal and farming economies. Only Prehistoric Site 1 a camp site is considered worthy of preservation or further investigation.

Recommendations

1. That if Prehistoric Site 1 is to be disturbed during the proposed development an archaeologist be employed to undertake a watching brief over the relevant areas.
2. That this archaeologist, in agreement with the Regional Manager for Cultural Heritage be empowered to undertake any necessary salvage excavations.
3. That the developer fund the excavation, the analysis of the excavated materials and any necessary radio-carbon dates.
4. That the position with regard to the weir which once controlled water flow in the big swamp be properly determined, and the weir either demolished or workably reinstated.

Further detail is contained in the Cultural Heritage Survey prepared by Turnix contained in Appendix 37.

4.12 Infrastructure Impacts

Traffic and Transport

Traffic and transport reports should include:

- details of assessment methodology adopted including a summary of consultation undertaken with transport authorities (for example, Department of Transport and Main Roads and Gold Coast City Council) regarding the scope of the impact assessment and methodology to be used. Subject to authorisation from Council's City Transport Branch, the EMME model for 2031 will be available for use
- details of all base data assumptions, including an assessment of the current condition of the affected network and its performance
- details on possible interruptions to transport operations
- details of any impacts on the natural environment within the jurisdiction of an affected transport authority (e.g. road or rail corridors) including impacts concerning the amenity and health of adjacent land use and sensitive ecological areas as a result of dust noise and vibration or other environmental nuisances
- details on the nature and likelihood of product spill during transport (if relevant)
- any socio economic impact or contribution by the project at the local or regional level.

Road impact assessment report should be in general accordance with the *Guidelines for Assessment of Road Impacts of Development* (Department of Main Roads 2006) (or as amended). The assessment must include:

- an assessment of project impacts (from either transport or project operations) on the safety efficiency and condition of road operations and assets
- an assessment of project impacts on overland water flows and their interaction with the current and future road network. The assessment will assume the presence of the proposed future intra-regional transport corridor
- an assessment of project impacts on any existing or proposed pedestrian cycle networks
- an assessment of project impacts on any existing public transport networks (assets and services)

Mitigation strategies to address project impacts should be included in the EIS for each project affected transport mode. The proponent is to discuss and recommend how identified impacts will be mitigated so as to maintain safety, efficiency, and condition of each mode. These mitigation strategies are to be prepared by the proponent in close consultation with relevant transport authorities and must include:

- consideration of any transport authorities works program and forward planning, in particular the proposed future intra-regional transport corridor
- proposed construction plans of all required transport infrastructure works in accordance with relevant and accepted authority standards and practices
- details on the timing of these works including the responsible parties for these works
- a summary of relevant approvals and legislative requirements needed to implement mitigation strategies and transport infrastructure works required by the project.

CRG have undertaken a Traffic and Transport Impact Assessment which is contained in Appendix 21 to the EIS. The assessment examines how the existing transport infrastructure will need to be upgraded to accommodate the proposal and whether any additional road infrastructure is required to that already planned by the Gold Coast City Council and the Department of Transport and Main Roads.

With regard to the State controlled road network, the assessment has been undertaken in accordance with the Department of Main Roads' *Guidelines for the Assessment of Road Impacts of Development (2006)*.

At the local level, the assessment addresses road network impacts upon the local road network, car parking supply, service vehicle access, pedestrian access, public transport access and bicycle parking.

Traffic Generation

The existing marine precinct on Waterway Drive comprises a range of commercial, showroom, boat storage, warehouse and factory uses as well as marine berths. It is therefore considered prudent to examine the traffic generation relating to this existing marine precinct to estimate the potential traffic generation of comparable uses for the proposed development in Shipper Drive.

A survey of all traffic movements associated with the existing development was conducted on Tuesday 23 March, Wednesday 24 March and Thursday 25 March 2010, between the hours of 7.00am and 6.00pm. The results are summarised

in the table below, and are contained in full within the Traffic and Transport Impact Assessment prepared by CRG contained in Appendix 21.

Table 32: Traffic Generation of Surveyed Marine Development

Day / Date	Daily Trips	AM Peak Hour		PM Peak Hour	
	TOTAL	IN	OUT	IN	OUT
Tuesday 23 March 2010	3,025	172	101	96	275
Wednesday 24 March 2010	3,242	179	98	48	340
Thursday 25 March 2010	2,965	192	97	40	350
Total Average	**3,077**	**181**	**99**	**61**	**322**

The total development area surveyed is approximately 426,506m^2 (42.65ha) including marina berth areas. Therefore the resultant traffic generation rates are:

Table 33: Traffic Generation Rates of Surveyed Marine Development

Traffic Generation Rate	Daily Trips	AM Peak Hour		PM Peak Hour	
	TOTAL	IN	OUT	IN	OUT
Trips per Hectare	72.1	4.2	2.3	1.4	7.5

The above rates were applied to the proposed marina berths, showroom, factory, boat storage and warehouse uses.

The proposed Industry Subdivision will incorporate a mix of light industry and warehouse style uses. Based on standard DTMR trip generation rates for Industry development, it is therefore considered appropriate to apply a rate of 7 daily trips per 100m2 GFA and 0.7 peak hour trips per 100m2 GFA to this component, where GFA is approximately 45% of site area. The GFA therefore equates to 81,000m2 (180000 × 0.45 = 81,000).

The proposed development also includes Retail, Hotel, Tavern and TAFE uses. It is considered reasonable to assume that a large proportion of the retail, hotel and tavern patrons will be associated with other uses in the development. They will therefore generate significantly less vehicle trips on the external road network when compared to stand-alone development. In this instance, the following rates are considered to be appropriate:

Table 34: Traffic Generation Rates

Land Use	Peak Hour	Daily
Retail	AM 1.5 trips / 100m^2 PM 3.0 trips / 100m^2	30 trips / 100m^2
Hotel	0.2 trips per room	2 trips / room
Tavern	AM - CLOSED PM 3.0 trips / 100m^2	30 trips / 100m^2

It is likely that a large proportion of students attending the TAFE will reside within the Coomera Town Centre, many of whom will cycle, walk or catch a bus to the campus. A total of 300 daily trips have been assumed for this component.

We note that each of the proposed design options includes a Dredge Spoil component. The intention of this area is to store dredge spoil associated with maintaining the proposed marina. In that regard, it will not generate truck movements on the external road network.

Application of the above rates to the proposed development yields the following traffic generation potential:

Table 35: Proposed Development Traffic Generation

Traffic Generation Rate	Daily Trips	AM Peak Hour		PM Peak Hour	
	TOTAL	IN	OUT	IN	OUT
Marina berths, Showroom, Factory, Boat Storage & Warehouse Uses (Approx 24.3 ha)	1,752	102	56	34	182
Industry Subdivision (81,000m2)	5,670	454	113	113	454
Retail (5,800m^2)	1,740	70	17	87	87
Hotel (110 rooms)	220	18	4	13	9
Tavern (1,500m^2)	450	-	-	22	23
TAFE	300	60	15	30	45
TOTAL	**10,132**	**704**	**205**	**299**	**800**

Traffic Distribution (EMME Transport Modeling)

Bitzios Consulting was engaged to undertake EMME Transport Modeling to assign the proposed development traffic to the surrounding road network. The methodology adopted by Bitzios Consulting was as follows:

1. Review the model zoning in the area of the development;

2. Split the zones in the 2011 and 2031 base models to add a new zone specifically for the development;
3. Extract Daily, AM & PM peak (2 hour) link volumes for 2011 and 2031 in the area of influence of the development; (base case)
4. Modify the demographics in the 2011 and 2031 models to reflect the traffic generation for the development;
5. Run the 2011 and the 2031 "with development" models and extract the Daily, AM Peak 2 hour and PM peak 2 hour volumes for the area of influence.

The resultant distribution of traffic through the road network is approximated in the Traffic and Transport Impact Assessment prepared by CRG contained in Appendix 21. Resultant estimates of development turning movement volumes on the surrounding road network are also shown in the Traffic and Transport Impact Assessment.

Local Road Network

Scope of Assessment
For the purposes of the Traffic and Transport Assessment, a capacity analysis has been undertaken at the following intersections:

- Shipper Drive / Ford Road / Proposed Access
- Shipper Drive / Waterway Drive / Proposed Access
- Foxwell Road / Shipper Drive
- Waterway Drive / Beattie Road

The proposed access intersections in Shipper Drive have each been modelled as a single lane roundabout with a 20m centre island diameter, similar to the existing roundabout at the Waterway Drive / Beattie Road intersection. The design of the proposed roundabouts is detailed in the Traffic and Transport Impact Assessment.

Capacity Analysis
The above intersections have been modeled using SIDRA for the morning and afternoon peak periods in 2021 with the proposed development traffic.
The results are presented in full in Appendix 21.

The Local Road Network Impact Assessment establishes that each of the intersections will operate satisfactorily for the foreseeable future with the proposed development traffic, with minimal delays and vehicle queuing on all approaches and movements. It is therefore concluded that the proposed development will not have any adverse impact upon the performance of the local road network.

State Controlled Road Network

The proposed development will generate a significant number of jobs and therefore will serve to contain trips in the local area. Whilst the proposed development will generate some new vehicle trips on the State controlled road network it will also significantly reduce the need for local residents to use the Pacific Motorway and other State controlled roads for work related travel.

In this respect, it is considered that the proposed development will provide a positive outcome for the local transport system in that it will:

- Contain a significant volume of work trips in the local area;
- Provide a local service to other development in the area, including the TAFE and other educational facilities.

Scope of Assessment

In accordance with Main Roads policy, the extent of proposed development traffic impacts must be assessed where the development proposal is likely to result in an increase of at least 5% of existing daily volumes on any State controlled road section or 5% of existing daily volumes on any individual turning movement at a State controlled intersection.

Proportional Impact of the Proposed Development

Based on the trip generation rates discussed above, it is estimated that the proposed development will generate in the order of 10,132 vehicles per day.

A summary of the daily development traffic volumes using the State controlled road network (expressed also as a percentage of existing daily volumes) for each individual turning movement is shown in the Traffic and Transport Impact Assessment prepared by CRG contained in Appendix 21.

As shown, the percentage impact is greater than 5% on some turning movements at the Foxwell Road interchange as well as the Beattie Road / Service Road intersection. A detailed capacity analysis was therefore required at these intersections, and is discussed as follows.

Capacity Analysis

The above intersections were modeled using SIDRA for the morning and afternoon peak periods in 2021 with the proposed development traffic.

The results are presented in full in the Traffic and Transport Impact Assessment prepared by CRG contained in Appendix 21.

Required Road Network Upgrades

As previously stated, the capacity analysis for the local road network indicates that the proposed development will not result in a need to upgrade the local road network other than that required to facilitate site access. It is recommended that a single lane roundabout be provided at each site access intersection.

The capacity analysis of the State Controlled Network shows that the existing Pacific Motorway interchange at Days Road and Foxwell Road will reach capacity by 2021 and require upgrading regardless of the proposed development. The Department of Transport and Main Roads in conjunction with Council has developed options for the upgrade of the interchange, however, there is no funding allocated for such.

It is noted that the proposed development traffic will increase the degree of saturation at each of the above intersections only marginally and therefore have a relatively minor impact upon their performance. It is considered reasonable, however, that the Applicant be required to contribute towards the development of the surrounding State controlled road network. Such contributions should only be required at the completion of each stage and be consistent with those required under the Gold Coast Priority Infrastructure Plan (State component).

Mitigation of Impacts

In order to mitigate the impact of the proposed development traffic upon the Pacific Motorway interchange at Foxwell Road, a traffic signal could be installed on the Motorway overpass (eastbound) approach, with a detection loop on the Motorway (southbound) off-ramp. A concept plan is shown below.

Figure 32: Concept Plan of Traffic Signal at the Pacific Motorway / Foxwell Road Roundabout.

The roundabout has been modelled with the proposed traffic signal and the results are presented in the table below.

Table 36: Summary of SIDRA Analysis (with proposed traffic signals)

Scenario	Level of Service	Degree of Saturation	Average Delay (sec)	95th Percentile Queue (m)
Pacific Motorway / Foxwell Rd Roundabout:				
AM 2021 - With Development	B	0.952	17.7	181.2
PM 2021 - With Development	F	1.324	85.5	1120.1

As shown in the table above, the proposed traffic signal would essentially mitigate the impact of the proposed development traffic on the intersection. Degree of saturation, average vehicle delays and queue lengths would return close to pre-development values with the traffic signal in operation.

We therefore put forward the installation of a traffic signal on the Pacific Motorway / Foxwell Road roundabout as an option that could be considered through further discussions with the Department of Transport & Main Roads.

Public Transport

The Coomera Rail Station is located on Foxwell Road, at the heart of the Coomera Town Centre. It is a key element of the Town Centre and local planning in the area encourages maximum use of rail services. The rail line through Coomera connects Coomera to Brisbane via a 53 minute service with trains departing at approximately 30 minute intervals during standard business hours. Southbound services to Robina / Varsity Lakes also depart every 30 minutes.

Various bus services also operate through the Coomera area. The Route 725 service operates along Shipper Drive directly past the subject site. The Route 725 service provides connectivity to the Coomera Town Centre and Coomera Rail Station as well as the Helensvale Town Centre and Rail Station. Services operate every 30-60 minutes through the Marine Precinct and are coordinated with rail services at Coomera and Helensvale.

Public transport routes through the Coomera area are presented within the Traffic and Transport Impact Assessment prepared by CRG contained in Appendix 21.

It is recommended that bus stops (indented bus bays / shelters) be located on Shipper Drive in the vicinity of both access intersections to accommodate additional passenger demands in this area.

Pedestrian refuges should also be installed in Shipper Drive to facilitate safe pedestrian movement between bus stops and the proposed development.

Cyclist Access

The regional cycleway corridor runs adjacent to the rail line through Coomera, in close proximity to the subject site. On-road bicycle lanes are also provided along Beattie Road and Foxwell Road east of the Coomera Rail Station.

This allows good connectivity for cyclists between the Marine Precinct and the Coomera Town Centre and Coomera Rail Station.

Bicycle lanes should be implemented on Shipper Drive so to link the marine precinct to Foxwell Road, and such should be provided regardless of the proposed development. It is noted that there is currently sufficient pavement width to allow this and therefore can be achieved through pavement markings.

It is recommended that Bicycle parking be supplied in accordance with the requirements set out in Table 10-1 of the Austroads publication ‘Guide to Traffic Engineering Practice - Part 14: Bicycles’.

End of trip facilities (lockers, showers) should also be provided where appropriate to encourage cycling trips.

Pedestrian Access

Pedestrian footpaths are proposed along all roads within the proposed development to encourage pedestrian movement between various uses and buildings.

A cycleway and walking track also follows the perimeter road and links to the western 'Marine Industry' precinct via a pedestrian / cycle bridge over the future IRTC corridor. This cycleway and walking track also connects to the future proposed pedestrian and cycle bridge linking the future residential development on the northern bank of Oakey Creek.

As previously discussed, it is recommended that pedestrian refuges be installed in Shipper Drive adjacent to the proposed bus stops to facilitate safe pedestrian movement between bus stops and the proposed development.

Car Parking

The applicable car parking rates for the proposed development are provided in the Gold Coast City Council 'Car Parking, Access and Transport Integration' Code. This code will be addressed in further detail in subsequent development applications.

As per the Traffic and Transport Impact Asssesment prepared by CRG contained in Appendix 21, it is suggested that the car parking requirement for the Retail component be reduced to 67% of the Planning Scheme rate on the basis that the retail shops proposed will benefit from a high proportion of walk-up trips from staff and visitors of other uses (e.g. marina berths, hotel staff & guests, office staff etc.).

It is also suggested that the car parking requirement for the Tavern component be reduced to 80% of the Planning Scheme rate given that it will draw a proportion of its patronage (including lunch & evening trade) from surrounding businesses and guests of the adjoining Hotel, many of whom will walk.

A comparison of Council car parking requirements and recommended car parking requirements is shown in the Table below.

Table 37: Car Parking Rates

Land Use	Planning Scheme Requirement	Recommended Requirement
Office	3 spaces per 100sqm	Planning Scheme
Showroom	2 spaces per 100sqm	Planning Scheme
Shop (Retail)	6.7 spaces per 100sqm	67% of Planning Scheme Rate
Hotel	▪ 1 space per room (first 75 rooms) ▪ 0.1 spaces per room thereafter ▪ Parking for associated commercial facilities at 75% of standard rate	Planning Scheme
Tavern	10 spaces per 100sqm	80% of Planning Scheme Rate
Marina		
Dry Berth	0.2 spaces per berth	Planning Scheme
Wet berth (≤10m)	0.6 spaces per berth	Planning Scheme
Wet berth (10-15m)	0.8 spaces per berth	Planning Scheme
Wet berth (>15m)	1 space per berth	Planning Scheme
Waterfront Industry	2 spaces per 100sqm	Planning Scheme

Application of the recommended car parking rates to the proposed development yields a total car parking requirement of 2537 car parking spaces for the Eastern Precinct. Details of these calculations are contained in the Traffic and Transport Assessment prepared by CRG contained in Appendix 21.

A total of 2720 spaces are proposed (including on-street car parking) which exceeds this minimum requirement. The inclusion of on-street car parking is considered to be acceptable in this instance given that the proposed development will act as an isolated 'closed' catchment. Car parking demands will only be generated by those uses on the site and there will be no external uses generating demands for on-street car parking within the eastern precinct.

It is therefore considered that the proposed car parking supply is satisfactory and will not result in any adverse car parking conditions.

Power and Telecommunications

Details should be provided of existing power and telecommunications services including locations, capacity and providers. This section should describe any impacts arising from the project on existing or planned power and telecommunications infrastructure (optical cables, microwave towers) and identify service upgrades required to support the project. Relevant service providers should be consulted to ensure that options identified to provide power and telecommunications services for the project are satisfactory.

MDA Consulting has prepared an Electrical and Telecommunication Services Report contained in Appendix 23. This report recommends what upgrades, if any, are required to the existing services.

An assessment of the existing services infrastructure was made by visiting the site to view what existing services were visible and requesting as constructed drawings for the electrical service for the projects local area. These drawings were requested from Energex and an organisation called Dial Before you Dig. A meeting was also arranged with Energex to discuss what infrastructure requirements would be necessary to supply the project both externally and internally within the project.

Electrical Infrastructure Investigations

<u>11kV feeder</u>
Site investigations revealed there is Energex underground11kV/415V network running past the opposite side of the development.

The high voltage feeder CMA10A & CMA11A which are being supplied at 11,000 volts (11kV) is being fed from the Coomera Zone Station to an underground 11kV network for the local area. This 11kV underground network is located approximately 50 meters south of development site.

Feeder CMA10A supplies a number of pole mounted transformers and pad mounted transformers. Feeder CMA11A supplies a number of pole mounted transformers and pad mounted transformers ranging in capacity from 100kVA to 1500kVA. The current load in CMA11A is about 15MVA.

Energex has also advised that there are two future zone substations that have been proposed to be constructed near the Foxwell Road and Cemetery Road roundabout and Beattie Road. Energex however could not give any further details on when this zone substation construction was to begin or be completed by. What Energex had advised is that when loads within the Coomera Town Precinct area dictated that a zone substation is required construction would begin.

11kV Cable
Energex require minimum 11kV 240mm2 3 Core Copper Triplex cable to be 11kV cable.

11kV Tie
HV feeder extension with ultimate load is greater than 3MVA, alternative supply arrangement must be provided.

The local asset manager is responsible for the technical and economic assessment of alternative supply arrangement (in accordance with reliability assessment planning guidelines) and determination of the preferred supply method.

Energex require a 4way Ring Main Unit in west roundabout and 3 way Ring Main unit in East roundabout.

Large Customer
Energex has introduced large customer connection recently. The large customer will get a different supply agreement with the URD subdivision.

Internal Conduit Layout
6 Conduits (4 x 125mm + 2 x 100mm) shall be installed along one side of the road, and 4 conduits (2 x 125mm + 2 x100mm) shall be installed to the opposite side of the road.

One Energex communication conduit to be installed with any 11kV conduit configuration installed.

Joint use trenches will not be permitted in the footpath of C &I subdivisions. Telstra, Optus and all other services are to be installed on their own alignment, except for road crossings where a share trench arrangement will be acceptable.

Padmount Transformer
For padmount transformer, 315kV and 500kVA are standard preferred size. Upon write request and supporting design justification, Energex may consider use of higher capacity transformers. Approval shall be solely at Energex's discretion. For the marine industry subdivision, there are 55 lots. 30kVA per lot x 55 lots = 1.65MVA will be required. To achieve that, minimum 3 x 500kVA + 1 x 315kVA may be required.

For the area situated eastern of the transport corridor, we estimate the required power based on our assumption:

- West mixed use - 1000kVA
- East mixed use - 1000kVA

- Hotel / Tavern - 1000kVA
- Water treatment - 315kVA
- Boat Stack Storage - 500kVA
- Education Establishment - 315kVA
- Shiplift Industry - 1000kVA

This presents a total load of 5130kVA.

Energex Reinforced Concrete Pit
Energex may require Type 3 reinforced concrete pit (minimum 6m long) in some road crossing.

Other Requirement
The cable shall be installed at the correct location and depth.

Drawings and layout plans pertaining to the above, are contained within the Electrical and Telecommunication Services Report contained in Appendix 23.

Telecommunication Infrastructure Investigations

From the current Telstra service there are SMOF cable running past the opposite side of the development and several pits.

Telstra officer has advised the government may introduce the new rule of optical fiber after 1st July 2010. Installation of optical fiber may be compulsory and copper wire will not be used unless the optical fiber is not practical in the new installation. But Telstra cannot provide official document.

Recommendations

As Energex has advised that the feeder CMA10A & CMA11A does not have enough capacity for the entire proposed development they recommended that the developer advise the exact required load, the staging plan and scheduled construction time so Energex will plan a new zone substation. This feeder however has only 2.5MVA spare capacity after September / October 2010 which would be insufficient for a retail/commercial development of this size. We estimate that the development site based upon air-conditioned retail/commercial premises would require 6.78MVA. With a load of this capacity the development would require to share a new 11kV feeder.

An Advantage for the client is that the 11kV feeders CMA10A/CMA11A are located in close proximity to the proposed location. There are existing spare conduits

available and the development site is not far from the two new zone substations. This being the case we believe that Energex would provide supply to the site from one of two new zone substations.

With regards to telecommunications, there are existing optical fibre cable and connection point in Shipper Drive. The matter is only to use optical fibre or copper wire but it depends on the federal government's new rule. Further detail is contained in the Electrical and Telecommunication Services Report contained in Appendix 23.

Water Supply and Wastewater

Water Supply

A detailed assessment of any impact of the proposal on the water supply network shall be submitted including the availability of water in terms of pressure and flows (including fire flows) by carrying out comprehensive dynamic network analysis. Analysis should at least cover three consecutive maximum demand days.

Details should be provided of any existing or upgraded town water supply required to meet the potable water demand of the project. Proposed sources of alternative water supply should also be described where practicable (e.g. groundwater bores, surface storages) and any approvals required under the *Water Act 2000*. Estimated rates of supply from each source (average and maximum rates) should be provided. Appropriate water conservation and management measures should be outlined for inclusion in the operations EMP.

A Water Supply Assessment Report should include:

- details of assessment methodology adopted including a summary of consultation undertaken with Allconnex Water, regarding the scope of the impact assessment and methodology to be used
- details of all base data assumptions, including an assessment of the current condition of the affected network and its performance
- detailed capacity assessment and the impacts on the existing system due to the additional demands from the development site and identified augmentation works involved and identify connection points
- details water conservation and management measures and use of recycled water (Class A +). The development site is within future Dual Reticulation System
- servicing arrangements and service boundaries (Allconnex Water and Principal Body Corporate)
- details on the timing of these works including the responsible parties for these works
- a summary of relevant approvals and legislative requirements needed to implement water infrastructure works required by the project
- infrastructure charges and funding.

A Water Supply Capacity Assessment has been prepared by Hyder Consulting and is contained in Appendix 24 of the EIS.

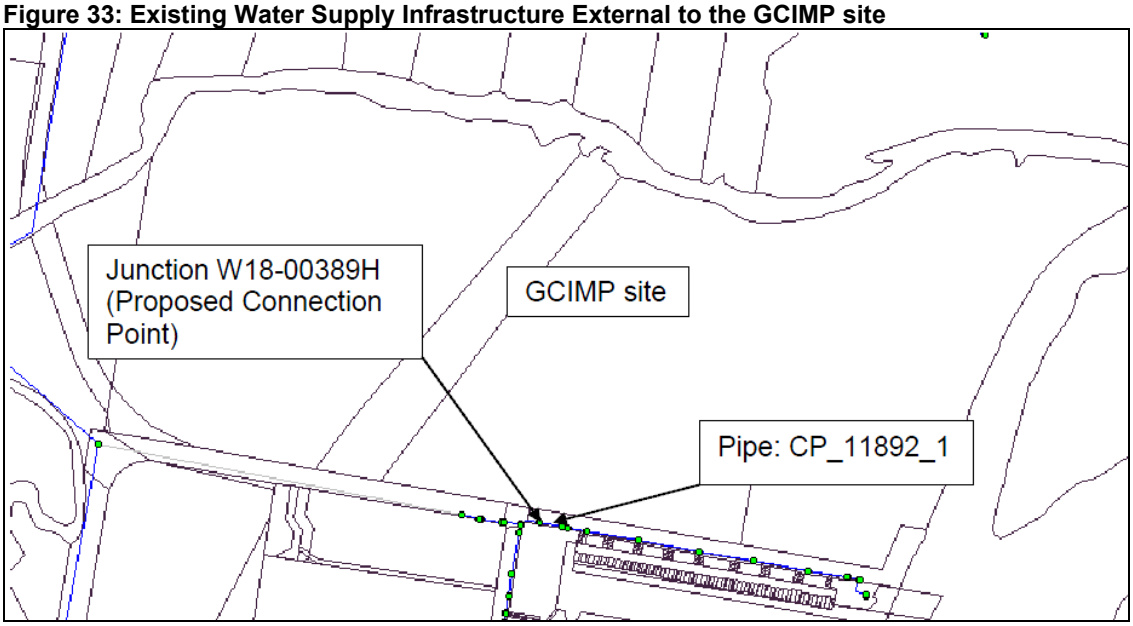
Existing Water Supply Infrastructure

There is an existing 225mm diameter main located within Waterway Drive, which terminates at the intersection of Waterway Drive and Shipper Drive. There is also a 450mm diameter main located in Foxwell Road, to the north of the site.

As the Foxwell Road water main is part of a separate demand managed zone, Allconnex have advised that this connection would not be allowed and the development should be limited to the potable connection point to the 225mm diameter water main in the Shipper Drive/Waterway Drive Intersection.

The figure below shows a diagrammatic representation of the existing water supply infrastructure.

Figure 33: Existing Water Supply Infrastructure External to the GCIMP site



Proposed Water Supply Infrastructure

As part of the former Gold Coast Water Infrastructure upgrades within the Coomera region, Council formed the Pimpama Coomera Water Futures Alliance. The Alliance group is currently delivering a large portion of trunk water infrastructure within the region and have plans for future connections relevant to the Gold Coast International Marine Precinct. Reference is made to the Pimpama Coomera Water Futures Master Plan implementation drawing PCWF-PW-001 dated 19/10/2007. A future potable water main of 150mm diameter is proposed to be constructed from Foxwell Road to the north of the project site, along Shipper Drive to the intersection with Waterway Drive. The proposed water main will connect to the existing 225mm diameter main in

Waterway Drive.

Estimated Water Equivalent Tenements

In order to calculate the demand on surrounding water infrastructure the increase in development loading is applied through the projected increase in Equivalent Tenements (ET). The calculated ETs for each planning horizon are included in the table below.

Table 38: Equivalent Tenement Calculations for Project Icon

Planning Horizons/Year	Total ET of proposed development	Assigned ET for development in Council IDM	Additional Demand ET
2011	0	590	0
2016	1317.76	590	727.76
2021	1317.76	590	727.76
PSD (2056)	1317.76	5083.85	-3766.09

Details of the equivalent tenement calculations can be found in the Water Supply Capacity Assessment prepared by Hyder Consulting contained in Appendix 24.

These equivalent tenements result in the following water demands:

Table 39: GCIMP Water Demands

Equivalent Tenements	AD (L/s)	MDMM (1 × AD) (L/s)	MD (1 × AD) (L/s)	MH (1.37 × AD) (L/s)
1317.76	14.28	14.28	14.28	19.56

These water demands have been calculated as per Policy 11: Land Development Guidelines Section 4 – Water Reticulation – Design Requirements of the GCCC Planning Scheme. These demands are input into the water model to estimate the impacts on existing infrastructure.

Estimate Water Equivalent Tenements

Measures have been taken on site to ensure appropriate water conservation and management. Where possible stormwater harvesting and reuse has been implemented on site through the use of stormwater harvesting tanks, as per the Queensland Development Code. Reuse is to be through irrigation of landscaped

areas, toilet flushing and other non-potable uses. The Hyder Stormwater Management Plan contained in Appendix 16 should be referred to for more details.

The site is also located within the Pimpama Coomera Water Futures Master Plan, which means that there are opportunities for recycled water use. An existing 450mm diameter recycled water main is located adjacent to the site and it is proposed to connect the GCIMP site to the existing recycled water network. It is assumed that there is sufficient capacity in the existing infrastructure to cater for the proposed GCIMP.

Modelling Methodology

The proposed development was incorporated into the H2OMap water model for each of the planning horizons. The impact on the existing water supply network was assessed by verifying and comparing the standard flow pressure, fire flow pressure and pipe velocity against Allconnex Water's (Southern District) Desired Standards of Service (DSS) in the vicinity of the development site. The DSS are:

- Minimum Standard Flow Pressure = 22m
- Maximum Standard Flow Pressure = 80m
- Minimum Fire Flow Pressure = 12m
- Maximum Pipe Velocity = 2.5m/s.

Infrastructure surrounding the development has been assessed to determine if the above DSS are met while catering for the increased loadings due GCIMP.

The modelling of the proposed development's impact on surrounding infrastructure was carried out through the use of the H2OMAP water model. The site's demands were applied to the model at the designated connection point for the given planning horizon. The impact on the existing water supply network was assessed by verifying and comparing the standard flow pressure, fire flow pressure and velocity against Allconnex Water's Desired Standards of Service (DSS) in the vicinity of the subject site.

Existing System Performance without Proposed Development

Standard Flow Pressures and Pipe Velocities

The model was run in an Extended Period Simulation for a 72 hour period with the minimum and maximum pressures of the surrounding area recorded without the demands applied by the proposed development included within the model. Results for the connecting node (W18- 00389H) and adjacent pipe (CP_18892_1) are shown in the Table below.

Table 40: Available minimum and maximum standard flow pressures and pipe velocity without the proposed development

Planning Horizon	Max Pressure (m)	Min Pressure (m)	Max Velocity (m/s)
2011	52.26 @ 26:30 hrs	51.88 @ 42:00 hrs	0.00837 @ 37:00 hrs
2016	52.26 @ 26:30 hrs	51.85 @ 42:00 hrs	0.00838 @ 37:00 hrs
2021	52.26 @ 26:30 hrs	51.80 @ 42:00 hrs	0.00838 @ 37:00 hrs
PSD (2056)	52.04 @ 26:30 hrs	50.32 @ 33:00 hrs	0.14007 @ 37:00 hrs

A graphical representation of the model output for each planning horizon is included in the Water Supply Capacity Assessment prepared by Hyder Consulting contained in Appendix 24.

It should be noted there are no serious issues in the vicinity of the proposed GCIMP site, particularly around the connection point in the Waterway Drive / Shipper Drive intersection. However there are areas in the model which do not meet the DSS. Areas to the west of the Pacific Highway, around Runway Drive, to the south, along River Links Boulevard East, and to the north, along Cunningham Drive South and Jones Street all fail to meet the minimum 22m standard flow pressure

Fire Flow Pressures

The model was also run to assess the sufficiency of the system in the event of a fire. This entails running the model in an Extended Period Simulation, however a fire flow demand of 30L/s for four (4) hours with two thirds of the background demand is imposed on the system. Results for connecting node (W18-00389H) are shown in the table below.

Table 41: Available fire flow pressure without the proposed development

Planning Horizon	Residual Pressure (m)	Critical Node ID
2011	42.31 @ 42:00 hrs	W14-03570H
2016	42.24 @ 42:00 hrs	W14-03570H
2021	42.12 @ 42:00 hrs	W14-0.3570H
PSD (2056)	39.03 @ 33:00hrs	W14-00605H

When a 30L/s fire flow demand is applied to the site as per the Planning Scheme Domain for a fire event the 12m standard service pressure is met for the development and the surrounding nodes.

System Performance with Proposed Development

Standard Flow Pressures and Pipe Velocities

The model was run in an Extended Period Simulation for a 72 hour period with the minimum and maximum pressures of the surrounding area recorded with the demands applied by the proposed development included within the model. Results for the connecting node (W18-00389H) and adjacent pipe (CP_11892_1) are shown in the table below.

Table 42: Available minimum and maximum standard flow pressures and pipe velocity with the proposed development

Planning Horizon	Max Pressure (m)	Min Pressure (m)	Max Velocity (m/s)
2011	52.26 @ 26:30 hrs	51.87 @ 42:00 hrs	0.00837 @ 37:00 hrs
2016	52.26 @ 26:30 hrs	51.84 @ 42:00 hrs	0.00838 @ 37:00 hrs
2026	52.26 @ 26:30 hrs	51.78 @ 42:00 hrs	0.00838 @ 37:00 hrs
PSD (2056)	51.83 @ 26:30 hrs	50.09 @ 33:00 hrs	0.14007 @ 37:00 hrs

A graphical representation of the model output for each planning horizon is included within the Water Supply Capacity Assessment contained in Appendix 24. It should be noted there are no serious issues in the vicinity of the proposed GCIMP site, particularly around the connection point in the Waterway Drive / Shipper Drive intersection. There is a very slight drop in the standard flow pressure around the site, however the pressures are still well within the GCCC's DSS, discounting the failures that are present within the existing case model.

Fire Flow Pressures

The model was also run to assess the sufficiency of the system in the event of a fire. This entails running the model in an Extended Period Simulation as in Section 6.2.1, however a fire flow demand of 30L/s for four (4) hours with two thirds of the background demand is imposed on the system. Results for connecting node (W18-0389H) are shown in the table below.

Table 43: Available fire flow pressure with the fire flow pressure with the proposed development.

Planning Horizon	Residual Pressure (m)	Critical Node ID
2011	42.23 @ 42:00 hrs	W14-03570H
2016	42.16 @ 42:00 hrs	W14-03570H
2026	42.04 @ 42:00 hrs	W14-03570H
PSD (2056)	38.94 @ 33:00 hrs	W14-00605H

When a 30L/s fire flow demand is applied to the site as per the Planning Scheme Domain for a fire event the 12m standard service pressure is met for the development and the surrounding nodes.

Summary of Water Supply Capacity Assessment

The Water Supply Capacity Assessment prepared by Hyder Consulting contained in Appendix 24, has shown that the GCIMP can meet the Allconnex Water Desired Standards of Service of potable water supply. Modelling has shown the DSS are generally met in the existing scenario for all planning horizons, with the exception of areas to the west of the Pacific Highway, around Runway Drive, to the south, along River Links Boulevard East, and to the north, along Cunningham Drive South and Jones Street which fail to meet the minimum 22m standard flow pressure in all planning horizons

When the demands of the GCIMP are imposed on the system no detrimental effects are incurred in the surrounding water network. The GCIMP can connect to the existing 225mm diameter water main in Waterway Drive while continuing to meet Allconnex Water's DSS.

Wastewater

As for water demand, wastewater capacity to meet demand should refer to the local authority planning scheme requirements. A detailed assessment of any impact of the proposal on the downstream wastewater network shall be submitted including any augmentation works identified on the downstream system by carrying out a comprehensive dynamic network analysis.

A Wastewater Assessment Report should include:

- details of assessment methodology adopted including a summary of consultation undertaken with Allconnex Water, regarding the scope of the impact assessment and methodology to be used
- details of all base data assumptions, including an assessment of the current condition of the affected network and its performance
- detailed capacity assessment and the impacts on the existing system due to the additional demands from the development site and identified augmentation works involved and identify connection points
- coordinate with Aecon Consulting Engineers who has been engaged by Allconnex Water for planning and implementation of Foxwell Trunk Gravity main by providing the demand requirements from the development site
- servicing arrangement and service boundaries (Allconnex Water and Principal Body Corporate)
- infrastructure charges and funding
- details on the timing of these works including the responsible parties for these works
- a summary of relevant approvals and legislative requirements needed to implement wastewater infrastructure works required by the project.

Detail pertaining to the wastewater network, and the impacts and requirements of the GCIMP on the wastewater network is contained within the Engineering Services Report prepared by Hyder Consulting contained in Appendix 19.

Existing Wastewater Network

The proposed development site forms part of the Pimpama-Coomera catchment area which has been identified by Gold Coast City Council for adoption of an integrated water management approach to the provision of wastewater infrastructure. Council's provisions for sewerage reticulation incorporate Reduced Infiltration Gravity Sewer Systems. No sewerage connection is currently proposed for the site.

An existing sewerage system is located adjacent to the development site area and is a vacuum pump station and rising main located within Waterway Drive which

currently services the existing Coomera Marine Industry and ultimately pumps sewerage west to Beattie Road and north to the Pimpama Coomera Wastewater Treatment plant.

Gold Coast Water (now Allconnex) have advised that the existing vacuum pump station located within Waterway Drive is at its peak capacity and discharge into the existing vacuum pump station and/or rising main would result in failure of the system.

Internal Wastewater Reticulation System

The internal sewer reticulation system for the subject development will incorporate a low pressure sewer system, with reduced infiltration gravity sewer principles for the gravity component of the sewer system. The developer shall, as part of the development works, construct the internal pressure sewer reticulation service for the proposed development in accordance with Gold Coast City Council's Land Development Guidelines.

Project Wastewater Demand

To determine the impacts of the proposed development onto the existing sewerage infrastructure, a sewerage network assessment analysis over the proposed development site was undertaken by Hyder Consulting. Development information relating to land use has been obtained from Push Architects, Gold Coast City Council Policy 3b – Policy for Infrastructure (Sewerage Network Developer Contributions) and the Temporary Local Planning Instrument (TLPI) Water Supply and Sewerage Land Use Category Demand Table for Policies 3A and 3B.

For a Marine Industry development type and in accordance with the Infrastructure Charges Water Supply and Wastewater Land Use Category Demand Table for Priority Infrastructure Plan, the accommodation density for the development is 10ET/ha with a demand conversion factor of 1.0. It is recognised that the exact development demand may be different from the planned demand as indicated in the Infrastructure Charges Water Supply and Wastewater Land Use Category Demand Table for Priority Infrastructure Plan, due to the specific land uses proposed over the site. A summary of the proposed Land uses and their respective accommodation densities and density conversion factors are provided in the table below.

Table 44: Summary of Proposed Development Types and Accommodation Densities

Development Type	Code	Density	Density Units	Demand Conversion Factor
Fringe Business	FB	16	ET/Ha	1.1
Marine Industry	MI	10	ET/Ha	1.0
Tertiary Education	CPTE	15	ET/Ha	1.0

The Engineering Drawings K237-AA001578-01 to K239-AA001578-01 contained as an attachment to the Engineering Services Report prepared by Hyder Consulting contained in Appendix 19 provide a detailed description of the proposed land use locations and the areas in which the calculations of the project sewerage discharge requirements are determined.

The calculations pertaining to the ETs for the GCIMP development have been provided within the Engineering Services Report.

To determine the external sewerage demand a summary of the discharge conversion between equivalent tenements and flow is provided. The flow calculations have been derived from the Gold Coast City Council Land Development Guidelines Section 5.2 and account for an Average Dry Weather Flow (ADWF) for Category 2 Infrastructure (for Reticulation Sewers) of 825 L/ET/d.

In order to design the reticulation and trunk sewerage infrastructure a wet weather peaking factor of 4x (for Pimpama-Coomera Catchment) has been adopted to take into consideration water infiltration into the system during rainfall events.

Table 45: External Sewerage Demand for Site

Location	Total Equivalent ET's	Flow (L / ET /day)	Flow (L/s)	Flow (L/s) using Peaking Factor of 4x
Eastern Marine (Mixed Use)	315.88	825	3.016	12.064
Eastern Marine (Berths)	156.00	825	1.490	5.960
Western Marina (Industrial Precinct)	189.90	825	1.813	7.253
Total	**661.78**	**825**	**6.319**	**25.277**

Project Wastewater Requirements

All wastewater supply systems shall be designed to meet Gold Coast City Council Land Development Guidelines. The gravity and pressure components of the domestic sewer supply system shall be designed in accordance with the specifications for reduced infiltration gravity systems.

All the proposed lots in the development are to be sewered. To facilitate the Council planning strategy density for the site, the sewer mains have been placed external to the individual lots where possible. This has been provided intentionally to maximise the usable built form area on the allotments and to enable effective access for future maintenance.

Sewage pumpout systems will be employed to service the marine vessels while they are docked at the marina. The pumpout system will either be at a fixed point, commonly located at a fuel dock, dock-end or other dedicated area that is easily accessible by boat or they will be located slip side so that two or four boats may be serviced from the same pumpout station. The pump unit includes a connector hose to provide access to the boats sewage holding tank and a pump that connects into the existing sewage network of the development site.

Internal to the development site a pressure sewerage system is to be constructed that utilises small, low powered grinder pumps in each property which are then connected to a centralised discharge network within the road verge where available or within the allotments for community title land designations. These pumps are capable of storing sewage from the individual allotment to which they are connected and are drained of sewerage via an electronic activation system when full via pressure and transported to the connecting sewer system. From the development collection point the sewerage is then pumped into the Council trunk main situated in Shipper Drive.

The Pressure Sewerage Code of Australia WSA07 identifies the pressure system philosophy generally as follows: “The pressure sewer system uses the combined flows under pressure from individual collection/pump units to transport sewage. In most instances the system will discharge to a sewage pumping station or a gravity sewer for further transport to a treatment plant. Compared to a traditional gravity system, pressure sewer systems have negligible inflow/infiltration issues and are not limited by the same strict grade controls. As a result the pipes are smaller and can be laid shallower, allowing reduced depths of excavation or other construction options, which lowers construction costs”.

The use of a pressure sewerage system is proposed on this site due to the low lying development platform and the existing subsoil conditions. A pressure

sewerage system can be constructed within a depth range of approximately 2m for the gravity and pressure lines allowing construction to proceed above the water table and limit the disturbance of acid sulphate soils. Construction methods allow for a faster construction method than for a traditional full gravity system as groundwater pumping, trench stability and acid sulphate treatment requirements can be reduced with a pressure system.

In addition should a traditional gravity trunk system be constructed, the length of pipe work to construct the system would result in the trunk lines being very deep at the location of the pump station and considerable detail would be required in relation to buoyancy effects of the pump station and manholes. On-going maintenance of the system in the future would also be more difficult than the proposed pressure sewerage system.

The design of pressure sewer systems and pump station components shall comply with the Water Services Association of Australia's publication "Pressure Sewerage Code of Australia" unless specified otherwise by Gold Coast City Council.

The above design criterion applies to the following:

a) Pressure sewers including junctions and property connection sewers.
b) Common effluent sewers both gravity and pressurized.
c) Maintenance holes and other structures.
d) Rising mains.
e) Pump stations.

The design will also comply with the following;

- Institute of Public Works Engineering Australia (IPWEA) - Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services).
- Water Resources Guidelines for Planning and Design of Sewerage Schemes Volumes 1 and 2
- Water Act 2000 and Sewerage and Water Supply Act 1949 incorporating amendments and subordinate legislation including Standard Sewerage Law
- Water Services Association of Australia (WSAA)
- WSA 02 - Sewerage Code of Australia
- WSA 07 – Pressure Sewerage Code of Australia

In addition the following specific requirements shall be adhered to in relation to general requirements for sewerage reticulation as part of the Gold Coast City Council specifications;

- Easements over sewers (gravity and pressure) are not required.
- Property connections (i.e. combine house drains) are not lawful in Queensland.

- The design shall be in accordance with the flow used for the design of sewers serving industrial areas and developments not specifically listed in the PRESSURE SEWERAGE CODE OF AUSTRALIA or Department of Natural Resources Guidelines. (WSA 07 Part 1, Section 1.5).
- The design shall take account of AS 2200, AS/NZS 2566.1, AS 3500, AS 3735, the PRESSURE SEWERAGE CODE OF AUSTRALIA and, the Department of Natural Resource Guidelines
- Where the pump station site is exposed to possible flooding, the design shall provide for the top of pump well to be one (1) meter above the 1 in 100 year flood level or to such other level as provided by Council's planning instruments, whichever is the higher. The pump stations will be positioned to a level 1 meter above the 1 in 100 year flood level.
- The design shall provide for the design of pump wells against flotation both during the construction/installation stage and whilst operating under flood conditions designed as above.
- The design shall size pipes and pump station capacity to avoid surcharges under design flow conditions. The design shall provide for overflows in strict accordance with the conditions of the license, if any, permitting sewage overflow.

Wastewater Contingency Measures

The proposed sewerage facilities to be contained within the project site are conventional gravity sewer mains and low pressure sewer rising mains. There will be a variation to the conventional aspect of the sewer facilities to be constructed within the project site; this will be the pressure sewer components of the proposed network system. The pressure sewerage system facility will be generally constructed to be compliant with the Pressure Sewerage Code of Australia WSA07-2007 and relevant amendments.

The Pressure Sewerage Code identifies the planning, design and construction of reticulation pressure sewers and laterals up to and including a nominal diameter of 250mm, discharge lines, collection/pump units and other appurtenances.

The project site infrastructure configuration will have regard to the requirements to accommodate the pump stations for sewerage reticulation. Generally, these pump stations will be situated in the frontage of the development allotments. The proposed pump stations location has been chosen for the following reasons:

- Vehicle access and parking;
- Emergency pumping arrangement;
- Maintenance clearances;
- Onsite or mobile generator facility; and
- Buffer between the station and adjoining properties.

The pump station is divided into two primary areas, an above ground plant room and a below ground wet well. The pump station provides generally for the following elements:

- The full level of the wet well is designed to suit the invert levels of the incoming sewers, the vessel diameter and dimensions of the selected sewer pumps.
- Pump stations will have an odour control system installed to minimise potential impacts from odour emissions from the site.

It is proposed that emergency pumping arrangements will be made in the pump station for bypass pumping and/or a pump out facility. Arrangements will also be made for a temporary standby generator in case of electrical power failure to the pump station.

An odour control filter (or bio filter) will be used to remove odours from the generator exhaust gases containing odorous compounds which will include biodegradable organic compounds bypassing gases to a natural biological active filter membrane.

The on-site generator configured to provide for an auto-start on loss of power and will be properly secured with required safety signage. Noise from the generator will comply with the relevant Gold Coast City Council and EPA noise guidelines and requirements.

The sewer will generally be located on the opposite side of the road reserve to the water main construction. The sewer will be located at depths to mitigate risk of third party intrusion and shall have a minimum depth of 600mm.

In summary the following contingency methods for the proposed Pressure Sewerage System within the development site are through the following measures.

i. Provision of adequate telemetry within pump stations and collection chambers to cater for emergency notification of Water Authority should failure of pumps or system be resultant
ii. Provision of backup pump within the pump station chamber to cater for increased flows and / or pump failure
iii. Location of pump station in an area that has quick and easy access by maintenance personnel
iv. Location of pump station away from environmentally sensitive areas such as waterways and wetland areas.
v. Provision of Noise and odour control facilities
vi. Emergency pump out facilities and access provisions

Potential Impacts on Existing and Planned Infrastructure

The proposed sewage from the project site is to be collected internally via a series of gravity sewer mains and pump stations with discharge rising mains. These are to then connect to the existing infrastructure associated with the alternative options for sewerage discharge that have been identified by the developer.

The preferred option for the development is to utilize an onsite pump station and rising main along Shipper Drive to connect to the proposed alignment under the allotments to the north of the GCIMP which in turn connect to the Amity Way Gravity Line. All services will be aligned with existing roads and no easements will be required.

It is proposed that the low pressure sewer reticulation and pump station system within the project site will be owned, operated and maintained by the body corporate. The sewer facilities external to the project site will become assets of Gold Coast City Council. The gravity mains up to the low pressure pods will be owned by the individual tenants, while the rising mains and pump station will be owned by the Water Authority. These facilities will ultimately be operated and maintained by Gold Coast City Council.

Required Infrastructure Upgrades

The construction of a rising main and pumping station will be required through the allotments to the north of Oakey Creek. It is anticipated that developers of these sites will be responsible for the construction of this rising main and pumping station. A connection to this proposed rising main will be made from the rising main that follows Shipper Drive that the developer will be responsible for.

4.13 Hazard and risk

Health and Safety

This EIS should describe any potential impacts on public health and safety arising from the project including air, noise and traffic environments. Nearby and other potentially affected populations should be identified and described, with particular attention to those sections of the population, such as children and the elderly that are especially sensitive to environmental health factors.

Maps should be provided showing the locations of sensitive receptors, such as, but not necessarily limited to, kindergartens, schools, hospitals, aged care facilities, residential areas, and centres of work (e.g. office buildings, factories and workshops).

The EIS should discuss how planned discharges from the project could impact on public health in the short and long term, and should include an assessment of the cumulative impacts on public health values caused by the project, either in isolation or by combination with other known existing or planned sources of contamination.

This section should define the objectives and practical measures for protecting or enhancing health and safety community values, including a description of how nominated quantitative standards and indicators may be achieved for social impacts management, and how the achievement of the objectives will be monitored, audited and managed.

An assessment should be undertaken of the effects on the project workforce of occupational health and safety risks and the impacts on the community in terms of health, safety, and quality of life from project operations and emissions. Any impacts on the health and safety of the community, workforce, suppliers and other stakeholders should be detailed in terms of health, safety, quality of life from factors such as air emissions and noise.

The EIS should address the project's potential for providing habitat for disease vectors. Measures to control mosquito and biting midge breeding should be described. Any use of recycled water should be assessed for its potential to cause infection by the transmission of bacteria and/or viruses by contact, dispersion of aerosols and ingestion (e.g. via use on food crops).

Hyder Consulting has prepared a Hazard and Risk Report which details health and safety concerns, if any, arising from the GCIMP. This Report is contained in Appendix 38.

All construction and operational works carry with them a level of potential health and safety risk both to the project personnel and to other stakeholders such as the general public.

Hyder was engaged to prepare this health and safety component. The health and safety component of the Hazard and Risk Report acknowledges that each site and its respective operations have varied hazards and risks which will be managed in compliance with all relevant workplace health and safety legislation, as well as the codes of practice and standards and industry best practice.

High level health and safety risks specific to this project have been identified and are contained in the Hazard and Risk Report prepared by Hyder Consulting contained in Appendix 38 which has been undertaken in accordance with AS 31000 and with reference to the *Queensland Workplace Health and Safety Act 1995*. Detailed OHS risk analyses of the various stages of the project will be conducted when detailed design information is available. A number of specific health and safety risks have been identified (such as snake bites, heat stroke, traffic accidents) and management and mitigation measures proposed.

A Safety in Design assessment will be undertaken prior to the detailed design for construction of the project to provide further information regarding existing and future health and safety risks to designers, constructors and operators.

The risks are to be managed through the documentation detailed in the Hazard and Risk Report. A key element in the management of risks during construction and operation is the monitoring and review of the risks and control measures and updating of the relevant plans and procedures accordingly. It is also critical that the requirements of the workplace health and safety documentation are communicated to all project personnel so that they are aware of their roles and responsibilities.

Relevant Documentation

The management of workplace/occupational health and safety risks for the project is undertaken through the range of systems, plans and policies outlined in the Table below. They provide a framework based on AS/NZS 4084 for Hyder and the contractor to meet their obligations under the *Queensland Workplace Health and Safety Act 1995.*

All of the plans and statements outlined below have not yet been fully developed for the project but will be in place prior to the commencement of works and will be developed in line with existing occupational health and safety management systems in place within Hyder and the construction contracting company.

Table 46: Safety / Emergency Plan Requirements

Health and Safety Management Systems	Operational and Construction Safety Plans	Work method Statements and JHAs
Responsibility: Hyder / GCIMP / construction contractor	Responsibility: Hyder / GCIMP / construction contractor	Responsibility: GCIMP / construction contractor
▪ Health and safety policy ▪ Management commitment ▪ Responsibilities and accountability ▪ Controls for suppliers, sub-contractors and purchasing ▪ Health and safety consultation ▪ Hazard identification, evaluation and control. ▪ Training and competence ▪ Incident reporting and investigation ▪ Measuring and evaluating workplace health and safety performance	▪ Workplace address ▪ Name and address of the principal contractor ▪ Principal contractor's ABN ▪ WHS committee ▪ WHS officer appointed ▪ Expected start date and duration of the work ▪ Induction and consultation procedures ▪ Type of construction ▪ Plant provided for common use ▪ Site rules ▪ Site hazards and risks and proposed control measures ▪ How the controls will be implemented ▪ Identification of major hazards and corresponding Work Method Statements ▪ Personal protective equipment ▪ First aid ▪ Contractor management ▪ Monitor and review procedures ▪ Emergency procedures ▪ Public safety strategies ▪ Site housekeeping ▪ Site security and access	▪ Nature of the high risk construction/operational activity ▪ The control measures to be used ▪ The way the activity will be performed ▪ How the control measures will be monitored and reviewed ▪ Any relevant prescribed occupations•

Site Based Management Plan

A Site Based Management Plan (SBMP) will be developed for the GCIMP operations. The SBMP will incorporated safety aspects and integrated risk management principles during the determination of its elements.

The SBMP shall be the primary means of ensuring risk from activities conducted at a facility is maintained at an acceptable level. The main safety components of a SBMP are to:

- commit and lead;
- plan;
- implement;
- monitor, measure and evaluate including risk assessment; and
- hazard auditing and review.

Hazards associated with the proposed GCIMP during both construction and operation have been assessed to determine from a qualitative perspective, respective likelihood and consequences of the identified hazard occurring. The results of the hazard and risk assessment are provided in the Hazard and Risk Report prepared by Hyder Consulting contained in Appendix 38.

Of the hazards identified, most were considered to be of low to medium risk following the implementation of risk mitigation measures. Therefore, risks associated with the SHMR during both the construction and operational phases are considered to be manageable through the implementation of the strategies and risk treatment measures identified in the Hazard and Risk Report.

Training and Education

The operation of the facilities within the GCIMP will depend on a preventative and quality assurance approach to reduce and maintain low risks. Key training components for all staff and operators of the various GCIMP operations include the following.

- Induction training for all staff.
- Quality assurance training.
- Safety and emergency response procedures and training.
- Site management and supervision training to ensure risk management and quality standards are met.

Workplace training programs including the various inductions programs required for different professionals will be prepared in consultation with an occupational health and safety specialist. All training programs should be delivered by a person competent in training both construction and administration workers. Appropriate

procedures will ensure all staff are sufficiently trained and aware of the requirements in the case of an emergency to protect human health and property and the environment. Records of all training undertaken by staff should be kept on site.

Supervisors and process operators should hold appropriate qualifications and specialist training in automated and manual procedures needed to ensure efficient and safe operation of all plant and equipment (this is particularly relevant to construction and marina operation). Any maintenance work should be performed by qualified persons with specialist training and knowledge of process hazards.

Audits

Internal workplace health and safety audits of the management system, hazard information and records, shift processes, safety measures and staff personal protective equipment should be conducted annually. The audit should include a review of all complaints and incidents for the audit period. Records of all audits should be maintained for review purposes.

Further detail pertaining to Health and Safety is contained within the Hazard and Risk Report contained in Appendix 38.

Hazard and Risk

This section of the EIS should describe the potential hazards and risks that may be associated with the project and should incorporate all known hazards, which may include:

- identification of potential hazards, accidents, spillages and abnormal events occurring during all stages of the project, including possible frequency of occurrence
- indication of cumulative risk levels to surrounding land uses
- identification of all hazardous substance to be used, stored, processed or produced and the rate of usage.

External risks to the project should also be considered. External risks from natural hazards could be determined on the basis of *Australia/New Zealand AS/NZS 4360:2004 Risk Management.* The study should assess risks during the construction, operational and decommissioning phases associated with the project. Possible hazards, accidents, and abnormal events that may arise for the project, both during construction and in operation should be described.

Analysis of the consequences of each of these events on safety and environmental damage in the project area should be conducted, including direct harm to the environment as a result of project hazards. The analysis should examine the likelihood of these consequences being experienced, both individually and collectively.

Details should be provided on the safeguards that would be employed or installed to reduce the likelihood and severity of hazards, consequences and risks to persons, fauna and environmentally sensitive sites within and adjacent to the project area.

A Hazard and Risk Assessment has been prepared by Hyder Consulting and is contained in Appendix 38.

The project is to be designed to provide a safe and efficient means for supporting the Gold Coast Marine Industry. All developments present some level of risk, this can be identified through an HRA so that appropriate management measures can be implemented to reduce or remove the risk.

The following methodology as per the Hazard and Risk Assessment, has been suggested as a suitable way to assess and manage risk and demonstrate ‘due diligence’.

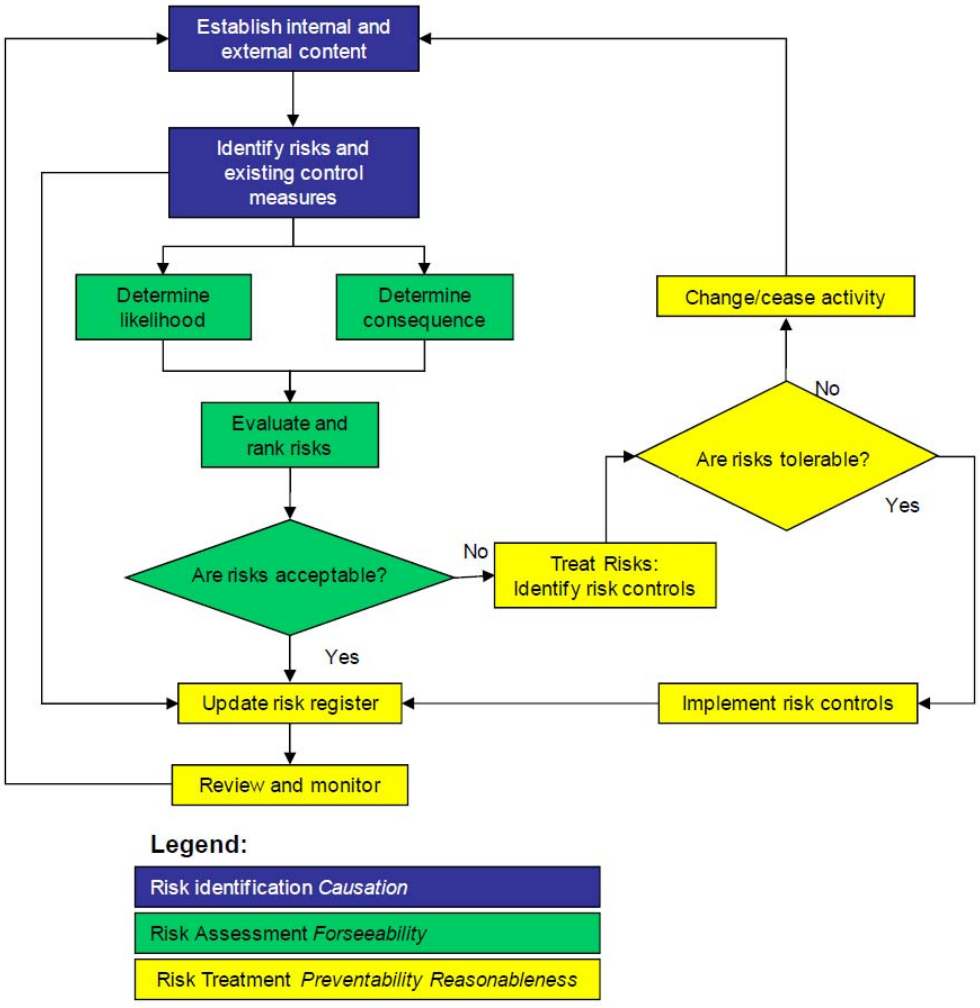
AS /IEC 61508 part 1 clauses 7.2-7.6 can be encapsulated into three steps (supported by AS/NZS ISO 31000:2009 Risk management):

- Step 1 – Concept and overall scope definition (demonstrate understanding and context, policy and accountability, communications and reporting);
- Step 2 – Hazard and risk analysis (risk identification and analysis); and
- Step 3 – Overall safety requirements and allocation (risk evaluation and treatment).

The last step allows that necessary risk reduction can be met through safety-related systems, other technology or external risk reduction facilities.

Risk analysis is discussed further in the Hazard and Risk Assessment prepared by Hyder Consulting contained in Appendix 38. This process is outlined in the figure below.

Figure 34: Safety Lifecycle



Risk Recording

Risk registers will be maintained to record the identified hazards and their proposed / accepted mitigation techniques. The risk registers will be updated as the detailed design for each stage is progressed. The risk register is contained in the Hazard and Risk Assessment prepared by Hyder Consulting contained in Appendix 38.

Emergency Management Plan

An outline of the proposed emergency management procedures should be provided for the range of situations identified in the above risk assessment where there are measurable risks.

Planning should include reference to State Planning Policy 1/03, Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (DLGP and DES 2003).

In particular, the following should be presented:

- contingency plans to deal with hydrocarbon (e.g. diesel, lubricating oils) oil spills during construction, operation and maintenance of the project
- contingency plans to account for natural disasters such as storms and fires during the construction, operation and maintenance phases
- emergency planning and response procedures.

Potential emergency situations that could arise during the construction and operation of the project will be determined through the Hazard and Risk Assessment prepared by Hyder Consulting contained in Appendix 38.

These hazards include, but not limited to the following:

- Natural hazards such flood, landslide, fire or cyclone
- Spills of hazardous materials
- Accidents at road crossings
- Occupational hazards – manual handling, slips trips and falls etc

The preliminary Hazard and Risk Assessment did not identify any of the above risks to be of a high level however risk identification is an ongoing process throughout the life of the project as new risk situations could arise. Emergency situations require effective planning and management to reduce the impact arising from the situation. This information is usually documented in an Emergency Action Plan (EAP) specific to the project.

Emergency Planning and Response Procedures

Hyder currently has a Disaster Management Plan in place under which there are sub plans including a Wildfire Action Plan, Cyclone Management Plan and site specific EAPs. A site specific EAP will be developed in conjunction with the appropriate emergency authorities for the operation of the project.

During construction, emergency management will be undertaken through the EAP. This will include control plans for some of the following issues:

- Handling and storage of hazardous goods
- Emergency incident response
- Health and safety management.

An EAP for the construction phase will include an emergency response procedure, example contents of which are outlined below:

- Emergency contacts and chain of command
- Responsibilities
- Alert systems
- Identification and control of emergency sources
- Access routes and transport methods
- Reporting and review requirements.

Involvement of State Agencies

Relevant state agencies that could be involved during an emergency situation are listed below with the likely nature of their involvement. There are local branches of these services, details of which will be provided in the EAP.

Table 47: Emergency Services Involvement

State Agency	Likely involvement in an emergency situation
Queensland Ambulance Service	▪ Provision of first aid ▪ Transport of injured ▪ Establishment of Casualty Clearing Station if required
Queensland Fire & Rescue Service	▪ The control of existing fire or explosive situations ▪ The negation of possible fire or explosive situations ▪ The rescue of trapped and/or injured ▪ The control of chemical emergencies•
State Emergency Service	▪ Provision of personnel and equipment ▪ Assistance with traffic and crowd control ▪ Assistance in the evacuation of person if necessary ▪ Construction of earth bunds ▪ Other assistance as required
Police	▪ Traffic control ▪ Crowd control ▪ Evacuation of persons if required ▪ Coordination of rescue of trapped or injured persons if required

Security

Strategies for site security and access during construction and operation will be developed. During construction one entry/exit point will be provided onto site and the entry/exit will be managed to prevent unauthorised access.

All visitors and contractors to the site will be inducted prior to commencing any construction activities.

Further detail pertaining to Emergency Management Plans is contained in the Hazard and Risk Assessment prepared by Hyder Consulting contained in Appendix 38.

4.14 Environmental Management Plan

An outline of the EMPs for the construction and operational phases should be presented, setting out the framework for continuing management, mitigation and monitoring programs for the project's impacts, including any provision for independent environmental auditing.

The EMP should include a mechanism to receive complaints from the community and stakeholders and a process to ensure these complaints are appropriately investigated, any required mitigation measures implemented within a timely fashion, and that these actions have been communicated to the complainant.

Hyder Consulting have prepared two management plan documents, one being the Environmental Management Plan (EMP) which pertains to the construction phase of the GCIMP contained in Appendix 14 and the other being the Site Based Management Plan (SBMP) which pertains to the operational phase of the GCIMP contained in Appendix 15.

Construction EMP

The objectives of the EMP are to:

- Ensure all environmental safeguards are carried out correctly;
- Manage site activities effectively;
- Mimimise adverse impacts on the environment;
- Ensure that the biodiversity of the site is conserved or enhanced;
- Minimise disruption to existing land and water users;
- Meet all requirements of relevant legislation; and
- Monitor environmental impacts associated with the construction, wet and dry excavation and spoil disposal activities.

Program and Contractual Obligations

The EMP covers the construction phase, from the commencement of construction and spoil disposal activities to the rehabilitation of the spoil disposal area and the implementation of maintenance including maintenance dredging.

The Proponent is generally responsible for ensuring that the provisions of the EMP are met, with the exception of certain planning of design issues which are explicitly noted throughout this EMP as being the responsibility of the Contractor or the Consultants.

The Proponent shall ensure that all persons who are to be employed or sub-contracted for the works shall be trained as to their individual responsibilities, as set out in this EMP and as provided by the *Environmental Protection Act 1994*, including the following:

This EMP recognises the *Environmental Protection Act 1994 (EP Act)* requirements relating to "general environmental duty".

General Environmental Duty

The EP Act requires that a person in the performance of their duties must not carry out an activity that causes, or likely to cause, environmental harm unless the person takes all reasonable and practical measures to prevent or minimise the harm.

Duty to Notify Environmental Harm

The EP Act requires that a person in the performance of their duties becomes aware that serious or material environmental harm is caused or threatened, the person must notify the administering authority of the nature and circumstances of the event as soon as reasonably practicable after becoming aware of the event. If the person is carrying out the activity as an employee, the person must notify the employer who must notify the administering authority.

EMP Components

The components of the EMP have been prepared in a format that nominates for each environmental issue or impacting activity, the tasks that are required to be addressed during the construction and operational phases of the development. The purpose of each component of the EMP is described below.

- Project Element: The aspect of the environment requiring management consideration.
- Environmental Objectives: The environmental performance objectives that are to be achieved.
- Environmental Values: Identification of the environmental values associated with each element that are to be protected.
- Control Measures: The actions to be undertaken to achieve the stated environmental objectives, including any necessary approval, applications, consulting or monitoring.
- Responsibility: Assignment of responsibility for carrying out each control measure to a relevant person and/or organization; including a process for dealing with complaints about the activity.
- Monitoring: The process of measuring actual performance and nomination of the time frame in which monitoring is to be carried out and or completed.

- Reporting: Description of the required reporting arrangements including auditing for each control measure.
- Performance Indicators: Nomination of the criteria against which the level of achievement of the stated environmental objectives are to be measured.
- Corrective Action: Nomination of the action to be implemented if the stated objectives are not being met or maintained, including the person or organisation responsible for implementing the required action.

Each EMP Element is summarised below and represents the component details for the Construction Environmental Management Plan (CEMP).

Table 48: EMP Elements

Element	Aspect
Element 1	Noise and Vibration Control
Element 2	Air Quality (Dust & Greenhouse Gases)
Element 3	Community Consultation & Residential Amenity
Element 4	Traffic and Transport
Element 5	Water & Sediment Quality
Element 6	Stormwater, Erosion and Sediment Control
Element 7	Flora and Fauna (including Marine)
Element 8	Weed Control
Element 9	Acid Sulfate Soils
Element 10	Cultural Heritage Management
Element 11	Visual Amenity
Element 12	Landscaping and Open Space
Element 13	Waste Minimisation and Management
Element 14	Dangerous and Hazardous Substances Management
Element 15	Site Rehabilitation and Decommissioning
Element 16	Contingency Plans for Emergency Events
Element 17	Navigational Safety
Element 18	Spoil Management

Due to the multiple construction / EMP components, detail pertaining to the management, mitigation, monitoring and environmental auditing of each of the abovementioned elements is contained in the EMP prepared by Hyder Consulting contained in Appendix 14.

A summary of monitoring, management and various components has been provided as follows.

Monitoring and Reporting

A regular program of monitoring and reporting shall be implemented by the Contractor to ensure that the requirements of the EMP are complied with. Should an area of non-compliance be identified, actions should be agreed upon with the Proponent, and where required, the relevant agency, to ensure compliance and minimise the potential for non-compliance in the future. Regular monitoring to determine the effectiveness of management measures are outlined in each element of this EMP.

Environmental Incident Report

An incident reporting system is to be prepared by the Contractor in accordance with the EMP prior to works commencing to allow the tracking and identification of non-compliances within construction and operation activities. All personnel are to be trained in the use of incident reports and be encouraged to use these reports when an incident is identified within the project site.

Complaints Response Procedure

In the event of a complaint being received by the Proponent or Contractors appointed by the Proponent relating to activities which are the subject of this EMP, a written report shall be prepared by the designated responsible person detailing:

- The date and time of the complaint;
- The method by which the complaint was lodged;
- Any personal details of the complainant which were provided by the complainant;
- The nature of the complaint; and
- The action taken by the responsible person in relation to the complaint, including any follow-up contact with the complainant.

This information shall be retained for a period of no less than three years from the date of receiving the complaint.

Project Management Meetings

Regular project management site meetings will be used as a means of identifying all issues at the site, including Workplace Health and Safety and Environmental Management. Details of the meeting program are to be provided by the Contractor in the Contractor's EMP.

Site Induction and Training

Construction personnel and sub-contractors site induction training will be one method of communication of the environmental management procedures which will operate at the site.

All staff involved on the site are to be made aware of their environmental responsibilities and requirements of the project, including meeting the requirements of the EMP. In addition to site specific construction induction, training in environmental requirements and responsibilities is to be provided as part of the induction process. This process will incorporate the training in regard to the Environmental Complaints Register and the Environmental Incident Reporting Management Systems.

Complaints by Local Community

There is potential for complaints by the local community during construction activities. As such, a formal complaint registered and management system is to be implemented by the Contractor that will monitor complaints and identify and track any follow-up actions required in accordance with the Proforma "Environmental Forms" contained in the EMP.

A contact telephone number should be provided which will allow the community to discuss complaints regarding the project. A verbal response should be provided to Complainants within 4 hours of the complaint during construction times and 24 hours during non-construction time. A written response should be provided to the proponent within five (5) days of the complaint.

Operational SBMP

The objectives of the SBMP are to:

- Identify all appropriate environmental safeguards and demonstrate how they will be implemented on site;
- Manage site activities effectively;
- Enable adverse impacts on the environment to be minimised;
- Provide for the conservation of the site's biodiversity values;

- Minimise disruption to existing land and water users;
- Meet all requirements of relevant legislation; and
- Monitor environmental impacts associated with the maintenance dredging and spoil disposal activities.

SBMP Components

Elements of the SBMP are specific to the operational phase of the development. The SBMP has been prepared in a format that nominates for each development or environmental issue or impacting activity, the tasks that are required to be addressed during the operational phases of the development.

- Project Element: The aspect of the environment requiring management consideration.
- Environmental Objectives: The environmental performance objectives that are to be achieved.
- Environmental Values: Identification of the environmental values associated with each element that are to be protected.
- Control Measures: The actions to be undertaken to achieve the stated environmental objectives, including any necessary approval, applications, consultation or monitoring.
- Responsibility: Assignment of responsibility for carrying out each control measure to a relevant person and/or organization; including a process for dealing with complaints about the activity.
- Monitoring: The process of measuring actual performance and nomination of the frequency and time frame in which monitoring is to be carried out and or completed.
- Reporting: Description of the required reporting arrangements including auditing for each control measure.
- Performance Indicators: Nomination of the criteria against which the level of achievement of the stated environmental objectives are to be measured.
- Corrective Action: Nomination of the action to be implemented if the stated objectives are not being met or maintained, including the person or organisation responsible for implementing the required action.

The SBMP is segregated to reflect all stages of operation. Elements are included for the operation phase, which is the phase from the substantial completion of the project to the expiry of the on-maintenance period. This operational phase includes elements for the mixed use, industrial use and marina use areas of the proposed development. The operation phase SBMP elements are:

Table 49: SBMP Elements

Element	Aspect
Element 1	Storm water Management
Element 2	Spill Emergency Response
Element 3	Bio Security
Element 4	Waste Management
Element 5	Noise Control
Element 6	Air Quality
Element 7	Dangerous and Hazardous Substances
Element 8	Oil and Hydrocarbon Pollution Prevention
Element 9	Sewerage Discharge Management
Element 10	Tenants and Sub-contractors
Element 11	Cyclone Management Plan
Element 12	Vessel Construction, Maintenance and Repair Management
Element 13	Ecologically Sustainable Development Principals
Element 14	Water Quality
Element 15	Flora and Fauna
Element 16	Landscaping and Weed Control
Element 17	Hazard and Safety Management
Element 18	Navigational Safety
Element 19	Maintenance Dredging

Due to the multiple operational components, detail pertaining to the management, mitigation, monitoring and environmental auditing of each of the abovementioned elements is contained in the SBMP prepared by Hyder Consulting contained in Appendix 15.

A summary of monitoring, management and various components has been provided as follows.

Responsibilities

The Individual Contractors shall be responsible for undertaking works in accordance with their specific contracts (e.g. road works, maintenance dredging and landscaping contracts) including the following.

- Implementing specific control measures contained in this SBMP that fall under the responsibility of their individual contract;
- Advising the GCIMP Operator of any non-compliance with this SBMP;
- Developing a contractor's EMP in accordance with any site specifications under their individual contracts and the requirements of this SBMP;
- Ensuring all staff are aware of environmental responsibilities and obligations and have received environmental training in accordance with this SBMP;
- Monitoring adherence of contractors to this SBMP and recommending required changes to the operator; and
- Consultation with Council, State Agencies and the community throughout construction on works which may affect their daily activities in accordance with the SBMP / EMP.

The contractor is responsible for any subcontractors engaged in works at the site, and must ensure that these subcontractors are aware of environmental responsibilities.

Each staff member, tenant and patron is also responsible for environmental compliance. There is a duty of care to the environment by all personnel. All members within the chain of command should be identified, along with their roles and responsibilities, including environmental responsibilities.

Upon the expiry of the on-maintenance period, infrastructure works (e.g. roads and drainage) will be accepted by Council or the Proponent/Operator as applicable. The Council, Proponent/Operator, body corporate or relevant authority may wish to adopt their own environmental management and monitoring programme, which would be suited to the regional context.

It is proposed the SBMP for the future operational phase of the development shall be provided to the operator(s) responsible for management of the Gold Coast International Marine Precinct.

Monitoring and Reporting

The developed SBMP will include a pro forma to assist with the compliance of monitoring including frequency and reporting.

Complaints Response Procedure

In the event of a complaint being received by the Gold Coast International Marine Precinct Management about activities which are the subject of this SBMP, a written report shall be prepared by the designated responsible person detailing:

- the date and time of the complaint;
- the method by which the complaint was lodged;
- any personal details of the complainant which were provided by the complainant;
- the nature of the complaint; and
- the action taken by the responsible person in relation to the complaint, including any follow-up contact with the complainant.

This information shall be retained for a period of five (5) years from the time of complaint. A copy of a pro-forma Environment Complaints Form has been included in the SBMP.

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